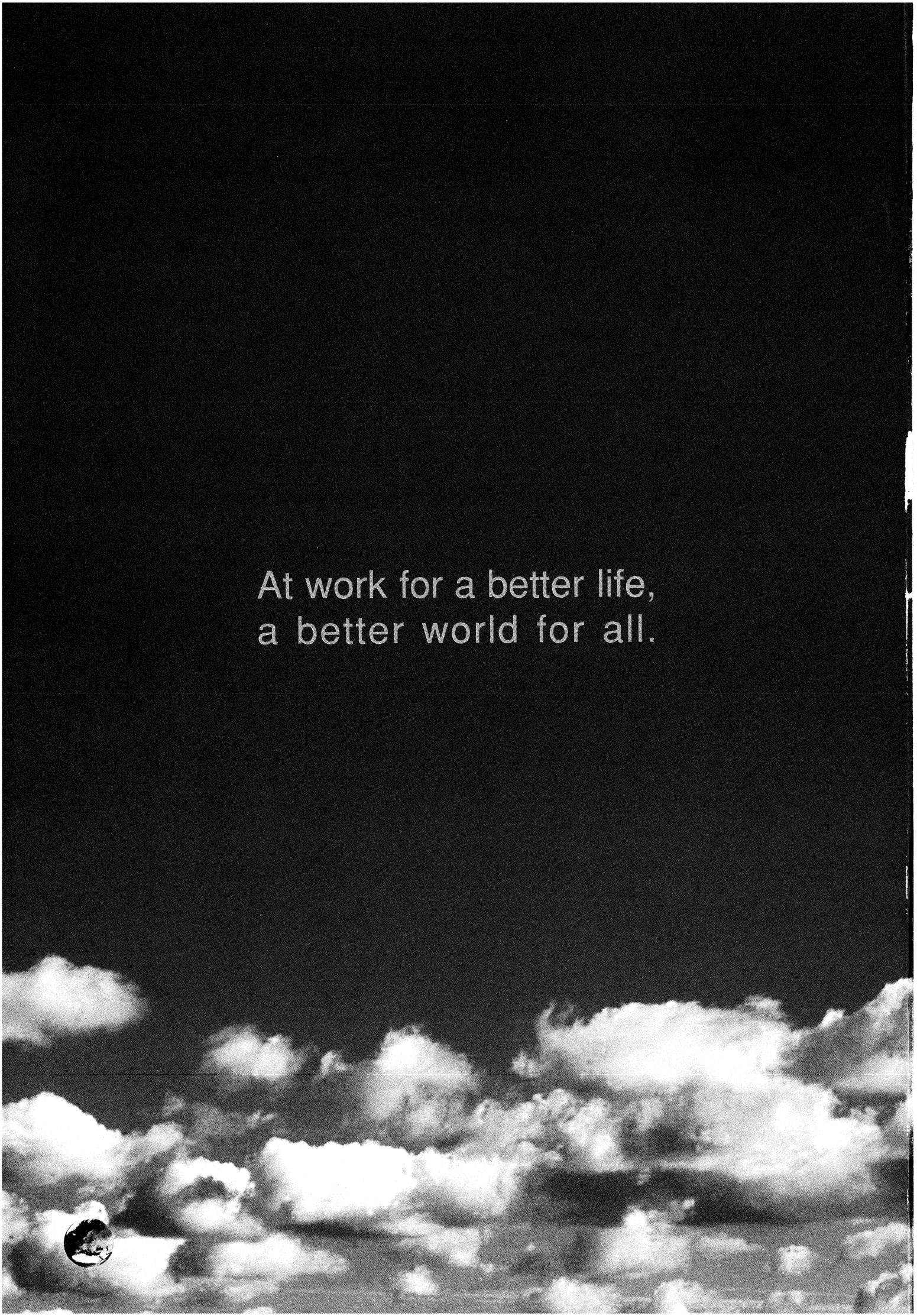
RELAYS
SWITCHES
CARD READERS
OPTO-SWITCHES


At work for a better life,
a better world for all.

OMRON

Following the establishment of OMRON Electronics in the UK in 1991, we created a division dedicated to supporting the client in the application of Electro-Mechanical and Electronic components. Utilising the expertise of internal and external sales, marketing and technical support, we have built a team of people who can assist you in making the right choice.

As part of OMRON Corporation, a leading manufacturer and supplier of control components, we are acutely aware of the changing trends in design, manufacturing techniques and technology and, as a result, we are in a position to offer you a variety of solutions to meet your needs.

Our latest catalogue underlines OMRON's committment to future growth. We have widened our product range to stay ahead of the increasing demands of today's market. To fulfill these requirements our products continue to carry a vast range of approvals, including BSI, BABT, BEAB, VDE, SEV, UL and CSA, all of which illustrate our commitment to quality as a leading manufacturer.

We remain committed to quality in all aspects of our business. In aiming to achieve this, we are in constant communication with our customers to ensure we deliver the level of service they require. We believe in strengthening partnerships and ensuring that we support your business in the way you want it supported.

Most of the products in this catalogue are available from stock in the UK or directly from our national distributors. For help with any product or application please contact our sales engineers on the Omron Technical Desk: .

OMRON

Worldwide Presence

Omron employs more than 23,000 people in 50 sites around the world, 19 of them in Europe. Omron Electronics was established in the UK in 1991, for the sales and support of components and systems for factory automation and electronics.

Product Range

The Omron product range contains more than 100,000 product lines, from the smallest of microswitches to highly complex control systems. New products are continuously being developed to meet the needs of the market place.

Quality Assured

Fully automated production ensures the highest levels of quality. Each stage of the production process is followed by strict quality control procedures. At the end of the manufacturing process every product is tested.

Leading Edge Technology

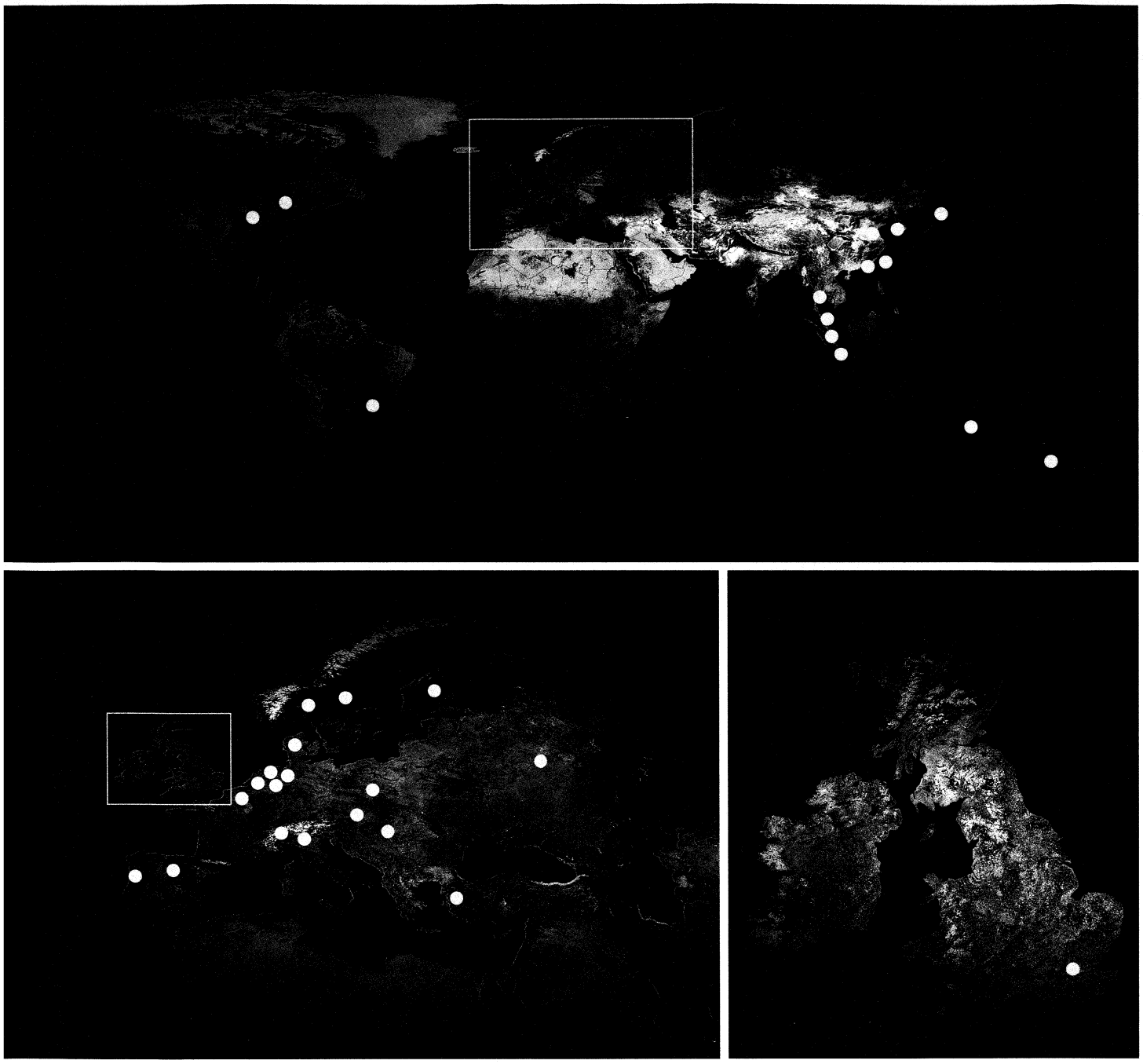
More than 1,600 engineers are employed in Omron's Research and Development centre in Japan. Our annual budget for R&D is more than £70,000,000. A long standing information exchange with industry and universities ensures continuous new development of market-led and future-oriented products.

Customer Service

Our Customer Service department is able to offer both commercial support and technical advice on application problems. Custom products can often be developed from standard product lines to suit individual applications.

Stock

Ninety percent of the lines in this catalogue are stocked at our warehouse facility in North London, which has 35,000 square feet of floor space. Most products are also available at selected distributor outlets throughout the British Isles.



Our worldwide office network spans the globe and is consolidated by a large range of independent distributors.

Austria
Belgium
Czech Republic
Denmark
Finland
France
Germany
Greece
Hungary
Italy
Netherands
Norway
Portugal
Russia
Spain
Sweden
Switzerland
Turkey
United Kingdom

Australia
China
New Zealand
Hong Kong
Indonesia
Japan
Korea
Malaysia
Singapore
Taiwan
Thailand

Brazil
Canada
USA

OMRON

Omron Electronics Limited was established in 1991 as part of Omron Corporation's European network. The Omron Corporation manufactures a very wide range of electrical and electronic control equipment and components and is recognised worldwide as a leading supplier of high quality and high technology products. These products are supplied from its warehouse in North London which is in turn serviced by our central European warehouse in the Netherlands. Omron's product offering is very broad and ranges from a simple switch to complete networked manufacturing control systems. As a result of this, Omron Electronics UK has set up separate divisions to provide specialist technical and sales support to its varied customer base.

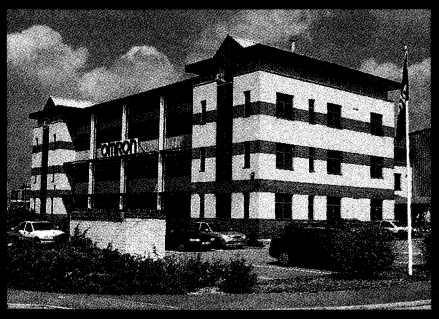
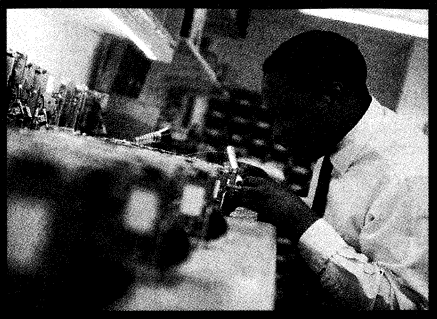
The Electronic Components Division specialises in the supply of PCB components, small switches and card readers. Already established as the No.1 supplier of electro-mechanical PCB relays in the UK, it also supplies Microswitches, DIP switches, Pushbutton switches, Opto-switches and has recently begun to supply card-reader products. A wide variety of applications is addressed from Domestic Appliances to Security and Computer products and a reputation for high quality products and services has been established throughout the UK and Ireland.

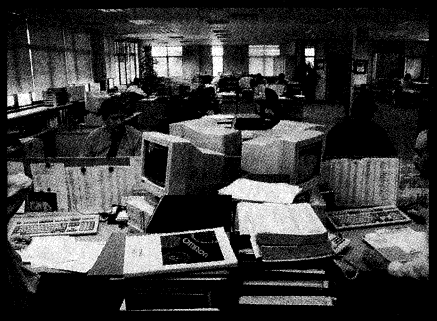
The Industrial Automation Division provides sensing and control components to OEMs and End Users via a network of specialist distributors. Technical support for this product range is provided by an engineering based sales force and is further supported by test facilities in London, which include a Sensor Test Laboratory to assist Omron engineers to solve customers' specific sensing problems.

The FA Systems Division provides support to the expanding range of Omron Factory Automation Systems, which offers fully integrated control systems including communication and software products. Full training facilities for this range of products are provided at the London Head Office. A product demonstration area - Factory Automation Plaza - is also available for customer visits and provides facilities for working demonstrations as well as allowing customers to see the range of Omron products available.

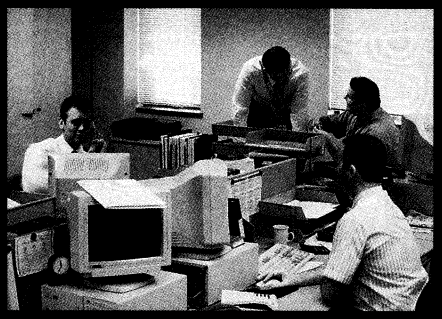
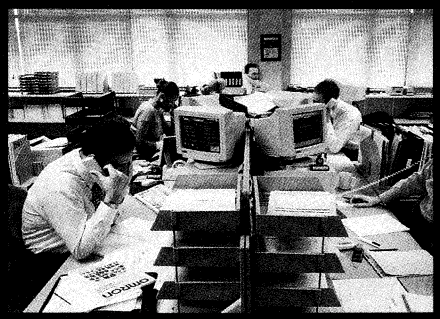
Omron continues to lead in the provision of application specific components to satisfy the increasingly demanding requirements of the marketplace. This is enhanced by the British and International Approval standards achieved by the product range. This level of market driven product introduction is assisted by the high level of communication and the close relationships fostered between Omron and its customer base.

Quality is the over-riding principle of Omron Electronics Limited and, as a result, the attainment of ISO 9002 Approval has been a priority since the company began trading in 1992. This objective has been realised with the award by LRQA of ISO 9002 Approval in October 1993 for the stock holding operation. This further demonstrates Omron's commitment to its philosophy "Quality First".

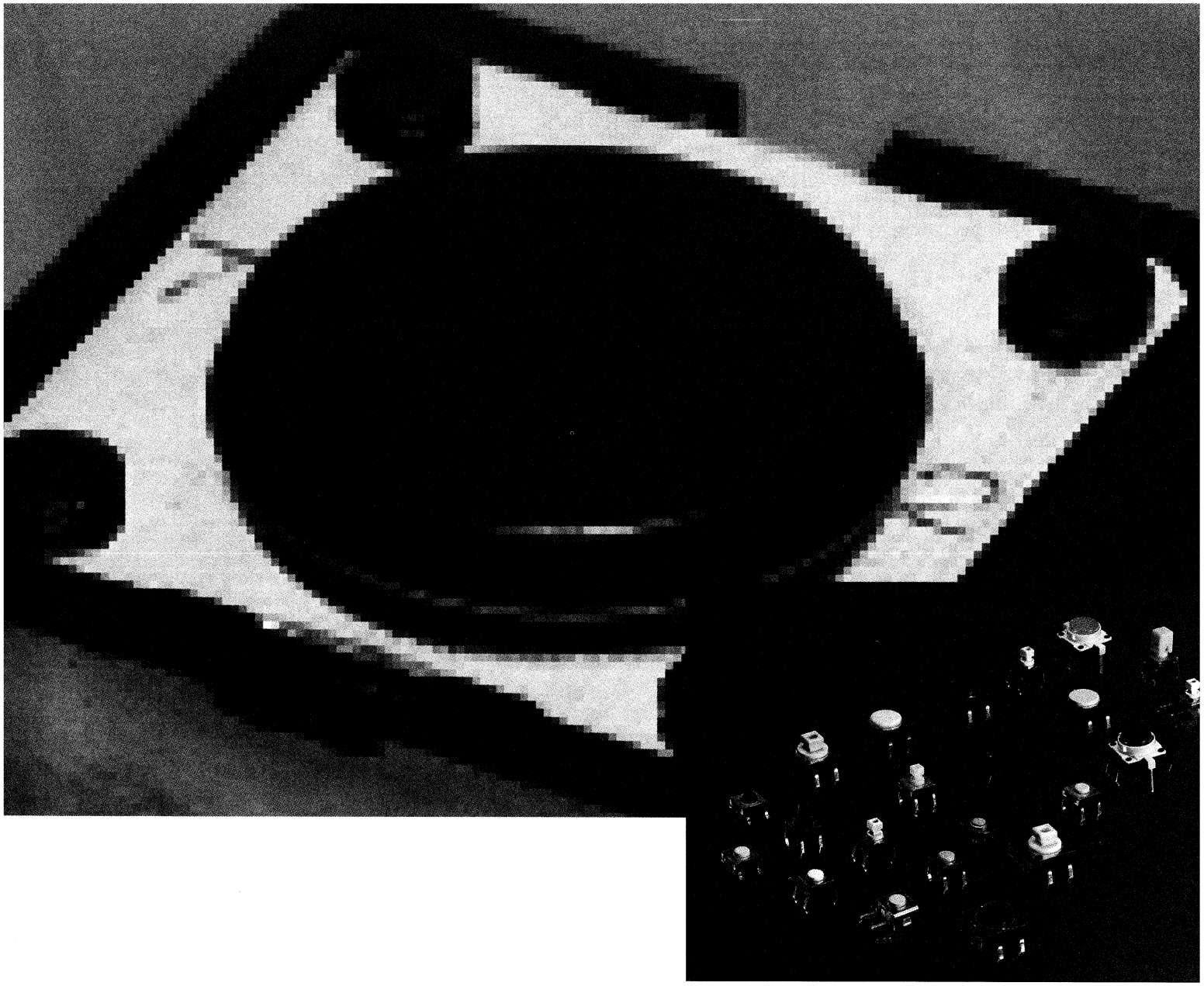


Omron UK's H.Q. in Staples Corner, North London.

OMRON

This catalogue has over 150 different products, and thousands of variations of these to suit all your needs. We have tried to maintain the ease of use of our catalogue so that you can find the product you need quickly, whilst offering enough information to decide which product is appropriate for your needs. There are seven sections in all, with a wide variety of options that should satisfy any demands.



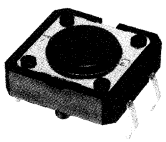
SECTION 1 Mechanical Keyswitches

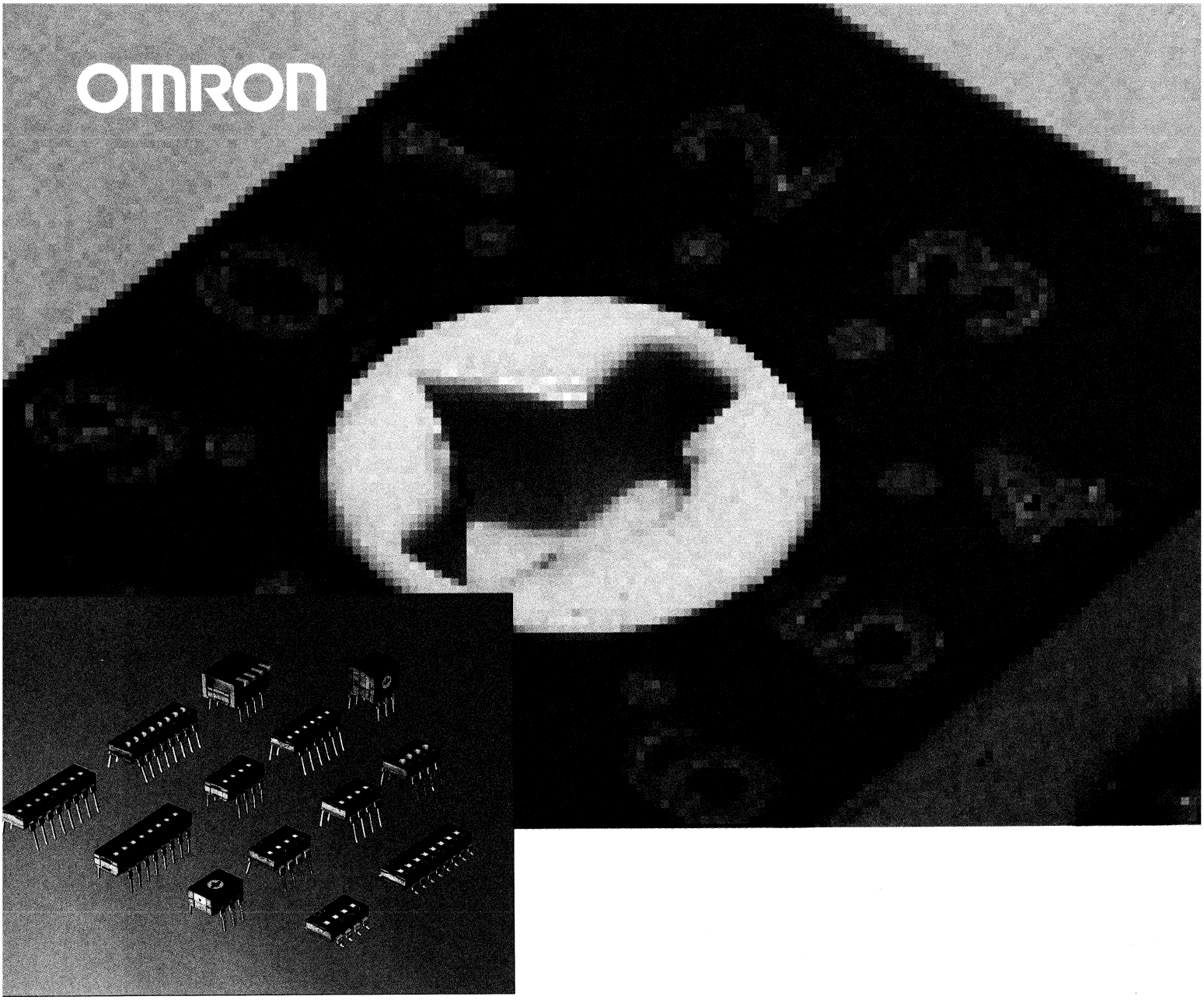
A comprehensive range of mechanical keyswitches suitable for keyboards with a membrane overlay or as a stand alone switch with key-pad.

Encompassing the high quality synonymous with Omron product, these switches provide a positive click action with tactile feedback in various operation forces to suit most applications.

Continuous development of the range has introduced sealed versions of the switch which allow immersion cleaning of the PCB and guard against contamination of contacts in dusty environments. This development has also led to the introduction of surface mount switches suitable for reflow soldering techniques.

Key-caps are available in three sizes and nine colours to provide for all applications, making this range of switches one of the most comprehensive in the market.



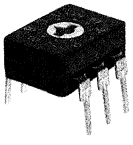


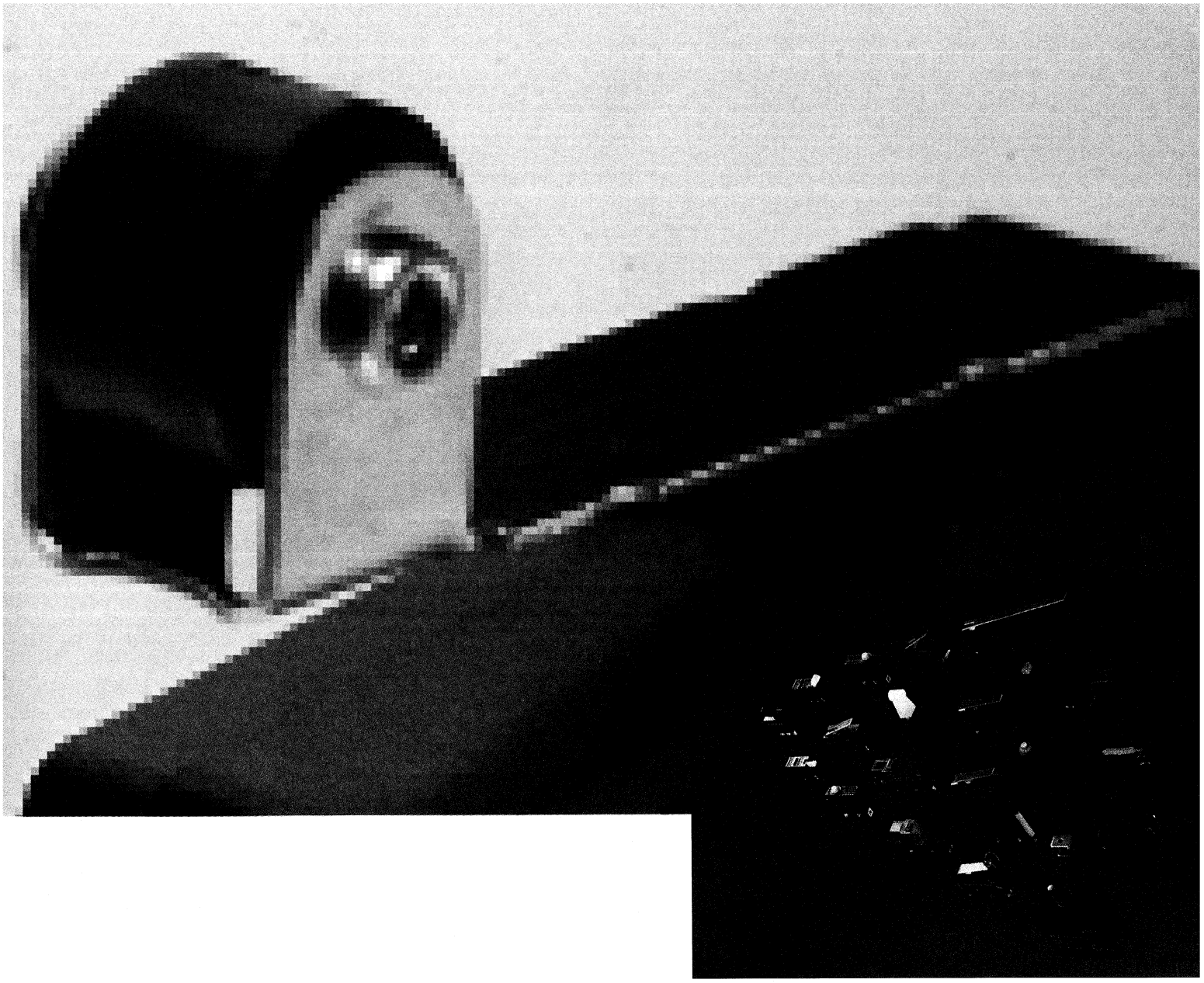
SECTION 2 DIP Switches

Omron produce a range of DIP Switches to suit most production processes. For processes that require immersion cleaning, the A6D series is ideal. Fully sealed and supplied in tubes for auto insertion, the A6D features bifurcated contacts and a smooth sliding action for reliable switching down to 10 A. The A6D is also available with flush, raised and piano style actuators.

For processes where no cleaning is necessary, the A6T series is a base sealed option which also offers cost benefits. Also available with a top tape seal to allow washing, it is available from 1 to 10 poles in flush or raised actuators.

The A6S series is a surface mount device available in 2 to 10 poles and base sealed or top tape sealed. Both the A6T and A6S are supplied in an IC style auto-insertible tube.



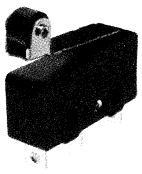


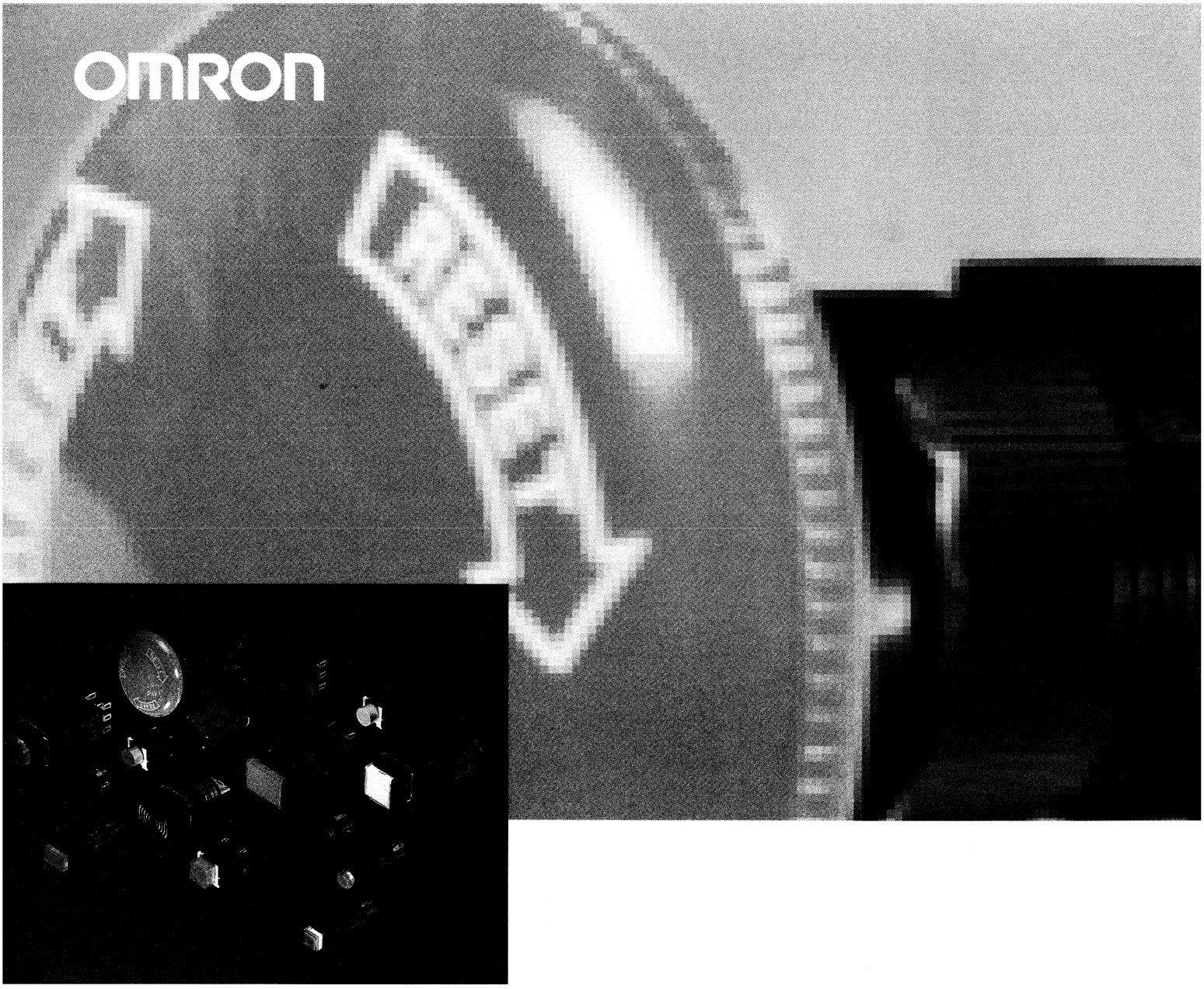
SECTION 3 Microswitches

Omron designs and manufactures a diverse range of high quality precision microswitches for use in applications across industry, including machine tools, automotive, security, domestic goods, vending machines and others.

In the UK we supply basic, miniature, subminiature, low torque and fully sealed types, with a wide array of actuators: pin plunger, hinge lever, leaf spring and roller lever are all options.

Connection can be provided by solder quick connect, PCB or screw terminals. Wire leads can be supplied for remote connection on selected types.



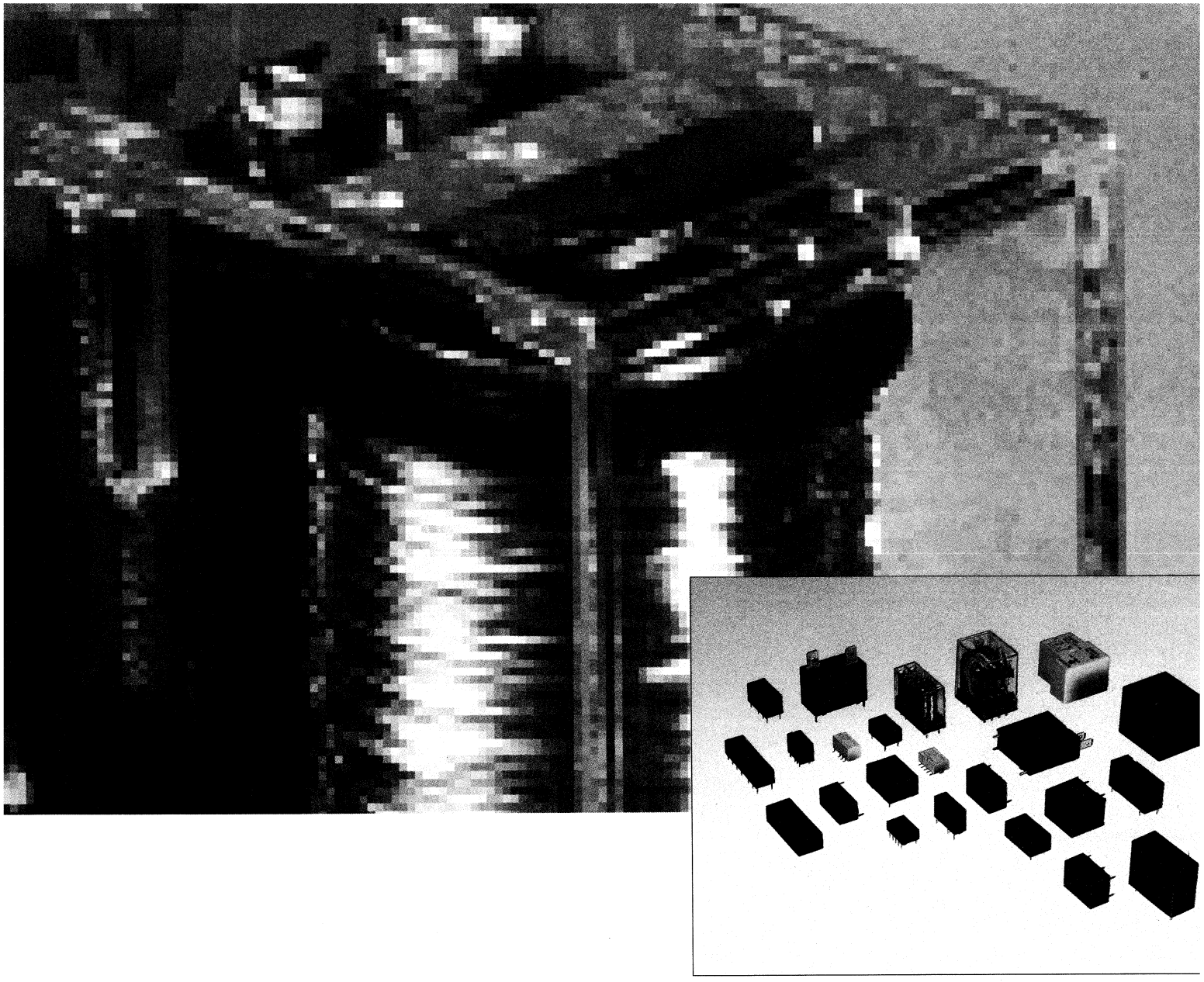


SECTION 4 Lighted Pushbutton Switches

Omron manufacture a variety of pushbutton switches including the well established A3G series of 16mm panel mount pushbutton switch. The A3G series features a modular design where the contact block is detachable, simplifying installation and replacement. Available with latching or momentary action, with round, square or rectangular bezels the A3G is ideal for control, instrumentation and automation applications.

With recent trends towards miniturisation of equipment, smaller and smaller switches are becoming more popular. The A3C pushbutton switch requires a panel cutout of 12mm while the A3D switch requires only 8mm.

All Omron Pushbutton Switches feature high visibility illuminated types and are amongst the most reliable switches in use today.

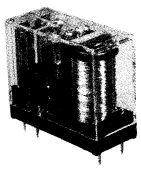


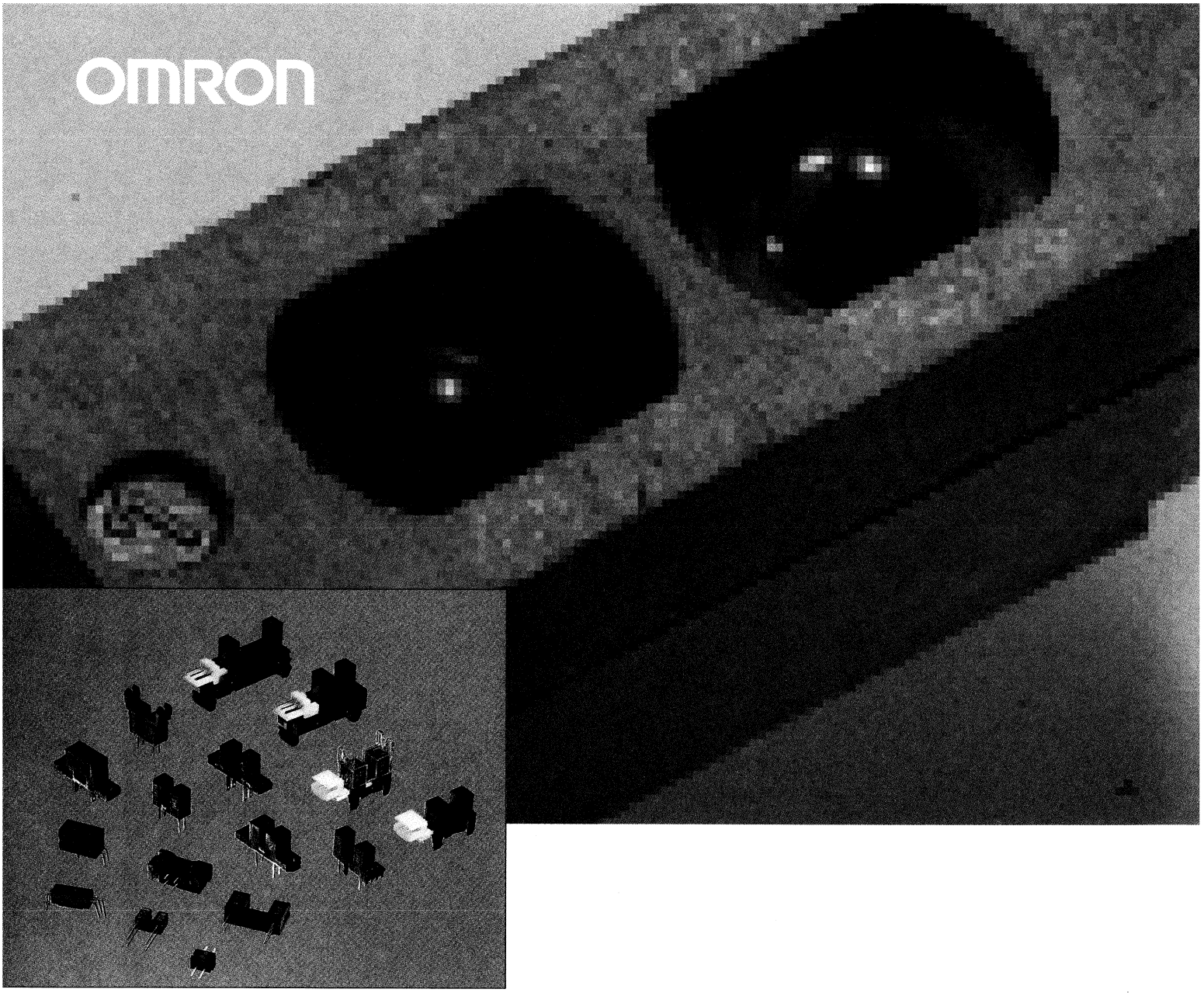
SECTION 5 Relays

Since developing the first Type '47 relay, Omron have continued to be at the forefront of technology, with noted advances into specialist isolation relays, RF switching and surface mount technology.

Today, we supply one of the widest ranges of electro-mechanical relays in the UK, with a PCB relay for practically any application; DC or AC coils; 1, 2 or 4 poles; single/twin coil latching versions and a comprehensive range of power ratings.

With vast investments in R&D, we are continually developing the product range to match the demands of our customers for smaller package sizes with reduced coil power consumption, wider switching loads and more adaptable packaging methods.



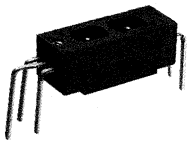


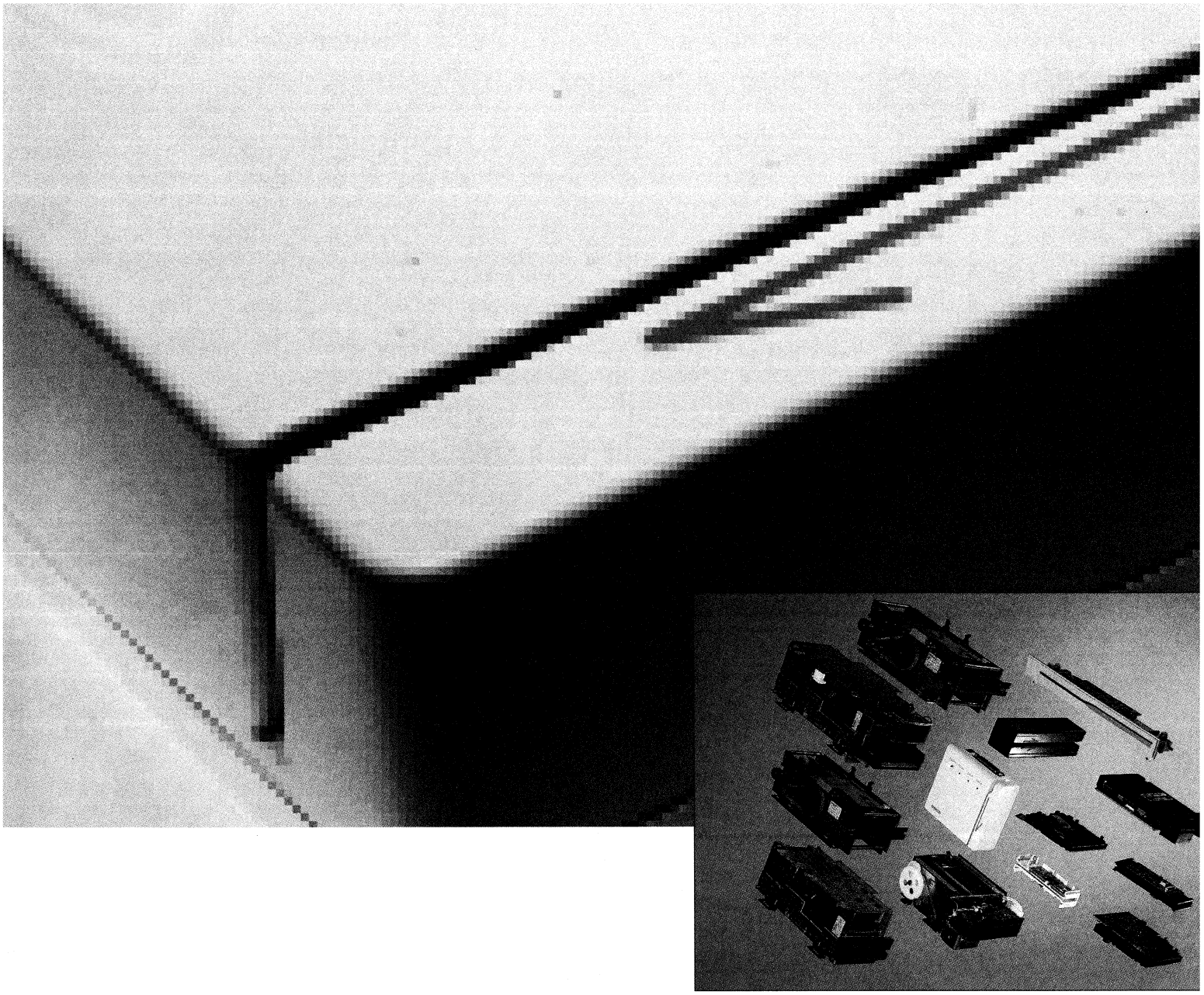
SECTION 6 Opto-Switches

Omron manufactures a wide range of high performance, high quality Opto-Switches designed to meet the demands of engineers looking for faster and more reliable switching.

Ideal for inclusion in Office Automation equipment, such as printers, photocopiers and fax machines, they are becoming more popular in applications within vending and domestic appliance manufacturers.

Omron Opto-Switches are either transmissive (slotted) or reflective. The former consists of an IR source and a detector housed in a slotted moulding, with objects being detected when the beam is interrupted. Reflective types rely on a beam being reflected back to the detector by an object in the field of view.





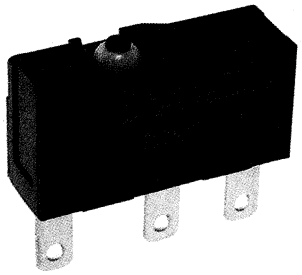
SECTION 7 Card Readers

Omron is pleased to introduce a range of magnetic stripe readers and smart card acceptors into this catalogue for the first time.

The section includes swipe readers, insertion readers and ready-to-use magnetic card encoding systems, complete with RS232 interfacing hardware and Windows® software. Omron also manufacture a comprehensive choice of oem bank card readers from the basic track two EFTPoS swipe reader, through to a motorised card transport, with card capture, shutter protection, low and high coercivity magnetic stripe reading and the possibility to upgrade for smart cards at any time in the future.

Omron offers a high performance product, used world wide in many different applications such as retail banking (EFTPoS and ATM systems), customer loyalty schemes, vending prepayment and utility meters, public pay phones, car parking and physical access control.

OMRON

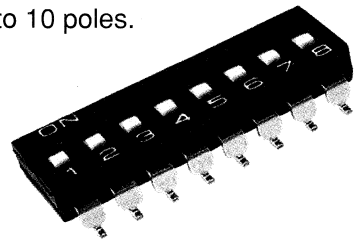


D2SW Microswitch

IP67 sealed subminature Microswitch available wire leads and all industry standard levers.

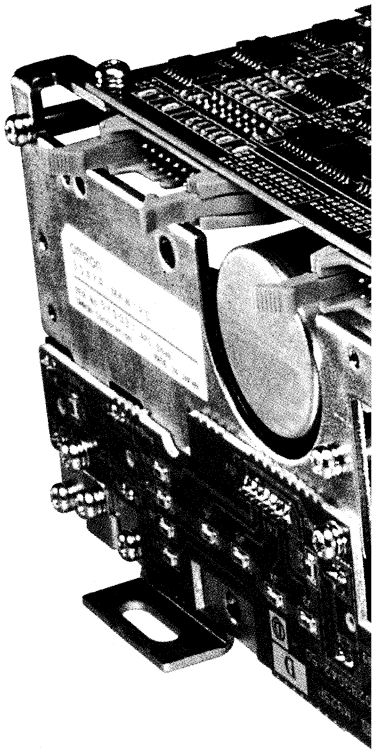
A6S DIP Switch

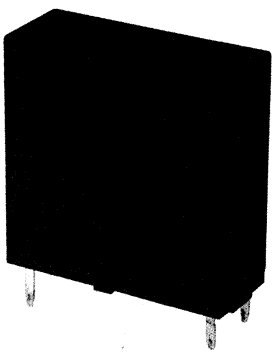
Low profile surface mount DIP Switch available in 2 to 10 poles.



HSR Manual Swipe Magnetic Card Reader

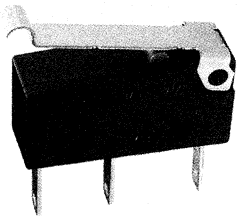
The industry standard 100mm swipe reader with TTL clock/data output or RS232 interface ready for PC connection. 300,000 pass head life with multiple track option.





G5PN Relay

Slimline power relay capable of switching high-in-rush loads, TV5 and TV8 versions are available.

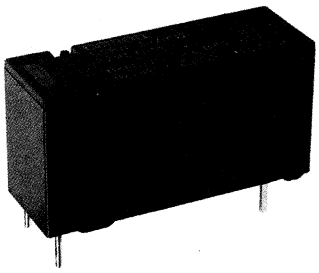


SSG Microswitch

A subminature Microswitch featuring an operating temperature of up to 125ºC and now BEAB approval.

EE-SX1101 Opto-Switch

Ultra-minature slotted Opto-Switch featuring micro fresnel lens technology.

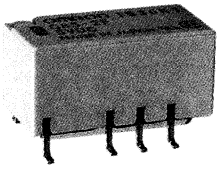


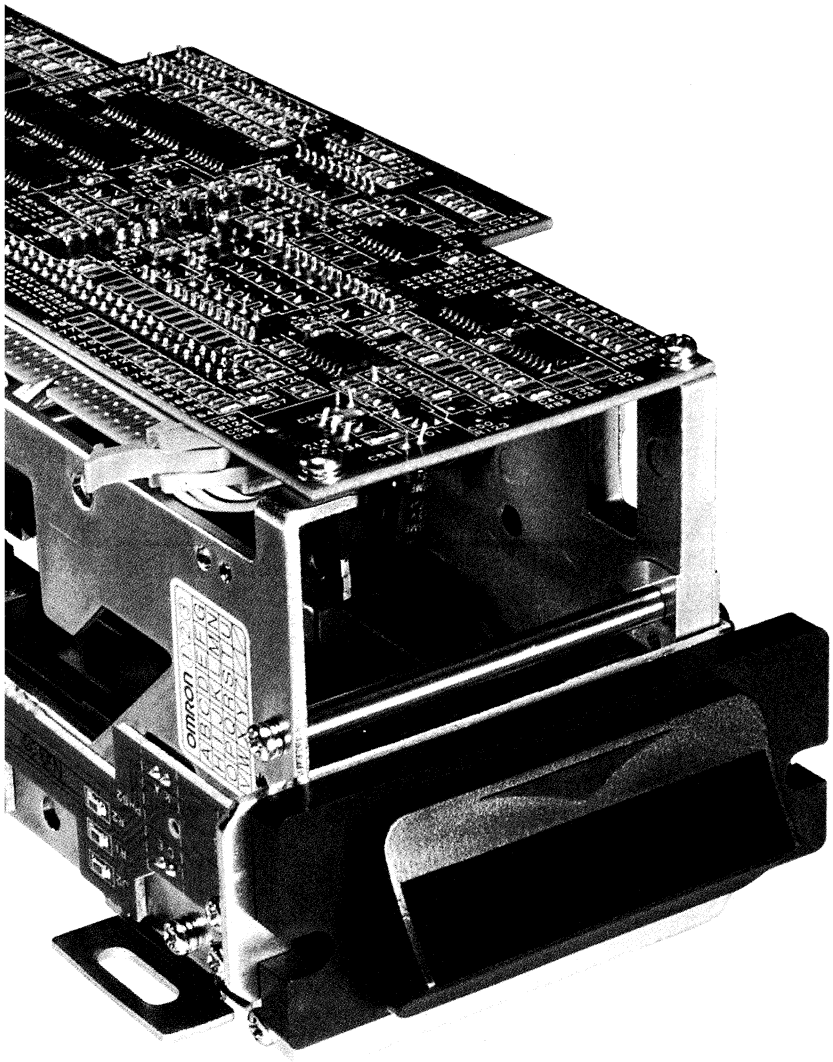
G6RN Relay

A low profile power Relay with high isolation characteristics.

G6S Relay

A true surface mount Relay designed to withstand SMT processes. Also available approved for supplementary isolation to EN60950.



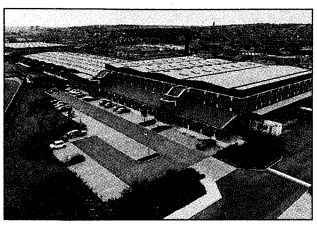


MKW Motor Driven Card Reader/Writer

The flagship of Omron's Card Systems products. Available with both low and high coercivity magnetic stripe writing; options include a shutter upgrade and the facility to read all ISO 7816 smart cards. The RS232 interface allows straightforward control of this product.

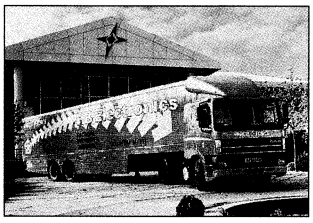
OMRON

Omron's Distributor network offers a wide range of Omron products ex-stock, with the complementary services which add real value for buyers and specifiers of Omron's high quality components. All Omron Distributors are commited to high quality service which is reflected in ISO 9002 certification. Among the services offered by the Distributor network are the highest levels of technical and commercial support combined with wide-ranging value added services and design-in support. The partnership between Omron and the Distributor network guarantees service, reliability and quality.



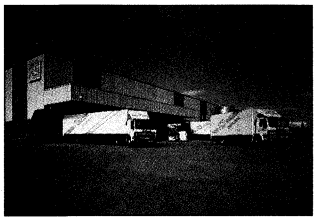
Farnell Electronic Components Ltd.
Canal Road
Leeds, LS12 2TU
Tel: 01132 636 311
Fax: 01132 633 411

Farnell
COMPONENTS

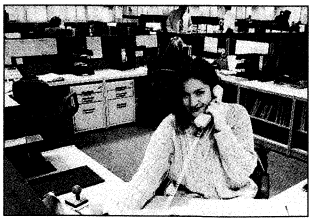


Eurodis HB Electronics Ltd
Lever Street, Bolton
BL3 6BJ
Tel: 01204 555 000
Fax: 01204 384 911

eurodis
HB Electronics



RS Components Ltd.
PO Box 99
Corby, Northamptonshire
NN17 9RS
Tel: 01536 201 201
Fax: 01536 201 501



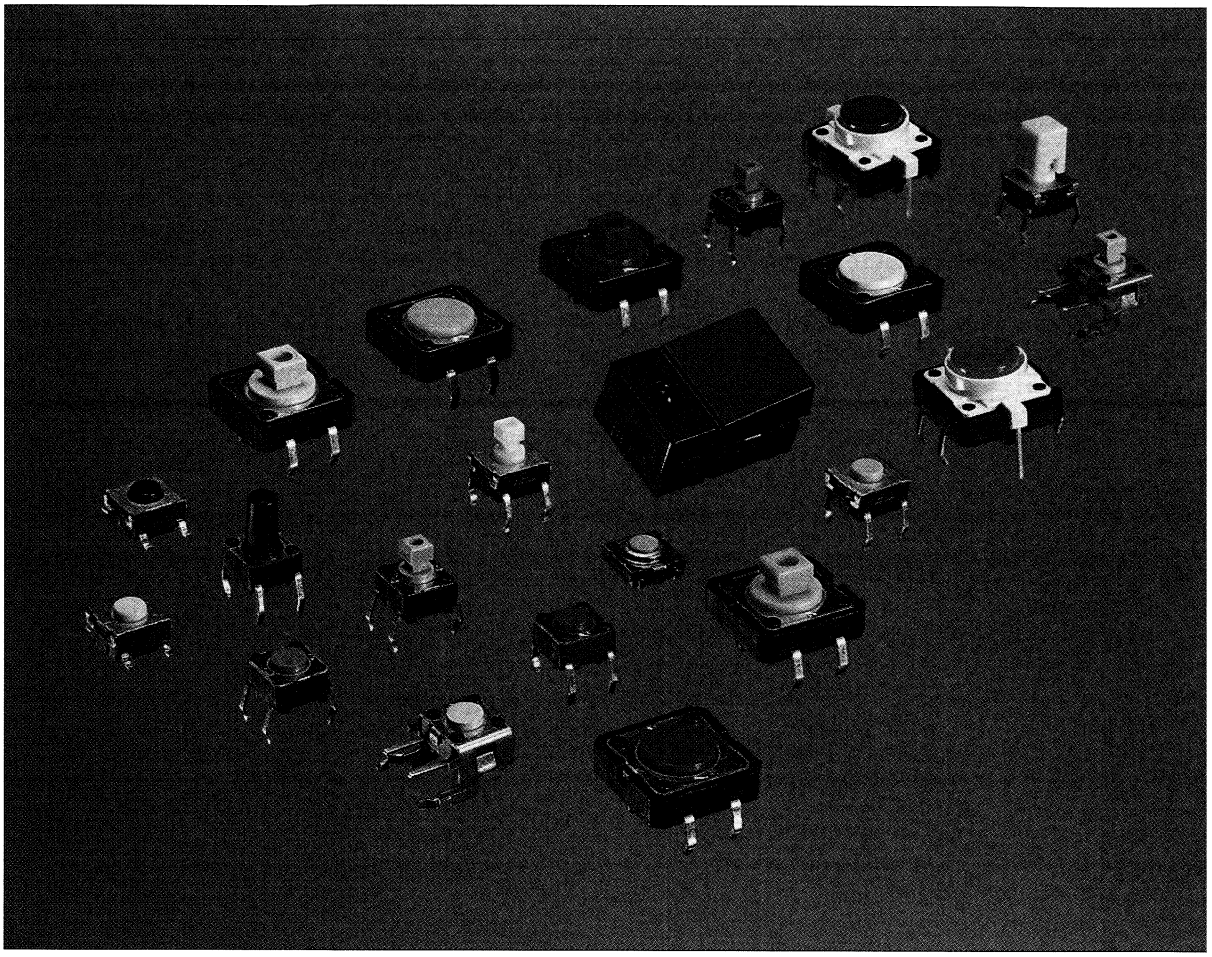
Arrow Jermyn Ltd.
St. Martin's Business Centre
Cambridge Road, Bedford
Bedfordshire, MK42 0LF
Tel: 01234 270 027
Fax: 01234 214 674

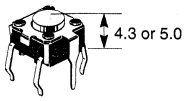
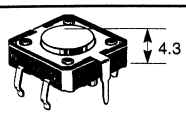
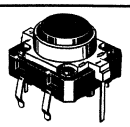
Arrow-Jermyn

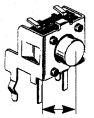
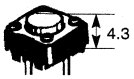
Contents

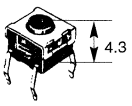
SECTION 1

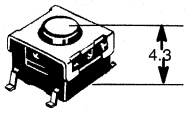
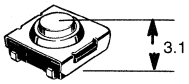
Mechanical Keyswitches



Item			B3F							
Size			6 x 6 mm			12 x 12 mm				
Appearance						 				
						Standard		Long life expectancy	High reliability	Surface illumination
Features			• Wide range of models, including types with 260-gf operating force for firm, sure action. • Nine colors of pushbutton key tops available. • Shipment available in stick packaging for automatic mounting.							
Contact			Silver-plated			Silver-plated			Gold-plated	Silver-plated
Operating force			0.98 N (100 gf)	1.47 N (150 gf)	2.55 N (260 gf)	1.27 N 130 gf	2.55 N (260 gf)	1.27 N (130 gf)		
Non-illuminated type	Flat type (height: 4.3 mm; 3.15 mm for vertical type)	Without ground	B3F -1000	B3F -1002	B3F -1005	B3F -4000	B3F -4005	B3F -5000	B3F -5001	---
		With ground	B3F -1100	B3F -1102	B3F -1105	B3F -4100	B3F -4105	B3F -5100	B3F -5101	---
	Flat type (height: 5.0 mm; 3.85 mm for vertical type)	Without ground	B3F -1020	B3F -1022	B3F -1025	---	---	---	---	---
		With ground	B3F -1120	B3F -1122	B3F -1125	---	---	---	---	---
	Flat type and others	Without ground	---	---	---	---	---	---	---	---
		With ground	B3F -1110	---	---	---	---	---	---	---
	Projected type	Without ground	B3F -1050	B3F -1052	B3F -1055	B3F -4050	B3F -4055	B3F -5050	B3F -5051	---
		With ground	B3F -1150	B3F -1152	B3F -1155	B3F -4150	B3F -4155	B3F -5150	B3F -5151	---
	Extended type	Without ground	B3F –1070	---	---	---	---	---	---	---
Illuminated type	Red LED	Without ground	---	---	---	---	---	---	---	B3F -9100
	Green LED	Without ground	---	---	---	---	---	---	---	B3F -9200
	Yellow LED	Without ground	---	---	---	---	---	---	---	B3F -9300
Life expectancy (operations)			1,000,000	300,000	100,000	3,000,000	1,000,000	10,000,000		1,000,000
Packaging	Bag (standard)		100			100				---
	Box (standard)		1,500/box			500/box				---
	Stick (Add S to end of model number.)		With ground: 75/stick Without ground: 90/stick			With ground: 40/stick Without ground: 45/stick				36/stick
	Embossed tape (Add P to end of model number.)		---			---				---
Key top (projected types)	4 x 4 mm		B32-10□0			---				---
	9 x 9 mm		---			B32-12□0				---
	12 x 12 mm		---			B32-13□0				---
Page			6							

Item			B3F			B3F-6		
Size			6 x 6 mm			6 x 6 mm		
Appearance			 3.15 or 3.85			 4.3		
			Vertical type			Radial type		
Features			• Wide range of models, including types with 260-gf operating force for firm, sure action. • Nine colors of pushbutton key tops available. • Shipment available in stick packaging for automatic mounting.			• Automatic mounting possible via general-purpose radial taped component inserters.		
Contact			Silver-plated			Silver-plated		Silver-plated
Operating force			0.98 N (100 gf)	1.47 N (150 gf)	2.55 N (260 gf)	0.98 N (100 gf)	1.47 N (150 gf)	2.55 N (260 gf)
Non-illuminated type	Flat type (height: 4.3 mm; 3.15 mm for vertical type)	Without ground	---	---	---	B3F-6000	B3F-6002	B3F-6005
		With ground	B3F-3100	B3F-3102	B3F-3105	B3F-6100	B3F-6102	B3F-6105
	Flat type (height: 5.0 mm; 3.85 mm for vertical type)	Without ground	---	---	---	B3F-6020	B3F-6022	---
		With ground	B3F-3120	B3F-3122	B3F-3125	B3F-6120	B3F-6122	---
	Flat type and others	Without ground	---	---	---	---	---	---
		With ground	---	---	---	---	---	---
	Projected type	Without ground	---	---	---	B3F-6050	B3F-6052	---
		With ground	B3F-3150	B3F-3152	B3F-3155	B3F-6150	B3F-6152	---
Illuminated type	Red LED	Without ground	---	---	---	---	---	---
	Green LED	Without ground	---	---	---	---	---	---
	Yellow LED	Without ground	---	---	---	---	---	---
Life expectancy (operations)			1,000,000	300,000	100,000	1,000,000	300,000	100,000
Packaging	Bag (standard)		100			---		
	Box (standard)		1,500/box			1,000/box (radial tape)		
	Stick (Add S to end of model number.)		---			---		
	Embossed tape (Add P to end of model number.)		---			---		
Key top (projected type)	4 x 4 mm		B32-10□0			B32-10□0		
	9 x 9 mm		---			---		
	12 x 12 mm		---			---		
Page			6			11		

Item			B3W (washable type)			
Size			6 x 6 mm		12 x 12 mm	
Appearance						
Features			• Sealed construction enables submersed washing after soldering. • Dust-proof for application in adverse environments.			
Contact			Silver-plated			
Operating force			1.57 N (160 gf max.)	2.25 N (230 gf max.)	1.96 N (200 gf max.)	3.43 N (350 gf max.)
Non-illuminated type	Flat type (height: 4.3 mm; 3.15 mm for vertical type)	Without ground	B3W-1000	B3W-1002	B3W-4000	B3W-4005
		With ground	B3W-1100	B3W-1102	B3W-4100	B3W-4105
	Flat type (height: 5.0 mm; 3.85 mm for vertical type)	Without ground	---	---	---	---
		With ground	---	---	---	---
	Flat type and others	Without ground	---	---	---	---
		With ground	---	---	---	---
	Projected type	Without ground	B3W-1050	B3W-1052	B3W-4050	B3W-4055
		With ground	B3W-1150	B3W-1152	B3W-4150	B3W-4155
Illuminated type	Red LED	Without ground	---	---	---	---
	Green LED	Without ground	---	---	---	---
	Yellow LED	Without ground	---	---	---	---
Life expectancy (operations)			1,000,000	300,000	3,000,000	1,000,000
Packaging	Bag (standard)		100		100	
	Box (standard)		1,500/box		500/box	
	Stick (Add S to end of model number.)		With ground: 75/stick Without ground: 80/stick		With ground: 40/stick Without ground: 45/stick	
	Embossed tape (Add P to end of model number.)		---		---	
Key top (projected type)	4 x 4 mm		B32-10□0		---	
	9 x 9 mm		---		B32-12□0	
	12 x 12 mm		---		B32-13□0	
Page			16			

Item			B3S (surface mounted type)		B3SN (surface mounted type)
Size			6 x 6 mm		6 x 6 mm
Appearance					
Features			• Surface-mounted device construction for high-density mounting.		• Low profile surface-mounted device construction for high-density mounting.
Contact			Silver-plated		Silver-plated
Operating force			1.57N (160 gf max.)	2.25 N (230 gf max.)	1.57 N (160 gf)
Non-illuminated type	Flat type (height: 4.3 mm; 3.85 mm for vertical type)	Without ground	B3S–1000	B3S–1002	Flat type (height: 3.1 mm) B3SN-3012
		With ground	B3S–1100	B3S–1102	Flat type (height: 3.1 mm) B3SN-3112
	Flat type (height: 5.0 mm; 3.85 mm for vertical type)	Without ground	---	---	---
		With ground	---	---	---
	Flat type and others	Without ground	---	---	---
		With ground	---	---	---
	Projected type	Without ground	---	---	---
		With ground	---	---	---
Illuminated type	Red LED	Without ground	---	---	---
	Green LED	Without ground	---	---	---
	Yellow LED	Without ground	---	---	---
Life expectancy (operations)			500,000	300,000	100,000
Packaging	Bag (standard)		100		100
	Box (standard)		1,500/box		1,500/box
	Stick (Add S to end of model number.)		---		---
	Embossed tape (Add P to end of model number.)		1,000/reel		3,000/reel
Key top (projected type)	4 x 4 mm		---		---
	9 x 9 mm		---		---
	12 x 12 mm		---		---
Page			21		24

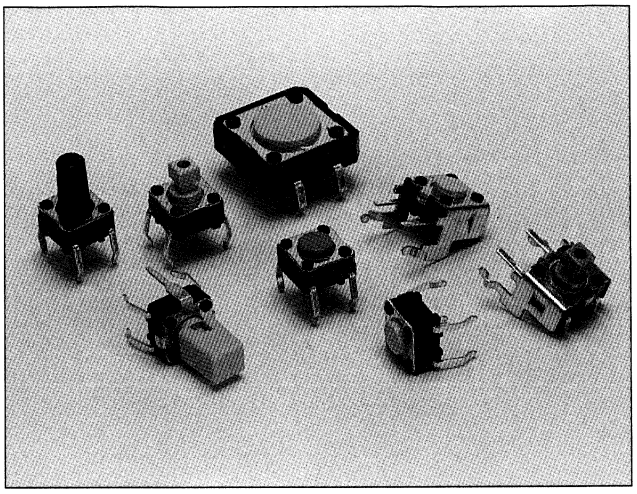
OMRON

Mechanical Key Switch

B3F

A Wide Range of Models: 6 x 6 mm, 12 x 12 mm, Vertical and High-force.

- Excellent tactile feel combined with high life expectancy.
- Available in stick packaging for automatic mounting to PCBs.
- Up to 2.55 N (260-gf) operating force for a firmer operating touch.
- Pushbuttons available in nine colors.

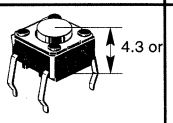
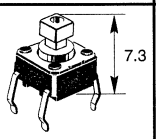
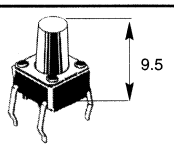
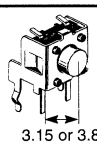
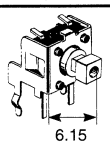


Ordering Information

6 x 6 mm Models

Type	Plunger	Height x pitch	Operating force (OF)	Without ground terminal		With ground terminal	
				Bags *	Sticks (90/stick)	Bags *	Sticks (75/stick)
Standard (B3F-1□□□)	Flat	4.3 x 6.5 mm	0.98 N (100 gf)	B3F-1000	B3F-1000S	B3F-1100	B3F-1100S
			1.47 N (150 gf)	B3F-1002	B3F-1002S	B3F-1102	B3F-1102S
			2.55 N (260 gf)	B3F-1005	B3F-1005S	B3F-1105	B3F-1105S
		5.0 x 6.5 mm	0.98 N (100 gf)	B3F-1020	B3F-1020S	B3F-1120	B3F-1120S
			1.47 N (150 gf)	B3F-1022	B3F-1022S	B3F-1122	B3F-1122S
			2.55 N (260 gf)	B3F-1025	B3F-1025S	B3F-1125	B3F-1125S
		5.0 x 7.5 mm	0.98 N (100 gf)	---	---	B3F-1110	---
	Projected	7.3 x 6.5 mm	0.98 N (100 gf)	B3F-1050	B3F-1050S	B3F-1150	B3F-1150S
			1.47 N (150 gf)	B3F-1052	B3F-1052S	B3F-1152	B3F-1152S
			2.55 N (260 gf)	B3F-1055	B3F-1055S	B3F-1155	B3F-1155S
	Extended	9.5 x 6.5 mm	0.98 N (100 gf)	B3F–1070	---	---	---
Vertical (B3F-3□□□)	Flat	3.15 mm	0.98 N (100 gf)	---	---	B3F-3100	---
			1.47 N (150 gf)	---	---	B3F-3102	---
			2.55 N (260 gf)	---	---	B3F-3105	---
		3.85 mm	0.98 N (100 gf)	---	---	B3F-3120	---
			1.47 N (150 gf)	---	---	B3F-3122	---
			2.55 N (260 gf)	---	---	B3F-3125	---
	Projected	6.15 mm	0.98 N (100 gf)	---	---	B3F-3150	---
			1.47 N (150 gf)	---	---	B3F-3152	---
			2.55 N (260 gf)	---	---	B3F-3155	---

* (100 / bag)

Plunger type	Flat	Projected	Extended	Flat (vertical)	Projected (vertical)
Appearance					

12 x 12 mm Models

Type	Plunger (or LED color)	Height x pitch	Operating force (OF)	Without ground terminal		With ground terminal	
				Bags **	Sticks (45/stick)*	Bags **	Sticks (45/stick)
Standard (B3F-4□□□)	Flat	4.3 x 12.5 mm	1.27 N (130 gf)	B3F-4000	B3F-4000S	B3F-4100	B3F-4100S
			2.55 N (260 gf)	B3F-4005	B3F-4005S	B3F-4105	B3F-4105S
	Projected	7.3 x 12.5 mm	1.27 N (130 gf)	B3F-4050	B3F-4050S	B3F-4150	B3F-4150S
			2.55 N (260 gf)	B3F-4055	B3F-4055S	B3F-4155	B3F-4155S
Long life expectancy (B3F-5□□0)	Flat	4.3 x 12.5 mm	1.27 N (130 gf)	B3F-5000	B3F-5000S	B3F-5100	B3F-5100S
	Projected	7.3 x 12.5 mm		B3F-5050	B3F-5050S	B3F-5150	B3F-5150S
High reliability gold-plated (B3F-5□□1)	Flat	4.3 x 12.5 mm	1.27 N (130 gf)	B3F-5001	B3F-5001S	B3F-5101	B3F-5101S
	Projected	7.3 x 12.5 mm		B3F-5051	B3F-5051S	B3F-5151	B3F-5151S
Surface illumination (B3F-9□□□)	Red LED	7.3 x 12.5 mm	1.27 N (130 gf)	---	B3F-9100	---	---
	Green LED			---	B3F-9200	---	---
	Yellow LED			---	B3F-9300	---	---

* 36 per stick for B3F-9□□□.
** (100 / bag)

■ Accessories (order separately)

Special keytops are available for projected plunger models. See page 27 (Product B32).

Specifications

■ Ratings

Switching capacity	5 to 24 VDC, 1 to 50 mA (resistive load)
Insulation voltage	30 VDC

■ Characteristics

Contact form	SPST-NO
Contact resistance	100 mΩ max. (at 5 VDC, 1 mA; initial value.)
Insulation resistance	100 MΩ min. (at 250 VDC)
Dielectric strength	500 VAC, 50/60 Hz for 1 min
Bounce time	5 ms max.
Vibration resistance	Malfunction: 10 to 55 Hz, 1.5 mm double amplitude
Shock resistance	Destruction: 1,000 m/s^2 min. (Approx. 100 G min.) Malfunction: 100 m/s^2 min. (Approx. 10G min.)
Life expectancy	B3F-1□□□, -3□□□: 100-gf OF: 1,000,000 operations min. 150-gf OF: 300,000 operations min. 260-gf OF: 100,000 operations min. B3F-4□□□: 130-gf OF: 3,000,000 operations min. 260-gf OF: 1,000,000 operations min. B3F-5□□□: 10,000,000 operations min. B3F-9□□□: 1,000,000 operations min.
Ambient temperature	–25°C to 70°C (with no icing)
Ambient humidity	35% to 85%
Weight	6 x 6 mm models: approx. 0.25 g 12 x 12 mm models: approx. 0.85 g

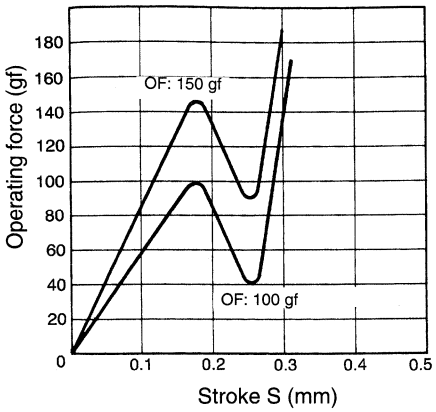
■ Operating Characteristics

Model	B3F-1□□□, -3□□□			B3F-4□□□, -5□□□, -9□□□	
	100 gf models	150 gf models	260 gf models	130 gf models	260 gf models
	B3F-1□□0, -3□□0	B3F-1□□2, -3□□2	B3F-1□□5, -3□□5	B3F-4□□0, -5□□0, -9□□0	B3F-4□□5
Operating force (OF)	0.98±0.32 N (100±30 gf)	1.47±0.49 N (150±50 gf)	2.55±0.69 N (260±70 gf)	1.27±0.49 N (130±50 gf)	2.55±0.69 N (260±70 gf)
Reset force (RF min.)	0.2 N (20 gf)	0.49 N (50 gf)	0.49 N (50 gf)	0.29 N (30 gf)	0.49 N (50 gf)
Pretravel (PT)	$0.25^{+0.2}/_{-0.1}$ mm			$0.3^{+0.2}/_{-0.1}$ mm	

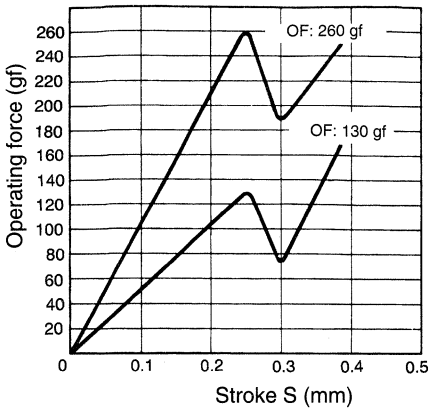
Engineering Data

Operating Force vs. Stroke (Typical)

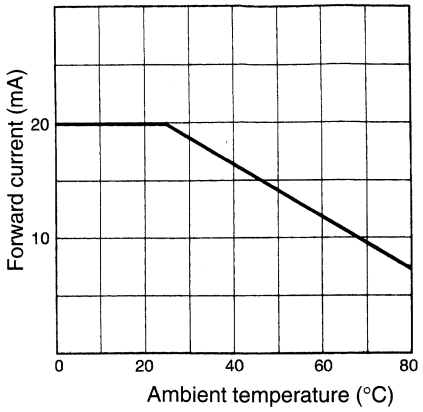
B3F-1□□□, -3□□□



B3F-4□□□, -5□□□, -9□□□



Forward Current Derating Curve

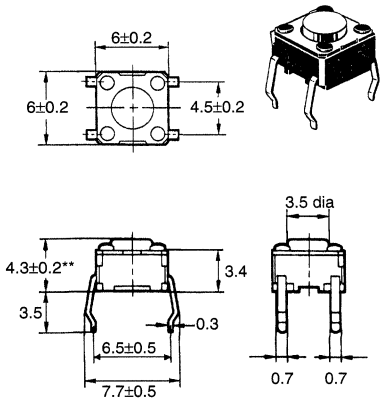


Note: To determine illuminated current of surface illumination types (B3F-9□□□), refer to the above forward current derating curve.

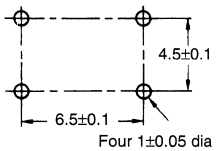
Dimensions

Note: 1. Unless otherwise stated, a tolerance of ± 0.4mm applies to all dimensions
2. No terminal numbers appear on the switches. To orient a switch in the "bottom view" position, turn it so that the terminals are on the up and down sides and the word OMRON is right-side up. (Bottom view)

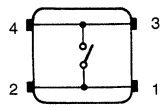
6 x 6 mm Models
Standard, Flat Plunger Type (without Ground Terminal)
B3F-1000, -1002, -1005, -1020**, -1022**, -1025**



PCB Mounting (Top View)

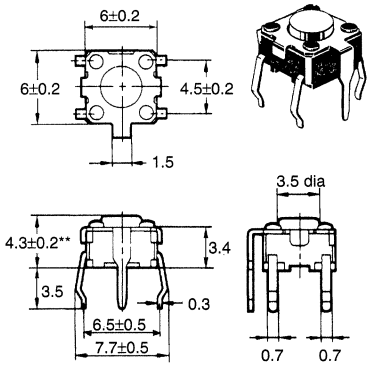


Terminal Arrangement /Internal Connections (Top View)

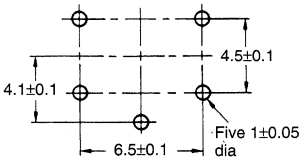


**Height of B3F-1020, -1022, -1025 is 5±0.2 mm.

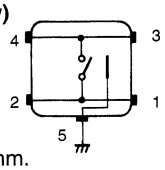
Standard, Flat Plunger Type (with Ground Terminal, Pitch: 6.5 mm)
B3F-1100, -1102, -1105, -1120**, -1122**, -1125**



PCB Mounting (Top View)

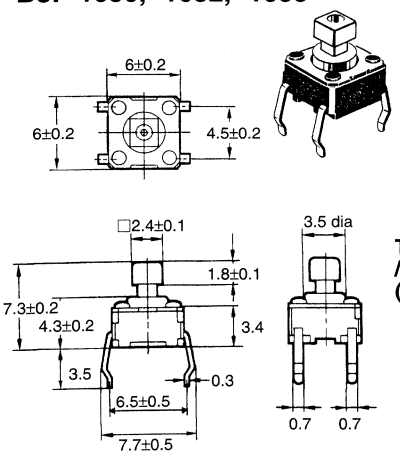


Terminal Arrangement /Internal Connections (Top View)

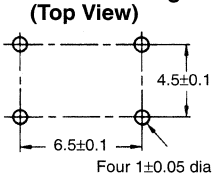


**Height of B3F-1120, -1122, -1125 is 5±0.2 mm.

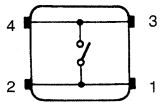
Standard, Projected Plunger Type (without Ground Terminal)
B3F-1050, -1052, -1055



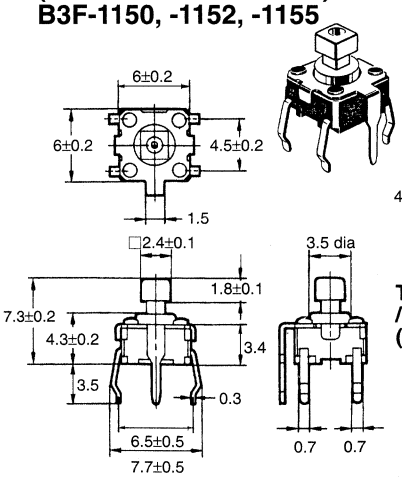
PCB Mounting (Top View)



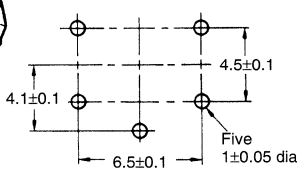
Terminal Arrangement /Internal Connections (Top View)



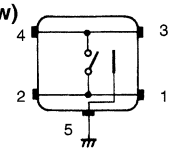
Standard, Projected Plunger Type (with Ground Terminal)
B3F-1150, -1152, -1155



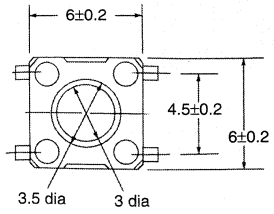
PCB Mounting (Top View)

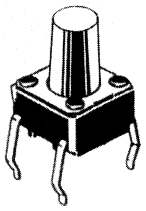


Terminal Arrangement /Internal Connections (Top View)

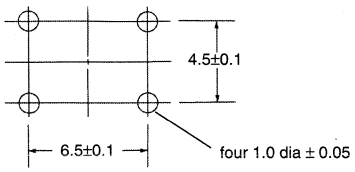


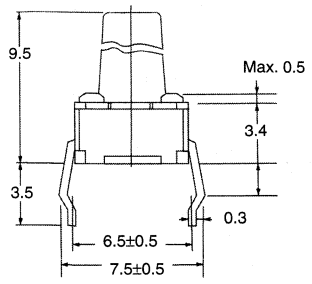
Extended Type
B3F-1070

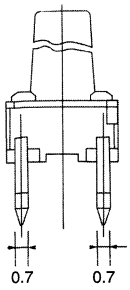




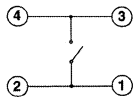
PCB Mounting (Top View)



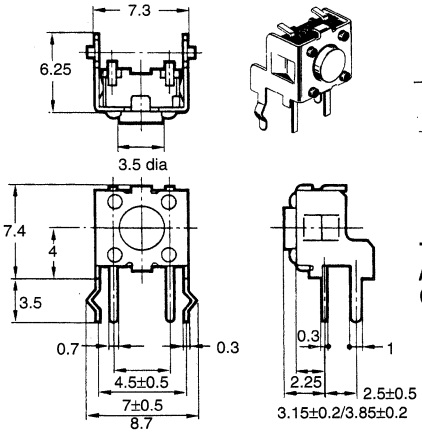




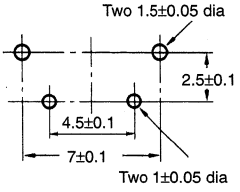
Internal Connections (Top View)



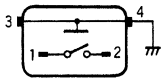
Vertical, Flat Plunger Type
(Height: 3.15 mm) B3F-3100, -3102, -3105
(Height: 3.85mm) B3F-3120, -3122, -3125



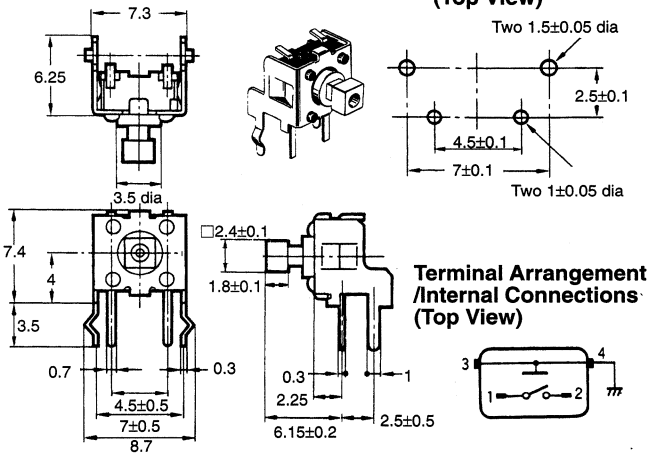
PCB Mounting (Top View)



Terminal Arrangement /Internal Connections (Top View)



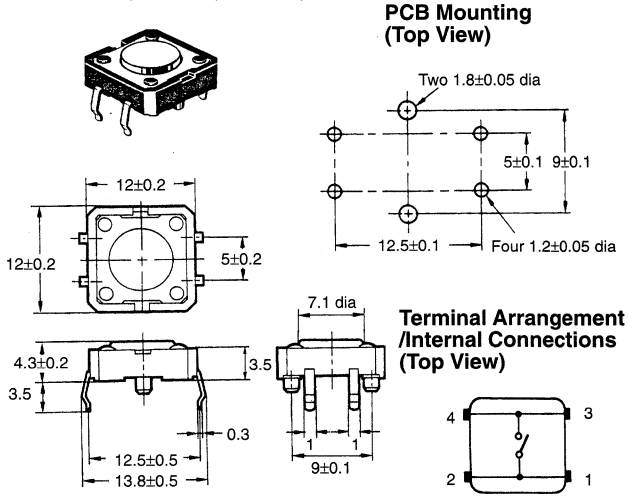
Vertical, Projected Plunger Type
(Height: 6.15 mm)
B3F-3150, -3152, -3155



PCB Mounting (Top View)

Terminal Arrangement /Internal Connections (Top View)

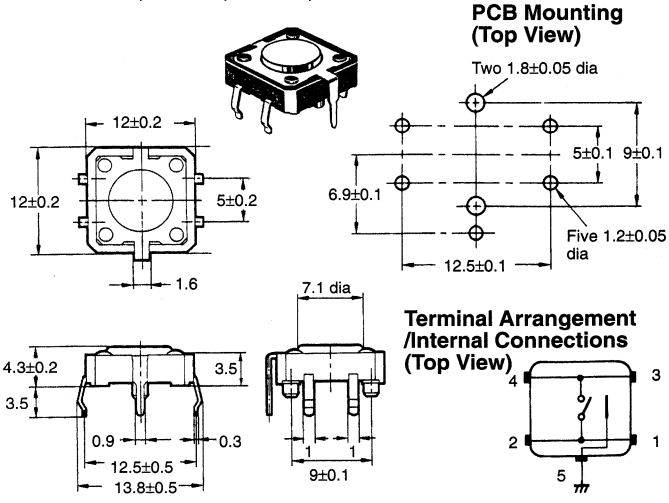
12 x 12 mm Models
Standard, Long Life Expectancy, High Reliability, Flat Plunger Type (without Ground Terminal)
B3F-4000, -4005, -5000, -5001



PCB Mounting (Top View)

Terminal Arrangement /Internal Connections (Top View)

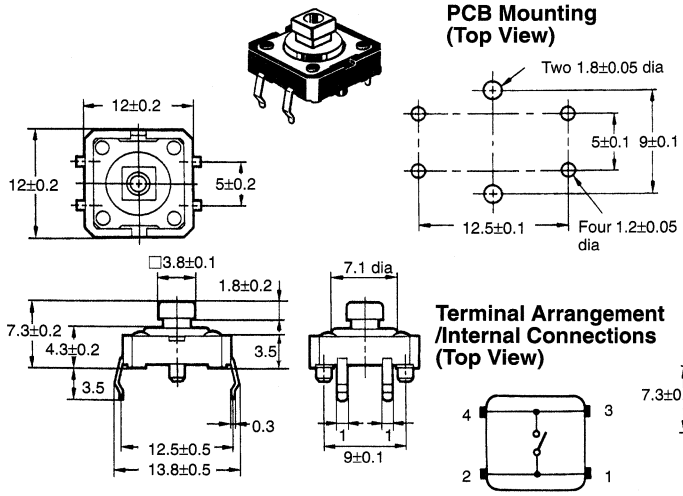
Standard, Long Life Expectancy, High Reliability, Flat Plunger Type (with Ground Terminal)
B3F-4100, -4105, -5100, -5101



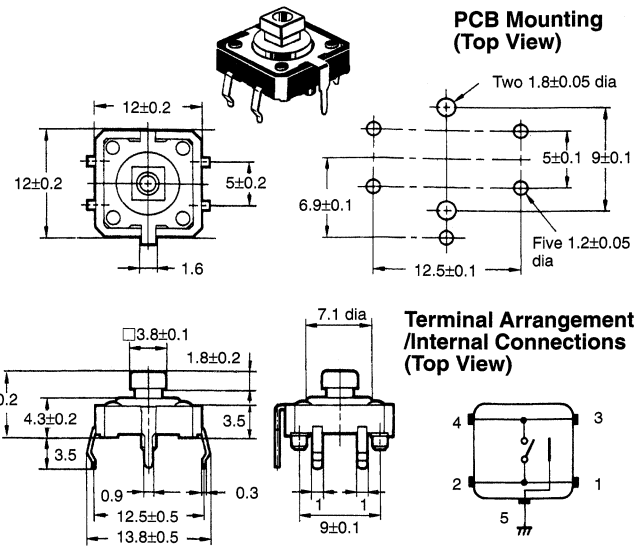
PCB Mounting (Top View)

Terminal Arrangement /Internal Connections (Top View)

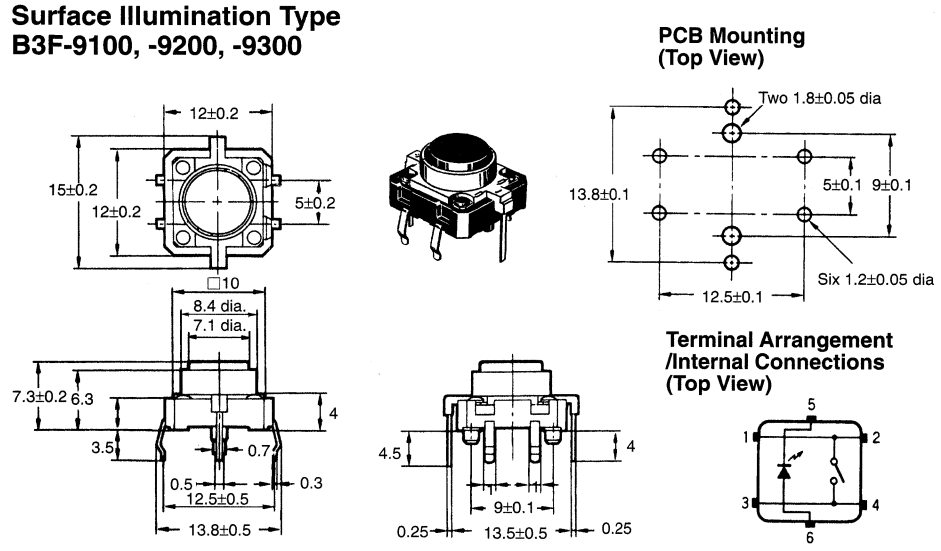
Standard, Long Life Expectancy, High Reliability, Projected Plunger Type (without Ground Terminal) B3F-4050, -4055, -5050, -5051



Standard, Long Life Expectancy, High Reliability, Projected Plunger Type (with Ground Terminal) B3F-4150, -4155, -5150, -5151

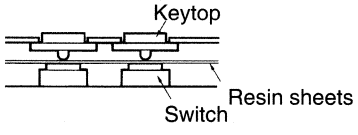


Surface Illumination Type B3F-9100, -9200, -9300



Precautions

- Do not apply additional force to the plunger once it has stopped moving.
- Solder at 260°±5°C within five seconds and within two tries.
- Do not wash the switches. The switches may be damaged by solvents if either wiped off using solvents or immersed in solvents.
- Do not allow flux or flux foam to penetrate onto the component side of the PCB.
- Use a single-sided PCB with a thickness of 1.6 mm. The switches may be damaged due to instability or heat from soldering if other PCBs (other thickness or through holes) are used. If it is necessary to use another PCB, test the compatibility and processing in advance.
- The switches are not sealed and should be protected with a resin sheet as shown below when used in dust-prone environments.

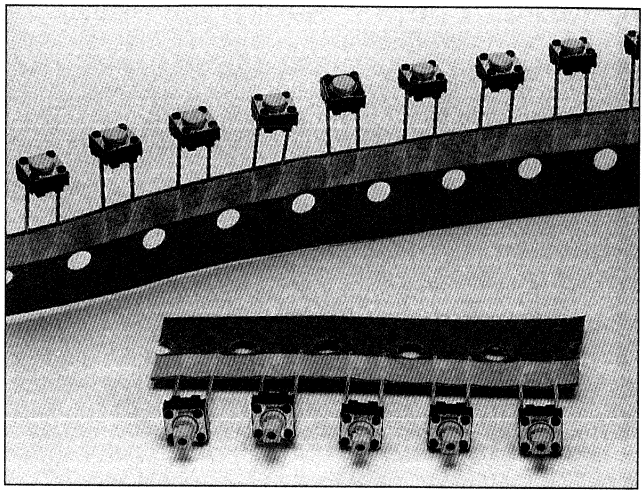


OMRON

Mechanical Key Switch (Radial) B3F-6

Taped Radial Switches

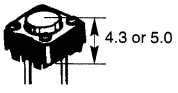
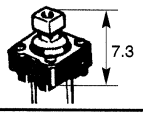
- Automatic mounting possible via general-purpose radial taped component inserters.
- Conform to EIAJ RC 1008A *Electronic Component Taping Dimensions.*
- The same snap-action contact construction as the B3F Series for a definite click action.
- Available with ground terminals for protection against static electricity.



Ordering Information

Type	Plunger	Height x pitch	Operating force (OF)		Without ground terminal	With ground terminal
6 x 6 mm B3F-6000	Flat type	4.3 x 6.5 mm	General purpose	0.98 N (100 gf)	B3F-6000	B3F-6100
			High-force	1.47 N (150 gf)	B3F-6002	B3F-6102
			Ultra high-force	2.55 N (260 gf)	B3F-6005	B3F-6105
		5.0 x 6.5 mm	General purpose	0.98 N (100 gf)	B3F-6020	B3F-6120
			High-force	1.47 N (150 gf)	B3F-6022	B3F-6122
	Projected type	7.3 x 6.5 mm	General purpose	0.98 N (100 gf)	B3F-6050	B3F-6150
			High-force	1.47 N (150 gf)	B3F-6052	B3F-6152

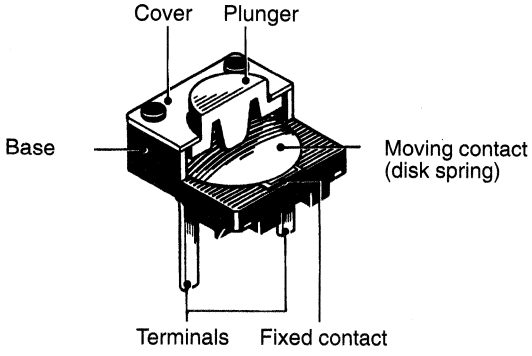
Note: The above switches must be ordered in units of 1,000.

Plunger type	Flat	Projected
Appearance		

■ Accessories (order separately)

Special keytops are available for projected plunger models. See page 27 (Product B32).

Structure



Specifications

■ Ratings

Switching capacity	5 to 24 VDC, 1 to 50 mA (resistive load)
Insulation voltage	30 VDC

■ Characteristics

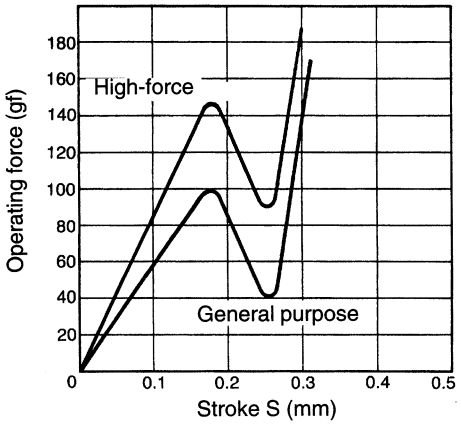
Contact configuration	SPST-NO
Contact resistance	100 mΩ max. (at 5 VDC, 1 mA)
Insulation resistance	100 MΩ min. (at 250 VDC)
Dielectric strength	500 VAC, 50/60 Hz for 1 min
Bounce time	5 ms max.
Vibration resistance	Malfunction: 10 to 55 Hz, 1.5-mm double amplitude
Shock resistance	Destruction: 1,000 m/s^2 min. (approx. 100G min.) Malfunction: 100 m/s^2 min. (approx. 10G min.)
Life expectancy	General type: 1,000,000 operations min. High-force type: 300,000 operations min.
Ambient temperature	–25°C to 70°C (with no icing)
Ambient humidity	35% to 85%
Weight	Approx. 0.25 g (flat plunger type, without ground terminal)

■ Operating Characteristics

Model	**B3F-6000**	
	General purpose	**High-force**
Operating force (OF)	0.98±0.32 N (100±30 gf)	1.47±0.49 N (150±50 gf)
Reset force (RF min.)	0.2 N (20 gf)	0.49 N (50 gf)
Pretravel (PT)	$0.25^{+0.2}/_{-0.1}$ mm	

Engineering Data

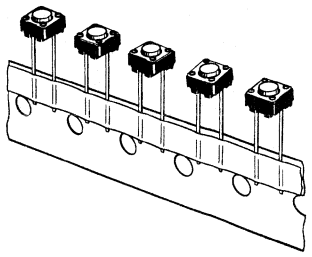
Operating Force vs. Stroke (Typical)
B3F-6000

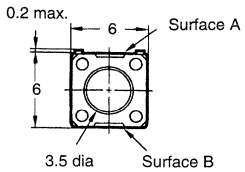


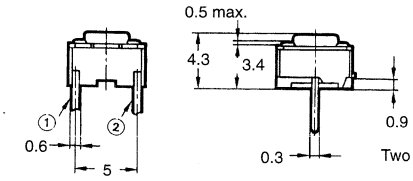
Dimensions

Note: Unless otherwise specified, a tolerance of ±0.4 mm applies to all dimensions.

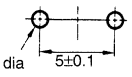
Flat Plunger Type (without Ground Terminal) B3F-6000, -6002, -6005



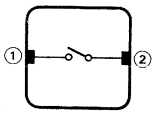




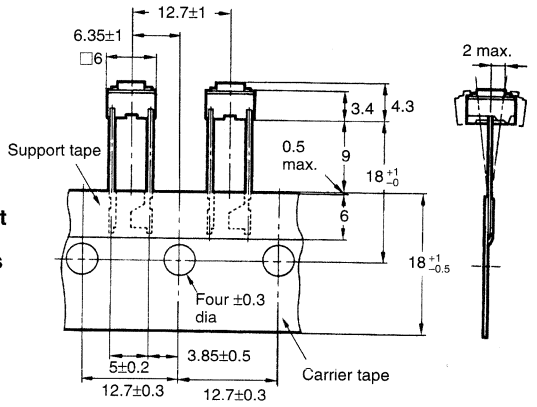
PCB Mounting (Top View)



Terminal Arrangement /Internal Connections (Top View)

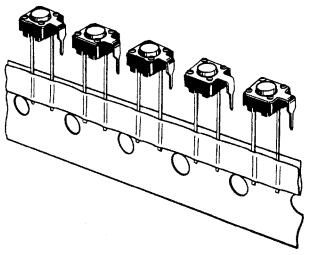


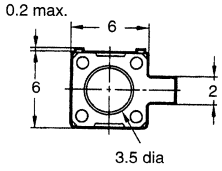
Tape-packaging Dimensions

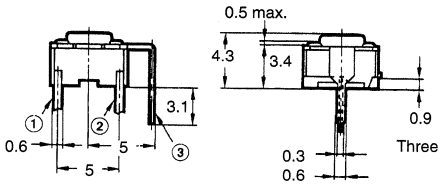


Note: The tape is random between surface A and surface B.

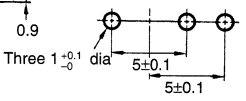
Flat Plunger Type (with Ground Terminal) B3F-6100, -6102, -6105



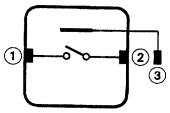




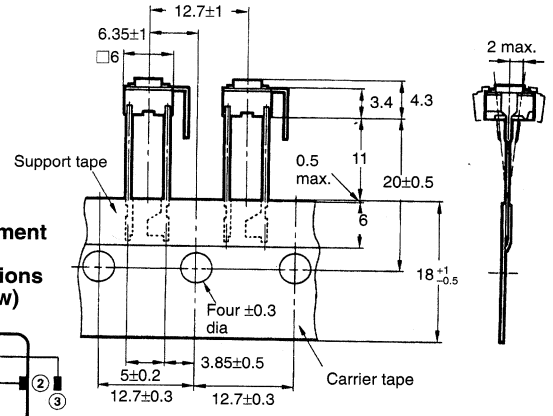
PCB Mounting (Top View)



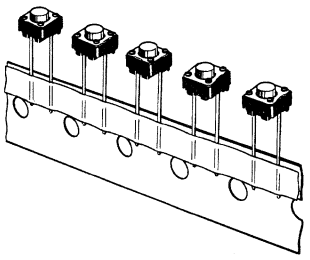
Terminal Arrangement /Internal Connections (Top View)

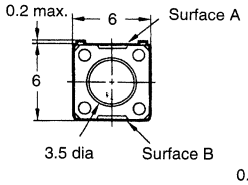


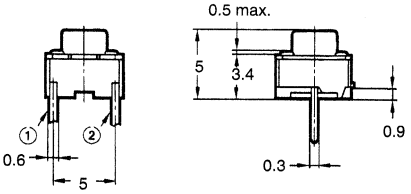
Tape-packaging Dimensions



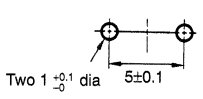
Flat Plunger Type (without Ground Terminal) B3F-6020, -6022



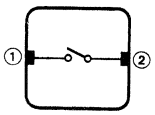




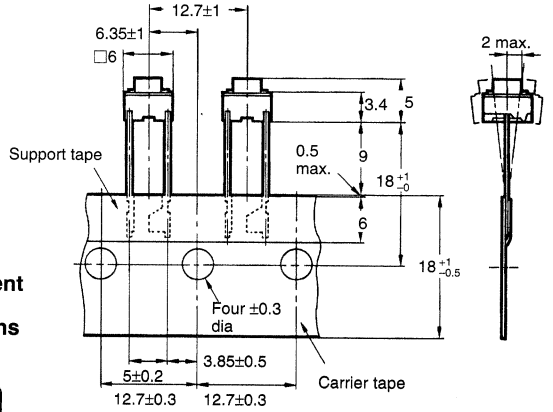
PCB Mounting (Top View)



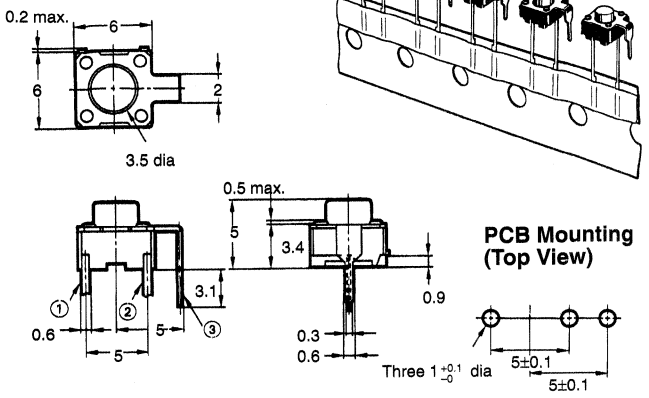
Terminal Arrangement /Internal Connections (Top View)



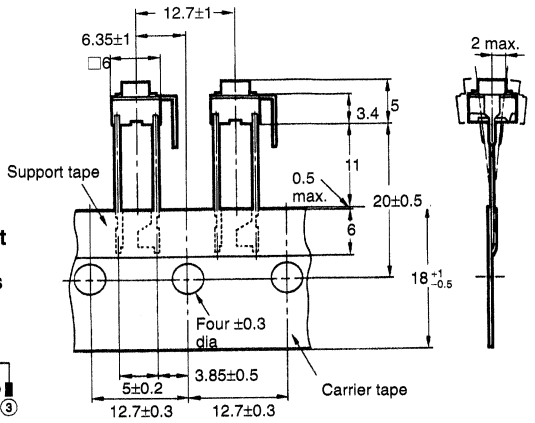
Tape-packaging Dimensions



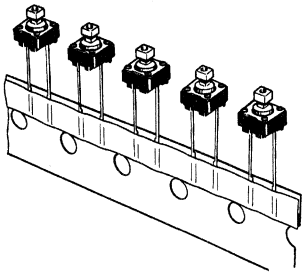
Flat Plunger Type (with Ground Terminal) B3F-6120, -6122

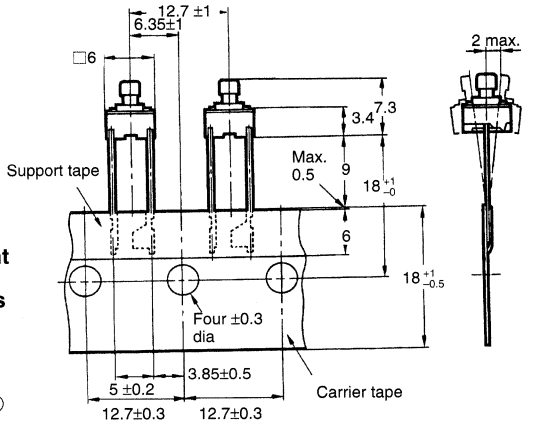


Tape-packaging Dimensions

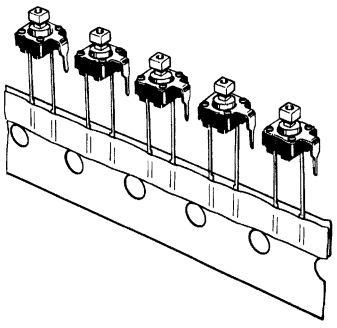


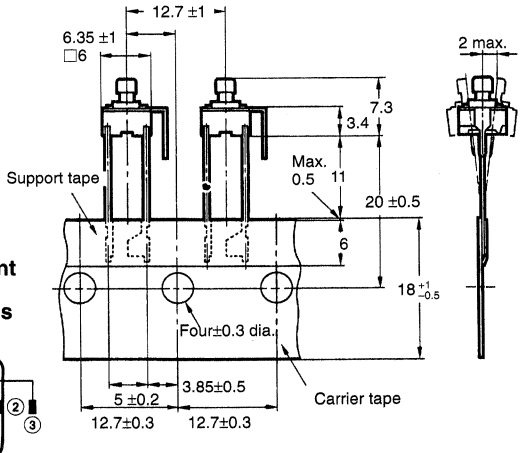
Projected Plunger Type (without Ground Terminal) B3F-6050, -6052





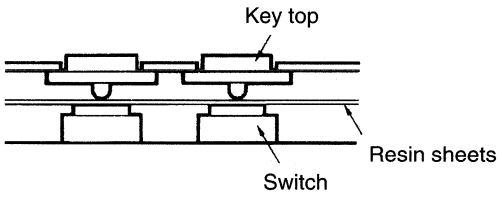
Projected Plunger Type (with Ground Terminal) B3F-6150, -6152





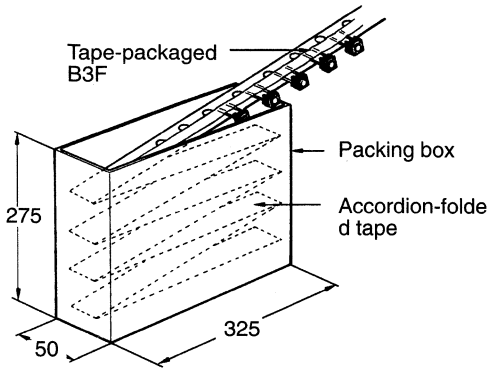
Precautions

- Use a single-sided PCB with a thickness of 1.6 mm. The switches may be damaged due to instability or heat from soldering if other PCBs (other thickness or through holes) are used. If is it necessary to use another PCB, test the compatibility and processing in advance.
- Do not apply additional force to the plunger once it has stopped moving.
- Solder at 260°±5°C within five seconds and within two tries.
- Do not wash the switches. The switches may be damaged by solvents if either wiped off using solvents or immersed in solvents.
- Do not allow flux or flux foam to penetrate onto the component side of the PCB.
- Do not apply force to switches packaged on tape, drop them in the packing box, or otherwise subject them to undue force. Doing so may damage the pins.
- The switches are not sealed and should be protected with a resin sheet as shown below when used in dust-prone environments.

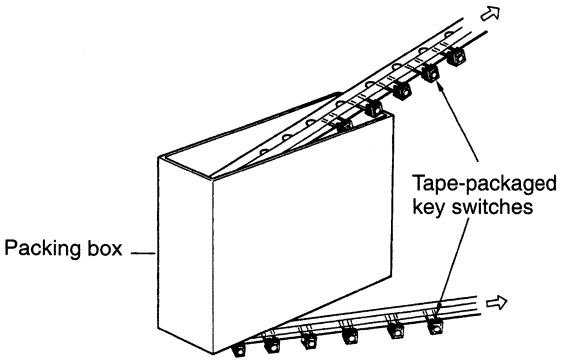


■ Key Switch Packing

- Key switches packed on tape are placed into packing boxes as shown below.



- Tape may be drawn from the box either from the top or from the bottom.

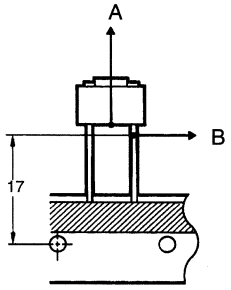


- Number of switches per box: 1,000

Taping Strength

The key switches will not release from the tape when pulled in directions A and B at the following forces.

A: 4.9 N (500 gf)
B: 0.98 N (100 gf)



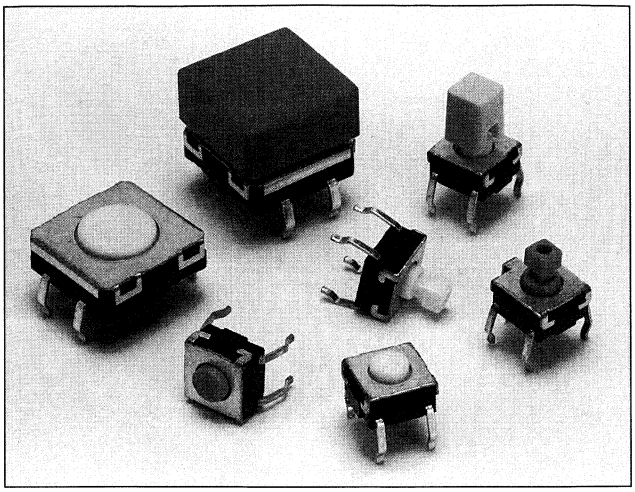
OMRON

Mechanical Key Switch (Washable)

B3W

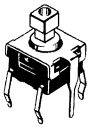
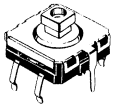
Sealed for Submersed Washing after Soldering

- Thin, compact construction in both 12 x 12 mm and 6 x 6 mm sizes.
- Snap-action contact construction for positive tactile feedback.
- Available with ground terminals for protection against static electricity.
- Sealed construction also provides high reliability in dusty environments.



Ordering Information

Type	Plunger	Operating force (OF)		Without ground terminal		With ground terminal	
				Bags*	Sticks*	Bags*	Sticks*
6 x 6 mm B3W-1□□□	Flat type	General purpose	1.57 N (160 gf)	B3W-1000	B3W-1000S	B3W-1100	B3W-1100S
		High-force	2.25 N (230 gf)	B3W-1002	B3W-1002S	B3W-1102	B3W-1102S
	Projected type	General purpose	1.57 N (160 gf)	B3W-1050	B3W-1050S	B3W-1150	B3W-1150S
		High-force	2.25 N (230 gf)	B3W-1052	B3W-1052S	B3W-1152	B3W-1152S
12 x 12 mm B3W-4□□□	Flat type	General purpose	1.96 N (200 gf)	B3W-4000	B3W-4000S	B3W-4100	B3W-4100S
		High-force	3.43 N (350 gf)	B3W-4005	B3W-4005S	B3W-4105	B3W-4105S
	Projected type	General purpose	1.96 N (200 gf)	B3W-4050	B3W-4050S	B3W-4150	B3W-4150S
		High-force	3.43 N (350 gf)	B3W-4055	B3W-4055S	B3W-4155	B3W-4155S

Plunger type	Flat	Projected	Flat (vertical)	Projected (vertical)
Appearance				

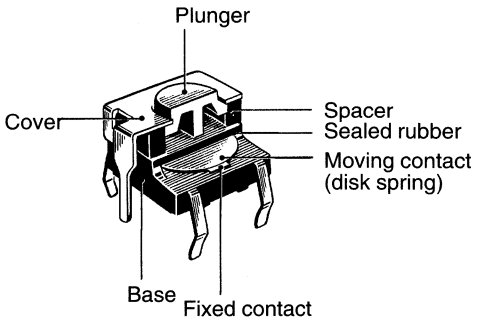
* The number of switches per stick/bag is as follows:

Size	Without ground	With ground
6 x 6 mm	80/stick, 100/bag	75/stick, 100/bag
12 x 12 mm	45/stick, 100/bag	40/stick, 100/bag

■ Accessories (Order Separately)

Special keytops are available for projected switch models. See page 27 (Product B32).

Structure



Specifications

■ Ratings

Switching capacity	5 to 24 VDC, 1 to 50 mA (resistive load)
Insulation voltage	30 VDC

■ Characteristics

Contact configuration	SPST-NO
Contact resistance	100 mΩ max. (Rated 5 VDC, 1 mA)
Insulation resistance	100 MΩ min. (at 250 VDC)
Dielectric strength	500 VAC, 50/60 Hz for 1 min
Bounce time	5 ms max.
Vibration resistance	Malfunction: 10 to 55 Hz, 1.5 mm double amplitude
Shock resistance	Destruction: 1,000 m/s^2 min. (Approx. 100 G min.) Malfunction: 100 m/s^2 min. (Approx. 10 G min.)
Life expectancy	B3W-1000: General purpose: 1,000,000 operations min. High-force: 300,000 operations min. B3W-4000: General purpose: 3,000,000 operations min. High-force: 1,000,000 operations min.
Ambient temperature	-25°C to 70°C (with no icing)
Ambient humidity	35% to 85%
Weight	6 x 6 mm: approx. 0.3 g, 12 x 12: approx. 1.00 g

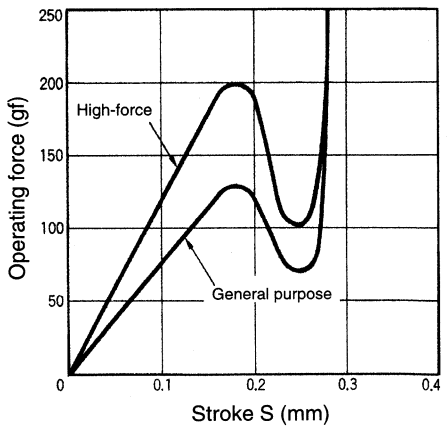
■ Operating Characteristics

Item	B3W-1000		B3W-4000	
	General purpose	High-force	General purpose	High-force
Operating force (OF)	1.57 N (160 gf max.)	2.25 N (230 gf max.)	1.96 N (200 gf max.)	3.43 N (350 gf max.)
Reset force (RF min.)	0.2 N (20 gf max.)	0.49 N (50 gf)	0.29 N (30 gf)	0.49 N (50 gf)
Pretravel (PT)	$0.25^{+0.2}_{-0.1}$ mm		$0.3^{+0.2}_{-0.1}$ mm	

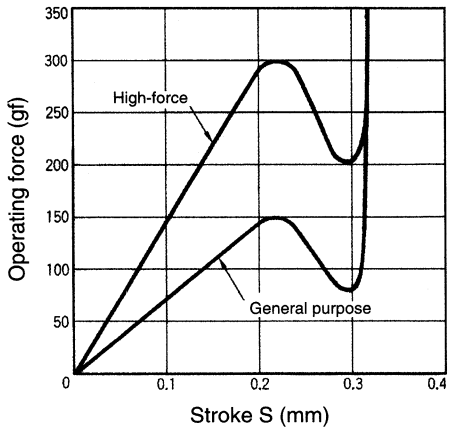
Engineering Data

Operating Force vs. Stroke (Typical)

B3W-1□□□



B3W-4□□□



Dimensions

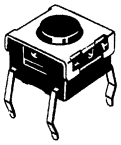
Note: 1. Unless otherwise specified, a tolerance of ± 0.4mm applies to all dimensions.

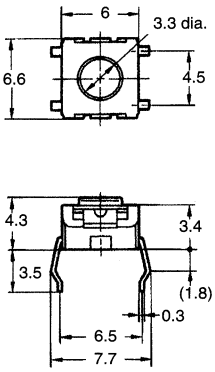
2. No terminal numbers appear on the switches. To orient a switch in the "bottom view" position, turn it so that the terminals are on the up and down sides and the word OMRON is right-side up.

(Bottom view)

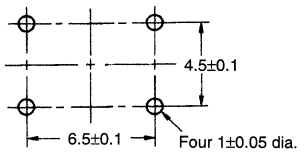
■ 6 x 6 mm Models

Flat Plunger Type (without Ground Terminal) B3W-1000, -1002

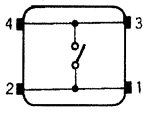




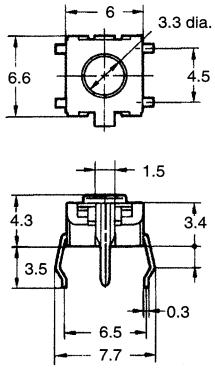
PCB Mounting (Top View)



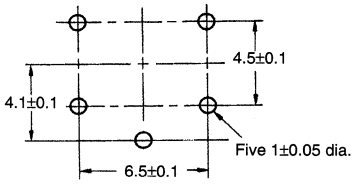
Terminal Arrangement /Internal Connections (Top View)



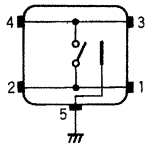
Flat Plunger Type (with Ground Terminal) B3W-1100, -1102



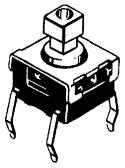
PCB Mounting (Top View)

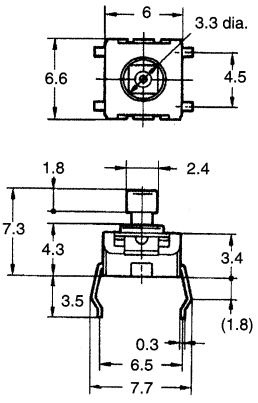


Terminal Arrangement /Internal Connections (Top View)

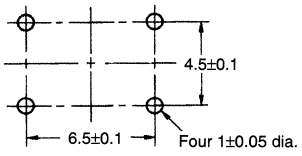


Projected Plunger Type (without Ground Terminal) B3W-1050, -1052

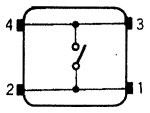




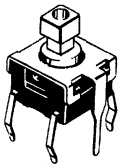
PCB Mounting (Top View)

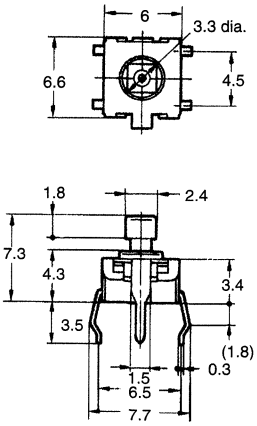


Terminal Arrangement /Internal Connections (Top View)

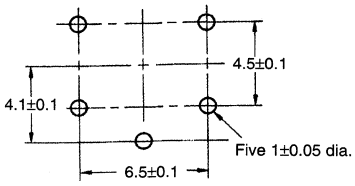


Projected Plunger Type (with Ground Terminal) B3W-1150, -1152

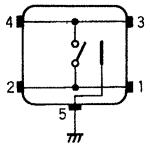




PCB Mounting (Top View)

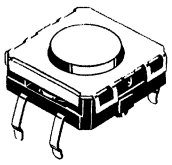


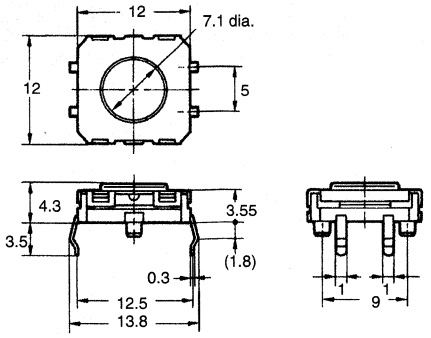
Terminal Arrangement /Internal Connections (Top View)



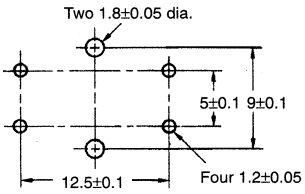
■ 12 x 12 mm Models

Flat Plunger Type (without Ground Terminal) B3W-4000, -4005

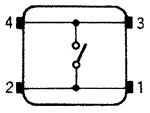




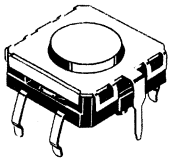
PCB Mounting (Top View)

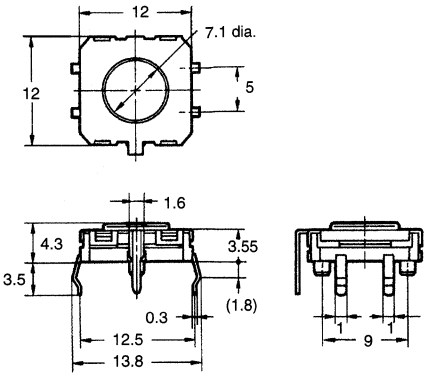


Terminal Arrangement /Internal Connections (Top View)

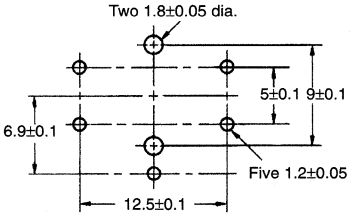


Flat Plunger Type (with Ground Terminal) B3W-4100, -4105

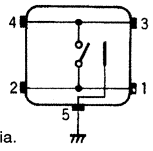




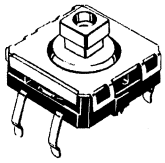
PCB Mounting (Top View)

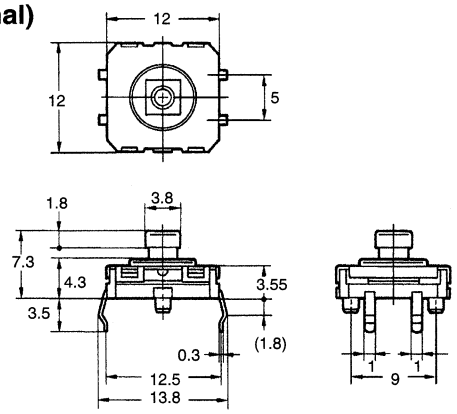


Terminal Arrangement /Internal Connections (Top View)

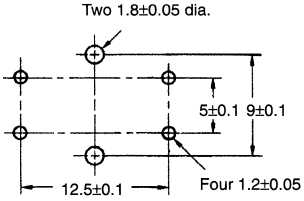


Projected Plunger Type (without Ground Terminal) B3W-4050, -4055

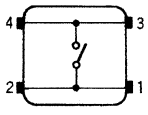




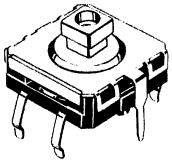
PCB Mounting (Top View)

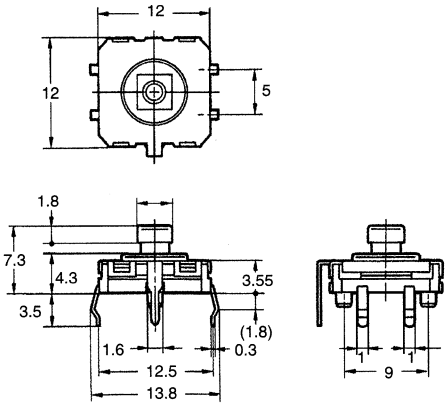


Terminal Arrangement /Internal Connections (Top View)

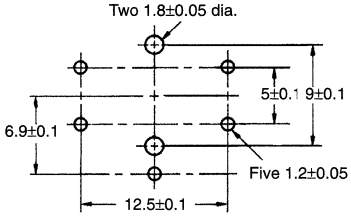


Projected Plunger Type (with Ground Terminal) B3W-4150, -4155

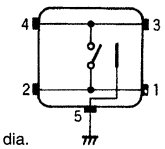




PCB Mounting (Top View)



Terminal Arrangement /Internal Connections (Top View)



Precautions

- Do not apply additional force to the plunger once it has stopped moving.
- Do not allow flux or flux foam to penetrate onto the component side of the PCB.
- Use a single-sided PCB with a thickness of 1.6 mm. The switches may be damaged due to instability or heat from soldering if other PCBs (other thickness or through holes) are used. If is it necessary to use another PCB, test the compatibility and processing in advance.
- Do not repeatedly press the plunger off-centre or from an acute angle.
- B3W Switches are designed to allow submersed washing after soldering. When washing, please follow the guidelines given as follows:

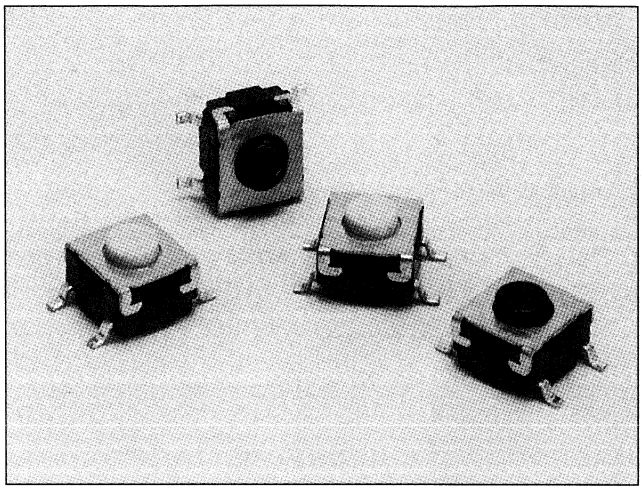
1. Clean with alcohol solvents. Do not use chlorine solvents or water.
2. When using ultrasonic cleaning in 2- or 3-tank systems, do not clean for more than 1 minute at a time or for more than 3 minutes total.
3. Do not apply external force to the switch during washing.
4. Do not wash immediately after soldering. Allow components to stand for at least 3 minutes before washing if possible.
5. Solder at 260°±5°C and within 2 tries.
6. The switch cannot be used where subject to direct contact with water.

Mechanical Key Switch (SMD)

B3S

Surface-mount Switch for High-density Mounting

- Sealed for submerged washing after soldering.
- Available with ground terminals for protection against static electricity.
- Sealed construction also provides high reliability in dusty environments.

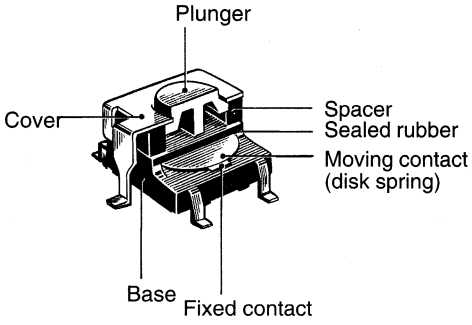


Ordering Information

Type	Operating Force (OF)	Without ground terminal		With ground terminal	
		Bags (100/bag)	Embossed tape*	Bags (100/bag)	Embossed tape*
6x6mm type B3S-1❑❑❑	General purpose: 160gf (1.57N)	B3S–1000	B3S–1000P	B3S–1100	B3S–1100P
	High-force: 230gf (2.25N)	B3S–1002	B3S–1002P	B3S–1102	B3S–1102P

* Switches on embossed tape must be ordered in units of 1,000.

Structure



Specifications

■ Ratings

Switching capacity	5 to 24 VDC, 1 to 50 mA (resistive load)
Insulation voltage	30 VDC

■ Operating Characteristics

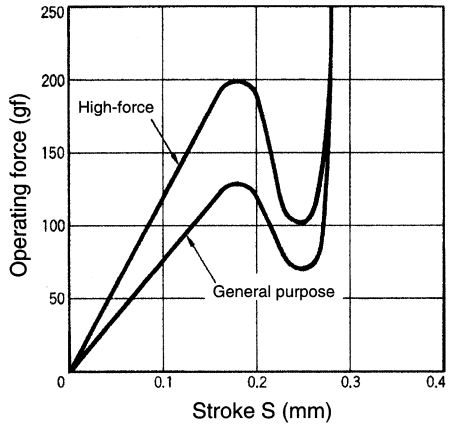
Item	B3S-1000/2	
	General purpose	High-force
Operating force (OF)	160 gf max. (1.57N)	230 gf max. (2.25N)
Reset force (RF min.)	20 gf min. (0.2N)	50 gf (0.49N)
Pretravel (PT)	$0.25^{+0.2}/_{-0.1}$ mm	

■ Characteristics

Contact configuration	SPST-NO
Contact resistance	100 mΩ max. (at 5 VDC, 1 mA)
Insulation resistance	100 MΩ min. (at 250 VDC)
Dielectric strength	500 VAC, 50/60 Hz for 1 min
Bounce time	5 ms max.
Vibration	Malfunction: 10 to 55 Hz, 1.5-mm double amplitude
Shock	Destruction: 1,000 m/s^2 min. (approx. 100G min.) Malfunction: 100 m/s^2 min. (approx. 10G min.)
Life expectancy	General type: 500,000 operations High-force type: 300,000 operations
Ambient temperature	–25°C to 70°C (with no icing)
Ambient humidity	35% to 85%
Weight	Approx. 0.3 g

Engineering Data

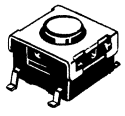
Operating Force vs. Stroke (Typical)

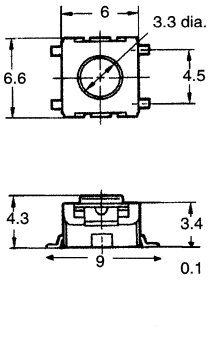


Dimensions

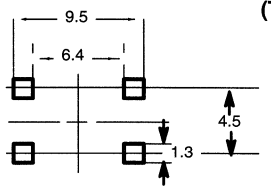
Note: 1. Unless otherwise specified, a tolerance of ± 0.4mm applies to all dimensions.

Without Ground Terminal
B3S-1000, -1002

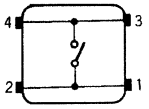




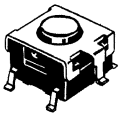
PCB Mounting (Top View)

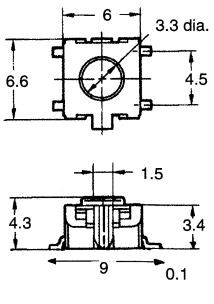


Terminal Arrangement /Internal Connections (Top View)

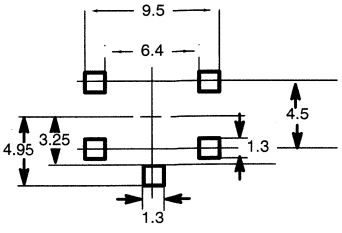


With Ground Terminal
B3S-1100, -1102

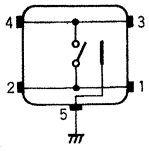




PCB Mounting (Top View)



Terminal Arrangement /Internal Connections (Top View)



Precautions

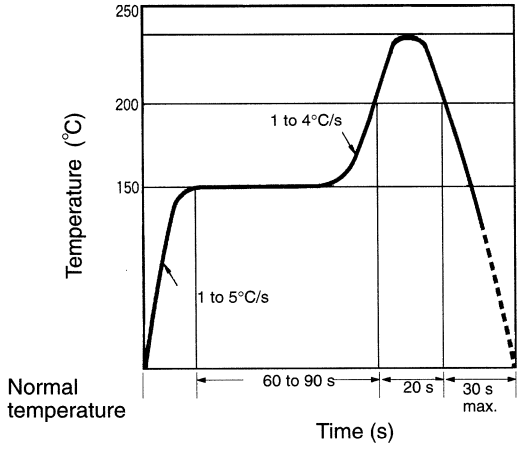
- Do not apply additional force to the plunger once it has stopped moving.
- Do not repeatedly press the plunger off-centre or from an acute angle.
- Use flourine or alcohol solvents for cleaning.

Seal Characteristics

- The seal of B3S Switches is A60 and was determined according to recognised test methods for control devices. A60 requires that no air bubbles appear when a switch is placed at a depth of 50mm in fluorocarbon FC–43 for one minute at 60° to 65°C.
- B3S Switches are designed to allow submersed washing after soldering. When washing, please follow the guidelines as follows:
  1. Clean with alcohol solvents. Do not use chlorine solvents or water.
  2. When using ultrasonic cleaning in two- or three-tank systems, do not clean for more than one minute at a time or for more than three minutes total.
  3. Do not apply external force to the switch while washing.
  4. Do not wash immediately after soldering. Allow components to stand for at least three minutes before washing.
  5. The switch cannot be used where subject to direct contact with water.

Reflow Soldering

Attach a thermocouple to one side of the terminal with high-temperature solder and use it to set the reflow oven to a peak terminal temperature of 250°C. The optimum heating curve is shown below.



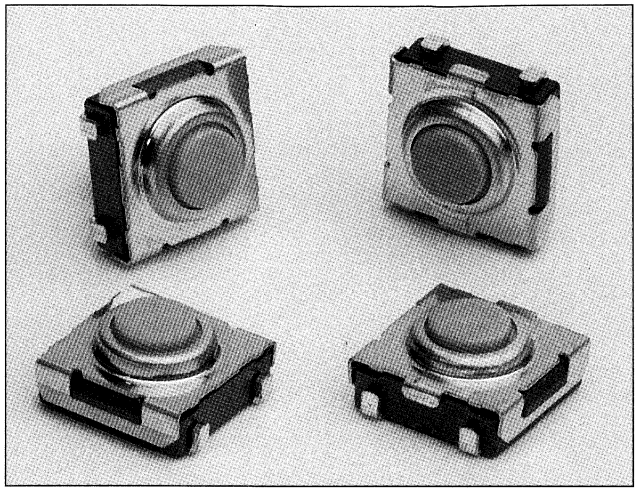
Note: The above heating curve applies if the thickness of the circuit board is 1.6 mm.

OMRON

Mechanical Key Switch (SMD) B3SN

Low Profile Surface-mounted Switch Meeting High-density Mounting Requirements

- Ideal mechanical key switch for surface-mounting.
- Compact and more than 1 mm thinner than conventional mechanical key switches.
- Available with ground terminals for protection against static electricity.
- Sealed construction provides high reliability in dusty or humid environments.



Ordering Information

Type	Bags (100/bag)	Embossed tape (see note)
Without ground terminal	B3SN-3012	B3SN-3012P
With ground terminal	B3SN-3112	B3SN-3112P

Note: Switched on embossed tape must be order in units of 3,000.

Specifications

■ Ratings/Characteristics

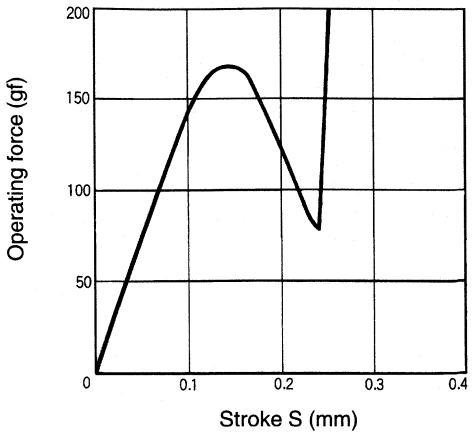
Switching capacity	5 to 24 VDC, 1 to 30 mA (resistive load)
Insulation voltage	30 VDC
Contact configuration	SPST-NO
Contact resistance	100 mΩ max. (initial value) (Rated 5 VDC, 1 mA)
Insulation resistance	100 MΩ min. (at 250 VDC)
Dielectric strength	250 VAC, 50/60 Hz for 1 min
Bounce time	5 ms max.
Vibration resistance	Malfunction: 10 to 55 Hz, 1.5-mm double amplitude
Shock resistance	Destruction: 1,000 m/s^2 min. (approx. 100G min.)
Life expectancy	50,000 operations min.
Ambient temperature	Operating: –25°C to 70°C (with no icing)
Ambient humidity	Operating: 35% to 85%
Weight	Approx. 0.2 g

■ Operating Characteristics

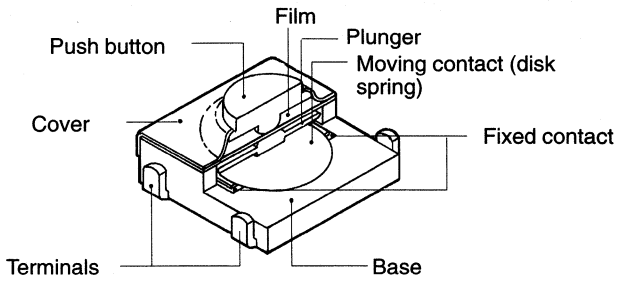
Item	Standard value
Operating force (OF max.)	1.57±0.49 N (160±50 gf)
Reset force (RF min.)	0.29 N (30 gf)
Pretravel (PT)	0.25±0.15 mm

Engineering Data

Operating Force vs. Stroke (Typical)



Nomenclature

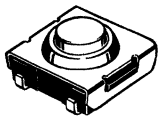


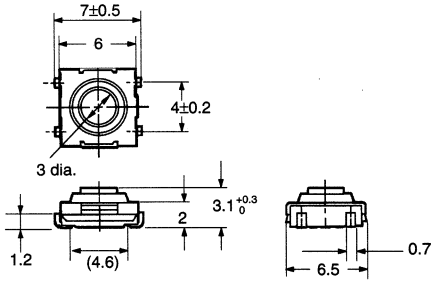
Dimensions

Note: 1. Unless otherwise specified, a tolerance of ± 0.4mm applies to all dimensions.

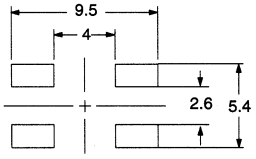
Without Ground Terminal

B3SN-3012
B3SN-3012P

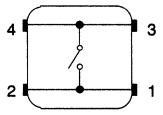




PCB Mounting (Top View)

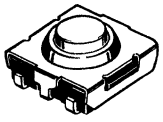


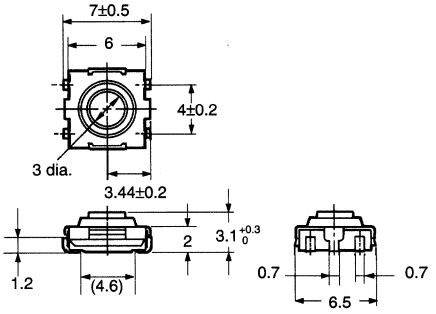
Terminal Arrangement /Internal Connections (Top View)



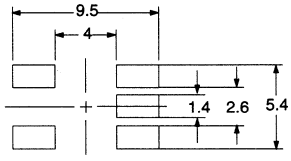
With Ground Terminal

B3SN-3112
B3SN-3112P

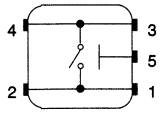




PCB Mounting (Top View)



Terminal Arrangement /Internal Connections (Top View)



Precautions

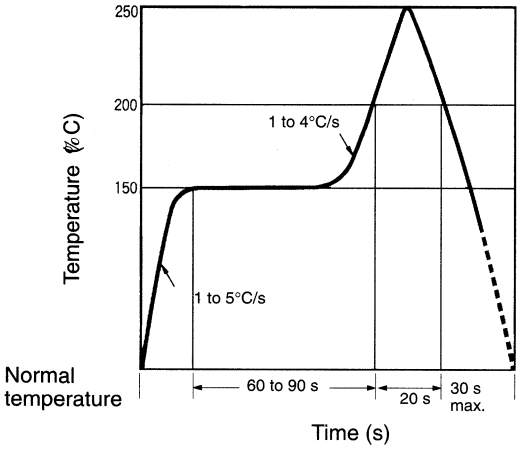
Reflow Soldering

IR Method

Attach a thermocouple to one side of the terminal with high-temperature solder and use it to set the reflow oven to a peak terminal temperature of 250°C. The optimum heating curve is shown below.

VPS Method

In the case of VPS-method soldering using fluorocarbon FC-70, the heating time must not exceed 30 seconds at a temperature more than 200°C.



Note: The above heating curve applies if the thickness of the circuit board is 1.6 mm.

Do not apply additional force to the plunger once it has stopped moving.

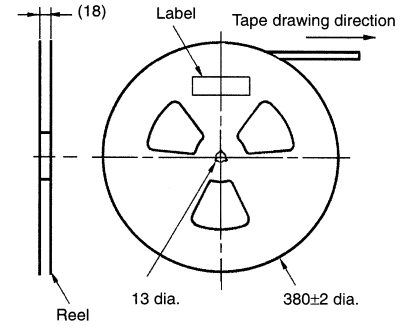
Do not repeatedly press the plunger off-center or from an acute angle.

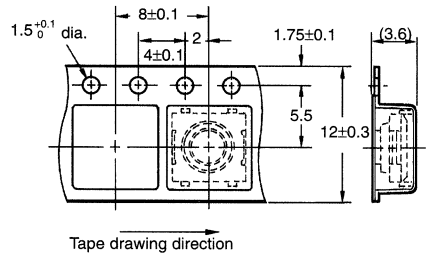
B3SN Switches are designed to allow submersed washing after soldering. When washing, follow the guidelines given as follows:

1. Clean with alcohol solvents. Do not use chlorine solvents or water.
2. When using ultrasonic cleaning in two- or three-tank systems, do not clean for more than one minute at a time or for more than three minutes total.
3. Do not apply external force to the switch while washing.
4. Do not wash immediately after soldering. Allow components to stand for at least three minutes before washing.
5. The switch cannot be used where subject to direct contact with water.

Key Switch Packing

Key switches are packed on tape as shown below.





Standard	Conform to EIAJ standards
Package	3,000 switches
Heat resistance	50°C for 24 hours (not to be deformed)

Note: The ground terminals of the switches are on the guide hole side of the package.

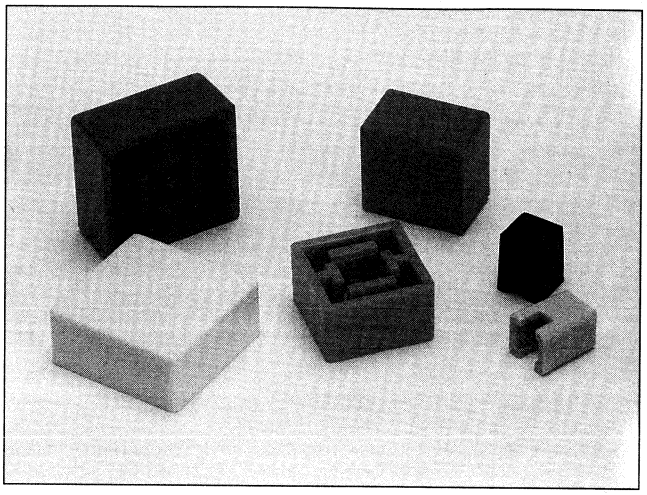
OMRON

Key Top for Mechanical Key Switches

B32

Designed Specially for Projected-plunger-type B3F and B3W Switches

- Available in a range of 9 colours.
- Three sizes of key top available.
  - 4x4mm for 6x6mm switch
  - 9x9 or 12x12mm for 12x12mm switch

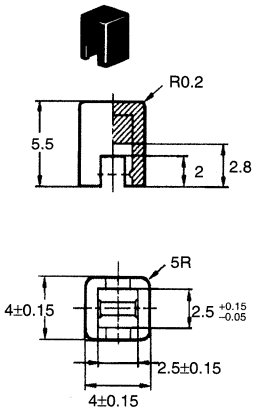


Ordering Information

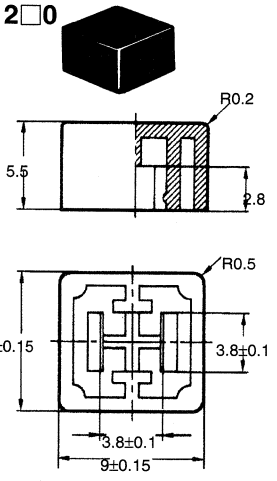
Available Colours for Key Tops	For 6 x 6 mm switches	For 12 x 12 mm switches	
	4 x 4 mm key top	9 x 9 mm key top	12 x 12 mm key top
Light grey	B32-1000	B32-1200	B32-1300
Black	B32-1010	B32-1210	B32-1310
Orange	B32-1020	B32-1220	B32-1320
Yellow	B32-1030	B32-1230	B32-1330
Blue	B32-1040	B32-1240	B32-1340
Green	B32-1050	B32-1250	B32-1350
White	B32-1060	B32-1260	B32-1360
Light green	B32-1070	B32-1270	B32-1370
Red	B32-1080	B32-1280	B32-1380

Dimensions

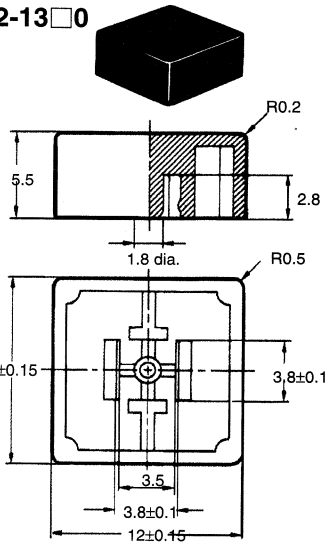
B32-10□0



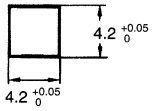
B32-12□0



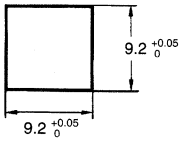
B32-13□0



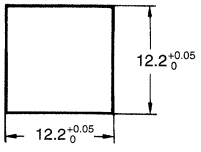
Panel Cutout of B32–10□0

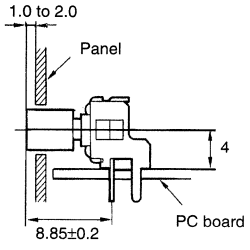


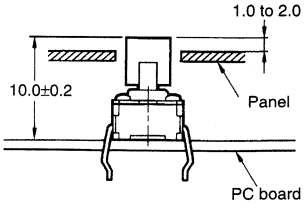
Panel Cutout of B32–12□0



Panel Cutout of B32–13□0

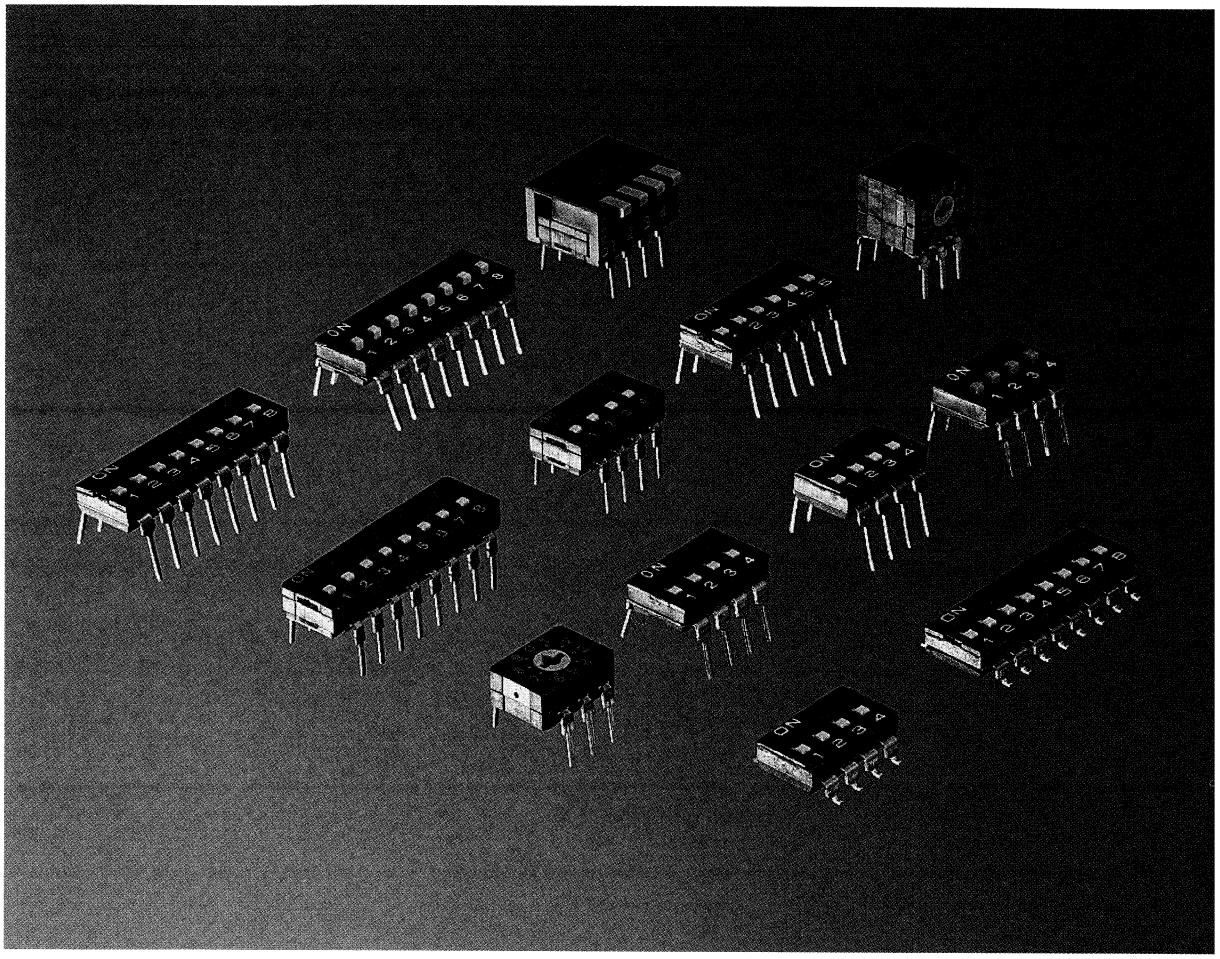


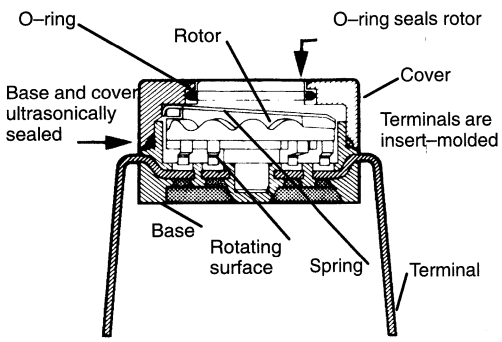
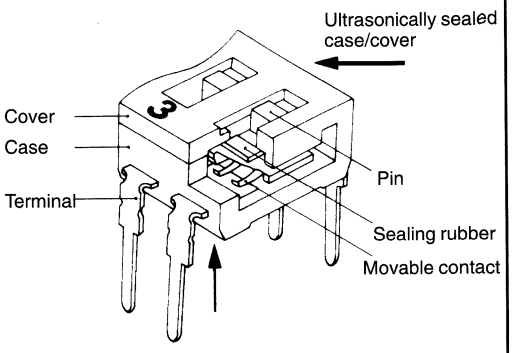


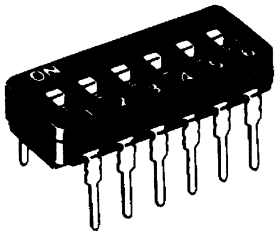
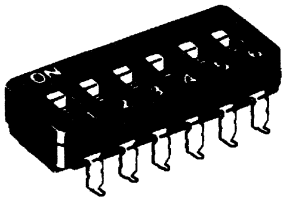


OMRON

DIP Switches



Item	A6C	A6D
Description	Rotary DIP Switch	Sealed DIP Switch
Number of Positions	10 and 16	2 to 10
Features	• Internally sealed (see below) • Top or side actuator 	• Internally sealed (see below) • Flush, raised or right angle actuator • DIL–IC auto insertable 
Page	31	34

Item	A6T	A6S
Description	Base and tape sealed DIP Switch	Surface mount DIP Switch
Number of Positions	1, 2, 4, 6, 8 and 10	2 to 10
Features	• Base sealed or top tape sealed • Flush or raised actuators • DIL–IC auto–insertible 	• Base sealed or top tape sealed • Flush or raised actuators • DIL–IC auto–insertible 
Page	36	38

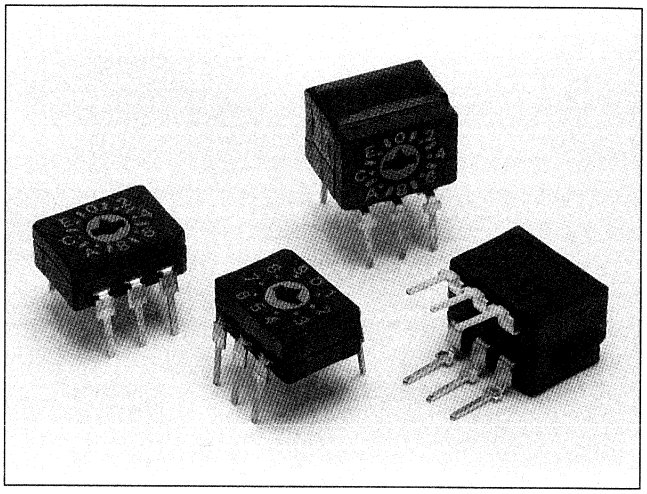
OMRON

Rotary DIP Switch

A6C

Internally Sealed DIL-IC Type Rotary DIP Switches

- Precision rotary cam/contact mechanism provides high reliability.
- Insert-moulded terminals and O-ring sealed rotor make sealing with tape unnecessary.
- Offset between terminal pins and side of case allows simple circuit inspection.



Ordering Information

No. of positions	10	16
Type/Output code	Binary-coded decimal code	Binary-coded hexadecimal code
Top actuated	A6C–10R (N) *	A6C–16R (N) *
Side actuated	A6CV–10R **	A6CV–16R **

* Supplied in tubes of 55
** Supplied in boxes of 100

Specifications

■ Ratings/Characteristics

Switching capacity	1 to 100 mA, 5 to 30VDC
Min. permissible load	10 μA, 3.5VDC
Carry current	100 mA
Contact resistance	200 mΩ max.
Insulation resistance	100 MΩ min. (at 250 VDC)
Dielectric strength	250 VAC for 1 minute between terminals of the same pole
Operating torque	100 gf–cm max. (0.98N–cm)
Vibration	Malfunction durability: 10 to 55 Hz, 1.5 mm double amplitude
Shock	Malfunction durability: Approx. 300 m/s^2 (30G)
Materials	Base/cover: PBT (Polybutylene sulfide) Rotor: PBT (Polybutylene terephthalate) O-ring: Acryl nitril butadiene rubber Movable contact: SUS plate, gold-plated Terminal: Copper alloy plate
Ambient temperature	Operating: –20°C to 70°C (with no icing)
Ambient humidity	35% to 95%
Materials	Mechanical: 10,000 operations min. Electrical: 2,000 operations min.
Weight	A6C–10R(N), –16R(N): approx 0.4g A6CV–10R, –16R: approx. 0.9g

■ Binary-coded Decimal Code

Type	A6C□–10R(N)			
Position\ Terminal No.	1	2	4	8
0				
1	♦			
2		♦		
3	♦	♦		
4			♦	
5	♦		♦	
6		♦	♦	
7	♦	♦	♦	
8				♦
9	♦			♦

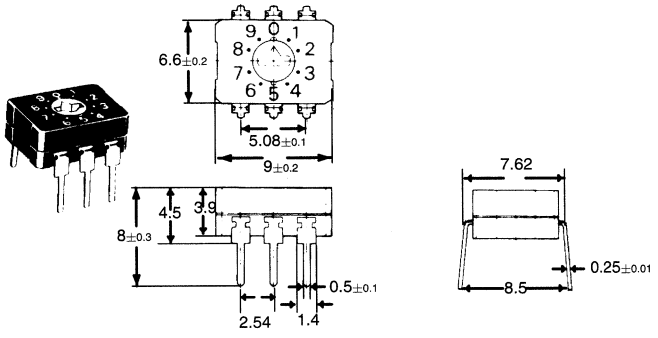
■ Binary-coded Hexadecimal Code

Type	A6C□–16R(N)			
Position\ Terminal No.	1	2	4	8
0				
1	♦			
2		♦		
3	♦	♦		
4			♦	
5	♦		♦	
6		♦	♦	
7	♦	♦	♦	
8				♦
9	♦			♦
A		♦		♦
B	♦	♦		♦
C			♦	♦
D	♦		♦	♦
E		♦	♦	♦
F	♦	♦	♦	♦

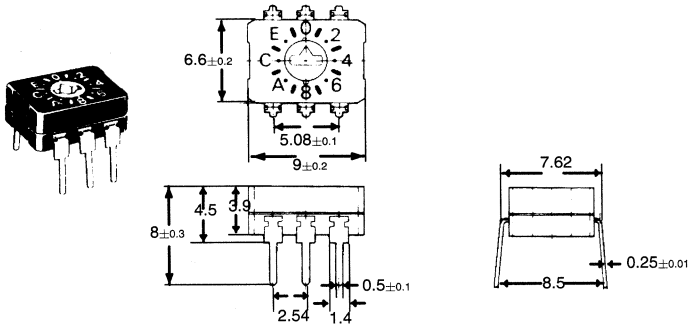
Note: '♦' in the above tables shows the output terminal no. that has continuity with the common terminal (C).

Dimensions

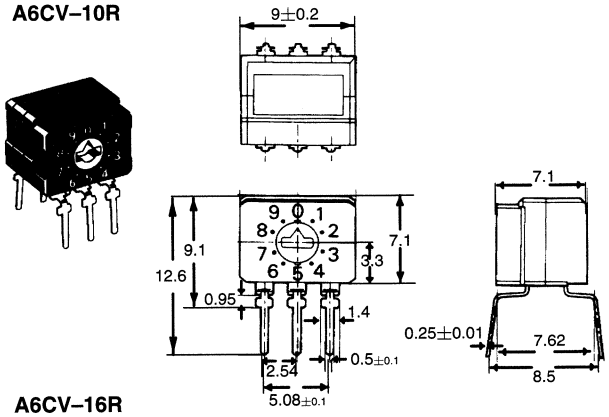
A6C–10R(N)



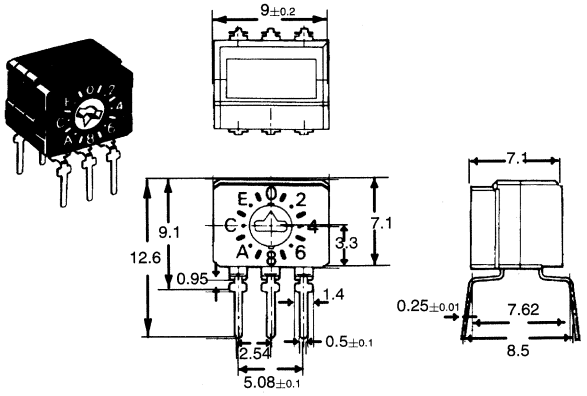
A6C–16R(N)



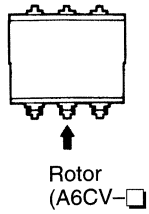
A6CV–10R



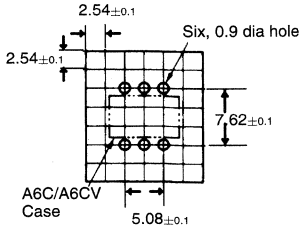
A6CV–16R



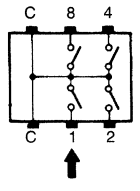
Terminal arrangement (Top view)



Mounting holes



Internal connections (Top view)



Precautions for A6C and A6D

The terminal pitch of all OMRON DIP switches is the same as a digital IC chip, which has a 2.54mm pitch. Moreover, Models A6C and A6D DIP switches are also identical to an DIL-IC chip in shape, so that they can be mounted on a PC board in exactly the same manner as ordinary IC chips.
When using these OMRON DIP switches, pay attention to the following points:

Circuit Design

Design the circuit for the DIP switch so that the switch can be used within the rated voltage and current ranges. The rated maximum voltage and current must not be exceeded (even momentarily) when the switch breaks or makes contact. The rated minimum current is 10μA (at 3.5 VDC). When CMOS iCs are used on the same PC board as the DIP switch, the momentary current applied to the DIP switch can be increased to improve the contact reliability on some occasions. At this time, however, the peak value of the current must not exceed the rated maximum value.

Mounting

The rotor is set to position 0 at the factory. Do not move the rotor to any other position, until after the switch has been mounted on a PC board, soldered, cleaned and dried.

1.Automatic mounting

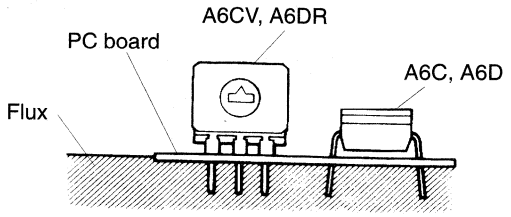
The top actuated types of models A6C and A6D are in the same shape as DIL-IC packages. Therefore, an automatic IC chip mounter can be used to mount these DIP switches without modification or, at worst, by slightly modifying the stopper. (A body stopper is recommended as the stopper for the shoot. Do not use a half-lead stopper. However, this depends on the automatic chip mounter to be used. Check the specifications of the chip mounter in advance.)
Use a PC board 1.2 to 1.6mm thick.
The mounting holes on the PC board should be 0.9mm or larger in diameter.

2.Manual mounting or use of IC socket

Use a commercially available IC chip inserting tool.
IC sockets (such as OMRON model XR) can be used to mount the DIP switch on a PC board as the terminal size and pitch of the switch are the same as ordinary IC chips.
When manually inserting the DIP switch terminal into the mounting holes on a PC board, position the Dip switch so that the terminals can be inserted into the respective mounting holes on the PC board (or on an IC socket) all at once. Then push down the switch as far as it will go. Apply the force at right angles to the PC board. When removing the DIP switch from the PC board or IC socket, do not twist the tip of a screwdriver or similar object inserted between the switch and the PC board or IC socket. Convenient pullout tools are commercially available.

Soldering

Before soldering, confirm that all the terminals of the DIP switch have been deeply inserted into the mounting holes on the PC board. Dip the PC board on which the DIP switch(es) are mounted in the solder flux. The flux must not come over the surface of the PC board.



Both hand and automatic soldering are possible, under the following conditions:

	Max. solder temperature	Max. solder time
Hand soldering	350°C	3 seconds
Automatic soldering	260°C	5 seconds

Cleaning

Use freon TES to remove the solder flux. Dip the switch in an ultrasonic oven, a solution oven and a vapophase oven to a depth of 5cm, for 60 seconds each.
Ethyl acohol or isopropyl alcohol can also be used. If used, however, finish the cleaning process within 5 minutes.
Do not use cleaning solvents other than these, as the switch materials may degrade.

Operation

1 Use the tip of a standard screwdriver or similar object to operate the rotary DIP switch.
Use an appropriately sized screwdriver. If the tip is too large or small, the groove of the actuator may be damaged or deformed.

2. The actuators of a slide type DIP switch can be moved by a stick or ball-point pen having a round tip. Do not use sharp edged objects such as tweezers.

3. The top actuated types and side actuated types of the slide DIP switches can also be operated with the fingers.

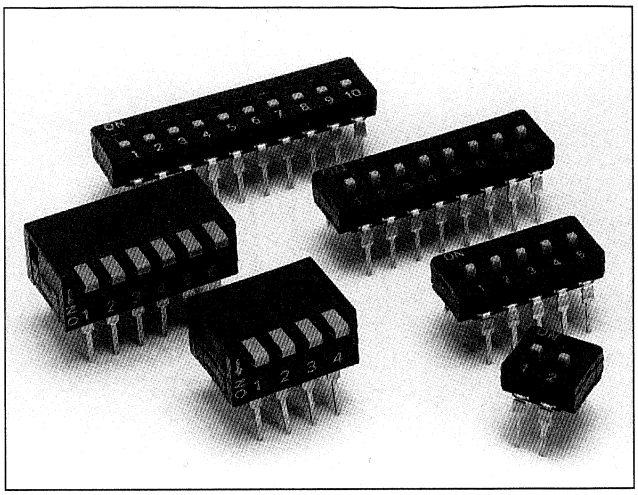
OMRON

Sealed DIP Switch

A6D

Completely Sealed Construction Allows Immersion Cleaning Without Taping

- Designed to standards of DIL-IC; top actuated types are auto insertable.
- Bifurcated movable contacts offer superb reliability.
- Smooth, sure switching action.



Ordering Information

No. of poles	Top actuated	Tube quantity	Raised actuated	Tube quantity	Side actuated	Box quantity
2	A6D–2100	74	A6D–2103	74	A6DR–2100	100
3	A6D–3100	54	A6D–3103	54	–	–
4	A6D–4100	43	A6D–4103	43	A6DR–4100	50
5	A6D–5100	35	A6D–5103	35	–	–
6	A6D–6100	30	A6D–6103	30	A6DR–6100	50
7	A6D–7100	26	A6D–7103	26	–	–
8	A6D–8100	23	A6D–8103	23	A6DR–8100	50
9	A6D–9100	21	A6D–9103	21	–	–
10	A6D–0100	19	A6D–0103	19	A6DR–0100	50

Specifications

■ Ratings/Characteristics

Switching capacity	100 mA, 5VDC; 30mA, 30VDC
Min. permissible load	10 μA, 3.5VDC
Carry current	100 mA
Contact resistance	100 mΩ max.
Insulation resistance	100 MΩ min. (at 250 VDC)
Dielectric strength	500 VAC for 1 minute
Vibration	Malfunction durability: 10 to 55 Hz, 1.5 mm total amplitude
Shock	Malfunction durability: Approx. 300 m/s^2 (30G)
Materials	Base/cover: PBT (Polybutylene sulfide) Rotor: PBT (Polyphenylene sulfide) O-ring: Acryl nitril butadiene rubber Movable contact: Beryllium copper Terminal: 42-alloy plate (nickel-iron alloy)
Ambient temperature	Operating: –20°C to 70°C (with no icing)
Ambient humidity	35% to 90%
Life expectancy	Mechanical: 5,000 operations min. Electrical: 2,000 operations min.
Weight	A6D (Top actuated) 2-pin: 0.25g, 4-pin: 0.45g, 6-pin:0.65g, 8-pin: 0.80g, 10-pin: 1.0g A6DR (Side actuated) 2-pin: 0.4g, 4-pin: 0.8g, 6-pin: 1.2g, 8-pin: 1.7g, 10-pin: 2.2g

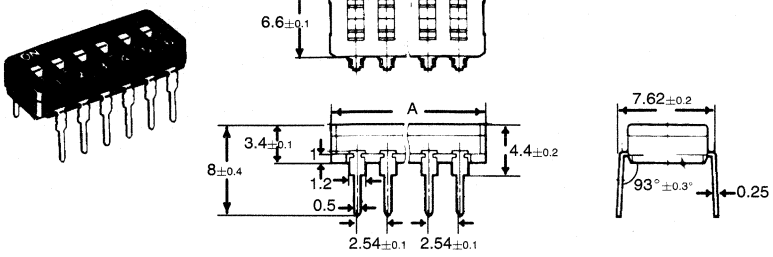
Dimensions

Model	Dimensions A±0.2
A6D–2100	7.1
A6D–3100	9.7
A6D–4100	12.2
A6D–5100	14.7
A6D–6100	17.3
A6D–7100	19.8
A6D–8100	22.4
A6D–9100	24.9
A6D–0100	27.4

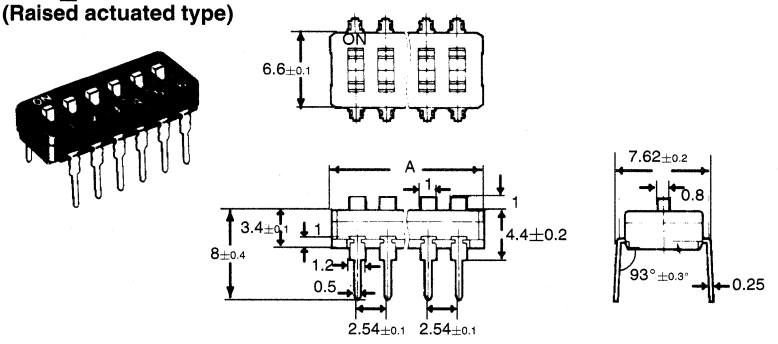
Model	Dimensions A±0.2
A6D–2103	7.1
A6D–3103	9.7
A6D–4103	12.2
A6D–5103	14.7
A6D–6103	17.3
A6D–7103	19.8
A6D–8103	22.4
A6D–9103	24.9
A6D–0103	27.4

Model	Dimensions A±0.2
A6DR–2100	7.1
A6DR–4100	12.2
A6DR–6100	17.3
A6DR–8100	22.4
A6DR–0100	27.4

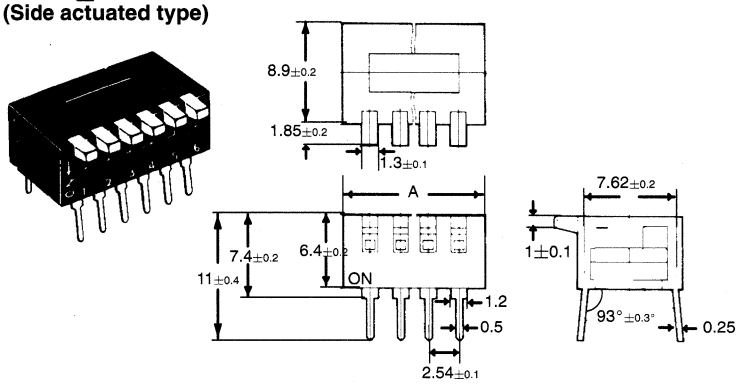
A6D–❑100
(Top actuated type)



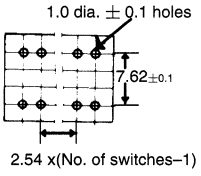
A6D–❑103
(Raised actuated type)



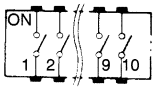
A6DR–❑100
(Side actuated type)



Mounting holes
(Bottom view)



Internal connections
(Top view)



Precautions – See A6C

DIP Switches

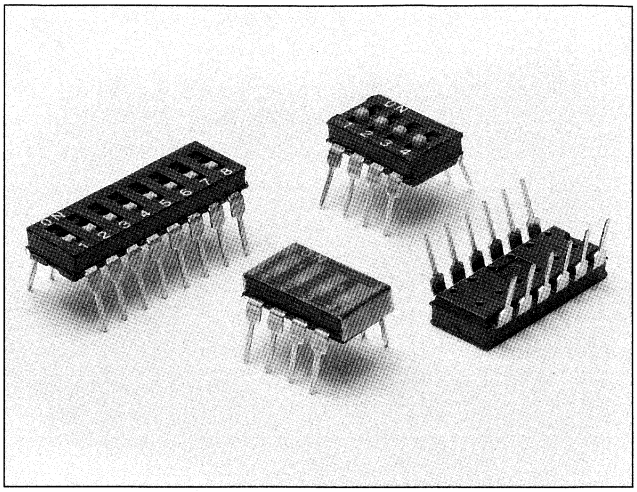
OMRON

DIP Switch

A6T

A Base or Tape Sealed Version to Suit Most Solder and Cleaning Processes.

- Designed to standards of DIL-IC; with all types auto insertable.
- Bifurcated movable contacts offer superb reliability.
- Smooth, sure switching action.
- Base and tape sealing, giving all round solderability.
- 1–10 way switching options.
- Raised and flush actuator types.



Ordering Information

Type No. of pins	Base sealed	Tape sealed	Raised actuator
1	A6T–1101	A6T–1102	A6T–1104
2	A6T–2101	A6T–2102	A6T–2104
4	A6T–4101	A6T–4102	A6T–4104
6	A6T–6101	A6T–6102	A6T–6104
8	A6T–8101	A6T–8102	A6T–8104
10	A6T–0101	A6T–0102	A6T–0104

No. of poles	Tube Quantity
1	130
2	76
4	42
6	28
8	22
10	18

Specifications

■ Ratings/Characteristics

Switching capacity	25 mA at 24VDC (resistive)
Contact resistance	200 mΩ max. (initial)
Insulation resistance	100 MΩ min. (at 250 VDC)
Dielectric strength	500 VAC for 1 minute
Vibration	Malfunction durability: 10 to 55 Hz, 1.5 mm total amplitude
Shock	Malfunction durability: Approx. 300 m/s^2 (30G)
Ambient temperature	Operating: –20°C to 70°C (with no icing)
Ambient humidity	35% to 90% R.H.
Life expectancy	Mechanical: 1,000 operations min. Electrical: 1,000 operations min. (at switch rating)

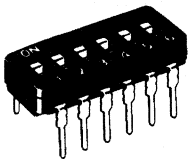
Dimensions

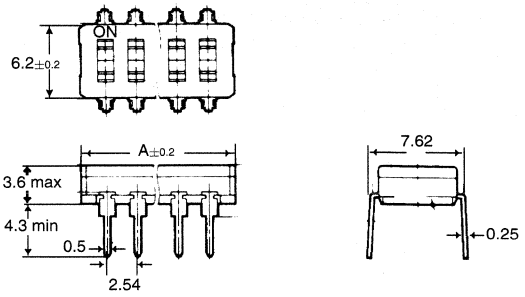
Model	Dimensions A±0.2
A6T-1101	3.48
A6T-2101	6.02
A6T-4101	11.10
A6T-6101	16.18
A6T-8101	21.26
A6T-0101	26.34

Model	Dimensions A±0.2
A6T-1102	3.48
A6T-2102	6.02
A6T-4102	11.10
A6T-6102	16.18
A6T-8102	21.26
A6T-0102	26.34

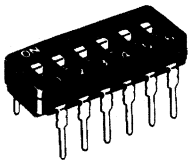
Model	Dimensions A±0.2
A6T-1104	3.48
A6T-2104	6.02
A6T-4104	11.10
A6T-6104	16.18
A6T-8104	21.26
A6T-0104	26.34

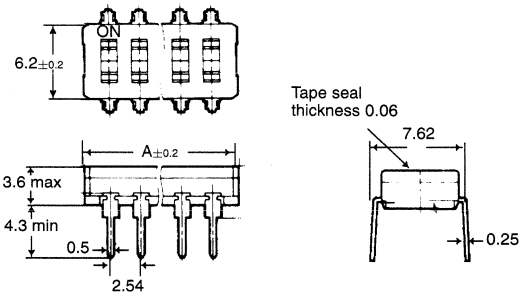
A6T-❑101
(Base sealed)



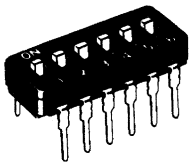


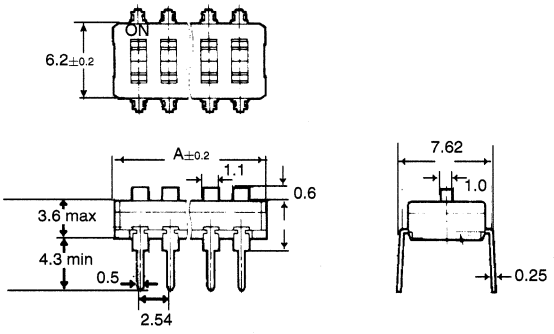
A6T-❑102
(Tape sealed)



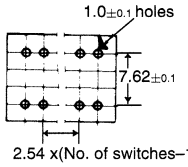


A6T-❑104
(Raised actuated)

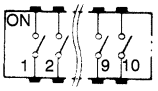




Mounting holes
(Bottom view)



Internal connections
(Top view)



DIP Switches

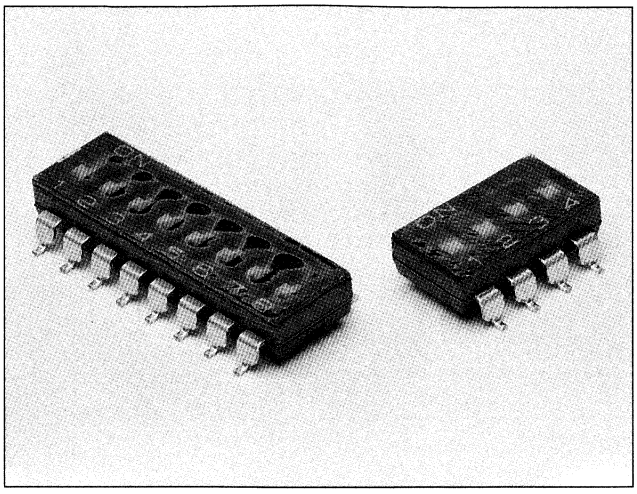
OMRON

Surface–Mount DIP Switch

A6S

Surface Mount For High Volume Manufacturing Processes.

- Designed to standards of DIL-IC; with all types auto insertable.
- Bifurcated movable contacts offer superb reliability.
- Smooth, sure switching action.
- Surface mount, compatible with automated manufacturing.
- Base and tape sealing, giving all round solderability.
- 2–10 way switch options
- Raised and flush actuator types.



Ordering Information

No. of poles	Base sealed	Tape sealed	Raised actuator
2	A6S–2101	A6S–2102	A6S–2104
3	A6S–3101	A6S–3102	A6S–3104
4	A6S–4101	A6S–4102	A6S–4104
5	A6S–5101	A6S–5102	A6S–5104
6	A6S–6101	A6S–6102	A6S–6104
7	A6S–7101	A6S–7102	A6S–7104
8	A6S–8101	A6S–8102	A6S–8104
9	A6S–9101	A6S–9102	A6S–9104
10	A6S–0101	A6S–0102	A6S–0104

No. of poles	Tube Quantity
2	76
3	55
4	42
5	35
6	28
7	25
8	22
9	20
10	18

Specifications

■ Ratings/Characteristics

Switching capacity	25 mA at 24VDC (Resistive)
Contact resistance	200 mΩ max. (Initial)
Insulation resistance	100 MΩ min. (at 250 VDC)
Dielectric strength	500 VAC for 1 minute
Vibration	Malfunction durability: 10 to 55 Hz, 1.5 mm total amplitude
Shock	Malfunction durability: Approx. 300 m/s^2 (30G)
Ambient temperature	Operating: –20°C to 70°C (with no icing)
Ambient humidity	35% to 90% R.H.
Life expectancy	Mechanical: 1,000 operations min. Electrical: 1,000 operations min. (at switch rating)

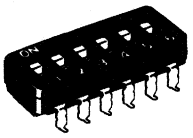
Dimensions

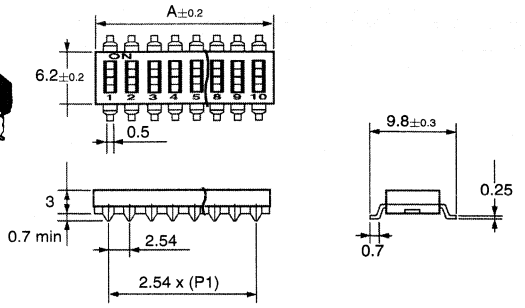
Model	Dimensions A±0.2
A6S–2101	6.02
A6S–3101	8.56
A6S–4101	11.10
A6S–5101	13.64
A6S–6101	16.18
A6S–7101	18.72
A6S–8101	21.26
A6S–9101	23.80
A6S–0101	26.34

Model	Dimensions A±0.2
A6S–2102	6.02
A6S–3102	8.56
A6S–4102	11.10
A6S–5102	13.64
A6S–6102	16.18
A6S–7102	18.72
A6S–8102	21.26
A6S–9102	23.80
A6S–0102	26.34

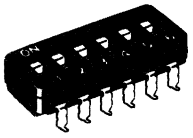
Model	Dimensions A±0.2
A6S–2104	6.02
A6S–3104	8.56
A6S–4104	11.10
A6S–5104	13.64
A6S–6104	16.18
A6S–7104	18.72
A6S–8104	21.26
A6S–9104	23.80
A6S–0104	26.34

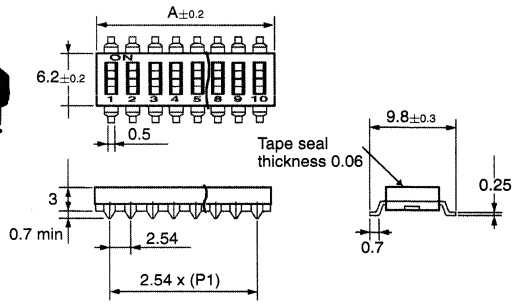
A6S–❑101
(Base sealed)



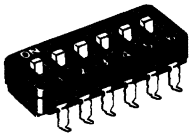


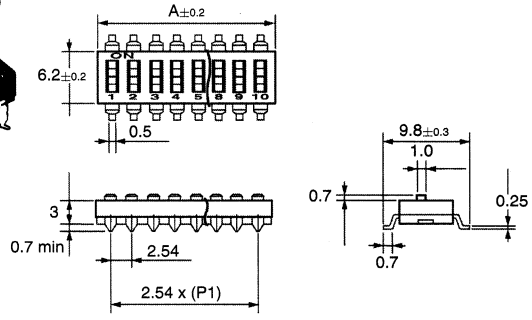
A6S–❑102
(Tape sealed)



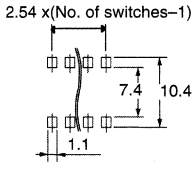


A6S–❑104
(Raised actuator)

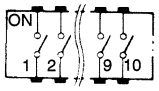




Mounting pads
(top view)



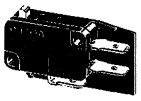
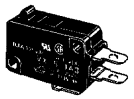
Internal connections
(Top view)



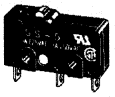
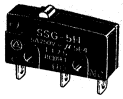
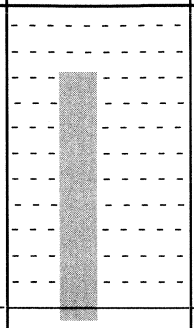
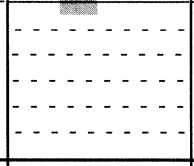
DIP Switches

SECTION 3

Microswitches

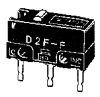
Classification		Miniature basic switches			Miniature basic switches	
Model		V			VX	
Appearance						
		V-21	V-16	V-15	VX-5	VX-01
Contact ratings	Resistive load	21 A at 250 VAC	16 A at 250 VAC	15 A at 250 VAC	5 A at 250 VAC	0.1 A at 125 VAC
	Max. operating current (A)	20 15 10 8 5 3 2 1 0.5 0.3 0.1				
	Min. permissible load (mA)	100 10 1 0.1 0.01				
Operating force (OF) (see note)		400gf	100, 200, 400 gf		25, 50 gf	
Life expectancy	Mechanical	50 x 10^6 min.			50 x 10^6 min.	10 x 10^6 min.
	Electrical	100 x 10^3 min.			500 x 10^3 min.	1 x 10^6 min.
Mounting pitch		10.3 x 22.2 mm			10.3 x 22.2 mm	
Actuator		Pin plunger, hinge lever, simulated hinge lever, hinge roller lever			Pin plunger, hinge lever, simulated hinge lever, hinge roller lever	
Terminals		Solder/quick connect (#187), solder, quick connect (#187), quick connect (#250), screw terminal			Solder/quick connect (#187), quick connect (#187)	
Approved standards		UL, CSA, VDE, SEMKO, DEMKO, SEV			UL, CSA, VDE	
Remarks		---			---	
Page		50			58	

Note: These values are for pin plunger type.

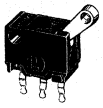
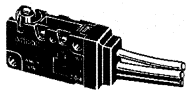
Classification		Subminiature basic switches				
Model		SS			SSG-5	SSG-01
Appearance						
		SS-10	SS-5	SS-01		
Contact ratings	Resistive load	10.1 A at 250 VAC	3 A at 250 VAC	0.1 A at 125 VAC	3 A at 250 VAC 5 A at 250 VAC *	0.1 A at 125 VAC
	Max. operating current (A)					
	Min. permissible load (mA)					
Operating force (OF) (see note)		150 gf	50, 150 gf	25, 50, 150 gf	25, 153 gf	
Life expectancy (see note)	Mechanical	10 x 10^6 min.	30 x 10^6 min.		10 x 10^6 min.	
	Electrical	50 x 10^3 min.	200 x 10^3 min.		200 x 10^3 min.	
Mounting pitch		9.5 mm			9.5 mm	
Actuator		Pin plunger, hinge lever, simulated hinge lever, hinge roller lever			Pin plunger, hinge lever, simulated hinge lever, hinge roller lever	
Terminals		Solder, quick connect (#110), PCB terminal			Solder, quick connect (#110), PCB terminal	
Approved standards		UL, CSA, VDE, SEMKO, SEV, EN (TUV)			BEAB*, TUV, UL, CSA	
Remarks		Split double spring mechanism assures life as long as 30 million operations.			---	
Page		63			69	

Note: These values are for pin plunger type.

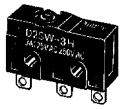
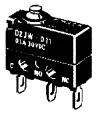
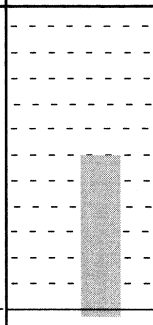
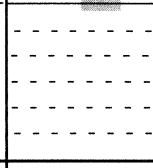
* BEAB approved to EN61058–1 at 5 A, 250 VAC for 50,000 operations.

Classification			Subminiature basic switches		Subminiature basic switches		
Model			D2MQ		D2F		
Appearance							
			Silver plated	Gold plated	Standard	Low force	Microvoltage /current load
Contact ratings	Resistive load		0.5 A at 30 VDC	50 mA at 30 VDC	3 A at 125 VAC	1 A at 125 VAC	0.1 A at 30 VDC
	Max. operating current (A)	20 15 10 8 5 3 2 1 0.5 0.3 0.1					
	Min. permissible load (mA)	100 10 1 0.1 0.01					
Operating force (OF) (see note)			120 gf		150 gf	75 gf	75, 150 gf
Life expectancy (see note)	Mechanical		30 x 10^3 min.		1 x 10^6 min.		
	Electrical		10 x 10^3 min.		30 x 10^3 min.		
Mounting pitch			4.0 mm		6.5 mm		
Actuator			Pin plunger, leaf spring		Pin plunger, hinge lever, simulated hinge lever, hinge roller lever		
Terminals			PCB, solder terminal		PCB (self-clinching), solder terminal		
Approved standards			---		UL, CSA		
Remarks			---		---		
Page			75		77		

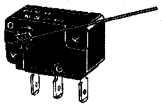
Note: These values are for pin plunger type.

Classification			Subminiature basic switches	Watertight miniature basic switch	
Model			D3C	D2VW	
Appearance					
				D2VW-5	D2VW-01
Contact ratings	Resistive load		0.1 A at 30 VDC	5 A, 250 VAC	0.1 A, 30 VDC
	Max. operating current (A)	20 15 10 8 5 3 2 1 0.5 0.3 0.1			
	Min. permissible load (mA)	100 10 1 0.1 0.01			
Operating force (OF) (see note)			40, 130 gf	200 gf	
Life expectancy (see note)	Mechanical		50 x 10^3 min.	10 x 10^6 min.	
	Electrical		50 x 10^3 min.	100 x 10^3 min.	1 x 10^6 min.
Mounting pitch			---	10.3 x 22.2 mm	
Actuator			HInge lever	Pin plunger hinge lever, simulated hinge lever, hinge roller lever	
Terminals			---	Lead wired, solder/quick connect (#187) terminal	
Approved standards			---	UL, CSA	
Remarks			---	---	
Page			81	83	

Note: These values are for pin plunger type.

Classification			Watertight miniature basic switch		
Model			D2SW		D2JW
Appearance					
			D2SW-3	D2SW-01	
Contact ratings	Resistive load		3 A at 125 VAC	0.1 A at 30 VDC	0.1 A at 30 VDC
	Max. operating current (A)	20 15 10 8 5 3 2 1 0.5 0.3 0.1			
	Min. permissible load (mA)	100 10 1 0.1 0.01			
Operating force (OF) (see note)			180 gf		250 gf
Life expectancy (see note)	Mechanical		5 x 10^6 min.		1 x 10^6 min.
	Electrical		200 x 10^3 min.		100 x 10^3 min.
Mounting pitch			9.5 mm		4.8 mm
Actuator			Pin plunger, hinge lever, simulated hinge lever, hinge roller lever		Pin plunger, hinge lever, simulated hinge lever, hinge roller lever
Terminals			Lead wired, solder, quick connect (#110), PCB terminal		Lead wired, solder terminal
Approved standards			UL, CSA, EN (IEC, VDE)		UL, CSA
Remarks			---		---
Page			87		92

Note: These values are for pin plunger type.

Classification		Low-torque basic switches		Special-purpose basic switch	Special-purpose basic switch
Model		D2MC		D2X	D2D
Appearance					
		D2MC-5	D2MC-01		
Contact ratings	Resistive load	5 A at 250 VAC	0.5 A at 30 VDC	0.1 A at 30 VDC	16 A at 30 VAC
	Max. operating current (A)	20 / 15 / 10 / 8 / 5 / 3 / 2 / 1 / 0.5 / 0.3 / 0.1			
	Min. permissible load (mA)	100 / 10 / 1 / 0.1 / 0.01			
Operating force (OF) (see note 1)		5.1, 7.6, 10.2 gf • cm		50 gf	200, 300, 2,000 (pull-on) gf
Life expectancy (see note)	Mechanical	10 x 10^6 min.		1 x 10^6 min.	10 x 10^6 min.
	Electrical	100 x 10^3 min.		50 x 10^3 min.	100 x 10^3 min.
Mounting pitch		8.7 x 23.8 mm		---	22mm
Actuator		Low-force torque		Rotary lever	Pin plunger
Terminals		Quick connect terminal (#205, #187)		---	Quick connect (#250) terminal
Approved standards		UL, CSA		---	UL, CSA, VDE, SEMKO
Remarks		---		---	Minimum contact gap: 3 mm (see note 2)
Page		95		98	100

Note 1: These values are for pin plunger type.

Note 2: Contact gap for pull-on lock model is 1 mm.

Mechanical Characteristics

Operating force, stroke and contact characteristics

The setting of the stroke is very important for the switch to operate with high reliability.

The chart below shows the relationship between the operating force, stroke and contact reliability. To obtain high reliability from the switch, the switch actuator must be manipulated within an appropriate range of operating forces. It is therefore necessary that the operating body (such as a cam or dog) must be set so that it allows the switch actuator to return to its free position after the switch is operated, when the switch is used to form a normally closed circuit. When the switch is used to form a normally open circuit, the operating body must move the switch actuator to a distance of 70 to 100% of the rated overtravel (OT) of the switch so that it can effectively absorb slight displacement errors.

If the stroke is set in the vicinity of the operating position (OP) or at the releasing position (RP), the switching operation may become unstable. If the stroke is at the total travel position (TTP), the moment inertia of the operating body may damage the actuator or the switch itself. It is therefore recommended to adjust the stroke by adjusting the position of the operating body or the mounting panel of the switch.

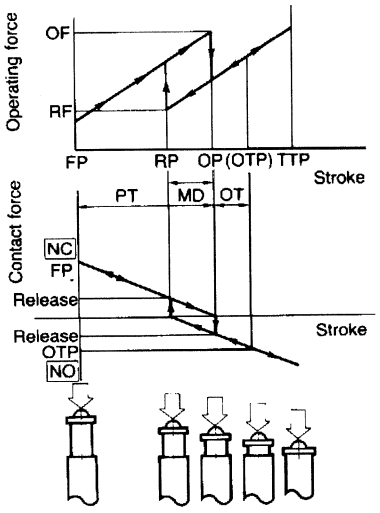
Mechanical Conditions

Depending on how the switch is to be operated, an appropriate actuator must be selected.

If the actuator is operated too slowly, the switching operation may become too unstable, causing faulty contact or metal deposition between the contacts. (When using the switch in an application where the operating speed of the actuator is extremely small or the pin plunger is set at midpoint between the free position and operating position, consult OMRON.)

The following chart shows the typical example of the changes in the operating force as the stroke increases or decreases. The switch cannot achieve high reliability with the stroke set at the OP or RP of the actuator. Moreover, the switch operation is more likely to be affected by vibration and shock.

If the actuator is operated too quickly, the switch may be damaged or the switching operation may become unstable because the contacts cannot keep pace with the operating speed of the actuator.



Terms on Operating Characteristics

Operating force (OF):

The force applied to the actuator required to operate the switch contacts.

Releasing force (RF):

The value to which the force on the actuator must be reduced to allow the contacts to return to the normal position.

Free position (FP):

The initial position of the actuator when there is no external force applied.

Operating position (OP):

The position of the actuator at which contacts snap to the operated contact position.

Releasing position (RP):

The position of the actuator at which the contacts snap from the operated contact position to their normal position.

Total travel position (TTP):

The position of the actuator when it reaches the stopper.

Pretravel (PT):

The distance of or angle through which the actuator moves from the free position to the operating position.

Overtravel (OT):

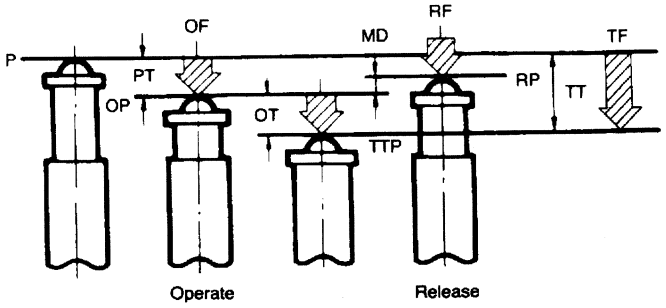
The distance or angle of the actuator movement beyond the operating position.

Movement differential (MD):

The distance or angle from the operating position to the releasing position.

Total travel (TT):

The sum of the pretravel and total overtravel expressed by distance or angle.



Mechanical Life Expectancy

The duration in which the normal switching operation is performed without the contacts energised as long as the switch is used with the rated overtravel (OT).

Terms on Electrical Life Expectancy:

The duration in which the normal switching operation is performed under the rated load (resistive) as long as the switch is used with the rated overtravel (OT).

Terminal Symbol and Contact Form

	Terminal symbol
COM	Common terminal
NC	Normally closed terminal
NO	Normally open terminal

	Contact form
Single pole Double Throw (SPDT)	
Single Pole Single Throw Normally Closed (SPST–NC)	
Single Pole Single Throw Normally Open (SPST–NO)	
Double Pole Double Break (DPDB)	

Electrical Characteristics

The switching capacity of the switch significantly differs depending on whether the switch is used to break an alternating current or a direct current. Be sure to check both the AC and DC ratings of the switch by referring to its datasheet.

In an application where a very weak current is to be switched, use a switch intended for microvoltage/current load.

The switch may be fatally damaged when too high a current known as an 'inrush current' is allowed to flow through it. How much inrush current is allowed to flow through, depends on the type of switch and the load to be connected to the switch. So, check the permissible inrush current, the time during which the rated inrush current is allowed to flow, as well as the steady-state current of the switch. The following chart shows the transition of the current flowing through the switch.

The contact resistance set forth in the datasheet was measured when the switch is to break a 1A load at 6 to 8 VDC. (The contact resistance of a microvoltage/current load version, however, was measured by applying the rated voltage and current to the switch).

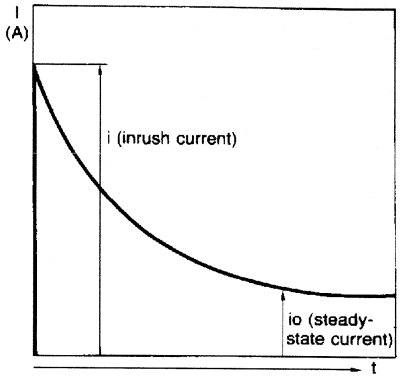
The rated loads of the switch are as follows:

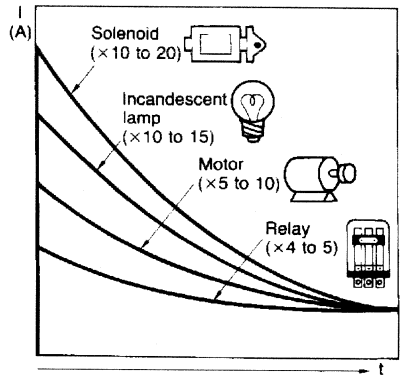
Inductive load: a load having a power factor of 0.4 (AC) or a time constant of 7 milliseconds or less (DC)

Lamp load: a load having an inrush current ten times the steady state current

Motor load: a load having an inrush current six time the steady state current

The following chart shows the inrush currents of various loads. The numerals in the parentheses indicate the inrush current of the load, as a multiple of the steady state current of the switch.





Note: It is especially important to know the time constant (L/R) of an inductive load in a DC circuit.

Notes on Handling

Do not modify the switch in any way, for example, by expanding the mounting holes.

Do not lubricate the sliding parts of the switch such as the pin plunger.

Make sure that the switch is provided with an appropriate distance from a mounting panel when the switch is mounted on the panel. If an adequate distance cannot be provided, use an optionally available insulation guard or separator. Especially when mounting the switch on a metallic object, be sure to use a separator.

When mounting the switch, use screws of specified size with specified plain or spring washers. Securely fix the switch. Also, remember to tighten the mounting screws of the switch at the specified torque.

Do not store the switch in an environment where it is subject to corrosive gases (e.g. near a kerosene heater), dust or humidity.

When using a pin plunger type switch, adjust the mounting position so that the stroke of the plunger and that of the operating body are aligned.

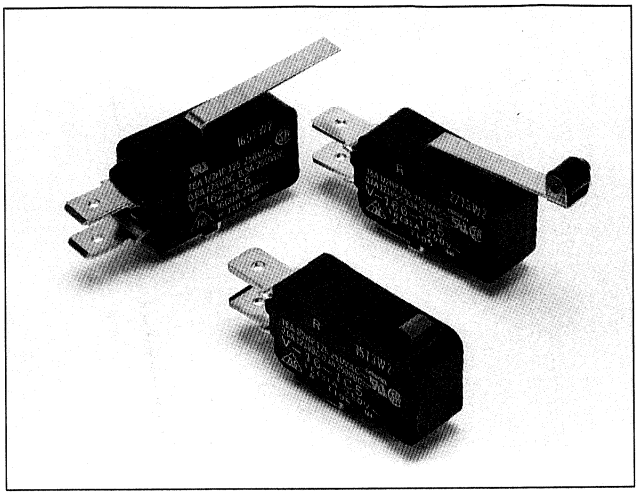
OMRON

Miniature Basic Switch

V

Reliable Basic Micro Switch

- Compatible with all industry standard V3 switches.
- Ratings up to 21 A available.
- Six variations of standard levers including straight and roller.
- High temperature (150°C) available.



Ordering Information

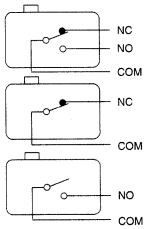
Model Number Legend

General Purpose Type

V -□ □ □- □ □ □ □ -□

1 2 3 4 5 6 7 8

1. **Ratings**
   21: 21A
   16: 16A
   15: 15A
2. **Contact Gap**
   None: 1mm (F gap)
   G: 0.5mm (G ap)
3. **Actuator**
   None: pin plunger
   1: short hinge lever
   2: hinge lever
   3: long hinge lever
   4: simulated hinge lever
   5: short hinge roller lever
   6: hinge roller lever
4. **Contact form and COMMON terminal position**



   1: **SPDT** bottom
   2: **SPST–NC** bottom
   3: **SPST–NO** bottom
5. **Terminal**
   A: solder/quick connect terminal (#187)
   C2: quick connect terminal (#187)
   C: quick connect terminal (#250)
   B: screw terminal
   E: solder terminal
6. **Barrier (models with thermoplastic case only)**
   R Right hand barrier
   L: Left hand barrier
7. **OF max.***
   6: 400g
   5: 200g
   4: 100g

*These forces apply to the models with pin plunger actuator

8. **Special purpose**
   T: Heat resistive type (TV)

■ Combination

General-purpose

Classification		Model	Ratings	Terminal					OF max. (pin plunger)			With barrier	Approved standards
				Shape (see note)					100 gf (0.98 N)	200 gf (1.96 N)	400 gf (3.92 N)		
				A	C2	C	B	E					
Standard model	Thermo-plastic case	V-21	21 A, 250 V			Yes					Yes	Yes	UL, CSA, VDE, SEMKO, DEMKO, SETI, KEMA, NEMKO, SEV
		V-16	16 A, 250 V	Yes	Yes	Yes			Only upon request	Yes	Only upon request	Yes	
	Thermo-setting case	V-15	15 A, 250 V	Yes	Yes	Yes	Yes	Yes	Only upon request	Yes	Only upon request		UL, CSA, TUV
Special model	Heat re-sistive	V-□-T	10 and 15 A, 250 V	Yes					Yes	Yes	Only upon request		UL, CSA

Actuator	Contact form	*Connect Terminal	15A Standard type	16A Standard type	21A Standard type	15A Heat Resistant type
Pin plunger	SPDT	A	V–15–1A5	V–16–1A5	–	V–15–1A5–T
		C2	V–15–1C25	V–16–1C25	–	–
		C	V–15–1C5	V–16–1C5	V–21–1C6	V–15–1C5–T
		B	V–15–1B5	–	–	–
		E	V–15–1E5	–	–	–
	SPST–NC	A	V–15–2A5	V–16–2A5	–	V–15–2A5–T
		C2	V–15–2C25	V–16–2C25	–	–
		C	V–15–2C5	V–16–2C5	V–21–2C6	V–15–2C5–T
	SPST–NO	A	V–15–3A5	V–16–3A5	–	V–15–3A5–T
		C2	V–15–3C25	V–16–3C25	–	–
		C	V–15–3C5	V–16–3C5	V–21–3C6	V–15–3C5–T
Short lever 	SPDT	A	V–151–1A5	V–161–1A5	–	V–151–1A5–T
		C2	V–151–1C25	V–161–1C25	–	–
		C	V–151–1C5	V–161–1C5	V–211–1C6	V–151–1C5–T
		B	V–151–1B5	–	–	–
		E	V–151–1E5	–	–	–
Standard lever 		A	V–152–1A5	V–162–1A5	–	V–152–1A5–T
		C2	V–152–1C25	V–162–1C25	–	–
		C	V–152–1C5	V–162–1C5	V–212–1C6	V–152–1C5–T
		B	V–152–1B5	–	–	–
		E	V–152–1E5	–	–	–
Long lever 		A	V–153–1A5	V–163–1A5	–	V–153–1A5–T
		C2	V–153–1C25	V–163–1C25	–	–
		C	V–153–1C5	V–163–1C5	V–213–1C6	V–153–1C5–T
		B	V–153–1B5	–	–	–
		E	V–153–1E5	–	–	–
Simulated roller lever 		A	V–154–1A5	V–164–1A5	–	V–154–1A5–T
		C2	V–154–1C25	V–164–1C25	–	–
		C	V–154–1C5	V–164–1C5	V–214–1C6	V–154–1C5–T
		B	V–154–1B5	–	–	–
		E	V–154–1E5	–	–	–
Short roller lever 		A	V–155–1A5	V–165–1A5	–	V–155–1A5–T
		C2	V–155–1C25	V–165–1C25	–	–
		C	V–155–1C5	V–165–1C5	V–215–1C6	V–155–1C5–T
		B	V–155–1B5	–	–	–
		E	V–155–1E5	–	–	–
Standard roller lever 		A	V–156–1A5	V–166–1A5	–	V–156–1A5–T
		C2	V–156–1C25	V–166–1C25	–	–
		C	V–156–1C5	V–166–1C5	V–216–1C5	V–156–1C5–T
		B	V–156–1B5	–	–	–
		E	V–156–1E5	–	–	–

Note: *Refer to *Ordering Information.*

5. Terminals

A: Solder/quick-connect terminal (#187)
C2: Quick-connect terminal (#187)
C: Quick-connect terminal (#250)
B: Screw terminal
E: Solder terminal

Specifications

■ Ratings

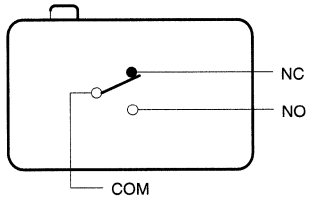
Ratings	Rated voltage	Non-inductive load				Inductive laod			
		Resistive load		Lamp load		Inductive load		Motor load	
		NC	NO	NC	NO	NC	NO	NC	NO
21 A	250 VAC	21 A		3 A		12 A		4 A	
	8 VDC	21 A		5 A		12 A		7 A	
	30 VDC	14 A		5 A		12 A		5 A	
	125 VDC	0.6 A		0.1 A		0.6 A		0.1 A	
	250 VDC	0.3 A		0.05 A		0.3 A		0.05 A	
16 A	250 VAC	16 A		2 A		10 A		3 A	
	8 VDC	16 A		4 A		10 A		6 A	
	30 VDC	10 A		4 A		10 A		4 A	
	125 VDC	0.6 A		0.1 A		0.6 A		0.1 A	
	250 VDC	0.3 A		0.05 A		0.3 A		0.05 A	
15 A	250 VAC	15 A		2 A		10 A		3 A	
	8 VDC	15 A		4 A		10 A		6 A	
	30 VDC	10 A		4 A		10 A		4 A	
	125 VDC	0.6 A		0.1 A		0.6 A		0.1 A	
	250 VDC	0.3 A		0.05 A		0.3 A		0.05 A	

Note: 1. The above current values are the normal current values of models with a contact gap of 1 mm (gap F), which vary with the normal current values of models with a contact gap of 0.5 mm (gap G).

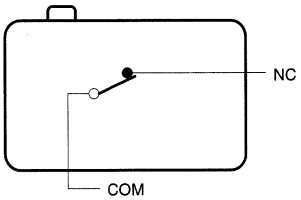
2. Inductive load has a power factor of 0.4 min. (AC) and a time constant of 7 ms max. (DC).
3. Lamp load has an inrush current of 10 times the steady-state current.
4. Motor load has an inrush current of 6 times the steady-state current.

Contact Form

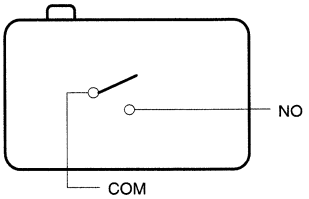
SPDT



SPST-NC



SPST-NO



■ Characteristics

Operating speed	0.1 mm to 1 m/s (at pin plunger)
Operating frequency	Mechanical: 600 operations/min Electrical: 60 operations/min
Insulation resistance	100 MΩ min. (at 500 VDC)
Contact resistance	15 mΩ max. (initial value)
Inrush current (NC/NO)	V-21: 50 A max., V-16: 40 A max., V-15: 36 A max., V-11: 24 V max., V-10: 24 A max.
Dielectric strength	1,000 VAC, 50/60 Hz for 1 min between non-continuous terminals 2,000 VAC (1,500 VAC for V-15 and V-10), 50/60 Hz for 1 min between each terminal and ground
Vibration resistance	Malfunction: 10 to 55 Hz, 1.5-mm double amplitude
Shock resistance	Mechanical: 1,000 m/s^2 min. (approx. 100G min.) Malfunction: V-21/V-16/V-15: 300 m/s^2 (approx. 30G min.) V-11/V-10: 200 m/s^2 (approx. 20G min.)
Life expectancy	Mechanical: 50,000,000 operations min. Electrical: V-21/V-16/V-15: 100,000 operations min. V-11/V-10: 300,000 operations min.
Ambient temperature	Operating: –25°C to 80°C (with no icing) –25°C to 150°C for heat-resistant model
Ambient humidity	Operating: 85% max.
Contact	Specifications: Rivet Materials: V-21/V-16/V-15: Silver alloy V-11/V-10: Silver
Weight	Approx. 6.2 g

Note: The operating speed value shown is for pin plunger models. For hinge lever models, this speed is for the plunger parts.

■ Approved Standards

UL (File No. E32667)/CSA (File No. LR21642)/
VDE (File No. 716)/SEMKO (File No. 9114062)
TÜV (File No. 940 3007)

■ Operating Characteristics

Switch model	V-21-1❑6	V-16-1❑5	V-15-1❑5
OF max. RF min.	400g 80g	200g 50g	200g 50g
PT max. OT min. MD max.	1.2mm 1.0mm 0.4mm (0.3mm)		1.6mm 0.8mm 0.6mm (0.5mm)
FP max. OP	14.7mm ±0.4mm		15.2mm ±0.5mm

Switch model	V-211-1❑6	V-161-1❑5	V-151-1❑5
OF max. RF min.	400g 80g	200g 50g	
PT max. OT min. MD max.	1.6mm 0.8mm 0.6mm (0.5mm)		
FP max. OP	15.2mm ±0.5mm		

Switch model	V-212-1❑6	V-162-1❑5	V-152-1❑5
OF max. RF min.	250g 25g	125g 14g	
PT max. OT min. MD max.	4.0mm 1.6mm 1.5mm (0.8mm)		
FP max. OP	15.2mm ±1.2mm		

Switch model	V-213-1❑6	V-163-1❑5	V-153-1❑5
OF max. RF min.	130g 12g	65g 6g	70g 6g
PT max. OT min. MD max.	9.0mm 2.0mm 2.8mm (2.0mm)		
FP max. OP	$15.2mm^{+2.6}_{-3.2}$		

Switch model	V-214-1❑6	V-164-1❑5	V-154-1❑5
OF max. RF min.	250g 25g	125g 14g	125g 14g
PT max. OT min. MD max.	4.0mm 1.6mm 1.5mm (0.8mm)		
FP max. OP	18.7mm ±1.2mm		

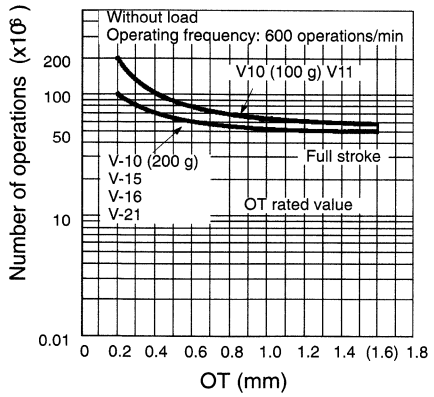
Switch model	V-215-1❑6	V-165-1❑5	V-155-1❑5
OF max. RF min.	480g 50g	240g 50g	240g 50g
PT max. OT min. MD max.	1.6mm 0.8mm 0.6mm (0.5mm)		
FP max. OP	20.7mm ±0.6mm		

Switch model	V-216-1❑6	V-166-1❑5	V-156-1❑5
OF max. RF min.	250g 25g	125g 14g	125g 14g
PT max. OT min. MD max.	4.0mm 1.6mm 1.5mm (0.8mm)		
FP max. OP	20.7mm ±1.2mm		

Engineering Data

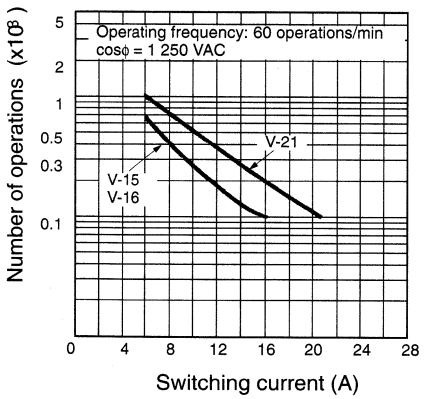
Mechanical Life Expectancy

V-21/-16/-15/-11/-10

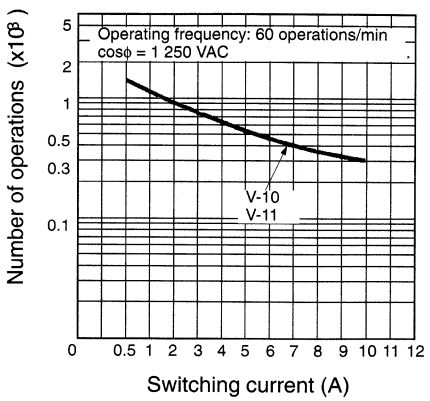


Electrical Life Expectancy

V-21/-16/-15



V-11/-10



Dimensions

Note: 1. All units are in millimetres unless otherwise indicated.

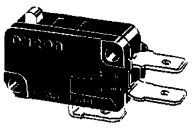
2. Unless otherwise specified, a tolerance of ±0.4 mm applies to all dimensions.

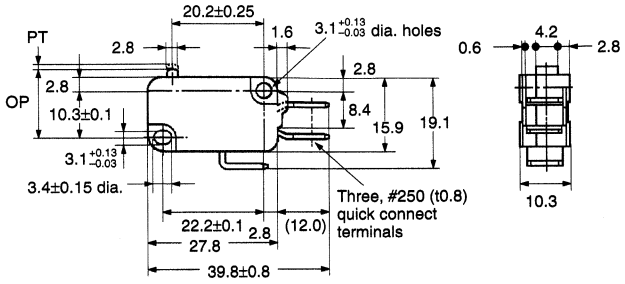
3. The following illustrations and drawings are for #250-series models with tab terminals (terminals C). V models with a switching current of 16 A or 11 A incorporates terminals A and C2. These models are different from #250-series models in terminal size only. Terminals A, C2, and side terminals are omitted from the following drawings. Refer to *Kinds of "Terminals"* on page NO TAG for these terminals.

Pin Plunger

(Without Barrier)

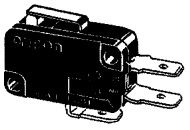
V-21-1□6
V-16-1□5

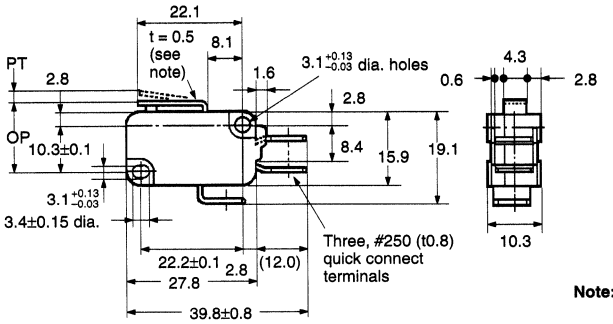




Short Lever

V-211-1□6
V-161-1□5

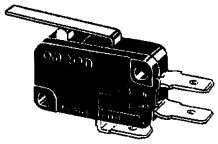


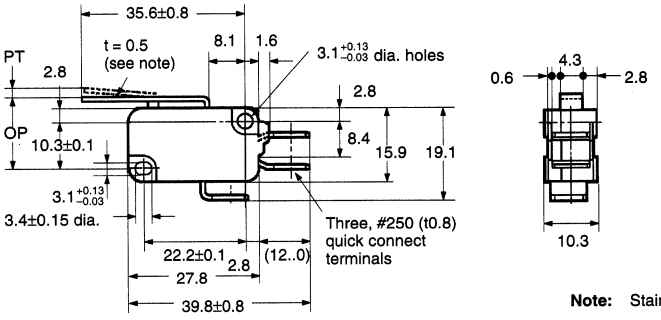


Note: Stainless steel lever

Standard Lever

V-212-1□6
V-162-1□5

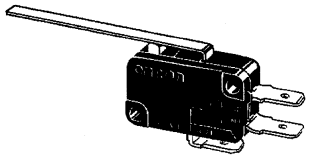


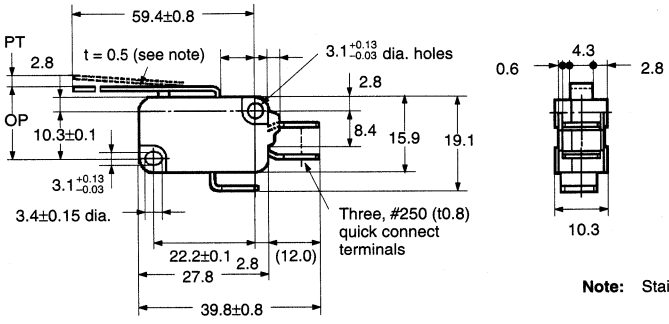


Note: Stainless steel lever

Long Lever

V-213-1□6
V-163-1□5

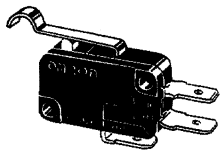


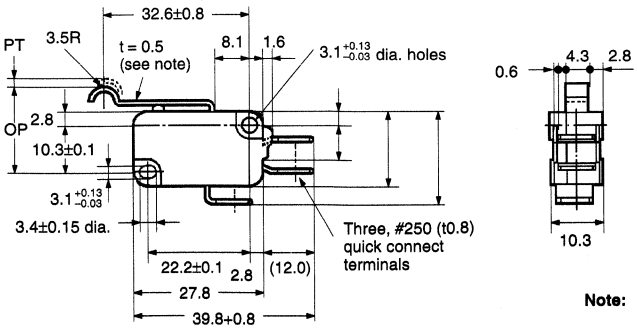


Note: Stainless steel lever

Simulated Roller Lever

V-214-1□6
V-164-1□5

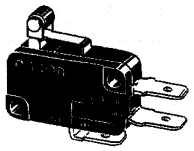


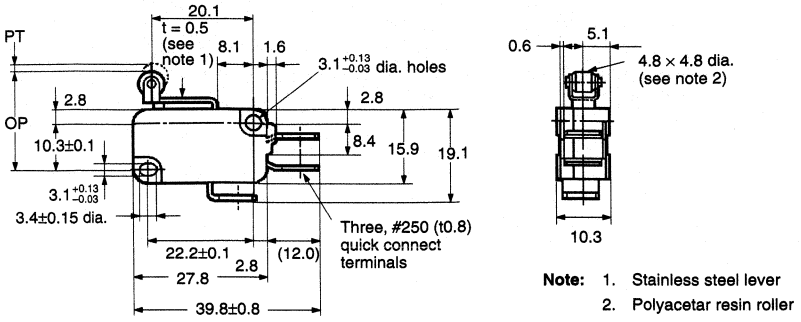


Note: Stainless steel lever

Short Roller Lever

V-215-1□6
V-165-1□5

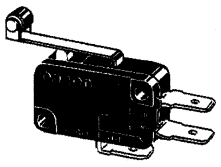


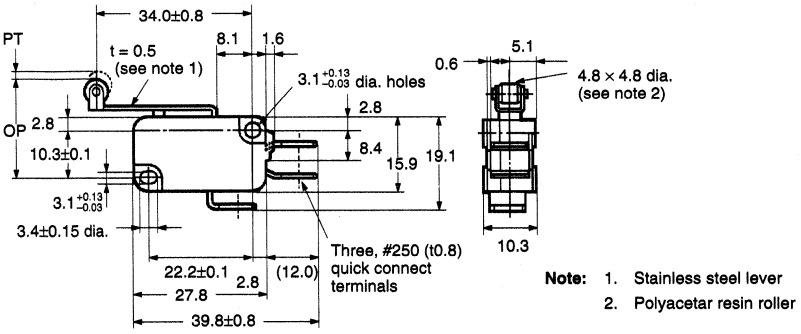


Note: 1. Stainless steel lever
2. Polyacetar resin roller

Standard Roller Lever

V-216-1□6
V-166-1□5





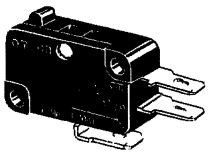
Note: 1. Stainless steel lever
2. Polyacetar resin roller

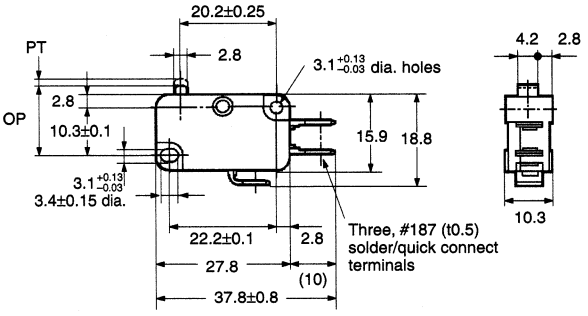
Thermoplastic Case (V-15/-10 Models)

The following illustration and drawing are for #187-series models with solder and tab terminals (terminals A). V models with a switching current of 15 A or 10 A incorporates terminals B, C2, and E. These models are different from #250-series models in terminal size only. Terminals B, C2, E, and side terminals are omitted from the following drawing. Refer to page NO TAG for these terminals.

Pin Plunger

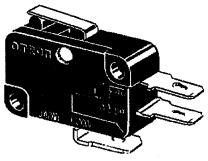
V-15-1□5
V-10-1□5

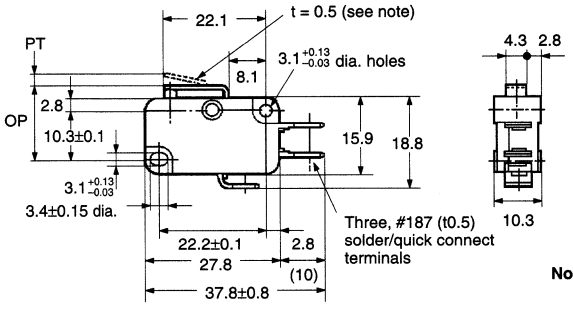




Short Lever

V-151-1□5
V-101-1□5

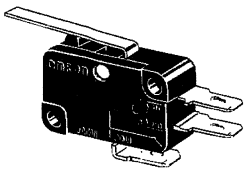


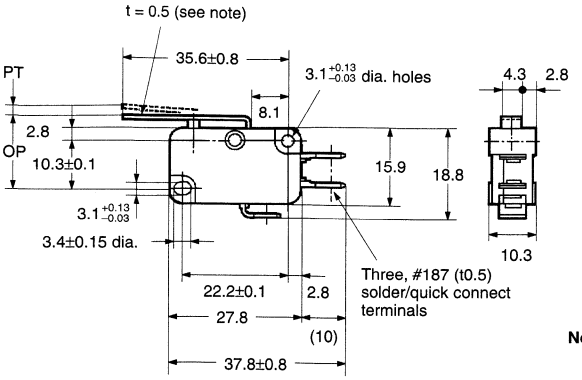


Note: Stainless steel lever

Standard Lever

V-152-1□5

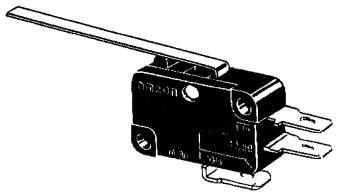


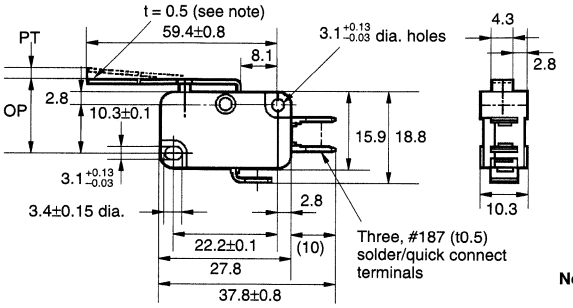


Note: Stainless steel lever

Long Lever

V-153-1□5

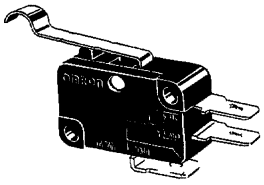


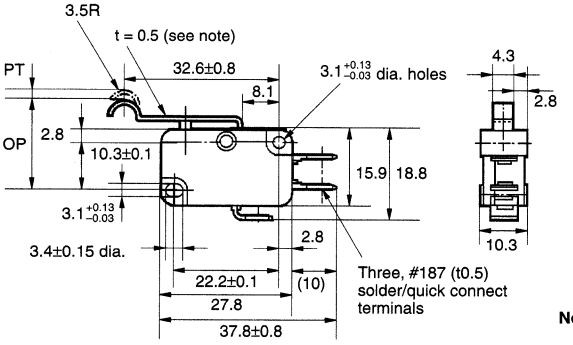


Note: Stainless steel lever

Simulated Lever

V-154-1□5

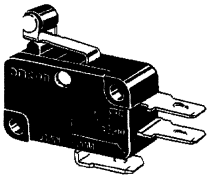


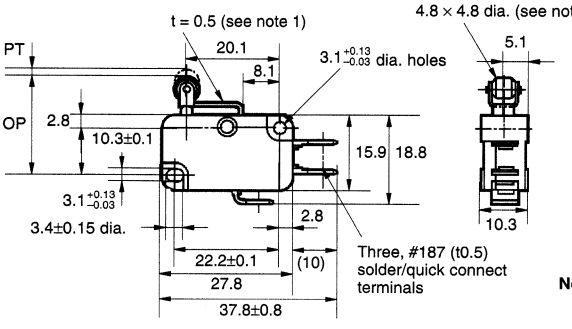


Note: Stainless steel lever

Short Roller Lever

V-155-1□5

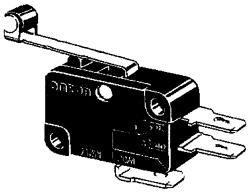


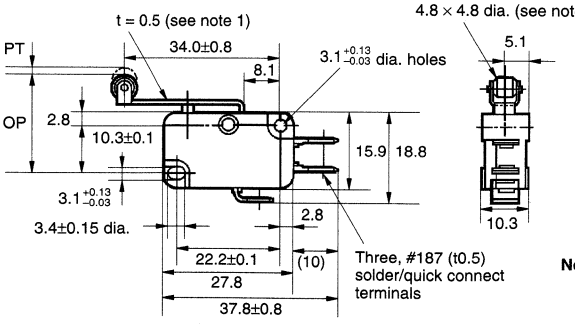


Note: 1. Stainless steel lever
2. Polyacetar resin roller

Standard Roller Lever

V-156-1□5

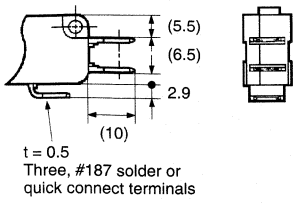


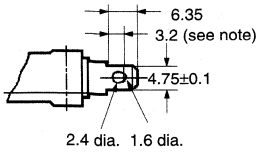


Note: 1. Stainless steel lever
2. Polyacetar resin roller

■ Terminals

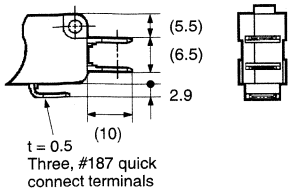
Solder/Quick-connect (#187) Terminal (A)

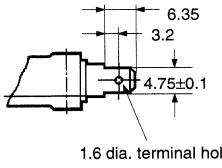




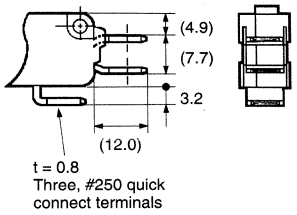
Note: Indicates the length to the center of the 1.6 dia. holes

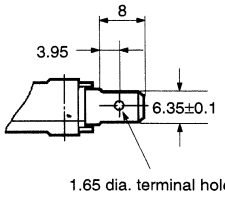
Quick-connect (#187) Terminal (C2)





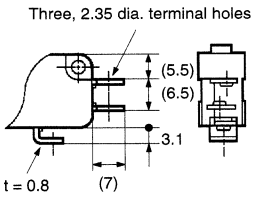
Quick-connect (#250) Terminal (C)



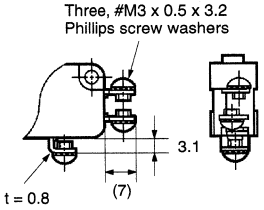


Bottom Terminal

Solder Terminal (E)



Screw Terminal (B)

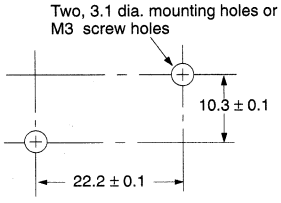


Precautions

Mounting

Use two M3 mounting screws with an appropriate screwdriver to mount the switch. Tighten the screws to a torque of 4 to 6 kg • cm (0.39 to 0.59 N • m).

Mountintg Holes



When soldering a lead wire to a terminal of the V, use a soldering iron with a maximum capacity of 60 W and do not take more than 5 s to solder the lead wire, otherwise the characteristics of the V may be altered.

Operation

Install the pin plunger switch so that the operating force is applied in alignment with the stroke of the actuator. The switch should be set so that is stroke is in the range of 60 to 90% of the rated OT (minimum value) when the switch has been operated.

Separator

When mounting a switch, check the insulation distance between the switch and the mounting plate. If the distance is not enough, mount the switch with an insulation guard or separator or use a switch that incorporates an insulation guard. Especially, when mounting a switch to a metal object, be sure to use an insulation guard or separator.

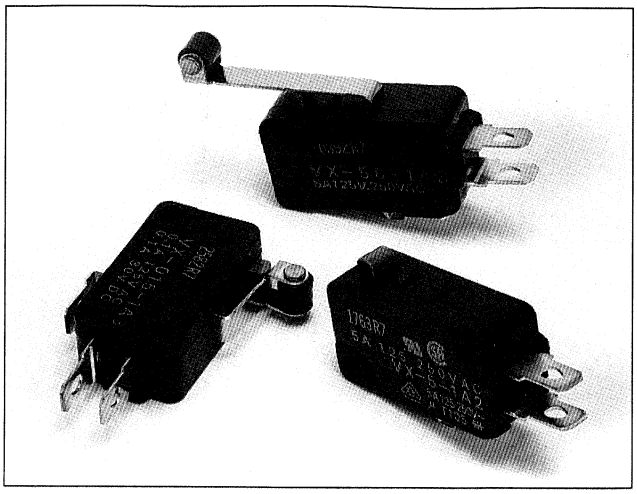
OMRON

Miniature Basic Switch

VX

Compact Basic Switch of Ultralow Gram Operation Assures Yet Higher Contact Reliability

- Uses an internal hinge lever mechanism for ultralow gram operation and outstanding contact reliability.
- Available in 5 A and 0.1 A rated versions.
- Shape is identical to that of the V-type compact Basic Switch.
- Electrical life in excess of 500,000 operations.

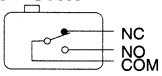


Ordering Information

Actuator	Connect terminal	OF max.	Model	
			5 A	0.1 A
Pin plunger	A	25 g	VX-5-1A2	VX-01-1A2
		50 g	VX-5-1A3	VX-01-1A3
	C2	25 g	VX-5-1C22	VX-01-1C22
		50 g	VX-5-1C23	VX-01-1C23
Short lever	A	50 g	VX-51-1A3	VX-011-1A3
	C2	50 g	VX-51-1C23	VX-011-1C23
Standard lever	A	30 g	VX-52-1A3	VX-012-1A3
	C2	30 g	VX-52-1C23	VX-012-1C23
Long lever	A	20 g	VX-53-1A3	VX-013-1A3
	C2	20 g	VX-53-1C23	VX-013-1C23
Simulated roller lever	A	30 g	VX-54-1A3	VX-014-1A3
	C2	30 g	VX-54-1C23	VX-014-1C23
Short roller lever	A	60 g	VX-55-1A3	VX-015-1A3
	C2	60 g	VX-55-1C23	VX-015-1C23
Standard roller lever	A	30 g	VX-56-1A3	VX-016-1A3
	C2	30 g	VX-56-1C23	VX-016-1C23

Note: Connect terminal
A: solder/187 tab common terminal
C2: tab terminal (187)

Contact Form



■ Approved Standards

UL (File No. E32667)/CSA (File No. LR21642)
VDE (File No. 62420)

■ Operating Characteristics

Model	VX-5-1□2	VX-5-1□3	VX-01-1□2	VX-01-1□3	VX-51-1□3	VX-011-1□3
OF max.	0.25 N (25 gf)	0.49 N (50 gf)	0.25 N (25 gf)	0.49 N (50 gf)	0.49 N (50 gf)	0.49 N (50 gf)
RF max.	0.03 N (3 gf)	0.05 N (5 gf)	0.03 N (3 gf)	0.05 N (5 gf)	(0.04 N (4 gf))	(0.04 N (4 gf))
PT max.	1.2 mm	1.2 mm	1.2 mm	1.2 mm	1.6 mm	1.6 mm
OT min.	1.0 mm	1.0 mm	1.0 mm	1.0 mm	0.8 mm	0.8 mm
MD max.	0.3 mm	0.3 mm	0.3 mm	0.3 mm	0.5 mm	0.5 mm
OP	14.7±0.4 mm				15.2±0.5 mm	

Note: The values in the parentheses are reference value.

Model	VX-52-1□3	VX-012-1□3	VX-53-1□3	VX-013-1□3	VX-54-1□3	VX-014-1□3
OF max.	0.29 N (30 gf)	0.29 N (30 gf)	0.2 N (20 gf)	0.2 N (20 gf)	0.29 N (30 gf)	0.29 N (30 gf)
RF max.	---	---	---	---	---	---
PT max.	4 mm	4 mm	9 mm	9 mm	4 mm	4 mm
OT min.	1.6 mm	1.6 mm	3.2 mm	3.2 mm	1.6 mm	1.6 mm
MD max.	0.8 mm	0.8 mm	2 mm	2 mm	0.8 mm	0.8 mm
OP	15.2±1.2 mm		15.2±2.6 mm		18.7±1.2 mm	

Model	VX-55-1□3	VX-015-1□3	VX-56-1□3	VX-016-1□3
OF max.	0.59 N (60 gf)	0.59 N (60 gf)	0.29 N (30 gf)	0.29 N (30 gf)
RF max.	(0.04 N (4 gf))	(0.04 N (4 gf))	---	---
PT max.	1.6 mm	1.6 mm	4 mm	4 mm
OT min.	0.8 mm	0.8 mm	1.6 mm	1.6 mm
MD max.	0.5 mm	0.5 mm	0.8 mm	0.8 mm
OP	20.7±0.6 mm		20.7±1.2 mm	

Note: The values in the parentheses are reference value.

Specifications

■ Ratings

Rated current	Rated voltage	Non-inductive load				Inductive laod				Inrush current
		Resistive load		Lamp load		Inductive load		Motor load		
		NC	NO	NC	NO	NC	NO	NC	NO	
5 A	250 VAC	5 A		0.5 A		4 A		---		Standard (VX-5): 15 A max.
	8 VDC	5 A		3 A		4 A		---		
	30 VDC	5 A		3 A		4 A		---		
	125 VDC	0.4 A		0.1 A		0.4 A		---		
	250 VDC	0.3 A		0.05 A		0.2 A		---		
0.1 A	125 VAC	0.1		---		---		---		
	8 VDC	0.1		---		---		---		
	30 VDC	0.1		---		---		---		

Note: 1. Inductive load has a power factor of 0.4 min. (AC) and a time constant of 7 ms max. (DC).
2. Lamp load has an inrush current of 10 times the steady-state current.
3. Motor load has an inrush current of 6 times the steady-state current.

■ Characteristics

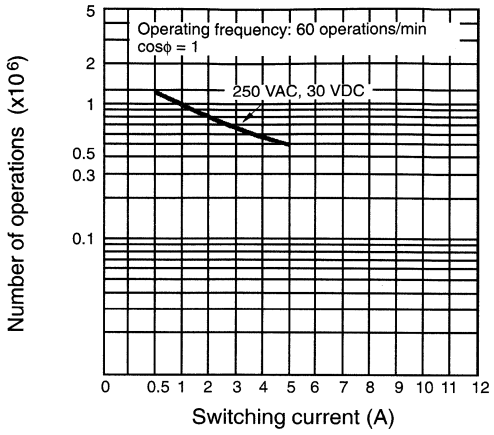
Item	VX-5	VX-01
Operating speed	0.1 mm to 1 m/s (at pin plunger)	
Operating frequency	Mechanical: 600 operations/min Electrical: 60 operations/min	
Insulation resistance	100 MΩ min. (at 500 VDC)	
Contact resistance	30 mΩ max. (initial value)	50 mΩ max. (initial value)
Dielectric strength	1,000 VAC, 50/60 Hz for 1 min between non-continuous terminals 1,500 VAC, 50/60 Hz for 1 min between each terminal and ground	
Vibration resistance (see note)	Malfunction: 10 to 55 Hz, 1.5-mm double amplitude	
Shock resistance (see note)	Destruction: 400 m/s^2 (approx. 40G) Malfunction: 100 m/s^2 (approx. 10G)	
Life expectancy	Mechanical: 50,000,000 operations min. Electrical: 500,000 operations min.	Mechanical: 10,000,000 operations min. Electrical: 1,000,000 operations min.
Ambient temperature	Operating: –25°C to 80°C (with no icing)	
Ambient humidity	Operating: 85% max.	
Weight	Approx. 6.2 g	

Note: The values are for pin plunger models.

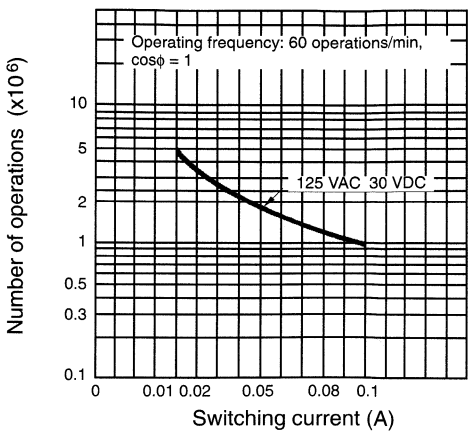
Engineering Data

Electrical Life Expectancy

VX-5



VX-01A

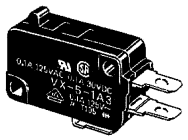


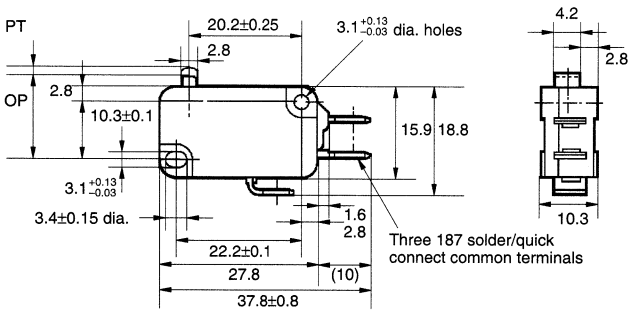
Dimensions

Note: 1. All units are in millimetres unless otherwise indicated.
2. Unless otherwise specified, a tolerance of ±0.4 mm applies to all dimensions.

Pin Plunger

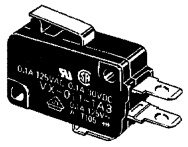
VX-5-1□2
VX-5-1□3
VX-01-1□2
VX-01-1□3

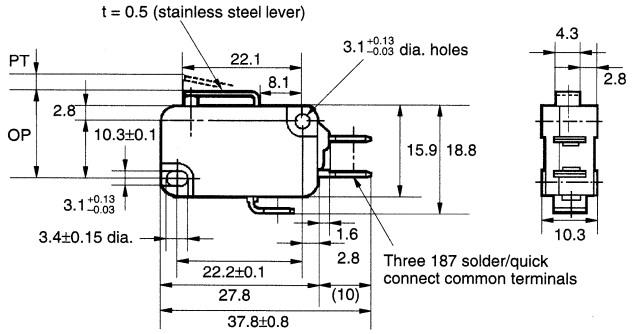




Short Lever

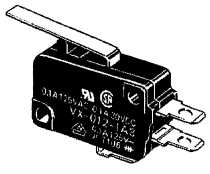
VX-51-1□3
VX-011-1□3

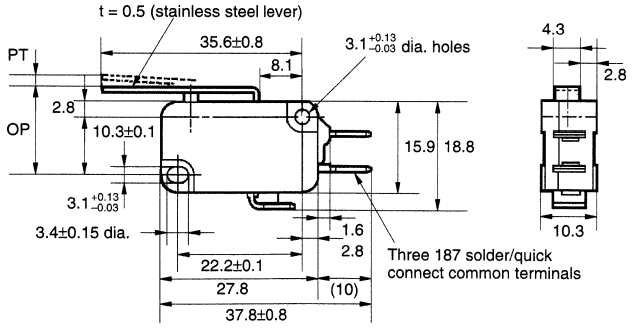




Standard Lever

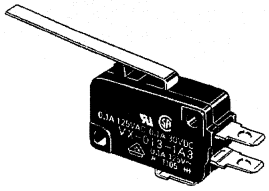
VX-52-1□3
VX-012-1□3

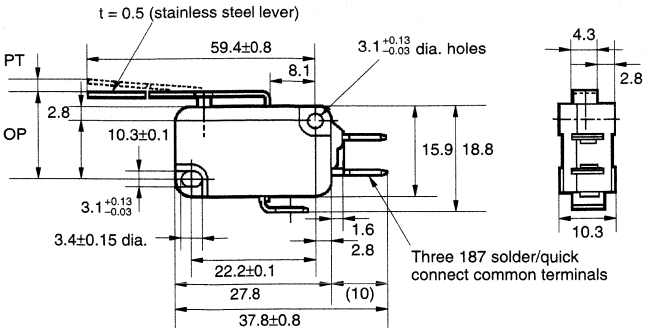




Long Lever

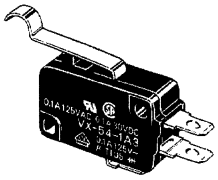
VX-53-1□3
VX-013-1□3

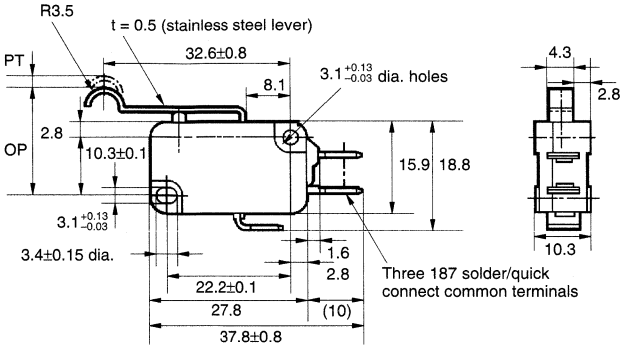




Simulated Roller Lever

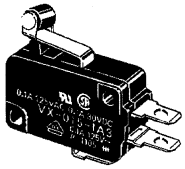
VX-54-1□3
VX-014-1□3

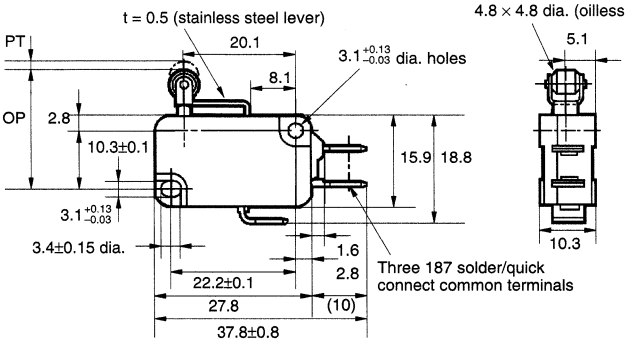




Short Roller Lever

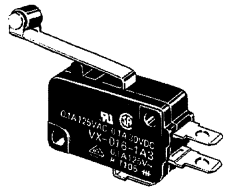
VX-55-1□3
VX-015-1□3

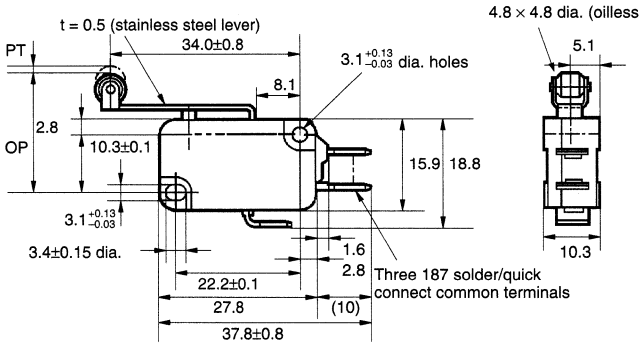




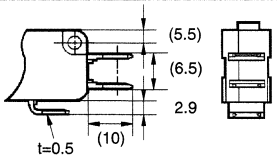
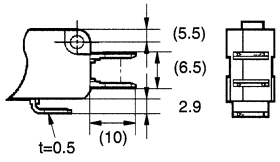
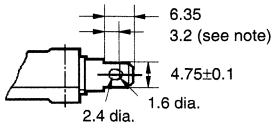
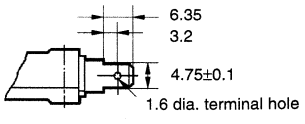
Standard Roller Lever

VX-56-1□3
VX-016-1□3





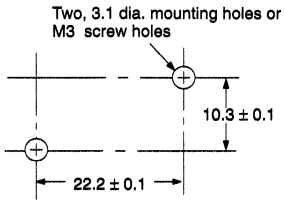
■ Terminals

Terminal	Solder/quick connect common terminal (187) (A terminal)	Quick connect terminal (187) (C2 terminal)
Bottom terminal	 Three 187 solder/quick connect common terminals	 Three 187 quick connect terminals
Terminal position	 **Note:** The length to the center of the 1.6 dia. holes.	

Precautions

Mounting

Use two M3 mounting screws with spring washers to mount the switch. Tighten the screws to a torque of 0.39 to 5.84 N • m (4 to 6 kg • cm).



When soldering a lead wire to a terminal of the VX, use a soldering iron with a maximum capacity of 60 W and do not take more than 5 s to solder the lead wire, otherwise the characteristics of the VX may be altered.

When mounting, make sure there is sufficient insulation distance between the switch and its mounting panel. if it is insufficient, install an insulation guard or separator. Always install an insulation guard or separator when mounting the microswitch on a metallic body. Contact your OMRON representative for information about insulation guards and separators.

Operation

Keep the operation control completely separate from the actuator of the switch, and push it down fully when starting operation. Do not displace the operating position of the actuator when machining.

Consult OMRON in advance if the operating speed is to be extremely slow, or if the pushbutton is to be set somewhere between the free position and operating position.
Mount pin pushbutton switches so the stroke of the pushbutton and the stroke of the operating control overlap on a vertical line. The stroke of the switch, after operation, should be set to 60% to 90% that of standard OT (MIN indication).

Switch Protection

Do not use where there are toxic gases (such as near an oil-burning stove), nor in a dusty or humid environment.
Depending on environmental conditions, the switch should be rechecked about 3 to 6 months after it has been assembled.

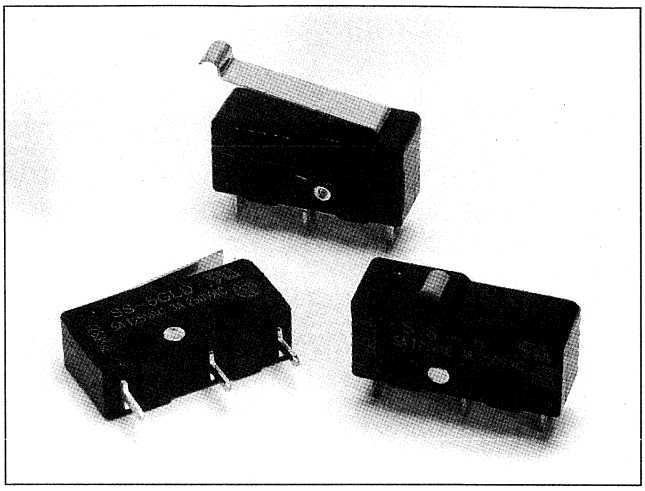
OMRON

Subminiature Basic Switch

SS

Economical, Subminiature Basic Switch Offers Long Life (30 x 10^6 Operations)

- Incorporating simple and stable two split springs which ensures a long service life (30,000,000 operations).
- A variety of models with low operating force to high operating force are available.
- Solder, quick-connect (#110) and PCB terminals are available.
- Wide switching capacity range from micro–voltage/current loads (1mA at 5VDC) to high capacity loads (10.1 A at 250 VAC)



Ordering Information

Note: A number of other lever options are available. See Note 2 under dimensions or contact Omron.

Rating	Actuator	OF max.	Soldering terminal	Quick-connect terminal (#110)	PCB terminal
0.1 A (bifurcated crossbar contacts for microvoltage/current load)	Pin plunger	25 g	SS-01-E	SS-01-ET	SS-01-ED
		50 g	SS-01-F	SS-01-FT	SS-01-FD
		150 g	SS-01	SS-01-T	SS-01D
	Standard lever	8 g	SS-01GL-E	SS-01GL-ET	SS-01GL-ED
		16 g	SS-01GL-F	SS-01GL-FT	SS-01GL-FD
		50 g	SS-01GL	SS-01GLT	SS-01GLD
	Simulated roller lever	8 g	SS-01GL13-E	SS-01GL13-ET	SS-01GL13-ED
		16 g	SS-01GL13-F	SS-01GL13-FT	SS-01GK13-FD
		50 g	SS-01GL13	SS-01GL13T	SS-01GL13D
	Standard roller lever	8 g	SS-01GL2-E	SS-01GL2-ET	SS-01GL2-ED
		16 g	SS-01GL2-F	SS-01GL2-FT	SS-01GL2-FD
		50 g	SS-01GL2	SS-01GL2T	SS-01GL2D
5 A (standard rivet contact)	Pin plunger	50 g	SS-5-F (see note)	SS-5-FT	SS-5-FD (see note)
		150 g	SS-5 (see note)	SS-5T	SS-5D (see note)
	Standard lever	16 g	SS-5GL-F (see note)	SS-5GL-FT	SS-5GL-FD (see note)
		50 g	SS-5GL (see note)	SS-5GLT	SS-5GLD (see note)
	Simulated roller lever	16 g	SS-5GL13-F (see note)	SS-5GL13-FT	SS-5GL13-FD (see note)
		50 g	SS-5GL13 (see note)	SS-5GL13T	SS-5GL13D (see note)
	Standard roller lever	16 g	SS-5GL2-F (see note)	SS-5GL2-FT	SS-5GL2-FD (see note)
		50 g	SS-5GL2 (see note)	SS-5GL2T	SS-5GL2D (see note)
10.1 A (standard rivet contact)	Pin plunger	150 g	SS-10 (see note)	SS-10T	SS-10D (see note)
	Standard lever	50 g	SS-10GL (see note)	SS-10GLT	SS-10GLD (see note)
	Simulated roller lever	50 g	SS-10GL13 (see note)	SS-10GL13T	SS-10GL13D (see note)
	Standard roller lever	50 g	SS-10GL2 (see note)	SS-10GL2T	SS-10GL2D (see note)

Note: EN61058-1 (IEC1058-1) approved by TÜV Rheinland.

Micro Switches

■ Model Number Legend

SS-□□□□

1 2 3 4

1. **Ratings**
   - 01: 0.1 A
   - 5: 5 A
   - 10: 10 A
2. **Actuator**
   - None: Pin plunger
   - GL: Hinge lever
   - GL13: Simulated hinge lever
   - GL2: Hinge roller lever
3. **OF Max. (at Pin Plunger)**
   - None: 150 gf
   - -F: 50 gf
   - -E: 25 gf
4. **Terminals**
   - None: Solder
   - T: Quick-connect (#110)
   - D: PCB

Specifications

■ Ratings

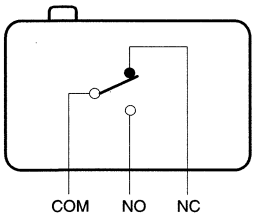
Type	Rated voltage	SS-10, SS-5								SS-01	
		Non-inductive load				Inductive load				Non-inductive load	
		Resistive load		Lamp load		Inductive load		Motor load		Resistive load	
		NC	NO	NC	NO	NC	NO	NC	NO	NC	NO
General-purpose	125 VAC	5 (10.1) A		1.5 A	0.7 A	3 A		2.5 A	1.3 A	0.1 A	
	250 VAC	3 (10.1) A		1 A	0.5 A	2 A		1.5 A	0.8 A	---	
	8 VDC	5 (10.1) A		2 A		5 A	4 A	3 A		---	
	14 VDC	5 (10.1) A		2 A		4 A	4 A	3 A		---	
	30 VDC	4 A		2 A		3 A	3 A	3 A		0.1 A	
	125 VDC	0.4 A		0.05 A		0.4 A	0.4 A	0.05 A		---	
	250 VDC	0.2 A		0.03 A		0.2 A	0.2 A	0.03 A		---	

Note:
1. Inductive load has a power factor of 0.4 min. (AC) and a time constant of 7 ms max. (DC).
2. Lamp load has an inrush current of 10 times the steady-state current.
3. Motor load has an inrush current of 6 times the steady-state current.
4. Data in parentheses apply to the SS-10 series only.
5. If the switch is used in a DC circuit and is subjected to a surge, connect a surge suppressor across the switch.

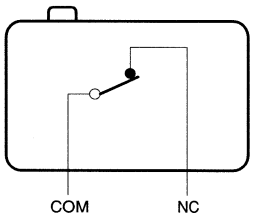
Contact Form

The normally open (SPST-NO) and normally closed (SPST-NC) types are not listed under *Ordering Information*. Consult OMRON directly.

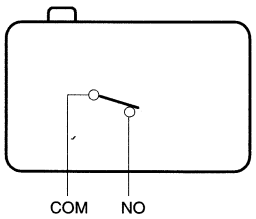
SPDT



SPST-NC



SPST-NO



■ Approved Standards

UL (File No. E32667)/CSA (File No. LR21642)

SS-10 series: 10.1 A at 250 VAC
SS-5 series: 5 A at 125 VAC, 3 A at 250 VAC
SS-01 series: 0.1 A at 125 VAC, 0.1 A at 30 VDC

SEMKO (File No. 8614026)/VDE (File No. 221)

SS-5 series: 5 A at 250 VAC

SEMKO (File No. 8916091)/VDE (File No. 221)

SS-10 series: 10 A at 250 VAC

SEV (File No. 93, 5, 51936, 01)

SS-5 series: 5 A at 250 VAC

EN61058-1 (IEC1058-1) (TÛV Rheinland, File No. T9451450)

SS-5: 5 A at 250 VAC, 5(1) A at 250 VAC
SS-10: 10 A at 250 VAC

■ Characteristics

Operating speed	0.1 mm to 1 m/s (at pin plunger)
Operating frequency	Mechanical: 400 operations/min Electrical: 60 operations/min
Insulation resistance	100 MΩ min. (at 500 VDC)
Contact resistance (initial value)	OF 150 gf: SS-01 series: 50 mΩ max. SS-5, SS-10 series: 30 mΩ max. OF 50 gf: SS-01 series: 100 mΩ max. SS-5 series: 50 mΩ max. OF 25 gf: SS-01 series: 150 mΩ max.
Inrush current	NC: 20 A max. for SS-10 and SS-5, 1 A max. for SS-01 NO: 15 A max. for SS-10, 10 A max. for SS-5, 1 A max. for SS-01
Dielectric strength	1,000 VAC (600 VAC for crossbar contact model), 50/60 Hz for 1 min between the same polarities 1,500 VAC, 50/60 Hz for 1 min between current-carrying metal part and ground, and between each terminal and non-current-carrying metal part
Vibration resistance	Malfunction: 10 to 55 Hz, 1.5-mm double amplitude
Shock resistance	Mechanical: OF 150 gf: 1,000 m/s^2 (approx. 100G min.) OF 25/50 gf: 500 m/s^2 (approx. 50G min.) Malfunction: OF 150 gf: 300 m/s^2 (approx. 30G min.) OF 25/50 gf: 200 m/s^2 min. (approx. 20G min.) **Note:** Lever-type model: Operating limit position (with a contact separation time of 1 ms max.)
Life expectancy	Mechanical: 30,000,000 operations min. (OT: rated value) 10,000,000 operations min. for SS-10 series Electrical: 200,000 operations min. (OT: full) 50,000 operations min. for SS-10 series
Ambient temperature	Operating: –25°C to 85°C (with no icing)
Ambient humidity	Operating: 85% max.
Contact	Type: Rivet for SS-10 and SS-5, crossbar for SS-01 Material: Silver alloy for SS-10, silver for SS-5, PGS alloy for SS-01
Weight	Approx. 1.6 g (pin plunger)

Characteristics Approved by TÜV Rheinland for EN61058-1

Enclosure rating	IP00
Degree of protection against electrical shock	Class 1
Ambient temperature	0°C to 85°C (with no icing)
Operating cycles	50,000
Proof Tracking Index (PTI)	175 V
Switch category	D

■ Operating Characteristics

Model	SS-01-E	SS-01-F, SS-5-F	SS-01, SS-5	SS-10
OF max.	0.25 N (25 gf)	0.49 N (50 gf)	1.47 N (150 gf)	1.47 N (150 gf)
RF min.	0.02 N (2 gf)	0.04 N (4 gf)	0.25 N (25 gf)	0.25 N (25 gf)
PT max.	0.5 mm	0.5 mm	0.5 mm	0.6 mm
OT min.	0.5 mm	0.5 mm	0.5 mm	0.4 mm
MD max.	0.1 mm	0.1 mm	0.1 mm	0.12 mm
OP	8.4±0.5 mm			

Model	SS-01GL-E	SS-01GL-F, SS-5GL-F	SS-01GL, SS-5GL	SS-10GL
OF max.	0.08 N (8 gf)	0.16 N (16 gf)	0.49 N (50 gf)	0.49 N (50 gf)
RF min.	(0.01 N (1 gf))	0.02 N (2 gf)	0.06 N (6 gf)	0.06 N (6 gf)
OT min.	1.2 mm	1.2 mm	1.2 mm	1.0 mm
MD max.	0.8 mm	0.8 mm	0.8 mm	1.0 mm
FP max.	13.6 mm			
OP	8.8±0.8 mm			

Note: Values in brackets are possible when the switch is mounted so that the weight of the lever will not be imposed on the plunger.

Model	SS-01GL13-E	SS-01GL13-F, SS-5GL13-F	SS-01GL13, SS-5GL13	SS-10GL13
OF max.	0.08 N (8 gf)	0.16 N (16 gf)	0.49 N (50 gf)	0.49 N (50 gf)
RF min.	(0.01 N (1 gf))	0.02 N (2 gf)	0.06 N (6 gf)	0.06 N (6 gf)
OT min.	1.2 mm	1.2 mm	1.2 mm	1.0 mm
MD max.	0.8 mm	0.8 mm	0.8 mm	1.0 mm
FP max.	15.5 mm			
OP	10.7±0.8 mm			

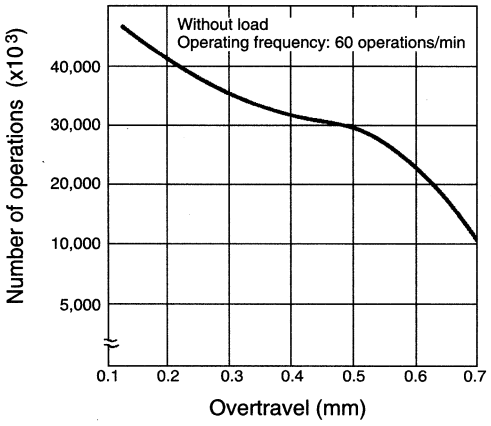
Model	SS-01GL2-E	SS-01GL2-F, SS-5GL2-F	SS-01GL2, SS-5GL2	SS-10GL2
OF max.	0.08 N (8 gf)	0.16 N (16 gf)	0.49 N (50 gf)	0.49 N (50 gf)
RF min.	(0.01 N (1 gf))	0.02 N (2 gf)	0.06 N (6 gf)	0.06 N (6 gf)
OT min.	1.2 mm	1.2 mm	1.2 mm	1.0 mm
MD max.	0.8 mm	0.8 mm	0.8 mm	1.0 mm
FP max.	19.3 mm			
OP	14.5±0.8 mm			

Note: Values in brackets are possible when the switch is mounted so that the weight of the lever will not be imposed on the plunger.

Engineering Data

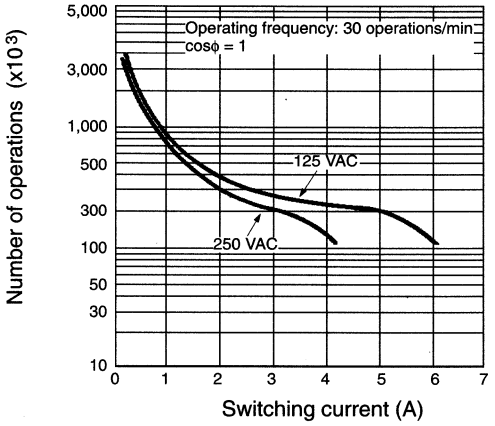
Mechanical Life Expectancy

SS-5, SS-01 Series



Electrical Life Expectancy

SS-5 Series

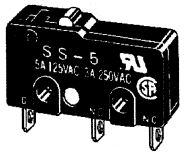


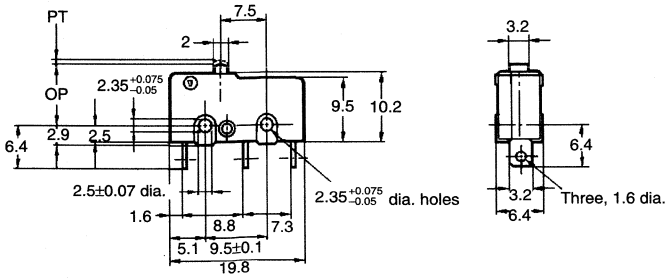
Dimensions

Note: 1. All units are in millimetres unless otherwise indicated.
2. Unless otherwise specified, a tolerance of ±0.4 mm applies to all dimensions.
3. The following illustration and drawing are for solder terminal models. Refer to page NO TAG for details on models with quick-connect terminals (#110) or PCB terminals.

Pin Plunger

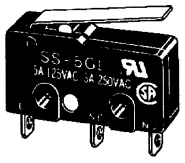
SS-01(-E, -F)
SS-5(-F)
SS-10

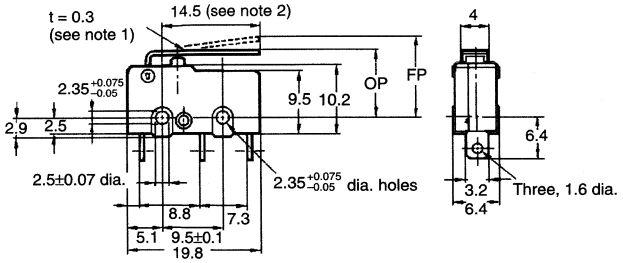




Standard Lever

SS-01GL(-E, -F)
SS-5GL(-F)
SS-10GL

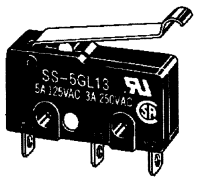


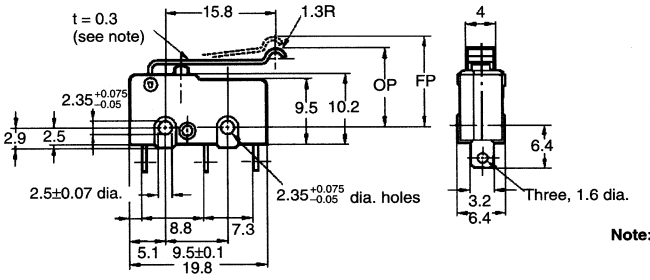


Note: 1. Stainless steel lever
2. Besides the SS-□GL-series models with a hinge lever length of 14.5, the SS-□GL11-series models with a hinge lever length of 18.5, the SS-□GL111-series models with a hinge lever length of 22.6, and the SS-□GL1111-series models with a hinge lever length of 37.8 are available. Contact your OMRON representative for these models

Simulated Roller Lever

SS-01GL13(-E, -F)
SS-5GL13(-F)
SS-10GL13

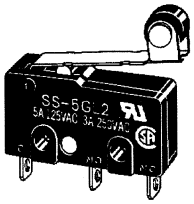


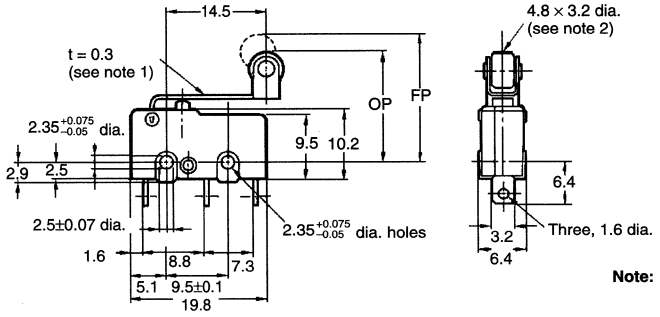


Note: Stainless steel spring lever

Standard Roller Lever

SS-01GL2(-E, -F)
SS-5GL2(-F)
SS-10GL2

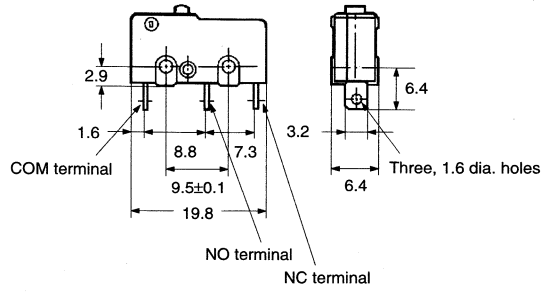




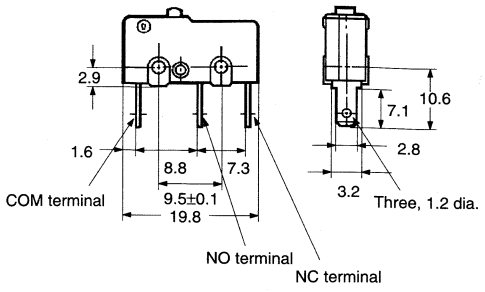
Note: 1. Stainless steel spring lever
2. Polyacetal resin roller

■ Terminals

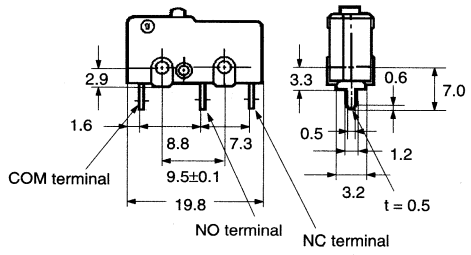
Solder Terminal



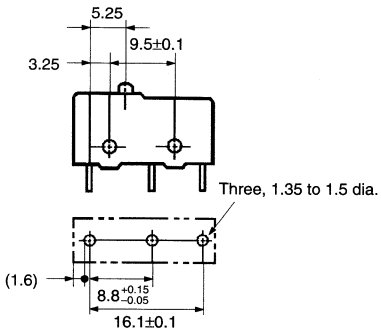
Quick-connect Terminal (#110)



PCB Terminal



PCB Mounting Dimensions (Reference)

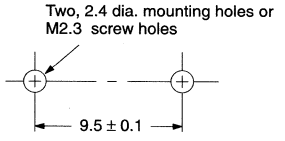


Precautions

Mounting

Use two M2.3 mounting screws with spring washers to mount the switch. Tighten the screws to a torque of 0.23 to 0.27 N • m (2.3 to 2.7 kgf • cm).

Mounting Holes



Actuating

For the secure operation, 60% to 90% of rated overtravel should be maintained.

Spacing

Switch does not have a ground terminal. The minimum thickness of insulation according to IEC1058-1 is 1.1 mm, and the minimum clearance between live terminals and mounting plate is 1.6 mm. If the proper insulation for the terminator cannot be obtained, add insulation such as a separator or insulation cover on the switch.

Soldering

When soldering switch terminals, apply a soldering iron rated at 60 W max. and finish soldering quickly within 5 seconds. During soldering and 1 minute after soldering, do not apply external force to the terminals. Solder terminals are provided with a hole for the mechanical mounting of a conductor.

Conductors for the soldering terminal should be flexible and its cross-section should be 0.5 to 0.75 mm^2 for the SS-5 series and 0.75 mm^2 for the SS-10 series.

Others

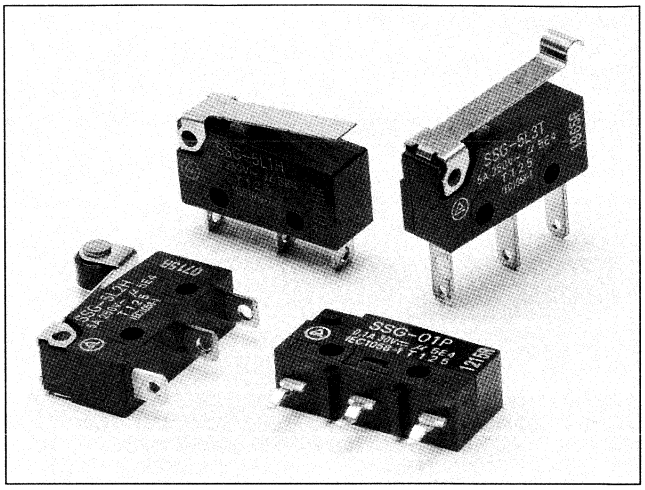
If a surge current or inrush current is involved in a DC circuit, it is recommended to use a cancellation circuit.

OMRON

Subminiature Basic Switch | SSG

Subminiature Basic Switch Approved by BEAB to EN61058–1

- A wide operating temperature range of –25°C to 125°C is available for at high-temperature use.
- A wide variety of terminals: Solder, Tab (#110), and PCB Terminal Models.
- PCB Terminal Models are resistant to flux.
- PCB terminal pin spacing conforms to DIN41635 Form B.



BEAB

Micro Switches

Ordering Information

Actuator	Rating	OF max.	Solder	Tab (#110)	PCB
Pin plunger	0.1 A	1.50 N	SSG-01H	SSG-01T	SSG-01P
		0.50 N	SSG-01H-5	SSG-01T-5	SSG-01P-5
	5 A	1.50 N	SSG-5H	SSG-5T	SSG-5P
		0.50 N	SSG-5H-5	SSG-5T-5	SSG-5P-5
Standard lever	0.1 A	0.60 N	SSG-01L1H	SSG-01L1T	SSG-01L1P
		0.20 N	SSG-01L1H-5	SSG-01L1T-5	SSG-01L1P-5
	5 A	0.60 N	SSG-5L1H	SSG-5L1T	SSG-5L1P
		0.20 N	SSG-5L1H-5	SSG-5L1T-5	SSG-5L1P-5
Simulated roller lever	0.1 A	0.60 N	SSG-01L3H	SSG-01L3T	SSG-01L3P
		0.20 N	SSG-01L3H-5	SSG-01L3T-5	SSG-01L3P-5
	5 A	0.60 N	SSG-5L3H	SSG-5L3T	SSG-5L3P
		0.20 N	SSG-5L3H-5	SSG-5L3T-5	SSG-5L3P-5
Standard roller lever	0.1 A	0.60 N	SSG-01L2H	SSG-01L2T	SSG-01L2P
		0.20 N	SSG-01L2H-5	SSG-01L2T-5	SSG-01L2P-5
	5 A	0.60 N	SSG-5L2H	SSG-5L2T	SSG-5L2P
		0.20 N	SSG-5L2H-5	SSG-5L2T-5	SSG-5L2P-5

Specifications

■ Ratings

1. General Ratings

Rated voltage	Non-inductive load				Inductive laod			
	Resistive load		Lamp load		Inductive load		Motor load	
	NC	NO	NC	NO	NC	NO	NC	NO
125 VAC	5 (0.1) A (see note 1)		1.5 A	0.7 A	3 A		2.5 A	1.3 A
250 VAC	3 A		1 A	0.5 A	2 A		1.5 A	0.8 A
8 VDC	5 A		2 A		5 A		3 A	
14 VDC	5 A		2 A		4 A		3 A	
30 VDC	4 (0.1) A (see note 1)		2 A		3 A		3 A	
125 VDC	0.4 A		0.05 A		0.4 A		0.05 A	
250 VDC	0.2 A		0.03 A		0.2 A		0.05 A	

Note:
1. The values in the parentheses are for the SSG-01.
2. The above current ratings are the values of the steady-state current.
3. Inductive load has a power factor of 0.7 min. (AC) and a time constant of 7 ms max. (DC).
4. Lamp load has an inrush current of 10 times the steady-state current.
5. Motor load has an inrush current of 6 times the steady-state current.
6. If the switch is used in a DC circuit and is subjected to a surge current, connect a surge suppressor across the switch.

2. BEAB, TÜV Rheinland Approved Rating (EN61058-1/IEC1058-1)

SSG-5 series: 5 A at 250 VAC (T125, 50,000 operations)
SSG-01 series: 0.1 A at 30 VDC (T125, 50,000 operations)

3. UL, CSA Approved Rating

SSG-5 series: 5 A at 125 VAC, 3 A at 250 VAC (6,000 operations)
SSG-01 series: 0.1 A at 125 VAC, 0.1 A at 30 VDC (6,000 operations)

■ Characteristics

Operating speed	0.1 mm to 1 m/s (at pin plunger)
Operating frequency	Mechanical: 400 operations/min Electrical: 60 operations/min
Insulation resistance	100 MΩ min.
Contact resistance	OF 1.50 N: SSG-5 series: 30 mΩ max. SSG-01 series: 50 mΩ max. OF 0.50 N SSG-5 series: 50 mΩ max. SSG-01 series: 100 mΩ max.
Dielectric strength	1,000 VAC, 50/60 Hz for 1 min between contacts of the same polarity (600 VAC for SSG-01H and SSG-01T series) 1,500 VAC, 50/60 Hz for 1 min between each terminal and ground 1,500 VAC, 50/60 Hz for 1 min between each terminal and non-current-carrying metal part
Inrush current	SSG-5: NO: 20 A max. NC: 10 A max. SSG–01: NO: 1 A max. NC: 1 A max.
Vibration resistance	Malfunction: 10 to 2,000 Hz, 196 m/s^2 (20G) (Contact open: 10 μs max., lever position: at TTP)
Shock resistance	Malfunction: 490 m/s^2 (approx. 50G) (Contact open: 10 μs max., lever position: at TTP)
Life expectancy	Mechanical: 10,000,000 operations min. (OT: rated value) Electrical: 200,000 operations min. (5 A at 125 VAC for SSG-5, 0.1 A at 125 VAC for SSG-01, resistive OT:full)
Degree of protection (IP code)	IP00 (IEC1058-1)
Degree of protection against electrical shock	Class I (IEC1058-1)
Proof tracking index	175 V (IEC1058-1)
Switch category (IEC335-1)	D (IEC1058-1)

■ Contact

Item	SSG-5	SSG-01
Specification	Rivet	Crossbar
Material	Silver	PGS alloy

■ Safety Standards

Certification body	Standard	File no.
BEAB	EN61058-1 (IEC1058-1)	CO746
TÜV Rheinland	EN61058-1 (IEC1058-1)	T9451449
UL	UL1054	E32667
CSA	C22.2 No.54	LR21642

■ Operating Characteristics

Solder/Tab Terminal

Type	Pin plunger		Standard lever		Simulated roller lever		Standard roller lever	
	SSG-01□ SSG-5□	SSG-01□-5 SSG-5□-5	SSG-01L1□ SSG-5L1□	SSG-01L1□-5 SSG-5L1□-5	SSG-01L3□ SSG-5L3□	SSG-01L3□-5 SSG-5L3□-5	SSG-01L2□ SSG-5L2□	SSG-01L2□-5 SSG-5L2□-5
OF max.	1.50 N (153 gf)	0.50 N (51 gf)	0.60 N (61 gf)	0.20 N (20 gf)	0.60 N (61 gf)	0.20 N (20 gf)	0.60 N (61 gf)	0.20 N (20 gf)
RF min.	0.25 N (25 gf)	0.04 N (4 gf)	0.06 N (6 gf)	0.02 N (2 gf)	0.06 N (6 gf)	0.02 N (2 gf)	0.06 N (6 gf)	0.02 N (2 gf)
PT max.	0.6 mm		1.0 mm		1.0 mm		1.0 mm	
OT min.	0.4 mm		0.8 mm		0.8 mm		0.8 mm	
MD max.	0.1 mm		---		---		---	
FP max.	---		13.6 mm		15.5 mm		19.0 mm	
OP	8.4±0.3 mm		$8.8^{+1.0}_{-0.6}$ mm		$10.7^{+1.0}_{-0.6}$ mm		$14.5^{+1.0}_{-0.6}$ mm	

PCB Terminal

Type	Pin plunger		Standard lever		Simulated roller lever		Standard roller lever	
	SSG-01P SSG-5P	SSG-01P-5 SSG-5P-5	SSG-01L1P SSG-5L1P	SSG-01L1P-5 SSG-5L1P-5	SSG-01L3P SSG-5L3P	SSG-01L3P-5 SSG-5L3P-5	SSG-01L2P SSG-5L2P	SSG-01L2P-5 SSG-5L2P-5
OF max.	1.50 N (153 gf)	0.50 N (51 gf)	0.60 N (61 gf)	0.20 N (20 gf)	0.60 N (61 gf)	0.20 N (20 gf)	0.60 N (61 gf)	0.20 N (20 gf)
RF min.	0.25 N (25 gf)	0.04 N (4 gf)	0.06 N (6 gf)	0.02 N (2 gf)	0.06 N (6 gf)	0.02 N (2 gf)	0.06 N (6 gf)	0.02 N (2 gf)
PT max.	0.6 mm		1.0 mm		1.0 mm		1.0 mm	
OT min.	0.4 mm		0.8 mm		0.8 mm		0.8 mm	
MD max.	0.1 mm		---		---		---	
FP max.	---		17.0 mm		18.9 mm		22.4 mm	
OP	11.8±0.4 mm		$12.2^{+1.1}_{-0.7}$ mm		$14.4^{+1.1}_{-0.7}$ mm		$17.9^{+1.1}_{-0.7}$ mm	

Dimensions

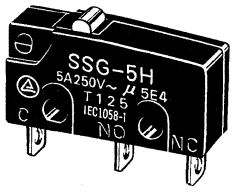
Note: 1. All units are in millimetres unless otherwise indicated.
2. Every actual model number includes the code instead of □ for the kind of terminals incorporated by the model.
3. Unless otherwise specified, a tolerance of ±0.4 mm applies to all dimensions.

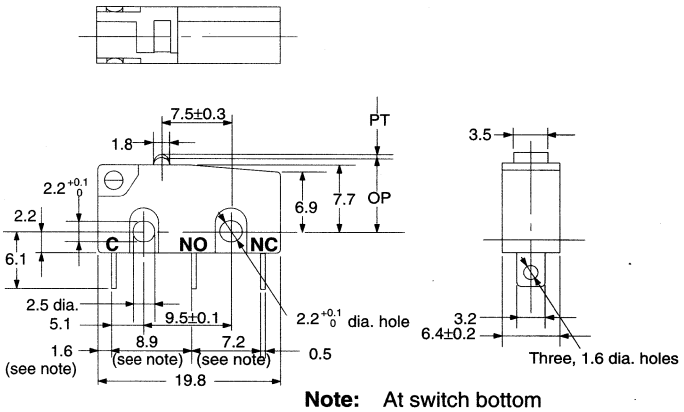
■ Terminal Model

Solder/Tab Terminal

Pin Plunger

SSG-01□
SSG-5□
SSG-01□-5
SSG-5□-5

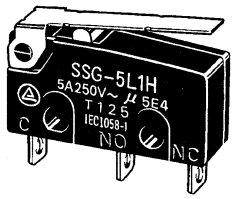


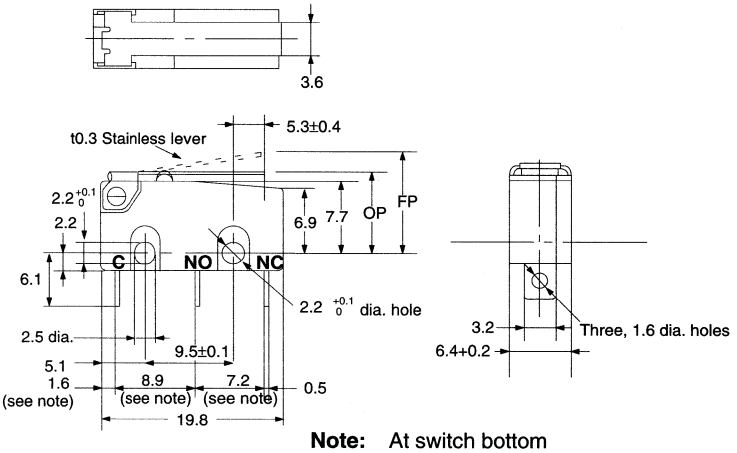


Note: At switch bottom

Standard Lever

SSG-01L1□
SSG-5L1□
SSG-01L1□-5
SSG-5L1□-5

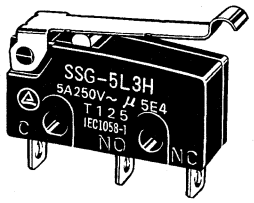


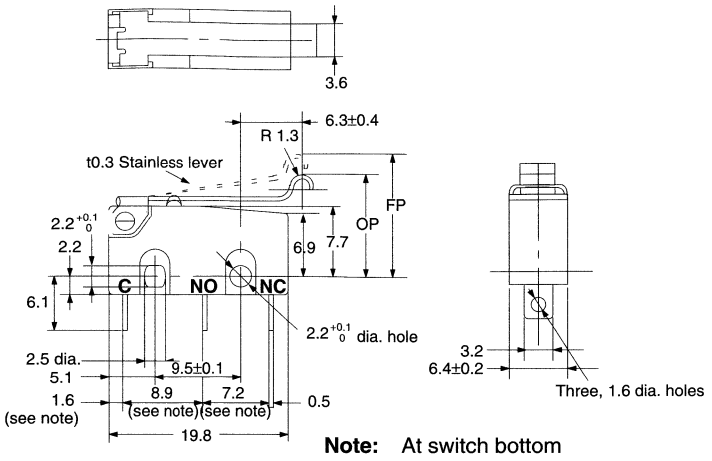


Note: At switch bottom

Simulated Roller Lever

SSG-01L3□
SSG-5L3□
SSG-01L3□-5
SSG-51L3□-5

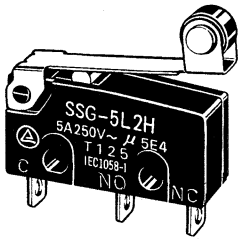


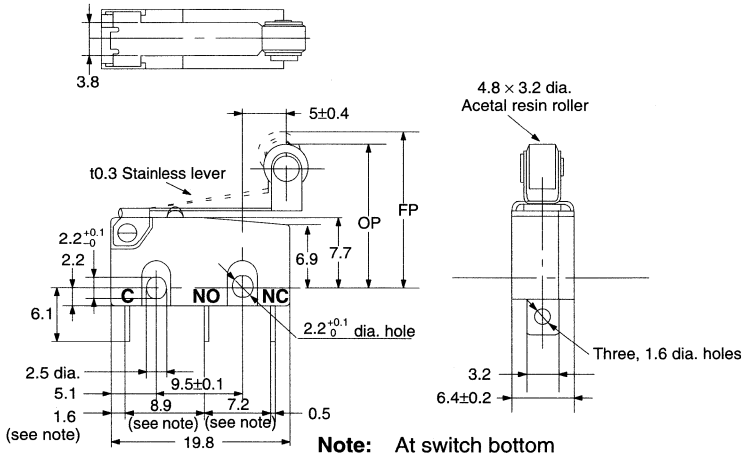


Note: At switch bottom

Standard Roller Lever

SSG-01L2□
SSG-5L2□
SSG-01L2□-5
SSG-5L2□-5



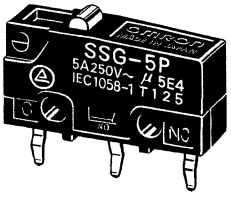


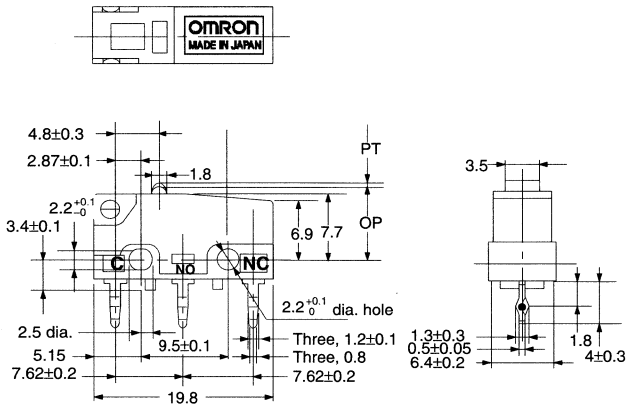
Note: At switch bottom

PCB Terminal

Pin Plunger

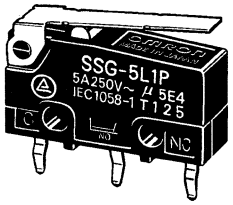
SSG-01P
SSG-5P
SSG-01P-5
SSG-5P-5

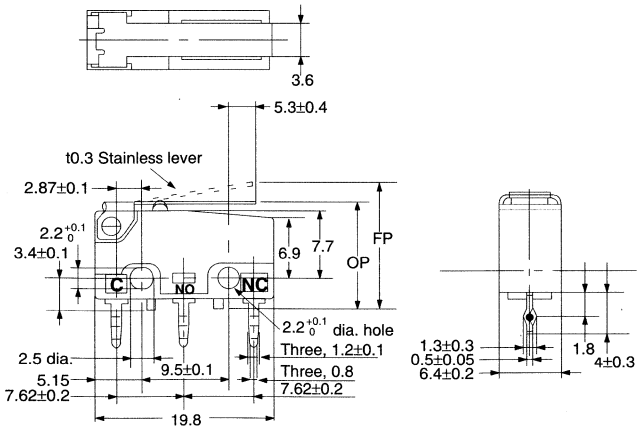




Standard Lever

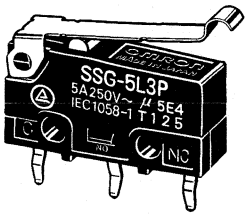
SSG-01L1P
SSG-5L1P
SSG-01L1P-5
SSG-5L1P-5

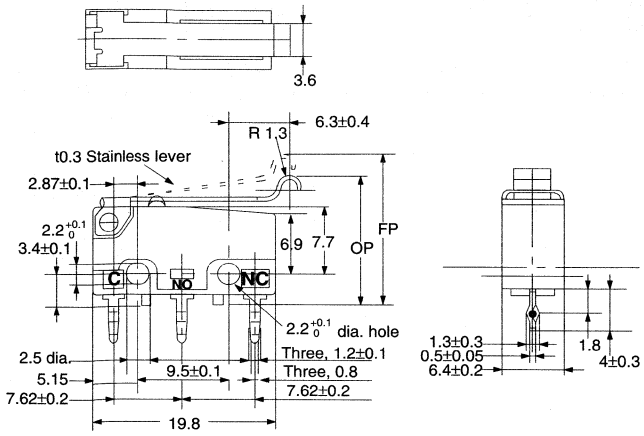




Simulated Roller Lever

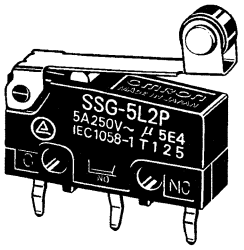
SSG-01L3P
SSG-5L3P
SSG-01L3P-5
SSG-51L3P-5

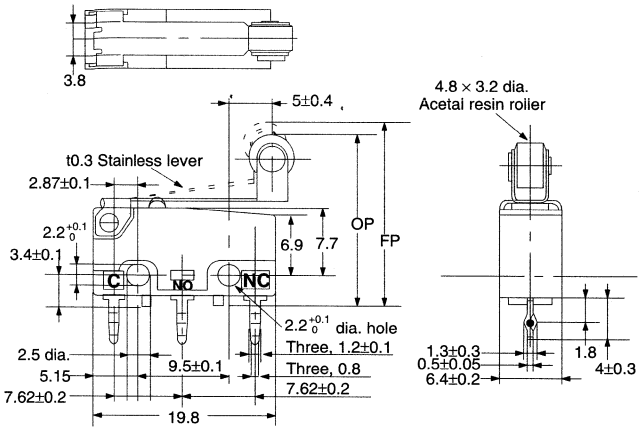




Standard Roller Lever

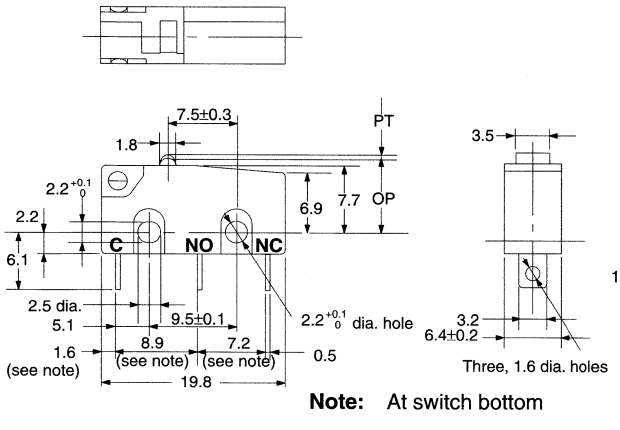
SSG-01L2P
SSG-5L2P
SSG-01L2P-5
SSG-5L2P-5





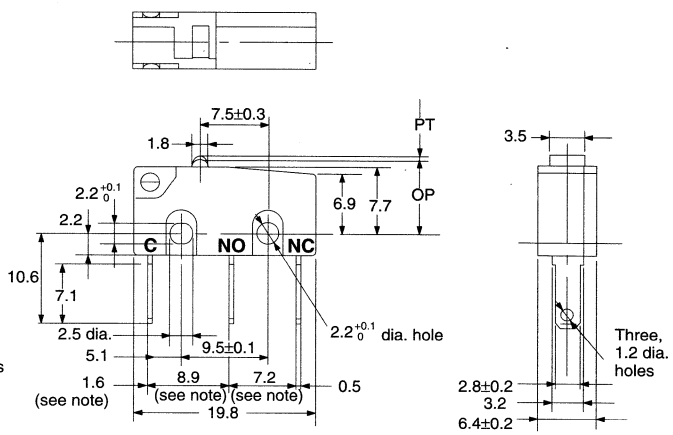
■ Terminals

Solder Terminals



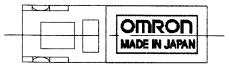
Note: At switch bottom

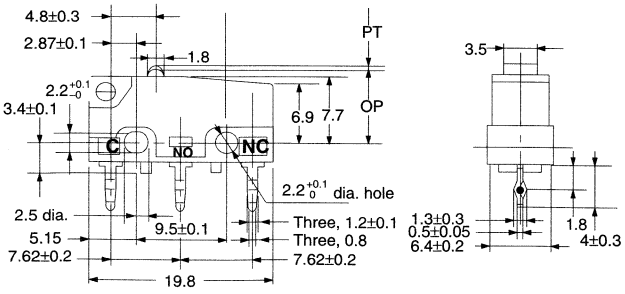
Tab Terminals (#110)



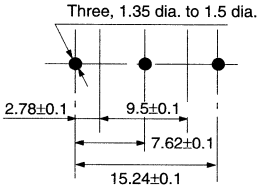
Note: At switch bottom

PCB Terminals





PCB Mounting



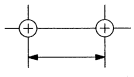
Micro Switches

Precautions

Mounting

Use two 2.2 mounting screws with spring washers to mount the switch. Tighten the screws to a torque of 0.20 to 0.25 N • m (2 to 2.5 kgf • cm).

Mounting Holes



The switch does not have a ground terminal. The minimum distance through insulation (IEC1058-1) is 0.9 mm. If proper insulation for the end product cannot be secured, additional insulation such as a separator or insulation cover should be attached.

Soldering

When soldering switch terminals, apply a soldering iron rated at 60 W max. and finish soldering quickly within 3 seconds. During soldering and 1 minute after soldering, do not apply external force to the terminals.
Solder terminal is provided with a hole so that a conductor can be secured mechanically.

The conductors for a soldering terminal (H type) should be flexible and its cross section should be AWG18 to 20 for the SSG-5H Series and AWG20 to 22 for the SSG-01H Series.

To automatically solder the switch to a PCB in a soldering bath, complete soldering within 5 seconds at a flux temperature of 250°C and avoid the overflow of flux onto the surface of the PCB where the switch or other parts are mounted.

Actuating

Make sure that the operating speed and frequency are within the permissible range of the switch.

1. Do not use the switch in an application where the operating speed is extremely slow or the switching operation could become unstable or malfunctioning could result due to contact failure or contact welding.
2. Do not use the switch in an application where the operating speed is too fast, or the switch will be broken due to a shock or the movable contact will not keep up with the speed.

The reliability of a switch is maintained within the permissible operating speed and frequency of the switch. The life of a switch is determined at a specified operating speed, therefore, it varies with the actual operating speed and frequency.

The switch should be set so that its stroke will be in the range of 60% to 90% of the rated OT when the switch is operated. The stroke must not exceed the rated OT value.

Malfunctioning can result if the switch is set with its stroke exceeding the rated OT. Therefore the proper adjustment of the mounting position is essential when installing the switch.

Do not apply excessive force to the actuator. Be very careful not to apply force in the opposite and lateral directions relative to the operating direction.

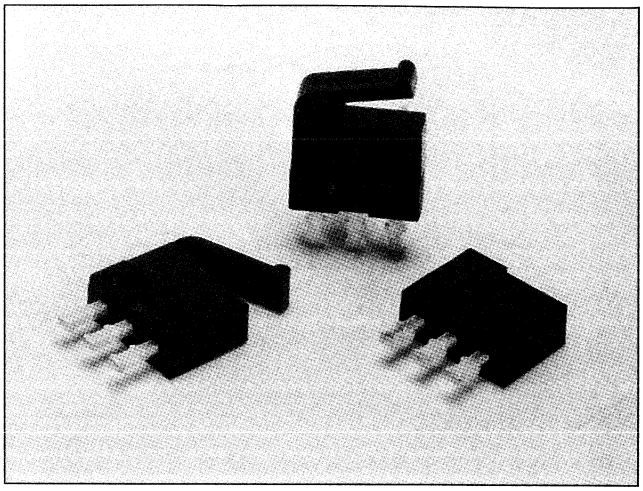
OMRON

Subminiature Basic Switch

D2MQ

Superminiaturized Basic Switch Ideal for Equipment Miniaturization

- Excels in electric characteristics with the snap-action mechanism despite superminiaturized design.
- Gold-plated (Au) contacts for micro load switching available in addition to the standard silver-plated contacts (Ag).
- Ideal for applications where size and weight requirements are crucial.
- Weighs only 0.3 g and measures 6.5mm (H) x 8.2mm (W) x 2.7mm (D).



Ordering Information

Actuator	Silver-plated (Ag–P)			Gold-plated (Au–P)
	Straight terminal	Left-angle terminal	Right-angle terminal	Straight terminal
Pin plunger	D2MQ–1	D2MQ–1–L	D2MQ–1–R	D2MQ–1–105
Lever	D2MQ–1L	D2MQ–1L–L	D2MQ–1L–R	D2MQ–1L–105

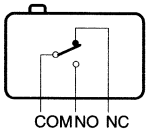
Note: The angle of the terminal illustration above is from the side of the arrow shown here:

Specifications

■ Ratings

Electrical ratings	D2MQ-□: 50 to 500 mA at 30 VDC (resistive load) D2MQ-□-105: 5 to 50 mA at 30 VDC (resistive load)
Inrush current	NO: 0.5 A max., NC: 0.5 A max. (standard model)

Contact Form

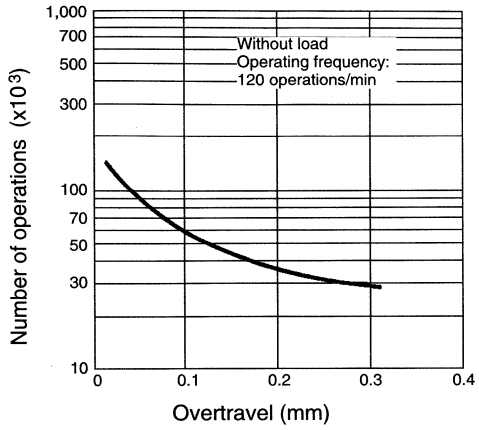


■ Characteristics

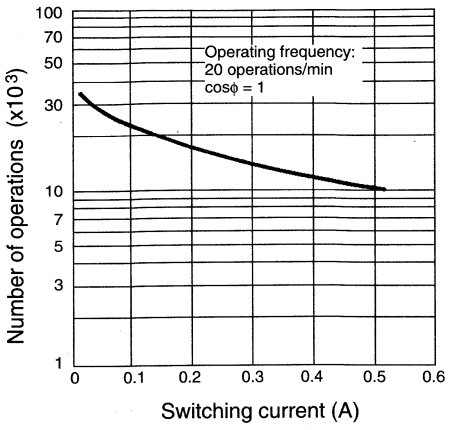
Operating speed	0.1 mm to 0.5 m/s (at pin plunger)
Operating frequency	Mechanical: 60 operations/min Electrical: 20 operations/min
Insulation resistance	100 MΩ min. (at 250 VDC)
Contact resistance	100 mΩ max. (initial value)
Dielectric strength	500 VAC, 50/60 Hz for 1 min between non-continuous terminals 500 VAC, 50/60 Hz for 1 min between each terminal and ground
Vibration resistance	Malfunction: 10 to 55 Hz, 1.5-mm double amplitude
Shock resistance	Mechanical: 1,000 m/s^2 min. (approx. 100G min.) Malfunction: 300 m/s^2 (approx. 30G min.)
Life expectancy	Mechanical: 30,000 operations min. (at full OT value) Electrical: 10,000 operations min. (at full OT value)
Ambient temperature	Operating: –15°C to 70°C (with no icing)
Ambient humidity	Operating: 45% to 85%
Weight	Approx. 0.3 g

Engineering Data

Mechanical Life Expectancy



Electrical Life Expectancy

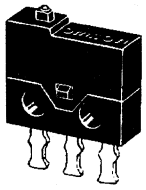


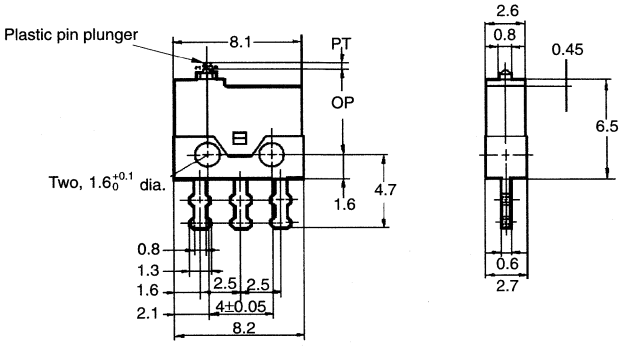
Ag plated: D2MQ-1
Au-plated: D2MQ-1-105

Dimensions

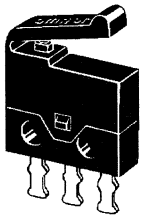
Note: 1. All units are in millimetres unless otherwise indicated.
2. Unless otherwise specified, a tolerance of ± 0.15 mm applies to all dimensions.

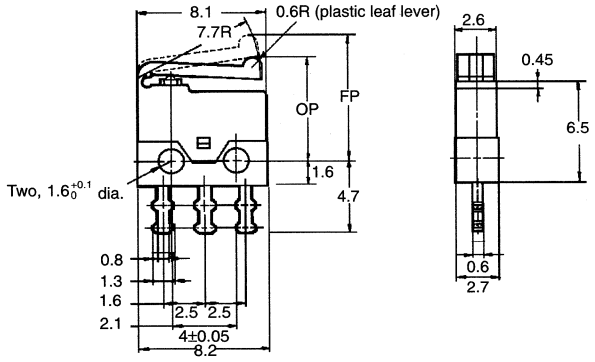
D2MQ-1
D2MQ-1-105



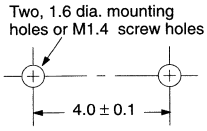


D2MQ-1L
D2MQ-1L-105





Mounting Holes



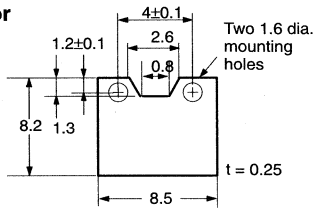
Precautions

Mounting

Use M1.4 mounting screws with screws to mount the switch. Tighten the screws to a torque of 0.1 N • m (1 kg • cm).

When mounting the switch, use an insulating separator. In particular, when the switch is to be mounted on a metallic mounting plate, be sure to insert the separator in between the switch and mounting plate.

Dimensions of Separator



When soldering a lead wire to a terminal of the D2MQ, use a soldering iron with a maximum capacity of 15 W max. and do not take more than 3 s to solder the lead wire, otherwise the characteristics of the D2MQ may be altered.

Applying a soldering iron for too long a time or using one that is rated at more than 15 W may degrade the switch characteristics.

Operation

Do not apply a force more than two times the rated operating force to the actuator and leaf lever.

Make sure that the actuator is not hindered by any objects from moving to or beyond the rated overtravel.

Do not change the operating position by modifying the actuator.

Do not use the switch in an application where the operating speed is extremely slow or the actuator is set in the midpoint between the free position and operating position.

Install the pin plunger switch so that the operating force is applied in alignment with the stroke of the actuator.

Do not apply a shock to the actuator, otherwise, the switch may be damaged.

Do not apply excessive force to the actuator of the leaf lever switch in the operating, releasing, and horizontal directions.

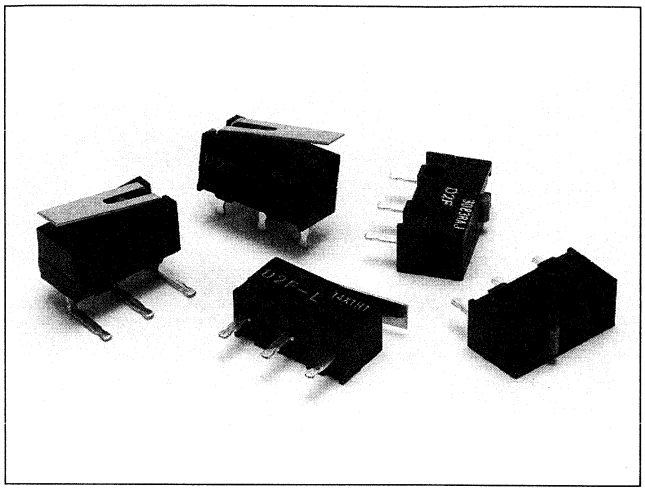
OMRON

Subminiature Basic Switch

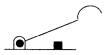
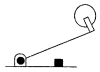
D2F

A Variety of D2F-series Models Including Models Incorporating Simulated Roller Lever and Roller Lever

- Subminiature switch (12.8 x 6.5 x 5.8 (W x H x D)) ideal for PCB mounting.
- Incorporating a reverse mechanism made with two highly precise split springs which ensures a long service life (1,000,000 operations).
- Construction resistant to flux wicking.
- PCB, self-standing, solder, and right angle terminals are available.



Ordering Information

Actuator	Terminals	Microvoltage/current load		Standard	
		0.1 A		1 A	3 A
		Low operating force (75 gf)	General-purpose (150 gf)	Low operating force (75 gf)	General-purpose (150 gf)
Pin plunger 	PCB terminals	D2F-01F	D2F-01	D2F-F	D2F
	Self-clinching terminals	D2F-01F-T	D2F-01-T	D2F-F-T	D2F-T
	Solder terminals	D2F-01F-D	D2F-01-D	D2F-F-D	D2F-D
	Right angle terminals	D2F-01F-A	D2F-01-A	D2F-F-A	D2F-A
Standard lever 	PCB terminals	D2F-01FL	D2F-01L	D2F-FL	D2F-L
	Self-clinching terminals	D2F-01FL-T	D2F-01L-T	D2F-FL-T	D2F-L-T
	Solder terminals	D2F-01FL-D	D2F-01L-D	D2F-FL-D	D2F-L-D
	Right angle terminals	D2F-01FL-A	D2F-01L-A	D2F-FL-A	D2F-L-A
Simulated roller lever 	PCB terminals	D2F-01FL3	D2F-01L3	D2F-FL3	D2F-L3
	Self-clinching terminals	D2F-01FL3-T	D2F-01L3-T	D2F-FL3-T	D2F-L3-T
	Solder terminals	D2F-01FL3-D	D2F-01L3-D	D2F-FL3-D	D2F-L3-D
	Right angle terminals	D2F-01FL3-A	D2F-01L3-A	D2F-FL3-A	D2F-L3-A
Standard roller lever 	PCB terminals	D2F-01FL2	D2F-01L2	D2F-FL2	D2F-L2
	Self-clinching terminals	D2F-01FL2-T	D2F-01L2-T	D2F-FL2-T	D2F-L2-T
	Solder terminals	D2F-01FL2-D	D2F-01L2-D	D2F-FL2-D	D2F-L2-D
	Right angle terminals	D2F-01FL2-A	D2F-01L2-A	D2F-FL2-A	D2F-L2-A

Specifications

■ Ratings

OF max.		Standard		Microvoltage/current load	
		150 g	75 g	150 g	75 g
Item		Resistive load			
Rated voltage	125 VAC	3 A	1 A	---	
	30 VDC	2 A	0.5 A	0.1 A	

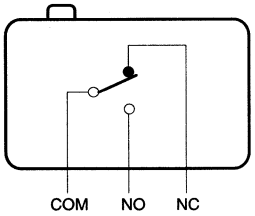
Note: Consult OMRON before using the switch with inductive or motor loads.

■ Approved Standards

UL (File No. E32667)/CSA (LR21642)

D2F-01 series: 0.1 A at 30 VDC
D2F-F series: 1 A at 125 VAC, 0.5 A at 30 VDC (100,000 cycles)
D2F-□ series: 3 A at 125 VAC, 2 A at 30 VDC

Contact Form



■ Characteristics

Operating speed	1 to 500 mm/s (at pin plunger)
Operating frequency (at pin plunger)	Mechanical: 200 operations/min Electrical: 30 operations/min
Insulation resistance	100 MΩ min. (at 500 VDC)
Contact resistance	Standard: 30 mΩ max. (initial value) Microvoltage/current load: 100 mΩ max. (initial value)
Dielectric strength	600 VAC, 50/60 Hz for 1 min between contacts of the same polarity 1,500 VAC, 50/60 Hz for 1 min between current-carrying metal parts and ground, and between each terminal and non-current-carrying metal part
Vibration resistance	Malfunction: 10 to 55 Hz, 1.5-mm double amplitude
Shock resistance	Malfunction: 300 m/s^2 (approx. 30G)
Life expectancy	Mechanical: 1,000,000 operations min. (OT value) Electrical: 30,000 operations min.
Ambient temperature	Operating: –25°C to 85C° (with no icing)
Ambient humidity	Operating: 85% max.
Weight (at pin plunger)	Approx. 0.5 g

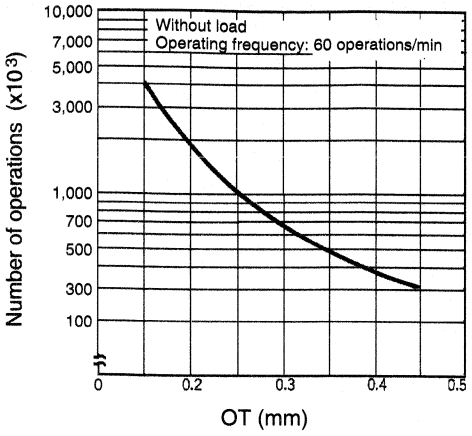
■ Operating Characteristics

Model	D2F□, D2F-01□	D2F-F□, D2F-01F□	D2F-L□, D2F-01L□	D2F-FL□, D2F-01FL□
OF max.	1.47 N (150 gf)	0.74 N (75 gf)	0.78 N (80 gf)	0.25 N (25 gf)
RF min.	0.20 N (20 gf)	0.05 N (5 gf)	0.05 N (5 gf)	0.02 N (2 gf)
PT max.	0.5 mm	0.5 mm	---	---
OT min.	0.25 mm	0.25 mm	0.55 mm	0.55 mm
MD max.	0.12 mm	0.12 mm	0.5 mm	0.5 mm
FP max.	---	---	10 mm	
OP	5.5±0.3 mm		6.8±1.5 mm	

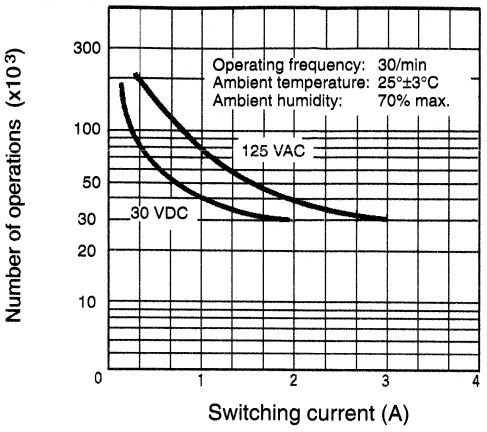
Model	D2F-L3□, D2F-01L3□	D2F-FL3□, D2F-01FL3□	D2F-L2□, D2F-01L2□	D2F-FL2□, D2F-01FL2□
OF max.	0.78 N (80 gf)	0.39 N (40 gf)	0.78 N (80 gf)	0.39 N (40 gf)
RF min.	0.05 N (5 gf)	0.02 N (2 gf)	0.05 N (5 gf)	0.02 N (2 gf)
OT min.	0.5 mm	0.5 mm	0.55 mm	0.55 mm
MD max.	0.45 mm	0.45 mm	0.5 mm	0.5 mm
FP max.	13 mm		16.5 mm	
OP	8.5±1.2 mm		13±2 mm	

Engineering Data

Mechanical Life Expectancy



Electrical Life Expectancy

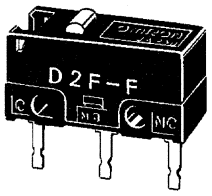


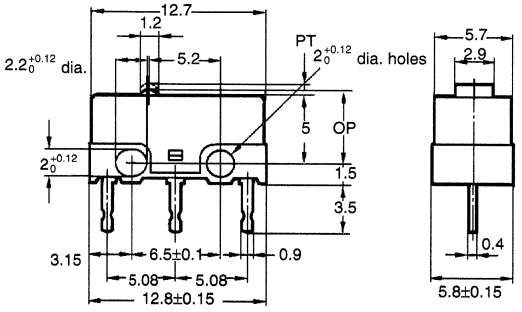
Dimensions

Note: 1. All units are in millimetres unless otherwise indicated.
2. Unless otherwise specified, a tolerance of ±0.4 mm applies to all dimensions.
3. The following illustrations and drawings are for D2F models with PCB terminals. Self-standing, solder, and right angle terminals are omitted from the following drawings. Refer to page 80 for these terminals. When ordering, replace □ with the code for the terminal that you need.

Pin Plunger

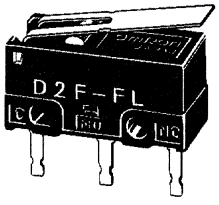
D2F□
D2F-01□
D2F-F□
D2F-01F□

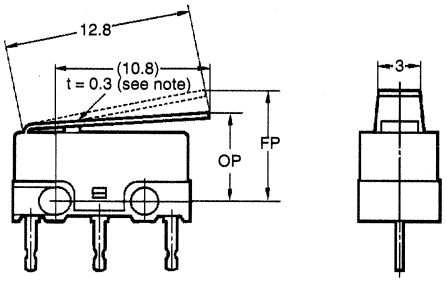




Standard Lever

D2F-L□
D2F-01L□
D2F-FL□
D2F-01FL□

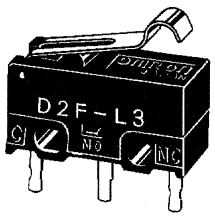


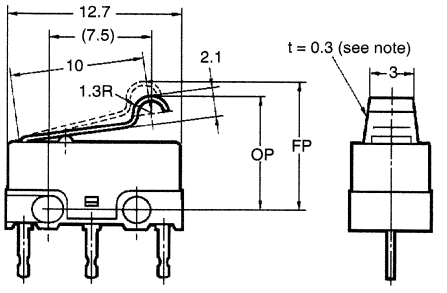


Note: Stainless steel lever

Simulate Roller Lever

D2F-L3□
D2F-01L3□
D2F-FL3□
D2F-01FL3□



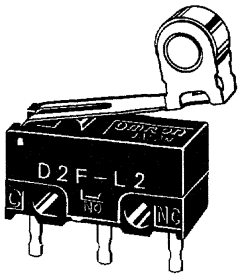


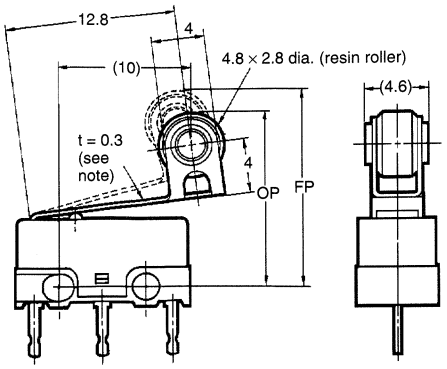
Note: Stainless steel lever

Micro Switches

Standard Roller Lever

D2F-L2□
D2F-01L2□
D2F-FL2□
D2F-01FL2□



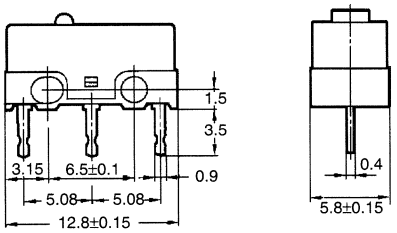


Note: Stainless steel lever

■ Terminals

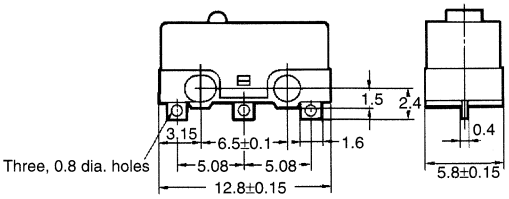
PCB Terminals

D2F



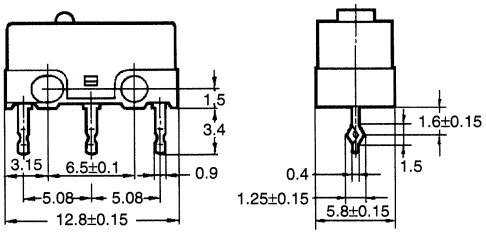
Solder Terminals

D2F-D



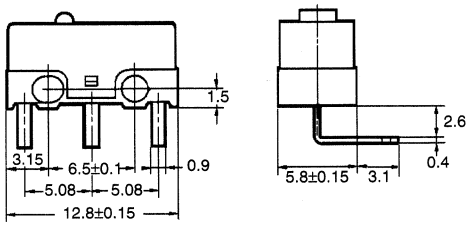
Self-clinching Terminals

D2F-T



Right Angle Terminals

D2F-A

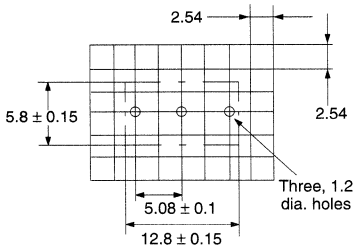


Precautions

Mounting

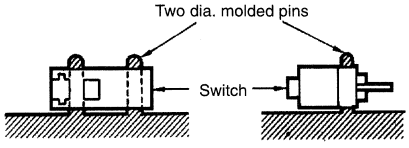
When mounting the switch to a PCB, refer to the following mounting dimensions. The gap between adjacent terminals is two pitches (2 x 2.54 cm).

Mounting Dimensions



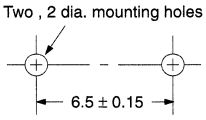
Use of moulded fittings is recommended to secure the switch.

Mounting with Molded Pin



Use M2 mounting screws with plain or spring washers to mount the switch. Tighten the screws to a torque of 0.08 to 0.1 N • m (0.8 to 1 kgf • cm).

Mounting Holes



When soldering the relay terminals, use 6:4 solder and apply a soldering iron rated at 30 W and finish soldering within three seconds. After soldering, do not move the soldered terminals for at least one minute.

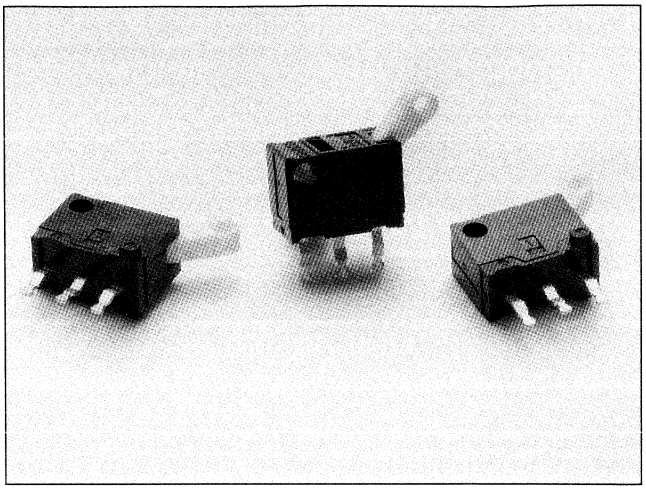
Make sure that each adjacent terminals of the switch are properly insulated from each other and the terminals and ground is properly insulated.

OMRON

Subminiature Basic Switch — D3C

A Low-cost Subminiature Switch With a Built-in Slide Mechanism

- Compact (8 x 6 x 4.2 (W x H x D)) and light (approximately 0.3 g).
- Built-in slide mechanism for selecting shorting or non-shorting timing of the switch.
- Available with a 3-mm long stroke.
- Ideal for household appliances, equipment, office equipment, communications equipment, etc.



Ordering Information

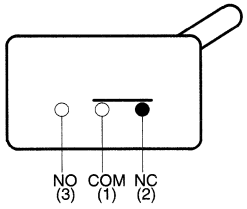
Actuator	General-purpose		Low operating force	
	Non-shorting Model	Shorting Model	Non-shorting Model	Shorting Model
Standard lever 	D3C-1210	D3C-2210	D3C-1220	D3C-2220

Specifications

■ Characteristics

Operating speed	1 to 500 mm/s
Operating frequency	Mechanical: 200 operations/min Electrical: 30 operations/min
Insulation resistance	100 MΩ (at 250 VDC)
Contact resistance	50 mΩ max. (initial value)
Dielectric strength	250 VAC, 50/60 Hz for 1 min between contacts of same polarity 250 VAC, 50/60 Hz for 1 min between each terminal and ground
Electrical rating	0.1 A at 30 VDC (resistive load)
Vibration resistance	Malfunction: 10 to 55 Hz, 1.5-mm double amplitude
Shock resistance	Malfunction: 300 m/s^2 (approx. 30G)
Life expectancy	50,000 operations min. at the rated switching frequency
Ambient temperature	Operating: –20°C to 80°C (with no icing)
Ambient humidity	Operating: 65% max. (at 5°C to 35°C)
Weight	Approx. 0.3 g

■ Contact Form



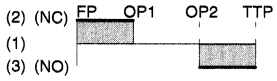
Micro Switches

■ Operating Characteristics

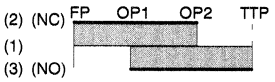
	Non-shorting Model		Shorting Model	
	D3C-1210	D3C-1220	D3C-2210	D3C-2220
OF max.	1.28 N (130 gf)	0.39 N (40 gf)	1.28 N (130 gf)	0.39 N (40 gf)
RF min.	0.10 N (10 gf)	0.03 N (3 gf)	0.10 N (10 gf)	0.03 N (3 gf)
TTP	1.3±0.4 mm		1.3±0.4 mm	
FP max.	4.8 mm		4.8 mm	
OP1	3.5±0.3 mm		3.4±0.3 mm	
OP2	2.5±0.3 mm		2.6±0.3 mm	

Switching Timing

Non-shorting Model



Shorting Model

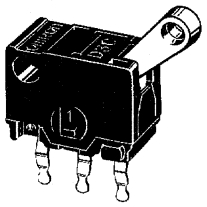


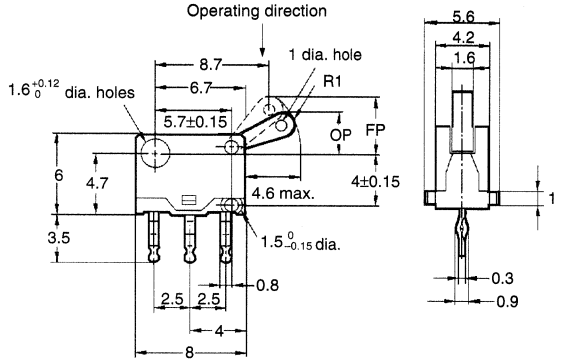
Dimensions

Note: 1. All units are in millimeters unless otherwise indicated.
2. Unless otherwise specified, a tolerance of ±0.4 mm applies to all dimensions.

Standard Lever

D3C-1210/-2210
D3C-1220/-2220



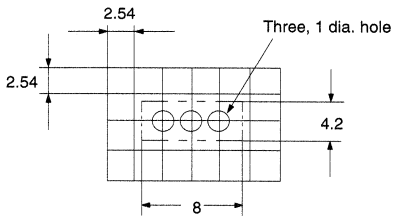


Precautions

Mounting

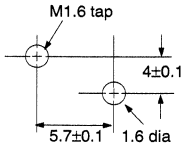
Refer to the following dimensions for PCB mounting. The distance between two adjacent terminals is 2.54 mm.

PCB Dimensions



When mounting the D3C with screws, use M1.6 mounting screws with plain washers or spring washers. Tighten the screws to a torque of 4.9 to 9.8 x 10^2 N • m (0.5 to 1 kgf • cm).

Mounting Holes



When soldering each terminal of the D3C, apply a soldering iron rated at 30 W for no longer than three seconds. Do not impose any external force to the terminals for approximately one minute after the terminals are soldered.

Make sure that the terminals of the D3C are insulated from one another and the ground.

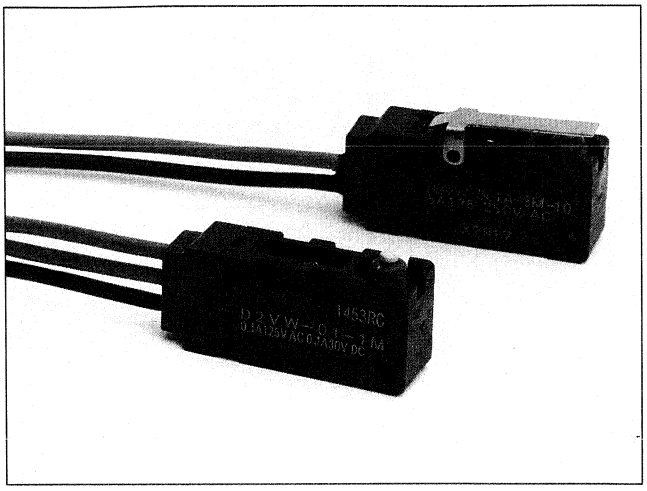
OMRON

Watertight Miniature Basic Switch

D2VW

A High-quality, High-precision Miniature Switch Conforms to IP67

- Monoblock construction made from single-liquid epoxy resin assures high sealing capability.
- V-series internal mechanism assures high operating-position accuracy (±0.4 mm) and long life (10 million operations).
- A wide operating temperature range of –40°C to 90°C is ideal for any operating environment.
- General-load (5 A at 250 VAC) models and Micro-load models are available.
- Model with tab terminals also available (IP50).



Micro Switches

Ordering Information

Actuator		Model	
		0.1 A	5 A
Pin plunger	With soldered and #187 tab terminals	D2VW-01-1	D2VW-5-1
	With lead wired	D2VW-01-1M	D2VW-5-1M
Short lever	With soldered and #187 tab terminals	D2VW-01L1A-1	D2VW-5L1A-1
	With lead wired	D2VW-01L1A-1M	D2VW-5L1A-1M
Standard lever	With soldered and #187 tab terminals	D2VW-01L1-1	D2VW-5L1-1
	With lead wired	D2VW-01L1-1M	D2VW-5L1-1M
Long lever	With soldered and #187 tab terminals	D2VW-01L1B-1	D2VW-5L1B-1
	With lead wired	D2VW-01L1B-1M	D2VW-5L1B-1M
Simulated roller lever	With soldered and #187 tab terminals	D2VW-01L3-1	D2VW-5L3-1
	With lead wired	D2VW-01L3-1M	D2VW-5L3-1M
Short roller lever	With soldered and #187 tab terminals	D2VW-01L2A-1	D2VW-5L2A-1
	With lead wired	D2VW-01L2A-1M	D2VW-5L2A-1M
Standard roller lever	With soldered and #187 tab terminals	D2VW-01L2-1	D2VW-5L2-1
	With lead wired	D2VW-01L2-1M	D2VW-5L2-1M

Note: 1. The standard lengths of the lead wires (AV0.75f) of models incorporating them are 30 cm.

Specifications

■ Ratings

Model	Rated voltage	Non-inductive load				Inductive laod			
		Resistive load		Lamp load		Inductive load		Motor load	
		NC	NO	NC	NO	NC	NO	NC	NO
D2VW-5	125 VAC	5 A		0.5 A		4 A		---	
	250 VAC	5 A		0.5 A		4 A		---	
	30 VDC	5 A		3 A		4 A		---	
	125 VDC	0.4 A		0.1 A		0.4 A		---	
D2VW-01	125 VAC	0.1 A		---		---		---	
	30 VDC	0.1 A		---		---		---	

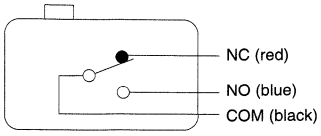
Note: 1. The above current ratings are the values of the steady-state current.
2. Inductive load has a power factor of 0.7 min. (AC) and a time constant of 7 ms max. (DC).
3. Lamp load has an inrush current of 10 times the steady-state current.
4. Motor load has an inrush current of 6 times the steady-state current.

■ Approved Standards

UL (File No. E32667)/CSA (File No. LR21642)

D2VW-01 series: 0.1 A at 125 VAC, 0.1 A at 30 VDC
D2VW-5 series: 5 A at 125/250 VAC

Contact Form



■ Characteristics

Item	D2VW-01	D2VW-5
Operating speed (see note)	0.1 mm to 1 m/s (at pin plunger)	
Operating frequency	Mechanical: 300 operations/min Electrical: 60 operations/min	
Insulation resistance	100 MΩ min. (at 500 VDC)	
Contact resistance	100 mΩ max. (initial value) for lead wired models	
Dielectric strength	1,000 VAC, 50/60 Hz for 1 min between contacts of same polarity 1,500 VAC, 50/60 Hz for 1 min between each terminal and ground	
Inrush current	---	15 A max.
Vibration resistance	Malfunction: 10 to 55 Hz, 1.5-mm double amplitude	
Shock resistance	Malfunction: 300 m/s^2 (approx. 30G)	
Life expectancy	Mechanical: 10,000,000 operations min. Electrical: 1,000,000 operations min.	Mechanical: 10,000,000 operations min. Electrical: 100,000 operations min.
Ambient temperature	Operating: –40°C to 90°C (with no icing)	
Ambient humidity	Operating: 95% max.	
Enclosure rating	IP67 for lead wire model IP50 for terminal model	
Weight	16 g (including lead wire)	

Note: The operating speed value shown is for pin plunger models. For hinge lever models, this speed is for the plunger parts.

■ Operating Characteristics

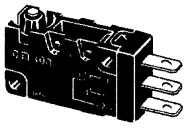
Type	Pin plunger	Short lever	Standard lever	Long lever	Simulated roller lever	Short roller lever	Standard roller lever
	D2VW-01-1 D2VW-01-1M D2VW-5-1 D2VW-5-1M	D2VW-01L1A-1 D2VW-01L1A-1M D2VW-5L1A-1 D2VW-5L1A-1M	D2VW-01L1-1 D2VW-01L1-1M D2VW-5L1-1 D2VW-5L1-1M	D2VW-01L1B-1 D2VW-01L1B-1M D2VW-5L1B-1 D2VW-5L1B-1M	D2VW-01L3-1 D2VW-01L3-1M D2VW-5L3-1 D2VW-5L3-1M	D2VW-01L2A-1 D2VW-01L2A-1M D2VW-5L2A-1 D2VW-5L2A-1M	D2VW-01L2-1 D2VW-01L2-1M D2VW-5L2-1 D2VW-5L2-1M
OF max.	1.96 N (200 gf)	1.96 N (200 gf)	1.18 N (120 gf)	0.59 N (60 gf)	1.18 N (120 gf)	2.25 N (230 gf)	1.18 N (120 gf)
RF min.	0.29 N (30 gf)	0.20 N (20 gf)	0.15 N (15 gf)	0.05 N (5 gf)	0.15 N (15 gf)	0.20 N (20 gf)	0.15 N (15 gf)
PT max.	1.2 mm	1.6 mm	4.0 mm	9.0 mm	4.0 mm	1.6 mm	4.0 mm
OT min.	1.0 mm	0.8 mm	1.6 mm	3.2 mm	1.6 mm	0.8 mm	1.6 mm
MD max.	0.4 mm	0.5 mm	0.8 mm	2.0 mm	0.8 mm	0.5 mm	0.8 mm
OP	14.7±0.4 mm	15.2±0.5 mm	15.2±1.2 m	15.2±2.6 mm	18.7± 1.2 mm	20.7±0.6 mm	20.7± 1.2 mm

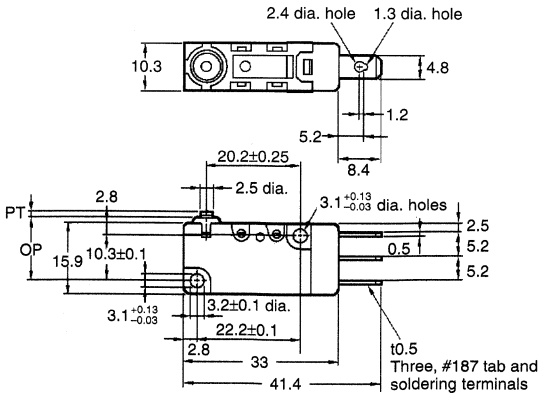
Dimensions

Note: 1 All units are in millimetres unless otherwise indicated.
2 Unless otherwise specified, a tolerance of ± 0.4mm applies to all dimensions.

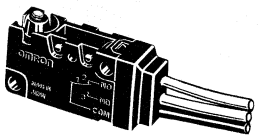
Pin Plunger

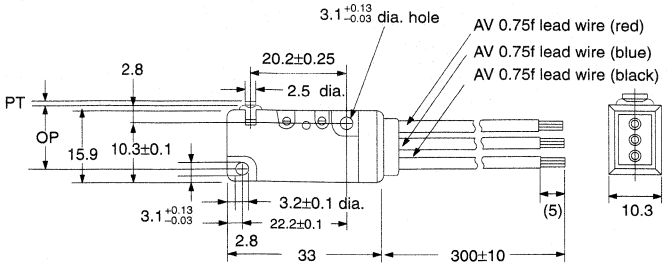
D2VW-01-1
D2VW-5-1





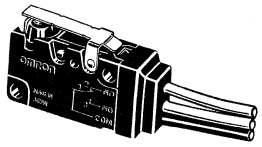
D2VW-01-1M
D2VW-5-1M

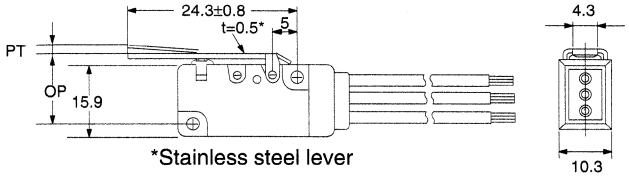




Short Lever

D2VW-01L1A-1M
D2VW-5L1A-1M

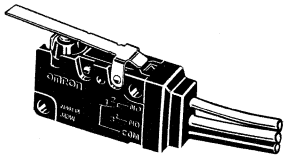


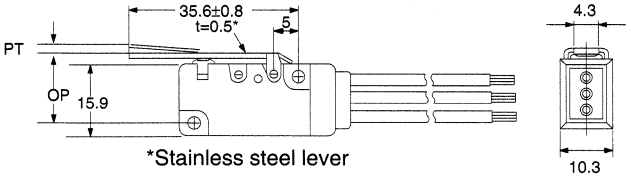


*Stainless steel lever

Standard Lever

D2VW-01L1-1M
D2VW-5L1-1M

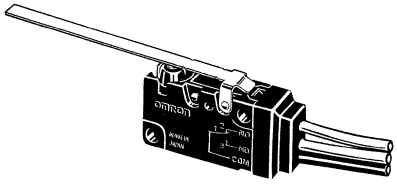


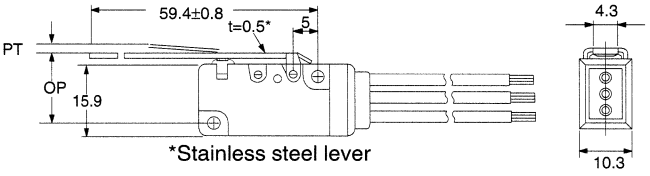


*Stainless steel lever

Long Lever

D2VW-01L1B-1M
D2VW-5L1B-1M

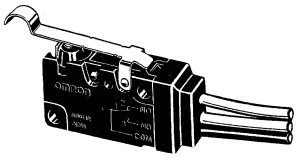


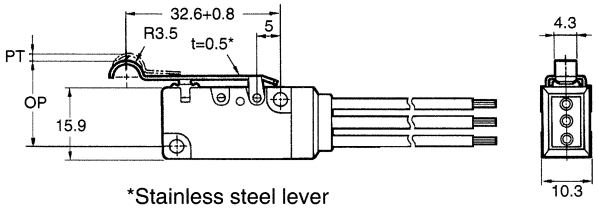


*Stainless steel lever

Simulated Roller Lever

D2VW-01L3-1M
D2VW-5L3-1M

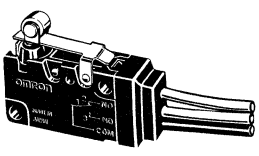


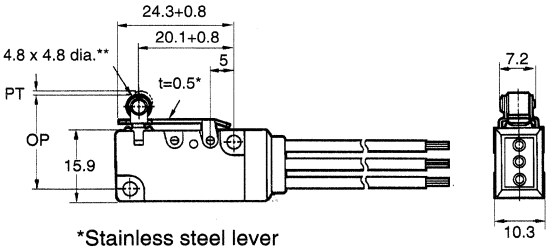


*Stainless steel lever

Short Roller Lever

D2VW-01L2A-1M
D2VW-5L2A-1M

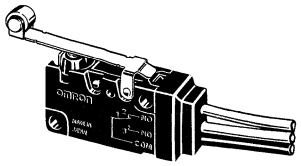


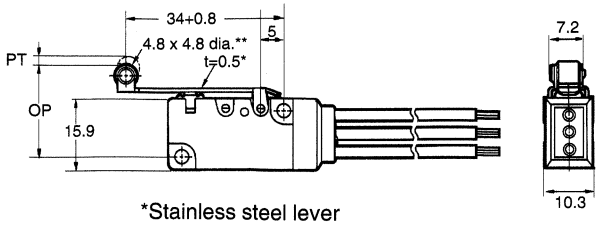


*Stainless steel lever
**Oilless polyacetar resin roller

Standard Roller Lever

D2VW-01L2-1M
D2VW-5L2-1M





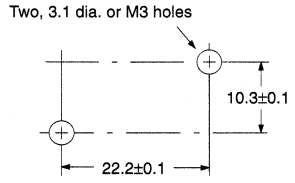
*Stainless steel lever
**Oilless polyacetar resin roller

Precautions

Mounting

Use two M3 mounting screws with spring washers to mount the switch. Tighten the screws to a torque of 0.39 to 0.59 N • m (4 to 6 kgf • cm).

Mounting Holes



Operations

Make sure that the switching object is perfectly separated from the actuator when the switch is not operated and the actuator is pressed appropriately by the switching object when the switch is operated.

The switch should be set so that its stroke will be within the rated OT when the switch is operated.

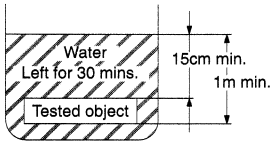
Install the switching object so that its moving direction is the same as that of the actuator.

Enclosure Ratings

The D2VW was tested under water and passed the following water-tightness tests, which however, does not mean that the D2VW can be used in the water.

JIS C0920 (rules for testing the watertightness of electrical devices and materials), class 7 (watertightness test). Refer to the following illustration for the test method.

IEC Publication 529, class IP67. Refer to the following illustration for the test method at OMRON.



Note: The object to be tested is left in the water for 30 minutes on condition that the distance between the surface of the water and the top of the object be 15 cm minimum and the distance between the surface of the water and the bottom of the object be 1 m minimum.

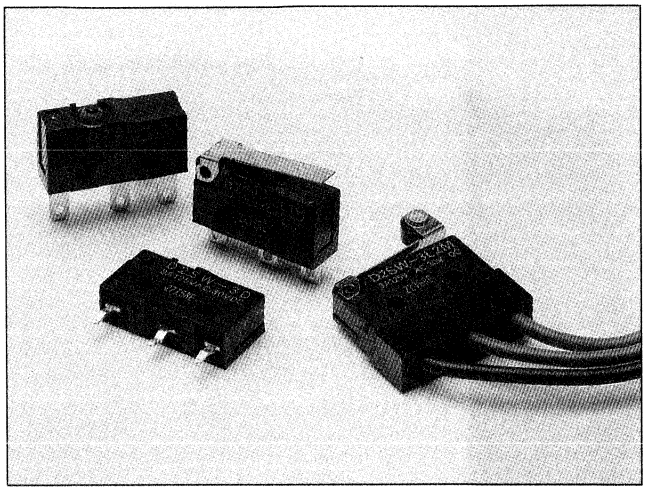
OMRON

Watertight Miniature Basic Switch

D2SW

A High-quality Watertight Miniature Basic Switch Conforms to IP67

- Monoblock construction assures high sealing capability.
- A wide operating temperature range of –40°C to 85°C is ideal for any operating environment.
- Available pre–wired, solder, PCB or quick connect terminals.
- VDE approved to EN61058–1.



Ordering Information

Actuator		Model	
		3 A	0.1A
Pin plunger	Solder terminals	D2SW-3H	D2SW-01H (see note 2)
	Tab terminals (#110)	D2SW-3T	D2SW-01T
	PCB terminals	D2SW-3D	D2SW-01D
	With lead wires	D2SW-3M	D2SW-01M
Standard lever	Solder terminals	D2SW-3L1H	D2SW-01L1H (see note 2)
	Tab terminals (#110)	D2SW-3L1T	D2SW-01L1T
	PCB terminals	D2SW-3L1D	D2SW-01L1D
	With lead wires	D2SW-3L1M	D2SW-01L1M
Simulated roller lever	Solder terminals	D2SW-3L3H	D2SW-01L3H (see note 2)
	Tab terminals (#110)	D2SW-3L3T	D2SW-01L3T
	PCB terminals	D2SW-3L3D	D2SW-01L3D
	With lead wires	D2SW-3L3M	D2SW-01L3M
Standard roller lever	Solder terminals	D2SW-3L2H	D2SW-01L2H (see note 2)
	Tab terminals (#110)	D2SW-3L2T	D2SW-01L2T
	PCB terminals	D2SW-3L2D	D2SW-01L2D
	With lead wires	D2SW-3L2M	D2SW-01L2M

Note: 1. The standard lengths of the lead wires (AV0.5f) of models incorporating them are 30 cm.
2. EN61058-1 (IEC1058-1) approved by VDE.

Specifications

■ Ratings

Model	Rated voltage	Non-inductive load				Inductive laod			
		Resistive load		Lamp load		Inductive load		Motor load	
		NC	NO	NC	NO	NC	NO	NC	NO
D2SW-3	125 VAC	3 A		1 A	0.5 A	1 A	0.5 A	1 A	0.5 A
	250 VAC	2 A		0.5 A	0.3 A	0.5 A	0.3 A	0.5 A	0.3 A
	30 VDC	3 A		1 A		1 A		1 A	
D2SW-01	125 VAC	0.1 A		---		---		---	
	30 VDC	0.1 A		---		---		---	

Note: 1. The above current ratings are the values of the steady-state current.
2. Inductive load has a power factor of 0.7 min. (AC) and a time constant of 7 ms max. (DC).
3. Lamp load has an inrush current of 10 times the steady-state current.
4. Motor load has an inrush current of 6 times the steady-state current.

■ Approved Standards

UL (File No. E32667)/CSA (File No. LR21642)

D2SW-3□: 3 A at 125 VAC, 2 A at 250 VAC
D2SW-01□: 0.1 A at 125 VAC, 0.1 A at 30 VDC

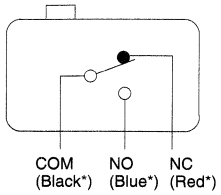
VDE (Licence No. 85002)/EN61058-1 (IEC1058-1) Approved

D2SW-01□H: 0.1 A at 125 VAC

■ Contact

Item	D2SW-3	D2SW-01
Specification	Rivet	Crossbar
Material	Silver	Gold alloy

Contact Form



*Indicates the color of the lead wire.

■ Characteristics

Item	D2SW-3	D2SW-01
Operating speed (see note)	0.1 mm to 1 m/s (at pin plunger)	
Operating frequency	Mechanical: 300 operations/min Electrical: 60 operations/min	
Insulation resistance	100 MΩ min. (at 500 VDC)	
Contact resistance	50 mΩ max. (initial value) for lead wire models	70 mΩ max. (initial value) for lead wire models
Dielectric strength	1,000 VAC, 50/60 Hz for 1 min between contacts of the same polarity 1,500 VAC, 50/60 Hz for 1 min between current-carrying metal parts and ground, and between each terminal and non-current-carrying metal part	600 VAC, 50/60 Hz for 1 min between contacts of the same polarity 1,500 VAC, 50/60 Hz for 1 min between current-carrying metal parts and ground, and between each terminal and non-current-carrying metal part
Inrush current	NO: 10 A NC: 20 A	NO: 1 A NC: 1 A
Vibration resistance	Malfunction: 10 to 55 Hz, 1.5-mm double amplitude	
Shock resistance	Malfunction: 300 m/s^2 (approx. 30G)	
Life expectancy	Mechanical: 5,000,000 operations min. (OT value) Electrical: 200,000 operations min. (3 A at 125 VAC), 100,000 operations min. (2 A at 250 VAC)	Mechanical: 5,000,000 operations min. (OT value) Electrical: 200,000 operations min.
Ambient temperature	Operating: –40°C to 85°C (with no icing)	
Ambient humidity	Operating: 95% max.	
Enclosure ratings	IP67 for lead wire models IP50 for terminal models	
Weight	Terminal model: 2 g, Lead wire model: 10 g	

Note: The operating speed value shown is for pin plunger models. For hinge lever models, this speed is for the plunger parts.

VDE-approved Characteristics (EN61058-1)

Degree of protection against electric shock	Class 1
Ambient temperature	0°C to 85°C
Operating cycles	50,000
Proof tracking index (PTI)	175 V
Switch category (IEC335-1)	A

■ Operating Characteristics

Type	Pin plunger	Hinge lever	Simulated hinge lever	Hinge roller lever
	D2SW-3□ D2SW-01□	D2SW-3L1□ D2SW-01L1□	D2SW-3L3□ D2SW-01L3□	D2SW-3L2□ D2SW-01L2□
OF max.	1.77 N (180 gf)	0.59 N (60 gf)	0.59 N (60 gf)	0.59 N (60 gf)
RF min.	0.29 N (30 gf)	0.06 N (6 gf)	0.06 N (6 gf)	0.06 N (6 gf)
PT max.	0.6 mm	---	---	---
OT min.	0.5 mm	1.0 mm	1.0 mm	1.0 mm
MD max.	0.1 mm	0.8 mm	0.8 mm	0.8 mm
FP max.	---	13.6 mm	15.5 mm	19.3 mm
OP	8.4±0.3 mm	8.8±0.8 mm	10.7±0.8 mm	14.5±0.8 mm

Dimensions

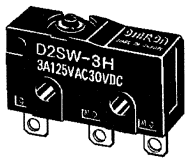
Note: 1. All units are in millimetres unless otherwise indicated.
2. Every actual model number includes the code instead of □ for the kind of terminals incorporated by the model.
3. Unless otherwise specified, a tolerance of ±0.4 mm applies to all dimensions.

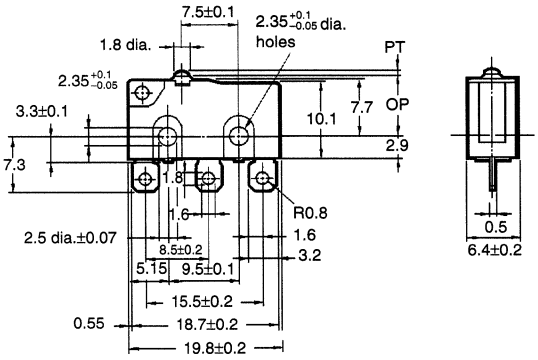
■ Terminal Model

Note: The following illustrations and dimensions are for models with soldered terminals. Refer to *Terminals* for models with tab (#110) and PCB terminals. The dimensions not described are the same as those of models with pin plungers.

Pin Plunger

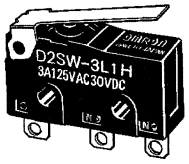
D2SW-3□
D2SW-01□

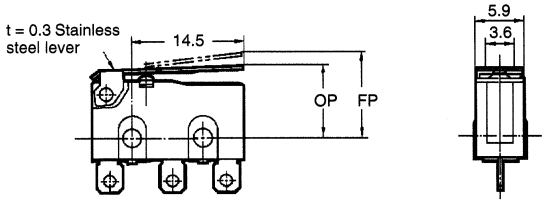




Standard Lever

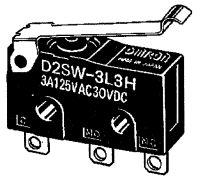
D2SW-3L1□
D2SW-01L1□

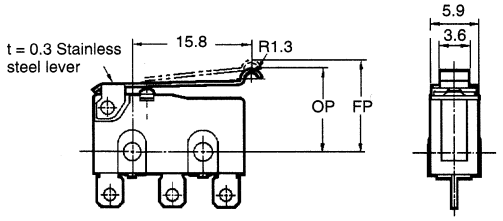




Simulated Roller Lever

D2SW-3L3□
D2SW-01L3□

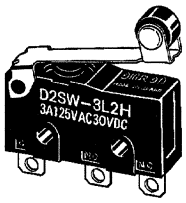


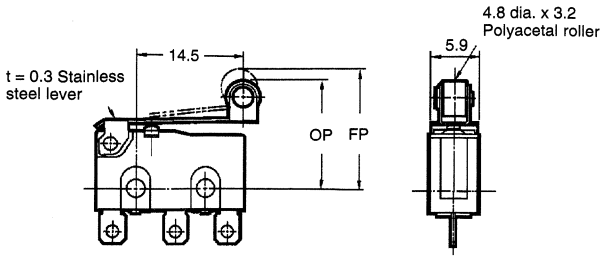


Micro Switches

Standard Roller Lever

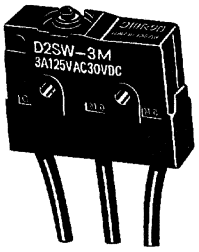
D2SW-3L2□
D2SW-01L2□

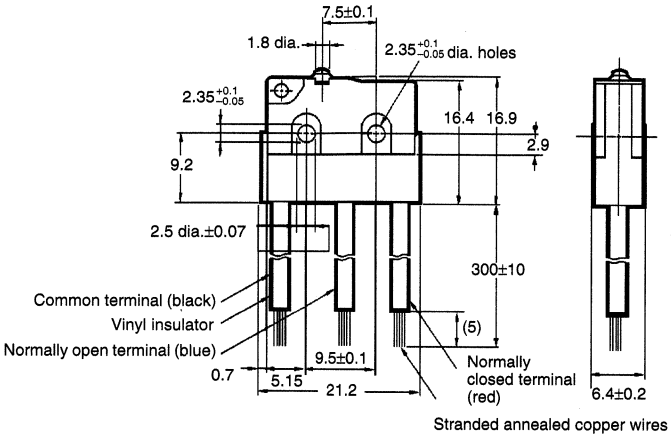




■ Lead Wire Model

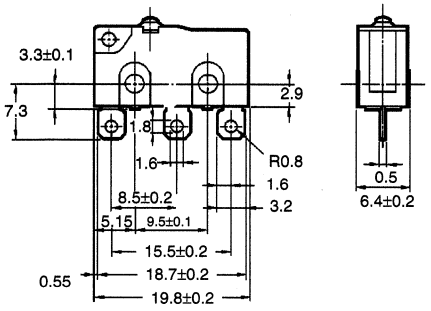
Note: The following illustration and dimensions are for models with pin plungers. The dimensions and operating characteristics of the actuators of models incorporating them are the same as those of the actuators of models with both actuators and terminals.



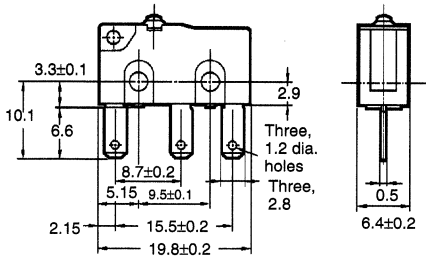


■ Terminals

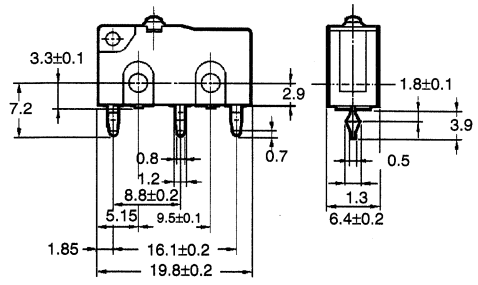
Solder Terminals



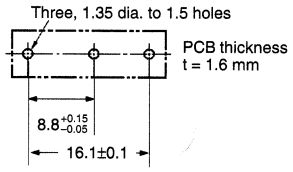
Tab Terminals (#110)



PCB Terminals



PCB Mounting

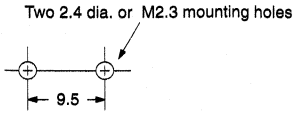


Precautions

Mounting

Use two M3 mounting screws with spring washers to mount the switch. Tighten the screws to a torque of 0.23 to 0.26 N • m (2.3 to 2.7 kgf • cm).

Mounting Holes



When soldering a lead wire to a terminal of the D2SW, use a soldering iron with a maximum capacity of 60 W and do not take more than 5 s to solder the lead wire, otherwise the characteristics of the D2SW may be altered.

Make sure that there is no icing when using the D2SW at low ambient temperatures.

Operations

Make sure that the switching object is perfectly separated from the actuator when the switch is not operated and the actuator is pressed appropriately by the switching object when the switch is operated.

The switch should be set so that its stroke will be within the rated OT when the switch is operated.

Install the switching object so that its moving direction is the same as that of the actuator.

Handle D2SW models with pin plungers with care so that the sealing rubber parts around the pin plungers will not be damaged.

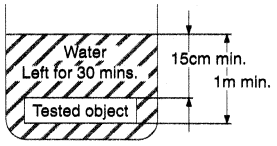
Recommended conductor size for the 0.1 A-series solder terminal is AWG26 to 18 (0.13 to 0.83 mm^2).

Enclosure Ratings

The D2SW was tested underwater and passed the following watertightness tests, which however, does not mean that the D2SW can be used in the water.

JIS C0920 (rules for testing the watertightness of electrical devices and materials), class 7 (watertightness test). Refer to the following illustration for the test method.

IEC Publication 529, class IP67. Refer to the following illustration for the test method.



Note: The object to be tested is left in the water for 30 minutes on condition that the distance between the surface of the water and the top of the object be 15 cm minimum and the distance between the surface of the water and the bottom of the object be 1 m minimum.

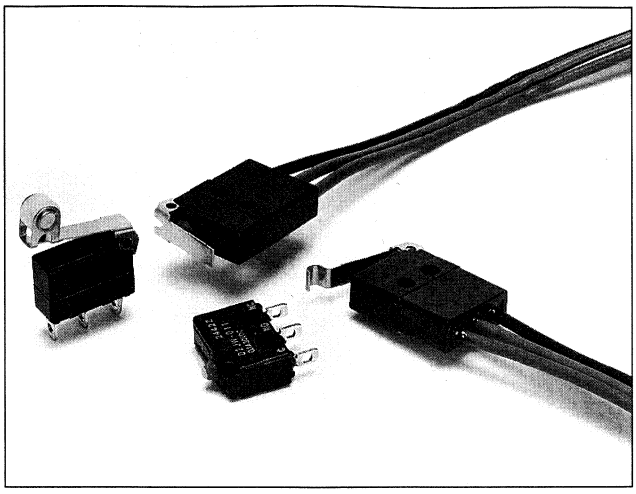
OMRON

Watertight Miniature Basic Switch

D2JW

Ultra-small and Fully Sealed

- Water-tight housing (reference to IP67).
- Wide range of operating temperature from –40°C to 85°C.
- Gold crossbar contact and coil spring offer long life expectancy and high contact reliability.
- Applications include: automotive, agricultural machines, security and heating and ventilation.



Ordering Information

Actuator	Model	
	Solder 	Molded lead wire 
Pin plunger 	D2JW-011	D2JW-011-MD
Short lever 	D2JW-01K1A1	D2JW-01K1A1-MD
Standard lever 	D2JW-01K11	D2JW-01K11-MD
Simulated roller lever 	D2JW-01K31	D2JW-01K31-MD
Standard roller lever 	D2JW-01K21	D2JW-01K21-MD

Note: The standard lengths of the lead wires (AV0.3f) of models incorporating them are 30 cm.

Specifications

■ Ratings/Characteristics

Operating speed	1 mm to 250 mm/s (at pin plunger)
Operating frequency	Mechanical: 240 operations/min Electrical: 60 operations/min
Insulation resistance	100 MΩ min. (at 500 VDC)
Contact resistance	100 mΩ max. (molded lead models: 140 mΩ min.)
Dielectric strength	600 VAC, 50/60 Hz for 1 min between contacts of the same polarity 1,000 VAC, 50/60 Hz for 1 min between current-carrying metal parts and ground, and between each terminal and non-current-carrying metal part
Electrical ratings	0.1 A at 30 VDC (resistive load)
Vibration resistance	Malfunction: 10 to 55 Hz, 1.5-mm double amplitude
Shock resistance	Malfunction: 200 m/s^2 (approx. 20G) Destruction: 1,000 m/s^2 (approx. 100G)
Life expectancy	Mechanical: 1,000,000 operations min. Electrical: 100,000 operations min.
Ambient temperature	Operating: –40°C to 85°C (with no icing)
Ambient humidity	Operating: 35% to 98% max.
Enclosure rating	IEC IP67
Weight	Approx. 7 g (molded leaf models, pin plunger model)

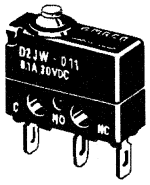
Dimensions

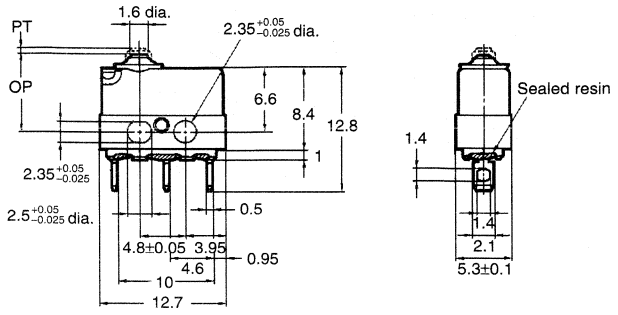
Note: 1. All units are in millimetres unless otherwise indicated.
2. Unless otherwise specified, a tolerance of ±0.4 mm applies to all dimensions.

■ Operating Characteristics

Model	Pin plunger
	D2JW-011
OF max.	2.45 N (250 gf)
RF min.	0.98 N (100 gf)
PT max.	0.6 mm
OT min.	0.3 mm
MD max.	0.1 mm
OP	8.1±0.3 mm

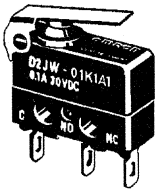
Pin Plunger
D2JW-011

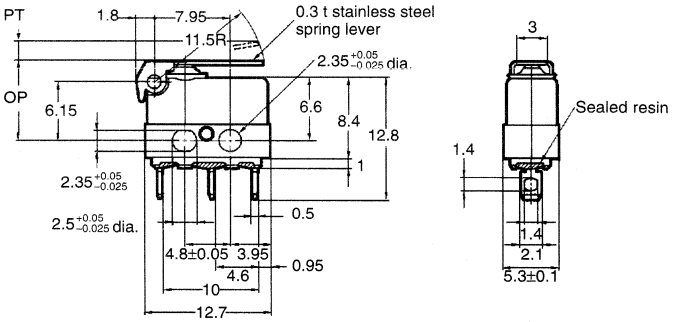




Model	Short lever
	D2JW-01k1A1
OF max.	1.15 N (117 gf)
RF min.	0.22 N (23 gf)
PT max.	5.4 mm
OT min.	0.7 mm
MD max.	0.5 mm
OP	8.4±0.8 mm

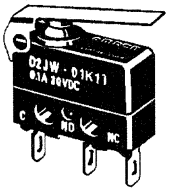
Short Lever
D2JW-01K1A1

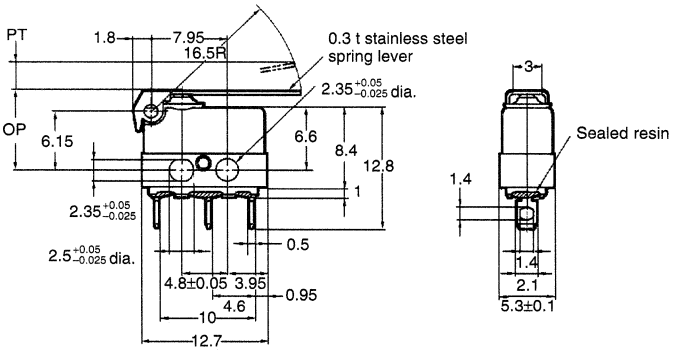




Model	Standard lever
	D2JW-01K11
OF max.	0.80 N (82 gf)
RF min.	0.15 N (16 gf)
PT max.	6.4 mm
OT min.	1.4 mm
MD max.	0.7 mm
OP	8.4±0.8 mm

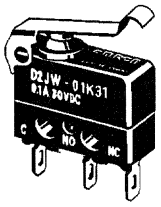
Standard Lever
D2JW-01K11

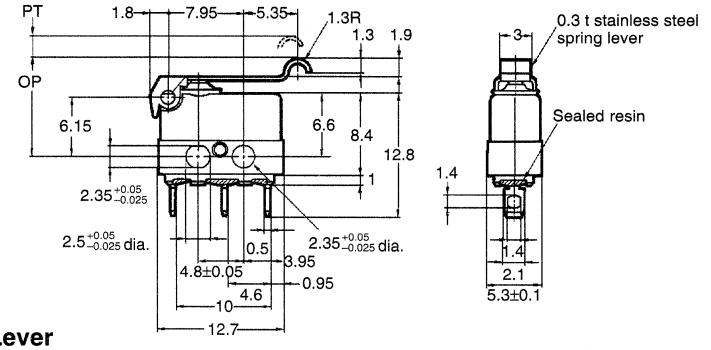




Model	Simulated roller lever
	D2JW-01K31
OF max.	0.95 N (97 gf)
RF min.	0.18 N (19 gf)
PT max.	5.5 mm
OT min.	1.1 mm
MD max.	0.6 mm
OP	10.3±0.8 mm

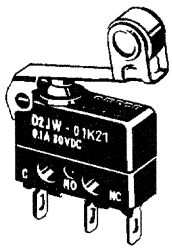
Simulated Roller Lever
D2JW-01K31

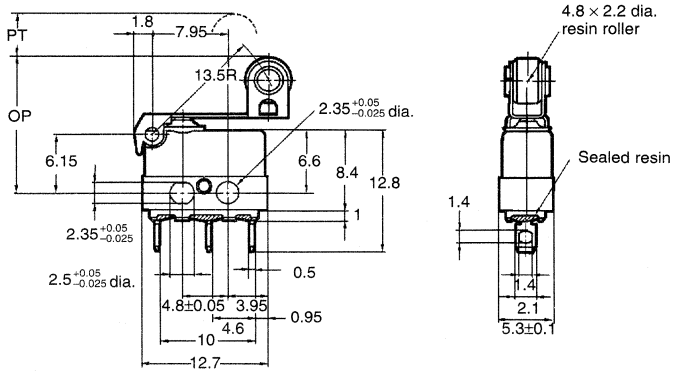




Model	Standard roller lever
	D2JW-01K21
OF max.	0.95 N (100 gf)
RF min.	0.19 N (20 gf)
PT max.	5.2 mm
OT min.	1.1 mm
MD max.	0.5 mm
OP	14.6±0.8 mm

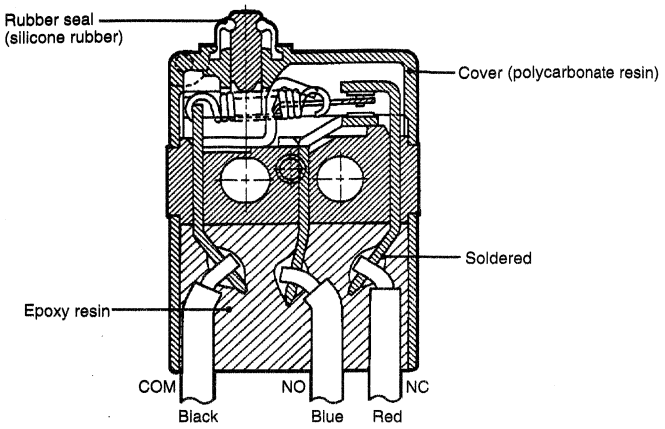
Standard Roller Lever
D2JW-01K21



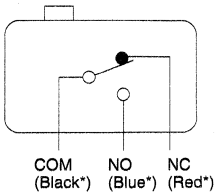


Micro Switches

Nomenclature



Contact Form



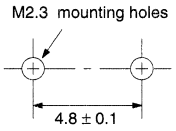
*Indicates the color of the lead wire.

Precautions

Mounting

Use M2.3 mounting screws with plain or spring washers to mount the switch. Tighten the screws to a torque of 0.20 to 0.29 N • m (2 to 3 kg • cm).

Mounting Holes



Because the switch uses polycarbonate resin as material for its component parts, contact OMRON if the switch material is likely to deteriorate due to adherence of oil or chemicals to the switch housing.

Soldering

To solder the lead to the terminal, apply a soldering iron rated at 30 W max. (temperature of soldering iron: 280°C max.) within 3 seconds.
Applying a soldering iron for too long a time or using one that is rated at more than 30 W may degrade the switch characteristics.

Operation

Make sure that the operating body pushes the switch actuator with an adequate force when the switch is to be operated, and that it does not touch the actuator when the switch is released.

Install the pin plunger switch so that the operating force is applied in alignment with the stroke of actuator.

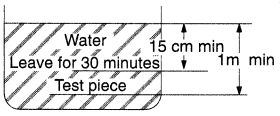
Do not apply a shock to the actuator; otherwise, the switch may be damaged.

Do not apply excessive force to the actuator of the lever switch in the operating, releasing and horizontal directions.

Enclosure Ratings

The D2JW satisfies the following test condition specified by the IEC Publication 529:

Enclosure rating: IP67
Test method: See the figure below.



Note: Temperature difference between the test piece and water must be 5°C or more.

Leave the test piece in water for 30 min with the top of the test piece submerged 15 cm or more below the water level and the bottom of the test piece submerged 1 m or more below the water level.

This test is to check the ingress of water into the switch enclosure after submerging the switch in water for a given time. Even if this test condition is met, the switch cannot be used in water.

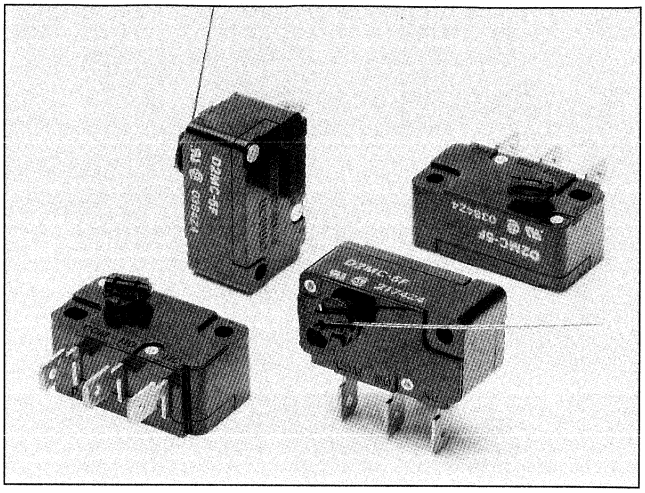
OMRON

Low–torque Basic Switch

D2MC

Highly Reliable Rotary-action Switch for Low Torque Operation

- 0.5 A rated model (D2MC-01□) employs crossbar alloy #1 contacts which exhibit unsurpassed contact reliability in very small load ranges.
- High-capacity 5 A Model (D2MC-5□) employs silver contacts.
- Long life (10,000,000 mechanical operations min.) through use of a movable coil spring.
- Optional 50mm or 120mm long wire actuators available.



Ordering Information

Direction of actuation	OF	5 A	0.5 A
Clockwise	5.1 g • cm max.	D2MC-5E	D2MC-01E
	7.6 g • cm max.	D2MC-5F	D2MC-01F
	10.2 g • cm max.	D2MC-5H	D2MC-01H
Counterclockwise	5.1 g • cm max.	D2MC-5EL	D2MC-01EL
	7.6 g • cm max.	D2MC-5FL	D2MC-01FL
	10.2 g • cm max.	D2MC-5HL	D2MC-01HL

Note: All the models listed here are supplied without actuator lever. If an actuator lever is required, please order separately by indicating the model name of the actuator lever.
See *Accessories.*

Micro Switches

Specifications

■ Ratings

Item	D2MC-5□	D2MC-01□
Electrical ratings	5 A at 125/250 VAC (resistive load)	0.5 A t 125VAC/30 VDC (resistive load)
Inrush current	NC: 15 A; NO: 7 A	0.5 A

■ Characteristics

Item	D2MC-5□	D2MC-01□
Operating speed	1° to 360°/sec	
Operating frequency	Mechanical: 240 operations/min Electrical: 20 operations/min	Mechanical: 240 operations/min Electrical: 60 operations/min
Insulation resistance	100 MΩ min. (at 500 VDC)	
Contact resistance	20 mΩ max. (initial value)	100 mΩ max. (initial value)
Dielectric strength	600 VAC, 50/60 Hz for 1 min between non-continuous terminals 1,500 VAC, 50/60 Hz for 1 min between current-carrying metal parts and ground, and between each terminal and non-current-carrying metal part	
Vibration resistance	Malfunction: 10 to 55 Hz, 1.5-mm double amplitude	
Shock resistance	Destruction: 1,000 m/s^2 (approx. 100G) Malfunction: D2MC-□E: 100 m/s^2 (approx. 10G) D2MC-□F: 100 m/s^2 (approx. 10G) D2MC-□H: 200 m/s^2 (approx. 20G)	
Life expectancy	Mechanical: 10,000,000 operations min. Electrical: 100,000 operations min.	Mechanical: 10,000,000 operations min. Electrical: 100,000 operations min. (1,000,000 operations at 0.1 A, 125 VAC/30 VDC)
Ambient temperature	Operating: –25°C to 80°C (with no icing)	
Ambient humidity	Operating: 85% max.	
Weight	Approx. 10.5 g	

Note: All the models listed here are supplied without actuator lever. If an actuator lever is required, please order separately by indicating the model name of the actuator lever.
See *"Accessories".*

■ Approved Standards

UL (File No. E41515)

CSA (File No. LR21642)

D2MC-5□ series: 5 A, 125 VAC
5 A, 250 VAC

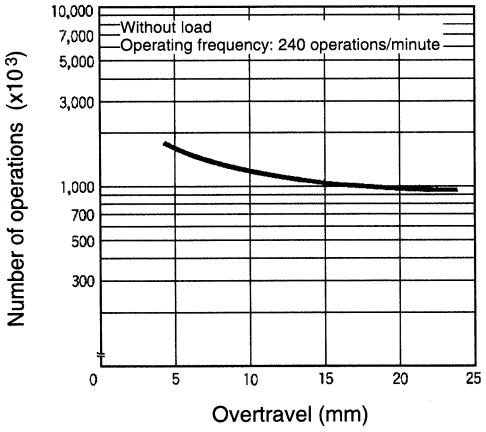
D2MC-01□ series: 0.5 A, 125 VAC
0.5 A, 30 VDC

■ Operating Characteristics

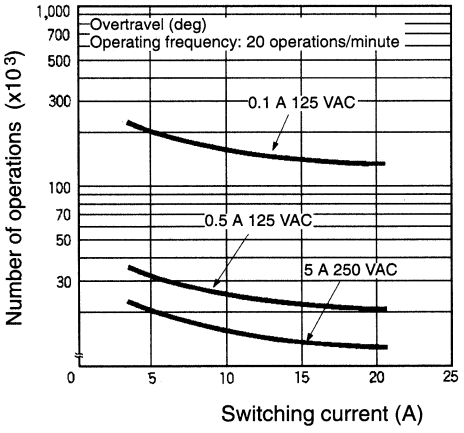
Model	D2MC-□E	D2MC-□F	D2MC-□H
OF max.	0.5 mN • m (5.1 gf • cm)	0.75 mN • m (7.6 gf • cm)	1.0 mN • m (10.2 gf • cm)
RF min.	0.05 mN • m (0.6 gf • cm)	0.09 mN • m (0.9 gf • cm)	0.13 mN • m (1.3 gf • cm)
PT max.	21°		
OT min.	17°		
MD min.	3°		
RT min.	5°		
TT min.	38°		
FP	15±3°		

Engineering Data

Mechanical Life Expectancy



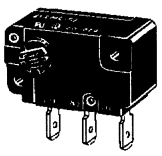
Electrical Life Expectancy



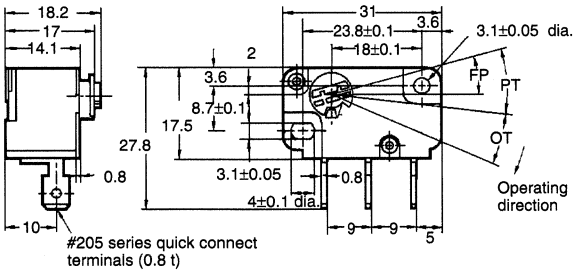
Dimensions

Note: 1. All units are in millimetres unless otherwise indicated.
2. Unless otherwise specified, a tolerance of ±0.4 mm applies to all dimensions.

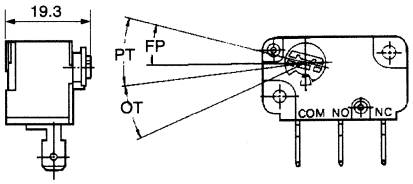
Snap-on Mounting



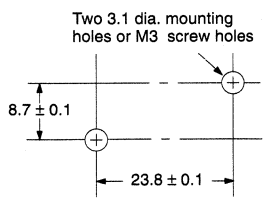
Clockwise



Counterclockwise



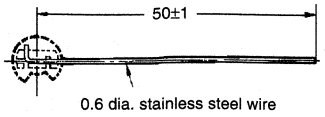
Mounting Holes



Accessories (Order Separately)

■ Actuator Lever

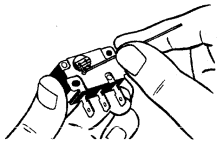
CAA1M for Snap-on Mounting



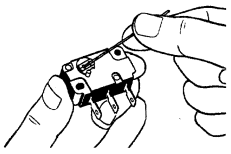
In addition to the standard wire lever model shown here, various other levers are available upon request.

Mounting Actuator Lever

1. Insert the end of the actuator lever into the hole in the rotary disc.



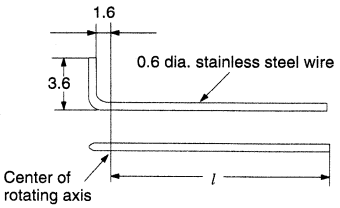
2. Push the lever down in the direction of the groove in the rotary disc.



Designing Own Actuator

If you decide to make your own actuator lever, the materials used should be stainless steel, piano wire, hard aluminum wire, etc.

There are no restrictions on the tip shape or length of the actuator lever. However, if the lever is too long, improper switch resetting or contact chattering may occur. Therefore, the shape of lever as shown below is suitable.



The appropriate value of dimension (l) from the fulcrum is 50 mm.

Precautions

Mounting/Soldering

Use M3 mounting screws with plain washers or spring washers to mount the switch. Tighten the screws to a torque of 3 kg • cm (0.29 N • m).

When soldering a lead wire to a terminal of the D2MC, use a soldering iron with a maximum capacity of 60 W and do not take more than 5 s to solder the lead wire, otherwise the characteristics of the D2MC may be altered.

Applying a soldering iron for too long a time or using one that is rated at more than 60 W may degrade the switch characteristics.

Do not change the operating position by modifying the actuator.

Microvoltage/current Load

For details, refer to *"General Information"*.

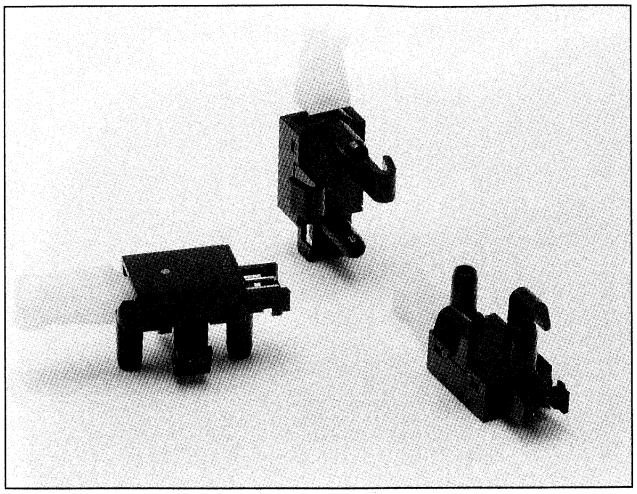
OMRON

Special–purpose Basic Switch

D2X

A Switch with Crimp-type Connectors that Greatly Reduces Wiring Time

- Clip-on wiring via AMP crimp-type connectors.
- Snap-fit attachment for easy installation.
- Operation possible from either side to enable mounting in either direction.
- High contact force and wiping action for greater contact reliability.



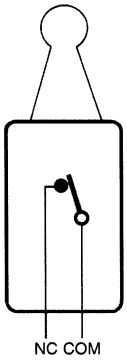
Specifications

■ Characteristics

Electrical ratings	0.1 A at 30 VDC, resistive load
Operating speed	0.1 to 100 mm/s
Operating frequency	Mechanical: 60 operations/min (OT: full stroke) Electrical: 30 operations/min (0.1 A at 30 VDC)
Insulation resistance	100 MΩ min. (at 250 VDC)
Contact resistance	200 mΩ min. (initial value)
Dielectric strength	250 VAC, 50/60 Hz for 1 min between contacts of same polarity 250 VAC, 50/60 Hz for 1 min between each terminal and ground
Vibration resistance	Malfunction: 10 to 55 Hz, 1.5-mm double amplitude
Shock resistance	Malfunction: 300 m/s^2 min. (approx. 30G min.)
Life expectancy	Mechanical: 1,000,000 operations min. (OT: full stroke) Electrical: 50,000 operations min. (rated load)
Ambient temperature	Operating: –10°C to 70°C (with no icing)
Ambient humidity	Operating: 45% to 85%
Weight	Approx. 1 g

Operation

■ Contact Construction

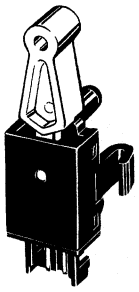


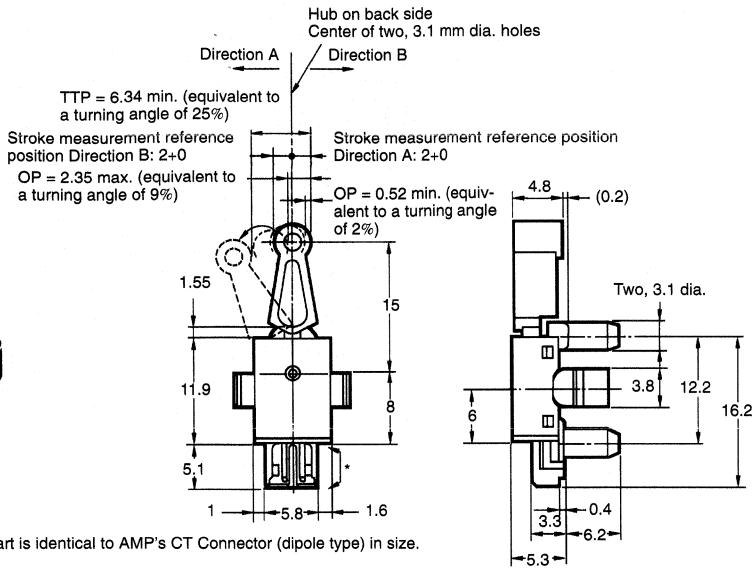
■ Operating Characteristics

OF max.	0.49 N (50 gf)
RF min.	0.02 N (2 gf)
OP	0.52 to 2.35 mm
TTP min.	6.34 mm

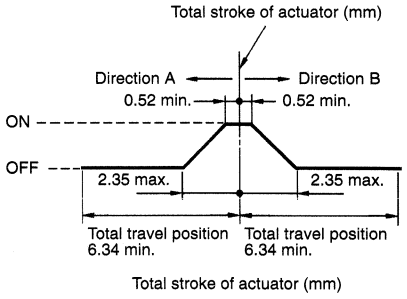
Dimensions

Note: 1. All units are in millimetres unless otherwise indicated.
2. Unless specified, a tolerance of +0.2 mm applies to all dimensions.





*This part is identical to AMP's CT Connector (dipole type) in size.



Precautions

Operations

To allow the actuator to travel properly, set the dog or cam stroke so that the dog or cam will not press the head of the lever with an excessive force when the switch is actuated. When the actuator is released, the dog or cam must be off the head.

Set the dog or cam so that it will press the head of the lever properly in the travelling direction of the lever.

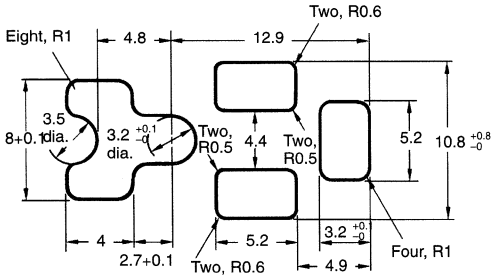
The lever must not be further pressed after the actuator has reached the TTP.

Mounting Plate

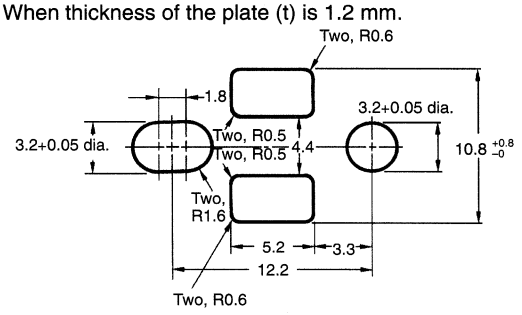
The back of the Mounting Plate has a bur. Mount the D2X onto the surface of the Mounting Plate.

Mounting Holes

When thickness of the plate (t) is 1.6 mm.



When thickness of the plate (t) is 1.2 mm.



Note: 1. The tolerance of the center of each hole is +0.07 mm.
2. Unless specified, a tolerance of +0.2 mm applies to all dimensions.

Wiring

For wiring, use AMP's CT Connector as follows:
Pressure connection type: 173977-2
Crimp style: Housing: 175778-2
Contact: 175102-1

The CT Connector is not sold by OMRON. Contact AMP directly.

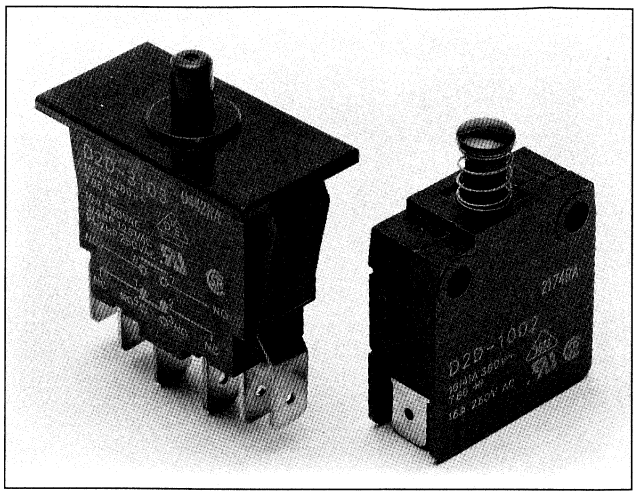
OMRON

Special–purpose Basic Switch

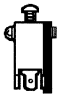
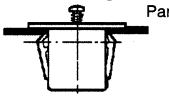
D2D

Safety Switch incorporating Positive Contact Opening

- Minimum contact gap of 3 mm.
- Fail-safe mechanisms with double return spring and direct drive positive contact opening features.
- Conforms to Class II of VDE Insulation. Safety-oriented structure with 6 mm min. insulation distance between terminals of the same polarity, 8 mm min. between current-carrying metal part and ground, and 8 mm min. between each terminal and non-current-carrying metal part.
- Pull-on lock model for easy maintenance.
- Quick-connect terminal #250 series (conforming to DIN standard).



Ordering Information

Mounting method	Contact form	Standard	Pull-on lock
		Contact gap: 3 mm min.	Contact gap: 1 mm
Screw mounting  Panel	SPDT-NO/NC	D2D-1000	D2D-2000
	SPST-NO	D2D-1001	---
	SPST-NC	D2D-1002	---
Panel mounting  Panel	SPDT-NO/NC	D2D-1100	D2D-2100
	SPST-NO	D2D-1101	---
	SPST-NC	D2D-1102	---
	DPST-NO + SPST-NC	D2D-3103	---
	DPST-NO	D2D-3104	---

Specifications

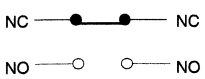
■ Ratings

Type	Rated voltage	Non-inductive load		Inductive load		Inrush current	
		Resistive load		Motor load			
		NC	NO	NC	NO	NC	NO
Standard	125 VAC	16 A		4 A		30 A max. (24 A max.)	30 A max. (24 A max.)
	250 VAC	16 A		4 A			
	380 VAC	16 A		4 A			
Pull-on lock	125 VAC	10 A		---			
	250 VAC	10 A		---			

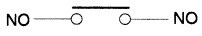
Note: 1. Inductive load has a power factor of 0.4 min. (AC) and a time constant of 7 ms max. (DC).
2. Motor load has an inrush current of 6 times the steady-state current.
3. Data in parentheses in the above table apply to the pull-on lock models.

Contact Form

SPDT

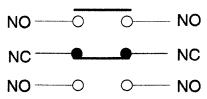


SPST-NO

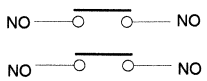


SPST-NC

SPST-NO + SPDT



DPST-NO



■ Characteristics

Operating speed	10 mm to 1 m/s
Operating frequency	Mechanical: 300 operations/min Electrical: 60 operations/min
Insulation resistance	100 MΩ min. (at 500 VDC)
Contact resistance	50 mΩ max. (initial value)
Dielectric strength	Standard 2,000 VAC, 50/60 Hz for 1 min between terminals of same polarity, and between current-carrying metal part and ground 2,500 VAC, 50/60 Hz for 1 min between each terminal and non-current-carrying metal part (1,000 Pull-on lock 1,000 VAC, 50/60 Hz for 1 min between terminals of same polarity 1,500 VAC, 50/60 Hz for 1 min between current-carrying metal part and ground, and between each terminal and non-current-carrying metal part
Temperature rise	30°C max. (initial value)
Vibration resistance	Malfunction: 10 to 55 Hz, 1.5-mm double amplitude
Shock resistance	Destruction: 1,000 m/s^2 min. (approx. 100G min.) Malfunction: 500 m/s^2 (approx. 50G) (300 m/s^2 (approx. 30G) for pull-on models)
Life expectancy	Mechanical: 10,000,000 operations min. Electrical: 100,000 operations min.
Ambient temperature	Operating: –25°C to 85°C (with no icing)
Ambient humidity	Operating: 85% max.
Weight	Approx. 14 g (D2D-1000)

■ Approved Standards

UL (File No. E32667)/CSA (File No. LR21642)

D2D-1 series: 16 A, 250 VAC
D2D-2 series: 10 A, 250 VAC
D2D-3 series: 16 A, 250 VAC
3/4 HP 125 VAC, 1-1/2 HP 250 VAC

VDE (File No. 1673)

D2D-1 series: 16 (4) A, 380 VAC
D2D-2 series: 10 A, 250 VAC

VDE (File No. 36132)

D2D-3 series: 16 (4) A, 380 VAC

SEMKO (File NO. 8444083)

D2D-2 series: 10 A, 250 VAC

■ Operating Characteristics

Note: NC-OFF: The force applied to the actuator to cause it to move from the free position to the position at which the NC contact opens.
NO-ON: The force applied to the actuator to cause it to move from the free position to the position at which the NC contact opens.

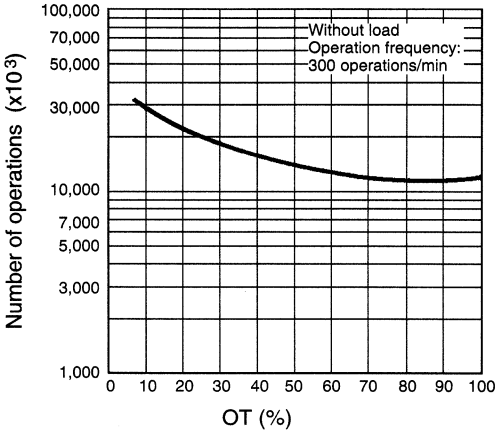
Model		Standard					
		Screw mount			Panel mount		
		D2D-1000	D2D-1001	D2D-1002	D2D-1100	D2D-1101	D2D-1102
OF max.	NC-OFF	2.94 N (300 gf)	---	2.94 N (300 gf)	2.94 N (300 gf)	---	2.94 N (300 gf)
	NO-ON	5.88 N (600 gf)	5.88 N (600 gf)	---	5.88 N (600 gf)	5.88 N (600 gf)	---
TTF max.		7.35 N (750 gf)	7.35 N (750 gf)	7.35 N (750 gf)	7.35 N (750 gf)	7.35 N (750 gf)	7.35 N (750 gf)
OT min.		2.3 mm	2.3 mm	5.5 mm	2.3 mm	2.3 mm	5.5 mm
TTP max.		10 mm	10 mm	10 mm	6 mm	6 mm	6 mm
FP max.		16.4 mm	17 mm	16.4 mm	12.4 mm	13 mm	12.4 mm
OP	NC-OFF	15.9±0.4 mm	---	15.9±0.4 mm	11.9±0.4 mm	---	11.9±0.4 mm
	NO-ON	12.7±0.4 mm	12.7±0.4 mm	---	8.7±0.4 mm	8.7±0.4 mm	---

Model		Standard		Pull-on lock	
		Panel mount		Screw mount (Momentary action (normal operation))	
Model		D2D-3103	D2D-3104	D2D-2000	D2D-2100
OF max.	NC-OFF	2.94 N (300 gf)	---	1.96 N (200 gf)	1.96 N (200 gf)
	NO-ON	5.88 N (600 gf)	5.88 N (600 gf)	2.94 N (300 gf)	2.94 N (300 gf)
TTF max.		9.81 N (1,000 gf)	9.81 N (1,000 gf)	5.88 N (600 gf)	5.88 N (600 gf)
OT min.		2.3 mm	2.3 mm	4.5 mm	4.5 mm
TTP max.		6.4 mm	6.4 mm	8.3 mm	4.3 mm
FP max.		12.4 mm	13.5 mm	14.3 mm	10.3 mm
OP	NC-OFF	11.9±0.8 mm	---	13.5±0.6 mm	9.5±0.6 mm
	NO-ON	8.7±0.8 mm	8.7±0.8 mm	12.7±0.6 mm	8.7±0.6 mm

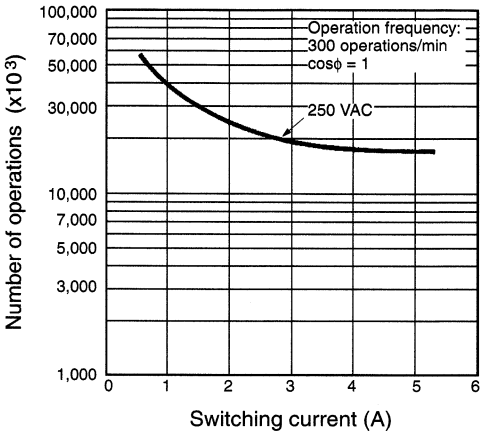
Model		Pull-on lock	
		Panel mount (Pull-on lock action)	
Model		D2D-2000	D2D-2100
OF max.	NC-OFF	19.61 N (2,000 gf)	19.61 N (2,000 gf)
PT max.		2 mm	2 mm
OT min.		0.4 mm	0.4 mm
MD max.		1.5 mm	1.5 mm
TTP max.		16.5 mm	12.5 mm
FP max.		14.3 mm	10.3 mm
OP		15.1±0.6 mm	11.1±0.6 mm

Engineering Data

Mechanical Life Expectancy

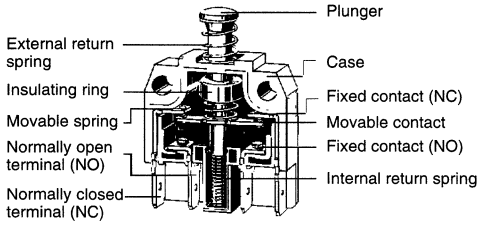


Electrical Life Expectancy

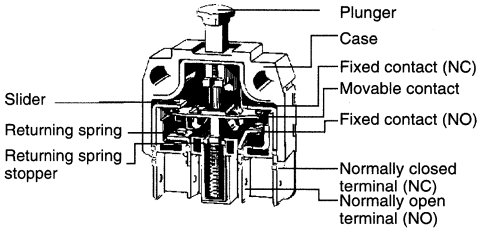


Nomenclature

Standard Model



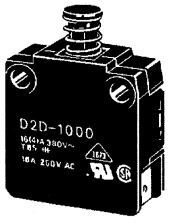
Pull-on Lock Model

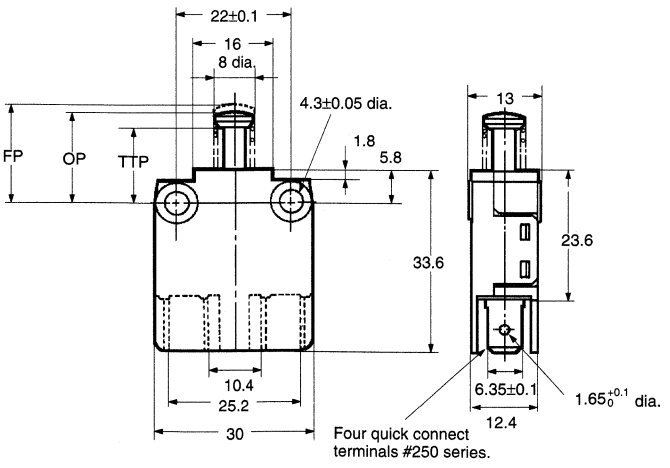


Dimensions

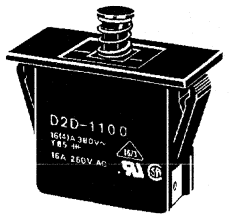
Note: 1. All units are in millimetres unless otherwise indicated.
2. Unless otherwise specified, a tolerance of ±0.4 mm applies to all dimensions.

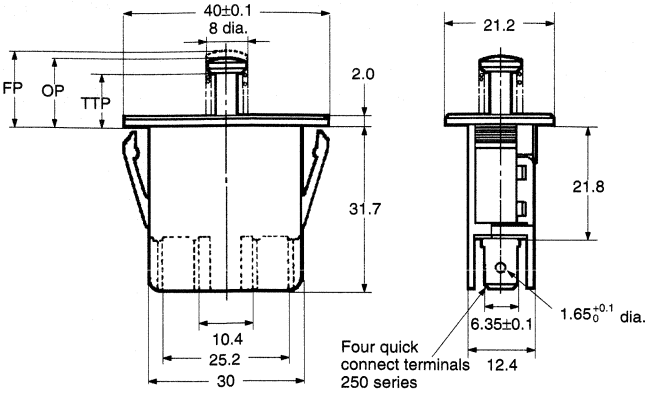
D2D-1000
D2D-1001
D2D-1002



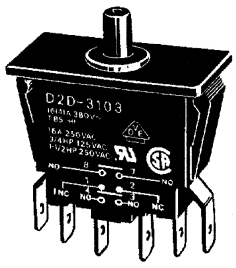


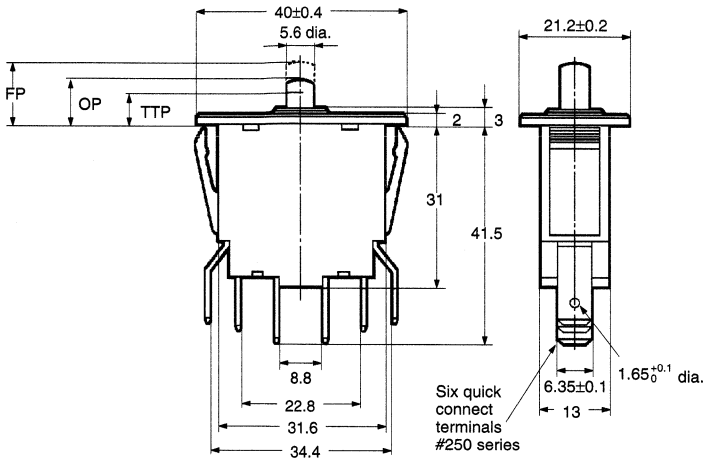
D2D-1100
D2D-1101
D2D-1102



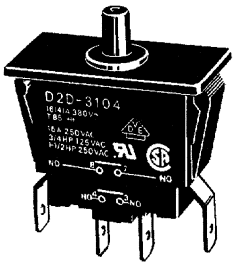


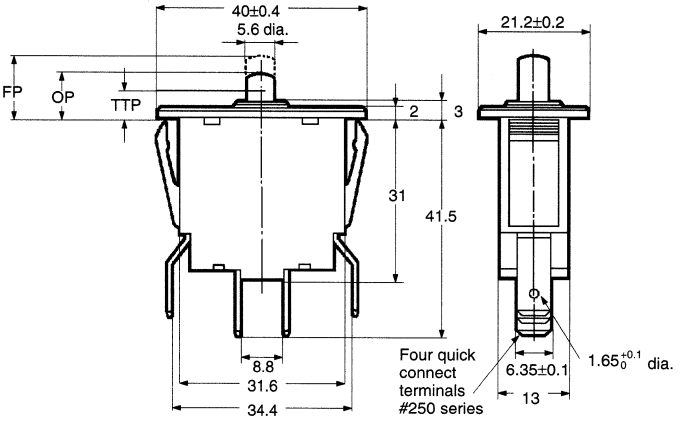
D2D-3103



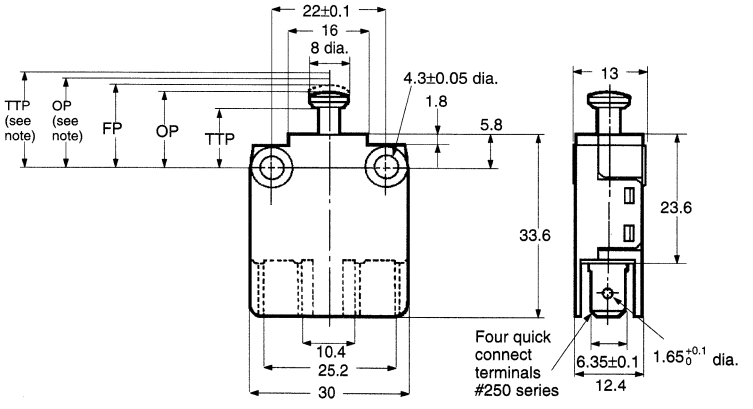


D2D-3104





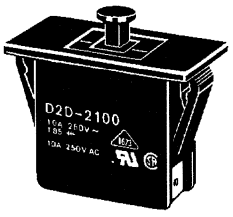
D2D-2000

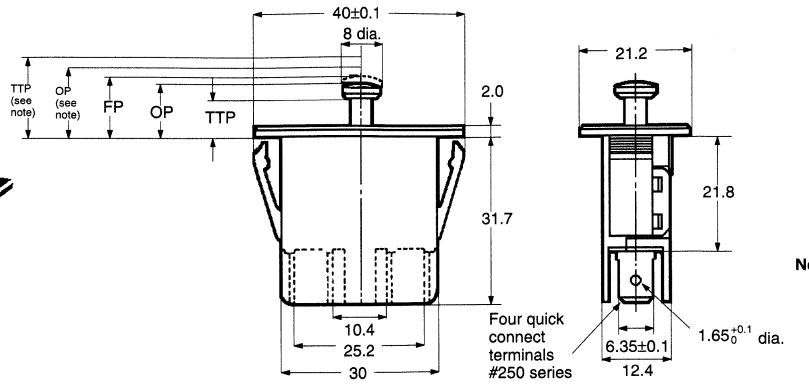


Note: At pull-on lock operation.

Micro Switches

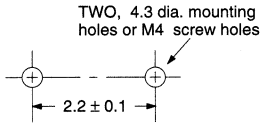
D2D2100





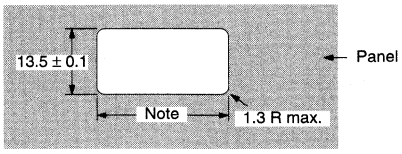
Note: At pull-on lock operation.

Mounting Holes



Panel Cutout

Panel thickness: 1.0 to 2.5 mm



Note: Dimension is 36.7±0.1 with a panel thickness of 1.0 mm and 37.0±0.1 with a panel thickness of 2.5 mm

Precautions

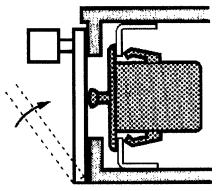
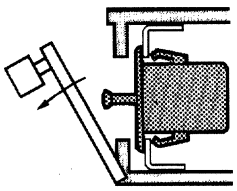
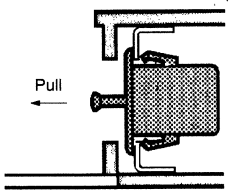
Mounting

Use M4 mounting screws with plain or spring washers to mount the switch. Tighten the screws to a torque of 5 to 7 kg • cm (0.49 to 0.69 N • m).

Pull-on Lock Function

When opening or closing the door, the power ON state of the switch can be checked with the door left open. By closing the door after maintenance inspection, the switch will resume the normal momentary action. (This feature is ideal for conducting the electrical continuity test, inspection, repair, etc. of the switch after its assembly.)

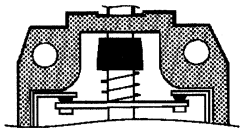
Use of a receptacle with an insulated sleeve or Positive Lock (by AMP) is recommended for terminal wiring. Exercise care that no excessive force is applied to the wired terminals.

Example		To turn on the power when the door is closed	To turn off the power when the door is open	To turn on the power with the door left open
State				
Connection	NO-NO	ON	OFF	ON
	NC-NC	(OFF)	(ON)	(OFF)

Fail-safe Mechanisms

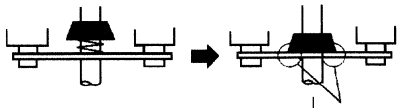
Double Spring Feature

Two return springs are provided for the pin plunger. Thus, when either of the spring is broken, this feature will prevent the switch from malfunctioning or short-circuiting.
(The pull-on lock switch is not provided with this function.)



Direct Drive positive Contact Opening Feature

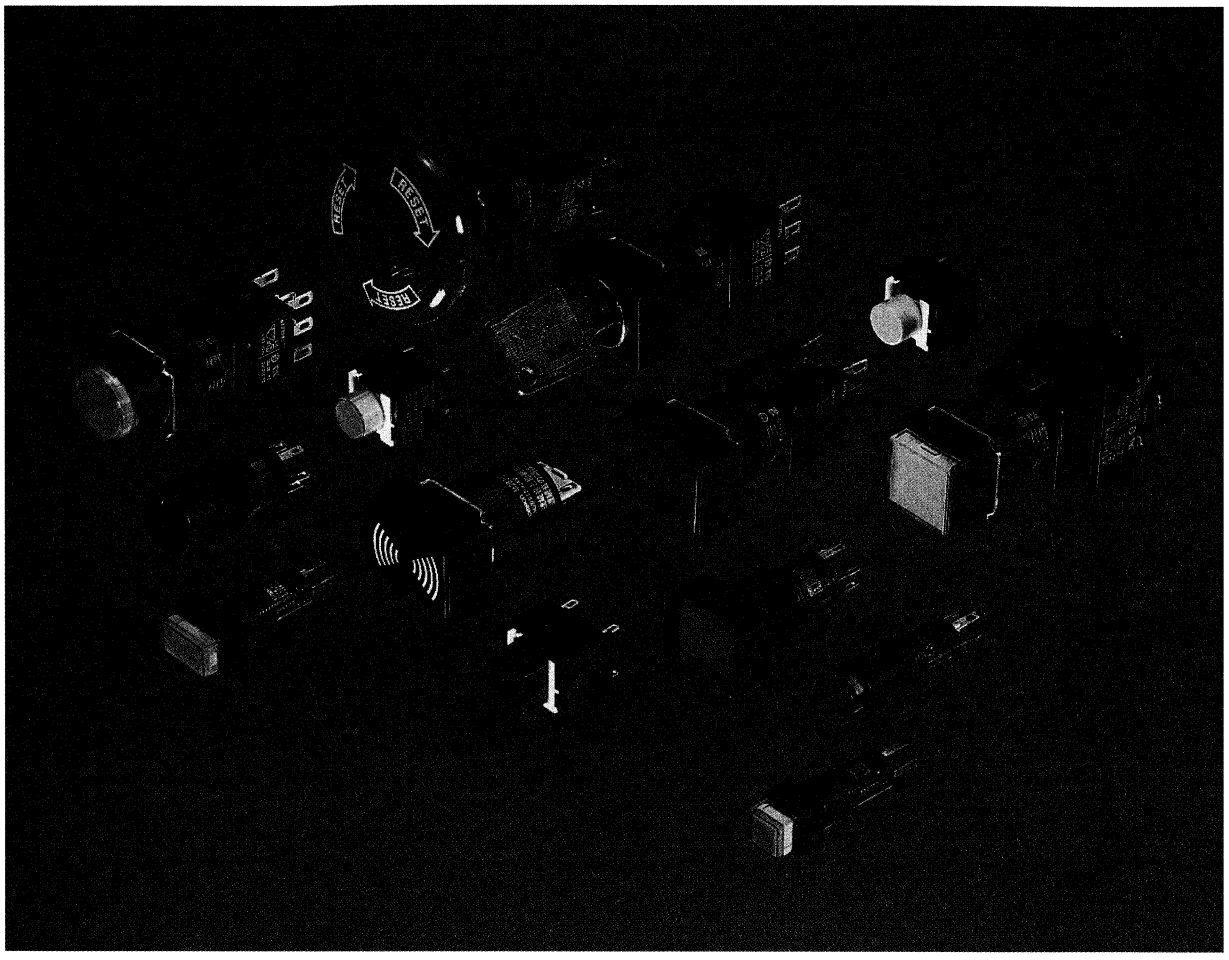
The section marked ▲ will positively break the circuit if a contact weld occurs in the switch.

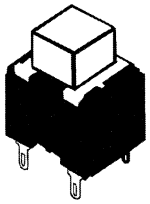


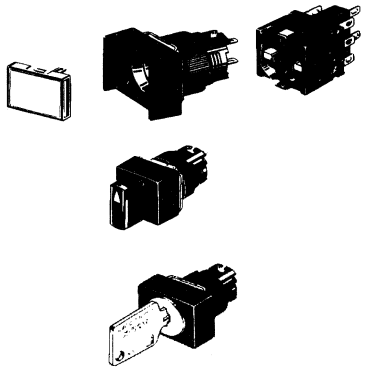
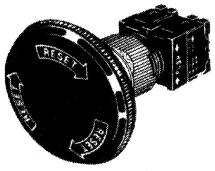
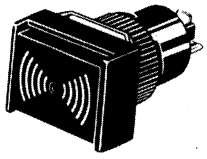
The section marked ▲ pushes the movable contact to apply force in the direction which separates the movable contact forcibly from the fixed contact.

SECTION 4

Lighted Pushbuttons



Item	A3A	A3C	A3D
Size	11.5mm	12mm	8mm
Appearance			
Features	• Wide switching range 1 mA 5 DC to 6 A to 125 VAC • PCB or panel mounting • Requires only 14.5 mm behind panel depth • UL and CSA approved	• Round, square or rectangular bezels • 20mm mounting depth • Indicator type available • Can be PCB mounted • UL and CSA approved	• Round, square or rectangular bezels • 18mm mounting depth • Indicator type available • Can be PCB mounted
Page	107	110	116

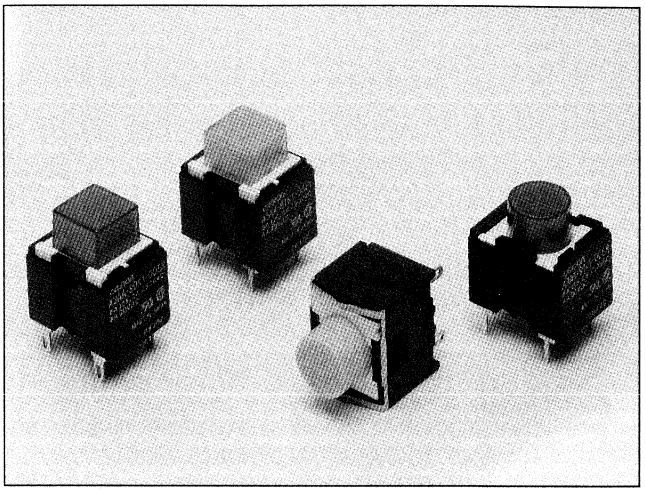
Item	A3G	A3GE	M2BJ
Size	16mm	16mm	16mm
Appearance			
Features	• Pushbutton, selector and key switches available • Detachable contact block • Faston, PCB or screw terminals • IP65 sealed types available • UL, CSA and VDE approved	• Emergency stop switch • Single or double pole, normally closed contacts • IP65 sealed • UL, CSA and VDE approved	• Eight sound variation from 4 models • Intermittent or continuous sound selected by jumper setting
Page	121	129	133

OMRON

Lighted Pushbutton Switch — A3A

Compact Switch Unit Allows Signal and Power Switching in the Same Model

- Capable of switching within the range 1mA 5VDC to 6A 125VAC.
- Mounting direct to PCB, or panel mounting using appropriate bezel.
- Requires only 14.5mm behind panel depth.
- Options include:
  - Round or Square
  - Momentary or Latching
  - Illuminated or Non–illuminated



Ordering Information

A3A □1 –9 □2 □3 1–00 □4

□ 1 Pushbutton Shape

Code	Shape
A	Square
T	Round

□ 2 Terminals

Code	Type
0	Solder
1	PCB

□ 3 Action

Code	Action
K	Momentary
L	Alternate

□ 4 Pushbutton

Code	Colour Type	Type
ER	Red	Illuminated
EY	Yellow	Illuminated
EG	Green	Illuminated
L	Grey	Non–illuminated
R	Red	Non–illuminated
Y	Yellow	Non–illuminated
G	Green	Non–illuminated
A	Blue	Non–illuminated
B	Black	Non–illuminated

Lighted Pushbuttons

Specifications

■ LED Ratings

Absolute Maximum

Characteristic	Unit	Value
Reverse Voltage	V_R	4V
Forward Current	I_F	25mA
Permissable loss	P_D	70mW
Operating Temp	T_{OPR}	–20 to + 75 C
Storage Temp	T_{STO}	–30 to + 100 C

■ Contact Ratings

Voltage (V)	Current (A)			
	Resistive	Lamp	Inductive	Motor
125 AC	6	1	2	1
250 AC	2	0.5	1	0.5
8 DC	4	1	2	1
14 DC	4	1	2	1
30 DC	4	1	1.5	1
125 DC	0.4	0.05	0.4	0.05
250 DC	0.4	0.03	0.2	0.03

Note: Min. permissible load 1mA 5VDC

■ LED Ratings

Standard Ratings

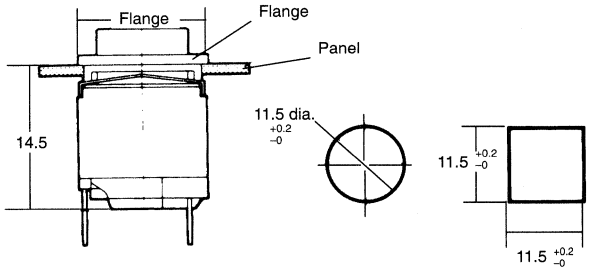
Characteristic	Unit	Condition	Typical	Max
Forward voltage	V_F	I_F = 15mA	2.05V	2.8V
Reverse current	I_R	V_R = 4V	–	100mA

■ Characteristics

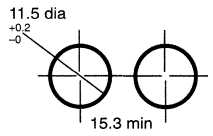
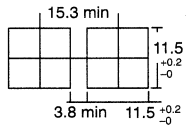
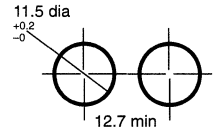
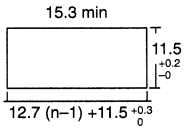
Insulation resistance	100MΩ min. (at 500VDC)
Dielectric strength	600 VAC, 50/60Hz for 1 minute between terminals of same polarity 2,000VAC, 50/60Hz for 1 minute between terminals of different polarity and also between each terminal and ground
Vibration	Mechanical and malfunction durabiltiy: 10 to 55Hz, 1.5mm double amplitude
Shock	Mechanical durability: 500 m/s^2 (approx. 50 G) Mechanical durability: 150 m/s^2 (approx. 15 G)
Ambient temperature	Operating: –10°C to 55°C
Humidity	35 to 85% RH
Life expectancy	**Mechanical:** Momentary action type: 1,000,000 operations min. Alternate action type: 50,000 operations min. **Electrical:** 50,000 operations min.
Weight	Approx. 3.2g

Dimensions

Panel cutout
For separate mounting

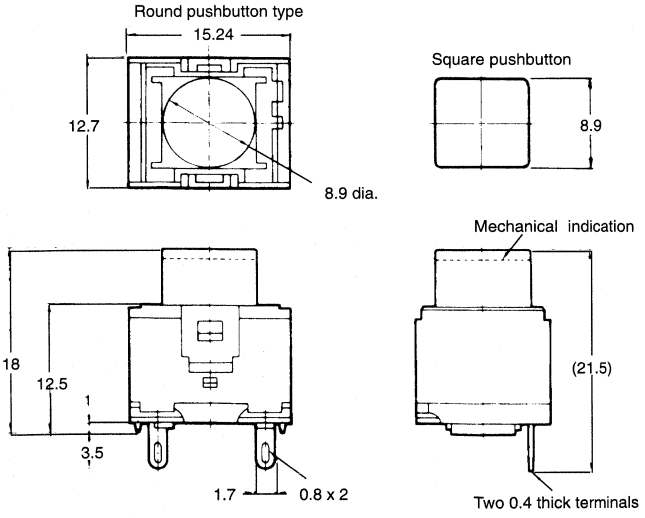


* Recommended panel thickness: 1 to 1.6 mm
** Flange dimensions:
Round: 12.7 dia.
Square: □ 12.7

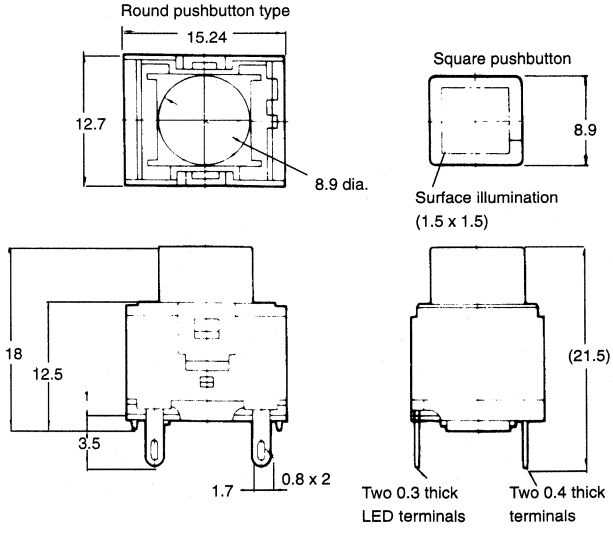
	For round pushbutton	For square pushbutton
Horizontal multiple mounting		
Vertical Multiple mounting		

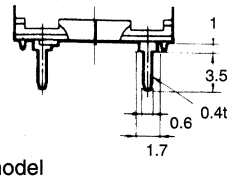
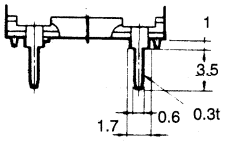
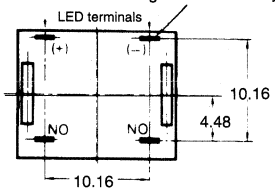
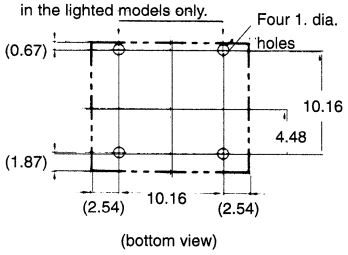
Note: 1. Unless otherwise specified, a tolerance of+/– 0.2mm applies to all dimensions.
2. The illustrations below show switches with solder terminals, without flange or leafspring.

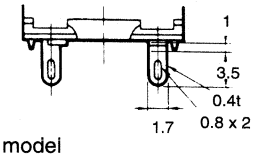
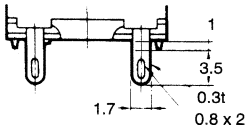
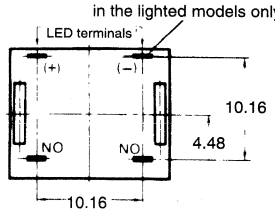
Non–lighted



Illuminated



Type	High capacity (SPST–NO)
PCB Terminals	Non–lighted model  Lighted model  LED terminals are provided in the lighted models only  Mounting holes Mounting holes are provided in the lighted models only.  (bottom view)

Type	High capacity (SPST–NO)
Solder terminals	Non–lighted model  Lighted model  LED terminals are provided in the lighted models only 

Accessories (Order Separately)

Flange (select according to colour)

Name	Shape	Classification	Model	Remarks
Flange		Flange alone	Black	A3A–251
			Light grey	A3A–252
			Black	A3A–241
			Light grey	A3A–242
		Leaf spring		A3A–200
		Flange and leaf spring (one each)	Black	A3A–221
			Light grey	A3A–222
			Black	A3A–211
			Light grey	A3A–212

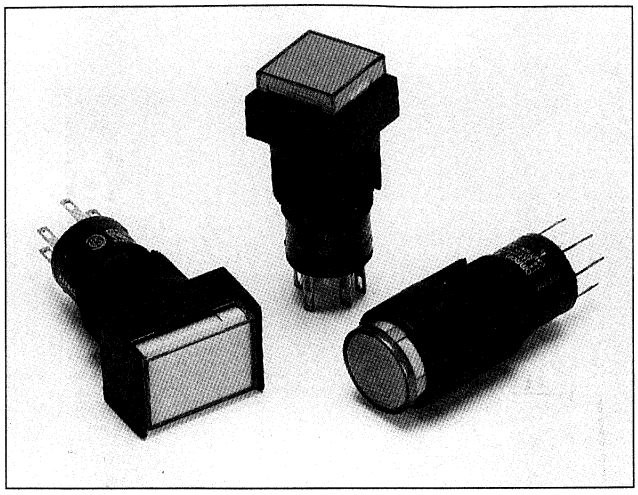
Note: Switch units having solder terminals are supplied with a black flange (appropriately round or square) and a metal leaf spring, used when panel mounting.

OMRON

Lighted PushButton Switch

A3C

Cylindrical 12mm dia. Pushbutton Series with Superb Operability, High Visibility and Compact Housing



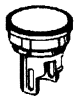
- Three models of pushbutton units (round, square and rectangular), two types of light-emitting elements (LED and lamp) and two types of switch units (switching general-purpose and microcurrent/voltage loads) available.
- Models that can be used as an indicator also available.
- Requires only 20mm mounting depth.
- All LEDs, lamps, lenses and legends replaceable without tools.
- Degree of protection conforms to IP40. UL (E41515) and CSA (LR45258–31) approved.

Ordering Information

Illuminated types

When placing your order, specify the individual component part model numbers of the screen, LED/lamp and switch unit as listed in the ordering tables below.

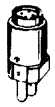
Screen



A3C❑–500❑

LED/Lamp

LED



A3B–0❑❑❑

Incandescent Lamp

A3B–0❑❑❑

Switch Unit

A3C❑–7❑❑❑
M2C❑–7❑❑❑*

* Model number unique for indicator unit

■ Screen

LED Illuminated

Shape / Button colour	Rectangular	Square	Round
Red	A3CJ–500R	A3CA–500R	A3CT–500R
Yellow	A3CJ–500Y	A3CA–500Y	A3CT–500Y
Green	A3CJ–500GY	A3CA–500GY	A3CT–500GY
White	A3CJ–500W	A3CA–500W	A3CT–500W

Note: 1. With the exception of green, all screens can be used with either LED or incandescent lamps. Since the hue of green changes with an incandescent light source, use the green LED light source listed elsewhere.

Incandescent Lamp Illuminated

Shape / Button colour	Rectangular	Square	Round
Red	A3CJ–500R	A3CA–500R	A3CT–500R
Yellow	A3CJ–500Y	A3CA–500Y	A3CT–500Y
Green	A3CJ–500G	A3CA–500G	A3CT–500G
White	A3CJ–500W	A3CA–500W	A3CT–500W
Blue	A3CJ–500A	A3CA–500A	A3CT–500A

■ Illumination Source

LED

Colour \ Rated voltage	5VDC	12VDC	24VDC
Red	A3B–005R	A3B–012R	A3B–024R
Yellow	A3B–005Y	A3B–012Y	A3B–024Y
Green	A3B–005G	A3B–012G	A3B–024G
White	A3B–005W	A3B–012W	A3B–024W

Incandescent lamp

All Colours \ Rated voltage	6VDC	14VDC	18VDC	28VDC
Model	A3B–006	A3B–014	A3B–018	A3B–028

■ Switch Unit

Degree of protection				IP40		
Appearance				Rectangular	Square	Round
Configuration	Contact	Switch action	Terminal			
General purpose	SPST–NO+ SPST–NC	Momentary	Solder	A3CJ–7011	A3CA–7011	A3CT–7011
		Alternate		A3CJ–7021	A3CA–7021	A3CT–7021
Micro-load		Momentary	Solder	A3CJ–7111	A3CA–7111	A3CT–7111
			PCB	A3CJ–7112	A3CA–7112	A3CT–7112
		Alternate	Solder	A3CJ–7121	A3CA–7121	A3CT–7121
			PCB	A3CJ–7122	A3CA–7122	A3CT–7122
Indicator			Solder	M2CJ–7001	M2CA–7001	M2CT–7001
			PCB	M2CJ–7002	M2CA–7002	M2CT–7002

Specifications

■ Contact Ratings

Type	AC resistive load	DC resistive load
General purpose load	0.5A, 250VAC 1A, 125VAC	1A, 30VDC
Micro* current/voltage load	0.1A, 125VAC	0.1A, 30VDC

Note: * The minimum permissible load is 1mA, 5VDC.

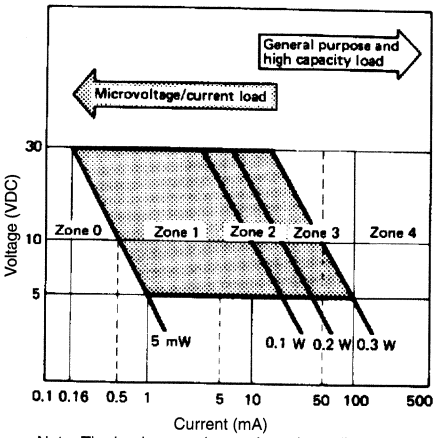
■ LED Ratings

Rated voltage	Rated current	Operating voltage
5 VDC	30mA	5VDC ± 5%
12 VDC	15mA	12VDC ± 5%
24 VDC	10mA	24VDC ± 5%

■ Lamp Ratings

Rated voltage	Rated current	Operating voltage
6V	60mA	5V
14V	40mA	12V
18V	26mA	15V
28V	24mA	24V

■ Applicable load range



Note: The load range shown above is applicable only during the standard conditions.

Lighted Pushbuttons

■ Characteristics

Operating frequency	**Mechanical**	Momentary-action type: 120 operations per minute max. Alternate-action type: 60 operations per minute max.
	Electrical	20 operations/minute max.
Insulation resistance		100MΩ min. (at 500VDC)
Dielectric strength		1,000VAC, 50/60Hz for 1 minute between terminals of same polarity 2,000VAC, 50/60Hz for 1 minute between terminals of different polarity and also between each terminal and ground
Vibration	**Malfunction**	10 to 55Hz, 1.5mm double amplitude
Shock	**Durability**	Approx. 500m/s^2 (50G)
	Malfunction	Approx. 150m/s^2 (15G)
Ambient temperature		Operating: −10°C to 55°C
Humidity		35 to 85% RH
Life expectancy	**Mechanical**	Momentary-action type: 1,000,000 operations min. Alternate-action type: 100,000 operations min.
Life expectancy	**Electrical**	100,000 operations min.
Weight		Approx. 5g

■ Operating Characteristics

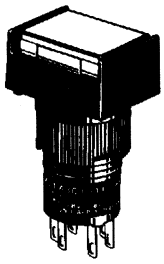
OF max.	250g
RF min.	30g
TT	3.5±0.5mm
LTA min.	0.5mm
PT max.	2.5mm

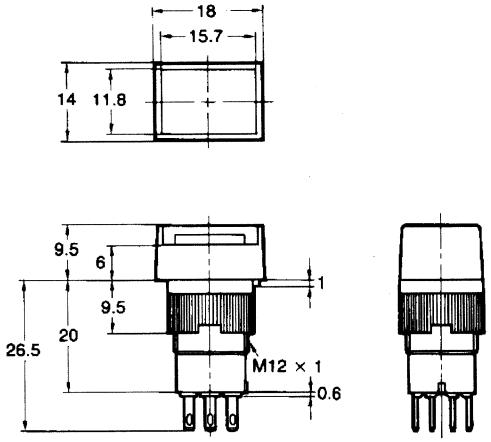
■ Approved by Standards

UL (File No.E41515)
CSA (File No. LR45258–31)

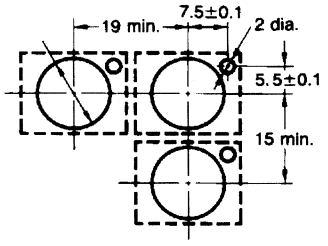
Dimensions

Rectangular
A3CJ



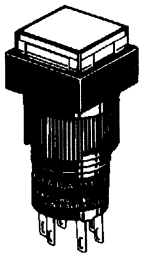


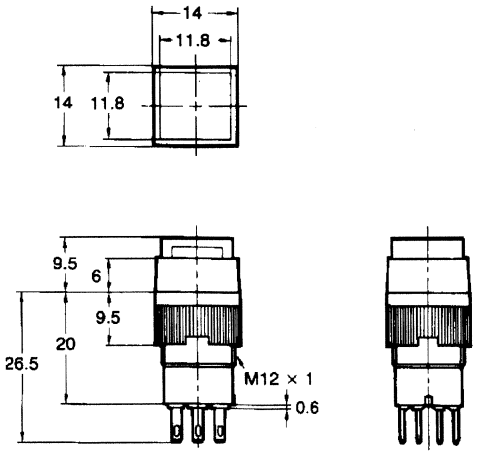
Panel cutout



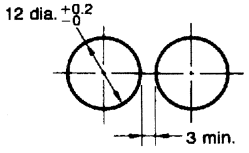
Note: Recommended panel thickness is 1.0 to 3.2mm.

Square
A3CA



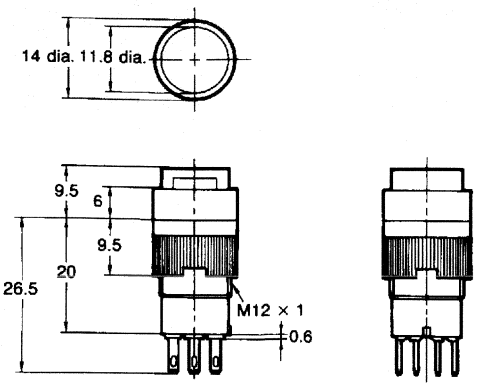


Panel cutout

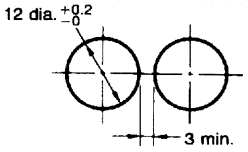


Note: Recommended panel thickness is 1.0 to 3.2mm.

Round
A3CT



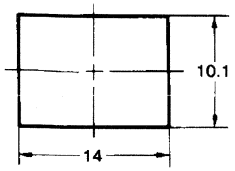
Panel cutout



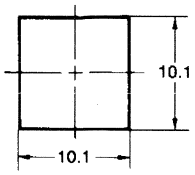
Note: Recommended panel thickness is 1.0 to 3.2mm.

Legend plate

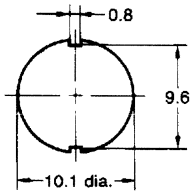
A3CJ



A3CA



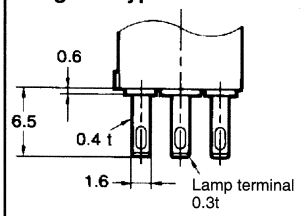
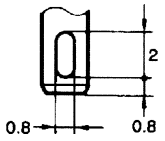
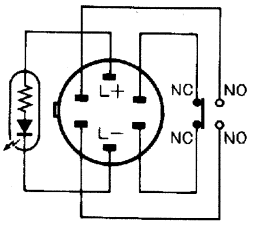
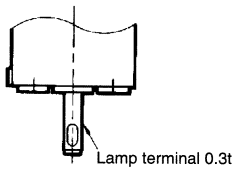
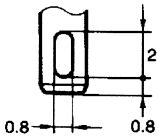
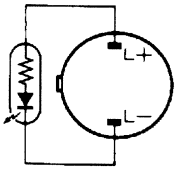
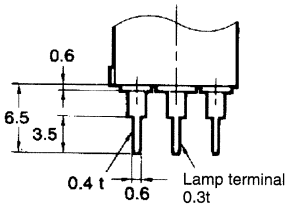
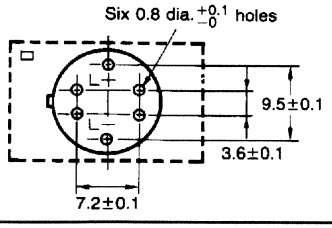
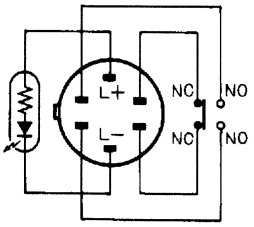
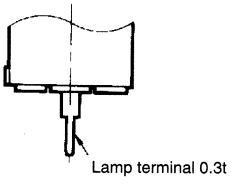
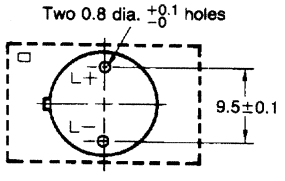
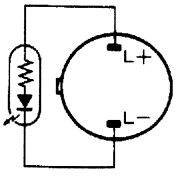
A3CT



Note: 1 The thickness is 0.8mm

2. Since the legend plate is made of polycarbonate, use alcohol-based paints such as melanin, phthalic acid or acryl paint when marking the legend.

Terminals/Connections

Type / Terminal	SPST–NO+SPST–NC	For Indication
Solder Terminal	**Lighted type**  **Terminal hole**   (Bottom view)	**Indicator**  **Terminal hole**   (Bottom view)
PCB Terminal	**Lighted type**  **Mounting hole (Bottom view)**   (Bottom view)	**Indicator**  **Mounting hole (Bottom view)**   (Bottom view)

Accessories (Order Separately)

Name	Shape	Classification	Model	Remarks
Socket		Wire-wrap terminal	A3C–4101	–
		PCB terminal	A3C–4102	
		Solder terminal	A3C–4103	
Switch guard		Rectangular	A3CJ–5050	–
Tightening tool		–	A3C–3004	Useful for mounting switch units one after another. Do not over-tighten.

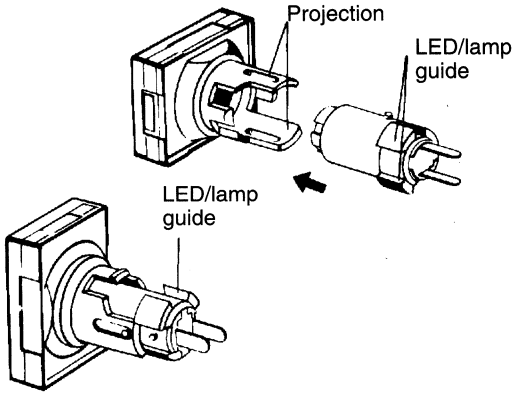
Assembly/Disassembly

■ Mounting and Replacing Pushbutton Unit

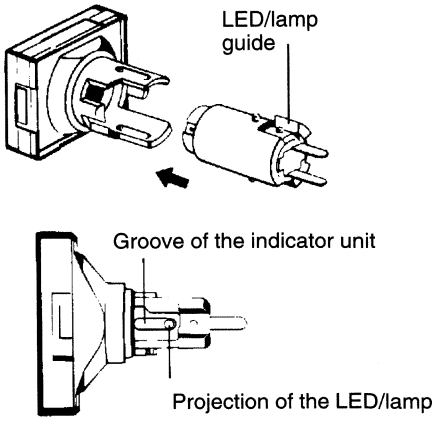
Mounting directions for the LED/lamp and Screen

The OMRON screen doubles the roles in which a pushbutton switch is normally used. The screen may be inserted one of two ways:

1. For operation as a lighted pushbutton switch, fit the LED/lamp so that its guide projection is inserted into the wider opening in the receptacle of the screen.



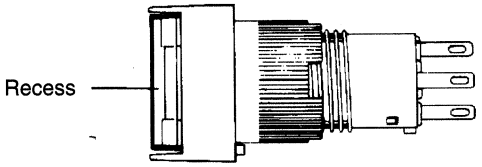
2. For operation as an indicator unit, insert the LED/lamp guide projection into the narrower opening in the indicator unit's receptacle. Push the projection of the LED/lamp in the groove of the screen so that the LED/lamp is firmly inserted into the screen of the indicator unit.



Note: The inserting direction of the LED/lamp for the screen is opposite to that for the indicator unit. Pay attention to the mounting direction of the legend plate.

Removing the pushbutton unit

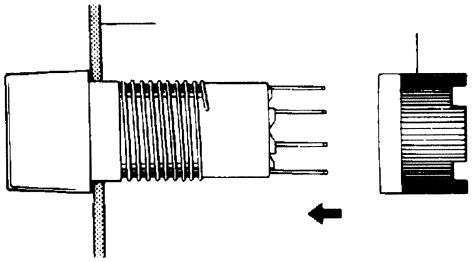
While holding the recessed portions on both sides, firmly and steadily pull out the top of the screen with your thumb and forefinger. Pulling out the cap with pliers or a similar tool will damage the cap.



■ Mounting the switch unit on panel

Nut mounting

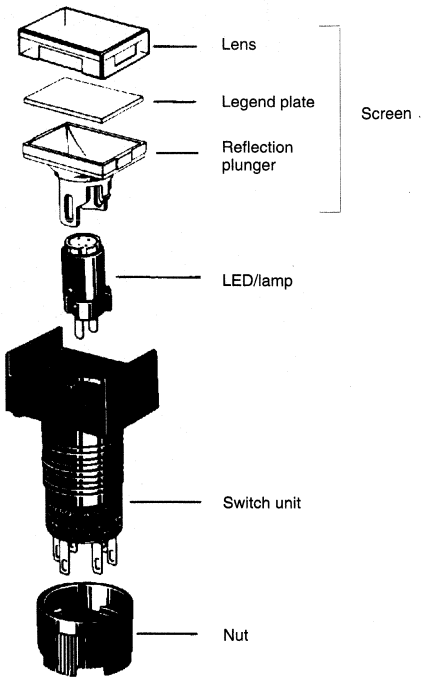
- Insert the switch unit from the front of the panel and tighten the mounting nut inserted from the rear of the panel.
- Since a projection exists on the rear portion of the switch unit, if the mounting unit cannot be fitted into position, turn the nut slightly.
- The tightening torque of the mounting nut should be less than 5kg–cm.
- Solder the terminals after mounting the nut. Otherwise, the terminals, when thickened by solder, may prevent the nut from being screwed down onto the switch unit.



Wiring

- Finish soldering within 5 seconds with a 30 watt soldering iron, or within 3 seconds at a solder temperature of 240°C. Do not apply any force to the switch unit for about a minute after soldering, to avoid deforming the softened plastic base of the switch unit.
- Use a non-corrosive, resin-based soldering flux.

Construction



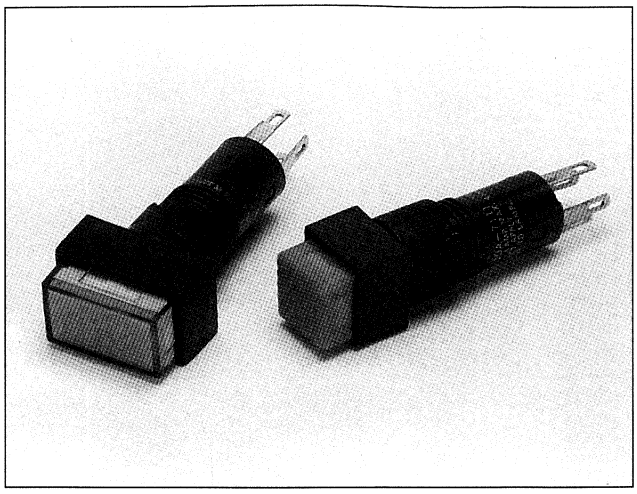
OMRON

Lighted PushButton Switch

A3D

Cylindrical 8mm dia. Subminiature Series Featuring Short Mounting Depth

- Round, square and rectangular LED pushbutton units.
- Indicator types also available.
- Requires only 18mm mounting depth.
- Efficiency in wiring improved by terminals arranged on the same level.
- All LEDs, lamps, lenses and legends replaceable without tools.
- Degree of protection conforms to IP40.



Ordering Information

Illuminated types

When placing your order, specify the individual component part numbers of the pushbutton unit, LED, lamp and switch unit, as listed in the ordering tables below.

Pushbutton Unit

A3D□–500□
M2D□–500□*

* Model number unique for indicator unit

Switch Unit

A3D□–7□□□
M2D□–7□□□*

* Model number unique for indicator unit

■ Pushbutton Unit

Lighted type, Built-in LED

Shape / Button colour	Rectangular	Square	Round
Red	A3DJ–500R	A3DA–500R	A3DT–500R
Yellow	A3DJ–500Y	A3DA–500Y	A3DT–500Y
Green	A3DJ–500GY	A3DA–500GY	A3DT–500GY
White	A3DJ–500W	A3DA–500W	A3DT–500W

Indicator

Shape / Button colour	Rectangular	Square	Round
Red	M2DJ–500R	M2DA–500R	M2DT–500R
Yellow	M2DJ–500Y	M2DA–500Y	M2DT–500Y
Green	M2DJ–500GY	M2DA–500GY	M2DT–500GY
White	M2DJ–500W	M2DA–500W	M2DT–500W

■ Switch Unit

Degree of protection			IP40		
Appearance			Rectangular	Square	Round
Contact configuration	Switch action	Terminal			
SPST–NO+ SPST–NC	Momentary	Solder	A3DJ–7111	A3DA–7111	A3DT–7111
		PCB	A3DJ–7112	A3DA–7112	A3DT–7112
	Alternate	Solder	A3DJ–7121	A3DA–7121	A3DT–7121
		PCB	A3DJ–7122	A3DA–7122	A3DT–7122
For Indication (without switch)		Solder	M2DJ–7001	M2DA–7001	M2DT–7001
		PCB	M2DJ–7002	M2DA–7002	M2DT–7002

Specifications

■ Contact Ratings

DC (Resistive load)	0.1A, 30VDC

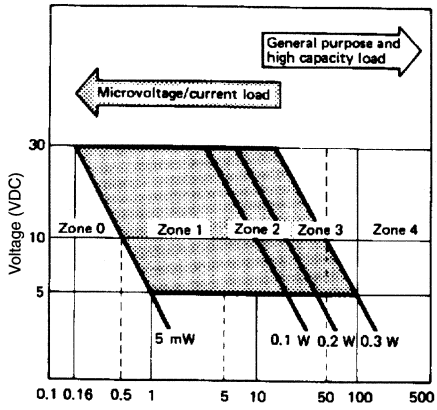
Note: The minimum permissible load is 1mA, 5VDC

■ Built-in LED Ratings

Item	LED colour	Red	Yellow	Green
Forward voltage V_F	**Standard value***	1.7V	2.2V	1.7V
	Max. value	2.0V	2.5V	2.0V
Forward current I_F	**Standard value***	20mA	20mA	20mA
	Absolute max. value	50mA	50mA	50mA
Permissible loss P_D	**Absolute max. value**	100mW	125mW	122mW
Reverse voltage V_R	**Absolute max. value**	4V	4V	4V

* Refer to V_F vs. I_F characteristics in Hints on Correct Use. Because no resistor is incorporated in the LED, connect an appropriate external resistance within the above limit.

■ Applicable load range



Note: The load range shown above is applicable only during the standard conditions.

■ Characteristics

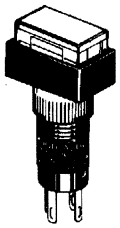
Operating frequency	**Mechanical**	Momentary-action type: 120 operations per minute max. Alternate-action type: 60 operations per minute max.
	Electrical	20 operations/minute max.
Insulation resistance		100MΩ min. (at 500VDC)
Dielectric strength		1,000VAC, 50/60Hz for 1 minute between terminals of same polarity 2,000VAC, 50/60Hz for 1 minute between terminals of different polarity and also between each terminal and ground
Vibration	**Malfunction**	10 to 55Hz, 1.5mm double amplitude
Shock	**Destruction**	Approx. 500m/s^2 (50G)
	Malfunction	Approx. 150m/s^2 (15G)
Ambient temperature		Operating: −10°C to 55°C
Humidity		35 to 85% RH
Life expectancy	**Mechanical**	Momentary-action type: 1,000,000 operations min. Alternate-action type: 100,000 operations min.
	Electrical	100,000 operations min.
Weight		Approx. 3g

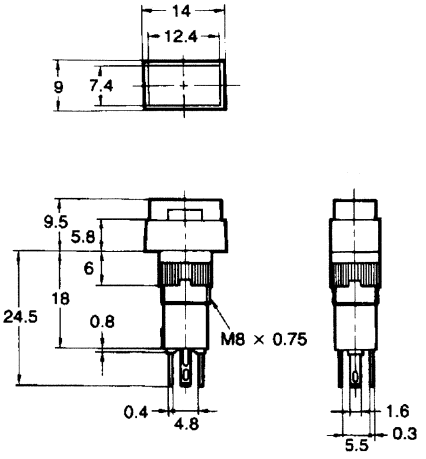
■ Operating Characteristics

OF max.	250g
RF min.	20g
TT	3.5±0.5mm
LTA min.	0.5mm
PT max.	2.5mm

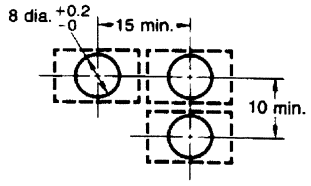
Dimensions

Rectangular
A3DJ/M2DJ

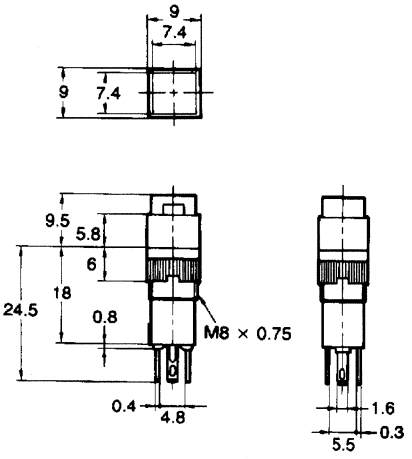




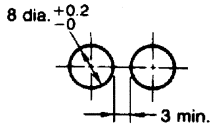
Panel cutout



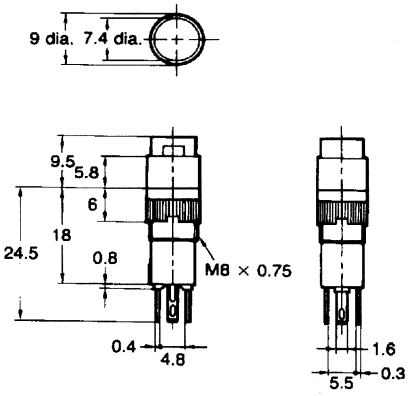
Square
A3DA/M2DA



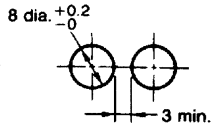
Panel cutout



Round
A3DT/M2DT

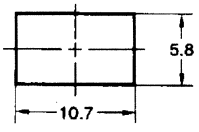


Panel cutout

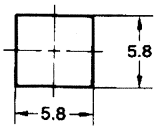


Legend plate

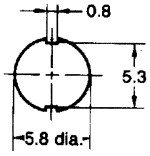
A3DJ



A3DA

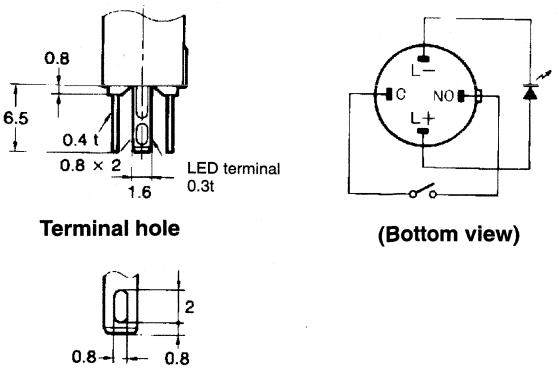
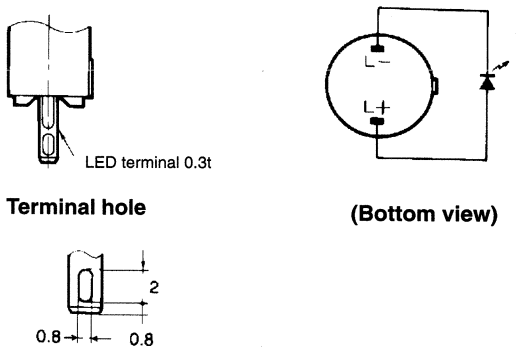
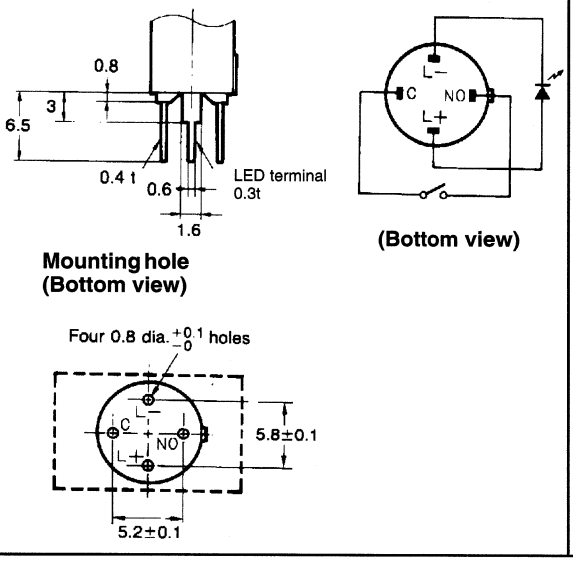
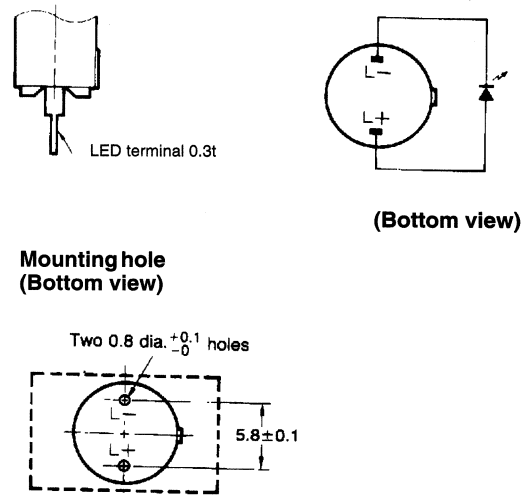


A3DT



Note: 1. The thickness is 0.8mm
2. Since the legend plate is made of polycarbonate, use alcohol-based paints such as melanin, phthalic acid or acryl paint when marking the legend.

Terminals/Connections

Terminal \ Type	SPST–NO	Indicator
Solder Terminal	**Lighted type**  **Terminal hole** **(Bottom view)**	**Indicator**  **Terminal hole** **(Bottom view)**
PCB Terminal	**Lighted type**  **Mounting hole (Bottom view)** **(Bottom view)**	**Indicator**  **Mounting hole (Bottom view)** **(Bottom view)**

Accessories (Order Separately)

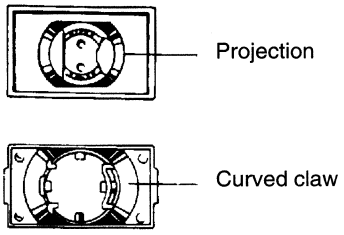
Name	Shape	Classification	Model	Remarks
Socket		Wire-wrap terminal	A3D–4101	Cannot be used with insulation cover
		PCB terminal	A3D–4102	
		Solder terminal	A3D–4103	
Tightening tool		–	A3D–3004	Useful for mounting switch units one after another. Do not over-tighten.

Assembly/Disassembly

Mounting directions for switch and pushbutton unit

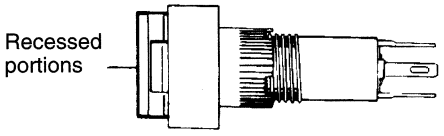
1. Insert the pushbutton unit in the switch unit so that the circular shaped claw outside the projection of the switch unit mates with the claw on the upper part of the switch unit.
2. The pressure applied during the insertion should be 2.5kg max.

Note: If the LED terminal is bent , it may not align with the mating hole. Before insertion, check to see if any LED terminal is bent and, if so, straighten it. The inserting direction of the LED for the pushbutton unit is opposite to that for the indicator unit. Pay attention to the mounting direction of the legend plate.



Removing the pushbutton unit

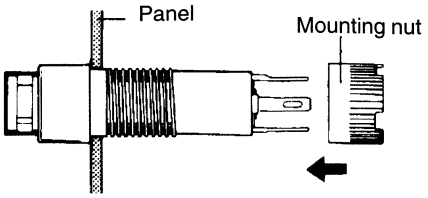
While holding the recessed portions on both sides, firmly and steadily pull out the top of the pushbutton unit with your thumb and forefinger. Pulling out the cap with pliers or a similar tool will damage the cap.



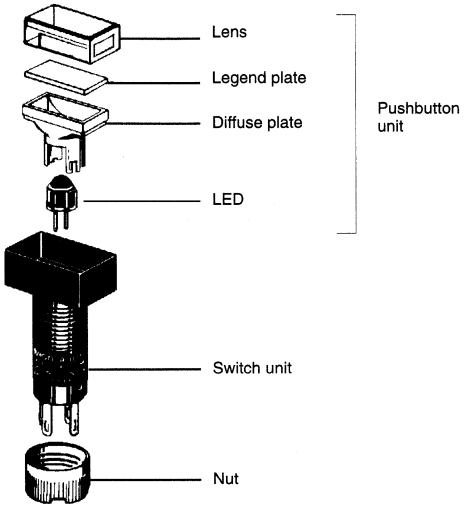
Mounting the switch unit on panel

Nut mounting

- Insert the switch unit from the front of the panel and tighten the mounting nut inserted from the rear of the panel.
- Since a projection exists on the rear portion of the switch unit, if the mounting unit cannot be fitted into position, turn the nut slightly.
- The tightening torque of the mounting nut should be less than 5kg–cm.
- Solder the terminals after mounting the nut. Otherwise, the terminals, when thickened by solder, may prevent the nut from being screwed down onto the switch unit.



Construction



Wiring

- Finish soldering within 5 seconds with a 30 watt soldering iron, or within 3 seconds at a solder temperature of 240°C. To avoid deforming the softened plastic switch unit base, do not apply any force to the switch unit for about a minute after soldering.
- Use a non-corrosive, resin-based soldering flux.

Hints on Correct Use

LED

- Because no resistor is incorporated in the LED of the lighted pushbutton switch, connect an appropriate external resistor.
- Make sure that the resistance of the resistor is within the permissible range determined by the LED characteristics. The forward current of the LED must be 8mA minimum.
- The resistance of the external resistor can be obtained by this equation:

  $R=E-V_F/I_F\ (\Omega)$

  where,
  E: operating voltage (V)
  V_F: LED forward voltage (V)
  I_F: LED forward current (mA)

  Determine the resistance of the external resistor that satisfies the characteristics of the LED. However, the average LED forward current must be 8mA or more.
- Example of resistance calculation
  When using a red LED where E=24V, I_F=20mA and Ta=25°C, from the VFvs. IF characteristics on the right, forward voltage V_F is 1.7V, when 20mA of I_F flows through the LED. Substituting these values for the variables in the above equation,

  $R=24(V)-1.7(V)=1111(\Omega)$
  $0.02(A)$ (or 20mA) (or 1.1kΩ)

  Therefore, the estimated resistance is 1kΩ, 1W.

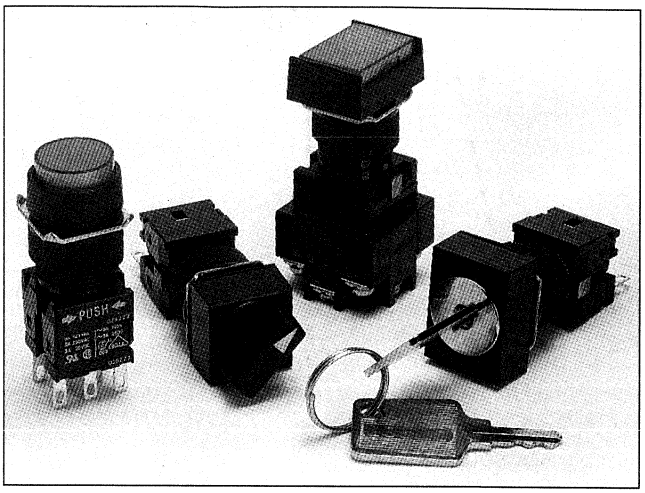
OMRON

Panel–mounted Switches

A3G

A Range of 16mm Pushbutton, Selector and Key Operated Switches

- Modular construction eases installation and replacement.
- Lamp, LED and Neon illumination.
- Contact block is available with solder, PCB or screw terminals.
- IP40 and IP65 versions.
- UL, CSA and VDE approved.

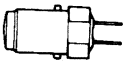


Ordering Information

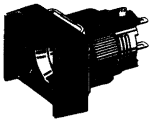
■ Pushbutton/Indicator

Screen

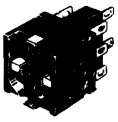
Illumination



Switch Unit

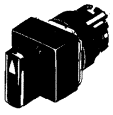


Contact Block

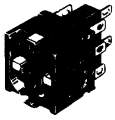


■ Selector Switch

Switch Unit

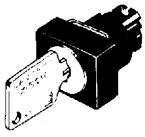


Contact Block

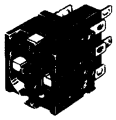


■ Key Switch

Switch Unit

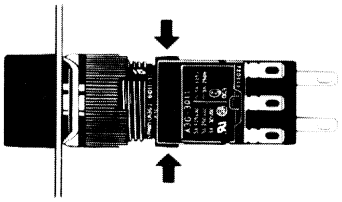


Contact Block



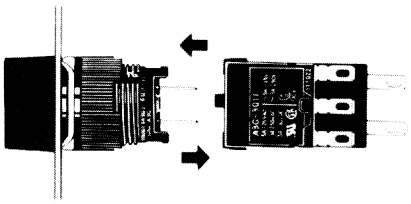
Snap-in action switch unit greatly improves wiring efficiency.

Press



Press

Simply insert the switch unit for complete connection.



Press the part indicated PUSH on the switch unit and pull to remove. Align white marks to insert.

Lighted Pushbuttons

Specifications

■ Contact

Type	AC resistive load	DC resistive load
General purpose load	AC 250V 3A AC 125V 5A	DC 30V 3A

■ LED

Rated voltage	Rated current	Operating voltage
DC 5V	30mA	DC 5V ± 5%
DC 12V	15mA	DC 12V ± 5%
DC 24V	10mA	DC 24V ± 5%

■ Incandescent lamp

Rated voltage	Rated current	Operating voltage
6V	60mA	5V
14V	40mA	12V
18V	26mA	15V
28V	24mA	24V

■ Neon lamp

Rated voltage	Rated current	Operating voltage
AC 110V	1.5mA	AC 100V ± 10%
AC 220V	1.5mA	AC 200V ± 10%

Operating temperature	−10°C to 55°C (with no icing)
Storage temperature	−25°C to 65°C
Operating temperature	35 to 85% RH

■ Characteristics

Item		Illuminated pushbutton switch	Knob-type selector switch*	Key-type selector switch*
Allowable operating frequency	Mechanical	Momentary operation: 120 operations/minute max. Alternating operation: 60 operations/minute max.	20 operations/minute max.	
	Electrical	20 operations/minute max.	10 operations/minute max.	
Insulation resistance		100MΩ min. (at 500VDC)		
Dielectric strength		1,000VAC, 50/60Hz for 1 minute between terminals of same polarity 2,000VAC, 50/60Hz for 1 minute between terminals of different polarity and also between each terminal and ground**		
Vibration	Malfunction	10 to 55Hz, 1.5mm double amplitude		
Shock	Durability	Approx. 500m/s2 (50G)		
	Malfunction	Approx. 150m/s2 (15G)		
Life expectancy	Mechnical	Momentary operation: 2,000,000 operations min. Alternating operation: 200,000 operations min.	250,000 operations min.	250,000 operations min. (Life of key, 100,000 operations min.)
	Electrical	100,000 operations min.		
Degree of protection		IP40/IP65 (Oil-resistant)	IP65 (Oil-resistant)	
Weight		Approx. 13g (for illuminated type 2-contact switches with solder terminals)	Approx. 9g (for illuminated type 2-contact switches)	Approx. 40g (with one 2-contact switch key)

Note: * Set and reset constitute one operation. ** With LED and incandescent lamp not mounted.

■ Operating Characteristics

Type / Features	Illuminated pushbutton switch				Knob-type and key-type selector switches	
	IP40		IP65 oil-resistant type		2-notch	3-notch
	SPDT	DPDT	SPDT	DPDT		
Operating force (OF) max.	250g/245cN	450g/441cN	300g/294cN	500g/490cN	1,000g–cm	
Releasing force (RF) min.	30g/29.4cN					
Total travel (TT)	Approx. 3mm					
Pretravel (PT) max.	2.5mm					
*Lock stroke (LTA) min.	0.5mm					
Set position (SP)	–				90°+5°	45°+10°

* Lock stroke is for alternating operation.

■ Pushbutton/Indicator Switches

Screen

IP Rating	IP40			IP65		
Colour	Rectangular 	Square 	Round 	Rectangular 	Square 	Round 
Blue	A3BJ–500A	A3BA–500A	A3BT–500A	A3BJ–510A	A3BA–510A	A3BT–510A
Yellow	A3BJ–500Y	A3BA–500Y	A3BT–500Y	A3BJ–510Y	A3BA–510Y	A3BT–510Y
Red	A3BJ–500R	A3BA–500R	A3BT–500R	A3BJ–510R	A3BA–510R	A3BT–510R
Red (Neon)	A3GJ–500D	A3GA–500D	A3GT–500D	A3GJ–510D	A3GA–510D	A3GT–510D
Green (Lamp)	A3BJ–500G	A3BA–500G	A3BT–500G	A3BJ–510G	A3BA–510G	A3BT–510G
Green (LED)	A3BJ–500GY	A3BA–500GY	A3BT–500GY	A3BJ–510GY	A3BA–510GY	A3BT–510GY
Green (Neon)	A3GJ–500GN	A3GA–500GN	A3GT–500GN	A3GJ–510GN	A3GA–510GN	A3GT–510GN
White	A3BJ–500W	A3BA–500W	A3BT–500W	A3BJ–510W	A3BA–510W	A3BT–510W
White (Neon)	A3GJ–500WN	A3GA–500WN	A3GT–500WN	A3GJ–510WN	A3GA–510WN	A3GT–510WN
Black	A3BJ–501B	A3BA–501B	A3BT–501B	A3BJ–511B	A3BA–511B	A3BT–511B

Illumination

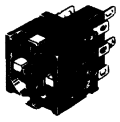
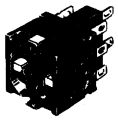
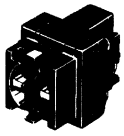
Voltage / Lamp/LED	5DC/6DC	12/14/18DC	24/28DC
Lamp (all colours)	A3B–006	A3B–014/018	A3B–028
LED – Red	A3B–005R	A3B–012R	A3B–024R
LED – Green	A3B–005G	A3B–012G	A3B–024G
LED – Yellow	A3B–005Y	A3B–012Y	A3B–24Y
LED – White	A3B–005Y	A3B–012Y	A3B–024Y

Voltage	110VAC	240VAC
Neon – Red	A3BH–1ND	A3BH–25ND
Neon – Green	A3BH–1NG	A3BH–25NG
Neon – White	A3BH–1ND	A3BH–25ND

Switch unit

IP Rating	IP40			IP65		
Switch type	Rectangular	Square	Round	Rectangular	Square	Round
Momentary	A3GJ–6011–1	A3GA–6011–1	A3GT–6011–1	A3GJ–6011–3	A3GA–6011–3	A3GT–6011–3
Alternate	A3GJ–6021–1	A3GA–6021–1	A3GT–6021–1	A3GJ–6021–3	A3GA–6021–3	A3GT–6021–3
Indicator	M2GJ–7001–1	M2GA–7001–1	M2GT–7001–1	M2GJ–7001–3	M2GA–7001–3	M2GT–7001–3

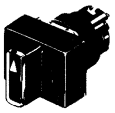
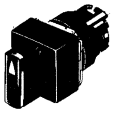
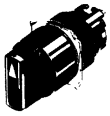
Contact block

	Standard 	Micro-load 	Screw terminals 
SPDT	A3G–4011	–	–
	–	A3G–4111	–
DPDT	A3G–4021	–	–
	–	A3G–4121	A3G–4024
Indicator	M2G–4901	–	–
	–	–	M2G–4904

Note: For PCB terminals please contact OMRON.

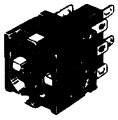
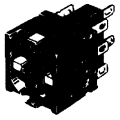
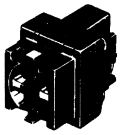
■ Selector Switches

Switch unit

Shape	No. of notches	Reset method	Model
Rectangular (A3GJ) 	2 notches	Manual	A3GJ–S511
		Automatic	A3GJ–S521
	3 notches	Manual	A3GJ–S552
		Combination	A3GJ–S562
		Combination	A3GJ–S572
		Automatic	A3GJ–S582
Square (A3GA) 	2 notches	Manual	A3GA–S511
		Automatic	A3GA–S521
	3 notches	Manual	A3GA–S552
		Combination	A3GA–S562
		Combination	A3GA–S572
		Automatic	A3GA–S582
Round (A3GT) 	2 notches	Manual	A3GT–S511
		Automatic	A3GT–S521
	3 notches	Manual	A3GT–S552
		Combination	A3GT–S562
		Combination	A3GT–S572
		Automatic	A3GT–S582

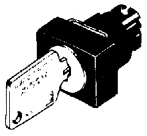
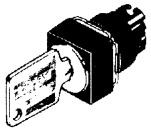
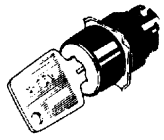
Note: For illuminated types please contact OMRON.

Contact block

	Standard 	Micro-load 	Screw terminals 
SPDT	A3G–4011	–	–
	–	A3G–4111	–
DPDT	A3G–4021	–	–
	–	A3G–4121	A3G–4024
Indicator	M2G–4901	–	–
	–	–	M2G–4904

■ Key Switches

Switch unit

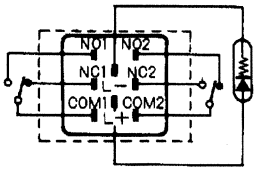
Shape	No. of notches	Reset method	Key release position	Model
Rectangular (A3GJ) 	2 notches	Manual		A3GJ-K511-C
				A3GJ-K511-B
				A3GJ-K511-G
		Automatic		A3GJ-K521-C
	3 notches	Manual		A3GJ-K552-A
				A3GJ-K552-B
				A3GJ-K552-C
				A3GJ-K552-F
		Combination		A3GJ-K562-A
				A3GJ-K562-B
		Combination		A3GJ-K572-A
				A3GJ-K572-C
		Automatic		A3GJ-K582-A
Square (A3GA) 	2 notches	Manual		A3GA-K511-C
				A3GA-K511-B
				A3GA-K511-G
		Automatic		A3GA-K521-C
	3 notches	Manual		A3GA-K552-A
				A3GA-K552-B
				A3GA-K552-C
				A3GA-K552-F
		Combination		A3GA-K562-A
				A3GA-K562-B
		Combination		A3GA-K572-A
				A3GA-K572-C
		Automatic		A3GA-K582-A
Round (A3GT) 	2 notches	Manual		A3GT-K511-C
				A3GT-K511-B
				A3GT-K511-G
		Automatic		A3GT-K521-C
	3 notches	Manual		A3GT-K552-A
				A3GT-K552-B
				A3GT-K552-C
				A3GT-K552-F
		Combination		A3GT-K562-A
				A3GT-K562-B
		Combination		A3GT-K572-A
				A3GT-K572-C
		Automatic		A3GT-K582-A

Note: For illuminated types please contact OMRON.

Contact block

See table of Contact Block on previous page.

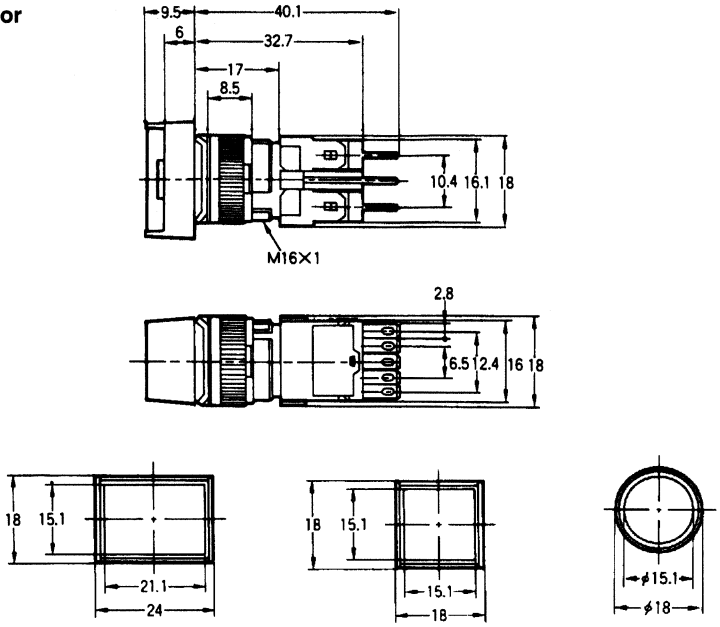
Terminal Arrangement (Bottom View)



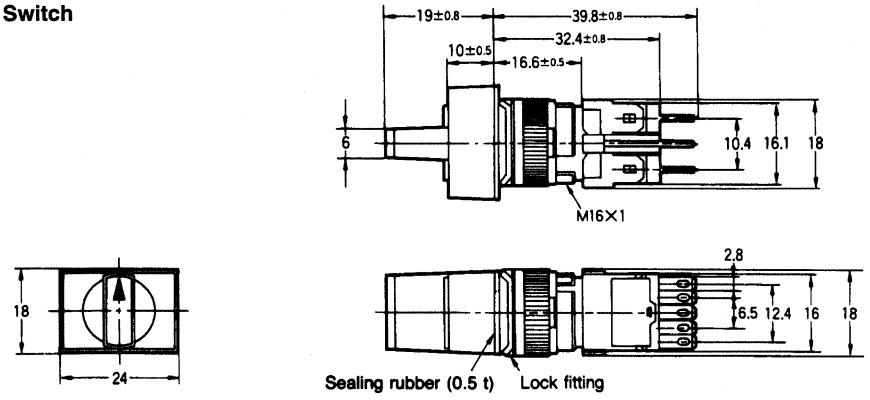
Do not connect L+ and L− terminals for non-illuminated type

Dimensions

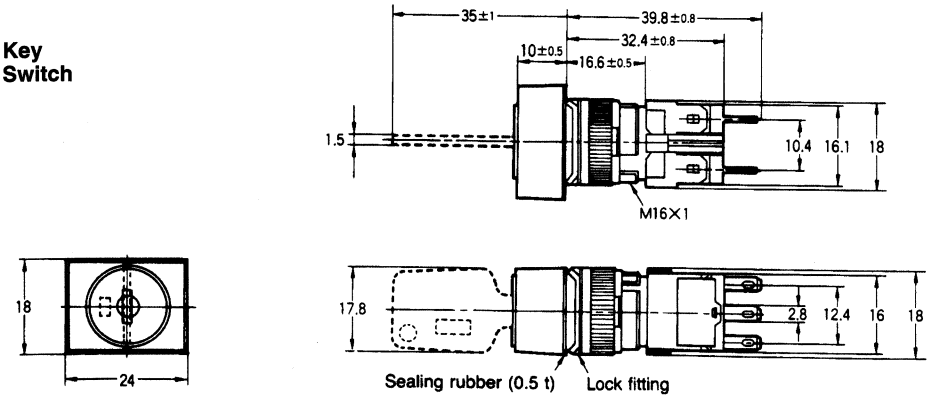
Pushbutton/Indicator Switch



Selector Switch



Key Switch



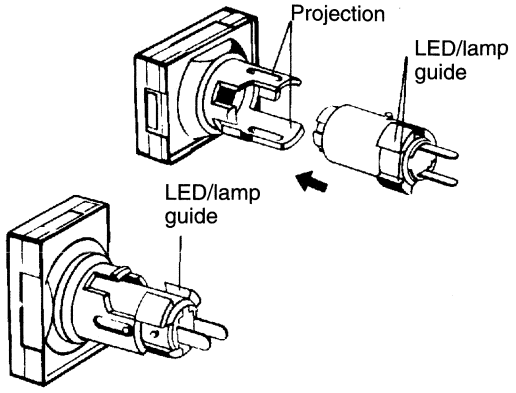
Assembly/Disassembly

■ Mounting and Replacing Pushbutton Unit

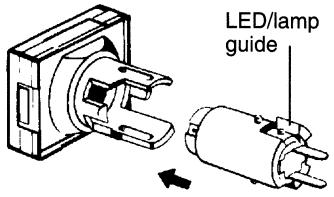
Mounting directions for the LED/lamp and screen

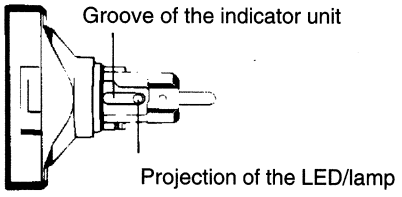
The OMRON screen doubles the roles in which a pushbutton switch is normally used. The screen may be inserted one of two ways:

1. For operation as a lighted pushbutton switch, fit the LED/lamp so that its guide projection is inserted into the wider opening in the receptacle of the screen.



2. For operation as an indicator unit, insert the LED/lamp guide projection into the narrower opening in the indicator unit's receptacle. Push the projection of the LED/lamp in the groove of the screen so that the LED/lamp is firmly inserted into the screen of the indicator unit.

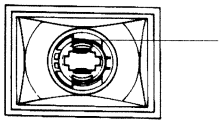




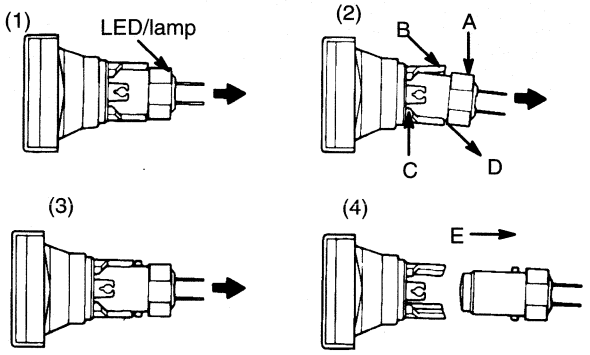
Note: The inserting direction of the LED/lamp for the screen is opposite to that for the indicator unit. Pay attention to the mounting direction of the legend plate.

Removal directions for the LED/lamp and screen

Position the pushbutton unit as shown in (1). Press down on the LED/lamp angling it in the direction indicated by A. Side B of the LED/lamp disconnects and side C angles away from the screen so that it looks like (2). Turn the LED/lamp in the direction indicated by D. The LED/lamp projections (two locations) will disconnect from the LED/lamp groove so that it looks like (3). Pull in the E direction and remove the LED/lamp.



LED/lamp projections disconnected from their grooves.

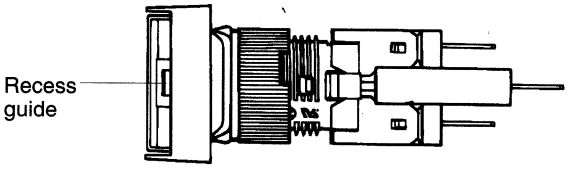


Mounting pushbutton unit into switch unit

Insert the LED/lamp unit into the aperture of the switch with the LED/lamp unit's guide facing the side of the aperture mouth that does not have the two projections. The pressure applied during insertion should be 2.5kg minimum.

Removing the pushbutton unit

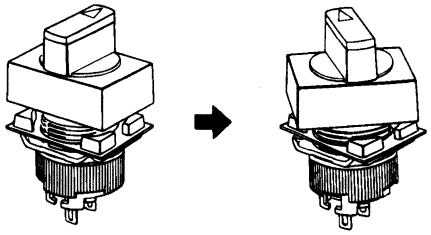
While holding the recessed portions on both sides, firmly and steadily pull out the top of the screen with your thumb and forefinger. Pulling out the cap with pliers or a similar tool will damage the cap.



■ Bezel Rotation

A3G-S and A3G-K.

- Twist the knob/key while holding the lock fitting to turn the bezel in 45° increments.



Mounting the Panel

■ Mounting the switch unit on panel

Nut mounting

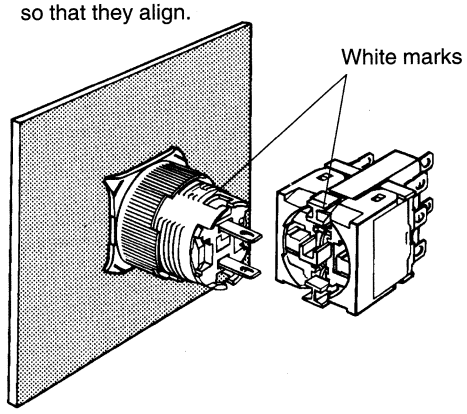
- Insert the switch unit from the front of the panel. Place the lock fitting and mounting nut on the terminal side and tighten the mounting nut. For the IP65 type use the rubber seal. Tighten the mounting nut to a torque of 10kg–cm or less.

■ Mounting Contact Block

After installing the main unit, mount the contact block from the back of the panel (by snapping into place).

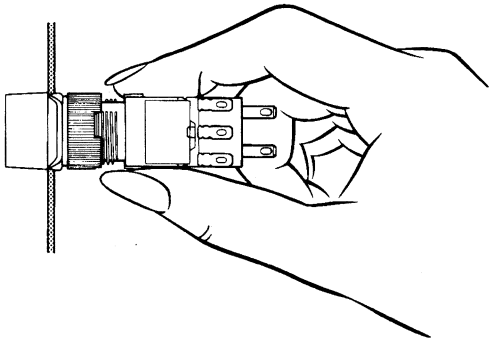
Mounting the contact block

- Push contact block into the main unit.
- Adjust the white mark of both main unit and contact block so that they align.



Removing the contact block

- Press the lock button of the contact block and pull to remove.
- Pull straight, not at an angle.



Precautions

Mounting

Apply less than 10kg/cm of fastening torque to secure the mounting ring.

Wiring

When soldering, apply a soldering iron rated at 30W quickly (within 5 secs) or within 3 seconds with a tip temperature of 240°C. Do not apply any external force to the switch for 1 minute after soldering to avoid possible plastic deformation.

Use a non-corrosive resin-type flux.

Operating environment

The protective structure of the IP65 type prevents damage due to dust from the front of the panel into the interior or direct spraying of water from any direction.

Lamps

Applying a voltage greater than the rated voltage to the lamp terminals will damage the LED. As the LED polarity is marked on the back of the switches connect the switches accordinglly. The neon lamp normally operates on AC.

Others

The oil-resistant type (IP65) was evaluated with cutting and cooling oils in general use, and it may not be resistant to special types of oil. When using other oils, be sure to contact your OMRON representative.

Operation of selector/key switches

Apply less than 5kg–cm of torque when operating selector and key switches.

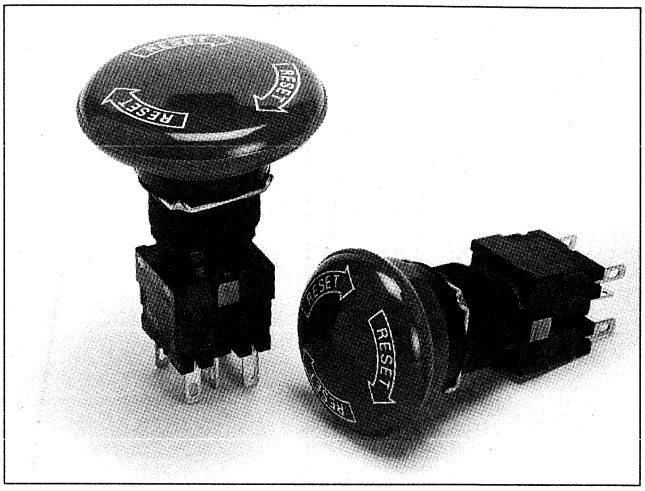
OMRON

Emergency Stop Switch

A3GE

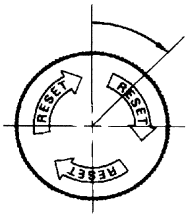
Separate Unit Type 16mm Cylindrical Series

- Contact gap more than 3mm.
- Button size 30mm and 40mm.
- Snap-in, snap-out switch units simplify wiring and maintenance.
- Sealed to IEC IP65.
- Illuminated buttons for use in areas of limited visibility.
- Complements the A3G range of pushbuttons, selector switches and keyswitches.



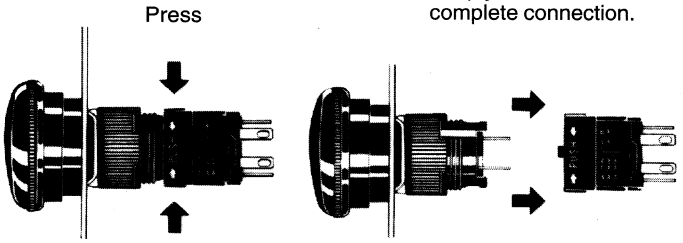
Ordering Information

Push-lock, Turn-reset system avoids misuse.



Snap-in action switch unit greatly improves wiring efficiency.

Simply insert the switch unit for complete connection.



Press the part indicated PUSH on the switch unit and pull to remove. Align white marks to insert.

Specifications

■ Contact

Type	AC resistive load	DC resistive load
General purpose load	AC 250V 3A AC 125V 5A	DC 30V 3A

Operating temperature	–10°C to 55°C (with no icing)
Storage temperature	–25°C to 65°C
Operating temperature	35 to 85% RH

■ LED

Rated voltage	Rated current	Operating voltage
DC 24V	10mA	DC 24V ± 5%

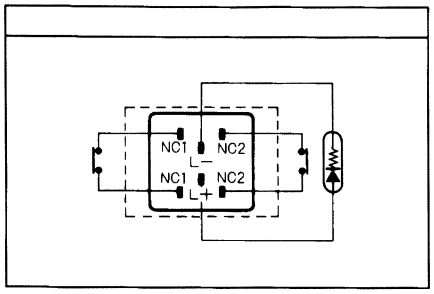
■ Characteristics

Item		A3GE
Allowable operating frequency	Mechanical	20 operations/minute max.
	Electrical	10 operations/minute max.
Insulation resistance		100MΩ min. (at 500VDC)
Dielectric strength		2,000VAC, 50/60Hz for 1 minute between terminals of same polarity 2,000VAC, 50/60Hz for 1 minute between terminals of different polarity 4,000VAC, 50/60Hz for 1 minute between each terminal and ground*
Vibration	Malfunction	10 to 55Hz, 1.5mm double amplitude
Shock	Durability	Approx. 500m/s^2 (50G)
	Malfunction	Approx. 300m/s^2 (30G)
Life expectancy**	Mechanical	100,000 operations min.
	Electrical	100,000 operations min.
Weight		Approx. 15g (for 2b contact switches)

Note: * LED not mounted ** Set and reset constitute one operation

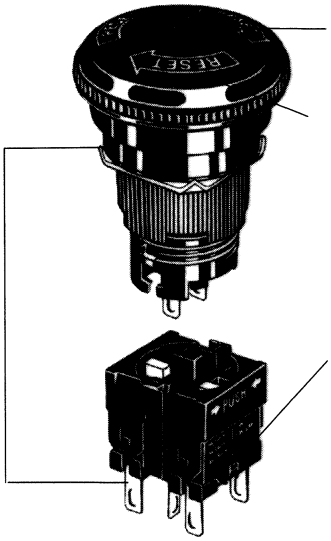
Setting force OFA max.	1,500gf (14.7N)
Resetting torque OFR max.	1,000gcm
Lock stroke LTA	2.5±0.5mm

Terminal Arrangement (Bottom View)



Do not connect No L+ and L− terminals for non-illuminated type

Structure



Colour of operating part
- LED illumination type RED
- Non-illuminated type RED

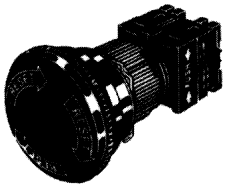
Illumination method
- LED
- Non-illuminated

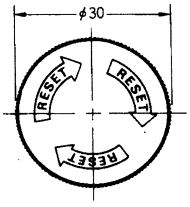
Protective structure and Terminal type
- Protective structure: Oil resistant IP65
- Terminal type Solder terminals

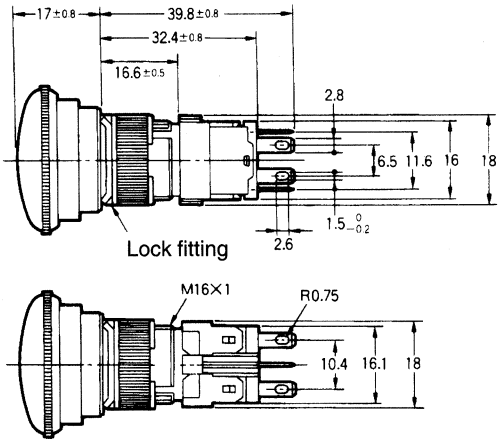
Contact block specification
- General purpose loads 125VAC = 5A 250VAC = 3A 30VDC = 3A

Dimensions

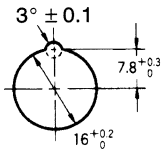
A3GE





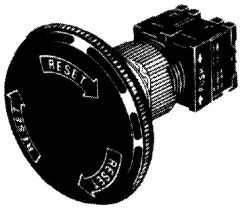


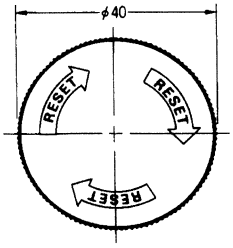
Panel cutouts

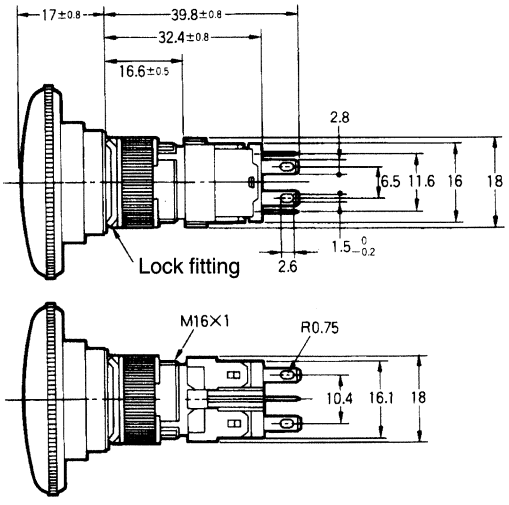


Recommended panel thickness 0.5 to 5.0mm

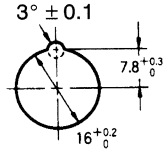
A3GE







Panel cutouts

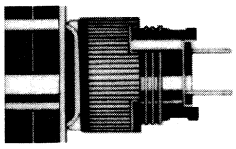


Recommended panel thickness 0.5 to 5.0mm

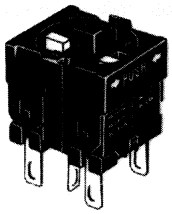
How to Order

Actuator

Switch Unit



Contact Block



1. Actuator
A3GE–51❑–R
❑ Actuator size and type

2. Switch Unit
A3GE–602❑–3
Illumination
0: Non-illuminated type
1: Illuminated type with LED

3. Contact Block
A3GE–40❑1
No. of poles
1: Single pole (SP–NC)
2: Double pole (DP–NC)

❑	Size	Type
0	30mm	Non-illuminated
1		Illuminated
2	40mm	Non-illuminated
3		Illuminated

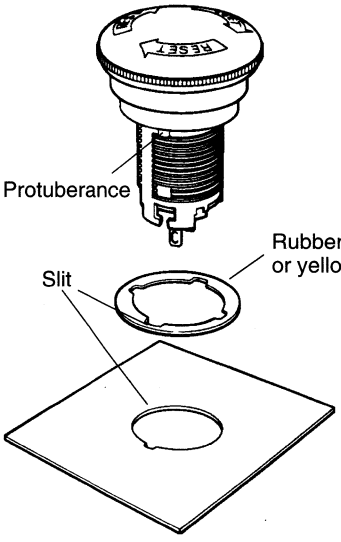
Precautions

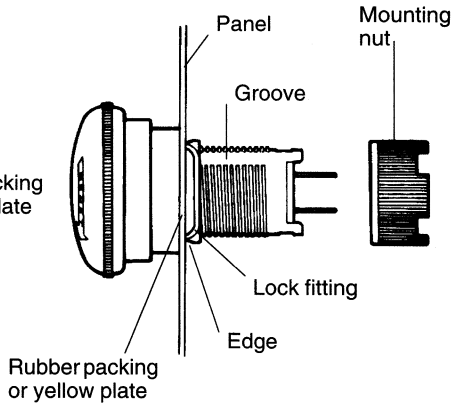
Mounting the Panel

After installing the main unit, mount the socket unit from the back of the panel (by snapping into place)

Installing the main unit

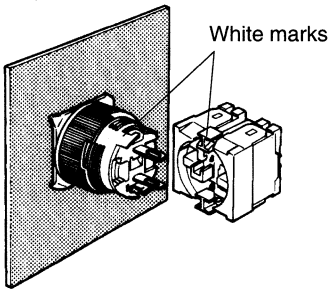
- Attach rubber packing or yellow plate onto the main unit from its terminal side. Insert the main unit into the panel from the front. Install lock fitting and nut from the terminal side and tighten.
- Adjust the slits on the hole of rubber packing and yellow plate to the protuberance on the unit.
- Rubber packing is not necessary when yellow plate is used.
- Tightening torque for the nut must be less than 10kg/cm.
- Case should be installed with its protuberance adjusted to the slit of the hole of the panel.





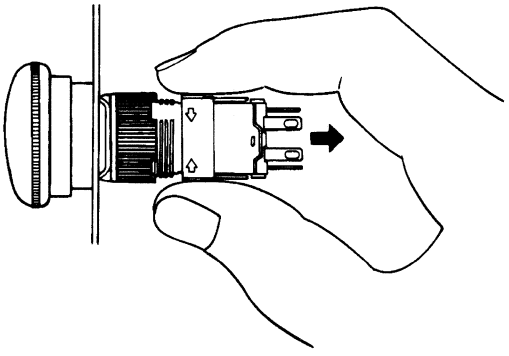
Mounting the contact block

- Push socket into the main unit.
- Adjust the white mark of both main unit and contact block so that they align.



Removing the contact block

- Press the lock button of the contact block and pull to remove.
- Pull straight, not at an angle.

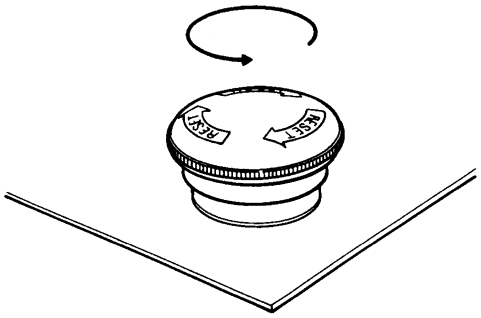


Lighted Pushbuttons

Mounting and Removing Cap

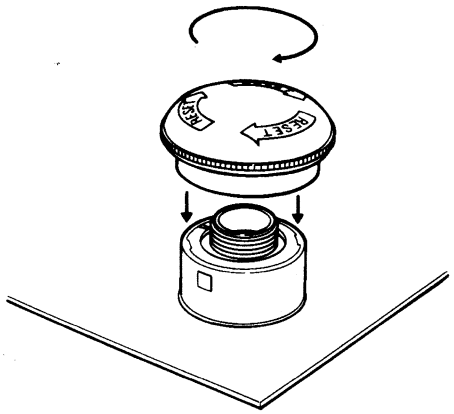
Removing the cap

- Turn anti-clockwise at the free position (reset position).



Mounting the cap

- Turn clockwise until it stops. The tightening torque should be less than 5kg/cm.



Mounting

Apply less than 10kg/cm of fastening torque to secure the mounting ring.

Wiring

When soldering, apply a soldering iron rated at 30W quickly (within 5 secs) or within 3 seconds with a tip temperature of 240°C. Do not apply any external force to the switch for 1 minute after soldering to avoid possible plastic deformation.

Use a non-corrosive resin-type flux.

Operating environment

The protective structure of the IP65 prevents damage due to dust from the front of the panel into the interior or direct spraying of water from any direction.

Lamps

Applying a voltage greater than the rated voltage to the lamp terminals will damage the LED.

Others

The oil-resistant type (IP65) was evaluated with cutting and cooling oils in general use, and it may not be resistant to special types of oil. When using other oils, be sure to contact your OMRON representative.

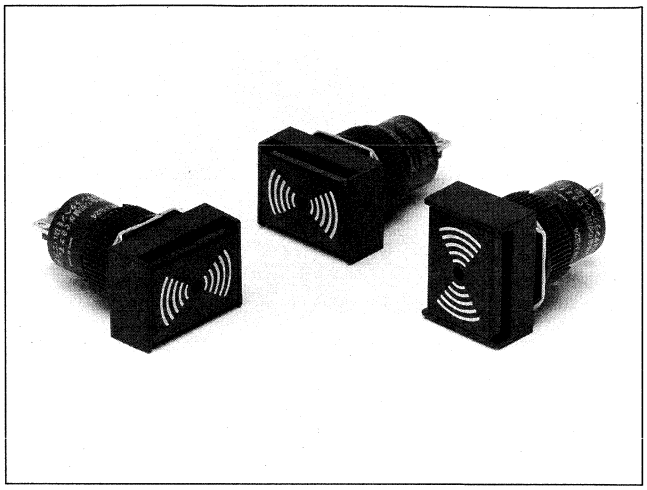
OMRON

Sounder

M2BJ–B

16mm Diameter Panel–Mounted Unit

- Four models offer eight different types of sounds.
- Intermittent or continuous sound selected by jumper setting.
- Two supply voltages: 6 VAC/DC and 12 to 24 VAC/DC.
- Jumper storage provided at bottom of unit.
- Complements the A3G range of pushbuttons, selector switches and keyswitches.



Ordering Information

Sound	**w/jumper**	Intermittent	Intermittent (short)	Intermittent (high–pitched)	Intermittent (short, high–pitched)
	w/o jumper	Continuous	Intermittent (long)	Continuous (high–pitched)	Intermittent (long, high–pitched)
Supply Voltage	**6 VAC/DC**	M2BJ–B06	M2BJ–B06A	M2BJ–B06B	M2BJ–B06C
	12 TO 24 VAC/DC	M2BJ–B24	M2BJ–B24A	M2BJ–B24B	M2BJ–B24C

Specifications

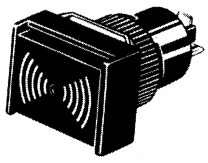
Rated Voltage	**6 VAC/DC**	**M2BJ–B06**	**M2BJ–B06A**	**M2BJ–B06B**	**M2BJ–B06C**
	12 TO 24 VAC/DC	**M2BJ–B24**	**M2BJ–B24A**	**M2BJ–B24B**	**M2BJ–B24C**
Sound pressure (distance: 0.1 m, at rated voltage)		Continuous sound: 80 dB (phons) min.	Continuous: 80 dB (phons) min.	Continuous sound: 80 dB (phons) min.	Continuous: 80 dB (phons) min.
Driving frequency		2 ± 0.5 k Hz	2 ± 0.5 k Hz	4 ± 0.5 k Hz	4 ± 0.5 k Hz
Intervals		190 times/minute ± 10%	Long: 55 times/minute ± 10% Short: 700 times/minute ± 10%	190 times/minute ± 10%	Long: 55 times/minute ± 10% Short: 700 times/minute ± 10%
Current consumption	**DC**	7 mA	7 mA	20 mA	20 mA
	AC	20 mA	20 mA	20 mA	20 mA
Life expectancy		1,000 hours min.			

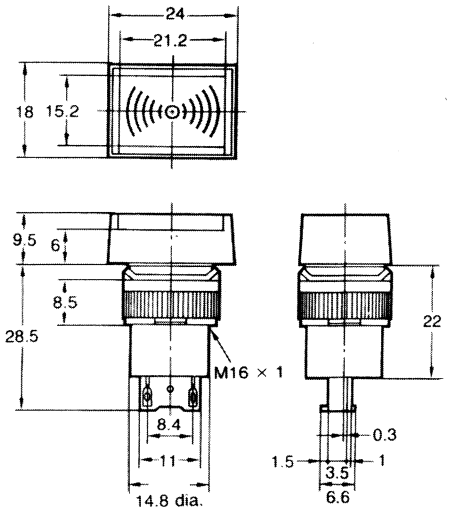
■ Characteristics

Insulation resistance	100 MΩ min. (between ground and current–carrying parts)
Dielectric strength	1,000 VAC for 1 min (between grounds)
Ambient temperature	Operating: –10°C to 55°C Storage: –25°C to 65°C
Humidity	25% to 85% RH

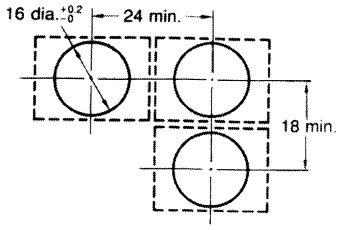
Dimensions

M2BJ–B





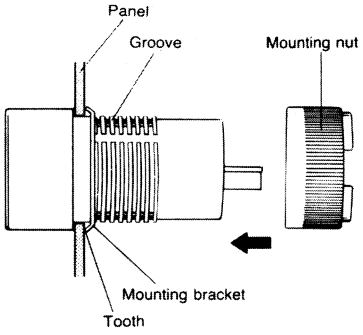
Panel cutout (top view)



Hints on Correct Use

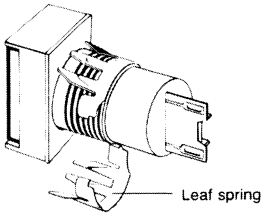
Nut mounting

- Insert the buzzer unit from the front of the panel and tighten the mounting nut inserted from the rear of the panel.
- Since a projection exists on the rear portion of the buzzer unit, if the mounting nut cannot be fitted into position, turn the nut slightly.
- The tightening torque of the mounting nut should be less than 5 kg–cm.
- Solder the terminals after mounting the nut. Otherwise, the terminals, when thickened by solder, may prevent the nut from being screwed down onto the buzzer unit.

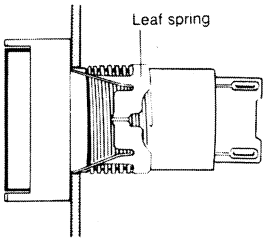


Snap–in mounting

- Attach the mounting leaf spring to the buzzer. Engage the edges of the leaf spring in the two grooves on the threaded section of the buzzer. After inserting the leaf spring edges into the grooves, confirm that the leaf spring has seated. Be sure to attach both leaf springs.

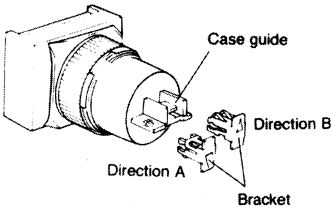


- Insert the buzzer assembly into the hole on the mounting panel from the front.

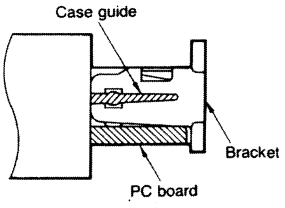


Short–circuiting jumper

- The buzzer sounds continuously or intermittently depending on how the short–circuiting bracket is attached to the case guide. When the bracket is attached with the triangle on it facing direction A (PC board side), the buzzer sounds intermittently.



- To create continuous sounds, attach the bracket on the case guide so that the triangle on the bracket faces direction B.



Mounting

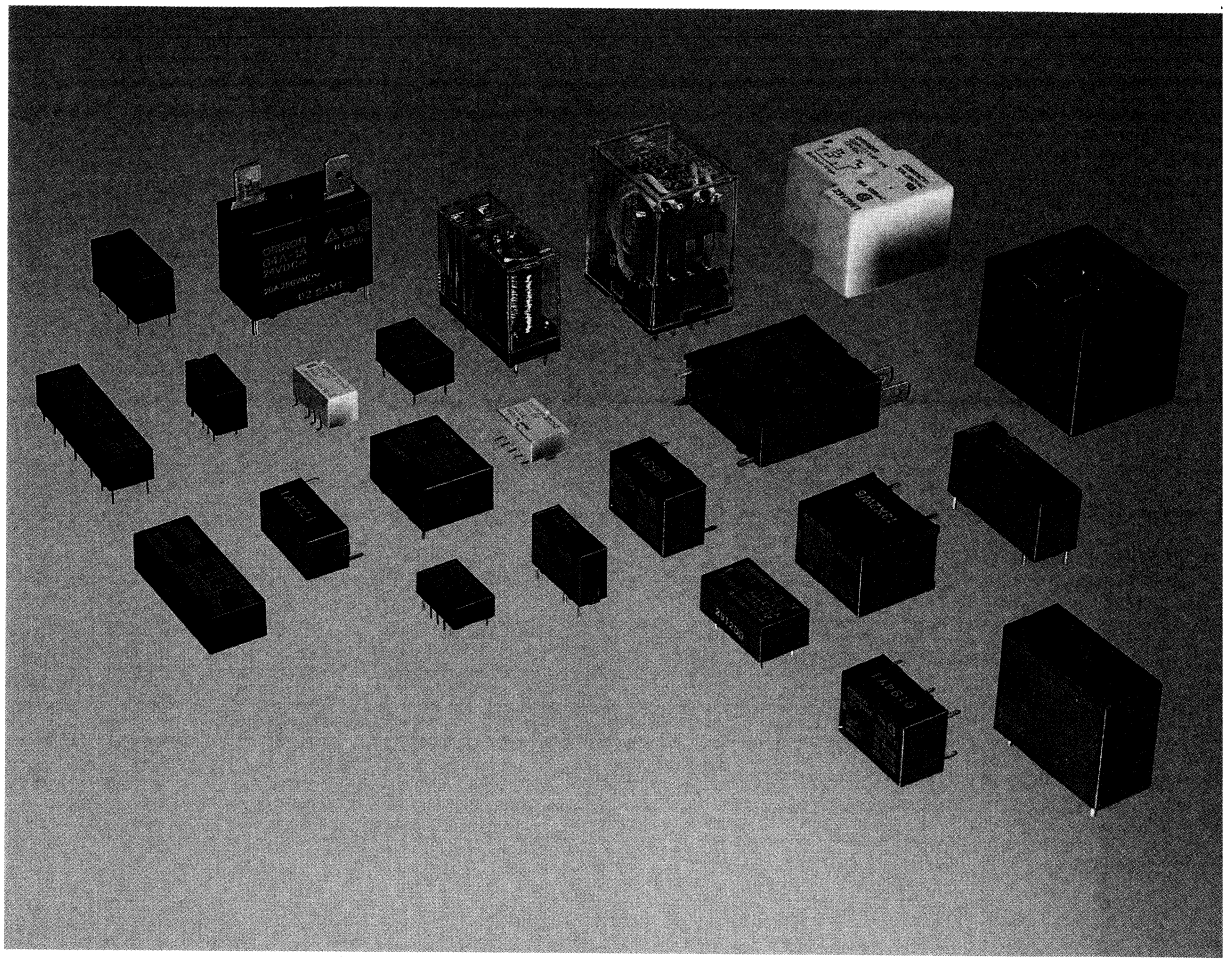
- Tighten the mounting nut at a torque of less than 5 kg–cm.

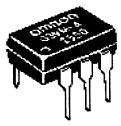
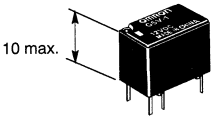
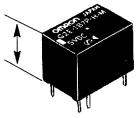
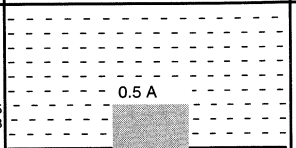
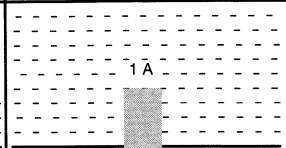
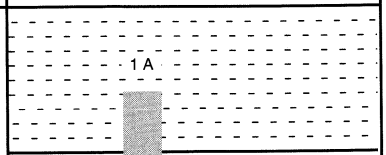
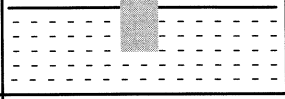
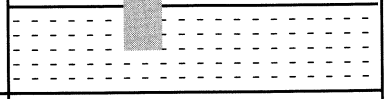
Wiring

- Exercise caution that the input terminals are not short circuited by the short–circuiting jumper.
- Finish soldering within 5 seconds with a 30 watt soldering iron, or within 3 seconds at a solder temperature of 240° C. For about a minute after soldering, do not apply any force to the buzzer unit, to avoid deforming the softened plastic buzzer unit base.
- Use a non–corrosive, resin based soldering flux.

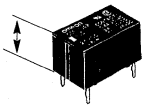
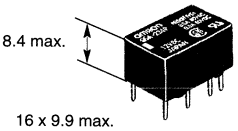
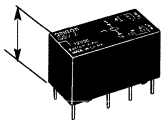
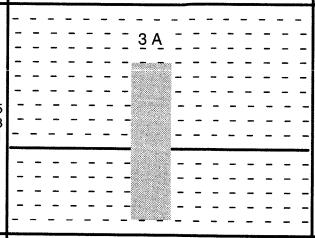
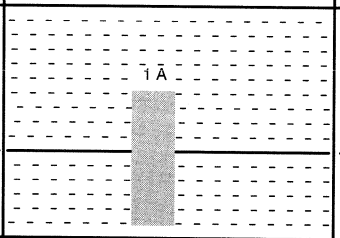
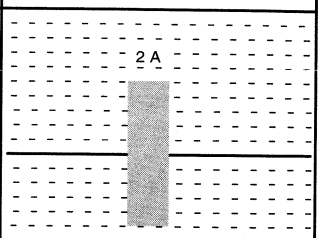
SECTION 5

Relays

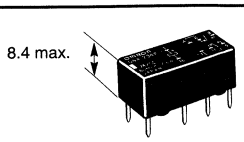
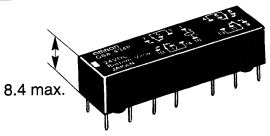
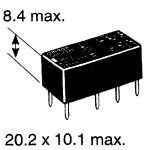
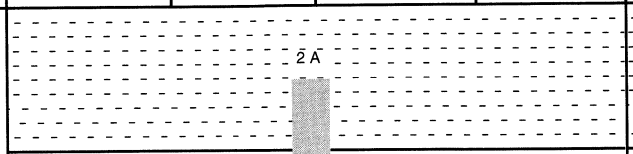
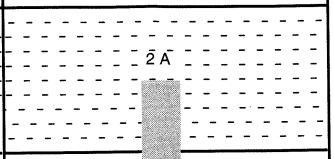
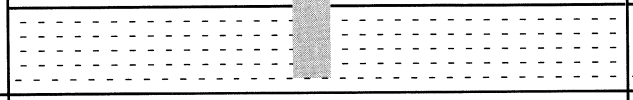
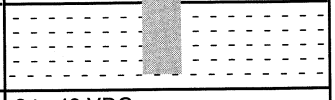


Classification		Photo MOS	Signal control	
Model		G3VM	G5V-1	G2E
Features		SSR with high isolation of 2.5kV between input and output terminals.	Ultra-miniature, highly sensitive SPDT relay	Miniature, single-pole PCB relay Conforms to FCC Part 68
Appearance Dimensions (W x D)			 12.5 x 7.5 max.	 15.5 x 10.5 max.
Contact ratings	Contact form	SPST-NO	SPDT	SPDT
	Contact type	Solid-state	Single crossbar	Single crossbar / Bifurcated crossbar
	Contact material	–	Ag (Au-clad)	AgPd (Au-clad)
	Resistive load	See data page	0.5 A at 125 VAC; 1 A at 24 VDC	0.5 A at 110 VAC; 1 A at 24 VDC
	Max. switching current (A) (under resistive load) 10 8 5 3 2 1 0.5 0.3 0.1			
	Min. permissible load (mA) 100 10 1 0.1 0.01			
Coil ratings	Rated voltage	Not applicable	3 to 24 VDC	5 to 24 VDC
	Power consumption	Not applicable	150 mW	200 to 450 mW
Life expectancy	Electrical (under rated load)	Not applicable	100,000 operations min.	500,000 operations min. at 1 A, 24 VDC 200,000 operations min. at 0.5 A, 110 VAC
	Mechanical	Not applicable	5,000,000 operations min.	10,000,000 operations min.
Dielectric withstand voltage	Between coil and contact	2,500 VAC (i/o)	1,000 VAC	500 VAC
	Between contacts of different polarity	---	---	---
	Between contacts of same polarity	---	400 VAC	500 VAC
	Between set and reset coils	---	---	---
Ambient temperature (operating)		–40°C to 85°C	–40°C to 70°C	–25°C to 60°C
Variations		---	---	■ High sensitivity type
Magazine packaging		50 relays/ magazine	25 relays/magazine	---
Approved standards		–	UL, CSA	UL, CSA
Weight		Approx. 1 g	Approx. 2.2 g	Approx. 3.7 g
Page		164	168	170

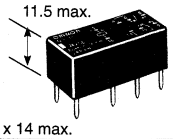
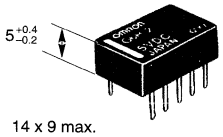
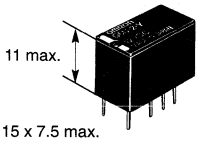
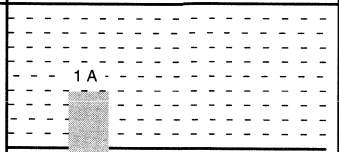
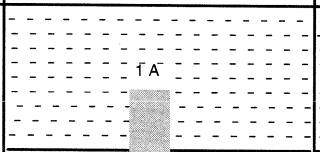
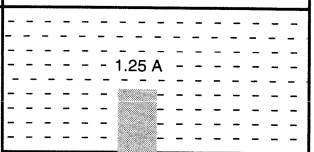
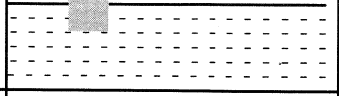
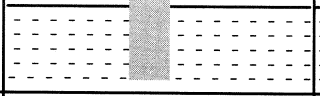
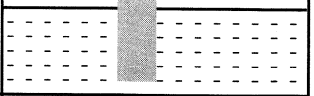
Note: For coil voltages not shown, please contact Omron for details.

Classification		Signal control		Signal control
Model		G6E	G5A	G5V-2
Features		Subminiature, sensitive SPDT relay	Subminiature relay with DPDT contact	Miniature DPDT relay for special signal circuits
Appearance Dimensions (W x D)				
Contact ratings	Contact form	SPDT	DPDT	DPDT
	Contact type	Bifurcated crossbar	Bifurcated crossbar	Bifurcated crossbar
	Contact material	Ag (Au-clad)	Ag (Au-clad)	Ag (Au-clad)
	Resistive load	0.4 A at 125 VAC; 2 A at 30 VDC	0.5 A at 30 VAC; 1 A at 30 VDC	0.5 A at 125 VAC; 2 A at 30 VDC
	Max. switching current (A) (under resistive load) 10 8 5 3 2 1 0.5 0.3 0.1 Min. permissible load (mA) 100 10 1 0.1 0.01			
Coil ratings	Rated voltage	3 to 48 VDC	4.5 to 48 VDC	4.5 to 48 VDC
	Power consumption	200 to 400 mW	200 mW	500 mW
Life expectancy	Electrical (under rated load)	AC: 100,000 operations min. DC: 500,000 operations min.	100,000 operations min.	100,000 operations min.
	Mechanical	100,000,000 operations min.	50,000,000 operations min.	15,000,000 operations min.
Dielectric withstand voltage	Between coil and contact	1,500 VAC	1,000 VAC	1,000 VAC
	Between contacts of different polarity	---	1,000 VAC	1,000 VAC
	Between contacts of same polarity	1,000 VAC	500 VAC	750 VAC
	Between set and reset coils	---	100 VAC	---
Ambient temperature (operating)		–40°C to 70°C	–40°C to 70°C	–25°C to °65C
Variations		■ Double-winding latching ■ Single-winding latching ■ Ultrasonic cleaning	■ Double-winding latching ■ Single-winding latching ■ Self-clinching terminals ■ BT Type 53 ■ FCC Pt 68 compliance	■ High sensitivity (150 mW) available
Magazine packaging		25 relays/magazine	25 relays/magazine	25 relays/magazine
Approved standards		UL, CSA	UL, CSA	UL, CSA
Weight		Approx. 2.7 g	Approx. 3 g	Approx. 5.8 g
Page		173	176	179

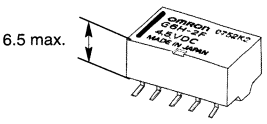
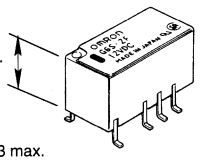
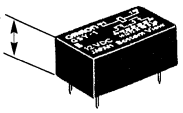
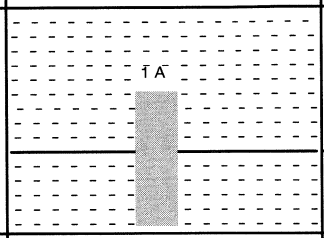
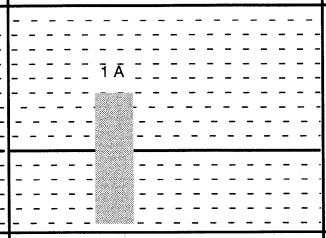
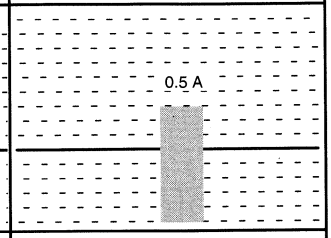
Note: For coil voltages not shown, please contact Omron for details.

Classification		Signal control				Signal control
Model		G6A				G6A-BS
Features		Plastic-sealed relay with high surge dielectric for use in telecommunications equipment				BABT approved relay, conforming to supplementary isolation requirements
Appearance						
Dimensions (W x D)		8.4 max. 20.2 x 10.1 max.		8.4 max. 35.4 x 10.1 max.		8.4 max. 20.2 x 10.1 max.
Contact ratings	**Contact form**	DPDT		4PDT		DPDT
	Contact type	Bifurcated crossbar				Bifurcated
	Contact material	Ag (Au-clad)	AgPd (Au-clad)	Ag (Au-clad)	AgPd (Au-clad)	AgPd (Au-clad)
	Resistive load	0.5 A at 125 VAC; 2 A at 30 VDC	0.3 A at 125 VAC; 1 A at 30 VDC	0.5 A at 125 VAC; 2 A at 30 VDC	0.3 A at 125 VAC; 1 A at 30 VDC	0.3 A at 125 VAC; 1 A at 30 VDC
	Max. switching current (A) (under resistive load) 10 8 5 3 2 1 0.5 0.3 0.1	 2 A				 2 A
	Min. permissible load (mA) 100 10 1 0.1 0.01					
Coil ratings	**Rated voltage**	3 to 48 VDC				3 to 48 VDC
	Power consumption	200 to 235 mW		360 mW		280 mW
Life expectancy	**Electrical (under rated load)**	500,000 operations min.				500,000 operations min.
	Mechanical	100,000,000 operations min.				100,000,000 operations min.
Dielectric withstand voltage	**Between coil and contact**	1,000 VAC				2,000 VAC
	Between contacts of different polarity	1,000 VAC				1,000 VAC
	Between contacts of same polarity	1,000 VAC				1,000 VAC
	Between set and reset coils	250 VAC				–
Ambient temperature (operating)		–40°C to 70°C				–40°C to 70°C
Variations		■ Double-winding latching ■ Single-winding latching ■ Self-clinching terminal				–
Magazine packaging		25 relays/magazine		10 relays/magazine		10 relays
Approved standards		UL, CSA				BS6301, EN41003:1993
Weight		Approx. 3.5 g		Approx. 6 g		Approx. 3.5 g
Page		182				189

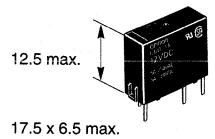
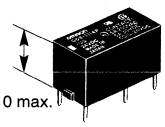
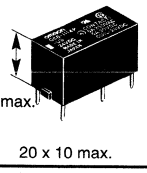
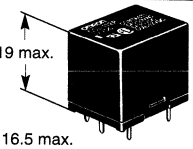
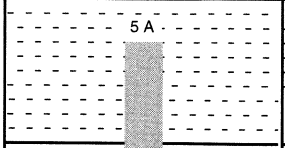
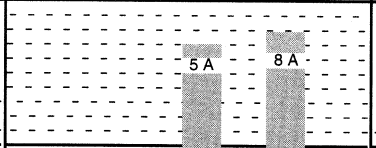
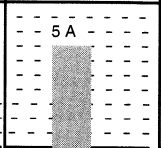
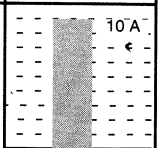
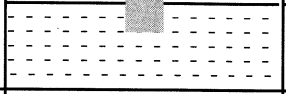
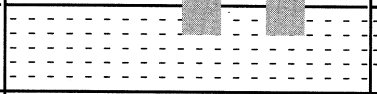
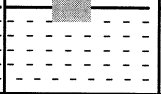
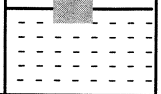
Note: For coil voltages not shown, please contact Omron for details.

Classification		Signal control		
Model		G6CN-2-BS	G6H	G6N
Features		Telecom relay conforming to BABT reinforced isolation requirements.	Ultra-small relay with 5 mm height	Ultracompact, ultrasensitive DPDT relay with 2.5kV surge voltage.
Appearance Dimensions (W x D)				
Contact ratings	Contact form	DPDT	DPDT	DPDT
	Contact type	Bifucated crossbar	Bifurcated crossbar	Bifurcated crossbar
	Contact material	Ag(Au-clad)	Ag (Au-clad)	Ag (Au-clad)
	Resistive load	1 A at 24 VDC	0.5 A at 125 VAC; 1 A at 30 VDC	0.5 A at 125 VAC; 1 A at 30 VDC
	Max. switching current (A) (under resistive load) 10 8 5 3 2 1 0.5 0.3 0.1			
	Min. permissible load (mA) 100 10 1 0.1 0.01			
Coil ratings	Rated voltage	5 to 24 VDC	5 to 24 VDC	4.5 to 24 VDC
	Power consumption	360 mW	140 mW	140 mW
Life expectancy	Electrical (under rated load)	100,000 operations min.	200,000 operations min.	300,000 operations min. (1A at 30 VDC) 200,000 operations min. (0.5 A at 125 VAC)
	Mechanical	1,000,000 operations min.	100,000,000 operations min.	100,000,000 operations min.
Dielectric withstand voltage	Between coil and contact	4,000 VAC	1,000 VAC	1,500 VAC
	Between contacts of different polarity	---	1,000 VAC	1,000 VAC
	Between contacts of same polarity	1,000 VAC	750 VAC	1,000 VAC
	Between set and reset coils	---	125 VAC	---
Ambient temperature (operating)		–25°C to 70°C	–40°C to 70°C	–40°C to 70°C
Variations		–	■ Double-winding latching ■ Single-winding latching	–
Magazine packaging		----	25 relays/magazine	25 relays/magazine
Approved standards		BS415, IEC65, CENELEC HD 195.56	UL, CSA	UL, CSA
Weight		Approx. 7 g	Approx. 1.5 g	Approx. 3 g
Page		191	193	197

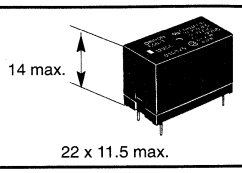
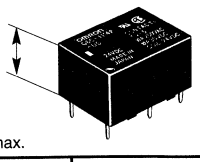
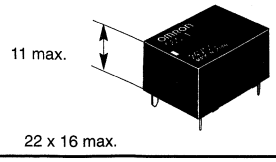
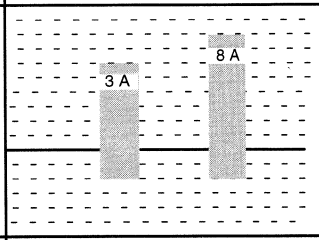
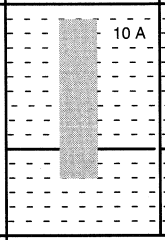
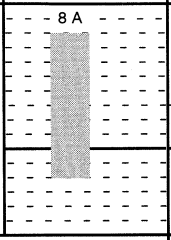
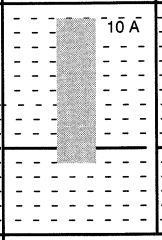
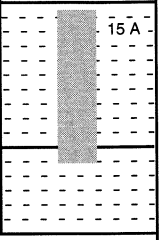
Note: For coil voltages not shown, please contact Omron for details.

Classification		Surface Mount Signal control	Surface Mount Signal control	High frequency signal control
Model		G6H–2F	G6S	G5Y-1
Features		Ultra-small surface mount relay.	Surface mount telecom relay	Special SPDT relay for VHF and UHF signal switching and transmission
Appearance Dimensions (W x D)		 14 x 9 max.	 14.8 x 7.3 max.	 11.5 x 20.5 max.
Contact ratings	Contact form	DPDT	DPDT	SPDT
	Contact type	Bifurcated crossbar	Bifurcated crossbar	Bifurcated
	Contact material	Ag (Au-clad)	Ag (Au-clad)	Movable: Au-clad + Ni-plated; Fixed: Au-plated + Ni-plated
	Resistive load	0.5 A at 125 VAC; 1 A at 30 VDC	0.5 A at 125 VAC; 2 A at 30 VDC	0.01 A at 24 VAC; 0.01 A at 24 VDC
	Max. switching current (A) (under resistive load) 10 8 5 3 2 1 0.5 0.3 0.1 Min. permissible load (mA) 100 10 1 0.1 0.01			
Coil ratings	Rated voltage	5 to 24 VDC	4.5 to 24 VDC	5 to 24 VDC
	Power consumption	140 mW	140 mW	200 or 300 mW
Life expectancy	Electrical (under rated load)	200,000 operations min.	100,000 operations min.	300,000 operations min.
	Mechanical	100,000,000 operations min.	100,000,000 operations min.	1,000,000 operations min.
Dielectric withstand voltage	Between coil and contact	1,000 VAC	2,000 VAC	1,000 VAC
	Between contacts of different polarity	1,000 VAC	1,500 VAC	---
	Between contacts of same polarity	750 VAC	1,000 VAC	500 VAC
	Between set and reset coils	---	---	---
Ambient temperature (operating)		–40°C to 85°C	–40°C to 85°C	–30°C to 70°C
Variations		■ Tape reeled	■ Tape reeled ■ EN60950 approved type	■ High sensitivity type
Magazine packaging		25 relays/magazine	50 relays/magazine	Available on request
Approved standards		UL, CSA	UL, CSA	---
Weight		Approx. 1.5 g	Approx. 2 g	Approx. 6 g
Page		200	204	210

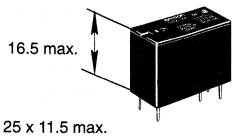
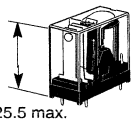
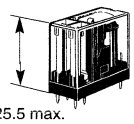
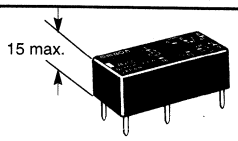
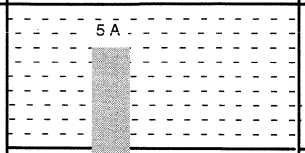
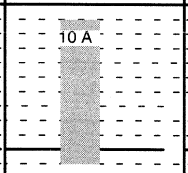
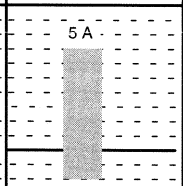
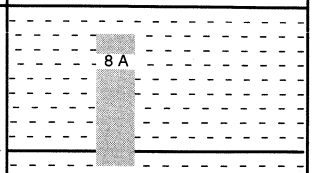
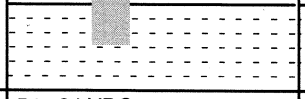
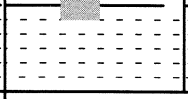
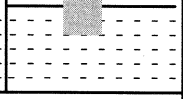
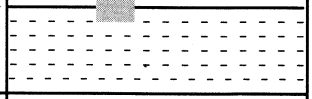
Note: For coil voltages not shown, please contact Omron for details.

Classification		Power drive			
Model		G6D	G6B		G5L(E)
Features		Slim, miniature relay, capable of relaying programmable controller and temperature controller outputs	Subminiature relay that switches up to 8-A.		Both 5-A and 10-A models available. A cubic, single-pole power relay.
Appearance Dimensions (W x D)					
Contact ratings	Contact form	SPST-NO	SPST-NO	DPST-NO DPST-NC	SPST-NO, SPDT
	Contact type	Single	Single		Single
	Contact material	AgCdO	AgCdO		AgCdO
	Resistive load	5 A at 250 VAC; 5 A at 30 VDC	5 A at 250 VAC; 5 A at 30 VDC High capacity type: 8–A at 250 VAC/30VDC		5 A at 120 VAC; 5 A at 30 VDC	10 A at 120 VAC; 8 A at 30 VDC
	Max. switching current (A) (under resistive load) 10 8 5 3 2 1 0.5 0.3 0.1					
	Min. permissible load (mA) 100 10 1 0.1 0.01					
Coil ratings	Rated voltage	5 to 24 VDC	3 to 24 VDC		3 to 48 VDC	
	Power consumption	200 mW	200 mW	300 mW	400 mW	
Life expectancy	Electrical (under rated load)	100,000 operations min. (5 A load) 300,000 operations min. (2 A load)	100,000 operations min.		100,000 operations min.	
	Mechanical	20,000,000 operations min.	50,000,000 operations min.		10,000,000 operations min.	
Dielectric withstand voltage	Between coil and contact	3,000 VAC	3,000 VAC		2,000 VAC	
	Between contacts of different polarity	---	---	2,000 VAC	---	
	Between contacts of same polarity	750 VAC	1,000 VAC		750 VAC	
	Between set and reset coils	---	250 VAC	---	---	
Ambient temperature (operating)		–25°C to 70°C	–25°C to 70°C		–25°C to 70°C (–25°C to 85°C for class-B)	
Variations		■ Plug–in socket	■ Double/single-winding latching (SPST-NO) ■ Plug-in socket		■ Flux protection ■ Plastic-sealed ■ Class B insulation type ■ High inrush current type	
Magazine packaging		---	20 relays/magazine		---	
Approved standards		UL, CSA, SEV	UL, CSA, SEV		UL, CSA, TÜV	
Weight		Approx. 3 g	Approx. 3.5/4.5 g		Approx. 12 g	
Page		213	216		221	

Note: For coil voltages not shown, please contact Omron for details.

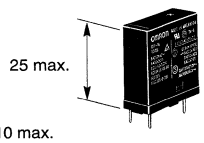
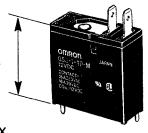
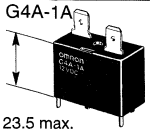
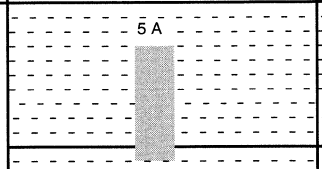
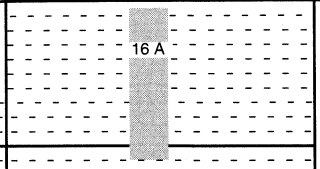
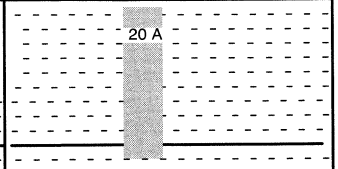
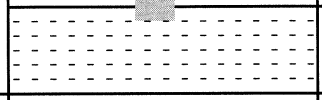
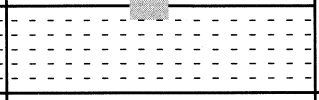
Classification		Power drive				
Model		G5B	G6C		G5C	
Features		Single-pole miniature relay.	SPST-NO types break 10-A load; SPST-NO/-NC types break 8-A load		Flat power relays that switch 10-A or 15-A loads.	
Appearance Dimensions (W x D)						
Contact ratings	Contact form	SPST-NO	SPST-NO	SPST-NO/-NC	SPST-NO	
	Contact type	Single	Single		Single	
	Contact material	Ag AgCdO – High capacity type	AgCdO		AgCdO	
	Resistive load	3 A at 125 VAC; 3 A at 30 VDC High capacity type: 8A at 125VAC/30VDC	10 A at 250 VAC; 10 A at 30 VDC	8 A at 250 VAC; 8 A at 30 VDC	10 A at 250 VAC; 10 A at 30 VDC	15 A at 110 VAC
	Max. switching current (A) (under resistive load) 10 8 5 3 2 1 0.5 0.3 0.1 Min. permissible load (mA) 100 10 1 0.1 0.01					
Coil ratings	Rated voltage	5 to 24 VDC	3 to 24 VDC		5 to 48 VDC	
	Power consumption	200 mW, 360 mW	200 mW		150/200 mW	
Life expectancy	Electrical (under rated load)	200,000 operations min. 100,000 operations min. for high capacity type	100,000 operations min.		300,000 operations min. (10 A load) 100,000 operations min. (15 A load)	
	Mechanical	5,000,000 operations min.	50,000,000 operations min.		20,000,000 operations min.	
Dielectric withstand voltage	Between coil and contact	2,000 VAC	2,000 VAC		2,500 VAC	
	Between contacts of different polarity	---	---	2,000 VAC	---	
	Between contacts of same polarity	750 VAC	1,000 VAC		1,000 VAC	
	Between set and reset coils	---	250 VAC		---	
Ambient temperature (operating)		–40°C to 70°C	–25°C to 70°C		–25°C to 70°C	
Variations		■ Flux protection ■ High sensitivity type ■ High capacity type	■ Double/single-winding latching ■ Flux protection ■ Plastic-sealed ■ Plug-in socket		■ Flux protection ■ Plastic- sealed ■ High sensitivity type ■ High capacity type ■ Quick connect terminals	
Magazine packaging		---	Possible		---	
Approved standards		UL, CSA, TÜV	UL, CSA, VDE, SEV, TÜV		UL, CSA, TÜV	
Weight		Approx. 7 g	Approx. 5.6 g		Approx. 8 g	
Page		225	228		234	

Note: For coil voltages not shown, please contact Omron for details.

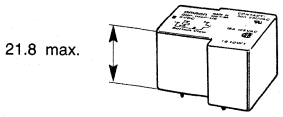
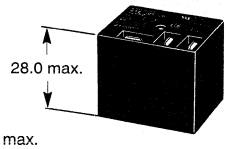
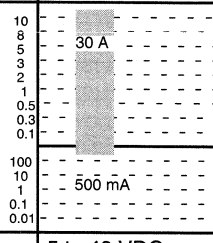
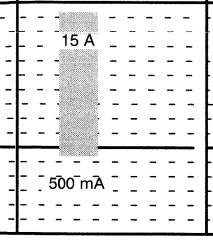
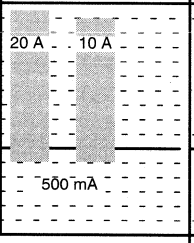
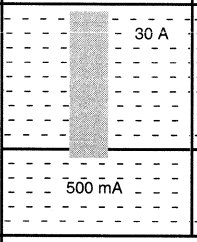
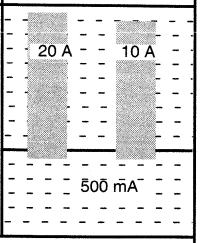
Classification		Power drive	Power drive		
Model		G5Z	G2R		G6RN
Features		Speaker protection relay	General-purpose power relays (single-pole: 10-A; double-pole: 5-A).		Slim, low profile power switching relay.
Appearance Dimensions (W x D)					
Contact ratings	Contact form	DPST-NO	SPST-NO, SPDT	DPST-NO, DPDT	SPST–NO, SPDT
	Contact type	Single crossbar	Single		Single
	Contact material	AgPd	AgCdO		AgCdO (Au Clad) AgNi (Au Clad)
	Resistive load	5 A at 40 VAC 5 A at 24 VAC	10 A at 250 VAC; 10 A at 30 VDC	5 A at 250 VAC; 5 A at 30 VDC	8 A at 250 VAC
	Max. switching current (A) (under resistive load) 10 8 5 3 2 1 0.5 0.3 0.1				
	Min. permissible load (mA) 100 10 1 0.1 0.01				
Coil ratings	Rated voltage	5 to 24 VDC	5 to 100 VDC, 12 to 240 VAC		5 to 48 VDC
	Power consumption	530 mW	DC: 530 mW; AC: 900 mVA		220 mW, 250 mW (48VDC)
Life expectancy	Electrical (under rated load)	30,000 operations min.	100,000 operations min.		100,000 operations min.
	Mechanical	500,000 operations min.	DC: 20,000,000 operations min. AC: 10,000,000 operations min.		10,000,000 operations min.
Dielectric withstand voltage	Between coil and contact	2,000 VAC	5,000 VAC		4,000 VAC
	Between contacts of different polarity	2,000 VAC	---	3,000 VAC	---
	Between contacts of same polarity	1,000 VAC	1,000 VAC		1,000 VAC
	Between set and reset coils	---	1,000 VAC		---
Ambient temperature (operating)		–25°C	–40°C to 70°C		–40°C to 85°C
Variations		■ High capacity type	■ Flux protection ■ Plastic-sealed ■ Plug-in terminal ■ Latching versions		■ Cadmium free type
Magazine packaging		---	Possible		Possible
Approved standards		UL, CSA, IEC	UL, CSA, SEV, SEMKO, TÜV, IEC, BEAB		VDE, IEC
Weight		Approx. 8g	Approx. 17 g		Approx. 9 g
Page		237	240		250

Note: For coil voltages not shown, please contact Omron for details.

Relays

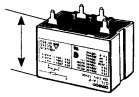
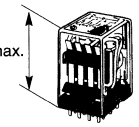
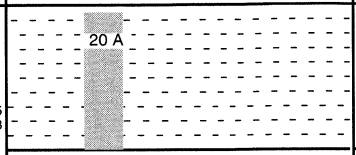
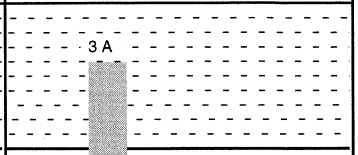
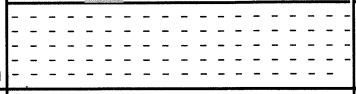
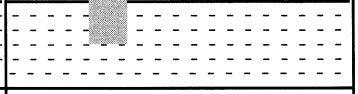
Classification		Power drive	Power drive	Power drive	
Model		G5PN	G5J	G4A	
Features		Slim power relay with TV5 and TV8 ratings available	Ideal for microwave oven magnetrons and heater switching	Miniature, single-pole relay with 80-A surge current and 20-A switching current	
Appearance Dimensions (W x D)				G4A-1A 	G4A-1A-P 
Contact ratings	Contact form	SPST-NO	SPST-NO	SPST-NO	
	Contact type	Single	Single	Single	
	Contact material	AgSn alloy	AgCdO	AgCdO	
	Resistive load	5 A at 250 VAC 5 A at 30 VDC	16 A at 250 VAC 16 A at 30 VDC	20 A at 250 VAC 20 A at 30 VDC	
	Max. switching current (A) (under resistive load) 10 8 5 3 2 1 0.5 0.3 0.1				
	Min. permissible load (mA) 100 10 1 0.1 0.01				
Coil ratings	Rated voltage	12 to 24 VDC	12 to 24 VDC	5 to 24 VDC	
	Power consumption	530 mW	700 mW	900 mW	
Life expectancy	Electrical (under rated load)	100,000 operations min.	100,000 operations min.	100,000 operations min.	
	Mechanical	2,000,000 operations min.	2,000,000 operations min.	1,000,000 operations min.	
Dielectric withstand voltage	Between coil and contact	4000 VAC	4,000 VAC	4,500 VAC	
	Between contacts of different polarity	---	---	---	
	Between contacts of same polarity	1,000 VAC	1,000 VAC	1,000 VAC	
	Between set and reset coils	---	---	---	
Ambient temperature (operating)		–40°C to 70°C	–25°C to 70°C	–25°C to 55°C	
Variations		■ High sensitivity type	---	■ Flux protection ■ Quick connect	
Magazine packaging		---	---	---	
Approved standards		UL, CSA, SEV, SEMKO, TÜV	UL, CSA, TÜV	UL, CSA, TÜV	
Weight		Approx. 11g	Approx. 22.5 g	Approx. 22.5 g	Approx. 22 g
Page		253	256	258	

Note: For coil voltages not shown, please contact Omron for details.

Classification		Power drive			Power drive	
Model		G8P			G7G	
Features		Small, low-cost 30-A power relay for PCB use.			Small, low-cost 30-A power relay for PCB use.	
Appearance **Dimensions (W x D)**		 33.9 x 28.2 max.			 32.3 x 27.5 max.	
Contact ratings	**Contact form**	SPST-NO	SPST-NC	SPDT	SPST-NO	SPDT
	Contact type	Single			Single	
	Contact material	AgCdO			AgCdO	
	Resistive load	30 A at 250 VAC; 20 A at 28 VDC	10 A at 250 VAC; 10 A at 28 VDC	20/10 A at 250 VAC; 20/10 A at 30 VDC	30 A at 250 VAC 30 A at 28 VDC	NO: 20 A at 250 VAC, 28 VDC; NC: 10 A at 250 VAC, 28 VDC
	Max. switching current (A) (under resistive load) **Min. permissible load (mA)**					
Coil ratings	**Rated voltage**	5 to 48 VDC			5 to 48 VDC	
	Power consumption	900 mW			900 mW	
Life expectancy	**Electrical (under rated load)**	100,000 operations min.			100,000 operations min.	
	Mechanical	10,000,000 operations min.			10,000,000 operations min.	
Dielectric withstand voltage	**Between coil and contact**	1,500 VAC			2,500 VAC	
	Between contacts of different polarity	---			---	
	Between contacts of same polarity	1,500 VAC			1,500 VAC	
	Between set and reset coils	---			---	
Ambient temperature (operating)		S tandard –55°C to 70°C Class B insulation type: –55°C to 85°C Class F insulation type: –55°C to 105°C			Class B insulation type: –55°C to 85°C Class F insulation type: –55°C to 105°)	
Variations		■ Unsealed ■ Plastic-sealed			■ Plastic-sealed	
Magazine packaging		---			---	
Approved standards		UL, CSA			UL, CSA	
Weight		Approx. 19 g and 27g (sealed type)			Approx. 32 g	
Page		261			266	

Note: For coil voltages not shown, please contact Omron for details.

Relays

Classification		Power drive	
Model		G7L	MY4–02
Features		High capacity, high withstand voltage relay.	Versatile relay for control applications.
Appearance Dimensions (W x D)		41 max.  52.5 x 35.5 max.	36 max.  21.5 x 28 max.
Contact ratings	Contact form	SPST-NO, DPST–NO	4PDT
	Contact type	Single	Single
	Contact material	Ag	Ag (Au-clad)
	Resistive load	20 A at 220 VAC	3 A at 220 VAC/24VDC
	Max. switching current (A) (under resistive load) 10 8 5 3 2 1 0.5 0.3 0.1		
	Min. permissible load (mA) 100 10 1 0.1 0.01		
Coil ratings	Rated voltage	6 to 100 VDC 6 to 240 VAC	6 to 100/110 VDC 6 to 220/240 VAC
	Power consumption	1.9 W (DC) 1.7 to 2.5VA (AC)	0.9 W (DC) 0.9 to 1.2 VA
Life expectancy	Electrical (under rated load)	100,000 operations min.	200,000 operations min.
	Mechanical	1,000,000 operations min.	50,000,000 operations min.
Dielectric withstand voltage	Between coil and contact	4,000 VAC	2,000 VAC
	Between contacts of different polarity	---	—
	Between contacts of same polarity	2,000 VAC	1,000 VAC
	Between set and reset coils	---	—
Ambient temperature (operating)		–25°C to 60°C	–55°C to 70°C
Variations		■ Flux protection ■ Quick connect	
Magazine packaging		---	—
Approved standards		UL, CSA, TÜV	UL, CSA
Weight		Approx. 100 g	Approx. 85 g
Page		269	273

Note: For coil voltages not shown, please contact Omron for details.

Technical Information

■ Construction

Sealing

Unsealed Relays

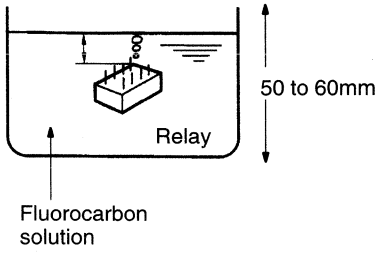
Relays of this type are intended for manual soldering. No measures are taken against penetration of flux and cleaning solvent into the relay. This type of relay cannot be immersion-cleaned.

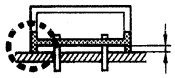
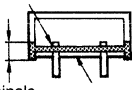
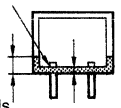
Flux protection Relays

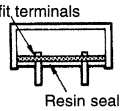
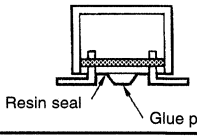
Special design construction prevents flux from penetrating into the relay housing, for example, due to capillary action up the terminals when the relay is soldered onto a PCB. This type of relay also cannot be immersion-cleaned.

Plastic-sealed Relays

Plastic-sealing prevents not only flux, but also cleaning solvent from penetrating into the relay housing. Therefore, this type of relay can be immersion-cleaned. Relays are tested before being shipped. The relay is immersed in fluorocarbon solution for 1 minute, at a temperature of 70°C $^{+5°C}_{-0°C}$, to see if gases escape from the relay. The following figure illustrates the test conditions.



Classification	Unsealed		Flux protection	
Construction	 Terminals separated from PCB	 Contacts located at upper part of relay case	 Press-fit terminals, Terminals separated from PCB, Resin seal	 Inserted terminals, Terminals separated from PCB, 0.3 mm min. base thickness
Features	Terminals are separated from PCB surface when relay is mounted.	Contacts are positioned away from base.	Terminals are pressed into base.	Terminals are inserted into base 0.3 mm min. thick.
Automatic flux application	Poor	Poor	Good	Good
Automatic soldering	Poor	Poor	Good	Good
Automatic cleaning	Poor	Poor	Poor	Poor
Manual soldering	Good	Good	Good	Good
Penetration of dust	Fair		Fair	
Penetration of corrosive gas	Poor		Poor	

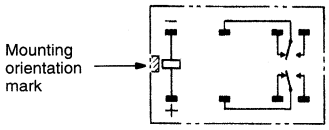
Classification	Plastic-sealed	Surface-mounting
Construction	 Press-fit terminals, Resin seal	 Resin seal, Glue pad
Features	Terminals are separated from PCB surface when relay is mounted.	Terminal and base, as well as the base and casing, are sealed with adhesive; the L-shaped terminals and adhesive pads allow temporary fixing to the board.
Automatic flux application	Good	Good
Automatic soldering	Good	Good
Automatic cleaning	Good	Good
Manual soldering	Good	Good
Penetration of dust	Good	Good
Penetration of corrosive gas	Fair	Good

■ Operation

Single-side Stable Relays (Standard)

The contacts of this simple type of relay momentarily turn ON and OFF, depending on the excitement state of the coil.

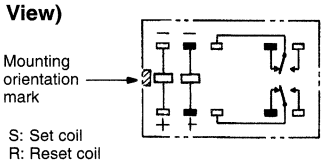
Terminal Arrangement/ Internal Connections (Bottom View)



Double-winding, Latching Relays

This latching relay has two coils: set and reset. It can retain the ON or OFF states even when a pulsating voltage is supplied, or when the voltage is removed.

Terminal Arrangement/ Internal Connections (Bottom View)

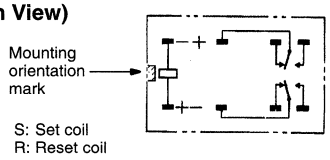


Relays

Single-winding, Latching Relays

Unlike the double-winding latching relay, the single-winding latching relay has only one coil. This coil, however, serves as both the set and reset coils, depending on the polarity (direction) of current flow. When current flows through the coil in the forward direction, it functions as a set coil; when current flows through the coil in the reverse direction, it functions as a reset coil.

Terminal Arrangement/ Internal Connections (Bottom View)



Built-in Diode

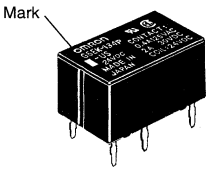
A diode is built into some relays, wired in parallel with the coil to absorb the counterelectromotive force (counter emf) generated by the coil.

Built-in Operation Indicator

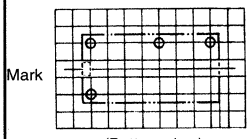
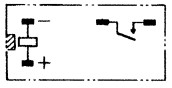
Some relays are provided with a light-emitting diode (LED), wired in parallel with the coil. This permits a fast-check of the relay's operating status.

Mounting Orientation Mark

On top of all OMRON relays is a mark indicating where the relay coil is located. Knowing the coil location aids in designing PCBs when spacing components. Also, pin orientation is easy to discern when automatic or hand–mounting relays.

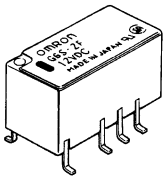


On dimensional drawings in all OMRON literature this mark is left-oriented. Mounting holes, terminal arrangements, and internal connections follow this alignment. The following two symbols are used to represent the orientation mark.

Drawing view	Bottom	Top
Detail	Mounting holes	Terminal arrangement/ internal connections
Symbol		
Example	 (Bottom view)	 (Bottom view)

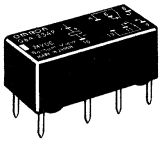
Terminal Arrangement/Internal Connections Top View

If the terminal arrangement of a relay can be seen from above the PCB, the top view of the relay is provided in the *Dimensions* section of the catalog or data sheet.



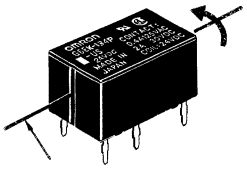
Bottom View

If the relay's terminals cannot be seen from above the PC board, as in this example, a bottom view is shown.



Rotation Direction to Bottom View

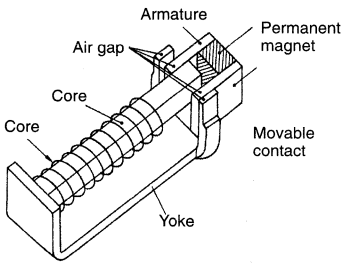
The bottom view shown in the catalog or data sheet is rotated in the direction indicated by the arrow, with the coil always on the left.



■ Moving Loop System

In U.S.A., the National Association of Relay Manufactures (NARM) in April 1984, awarded OMRON for monumental advances in relay technology, as embodied in the Moving Loop System.

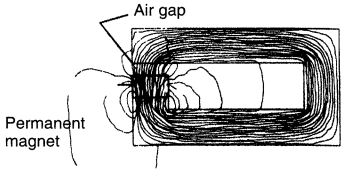
This unique relay construction maximizes electrical and permanent magnet energy. A high-efficiency magnet adds to the magnetic flux of the relay coil, which also allows for tighter packing of relay parts. Relays having such a coil are known as "polarized relays." Details of construction are shown below.



The moving loop design has similarities with polarized relays; however, the following two features make for a large performance distinction.

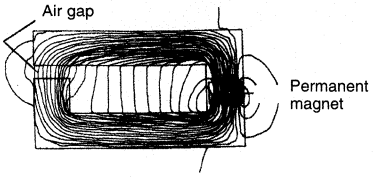
A permanent magnet is placed in the vicinity of the "working gaps." The flux energy of this permanent magnet complements that of the electrical coil. This increased efficiency enables the mechanism holding the contacts closed to ultimately switch larger loads, and at the same time reduces the power consumed by the coil.

The following diagram shows concentric lines of magnetic flux when the permanent magnet is placed near the working gap.



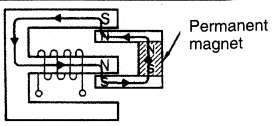
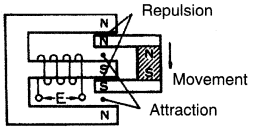
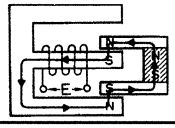
Conventional Relay Coil

The following diagram shows the lines of magnetic flux when the permanent magnet is placed away from the working gap. These lines of flux detract from the total strength of the coil.



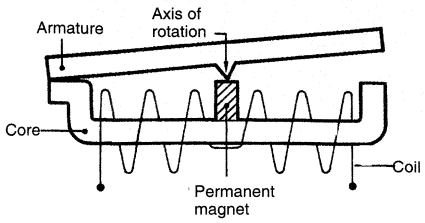
When the operating voltage is removed from the coil, the collapse of the magnetic flux created by the permanent magnet and the electrical coil provides the force to return the relay contacts to the reset position. Note the flux path and magnet polarity in the table below.

Operating Principle

Release	
Transition from release to operation (operating voltage supplied)	
Operation	

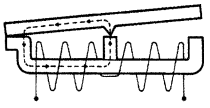
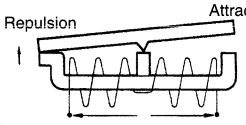
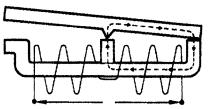
Super Moving Loop System

A very small high-sensitivity magnetic circuit is incorporated to further minimize the conventional moving loop system.



This magnetic circuit has the following features:

1. High-efficiency polarized magnetic circuit utilizes power of both attraction and repulsion.
2. Balanced armature system improves resistance to both vibration and impacts.
3. Ideal mechanism for a low-profile relay.

Release		Released status is maintained by permanent magnet.
Transition from release to operation (operating voltage supplied)		The armature see-saws due to the attraction and repulsion torque exerted on the armature by the coil voltage and the permanent magnet.
Operation		Energized status is maintained by the coil voltage and permanent magnet.

Note: The above applies to a latching relay.

■ Glossary

Terms Related to Contacts

Carry Current

The value of the current which can be continuously applied to the relay contacts without opening or closing them, and which allows the relay to stay within the permissible temperature rise.

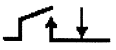
Maximum Switching Current

A current which serves as a reference in determining the performance of the relay contacts. This value will never exceed the current flow. When using a relay, do not exceed this value.

Contact Form

OMRON uses the following relay terminology for the various polarity and switch configurations.
SPST-NO (Single-pole, single-throw, normally open)
SPST-NC (Single-pole, single-throw, normally closed)
SPDT (or changeover contact) (single-pole, double-throw)
DPDT (Double-pole, double-throw)

Contact Symbols

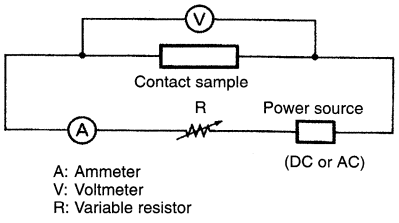
NO	NC	DT (NO/NC)	MBB
			

Make-before-break (MBB) Contact

A contact arrangement in which part of the switching section is shared between both an NO and NC contact. When the relay operates or releases, the contact that closes the circuit operates before the contact that opens the circuit releases. Thus both contacts are closed momentarily at the same time.

Contact Resistance

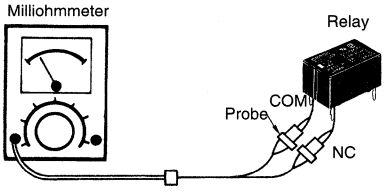
The total resistance of the conductor, as well as specific resistivities such as of the armature and terminal, and the resistance of the contacts. This value is determined by measuring the voltage drop across the contacts by applying test currents as shown in the table below.



Test Current

Rated current or switching current	Test current (mA)
Less than 0.01	1
0.01 or higher but less than 0.1	10
0.1 or higher but less than 1	100
1 or higher	1,000

To measure the contact resistance, a milliohmmeter can be also used, although the accuracy drops slightly.



Maximum Switching Capacity

The maximum value of the load capacity which can be switched without problem. When using a relay, do not exceed this value. For example, when maximum switching voltage V_1 is known, maximum switching current I_1 can be obtained at the point of intersection

Relays

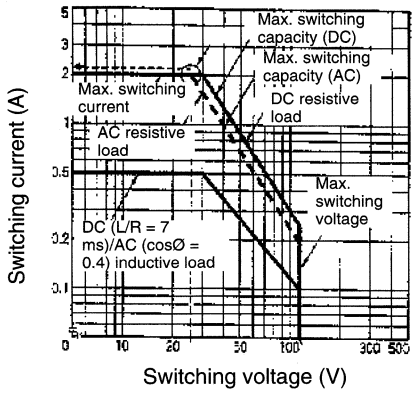
on the characteristic curve "Maximum switching capacity" shown below. Conversely, maximum switching voltage V_1 can be obtained if I_1 is known.

$$\text{Maximum switching current } (I_1) = \frac{\textit{Max. switching capacity [W(VA)]}}{\textit{Max. switching voltage (V1)}}$$

$$\text{Maximum switching current } (V_1) = \frac{\textit{Max. switching capacity [W(VA)]}}{\textit{Max. switching voltage (V1)}}$$

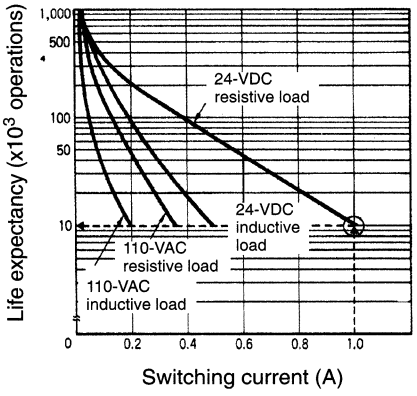
For instance, if the maximum switching voltage = 40 V
Maximum switching current = 2 A (see circled point on graph below.)

Maximum Switching Capacity



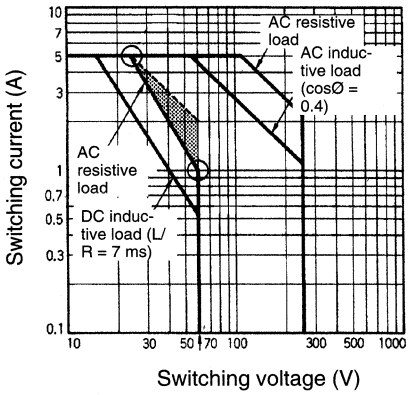
The life expectancy of the relay can be determined from the "Life expectancy" curve shown below, based on the rated switching current (I_1) obtained above. For instance, the electrical life expectancy at the obtained maximum switching current of 2 A is slightly over 300,000 operations (see circled point on graph below).

Life Expectancy



However, with a DC load, it may become difficult to break the circuit of 48 V or more due to arcing. Determine the suitability of the relay in actual usage testing.
The correlation between the contact ratings is shown in the following figure:

Maximum Switching Capacity



Minimum Permissible Load

The minimum permissible load indicates the lower limit of the switching capability of a relay. Such minute load levels are found in microelectronic circuits. This value may vary, depending on operating frequency, operating conditions, expected reliability level of the relay, etc. It is always recommended to double-check relay suitability under actual load conditions.
In this catalog, the minimum permissible load of each relay is indicated as a reference value. It indicates failure level at a reliability level of 60% (λ_{60}). $\lambda_{60} = 0.1 \times 10^{-6}$/operation means that one failure is presumed to occur per 10,000,000 (ten million) operations at a reliability level of 60%.

Number of Poles

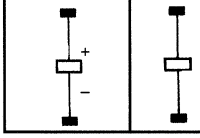
The number of contact circuits. See "*Contact Form*" for reference.

Terms Related to Coils

Rated Coil Voltage

A reference voltage applied to the coil when the relay is used under normal operating conditions.

Coil Symbols

Single-side stable		Double-winding latching		Single-winding latching
Polarized	Non-polarized	w/4 terminals	w/3 terminals	
				

Coil Resistance (Applicable to DC-switching Relays only)

The resistance of the coil is measured at a temperature of 23°C with a tolerance of ±10% unless otherwise specified. (The coil resistance of an AC-switching type relay may be given for reference when the coil inductance is specified.)

Hot Start

The ratings set forth in the catalogue or data sheet are measured at a coil temperature of 23°C.

Maximum Voltage

The maximum value of the pulsating voltage fluctuations in the operating power supply to the relay coil.

Minimum Pulse Width

The minimum value of the pulsating voltage required to set and reset a latching relay at a temperature of 23°C.

Must Operate (Must Set) Voltage

The threshold value of a voltage at which a relay operates when the input voltage applied to the relay coil in the reset state is increased gradually.

Must Release (Must Reset) Voltage

The threshold value of a voltage at which a relay releases when the rated input voltage applied to the relay coil in the operating state is decreased gradually.

Power Consumption

The power (= rated voltage x rated current) consumed by the coil when the rated voltage is applied to it. A frequency of 60 Hz is assumed if the relay is intended for AC operation. The current flows through the coil when the rated voltage is applied the coil at a temperature of 23°C. The tolerance is $^{+15\%}/_{-20\%}$ unless otherwise specified.

Terms Related to Electrical Characteristics

Dielectric Withstand Voltage

The critical value which a dielectric can withstand without rupturing when a high-tension voltage is applied for 1 minute between the following points:
Between coil and contact
Between contacts of different polarity
Between contacts of same polarity
Between set coil and reset coil
Between current-carrying metal parts and ground terminal

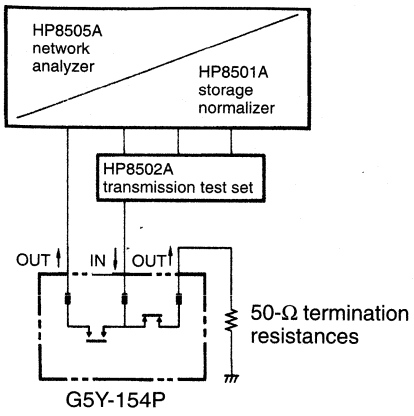
Note that normally a leakage current of 3 mA is detected; however, a leakage current of 1 mA to 10 mA may be detected on occasion.

Life Expectancy

The life of a relay when it is switched at the rated operating frequency with the rated load applied to its contacts.

High-frequency Isolation (Applicable to High-frequency Relay only)

The degree of isolation of a high-frequency signal, which is equivalent to the insulation resistance of ordinary relays.



The following characteristics are measured with contacts unrelated to the measurement terminated at 50 Ω, when a signal is applied from input terminal 11 to output terminal 8 or from input terminal 11 to output terminal 14 of the sample.

1. Isolation characteristics
2. Insertion loss characteristics
3. Return loss

The following conversion formula converts from return loss to VSWR.

$$VSWR = \frac{1 + 10^{-\frac{x}{20}}}{1 - 10^{-\frac{x}{20}}}$$

where,
x = return loss

High-frequency Switching Power (Applicable to High-frequency Relays Only)

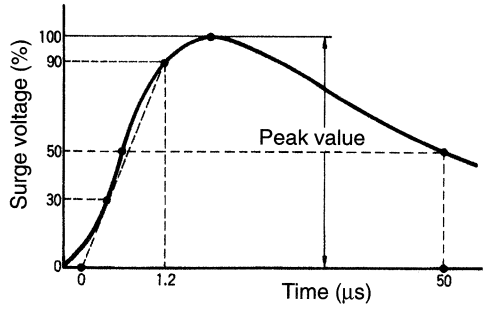
The power of a high-frequency signal that can be switched.

High-frequency Transmitted Power (Applicable to High-frequency Relays Only)

The transmission capacity of a high-frequency signal.

Impulse Withstand Voltage

The critical value which the relay can withstand when the voltage surges momentarily due to lightning, switching an inductive load, etc. The surge waveform which has a pulse width of ±1.2 x 50 μs is shown below:



Insertion Loss (Applicable to High-frequency Relays Only)

The attenuation of a high-frequency signal in a transmission line and is equivalent to the contact resistance of ordinary relays.

Insulation Resistance

The resistance between an electric circuit such as the contacts and coil, and grounded, non-conductive metal parts such as the core, or the resistance between the contacts. The measured values are as follows:

Rated insulation voltage	Measured value
60 V max.	250 V
61 V max.	500 V

Maximum Operating Frequency

The frequency or intervals at which the relay continuously operates and releases, satisfying the rated mechanical and electrical life expectancies.

Life Expectancy

The life of a relay when it is switched at the rated operating frequency without the rated load.

Operate Bounce Time

The bounce time of the normally open (NO) contact of a relay when the rated coil voltage is applied to the relay coil at an ambient temperature of 23°C.

Operate Time

The time that elapses after power is applied to a relay coil until the NO contacts have closed, at an ambient temperature of 23°C. Bounce time is not included. For the relays having an operate time of less than 10 ms, the mean (reference) value of its operate time is specified as follows:

Operate time	5 ms max. (mean value: approx. 2.3 ms)

Release Bounce Time

The bounce time of the normally closed (NC) contact of a relay when the coil is deenergized at an ambient temperature of 23°C.

Release Time

The time that elapses between the moment a relay coil is deenergized until the NC contacts have closed, at an ambient temperature of 23°C. (With a relay having SPST-NO or DPST-NO contacts, this is the time that elapses until the NO contacts have operated under the same condition.) Bounce time is not included. For the relays having an operate time of less than 10 ms, the mean (reference) value of its operate time is specified as follows:

Release time	5 ms max. (mean value: approx. 2.3 ms)

Reset Time (Applicable to Latching Relays Only)

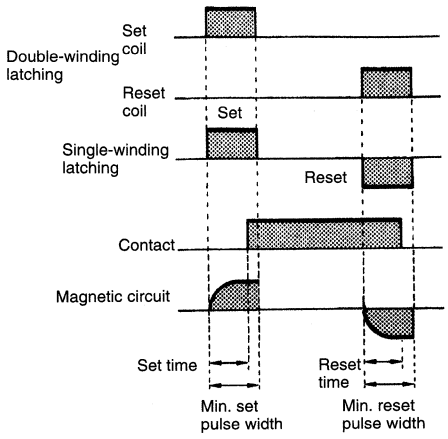
The time that elapses from the moment a relay coil is deenergized until the NC contacts have closed, at an ambient temperature of 23°C. (With a relay having SPST-NO contacts, this is the time that elapses until the NO contacts have operated under the same condition.) Bounce time is not included. For the relays having an operate time of less than 10 ms, the mean (reference) value of its operate time is specified as follows:

Reset time	5 ms max. (mean value: approx. 2.3 ms)

Set Time

The time that elapses after power is applied to a relay coil until the NO contacts have closed, at an ambient temperature of 23°C. Bounce time is not included. For the relays having an operate time of less than 10 ms, the mean (reference) value of its operate time is specified as follows:

Set time	5 ms max. (mean value: approx. 2.3 ms)



The shock resistance of a relay is divided into two categories: "Destruction" which quantifies the characteristic change of, or damage to, the relay due to considerably large shocks which may develop during the transportation or mounting of the relay, and "Malfunction" which quantifies the malfunction of the relay while it is in operation.

Stray Capacitance

The capacitance measured between terminals at an ambient temperature of 23°C and a frequency of 1 kHz.

VSWR (Applicable to High-frequency Relays Only)

Stands for voltage standing-wave ratio. The degree of reflected wave that is generated in the transmission line.

Vibration Resistance

The vibration resistance of a relay is divided into two categories: "Destruction" which quantifies the characteristic changes of, or damage to, the relay due to considerably large vibrations which may develop during the transportation or mounting of the relay, and "Malfunction" which quantifies the malfunction of the relay due to vibrations while it is in operation.

$a = 0.002f^2A$

where,

a: Acceleration of vibration
f: Frequency
A: Double amplitude

Precautions

■ Basic Information

Before actually committing any component to a mass-production situation, OMRON strongly recommends situational testing, in as close to actual production situations as possible. One reason is to confirm that the product will still perform as expected after surviving the many handling and mounting processes in involved in mass production. Also, even though OMRON relays are individually tested a number of times, and each meets strict requirements, a certain testing tolerance is permissible. When a high-precision product uses many components, each depends upon the rated performance thresholds of the other components. Thus, the overall performance tolerance may accumulate into undesirable levels. To avoid problems, always conduct tests under the actual application conditions.

General

To maintain the initial characteristics of a relay, exercise care that it is not dropped or mishandled. For the same reason, do not remove the case of the relay; otherwise, the characteristics may degrade. Avoid using the relay in an atmosphere containing sulphur dioxide (SO_2), hydrogen sulfide (H_2S), or other corrosive gases. Do not continuously apply a voltage higher than the rated maximum voltage to the relay. Never try to operate the relay at a voltage and a current other than those rated.

If the relay is intended for DC operation, the coil has polarity. Connect the power source to the coil in the correct direction. Do not use the relay at temperatures higher than that specified in the catalogue or data sheet.

Coil

1) AC-switching Relays

Generally, the coil temperature of the AC-switching relay rises higher than that of the DC-switching relay. This is because of resistance losses in the shading coil, eddycurrent losses in the magnetic circuit, and hysteresis losses. Moreover, a phenomenon known as "beat" may take place when the AC-switching relay operates on a voltage lower than that rated. For example, beat may occur if the relay's supply voltage drops. This often happens when a motor (which is to be controlled by the relay) is activated. This results in damage to the relay contacts by burning, contact weld, or disconnection of the self-holding circuit. Therefore, countermeasures must be taken to prevent fluctuation in the supply voltage.

One other point that requires attention is the "inrush current." When the relay operates, and the armature of the relay is released from the magnet, the impedance drops. As a result, a current much higher than that rated flows through the coil. This current is known as the inrush current. (When the armature is attracted to the magnet, however, the impedance rises, decreasing the inrush current to the rated level.) Adequate consideration must be given to the inrush current, along with the power consumption, especially when connecting several relays in parallel.

2) DC-switching Relays

This type of relay is often used as a so-called "marginal" relay that turns ON or OFF when the voltage or current reaches a critical value, as a substitute for a meter. However, if the relay is used in this way, its control output may fail to satisfy the ratings because the current applied to the coil gradually increases or decreases, slowing down the speed at which the contacts move. The coil resistance of the DC-switching relay changes by about 0.4% per degree C change in the ambient temperature. It also changes when the relay generates heat. This means that the must operate and must release voltages may increase as the temperature rises.

Coil Operating Voltage Source

If the supply voltage fluctuates, the relay will be caused to malfunction regardless of whether the fluctuation lasts for a long time or only for a moment.

For example, assume that a large-capacity solenoid, relay, motor, or heater is connected to the same power source as the relay, or that many relays are used at the same time. If the capacity of the power source is insufficient to operate these devices at the same time, the relay may not operate, because the supply voltage has dropped. Conversely, if a high voltage is applied to the relay (even after taking voltage drop into account), chances are that the full voltage will be applied. As a consequence, the relay's coil will generate heat. Therefore, be sure 1) to use a power source with sufficient capacity and 2) that the supply voltage to the relay is within the rated must operate voltage range of the relay.

Minimum Must Operate Voltage

When the relay is used at a high temperatures, or when the relay coil is continuously energized, the coil temperature rises and coil resistance increases. Consequently, the must operate voltage increases. This increase in the must operate voltage requires attention when determining the minimum must operate voltage are given below for reference when designing a power source appropriate for the relay.

Assuming a coil temperature rise of 10°C, the coil resistance will increase about 4%.

■ Coil Input

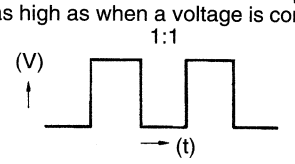
To guarantee accurate and stable relay operation, the first and foremost condition to be satisfied is the application of the rated voltage to the relay. Additionally, the rated voltage in light of the type of the power source, voltage fluctuation, and changes in coil resistance due to temperature rise. If a voltage higher than the rated maximum voltage is applied to the coil for a long time, layer short-circuiting and damage to the coil by burning may take place.

Coil Temperature Rise

When a current flows through the coil, the coil's temperature rises to a measurable level, because of copper loss. If an alternating current flows, the temperature rises even more, due not only to the copper loss, but additionally to the iron loss of the magnetic materials, such as the core. Moreover, when a current is applied to the contact, heat is generated on the contacts, raising the coil temperature even higher (however, with relays whose contact current is rated at 2 A or lower, this rise is insignificant).

Temperature Rise by Pulsating Voltage

When a pulsating voltage having an ON time of less than 2 minutes is applied to the relay, the coil temperature rise varies, and is independent of the duration of the ON time, depending only on the ratio of the ON time to the OFF time. The coil temperature in this case does not rise as high as when a voltage is continuously applied to the relay.



Energization time	Release temperature rise
Continuous energization	100%
ON:OFF = 3:1 approx.	80%
ON:OFF = 1:1 approx.	50%
ON:OFF = 1:3 approx.	35%

Changes in Must Operate Voltage by Coil Temperature Rise

The coil resistance of a DC-switching relay increases (as the coil temperature rises) when the coil has been continuously energized, deenergized once, and then immediately energized again. This increase in the coil resistance raises the voltage value at which the relay operates. Additionally, the coil resistance rises when the relay is used at a high ambient temperature.

Maximum Must Operate Voltage

The maximum voltage applicable to a relay is determined in accordance with the coil temperature rise and the coil insulation materials' heat resistivity, electrical as well as mechanical life expectancy, general characteristics, and other factors.

If a voltage exceeding the maximum voltage is applied to the relay, it may cause the insulation materials to degrade, the coil to be burnt, and the relay to not operate at normal levels. Actually, however, there are occasions when the maximum voltage is exceeded to compensate for fluctuation in the supply voltage. In this event, pay attention to the following points.

The coil temperature must not exceed the temperature that the spool and wound wire constituting the coil can withstand. The following table shows the wires often used for a coil. In this table, the coil temperature is measured through calculation of the coil resistance.

Wire material	Maximum coil temperature
Polyurethane (UEW)	120°C
Polyester (PEW)	155°C

How to Calculate Coil Temperature

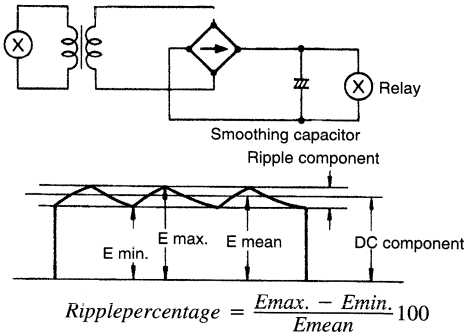
$$t = \frac{R2 - R1}{R1}(234.5 + T1) + T1\ [°C]$$

where,
R1 (Ω): coil resistance before energization
R2 (Ω): coil resistance after energization
T1 (°C): coil temperature (ambient) before energization
t (°C): coil temperature after energization

Before using the relay confirm that there are no problems.

DC Input Power Source

Pay attention to the coil polarity of the DC-switching relay. Power sources for DC-operated relays are usually a battery or a DC power supply, either with a maximum ripple of 5%. If power is supplied to the relay via a rectifier, the must operate and must release voltages vary with the ripple percentage. Therefore, check the voltages before actually using the relay. If the ripple component is extremely large, beat may occur. If this happens, it is recommended that a smoothing capacitor be inserted as shown in the following diagram.



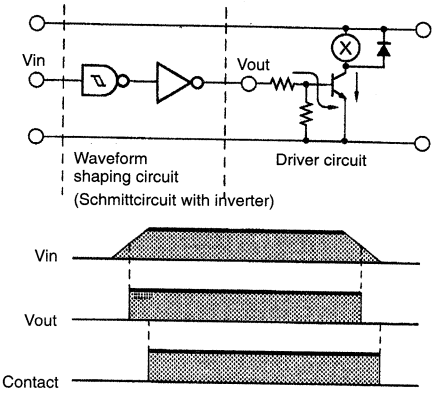
$$Ripplepercentage = \frac{Emax. - Emin.}{Emean}100$$

where,
E max.: maximum value of ripple component
E min.: minimum value of ripple component
E mean: mean value of DC component

If the voltage applied to the DC-operated coil increases or decreases slowly, each contact of a multi-pole contact relay may not operate at the same time. It is also possible for this situation to result in the must operate voltage varying each time the relay operates. Either way, circuit sequencing will not be correct. In critical applications, the use of a Schmitt circuit is recommended, reshape the DC waveform to trigger all contacts of the relay at the same time.

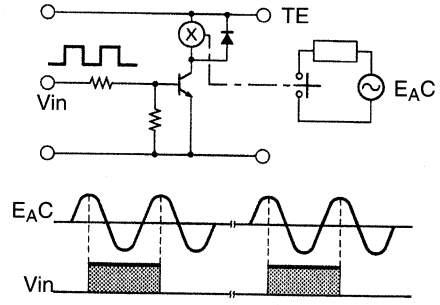
Relay Driving Signal Waveform

A long rise time and/or fall time of the signal driving the relay may prolong the operate time and/or release time of the relay. This situation may shorten the life expectancy of the contacts. If this situation cannot be avoided, providing a Schmitt trigger circuit at the circuit stage preceding the relay circuit will shape a waveform with sharp transitions, as shown in the following diagram:



If the Schmitt trigger circuit is configured of transistors, a residual voltage may exist in the output of the circuit. Therefore, confirm that the rated voltage is present across the relay coil, or that the residual voltage drops to zero when the relay releases. When an IC (e.g., TC74HC132P) is used, this value is close to zero.

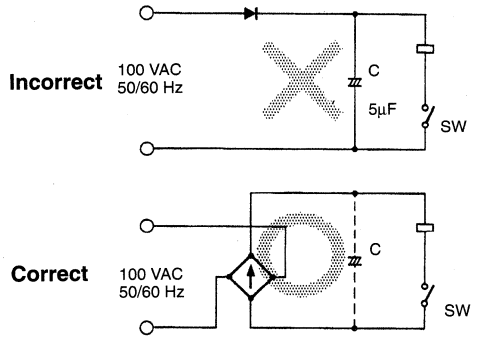
Cyclic Switching of AC Load



If the relay operates in synchronization with the supply voltage, the life of the relay may be shortened. When designing the control system in which the relay is used, estimate the life expectancy of the relay and thus the reliability of the overall system under actual operating conditions. Moreover, construct the circuit so that the relay operates in a random phase or in the vicinity of the zero point.

Overcoming Beat in DC Relays

When using AC power to generate power for operating a DC relay, the use of half-wave rectification causes the formation of a pulsating current. Therefore, when the capacitance of the smoothing capacitor C is low, the relay generates a beat. However, when a bridge rectification circuit is used, the frequency of the pulsating current doubles, generating no beat even when a smoothing capacitor C is not provided. The bridge rectification circuit can provide a higher rectification efficiency to increase the contact attraction, which is desirable in terms of prolonging the service life of the contact.

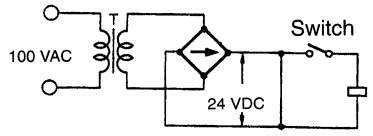


Voltage Considerations for AC Relays

For stable relay operation, a voltage +10% to –20% of the rated voltage should be applied to the relay. The voltage applied to the relay must be a sine wave. When a commercial power source is used, there should be no problem. However, if an AC stabilized power source is used, either beat or abnormal heating may occur, depending on the wave distortion of the power source. A shading coil is used to suppress beat in an AC current coil, but wave distortion defeats this function.

When a motor, solenoid, transformer, or other device is connected to the same power line source as the relay controller, and any of these devices causes a drop in the line voltage, the relay may vibrate, damaging the contact. This commonly occurs when a small transformer is added to the line, when the transformer is too small, when long wiring is used, or when thin wiring is used in the customer's premises. Be aware of this phenomenon, as well as normal voltage fluctuations. Should this problem occur, check the change in voltage with a synchroscope or the like, and take appropriate countermeasures. Effective countermeasures include replacing the relay with a special relay suited to the circumstances, or use of a DC circuit and inclusion of a capacitor to compensate for the voltage change, as shown in the following circuit diagram.

Voltage change compensation circuit incorporating a capacitor



■ Contacts

The contacts are the most important constituent of a relay. Their characteristics are significantly affected by factors such as the material of the contacts, voltage and current values applied to them (especially, the voltage and current waveforms when energizing and deenergizing the contacts), the type of load, operating frequency, atmosphere, contact arrangement, and bounce. If any of these factors fail to satisfy predetermined values, problems such as metal deposition between contacts, contact welding, wear, or rapid increase in the contact resistance may occur.

Contact Voltage (AC, DC)

When a relay breaks an inductive load, a fairly high counterelectromotive force (counter emf) is generated in the relay's contact circuit. The higher the counter emf, the greater the damage to the contacts. This may result in a significant decrease in the switching capacity of DC-switching relays. This is because, unlike the AC-switching relay, the DC-switching relay does not have a zero-cross point. Once arc has been generated, it does not easily diminish, prolonging the arc time. Moreover, the unidirectional flow of the current in a DC circuit may cause metal deposition to occur between contacts and the contacts to wear rapidly (this is discussed later).

Despite the information a catalogue or data sheet sets forth as the approximate switching power of the relay, always confirm the actual switching power by performing a test with the actual load.

Contact Current

The quantity of electrical current which flows through the contact directly influences the contact' characteristics. For example, when the relay is used to control an inductive load such as a motor or a lamp, the contacts will wear more quickly, and metal deposition between the mating contacts will occur more often as the inrush current to the contacts increases. Consequently, at some point the contacts may not be able to open. (See notes on page 156 and 157)

Contact Materials

Selection of an appropriate contact material according to the load to be opened or closed is important. Several contact materials and their properties are listed below.

Contact Materials and Features

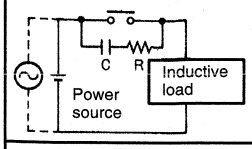
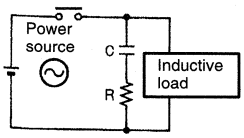
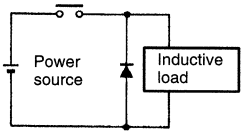
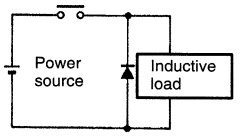
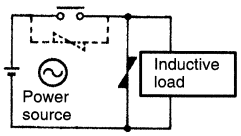
P. G. S. Alloy	This material has excellent corrosion resistance and is suitable for very small current circuits. (Au : Ag : Pt = 69 : 25 : 6)
AgPd	This material exhibits good corrosion and sulfur resistance. In a dry circuit, it attracts organic gas to generate a polymer, therefore it is usually plated with gold or other material.
Ag	This material has the highest electric and heat conductivities among all metals. It exhibits low contact resistance, but easily forms sulfide film in a sulfide gas environment. This may result in defective contact performance at a low-voltage small-current operation.
AgCdO	This material exhibits the same high electric conductivity as silver, low contact resistance, and excellent deposition resistance. It easily forms sulfide film in a sulfide gas environment.
AgNi	This material exhibits the same high electric conductivity as silver and excellent arc resistance.
AgSnIn	This material exhibits excellent deposition resistance and exhaustion resistance.
AgW	This material exhibits a high hardness and melting point. It also exhibits excellent arc resistance and superior resistance to deposition and transfer. However, it shows high contact resistance and inferior environmental resistance.

Key to contact materials:

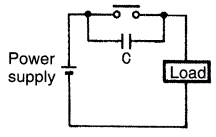
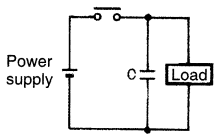
AgPd = Silver Palladium
Ag = Silver
AgCdO = Silver Cadmium Oxide
AgNi = Silver Nickel
AgSnIn = Silver Tin Indium
AgW = Silver Tungsten

Contact Protection Circuit

A contact protection circuit, designed to prolong the life expectancy of the relay, is recommended. This protection will have the additional advantages of suppressing noise, as well as preventing the generation of carbide and nitric acid, which otherwise would be generated at the contact surface when the relay contact is opened. However, unless designed correctly, the protection circuit may produce adverse effects, such as prolonging the release time of the relay. The following table lists examples of contact protection circuits.

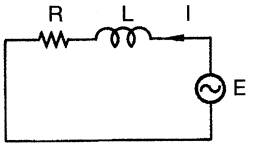
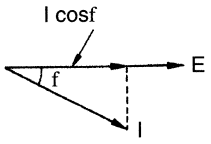
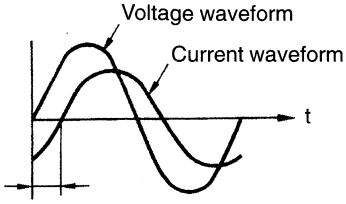
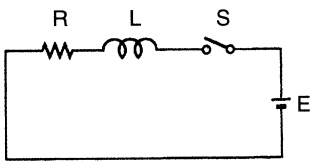
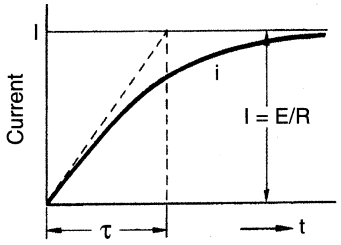
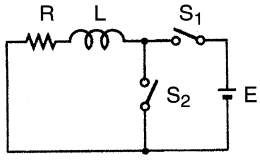
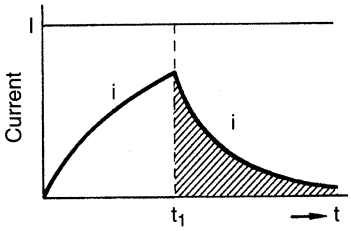
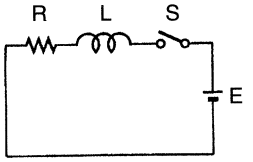
Circuit example		Applicability AC	Applicability DC	Features and remarks	Element selection
RC		Fair	Good	Load impedance must be much smaller than the RC circuit when the relay operates on an AC voltage.	Optimum C and R values are: C: 1 to 0.5 μF for 1-A contact current R: 0.5 to 1 Ω for 1-V contact voltage
		Good	Good	The release time of the contacts will be delayed when a relay solenoid is used as a load. This circuit is effective if connected across the load when the supply voltage is 24 to 48 V. When the supply voltage is 100 to 240 V, connect the circuit across the contacts.	These values do not always agree with the optimum values due to the nature of the load and the dispersion in the relay characteristics. Confirm optimum values experimentally. Capacitor C suppresses discharge when the contacts are opened, while resistor R limits the current applied when the contacts are closed the next time. Generally, employ a capacitor C whose dielectric strength is 200 to 300 V. If the circuit is powered by an AC power source, employ an AC capacitor (non-polarized).
Diode		Poor	Good	The energy stored in a coil (inductive load) reaches the coil as current via the diode connected in parallel with the coil, and is dissipated as Joule (measurable) heat by the resistance of the inductive load. This type of circuit delays the release time more than the RC type.	Employ a diode having a reverse breakdown voltage of more than 10 times the circuit voltage and a forward current rating greater than the load current. A diode having a reverse breakdown voltage two to three times that of the supply voltage can be used in an electronic circuit where the circuit voltage is not particularly high.
Diode + Zener diode		Poor	Good	This circuit effectively shortens release time in applications where the release time of a diode protection circuit proves to be too slow.	The zener diode breakdown voltage should be about the same as the supply voltage.
Varistor		Good	Good	By utilizing the constant-voltage characteristic of a varistor, this circuit prevents high voltages from being applied across the contacts. This circuit also somewhat delays the release time. This circuit, if connected across the load, is effective when the supply voltage is 24 to 48 V. If the supply voltage is 100 to 240 V, connect the circuit across the contacts.	---

Avoid use of a surge suppressor in the manner shown below.

	
This circuit arrangement is very effective for diminishing sparking (arcing) at the contacts, when breaking the circuit. However, since electrical energy is stored in C (capacitor) when the contacts are open, the current from C flows into the contacts when they close. Therefore, metal deposition is likely to occur between mating contacts.	This circuit arrangement is very useful for diminishing sparking (arcing) at the contacts when breaking the circuit. However, since the charging current to C flows into the contacts when they are closed, metal deposition is likely to occur between the mating contacts.

Although it is considered that switching a DC inductive load is more difficult than a resistive load, an appropriate contact protection circuit can achieve almost the same characteristics.

General Terms Relating to Inductive Loads

Term	Meaning
Power factor	With DC power, electric power is the product of a voltage and current. With AC power, however, electric power is the product of the voltage and current multiplied by the cosine of the phase difference between the voltage and current (cosf, called the power factor). In the electric circuit shown, the current (I) lags behind the voltage by f and the electric power (P) is EI cosf. The power factor can be obtained as follows (note: R = W, L = H, f = Hz): $\cos\phi = \frac{R}{\sqrt{R^2 + (2\pi fL)^2}}$    $t_1 = \frac{\phi}{2\pi f}$ In this formula, rad. is used as a unit for f. If the load is resistive only, cosf is 1 and if the load is inductive only, cosf is 0.
Time constant	If DC voltage is applied to a circuit with R and L, the current increases with time (t) and reaches the normal current (I) (refer to the figure below). The time constant (τ) is obtained from the intersection of the asymptotic line of the current (I) and the tangent line of the current increment curve (i) drawn from the origin. The time factor can be obtained as follows (Note: R = W, L = H, τ = s): $\tau = L/R$  
Inductive load	Transformers, solenoids, and electromagnetic switches are called inductive loads because they incorporate circuitry with R (the resistance of the coils) and L. The magnetic energy accumulated by inductance of an inductive load loses its destination when the contacts are open with the energy discharged as arc energy. This happens in both AC and DC circuits. If S_1 is closed with S_2 left open, DC applied to the circuit (refer to the figure) and then S_2 is closed upon opening S_1, the current change according to time is shown by the graph below. In this example, the shaded portion of energy instantly changes to arc energy.    In the case of an inductive load with an iron-core coil, a large energizing current flows at the moment AC is applied thus causing arcing. The contacts will wear if there is contact bounce.

TV Standard (UL/CSA)

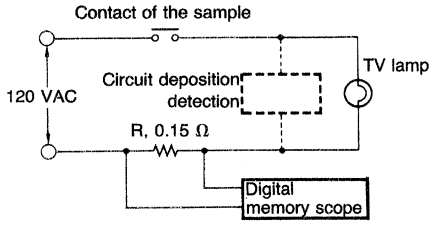
With fire accidents of TVs in the U.S.A. as a turning point, a new requirement corresponding to switches for use in TVs was enforced by UL from 1970. The CSA also enforced a new requirement almost the same as that of the UL from 1971. The switches for use in TVs were required to have the self-fire-extinguishing quality 94VE-0 in their shell material, be made of a noncombustible material with an anti-arcing ability of at least 180 seconds, and in addition to this, the open-hole area was regulated to less than a fixed amount and the contact portion had to withstand a tungsten lamp load including a difficult inrush current. Switches which passed this regulation were, for example, indicated as TV-4 and called TV-rated switches.

The standards which require these TV-rated switches include the Underwriter's Laboratories UL12780 (Radio Receivers, Audio Systems and Accessories), and the UL1410 (Television Receivers and Video Products), where the switches are used as power supply circuit control switches within the receiving equipment. Similarly, in the case of the CSA, the standard is the CSA C22, Z, No. 1 Power-Operated Radio, Television and Electronic Devices. Besides radio and TV receiving equipment these standards of course apply to associated amplifiers, cameras, transceivers, record players, recorders, tape players, and other similar devices used in the household.

Note that when the rated current of the switch is taken to be I, and the inrush current of the set is less than 21, use of a TV-rated switch is not necessary and it is possible to use a contemporary switch. Also note that in equipment including TVs, VTRs, and audio equipment, it is compulsory that the switching device used in the power supply circuit passes the TV standard. A tungsten lamp is used as the load in the switching test, and the characteristics of the lamp are established separately.

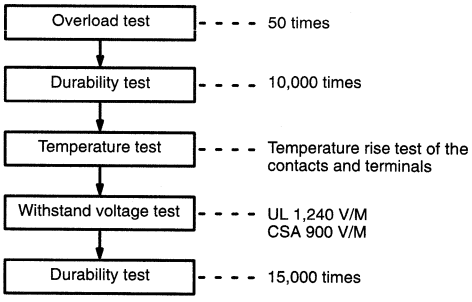
Test Method

In the circuit diagram below, the TV lamp is switched on and off and a switching test is performed to determine if switching can be performed without an irregularity for the number of times specified in the standard.



The inrush current and the steady-state current in the circuit of the above diagram are measured with a digital memory scope.

The overload test and the durability test are parts of the switching test. The tests are performed by the method indicated in the diagram below.



Overload and Durability Test Conditions Table/Test Current Values (Lamp Load) 120 VAC

In the overload test and the durability test, the respective inrush currents and steady-state currents have been set. For details, see the following table.

Rating of TV-relay Amp	Overload test				Durability test			
	Steady-state current (rms) (Amp)		Minimum inrush current (peak) (Amp)		Steady-state current (rms) (Amp)		Minimum inrush current (peak) (Amp)	
1	1.5		27		1		18	
2	3.0		51		2		35	
3	4.5		71		3		51	
4	6.0		91		4		65	
5	7.5		111		5		78	
	UL	CSA	UL	CSA	UL	CSA	UL	CSA
6	9.0	9.0	130	128	6	6	92	91
7	10.5		147		7		105	
8	12.0	12.0	163	163	8	8	117	117
9	13.5		178		9		130	
10	15.0	15.0	191	191	10	10	141	141
11	13.75		180		11		153	
12	15.0	16.5	191	198	12	12	163	156
13	16.25		201		13		173	
14	17.5		211		14		183	
15	18.75	18.8	215	215	15	15	191	191
16	20.0		226		16		199	
17	21.25		230		17		207	
18	22.5		239		18		214	
19	23.75		243		19		220	
20	25.0	25.0	247	247	20	20	226	226

■ Latching Relays

Avoid use in locations subject to excessive magnetic particles or dust.

Avoid use in magnetic fields (over 8,000 A.m).

Take measures to preventing problems caused by vibration or shock. Problems may originate from other relay(s) operating or releasing on the same panel.

Avoid simultaneous energization of the set and reset coils, even though both coils can be continuously energized.

Avoid use under conditions where excessive surge-generating sources exist in the coil power source.

When planning to mount multiple relays together, observe the minimum mounting interval of each type of relay.

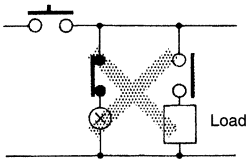
Drive Circuit (Double-winding Relays G5AK, G6AK, G6BK, etc.)

When a DC-switching latching relay is used in one of the circuits shown in the following diagram, the relay contacts may be released from the locked state unless a diode (enclosed in the dotted box in the circuit diagram) is connected to the circuit.

When connecting a diode to the relay circuit, be sure to use a diode with a repetitive peak-inverse voltage, and a DC reverse voltage sufficient to withstand external noise or surge. Also be sure that the diode has an average rectified current greater than the coil current.

If the contact of the relay is used to deenergize the relay, the relay may not operate normally. Avoid using the relay in a circuit like the one shown below:

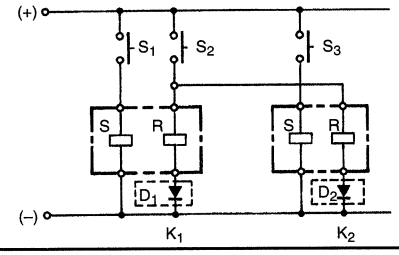
Incorrect Use:



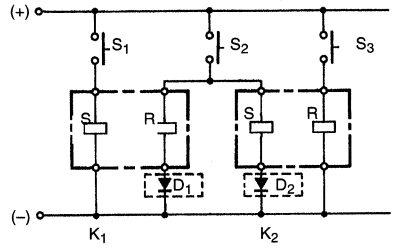
X_L: Latching relay
X_b: NC contact of relay

Circuits

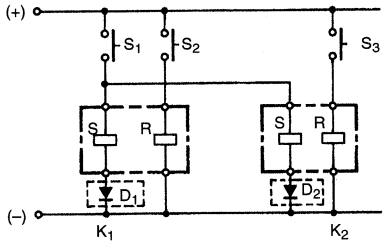
Circuit connecting two reset coils in parallel.



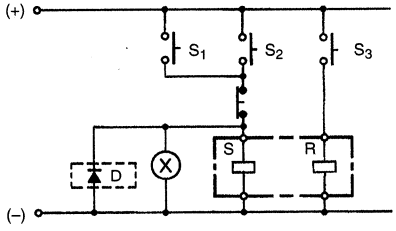
Circuit connecting set coil to reset coil.



Circuit connecting two set coils in parallel



Circuit connecting set coil of latching relay in parallel with another relay coil.



■ PCB Design

Soldering

As demands for more compact electronic devices have grown, so have demands declined for the plug-in relays that requires a bulky socket for connection. This trend has lead to the development of relays that can be soldered directly onto the PCB. Smaller relays have made possible great density increases on the PCB, which in turn reduces the size of the product or device. However, unless the relay is plastic-sealed, when soldered onto a PCB, flux may penetrate into the housing, adversely affecting the internal circuitry.
The following points will help when designing a product which uses relays. This section points out details to be noted when soldering a relay to a PCB.

PCB Selection

In general, relays are directly mounted and soldered onto a PCB. Although seemingly an uninvolved process, soldering and its related processes of flux application, relay mounting, heat application, and washing can be detrimental to a relay's performance. For example, if the PCB were to warp, the internal mechanism of the relay could become distorted, degrading the performance characteristics. Thus it could be said that the relay's characteristics are also affected by the size, thickness, and material of the PCB. Therefore, carefully select a PCB that will not jeopardize the performance of the relay.

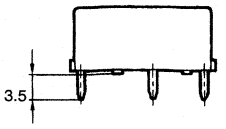
PCB Materials

Generally, the substrate of a PCB is made of glass epoxy (GE), paper epoxy (PE), or paper phenol (PP). Of these, the glass-epoxy or paper-epoxy PCB is recommended for mounting relays. See the following table.

Item	Epoxy-based		Phenol-based
	Glass epoxy (GE)	Paper epoxy (PE)	Paper phenol (PP)
Electrical characteristics	High insulation resistance. Insulation resistance hardly affected by humidity.	Fair	Insulation resistance degraded by humidity.
Mechanical characteristics	Little expansions/shrinkage caused by change in temperature or humidity. Suitable for thru-hole PCBs and multi-layered PCBs.	Fair	Much expansion/shrinkage caused by changes in temperature or humidity. Not suitable for thru-hole PCB.
Cost effectiveness	Expensive	Fair	Inexpensive

PCB Thickness

PCBs having a thickness of 0.8, 1.2, 1.6, or 2.0 mm are generally used. A PCB that is 1.6 mm thick is best for mounting a PCB relay, considering the weight of the relay and the length of the terminals. (The terminal length of OMRON relays is 3.5 or 4.0 to 5.0 mm.)



Terminal Hole Diameter and Land Diameter

Select the appropriate terminal hole and land diameters from the following table, based on the PCB mounting hole drawing. Land diameters may be reduced to less than those listed below if the thru-hole connection process is to be employed.

Terminal Hole and Land Diameters

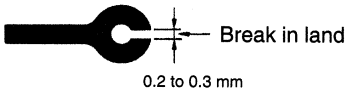
Terminal hole diameter		Minumum land diameter
Normal	Tolerance	
0.6 mm	±0.1%	1.5 mm
0.8 mm		1.8 mm
1.0 mm		2.0 mm
1.2 mm		2.5 mm
1.3 mm		2.5 mm
1.5 mm		3.0 mm
1.6 mm		3.0 mm
2.0 mm		3.0 mm

Shape of Lands

The land section should be on the center line of the copper-foil pattern, so that the soldered fillets become uniform.

Correct	
Incorrect	

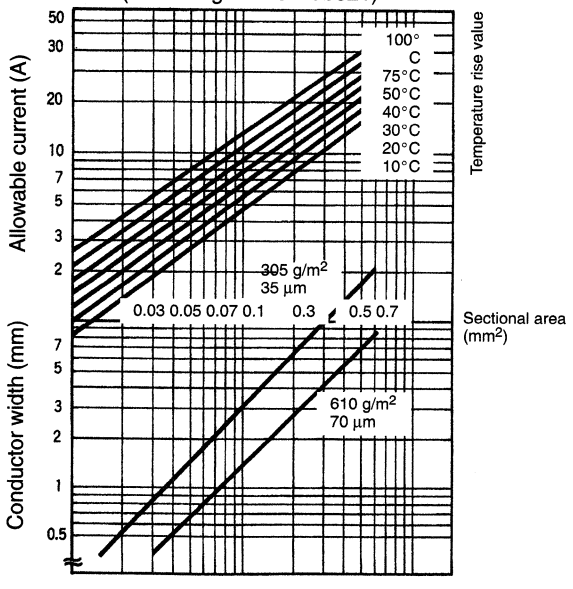
A break in the circular land area will prevent molten solder from filling holes reserved for components which must be soldered manually after the automatic soldering of the PCB is complete.



Conductor Width and Microstrip

The following thickness of copper foil are standard: 35 μm and 70 μm. The conductor width is determined by the current flow and allowable temperature rise. Refer to the chart below.

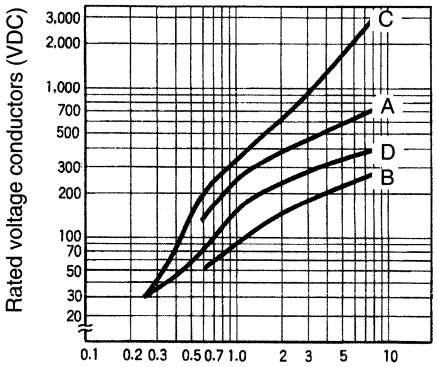
Conductor Width and Carry Current (according to IEC Pub321)



Conductor Pitch

The conductor pitch on a PCB is determined according to the insulation resistance between conductors and the environmental conditions under which the PCB is to be placed. The following graph shows the general relationship between the voltage between conductors and the conductor pitch on a PCB. However, if the PCB must conform to safety organization standards (such as UL, CSA, VDE, etc.), priority must be given to fulfilling their requirements.

Voltage between Conductors vs. Conductor Pitch



A = w/o coating at altitude of 3,000 m max.
B = w/o coating at altitude of 3,000 m or higher but lower than 15,000 m
C = w/coating at altitude of 3,000 m max.
D =w/coating at altitude of 3,000 m or higher

Temperature and Humidity

PCBs expand or contract with changes in temperature. Should expansion occur with a relay mounted on the PCB, the internal components of the relay may be shifted out of operational tolerance. As a result, the relay may not be able to operate with its normal characteristics.

PCB materials have "directionality," which means that a PCB generally has expansion and contraction coefficients 1/10 to 1/2 higher in the vertical direction than in the horizontal direction. Conversely, its warp in the vertical direction is 1/10 to 1/2 less than in the horizontal direction. Therefore, take adequate countermeasures against humidity by coating the PCB. Should heat or humidity be entirely too high, the relay's physical characteristics will likewise be affected. For example, as the heat rises the PCB's insulation resistance degrades. Mechanically, PCB parts will continue to expand as heat is applied, eventually passing the elastic limit, which will permanently warp components.

Moreover, if the relay is used in an extremely humid environment, silver migration may take place.

Gas

Exposure to gases containing substances such as sulfuric acid, nitric acid, or ammonia can cause malfunctions such as faulty contacting in relays. They can also cause the copper film of a PCB to corrode, or prevent positive contacts between the PCB's connectors. Of the gases mentioned, nitric acid is particularly damaging as it tends to accelerate the silver migration. As a countermeasures against gas exposure damage, the following processes on the relay and PCB have proved useful.

Item	Process
Outer casing, housing	Sealed construction by using packing, etc.
Relay	Use of simplified hermetically sealed type relay, DIP relay, reed relay
PCB, copper firm	Coating
Connector	Gold-plating, rhodium-plating process

Vibration and Shock

Although the PCB itself is not usually a source of vibration or shock, it may simplify or prolong the vibration by resonate with external vibrations or shocks. Securely fix the PCB, paying attention to the following points.

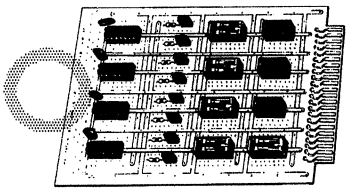
Relays

Mounting method	Process
Rack mounting	No gap between rack's guide and PCB
Screw mounting	Securely tighten screw. Place heavy components such as relays on part of PCB near where screws are to be used. Attach rubber washers to screws when mounting components that are affected by shock (such as audio devices.)

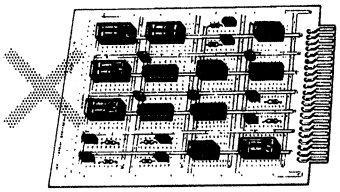
Mounting Position

Depending on where the relay is mounted, the function of the relay (and the performance of the circuit which includes the relay) may be adversely affected.
The relay may malfunction if it is mounted near a transformer or other device that generates a large magnetic field, or much heat. Provide an adequate distance between the relay and such devices.
Also, keep the relay away from semiconductor devices, if they are to be mounted on the same PCB.

Correct



Incorrect



Mounting Direction

To allow a relay to operate to its full capability, adequate consideration must be given to the mounting direction of the relay. Relay characteristics that are considerably influenced by mounting direction are shock resistance, life expectancy, and contact reliability.

Shock Resistance

Ideally, the relay must be mounted so that any shock or vibration is applied to the relay at right angles to the operating direction of the armature of the relay. Especially when a relay's coil is not energized, the shock resistance and noise immunity are significantly affected by the mounting direction of the relay.

Life Expectancy

When switching a heavy load that generates arc (generally, having a greater impedance than that of the relay coil), substances spattered from the contact may accumulate in the vicinity, resulting in degradation of the insulation resistance of the circuit. Mounting the relay in the correct direction is also important in preventing this kind of degradation of the insulation resistance.

Contact Reliability

Switching both a heavy and a minute load with a single relay contact is not recommended. The reason for this is that the substances scattered from the contact when the heavy load is switched degrade the contact when switching the minute load. For example, when using a multi-pole contact relay, avoid the mounting direction or terminal connections in which the minute load switching contact is located below the heavy load switching contact.

Mounting Interval

When mounting multiple relays side by side on a PCB, pay attention to the following points:

When many relays are mounted together, they may generate an abnormally high heat due to the thermal interference between the relays. Therefore, provide an adequate distance between the relays to dissipate the heat. When using a relay, be sure to check the minimum mounting interval.

Also, if multiple PCBs with relays are mounted to a rack, the temperature may rise. In this case, preventive measures must be taken so that the ambient temperature falls within the rated value.

Pattern Layout

Countermeasures Against Noise

The relay can be a noise source when viewed from a semiconductor circuit. This must be taken into consideration when designing the layout positioning of the relay and other semiconductor components on the PCB.

Keep the relay away from semiconductor components as far away as possible.

Locate the surge suppressor for the relay coil as close to the relay as possible.

Do not route wiring for signals such as audio signals that are likely to be affected by noise below the relay.

Design the shortest possible pattern.

One method for separating the power source and relay from other electronic components is to use shielded patterns.

Coating

As is also the case in humid environments, coating the PCB is recommended to prevent the insulation of its pattern form being degraded by gases containing harmful substances. When coating the PCB, however, care must be exercised not to allow the coating agent to penetrate into the relays mounted on the PCB; otherwise, faulty contact of the relay may occur due to sticking or coating. Moreover, some coating agents may degrade or adversely affect the relay. Select the coating agent carefully.

Type of Coating

Item	Applicability to PCB with relays mounted	Feature
Epoxy	Good	Good insulation. Performing this coating is a little difficult, but has no effect on relay contact.
Urethane	Good	Good insulation and easy to coat. Be careful not to allow the coating on the relay itself, as thinner-based solvents are often used with this coating.
Silicon	Poor	Good insulation and easy to coat. However, silicon gas may cause faulty contact of relay.

■ Automatic Mounting of Relay on PCB

Thru-hole Mounting

The following tables list the processes required for mounting a relay onto a PCB and the points to be noted in each process.

Process 1: Placement

Do not bend any terminal of the relay to use it as a self-clinching relay or the relay may malfunction.
It is recommended to use magazine-packaged self-clinching relays for placement onto the PCB.

Possibility of Automatic Placement

Construction	Unsealed	Flux protection	Plastic-sealed
Magazine-packaged relay	NO	YES	YES
Self-clinching relays			

Process 2: Flux Application

To apply flux to a flux protection or plastic-sealed relay, a sponge soaked with flux can be used. Place the relay in the holes drilled in the PCB and press the PCB (with the relay still mounted) firmly against the sponge. The flux will be pushed up the relay's contact legs, and through the PCB holes. This method must never be applied with an unsealed relay because the flux will penetrate into the relay.
The flux used with the sponge must be a non-corrosive resin-type flux.
For the flux solvent, use an alcohol-based solvent, which tends to be less chemically reactive.
Apply the flux sparingly and evenly to prevent penetration into the relay. When dipping the relay terminals into liquid flux, be sure to adjust the flux level, so that the upper surface of the PCB is not flooded with flux.

Possibility of Dipping Method

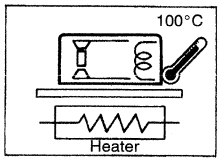
Unsealed	Flux protection	Plastic-sealed
NO	YES	YES

Process 3: Transportation

When the PCB is transported, the relay mounted on the PCB may be lifted from the board surface due to vibration. This can be prevented if the relay mounted on the PCB has self-clinching terminals.

Process 4: Preheating

Preheat the PCB at a temperature of 100°C maximum within a period of approximately one minute for smooth soldering. The characteristics of the relay may change if it is heated at a high temperature for a long time.



Possibility of Preheating

Unsealed	Flux protection	Plastic-sealed
NO	YES	YES

Process 5: Soldering

Flow soldering is recommended to assure a uniform solder joint.
- Solder: JIS Z3282, H60, or H63*
- Solder temperature and soldering time: 240°C, 3 s max.
- Adjust the level of the molten solder so that the PCB is not flooded with solder.

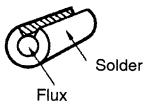
Possibility of Automatic Soldering

Unsealed	Fluxprotection	Plastic-sealed
Poor	Good	Good

Manual Soldering

Complete the soldering operation quickly. Use the correct wattage of soldering iron. Do not overheat while smoothing the applied solder with the tip of the iron.
- Solder: JIS Z3282, H60, or H63 (containing resin-type flux)
- Soldering iron: rated at 30 to 60 W
- Tip temperature: 280°C to 300°C
- Soldering time: 3 s max.
- The following table contains recommended solders:

Type	Sparkle solder
Applicable solder diameter	0.8 to 1.6 mm
Sn	58.8%
Flux content	1.67%
Impurities	JIS Z3282 Class A
Spread rate	90%
Storage	3 months max.



The solder in the illustration shown above is provided with a cut section to prevent the flux from splattering.

Possibility of Manual Soldering

Unsealed	Flux protection	Plastic-sealed
Good	Good	Good

Process 6: Cooling

Upon completion of automatic soldering, use a fan or other device to forcibly cool the PCB. This helps prevent the relay and other components from deteriorating from the residual heat of soldering.

Plastic-sealed relays are washable. Do not, however, put plastic-sealed relays in a cold cleaning solvent immediately after soldering or the plastic seals may be damaged.

Fluxprotection	Plastic-sealed
Necessary	Necessary

Process 7: Cleaning

Avoid cleaning the soldered terminals whenever possible. When a resin-type flux is used, no cleaning is necessary. If cleaning cannot be avoided, exercise care in selecting an appropriate cleaning solvent.

Cleaning Method

Unsealed	Fluxprotection	Plastic-sealed
Boiling cleaning and immersion cleaning are not possible. Clean only the back of the PCB with a brush.		Boiling cleaning and immersion cleaning are possible. Ultrasonic cleaning may have an adverse effect on the performance of relays not specifically manufactured for ultrasonic cleaning. When cleaning the G2R or any other relay, the ambient temperature must be within the permissible ambient operating temperature range of the relay.

List of Cleaning Solvents

Solvent		Flux protection	Plastic-sealed
Chlorine-based	■ Perochlene ■ Chlorosolder ■ Trichloroethylene	NO	YES
Freon-based	■ HCFC-1416 (see note 4)	NO	YES (see note 5)
Water-based	■ Indusco ■ Holys	YES	YES
Alcohol-based	■ IPA ■ Ethanol	YES	YES
Others	■ Thinner ■ Gasoline	NO	NO
Cleaning method		Manual cleaning Clean only bottom surface of PCB.	Automatic cleaning Ultrasonic cleaning (see note 6)

Note:
1. Consult your OMRON representative before using any other cleaning solvent. Do not use Freon-TMC-based, thinner-based, or gasoline-based cleaning solvents.
2. Worldwide efforts are being made at discontinuing the use of CFC-113-based (fluorochlorocarbon-based) and trichloroethylene-based cleaning solvents. The user is requested to refrain from using these cleaning solvents
3. It may be difficult to clean the space between the relay and PCB using hydrogen-based or alcohol-based cleaning solvent. It is recommended the stand-off-type be used G6A-_–ST when using hydrogen-based or alcohol-based cleaning solvents.
4. There will be restrictions on the usage of HCFC-1416 in the future.
5. Freon-based cleaning solvents cannot be used for relays with transparent cases made of polycarbonate resin.
6. Ultrasonic cleaning may have an adverse effect on the performance of relays not specifically manufactured for ultrasonic cleaning. Please refer to the model number to determine if your relay is intended to be cleaned ultrasonically.

Process 8: Coating

Do not apply a coating agent to any flux-resistant relay or relay with a case because the coating agent will penetrate into the relay and the contacts may be damaged.
Some coating agents may damage the case of the relay. Be sure to use a proper coating agent.
Do not fix the position of relay with resin or the characteristics of the relay will change.

Resin	Plastic-sealed
Epoxy	Good
Urethan	Good
Silicone	Poor

Surface Mounting

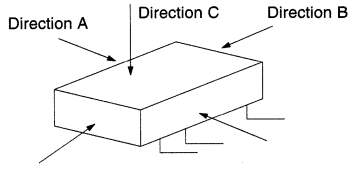
The following tables list the processes required for mounting a relay onto a PCB and the points to be noted in each process.

Process 1: Cream Solder Printing

Do not use a cream solder that contains a flux with a large amount of chlorine or the terminals of the relay may be corroded.

Process 2: Relay Mounting

The holding force of the relay holder must be the same as or more than the minimum holding force value required by the relay.



Direction	G6S	G6H
A	200 gf max	200 gf max.
B	500 gf max.	500 gf max.
C	200 gf max.	200 gf max.

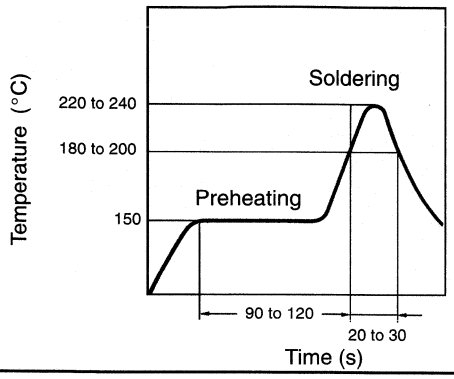
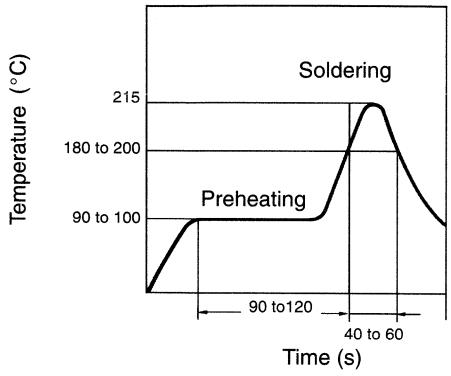
Process 3: Transportation

The relay may be dismounted by vibration during transportation. To prevent this, it is recommended an adhesive agent be applied to the relay's gluing part (protruding part) to tack the relay.

Adhesive Agent Application Methods

Dispenser method	Screen-printing method
YES	YES

Process 4: Soldering Reflow

IRS (infrared soldering)	VPS (vapor-phase soldering)
The following recommended soldering conditions show the temperature changes of the PCB surface. The conditions vary with the relay model. Do not put the relay in a cold cleaning solvent immediately after soldering or the seal of the relay may be damaged. **Recommended IRS Conditions (G6H-2F)**  	Do not put the relay in a cold cleaning solvent immediately after soldering or the seal of the relay may be damaged. **Recommended VPS Conditions** 

Process 5: Cleaning

Boiling cleaning and immersion cleaning are recommended.
Ultrasonic cleaning may have an adverse effect on the performance of relays not specifically manufactured for ultrasonic cleaning.

List of Cleaning Solvent

Solvent		Flux protection	Plastic-sealed
Chlorine-based	■ Perochlene ■ Chlorosolder ■ Trichloroethylene	NO	YES
Freon-based	■ HCFC-1416 (see note 4)	NO	YES (see note 5)
Water-based	■ Indusco ■ Holys	YES	YES
Alcohol-based	■ IPA ■ Ethanol	YES	YES
Others	■ Thinner ■ Gasoline	NO	NO
Cleaning method		Manual cleaning Clean only bottom surface of PCB.	Automatic cleaning Ultrasonic cleaning (see note 6)

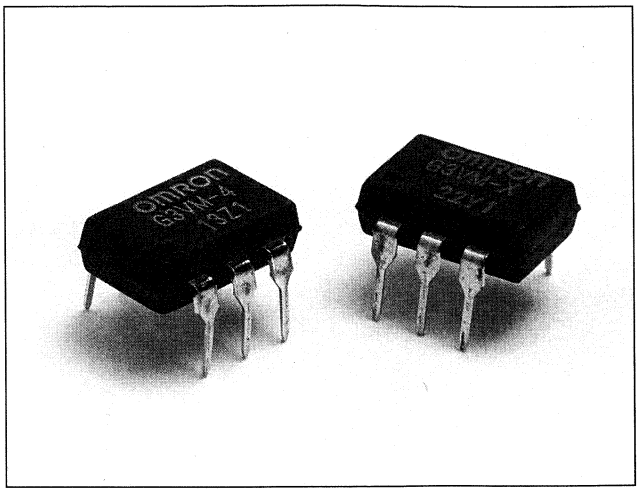
Note:
1. Consult your OMRON representative before using any other cleaning solvent. Do not use Freon-TMC-based, thinner-based, or gasoline-based cleaning solvents.
2. Worldwide efforts are being made at discontinuing the use of CFC-113-based (fluorochlorocarbon-based) and trichloroethylene-based cleaning solvents. The user is requested to refrain from using these cleaning solvents
3. It may be difficult to clean the space between the relay and PCB using hydrogen-based or alcohol-based cleaning solvent. It is recommended the stand-off-type be used G6A-□-ST when using hydrogen-based or alcohol-based cleaning solvents.
4. There will be restrictions on the usage of HCFC-1416 in the future.
5. Freon-based cleaning solvents cannot be used for relays with transparent cases made of polycarbonate resin.
6. Ultrasonic cleaning may have an adverse effect on the performance of relays not specifically manufactured for ultrasonic cleaning. Please refer to the model number to determine if your relay is intended to be cleaned ultrasonically.

OMRON

MOS FET Relay

G3VM

SSR for Switching Analog Signals, with an Isolation Value of 2.5 kVAC between Input and Output Terminals



- Switching minute analog signals.
- Linear voltage and current characteristics.
- Switching AC and DC.
- Ultra-highly sensitive and subminiature SSR assuring long life.
- Low ON-resistance.
- Low current leakage between output terminals when they are open.
- Surface-mounting-type models are also available.

Ordering Information

Model Number Legend:

G3VM - □ □
1 2

1. Load Voltage
X: A load voltage of 60 VDC or 60 VAC (peak value)
4: A load voltage of 400 VDC or 400 VAC (peak value)

2. Terminal
None: PCB terminals
F: Surface-mounting terminals

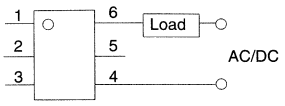
Contact form	Terminals	Load voltage	Model
SPST-NO	PCB terminals	60 VAC (peak value)	G3VM-X
		400 VAC (peak value)	G3VM-4
	Surface-mounting terminals	60 VAC (peak value)	G3VM-XF
		400 VAC (peak value)	G3VM-4F

Specifications

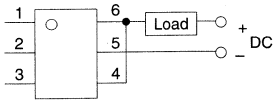
■ Absolute Maximum Ratings (Ta = 25°C)

Item		G3VM-X/-XF	G3VM-4/-4F	Conditions
Input	LED forward current	20 mA		---
	Repetitive peak LED forward current	40 mA		Duty: 50% max.; pulse width: 100 ms max.
	Excessive peak LED forward current	100 mA		Duty: 1% max.; pulse width: 0.2 ms max.
	LED reverse voltage	3 V		---
Output	Output dielectric strength	–60 to 60 V	–400 to 400 V	DC or AC peak value; AC connection (see note 1)
		0 to 60 V	0 to 400 V	DC; DC parallel connection (see note 2)
	Continuous load current	500 mA	150 mA	AC connection (see note 1)
		650 mA	200 mA	DC parallel connection (see note 2)
	Peak load current	3.5 A	1.0 A	Pulse width: 100 ms max. per shot
	Output permissible loss	425 mW		–5 mW/°C 40°C
Dielectric strength between I/O terminals		2,500 VAC		1 min
Ambient temperature		Operating: –40°C to 85°C Storage: –55°C to 125°C		With no icing and condensation
Max. soldering temperature and time		260°C		5 s

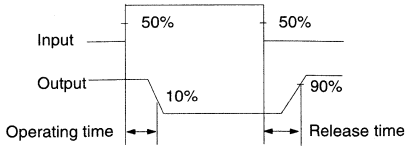
Note: 1. **AC Connection**



2. DC Parallel Connection



3. Operate and Release Times

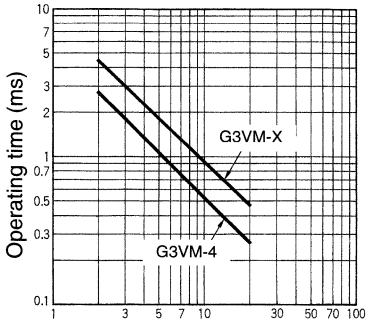


■ Characteristics (Ta = 25°C)

Item	G3VM-X/-XF	G3VM-4/-4F	Conditions
ON-resistance	0.7 Ω max.	10.0 Ω max.	AC connection I_F = 10 mA, I_O = 500/150 mA (see note 1)
	0.18 Ω max.	2.5 Ω max.	DC parallel connection I_F = 10 mA, I_O = 650/200 mA (see note 2)
Current leakage when the relay is open	1.0 μA		V_F = 0.8 V, V_O = 60/400 V
LED forward current	1.3 V min., 1.85 V max.		I_F = 10 mA
Capacity between input and output terminals	Approx. 1.0 pF		1 MHz
Insulation resistance between input and output	1,000 MΩ min.		500 VDC
Operate time	1.4 ms max.	0.95 ms max.	I_F = 10 mA (see note 3)
Release time	0.1 ms max.	0.1 ms max.	I_F = 0 mA (see note 3)

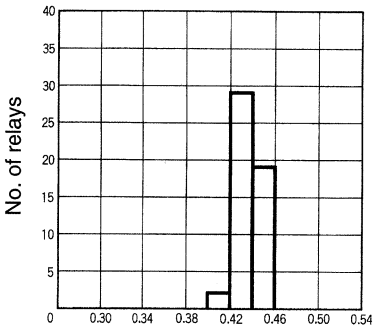
Engineering Data

Operating Time vs. LED Forward Current

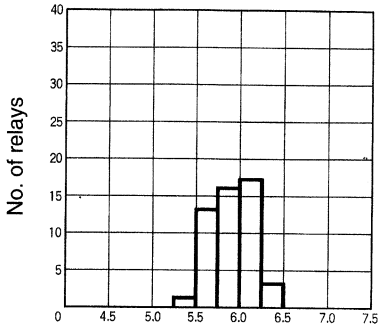


Distribution of ON-resistance (AC Connection)

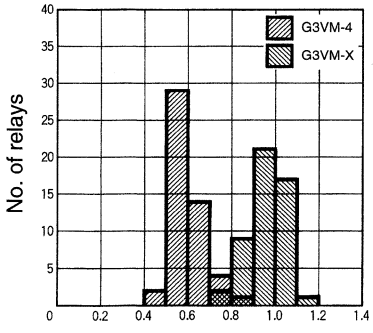
G3VM-X



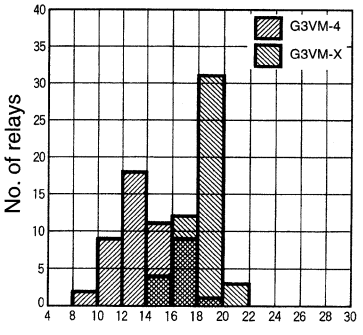
G3VM-4



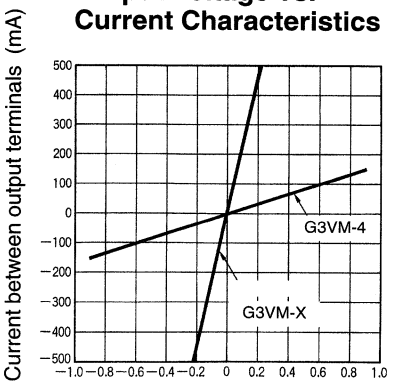
Distribution of Operating Time



Distribution of Release Time

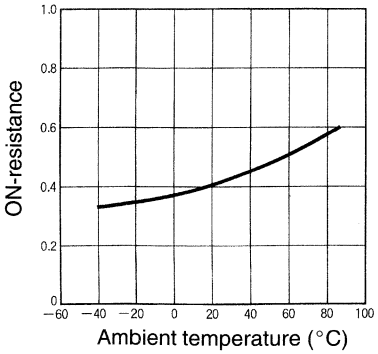


Output Voltage vs. Current Characteristics

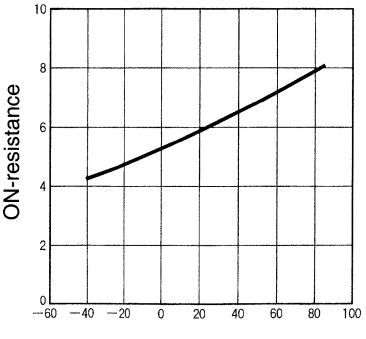


ON-resistance vs. Ambient Temperature

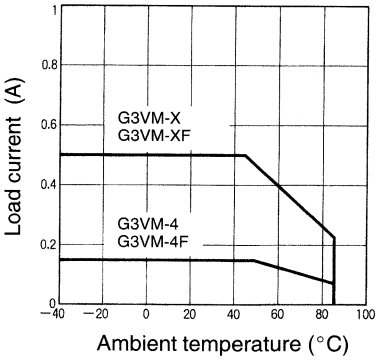
G3VM-X



G3VM-4



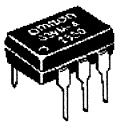
Load Current vs. Ambient Temperature Characteristi

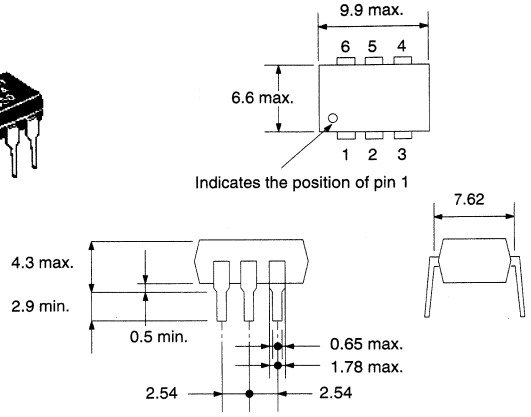


Relays

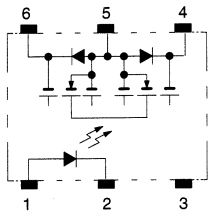
Dimensions

G3VM-X
G3VM-4

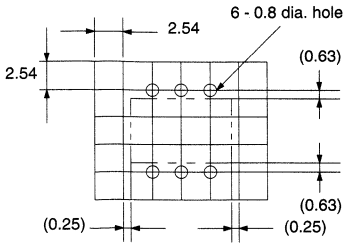




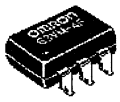
Terminal Arrangement/ Internal Connections (Bottom View)

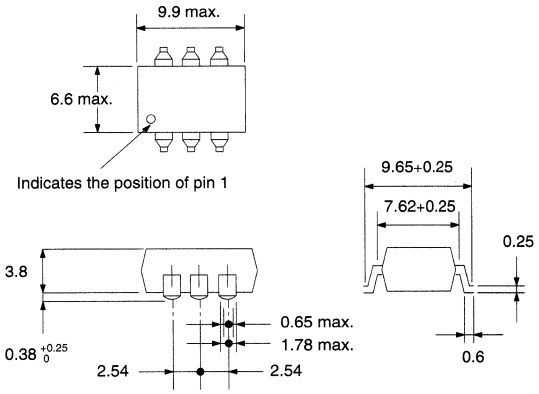


PCB Dimensions (Bottom View)

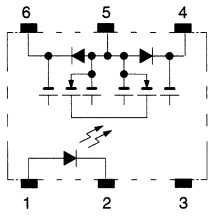


G3VM-XF
G3VM-4F

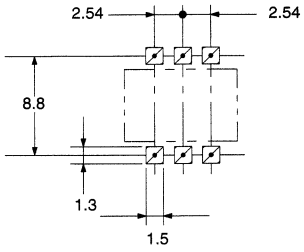




Terminal Arrangement/ Internal Connections (Bottom View)



Actual Mounting Pad Dimensions (Recommended Value, Top View)



Note: Mounting pad dimensions shown are a top view.

Precautions

Recommended Operating Conditions

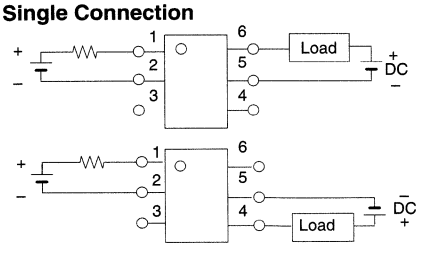
Use the G3VM under the following conditions so that the relay will operate accurately.

Item	Min.	Type	Max.
Operating LED forward current	5 mA	10 mA	20 mA
Releasing LED forward current	0 V	---	0.8 V

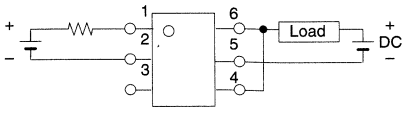
Load Connection

Do not short-circuit the input and output terminals while the relay is operating or the relay may malfunction.

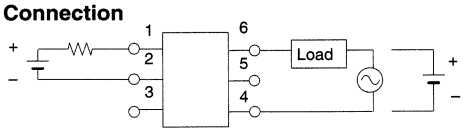
DC Single Connection



DC Parallel Connection

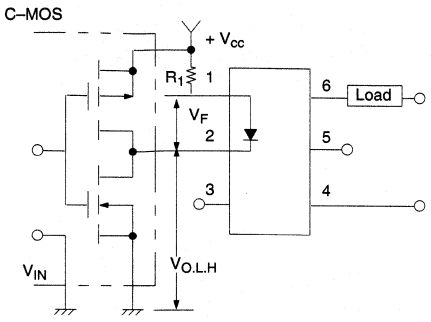


AC Connection

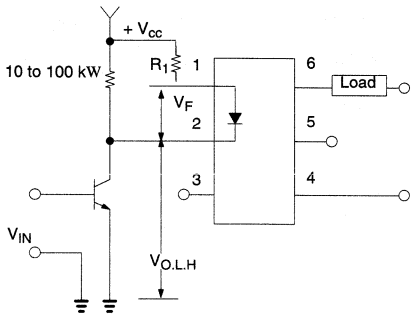


Typical Relay Driving Circuit Examples

C-MOS



Transistor



Use the following formula to obtain the LED current limiting resistance value to assure that the relay operates accurately.

$$R_1 = \frac{V_{CC} - V_{OL} - V_F\ (ON)}{5 \text{ to } 20 \text{ mA}}$$

Use the following formula to obtain the LED forward voltage value to assure that the relay releases accurately.

$$V_{F\ (OFF)} = V_{CC} - V_{OH} < 0.8 \text{ V}$$

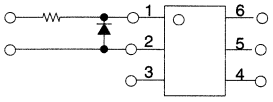
Destruction of MOS FET by Static Electricity

Handle the relay with utmost care in order to avoid the destruction of the relay by static electricity.

Protection from Surge Voltage on the Input Terminals

If any reversed surge voltage is imposed on the input terminals, insert a diode in parallel to the input terminals as shown in the following circuit diagram and do not impose a reversed voltage value of 3 V or more.

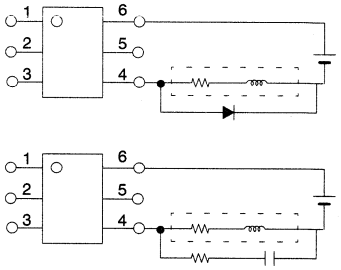
Surge Voltage Protection Circuit Example



Protection from Spike Voltage on the Output Terminals

If a spike voltage exceeding the absolute maximum rated value is generated between the output terminals, insert a C-R snubber or clamping diode in parallel to the load as shown in the following circuit diagram to limit the spike voltage.

Spike Voltage Protection Circuit Example



Unused Terminals

Terminal 3 is connected to the internal circuit. Do not connect anything to terminal 3 externally.

Relays

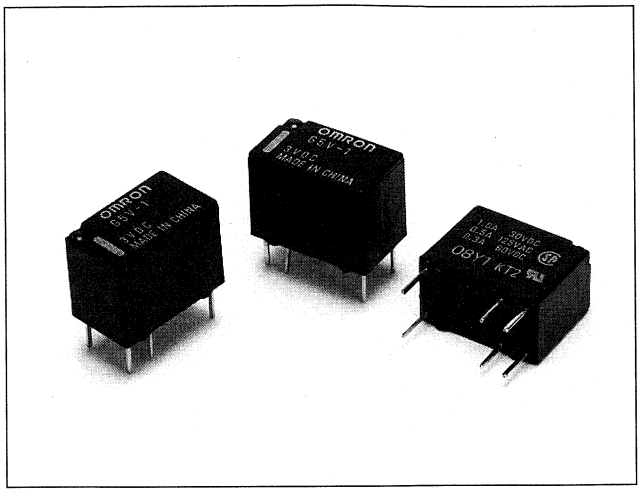
OMRON

PCB Relay

G5V-1

Ultra-miniature, Highly Sensitive SPDT Relay for Signal Circuits

- Ultra-miniature at 12.5 x 7.5 x 10 mm (W x L x H).
- Wide switching capacity of 1 mA to 1 A.
- High sensitivity: 150 mW nominal coil power.
- Plastic-sealed construction.
- International 2.54-mm terminal pitch.
- Impulse withstand voltage meets FCC Part 68 requirements.
- UL508 (File No. E41515)/CSA C22.2 No.14 (File No. LR24825) Approval.



Ordering Information

Classification				Model
Contact form	Contact type	Contact material	Structure	
SPDT	Single crossbar	Ag + Au-clad	Plastic-sealed	G5V-1

Note: When ordering, add the rated coil voltage to the model number.
Example: G5V-1 12 VDC
Rated coil voltage

Model Number Legend:

G5V - □ □ VDC
1 2

1. **Contact Form**
   1: SPDT
2. **Rated Coil Voltage**
   3, 5, 9, 12, 24 VDC

Specifications

■ Coil Ratings (at 23°C Ambient)

Rated voltage		3 VDC	5 VDC	9 VDC	12 VDC	24 VDC
Rated current		50 mA	30 mA	16.7 mA	12.5 mA	6.25 mA
Coil resistance		60 Ω	167 Ω	540 Ω	960 Ω	3,840 Ω
Coil inductance (H) (ref. value)	Armature OFF	0.05	0.15	0.45	0.85	3.48
	Armature ON	0.11	0.29	0.93	1.63	6.61
Must operate voltage		80% max. of rated voltage				
Must release voltage		10% min. of rated voltage				
Max. voltage		200% of rated voltage at 55°C, 160% at 70°C				
Power consumption		Approx. 150 mW				

Note: 1. The rated current and coil resistance are measured at a coil temperature of 23°C with a tolerance of ±10%.

■ Contact Ratings

Load	Resistive load (cosØ = 1)
Rated load	0.5 A at 125 VAC; 1 A at 24 VDC
Contact material	Ag + Au-clad
Rated carry current	2 A
Max. switching voltage	125 VAC, 60 VDC
Max. switching current	1 A
Max. switching capacity	62.5 VA, 30 W
Min. permissible load	1 mA at 5 VDC

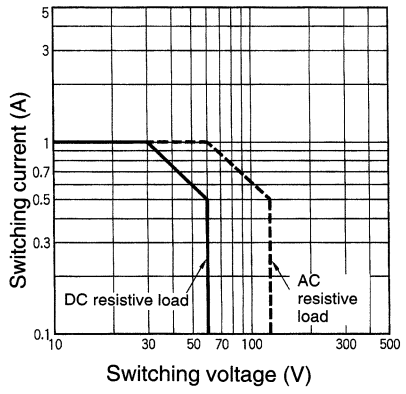
Note: P level: $\lambda_{60} = 0.1 \times 10^{-6}$/operation

■ Characteristics

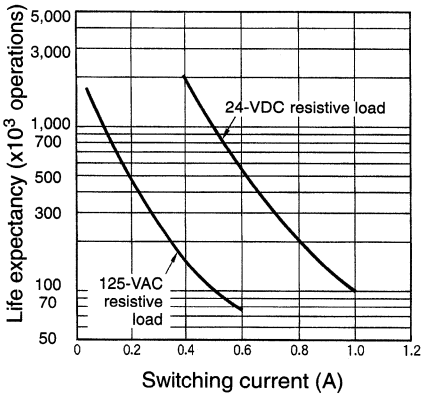
Contact resistance	100 mΩ max.
Operate time	5 ms max. (mean value: approx. 2.5 ms)
Release time	5 ms max. (mean value: approx. 0.9 ms)
Bounce time	Operate: approx. 0.2 ms Release: approx. 5 ms
Max. operating frequency	Mechanical: 36,000 operations/hr Electrical: 1,800 operations/hr (under rated load)
Insulation resistance	1,000 MΩ min. (at 500 VDC between coil and contacts, at 250 VDC between contacts of same polarity.)
Dielectric withstand voltage	1,000 VAC, 50/60 Hz for 1 min between coil and contacts 400 VAC, 50/60 Hz for 1 min between contacts of same polarity
Impulse withstand voltage	1,500 V 10 x 160 μs between coil and contacts (conforms to FCC Part 68)
Vibration resistance	Destruction: 10 to 55 Hz, 3.3-mm double amplitude Malfunction: 10 to 55 Hz, 3.3-mm double amplitude
Shock resistance	Destruction: 1,000 m/s^2 (approx. 100G) Malfunction: 100 m/s^2 (approx. 10G)
Life expectancy	Mechanical: 5,000,000 operations min. (at 18,000 operations/hr) Electrical: 100,000 operations min. (under rated load, at 18,000 operations/hr)
Ambient temperature	Operating: –40°C to 70°C (with no icing) Storage: –40°C to 70°C (with no icing)
Ambient humidity	Operating: 35% to 85%
Weight	Approx. 2.2 g

Engineering Data

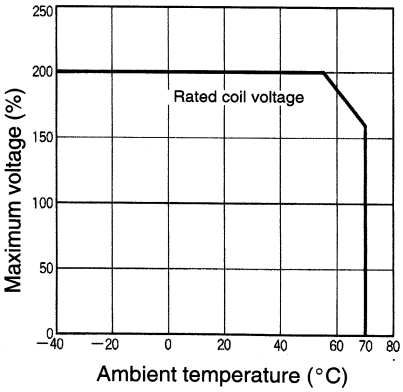
Max. Switching Capacity



Life Expectancy

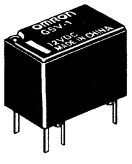


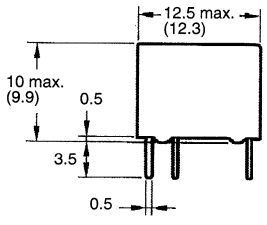
Ambient Temperature vs. Maximum Voltage

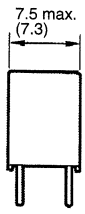


Dimensions

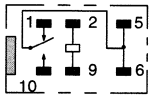
Note: 1. Tolerance: ±0.1
2. Numbers in parentheses are reference values.
3. Orientation marks are indicated as follows:



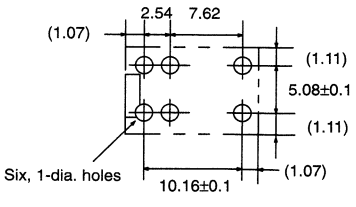




Terminal Arrangement/ Internal Connections (Bottom View)



Mounting Holes (Bottom View)



Relays

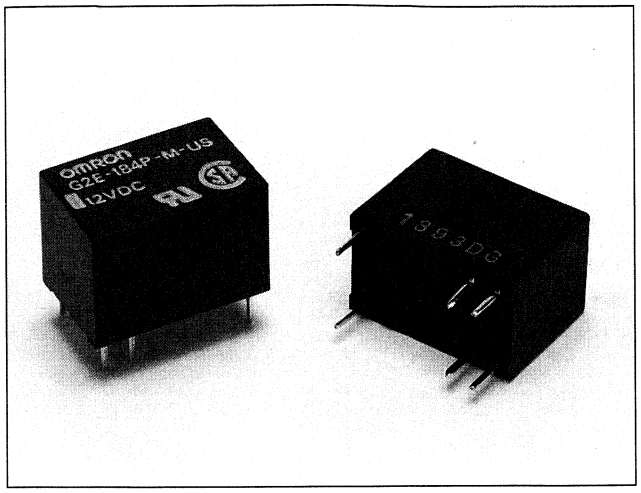
OMRON

PCB Relay

G2E

Miniature, Single-pole PCB Relay

- Miniature: 15.5 x 10.5 x 11.5 mm (W x L x H).
- Low power consumption: 200 mW.
- Bifurcated crossbar contacts available.
- Gold-clad contacts.
- Ideal for telecommunications equipment and security systems.



Ordering Information

Contact		General-purpose	High-sensitivity
		Plastic-sealed	**Plastic-sealed**
SPDT, Single Crossbar	Standard	G2E-184P-M	G2E-184P-H-M
	UL, CSA certfied	G2E-184P-M-US	G2E-184P-H-M-US

Note: When ordering, add the rated coil voltage to the model number.
Example: G2E-184P-M 12 VDC
Rated coil voltage

Model Number Legend:

G2E - □ □ □ □ - □ - □ - □ - □ □ **VDC**
1 2 3 4 5 6 7 8 9

1. **Contact Form**
   1: SPDT
2. **Contact Type**
   3: Bifurcated crossbar (consult Omron for details)
   8: Single crossbar
3. **Enclosure Rating**
   4: Plastic-sealed
4. **Terminals**
   P: Straight PCB
5. **Contacts**
   None: General-purpose
   HD: FCC certified
6. **Power Consumption**
   None: General-purpose (450 mW)
   H: High-sensitivity (200 mW)
7. **Classification**
   M: General-purpose
8. **Approved Standards**
   None: Not certified (OMRON standard)
   US: UL, CSA certified
9. **Rated Coil Voltage**
   5, 6, 9, 12, 24 VDC

Specifications

■ Coil Ratings

General-purpose Relays

Rated voltage		5 VDC	6 VDC	9 VDC	12 VDC	24 VDC
Rated current		89.3 mA	75 mA	50 mA	37.5 mA	18.8 mA
Coil resistance		56 Ω	80 Ω	180 Ω	320 Ω	1,280 Ω
Coil inductance	**Armature OFF**	0.044	0.067	0.137	0.229	0.94
(H) (ref. value)	**Armature ON**	0.091	0.136	0.297	0.496	2.1
Must operate voltage		70% max. of rated voltage				
Must release voltage		10% min. of rated voltage				
Max. voltage		120% of rated voltage at 23°C, 110% at 60°C				
Power consumption		Approx. 450 mW				

High-sensitivity Relays

Rated voltage		5 VDC	6 VDC	9 VDC	12 VDC	24 VDC
Rated current		41.7 mA	33.3 mA	22.5 mA	17.1 mA	8.6 mA
Coil resistance		120 Ω	180 Ω	400 Ω	700 Ω	2,800 Ω
Coil inductance (H) (ref. value)	**Armature OFF**	0.055	0.083	0.165	0.228	1.465
	Armature ON	0.092	0.129	0.303	0.504	2.287
Must operate voltage		80% max. of rated voltage				
Must release voltage		10% min. of rated voltage				
Max. voltage		140% of rated voltage at 23°C, 130% at 65°C				
Power consumption		Approx. 200 mW				

Note: 1. The rated current and coil resistance are measured at a coil temperature of 23°C with a tolerance of ±10%.
2. Operating characteristics are measured at a coil temperature of 23°C.

■ Contact Ratings

Item	Single crossbar		Bifurcated crossbar	
Load	Resistive load (cosØ = 1)	Inductive load (cosØ = 0.4; L/R = 7 ms)	Resistive load (cosØ = 1)	Inductive load (cosØ = 0.4; L/R = 7 ms)
Rated load	0.5 A at 110 VAC; 1 A at 24 VDC	0.2 A at 110 VAC; 0.3 A at 24 VDC	0.5 A at 110 VAC; 1 A at 24 VDC	0.2 A at 110 VAC; 0.3 A at 24 VDC
Contact material	AgPd (Au-clad)			
Rated carry current	2 A			
Max. switching voltage	125 VAC, 60 VDC			
Max. switching current	1 A			
Max. switching capacity	120 VA, 30 W	60 VA, 15 W	120 VA, 30 W	60 VA, 15 W
Min. permissible load	1 mA at 5 VDC		0.1 mA at 0.1 VDC	

Note: P level: $\lambda_{60} = 0.1 \times 10^{-6}$/operation

■ Characteristics

Contact resistance	50 mΩ max.
Operate time	General-purpose type: 5 ms max. (mean value: approx. 2.5 ms) High-sensitivity type: 7 ms max. (mean value: approx. 3.5 ms)
Release time	3 ms max. (mean value: approx. 0.8 ms)
Bounce time	Operate: 0.8 ms max. (high-sensitivity type: approx. 0.6 ms) Release: 4.4 ms max. (high-sensitivity type: approx. 5.4 ms)
Max. operating frequency	Mechanical: 18,000 operations/hr Electrical: 1,800 operations/hr (under rated load)
Insulation resistance	100 MΩ min. (at 500 VDC)
Dielectric withstand voltage	500 VAC, 50/60 Hz for 1 min between coil and contacts 500 VAC, 50/60 Hz for 1 min between contacts of same polarity
Vibration resistance	Destruction: 10 to 55 Hz, 3.3-mm double amplitude Malfunction: 10 to 55 Hz, 3.3-mm double amplitude
Shock resistance	Destruction: 1,000 m/s^2 (approx. 100G) Malfunction: 200 m/s^2 (approx. 20G)
Life expectancy	Mechanical: 10,000,000 operations min. (at 18,000 operations/hr) Electrical: DC: 500,000 operations min. (1 A at 24 VDC resistive load) AC: 200,000 operations min. (0.5 A at 110 VAC resistive load) (at 1,800 operations/hr)
Ambient temperature	Operating: –25°C to 60°C (with no icing) (high-sensitivity type: –25°C to 65°C)
Ambient humidity	Operating: 35% to 85%
Weight	Approx. 3.7 g

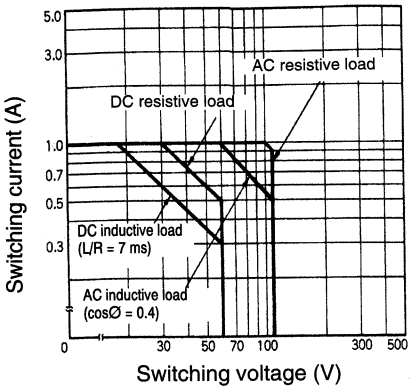
■ Approved Standards

UL114, UL478, UL1950 (File No. E41515)/CSA C22.2 No.0, No.14 (File No. LR34815-97)

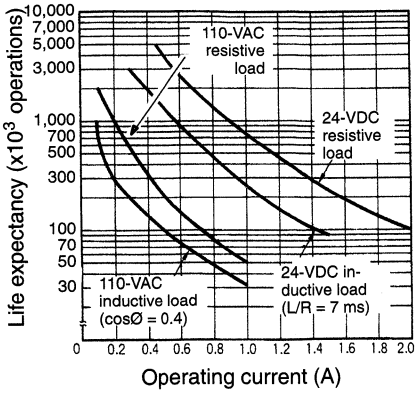
Model	Contact form	Coil ratings	Contact ratings
G2E-184P-M-US G2E-184P-H-M-US G2E-134P-M-US G2E-134P-H-M-US	SPDT	1.5 to 24 VDC	0.5 A, 125 VAC (general use) 1 A, 28 VDC (resistive)

Engineering Data

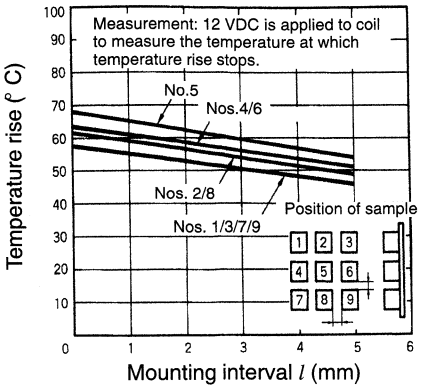
Max. Switching Capacity G2E-184P-M



Life Expectancy G2E-184P-M

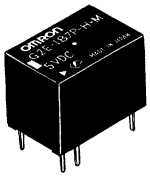


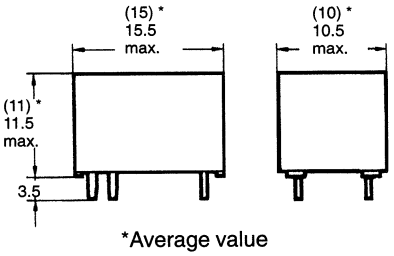
Coil Temperature Rise G2E-184P-M 12 VDC



Dimensions

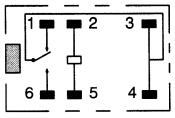
Note: 1. Orientation marks are indicated as follows: ▩ □





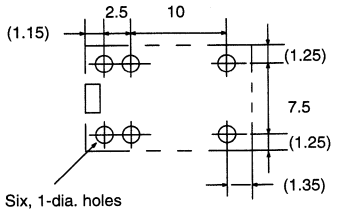
*Average value

Terminal Arrangement/ Internal Connections (Bottom View)



Mounting Holes (Bottom View)

Tolerance: ±0.1



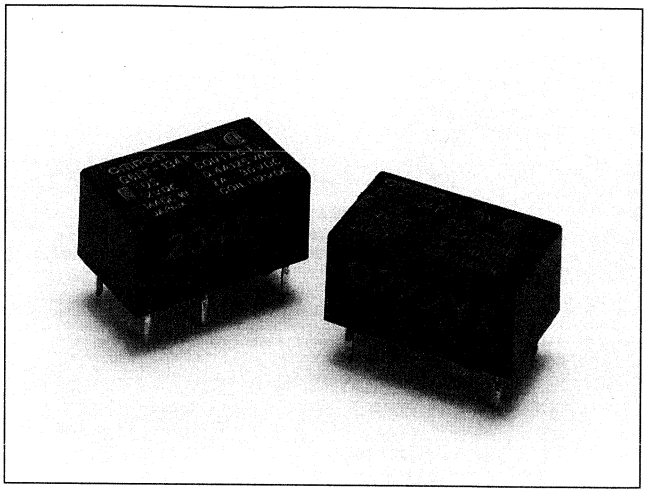
OMRON

PCB Relay

G6E

Subminiature, Sensitive SPDT Signal Switching Relay

- Can switch mains voltage – 240 VAC.
- High sensitivity: 98 mW pickup coil power.
- Impulse withstand voltage meets FCC Part 68 requirements.
- Plastic-sealed construction.
- Unique moving loop armature reduces relay size, magnetic interference, and contact bounce time.
- Single- and double-winding latching types also available.



Ordering Information

Contact form	Terminal	Single-side stable	Single-winding latching	Double-winding latching
SPDT Bifurcated crossbar	Straight terminal	G6E-134P-US	G6EU-134P-US	G6EK-134P-US

Note: When ordering, add the rated coil voltage to the model number.
Example: G6E-134P-US 12 VDC
Rated coil voltage

Model Number Legend:

G6E □ - □ □ □ □ - □ - □ - □ □ VDC
1 2 3 4 5 6 7 8 9

1. **Relay Function**
   None: Single-side stable
   U: Single-winding latching
   K: Double-winding latching
2. **Contact Form**
   1: SPDT
3. **Contact Type**
   3: Bifurcated crossbar Ag (Au-clad) contact
   9: Bifurcated crossbar AgNi (Au-clad) contact
4. **Enclosure Rating**
   4: Plastic-sealed
5. **Terminals**
   P: Straight PCB
6. **Stand-off**
   ST: Stand-off 0.64 mm
7. **Approved Standards**
   US: UL, CSA certified
8. **Special Function**
   U: For ultrasonically cleanable
9. **Rated Coil Voltage**
   3, 5, 6, 9, 12, 24, 48 VDC

Specifications

■ Approved Standards

UL508 (File No. E41515)/CSA C22.2, No.14 (File No. LR31928)

Contact form	Coil ratings	Contact ratings	
SPDT	1.5 to 48 VDC	0.2 A, 250 VAC (general use) 2 A, 30 VDC (resistive)	0.6 A, 125 VAC (general use) 0.6 A, 125 VDC (resistive, Ag contact only)

■ Coil Ratings

Single-side Stable, Bifurcated Crossbar Contact Type

Rated voltage		3 VDC	5 VDC	6 VDC	9 VDC	12 VDC	24 VDC	48 VDC
Rated current		66.7 mA	40 mA	33.3 mA	22.2 mA	16.7 mA	8.3 mA	8.3 mA
Coil resistance		45 Ω	125 Ω	180 Ω	405 Ω	720 Ω	2,880 Ω	5,760 Ω
Coil inductance (H) (ref. value)	Armature OFF	0.08	0.18	0.31	0.62	1.20	4.70	5.35
	Armature ON	0.06	0.17	0.24	0.50	0.99	3.90	5.12
Must operate voltage		70% max. of rated voltage						
Must release voltage		10% min. of rated voltage						
Max. voltage		155% of rated voltage at 50°C, 130% at 70°C						140% of rated voltage at 50°C
Power consumption		Approx. 200 mW						Approx. 400 mW

Relays

Single-winding Latching, Bifurcated Crossbar Contact Type

Rated voltage		3 VDC	5 VDC	6 VDC	9 VDC	12 VDC	24 VDC
Rated current		66.7 mA	40 mA	33.3 mA	22.2 mA	16.7 mA	8.3 mA
Coil resistance		45 Ω	125 Ω	180 Ω	405 Ω	720 Ω	2,880 Ω
Coil inductance (H) (ref. value)	Armature OFF	0.05	0.13	0.19	0.45	0.84	3.56
	Armature ON	0.04	0.12	0.17	0.40	0.79	3.10
Must set voltage		70% max. of rated voltage					
Must reset voltage		70% max. of rated voltage					
Max. voltage		190% of rated voltage at 23°C, 130% at 70°C					
Power consumption		Approx. 200 mW					

Double-winding Latching, Bifurcated Crossbar Contact Type

Rated voltage			3 VDC	5 VDC	6 VDC	9 VDC	12 VDC	24 VDC
Set coil	Rated current		66.7 mA	40 mA	33.3 mA	22.2 mA	16.7 mA	8.3 mA
	Coil resistance		45 Ω	125 Ω	180 Ω	405 Ω	720 Ω	2,880 Ω
	Coil inductance (H) (ref. value)	Armature OFF	0.03	0.09	0.12	0.25	0.44	1.66
		Armature ON	0.03	0.08	0.11	0.22	0.41	1.62
Reset coil	Rated current		66.7 mA	40 mA	33.3 mA	22.2 mA	16.7 mA	8.3 mA
	Coil resistance		45 Ω	125 Ω	180 Ω	405 Ω	720 Ω	2,880 Ω
	Coil inductance (H) (ref. value)	Armature OFF	0.03	0.09	0.12	0.25	0.44	1.66
		Armature ON	0.03	0.08	0.11	0.22	0.41	1.62
Must set voltage			70% max. of rated voltage					
Must reset voltage			70% max. of rated voltage					
Max. voltage			190% of rated voltage at 23°C, 130% at 70°C					
Power consumption			Set coil: Approx. 200 mW Reset coil: Approx. 200 mW					

Note: 1. The rated current and coil resistance are measured at a coil temperature of 23°C with a tolerance of ±10%.

2. Operating characteristics are measured at a coil temperature of 23°C.

■ Contact Ratings

Load	Resistive load (cosØ = 1)	Inductive load (cosØ = 0.4; L/R = 7 ms)
Rated load	0.4 A at 125 VAC; 2 A at 30 VDC	0.2 A at 125 VAC; 1 A at 30 VDC
Contact material	Ag (Au-clad)	
Rated carry current	3 A	
Max. switching voltage	250 VAC, 220 VDC	
Max. switching current	3 A	3 A
Max. switching capacity	50 VA, 60 W	25 VA, 30 W
Min. permissible load	10 μA at 10 mVDC	

Note: P level: $\lambda_{60} = 0.1 \times 10^{-6}$/operation

■ Characteristics

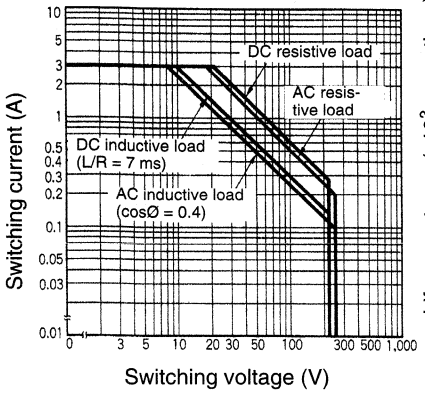
Contact resistance	50 mΩ max.
Operate (set*) time	5 ms max. (mean value: approx. 2.9 ms; 48 VDC type: approx. 2.4 ms)
Release (reset*) time	5 ms max. (mean value: approx. 1.3 ms)
Bounce time	Operate: 3 ms max. (mean value: 0.37 ms) Release: 3 ms max. (mean value: 1.12 ms)
Max. operating frequency	Mechanical: 36,000 operations/hr Electrical: 1,800 operations/hr (under rated load)
Insulation resistance	1,000 MΩ min. (at 500 VDC)
Dielectric withstand voltage	1,500 VAC, 50/60 Hz for 1 min between coil and contacts 1,000 VAC, 50/60 Hz for 1 min between contacts of same polarity
Impulse withstand voltage	1,500 V 10 x 160 μs (conforms to FCC Part 68)
Vibration resistance	Destruction: 10 to 55 Hz, 5-mm double amplitude Malfunction: 10 to 55 Hz, 3.3-mm double amplitude
Shock resistance	Destruction: 1,000 m/s^2 (approx. 100G) Malfunction: 300 m/s^2 (approx. 30G)
Life expectancy	Mechanical: 100,000,000 operations min. (at 36,000 operations/hr) Electrical: 100,000 operations min. (0.4 A at 125 VAC resistive load; 0.2 A at 125 VAC inductive load) 500,000 operations min. (2 A at 30 VDC resistive load; 1 A at 30 VDC inductive load) 200,000 operations min. (3 A at 30 VDC resistive load)

Ambient temperature	Operating: –40°C to 70°C (with no icing) Storage: –40°C to 70°C (with no icing)
Ambient humidity	45% to 85%
Weight	Approx. 2.7 g

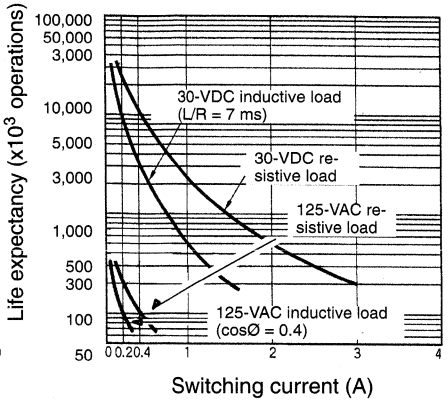
*Minimum set and reset signals width is 7 ms min.

Engineering Data

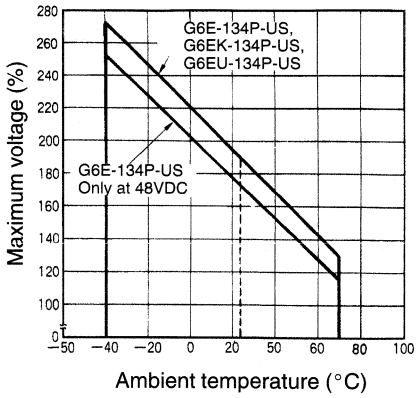
Max. Switching Capacity



Life Expectancy



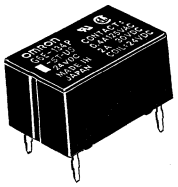
Ambient Temperature vs. Maximum Voltage



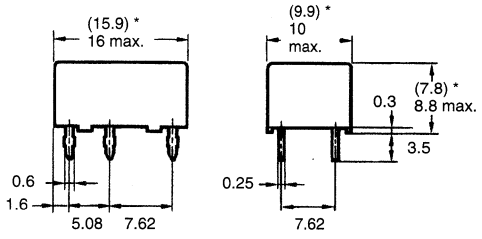
Dimensions

Note: 1. Orientation marks are indicated as follows:

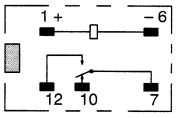
G6E-134P-US, G6E-194P-US



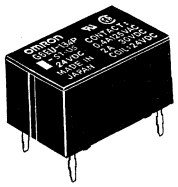
* Average value



Terminal Arrangement/ Internal Connections (Bottom View)



G6EU-134P-US, G6EU-194P-US



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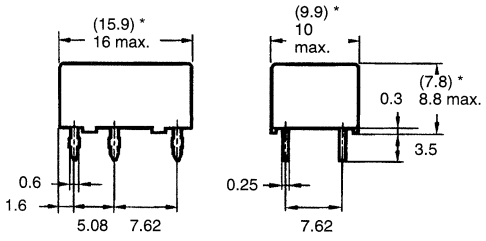
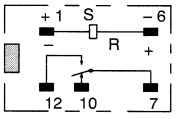
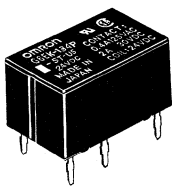


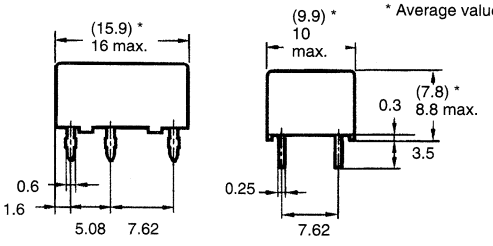
Terminal Arrangement/ Internal Connections (Bottom View)



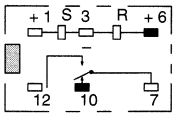
G6EK-134P-US, G6EK-194P-US



* Average value



Terminal Arrangement/ Internal Connections (Bottom View)



Relays

OMRON

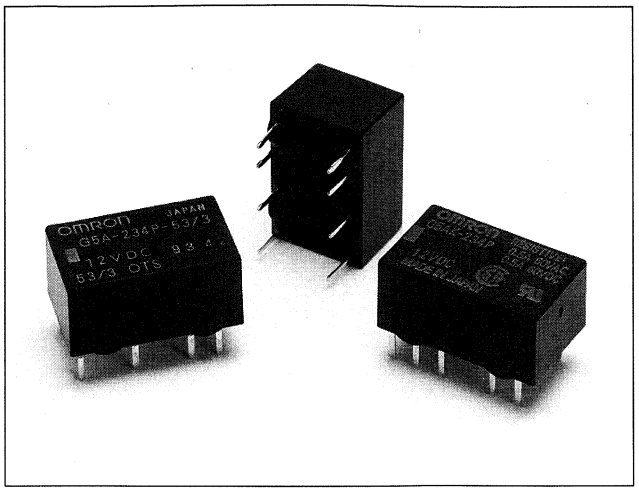
PCB Relay

G5A

FCC

Subminiature Relay 16 x 9.9 x 8.4 mm (W x L x H) with DPDT Contact

- Minimum permissible load: 0.01 mA 10 mVDC.
- Bifurcated gold-clad crossbar contact.
- Unique moving-loop armature reduces relay size, magnetic interference and contact bounce time.
- International 2.54-mm terminal pitch.
- Special models available for FCC Part 68 compliance.
- BT Type 53 versions available.



Ordering Information

Classification		Single-side stable	Single-winding latching	Double-winding latching
DPDT	Plastic-sealed	G5A-234P(-53)	G5AU-234P	G5AK-234P

Note: When ordering, add the rated coil voltage to the model number. Example: G5A-234P 12 VDC
Rated coil voltage

Model Number Legend:

G5A □ - □ □ □ □ - □ □
1 2 3 4 5 6 7

1. **Relay Function**
   None: Single-side stable
   U: Single-winding latching
   K: Double-winding latching
2. **Contact Form**
   2: DPDT
3. **Contact Type**
   3: Bifurcated crossbar Ag (Au-clad)
4. **Enclosure Rating**
   4: Plastic-sealed
5. **Terminals**
   P: Straight PCB
   C: Self-clinching terminals
6. **Special Function**
   None: General-purpose
   53: Type 53 Approval (see Coil rating)
   FC: FCC part 68 compliance
   U: For ultrasonically cleanable
7. **Rated Coil Voltage**
   4.5, 5, 12, 24, 48 VDC

Specifications

■ Coil Ratings

Single-side Stable Types

Designated code						53/1	53/3	53/5
Rated voltage		5 VDC	12 VDC	24 VDC	48 VDC	4.5 VDC	12 VDC	24 VDC
Rated current		40 mA	16.7 mA	8.3 mA	5.8 mA	44.6mA	16.7mA	8.3mA
Coil resistance (± 10%)		125 Ω	720 Ω	2,880 Ω	8,230 Ω	101Ω	720Ω	2880Ω
Coil inductance	Armature OFF	0.13	0.71	2.76	7.44	0.012	0.13	0.17
(H) (ref. value)	Armature ON	0.12	0.68	2.70	7.25	0.011	0.12	0.16
Must operate voltage		70% max. of rated voltage						
Must release voltage		10% min. of rated voltage						
Max. voltage		200% of rated voltage at 23°C, 140% at 70°C			170% of rated voltage at 23°C	200% of rated voltage at 23°C, 140% of rated voltage at 70°C		
Power consumption		Approx. 200 mW			Approx. 280 mW	Approx. 200mW		

Single/Double-winding Latching Types

Rated voltage		5 VDC	12 VDC	24 VDC
Rated current		40 mA	16.7 mA	8.3 mA
Coil resistance		125 Ω	720 Ω	2,880 Ω
Coil inductance (H) (ref. value)	**Armature OFF**	0.06	0.29	1.1
	Armature ON	0.05	0.24	0.85
Must set voltage		80% max. of rated voltage		
Must reset voltage		80% min. of rated voltage		
Max. voltage		200% of rated voltage at 23°C, 140% at 70°C		
Power consumption		Approx. 200 mW		

Note: 1. The rated current and coil resistance are measured at a coil temperature of 23°C with a tolerance of ±10%.
2. Operating characteristics are measured at a coil temperature of 23°C.

■ Contact Ratings

Load	Resistive load (cosØ = 1)	Inductive load (cosØ = 0.4) (L/R = 7 ms)
Rated load	0.5 A at 30 VAC; 1 A at 30 VDC	0.1 A at 30 VAC; 0.2 A at 30 VDC
Contact material	Ag (Au-clad)	
Rated carry current	1 A	
Max. switching voltage	125 VAC, 125 VDC	
Max. switching current	1 A	0.5 A
Max. switching capacity	37.5 VA, 33 W	12.5 VA, 11 W
Min. permissible load	0.01 mA at 10 mVDC	

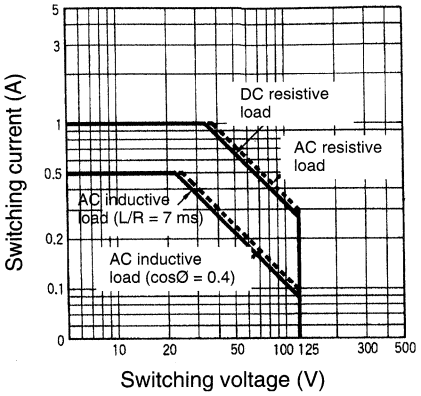
Note: P level: $\lambda_{60} = 0.1 \times 10^{-6}$/operation

■ Characteristics

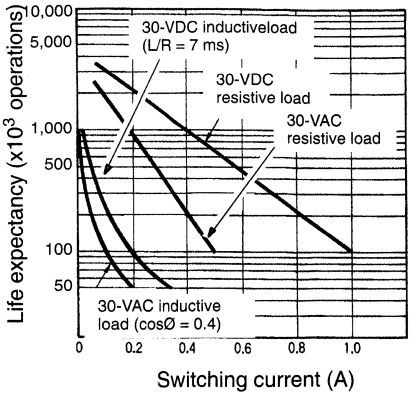
Contact resistance	50 mΩ max. (5DC 10mA applied)	100 mΩ max. (20mV 10mA applied) Type 53
Operate (set) time	Single-side stable types: 5 ms max. (mean value: approx. 2.4 ms) Latching types: 5 ms max. (mean value: approx. 2 ms)	
Release (reset) time	Single-side stable types: 5 ms max. (mean value: approx. 1.1 ms) Latching types: 5 ms max. (mean value: approx. 1.8 ms)	
Bounce time	Operate: Approx. 0.5 ms Release: Approx. 0.5 ms	
Min. set/reset signal width	Latching type: 7 ms	
Max. operating frequency	Mechanical: 36,000 operations/hr Electrical: 1,800 operations/hr (under rated load)	
Insulation resistance	1,000 MΩ min. (at 500 VDC)	100 MΩ min. (Type 53)
Dielectric withstand voltage	1,200 VAC (Type 53), 1,000VAC (Standard type), 50/60 Hz for 1 min between coil and contacts, 1,200 VAC (Type 53), 1,000VAC (Standard type), 50/60 Hz for 1 min between contacts of different polarity, 750 VAC, (Type 53), 500VAC (Standard type), 50/60 Hz for 1 min between contacts of same polarity, 100 VAC, 50/60 Hz for 1 min between set and reset coils (double-winding type only)	
Impulse withstand voltage	1,500 V 10 x 160 μs between contacts of same polarity (conforms to FCC Part 68)	
Vibration resistance	Destruction: 10 to 55 Hz, 1.5-mm double amplitude Malfunction: 10 to 55 Hz, 1.5-mm double amplitude	
Shock resistance	Destruction: 1,000 m/s^2 (approx. 100G) Malfunction: 300 m/s^2 (approx. 30G)	
Life expectancy	Mechanical: 50,000,000 operations min. (at 36,000 operations/hr) Electrical: 100,000 operations min. (at 1,800 operations/hr)	
Ambient temperature	Operating: –40°C to 70°C (with no icing) Storage: –40°C to 70°C (with no icing)	
Ambient humidity	Operating: 45% to 85% RH	
Weight	Approx. 3 g	

Engineering Data

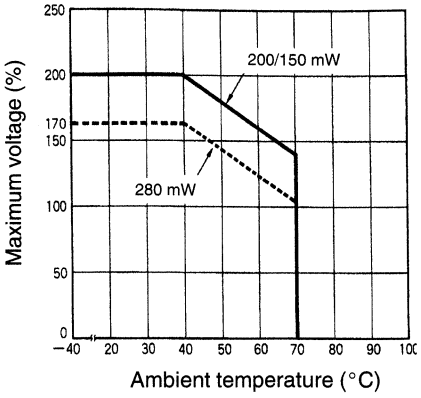
Max. Switching Capacity



Life Expectancy



Ambient Temperature vs. Maximum Voltage



■ Approved Standards

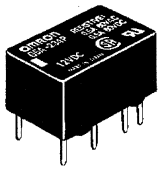
UL114, UL478 (File No.E41515)/CSA C22.2 No.0, No.14 (File No.LR24825)

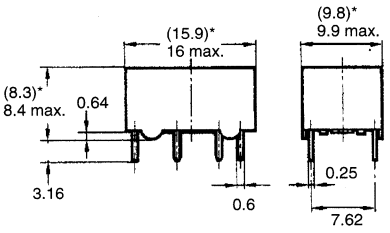
Model	Contact form	Coil ratings	Contact ratings
G5A-234P	DPDT	4.5 to 48 VDC	0.5 A, 60 VAC
G5AU-234P G5AK-234P		5 to 24 VDC	0.5 A, 60 VDC 1 A, 30 VDC

Dimensions

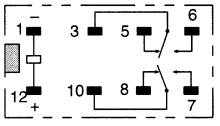
Note: 1. Orientation marks are indicated as follows: ▩ □

G5A-234P
G5A–234P–53



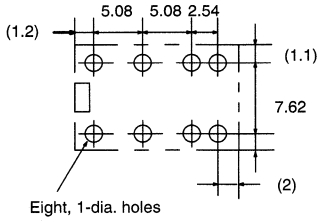


Terminal Arrangement/ Internal Connections (Bottom View)

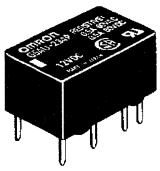


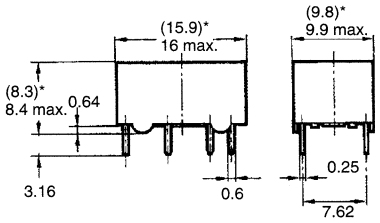
Mounting Holes (Bottom View)

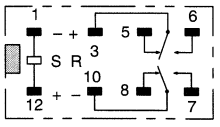
Tolerance: ±0.1

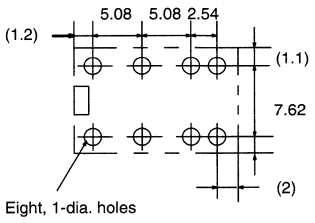


G5AU-234P

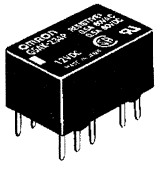


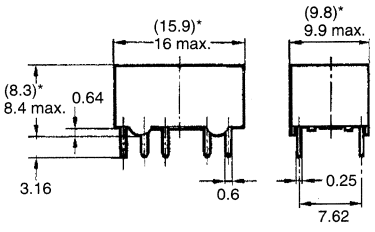


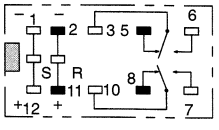




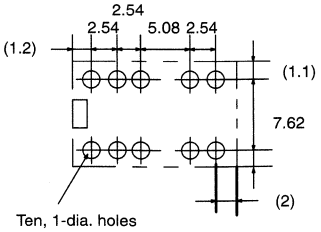
G5AK-234P







S: Set coil
R: Reset coil



*Average value

OMRON

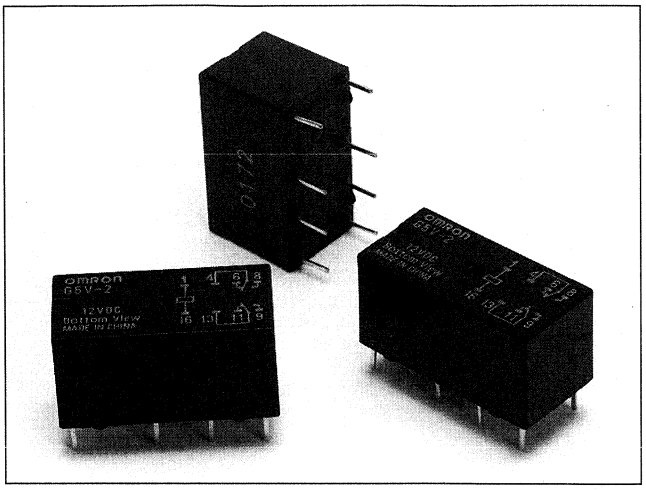
PCB Relay

G5V-2

FCC

Miniature Relay for Special Signal Circuits

- Wide switching capacity of 10 μA to 2 A.
- High dielectric strength coil-contacts:1,000 VAC; open contacts: 750 VAC.
- Conforms to FCC Part 68 requirements.
- Ag + Au clad bifurcated crossbar contacts and fully sealed for high contact reliability.



Ordering Information

Contact form	Contact type	Contact material	Structure	Model
DPDT	Bifurcated crossbar	Ag + Au-clad	Plastic-sealed	G5V-2

Note: When ordering, add the rated coil voltage to the model number.
Example: G5V-2 12 VDC
Rated coil voltage

Model Number Legend:

G5V - □ □ VDC
1 2

1. **Contact Form**
   2: DPDT
2. **Sensitivity**
   None: Standard 500mW
   H1: High Sensitivity 150mW
3. **Rated Coil Voltage**
   4.5, 5, 6, 9, 12, 24, 48 VDC

Specifications

■ Coil Ratings

Low Sensitivity (500mW)

Rated voltage		4.5 VDC	5 VDC	6 VDC	9 VDC	12 VDC	24 VDC	48 VDC
Rated current		111 mA	100 mA	83.3 mA	55.6 mA	41.7 mA	20.8 mA	12 mA
Coil resistance		40 Ω	50 Ω	72 Ω	162 Ω	288 Ω	1152 Ω	4000 Ω
Coil inductance	**Armature OFF**	0.08	0.09	0.16	0.31	0.47	1.98	7.23
(H) (ref. value)	**Armature ON**	0.10	0.11	0.19	0.49	0.74	2.63	10.00
Must operate voltage		75% max. of rated voltage						
Must release voltage		5% min. of rated voltage						
Max. voltage		120% of rated voltage at 65°C, 100% at 70°C						120% at 60°C
Power consumption		Approx. 500 mW						Approx. 580 mW

High Sensitivity (150mW)

Rated voltage		4.5 VDC	5 VDC	6 VDC	9 VDC	12 VDC	24 VDC	48 VDC
Rated current		33 mA	30 mA	25 mA	16.7 mA	12.5 mA	8.3 mA	6.25 mA
Coil resistance		150 Ω	166.7 Ω	240 Ω	540 Ω	960 Ω	2880 Ω	7680 Ω
Coil inductance	**Armature OFF**	0.42	0.46	0.70	1.67	2.90	6.72	20.1
(H) (ref. value)	**Armature ON**	0.57	0.71	0.97	2.33	3.99	9.27	26.7
Must operate voltage		75% max. of rated voltage						
Must release voltage		5% min. of rated voltage						
Max. voltage		150% of rated voltage at 23°C						
Power consumption		Approx. 150 mW					Approx. 200 mW	Approx. 300 mW

Note: 1. The rated current and coil resistance are measured at a coil temperature of 23°C with a tolerance of +10%.
2. Operating characteristics are measured at a coil temperature of 23°C.

Relays

■ Contact Ratings

Relay Type	G5V-2	G5V-2H1
Load	Resistive load (cosØ = 1)	
Rated load	0.5 A at 125 VAC; 2 A at 30 VDC	0.5 A at 125 VAC; 1 A at 24 VDC
Contact material	Ag + Au-clad	
Rated carry current	2 A	1 A
Max. switching voltage	125 VAC, 125 VDC	
Max. switching current	2 A	1 A
Max. switching capacity	62.5 VA, 60 W	62.5 VA, 24 W
Min. permissible load	0.01 mA at 10 mVDC	

Note: P level: $\lambda_{60} = 0.1 \times 10^{-6}$/operation

■ Characteristics

Relay Type	G5V-2	G5V-2H1
Contact resistance	50 mΩ max.	100 mΩ max.
Operate time	7 ms max.	
Release time	3 ms max.	
Bounce time	Operate: approx. 0.3 ms Release: approx. 1.5 ms	
Max. operating frequency	Mechanical: 36,000 operations/hr Electrical: 1,800 operations/hr (under rated load)	
Insulation resistance	1,000 MΩ min. (at 500 VDC)	
Dielectric withstand voltage	1,000 VAC, 50/60 Hz for 1 min between coil and contacts 1,000 VAC, 50/60 Hz for 1 min between contacts of different polarity 750 VAC, 50/60 Hz for 1 min between contacts of same polarity	1,000 VAC, 50/60 Hz for 1 min between coil and contacts 1,000 VAC, 50/60 Hz for 1 min between contacts of different polarity 500 VAC, 50/60 Hz for 1 min between contacts of same polarity
Impulse withstand voltage	1,500 V 10 x 160 μs between coil and contacts (conforms to FCC Part 68)	
Vibration resistance	Destruction: 10 to 55 Hz, 1.5-mm double amplitude Malfunction: 10 to 55 Hz, 1.5-mm double amplitude	
Shock resistance	Destruction: 1,000 m/s^2 (approx. 100G) Malfunction: 200 m/s^2 (approx. 20G)	Destruction: 1,000 m/s^2 (approx. 100G) Malfunction: 100 m/s^2 (approx. 10G)
Life expectancy	Mechanical: 15,000,000 operations min. (at 36,000 operations/hr) Electrical: 100,000 operations min. (at 1,800 operations/hr)	
Ambient temperature	Operating: –25°C to 65°C (with no icing) Storage: –25°C to 65°C (with no icing)	Operating: –25°C to 70°C (with no icing) Storage: –25°C to 70°C (with no icing)
Ambient humidity	Operating: 35% to 85%	
Weight	Approx. 5.8 g	

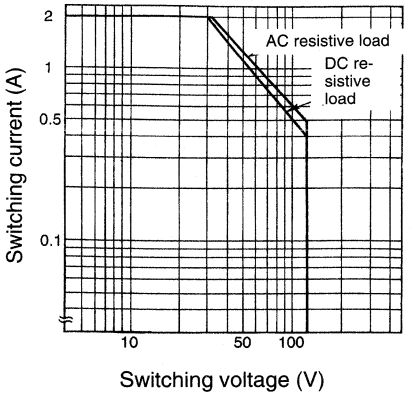
■ Approved Standards

UL478, UL1950 (File No. E41515)/CSA C22.2 No.0, No.14 (File No. LR24825)

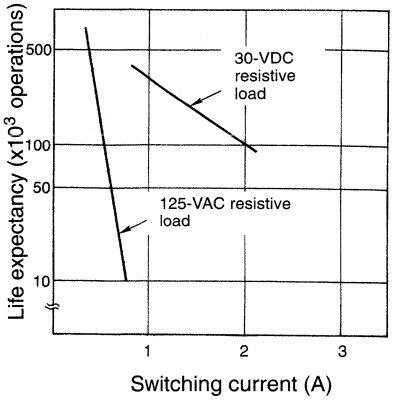
Contact form	Coil ratings	Contact ratings
DPDT	4.5 to 48 VDC	0.6 A, 125 VAC (general use) 0.6 A, 110 VDC (resistive load) 2 A, 30 VDC (resistive load)

Engineering Data

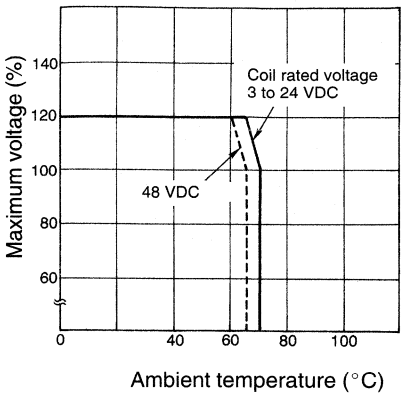
Max. Switching Capacity G5V–2



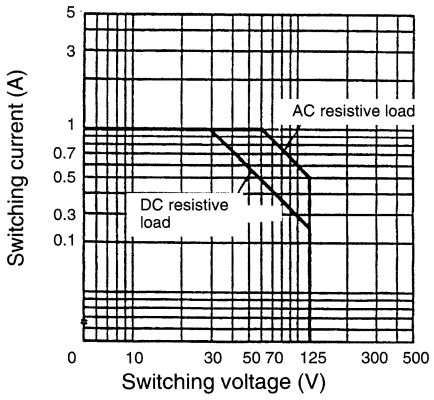
Life Expectancy G5V–2



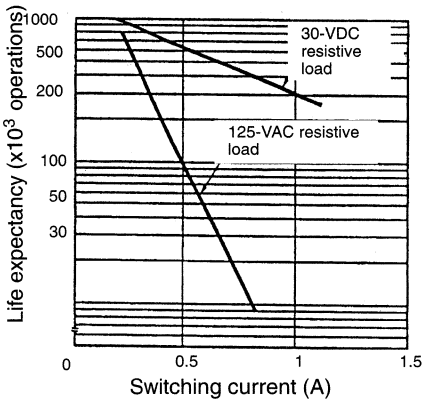
Ambient Temperature vs. Maximum Voltage G5V–2



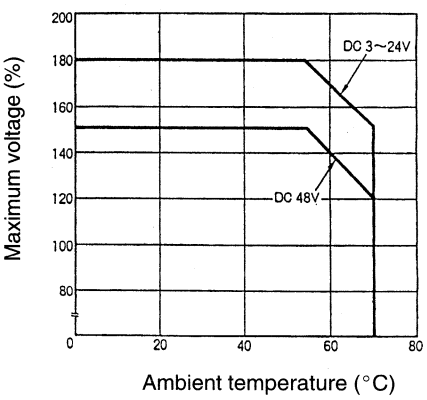
Max. Switching Capacity G5V–2H1



Life Expectancy G5V–2H1



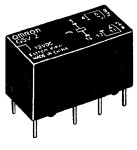
Ambient Temperature vs. Maximum Voltage G5V–2H1

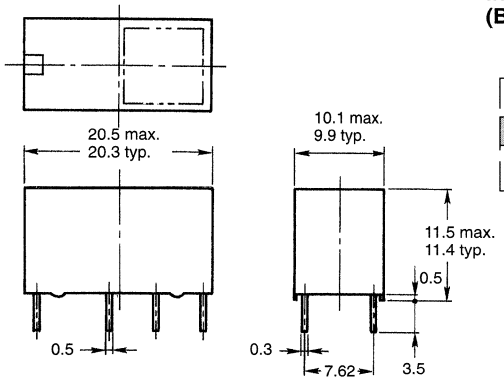


Dimensions

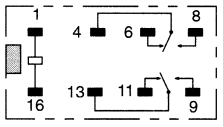
Note: 1. Orientation marks are indicated as follows:

G5V–2 G5V–2H1



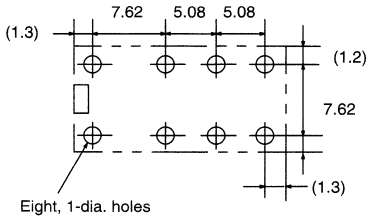


Terminal Arrangement/ Internal Connections (Bottom View)



Mounting Holes (Bottom View)

Tolerance: +0.1



Relays

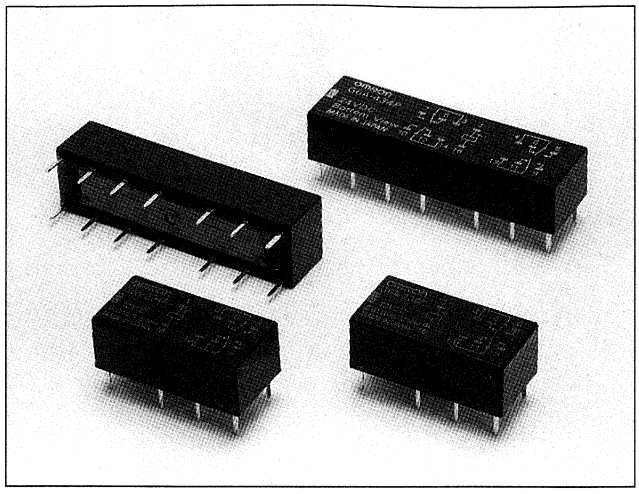
OMRON

PCB Relay

G6A

Plastic-sealed Relay with High Impulse Dielectric for Use in Telecommunications Equipment

- High sensitivity - can be driven by digital circuits.
- Horizontal design allows use in 11mm PCB racks.
- Impulse withstand voltage meets FCC Part 68 requirements.
- Relays can be mounted side-by-side due to low magnetic leakage.
- Single- and double-winding latching relays are also available.
- Special models are available for low thermoelectromotive force.



FCC

Ordering Information

Model Number Legend:

G6A - □ - □ □ □ □ - □ □ - □ □ VDC

1 2 3 4 5 6 7 8 9

1. **Relay Function**
   None: Single-side stable
   U: Single-winding latching
   K: Double-winding latching
2. **Contact Form**
   2: DPDT
   4: 4PDT
3. **Contact Type**
   7: Bifurcated crossbar Ag (Au-clad) contact
   3: Bifurcated crossbar AgPd (Au-clad) contact
4. **Enclosure Rating**
   4: Plastic-sealed
5. **Terminals**
   P: Straight PCB
6. **Stand-off**
   ST: Stand-off 0.64 mm
7. **Special Function**
   ST40: 0.64 mm stand-off, low-sensitivity (400 mW)
   40: Low-sensitivity (400 mW)
   LT: Low thermoelectromotive force
8. **Approved Standards**
   US: UL, CSA certified type
9. **Rated Coil Voltage**
   3, 4.5, 5, 6, 9, 12, 24, 48 VDC

Single-side Stable Type

Contact		Ag + Au-clad	AgPd + Au-clad
General purpose	DPDT	G6A-274P-ST-US	G6A-234P-ST-US
	4PDT	G6A-474P-ST-US	G6A-434P-ST-US
Low sensitivity	DPDT	G6A-274P-ST40-US	G6A-234P-ST40-US
	4PDT	G6A-474P-ST40-US	G6A-434P-ST40-US

Single-winding Latching Type

Contact		Ag + Au-clad	AgPd + Au-clad
General purpose	DPDT	G6AU-274P-ST-US	G6AU-234P-ST-US
	4PDT	G6AU-474P-ST-US	G6AU-434P-ST-US

Double-winding Latching Type

Contact		Ag + Au-clad	AgPd + Au-clad
General purpose	DPDT	G6AK-274P-ST-US	G6AK-234P-ST-US
	4PDT	G6AK-474P-ST-US	G6AK-434P-ST-US
Low sensitivity	DPDT	G6AK-274P-ST40-US	G6AK-234P-ST40-US
	4PDT	G6AK-474P-ST40-US	G6AK-434P-ST40-US

Note: When ordering, add the rated coil voltage to the model number.
Example: G6A-274P-ST-US 12 VDC
(12 VDC: Rated coil voltage)

Specifications

■ Coil Ratings

General purpose, DPDT Relays

Rated voltage (VDC)		3	4.5	5	6	9	12	24	48
Rated current (mA)		66.7	44.6	40	33.3	22.2	16.7	8.3	4.9
Coil resistance (Ω)		45	101	125	180	405	720	2,880	9,750
Coil inductance (H) (ref. value)	Armature OFF	0.07	0.16	0.2	0.29	0.63	1.1	4.5	13.7
	Armature ON	0.065	0.14	0.18	0.26	0.57	1.06	4.1	12.5
Must operate voltage		70% max. of rated voltage							
Must release voltage		10% min. of rated voltage							
Max. voltage		200% of rated voltage at 23°C, 150% at 70°C							
Power consumption		Approx. 200 mW							Approx. 235 mW

General purpose, 4PDT Relays

Rated voltage (VDC)		3	4.5	5	6	9	12	24	48
Rated current (mA)		120	79.9	72.5	60	40	30	15	7.5
Coil resistance (Ω)		25	56.3	69	100	225	400	1,600	6,400
Coil inductance (H) (ref. value)	Armature OFF	0.05	0.11	0.14	0.2	0.45	0.8	3.2	12.8
	Armature ON	0.045	0.095	0.12	0.17	0.38	0.68	2.7	10.9
Must operate voltage		70% max. of rated voltage							
Must release voltage		10% min. of rated voltage							
Max. voltage		150% of rated voltage at 23°C, 110% at 70°C							
Power consumption (mW)		Approx. 360							

Low sensitivity DPDT Relays

Rated voltage (VDC)		3	4.5	5	6	9	12	24	48
Rated current (mA)		133.3	88.9	80	66.7	44.3	33.3	16.7	8.3
Coil resistance (Ω)		22.5	50.6	62.5	90	203	360	1,440	5,760
Coil inductance (H) (ref. value)	Armature OFF	0.03	0.065	0.08	0.11	0.27	0.52	2.1	7.5
	Armature ON	0.02	0.06	0.07	0.1	0.23	0.43	1.8	6.4
Must operate voltage		70% max. of rated voltage							
Must release voltage		10% min. of rated voltage							
Max. voltage		150% of rated voltage at 23°C, 110% at 70°C							
Power consumption		Approx. 400 mW							

Low sensitivity 4PDT Relays

Rated voltage (VDC)		3	4.5	5	6	9	12	24	48
Rated current (mA)		133.3	88.9	80	66.7	44.3	33.3	16.7	8.3
Coil resistance (Ω)		22.5	50.6	62.5	90	203	360	1,440	5,760
Coil inductance (H) (ref. value)	Armature OFF	0.035	0.1	0.12	0.17	0.42	0.7	2.8	10.2
	Armature ON	0.02	0.07	0.09	0.13	0.3	0.52	2.2	8.6
Must operate voltage		70% max. of rated voltage							
Must release voltage		10% min. of rated voltage							
Max. voltage		150% of rated voltage at 23°C, 110% at 70°C							
Power consumption		Approx. 400 mW							

Single-winding Latching, DPDT Relays

Rated voltage (VDC)		3	4.5	5	6	9	12	24	48
Rated current (mA)		33.7	22.2	20	16.7	11.1	8.3	4.2	2.5
Coil resistance (Ω)		89	202	250	360	810	1,440	5,760	19,000
Coil inductance (H) (ref. value)	Armature OFF	0.15	0.34	0.44	0.64	1.38	2.5	9.2	28.5
	Armature ON	0.11	0.25	0.35	0.48	1.07	2	7.2	22
Must set voltage		70% max. of rated voltage							
Must reset voltage		70% min. of rated voltage							
Max. voltage		200% of rated voltage at 23°C, 150% at 70°C							
Power consumption		Approx. 100 mW							Approx. 120 mW

Single-winding Latching, 4PDT Relays

Rated voltage (VDC)		3	4.5	5	6	9	12	24	48
Rated current (mA)		106.8	71.2	64	53.3	35.6	25.7	13.3	6.7
Coil resistance (Ω)		28.1	63.2	78.1	112.5	253	450	1,800	7,200
Coil inductance (H) (ref. value)	**Armature OFF**	0.03	0.06	0.08	0.11	0.25	0.45	1.8	7
	Armature ON	0.02	0.04	0.06	0.08	0.18	0.32	1.3	5.2
Must set voltage		70% max. of rated voltage							
Must reset voltage		70% min. of rated voltage							
Max. voltage		150% of rated voltage at 23°C, 110% at 70°C							
Power consumption		Approx. 320 mW							

Double-winding Latching, DPDT Relays

Rated voltage (VDC)			3	4.5	5	6	9	12	24	48
Rated current (mA)			66.7	40.2	36	30	20	15	7.5	4.2
Coil resistance (Ω)			45	112	139	200	450	800	3,200	11,520
Coil inductance (H) (ref. value)	**Set**	**Armature OFF**	0.037	0.09	0.11	0.16	0.38	0.6	2.1	8.5
		Armature ON	0.027	0.065	0.08	0.12	0.28	0.45	1.5	6.3
	Reset	**Armature OFF**	0.027	0.065	0.08	0.12	0.28	0.45	1.5	6.3
		Armature ON	0.037	0.09	0.11	0.16	0.38	0.6	2.1	8.5
Must set voltage			70% max. of rated voltage							
Must reset voltage			70% min. of rated voltage							
Max. voltage			200% of rated voltage at 23°C, 150% at 70°C							
Power consumption			Approx. 200 mW	Approx. 180 mW						Approx. 200 mW

Double-winding Latching, 4PDT Relays

Rated voltage (VDC)			3	4.5	5	6	9	12	24	48
Rated current (mA)			106.8	71.2	64	53.3	35.6	26.7	13.3	6.7
Coil resistance (Ω)			28.1	63.2	78.1	112.5	253	450	1,800	7,200
Coil inductance (H) (ref. value)	**Set**	**Armature OFF**	0.03	0.06	0.08	0.11	0.25	0.45	1.8	7
		Armature ON	0.02	0.04	0.06	0.08	0.18	0.32	1.3	5.2
	Reset	**Armature OFF**	0.02	0.04	0.06	0.08	0.18	0.32	1.3	5.2
		Armature ON	0.03	0.06	0.08	0.11	0.25	0.45	1.8	7
Must set voltage			70% max. of rated voltage							
Must reset voltage			70% min. of rated voltage							
Max. voltage			150% of rated voltage at 23°C, 110% at 70°C							
Power consumption			Approx. 320 mW							

Double-winding Latching, Low-sensitivity DPDT Relays

Rated voltage (VDC)			3	4.5	5	6	9	12	24	48
Rated current (mA)			120	79.9	72.5	60	40	30	15	7.5
Coil resistance (Ω)			25	56.3	69	100	225	400	1,600	6,400
Coil inductance (H) (ref. value)	**Set**	**Armature OFF**	0.015	0.04	0.05	0.07	0.16	0.28	1.1	4
		Armature ON	0.01	0.025	0.035	0.05	0.12	0.2	0.75	2.9
	Reset	**Armature OFF**	0.01	0.025	0.035	0.05	0.12	0.2	0.75	2.9
		Armature ON	0.015	0.04	0.05	0.07	0.16	0.28	1.1	4
Must set voltage			70% max. of rated voltage							
Must reset voltage			70% min. of rated voltage							
Max. voltage			150% of rated voltage at 23°C, 110% at 70°C							
Power consumption			Approx. 360 mW							

Double-winding Latching, Low-sensitivity 4PDT Relays

Rated voltage (VDC)			3	4.5	5	6	9	12	24	48
Rated current (mA)			120	79.9	72	60	40	30	15	7.5
Coil resistance (Ω)			25	56.3	69.4	100	225	400	1,600	6,400
Coil inductance (H) (ref. value)	Set	Armature OFF	0.02	0.045	0.065	0.09	0.18	0.3	1.2	4.4
		Armature ON	0.015	0.035	0.05	0.075	0.14	0.23	0.82	3.2
	Reset	Armature OFF	0.015	0.035	0.05	0.075	0.14	0.23	0.82	3.2
		Armature ON	0.02	0.045	0.065	0.09	0.18	0.3	1.2	4.4
Must set voltage			70% max. of rated voltage							
Must reset voltage			70% min. of rated voltage							
Max. voltage			150% of rated voltage at 23°C, 110% at 70°C							
Power consumption			Approx. 360 mW							

Note: 1. The rated current and coil resistance are measured at a coil temperature of 23°C with a tolerance of +10%.
2. Operating characteristics are measured at a coil temperature of 23°C.

■ Contact Ratings

Item	G6A-234P-ST(40)-US/434P-ST(40)-US		G6A-274P-ST(40)-US/474P-ST(40)-US	
Load	Resistive load (cosØ = 1)	Inductive load (cosØ = 0.4; L/R = 7 ms)	Resistive load (cosØ = 1)	Inductive load (cosØ = 0.4; L/R = 7 ms)
Rated load	0.3 A at 125 VAC; 1 A at 30 VDC	0.2 A at 125 VAC; 0.5 A at 30 VDC	0.5 A at 125 VAC; 2 A at 30 VDC	0.25 A at 125 VAC; 1 A at 30 VDC
Contact material	AgPd (Au-clad)		Ag (Au-clad)	
Rated carry current	3 A			
Max. switching voltage	250 VAC, 220 VDC			
Max. switching current	DC: 2A; AC: 1 A	DC: 1 A; AC: 0.5 A	DC: 2 A; AC: 1 A	DC: 1 A; AC: 0.5 A
Max. switching capacity	125 VA, 60 W	62.5 VA, 30 W	125 VA, 60 W	62.5 VA, 30 W
Min. permissible load	0.01 mA at 10 mVDC			

Item	G6AK-234P-ST(40)-US/G6AK-434P-ST(40)-US G6AU-234P-ST-US/G6AU-434P-ST-US		G6AK-274P-ST(40)-US/G6AK-474P-ST(40)-US G6AU-274P-ST-US/G6AU-474P-ST-US	
Load	Resistive load (cosØ = 1)	Inductive load (cosØ = 0.4; L/R = 7 ms)	Resistive load (cosØ = 1)	Inductive load (cosØ = 0.4; L/R = 7 ms)
Rated load	0.3 A at 125 VAC; 1 A at 30 VDC	0.2 A at 125 VAC; 0.5 A at 30 VDC	0.5 A at 125 VAC; 2 A at 30 VDC	0.25 A at 125 VAC; 1 A at 30 VDC
Contact material	AgPd (Au-clad)		Ag (Au-clad)	
Rated carry current	3 A		3 A	
Max. switching voltage	250 VAC, 220 VDC		250 VAC, 220 VDC	
Max. switching current	DC: 2 A; AC: 1 A	DC: 1 A; AC: 0.5 A	DC: 2 A; AC: 1 A	DC: 1 A; AC: 0.5 A
Max. switching capacity	125 VA, 60 W	62.5 VA, 30 W	125 VA, 60 W	62.5 VA, 30 W
Min. permissible load	0.01 mA at 10 mVDC		0.01 mA at 10 mVDC	

Note: P level: $\lambda_{60} = 0.1 \times 10^{-6}$/operation

■ Characteristics

Contact resistance	50 mΩ max.
Operate (set) time	Single-side stable types: DPDT :5 ms max. (mean value: approx. 3 ms) 4PDT :7 ms max. (mean value: approx. 3.8 ms) Latching types: DPDT: 5 ms max. (mean value: approx. 2.5 ms) 4PDT: 7 ms max. (mean value: approx. 3.3 ms)
Release (reset) time	Single-side stable types: DPDT: 3 ms max. (mean value: approx. 1.2 ms) 4PDT: 5 ms max. (mean value: approx. 1.3 ms) Latching types: DPDT: 5 ms max. (mean value: approx. 2.5 ms) 4PDT: 7 ms max. (mean value: approx. 2.7 ms)
Bounce time	Operate: mean value: approx. 0.5 ms Release: mean value: approx. 0.5 ms
Min. set/reset signal width	Latching type: 7 ms
Max. operating frequency	Mechanical: 36,000 operations/hr Electrical: 1,800 operations/hr (under rated load)
Insulation resistance	1,000 MΩ min. (at 500 VDC); except for set-reset
Dielectric withstand voltage	1,000 VAC, 50/60 Hz for 1 min between coil and contacts 1,000 VAC, 50/60 Hz for 1 min between contacts of different polarity 1,000 VAC, 50/60 Hz for 1 min between contacts of same polarity 250 VAC, 50/60 Hz for 1 min between set and reset coils
Impulse withstand voltage	1,500 V 10 x 160 μs (conforms to FCC Part 68)
Vibration resistance	Destruction: 10 to 55 Hz, 5-mm double amplitude Malfunction: 10 to 55 Hz, 3.3-mm double amplitude
Shock resistance	Destruction: 1,000 m/s^2 (approx. 100G) Malfunction: DPDT: 500 m/s^2 (approx. 50G) 4PDT, Latching type: 300 m/s^2 (approx. 30G)
Life expectancy	Mechanical: 100,000,000 operations min. (at 36,000 operations/hr) Electrical: 500,000 operations min. (at 1,800 operations/hr)
Ambient temperature	Operating: –40°C to 70°C (with no icing) Storage: –40°C to 70°C (with no icing)
Ambient humidity	Operating: 45% to 85%
Weight	DPDT: Approx. 3.5 g 4PDT: Approx. 6 g

Note: The data shown above are initial values.

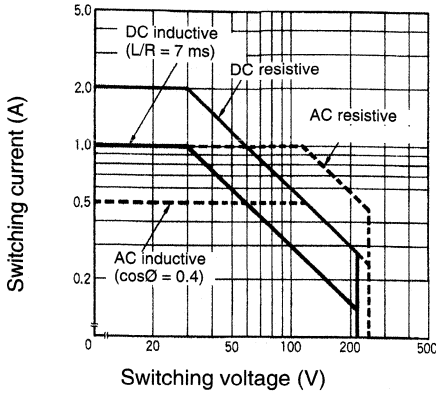
■ Approved Standards

UL114, UL478 (File No. E41515)/CSA C22.2 No.0, No.14 (File No. LR24825)

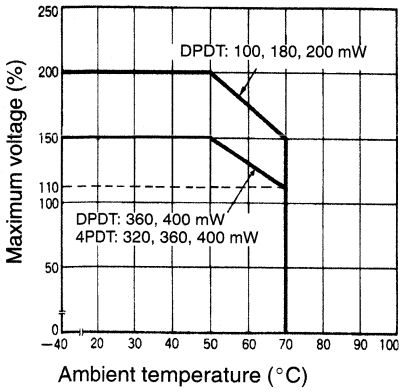
Model	Contact form	Coil ratings	Contact ratings
G6A-234P-ST(40)-US G6AK-234P-ST(40)-US G6AU-234P-ST-US	DPDT	3 to 48 VDC	0.6 A, 125 VAC 1 A, 30 VDC 0.6 A, 110 VDC
G6A-274P-ST(40)-US G6AK-274P-ST(40)-US G6AU-274P-ST-US	DPDT		0.6 A, 125 VAC 2 A, 30 VDC 0.6 A, 110 VDC
G6A-434P-ST(40)-US G6AK-434P-ST(40)-US G6AU-434P-ST-US	4PDT		0.6 A, 125 VAC 1 A, 30 VDC 0.6 A, 110 VDC
G6A-474P-ST(40)-US G6AK-474P-ST(40)-US G6AU-474P-ST-US	4PDT		0.6 A, 125 VAC 2 A, 30 VDC 0.6 A, 110 VDC

Engineering Data

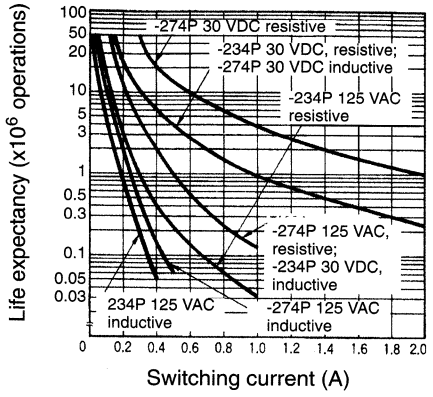
Max. Switching Capacity DPDT, 4PDT



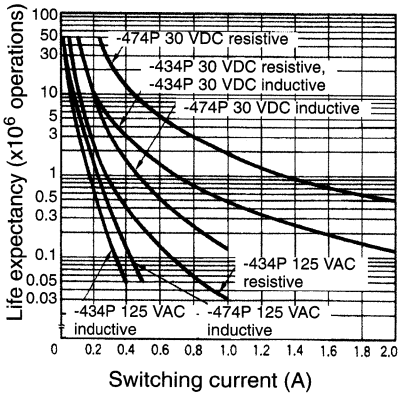
Ambient Temperature vs. Maximum Voltage



Life Expectancy DPDT



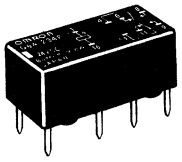
4PDT

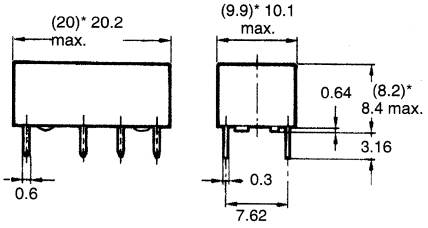


Dimensions

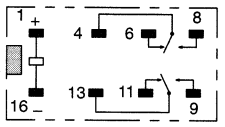
Note: 1. Orientation marks are indicated as follows:

G6A-234P-ST(40)-US, G6A-274P-ST(40)-US

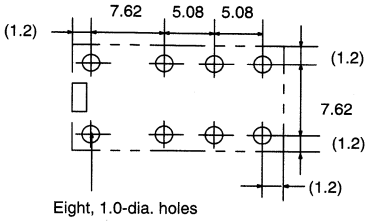




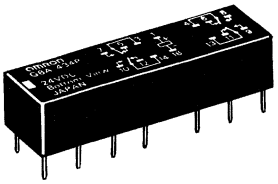
Terminal Arrangement/ Internal Connections (Bottom View)

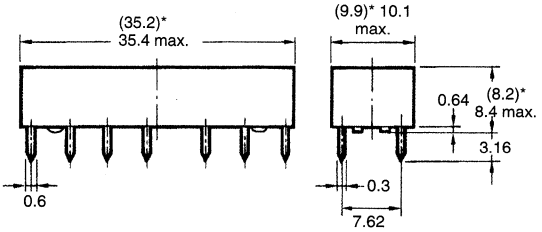


Mounting Holes (Bottom View)
Tolerance: +0.1

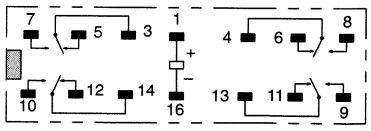


G6A-434P-ST(40)-US, G6A-474P-ST-US

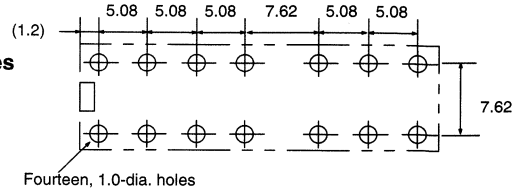




Terminal Arrangement/ Internal Connections (Bottom View)

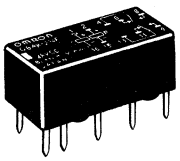


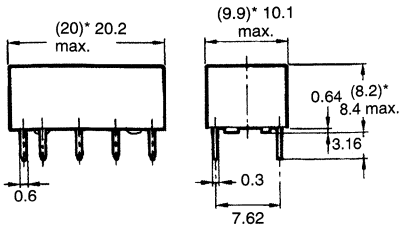
Mounting Holes (Bottom View)
Tolerance: +0.1



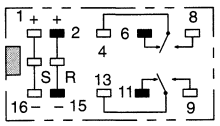
Relays

G6AK-234P-ST(40)-US, G6AK-274P-ST(40)-US

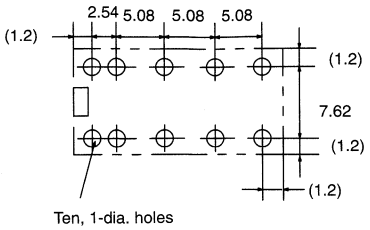




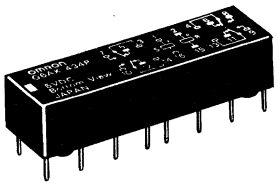
Terminal Arrangement/ Internal Connections (Bottom View)

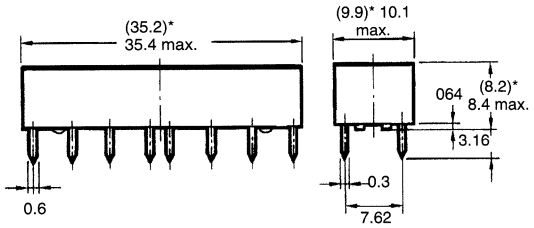


Mounting Holes (Bottom View)
Tolerance: +0.1

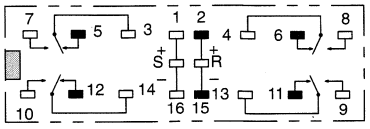


G6AK-434P-ST(40)-US, G6AK-474P-ST(40)-US

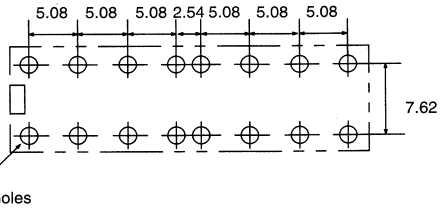




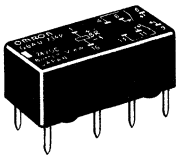
Terminal Arrangement/ Internal Connections (Bottom View)

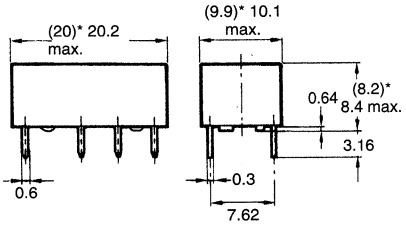


Mounting Holes (Bottom View)
Tolerance: +0.1

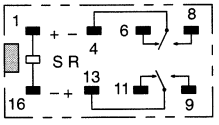


G6AU-234P-ST-US, G6AU-274P-ST-US

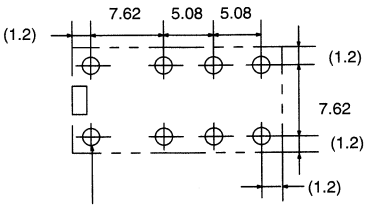




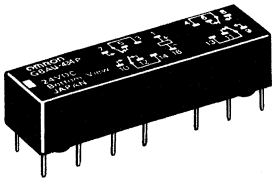
Terminal Arrangement/ Internal Connections (Bottom View)

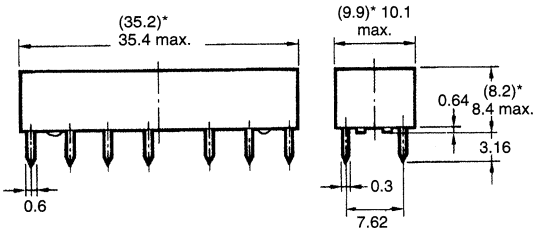


Mounting Holes (Bottom View)
Tolerance: +0.1

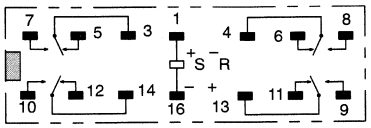


G6AU-434P-US, G6AU-474P-ST-US

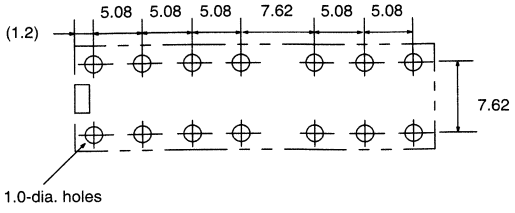




Terminal Arrangement/ Internal Connections (Bottom View)



Mounting Holes (Bottom View)
Tolerance: +0.1



OMRON

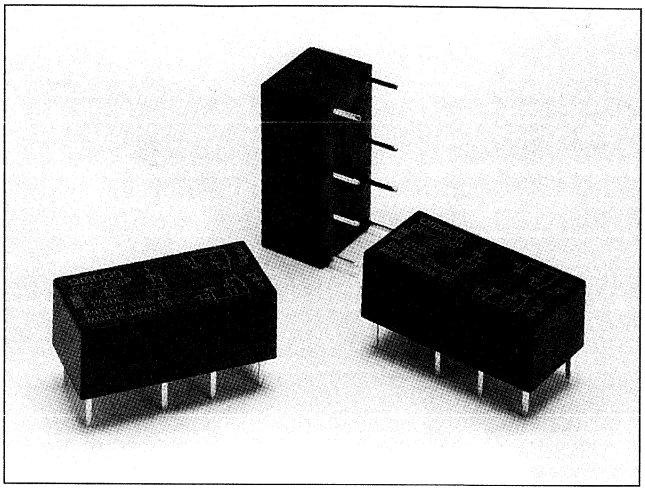
BABT Approved Relay

G6A–BS

BABT

BABT Approved Relay Meeting the Requirements of EN41003:1993 as endorsed, formerly BS6301:1989 Amendment 5 for Supplementary Isolation

- BABT Approved No. CR/0098.
- Height of only 8mm from PCB.
- Wide switching load – 10μA to 2A.
- Fully sealed construction.



Ordering Information

Single-side Stable Type

Model	Classification			
G6A–234P–BS	Contact Form – DPDT	Contact Type – Bifurcated crossbar	Contact Material – AgPd+Au clad	Structure – Plastic sealed

Note: When ordering, add the rated coil voltage to the model number.
Example: G6A-234P-BS 12 VDC
Rated coil voltage

Specifications

■ Coil Ratings

General purpose, DPDT Relays

Rated voltage (VDC)		3	4.5	5	6	9	12	24	48
Rated current (mA)		93.8	62.5	56.2	46.5	31.1	23.3	11.7	7.0
Coil resistance (Ω)		32	72	89	129	289	514	2,057	6,882
Coil inductance	Armature OFF	0.07	0.16	0.2	0.29	0.63	1.1	4.5	13.7
(H) (ref. value)	Armature ON	0.065	0.14	0.18	0.26	0.57	1.06	4.1	12.5
Must operate voltage		70% max. of rated voltage							
Must release voltage		10% min. of rated voltage							
Max. voltage		150% of rated voltage at 23°C, 150% at 70°C							
Power consumption		Approx. 280 mW							Approx. 330 mW

■ Contact Ratings

Item	G6A-234P-BS	
Load	Resistive load (cosØ = 1)	Inductive load (cosØ = 0.4; L/R = 7 ms)
Rated load	0.3 A at 125 VAC; 1 A at 30 VDC	0.2 A at 125 VAC; 0.5 A at 30 VDC
Contact material	AgPd (Au-clad)	
Rated carry current	3 A	
Max. switching voltage	250 VAC, 220 VDC	
Max. switching current	DC: 2A; AC: 2 A	DC: 1 A; AC: 1 A
Max. switching capacity	125 VA, 60 W	62.5 VA, 30 W
Min. permissible load	0.01 mA at 10 mVDC	

Relays

■ Characteristics (at Ambient Temperature 23°C)

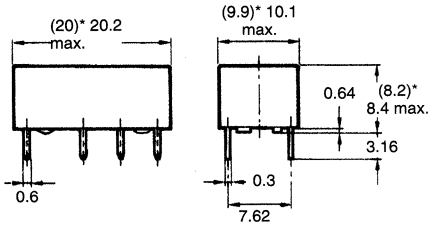
Contact resistance	50 mΩ max.
Operate (set) time	5 ms max.
Release (reset) time	3 ms max.
Max. operating frequency	Mechanical: 36,000 operations/hr Electrical: 1,800 operations/hr (under rated load)
Insulation resistance	1,000 MΩ min. (at 500 VDC)
Dielectric withstand voltage	1,000 VAC, 50/60 Hz for 1 min between open contacts 2,000 VAC, 50/60 Hz for 1 min between coil and contacts
Impulse withstand voltage	1,500 V 10 x 160 μs (conforms to FCC Part 68)
Vibration resistance	Destruction: 10 to 55 Hz, 5-mm double amplitude Malfunction: 10 to 55 Hz, 3.3-mm double amplitude
Shock resistance	Destruction: 1,000 m/s^2 (approx. 100G) Malfunction: DPDT: 500 m/s^2 (approx. 50G)
Life expectancy	Mechanical: 100,000,000 operations min. (at 36,000 operations/hr) Electrical: 500,000 operations min. (at 1,800 operations/hr)
Ambient temperature	Operating: –40°C to 70°C (with no icing) Storage: –40°C to 70°C (with no icing)
Ambient humidity	Operating: 45% to 85%
Weight	DPDT: Approx. 3.5 g

Note: The data shown above are initial values.

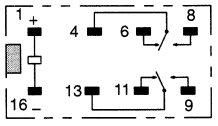
Dimensions

Note: 1. Orientation marks are indicated as follows:

G6A-234P-BS

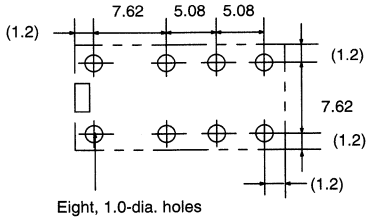


Terminal Arrangement/ Internal Connections (Bottom View)



Mounting Holes (Bottom View)

Tolerance: +0.1



Eight, 1.0-dia. holes

OMRON

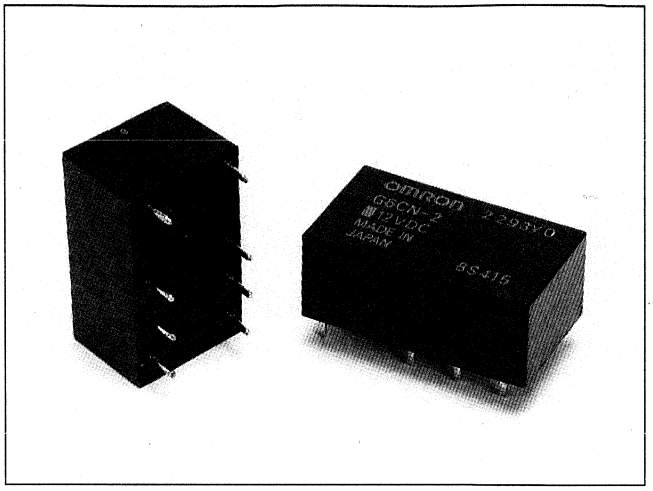
Line Isolation Relay

G6CN–2–BS

BSI

Telecom Relay Conforming to the BABT Re–inforced Isolation Requirements

- BSI Approved to BS415, CENELEC HD 195.S6 and IEC 65.
- 4kV RMS coil to contact isolation.
- 6mm Creepage and clearance distance.
- Meets CCITT lightning test requirements.
- Sealed construction for immersion cleaning.



Ordering Information

Single-side Stable Type

Model	Classification			
G6CN–2–BS	Contact Form – DPDT	Contact Type – Bifurcated crossbar	Contact Material – Ag+Au clad	Structure – Plastic sealed

Note: When ordering, add the rated coil voltage to the model number.
Example: G6CN-2-BS 12 VDC
Rated coil voltage

Specifications

■ Coil Ratings

General purpose, DPDT Relays

Rated voltage (VDC)	5	12	24
Rated current (mA)	72	30	15
Coil resistance (Ω)	69.4	400	1,600
Must operate voltage	70% max. of rated voltage		
Must release voltage	10% min. of rated voltage		
Max. voltage	110% of rated voltage at 23°C		
Power consumption	Approx. 360 mW		

■ Contact Ratings

Item	G6CN–2–BS
Load	Resistive load (cosØ = 1)
Rated load	1 A at 24 VDC
Contact material	Ag (Au-clad)
Rated carry current	1 A
Max. switching voltage	100 VDC
Max. switching current	1A
Max. switching capacity	24 W
Min. permissible load	5 VDC, 10mA

Relays

■ Characteristics (at Ambient Temperature 23°C)

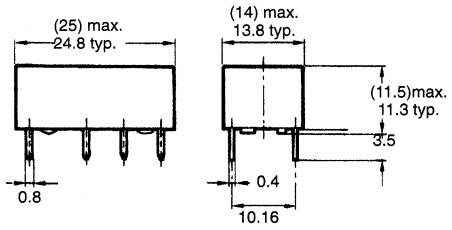
Contact resistance	50 mΩ max.
Operate (set) time	10 ms max.
Release (reset) time	5 ms max.
Insulation resistance	1,000 MΩ min. (at 500 VDC)
Dielectric withstand voltage	4,000 VAC, 50/60 Hz for 1 min between coil and contacts 1,000 VAC, 50/60 Hz for 1 min between contacts of same pole
Vibration resistance	Destruction: 10 to 55 Hz, 1.5-mm double amplitude Malfunction: 10 to 55 Hz, 1.5-mm double amplitude
Shock resistance	Destruction: 1,000 m/s^2 (approx. 100G) Malfunction: 200 m/s^2 (approx. 20G)
Life expectancy	Mechanical: 100,000,000 operations min. (at 36,000 operations/hr) Electrical: 100,000 operations min. (at 1,800 operations/hr)
Ambient temperature	Operating: –25°C to 70°C (with no icing)
Ambient humidity	Operating: 35% to 85%
Weight	Approx. 7 g

Note: The data shown above are initial values.

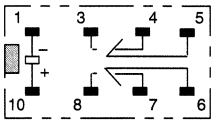
Dimensions

Note: 1. Orientation marks are indicated as follows: ▨ □

G6CN-2-BS

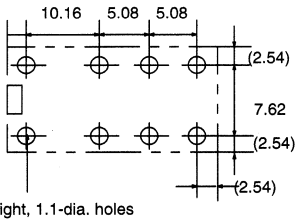


Terminal Arrangement/ Internal Connections (Bottom View)



Mounting Holes (Bottom View)

Tolerance: ±0.1



Eight, 1.1-dia. holes

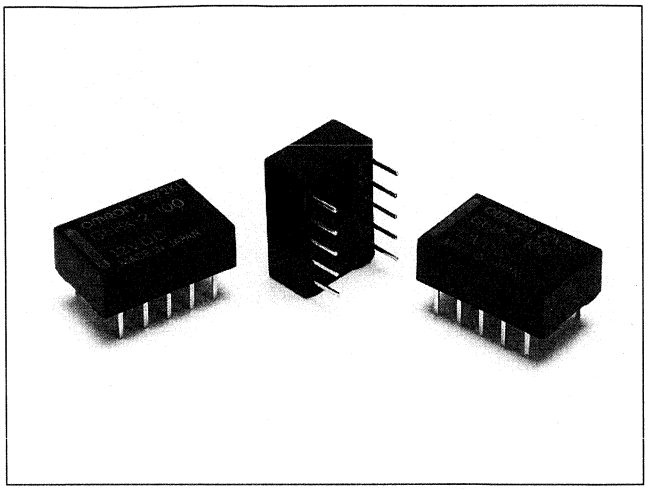
OMRON

PCB Relay

G6H

Ultracompact, Ultrasensitive DPDT Relay

- Compact size and low 5-mm profile.
- Low power consumption (140 mW for single-side stable, 100 to 300 mW for latching type).
- Low thermoelectromotive force.
- Low magnetic interference enables high-density mounting.
- Single- and double-winding latching types also available.
- UL and CSA approval.



Ordering Information

Classification		Single-side stable	Single-winding latching	Double-winding latching
DPDT	Plastic sealed	G6H-2100	G6HU-2100	G6HK-2100

Note: When ordering, add the rated coil voltage to the model number.
Example: G6HK-2100 12 VDC
Rated coil voltage

Model Number Legend:

G6H □ - □ - □ □ VDC
1 2 3 4

1. **Relay Function**
   None: Single-side stable
   U: Single-winding latching
   K: Double-winding latching
2. **Contact Form**
   2100: DPDT
3. **Classification**
   U: Ultrasonically cleanable
4. **Rated Coil Voltage**
   5, 6, 9, 12, 24 VDC

Specifications

■ Coil Ratings

Single-side Stable Type (G6H-2100)

Rated voltage		5 VDC	6 VDC	9 VDC	12 VDC	24 VDC
Rated current		28.1 mA	23.3 mA	15.5 mA	11.7 mA	8.3 mA
Coil resistance		178 Ω	257 Ω	579 Ω	1,028 Ω	2,880 Ω
Coil inductance (H) (ref. value)	Armature OFF	0.065	0.11	0.24	0.43	1.2
	Armature ON	0.058	0.09	0.20	0.37	1.0
Must operate voltage		75% max. of rated voltage				
Must release voltage		10% min. of rated voltage				
Max. voltage		200% of rated voltage at 23°C, 150% at °70C				170% of rated voltage at 23°C, 130% at 70°C
Power consumption		Approx. 140 mW				Approx. 200 mW

Note: 48 VDC (single-side stable) model is also available. Consult OMRON for details.

Single-winding Latching Type (G6HU-2100)

Rated voltage		5 VDC	6 VDC	9 VDC	12 VDC	24 VDC
Rated current		20 mA	16.7 mA	11.1 mA	8.3 mA	6.25 mA
Coil resistance		250 Ω	360 Ω	810 Ω	1,440 Ω	3,840 Ω
Coil inductance (H) (ref. value)	Armature OFF	0.11	0.14	0.33	0.60	1.6
	Armature ON	0.09	0.12	0.28	0.50	1.3

Relays

Must set voltage	75% max. of rated voltage	
Must reset voltage	75% min. of rated voltage	
Max. voltage	180% of rated voltage at 23°C, 140% at 70°C	
Power consumption	Approx. 100 mW	Approx. 150 mW

Double-winding Latching Type (G6HK-2100)

Rated voltage		5 VDC	6 VDC	9 VDC	12 VDC	24 VDC
Rated current		40 mA	33.3 mA	22.2 mA	16.7 mA	12.5 mA
Coil resistance		125 Ω	180 Ω	405 Ω	720 Ω	1,920 Ω
Coil inductance	**Armature OFF**	0.042	0.065	0.16	0.3	0.63
(H) (ref. value)	**Armature ON**	0.023	0.035	0.086	0.16	0.33
Must set voltage		75% max. of rated voltage				
Must reset voltage		75% min. of rated voltage				
Max. voltage		160% of rated voltage at 23°C, 130% at 70°C				130% of rated voltage at 23°C, 110% at 70°C
Power consumption		Approx. 200 mW				Approx. 300 mW

Note: 1. The rated current and coil resistance are measured at a coil temperature of 23°C with a tolerance of ±10%.
2. Operating characteristics are measured at a coil temperature of 23°C.

■ Contact Ratings

Load	Resistive load (cosØ = 1)
Rated load	0.5 A at 125 VAC; 1 A at 30 VDC
Contact material	Ag (Au-clad)
Rated carry current	1 A
Max. switching voltage	125 VAC, 110 VDC
Max. switching current	1 A
Max. switching capacity	62.5 VA, 33 W
Min. permissible load	10 μA at 10 mVDC

Note: P level: $\lambda_{60} = 0.1 \times 10^{-6}$/operation

■ Characteristics

Contact resistance	50 mΩ max.
Operate (set) time	Single-side stable types: 3 ms max. (mean value: approx. 2 ms) Latching types: 3 ms max. (mean value: approx. 1.5 ms)
Release (reset) time	Single-side stable types: 2 ms max. (mean value: approx. 1 ms) Latching types: 3 ms max. (mean value: approx. 1.5 ms)
Bounce time	Operate: Approx. 0.5 ms Release: Approx. 0.5 ms Set/reset: Approx. 0.5 ms
Min. set/reset signal width	Latching type: 5 ms min. (at 23°C)
Max. operating frequency	Mechanical: 36,000 operations/hr Electrical: 1,800 operations/hr (under rated load)
Insulation resistance	1,000 MΩ min. (at 500 VDC)
Dielectric withstand voltage	1,000 VAC, 50/60 Hz for 1 min between coil and contacts 1,000 VAC, 50/60 Hz for 1 min between contacts of different polarity 750 VAC, 50/60 Hz for 1 min between contacts of same polarity
Impulse withstand voltage	1,500 V 10 x 160 μs between contacts of same polarity (conforms to FCC Part 68)
Vibration resistance	Destruction: 10 to 55 Hz, 5-mm double amplitude Malfunction: 10 to 55 Hz, 3-mm double amplitude
Shock resistance	Destruction: 1,000 m/s^2 (approx. 100G) Malfunction: 500 m/s^2 (approx. 50G)
Life expectancy	Mechanical: 100,000,000 operations min. (at 36,000 operations/hr) Electrical: 200,000 operations min. (at 1,800 operations/hr)
Ambient temperature	Operating: –40°C to 70°C (with no icing) Storage: –40°C to 70°C (with no icing)
Ambient humidity	Operating: 45% to 85%
Weight	Approx. 1.5 g

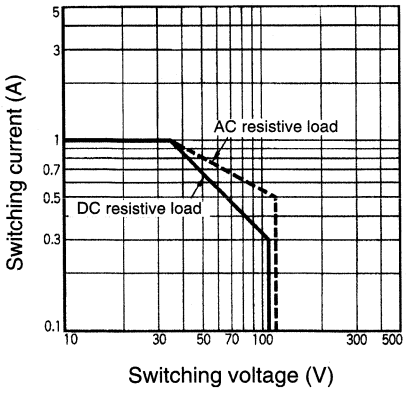
■ Approved Standards

UL114, UL478 (File No. E41515)/CSA C22.2 No.0, No.14 (File No. LR24825)

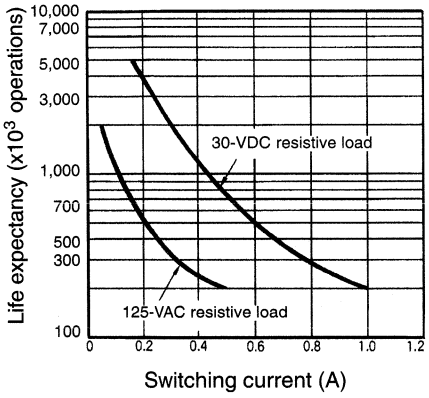
Model	Contact form	Coil ratings	Contact ratings
G6H(U/K)-2-U G6H(U/K)-2-100	DPDT	5 to 48 VDC	1 A, 30 VDC 0.3 A, 110 VDC 0.5 A, 125 VAC

Engineering Data

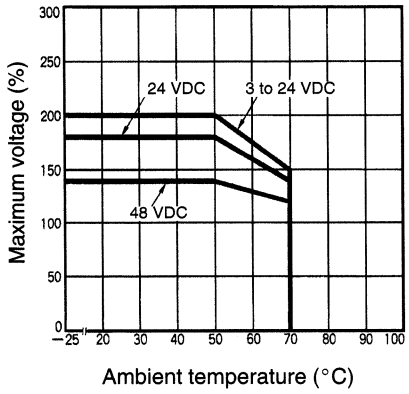
Max. Switching Capacity



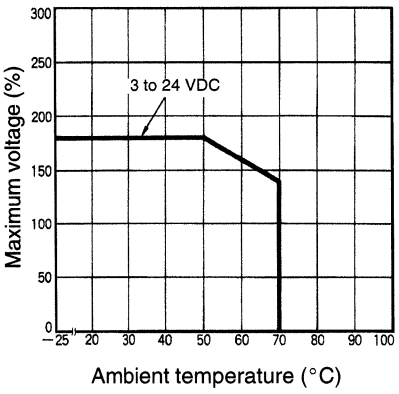
Life Expectancy



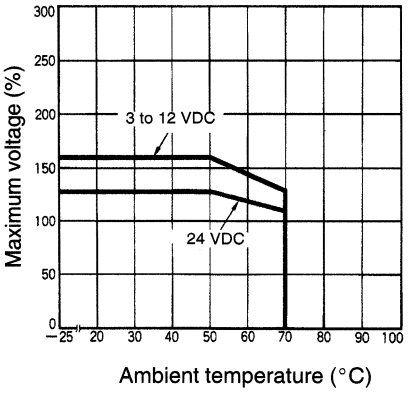
Ambient Temperature vs. Maximum Voltage Single-side Stable (G6H-2100)



Single-winding Latching (G6HU-2100)



Double-winding Latching (G6HK-2100)

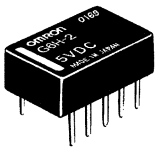


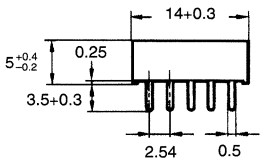
Relays

Dimensions

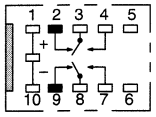
Note: 1. Orientation marks are indicated as follows:

Single-side Stable Type
G6H-2100(-U)



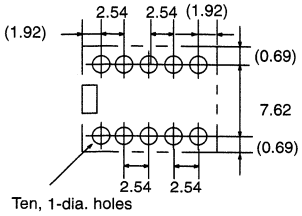


Terminal Arrangement/ Internal Connections (Bottom View)

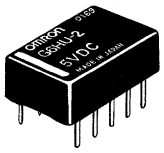


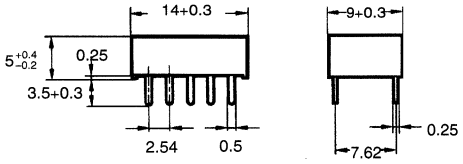
Mounting Holes (Bottom View)

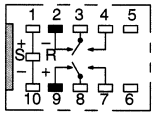
Tolerance: +0.1

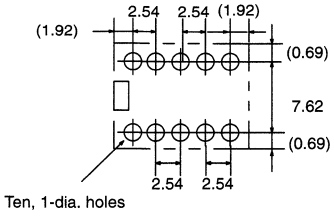


Single-winding Latching Type
G6HU-2100(-U)

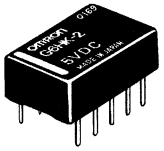


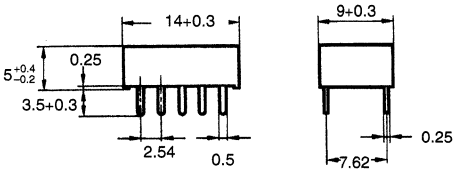


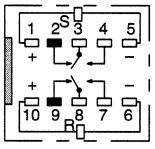


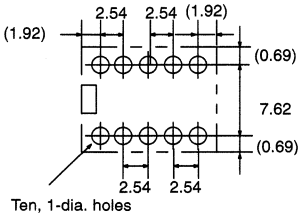


Double-winding Latching Type
G6HK-2100(-U)









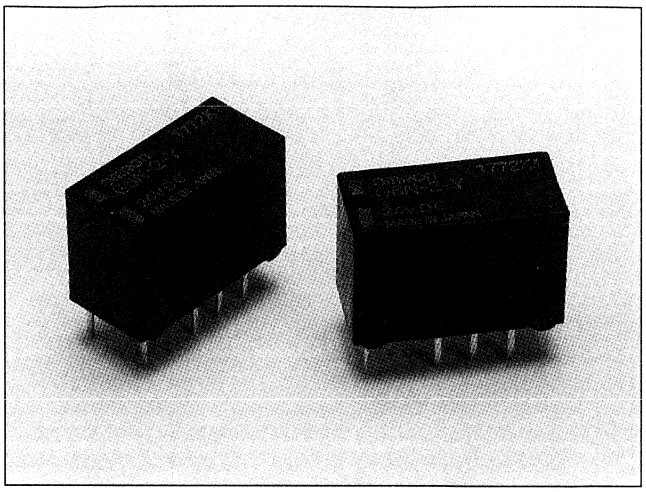
OMRON

PCB Relay

G6N

Telecom Relay Which Meets the Bell-Core Requirements for 2.5KV Coil-Contact Isolation

- Surge withstand of 2.5KV for 2x10μs meets Bell–Core requirements.
- Dielectric Strength of 1,500 VAC.
- Low coil power consumption 140 mW – 200 mW.
- Very small footprint with a maximum height of 11mm.
- Fully sealed construction.
- UL and CSA approved.



Ordering Information

Model	Classification			
	Contact form	Contac ttype	Contact Material	Structure
G6N–2Y	DPDT	Bifucated crossbar	Ag+Au clad	Plastic sealed

Model Number Legend:

G6N □ - □ - □ □ **VDC**

1 2 3 4

1. **Relay Function**
   None:Single-side stable
2. **Contact Form**
   2: DPDT
3. **Classification**
   Y: High dielectric withstand
4. **Rated Coil Voltage**
   4.5, 5, 6, 9, 12, 24 VDC

Specifications

■ Coil Ratings (G6N-2-Y)

Rated voltage		4.5 VDC	5 VDC	6 VDC	9 VDC	12 VDC	24 VDC
Rated current		31 mA	28.1 mA	23.3 mA	15.5 mA	11.7 mA	8.3 mA
Coil resistance		145 Ω	178 Ω	257 Ω	579 Ω	1,028 Ω	2,880 Ω
Coil inductance (H) (ref. value)	Armature OFF	0.096	0.065	0.11	0.24	0.43	1.2
	Armature ON	0.083	0.058	0.09	0.20	0.37	1.0
Must operate voltage		75% max. of rated voltage					
Must release voltage		10% min. of rated voltage					
Max. voltage		200% of rated voltage at 23°C, 140% at 70°C					170% of rated voltage at 23°C, 120% at 70°C
Power consumption		Approx. 140 mW					Approx. 200 mW

Note: 1. The rated current and coil resistance are measured at a coil temperature of 23°C with a tolerance of +10%.
2. Operating characteristics are measured at a coil temperature of 23°C.

Relays

■ Contact Ratings

Load	Resistive load (cosØ = 1)
Rated load	0.5 A at 125 VAC; 1 A at 30 VDC
Contact material	Ag (Au-clad)
Rated carry current	2 A
Max. switching voltage	250 VAC, 220 VDC
Max. switching current	1.25 A
Max. switching capacity	62.5 VA, 30 W
Min. permissible load	10 μA at 10 mVDC

Note: P level: $\lambda_{60} = 0.1 \times 10^{-6}$/operation

■ Characteristics

Contact resistance	50 mΩ max.
Operate time	5 ms max. (mean value: approx. 2.5 ms)
Release time	3 ms max. (mean value: approx. 1.5 ms)
Bounce time	Operate: Approx. 0.5 ms Release: Approx. 0.5 ms Set/reset: Approx. 0.5 ms
Max. operating frequency	Mechanical: 36,000 operations/hr Electrical: 1,800 operations/hr (under rated load)
Insulation resistance	1,000 MΩ min. (at 500 VDC)
Dielectric withstand voltage	1,500 VAC, 50/60 Hz for 1 min between coil and contacts 1,000 VAC, 50/60 Hz for 1 min between contacts of different polarity 1,000 VAC, 50/60 Hz for 1 min between contacts of same polarity
Impulse withstand voltage	2,500 V 2 x 10 μs between coil and contacts 1,500 V 10 x 160 μs between contacts of same polarity (conforms to FCC Part 68)
Vibration resistance	Destruction: 10 to 55 Hz, 5-mm double amplitude Malfunction: 10 to 55 Hz, 3-mm double amplitude
Shock resistance	Destruction: 1,000 m/s^2 (approx. 100G) Malfunction: 500 m/s^2 (approx. 50G)
Life expectancy	Mechanical: 100,000,000 operations min. (at 36,000 operations/hr) Electrical: 300,000 operations min. (1 A at 30 VDC, resistive load) 200,000 operations min. (0.5 A at 125 VAC, resistive load)
Ambient temperature	Operating: –40°C to 70°C (with no icing) Storage: –40°C to 70°C (with no icing)
Ambient humidity	Operating: 35% to 85%
Weight	Approx. 3 g

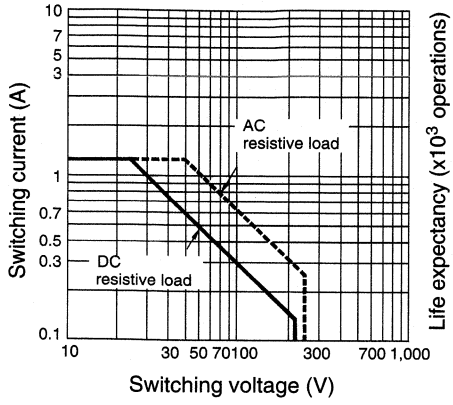
■ Approved Standards

UL478, UL1950 (File No. E41515)/CSA C22.2 No.0, No.14 (File No. LR24825)

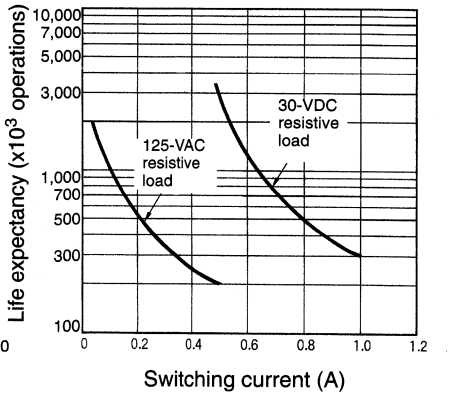
Model	Contact form	Coil ratings	Contact ratings
G6N-2-Y	DPDT	4.5 to 48 VDC	2 A, 30 VDC 0.3 A, 110 VDC 0.5 A, 125 VAC

Engineering Data

Max. Switching Capacity

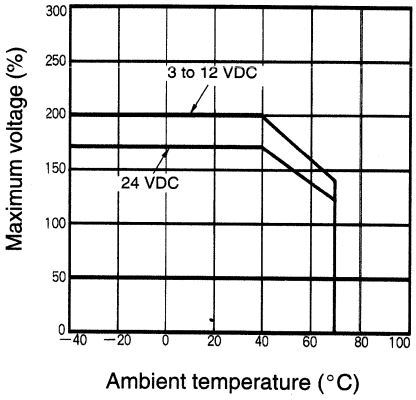


Life Expectancy



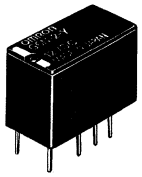
Ambient Temperature vs. Maximum Voltage

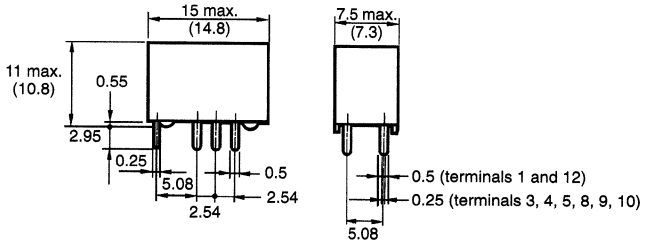
Single-side Stable (G6N-2-Y)



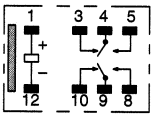
Dimensions

Note: 1. Orientation marks are indicated as follows:



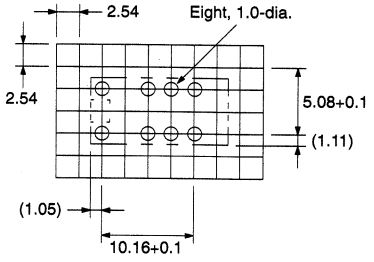


Terminal Arrangement/ Internal Connections (Bottom View)



Mounting Holes (Bottom View)

Tolerance: +0.1



Relays

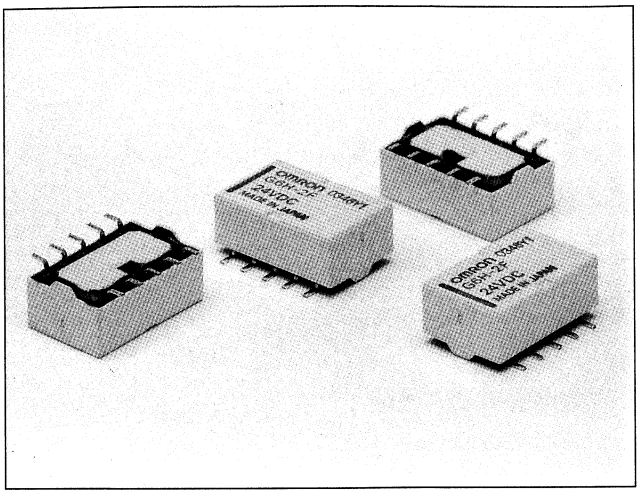
OMRON

Surface Mount Relay

G6H–2F

Low Profile, Miniature, Surface Mount Relay

- Ultra low profile only 5.2mm.
- Can be soldered by VPS or IRS methods.
- Impulse withstand voltage meets FCC and CCITT rules.
- Low power consumption, 140mW.
- Available on tape for automatic insertion.



Ordering Information

Classification		Single-side stable
DPDT	Fully sealed	G6H-2F

Note: 1. When ordering, add the rated coil voltage to the model number.
Example: G6H-2F 12 VDC
Rated coil voltage

2. When ordering tape packing, add 'TR' to the model number.
Example: G6H-2F TR 12 VDC
Tape packing

3. 'TR'is not part of the relay model number, it is not marked on the relay case.

Model Number Legend:

G6H–2F □ - □
1 **2**

1. **Taped Version**
TR: Taped right
TL: Taped left

2. **Rated Coil Voltage**
5, 12, 24 VDC

Specifications

■ Coil Ratings

Single-side Stable Types

Rated voltage		5 VDC	12 VDC	24 VDC
Rated current		28.1 mA	11.7 mA	8.3 mA
Coil resistance		178 Ω	1,028 Ω	2,880 Ω
Coil inductance (H) (ref. value)	**Armature OFF**	0.065	0.43	1.2
	Armature ON	0.058	0.37	1.0
Must operate voltage		75% max. of rated voltage		
Must release voltage		10% min. of rated voltage		
Max. voltage		200% of rated voltage at 23°C, 150% at 70°C		170% of rated voltage at 23°C, 130% at 70°C
Power consumption		Approx. 140 mW		Approx. 200 mW

Note: 1. The rated current and coil resistance are measured at a coil temperature of 23°C with a tolerance of ±10%.
2. Operating characteristics are measured at a coil temperature of 23°C.

■ Contact Ratings

Load	Resistive load (cosØ = 1)
Rated load	0.5 A at 125 VAC; 1 A at 30 VDC
Contact material	Ag (Au-clad)
Rated carry current	1 A
Max. switching voltage	125 VAC, 110 VDC
Max. switching current	1 A
Max. switching capacity	62.5 VA, 33 W
Min. permissible load	10 μA at 10 mVDC

Note: P level: $\lambda_{60} = 0.1 \times 10^{-6}$/operation

■ Characteristics

Contact resistance	60 mΩ max.
Operate (set) time	3 ms max. (mean value: approx. 2 ms)
Release (reset) time	2 ms max. (mean value: approx. 1 ms)
Bounce time	Operate: 0.5 ms max. Release: 0.5 ms max.
Max. operating frequency	Mechanical: 36,000 operations/hr Electrical: 1,800 operations/hr (under rated load)
Insulation resistance	1,000 MΩ min. (at 500 VDC)
Dielectric withstand voltage	1,000 VAC, 50/60 Hz for 1 min between coil and contacts 1,000 VAC, 50/60 Hz for 1 min between contacts of different polarity 750 VAC, 50/60 Hz for 1 min between contacts of same polarity
Impulse withstand voltage	1,500 V 10 x 160 μs between contacts of same polarity (conforms to FCC Part 68)
Vibration resistance	Destruction: 10 to 55 Hz, 5-mm double amplitude Malfunction: 10 to 55 Hz, 3-mm double amplitude
Shock resistance	Destruction: 1,000 m/s^2 (approx. 100G) Malfunction: 500 m/s^2 (approx. 50G)
Life expectancy	Mechanical: 100,000,000 operations min. (at 36,000 operations/hr) Electrical: 200,000 operations min. (0.1 A at 110 VAC inductive load)
Ambient temperature	Operating: –40°C to 85°C (with no icing)
Ambient humidity	Operating: 35% to 85%
Weight	Approx. 1.5 g

Note: The data shown above are initial values.

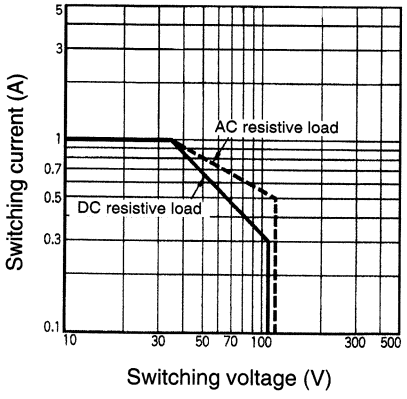
■ Approved by Standards

UL114, UL478 (File No. E41515)/CSA C22.2 No. 0, No. 14 (File No. LR24825)

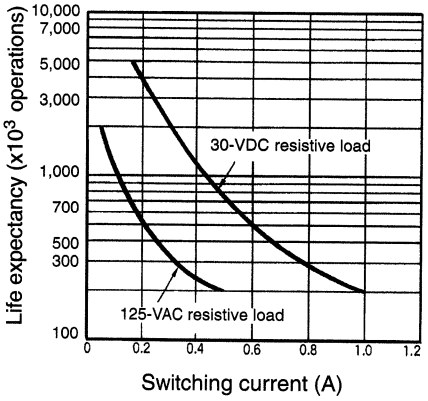
Model	Contac tform	Contac tform	Contact form
G6H-2F	DPDT	3 to 48 VDC	1A, 30 VDC 0.3A, 100 VDC 0.5A, 125 VDC

Engineering Data

Max. Switching Capacity

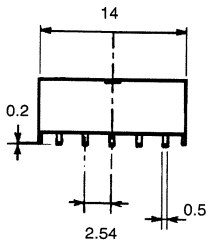


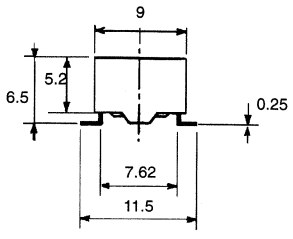
Life Expectancy

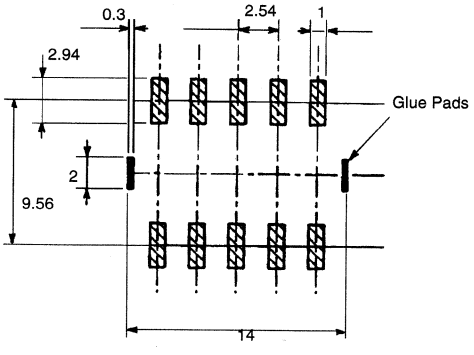


Dimensions

Note: Orientation marks are as follows: ▩ □





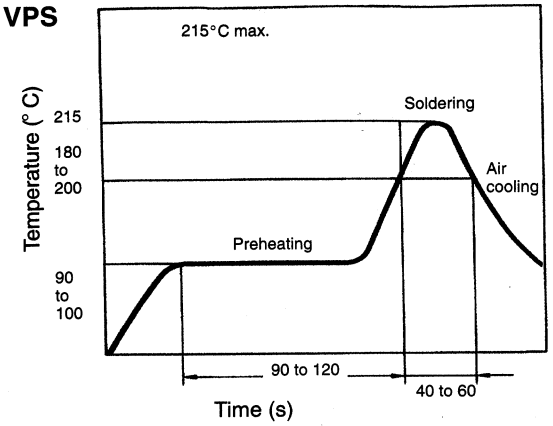


Relays

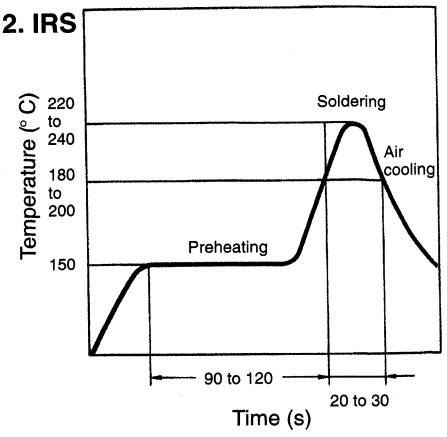
Precautions

Surface Temperature of PC Board VS. Recommended Soldering Time

1. VPS



2. IRS



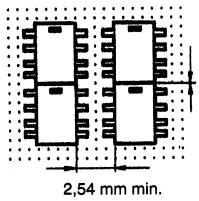
3. Other Considerations

- Soldering iron heat
  Temperature at tip: 280°C to 300°C
  Power: 30 W to 60 W
  Heating time: 3 s to 5 s
- When soldering with a pulse heater, hot air, or laser, take into account such factors as heat stress, and test the process under actual conditions.

Mounting

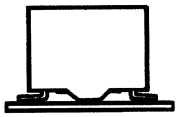
- Can be mounted in any orientation.
- Not suitable for socket mounting.
- Do not reverse the coil polarity.
- The diagram below the minimum spacing necessary when mounting more than one relay on a printed circuit board.

Surface Mounting Terminals



Terminals

L Terminals (G6H-2F)

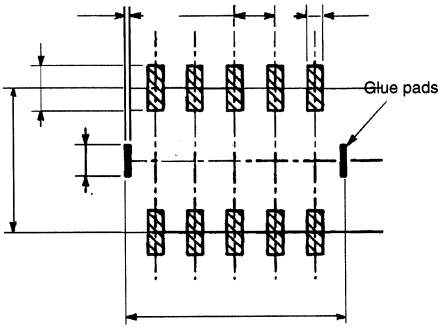


Characteristics

- Soldering methods

IRS (Infrared radiation furnace)
VPS (Vapor phase)

- Removal and replacement is simple.



Glue Pads

Glue pads are projections from the relay case where adhesive is applied to temporarily attach the relay to the printed circuit board before soldering. The soldering points are where solder is applied during soldering.

- Glue pads are for use with epoxy or UV adhesives. Glue pads are located on the sides to allow UV illumination and adhesive curing. Two points are provided for stability.

Orientation Marks

These marks are provided to properly position the relays when they are supplied to the printed circuit board automatically. Two types of orientation marks are provided.

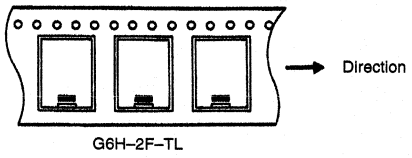
- Mechanical: A U-shaped impression along the top edge is used for alignment.
- Optical: A dark mark on the top surface is used for alignment.

Cleaning Methods

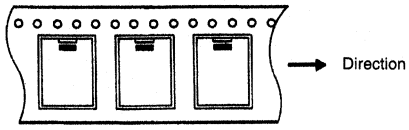
Brushing	Fine as long as the detergent has no chemical or electrical affect on the relay.
Dipping	
Spraying	
Vapor	
Hot water	
Ultrasonic	Fine as long as the detergent has no chemical or electrical affect on the relay. The model number of the ultrasound cleaning-type relay ends in "-U".

Tape Packing

- Taping method
  Tape type: TE2416R (or L)
  Reel type: R53
  There are 500 relays per reel.
  Relay orientation:

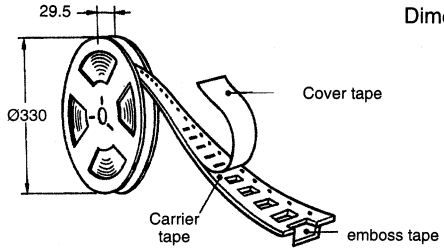


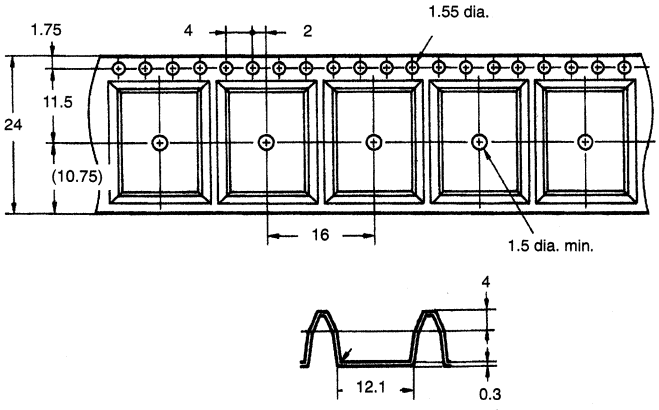
G6H–2F–TL

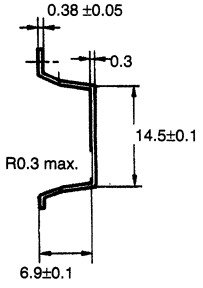


G6H-2F-TR

Dimensions







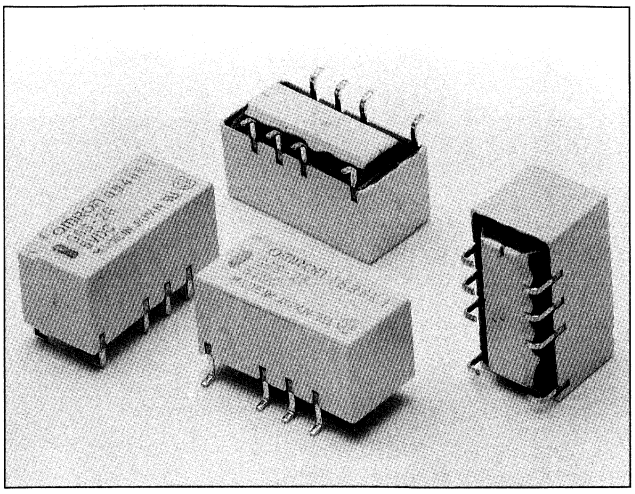
Relays

OMRON

PCB Relay

G6S

Surface Mount DPDT Relay



- Surface mount relay conforming to EN60950 supplementary isolation requirements.
- Long terminals for ideal for soldering and mounting reliability.
- Space-saving inside-L terminal.
- High dielectric withstand voltages between coil and contacts (2,000 VAC), and between contacts of different polarity (1,500 VAC).
- High impulse withstand voltages between coil and contacts, and between contacts of different polarity (2,500 V, 2 x 10 μs: Bellcore requirements).
- Low power consumption (140 mW).
- Bifurcated crossbar contact (Au-clad) and plastic sealed construction for high reliability.
- High sealability after IRS.
- Ultra-miniature at 15 x 7.5 x 9.4 mm (L x W x H).

Ordering Information

Classification			Single-side stable	Single-winding latching	Double-winding latching
DPDT	Plastic sealed	Outside-L	G6S-2F	G6SU-2F	G6SK-2F
		Inside-L	G6S-2G	G6SU-2G	G6SK-2G

Note: 1. When ordering, add the rated coil voltage to the model number. Rated coil voltages are given in the coil ratings table in "Specifications."

Example: G6S-2F 12 VDC
└── Rated coil voltage

2. When ordering tape packing, add "-TR" to the model number.

Example: G6S-2F-TR 12 VDC
└── Tape packing

3. "-TR" is not part of the relay model number, it is not marked on the relay case.

Model Number Legend:

G6S□-□□ □ □ VDC

1 2 3 4 5

1. **Relay Function**
   None: Single-side stable
   U: Single-winding latching
   K: Double-winding latching
2. **Contact Form**
   2: DPDT
3. **Terminal Shape**
   F: Outside-L surface mount terminal
   G: Inside-L surface mount terminal
4. **Approval Type**
   Y: EN60950 approved
5. **Rated Coil Voltage**
   4.5, 5,12 and 24 DC

Applications

- Public exchanger
- PBX (Private Branch Exchanger)
- Facsimile
- Telephone
- Modem
- Computer peripheral equipment

Specifications

■ Coil Ratings

Single-side Stable Type (G6S-2F, G6S-2G)

Rated voltage	4.5 VDC	5 VDC	12 VDC	24 VDC
Rated current	31.1 mA	28.0 mA	11.7 mA	8.3 mA
Coil resistance	145 Ω	178 Ω	1,028 Ω	2,880 Ω
Must operate voltage	75% max. of rated voltage			
Must release voltage	10% min. of rated voltage			
Max. voltage	200% of rated voltage at 23°C, 130% at 85°C			170% of rated voltage at 23°C, 130% at 85°C
Power consumption	Approx. 140 mW			Approx. 200 mW

Note: 1. The rated current and coil resistance are measured at a coil temperature of 23°C with a tolerance of ±10%.
2. Operating characteristics are measured at a coil temperature of 23°C.

Single-winding Latching Type (G6SU-2F, G6SU-2G)

Rated voltage		4.5 VDC	5 VDC	12 VDC	24 VDC
Rated current		22.2 mA	20 mA	8.3 mA	6.3 mA
Coil resistance		203 Ω	250 Ω	1,440 Ω	3,840 Ω
Coil inductance (H) (ref. value)	**Armature OFF**	0.27	0.36	2.12	5.80
	Armature ON	0.14	0.18	1.14	3.79
Must set voltage		75% max. of rated voltage			
Must reset voltage		75% max. of rated voltage			
Max. voltage		180% of rated voltage at 23°C, 140% at 85°C			
Power consumption		Approx. 100 mW			Approx. 150 mW

Note: 1. The rated current and coil resistance are measured at a coil temperature of 23°C with a tolerance of ±10%.
2. Operating characteristics are measured at a coil temperature of 23°C.

Double-winding Latching Type (G6SK-2F, G6SK-2G)

Rated voltage			4.5 VDC	5 VDC	12 VDC	24 VDC
Rated current			44.4 mA	40 mA	16.7 mA	12.5 mA
Coil resistance			101 Ω	125 Ω	720 Ω	1,920 Ω
Coil inductance (H) (ref. value)	**Set**	**Armature OFF**	0.12	0.14	0.60	1.98
		Armature ON	0.074	0.088	0.41	1.23
	Reset	**Armature OFF**	0.082	0.098	0.46	1.34
		Armature ON	0.14	0.16	0.54	2.23
Must set voltage			75% max. of rated voltage			
Must reset voltage			75% max. of rated voltage			
Max. voltage			170% of rated voltage at 23°C, 130% at 85°C			140% of rated voltage at 23°C, 110% at 70°C
Power consumption			Approx. 200 mW			Approx. 300 mW

Note: 1. The rated current and coil resistance are measured at a coil temperature of 23°C with a tolerance of ±10%.
2. Operating characteristics are measured at a coil temperature of 23°C.

■ Contact Ratings

Load	Resistive load ($\cos\phi = 1$)
Rated load	0.5 A at 125 VAC; 2 A at 30 VDC
Contact material	Ag (Au-clad)
Rated carry current	2 A
Max. switching voltage	250 VAC, 220 VDC
Max. switching current	2 A
Max. switching capacity	62.5 VA, 60 W
Min. permissible load	10 μA at 10 mVDC

Note: P level: $\lambda_{60} = 0.1 \times 10^{-6}$/operation

■ Characteristics

Contact resistance	75 mΩ max.
Operate (set)time	4 ms max. (mean value: approx. 2.5 ms; latching type: approx. 2 ms)
Release (reset) time	4 ms max. (mean value: approx. 1.5 ms; latching type: approx. 2 ms)
Bounce time	Operate: Approx. 0.5 ms Release: Approx. 0.5 ms Set/Reset: Approx. 0.5 ms
Max. operating frequency	Mechanical: 36,000 operations/hr Electrical: 1,800 operations/hr (under rated load)
Insulation resistance	1,000 MΩ min. (at 500 VDC)
Dielectric withstand voltage	2,000 VAC, 50/60 Hz for 1 min between coil and contacts 1,000 VAC, 50/60 Hz for 1 min between coil and contacts (double-winding latching) 1,500 VAC, 50/60 Hz for 1 min between contacts of different polarity 1,000 VAC, 50/60 Hz for 1 min between contacts of same polarity
Impulse withstand voltage	2,500 V, 2 x 10 μs between coil and contacts 1,500 V, 10 x 160 μs between coil and contacts (double-winding latching) 2,500 V, 2 x 10 μs between contacts of different polarity 1,500 V, 10 x 160 μs between contacts of same polarity (conforms to FCC Part 68)
Vibration resistance	Destruction: 10 to 55 Hz, 5-mm double amplitude Malfunction: 10 to 55 Hz, 3.3-mm double amplitude
Shock resistance	Destruction: 1,000 m/s^2 (approx. 100G) Malfunction: 750 m/s^2 (approx. 75G)
Life expectance	Mechanical: 100,000,000 operations min. (at 36,000 operations/hr) Electrical: 100,000 operations min. (2 A at 30 VDC, resistive load: 1,200 operations/hr) 100,000 operations min. (0.5 A at 125 VAC, resistive load)
Ambient temperature	Operating: –40°C to 85°C (with no icing), –40°C to 70°C (double-winding latching, 24 VDC) Storage: –40°C to 85°C (with no icing)
Ambient humidity	Operating: 35% to 85%
Weight	Approx. 2 g

■ Approved Standards

UL1950 (File No. E41515)/CSA C22.2 No.950 (File No. LR24825)

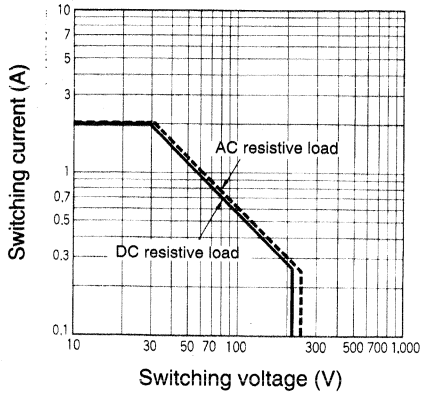
Model	Contact form	Coil ratings	Contact ratings
G6S-2F, G6S-2G G6SU-2F, G6SU-2G G6SK-2F, G6SK-2G	DPDT	1.5 to 48 VDC	2 A, 30 VDC 0.3 A, 110 VDC 0.5 A, 125 VAC

(EN60950 to Supplemantary Isolation)

Consult Omron for details.

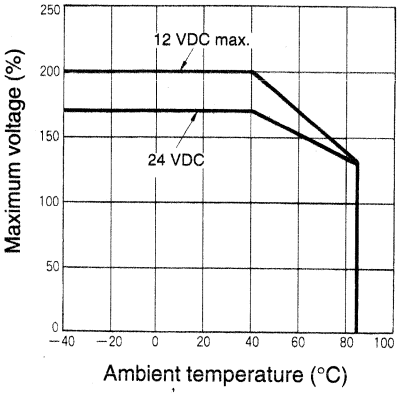
Engineering Data

Max. Switching Capacity

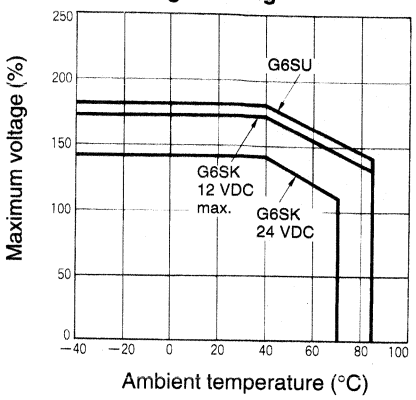


Ambient Temperature vs. Maximum Voltage

Single-side Stable



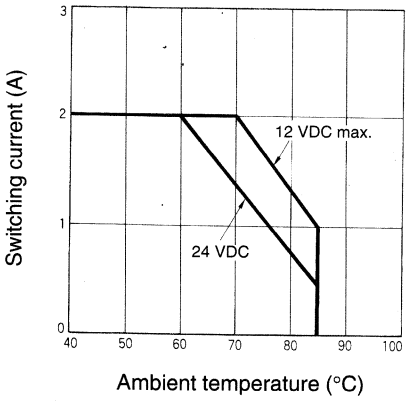
Single-winding Latching
Double-winding Latching



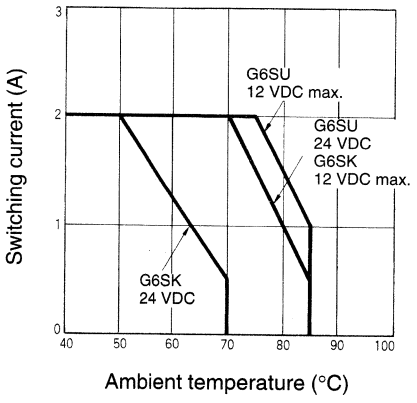
Reference Data

Ambient Temperature vs. Switching Current

Single-side Stable



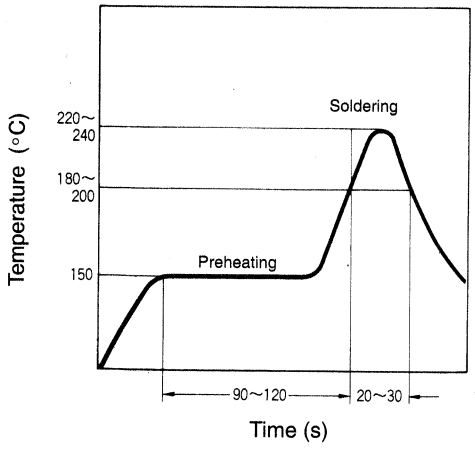
Single-winding Latching
Double-winding Latching



Recommended Soldering Time vs. Surface PCB Temperature

(The temperature profile indicates the temperature on the surface of the PCB.)

IRS



Relays

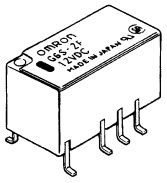
Dimensions

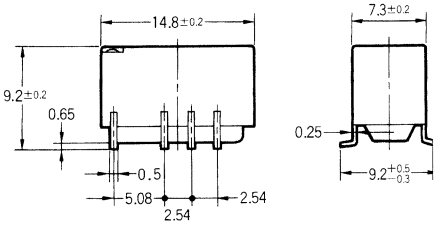
Note: All units are in millimeters unless otherwise indicated.

Single-side Stable

G6S-2F

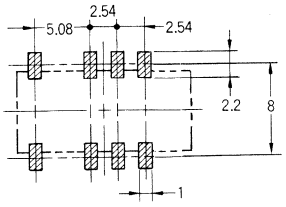
Tolerance: ±0.3



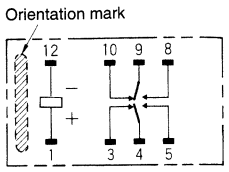


Footprint (Top View)

Tolerance: ±0.1

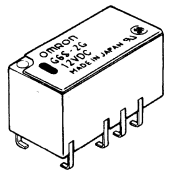


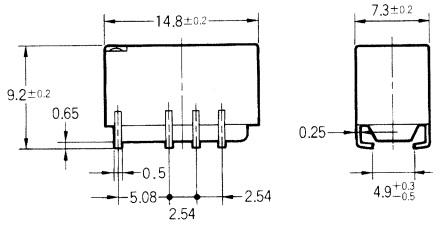
Terminal Arrangement/ Internal Connections (Top View)



G6S-2G

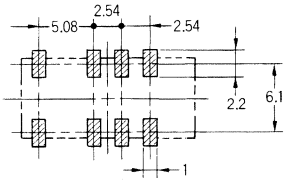
Tolerance: ±0.3



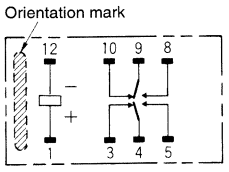


Footprint (Top View)

Tolerance: ±0.1



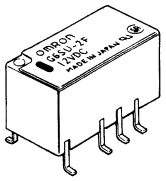
Terminal Arrangement/ Internal Connections (Top View)

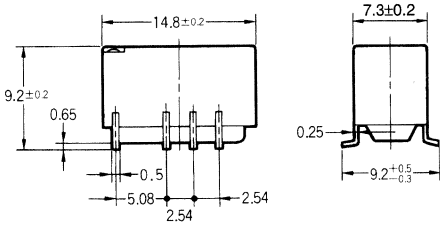


Single-winding Latching

G6SU-2F

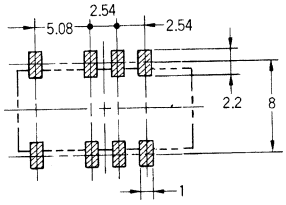
Tolerance: ±0.3



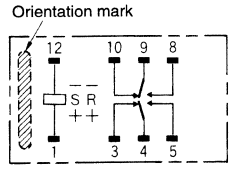


Footprint (Top View)

Tolerance: ±0.1

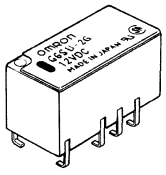


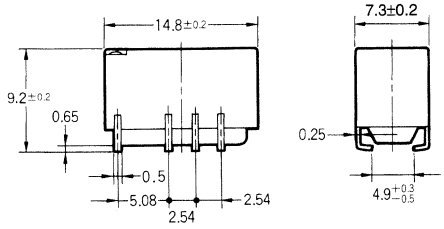
Terminal Arrangement/ Internal Connections (Top View)



G6SU-2G

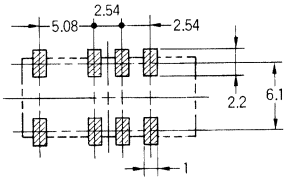
Tolerance: ±0.3



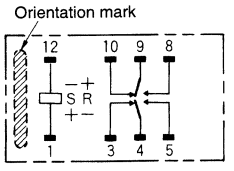


Footprint (Top View)

Tolerance: ±0.1



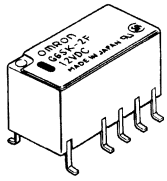
Terminal Arrangement/ Internal Connections (Top View)

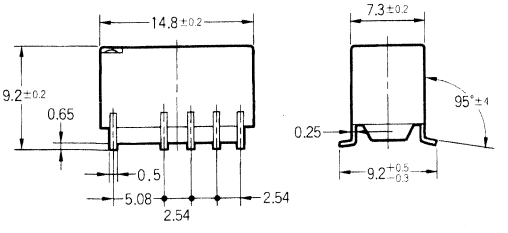


Double-winding Latching

G6SK-2F

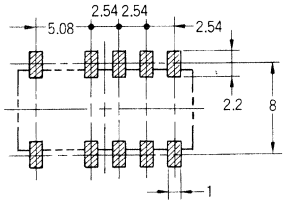
Tolerance: ±0.3



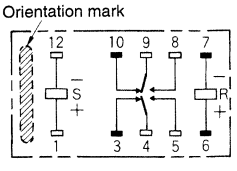


Footprint (Top View)

Tolerance: ±0.1

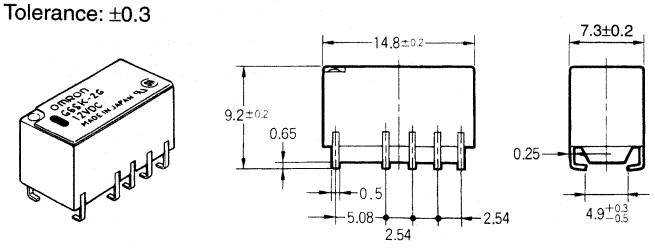


Terminal Arrangement/ Internal Connections (Top View)



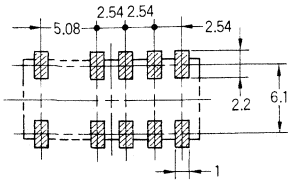
G6SK-2G

Tolerance: ±0.3

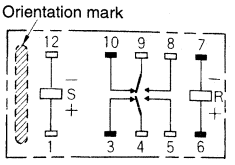


Footprint (Top View)

Tolerance: ±0.1



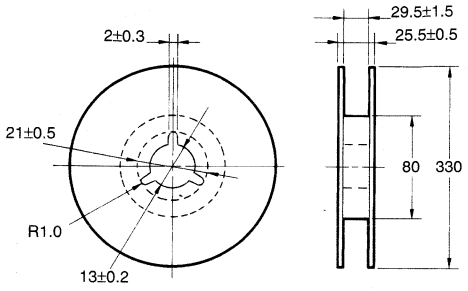
Terminal Arrangement/ Internal Connections (Top View)

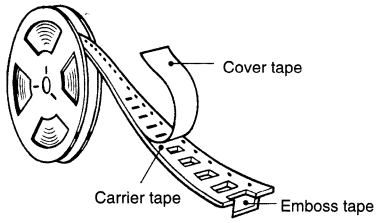


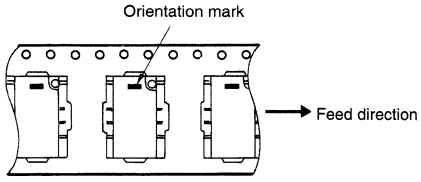
■ Tape Packing

When ordering, add "-TR" before the rated coil voltage for tape packing.

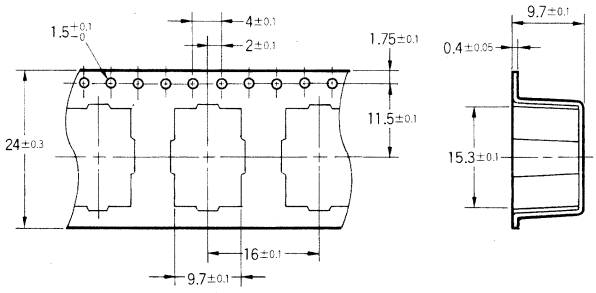
Tape type: TE2416R (Refer to EIAJ)
Relays per reel: 400



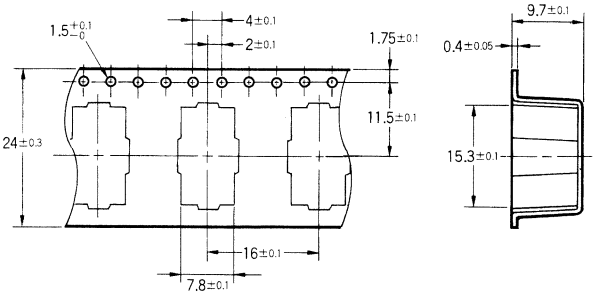




G6S-2F, G6SU-2F, G6SK-2F



G6S-2G, G6SU-2G, G6SK-2G



Precautions

Use a DC power supply with 5% or less ripple factor to operate the coil.

Do not use the G6S where subject to strong external magnetic fields.

Do not use the G6S where subject to magnetic particles or excessive amounts of dust.

Do not reverse the polarity of the coil (+, –).

Latching types are delivered in the reset position. We recommend that a reset voltage be applied in advance to start operation.

Do not drop the G6S or otherwise subject it to excessive shock.

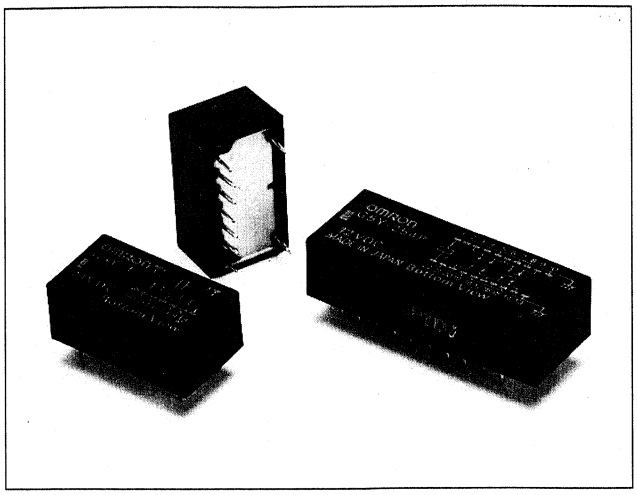
Remove the relay from the packing immediately prior to usage.

OMRON

PCB Relay

G5Y

Miniature RF Switching Relay with Excellent High Frequency Characteristics



- Threshold of malfunction by shock: 500 m/s^2 (50G) min. (mean value, 1,000 m/s^2 or greater).
- Max. height is 9 mm.
- High frequency isolation: 60 dB min. at 900 MHz (actual value 68 dB).
- Video applications: CATV, VTRs, TVs, BS tuners, TV games.
- Communications applications: Car telephones, marine mobile telephone systems, emergency traffic for disaster protection, PCM switch transceivers, optical transmission devices.
- Measurement applications: Measuring instrument for above apparatus.

Ordering Information

Classification	Contact form	Sealing	Model
General-purpose	SPDT	Plastic-sealed	G5Y-1
High-sensitivity			G5Y-1-H

Note: When ordering, add the rated coil voltage to the model number.
Example: G5Y-1 12 VDC
└ Rated coil voltage

Model Number Legend:

G5Y - □ - □ □ VDC
1 2 3

1. **Contact Form**
   1: SPDT
2. **Classification**
   None: General-purpose (300 mW)
   H: High-sensitivity (200 mW)
3. **Rated Coil Voltage**
   5, 12, 24 VDC

Specifications

■ Coil Ratings

Item		General-purpose			High-sensitivity		
Rated voltage		5 VDC	12 VDC	24 VDC	5 VDC	12 VDC	24 VDC
Rated current		60.2 mA	25 mA	12.5 mA	40 mA	16.7 mA	8.3 mA
Coil resistance		83 Ω	480 Ω	1,920 Ω	125 Ω	720 Ω	2,880 Ω
Coil inductance (H) (ref. value)	**Armature OFF**	0.27	1.7	6.7	0.42	2.55	10.5
	Armature ON	0.32	1.9	7.6	0.50	2.95	12.5
Must operate voltage		75% max. of rated voltage					
Must release voltage		10% min. of rated voltage					
Max. voltage		130% of rated voltage at 23°C					
Power consumption		Approx. 300 mW			Approx. 200 mW		

Note: 1. The rated current and coil resistance are measured at a coil temperature of 23°C with a tolerance of +10%.
2. Operating characteristics are measured at a coil temperature of 23°C.

■ Contact Ratings

Load	Resistive load (cosØ = 1)
Rated load	0.01 A at 24 VAC; 0.01 A at 24 VDC; 900 MHz, 1 W (VSWR: 1.2 max.)
Contact material	Au-plated
Rated carry current	0.5 A
Max. switching voltage	30 VAC, 30 VDC
Max. switching current	0.5 A
Max. switching capacity	10 VA, 10 W
Min. permissible load	0.01 mA at 10 mVDC

High-frequency Characteristics

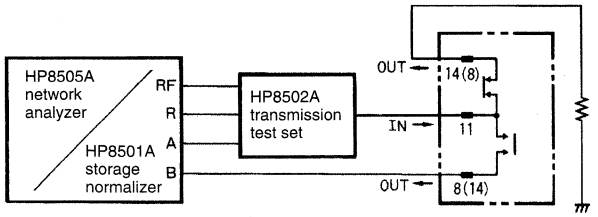
Item	250 MHz	900 MHz
Isolation	80 dB min.	60 dB min.
Insertion loss	0.5 dB max.	0.5 dB max.
VSWR	1.5 max.	1.8 max.
Switching power	10 W	
Carry power	10 W (VSWR: 1.2)	

Note: Line impedance (Zo) of the measuring instrument is 50 Ω.

■ Characteristics

Contact resistance	100 mΩ max. (mean value: approx. 30 mΩ)
Operate time	10 ms max. (mean value: approx. 5 ms)
Release time	5 ms max. (mean value: approx. 1 ms)
Bounce time	Operate: 5 ms max. (mean value: approx.1 ms)
Max. operating frequency	Mechanical: 1,800 operations/hr Electrical: 1,800 operations/hr (under rated load)
Insulation resistance	100 MΩ min. (at 500 VDC)
Dielectric withstand voltage	1,000 VAC, 50/60 Hz for 1 min between coil and contacts 500 VAC, 50/60 Hz for 1 min between contacts of same polarity 500 VAC, 50/60 Hz for 1 min between contacts, coil, and ground
Vibration resistance	Destruction: 10 to 55 Hz, 1.5-mm double amplitude Malfunction: 10 to 55 Hz, 1.5-mm double amplitude
Shock resistance	Destruction: 1,000 m/s^2 (approx. 100G) Malfunction: 500 m/s^2 (approx. 50G)
Life expectancy	Mechanical: 1,000,000 operations min. (at 1,800 operations/hr) Electrical: 300,000 operations min. (under rated load at 1,800 operations/hr)
Ambient temperature	Operating: –30°C to 70°C (with no icing) Storage: –30°C to 70°C (with no icing)
Ambient humidity	35% to 85%
Weight	Approx. 6 g

Engineering Data



Connecting socket
50 Ω termination

When a signal is applied from the transfer contacts to the NO contacts or from the transfer contacts to the NC contacts of the sample, the following characteristics are measured at contacts unrelated to the measurement terminated at 50 Ω.

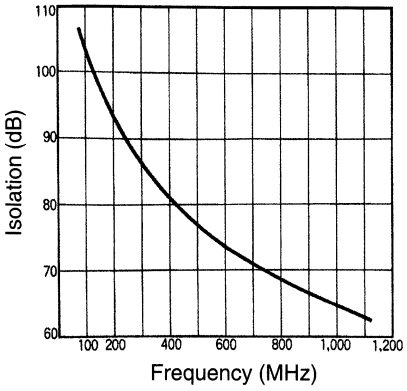
1. Isolation characteristics
2. Insertion loss characteristics
3. Return loss

Note: Conversion formulas between return loss and VSWR. (*x*: return loss)

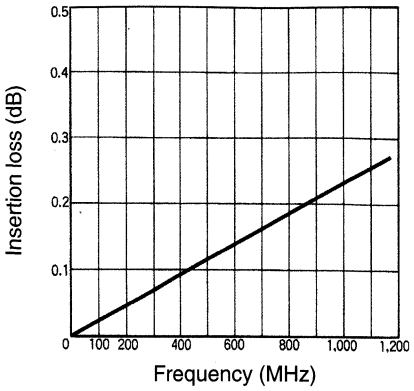
$$VSWR = \frac{1 + 10^{-\frac{x}{20}}}{1 - 10^{-\frac{x}{20}}}$$

Relays

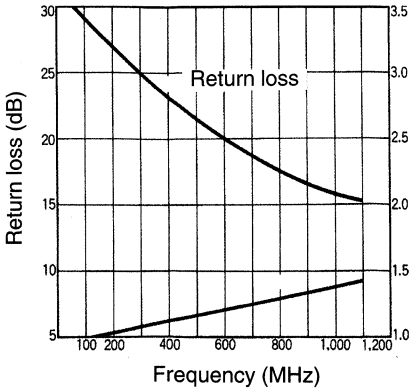
Isolation Characteristics Frequency vs. Isolation



Insertion Loss Characteristics Frequency vs. Isolation

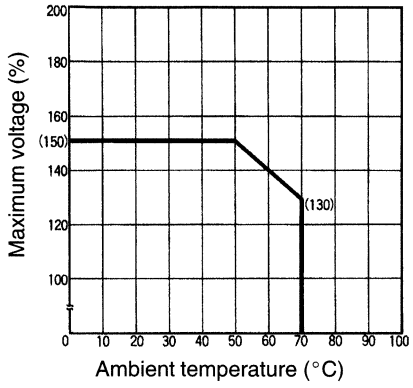


Isolation Characteristics Frequency vs. Return Loss and VSWR



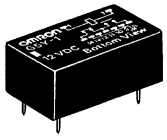
Note: VSWR stands for voltage standing wave ratio.

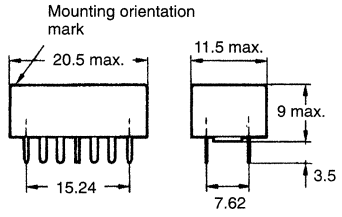
Ambient Temperature vs. Maximum Voltage



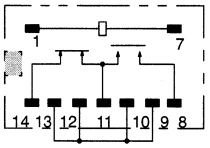
Dimensions

Note: 1. Orientation marks are indicated as follows:

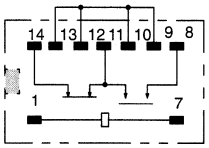




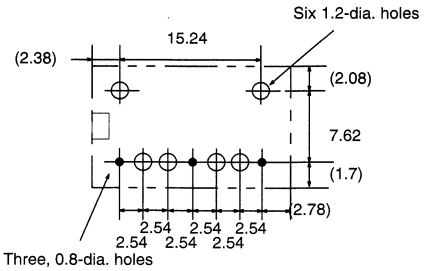
Terminal Arrangement/ Internal Connections (Bottom View)



(Top View)



Mounting Holes (Bottom View)
Tolerance: +0.1

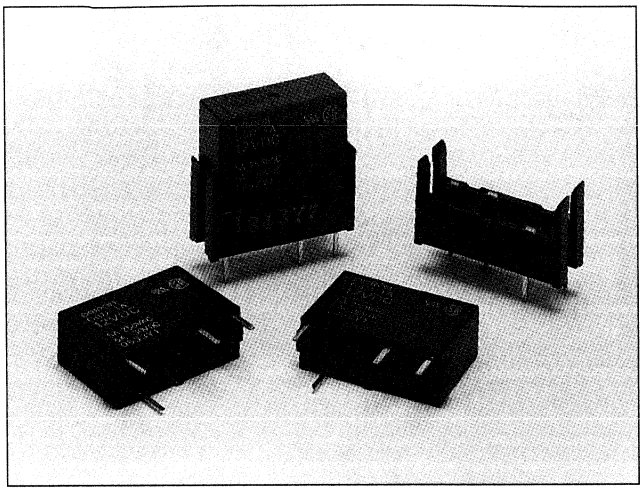


OMRON

Power Relay

G6D

Slim, Miniature Relay 6.5 x 12.5 x 17.5 mm (W x H x D), Capable of Relaying Programmable Controller and Temperature Controller Outputs



- Reduced board area (45% smaller than the G6B's bottom area) ideal for high-density mounting.
- Switches 5 A at 250 VAC/30 VDC.
- Pilot duty, D150 (UL/CSA).
- Allows 300,000 operations with a 2-A load at 250 VAC or 30 VDC.
- Actual load switching capability equals the G6B's capability.
- Suitable for immersion cleaning.

Ordering Information

Contact form	Rated coil voltage	Model
SPST-NO	5, 12, 24 VDC	G6D-1A

Classification

Contact form: SPST-NO
Enclosure: Plastic sealed
Terminal: PCB terminal

Model Number Legend:

G6D - □ □ □
1 2 3

1. Number of Poles
1: 1 pole

2. Contact Form
A: SPST-NO

3. Rated Coil Voltage
5, 12, 24 VDC

■ Accessories (Order Separately)

Connecting Socket	P6D-04P

Specifications

■ Coil Ratings

Rated voltage	5 VDC	12 VDC	24 VDC
Rated current	40 mA	16.7 mA	8.3 mA
Coil resistance	125 Ω	720 Ω	2,880 Ω
Must operate voltage	70% max. of rated voltage		
Must release voltage	10% min. of rated voltage		
Max. voltage	130% of rated voltage		
Power consumption	Approx. 200 mW		

Note: The must operate voltage is 75% or less of the rated voltage if the relay is mounted upside down.

■ Contact Ratings

Load	Resistive load (cosØ = 1)
Rated load	5 A at 250 VAC, 5 A at 30 VDC
Rated carry current	5 A
Max. switching voltage	250 VAC, 30 VDC
Max. switching current	5 A
Max. switching capacity	1,250 VA, 150 W
Min. permissible load	10 mA at 5 VDC

Note: P level: $\lambda_{60} = 0.1 \times 10^{-6}$/operation

■ Characteristics

Contact resistance	100 mΩ max.
Operating time	10 ms max.
Release time	5 ms max.
Insulation resistance	1,000 MΩ min. (at 500 VDC)
Dielectric withstand voltage	3,000 VAC, 50/60 Hz for 1 min between coil and contacts 750 VAC, 50/60 Hz for 1 min between contacts of same polarity
Surge withstand voltage	6,000 V 1.2 x 50 μs (between coil and contacts)
Vibration resistance	Destruction: 10 to 55 Hz, 1.5-mm double amplitude Malfunction: 10 to 55 Hz, 1.5-mm double amplitude
Shock resistance	Destruction: 1,000 m/s^2 (approx. 100G) Malfunction: 100 m/s^2 (approx. 10G)
Life expectancy	Mechanical: 20,000,000 operations min. (at 18,000 operations/hr) Electrical: 100,000 operations min. (5 A at 250 VAC/30 VDC, resistive load) 300,000 operations min. (2 A at 250 VAC/30 VDC, resistive load)
Ambient temperature	Operating: –25°C to °70C (with no icing)
Ambient humidity	Operating: 45% to 85%
Weight	Approx. 3 g

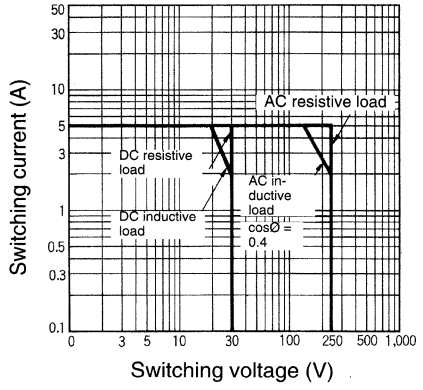
■ Approved Standards

UL508 (File No. E41515)/CSA C22.2 No.14 (File No. LR31928)

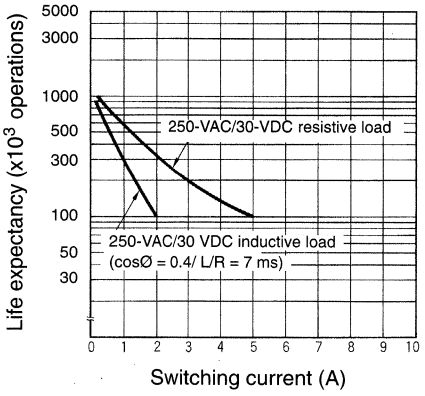
Model	Coil ratings	Contact ratings
G6D-1A	5 to 24 VDC	5 A, 250 VAC 5 A, 30 VDC

Engineering Data

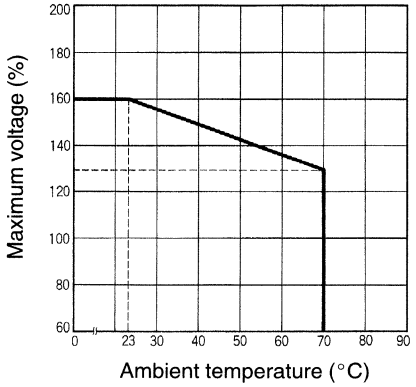
Max. Switching Capacity



Life Expectancy



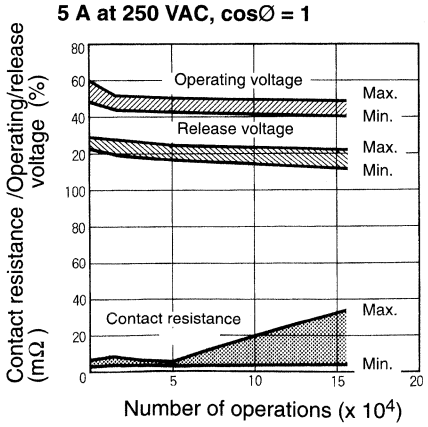
Ambient Temperature vs. Maximum Voltage



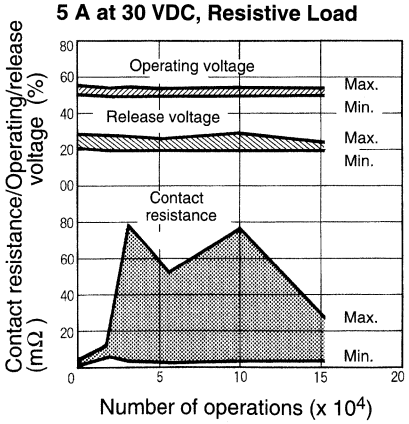
■ Reference Data

Electrical Life Expectancy

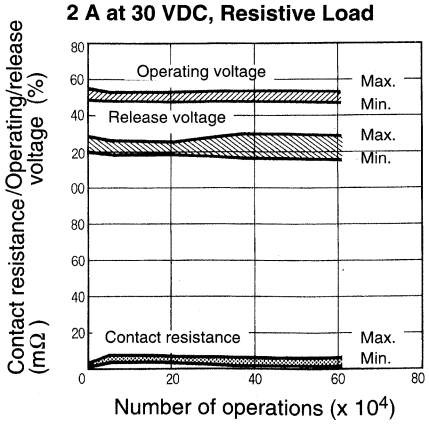
5 A at 250 VAC, cosØ = 1



5 A at 30 VDC, Resistive Load

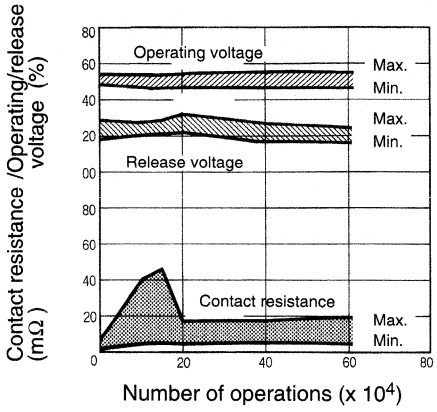


2 A at 30 VDC, Resistive Load



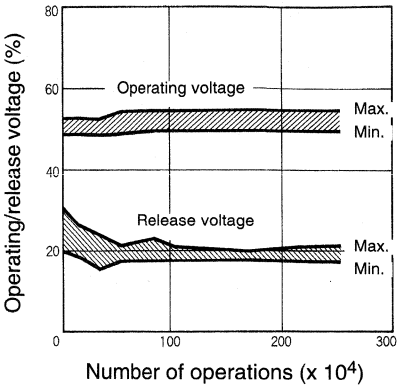
Electrical Life Expectancy

2 A at 250 VAC, cosØ = 1

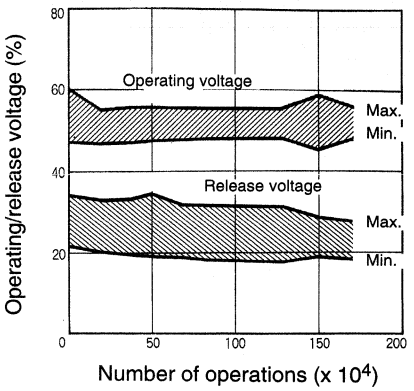


Actual Load Test Data

With OMRON's H3BA Timer (5 mA at 200 VAC)



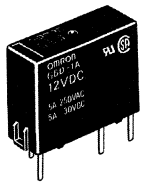
With OMRON's MA415A Contacter (40 mA at 200 VAC)

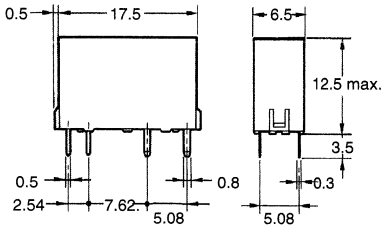


Dimensions

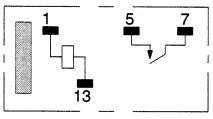
Note: 1. Orientation marks are indicated as follows:

G6D-1A



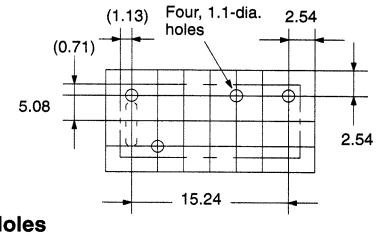


Terminal Arrangement/ Internal Connections (Bottom View)

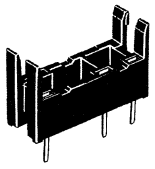


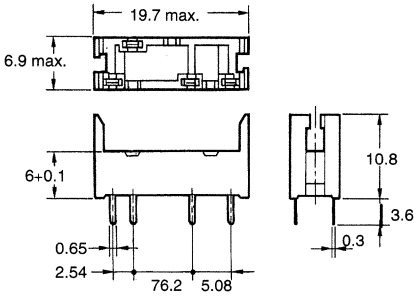
Mounting Holes (Bottom View)

Tolerance: +0.1



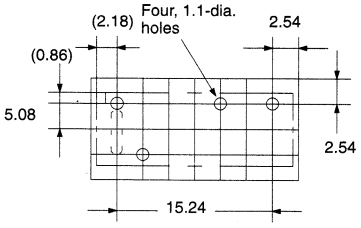
Socket P6D-04P





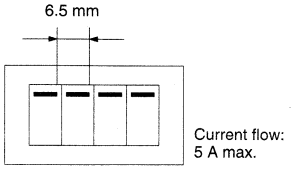
Mounting Holes (Bottom View)

Tolerance: +0.1

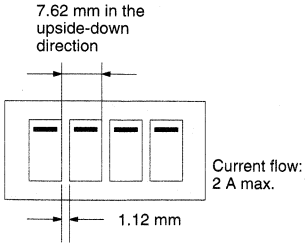


Precautions

More than two relays can be closely mounted right side up as shown in the following illustration.

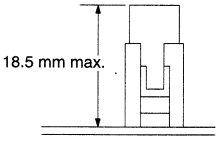


More than two relays can be closely mounted upside down as shown in the following illustration.



Note: The space between each relay required for heat radiation may vary with operating conditions. Contact your OMRON representative for details.

Socket Mounting Height



When mounting the relay, insert it into the socket as vertically as possible so that the relay terminals contact securely with the contact pins on the socket.

The P6D is flux-resistive. Do not wash the P6D with water.

Dismount the relay from the socket before soldering the socket to a PCB.

Relays

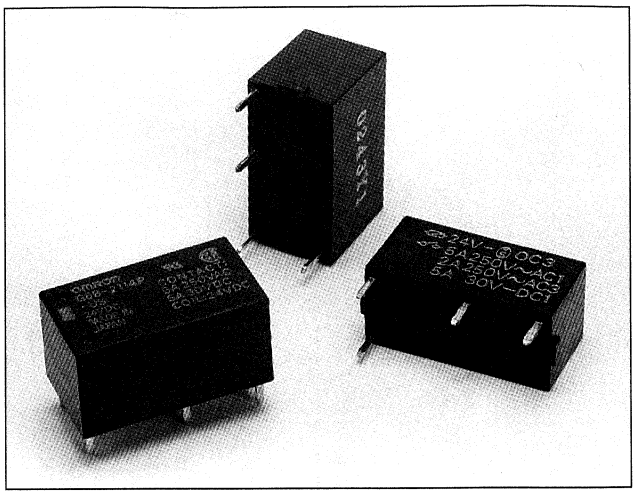
OMRON

PCB Relay

G6B

Subminiature Relay that Switches up to 8 A

- Subminiature: 20 (W) x 10 (L) x 10 (H) mm version.
- Low power consumption: 200 mW.
- Surge withstand voltage meets FCC Part 68.
- Unique moving loop armature reduces relay size, magnetic interference, and contact bounce time.
- Single- and double-winding latching types also available.
- High Capacity type to switch 8A.



Ordering Information

Contact form	Terminal type	Single-side stable	Single winding latching	Double-winding latching
SPST-NO	Straight PCB	G6B-1114P-US	G6BU-1114P-US	G6BK-1114P-US
	High Capacity type	G6B-1174P-US	---	---
SPST-NO + SPST-NC	Straight PCB	G6B-2114P-US	---	
DPST-NO	Straight PCB	G6B-2214P-US	---	
DPST-NC	Straight PCB	G6B-2014P-US	---	

Note: When ordering, add the rated coil voltage to the model number.
Example: G6B-1114P-US 12 VDC
Rated coil voltage

Model Number Legend:

G6B - □ - □ □ □ □ □ □ - □ □ VDC
1 2 3 4 5 6 7 8

1. **Relay Function**
   None: Single-side stable
   U: Single-winding latching
   K: Double-winding latching
2. **Contact Form**
   21: SPST-NO + SPST-NC
   22: DPST-NO
   20: DPST-NC
   11: SPST-NO
4. **Contact Type**
   1: Single button
   7: High Capacity type
5. **Enclosure Rating**
   4: Plastic-sealed
6. **Terminals**
   P: Straight PCB
   C: Self-clinching PCB
7. **Approved Standards**
   US: UL/CSA certified
8. **Rated Coil Voltage**
   3, 5, 6, 12, 24 VDC

■ Accessories (Order Separately)

Back Connecting Sockets

Applicable relay	Back connecting socket*
G6B(U)-1114P-US	P6B-04P
G6BK-1114P-US	P6B-06P

*Not applicable to the self-clinching type.

Removal Tool	P6B-Y1
Hold-down Clips	P6B-C2

Specifications

■ Coil Ratings

Single-side Stable Type

Item		SPST-NO					SPST-NO + SPST-NC, DPST-NO, DPST-NC				
Rated voltage (VDC)		3	5	6	12	24	3	5	6	12	24
Rated current (mA)		67	40	33.3	16.7	8.3	100	60	50	25	12.5
Coil resistance (Ω)		45	125	180	720	2,880	30	83.3	120	480	1,920
Coil inductance (H) (ref. value)	Armature OFF	0.20	0.28	0.31	1.2	4.9	---	---	---	---	---
	Armature ON	0.18	0.26	0.28	1.1	4.1	---	---	---	---	---
Must operate voltage		70% max. of rated voltage					80% max. of rated voltage				
Must release voltage		10% min. of rated voltage									
Max. voltage		130% of rated voltage					110% of rated voltage				
Power consumption		Approx. 200 mW					Approx. 300 mW				

Single-winding Latching Type

Rated voltage		3 VDC	5 VDC	6 VDC	12 VDC	24 VDC
Rated current		67 mA	40 mA	33.3 mA	16.7 mA	8.3 mA
Coil resistance		45 Ω	125 Ω	180 Ω	720 Ω	2,880 Ω
Coil inductance (H) (ref. value)	Armature OFF	0.20	0.28	0.31	1.2	4.9
	Armature ON	0.18	0.26	0.28	1.1	4.1
Must operate voltage		70% max. of rated voltage				
Must release voltage		70% min. of rated voltage				
Max, voltage		130% of rated voltage				
Power consumption		Approx. 200 mW				

Double-winding Latching Type

Rated voltage			3 VDC	5 VDC	6 VDC	12 VDC	24 VDC
Set coil	Rated current		93.2 mA	56 mA	46.8 mA	23.3 mA	11.7 mA
	Coil resistance		32.2 Ω	89.2 Ω	128.5 Ω	515 Ω	2,060 Ω
	Coil inductance (H) (ref. value)	Armature OFF	0.11	0.15	0.18	0.52	1.2
		Armature ON	0.11	0.15	0.18	0.52	1.2
Reset coil	Rated current		93.2 mA	56 mA	46.8 mA	23.3 mA	11.7 mA
	Coil resistance		32.2 Ω	89.2 Ω	128.5 Ω	515 Ω	2,060 Ω
	Coil inductance (H) (ref. value)	Armature OFF	0.11	0.15	0.18	0.52	1.2
		Armature ON	0.11	0.15	0.18	0.52	1.2
Must set voltage			70% max. of rated voltage				
Must reset voltage			70% min. of rated voltage				
Maximum voltage			130% of rated voltage				
Power consumption			Set coil: Approx. 280 mW Reset coil: Approx. 280 mW				

Note: 1. The rated current and coil resistance are measured at a coil temperature of 23°C with a tolerance of ±10%.

2. Operating characteristics are measured at a coil temperature of 23°C.

■ Contact Ratings

Item	SPST-NO		SPST-NO + SPST-NC, DPST-NO, DPST-NC	
Load	Resistive load (cosØ = 1)	Inductive load (cosØ = 0.4; L/R = 7 ms)	Resistive load (cosØ = 1)	Inductive load (cosØ = 0.4; L/R = 7 ms)
Rated load	5 A (8A) at 250 VAC; 5A (8A) at 30 VDC	2 A at 250 VAC; 2 A at 30 VDC	5 A at 250 VAC; 5A at 30 VDC	1.5 A at 250 VAC; .5 A at 30 VDC
Contact material	AgCdO			
Rated carry current	5 A (8A)		5 A	
Max. switching voltage	380 VAC, 125 VDC			
Max. switching current	5 A (8A)		5 A	
Max. switching capacity	1,250 VA, 150 W (2,000 VA, 240 W)	500 VA, 60 W	1,250 VA, 150 W	375 VA, 60 W
Min. permissible load0	10 mA at 5 VDC			

3.: P level: $\lambda_{60} = 0.1 \times 10^{-6}$/operation

4. Figures in parentheses relate to High Capacity type.

Relays

■ Characteristics

Contact resistance	30 mΩ max.
Operate (set) time	10 ms max. (mean value: 1-pole approx. 3 ms, 2-pole approx. 4 ms)
Release (reset) time	Single-side stable types: 10 ms max. (mean value: 1-pole approx. 1 ms, 2-pole approx. 2 ms) Latching types: 10 ms max. (mean value: approx. 3 ms)
Bounce time	Operate: 5 ms max. (mean value: approx. 3 ms) Release: 5 ms max. (mean value: approx. 1 ms)
Min. set/reset signal width	Latching type: 15 ms min. (at 23°C)
Max. operating frequency	Mechanical: 18,000 operations/hr Electrical: 1,800 operations/hr (under rated load)
Insulation resistance	1,000 MΩ min. (at 500 VDC)
Dielectric withstand voltage	3,000 VAC (Latching types: 2,000 VAC), 50/60 Hz for 1 min between coil and contacts 1,000 VAC, 50/60 Hz for 1 min between contacts of same polarity 250 VAC, 50/60 Hz for 1 min between set and reset coils 2,000 VAC, 50/60 Hz for 1 min between contacts of different polarity
Vibration resistance	Destruction: 10 to 55 Hz, 1.5-mm double amplitude Malfunction: 10 to 55 Hz, 1.5-mm double amplitude
Shock resistance	Destruction: 1,000 m/s^2 (approx. 100G) Malfunction: Single-side stable: 100 m/s^2 (approx. 10G); Latching: 300 m/s^2 (approx. 30G)
Life expectancy	Mechanical: 50,000,000 operations min. (at 18,000 operations/hr) Electrical: 100,000 operation min. (at 1,800 operations/hr)
Ambient temperature	Operating: –25°C to 70°C (with no icing) Storage: –25°C to 70°C (with no icing)
Ambient humidity	Operating: 45% to 85%
Weight	Double-winding latching: Approx. 3.7 g Double pole: Approx. 4.5 g Other: Approx. 3.5 g

Note: The data shown above are initial value

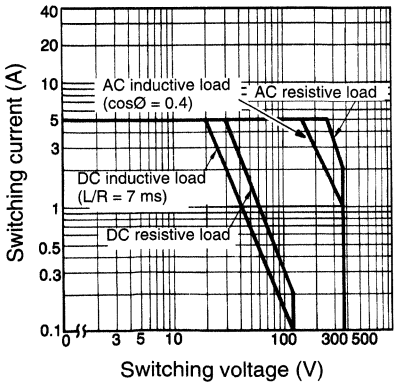
■ Approved Standards

UL508 (File No. E41643)/CSA C22.2 No.14 (File No. LR31928)

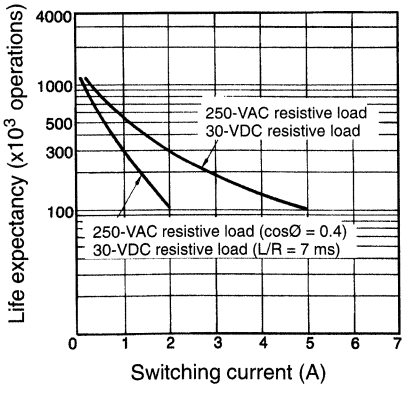
Model	Contact form	Coil rating	Contact rating
G6B-1114P-US G6B-1114C-US G6BU-1114P-US G6BU-1114C-US G6BK-1114P-US G6BK-1114C-US G6B-1114P-US G6B-1114C-US G6BU-1114P-US G6BU-1114C-US G6BK-1114P-US G6BK-1114C-US	SPST-NO	3 to 24 VDC	5 A, 250 VAC (general use) 5 A, 30 VDC (resistive load) 1/8 hp, 250 VAC (motor load) 1/6 hp, 250 VAC (motor load) 360 WT, 120 VAC (tungsten)
G6B-2114P-US G6B-2114C-US G6B-2214P-US G6B-2214C-US G6B-2014P-US G6B-2014C-US	SPST-NO + SPST-NC SPST-NO SPST-NC		5 A, 250 VAC (general use) 5 A, 30 VDC (resistive load)

Engineering Data

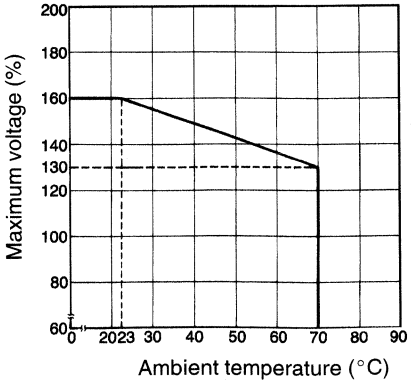
G6B-1114P-US Max. Switching Capacity



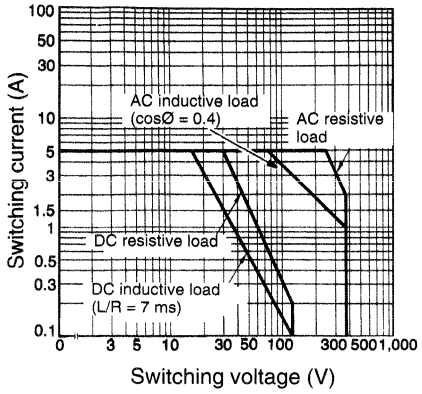
Life Expectancy



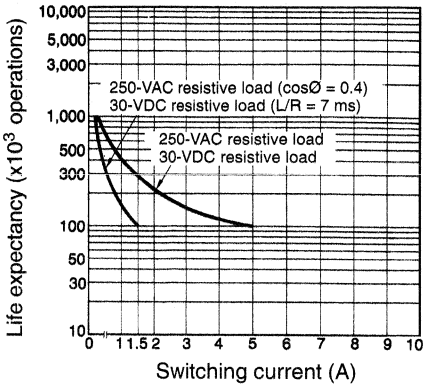
Ambient Temperature vs. Maximum Voltage



G6B-2114P-US, G6B-2214P-US, G6B-2014P-US
Max. Switching Capacity



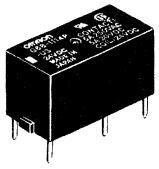
Life Expectancy

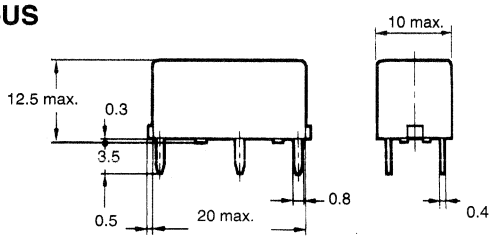


Dimensions

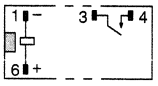
Note: 1. Orientation marks are indicated as follows:

G6B-1174P-US

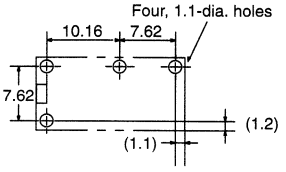




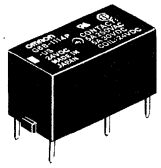
Terminal Arrangement/Internal Connections (Bottom View)
G6B-1174P–US

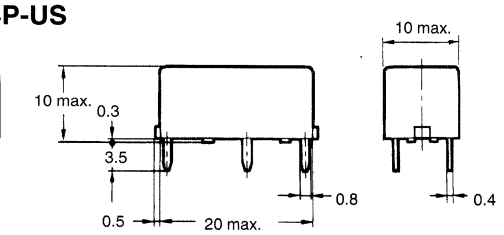


Mounting Holes (Bottom View)
G6B-1114P, -1174P

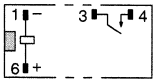


G6B-1114P-US
G6BU-1114P-US

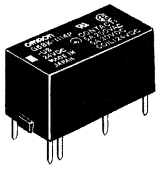


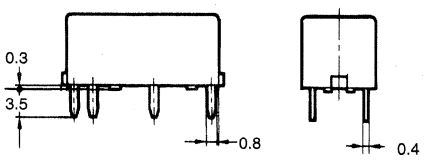


Terminal Arrangement/Internal Connections (Bottom View)
G6B-1114P

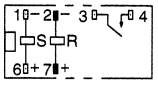


G6BK-1114P-US

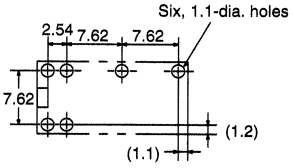




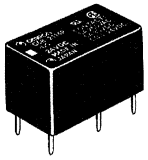
Terminal Arrangement/Internal Connections (Bottom View)
G6BK-1114P



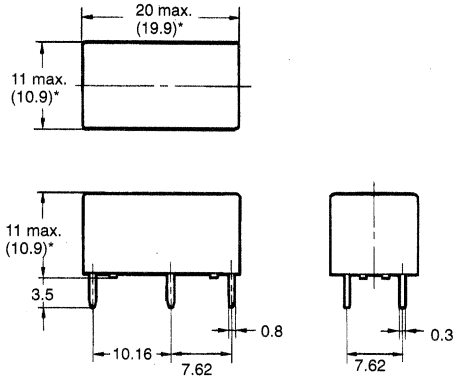
Mounting Holes (Bottom View)
G6BK-1114P



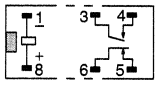
G6B-2114P-US
G6B-2214P-US
G6B-2014P-US



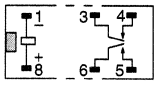
*Average value



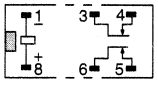
Terminal Arrangement/Internal Connections (Bottom View)
G6B-2114P-US



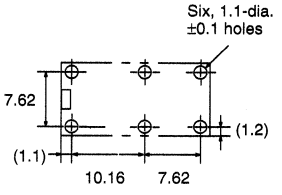
G6B-2214P-US



G6B-2014P-US

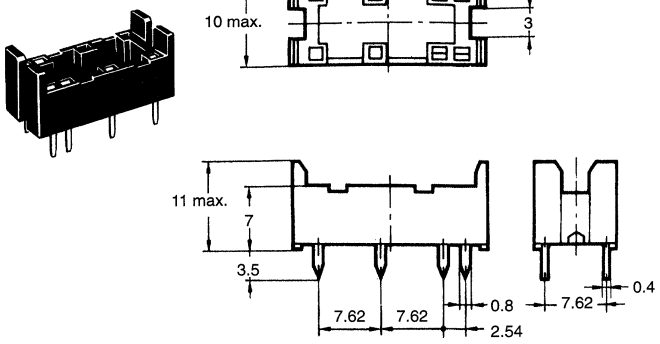


Mounting Holes (Bottom View)
Tolerance: ±0.1



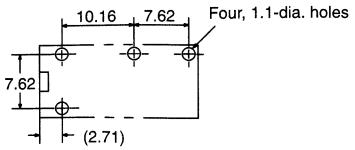
Relays

Back Connecting Socket

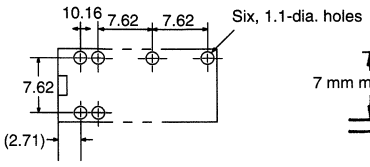


Mounting Holes (Bottom View)

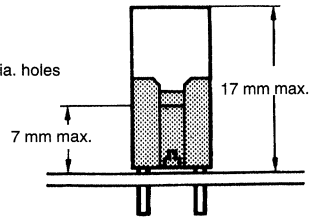
P6B-04P



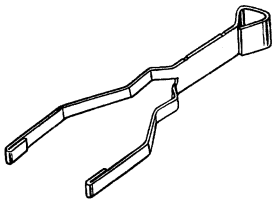
P6B-06P



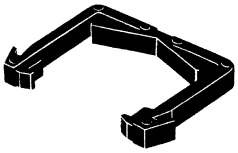
Mounting Height



Removal Tool
P6B-Y1



Hold-down Clips
P6B-C2



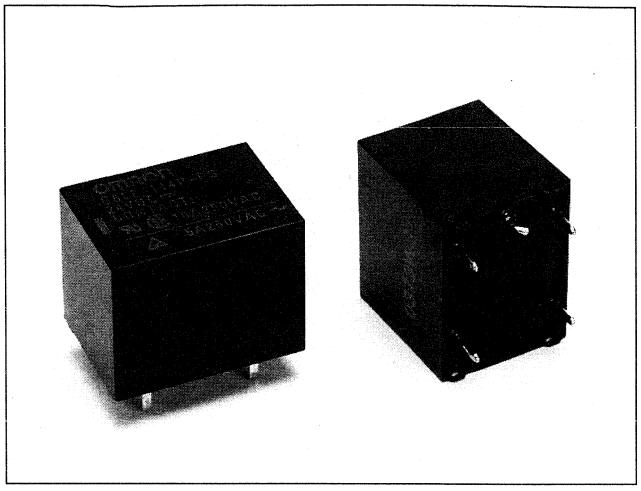
OMRON

PCB Relay

G5L(E)

A Cubic, Single-pole Power Relay Available in 5-A and 10-A Models

- Subminiature 'sugar cube' relay.
- Contact ratings of 5 A or 10 A.
- Withstands impulses of up to 4,500 V.
- Three types of seal available: unsealed, flux protection and plastic-sealed.
- UL class-B insulation type also available.



Ordering Information

Seal	Contact form	Standard	High capacity	UL class-B insulation
Unsealed	SPDT	G5L-112P–PS	G5LE-112P-PS	G5LE-112P-T130-PS
	SPST-NO	G5L-1112P–PS	G5LE-1112P-PS	G5LE-1112P-T130-PS
Flux protection	SPDT	G5L-117P–PS	G5LE-117P-PS	G5LE-117P-T130-PS
	SPST-NO	G5L-1117P–PS	G5LE-1117P-PS	G5LE-1117P-T130-PS
Plastic-sealed	SPDT	G5L-114P–PS	G5LE-114P-PS	G5LE-114P-T130-PS
	SPST-NO	G5L-1114P–PS	G5LE-1114P-PS	G5LE-1114P-T130-PS

Note: 1. When ordering, add the rated coil voltage to the model number.
Example: G5L(E)-112P 12 VDC
Rated coil voltage

2. G5L plastic-sealed relay terminals are pre-soldered in the standard product.

Model Number Legend:

G5L(E) -□ □ □ □ □ - □ - □ - □ □ VDC
1 2 3 4 5 6 7 8 9

1. **Number of Poles**
   1: 1 pole
2. **Contact Form**
   None: SPDT
   1: SPST-NO
3. **Contact Type**
   1: Single button
4. **Sealing**
   2: Unsealed
   7: Flux protection
   4: Plastic-sealed
5. **Terminals**
   P: Straight PCB
6. **Insulation**
   None: Standard
   T130: UL Class B
7. **Terminal Arrangement**
   None: Non-soldered type
   PS: Pre-soldered type
8. **Approved Standards**
   None: UL/CSA
9. **Rated Coil Voltage**
   5, 6, 9, 12, 24, 48 VDC

Relays

Specifications

■ Coil Ratings

Rated voltage (VDC)	3	5	6	9	12	24	48
Rated current (mA)	133.3	79.4	66.7	45	33.3	16.7	8.33
Coil resistance (Ω)	22.5	63	90	200	360	1,440	5,760
Must operate voltage	75% of rated voltage (max.)						
Must release voltage	10% of rated voltage (min.)						
Max. voltage	130% of rated voltage at 70°C, 170% of rated voltage at °23C						
Power consumption (mW)	Approx. 400						

Note: 1: The rated current and coil resistance are measured at a coil temperature of 23°C with a tolerance of ±10%.
2: Operating characteristics are measured at a coil temperature of 23°C.

■ Contact Ratings

Item	G5L	G5LE
Load	resistive load (cosØ = 1)	
Rated load	5 A at 120 VAC; 5 A at 30 VDC	10 A at 120 VAC; 8 A at 30 VDC
Contact material	AgCdO	
Rated carry current	5 A	10 A
Max. switching voltage	250 VAC, 125 VDC (30 VDC when UL/CSA standard is applied)	
Max. switching current	AC or DC: 5 A	AC: 10 A; DC: 8 A
Max. switching capacity	600 VA, 150 W	1,200 VA, 240 W
Min. permissible load	100 mA at 5 VDC	

■ Characteristics

Item	G5L	G5LE
Contact resistance	100 mΩ max.	
Operate time	10 ms max.	
Release time	5 ms max.	
Bounce time	Operate: Approx. 0.6 ms Release: Approx. 7.2 ms	
Max. switching frequency	Mechanical: 18,000 operations/hr Electrical: 1,800 operations/hr (under rated load)	
Insulation resistance	100 MΩ min. (at 500 VDC)	
Dielectric withstand voltage	750 VAC, 50/60 Hz for 1 min between contacts of same polarity 2,000 VAC, 50/60 Hz for 1 min between coil and contacts	
Impulse withstand voltage	4,500 V between coil and contacts	
Vibration resistance	Destruction: 10 to 55 Hz, 1.5-mm double amplitude Malfunction: 10 to 55 Hz, 1.5-mm double amplitude	
Shock resistance	Destruction: 1,000 m/s^2 (approx. 100G) Malfunction: 100 m/s^2 (approx. 10G)	
Life expectancy	Mechanical: 10,000,000 operations min. (at 18,000 operations/hr) Electrical: 100,000 operations min. (at 1,800 operations/hr)	
	60k ops min at 3A, 250VAC resistive	30k ops min at 10A, 250V resistive
Ambient temperature	Operating: –25°C to 70°C Class B –25°C to 85°C	
Ambient humidity	Operating: 35% to 85%	
Weight	Approx. 12 g	

■ Approved Standards

UL114, UL478, UL325, UL508, UL1409, UL1950 (File No. E41643)

Model	Coil rating	Contact rating
G5L	3 to 48 VDC	5 A, 250 VAC (general use) 5 A, 30 VDC (resistive load) 125 VA, 120 VAC (P.D 100,000 cycles) 5 A, 125 VAC (G.P), 30K, 70°C NO: 1/8 hp, 120 VAC (50,000 cycles) 4 FLA, 4 LRA, 120 VAC (100,000 cycles) 1/2 s, ON:OFF Ambient temperature: 105°C 5 FLA, 30 LRA, 120 VAC Mechanical life: 100,000 cycles (for G5L-112P) TV-3, 120 VAC NC: 1/10 hp, 120 VAC (50,000 cycles) 2 FLA, 4 LRA, 120 VAC (100,000 cycles) 1/2 s, ON:OFF Ambient temperature: 105°C
G5LE		10 A, 250 VAC (general use) 8 A, 30 VDC (resistive load) NO: 1/6 hp, 120 VAC (50,000 cycles) 1/3 hp, 125 VAC, 70°C 30K with Class 130B system 65°C 30K with Class 105 Coil insulation system NC: 1/8 hp, 120 VAC (50,000 cycles)

CSA C22.2 NO. 14 (File No. LR34815)

Model	Coil rating	Contact rating
G5L	3 to 48 VDC	5 A, 250 VAC (general use) 5 A, 30 VDC (resistive load) 125 VA, 120 VAC (P.D 100,000 cycles) 5 A, 125 VAC (G.P), 30K, 70°C NO: 1/8 hp, 120 VAC (50,000 cycles) TV-3 NC: 1/10 hp, 120 VAC (50,000 cycles)
G5LE		10 A, 250 VAC (general use) 8 A, 30 VDC (resistive load) 6 A, 277 VAC (general use), 100K NO: 1/6 hp, 120 VAC (50,000 cycles) 1/3 hp, 125 VAC, 70°C 30K NC: 1/10 hp, 120 VAC (50,000 cycles)

Note: Only model numbers with the suffix "ASI" are TV-5 approved.

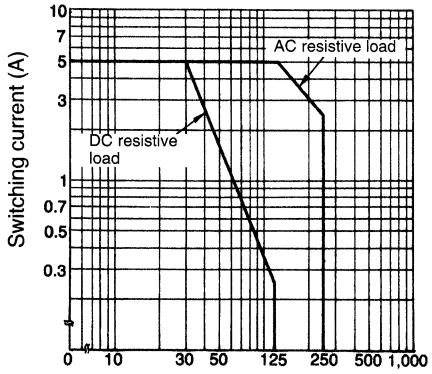
TÜV (VDE File No. R9151267)

Model	Coil rating	Contact rating
G5L	3, 5, 6, 9, 12, 24 VDC	1.2 A, 250 VAC (cosØ = 0.4) 2.5 A, 250 VAC (resistive load) 5 A, 30 VDC (resistive load)
G5LE		2.5 A, 250 VAC (cosØ = 0.4) 5 A, 250 VAC (resistive load) 8 A, 30 VDC (resistive load)

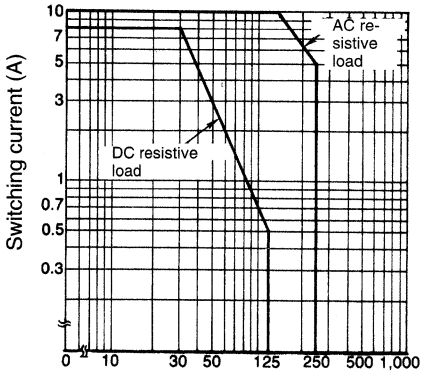
Engineering Data

Max. Switching Capacity

G5L

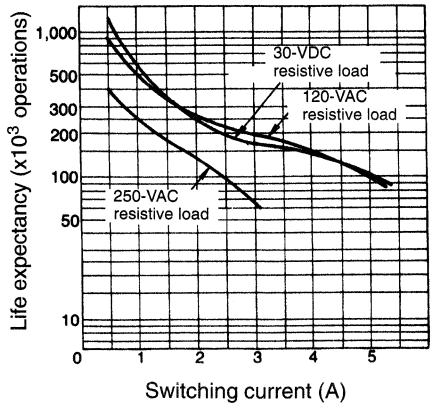


G5LE

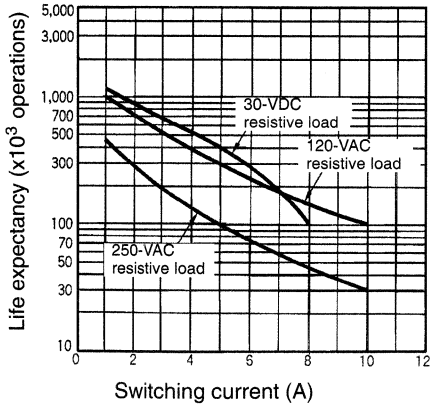


Life Expectancy

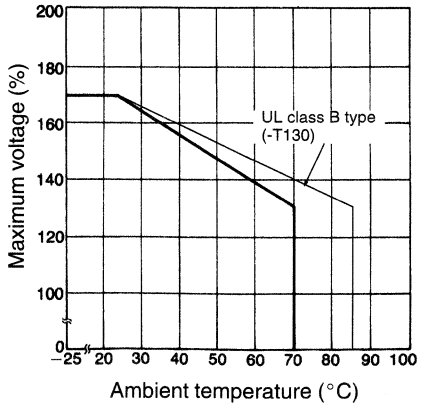
G5L



G5LE



Ambient Temperature vs. Maximum Voltage

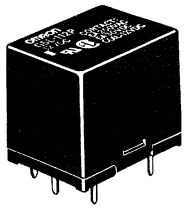


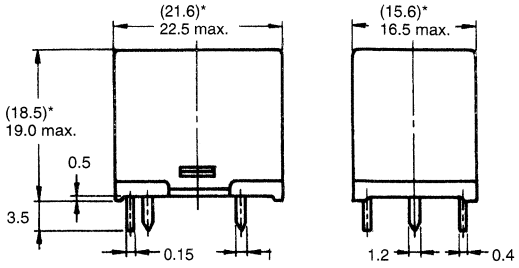
Relays

Dimensions

Note: 1. Orientation marks are indicated as follows:

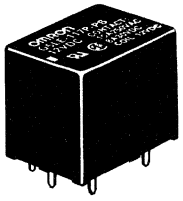
G5L(E)-112P, G5L(E)-117P

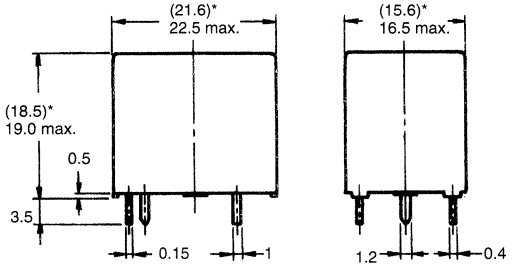




*Average value

G5L(E)-114P, G5L(E)-1114P

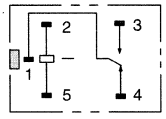




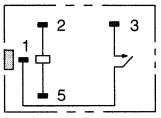
*Average value

Terminal Arrangement/Internal Connections (Bottom View)

SPDT



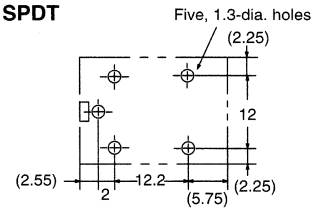
SPST-NO



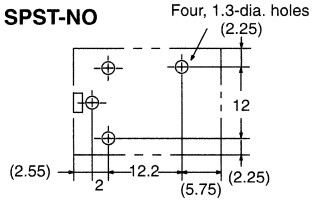
Mounting Holes (Bottom View)

Tolerance: ±0.1 mm

SPDT



SPST-NO



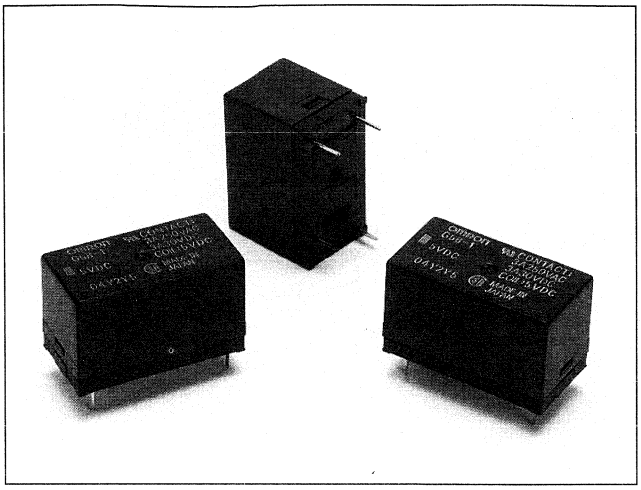
OMRON

PCB Relay

G5B

Single-pole 3-A Miniature Relay

- Impulse withstand voltage of 10 kV (between coil and contact).
- Models available with 200-mW current consumption (High-sensitivity Type).
- High-capacity (8 A) type available.
- IEC/CENELEC/UL/CSA/SEMKO approved. VDE approval for G5B–1 only.
- Meets reinforced insulation requirements for use in office machines (IEC950/EN60950).
- Spacings: Clearance of 6.14 mm, creepage of 6.14 mm.



Ordering Information

Classification	Contact form	Coil	Model
Basic type	SPST-NO	Single-stable type	G5B-1
High-sensitivity type			G5B-1-H
High-capacity type			G5B-1-E

Note: 1. 3 VDC, 6 VDC and 18 VDC can also be produced.

2. When ordering, add the rated coil voltage to the model number.
Example: G5B-1 12 VDC
Rated coil voltage

Model Number Legend:

G5B - □ □ - □ □ VDC
1 2 3 4

1. **Number of Poles**
2. **Contact Form**
None:SPST-NO
3. **Classification**
H: High-sensitivity type
E: High-capacity type
4. **Rated Coil Voltage**
5, 12, 24 VDC

Specifications

■ Coil Ratings

Item	Standard type, high-capacity type			High-sensitivity type		
Rated voltage	5 VDC	12 VDC	24 VDC	5 VDC	12 VDC	24 VDC
Rated current	72.0 mA	30.0 mA	15.0 mA	40.0 mA	16.7 mA	8.33 mA
Coil resistance	69.4 Ω	400 Ω	1,600 Ω	125 Ω	720 Ω	2,880 Ω
Must operate voltage	Standard type: 70% max. of rated voltage High-capacity type: 75% max. of rated voltage			75% max. of rated voltage		
Must release voltage	5% min. of rated voltage					
Max. voltage	140% at 23°C/110% at °70C of rated voltage			160% at 23°C/130% at 70°C of rated voltage		
Power consumption	Approx. 360 mW			Approx. 200 mW		

Relays

■ Contact Ratings

Item	Standard type, high-sensitivity type	High-capacity type
Load	Resistive load (cosØ = 1)	
Rated load	3 A at 125 VAC, 3 A at 30 VDC	8 A at 125 VAC, 8 A at 30 VDC
Contact material	Ag	AgCdO
Rated carry current	3 A	8 A
Max. switching voltage	250 VAC, 30 VDC	
Max. switching current	3 A	8 A
Max. switching capacity	750 VA, 90 W	2,000 VA, 240 W
Min. permissible load	5 VDC, 10 mA	5 VDC, 100 mA

Note: P level: $\lambda_{60} = 0.1 \times 10^{-6}$/operation (with an operating frequency of 120 operations/min)

■ Characteristics

Contact resistance	50 mΩ max.
Operate time	10 ms max.
Release time	10 ms max.
Insulation resistance	1,000 MΩ max. (at 500 VDC)
Dielectric withstand voltage	2,000 VAC, 50/60 Hz for 1 min between coil and contacts; 750 VAC, 50/60 Hz for 1 min between contacts of same polarity
Vibration resistance	Destruction: 10 to 55 Hz, 1.5-mm double amplitude Malfunction: 10 to 55 Hz, 1.5-mm double amplitude
Shock resistance	Destruction: 1,000 m/s^2 (approx.100G) Malfunction: 100 m/s^2 (approx.10G)
Life expectancy	Mechanical: 5,000,000 operations min. (at 18,000 operations/hr) Electrical: 200,000 operations min. (at 1,800 operations/hr) for standard type, high-sensitivity type 100,000 operations min. (at 1,200 operations/hr) for high-capacity type
Ambient temperature	Operating: –40°C to 70°C (with no icing) Storage: –40°C to 70°C (with no icing)
Ambient humidity	Operating: 35% to 85%
Sealing	Flux protection
Weight	Approx. 7 g

Note: The data shown above are initial values.

■ Approved Standards

UL22, UL45, UL250, UL478, UL484, UL508, UL751, UL923, UL998, UL1950 (File No. E41515) /CSA C22.2 No.0, No.1, No.14 (File No. LR31928)

Model	Coil ratings	Contact ratings
G5B-1, G5B-1-H	5 to 24 VDC	3 A, 250 VAC (general use) 3 A, 30 VDC (resistive) 1/8 hp, 125 VAC/1/8 hp, 250 VAC TV-2 125 VAC

SEMKO IEC65, IEC158-3 (File No. 8952240, 8952242)

Model	Coil ratings	Contact ratings
G5B-1, G5B-1-H	5 to 24 VDC	3 A, 250 VAC, 1 3 A, 30 VDC

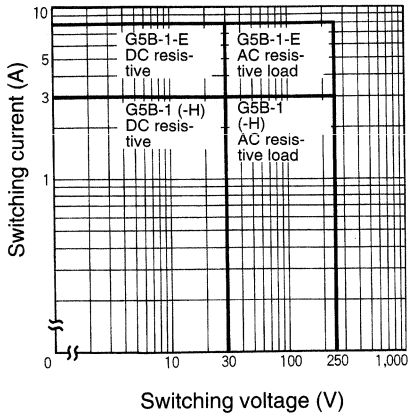
TÜV VDE0435 IEC255, IEC950*, IEC355-1, IEC65, IEC378, EN60950*, EN60355-1 (File No. R9251225)

Model	Coil ratings	Contact ratings	Condition
G5B-1, G5B-1-H	5 to 24 VDC	3 A, 250 VAC~ (cosØ = 1) 3 A, 30 VDC= (0 ms)	Electrical and Mechanical life: See "*Life expectancy graphs*" in Engineering data of G6B. Duty level: class III Operative range: 2 Pick-up class: class a
G5B-1-E		8 A, 125 VAC~ (cosØ = 1) 3 A, 30 VDC= (0 ms)	Pollution degree: 2 Overvoltage category: II Material group: IIIa Ambient temperature: –40°C to 70°C

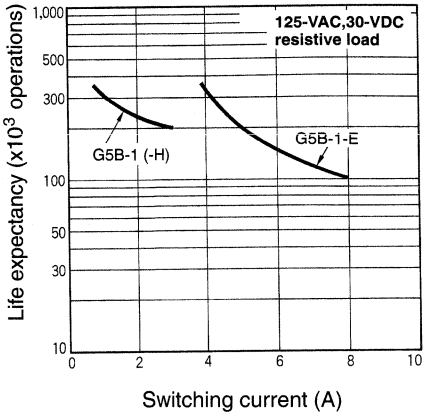
*Meets reinforced insulation requirements.

Engineering Data

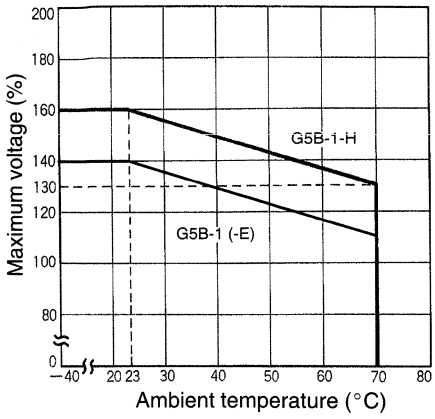
Max. Switching Capacity



Life Expectancy

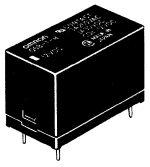


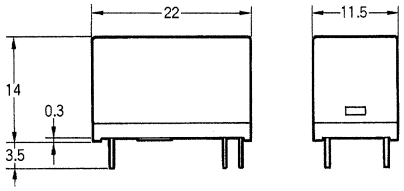
Ambient Temperature vs. Maximum Voltage



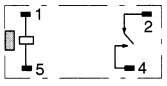
Dimensions

Note: 1. Orientation marks are indicated as follows:

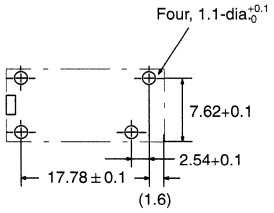




Terminal Arrangement/Internal Connections (Bottom View)



Mounting Holes (Bottom View)



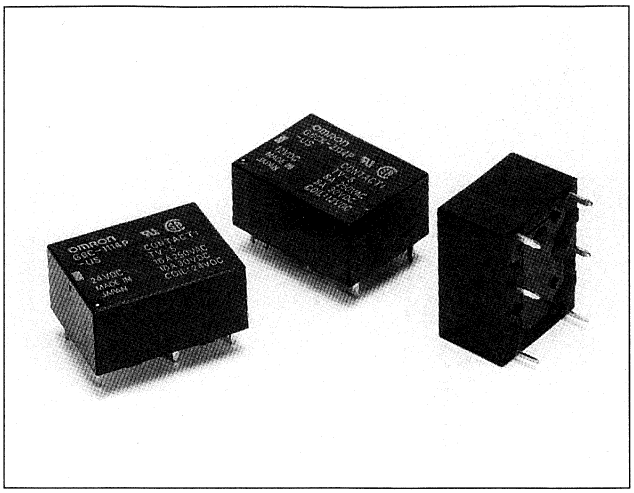
Relays

OMRON

PCB Relay

G6C

SPST-NO Type Breaks 10-A Loads; SPST-NO + SPST-NC Type Breaks 8-A Load



- Compact: 20 x 15 x 10 mm (L x W x H).
- Low power consumption: 200 mW.
- Flux protection or plastic-sealed construction available.
- Unique moving loop armature reduces relay size, magnetic interference and contact bounce.
- Single- and double-winding latching types also available.

Ordering Information

Classification		Straight PCB	
		Flux protection	Plastic-sealed
Single-side stable	SPST-NO	G6C-1117P-US	G6C-1114P-US
	SPST-NO + SPST-NC	G6C-2117P-US	G6C-2114P-US
Single-winding latching	SPST-NO	G6CU-1117P-US	G6CU-1114P-US
	SPST-NO + SPST-NC	G6CU-2117P-US	G6CU-2114P-US
Double-winding latching	SPST-NO	G6CK-1117P-US	G6CK-1114P-US
	SPST-NO + SPST-NC	G6CK-2117P-US	G6CK-2114P-US

Note: When ordering, add the rated coil voltage to the model number.
Example: G6C-1117P-US 12 VDC
Rated coil voltage

Model Number Legend:

G6C □ - □ □ □ □ - □ □ **VDC**
1 2 3 4 5 6 7

1. **Relay Function**
   None: Single-side stable
   U: Single-winding latching
   K: Double-winding latching
2. **Contact Form**
   11: SPST-NO
   21: SPST-NO + SPST-NC
3. **Contact Type**
   1: Single button
4. **Enclosure Rating**
   7: Flux protection
   4: Plastic-sealed
5. **Terminals**
   P: Straight PCB
   C: Self-clinching PCB
6. **Approved Standards**
   US: UL/CSA certified
7. **Rated Coil Voltage**
   3, 5, 6, 12, 24 VDC

■ Accessories (Order Separately)

Back Connecting Sockets

Applicable relay	Back connecting socket*
G6C(U)	P6C-06P
G6CK	P6C-08P

Removal Tool	P6B-Y1
Hold-down Clips	P6B-C2

Specifications

■ Coil Ratings

Single-side Stable Type

Rated voltage		3 VDC	5 VDC	6 VDC	12 VDC	24 VDC
Rated current		67 mA	40 mA	33.3 mA	16.7 mA	8.3 mA
Coil resistance		45 Ω	125 Ω	180 Ω	720 Ω	2,880 Ω
Coil inductance (H) (ref. value)	Armature OFF	0.078	0.22	0.36	1.32	4.96
	Armature ON	0.067	0.18	0.29	1.13	4.19
Must operate voltage		70% max. of rated voltage				
Must release voltage		10% min. of rated voltage				
Max. voltage		130% of rated voltage				
Power consumption		Approx. 200 mW				

Single-winding Latching Type

Rated voltage		3 VDC	5 VDC	6 VDC	12 VDC	24 VDC
Rated current		67 mA	40 mA	33.3 mA	16.7 mA	8.3 mA
Coil resistance		45 Ω	125 Ω	180 Ω	720 Ω	2,880 Ω
Coil inductance (H) (ref. value)	Armature OFF	0.09	0.25	0.36	1.75	5.83
	Armature ON	0.06	0.20	0.24	1.17	3.84
Must operate voltage		70% max. of rated voltage				
Must release voltage		70% min. of rated voltage				
Max. voltage		130% of rated voltage				
Power consumption		Approx. 200 mW				

Double-winding Latching Type

Rated voltage			3 VDC	5 VDC	6 VDC	12 VDC	24 VDC
Set coil	Rated current		93.5 mA	56.0 mA	46.7 mA	23.3 mA	11.7 mA
	Coil resistance		32.1 Ω	89.3 Ω	129 Ω	514 Ω	2,056 Ω
	Coil inductance (H) (ref. value)	Armature OFF	0.03	0.07	0.10	0.37	1.56
		Armature ON	0.02	0.06	0.08	0.32	1.18
Reset coil	Rated current		93.5 mA	56.0 mA	46.7 mA	23.3 mA	11.7 mA
	Coil resistance		32.1 Ω	89.3 Ω	129 Ω	514 Ω	2,056 Ω
	Coil inductance (H) (ref. value)	Armature OFF	0.03	0.08	0.12	0.47	1.46
		Armature ON	0.02	0.07	0.10	0.38	1.13
Must set voltage			70% max. of rated voltage				
Must reset voltage			70% min. of rated voltage				
Max. voltage			110% of rated voltage				
Power consumption			Set coil: Approx. 280 mW Reset coil: Approx. 280 mW				

Note: 1. The rated current and coil resistance are measured at a coil temperature of 23°C with a tolerance of ±10%.
2. Operating characteristics are measured at a coil temperature of 23°C.
3. The minimum pulse width of the set and reset voltage is 20 ms.

■ Contact Ratings

Item	SPST-NO		SPST-NO+SPST-NC	
Load	Resistive load (cosØ = 1)	Inductive load (cosØ = 0.4; L/R = 7 ms)	Resistive load (cosØ = 1)	Inductive load (cosØ = 0.4; L/R = 7 ms)
Rated load	10 A at 250 VAC; 10A at 30 VDC	5 A at 250 VAC; 5 A at 30 VDC	8 A at 250 VAC; 8A at 30 VDC	3.5 A at 250 VAC; 3.5 A at 30 VDC
Contact material	AgCdO			
Rated carry current	10 A		8 A	
Max. switching voltage	380 VAC, 125 VDC			
Max. switching current	10 A		8 A	
Max. switching capacity	2,500 VA, 300 W	1,250 VA, 220 W	2,000 VA, 240 W	875 VA, 170 W
Min. permissible load	10 mA at 5 VDC			

■ Characteristics

Contact resistance	30 mΩ max.
Operate (set) time	10 ms max. (mean value: approx. 5 ms)
Release (reset) time	10 ms max. (mean value: approx. 2 ms; latching types: mean value: approx. 5 ms)
Bounce time	Operate: Approx. 3 ms (mean value) Release: Approx. 3 ms (mean value)
Min. set/reset signal width	Latching type: 20 ms (at 23°C)
Max. switching frequency	Mechanical: 18,000 operations/hr Electrical: 1,800 operations/hr (under rated load)
Insulation resistance	1,000 MΩ min. (at 500 VDC, at 250 VDC between set coil and reset coil)
Dielectric withstand voltage	2,000 VAC, 50/60 Hz for 1 min between coil and contacts 2,000 VAC, 50/60 Hz for 1 min between contacts of different polarity 1,000 VAC, 50/60 Hz for 1 min between contacts of same polarity 250 VAC, 50/60 Hz for 1 min between set and reset coils
Impulse withstand voltage	6,000 V 1 x 40 μs (between coil and contacts)
Vibration resistance	Destruction: 10 to 55 Hz, 1.5-mm double amplitude Malfunction: 10 to 55 Hz, 1.5-mm double amplitude
Shock resistance	Destruction: 1,000 m/s^2 (approx. 100G) Malfunction: 100 m/s^2 (approx. 10G)
Ambient temperature	Operating: –25°C to 70°C (with no icing) Storage: –25°C to 70°C (with no icing)
Ambient humidity	Operating: 45% to 85%
Life expectancy	Mechanical: 50,000,000 operations min. (at 18,000 operations/hr) Electrical: 100,000 operations min. (at 1,800 operations/hr)
Weight	Approx. 5.6 g

■ Approved Standards

UL508 (File No. E41643)

Model	Contact form	Coil rating	Contact rating
G6C-1114P-US G6C-1114C-US G6C-1117P-US G6C-1117C-US	SPST-NO	3 to 24 VDC	10 A, 250 VAC (general use) 10 A, 30 VDC (resistive load) 1/6 hp, 125 VAC 1/4 hp, 125 VAC 1/4 hp, 250 VAC/3 hp, 250 VAC TV-5 600 WT, 120 VAC (tungsten) 530 VA, 20 to 265 VAC, 2 A max. (pilot duty) 43.2 VA, 30 VDC (pilot duty) 12LRA, 2FLA, 30 VDC (30,000 cycle)
G6C-2114P-US G6C-2114C-US G6C-2117P-US G6C-2117C-US	SPST-NO + SPST-NC		8 A, 250 VAC (general use) 8 A, 30 VDC (resistive load) 1/6 hp, 125 VAC 1/4 hp, 125 VAC 1/4 hp, 250 VAC 1/3 hp, 250 VAC TV-5 600 WT, 120 VAC (tungsten) 530 VA, 20 to 265 VAC, 2 A max. (pilot duty) 43.2 VA, 30 VDC (pilot duty) 12LRA, 2FLA, 30 VDC (30,000 cycle)

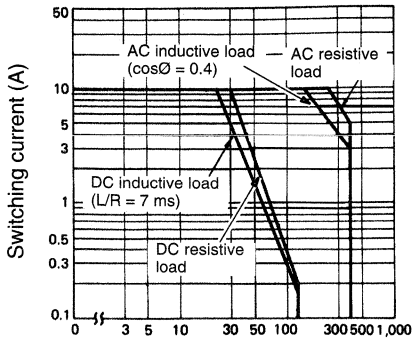
CSA C22.2 No.14 (File No. LR31928)

Model	Contact form	Coil rating	Contact rating
G6C-1114P-US G6C-1114C-US G6C-1117P-US G6C-1117C-US	SPST-NO	3 to 60 VDC	10 A, 250 VAC (general use) 10 A, 30 VDC (resistive load) 1/6 hp, 125 VAC 1/4 hp, 125 VAC 1/4 hp, 250 VAC 1/3 hp, 250 VAC TV-5 600 WT, 120 VAC (tungsten)
G6C-2114P-US G6C-2114C-US G6C-2117P-US G6C-2117C-US	SPST-NO + SPST-NC	3 to 60 VDC	8 A, 250 VAC (general use) 8 A, 30 VDC (resistive load) 1/6 hp, 125 VAC 1/4 hp, 125 VAC 1/4 hp, 250 VAC 1/3 hp, 250 VAC TV-5 600 WT, 120 VAC (tungsten)

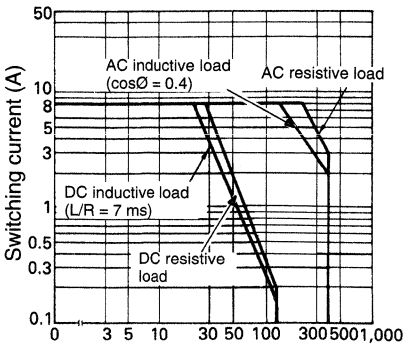
Engineering Data

Max. Switching Capacity

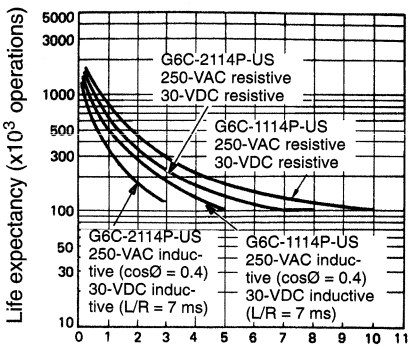
SPST-NO



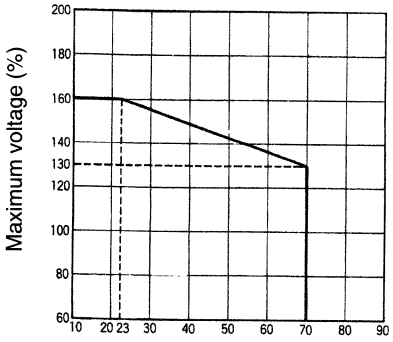
SPST-NO + SPST-NC



Life Expectancy



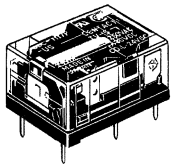
Ambient Temperature vs. Maximum Voltage

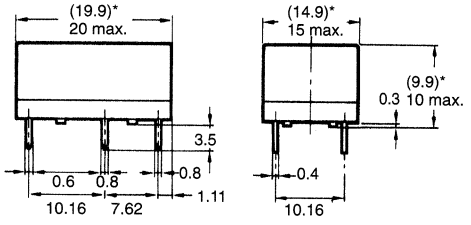


Dimensions

Note: 1. Orientation mark is indicated as follows:

G6C-❑117P-US

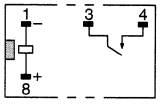




*Average value

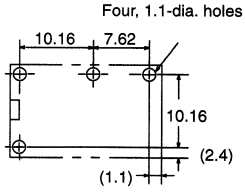
G6C-1117P-US, G6C-1114P-US

Terminal Arrangement/ Internal Connections (Bottom View)

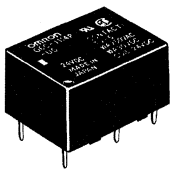


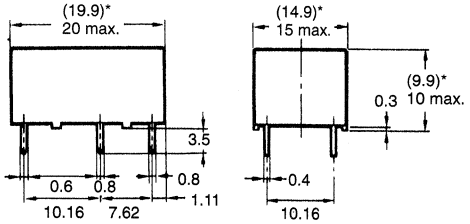
Mounting Holes (Bottom View)

Tolerance: +0.1



G6C-❑114P-US

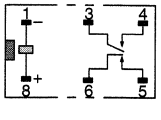




*Average value

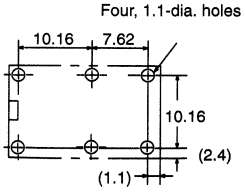
G6C-2117P-US, G6C-2114P-US

Terminal Arrangement/ Internal Connections (Bottom View)



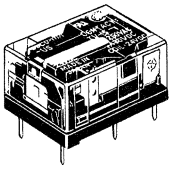
Mounting Holes (Bottom View)

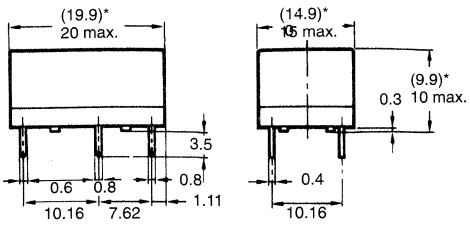
Tolerance: +0.1



Relays

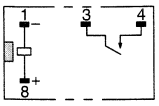
G6CU-❑117P-US



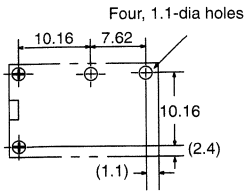


*Average value

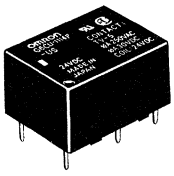
G6CU-1117P-US, G6CU-1114P-US
Terminal Arrangement/ Internal Connections (Bottom View)

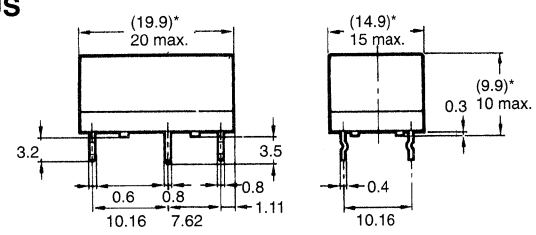


Mounting Holes (Bottom View)



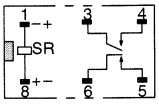
G6CU-❑114P-US



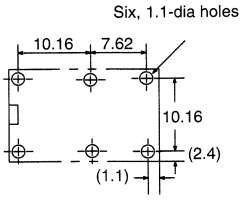


*Average value

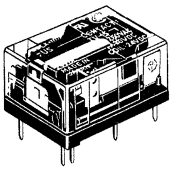
G6CU-2117P-US, G6CU-2114P-US
Terminal Arrangement/ Internal Connections (Bottom View)

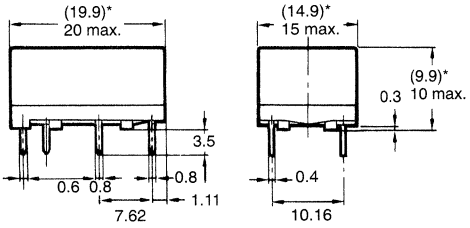


Mounting Holes (Bottom View)



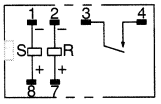
G6CK-❑117P-US



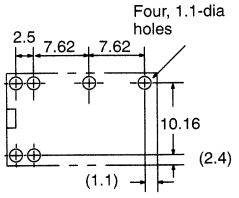


*Average value

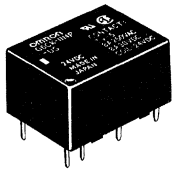
G6CK-1117P-US, G6CK-1114P-US
Terminal Arrangement/ Internal Connections (Bottom View)

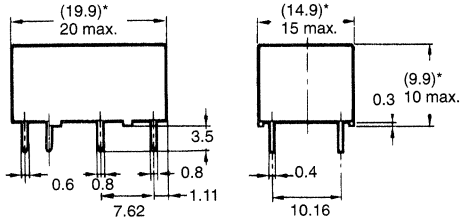


Mounting Holes (Bottom View)



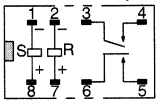
G6CK-❑114P-US



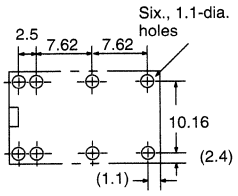


*Average value

G6CK-2117P-US, G6CK-2114P-US
Terminal Arrangement/ Internal Connections (Bottom View)

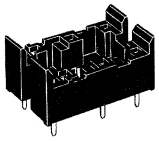


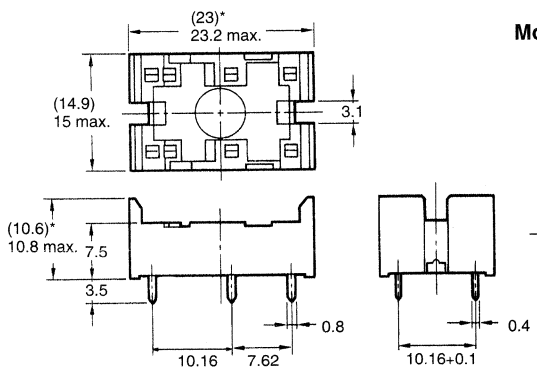
Mounting Holes (Bottom View)



Back Connecting Sockets

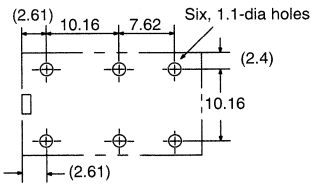
P6C-06P



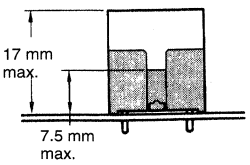


*Average value

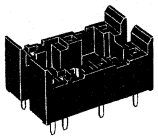
Mounting Holes (Bottom View)

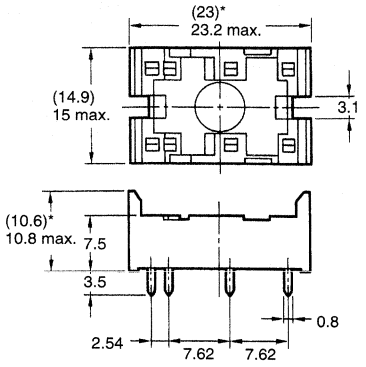


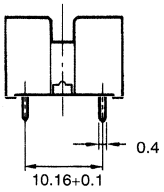
Mounting Height of Relay with Connecting Socket



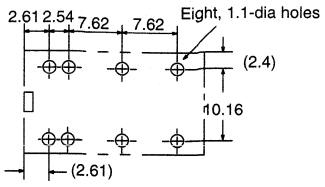
P6C-08P







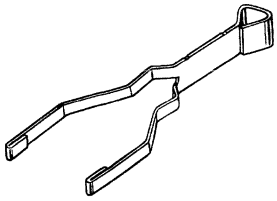
Mounting Holes (Bottom View)



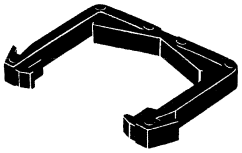
*Average value

Note: Rated current of socket max. 5 A

Removal Tool
P6B-Y1



Hold-down Clips
P6B-C2



Relays

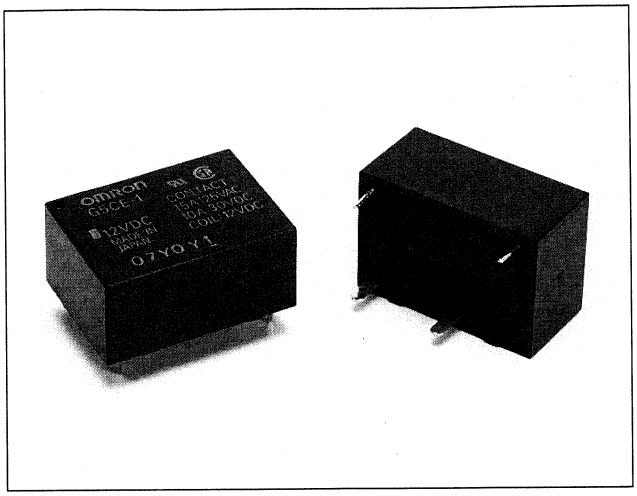
OMRON

PCB Relay

G5C

Flat Power Relays that Switch 10 A or 15 A Loads

- Ideal for switching power supplies on small home appliances and outputs to industrial equipment.
- Flat design with a height of 11 mm.
- High-sensitivity type available.
- UL and CSA approved.
- Models available with plastic seals.
- Models also available with quick-connect terminals (#187 load contact terminals).



Ordering Information

Contact form	Classification	Enclosure rating	
		Flux protection	Plastic-sealed
SPST-NO	Standard	G5C-1	G5C-14
	High-sensitivity type	G5C-1-H	G5C-14-H
	High-capacity type	G5CE-1	---
	Quick-connect terminals	G5CE-1–TP	---

Note: 1. When ordering, add the rated coil voltage to the model number.
Example: G5C-1 12 VDC
Rated coil voltage

2. High-capacity models with a plastic-sealed structure are not available.
3. Standard or high-sensitivity models with quick-connect terminals are not available.

Model Number Legend:

G5C □ - □ □ □ □ VDC
1 2 3 4 5

1. **Relay Function**
None: General-purpose
E: High-capacity

2. **Number of Poles**
1: 1 pole (SPST-NO)

3. **Enclosure Rating**
None: Flux protection
4: Plastic-sealed

4. **Series**
H: High-sensitivity
TP: Quick-connect terminals (#187)

5. **Rated Coil Voltage**
5, 12, 24, 48 VDC

Specifications

■ Coil Ratings

Standard/High-capacity Type

Rated voltage	5 VDC	12 VDC	24 VDC	48 VDC
Rated current	40 mA	16.7 mA	8.33 mA	4.2 mA
Coil resistance	125 Ω	720 Ω	2,880 Ω	11,430 Ω
Must operate voltage	75% max. of rated voltage			
Must release voltage	10% min. of rated voltage			
Max. voltage	130% (standard)/110% (high-capacity) of rated voltage			
Power consumption	Approx. 200 mW			

High-sensitivity Type

Rated voltage	5 VDC	12 VDC	24 VDC	48 VDC
Rated current	30 mA	12.5 mA	6.25 mA	3.1 mA
Coil resistance	167 Ω	960 Ω	3,840 Ω	15,480 Ω
Must operate voltage	80% max. of rated voltage			
Must release voltage	10% min. of rated voltage			
Maximum voltage	130% of rated voltage			
Power consumption	Approx. 150 mW			

■ Contact Ratings

Item	Standard type		High-sensitivity type		High-capacity or quick-connect types	
	Resistive load (cosØ=1)	**Inductive load (cosØ=0.4, L/R=7ms)**	**Resistive load (cosØ=1)**	**Inductive load (cosØ=0.4, L/R=7ms)**	**Resistive load (cosØ=1)**	**Inductive load (cosØ=0.4, L/R=7ms)**
Rated load	10 A, 250 VAC; 10 A, 30 VDC	3 A, 250 VAC; 3 A, 30 VDC	10 A, 250 VAC; 10 A, 30 VDC	3 A, 250 VAC; 3 A, 30 VDC	15 A, 110 VAC	5 A, 110 VAC; 3 A , 30 VDC
Rated carry current	10 A		10 A		15 A	
Max. switching voltage	250 VAC					
Max. switching current	10 A		10 A		15 A	
Max. switching capacity	2,500 VA, 300 W	750 VA, 90 W	2,500 VA, 300 W	750 VA, 90 W	2,500 VA, 300 W	750 VA, 90 W

■ Characteristics

Contact resistance	30 mΩ max.
Operate time	10 ms max. (High-sensitivity type: 15 ms max.)
Release time	10 ms max.
Bounce time	Operate: 3 ms (mean value) Release: 3 ms (mean value)
Insulation resistance	1,000 MΩ min.
Dielectric withstand voltage	2,500 VAC, 50/60 Hz for 1 min between contacts of same polarity 1,000 VAC, 50/60 Hz for 1 min between contacts of same polarity
Impulse withstand voltage	4,500 V, 1.2 x 50 μ sec
Vibration resistance	Destruction: 10 to 55 Hz, 1.5-mm double amplitude Malfunction: 10 to 55 Hz, 1.5-mm double amplitude
Shock resistance	Destruction: 1,000 m/s^2 (approx. 100G's) Malfunction: 200 m/s^2 (approx. 20G's)
Life expectancy	Mechanical: 20,000,000 operations min. at 18,000 operations/hr Electrical: 300,000 operations min. (100,000 operations min. for Plastic-sealed Type) at 1,200 operations/hr under rated load of 10 A at 250 VAC; 100,000 operations min. at 1,200 operations/hr under rated load of 10 A at 30 VDC
Ambient temperature	Operating: –25°C to 70°C (with no icing) Storage: –25°C to 70°C
Ambient humidity	Operating: 45% to 85%
Weight	Approx. 8 g

Note: 1. The rated current and coil resistance are measured at a coil temperature of 23°C with a tolerance of ±10%.

2. Operating characteristics are measured at a coil temperature of 23°C.

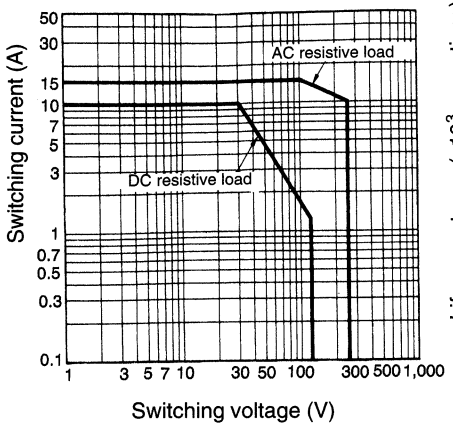
■ Approved Standards

UL508 (file No. E41515)/CSA C22.2 (file No. LR31928)

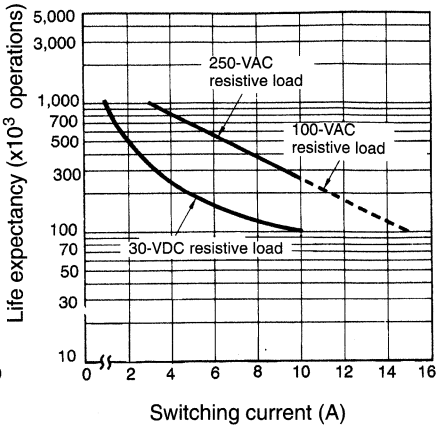
Coil rating	Contact rating
3 to 60 VDC	15 A, 125 VAC 10 A, 250 VAC 10 A, 30 VDC (resistive load only)

Engineering Data

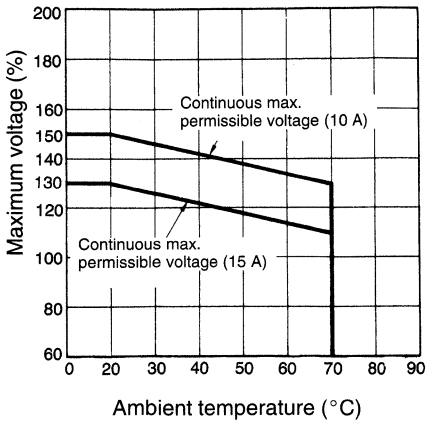
Max. Switching Capacity



Electrical Life Expectancy



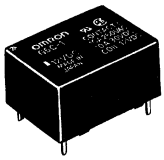
Ambient Temperature vs. Maximum Voltage

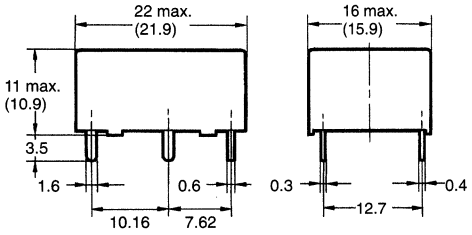


Dimensions

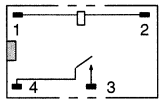
Note: 1. Orientation marks are indicated as follows:

G5C(E)–1

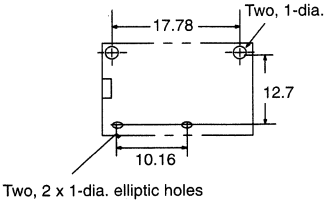




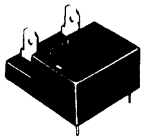
Terminal Arrangement/Internal Connections (Bottom View)

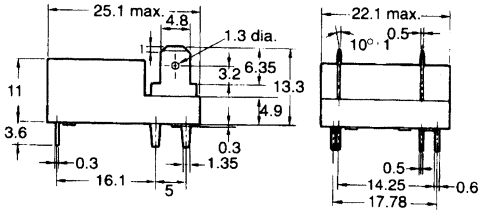


Mounting Holes (PCB)

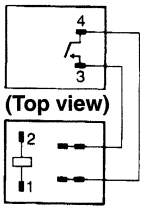


G5CE–1–TP

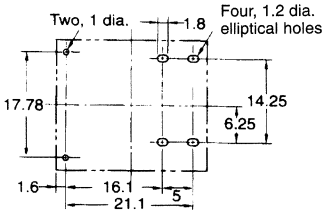




Terminal Arrangement/ Internal Connections



Mounting Holes (Bottom View)



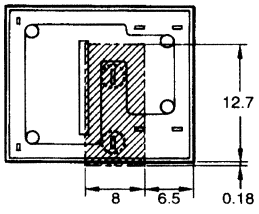
Precautions

Quick-connect Terminals

The quick-connect terminals can be connected to an appropriate load. Consult your OMRON representative, however, when you intend to impose voltage on the quick-connect terminals mounted on a PCB.

The terminals are compatible to the Faston receptacle #187 positive block connector.

The shaded area of the diagram includes the charged terminals of the power relay. When you mount the power relay on a PCB, make sure any unnecessary metal patterns on the PCB are kept away from this portion.



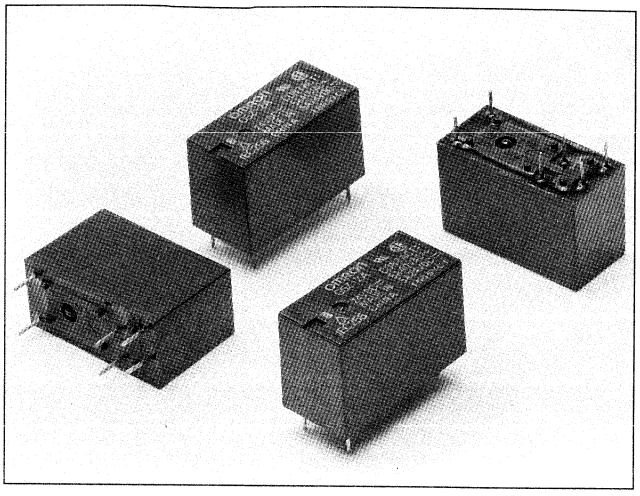
OMRON

Power Relay

G5Z

Double-pole Relays Ideal for Protecting Audio Speakers

- A compact DPST-NO relay (25 x 11.5 x 16.5 mm).
- Employs a single crossbar for high contact reliability.
- Sealed construction for resistance to ambient conditions (not submersible).
- High-capacity models (750 VA) available for vending machines.
- IEC/CENELEC/UL/CSA approved.



IEC

Ordering Information

Sealing structure	Contact form	Classification	Model
Plastic-sealed (not submersible)	DPST-NO	Standard	G5Z-2A
		High-capacity	G5Z-2A-E

Note: When ordering, add the rated coil voltage to the model number.
Example: G5Z-2A 12 VDC
└— Rated coil voltage

Model Number Legend:

G5Z - □ - □ □ VDC
1 2 3

1. **Contact Form**
   2A: 2 poles (DPST-NO)
2. **Classification**
   None: Standard type
   E: High-capacity type
3. **Rated Coil Voltage**
   5, 12, 24 VDC

Specifications

■ Coil Ratings

Rated voltage	5 VDC	12 VDC	24 VDC
Rated current	106 mA	44.2 mA	22.1 mA
Coil resistance	47 Ω	270 Ω	1,090 Ω
Must operate voltage	80% of rated voltage max.		
Must release voltage	10% of rated voltage min.		
Max. permissible voltage	110% of rated voltage		
Power consumption	Approx. 0.53 W		

Relays

■ Contact Ratings

Model	G5Z-2A	G5Z-2A-E
Rated load	5 A at 40 VAC; 5 A at 24 VDC, resistive load (cosϕ = 1)	3 A at 250 VAC, resistive load (cosϕ = 1)
Rated carry current	5 A	
Max. switching voltage	40 VAC, 24 VDC	250 VAC
Max. switching current	5 A	
Max. switching capacity	200 VA, 120 W	750 VA
Min. permissible load	1 mA, 1 VDC	

Note: P level: $\lambda_{60} = 0.1 \times 10^{-6}$ operations (with an operating frequency of 120 operations/min)

■ Characteristics

Contact resistance	50 mW max.
Operating time	15 ms max.
Release time	5 ms max.
Insulation resistance	1,000 MW min.
Dielectric withstand voltage	2,000 VAC 50/60 Hz for 1 min between coil and contact
	1,000 VAC 50/60 Hz for 1 min between contacts of same polarity
	2,000 VAC 50/60 Hz for 1 min between contacts of differnce polarity
Vibration resistance	Destruction: 10 to 55 Hz, 1.5-mm double amplitude Malfunction: 10 to 55 Hz, 1.5-mm double amplitude
Shock resistance	Destruction: 1,000 m/s^2 (approx. 100G) Malfunction: 100 m/s^2 (approx. 10G)
Life expectancy	Mechanical: 500,000 operations min. Electrical: 30,000 operations min.
Ambient temperature	Operating: –25°C to 55°C (with no icing)
Ambient humidity	Operating: 35% to 85%
Weight	Approx. 8 g

■ Approved Standards

UL508 (File No.41515)/CSA 22.2 No.0, No.14 (File No.LR31928)

Model	Coil ratings	Contact ratings
G5Z-2A	5 to 24 VDC	5 A, 40 VAC (resistive) 5 A, 24 VDC (resistive)
G5Z-2A-E		3 A, 250 VAC (resistive) 5 A, 24 VDC (resistive)

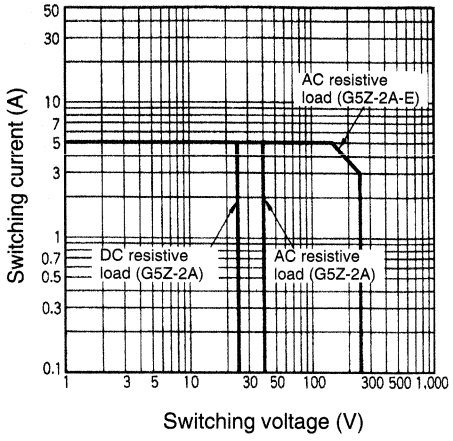
TÜV VDE0435 IEC255, IEC950, IEC65*, IEC335-1, IEC378*, EN60335-1, EN60950 (File No.R9251229)

Model	Coil ratings	Contact ratings	Contact ratings
G5Z-2A	5 to 24 VDC	5 A, 40 VAC~ (cosϕ = 1) 5 A, 24 VDC= (0 ms)	Electrical life: See "*Life expectancy*" Mechanical life: See "*Life expectancy*" Duty level: class III Operating range: 1
G5Z-2A-E		3 A, 250 VAC~ (cosϕ = 1) 5 A, 24 VDC= (0 ms)	Pick-up class: a Pollution degree: 2 Overvoltage category: II Material group: IIIa Ambient temperature: –25°C to 55°C

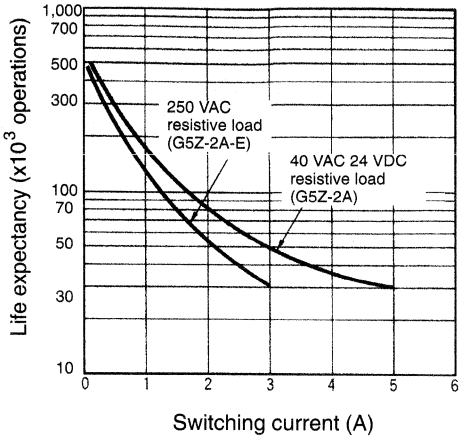
Max. operating voltage at 250 V (*max. operating voltage at 130 V)

Engineering Data

Max. Switching Capacity



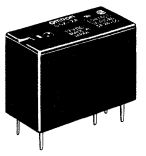
Life Expectancy

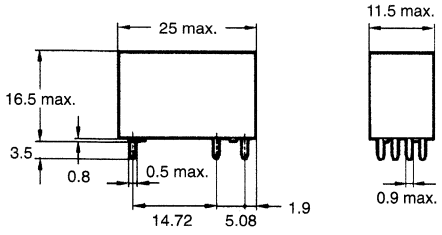


Dimensions

Note: 1. All units are in millimeters unless otherwise indicated.

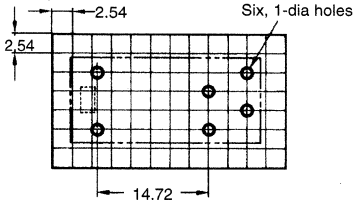
2. Orientation marks are indicated as follows:



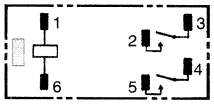


Mounting Holes
(Bottom View)

Tolerances: +0.1 mm.



Terminal Arrangement /Internal Connections
(Bottom View)



Precautions

- Do not submerge the relay.

Relays

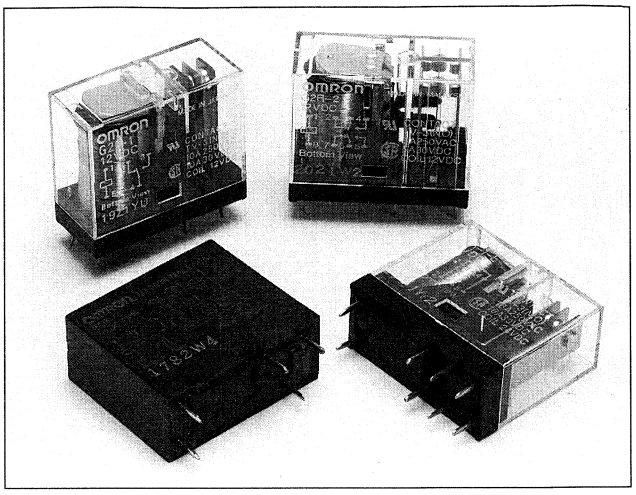
OMRON

PCB Relay

G2R

The Redesigned G2R Power Relay

- Flux protection, pre-tinned terminals now standard.
- 10% to 20% reduction in temperature rise at the contacts.
- High-sensitivity (360 mW) and high-capacity (16 A) types available.
- Creepage distance of 8 mm min. between coil and contact.
- Double-winding latching type also available.
- Models meeting SEV, SEMKO, VDE and BEAB standards available.



SEMKO
BEAB

Ordering Information

Classification		Sealing	Coil ratings	Contact form			
				SPST-NO	SPDT	DPST-NO	DPDT
PCB terminal	General-purpose	Flux protection	AC/DC	G2R-1A	G2R-1	G2R-2A	G2R-2
		Plastic-sealed	AC/DC	G2R-1A4	G2R-14	G2R-2A4	G2R-24
	Twin contact	Flux protection	DC	G2R-1AZ	G2R-1Z	---	---
		Plastic-sealed	DC	G2R-1AZ4	G2R-1Z4	---	---
	High-capacity	Flux protection	AC/DC	G2R-1A-E	G2R-1-E	---	---
	High-sensitivity	Flux protection	DC	G2R-1A-H	G2R-1-H	G2R-2A-H	G2R-2-H
	Double-winding latching	Flux protection	DC	G2RK-1A	G2RK-1	G2RK-2A	G2RK-2

Model Number Legend:

G2R □-□ □ □ □-□ □-□-□ □

1 2 3 4 5 6 7 8 9 10

1. **Relay Function**
   None: General-purpose
   K: Double-winding latching
2. **Number of Poles**
   1: 1 pole
   2: 2 poles
3. **Contact Form**
   None: SPDT
   A: SPST-NO
4. **Contact Type**
   None: Single
   Z: Bifurcated
5. **Sealing**
   None: Flux protection
   4: Plastic-sealed
6. **Terminals**
   None: Straight PCB
7. **Classification**
   None: General-purpose
   E: High-capacity
   H: High-sensitivity
8. **Approved Standards**
   None: UL, CSA, IEC, TUV & VDE certified
   SKVD: SEV, SEMKO, VDE certified
9. **Contact Material**
   None: AgCdO
   ASI: AgSnIn
10. **Rated Coil Voltage**

Note:
1. When ordering, add the rated coil voltage to the model number.
   Example: G2R-1A 12 VDC
   └── Rated coil voltage
2. OMRON has also prepared the above relays with AgSnIn contacts, which are more tolerant of large inrush currents and physical movement compared with relays with standard contacts. When ordering, add "-ASI" to the model number.
   Example: G2R-1A-ASI
3. Standard, NO contact type relays are TV-3 class products in accordance with the TV standards of the UL/CSA. Models with AgSnIn contacts are TV-5 class products.
   Example: G2R-1A-ASI
   When ordering a TV-8 class model, insert "-TV8" into the model number as follows:
   Example: G2R-1A-E–ASI–TV8
4. BEAB approval relates to High Capacity type only.

Specifications

■ Coil Ratings (Measured at 23°C ambient)

Rated voltage (AC)		12 VAC	24 VAC	110 VAC	120 VAC	200 VAC	220 VAC	230 VAC	240 VAC
Rated current*	50 Hz	93 mA	46.5 mA	10.2 mA	9.3 mA	5.5 mA	5.1 mA	4.7 mA	4.7 mA
	60 Hz	75 mA	37.5 mA	8.2 mA	7.5 mA	4.5 mA	4.1 mA	3.8 mA	3.8 mA
Coil resistance		65 Ω	260 Ω	5,500 Ω	6,500 Ω	20,200 Ω	25,000 Ω	26,850 Ω	30,000 Ω
Coil inductance	Armature OFF	0.19	0.81	17	21	51.3	57.5	62	65.5
(H) (ref. value)	Armature ON	0.39	1.55	35	42	102	117	124	131
Must operate voltage		80% max. of rated voltage							
Must release voltage		30% max. of rated voltage							
Max. voltage		110% of rated voltage							
Power consumption		Approx. 0.9 VA at 60 Hz							

Rated voltage (DC)		5 VDC	6 VDC	12 VDC	24 VDC	48 VDC	100 VDC
Rated current* (50/60 Hz)		106 mA	88.2 mA	43.6 mA	21.8 mA	11.5 mA	5.3 mA
Coil resistance		47 Ω	68 Ω	275 Ω	1,100 Ω	4,170 Ω	18,860 Ω
Coil inductance	Armature OFF	0.20	0.28	1.15	4.27	13.86	67.2
(H) (ref. value)	Armature ON	0.39	0.55	2.29	8.55	27.71	93.2
Must operate voltage		70% min. of rated voltage					
Must release voltage		15% min. of rated voltage					
Max. voltage		110% of rated voltage					
Power consumption		Approx. 0.53 W					

High-sensitivity Relays

Rated voltage		5 VDC	6 VDC	12 VDC	24 VDC	48 VDC
Rated current (50/60 Hz)		71.4 mA	60 mA	30 mA	15 mA	7.5 mA
Coil resistance		70 Ω	100 Ω	400 Ω	1,600 Ω	6,400 Ω
Coil inductance	Armature OFF	0.37	0.53	2.14	7.80	31.20
(H) (ref. value)	Armature ON	0.75	1.07	4.27	15.60	62.40
Must operate voltage		70% max. of rated voltage				
Must release voltage		15% max. of rated voltage				
Max. voltage		110% of rated voltage				
Power consumption		Approx. 0.36 W				

Double-winding Latching Relays

Rated voltage			5 VDC	6 VDC	12 VDC	24 VDC
Set coil	Rated current		167 mA	138 mA	70.6 mA	34.6 mA
	Coil resistance		30 Ω	43.5 Ω	170 Ω	694 Ω
	Coil inductance	Armature OFF	0.073	0.104	0.42	1.74
	(H) (ref. value)	Armature ON	0.146	0.208	0.83	3.43
Reset coil	Rated current		119 mA	100 mA	50 mA	25 mA
	Coil resistance		42 Ω	60 Ω	240 Ω	960 Ω
	Coil inductance	Armature OFF	0.003	0.005	0.018	0.079
	(H) (ref. value)	Armature ON	0.006	0.009	0.036	0.148
Must set voltage			70% of rated voltage			
Must reset voltage			70% of rated voltage			
Max. voltage			110% of rated voltage			
Power consumption			Set coil: Approx. 850 mW; Reset coil: Approx. 600 mW			

■ Contact Ratings

Flux Protection Relays

Item	Standard		Standard		High-capacity	
Number of poles	1 pole		2 pole		1 pole	
Load	Resistive load (cosØ = 1)	Inductive load (cosØ = 0.4; L/R = 7 ms)	Resistive load (cosØ = 1)	Inductive load (cosØ = 0.4; L/R = 7 ms)	Resistive load (cosØ = 1)	Inductive load (cosØ = 0.4; L/R = 7 ms)
Rated load	10 A at 250 VAC; 10 A at 30 VDC	7.5 A at 250 VAC; 5 A at 30 VDC	5 A at 250 VAC; 5 A at 30 VDC; 10A at 250 VAC*	2 A at 250 VAC; 3 A at 30 VDC	16 A at 250 VAC; 16 A at 30 VDC	8 A at 250 VAC; 8 A at 30 VDC
Rated carry current	10 A		5 A		16 A	
Max. operating voltage	380 VAC, 125 VDC		380 VAC, 125 VDC		380 VAC, 125 VDC	
Max. operating current	10 A		5 A		16 A	
Max. switching capacity	2,500 VA, 300 W	1,875 VA, 150 W	1,250 VA, 150 W	500 VA, 90 W	4,000 VA, 480 W	2,000 VA, 240 W
Min. permissible load	100 mA at 5 VDC		10 mA at 5 VDC		100 mA at 5 VDC	

Note: * The G2R–2 relay is rated at 10A, 250 VAC for 60,000 operations

Item	Bifurcated contacts		High-sensitivity			
Number of poles	1 pole		1 pole		2 pole	
Load	Resistive load (cosØ = 1)	Inductive load (cosØ = 0.4; L/R = 7 ms)	Resistive load (cosØ = 1)	Inductive load (cosØ = 0.4; L/R = 7 ms)	Resistive load (cosØ = 1)	Inductive load (cosØ = 0.4; L/R = 7 ms)
Rated load	5 A at 250 VAC; 5 A at 30 VDC	2 A at 250 VAC; 3 A at 30 VDC	5 A at 250 VAC; 5 A at 30 VDC	2 A at 250 VAC; 3 A at 30 VDC	3 A at 250 VAC; 3 A at 30 VDC	1 A at 250 VAC; 1.5 A at 30 VDC
Rated carry current	5 A		5 A		3 A	
Max. operating voltage	380 VAC, 125 VDC		380 VAC, 125 VDC		380 VAC, 125 VDC	
Max. operating current	5 A		5 A		3 A	
Max. switching power	1,250 VA, 150 W	1,875 VA, 150 W	1,250 VA, 150 W	500 VA, 90 W	750 VA, 90 W	250 VA, 45 W
Min. permissible load	1 mA at 5 VDC		100 mA at 5 VDC		10 mA at 5 VDC	

Plastic-sealed Relays

Item	Standard				Bifurcated contact	
Number of poles	1 pole		2 pole		1 pole	
Load	Resistive load (cosØ = 1)	Inductive load (cosØ = 0.4; L/R = 7 ms)	Resistive load (cosØ = 1)	Inductive load (cosØ = 0.4; L/R = 7 ms)	Resistive load (cosØ = 1)	Inductive load (cosØ = 0.4; L/R = 7 ms)
Rated load	8 A at 250 VAC; 8 A at 30 VDC	6 A at 250 VAC; 4 A at 30 VDC	4 A at 250 VAC; 4 A at 30 VDC	1.5 A at 250 VAC; 2.5 A at 30 VDC	5 A at 250 VAC; 5 A at 30 VDC	2 A at 250 VAC; 3 A at 30 VDC
Rated carry current	8 A		4 A		5 A	
Max. operating voltage	380 VAC, 125 VDC		380 VAC, 125 VDC		380 VAC, 125 VDC	
Max. operating current	8 A		4 A		5 A	
Max. switching capacity	2,000 VA, 240 W	1,500 VA, 120 W	1,000 VA, 120 W	375 VA, 75 W	1,250 VA, 150 W	500 VA, 90 W
Min. permissible load	100 mA at 5 VDC		10 mA at 5 VDC		1 mA at 5 VDC	

Latching Relays

Item	1 pole		2 pole	
Load	Resistive load (cosØ = 1)	Inductive load (cosØ = 0.4; L/R = 7 ms)	Resistive load (cosØ = 1)	Inductive load (cosØ = 0.4; L/R = 7 ms)
Rated load	5 A at 250 VAC; 5 A at 30 VDC	3.5 A at 250 VAC; 2.5 A at 30 VDC	3 A at 250 VAC; 3 A at 30 VDC	1.5 A at 250 VAC; 2 A at 30 VDC
Rated carry current	5 A		3 A	
Max. operating voltage	380 VAC, 125 VDC		380 VAC, 125 VDC	
Max. operating current	5 A		3 A	
Max. switching power	1,250 VA, 150 W	875 VA, 75 W	750 VA, 90 W	375 VA, 60 W
Min. permissible load	100 mA at 5 VDC		10 mA at 5 VDC	

■ Characteristics

Standard Relays

Item	1 pole	2 pole
Contact resistance	30 mΩ max.	50 mΩ max.
Operate (set) time	15 ms max.	
Release (reset) time	AC: 10 ms max.; DC: 5 ms max.	
Max. operating frequency	Mechanical: 18,000 operations/hr Electrical: 1,800 operations/hr (under rated load)	
Insulation resistance	1,000 MΩ min. (at 500 VDC)	
Dielectric withstand voltage	5,000 VAC, 50/60 Hz for 1 min between coil and contacts; 1,000 VAC, 50/60 Hz for 1 min between contacts of same polarity	5,000 VAC, 50/60 Hz for 1 min between coil and contacts; 3,000 VAC, 50/60 Hz for 1 min between contacts of different polarity 1,000 VAC, 50/60 Hz for 1 min between contacts of same polarity
Vibration resistance	Destruction: 10 to 55 Hz, 1.5-mm double amplitude Malfunction: 10 to 55 Hz, 1.5-mm double amplitude	
Shock resistance	Destruction: 1,000 m/s^2 (approx. 100G) Malfunction: 200 m/s^2 when energized (approx. 20G); 100m/s^2 when not energized (approx. 10G)	
Life expectancy	Mechanical: AC coil: 10,000,000 operations min.; DC coil: 20,000,000 operations min. (at 18,000 operations/hr) Electrical: 100,000 operations min. (at 1,800 operations/hr under rated load)	
Ambient temperature	Operating: –40°C to 70°C (with no icing) Storage: –40°C to 70°C (with no icing)	
Ambient humidity	Operating: 35% to 85%	
Weight	Approx. 17 g	

Double-winding Latching Relays

Item	1 pole	2 poles
Contact resistance	30 mΩ max.	50 mΩ max.
Set time	20 ms max.	
Reset time	20 ms max.	
Min. set/reset signal width	30 ms max.	
Max. operating frequency	Mechanical: 18,000 operations/hr Electrical: 1,800 operations/hr (under rated load)	
Insulation resistance	1,000 MΩ min. (at 500 VDC)	
Dielectric withstand voltage	5,000 VAC, 50/60 Hz for 1 min between coil and contacts; 1,000 VAC, 50/60 Hz for 1 min between contacts of same pole; 1,000 VAC, 50/60 Hz for 1 min between set and reset coil	5,000 VAC, 50/60 Hz for 1 min between coil and contacts; 3,000 VAC, 50/60 Hz for 1 min between contacts of different poles 1,000 VAC, 50/60 Hz for 1 min between contacts of same pole 1,000 VAC, 50/60 Hz for 1 min between set and reset coil
Vibration resistance	Destruction: 10 to 55 Hz, 1.5 mm double amplitude Malfunction: 10 to 55 Hz, 1.5 mm double amplitude	
Shock resistance	Destruction: 1,000 m/s^2 (approx. 100G) Malfunction: Set: 500 m/s^2 (approx. 50G); 200m/s^2 (approx. 20G) Reset: 100 m/s^2 (approx. 10G)	
Life expectancy	Mechanical: 10,000,000 operations min (at 18,000 operations/hr) Electrical: 100,000 operations min. (at 1,800 operations/hr under rated load)	
Weight	Approx. 17 g	

■ Approved Standards

UL 508 (File No. E41643)/CSA 22.2 No.0, No.14 (File No. LR31928)

Model	Contact form	Coil ratings	Contact ratings
G2R-1 G2R-14 G2R-1-H	SPDT	3 to 110 VDC 3 to 240 VAC	10 A, 30 VDC (resistive) 10 A, 250 VAC (general use) 5 A, 277 VAC (general use) 360 WT, 120 VAC (tungsten, 250 cycles) TV-3 (NO contact only)
G2R-1A G2R-1A4 G2R-1A-H	SPST-NO		1/4 hp, 125 VAC, 1/2 hp, 250 VAC 1/2 hp, 277 VAC
G2R-1-E	SPDT		16 A, 30 VDC (resistive, NO contact only) 360 WT, 120 VAC (tungsten, 25,000 cycles) 16 A, 250 VAC (general use, NO contact only)
G2R-1A-E	SPST-NO		TV-3 (NO contact only); 1/3 hp, 120 VAC, 1/2HP 120 VAC (UL only) 3 A, 240 VAC (pilot duty)
G2R-2 G2R-24 G2R-2-H	DPDT		5A, 30 VDC (resistive); 5 A, 240 VAC (resistive) 5 A, 250 VAC (general use), TV-3 (NO contact only) 1/10 hp, 120 VAC, (UL only); 1/10 hp, 125 VAC, 1/10 hp, 250VAC; 1/6hp, 120VAC; 1/4 hp 240VAC (UL only); 1/3 hp, 240VAC; 1/6 hp, 265VAC; 1/3 hp, 265 VAC
G2R-2A G2R-2A4 G2R-2A-H	DPST-NO		
G2R-1A-ASI	SPST-NO		10 A, 30 VDC (resistive) 10 A, 250 VAC (general use) 600 WT, 120 VAC (tungsten, 25,000 cycles) TV-5(nNo contact, UL only), /TV-8 (NO) 1/4 hp, 125 VAC; 1/2 hp, 125 VAC 1/2 hp, 277 VAC

SEV

Contact form	Coil ratings	Contact ratings
1 poles	3 to 110 VDC	16 A, 250 VAC1 (AgCdO contacts) 5 A, 250 VAC3 (AgCdO contacts) 16 A, 30 VDC1 (AgCdO contacts) 10 A, 250 VAC1 5 A, 250 VAC 10 A, 30 VDC1
2 poles	3 to 240 VAC	5 A, 250 VAC1 2 A, 380 VAC1 5 A, 30 VDC1

SEMKO

Contact form	Coil ratings	Contact ratings
1 poles	3 to 110 VDC	10/80 A, 250 VAC 3/100 A, 250 VAC 16/128 A, 250 VAC (AgCdO contacts)
2 poles		5/40 A, 250 VAC

TÜV (VDE File 0435)

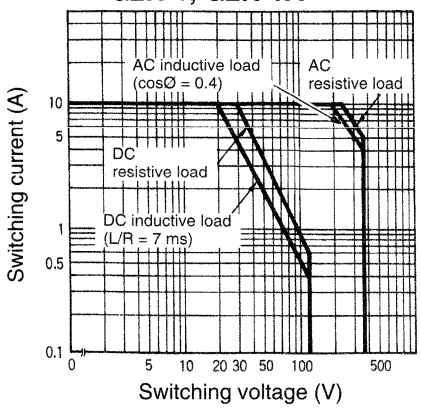
Contact form	Coil ratings	Contact ratings
1 poles	3, 5, 6, 12, 18, 24, 48, 60, 110 VDC 6, 12, 24, 50, 100, 110, 120 VAC	16 A, 250 VAC (cosØ = 1.0) (AgInO contact) 9 A, 250 VAC (cosØ = 0.4) (AgInO contact) 16 A, 30 VDC (0 ms) (AgInO contact) 5 A, 30 VDC (40 ms) (AgInO contact) 1 A, 250 VAC (cosØ = 1.0); 0.75 A, 250 VAC (cosØ = 0.4) 1 A, 30 VDC (0 ms); 10 A, 250 VAC (cosØ = 1.0) 7.5 A, 250 VAC (cosØ = 0.4); 10 A, 30 VDC (0 ms)
2 poles		5 A, 250 VAC (cosØ = 1.0); 2 A, 250 VAC (cosØ = 0.4) 5 A, 30 VDC (0 ms)

Engineering Data

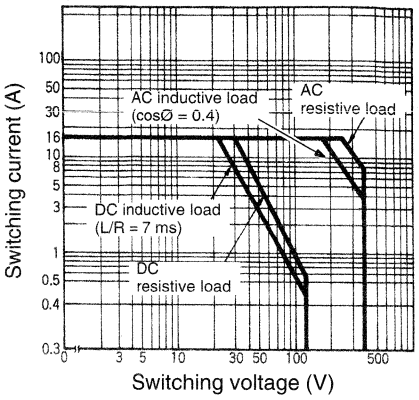
Life Expectancy

Max. Switching Capacity

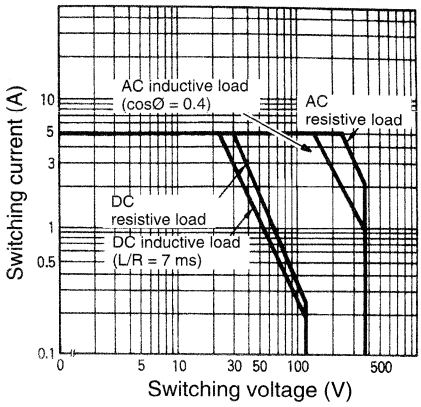
G2R-1, G2R-1A



G2R-1-E, G2R-1A-E

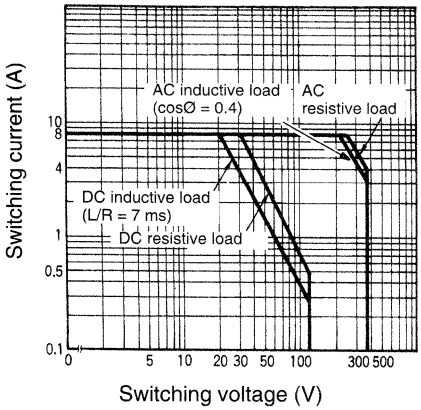


G2R-1Z, G2R-1AZ

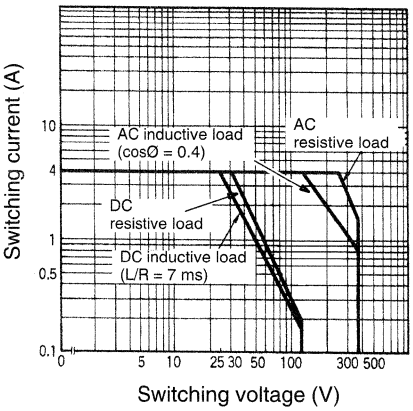


Plastic-sealed Relays

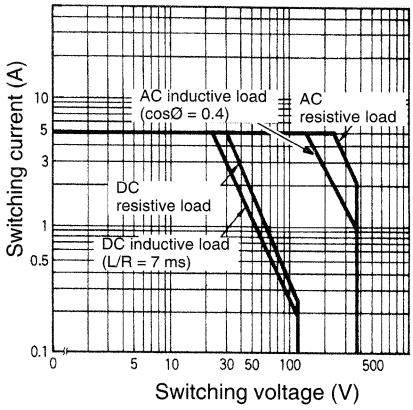
G2R-14, G2R-1A4



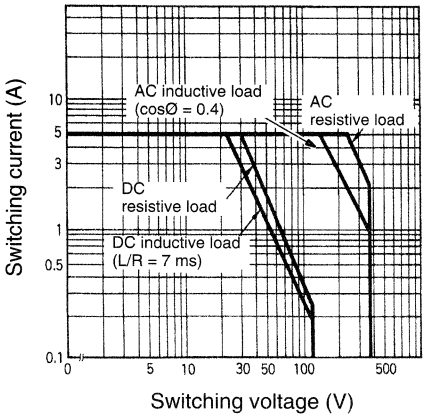
G2R-24, G2R-2A4



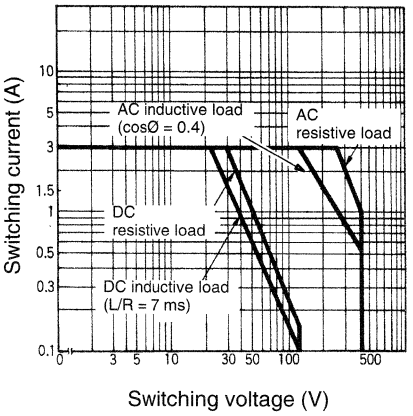
G2R-1Z4, G2R-1AZ4



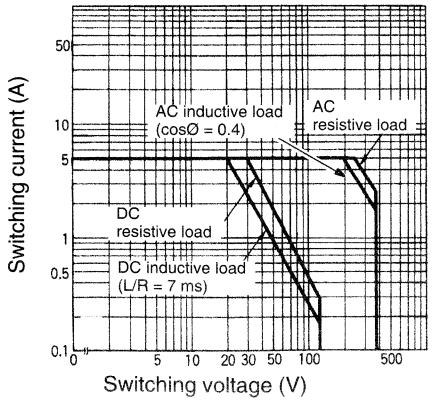
G2R-1-H, G2R-1A-H, G2R-2 G2R-2A



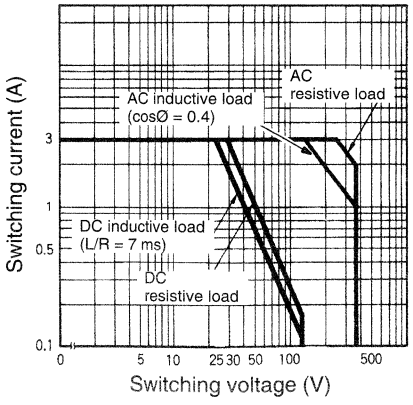
G2R-2-H, G2R-2A-H



G2RK-1A, G2RK-1

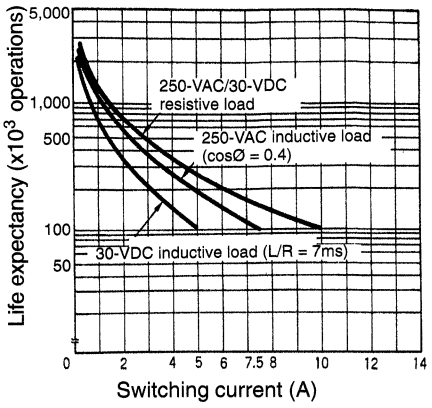


G2RK-2A, G2RK-2

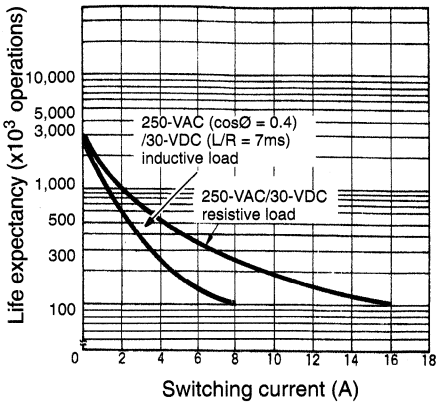


Relays

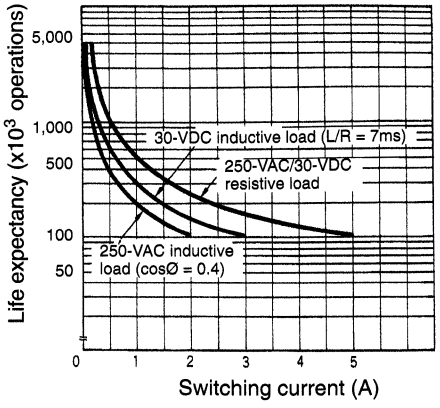
Flux Protection
G2R-1, G2R-1A



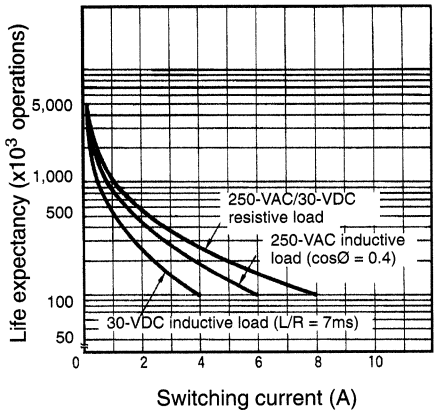
G2R-1-E, G2R-1A-E



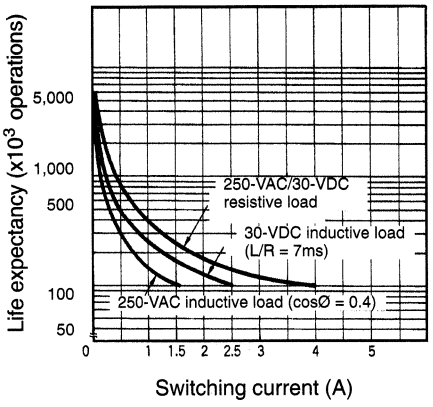
G2R-1Z, G2R-1AZ



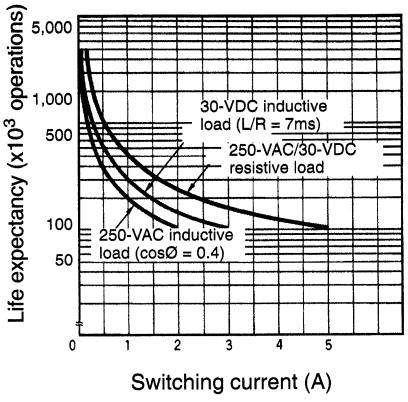
Plastic-sealed Relays
G2R-14, G2R-1A4



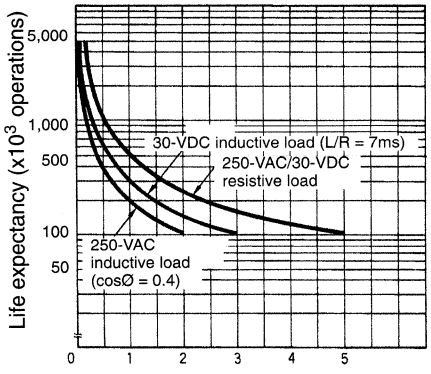
G2R-24, G2R-2A4



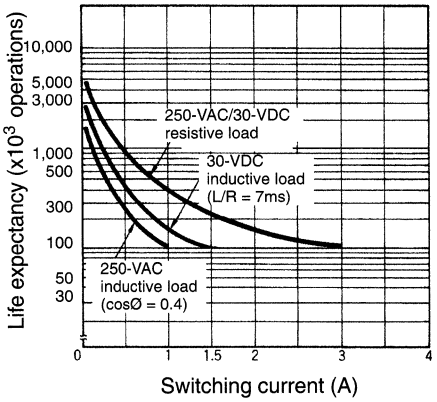
G2R-1Z4, G2R-1AZ4



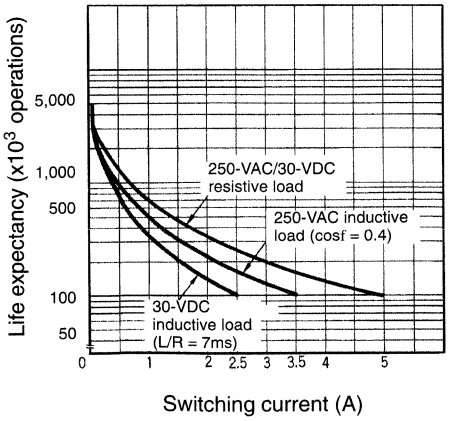
G2R-1-H, G2R-1A-H, G2R-2
G2R-2A, G2R-2-S



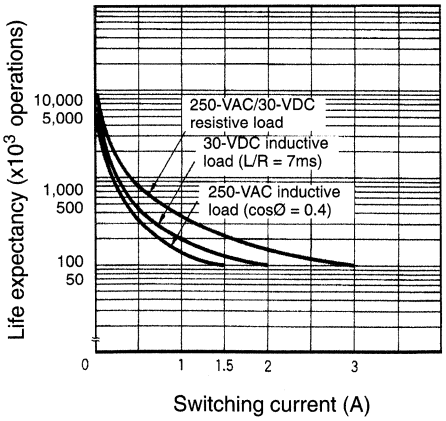
G2R-2-H, G2R-2A-H



G2RK-1A, G2RK-1



G2RK-2A, G2RK-2

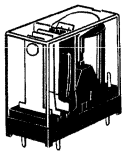


Dimensions

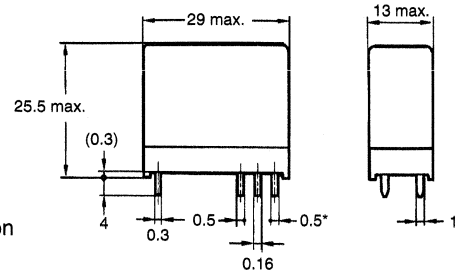
Note: 1. Orientation marks are indicated as follows:

Relays with PCB Terminals

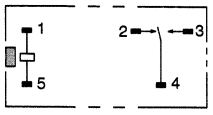
SPDT Relays
G2R-1, G2R-1Z, G2R-1-H



The illustration shows the G2R-1.

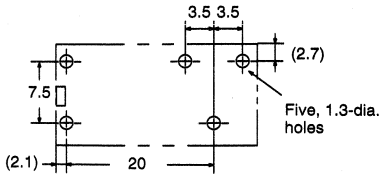


Terminal Arrangement/ Internal Connections (Bottom View)

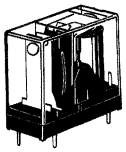


Mounting Holes (Bottom View)

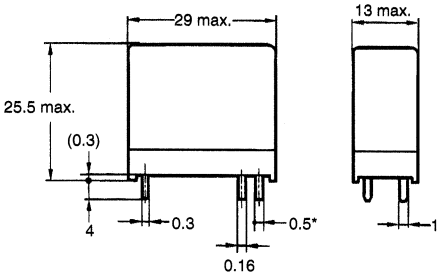
Tolerance: ±0.1

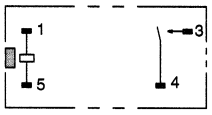


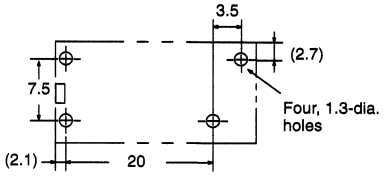
SPST-NO Relays
G2R-1A, G2R-1AZ, G2R-1A-H



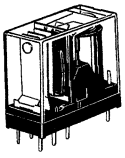
The illustration shows the G2R-1A.

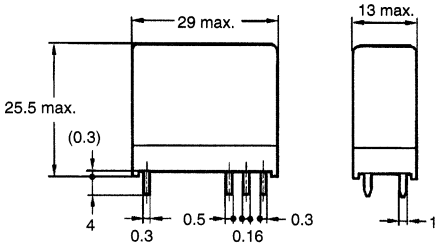


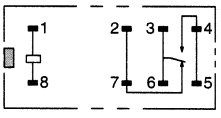


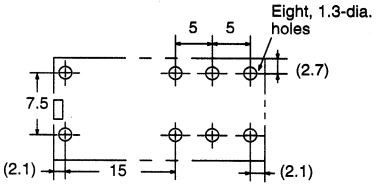


SPDT/High-capacity Relays
G2R-1-E

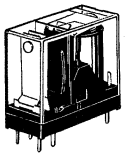


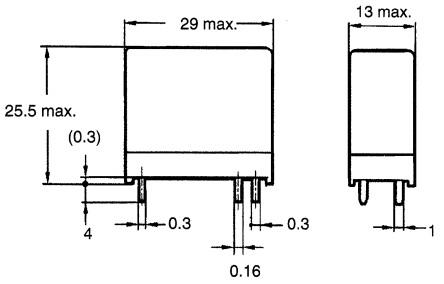


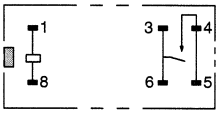


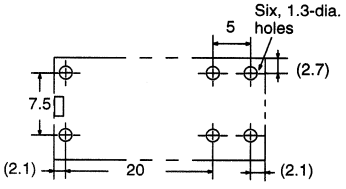


SPST-NO/High-capacity Relays
G2R-1A-E





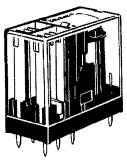


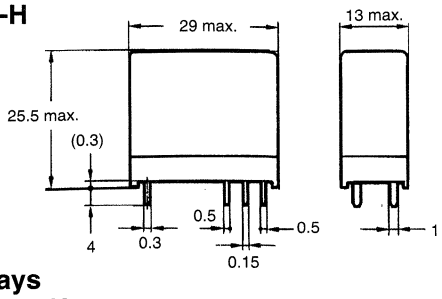


Relays

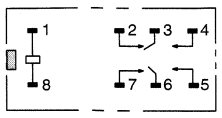
Relays with PCB Terminals

DPDT Relays
G2R-2, G2R-2-H



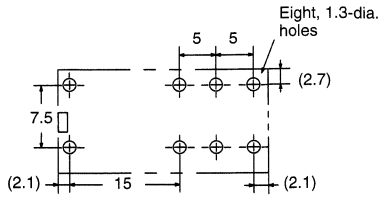


Terminal Arrangement/ Internal Connections (Bottom View)

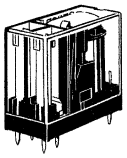


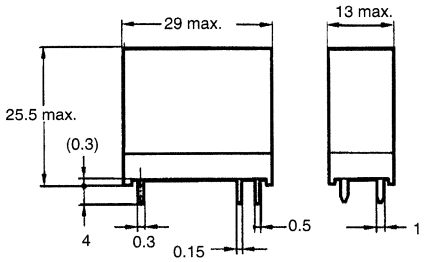
Mounting Holes (Bottom View)

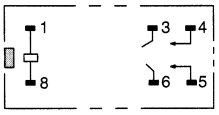
Tolerance: ±0.1

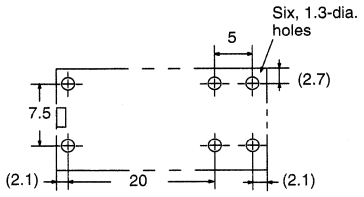


DPST-NO Relays
G2R-2A, G2R-2A-H

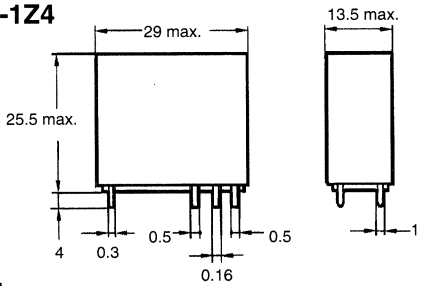


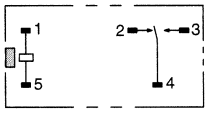


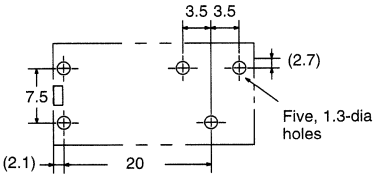




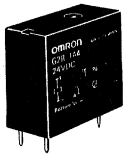
SPDT Relays
G2R-14, G2R-1Z4

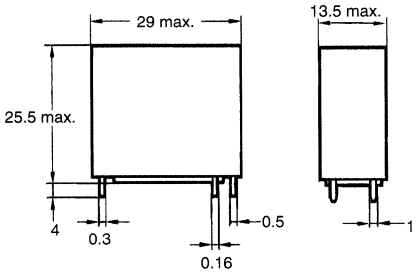


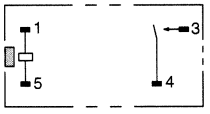


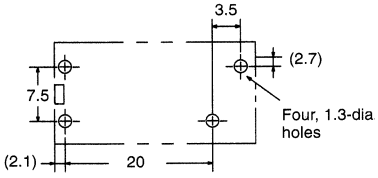


SPST-NO Relays
G2R-1A4, G2R-1AZ4

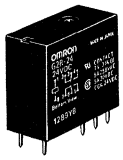


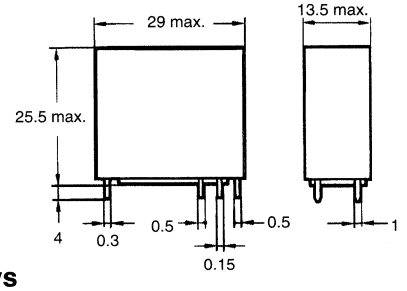


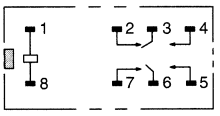


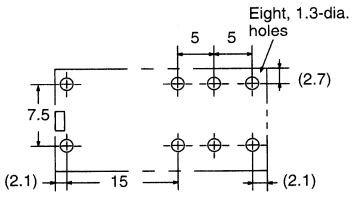


DPDT Relays
G2R-24

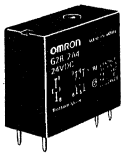


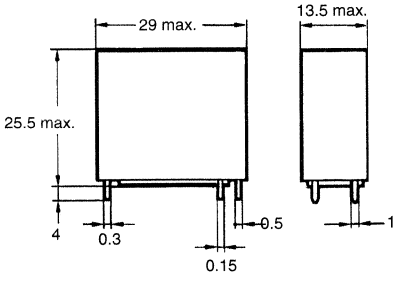


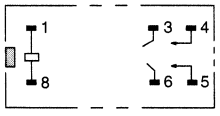


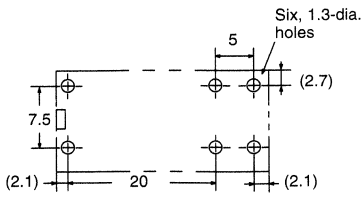


DPST-NO Relays
G2R-2A4



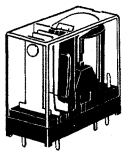


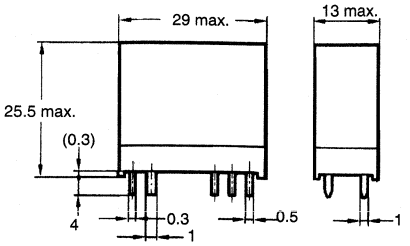




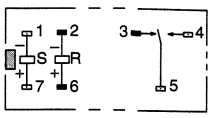
Double-winding Latching Relays with PCB Terminals

SPDT Relays
G2RK-1

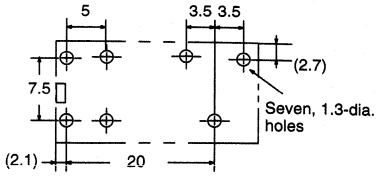




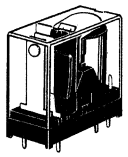
Terminal Arrangement/ Internal Connections (Bottom View)

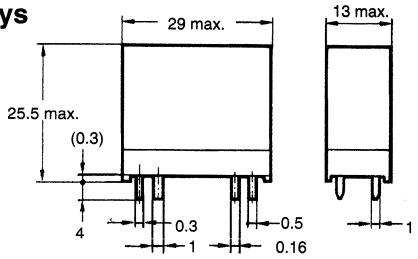


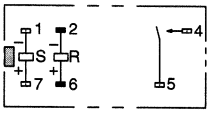
Mounting Holes (Bottom View)
Tolerance: ±0.1

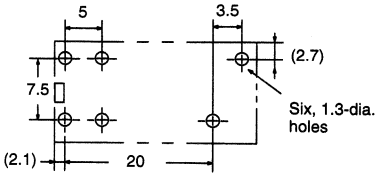


SPST-NO Relays
G2RK-1A

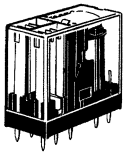


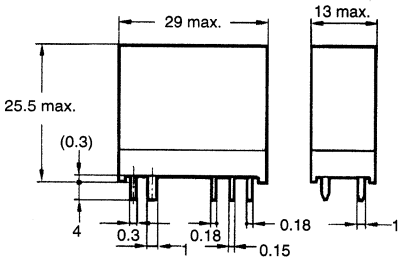


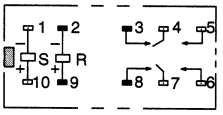


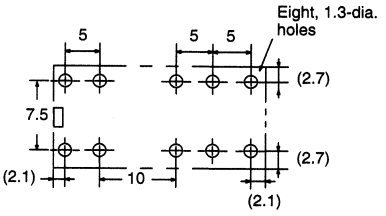


DPDT Relays
G2RK-2

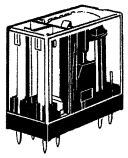


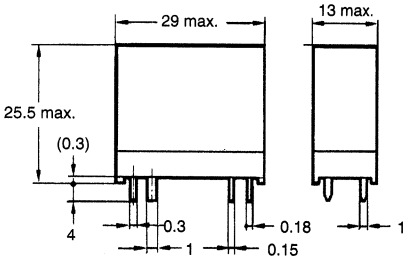


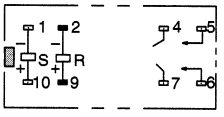


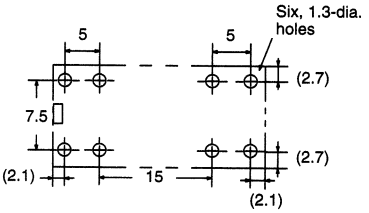


DPST-NO Relays
G2RK-2A





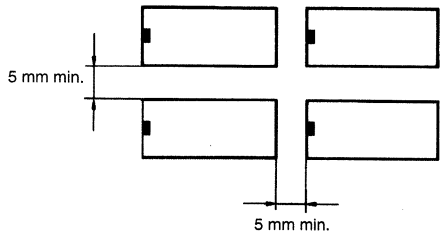




Precautions

■ Mounting

When mounting a number of relays on a PCB, be sure to provide a minimum mounting space of 5 mm between the two juxtaposed relays as shown below.



The above minimum mounting space is necessary due to mutual thermal interference generated by the relays. This restriction may be ignored, however, depending on the operating conditions of the relays. Consult OMRON for details.

There is no restriction on the mounting direction of each relay on the PCB.

When using this circuit, confirm the set and reset states and then take into account the circuit constant.

Relays

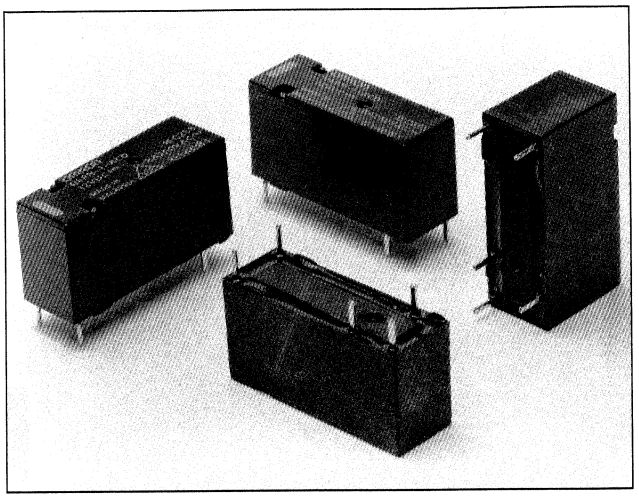
OMRON

Power Relay

G6RN

Heavy-duty Miniature Relay

- Incorporates environment–friendly, cadmium–free type.
- Variety of contact forms: SPDT or SPST-NO (continuous current rating: 8 A)
- Mechanical and electrical characteristics comply with VDE0435.
- Satisfies VDE0700 requirements with a dielectric strength of 4 kV at a distance of 8 mm.
- Satisfies C/250 insulation requirements of VDE0110.
- Conforms to class II, part 1 of VDE0106.



IEC

Ordering Information

Classification	Structure	Contact material	Contact form	
			SPST-NO	SPDT
Standard	Plastic-sealed	AgNi + gold plating	G6RN-1A	G6RN-1
		AgCdO + gold plating	G6RN-1A–ACD	G6RN-1–ACD

Note: When ordering, add the rated coil voltage to the model number.
Example: G6RN-1A 24 VDC
Rated coil voltage

Model Number Legend:

G6RN-□□□□□-□
1 2 3 4 5 6

1. **Number of Poles**
   1: 1 pole
2. **Contact Form**
   None: SPDT
   A: SPST-NO
3. **Contact Type**
   None: Single contact
4. **Enclosure Ratings**
   None: Plastic-sealed
5. **Terminals**
   None: Standard PCB
6. **Contact Material**
   None: AgNi + gold plating
   ACD: AgCdO + gold plating

Specifications

■ Coil Ratings

Rated voltage	5 VDC	6 VDC	12 VDC	24 VDC	48 VDC
Rated current	44 mA	36.7 mA	18.3 mA	9.2 mA	5.2 mA
Coil resistance	114 Ω	164 Ω	655 Ω	2,620 Ω	9,210 Ω
Must operate voltage	70% max. of rated voltage				
Must release voltage	10% min. of rated voltage				
Max. voltage	110% of rated voltage				
Power consumption	Approx. 220 mW				Approx. 250 mW

Note: 1. The rated current and coil resistance are measured at a coil temperature of 23°C with a tolerance of ±10%.
2. Operating characteristics are measured at a coil temperature of 23°C.

■ Contact Ratings

Contact type	Single contact	ACD Single contact
Configuration	SPDT, SPST-NO	
Contact material	AgNi + gold plating (standard)	AgCDO+ gold plating
Max. switching voltage	250 VAC	
Rated switching current	8 A	
Max. switching capacity	2,000 VA	

■ Characteristics

Operate time	15 ms max.
Release time	5 ms max.
Max. operating frequency	Mechanical: 36,000 operations/hr Electrical: 360 operations/hr (under rated load)
Insulation resistance	1,000 MΩ min.
Dielectric strength	4,000 VAC between coil and contacts 1,000 VAC between contacts
Creepage/clearance	8 mm min. between coil and contacts
Vibration resistance	Malfunction: NO: 10 to 55 Hz, 1.5-mm double amplitude NC: 10 to 55 Hz, 0.8-mm double amplitude
Shock resistance	Destruction: 1,000 m/s^2 (approx. 100G) Malfunction: 100 m/s^2 (approx. 10G)
Life expectancy	Mechanical: 10,000,000 operations min. Electrical: Approx. 100,000 operations (see note)
Ambient temperature	Operating: –40°C to 85°C Storage: –40°C to 85°C
Ambient humidity	Operating: 35% to 85%
Weight	Approx. 9 g
Protection class	II according to VDE0106 Part 1
Insulation class	C/250.according to VDE0110

■ Approved Standards

IEC255 (Meets Reinforced Insulation and Spacing Requirements According to IEC65, 335-1, 950, EN60335-1, 60950)

Standard	Contact form	Coil ratings	Contact ratings	Conditions
IEC255-1-00 IEC255-0-20	SPDT SPST-NO	5, 6, 12, 24, 48 VDC	8 A at 250 VAC (cosϕ = 1) (see note)	Pollution degree: 3 Overvoltage category: II Operating range: class 1 Pick-up class: class C Ambient temperature: –40°C to 85°C

Note: VAC according to IEC417.

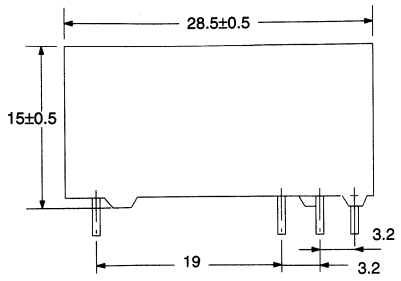
VDE

Standard	Contact form	Coil ratings	Contact ratings	Conditions
VDE0435 Part201 VDE0435 Part120	SPDT SPST-NO	5, 6, 12, 24, 48 VDC	8 A at 250 VAC (cosϕ = 1)	Insulation group according to VDE0110 C/250 Operating range: class 1 Pick-up class: class C Ambient temperature: –40°C to 85°C

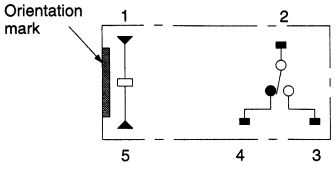
Dimensions

Note: All units are in millimeters unless otherwise indicated.

SPDT Type

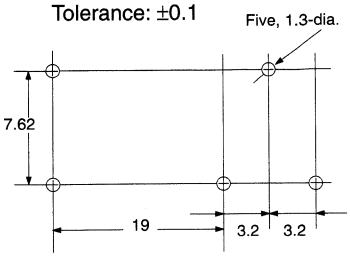


Terminal Arrangement/ Internal Connections (Bottom View)

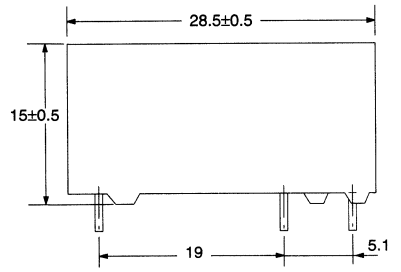


Mounting Holes (Bottom View)

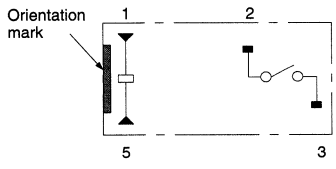
Tolerance: ±0.1



SPST-NO Type

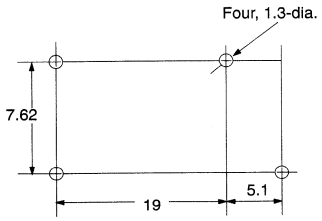


Terminal Arrangement/ Internal Connections (Bottom View)



Mounting Holes (Bottom View)

Tolerance: ±0.1

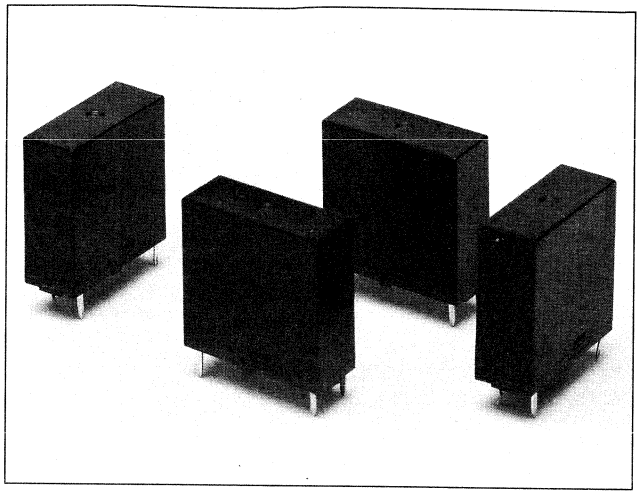


OMRON

Power Relay

G5PN

New G5P Relay Model Lineup Ideal for TV and Audio Equipment Power Supplies, Including a High-sensitivity Model (Power Consumption: 250 mW)



- Satisfy the TV-5 standards required for TV and audio equipment power supplies.
- The power consumption of the high-sensitive model is 50% maximum of that of the standard model and there is no difference in size (10 (W) x 25 (H) x 24 D) between the high-sensitive model and standard model.
- Double insulation construction assures high insulation capability
- A series of high-capacity models meets UL TV-8.
- UL, CSA, SEMKO, TÜV, and SEV are approved.

SEMKO

TÜV Rheinland

Ordering Information

Classification	Contact form	Rated coil voltage	Model
Standard	SPST-NO	12 VDC	G5P-1A
		24 VDC	
High-sensitivity		12 VDC	G5P-1A-H
		24 VDC	
High-capacity		12 VDC	G5P-1A-E
		24 VDC	

Model Number Legend:

G5P-1A- □
1 2

1. **Number of Poles/Contact Form**
   1A: 1 pole/SPST-NO

2. **Series**
   None: Standard
   H: High-sensitivity (current consumption: 250 mW)
   E: High-capacity (10 A, TV-8)

Specifications

■ Coil Ratings

Item	Standard type		High-sensitivity type	
Rated voltage	12 VDC	24 VDC	12 VDC	24 VDC
Rated current	44.2 mA	22.1 mA	20.8 mA	10.4 mA
Coil resistance	272 Ω	1,087 Ω	576 Ω	2,304 Ω
Must operate voltage	75% max. of rated voltage			
Must release voltage	10% min. of rated voltage			
Max. voltage	110% of rated voltage			
Power consumption	530 mW		250 mW	

Relays

■ Contact Ratings

Item	Standard/high-sensitivity type
Load	Resistive load ($\cos\phi = 1$)
Rated load	5 A at 250 VAC; 5 A at 30 VDC
Rated carry current	5 A
Max. switching voltage	250 VAC, 30 VDC
Max. switching current	5 A
Max. switching capacity	1,250 VA, 150 W
Min. permissible load	100 mA at 5 VDC

Note: P level: $\lambda_{60} = 0.1 \times 10^{-6}$operations (with an operating frequency of 120 operations/min; ambient temperature: 23°C)

■ Characteristics

Contact resistance	30 mΩ max.
Operate time	15 ms max.
Release time	5 ms max.
Insulation resistance	1,000 MΩ min. (at 500 VDC)
Dielectric withstand voltage	4,000 VAC, 50/60 Hz for 1 min between coil and contact 1,000 VAC, 50/60 Hz for 1 min between contacts of same polarity
Impulse withstand voltage	10,000 V, 1.2 x 50 μs between coil and contact
Vibration resistance	Destruction: 10 to 55 Hz, 1.5-mm double amplitude Malfunction: 10 to 55 Hz, 1.5-mm double amplitude
Shock resistance	Destruction: 1,000 m/s^2 (approx. 100G) Malfunction: 200 m/s^2 (approx. 20G)
Life expectancy	Mechanical: 2,000,000 operations min. (at 18,000 operations/hr) Electrical: 100,000 operations min. (at 1,800 operations/hr under rated load)
Ambient temperature	Operating: –40°C to 70°C (with no icing)
Ambient humidity	Operating: 45% to 85%
Weight	Approx. 11 g

■ Approved Standards

UL508 (File No. E41643)
CSA C22.2 No. 14 (File No. LR31928)

Model	Coil ratings	Contact ratings
G5P-1A	5 to 48 VDC	5 A, 250 VAC, general use 5 A, 30 VDC, resistive TV-5 rating
G5P-1A-H		
G5P-1A-E		10 A, 250 VAC, general use 10 A, 30 VDC, resistive TV-8 rating

SEV 1025.1984 (File No.93, 100340, 03-04)

Model	Coil ratings	Contact ratings
G5P-1A	5, 6, 9, 12, 24, 48 VDC	5 A, 250 VAC, 10 A, AC-1 5 A, 250 VAC, 7 A, AC-3 5 A, 30 VDC, 10 A, DC-1
G5P-1A-H		
G5P-1A-E		

SEMKO IEC65 (File No. 9311076, 9346124, 9403003)

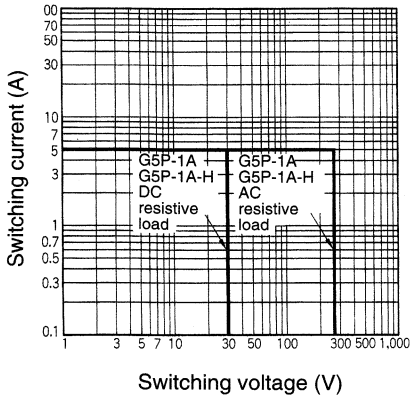
Model	File no.	Coil ratings	Contact ratings
G5P-1A	9311076	3 to 48 VDC	5 A, 250 VAC 3/100 A, 5/40 A, 250 VAC
G5P-1A-H	9403003	12 to 24 VDC	8 A, 250 VAC
G5P-1A-E	9346124	3 to 48 VDC	10 A, 250 VAC 10/80 A, 5/40 A, 250 VAC

TÜV IEC255 (IEC335-1, IEC65) (File No. R9351221)

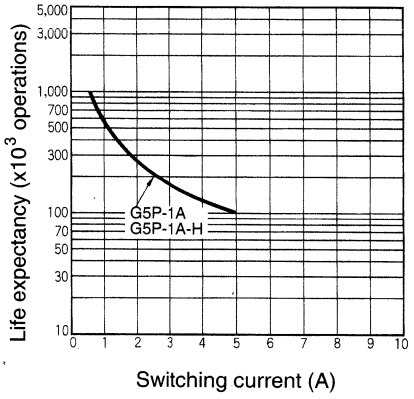
Model	Coil ratings	Contact ratings	Remarks
G5P-1A	5 to 48 VDC	5 A, 250 VAC (cosϕ = 1) 5 A, 30 VDC (L/R: 0 ms)	Electrical life: 100,000 operations min. (at 1,800 operations/hr under rated load) Mechanical life: 2,000,000 operations min. (at 1,800 operations/hr) Duty level: class III Operative range: 2 Pick-up class: class a Pollution degree: 2 Overvoltage category: ii Material group: IIIa Ambient temperature: –40°C to 70°C
G5P-1A-H			
G5P-1A-E		10 A, 250 VAC (cosϕ = 1) 10 A, 30 VDC (L/R: 0 ms)	

Engineering Data

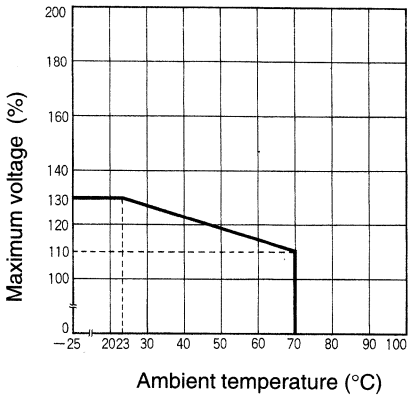
Max. Switching Capacity



Life Expectancy



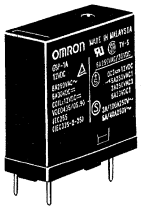
Ambient Temperature vs. Maximum Voltage

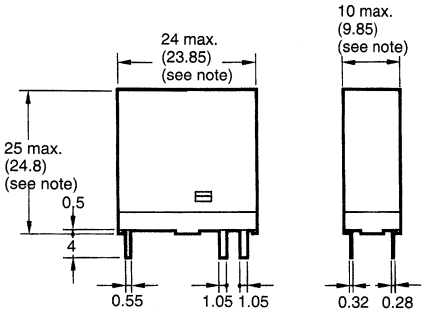


Note: The maximum voltage is the permissible peak voltage that can be imposed on the coil. The maximum voltage must not be imposed on the coil continuously.

Dimensions

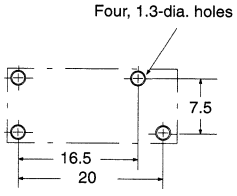
Note: All units are in millimeters unless otherwise indicated.





Note: Average

Mounting Holes
(Bottom View)
Tolerance: ±0.1 mm



Terminal Arrangement /Internal Connections
(Bottom View)
(No coil polarity)

Relays

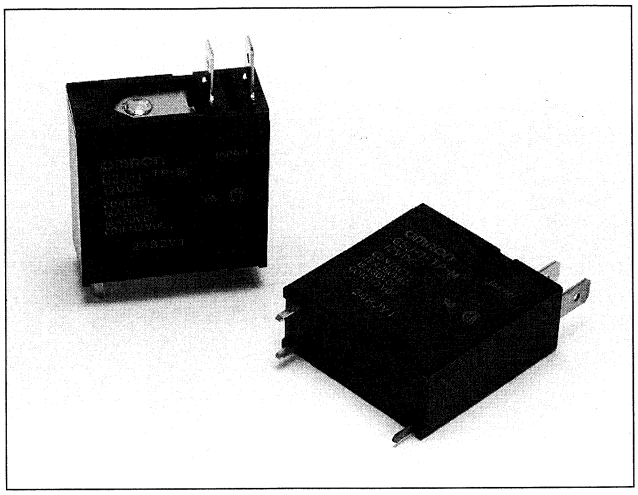
OMRON

PCB Relay

G5J

Ideal for Microwave Oven Magnetrons and Heater Switching

- Dual tab/PCB terminals.
- Small, space-saving bottom surface area.
- High impulse withstand voltage: 10 kV



Ordering Information

Sealing	Contact form	Model
Unsealed	SPST-NO	G5J-1-TP-M

Note: When ordering, add the rated coil voltage to the model number.

Example: G5J-1-TP-M 12 VDC
Rated coil voltage

Model Number Legend:

G5J - □ - □ - □ □
1 2 3 4

1. Number of Poles
1: 1 pole (SPST-NO contact)

2. Terminal
TP: Tab/PCB terminals

3. Others
M: Indicates new type.

4. Rated coil
12, 18, 24 VDC

Specifications

■ Coil Ratings

Rated voltage (DC)	12	18	24
Rated current	58.3 mA	38.9 mA	29.2 mA
Coil resistance	206 Ω	463 Ω	822 Ω
Must operate voltage	70% max. of rated voltage		
Must release voltage	10% min. of rated voltage		
Maximum voltage	110% of rated voltage		
Power consumption	Approx. 700 mW		

■ Contact Ratings

Rated load	16 A at 250 VAC/30 VDC (cosØ = 1)
Rated carry current	16 A
Max. switching voltage	250 VAC; 30 VDC

Note: 1. The rated current and coil resistance are measured at a coil temperature of 23°C with a tolerance of ±10%.

■ Approved by Standards

UL508 (File No. E41643)

Coil ratings	Contact ratings	
6 to 24 VDC	16 A 250 VAC 1/2 HP 125 VAC	16 A 30 VDC 1 HP 250 VAC

CSA C22.2 No. 14 (File No. LR31928)

Coil ratings	Contact ratings	
6 to 24 VDC	16 A 250 VAC 1/2 HP 125 VAC	16 A 30 VDC 1 HP 250 VAC

VDE0435/05.90, IEC255, (IEC355-2-25)

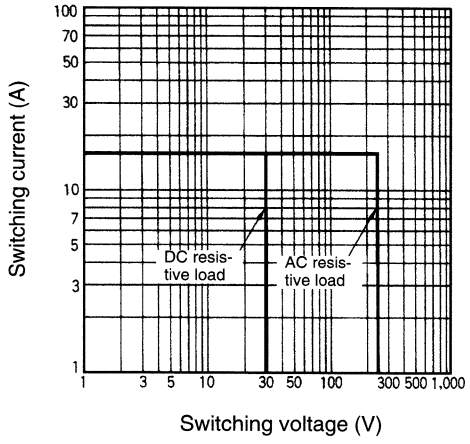
Coil ratings	Contact ratings	Approved conditions
12, 24 VDC	16 A at 250 VAC (cosØ = 1)	Duty level: class III Operative range: class I Pick-up class: class c Pollution degree: 2 Overvoltage category: II Material group: IIIa Ambient temperature: –25°C to 70°C

■ Characteristics

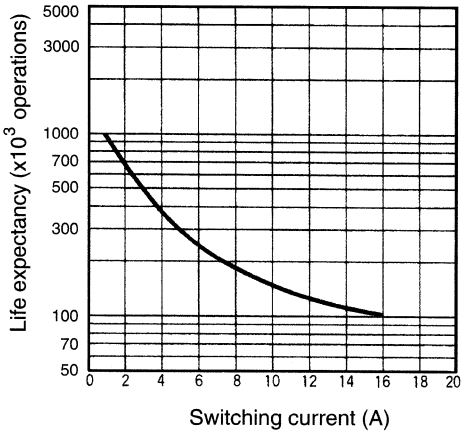
Contact resistance	30 mΩ max.
Operate time	20 ms max.
Release time	5 ms max.
Insulation resistance	1,000 MΩ min. (at 500 VDC)
Dielectric withstand voltage	4,000 VAC between coil and contacts (1 min.) 1,000 VAC between contacts of same pole (1 min.)
Impulse withstand voltage	10 kV (1.2 x 50μs) between coil and contacts
Vibration resistance	Destruction: 10 to 55 Hz, 1.5-mm double amplitude Malfunction: 10 to 55 Hz, 1.5-mm double amplitude
Shock resistance	Destruction: 1,000 m/s^2 (approx. 100G) Malfunction: 200 m/s^2 (approx. 20G)
Life expectancy	Mechanical: 2,000,000 operations min. (18,000 operations/hr) Electrical: 100,000 operations min. (1,800 operations/hr)
Ambient temperature	Operating: –25°C to 70°C (with no icing)
Ambient humidity	45% to 85%
Weight	Approx. 22.5 g

Engineering Data

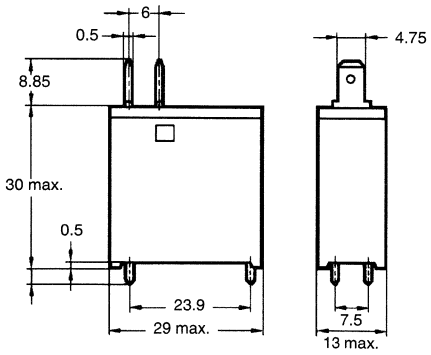
Max. Switching Capacity



Life Expectancy

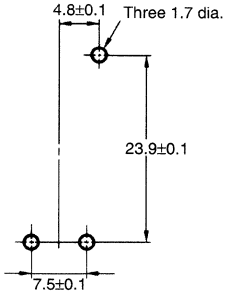


Dimensions

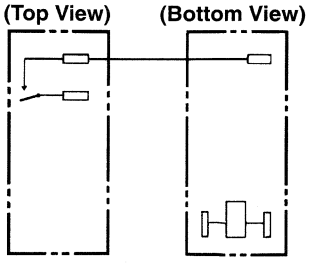


Mounting Holes (Bottom View)

Tolerance: ±0.1



Terminal Arrangement/ Internal Connections



Relays

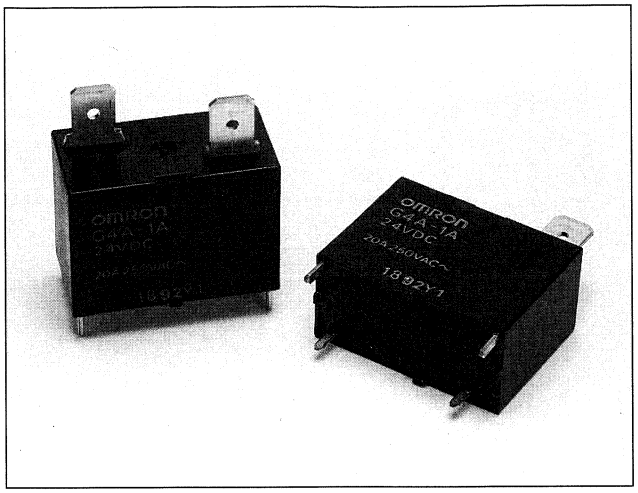
OMRON

Power Relay

G4A

Miniature Single-pole Relay with 80-Amp Surge Current and 20-Amp Switching Current

- Ideal for motor switching.
- Miniature, relay with high switching capacity.
- Creepage distance conforms to UL and CSA standards.
- Standard model available with flux protection construction.
- Available with PCB or dual PCB/tab terminals.



Ordering Information

Contact form	Terminals	Coil terminals	Rated voltage	Model
SPST-NO	#250 tab terminals	PCB terminals	5, 12, 24 VDC	G4A-1A
	PCB terminals			G4A-1A-P

Model Number Legend:

G4A - □ □ - □ □ VDC
1 2 3 4

1. **Number of Poles**
   1: 1 pole
2. **Contact Form**
   A: SPST-NO
3. **Terminals**
   None: Relays with #250 tab/PCB terminals
   P: PCB terminals
4. **Rated Coil Voltage**
   5, 12, 24 VDC

Specifications

■ Coil Ratings

Rated voltage		5 VDC	12 VDC	24 VDC
Rated current		180 mA	75 mA	37.5 mA
Coil resistance		27.8 Ω	160 Ω	640 Ω
Coil inductance (ref. value)	Armature OFF	---	0.8 H	3.5 H
	Armature ON	---	1.1 H	4.8 H
Must operate voltage		70% of rated voltage max.		
Must release voltage		10% of rated voltage min.		
Max. voltage		110% of rated voltage		
Power consumption		Approx. 0.9 W		

Note: 1. The rated current and coil resistance are measured at a coil temperature of 23°C with a tolerance of ±10%.
2. Operating characteristics are measured at a coil temperature of 23°C.

■ Contact Ratings

Rated load	20 A at 250 VAC
Rated carry current	20 A
Max. switching voltage	250 VAC
Max. switching current	20 A
Max. switching capacity	5,000 VA
Min. permissible load	100 mA at 5 VDC

Note: P level: λ_{60} = 0.1 x 10 operations (with an operating frequency of 120 operations/min)

■ Life Expectancies

With Motor Load

Load conditions	Switching frequency	Electrical life expectancy
250 VAC: Inrush current: 80 A, 0.3 s (cosØ= 0.7) Break current: 20 A (cosØ = 0.9)	ON: 1.5 s OFF: 1.5 s	100,000 operations

With Overload

Load conditions	Switching frequency	Electrical life expectancy
250 VAC: Inrush current: 80 A (cosØ= 0.7) Break current: 80 A (cosØ = 0.7)	ON: 1.5 s OFF: 1.5 s	1,500 operations

With Inverter Load

Load conditions	Switching frequency	Electrical life expectancy
100 VAC; Inrush current: 200 A (0–P) Break current: 20 A	ON: 3 s OFF: 5 s	30,000 operations

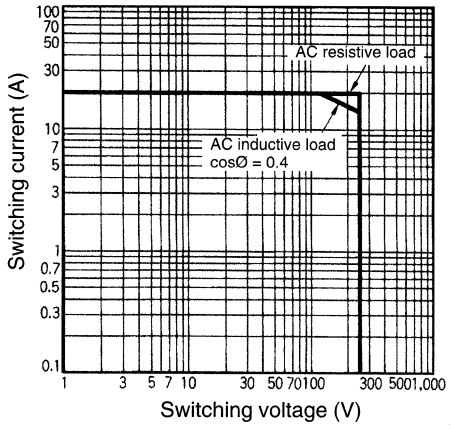
■ Characteristics

Contact resistance	30 mΩ max.
Operate time	20 ms max.
Release time	10 ms max.
Max. operating frequency	Mechanical: 18,000 operations/hr
Insulation resistance	1,000 MΩ min. (at 500 VDC)
Dielectric withstand voltage	4,500 VAC 50/60 Hz for 1 min between coil and contact
	1,000 VAC 50/60 Hz for 1 min between contacts of same polarity
Vibration resistance	Destruction: 10 to 55 Hz, 1.5-mm double amplitude Malfunction: 10 to 55 Hz, 1.5-mm double amplitude
Shock resistance	Destruction: 1,000 m/s^2 (approx. 100G) Malfunction: 200 m/s^2 (approx. 20G)
Life expectancy	Mechanical: 2,000,000 operations min. (at 18,000 operations/hr) Motor load: 100,000 operations min. (ON/OFF: 1.5 s) Inverter load: 30,000 operations min. (ON: 3 s, OFF: 5 s)
Ambient temperature	Operating: –25°C to 55°C (with no icing)
Ambient humidity	Operating: 35% to 85%
Weight	Approx. 23 g

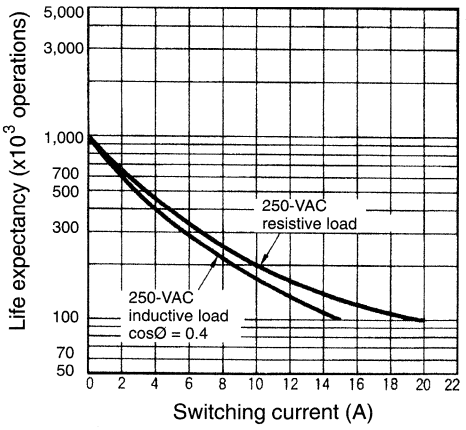
Note: The data shown above are initial values.

Engineering Data

Max. Switching Capacity



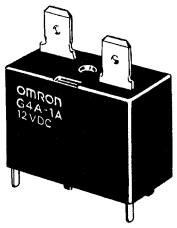
Life Expectancy

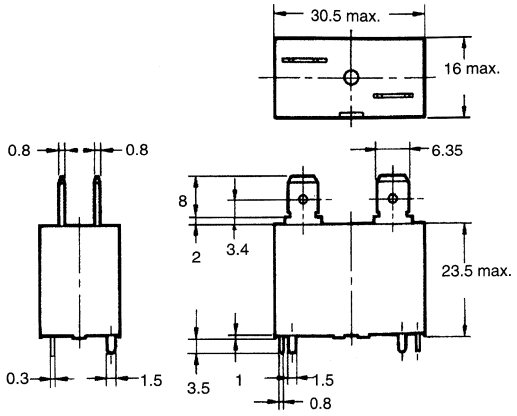


Relays

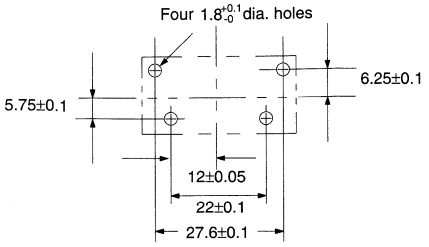
Dimensions

G4A-1A



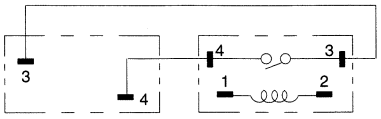


Mounting Holes
(Bottom view)

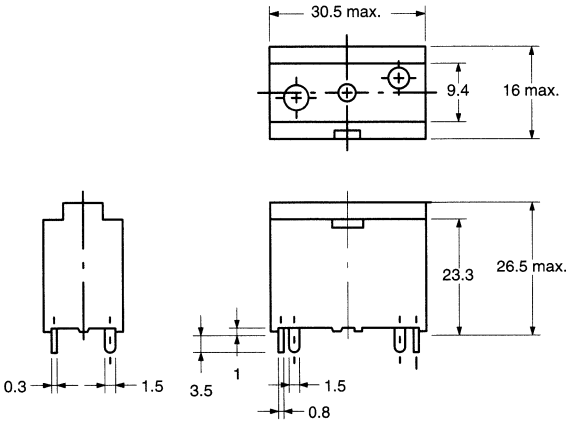


Terminal Arrangement /Internal Connections

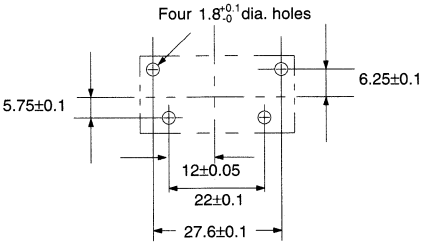
Tab terminals (Top view) PCB terminals (Bottom view)



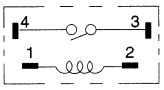
G4A-1A-P



Mounting Holes
(Bottom view)



Terminal Arrangement /Internal Connections
(Bottom View)



Precautions

Mounting

When mounting two or more relays side by side, provide a minimum space of 3 mm between relays.

Terminal Connection

The terminals fit FASTON receptacle 250 and are suitable for positive-lock mounting.

Do not apply excessive force on the terminals when mounting or dismounting the relay.

The following positive-lock connectors made by AMP are recommended.

Type	Receptacle terminals	Positive housing
#250 terminals (width: 6.35 mm)	AMP 170333-1 (170327-1) AMP 170334-1 (170328-1) AMP 170335-1 (170329-1)	AMP 172076-1 natural color AMP 172076-4 yellow AMP 172076-5 green AMP 172076-6 blue

Note: The numbers shown in parentheses are for air-feeding.

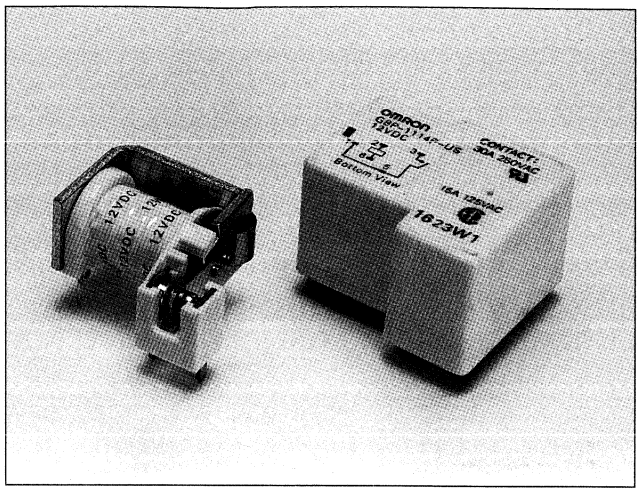
OMRON

PCB Relay

G8P

Small, Low-Cost 30-A Power Relay for PCB Applications

- Small, yet capable of switching up to a 30-A loads.
- Inexpensive.
- Ideal for home and industrial appliances, HVAC (heating, ventilating and air conditioning) and many other applications.
- A variety of contact forms: SPDT, SPST-NO and SPST-NC.
- UL Class B and F insulation, sealed versions and dust cover available.



Ordering Information

Contact form	Standard Relays		Relays with class B insulation		Relays with class F insulation	
	Open	Plastic-sealed	Open	Plastic-sealed	Open	Plastic-sealed
SPST-NO	G8P-1111P-US	G8P-1114P-US	G8P-1111P-BI-US	G8P-1114P-BI-US	G8P-1111P-CF-US	G8P-1114P-CF-US
SPST-NC	G8P-1011P-US	G8P-1014P-US	G8P-1011P-BI-US	G8P-1014P-BI-US	G8P-1011P-CF-US	G8P-1014P-CF-US
SPDT	G8P-111P-US	G8P-114-US	G8P-111P-BI-US	G8P-114P-BI-US	G8P-111P-CF-US	G8P-114P-CF-US

Note: 1. When ordering, add the rated coil voltage to the model number.
Example: G8P-111P-US 12 VDC
Rated coil voltage

Model Number Legend:

G8P - □ □ □ □ □ - □ □ VDC
1 2 3 4 5 6 7

1. **Number of Poles**
   1: 1 pole
2. **Contact Form**
   None: SPDT
   1: SPST-NO
   0: SPST-NC
3. **Contact Types**
   1: Single button
4. **Sealing**
   1: Open
   4: Plastic-sealed
5. **Terminals**
   P: Straight PCB
6. **UL Insulation Rate**
   None: Standard
   BI: Class B insulation
   CF: Class F insulation
7. **Rated Coil Voltage**
   5, 12, 24, 48 VDC

■ Accessories (Order Separately)

Dust cover	R99-C01

Specifications

■ Coil Ratings

Rated voltage		5 VDC	12 VDC	24 VDC	48 VDC
Rated current		185 mA	77 mA	36 mA	19 mA
Coil resistance		27 Ω	155 Ω	660 Ω	2,480 Ω
Coil inductance (H) (ref. value)	Armature OFF	0.12	0.58	2.43	9.41
	Armature ON	0.18	0.92	4.14	14.7
Must operate voltage		75% max. of rated voltage			
Must release voltage		10% min. of rated voltage			
Max. voltage		120% of rated voltage			
Power consumption		Approx. 900 mW			

Note: The rated current and coil resistance are measured at a coil temperature of 20°C with tolerances of ±10%.

Relays

■ Contact Ratings

Item	SPST-NO	SPST-NC	SPDT
Load	Resistive load (cosØ = 1)		
Rated load	30 A at 250 VAC; 20 A at 28 VDC	15 A at 250 VAC; 10 A at 28 VDC	20 A/10 A* at 250 VAC; 20 A/10 A* at 28 VDC
Contact material	AgCdO		
Rated carry current	30 A	15 A	20 A/10 A*
Max. switching voltage	250 VAC, 28 VDC		
Max. switching current	AC: 30 A, DC: 20 A	AC: 15 A, DC: 10 A	AC: 20 A/10 A, DC: 20 A/10 A*
Max. switching capacity	7,500 VA, 560 W	3,750 VA, 280 W	5,000/250 VA, 560/280 W*
Min. permissible load	500 mA at 5 VDC		

Note: *NO contact/NC contact

■ Characteristics

Contact resistance	20 mΩ max.
Operate time	15 ms max. (mean value: approx. 8.4 ms)
Release time	10 ms max. (mean value: approx. 1.6 ms)
Max. operating frequency	Mechanical: 18,000 operations/hr Electrical: 1,800 operations/hr (under rated load)
Insulation resistance	10 MΩ min. (at 500 VDC)
Dielectric withstand voltage	1,500 VAC, 50/60 Hz for 1 min
Vibration resistance	Destruction:10 to 55 Hz, 1.65-mm double amplitude for 2 hours Malfunction:10 to 55 Hz, 1.65-mm double amplitude for 5 minutes
Shock resistance	Destruction: 1,000m/s^2 (approx. 100G) Malfunction: 100 m/s^2 (approx. 10G)
Life expectancy	Mechanical: 10,000,000 operation min. (at 18,000 operations/hr) Electrical: See *Engineering Data.*
Ambient temperature	Standard types: –55°C to 70°C Class B insulation types: –55°C to 85°C Class F insulation types: –55°C to 105°C
Ambient humidity	Operating: 45% to 85%
Weight	Approx. 19 g (G8P-111P), approx. 27 g (G8P-114P)

Note: The data shown above are initial values.

■ Approved Standards

UL (File No. E41643)

Type	Contact form	Coil ratings	Contact ratings	
			UL508-recognized	**UL114-recognized**
G8P-1111P-US	SPST-NO	5 to 48 VDC	15 A, 125 VAC (inductive load) 10 A, 250 VAC (inductive load) 15 A, 28 VDC (resistive load) 1 hp, 125 VAC (motor load) 1 hp, 250 VAC (motor load) 5 A (1,250 W), 250 VAC (tungsten load)	30 A, 250 VAC (inductive load) 20 A, 28 VAC (inductive load) 1 hp, 125 VAC (motor load) 2 hp, 250 VAC (motor load) 12 A, 277 VAC (inductive load)
G8P-1011P-US	SPST-NC		15 A, 125 VAC (inductive load) 10 A, 250 VAC (inductive load) 10 A, 28 VDC (resistive load) 0.25 hp, 125 VAC (motor load) 0.5 hp, 250 VAC (motor load) 3 A (750 W), 250 VAC (tungsten load)	15 A, 250 VAC (inductive load) 10 A, 28 VAC (inductive load) 0.25 hp, 125 VAC (motor load) 0.5 hp, 250 VAC (motor load) 6 A, 277 VAC (inductive load)
G8P-111P-US	SPDT		NO/NC 15 A/10 A, 125 VAC (inductive load) 10 A/10 A, 250 VAC (inductive load) 15 A/10 A, 28 VDC (resistive load) 1 hp/0.25 hp, 125 VAC (motor load) 1 hp/0.5 hp, 250 VAC (motor load) 5 A/3 A, 250 VAC (tungsten load)	NO/NC 20 A/10 A, 250 VAC (inductive load) 20 A/10 A, 28 VAC (inductive load) 1 hp/0.25 hp, 125 VAC (motor load) 2 hp/0.5 hp, 250 VAC (motor load) 12 A/6 A, 277 VAC (inductive load)

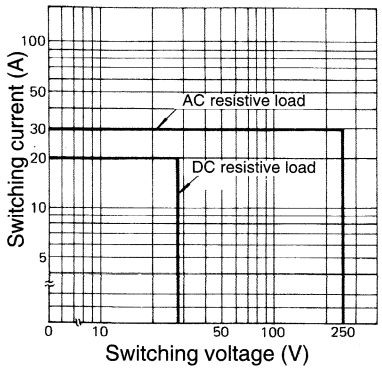
CSA (File No. LR34815-124)

Type	Contact form	Coil ratings	Contact ratings
G8P-1111P-US	SPST-NO	5 to 48 VDC	6 A, 277 VAC (inductive load) 15 A, 125 VAC (inductive load) 10 A, 250 VAC (inductive load) 15 A, 28 VDC (resistive load) 0.5 hp, 125 VAC (motor load) 1 hp, 250 VAC (motor load) 5 A, 125 VAC (tungsten load) 5 A, 250 VAC (tungsten load)
G8P-1011P-US	SPST-NC		3 A, 277 VAC (inductive load) 15 A, 125 VAC (inductive load) 10 A, 250 VAC (inductive load) 10 A, 28 VDC (resistive load) 0.25 hp, 125 VAC (motor load) 0.5 hp, 250 VAC (motor load) 3 A, 125 VAC (tungsten load) 3 A, 250 VAC (tungsten load)
G8P-111P-US	SPDT		NO/NC 6 A/3 A, 277 VAC (inductive load) 15 A/10 A, 125 VAC (inductive load) 10 A/10 A, 250 VAC (inductive load) 15 A/10 A, 28 VDC (resistive load) 0.5 hp/0.25 hp, 125 VAC (motor load) 1 hp/0.5 hp, 250 VAC (motor load) 5 A/3 A, 125 VAC (tungsten load) 5 A/3 A, 250 VAC (tungsten load)

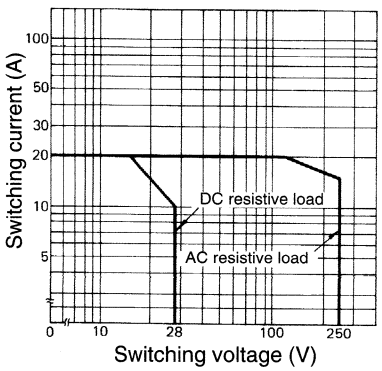
Engineering Data

Max. Switching Capacity

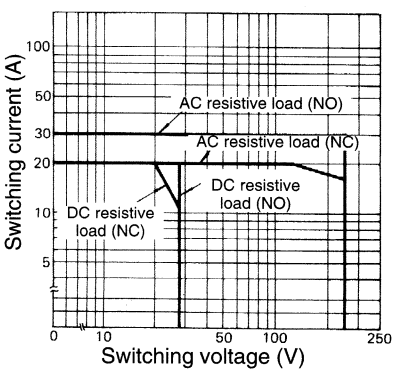
SPST-NO



SPST-NC

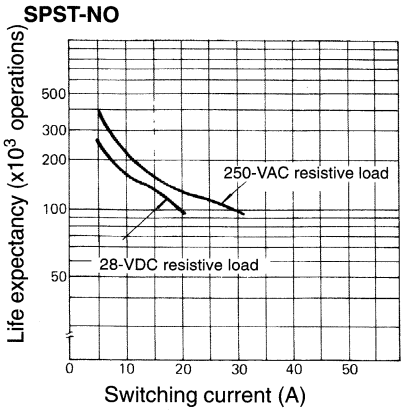


SPDT

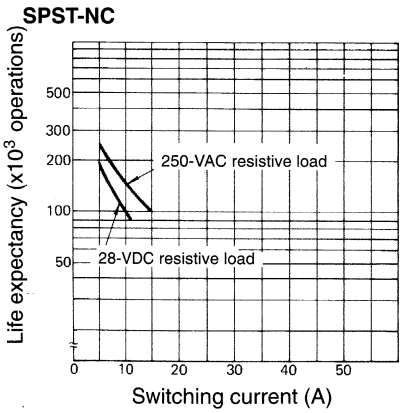


Life Expectancy

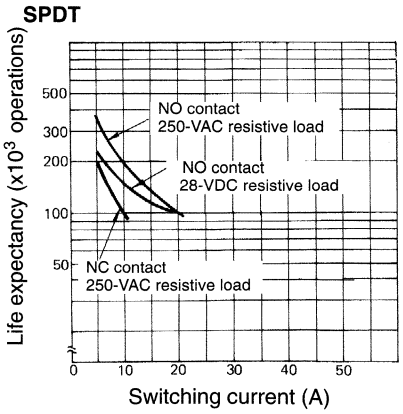
SPST-NO



SPST-NC



SPDT

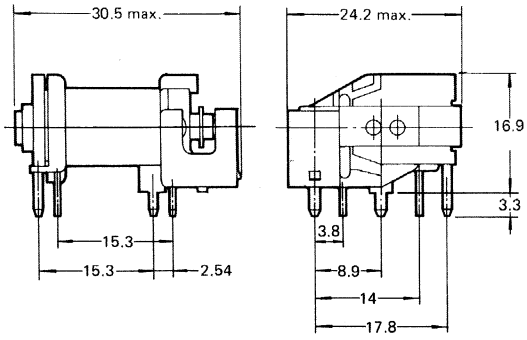


Relays

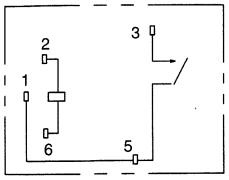
Dimensions

■ Open Types

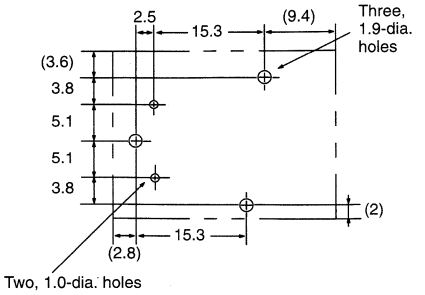
G8P-1111P-(B1)-US



Terminal Arrangement/ Internal Connections (Bottom View)



Mounting Holes (Bottom View)



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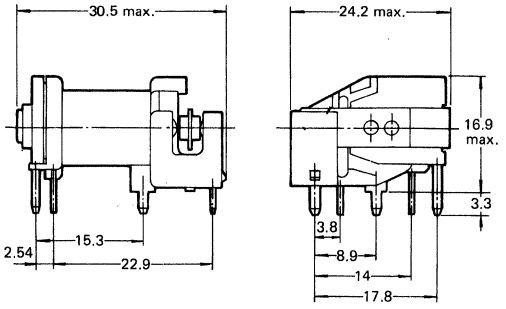
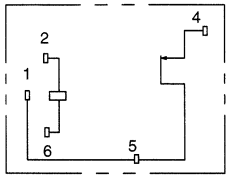
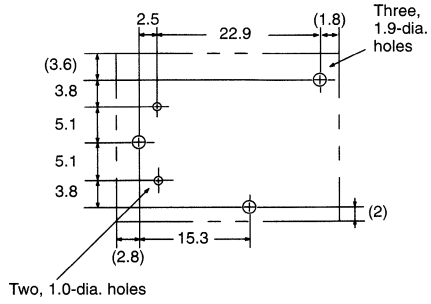


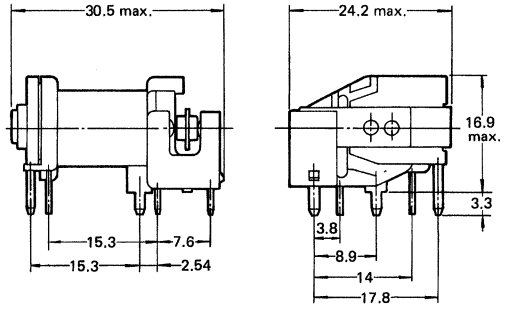
Terminal Arrangement/ Internal Connections (Bottom View)



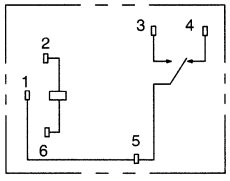
Mounting Holes (Bottom View)



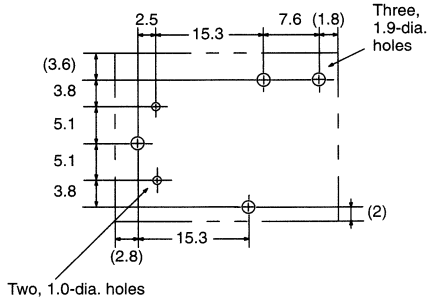
G8P-111P-(B1)-US



Terminal Arrangement/ Internal Connections (Bottom View)

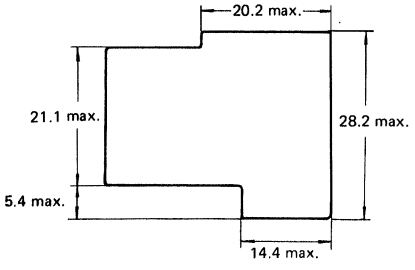


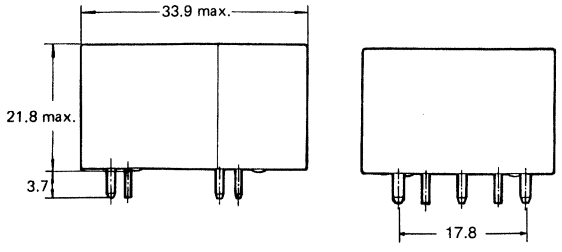
Mounting Holes (Bottom View)



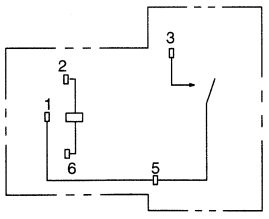
■ Plastic-sealed Types

G8P-1114P-(B1)-US

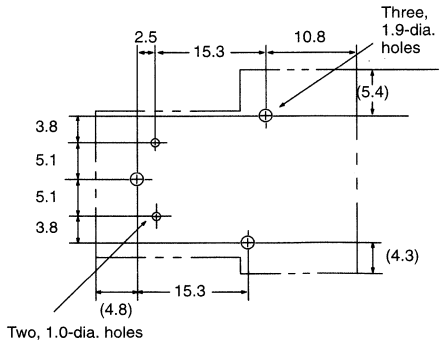




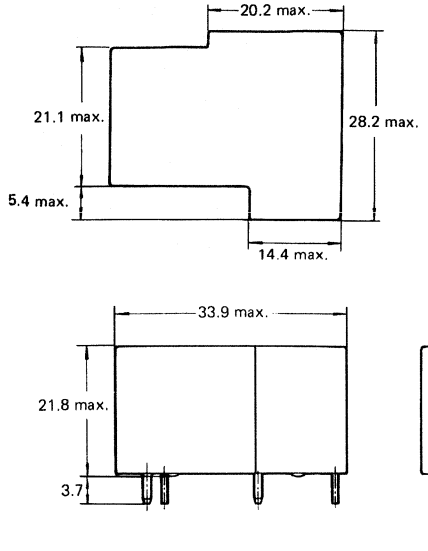
Terminal Arrangement/ Internal Connections (Bottom View)



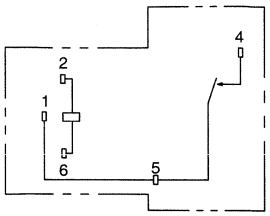
Mounting Holes (Bottom View)



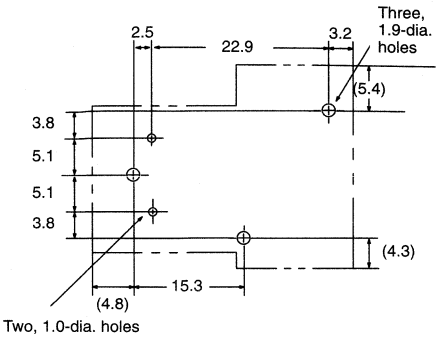
G8P-1014P-(B1)-US



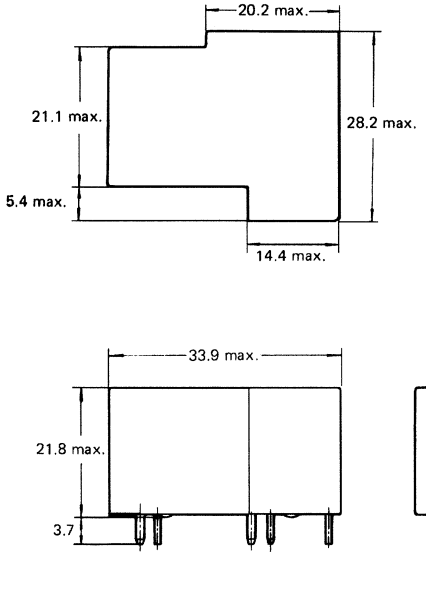
Terminal Arrangement/ Internal Connections (Bottom View)



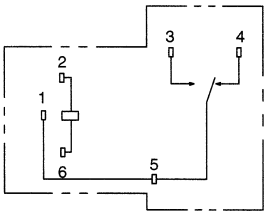
Mounting Holes (Bottom View)



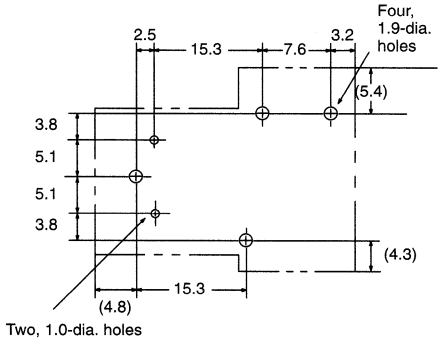
G8P-114P-(B1)-US



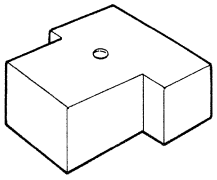
Terminal Arrangement/ Internal Connections (Bottom View)

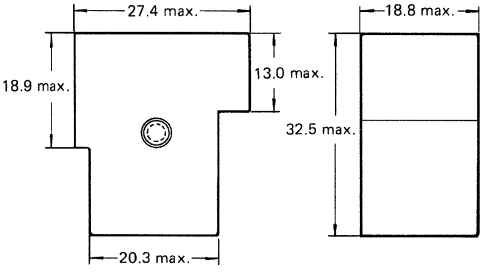


Mounting Holes (Bottom View)



Dust Cover R99-C01





Precautions

Sealed Relays

Remove the vent hole tape seal from the cover after all soldering and cleaning have been completed to allow air circulation within sealed G8P Relays.

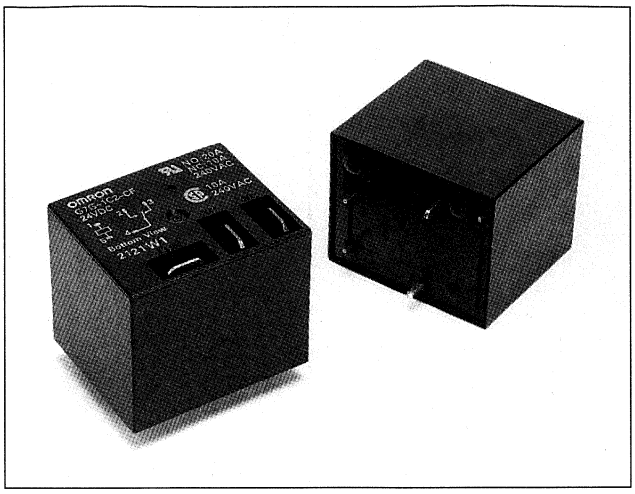
OMRON

PCB Relay

G7G

Small, Low-Cost 30-A Power Relay for PCB Applications

- Small, yet capable of switching up to a 30-A loads.
- A selection of contact forms: SPDT and SPST-NO.
- UL Class B and F insulation and sealed versions.
- Quick-connect terminals ideal for PCB and panel mounting.
- Solder-plated terminals for better solderability.
- Typical applications include home appliances, industrial equipment, and HVAC (heating, ventilating and air conditioning) products.



Ordering Information

Contact Form	Plastic-unsealed		Plastic-sealed	
	Class B	Class F	Class B	Class F
SPST-NO	G7G-1A2-CB	G7G-1A2-CF	G7G-1A4-CB	G7G-1A4-CF
SPDT	G7G-1C2-CB	G7G-1C2-CF	G7G-1C4-CB	G7G-1C4-CF

Note: When ordering, add the rated coil voltage to the model number.
Example: G7G-1A2-CB 12 VDC
Rated coil voltage

Model Number Legend:

G7G - □ □ □ - □ □ **VDC**
1 2 3 4 5

1. **Number of Poles**
   1: 1 pole
2. **Contact Form**
   A: SPST-NO
   C: SPDT
3. **Sealing**
   2: Unsealed
   4: Plastic-sealed
4. **UL Insulation Rate**
   CB: Class B
   CF: Class F
5. **Rated Coil Voltage**
   5, 12, 24, 48 VDC

Specifications

■ Coil Ratings

Rated voltage (VDC)		5	12	24	48
Rated current (mA)		185	77	36	19
Coil resistance (Ω)		27	155	660	2,480
Coil inductance (H) (ref. value)	Armature OFF	0.12	0.58	2.43	9.41
	Armature ON	0.18	0.92	4.14	14.7
Must operate voltage		75% max. of rated voltage			
Must release voltage		10% min. of rated voltage			
Max. voltage		120% of rated voltage			
Power consumption (mW)		Approx. 900			

Note: The rated current and coil resistance are measured at a coil temperature of 20°C with a tolerances of ±10%

■ Contact Ratings

Item	SPST-NO	SPDT
Load	Resistive load (cosØ = 1)	
Rated load	30 A at 250 VAC, 28 VDC	NO: 20 A at 250 VAC, 28 VDC NC: 10 A at 250 VAC, 28 VDC
Rated carry current	30 A	NO: 20 A; NC: 10 A
Max. switching voltage	250 VAC, 28 VDC	
Max. switching capacity	7,500 VA, 840 W	5,000/2,500 VA, 560/280 W
Min. permissible load	5 VDC, 500 mA	

■ Characteristics

Contact resistance	100 mΩ max.
Operate time	15 ms max. (including bounce time)
Release time	10 ms max. (including bounce time)
Max. operating frequency	Mechanical: 18,000 operations/hr Electrical: 1,800 operations/hr (under rated load)
Insulation resistance	1,000 MΩ min. (at 500 VDC)
Dielectric withstand voltage	1,500 VAC, 50/60 Hz for 1 minute between contacts of same polarity; 2,500 VAC, 50/60 Hz for 1 minute between coil and contacts, current-carrying parts, non current-carrying parts, and terminals of opposite polarity
Vibration resistance	Destruction:0 to 55 Hz, 1.65-mm double amplitude for 2 hrs Malfunction:10 to 55 Hz, 1.65-mm double amplitude for 10 min
Shock resistance	Destruction: 1,000m/s^2 (approx. 100G) Malfunction: 200 m/s^2 (approx. 20G)
Life expectancy	Mechanical: 10,000,000 operations min. (at 18,000 operations/hr) Electrical: 100,000 operations min. for 20 A (NO) or 10 A (NC) at 250 VAC/28 VDC
Ambient temperature	Class B insulation types: –55°C to 85°C Class F insulation types: –55°C to 105°C (See *Engineering Data*.)
Ambient humidity	Operating: 45% to 85%
Weight	Approx. 32 g

Note: The data shown above are initial values.

■ Approved Standards

UL (File No. E41643)

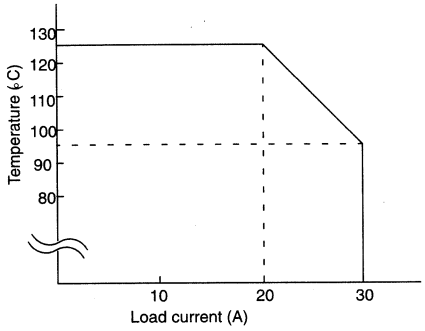
Model	Contact form	Coil ratings	Contact ratings	
			UL508/873-recognized	UL114/478-recognized
G7G-1A-CB	SPST-NO	5 to 48 VDC	10 A, 240 VAC (general use) 1 hp, 125 VAC (motor load) 1 hp, 240 VAC (motor load) 5 A, 240 VAC (tungsten load) 6 A, 277 VAC (ballast load) 20 A, 28 VDC (resistive load) 15 A, 125 VAC (general use) (100,000 cycles)	30 A, 240 VAC (general use) 1 hp, 125 VAC (motor load) 2 hp, 240 VAC (motor load) 5 A, 240 VAC (tungsten load) 6 A, 250 VAC (ballast load) 20 A, 28 VDC (resistive load) 15 A, 125 VAC (general use) (100,000 cycles) 12 A, 250 VAC (general use) (100,000 cycles)
G7G-1C-CB	SPDT	5 to 48 VDC	NO/NC 10 A/10 A, 240 VAC (general use) 1 hp/0.5 hp, 125 VAC (motor load) 1 hp/0.5 hp, 240 VAC (motor load) 5 A/3 A, 240 VAC (tungsten load) 6 A/3 A, 277 VAC (ballast load) 20 A/10 A, 28 VDC (resistive load) 15 A/15 A, 125 VAC (general use) (NO:100,000 cycles: NC: 6,000 cycles)	NO/NC 20 A/10 A, 240 VAC (general use) 1 hp/0.5 hp, 125 VAC (motor load) 2 hp/0.5 hp 240 VAC (motor load) 5 A/3 A, 125 VAC (tungsten load) 6 A/3 A, 250 VAC (ballast load) 29 A/10 A, 28 VAC (resistive load) 15 A 15 A, 125 VDC (NO: 100,000 cycles; NC: 6,000 (general use) cycles) 12 A/6 A, 250 VAC (general use) (NO: 100,000 cycles; NC: 6,000 cycles)

CSA (File No. LR34815-124)

Model	Contact form	Coil ratings	Contact ratings
G7G-1A-CB	SPST-NO	5 to 48 VDC	10 A, 240 VAC (general use) 0.5 hp, 125 VAC (motor load) 1 hp, 240 VAC (motor load) 5 A, 240 VAC (tungsten load) 6 A, 277 VAC (ballast load) 15 A, 28 VDC (resistive load) 15 A, 125 VAC (resistive load) (100,000 cycles) 6 A, 277 VAC (general load)
G7G-1C-CB	SPDT	5 to 48 VDC	NO/NC 10 A/10 A, 240 VAC (general use) 0.5/0.25 hp, 125 VAC (motor load) 1/0.5 hp, 240 VAC (motor load) 5 A/3 A, 240 VAC (tungsten load) 6 A/3 A, 277 VAC (ballast load) 15 A/10 A, 28 VDC (resistive load) 15 A/15 A, 125 VAC (general use) 6 A/3 A, 277 VAC (general use)

Engineering Data

Ambient Temperature vs Load Current

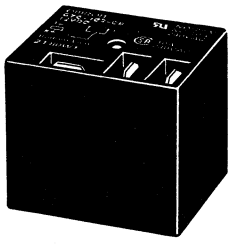


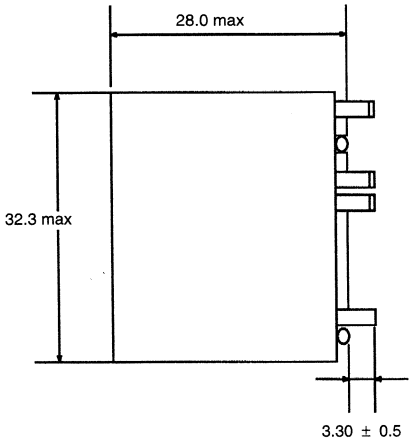
Precautions

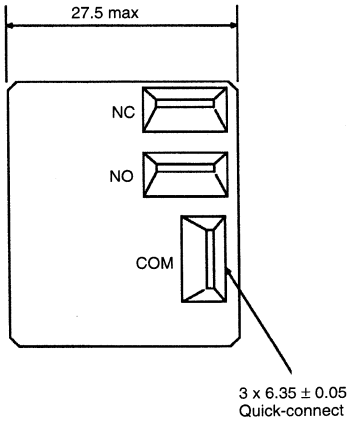
Sealed Relays

Remove the vent hole tape seal from the cover after all soldering and cleaning have been completed to allow air circulation within the sealed G7G Relays.

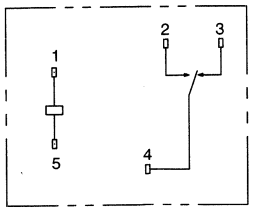
Dimensions



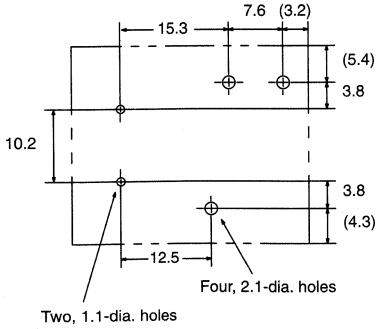




Terminal Arrangement/ Internal Connections (Bottom View)



Mounting Holes (Bottom View)

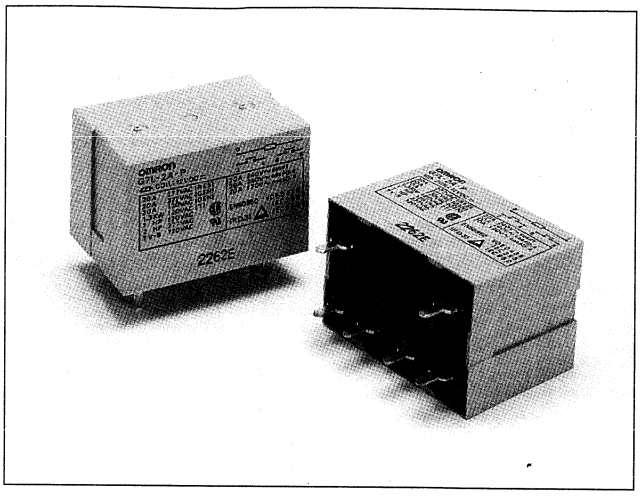


OMRON

Power Relay

G7L

A High Capacity, High-withstand -voltage Relay Resistant to Momentary Voltage Drops



- No contact chattering for momentary voltage drops up to 50% of rated voltage.
- Wide-range AC-activated coil that handles 100 to 120 and 200 to 240 VAC at either 50 or 60Hz.
- Miniature hinge for maximum switching capacity, particularly for inductive loads.
- Contact gap of 3mm minimum assures stable switching of 20A minimum at 200 VAC.
- Flame resistant materials (UL94V–0) used for all insulation material.
- Quick-connect, screw and PCB terminals available.
- Standard models are UL, CSA, VDE and IEC approved.

Ordering Information

Mounting type	Contact form	PCB terminals
PCB mounting	SPST–NO	G7L–1A–P
	DPST–NO	G7L–2A–P

Note: When ordering, add the rated coil voltage to the model number.

Example: G7L-1A-P 6 VAC
Rated coil voltage

Model Number Legend:

G7L - □ □ - □ □ □ □
1 2 3 4 5

1. Contact Form
1A: SPST–NO
2A: DPST–NO

2.* Terminal Shape
P: PCB terminals
T: Quick-connect terminals
B: Screw terminals

3. Mounting Construction
None: E–bracket
UB: Upper bracket

4. Special Functions
None: Standard mode
J: with test button

5. Rated Coil Voltage
AC: 6, 12, 24, 50, 100 to 120, 200 to 240
DC: 6, 12, 24, 48, 100

***Note:** Screw and Quick-connect terminals are also available, please contact OMRON.

Application Examples

- Compressors for air conditioners and heater switching controllers.
- Switching controllers for power tools or motors.
- Power controllers for water heaters.
- Lamp controls, motor drives and power suppply switching in copy machines, facsimiles and other office equipment.
- Power controllers for packers or food processing equipment.
- Power controllers for dryers.
- Lighting controllers.
- Magnetron control in microwaves.

Relays

Specifications

■ Coil Ratings

Rated voltage		Rated current	Coil resistance	Must operate voltage	Must release voltage	Max. voltage	Power consumption
AC	6 VAC	283 mA	—	75% max. of rated voltage	15% min. of rated voltage	110% of rated voltage	Approx. 1.7 to 2.5VA
	12 VAC	142mA	—				
	24 VAC	71mA	—				
	50 VAC	34mA	—				
	100 to 200 VAC	17.0 to 20.4mA	—	75 V	18 V	132 V	
	200 to 240 VAC	8.5 to 10.2mA	—	150 V	32 V	264 V	
DC	6 VDC	317mA	18.9Ω	75% max. of rated voltage	15% min. of rated voltage	110% of rated voltage	Approx. 1.9 W
	12 VDC	158mA	75Ω				
	24 VDC	79mA	303Ω				
	48 VDC	40mA	1220Ω				
	100 VDC	19mA	5260Ω				

Note: 1. The rated current and coil resistance are measured at a coil temperature of 23°C with tolerances of +15%/–20% for AC rated current and ±15% for DC coil resistance.

2. Performance characteristic data is measured at a coil temperature of 23°C.

■ Contact Ratings

Model	G7L–1A–P/G7L–2A–P	
	Resistive load (cosØ=1)	Inductive load (cosØ=0.4)
Rated load	20A, 220 VAC	
Rated carry current	20A	
Max. switching voltage	250 VAC	

Max. switching current	20A
Max. switching capacity	4,400 VAC
Min. permissble load *	100 mA, 5 VDC

***Note:** P level:λ_{60}=0.1 x 10^{-6}/operation

■ Characteristics

Contact resistance	50mΩ max.
Operate time	30 ms max.
Release time	30 ms max.
Max. operating frequency	Mechanical: 1,800 operations/hr Electrical: 1,800 operations/hr (under rated load)
Insulation resistance	1,000 MΩ min. (at 500 VDC)
Dielectric withstand voltage	4,000 VAC min./5,000 VAC typ., 50/60Hz for 1 minute between coil and contacts 2,000 VAC, 50/60Hz for 1 minute between contacts of same polarity 2,000 VAC, 50/60Hz for 1 minute between contacts of different polarity (DPST–NO type)
Impulse withstand voltage	10,000 V* between coil and contact
Vibration resistance	Destruction: 10 to 55Hz, 1.5mm double amplitude Malfunction: 10 to 55Hz, 1.5mm double amplitude
Shock resistance	Destruction: 1,000 m/s2 (approx. 100G) Malfunction: 100 m/s2 (approx. 10G)
Life expectancy	Mechanical: 1,000,000 operations min. (at 1,800 operations/hr) Electrical: 100,000 operations min. (at 1,800 operations/hr under rated load)
Ambient temperature	Operating: –25°C to 60°C (with no icing)
Ambient humidity	Operating: 35% to 85%
Weight	PCB Terminal Type: approx. 100g

Note: 1. The values given are intial values.

2.* Impulse wave used: 1.2 x 50μs

■ Approved by Standards

UL 508 Recognitions (File No. E41643)/ CSA22.2 No. 14 Listings (File No. LR35535)

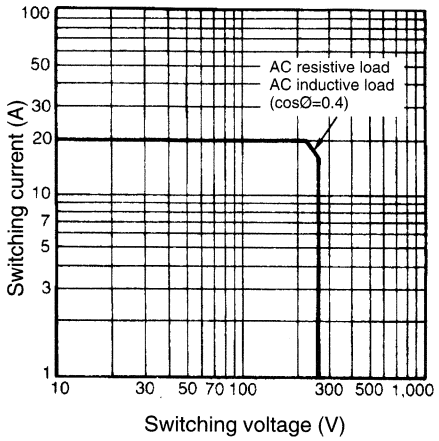
Coil ratings	Contact ratings	
	PCB terminals	
6 to 265 VAC 6 to 220 VDC	20A	277 VAC, Resistive
	20A	277 VAC, General use
	1.5KW	120 VAC, Tungsten
	1.5hp	120 VAC
	3.0hp	240/265/277 VAC
	20 FLA/120 LRA	120 VAC
	17 FLA/102 LRA	277 VAC
	TV–10	120 VAC

VDE 0435, IEC 255, IEC 950 (TUV: File No. R9051158; Pollution Degree 3, Overvoltage Category III)

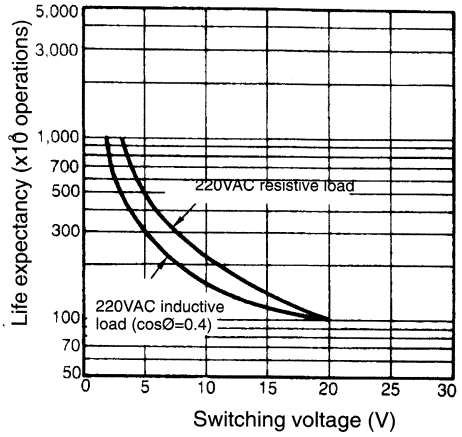
Coil ratings	Contact ratings	
	PCB terminals	
	SPST–NO	DPST–NO
6, 12, 24, 48, 100, 110, 200, 220 VDC 6, 12, 24, 50, 100/120, 200/240 VAC	20A, 240VAC (cosØ=1) 20A, 240VAC (cosØ=0.4)	20A, 240VAC (cosØ=1) 20A, 240VAC (cosØ=0.4)

Engineering Data

G7L–1A–P/G7L–2A–P Maximum Switching Capacity

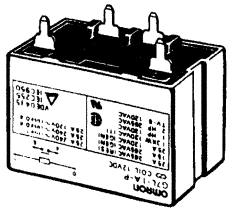


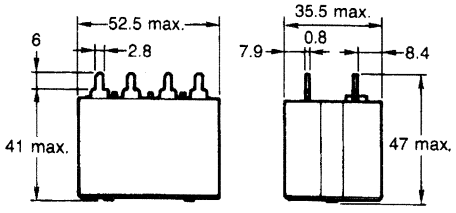
Life Expectancy



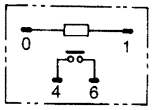
Dimensions

G7L–1A–P

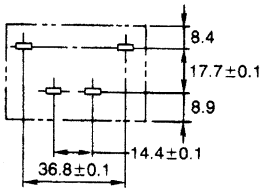




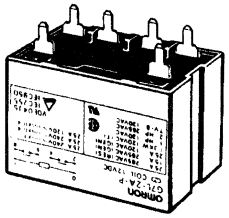
Terminal Arrangement/ Internal Connections (Top view)

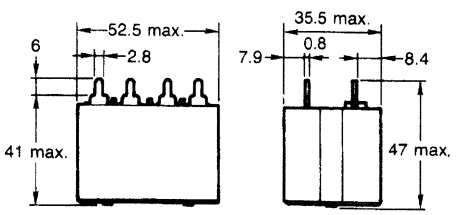


Mounting Holes (Bottom view)

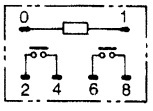


G7L–2A–P

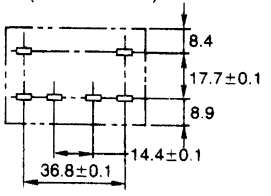




Terminal Arrangement/ Internal Connections (Top view)

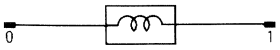


Mounting Holes (Bottom view)

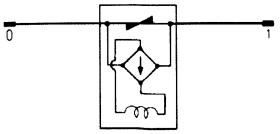


■ Internal Coil Circuit

DC Operating Coil



AC Operating Coil



Precautions

■ Handling

- To preserve performance, do not drop or otherwise subject the Power Relay to shock.
- The case is not designed to be removed during normal handling and operation. Doing so may affect performance.
- Use the Power Relay in a dry environment free from excessive dust, SO2, H_2S or organic gas.
- Do not allow a voltage greater than the maximum allowable coil voltage to be applied continuously.
- Do not use the Power Relay outside of specified voltages and currents.
- Do not allow the ambient operating temperature to exceed the specified limit.

■ Installation

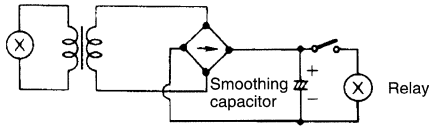
- Although there are not specific limits on the installation site, it should be as dry and dust-free as possible.
- PCB Terminal-equipped Relays weigh approximately 100g. Be sure that the PCB is strong enough to support them. We recommend dual-side through-hole PCBs to reduce solder cracking from heat stress.

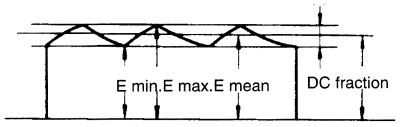
■ Cleaning PCB Terminals

PCB terminals have flux-tight construction which prevents flux from penetrating into the relay base housing e.g. due to capillary action up the terminals when the relay is soldered onto the PC board. This type of relay cannot be immersed for cleaning.

■ Operating Coil

- As a rule, either a DC battery or a DC power supply with a maximum of 5% ripple is used for the operating voltage for DC relays. Before using a rectified AC supply, confirm that the ripple is not greater than 5%. Ripple greater than this can lead to variations in the operating and reset voltages.
  An excessive ripple can generate pulses, the insertion of a smoothing capacitor is recommended as shown below.





$$\%\ of\ ripple = \frac{E\ max. - E\ min.}{E\ mean} \times 100$$

E max.: Max. ripple
E min.: Min. ripple
E mean: Mean DC value

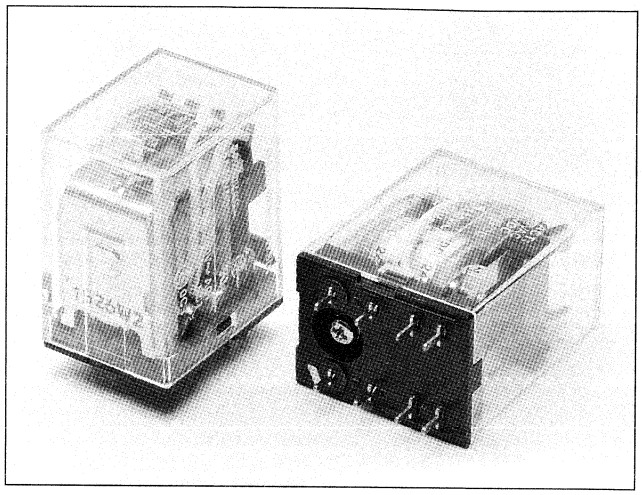
- When driving a transistor, check the leakage current and connect a bleeder resistor if necessary.

OMRON

General Purpose Relay — MY

PCB Version of the General Purpose Relay Series

- Good general purpose switching relay.
- Arc barrier standard on 3- and 4-pole relays.
- Withstand voltage: 2,000 VAC.
- UL and CSA approved.



Ordering Information

Type		PCB terminals
Standard	**DPDT**	MY2–02
	DPDT (Bifurcated)	MY2Z–02
	3PDT	MY3–02
	4PDT	MY4–02
	4PDT (Bifurcated)	MY4Z–02

Note: When ordering, add the rated coil voltage to the model number. Rated coil voltages are given in the coil ratings table below.
Example: MY2, 12 VDC
Rated coil voltage

Specifications

■ Coil Ratings

Rated voltage		Rated current (mA)		Coil resistance (Ω)	Inductance (H reference value)		Must operate	Must release	Max. voltage	Power consumption (approx.)
		50HZ	60Hz		Arm. OFF	Arm. ON	% of rated voltage			
AC	6V	214.1	183	12.2	0.04	0.08	80% max.	30% min.	110%	1.0 to 1.2 VA (60Hz)
	12V	106.5	90	46	0.17	0.33				
	24V	53.8	46	180	0.69	1.30				
	50V	25.7	22	788	3.22	5.66				
	100/110V	11.7 12.9	10/11	3,750	14.54	24.60				0.9 to 1.1 VA (60Hz)
	110/120V	9.9 10.8	8.4/9.2	4,430	19.20	32.10				
	200/220V	6.2 6.8	5.3/5.8	12,950	54.75	94.07				
	220/240V	4.8 5.3	4.2/4.6	18,790	83.50	136.40				
DC	6V	150		40	0.17	0.33		10% min.		0.9W
	12V	75		160	0.73	1.37				
	24V	36.9		650	3.20	5.72				
	48V	18.5		2,600	10.60	21.00				
	100/110V	9.1 10.0		11,000	45.60	86.20				

Note:
1. The rated current and coil resistance are measured at a coil temperature of 23°C with tolerances of –15%/+20% for rated currents and ±15% for DC coil resistance.
2. Performance characteristic data is measured at a coil temperature of 23°C.
3. The must operate and must release voltages for High-sensitivity relays was measured at the rated power supply voltage.
4. AC coil resistance and impedance are provided as reference values (at 60Hz).
5. Power consumption drop was measured for the above data. When driving transistors, check leakage current and connect a bleeder resistor if required.

Relays

■ Contact Ratings

Item	Double or three pole		Four pole	
Type of load	Resistive load (cosØ=1)	Inductive load (cosØ=0.4, L/R=7ms)	Resistive load (cosØ=1)	Inductive load (cosØ=0.4, L/R=7ms)
Rated load	5A, 220 VAC 5A, 24 VDC	2A, 220 VAC 2A, 24 VDC	3A, 220 VAC 3A, 24 VDC	0.8A, 220 VAC 1.5A, 24 VDC
Carry current	5A		3A	
Max. switching voltage	250 VAC 125 VDC			
Max. switching current	5A		3A	
Max. switching capacity	1,100 VA 120W	440 VA 48W	660 VA 72W	16 VA 36W
Min. permissible load*	Standard type: 100mA, 5VDC Bifurcated type: 100μA, 1VDC		Standard and High sensitivity types: 1mA, 1VDC Bifurcated type: 100μA, 1VDC	

***Note:** P level: $\lambda_{60} = 0.1 \times 10^{-6}$/operation

■ Characteristics

Contact resistance	50 mΩ max.
Operate (set) time	20 ms max.
Release (reset) time	20 ms max.
Max. operating frequency	Mechanical: 18,000 operations/hr Electrical: 1,800 operations/hr (under rated load)
Insulation resistance	1,000 MΩ min. (at 500 VDC)
Dielectric withstand voltage	2,000 VAC, 50/60 Hz for 1 min (1,000 VAC between contacts of same polarity)
Vibration resistance	Destruction: 10 to 55 Hz, 1.0-mm double amplitude Malfunction: 10 to 55 Hz, 1.0-mm double amplitude
Shock resistance	Destruction: 1,000 m/s^2 (approx. 100G) Malfunction: 200 m/s^2 (approx. 20G)
Life expectancy	See next table
Ambient temperature	DPDT & DPDT Bifurcated: Operating: –55°C to 70°C (with no icing) All others: Operating: –55°C to 60°C (with no icing)
Ambient humidity	Operating: 35% to 85%
Weight	Approx. 85 g

Note: The data shown is an initial value.

■ Life Expectancy Characteristics

Relays	Mechanical Life (at 18,000 operations/hr)	Electrical Life (at 1,800 operations/hr under rated load)
Normal	AC: 50,000,000 operations min. DC: 100,000,000 operations min.	2-, 3-pole: 500,000 operations min. 4-pole: 200,000 operations min.
With bifurcated contacts	2-pole: 50,000,000 operations min. 4-pole: 20,000,000 operations min.	2-pole: 200,000 operations min. 4-pole: 100,000 operations min.

■ Life Expectancy under Real Loads

MY2

Rated voltage	Load type	Conditions	Operating frequency	Electrical life
Normal	AC motor	50W, 100 VAC single phase with 2.8A inrush current, 0.4A carry current	ON for 2 seconds, OFF for 30 seconds	100,000 operations
		50W, 100 VAC single phase with 1.6A inrush current, 1A carry current	ON for 1 second, OFF for 30 seconds	300,000 operations
With bifurcated contacts	AC solenoid	24W with 1A carry current	ON for 1.5 seconds, OFF for 1.5 seconds	4,000,000 operations

MY4

Rated voltage	Load type	Conditions	Operating frequency	Electrical life
100 VAC	AC solenoid	50 VA with 2A inrush current, 0.7A carry current	ON for 1 second OFF for 3 seconds	25,000 operations
	DC magnetic switch	25 W with L/R=40ms, 0.2A carry current		
	AC magnetic switch	35 VA with 1.5A inrush current, 0.35A carry current		500,000 operations

Rated voltage	Load type	Conditions	Operating frequency	Electrical life
24 VDC	DC solenoid	40W with L/R=10ms, 1.6A carry current	ON for 5 seconds OFF for 1.5 seconds	5,000,000 operations
		30W with L/R=10ms, 0.34A carry current		6,000,000 operations

■ Approved by Standards

Some MY relays are available in models meeting various safety standards. When ordering, you must specify the desired standards. Refer to Ordering Information for specific models. Note that the rating recognised by the various standards sometimes vary from the ratings of the individual relays.

UL 508 Recognitions (File No. 41515)

No. of poles	Coil ratings	Contact ratings
2	6 to 240 VAC 6 to 120 VDC	5A, 120 VAC resistive load 5A, 28 VDC resistive load 5A, 240 VAC inductive load
3		5A, 28 VDC resistive load 5A, 240 VAC inductive load
4	6 to 240 VAC 6 to 120 VDC	3A, 28 VDC resistive load 3A, 120 VAC inductive load 1.5A, 240 VAC inductive load 5A, 240 VAC inductive load (between contacts of same polarity) 5A, 28 VDC resistive load (between contacts of same polarity) 0.2A, 120 VDC

CSA 22.2 No. 0 and No. 14 (File No. LR31928)

Model	No. of poles	Coil ratings	Contact ratings
MY❑	2, 3	6 to 240 VAC 6 to 120 VDC	5A, 28 VDC resistive load 5A, 240 VAC inductive load
	4		3A, 28 VDC resistive load 3A, 240 VAC inductive load 5A, 240 VAC inductive load (between contacts of same polarity) 5A, 28 VDC resistive load (between contacts of same polarity) 0.2A, 120 VDC

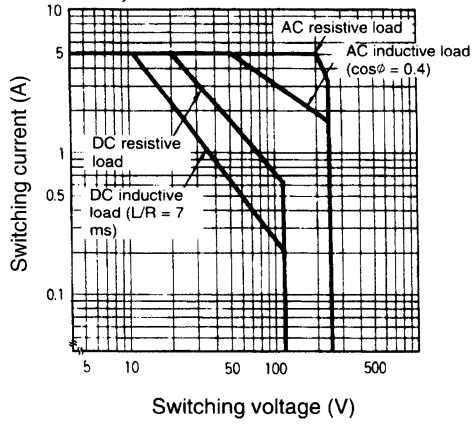
SEV

Model	No. of poles	Coil ratings	Contact ratings
MY❑	2, 3	6 to 100 VDC 6 to 220 VAC	5A, 200 VAC 5A, 24 VAC

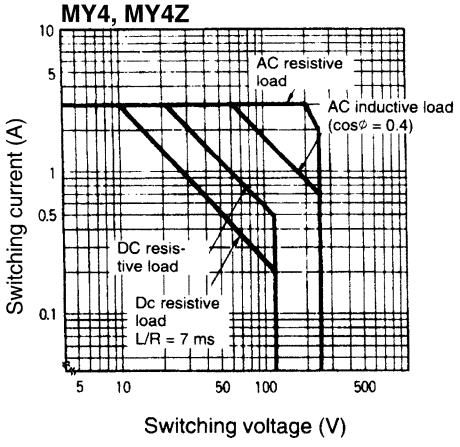
Engineering Data

Max. Switching Capacity

MY2, MY3

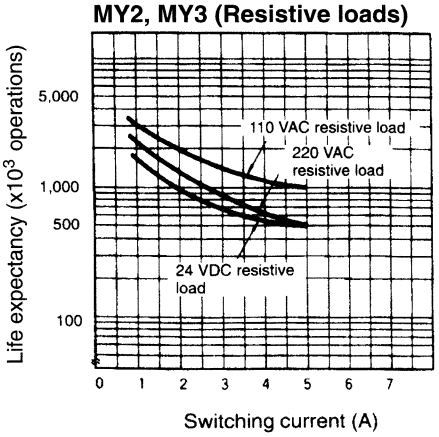


MY4, MY4Z

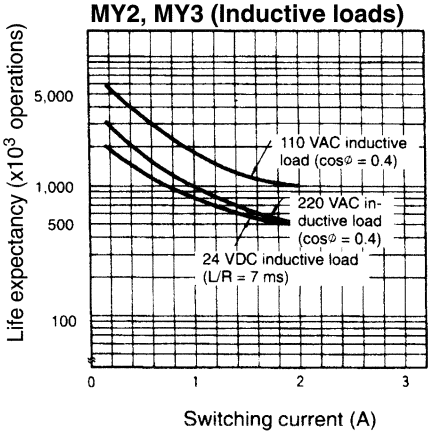


Life Expectancy

MY2, MY3 (Resistive loads)

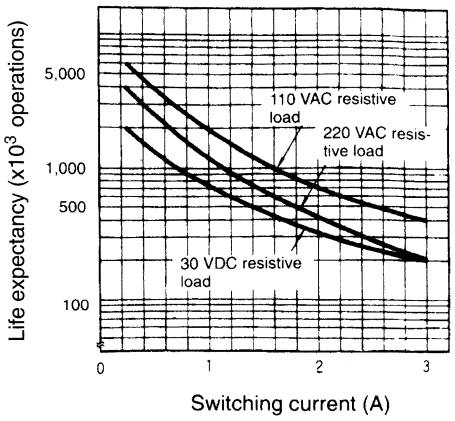


MY2, MY3 (Inductive loads)

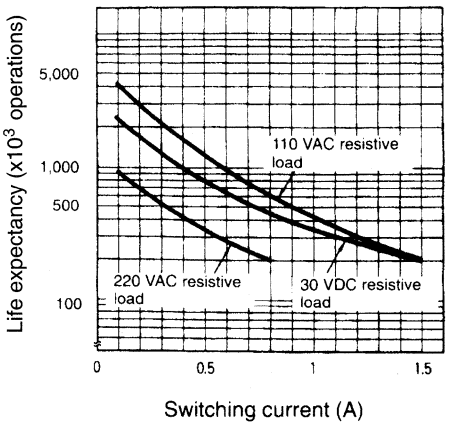


Relays

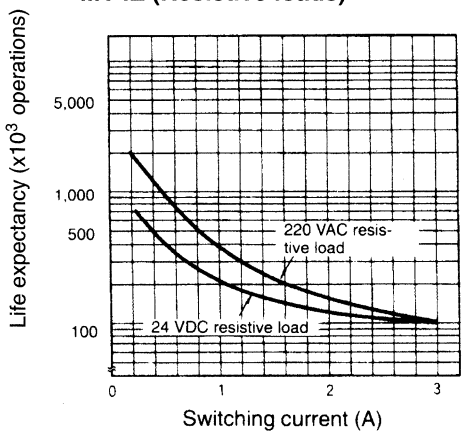
MY4 (Resistive loads)



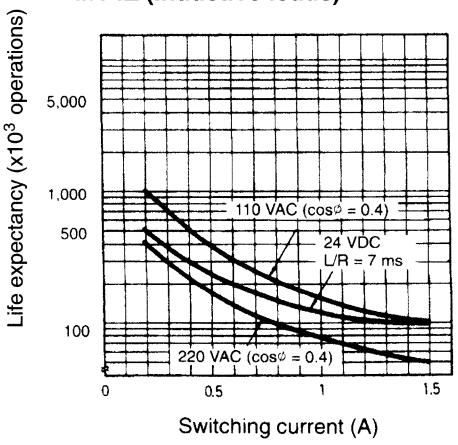
MY4 (Inductive loads)



MY4Z (Resistive loads)



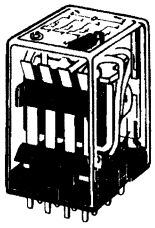
MY4Z (Inductive loads)



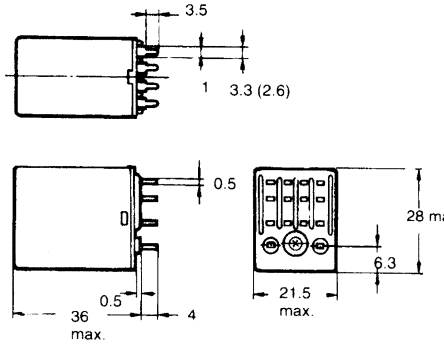
Dimensions

Note: 1. The figures in parentheses are for MY4–02.
2. The above dimensions also apply to the DPDT and 3PDT relays.
3. The internal connections of the above relays are same as those of MY❑ relays.

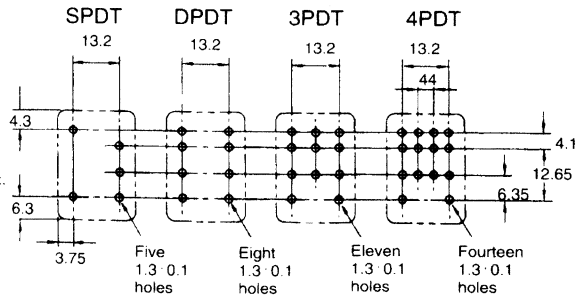
MY❑–02



MY4–02 (4PDT)

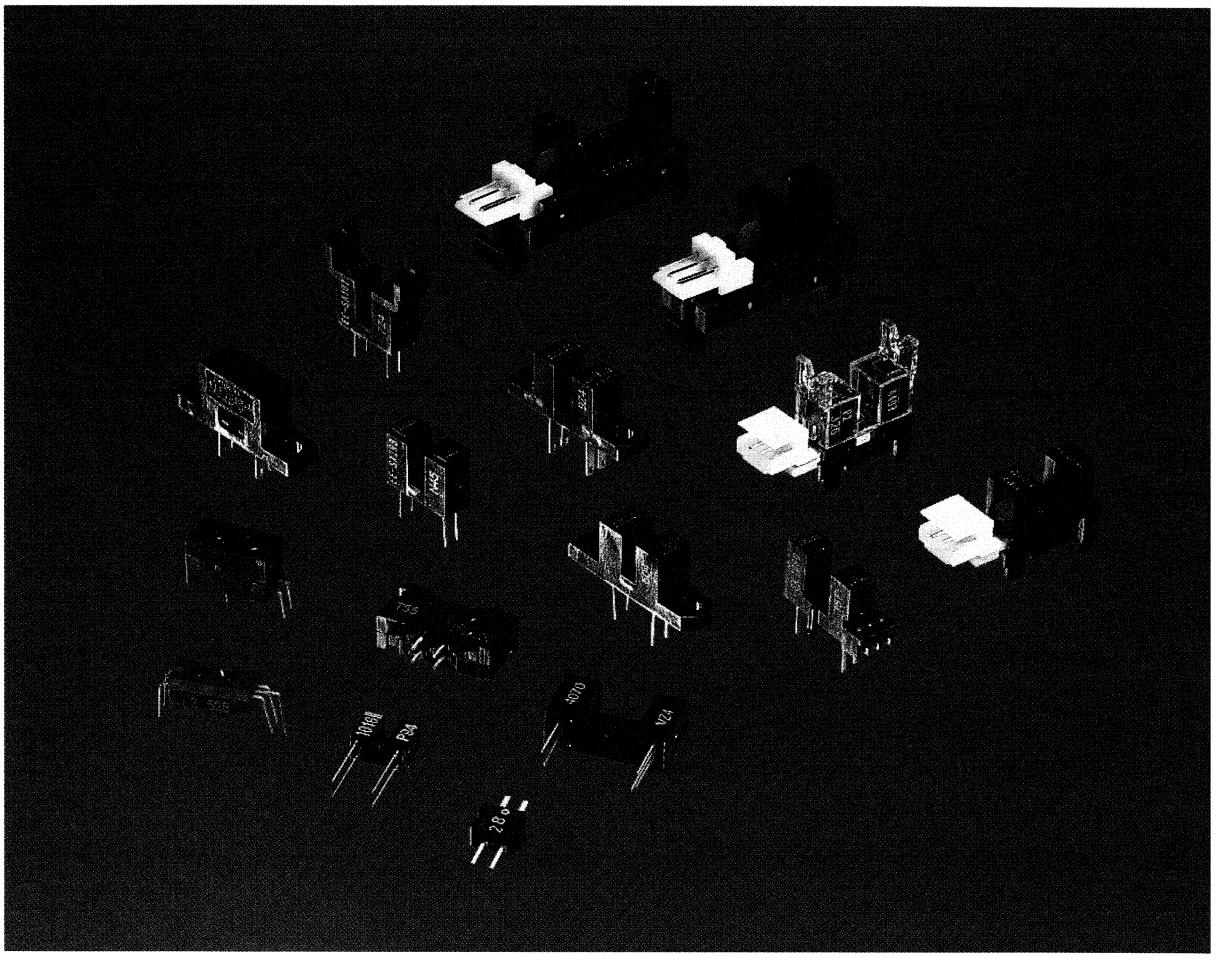


PC Board mounting holes



SECTION 6

Opto-Switches



Sensing method	Slit width/ Sensing distance	Model	Output configuration	Features	Page
Transmissive	2.0 mm	EE-SX1018	Phototransistor	Compact, general purpose	292
		EE-SX1101	Phototransistor	Miniature, general purpose	320
		EE-SX4101	Photo-IC	Miniature with low operating voltage	398
		EE-SX493	Photo-IC	High resolution	388
	2.8 mm	EE-SX1025	Phototransistor	Compact, general purpose	294
		EE-SX1031	Phototransistor	Dual-channel output	296
	3.0 mm	EE-SX1046	Phototransistor	With a horizontal slit	306
		EE-SX129	Phototransistor	High resolution	324
		EE-SX198	Phototransistor	General purpose	330
		EE-SX199	Phototransistor	With a positioning boss	332
		EE-SX298	Photo-Darlington transistor	General purpose	357
		EE-SJ3W-B	Photo-Darlington transistor	General purpose	359
		EE-SK3W-B	Photo-Darlington transistor	Screw mounting	361
		EE-SM3	Photo-Darlington transistor	Screw mounting	363
		EE-SM3B	Photo-Darlington transistor	Screw mounting	365
		EE-SX398/498	Photo-IC	General purpose	391
	3.4 mm	EE-SX1055	Phototransistor	Compact, excellent cost performance	304
		EE-SX1071	Phototransistor	General purpose	310
		EE-SX1088	Phototransistor	Screw mounting	316
		EE-SX1096	Phototransistor	With a horizontal slit	318
		EE-SX138	Phototransistor	Screw mounting	326
		EE-SX153	Phototransistor	Screw mounting	328
		EE-SH3 series	Phototransistor	Screw mounting	346
		EE-SJ3 series	Phototransistor	Screw mounting	349
		EE-SV3 series	Phototransistor	Screw mounting	354
		EE-SX301/401	Photo-IC	General purpose	367
		EE-SX305/405	Photo-IC	With a horizontal slit	370
		EE-SX3088/4088	Photo-IC	Screw mounting	382
	3.5 mm	EE-SX384/484	Photo-IC	General purpose	385
	3.6 mm	EE-SG3(-B)	Phototransistor	Dust-proof construction	344
	5.0 mm	EE-SX1041	Phototransistor	General purpose	300
		EE-SX1042	Phototransistor	Tall	302
		EE-SX1080	Phototransistor	With a lead wire holder	312
		EE-SX1081	Phototransistor	General purpose	314
		EE-SX1235A-P2	Phototransistor	Snap-in mounting	322
		EE-SJ5-B	Phototransistor	General purpose	352
		EE-SX3080/4080	Photo-IC	With a lead wire holder	376
		EE-SX3081/4081	Photo-IC	General purpose	379
		EE-SX4009-P1	Photo-IC	Screw mounting	394
		EE-SX4019-P2	Photo-IC	Screw mounting	396
		EE-SX4235A-P2	Photo-IC	Snap-in mounting	401
		EE-SX460-P1	Photo-IC	Snap-in mounting	403
	5.2 mm	EE-SX1035	Phototransistor	Compact, wide	298
	8.0 mm	EE-SX1070	Phototransistor	General purpose	308
		EE-SX3070/4070	Photo-IC	General purpose	373
	15.0 mm	EE-SX461-P11	Photo-IC	Easy to mount	405

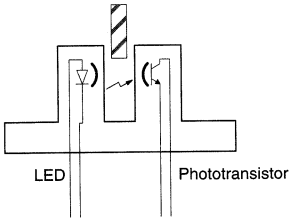
Sensing method	Slit width/ Sensing distance	Model	Output configuration	Features	Page
Actuator mounting	---	EE-SA102	Phototransistor	General purpose	334
		EE-SA103	Phototransistor	Compact	336
		EE-SA104	Phototransistor	Compact	338
		EE-SA107-P2	Phototransistor	Easy to mount	342
		EE-SA407-P2	Photo-IC	Easy to mount	407
Actuator	---	EE-SA105	Phototransistor	General purpose	340
Reflective	3.5 mm	EE-SY171	Phototransistor	Thin	421
	4.0 mm	EE-SY169	Phototransistor	High resolution (red LED)	415
		EE-SY169A	Phototransistor	High resolution (infrared LED)	418
		EE-SY201	Photo-Darlington transistor	Compact	436
	4.4 mm	EE-SY113	Phototransistor	Dust-proof	412
		EE-SY313/413	Photo-IC	Dust-proof	442
	4.5 mm	EE-SY190	Phototransistor	Convergent reflective, top view	424
		EE-SY191	Phototransistor	Convergent reflective, side view	427
	5.0 mm	EE-SY110	Phototransistor	General purpose	409
		EE-SB5(-B)	Phototransistor	Screw mounting	430
		EE-SF5(-B)	Phototransistor	Dust-proof	433
		EE-SY310/410	Photo-IC	General purpose	439

Technical Data

Features of Opto–Switches

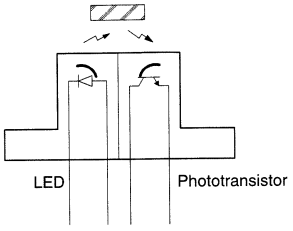
The Opto–Switch is a compact optical sensor that senses objects or object positions with an optical beam.
Transmissive (or slotted) Opto–Switches incorporate an emitter and a detector that face each other as shown in Figure 1. When an object is located in the sensing position between the emitter and the detector, the object intercepts the optical beam of the emitter, thus reducing the amount of optical energy reaching the detector.

Figure 1. Transmissive Opto–Switch



Reflective Opto–Switches incorporate an emitter and a detector as shown in Figure 2. When an object is located in the sensing area of the reflective Opto–Switch, the object reflects the optical beam of the emitter, thus changing the amount of optical energy reaching the detector.

Figure 2. Reflective Opto–Switch



Datasheet

■ Absolute Maximum Ratings and Electrical and Optical Characteristics

The datasheets of Opto–Switches include the absolute maximum ratings and electrical and optical characteristics as well as the datasheets of transistors and ICs. It is necessary to understand the difference between the absolute maximum ratings and electrical and optical characteristics of various Opto–Switches.

■ Absolute Maximum Ratings

The absolute maximum ratings of Opto–Switches and other products with semiconductors specify the permissible operating voltage, current, temperature, and power limits of these products. The products must be operated absolutely within these limits.
Therefore, when using any Opto–Switch, do not ignore the absolute maximum ratings, otherwise the Opto–Switch will not operate precisely. Furthermore, the Opto–Switch may be deteriorate or become damaged, in which case OMRON will not be responsible.
Practically, Opto–Switches should be used so that there will be some margin between their absolute maximum ratings and actual operating conditions.

■ Electrical and Optical Characteristics

The electrical and optical characteristics of Opto–Switches indicate the performance of Opto–Switches under certain conditions. Most items of the electrical and optical characteristics are indicated by maximum or minimum values. OMRON usually supply Opto–Switches with standard electrical and optical characteristics. The electrical and optical characteristics of Opto–Switches may be changed upon request. All electrical and optical characteristic items of Opto–Switches indicated by maximum or minimum values are checked and those of the Opto–Switches indicated by typical values are regularly checked before shipping so that OMRON can guarantee the performance of the Opto–Switches.
In short, the absolute maximum ratings indicate the permissible operating limits of the Opto–Switches and the electrical and optical characteristics indicate the maximum performance of the Opto–Switches.

Terminology

The terms used in the datasheet of each Opto–Switch with a phototransistor output circuit or a photo IC output circuit are explained below.

■ Phototransistor Output Opto–Switch

Symbol	Item	Definition
I_{FP}	Pulse forward current	The maximum pulse current that is allowed to flow continuously from the anode to cathode of an LED under a specified temperature, a repetition period, and a pulse width condition.
I_C	Collector current	The current that flows to the collector junction of a phototransistor.
P_C	Collector dissipation	The maximum power that is consumed by the collector junction of a phototransistor.
I_D	Dark current	The current leakage of the phototransistor when a specified bias voltage is imposed on the phototransistor so that the polarity of the collector is positive and that of the emitter is negative on condition that the illumination of the Opto–Switch is 0 ℓx.
I_L	Light current	The collector current of a phototransistor under a specified input current condition and at a specified bias voltage.
V_{CE} (sat)	Collector-emitter saturated voltage	The ON-state voltage between the collector and emitter of a phototransistor under a specified bias current condition.
I_{LEAK}	Leakage current	The collector current of a phototransistor under a specified input current condition and at a specified bias voltage when the phototransistor is not exposed to light.
tr	Rising time	The time required for the leading edge of an output waveform of a phototransistor to rise from 10% to 90% of its final value when a specified input current and bias condition is given to the phototransistor.
tf	Falling time	The time required for the trailing edge of an output waveform of a phototransistor to decrease from 90% to 10% of its final value when a specified input current and bias condition is given to the phototransistor.
V_{CEO}	Collector-emitter voltage	The maximum positive voltage that can be applied to the collector of a phototransistor with the emitter at reference potential.
V_{ECO}	Emitter-collector voltage	The maximum positive voltage that can be applied to the emitter of a phototransistor with the collector at reference potential.

■ Phototransistor/Photo IC Output Opto–Switch

Symbol	Item	Definition
I_F	Forward current	The maximum DC voltage that is allowed to flow continuously from the anode of the LED to the cathode of the LED under a specified temperature condition.
V_R	Reverse voltage	The maximum negative voltage that can be applied to the anode of the LED with the cathode at reference potential.
V_{CC}	Supply voltage	The maximum positive voltage that can be applied to the voltage terminals of the photo IC with the ground terminal at reference potential.
V_{OUT}	Output voltage	The maximum positive voltage that can be applied to the output terminal with the ground terminal of the photo IC at reference potential.
I_{OUT}	Output current	The maximum current that is allowed to flow in the collector junction of the output transistor of the photo IC.
P_{OUT}	Output permissible dissipation	The maximum power that is consumed by the collector junction of the output transistor of the photo IC.
V_F	Forward voltage	The voltage drop across the LED in the forward direction when a specified bias current is applied to the photo IC.
I_R	Reverse current	The reverse leakage current across the LED when a specified negative bias is applied to the anode with the cathode at reference potential.
V_{OL}	Output low voltage	The voltage drop in the output of the photo IC when the IC output is turned ON under a specified voltage and output current applied to the photo IC.
V_{OH}	Output high voltage	The voltage output by the photo IC when the IC output is turned OFF under a specified supply voltage and bias condition given to the photo IC.
I_{CC}	Current consumption	The current that will flow into the sensor when a specified positive bias voltage is applied from the power source with the ground of the photo IC at reference potential.
I_{FT} ($I_{FT\ OFF}$)	LED current when output is turned OFF	The forward LED current value that turns OFF the output of the photo IC when the forward current to the LED is increased under a specified voltage applied to the photo IC.
I_{FT} ($I_{FT\ ON}$)	LED current when output is turned ON	The forward LED current value that turns ON the output of the photo IC when the forward current to the LED is increased under a specified voltage applied to the photo IC.
ΔH	Hysteresis	The difference in forward LED current value, expressed in percentage, calculated from the respective forward LED currents when the photo IC is turned ON and when the photo IC is turned OFF.
f	Response frequency	The number of revolutions of a disk with a specified shape rotating in the light path, expressed by the number of pulse strings during which the output logic of the photo IC can be obtained under a specified bias condition given to the LED and photo IC (the number of pulse strings to which the photo IC can respond in a second).

Design

The following explains how systems using Opto–Switches must be designed.

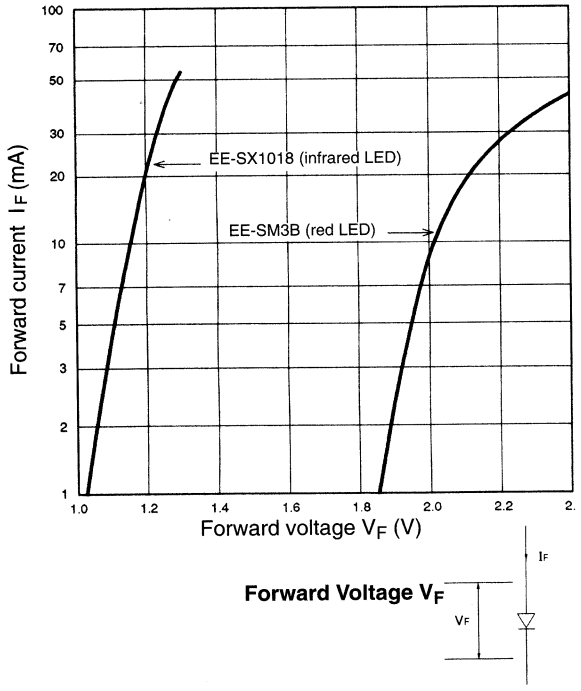
■ Emitter

Characteristics of Emitter

The emitter of each Opto–Switch has an infrared LED or red LED. Figure 3 shows how the LED forward current characteristics of the EE-SX1018, which has an emitter with an infrared LED, and those of the EE-SM3B, which has an emitter with a red LED, are changed by the voltages imposed on the EE-SX1018 and EE-SM3B. As shown in this figure, the LED forward current characteristics of the EE-SX1018 greatly differ from those of the EE-SM3B. The LED forward current characteristics of any Opto–Switch indicate how the voltage drop of the LED incorporated by the emitter is changed by the LED's forward current (I_F) flowing from the anode to cathode. Figure 3 shows that the forward voltage (V_F) of the red LED is higher than that of the infrared LED.

The forward voltage (V_F) of the infrared LED is approximately 1.2 V and that of the red LED is approximately 2 V provided that the practical current required by the infrared LED and that required by the red LED flow into these LEDs respectively.

Figure 3. LED Forward Current vs. Forward Voltage Characteristics (Typical)



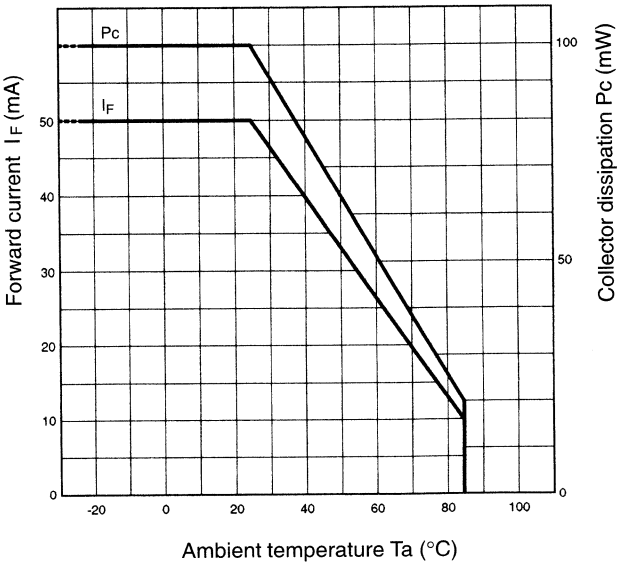
Driving Current Level

It is especially important to decide the level of the forward current (I_F) of the emitter incorporated by any Opto–Switch. The forward current must not be too large or too small.

Before using any Opto–Switch, refer to the absolute maximum ratings in the datasheet to find the emitter's forward current upper limit. For example, the first item in the absolute maximum ratings in the datasheet of the EE-SX1018 shows that the forward current (I_F) of its emitter is 50 mA at a Ta (ambient temperature) of 25°C. This means the forward current (I_F) of the emitter is 50 mA maximum at a Ta of 25°C. As shown in Figure 4, the forward current must be reduced according to changes in the ambient temperature.

Figure 4 indicates that the forward current (I_F) is approximately 27 mA maximum if the EE-SX1018 is used at a Ta of 60°C. This means that a current exceeding 27 mA must not flow into the emitter incorporated by the EE-SX1018 at a Ta of 60°C.

Figure 4. Temperature Characteristics (EE-SX1018)



In short, the forward current lower limit of the emitter must be 5 mA minimum if the emitter has an infrared LED and 2 mA minimum if the emitter has a red LED. If the forward current of the emitter is too low, the optical output of the emitter will not be stable. To find the ideal forward current value of the Opto–Switch, refer to the light current (I_L) shown in the datasheet. The light current (I_L) indicates the relationship between the forward current (I_F) of the LED incorporated by the Opto–Switch and the output of the LED. The light current (I_L) is one of the most important characteristics. If the forward current specified by the light current (I_L) flows into the emitter, even though there is no theoretical ground, the output of the emitter will be stable. This characteristic makes it possible to design the output circuits of the Opto–Switch with ease. For example, the datasheet of EE-SX1018 indicates that a forward current (I_F) of 20 mA is required.

Design Method

The following explains how the constants of a Opto–Switch must be determined. Figure 5 shows a basic circuit that drives the LED incorporated by a Opto–Switch.

The basic circuit absolutely requires a limiting resistor (R). If the LED is imposed with a forward bias voltage without the limiting resistor, the current of the LED is theoretically limitless because the forward impedance of the LED is low. As a result the LED will burn out. Users often ask OMRON about the appropriate forward voltage to be imposed on the LED incorporated by each Opto–Switch model that they use. There is no upper limit of the forward voltage imposed on the LED provided that an appropriate limiting resistor is connected to the LED. There is, however, the lower limit of the forward voltage imposed on the LED. As shown in Figure 3, the lower limit of the forward voltage imposed on the LED must be at least 1.2 to 2 V, otherwise no forward current will flow into the LED. The supply voltage of a standard electronic circuit is 5 V minimum. Therefore, a minimum of 5 V should be imposed on the LED. A system incorporating any Opto–Switch must be designed by considering the following.

1. Forward current (I_F)
2. Limiting resistor (R) (refer to Figure 5)

As explained above, determine the optimum level of the forward current (I_F) of the LED. The forward current (I_F) of the EE-SX1018, for example, is 20 mA. Therefore, the resistance of the limiting resistor connected to the LED must be decided so that the forward current of the LED will be approximately 20 mA. The resistance of the limiting resistor is obtained from the following.

$$R = \frac{Vcc - V_F}{I_F}$$

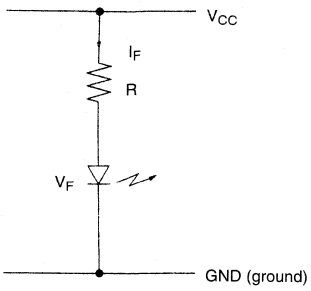
In this case 5 V must be substituted for the supply voltage (V_{CC}). The forward voltage (V_F) obtained from Figure 3 is approximately 1.2 V when the forward current (I_F) of the LED is 20 mA. Therefore, the following resistance is obtained.

$$R = \frac{Vcc - V_F}{I_F} = \frac{5 \text{ to } 1.2 \text{ V}}{20 \text{ mA}} = 190\ \Omega$$

= approx. 180 to 220 Ω

The forward current (I_F) varies with changes in the supply voltage (V_{CC}), forward voltage (V_F), or resistance. Therefore, make sure that there is some margin between the absolute maximum ratings and the actual operating conditions of the Opto–Switch.

Figure 5. Basic Circuit



The positions of the limiting resistor (R) and the LED in Figure 5 are interchangeable. If the LED is imposed with reverse voltages including noise and surge voltages, add a rectifier diode to the circuit as shown in Figure 6. LEDs can be driven by pulse voltages, the method of which is, however, rarely applied to Opto–Switches.

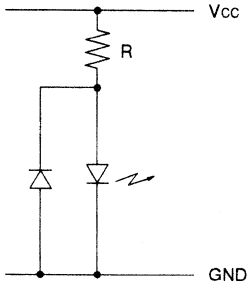
In short, the following are important points required to operate any Opto–Switch.

A forward voltage (V_F) of approximately 1.2 V is required if the Opto–Switch has an infrared LED and a forward voltage (V_F) of approximately 2 V is required if the Opto–Switch has a red LED.

Decide the resistance of the limiting resistor connected to the LED after deciding the value of the forward current (I_F).

If the LED is imposed with a reverse voltage, connect a rectifier diode to the LED in parallel with and in the direction opposite to the direction of the LED.

Figure 6. Reverse Voltage Protection Circuit



Design of Systems Incorporating Opto–Switches (1)

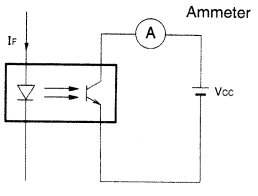
Design of systems incorporating Opto–Switches (1)

■ Phototransistor Output

Characteristics of Detector Element

The changes in the current flow of the detector element with and without an optical input are important characteristics of a detector element. Figure 7 shows a circuit used to check how the current flow of the phototransistor is changed by the LED with or without an appropriate forward current (I_F) flow, provided that the ambient illumination of the Opto–Switch is ideal (i.e., 0 ℓx). When there is no forward current (I_F) flowing into the LED or the optical beam emitted from the LED is intercepted by an opaque object, the ammeter indicates several nanoamperes due to a current leaking from the phototransistor. This current is called the dark current (I_D). When the forward current (I_F) flows into the LED with no object intercepting the optical beam emitted from the LED, the ammeter indicates several milliamperes. This current is called the light current (I_L). The standard light current of a phototransistor is 10^6 times as large as the dark current of the phototransistor. This difference in current can be applied to the sensing of a variety of objects.

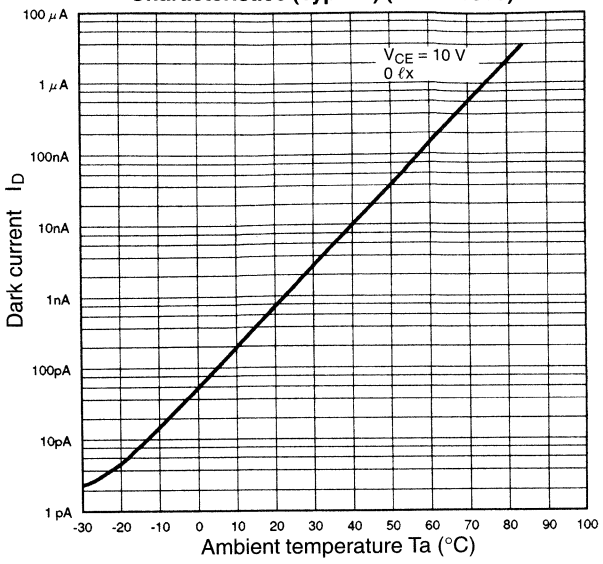
Figure 7. Measuring Circuit



The ambient illumination of the LED and phototransistor incorporated by the Opto–Switch in actual operation is not 0 ℓx. Therefore, a current larger than the dark current of the phototransistor will flow into the phototransistor when the optical beam emitted from the LED is interrupted. This current is rather large and must not be ignored if the Opto–Switch has a photo–Darlington transistor, which is highly sensitive, as the detector element of the Opto–Switch. The dark current of the phototransistor incorporated by any reflective Opto–Switch flows if there is no reflective object in the sensing area. Furthermore, due to the structure of the reflective Opto–Switch, a small portion of the optical beam emitted from the LED reaches the phototransistor after it is reflected inside the reflective Opto–Switch. Therefore, the dark current and an additional current will flow into the phototransistor if there is no sensing object in the sensing area. This additional current is called leakage current (I_{LEAK}). The leakage current of the phototransistor is several hundred nanoamperes and the dark current of the phototransistor is several nanoamperes.

The dark current temperature and light current temperature dependencies of the phototransistor incorporated by any Opto–Switch must not be ignored. The dark current temperature dependency of the phototransistor increases when the ambient temperature of the Opto–Switch in operation is high or the Opto–Switch has a photo–Darlington transistor as the detector element. Figure 8 shows the dark current temperature dependency of the phototransistor incorporated by the EE-SX1018.

Figure 8. Dark Current vs. Ambient Temperature Characteristics (Typical) (EE-SX1018)



Due to the temperature dependency of the phototransistor, the light current (I_L) of the phototransistor as the detector element increases according to a rise in the ambient temperature. As shown in Figure 9, however, the output of the LED decreases according to a rise in the ambient temperature due to the temperature dependency of the LED. An increase in the light current of the phototransistor is set off against a decrease in the output of the LED and consequently the change of the output of the Opto–Switch according to the ambient temperature is comparatively small. Refer to Figure 10 for the light current temperature dependency of the phototransistor incorporated by the EE-SX1018.

The light current temperature dependency shown in Figure 10 is, however, a typical example. The tendency of the light current temperature dependency of each phototransistor is indefinite. This means the temperature compensation of any Opto–Switch is difficult.

Figure 9. LED and Phototransistor Temperature Characteristics (Typical)

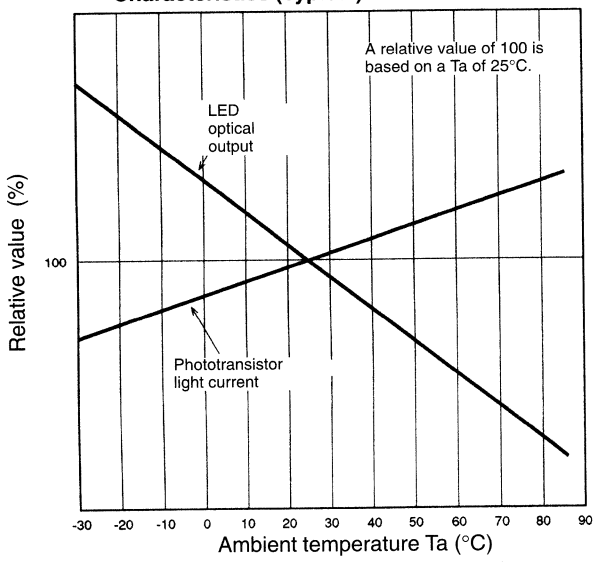
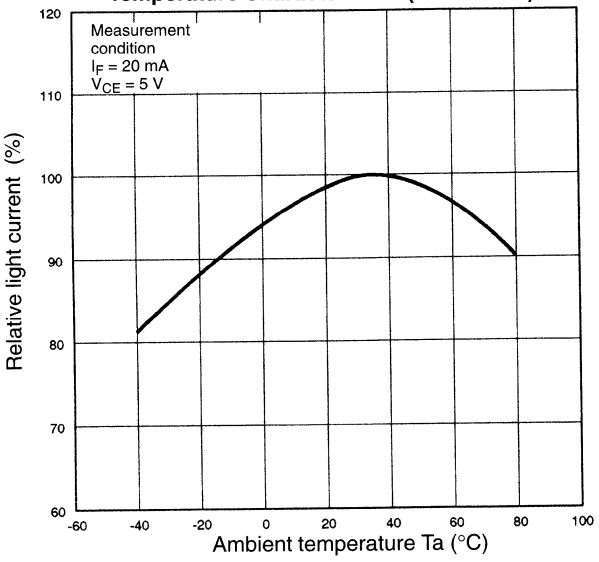


Figure 10. Relative Light Current vs. Ambient Temperature Characteristics (EE-SX1018)



Changes in Characteristics

The following explains the important points required for the designing of systems incorporating Opto–Switches by considering worst case design technique. Worst case design technique is a method to design systems so that the Opto–Switches will operate normally. A system incorporating any Opto–Switch must be designed so that they will operate even if the light current (I_L) of the phototransistor is minimal and the dark current (I_D) and leakage current of the phototransistor are maximal. This means that the system must be designed so that it will operate even if the difference in the current flow of the phototransistor between the time that the Opto–Switch senses an object and the time that the Opto–Switch does not sense the object is minimal.

The worst light current (I_L) and dark current (I_D) values of the phototransistor incorporated by any Opto–Switch is specified in the datasheet.

Table 1 shows the dark current (I_D) upper limit and light current (I_L) lower limit values of the phototransistors incorporated by a variety of Opto–Switches.

Systems must be designed by considering the dark current (I_D) upper limit and light current (I_L) lower limit values of the phototransistors. Not only these values but also the following factors must be taken into calculation to determine the upper limit of the dark current (I_D) of each of the phototransistors.

- External light interference
- Temperature rise
- Supply voltage
- Leakage current caused by internal light reflection if the systems use reflective Opto–Switches.

These factors increase the dark current (I_D) of each phototransistor.

As for the light current (I_L) lower limit of each phototransistor, the following factors must be taken into calculation.

- Temperature change
- Secular change

The above factors decrease the light current (I_L) of each phototransistor.

Table 2 shows the increments of the dark current (I_D) and the decrements of the light current (I_D) of the phototransistors.

Therefore, if the EE-SX1018 is operated at a Ta of 60°C maximum and a V_{CC} of 10 V for approximately 50,000 hours, for example, the dark current (I_D) of the phototransistor incorporated by the EE-SX1018 will be approximately 4 μA and the light current (I_L) of the phototransistor will be approximately 1 mA because the dark current (I_D) of the phototransistor at a Ta of 25°C is 200 nanoamperes maximum and the light current (I_L) of the phototransistor at a Ta of 25°C is 2 mA minimum.

Table 3 shows the estimated worst values of a variety of Opto–Switches, which must be considered when designing systems using these Opto–Switches.

The dispersion of the characteristics of the Opto–Switches must be also considered, which is explained in detail later. The light current (I_L) of the phototransistor incorporated by each reflective Opto–Switch shown in its datasheet was measured under the standard conditions specified by OMRON for its reflective Opto–Switches. The light current (I_L) of any reflective Opto–Switch greatly varies with its sensing object and sensing distance.

Table 1. Rated Dark Current (I_D) and Light Current (I_L) Values

Model	Upper limit (I_D)	Lower limit (I_L)	Condition
EE-SG3(-B)	200 nA	2 mA	I_F = 15 mA
EE-SX1018, -SX1025 EE-SX1041, -SX1042 EE-SX1070, -SX1071 EE-SX198, -SX199	200 nA	0.5 mA	I_F = 20 mA
EE-SM3 EE-SM3B EE-SJ3W-B EE-SK3W-B	250 nA	1.5 mA	I_F = 3 mA
EE-SB5(-B) EE-SF5(-B) EE-SY110	200 nA	0.2 mA	I_F = 20 mA (see note)
EE-SY201	250 nA	0.3 mA	I_F = 5 mA (see note)
Condition	V_{CE} = 10 V, 0 ℓx Ta = 25°C	V_{CE} = 10 V Ta = 25°C	---

Note: These values were measured under the standard conditions specified by OMRON for the corresponding Opto–Switches.

Table 2. Dependency of Detector Elements on Various Factors

Elements		Phototransistor	Photo-Darlington transistor
Dark current I_D	**External light interference**	To be checked using experiment	To be checked using experiment
	Temperature rise	Increased by approximately 10 times with a temperature rise of 25°C.	Increased by approximately 28 times with a temperature rise of 25°C.
	Supply voltage	See Figure 11.	See Figure 12.
Light current I_L	**Temperature change**	Approximately –20% to 10%	Approximately –20% to 10%
	Secular change (20,000 to 50,000 hours)	Decreased to approximately one-half of the initial value considering the temperature changes of the element.	Decreased to approximately one-half of the initial value considering the temperature changes of the element.

Figure 11. Dark Current Imposed Voltage Dependency (Typical) (EE-SX1018)

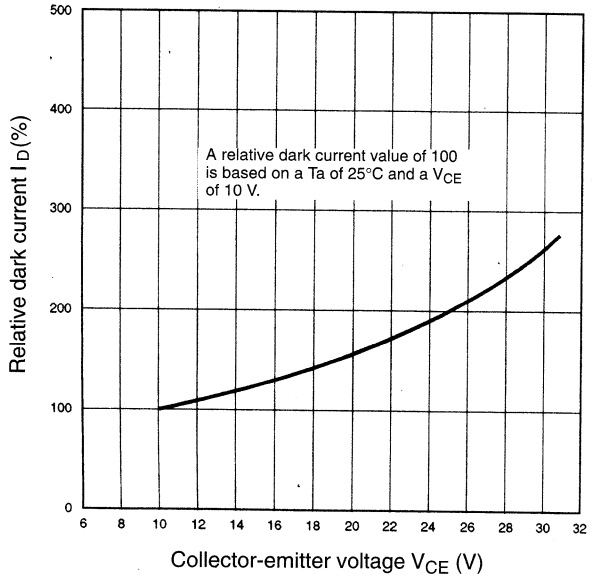


Figure 12. Dark Current Imposed Voltage Dependency (Typical) (EE-SM3B)

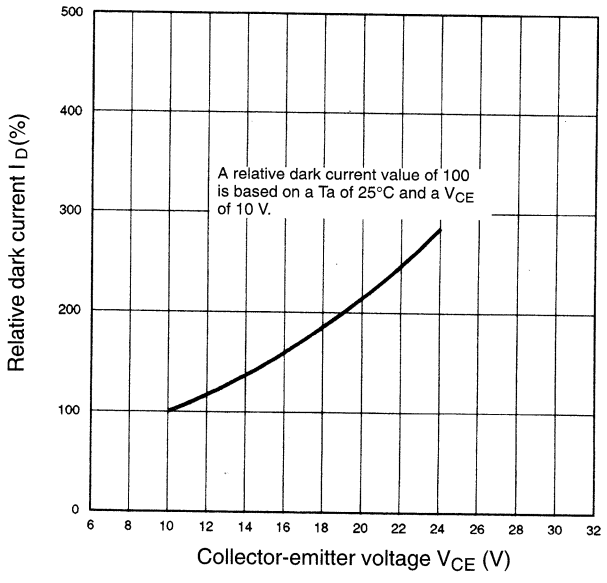


Table 3. Estimated Worst Values of a Variety of Opto–Switches

Model	Estimated worst value (I_D)	Estimated worst value (I_L)	Condition
EE-SG3(-B)	4 nA	1 mA	I_F = 15 mA
EE-SX1018, -SX1025 EE-SX1041, -SX1042 EE-SX1070, -SX1071 EE-SX198, -SX199	4 nA	0.25 mA	I_F = 20 mA
EE-SM3 EE-SM3B EE-SJ3W-B EE-SK3W-B	25 nA	0.75 mA	I_F = 3 mA
EE-SB5(-B) EE-SF5(-B) EE-SY110	4 nA	0.1 mA	I_F = 20 mA (see note)
EE-SY201	25 nA	0.15 mA	I_F = 5 mA (see note)
Condition	V_{CE} = 10 V, 0 ℓx Ta = 60°C	V_{CE} = 10 V, Operating hours = 50,000 to 100,000 hrs Ta = Topr	---

Note: These values were measured under the standard conditions specified by OMRON for the corresponding Opto–Switches.

Design of Basic Circuitry

The following explains the basic circuit incorporated by a typical Opto–Switch and the important points required for the basic circuit. The flowing currents (i.e., I_L and I_D) of the phototransistor incorporated by the Opto–Switch must be processed to obtain the output of the Opto–Switch. Refer to Figure 13 for the basic circuit. The light current (I_L) of the phototransistor will flow into the resistor (R_L) if the phototransistor receives an optical input and the dark current (I_D) and leakage current of the phototransistor will flow into the resistor (R_L) if the phototransistor does not receive any optical input. Therefore, if the phototransistor receives an optical input, the output voltage imposed on the resistor (R_L) will be obtained from the following.

$I_L \times R_L$

If the phototransistor does not receive any optical input, the output voltage imposed on the resistor (R_L) will be obtained from the following.

(I_D + leakage current) x R_L

The output voltage of the phototransistor is obtained by simply connecting the resistor (R_L) to the phototransistor. For example, to obtain an output of 4 V minimum from the phototransistor when it is ON and an output of 1 V maximum when the phototransistor is OFF on condition that the light current (I_L) of the phototransistor is 1 mA and the leakage current of the phototransistor is 0.1 mA, and these are the worst light current and leakage current values of the phototransistor, the resistance of the resistor (R_L) must be approximately 4.7 kΩ. Then, an output of 4.7 V (i.e., 1 mA x 4.7 kΩ) will be obtained when the phototransistor is ON and an output of 0.47 V (i.e., 0.1 mA x 4.7 kΩ) will be obtained when the phototransistor is OFF. Practically, the output voltage of the phototransistor will be more than 4.7 V when the phototransistor is ON and less than 0.47 V when the phototransistor is OFF because the above voltage values are based on the worst light current and leakage current values of the phototransistor. The outputs obtained from the phototransistor are amplified and input to ICs to make practical use of the Opto–Switch.

Figure 13. Basic Circuit

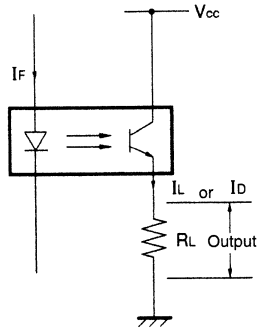
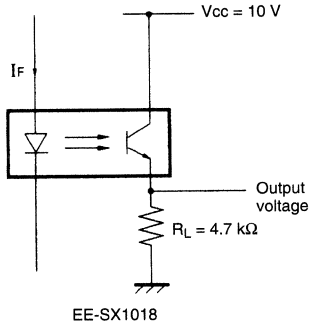


Figure 14. Output Example



Design of Applied Circuit

The following explains the designing of the applied circuit shown in Figure 15.

The light current (I_L) of the phototransistor flows into R_1 and R_2 when the phototransistor receives the optical beam emitted from the LED. Part of the light current (I_L) will flow into the base and emitter of Q_1 when the voltage imposed on R_2 exceeds the bias voltage (i.e., approximately 0.6 to 0.9 V) imposed between the base and emitter of the transistor (Q_1). The light current flowing into the base turns Q_1 ON. A current will flow into the collector of Q_1 through R_3 when Q_1 is ON. Then, the electric potential of the collector will drop to a low logic level. The dark current and leakage current of the phototransistor flow when the optical beam emitted from the LED is intercepted. The electric potential of the output of the phototransistor (i.e., (I_D + leakage current) x R_2) is, however, lower than the bias voltage between the base and emitter of Q_1. Therefore, no current will flow into the base of Q_1 and Q_1 will be OFF. The output of Q_1 will be at a high level. As shown in Figure 16, when the phototransistor is ON, the phototransistor will be seemingly short-circuited through the base and emitter of the Q_1, which is equivalent to a diode, and if the light current (I_L) of the phototransistor is large and R_1 is not connected to the phototransistor, the light current (I_L) will flow into Q_1 and the collector dissipation of the phototransistor will be excessively large.

The following items are important when designing the above applied circuit:

- The voltage output (i.e., $I_L \times R_2$) of the phototransistor receiving the optical beam emitted from the LED must be much higher than the bias voltage between the base and emitter of Q_1.
- The voltage output (i.e., (I_D + leakage current) x R_2) of the phototransistor not receiving the optical beam emitted from the LED must be much lower than the bias voltage between the base and emitter of Q_1.

Therefore, it is important to determine the resistance of R_2. Figure 17 shows a practical applied circuit example using the EE-SX1018 Opto–Switch at a supply voltage (V_{CC}) of 5V to drive a 74-series TTL IC. This applied circuit example uses R_1 and R_2 with appropriate resistance values.

Figure 15. Applied Circuit

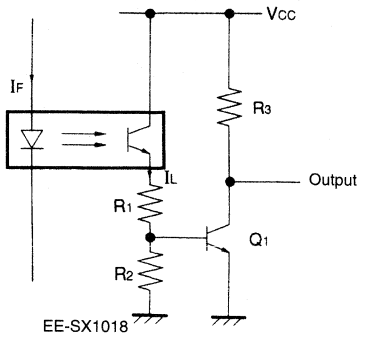


Figure 16. Equivalent Circuit

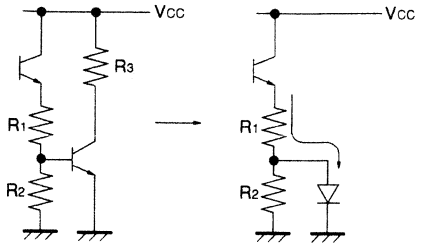
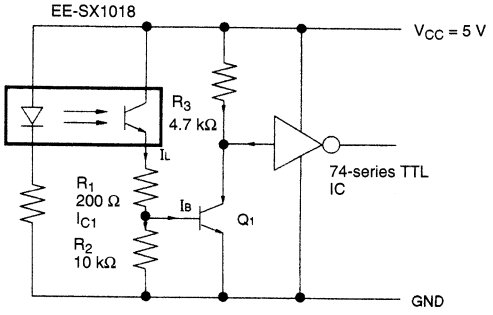


Figure 17. Applied Circuit Example



Calculation of R_2

The resistance of R_2 should be decided using the following so that the appropriate bias voltage ($V_{BE(ON)}$) between the base and emitter of the transistor (Q_1) to turn Q_1 ON will be obtained.

$I_{C1} \times R_2 > V_{BE(ON)}$

$I_{C1} = I_L = I_B$

$\therefore (I_L - I_B) \times R_2 > V_{BE(ON)}$

$$\therefore R_2 > \frac{V_{BE(ON)}}{I_L - I_B}$$

The bias voltage ($V_{BE(ON)}$) between the base and emitter of Q_1 is approximately 0.8 V and the base current (I_B) of Q_1 is approximately 20 μA if Q_1 is a standard transistor controlling small signals. The estimated worst value of the light current (I_L) of the phototransistor is 0.25 mA according to Table 3.

Therefore, the following is obtained.

$$R_2 > \frac{0.8\ V}{0.25\ mA - 20\ \mu A} = \text{approx. } 3.48\ k\Omega$$

R_2 must be larger than the above result. Therefore, the actual resistance of R_2 must be two to three times as large as the above result. In the above applied circuit example, the resistance of R_2 is 10 kΩ.

Verification of R_2 Value

The resistance of R_2 obtained from the above turns Q_1 ON. The following explains the way to confirm whether the resistance of R_2 obtained from the above can turns Q_1 OFF as well. The condition required to turn Q_1 OFF is obtained from the following.

$(I_D + \alpha) \times R_2 < V_{BE(OFF)}$

Substitute 10 kΩ for R_2, 4 μA for the dark current (I_D) according to Table 3, and 10 μA for the leakage current on the assumption that the leakage current is 10 μA in formula 3. The following is obtained.

$(I_D + \alpha) \times R_2 < V_{BE(OFF)}$

$(4\ \mu A + 10\ \mu A) \times 10\ k\Omega = 0.140\ V$

$V_{BE(OFF)} = 0.4\ V$

$\therefore 0.140\ V < 0.4\ V$

The above result verifies that the resistance of R_2 satisfies the condition required to turn Q_1 OFF.

If the appropriateness of the resistance of R_2 has been verified, the design of the circuit is almost complete.

R_1

As shown in Figure 16, when the phototransistor is ON, the phototransistor will be seemingly short-circuited through the base and emitter of the Q_1, and if the light current (I_L) of the phototransistor is large and R_1 is not connected to the phototransistor, the light current will flow into Q_1 and the collector dissipation of the phototransistor will be excessively large. The resistance of R_1 depends on the maximum permissible collector dissipation (P_C) of the phototransistor, which can be obtained from the datasheet of the Opto–Switch. The resistance of R_1 of a phototransistor is several hundred ohms. In the above applied circuit example, the resistance of R_1 is 200 Ω.

If the resistance of R_1 is determined, the design of the circuit is complete.

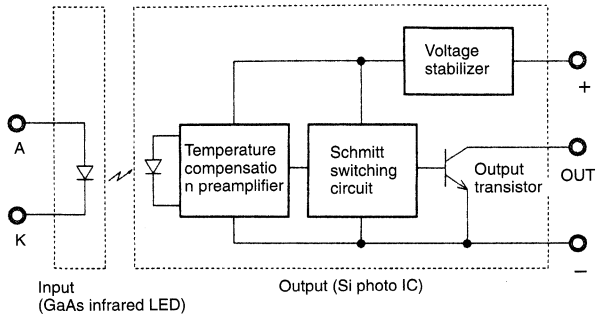
It is important to connect a transistor to the phototransistor incorporated by the Opto–Switch to amplify the output of the phototransistor, which increases the reliability and stability of the Opto–Switch. Such reliability and stability of the Opto–Switch cannot be achieved if the output of the phototransistor is not amplified. The response speed and other performance characteristics of the circuit shown in Figure 15 are far superior to those of the circuit shown in Figure 13 because the apparent impedance (i.e., load resistance) of the Opto–Switch is determined by R_1, the resistance of which is comparatively small. Recently, Opto–Switches that have photo IC amplifier circuits are increasing in number because they are easy to use and make it possible to design systems using Opto–Switches without problem.

■ Design of Systems Incorporating Opto–Switches (2)

Photo IC Output

Figure 18 shows the circuit configuration of the EE-SX301 or EE-SX401 Opto–Switch incorporating a photo IC output circuit. The following explains the structure of a typical Opto–Switch with a photo IC output circuit.

Figure 18. Circuit Configuration



LED Forward Current (I_F) Supply Circuit

The LED in the above circuitry is an independent component, to which an appropriate current must be supplied from an external power supply. This is the most important item required by the Opto–Switch.

It is necessary to determine the appropriate forward current (I_F) of the LED that turns the photo IC ON. If the appropriate forward current is determined, the Opto–Switch can be easily used by simply supplying power to the detector circuitry (i.e., the photo IC). Refer to the datasheet to find the current of the LED turning the photo IC ON. Table 4 is an extract of the datasheet of the EE-SX301/EE-SX401.

Table 4. Abstract of Characteristics

Item	Symbol	EE-SX301, -SX401	
		Value	Condition
LED current when output is turned OFF (EE-SX301)	I_{FTOFF}	8 mA max.	V_{CC} = 4.5 to 16 V Ta = 25°C
LED current when output is turned ON (EE-SX401)	I_{FTON}		

To design systems incorporating EE-SX301 or EE-SX401 Opto–Switches, the following are important points.

- A forward current equivalent to or exceeding the I_{FTOFF} value must flow into the LED incorporated by each EE-SX301 Opto–Switches.
- A forward current equivalent to or exceeding the I_{FTON} value must flow into the LED incorporated by the EE-SX401 Opto–Switches.

The I_{FTON} value of the EE-SX301 is 8 mA maximum and so is the I_{FON} value of the EE-SX401. The forward current (I_F) of LED incorporated by the EE-SX301 in actual operation must be 8 mA or more and so must the actual forward current of (I_F) the LED incorporated by the EE-SX401 in actual operation. The actual forward currents of the LEDs incorporated by the EE-SX301 and EE-SX401 are limited by their absolute maximum forward currents respectively. The upper limit of the actual forward current of the LED incorporated by the EE-SX301 and that of the LED incorporated by the EE-SX401 must be decided according Figure 19, which shows the temperature characteristics of the EE-SX301 and EE-SX401. The forward current (I_F) of the EE-SX301 must be as large as possible within the absolute maximum forward current and maximum ambient temperature shown in Figure 19 and so must be the forward current (I_F) of the EE-SX401. The forward current (I_F) of the EE-SX301 or that of the EE-SX401 must not be close to 8 mA, otherwise the photo IC of the EE-SX301 or that of the EE-SX401 may not operate if there is any ambient temperature change, secular change that reduces the optical output of the LED, or dust sticking to the LED. The forward current (I_F) values of the EE-SX301 and the EE-SX401 in actual operation must be twice as large as the I_{FOFF} values of the EE-SX301 and EE-SX401 respectively. Figure 20 shows the basic circuit of a typical Opto–Switch with a photo IC output circuit.

If the Opto–Switch with a photo IC output circuit is used to drive a relay, be sure to connect a reverse voltage absorption diode (D) to the relay in parallel as shown in Figure 21.

Detector Circuit

Supply a voltage within the absolute maximum supply voltage to the positive and negative terminals of the photo IC circuit shown in Figure 18 and obtain a current within the I_{OUT} value of the output transistor incorporated by the photo IC circuit.

Figure 19. Forward Current vs. Ambient Temperature Characteristics (EE-SX301/-SX401)

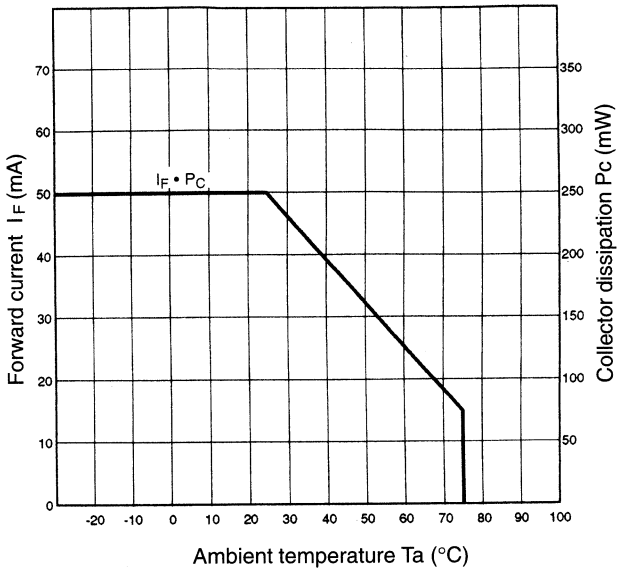


Figure 20. Basic Circuit

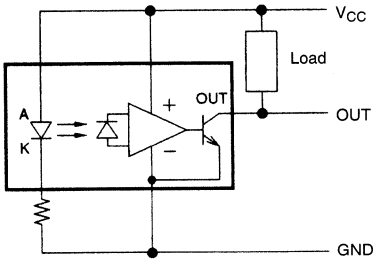
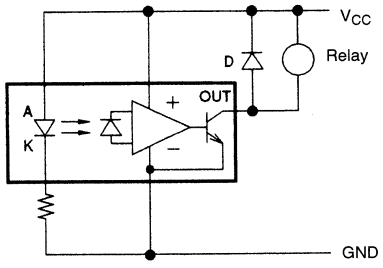


Figure 21. Connected to Inductive Load



Precautions

The following provides the instructions required for the operation of Opto–Switches.

■ Transmissive Opto–Switch Incorporating Phototransistor Output Circuit

When using a transmissive Opto–Switch to sense the following objects, make sure that it operates efficiently.

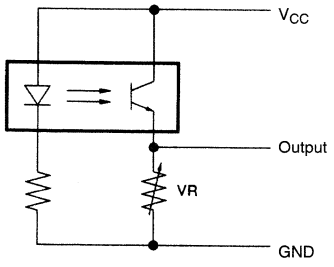
- Highly permeable objects such as paper, film, and plastic
- Objects smaller than the size of the optical beam emitted by the LED or the size of the aperture of the detector.

The above objects do not fully intercept the optical beam emitted by the LED. Therefore, some part of the optical beam, which is considered noise, reaches the detector and a current flows from the phototransistor incorporated by the detector. Before sensing such type of objects, it is necessary to measure the light currents of the phototransistor with and without an object to make sure that the transmissive Opto–Switch can sense objects without being interfered by noise. If the light current of the phototransistor sensing any one of the objects is $I_L(N)$ and that of the phototransistor sensing none of the objects is $I_L(S)$, the signal-noise ratio of the phototransistor due to the object is obtained from the following.

$$S/N = I_L(S)/I_L(N)$$

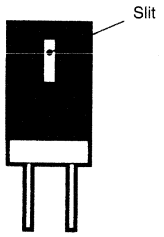
The light current (I_L) of the phototransistor varies with the ambient temperature and secular changes. Therefore, if the signal-noise ratio of the phototransistor is 4 maximum, it is necessary to pay utmost attention to the circuit connected to the transmissive Opto–Switch so that it can sense the object without problem. The light currents of phototransistors are different to one another. Therefore, when multiple transmissive Opto–Switches are required, a variable resistor must be connected to each transmissive Opto–Switch as shown in Figure 22 if the light currents of the phototransistors greatly differ from one another.

Figure 22. Sensitivity Adjustment



The optical beam of the emitter and the aperture of the detector must be as narrow as possible. A slit each can be attached to the emitter and detector to make the optical beam of the emitter and the aperture of the detector narrower. If slits are attached to both the emitter and detector, however, the light current (I_L) of the phototransistor incorporated by the detector will decrease. It is desirable to attach slits to both the emitter and detector. If a slit is attached to the detector only, the transmissive Opto–Switch will have trouble sensing the above objects when they pass near the emitter.

Figure 23. Slit Example



When using the transmissive Opto–Switch to sense any object that vibrates, moves slowly, or has highly reflective edges, make sure to connect a proper circuit which processes the output of the transmissive Opto–Switch so that it can operate properly, otherwise a chattering output signal can result as shown in Figure 24. If this signal is input to a counter, the counter will have a counting error or operate improperly. To protect against this, connect a 0.01- to 0.02-μF capacitor to the circuit as shown in Figure 25 or connect a Schmitt trigger circuit to the circuit as shown in Figure 26.

Figure 24. Chattering Output Signal

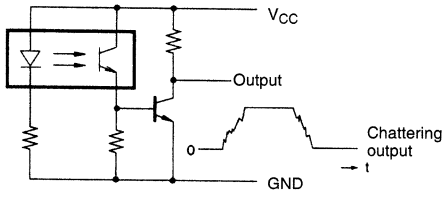


Figure 25. Chattering Prevention (1)

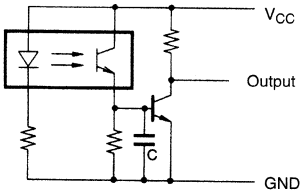
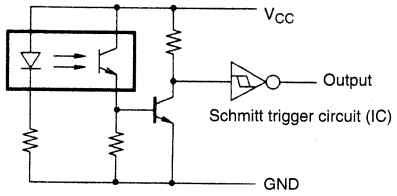


Figure 26. Chattering Prevention (2)



■ Reflective Opto–Switch Incorporating Phototransistor Output Circuit

When using a reflective Opto–Switch to sense objects, pay attention to the following so that it operates efficiently.

- External light interference
- Background condition of sensing objects
- Output level of the LED

The reflective Opto–Switch incorporates a detector element in the direction shown in Figure 27. Therefore, it is apt to be affected by external light interference. The reflective Opto–Switch, therefore, incorporates a filter to intercept any light, the wavelength of which is shorter than a certain wavelength, to prevent external light interference. The filter does not, however, perfectly intercept the light. Refer to Figure 28 for the light interception characteristics of filters. A location with minimal external light interference is best suited for the reflective Opto–Switch.

Figure 27. Configuration of convergent Reflective Opto–Switch

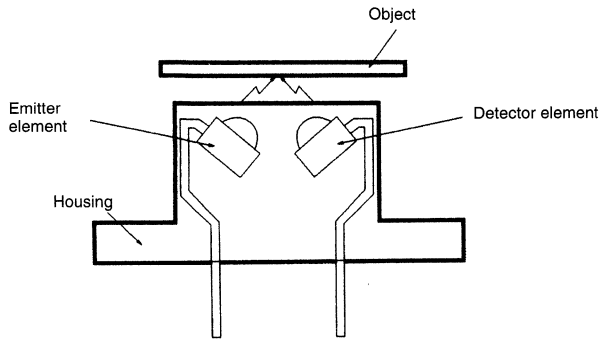


Figure 28. Light Interception Characteristics of Filters

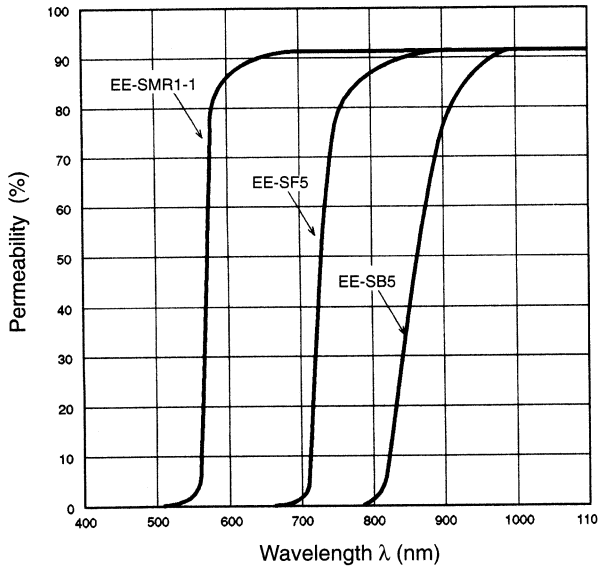


Figure 29. Influence of Background Object

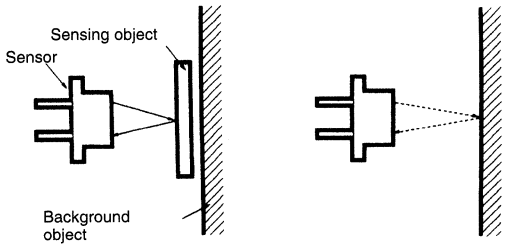


Figure 29 shows that the optical beam emitted from the LED incorporated by a reflective Opto–Switch is reflected by a sensing object and background object. The optical beam reflected by the background object and received by the phototransistor incorporated by the detector is considered noise that lowers the signal-noise ratio of the phototransistor. If any reflective Opto–Switch is used to sense paper passing through the sensing area on condition that there is a stainless steel or zinc-plated object behind the paper, the light current (I_L(N)) of the phototransistor not sensing the paper may be larger than the light current (I_L(S)) of phototransistor sensing the paper, in which case remove the background object, make a hole larger than the area of the sensor surface in the background object as shown in Figure 30, coat the surface of the background object with black lusterless paint, or roughen the surface of the background. Most malfunctions of a reflective Opto–Switch are caused by an object located behind the object to be sensed.
Unlike the output (i.e., I_L) of any transmissive Opto–Switch, the light current (I_L) greatly varies according to sensing object type, sensing distance, and sensing object size.

Figure 30. Example of Countermeasure

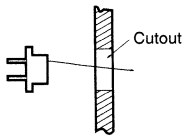
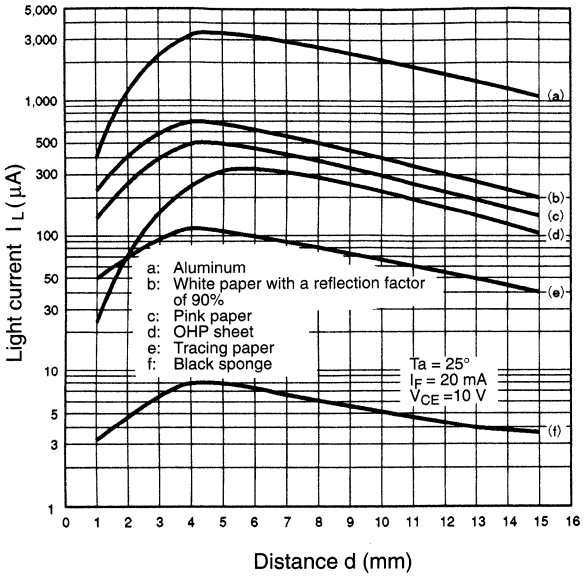


Figure 31. Sensing Distance Characteristics (EE-SF5)

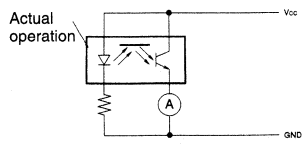


The light current (I_L) of the phototransistor incorporated by the transmissive Opto–Switch is output when there is no sensing object in the sensing groove of the transmissive Opto–Switch. On the other hand, the light current (I_L) of the phototransistor incorporated by the reflective Opto–Switch is output when there is a reflective object located in the standard sensing distance of the reflective Opto–Switch. The light current (I_L) of the phototransistor incorporated by the reflective Opto–Switch varies when the reflective Opto–Switch senses any other type of sensing object located at a sensing distance other than the standard sensing distance. Figure 31 shows how the output of the phototransistor incorporated by the EE-SF5(-B) varies according to varieties of sensing objects and sensing distances. Before using the EE-SF5(-B) to sense any other type of sensing objects, measure the light currents of the phototransistor in actual operation with and without one of the sensing objects as shown in Figure 32. After measuring the light currents, calculate the signal-noise ratio of the EE-SF5(-B) due to the sensing object to make sure if the sensing objects can be sensed smoothly. The light current of the reflective Opto–Switch is, however, several tens to hundreds of microamperes. This means that the absolute signal levels of the reflective Opto–Switch are low. Even if the reflective Opto–Switch in operation is not interfered by external light, the dark current (I_D) and leakage current (I_{LEAK}), which are considered noise, may amount to several to tens of microamperes due to a rise in the ambient temperature. This noise cannot be ignored. As a result, the signal-noise ratio of the reflective Opto–Switch will be extremely low if any object has a low reflection ratio. Pay utmost attention when applying the reflective Opto–Switch to the sensing of the following.

- Marked objects (e.g., White objects with a black mark each)
- Minute objects

The above objects can be sensed if the signal-noise ratio of the reflective Opto–Switch is not too low.
The reflective Opto–Switch must be used with great care, otherwise it will not operate properly.

Figure 32. Output Current Measurement



Precautions

■ Structure and Materials

The emitter and detector elements of conventional Opto–Switches are fixed with transparent epoxy resin and the main bodies are made of polycarbonate. Unlike ICs and transistors, which are covered with black epoxy resin, Opto–Switches are subject to the following restrictions.

1. **Low Heat Resistivity**
   The storage temperature of standard ICs and transistors is approximately 150°C. On the other hand, the storage temperature of highly resistant Opto–Switches is 100°C maximum.
2. **Low Mechanical Strength**
   Black epoxy resin, which is used for the main bodies of ICs and transistors, contains additive agents including glass fiber to increase the heat resistivity and mechanical strength of the main bodies. Materials with additive agents cannot be used for the bodies of Opto–Switches because they must maintain good optical permeability. Unlike ICs and transistors, Opto–Switches must be handled with utmost care because they are not as heat or mechanically resistant as ICs and transistors. No excessive force must be imposed on the lead.
3. Do not mount Opto–Switches to plates stained with machining oil, otherwise the machining oil may cause cracks on the Opto–Switches.
4. Do not impose excessive forces on Opto–Switches mounted to PCBs. Make sure that no continuous or instantaneous external force exceeding 500 g (4.9 N) is imposed on any lead wire of the Opto–Switches.

■ Soldering

Lead Wires

Make sure to solder the lead wires of Opto–Switches so that no excessive force will be imposed on the lead wires. If an excessive forces is likely to be imposed on the lead wires, hold the bases of the lead wires.

Soldering Temperature

1. **Manual Soldering**
   Unless otherwise specified, the lead wires of Opto–Switches can be soldered manually under the following conditions.

Soldering temperature:	350°C max. (The temperature of the tip of a 30-W soldering iron is approximately 320°C when the soldering iron is heated up.)
Soldering time:	3 s max.
Soldering position:	At least 1.5 mm away from the bases of the lead wires.

   The temperature of the tip of any soldering iron depends on the shape of the tip. Check the temperature with a thermometer before soldering the lead wires. A highly resistive soldering iron incorporating a ceramic heater is recommended for soldering the lead wires.
2. **Dip Soldering**
   The lead wires of Opto–Switches can be dip-soldered under the following conditions unless otherwise specified.

Preheating temperature:	Must not exceed the storage temperature of the Opto–Switches.
Soldering temperature:	260°C.
Soldering time:	10 s max.
Soldering position:	At least 1.5 mm away from the bases of the lead wires.

   Do not use non-washable flux when soldering EE-SA-series Opto–Switches, otherwise the Opto–Switches will have operational problems.
3. **Reflow Soldering**
   The reflow soldering of Opto–Switches is not possible.

External Forces

The heat resistivity and mechanical strength of Opto–Switches are lower than those of ICs or transistors. Do not to impose external force on Opto–Switches immediately after soldering. Especially, do not impose external force immediately after the Opto–Switches are dip-soldered.

■ Cleaning Precautions

Cleaning

Opto–Switches (except the EE-SA105) can be cleaned subject to the following restrictions.

1. **Types of Detergent**
   Polycarbonate is used for the bodies of most Opto–Switches. Some types of detergent dissolve or crack polycarbonate. Before cleaning, refer to the following results of experiments, which indicate what types of detergent are suitable for cleaning Opto–Switches other than the EE-SA105.
   Observe the law and prevent against any environmental damage when using any detergent.

   Results of Experiments

Ethyl alcohol:	OK
Methyl alcohol:	OK
Isopropyl alcohol:	OK
Chlorofuorocarbon:	Depends on the additive agents (see note)
Trichlene:	NG
Acetone:	NG
Methylbenzene:	NG
Water (hot water):	The lead wires corrode depending on the conditions

   Note: Chlorofluorocarbon containing ethyl alcohol or methyl alcohol as an additive agent can be used to clean Opto–Switches except the EE-SA105. Chlorofluorocarbon containing acetone as an additive agent must not be used to clean any Opto–Switch. For reasons of enviromental protection, refrain from using any detergent containing chlorofluorocarbon.
2. **Cleaning Method**
   Unless otherwise specified, Opto–Switches other than the EE-SA105 can be cleaned under the following conditions. Do not apply an unclean detergent to the Opto–Switches.

DIP cleaning:	OK
Ultrasonic cleaning:	Depends on the equipment and the PCB size. Before cleaning Opto–Switches, conduct a cleaning test with a single Opto–Switch and make sure that the Opto–Switch has no broken lead wires after cleaning.
Brushing:	The marks on Opto–Switches may be brushed off. The emitters and detectors of reflective Opto–Switches may have scratches and deteriorate when they are brushed. Before brushing Opto–Switches, conduct a brushing test with a single Opto–Switch and make sure that it is not damaged after it is brushed.

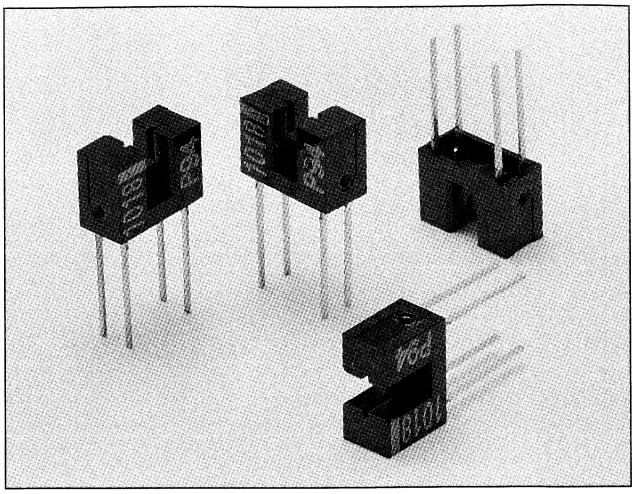
OMRON

Opto–Switch

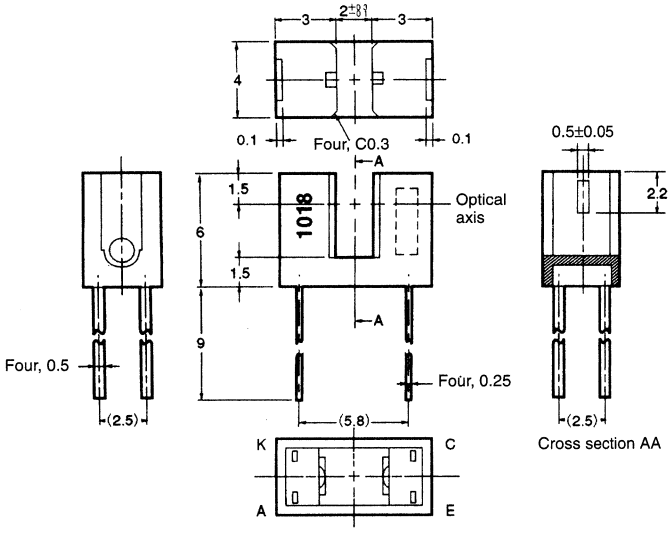
EE–SX1018

Transmissive

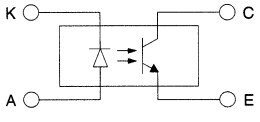
- Phototransistor output.
- Compact model with a 2-mm-wide slot.
- PCB mounting type.
- High resolution with a 0.5-mm-wide aperture.



Dimensions



Internal Circuit



Terminal No.	Name
A	Anode
K	Cathode
C	Collector
E	Emitter

Unless otherwise specified, the tolerances are as shown below.

Dimensions	Tolerance
3 mm max.	±0.3
3 < mm ≤ 6	±0.375
6 < mm ≤ 10	±0.45
10 < mm ≤ 18	±0.55
18 < mm ≤ 30	±0.65

Specifications

■Absolute Maximum Ratings (Ta = 25°C)

Item		Symbol	Rated value
Emitter	Forward current	I_F	50 mA (see note 1)
	Pulse forward current	I_{FP}	1 A (see note 2)
	Reverse voltage	V_R	4 V
Detector	Collector–Emitter voltage	V_{CEO}	30 V
	Emitter–Collector voltage	V_{ECO}	---
	Collector current	I_C	20 mA
	Collector dissipation	P_C	100 mW (see note 1)
Ambient temperature	Operating	Topr	–25°C to 85°C
	Storage	Tstg	–30°C to 100°C
	Soldering	Tsol	260°C

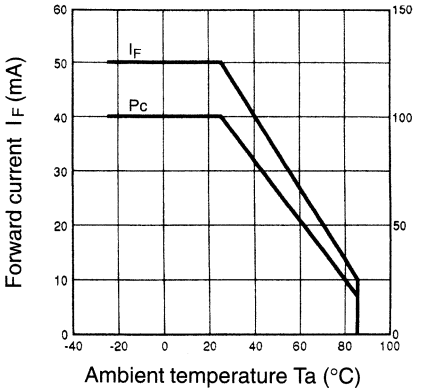
Note: 1.Refer to the temperature rating chart if the ambient temperature exceeds 25°C.
2.The pulse width is 10 μs maximum with a frequency of 100 Hz.

■ Electrical and Optical Characteristics (Ta = 25°C)

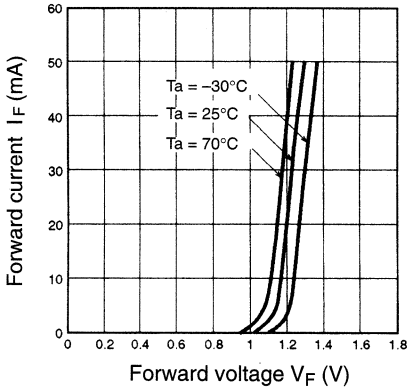
Item		Symbol	Value	Condition
Emitter	Forward voltage	V_F	1.2 V typ., 1.5 V max.	I_F = 30 mA
	Reverse current	I_R	0.01 μA typ., 10 μA max.	V_R = 4 V
	Peak emission wavelength	λ_P	940 nm typ.	I_F = 20 mA
Detector	Light current	I_L	0.5 mA min., 14 mA max.	I_F = 20 mA, V_{CE} = 10 V
	Dark current	I_D	2 nA typ., 200 nA max.	V_{CE} = 10 V, 0 ℓx
	Leakage current	I_{LEAK}	---	---
	Collector–Emitter saturated voltage	V_{CE} (sat)	0.1 V typ., 0.4 V max.	I_F = 20 mA, I_L = 0.1 mA
	Peak spectral sensitivity wavelength	λ_P	850 nm typ.	V_{CE} = 10 V
Rising time		tr	4 μs typ.	V_{CC} = 5 V, R_L = 100 Ω, I_L = 5 mA
Falling time		tf	4 μs typ.	V_{CC} = 5 V, R_L = 100 Ω, I_L = 5 mA

Engineering Data

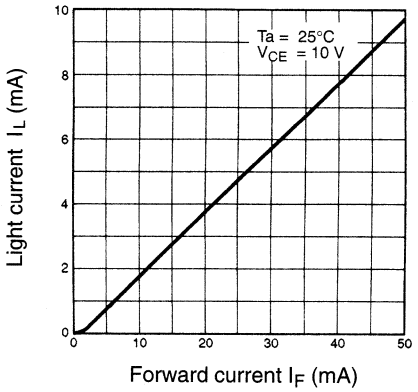
Forward Current vs. Collector Dissipation Temperature Rating



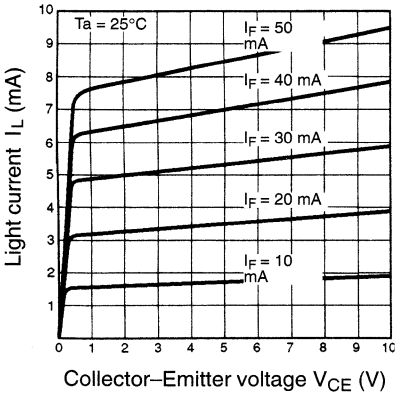
Forward Current vs. Forward Voltage Characteristics (Typical)



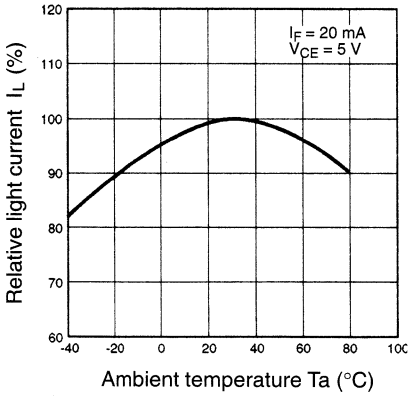
Light Current vs. Forward Current Characteristics (Typical)



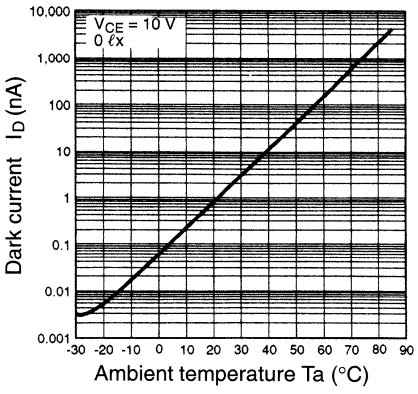
Light Current vs. Collector–Emitter Voltage Characteristics (Typical)



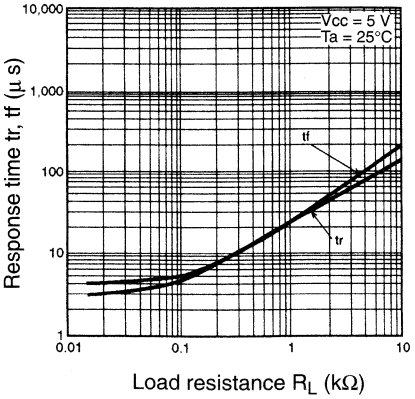
Relative Light Current vs. Ambient Temperature Characteristics (Typical)



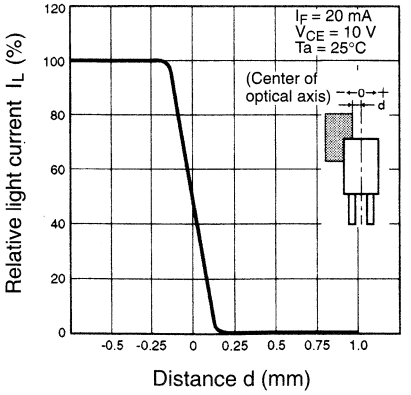
Dark Current vs. Ambient Temperature Characteristics (Typical)



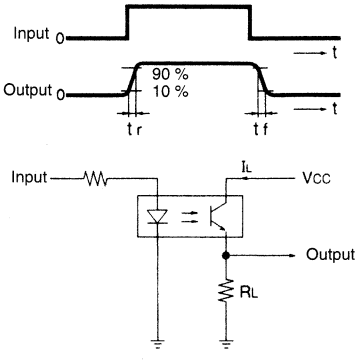
Response Time vs. Load Resistance Characteristics (Typical)



Sensing Position Characteristics (Typical)



Response Time Measurement Circuit



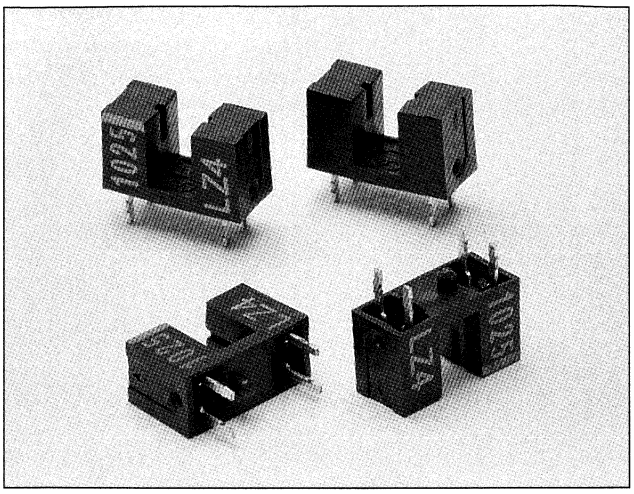
OMRON

Opto–Switch

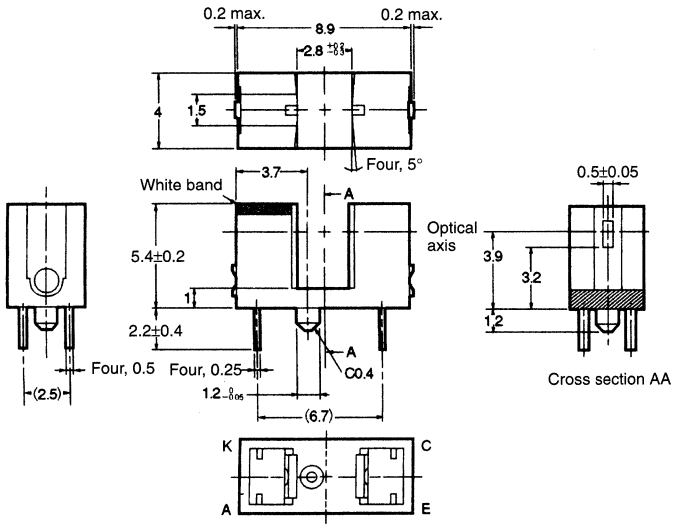
EE–SX1025

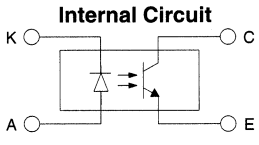
Transmissive

- Phototransistor output.
- 5.4-mm-tall low profile model.
- PCB mounting type.
- High resolution with a 0.5-mm-wide aperture.
- 2.8mm slot width.
- Off–centre location pip for correct orientation.



Dimensions





Terminal No.	Name
A	Anode
K	Cathode
C	Collector
E	Emitter

Unless otherwise specified, the tolerances are as shown below.

Dimensions	Tolerance
3 mm max.	±0.3
3 < mm ≤ 6	±0.375
6 < mm ≤ 10	±0.45
10 < mm ≤ 18	±0.55
18 < mm ≤ 30	±0.65

Specifications

■Absolute Maximum Ratings (Ta = 25°C)

Item		Symbol	Rated value
Emitter	Forward current	I_F	50 mA (see note 1)
	Pulse forward current	I_{FP}	1 A (see note 2)
	Reverse voltage	V_R	4 V
Detector	Collector–Emitter voltage	V_{CEO}	30 V
	Emitter–Collector voltage	V_{ECO}	---
	Collector current	I_C	20 mA
	Collector dissipation	P_C	100 mW (see note 1)
Ambient temperature	Operating	Topr	–25°C to 85°C
	Storage	Tstg	–30°C to 100°C
	Soldering	Tsol	260°C

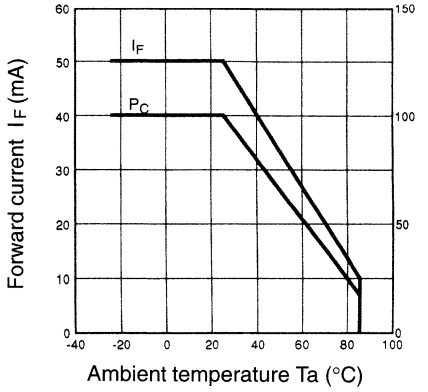
Note: 1.Refer to the temperature rating chart if the ambient temperature exceeds 25°C.
2.The pulse width is 10 μs maximum with a frequency of 100 Hz.

■ Electrical and Optical Characteristics (Ta = 25°C)

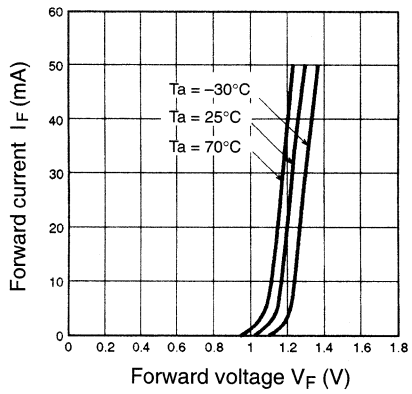
Item		Symbol	Value	Condition
Emitter	Forward voltage	V_F	1.2 V typ., 1.5 V max.	I_F = 30 mA
	Reverse current	I_R	0.01 μA typ., 10 μA max.	V_R = 4 V
	Peak emission wavelength	λ_P	940 nm typ.	I_F = 20 mA
Detector	Light current	I_L	0.5 mA min., 14 mA max.	I_F = 20 mA, V_{CE} = 10 V
	Dark current	I_D	2 nA typ., 200 nA max.	V_{CE} = 10 V, 0 ℓx
	Leakage current	I_{LEAK}	---	---
	Collector–Emitter saturated voltage	V_{CE} (sat)	0.1 V typ., 0.4 V max.	I_F = 20 mA, I_L = 0.1 mA
	Peak spectral sensitivity wavelength	λ_P	850 nm typ.	V_{CE} = 10 V
Rising time		tr	4 μs typ.	V_{CC} = 5 V, R_L = 100 Ω, I_L = 5 mA
Falling time		tf	4 μs typ.	V_{CC} = 5 V, R_L = 100 Ω, I_L = 5 mA

Engineering Data

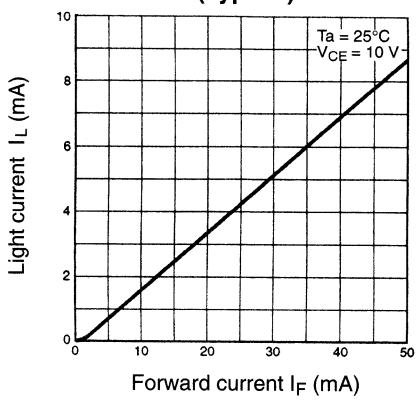
Forward Current vs. Collector Dissipation Temperature Rating



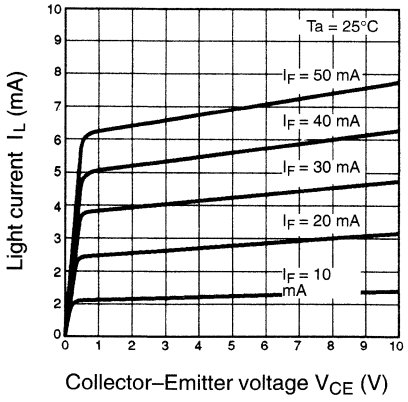
Forward Current vs. Forward Voltage Characteristics (Typical)



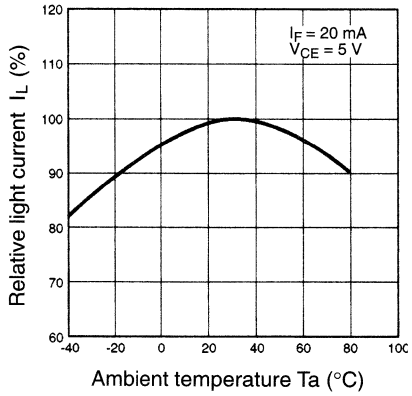
Light Current vs. Forward Current Characteristics (Typical)



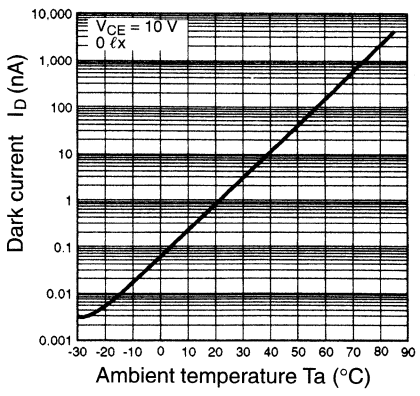
Light Current vs. Collector–Emitter Voltage Characteristics (Typical)



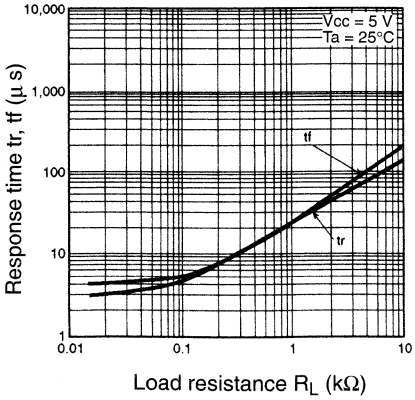
Relative Light Current vs. Ambient Temperature Characteristics (Typical)



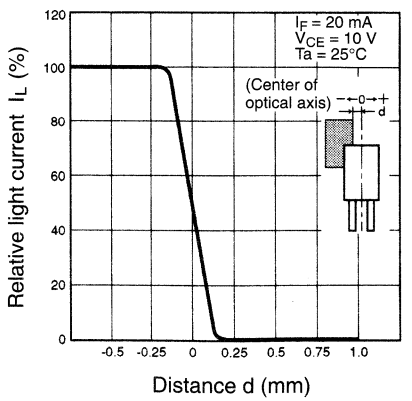
Dark Current vs. Ambient Temperature Characteristics (Typical)



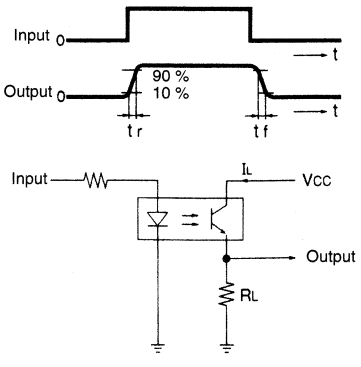
Response Time vs. Load Resistance Characteristics (Typical)



Sensing Position Characteristics (Typical)



Response Time Measurement Circuit



Opto-Switches

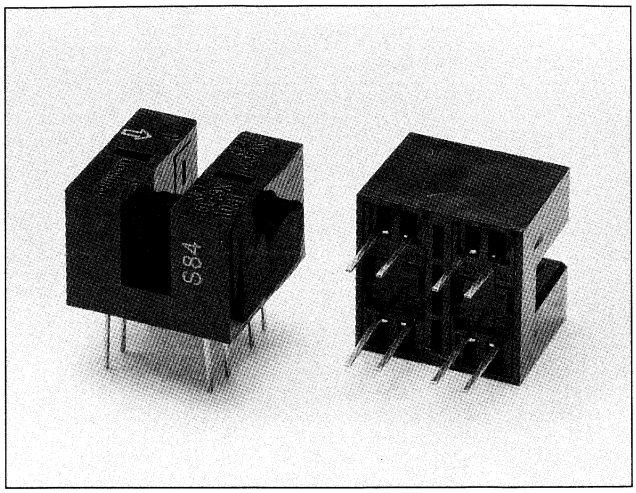
OMRON

Opto–Switch

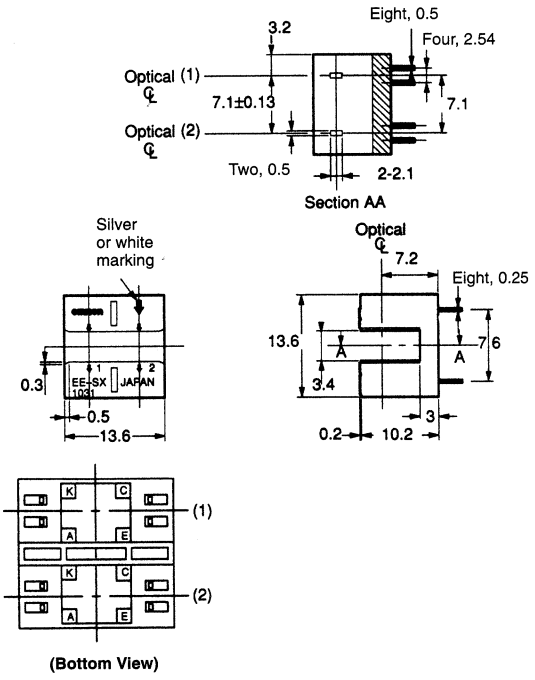
EE–SX1031

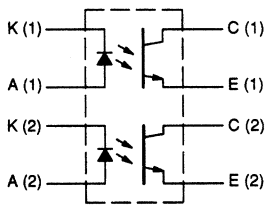
Transmissive

- Phototransistor output.
- Dual channel opto–switch, ideal for encoder applications.
- High resolution with a 0.5-mm-wide aperture.
- Separate LED/Phototransistor combinations within a single housing.
- PCB mounting type.



Dimensions





Terminal No.	Name
A	Anode
K	Cathode
C	Collector
E	Emitter

Unless otherwise specified, the tolerances are as shown below.

Dimensions	Tolerance
3 mm max.	±0.3
3 < mm ≤ 6	±0.375
6 < mm ≤ 10	±0.45
10 < mm ≤ 18	±0.55
18 < mm ≤ 30	±0.65

Specifications

■Absolute Maximum Ratings (Ta = 25°C)

Item		Symbol	Rated value
Emitter	Forward current	I_F	50 mA (see note)
	Reverse voltage	V_R	4 V
Detector	Collector–Emitter voltage	V_{CEO}	30 V
	Collector current	I_C	20 mA
	Collector dissipation	P_C	100 mW
Ambient temperature	Operating	Topr	–25°C to 85°C
	Storage	Tstg	–30°C to 100°C

Note: Refer to the temperature rating chart if the ambient temperature exceeds 25°C.

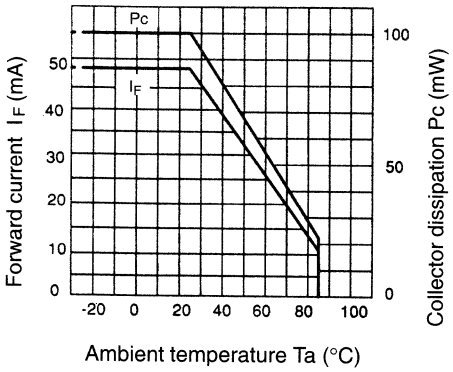
■ Electrical and Optical Characteristics (Ta = 25°C)

Item		Symbol	Value	Condition
Emitter	Forward voltage	V_F	1.2 V typ., 1.5 V max.	I_F = 30 mA
	Reverse current	I_R	0.01 μA typ., 10 μA max.	V_R = 4 V
	Peak emission wavelength	λ_P	940 nm typ.	I_F = 20 mA
Detector	Light current	I_L	0.5 to 14 mA max.	I_F = 20 mA, V_{CE} = 10 V
	Dark current	I_D	2 nA typ., 200 nA max.	V_{CE} = 10 V, 0 ℓx
	Collector–Emitter saturated voltage	V_{CE} (sat)	0.15 V typ., 0.4 V max.	I_F = 20 mA, I_L = 0.1 mA
	Peak spectral sensitivity wavelength	λ_P	850 nm typ.	V_{CE} = 10 V
Rising time (see note)		tr	4 μs typ.	V_{CC} = 5 V, R_L = 100 Ω, I_L = 5 mA
Falling time		tf	4 μs typ.	V_{CC} = 5 V, R_L = 100 Ω, I_L = 5 mA

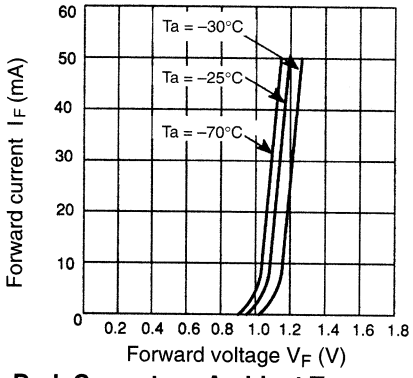
Note: Refer to *"Response Time Measurement Circuit"*.

■ Engineering Data

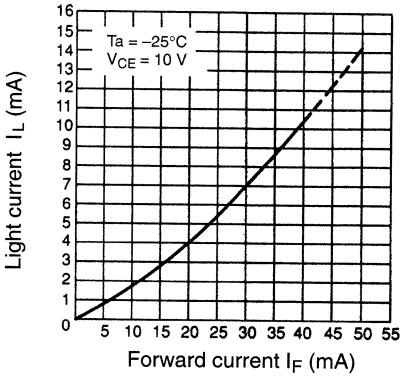
Forward Current vs. Collector Dissipation Temperature Rating



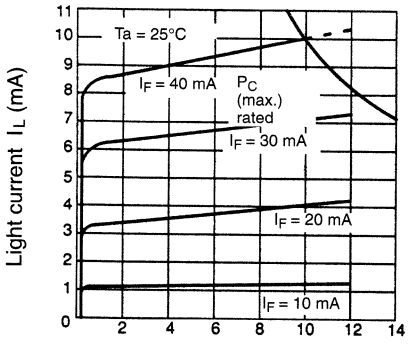
Forward Current vs. Forward Voltage Characteristics (Typical)



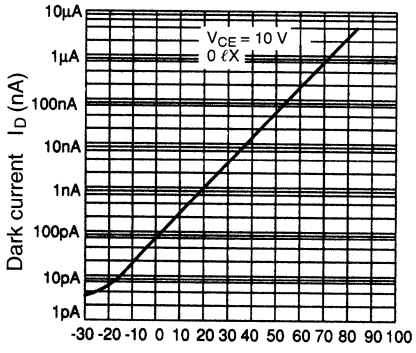
Light Current vs. Forward Current Characteristics (Typical)



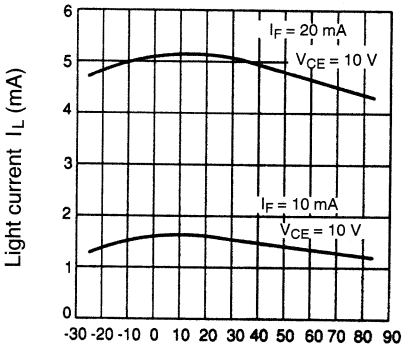
Light Current vs. Collector–Emitter Voltage Characteristics (Typical)



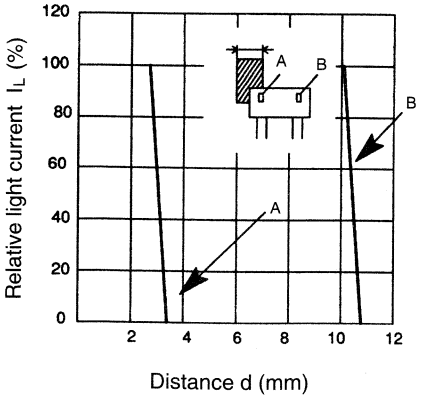
Dark Current vs. Ambient Temperature Characteristics (Typical)



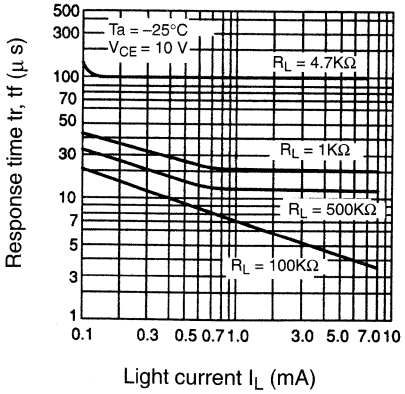
Light Current vs. Ambient Temperature Characteristics (Typical)



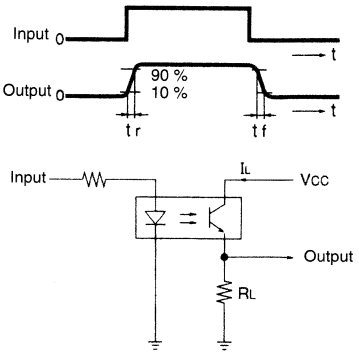
Sensing Position Characteristics (Typical)



Response Time vs. Load Resistance Characteristics (Typical)



Response Time Measurement Circuit



Note: The operating conditions of the Photomicrosensor must be within the absolute maximum rating ranges.

Opto-Switches

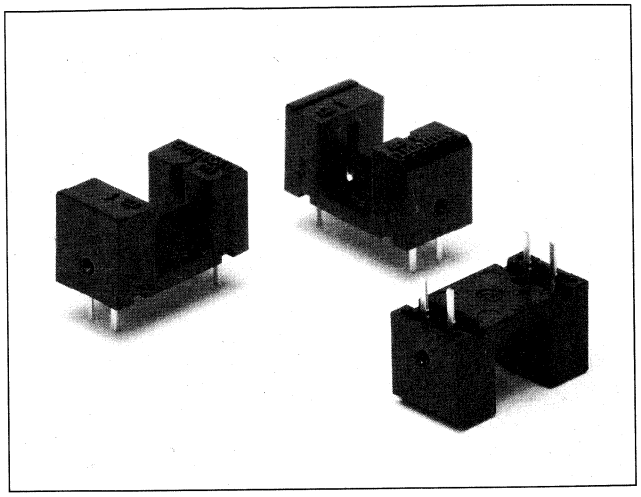
OMRON

Opto–Switch

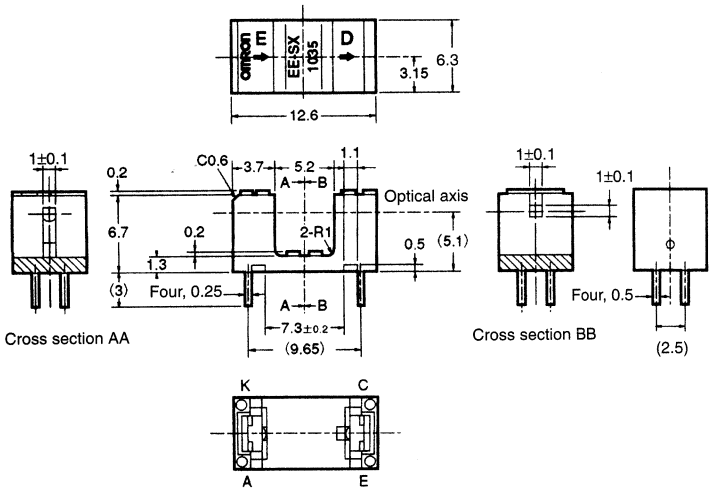
EE–SX1035

Transmissive

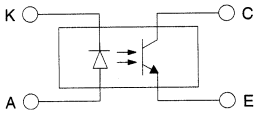
- Phototransistor output.
- Low profile at only 6.7mm tall.
- Compact model with a 5.2-mm-wide slot.
- PCB mounting type.



Dimensions



Internal Circuit



Terminal No.	Name
A	Anode
K	Cathode
C	Collector
E	Emitter

Unless otherwise specified, the tolerances are as shown below.

Dimensions	Tolerance
3 mm max.	±0.2
3 < mm ≤ 6	±0.24
6 < mm ≤ 10	±0.29
10 < mm ≤ 18	±0.35
18 < mm ≤ 30	±0.42

Specifications

■ Absolute Maximum Ratings (Ta = 25°C)

Item		Symbol	Rated value
Emitter	Forward current	I_F	50 mA (see note 1)
	Pulse forward current	I_{FP}	1 A (see note 2)
	Reverse voltage	V_R	4 V
Detector	Collector–Emitter voltage	V_{CEO}	30 V
	Emitter–Collector voltage	V_{ECO}	5 V
	Collector current	I_C	20 mA
	Collector dissipation	P_C	100 mW (see note 1)
Ambient temperature	Operating	Topr	–25°C to 85°C
	Storage	Tstg	–30°C to 100°C
	Soldering	Tsol	260°C

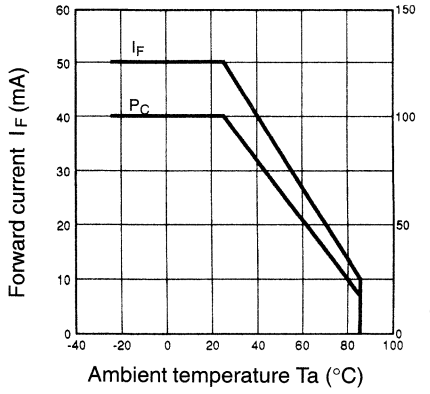
Note: 1.Refer to the temperature rating chart if the ambient temperature exceeds 25°C.
2.The pulse width is 10 μs maximum with a frequency of 100 Hz.

■ Electrical and Optical Characteristics (Ta = 25°C)

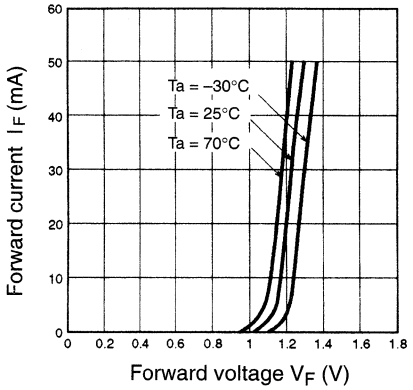
Item		Symbol	Value	Condition
Emitter	Forward voltage	V_F	1.2 V typ., 1.5 V max.	I_F = 30 mA
	Reverse current	I_R	0.01 μA typ., 10 μA max.	V_R = 4 V
	Peak emission wavelength	λ_P	940 nm typ.	I_F = 20 mA
Detector	Light current	I_L	0.5 mA min.	I_F = 20 mA, V_{CE} = 10 V
	Dark current	I_D	2 nA typ., 200 nA max.	V_{CE} = 10 V, 0 ℓx
	Leakage current	I_{LEAK}	---	---
	Collector–Emitter saturated voltage	V_{CE} (sat)	0.15 V typ., 0.4 V max.	I_F = 20 mA, I_L = 0.1 mA
	Peak spectral sensitivity wavelength	λ_P	850 nm typ.	V_{CE} = 10 V
Rising time		tr	4 μs typ.	V_{CC} = 5 V, R_L = 100 Ω, I_L = 5 mA
Falling time		tf	4 μs typ.	V_{CC} = 5 V, R_L = 100 Ω, I_L = 5 mA

Engineering Data

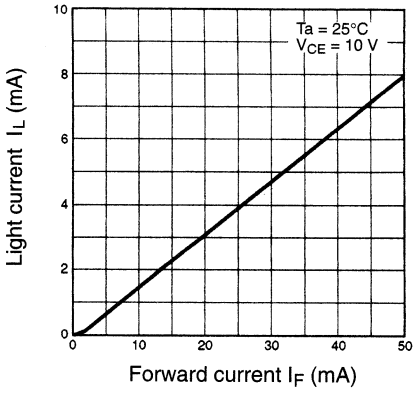
Forward Current vs. Collector Dissipation Temperature Rating



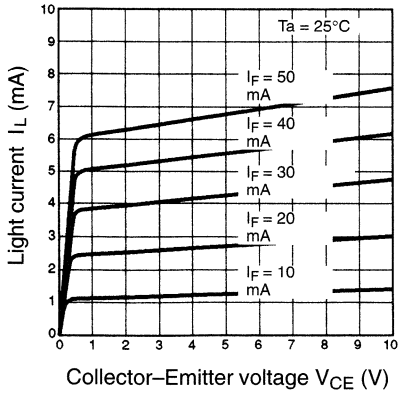
Forward Current vs. Forward Voltage Characteristics (Typical)



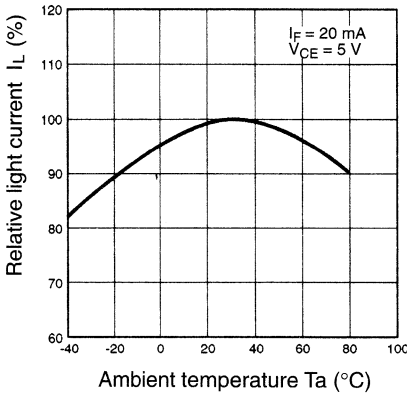
Light Current vs. Forward Current Characteristics (Typical)



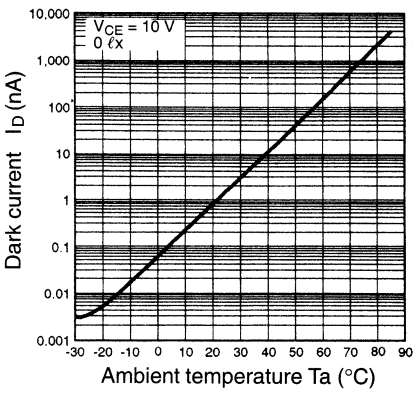
Light Current vs. Collector–Emitter Voltage Characteristics (Typical)



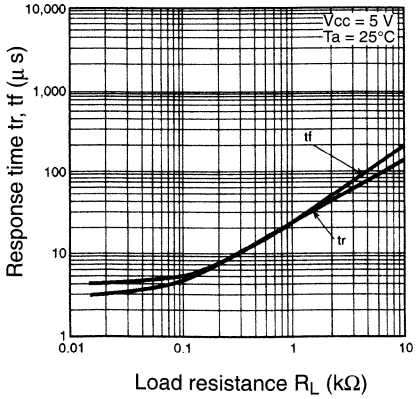
Relative Light Current vs. Ambient Temperature Characteristics (Typical)



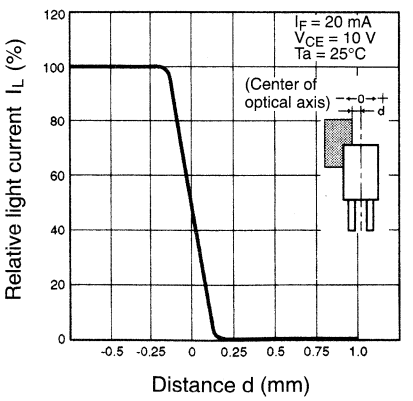
Dark Current vs. Ambient Temperature Characteristics (Typical)



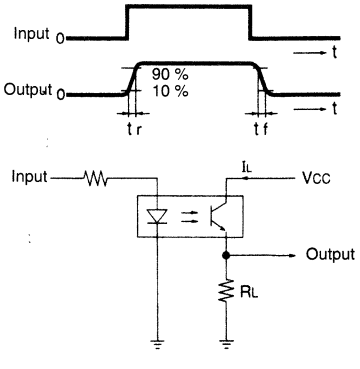
Response Time vs. Load Resistance Characteristics (Typical)



Sensing Position Characteristics (Typical)



Response Time Measurement Circuit



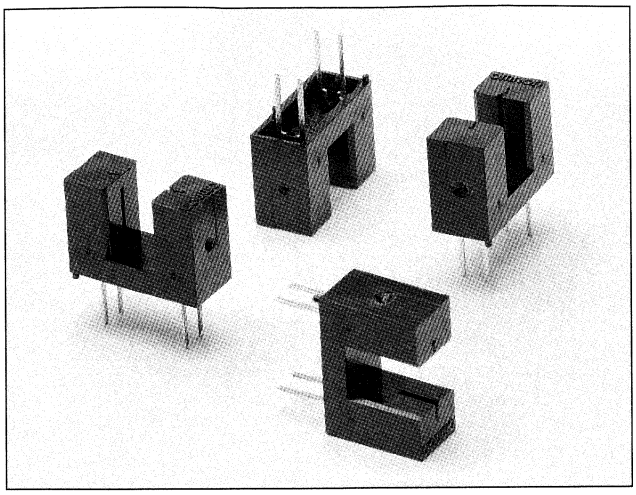
OMRON

Opto–Switch

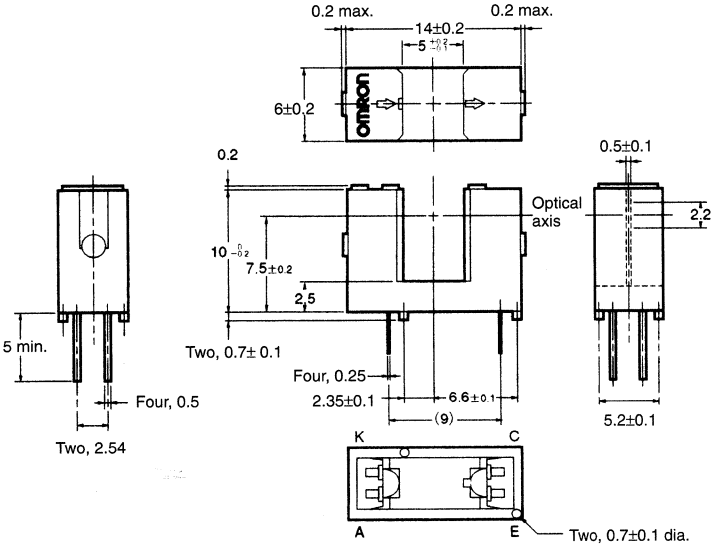
EE–SX1041

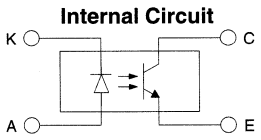
Transmissive

- Phototransistor output.
- Stable sensing at temperatures as high as 95°C.
- General-purpose model with a 5-mm-wide slot.
- PCB mounting type.
- High resolution with a 0.5-mm-wide aperture.



Dimensions





Terminal No.	Name
A	Anode
K	Cathode
C	Collector
E	Emitter

Unless otherwise specified, the tolerances are as shown below.

Dimensions	Tolerance
3 mm max.	±0.3
3 < mm ≤ 6	±0.375
6 < mm ≤ 10	±0.45
10 < mm ≤ 18	±0.55
18 < mm ≤ 30	±0.65

Specifications

■ Absolute Maximum Ratings (Ta = 25°C)

Item		Symbol	Rated value
Emitter	Forward current	I_F	50 mA (see note 1)
	Pulse forward current	I_{FP}	1 A (see note 2)
	Reverse voltage	V_R	4 V
Detector	Collector–Emitter voltage	V_{CEO}	30 V
	Emitter–Collector voltage	V_{ECO}	---
	Collector current	I_C	20 mA
	Collector dissipation	P_C	100 mW (see note 1)
Ambient temperature	Operating	Topr	–25°C to 95°C
	Storage	Tstg	–30°C to 100°C
	Soldering	Tsol	260°C

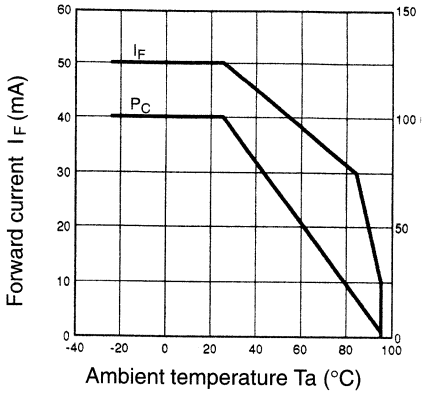
Note: 1.Refer to the temperature rating chart if the ambient temperature exceeds 25°C.
2.The pulse width is 10 μs maximum with a frequency of 100 Hz.

■ Electrical and Optical Characteristics (Ta = 25°C)

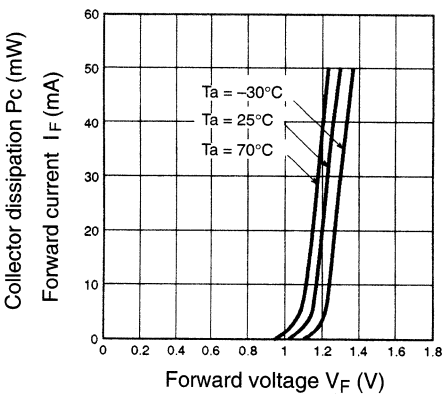
Item		Symbol	Value	Condition
Emitter	Forward voltage	V_F	1.2 V typ., 1.5 V max.	I_F = 30 mA
	Reverse current	I_R	0.01 μA typ., 10 μA max.	V_R = 4 V
	Peak emission wavelength	λ_P	940 nm typ.	I_F = 20 mA
Detector	Light current	I_L	0.5 mA min., 14 mA max.	I_F = 20 mA, V_{CE} = 10 V
	Dark current	I_D	2 nA typ., 200 nA max.	V_{CE} = 10 V, 0 ℓx
	Leakage current	I_{LEAK}	---	---
	Collector–Emitter saturated voltage	V_{CE} (sat)	0.1 V typ., 0.4 V max.	I_F = 20 mA, I_L = 0.1 mA
	Peak spectral sensitivity wavelength	λ_P	850 nm typ.	V_{CE} = 10 V
Rising time		tr	4 μs typ.	V_{CC} = 5 V, R_L = 100 Ω, I_L = 5 mA
Falling time		tf	4 μs typ.	V_{CC} = 5 V, R_L = 100 Ω, I_L = 5 mA

Engineering Data

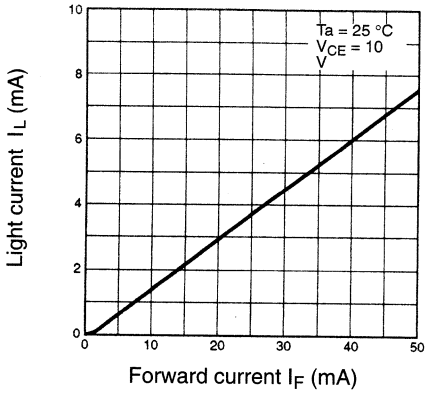
Forward Current vs. Collector Dissipation Temperature Rating



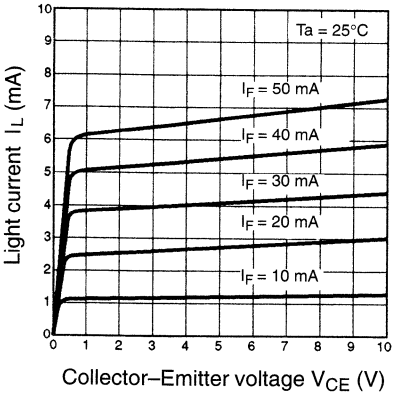
Forward Current vs. Forward Voltage Characteristics (Typical)



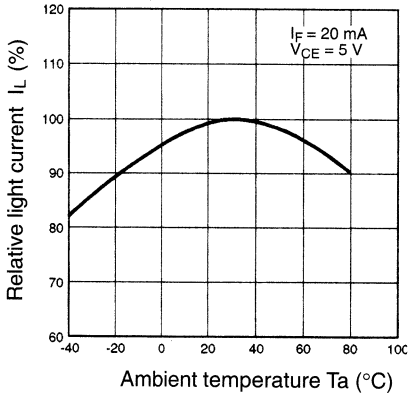
Light Current vs. Forward Current Characteristics (Typical)



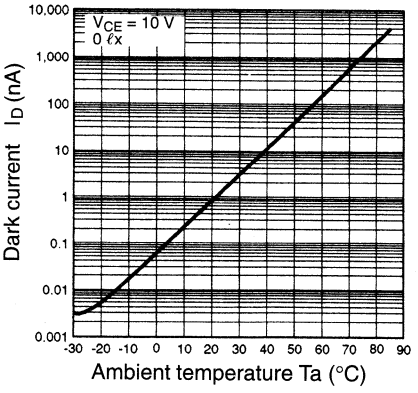
Light Current vs. Collector–Emitter Voltage Characteristics (Typical)



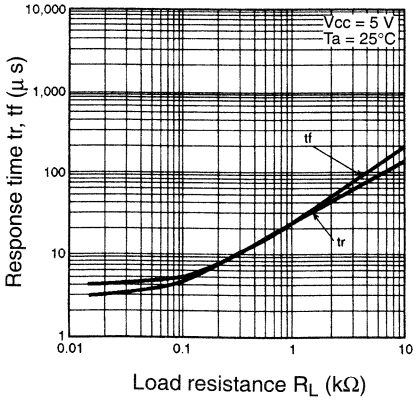
Relative Light Current vs. Ambient Temperature Characteristics (Typical)



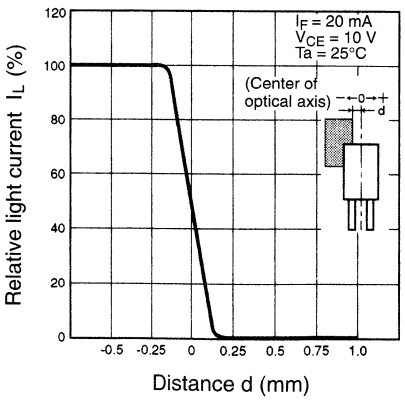
Dark Current vs. Ambient Temperature Characteristics (Typical)



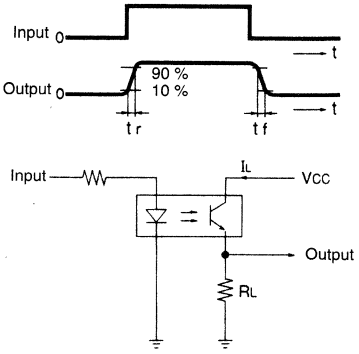
Response Time vs. Load Resistance Characteristics (Typical)



Sensing Position Characteristics (Typical)



Response Time Measurement Circuit



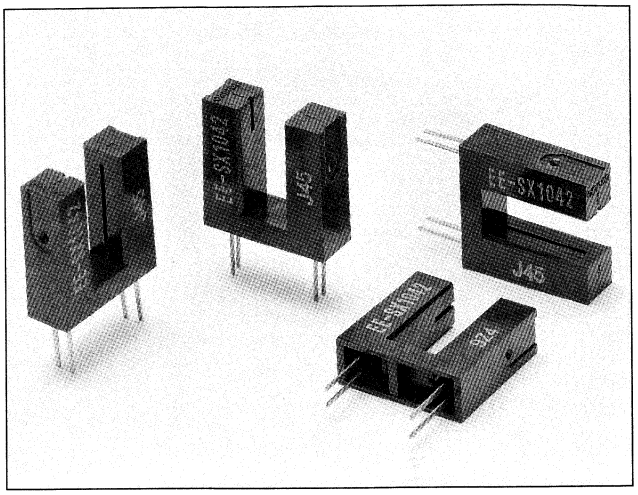
OMRON

Opto–Switch

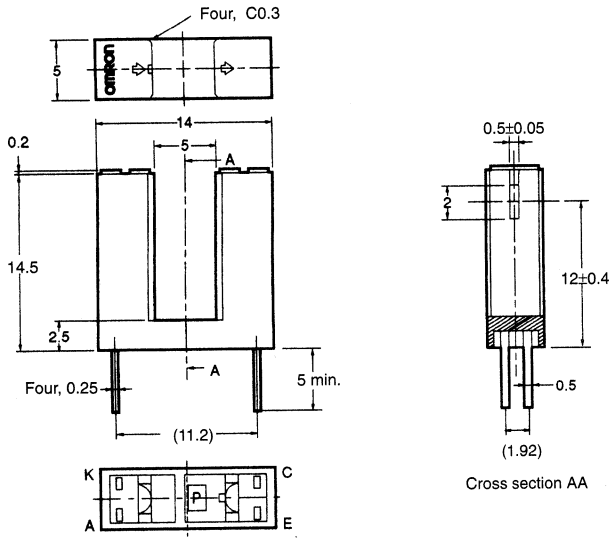
EE–SX1042

Transmissive

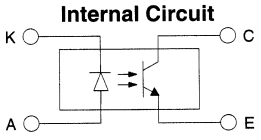
- Phototransistor output.
- 12mm deep and 5mm wide sensing slot.
- PCB mounting type.
- High resolution with a 0.5-mm-wide aperture.



Dimensions



Cross section AA



Terminal No.	Name
A	Anode
K	Cathode
C	Collector
E	Emitter

Unless otherwise specified, the tolerances are as shown below.

Dimensions	Tolerance
3 mm max.	±0.3
3 < mm ≤ 6	±0.375
6 < mm ≤ 10	±0.45
10 < mm ≤ 18	±0.55
18 < mm ≤ 30	±0.65

Specifications

■ Absolute Maximum Ratings (Ta = 25°C)

Item		Symbol	Rated value
Emitter	Forward current	I_F	50 mA (see note 1)
	Pulse forward current	I_{FP}	1 A (see note 2)
	Reverse voltage	V_R	4 V
Detector	Collector–Emitter voltage	V_{CEO}	30 V
	Emitter–Collector voltage	V_{ECO}	---
	Collector current	I_C	20 mA
	Collector dissipation	P_C	100 mW (see note 1)
Ambient temperature	Operating	Topr	–25°C to 85°C
	Storage	Tstg	–30°C to 100°C
	Soldering	Tsol	260°C

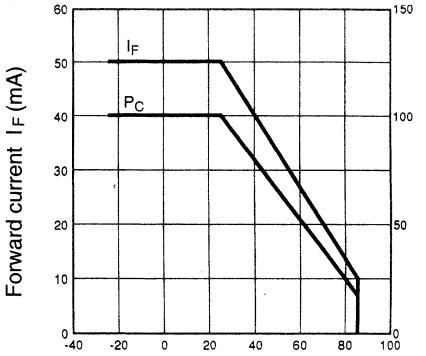
Note: 1. Refer to the temperature rating chart if the ambient temperature exceeds 25°C.
2. The pulse width is 10 μs maximum with a frequency of 100 Hz.

■ Electrical and Optical Characteristics (Ta = 25°C)

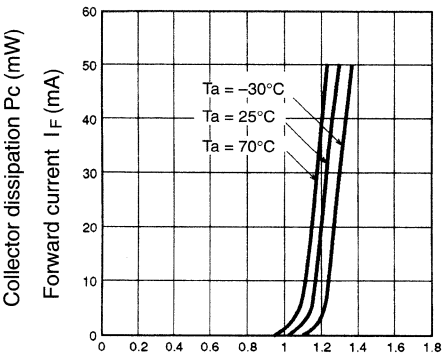
Item		Symbol	Value	Condition
Emitter	Forward voltage	V_F	1.2 V typ., 1.5 V max.	I_F = 30 mA
	Reverse current	I_R	0.01 μA typ., 10 μA max.	V_R = 4 V
	Peak emission wavelength	λ_P	940 nm typ.	I_F = 20 mA
Detector	Light current	I_L	0.5 mA min., 14 mA max.	I_F = 20 mA, V_{CE} = 10 V
	Dark current	I_D	2 nA typ., 200 nA max.	V_{CE} = 10 V, 0 ℓx
	Leakage current	I_{LEAK}	---	---
	Collector–Emitter saturated voltage	V_{CE} (sat)	0.1 V typ., 0.4 V max.	I_F = 20 mA, I_L = 0.1 mA
	Peak spectral sensitivity wavelength	λ_P	850 nm typ.	V_{CE} = 10 V
Rising time		tr	4 μs typ.	V_{CC} = 5 V, R_L = 100 Ω, I_L = 5 mA
Falling time		tf	4 μs typ.	V_{CC} = 5 V, R_L = 100 Ω, I_L = 5 mA

Engineering Data

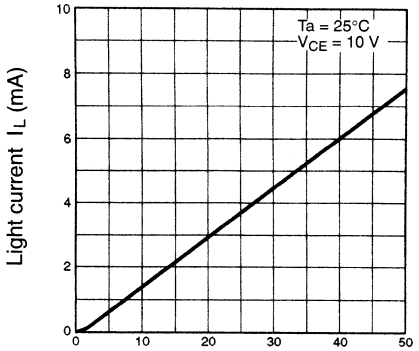
Forward Current vs. Collector Dissipation Temperature Rating



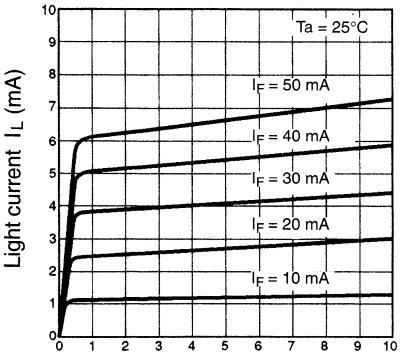
Forward Current vs. Forward Voltage Characteristics (Typical)



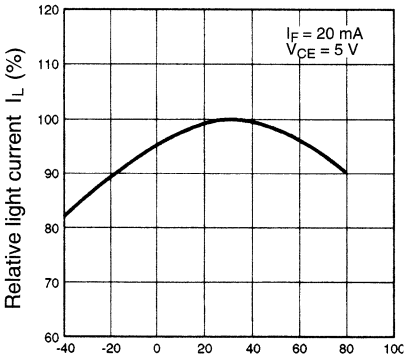
Light Current vs. Forward Current Characteristics (Typical)



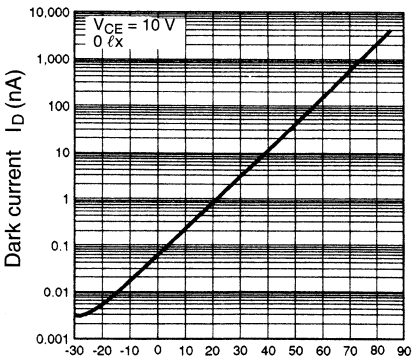
Light Current vs. Collector–Emitter Voltage Characteristics (Typical)



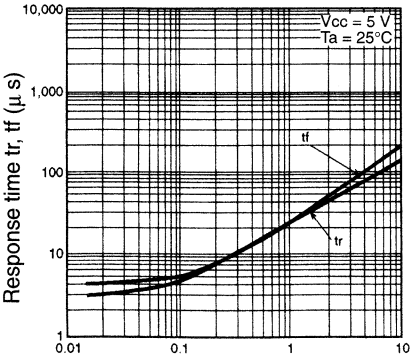
Relative Light Current vs. Ambient Temperature Characteristics (Typical)



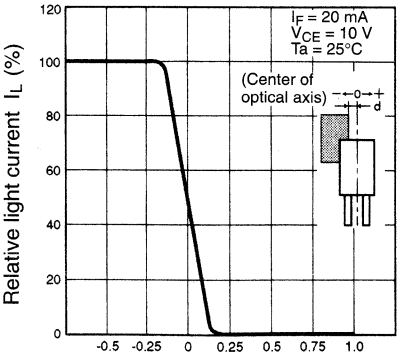
Dark Current vs. Ambient Temperature Characteristics (Typical)



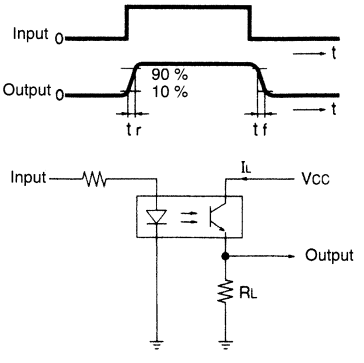
Response Time vs. Load Resistance Characteristics (Typical)



Sensing Position Characteristics (Typical)



Response Time Measurement Circuit



Opto-Switches

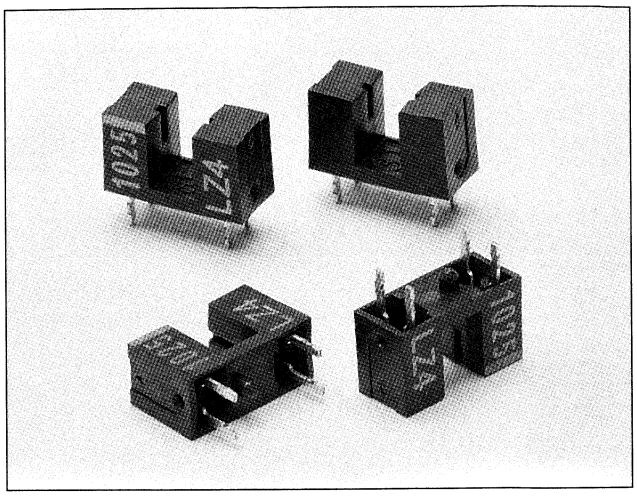
OMRON

Opto–Switch

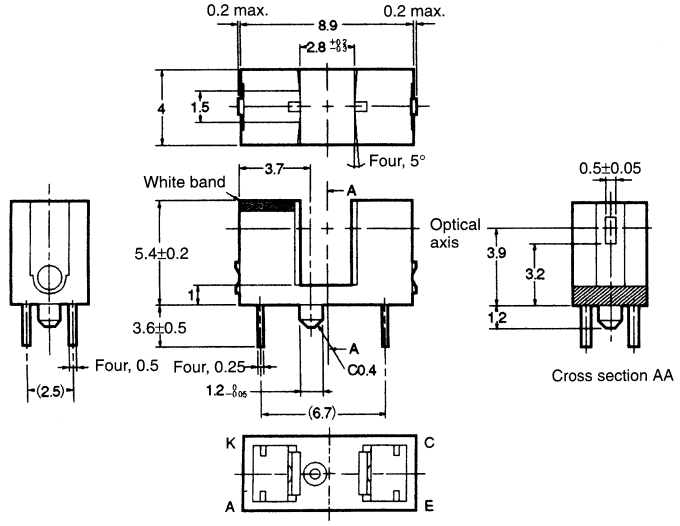
EE–SX1055

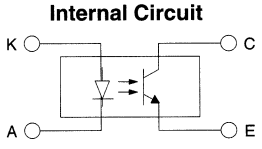
Transmissive

- Phototransistor output.
- Long lead version of EE–SX1025
- Longer leads allow the sensor to be mounted to a 1.6-mm thick board.
- 5.4-mm-tall compact model.
- PCB mounting type.
- High resolution with a 0.5-mm-wide aperture.



Dimensions





Terminal No.	Name
A	Anode
K	Cathode
C	Collector
E	Emitter

Unless otherwise specified, the tolerances are as shown below.

Dimensions	Tolerance
3 mm max.	±0.3
3 < mm ≤ 6	±0.375
6 < mm ≤ 10	±0.45
10 < mm ≤ 18	±0.55
18 < mm ≤ 30	±0.65
30 < mm ≤ 50	±0.8
50 < mm ≤ 80	±0.95
80 < mm ≤ 100	±1.1

Specifications

■ Absolute Maximum Ratings (Ta = 25°C)

Item		Symbol	Rated value
Emitter	Forward current	I_F	50 mA (see note 1)
	Pulse forward current	I_{FP}	1 A (see note 2)
	Reverse voltage	V_R	4 V
Detector	Collector–Emitter voltage	V_{CEO}	30 V
	Emitter–Collector voltage	V_{ECO}	---
	Collector current	I_C	20 mA
	Collector dissipation	P_C	100 mW (see note 1)
Ambient temperature	Operating	Topr	–25°C to 85°C
	Storage	Tstg	–30°C to 100°C
	Soldering	Tsol	260°C

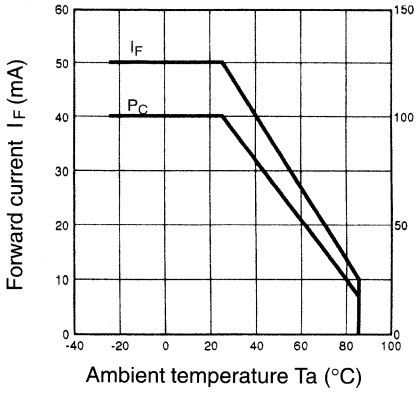
Note: 1. Refer to the temperature rating chart if the ambient temperature exceeds 25°C.
2. The pulse width is 10 μs maximum with a frequency of 100 Hz.

■ Electrical and Optical Characteristics (Ta = 25°C)

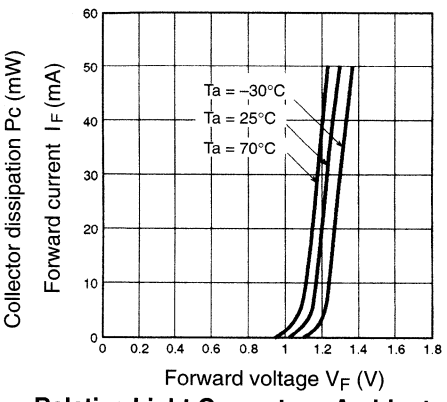
Item		Symbol	Value	Condition
Emitter	Forward voltage	V_F	1.2 V typ., 1.5 V max.	I_F = 30 mA
	Reverse current	I_R	0.01 μA typ., 10 μA max.	V_R = 4 V
	Peak emission wavelength	λ_P	940 nm typ.	I_F = 20 mA
Detector	Light current	I_L	0.5 mA min., 14 mA max.	I_F = 20 mA, V_{CE} = 10 V
	Dark current	I_D	2 nA typ., 200 nA max.	V_{CE} = 10 V, 0 ℓx
	Leakage current	I_{LEAK}	---	---
	Collector–Emitter saturated voltage	V_{CE} (sat)	0.1 V typ., 0.4 V max.	I_F = 20 mA, I_L = 0.1 mA
	Peak spectral sensitivity wavelength	λ_P	850 nm typ.	V_{CE} = 10 V
Rising time		tr	4 μs typ.	V_{CC} = 5 V, R_L = 100 Ω, I_L = 5 mA
Falling time		tf	4 μs typ.	V_{CC} = 5 V, R_L = 100 Ω, I_L = 5 mA

Engineering Data

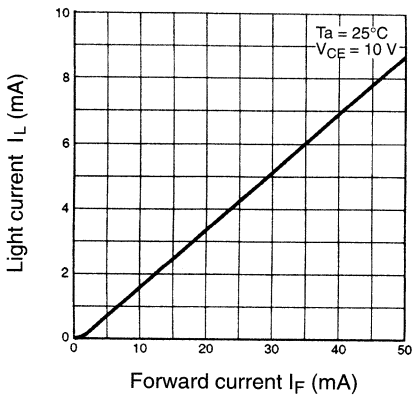
Forward Current vs. Collector Dissipation Temperature Rating



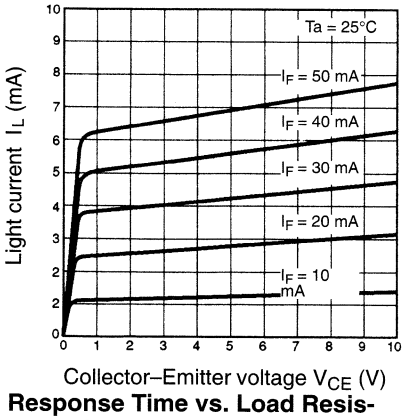
Forward Current vs. Forward Voltage Characteristics (Typical)



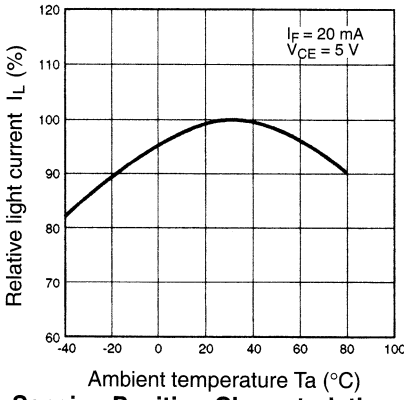
Light Current vs. Forward Current Characteristics (Typical)



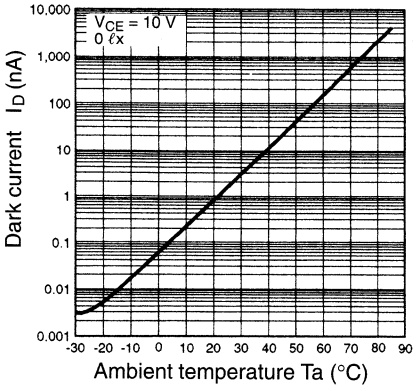
Light Current vs. Collector–Emitter Voltage Characteristics (Typical)



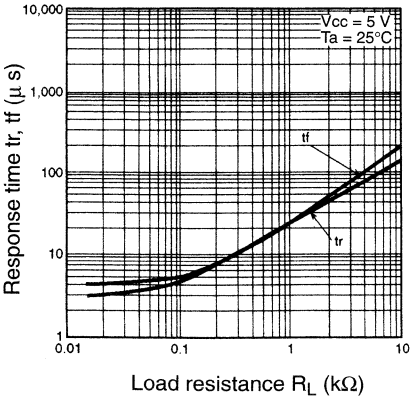
Relative Light Current vs. Ambient Temperature Characteristics (Typical)



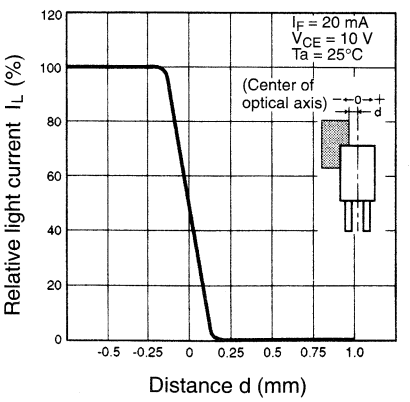
Dark Current vs. Ambient Temperature Characteristics (Typical)



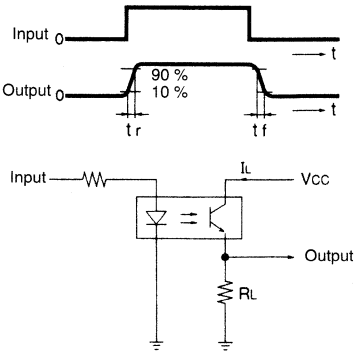
Response Time vs. Load Resistance Characteristics (Typical)



Sensing Position Characteristics (Typical)



Response Time Measurement Circuit



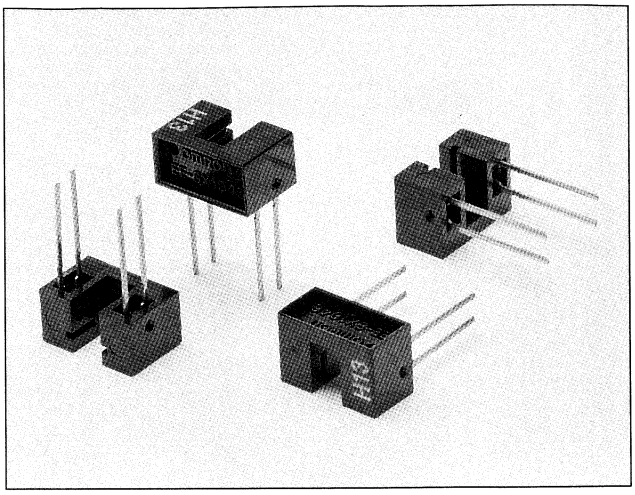
OMRON

Opto–Switch

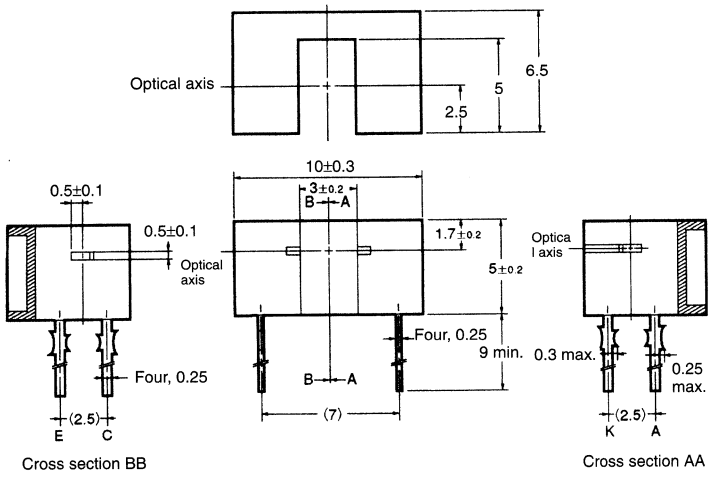
EE–SX1046

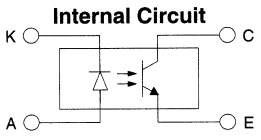
Transmissive

- Phototransistor output.
- Model incorporating vertical slot.
- PCB mounting type.
- High resolution model, detecting objects with 0.5mm (minimum) diameter.
- Low profile model at 5mm high.



Dimensions





Terminal No.	Name
A	Anode
K	Cathode
C	Collector
E	Emitter

Unless otherwise specified, the tolerances are as shown below.

Dimensions	Tolerance
3 mm max.	±0.3
3 < mm ≤ 6	±0.375
6 < mm ≤ 10	±0.45
10 < mm ≤ 18	±0.55
18 < mm ≤ 30	±0.65

Specifications

■ Absolute Maximum Ratings (Ta = 25°C)

Item		Symbol	Rated value
Emitter	Forward current	I_F	50 mA (see note 1)
	Pulse forward current	I_{FP}	1 A (see note 2)
	Reverse voltage	V_R	4 V
Detector	Collector–Emitter voltage	V_{CEO}	30 V
	Emitter–Collector voltage	V_{ECO}	---
	Collector current	I_C	20 mA
	Collector dissipation	P_C	100 mW (see note 1)
Ambient temperature	Operating	Topr	–25°C to 85°C
	Storage	Tstg	–30°C to 100°C
	Soldering	Tsol	260°C

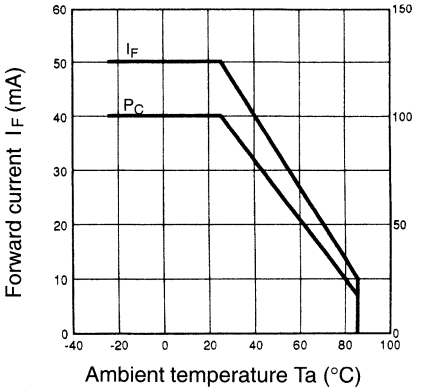
Note: 1. Refer to the temperature rating chart if the ambient temperature exceeds 25°C.
2. The pulse width is 10 μs maximum with a frequency of 100 Hz.

■ Electrical and Optical Characteristics (Ta = 25°C)

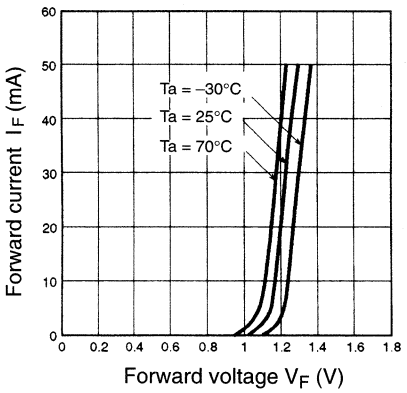
Item		Symbol	Value	Condition
Emitter	Forward voltage	V_F	1.2 V typ., 1.5 V max.	I_F = 30 mA
	Reverse current	I_R	0.01 μA typ., 10 μA max.	V_R = 4 V
	Peak emission wavelength	λ_P	920 nm typ.	I_F = 20 mA
Detector	Light current	I_L	1.2 mA min., 14 mA max.	I_F = 20 mA, V_{CE} = 5 V
	Dark current	I_D	2 nA typ., 200 nA max.	V_{CE} = 10 V, 0 ℓx
	Leakage current	I_{LEAK}	---	---
	Collector–Emitter saturated voltage	V_{CE} (sat)	0.1 V typ., 0.4 V max.	I_F = 20 mA, I_L = 0.1 mA
	Peak spectral sensitivity wavelength	λ_P	850 nm typ.	V_{CE} = 10 V
Rising time		tr	4 μs typ.	V_{CC} = 5 V, R_L = 100 Ω, I_L = 5 mA
Falling time		tf	4 μs typ.	V_{CC} = 5 V, R_L = 100 Ω, I_L = 5 mA

Engineering Data

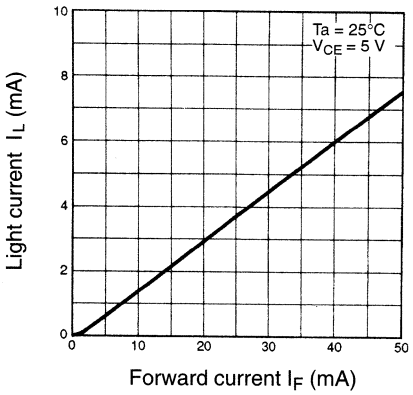
Forward Current vs. Collector Dissipation Temperature Rating



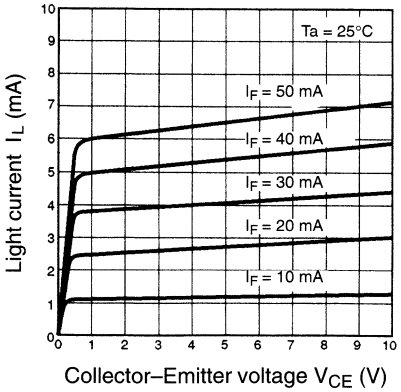
Forward Current vs. Forward Voltage Characteristics (Typical)



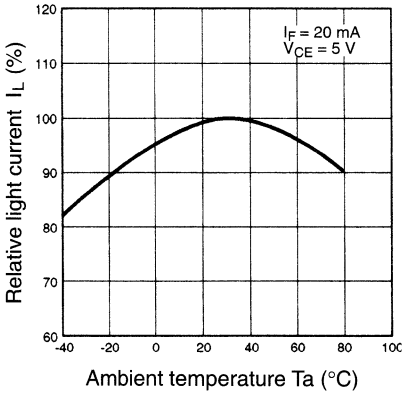
Light Current vs. Forward Current Characteristics (Typical)



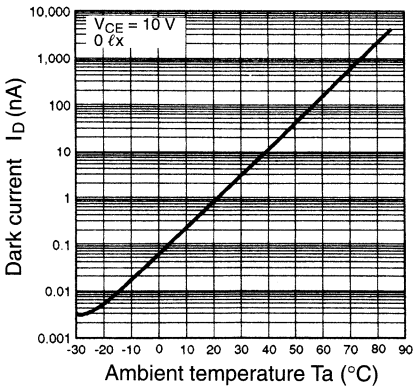
Light Current vs. Collector–Emitter Voltage Characteristics (Typical)



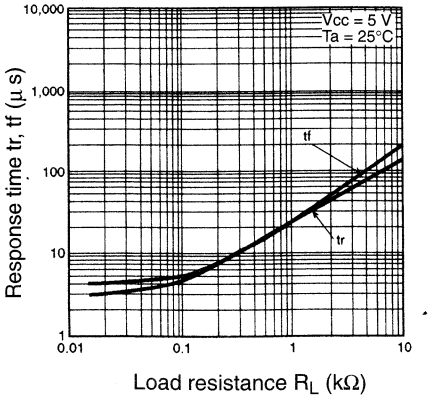
Relative Light Current vs. Ambient Temperature Characteristics (Typical)



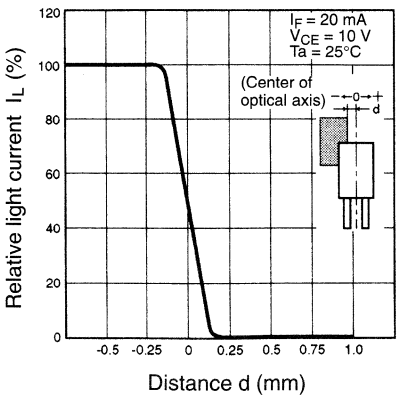
Dark Current vs. Ambient Temperature Characteristics (Typical)



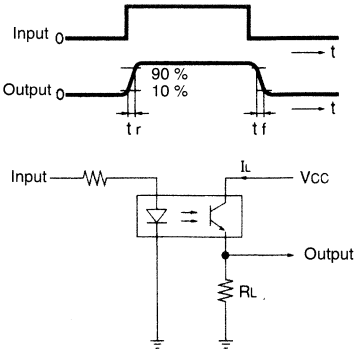
Response Time vs. Load Resistance Characteristics (Typical)



Sensing Position Characteristics (Typical)



Response Time Measurement Circuit



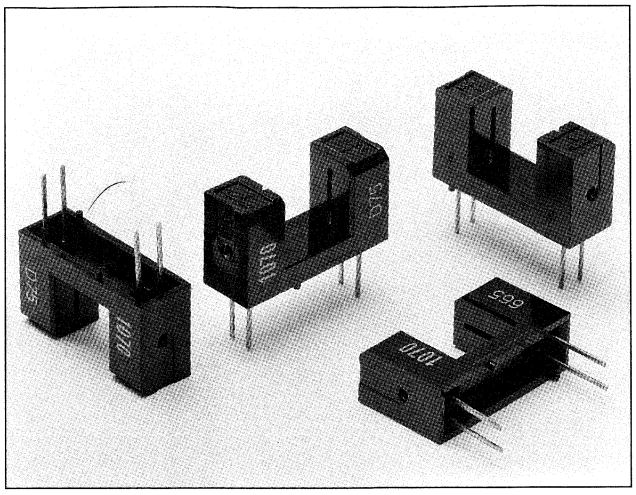
OMRON

Opto–Switch

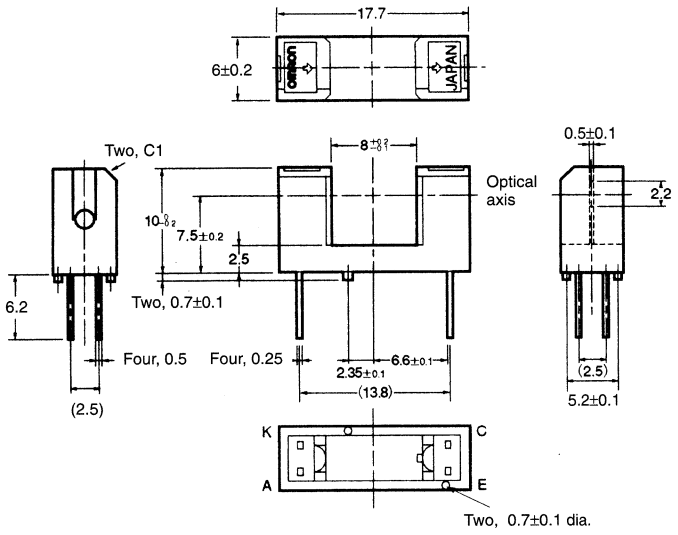
EE–SX1070

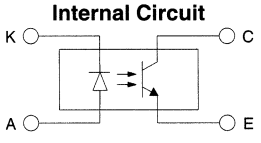
Transmissive

- Phototransistor output.
- Stable sensing at temperatures as high as 95°C
- Wide model with a 8-mm slot, allows sensing of wide objects.
- PCB mounting type.
- High resolution with a 0.5-mm-wide aperture.



Dimensions





Terminal No.	Name
A	Anode
K	Cathode
C	Collector
E	Emitter

Unless otherwise specified, the tolerances are as shown below.

Dimensions	Tolerance
3 mm max.	±0.3
3 < mm ≤ 6	±0.375
6 < mm ≤ 10	±0.45
10 < mm ≤ 18	±0.55
18 < mm ≤ 30	±0.65

Specifications

■ Absolute Maximum Ratings (Ta = 25°C)

Item		Symbol	Rated value
Emitter	Forward current	I_F	50 mA (see note 1)
	Pulse forward current	I_{FP}	1 A (see note 2)
	Reverse voltage	V_R	4 V
Detector	Collector–Emitter voltage	V_{CEO}	30 V
	Emitter–Collector voltage	V_{ECO}	---
	Collector current	I_C	20 mA
	Collector dissipation	P_C	100 mW (see note 1)
Ambient temperature	Operating	Topr	–25°C to 95°C
	Storage	Tstg	–30°C to 100°C
	Soldering	Tsol	260°C

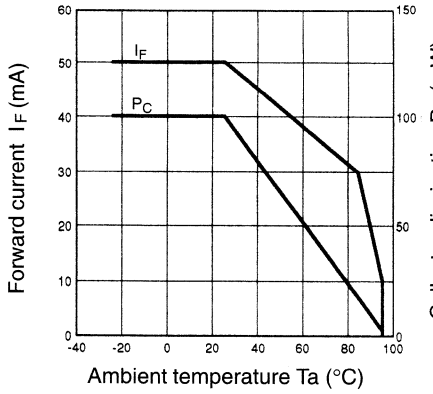
Note: 1. Refer to the temperature rating chart if the ambient temperature exceeds 25°C.
2. The pulse width is 10 μs maximum with a frequency of 100 Hz.

■ Electrical and Optical Characteristics (Ta = 25°C)

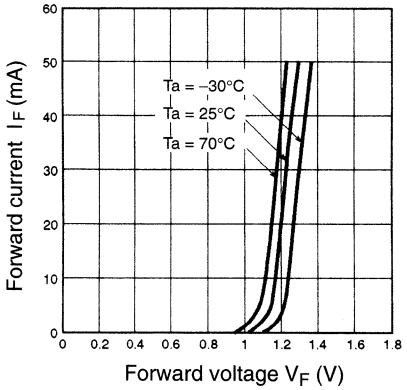
Item		Symbol	Value	Condition
Emitter	Forward voltage	V_F	1.2 V typ., 1.5 V max.	I_F = 30 mA
	Reverse current	I_R	0.01 μA typ., 10 μA max.	V_R = 4 V
	Peak emission wavelength	λ_P	940 nm typ.	I_F = 20 mA
Detector	Light current	I_L	0.5 mA min., 14 mA max.	I_F = 20 mA, V_{CE} = 10 V
	Dark current	I_D	2 nA typ., 200 nA max.	V_{CE} = 10 V, 0 ℓx
	Leakage current	I_{LEAK}	---	---
	Collector–Emitter saturated voltage	V_{CE} (sat)	0.1 V typ., 0.4 V max.	I_F = 20 mA, I_L = 0.1 mA
	Peak spectral sensitivity wavelength	λ_P	850 nm typ.	V_{CE} = 10 V
Rising time		tr	4 μs typ.	V_{CC} = 5 V, R_L = 100 Ω, I_L = 5 mA
Falling time		tf	4 μs typ.	V_{CC} = 5 V, R_L = 100 Ω, I_L = 5 mA

Engineering Data

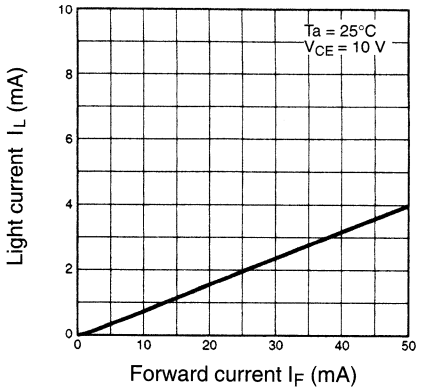
Forward Current vs. Collector Dissipation Temperature Rating



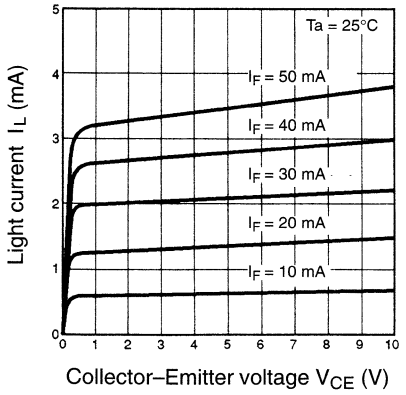
Forward Current vs. Forward Voltage Characteristics (Typical)



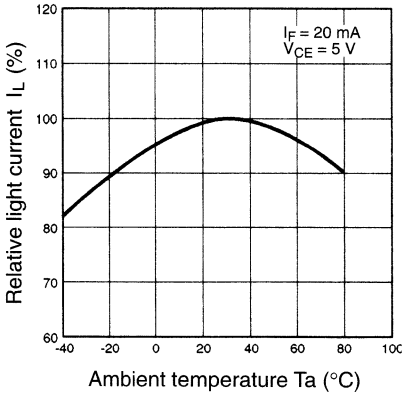
Light Current vs. Forward Current Characteristics (Typical)



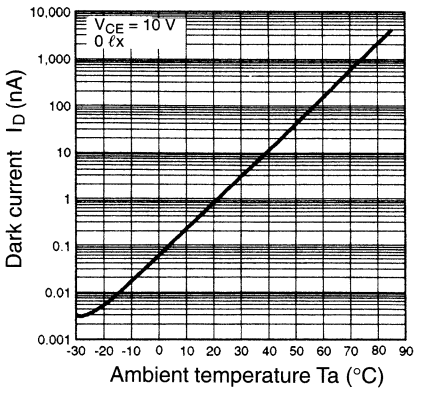
Light Current vs. Collector–Emitter Voltage Characteristics (Typical)



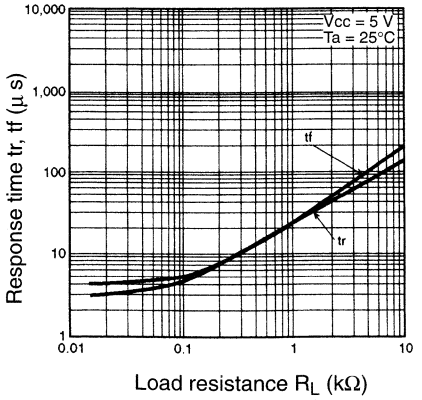
Relative Light Current vs. Ambient Temperature Characteristics (Typical)



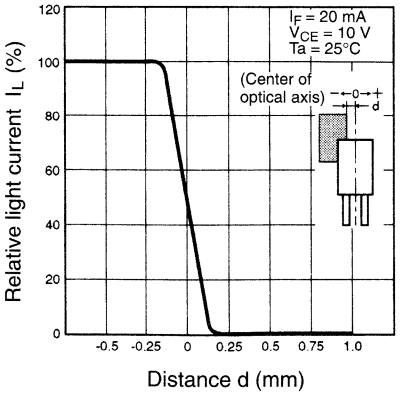
Dark Current vs. Ambient Temperature Characteristics (Typical)



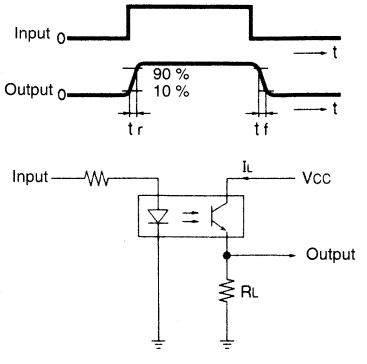
Response Time vs. Load Resistance Characteristics (Typical)



Sensing Position Characteristics (Typical)



Response Time Measurement Circuit



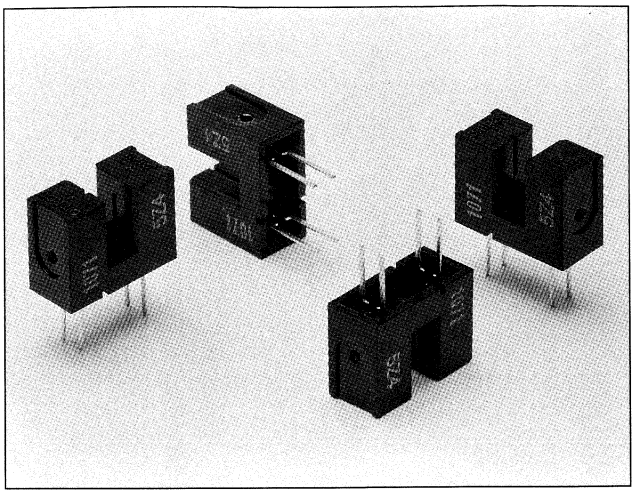
OMRON

Opto–Switch

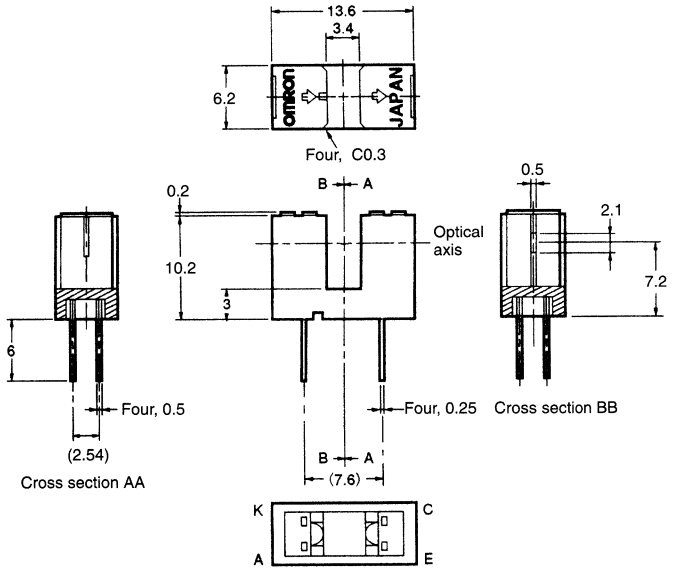
EE–SX1071

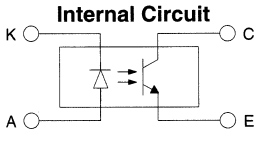
Transmissive

- Phototransistor output.
- General-purpose model with a 3.4-mm-wide slot.
- PCB mounting type.
- High resolution with a 0.5-mm-wide aperture.



Dimensions





Terminal No.	Name
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K	Cathode
C	Collector
E	Emitter

Unless otherwise specified, the tolerances are as shown below.

Dimensions	Tolerance
3 mm max.	±0.3
3 < mm ≤ 6	±0.375
6 < mm ≤ 10	±0.45
10 < mm ≤ 18	±0.55
18 < mm ≤ 30	±0.65

Specifications

■ Absolute Maximum Ratings (Ta = 25°C)

Item		Symbol	Rated value
Emitter	Forward current	I_F	50 mA (see note 1)
	Pulse forward current	I_{FP}	1 A (see note 2)
	Reverse voltage	V_R	4 V
Detector	Collector–Emitter voltage	V_{CEO}	30 V
	Emitter–Collector voltage	V_{ECO}	---
	Collector current	I_C	20 mA
	Collector dissipation	P_C	100 mW (see note 1)
Ambient temperature	Operating	Topr	–25°C to 85°C
	Storage	Tstg	–30°C to 100°C
	Soldering	Tsol	260°C

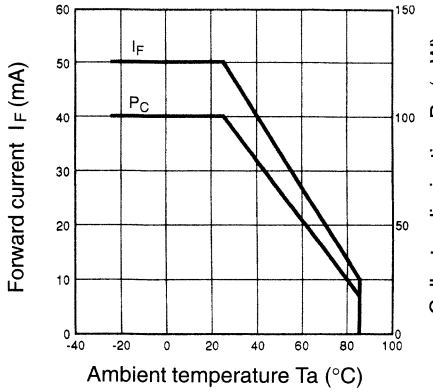
Note: 1. Refer to the temperature rating chart if the ambient temperature exceeds 25°C.
2. The pulse width is 10 μs maximum with a frequency of 100 Hz.

■ Electrical and Optical Characteristics (Ta = 25°C)

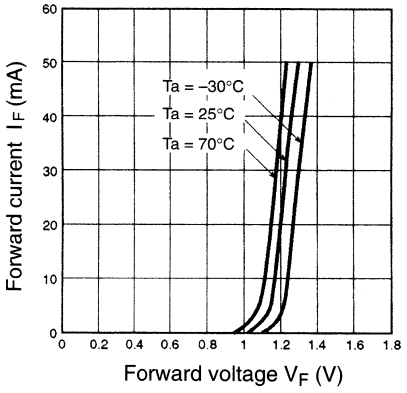
Item		Symbol	Value	Condition
Emitter	Forward voltage	V_F	1.2 V typ., 1.5 V max.	I_F = 30 mA
	Reverse current	I_R	0.01 μA typ., 10 μA max.	V_R = 4 V
	Peak emission wavelength	λ_P	940 nm typ.	I_F = 20 mA
Detector	Light current	I_L	0.5 mA min., 14 mA max.	I_F = 20 mA, V_{CE} = 10 V
	Dark current	I_D	2 nA typ., 200 nA max.	V_{CE} = 10 V, 0 ℓx
	Leakage current	I_{LEAK}	---	---
	Collector–Emitter saturated voltage	V_{CE} (sat)	0.1 V typ., 0.4 V max.	I_F = 20 mA, I_L = 0.1 mA
	Peak spectral sensitivity wavelength	λ_P	850 nm typ.	V_{CE} = 10 V
Rising time		tr	4 μs typ.	V_{CC} = 5 V, R_L = 100 Ω, I_L = 5 mA
Falling time		tf	4 μs typ.	V_{CC} = 5 V, R_L = 100 Ω, I_L = 5 mA

Engineering Data

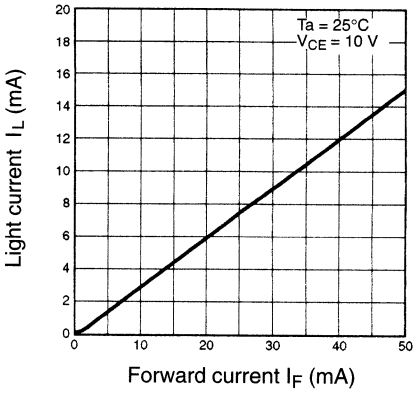
Forward Current vs. Collector Dissipation Temperature Rating



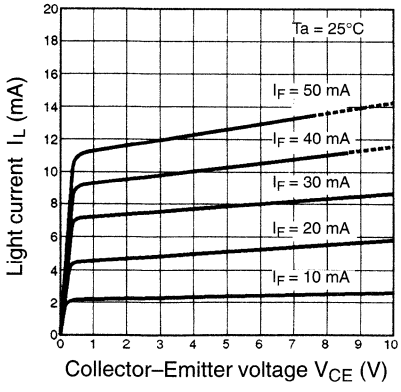
Forward Current vs. Forward Voltage Characteristics (Typical)



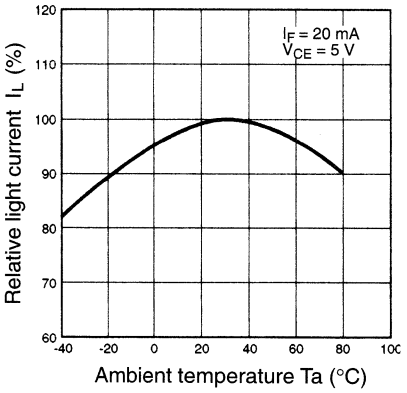
Light Current vs. Forward Current Characteristics (Typical)



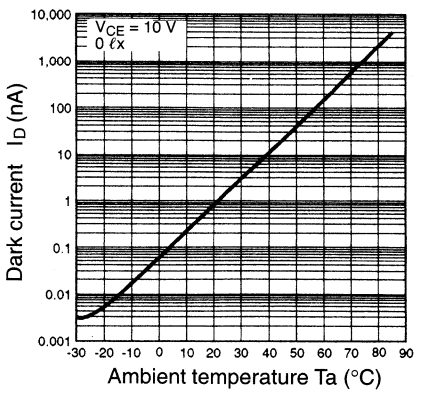
Light Current vs. Collector–Emitter Voltage Characteristics (Typical)



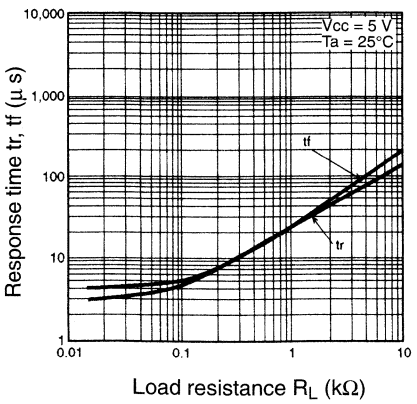
Relative Light Current vs. Ambient Temperature Characteristics (Typical)



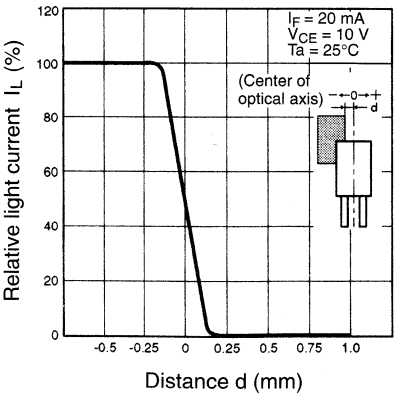
Dark Current vs. Ambient Temperature Characteristics (Typical)



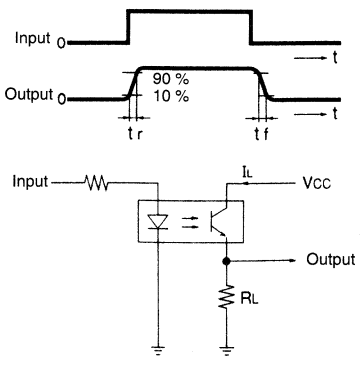
Response Time vs. Load Resistance Characteristics (Typical)



Sensing Position Characteristics (Typical)



Response Time Measurement Circuit



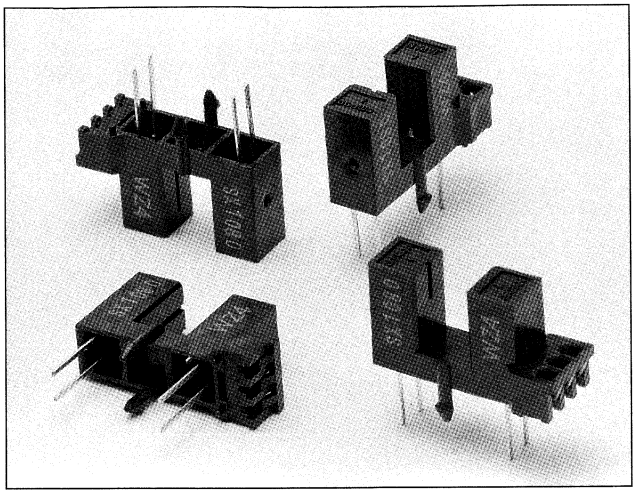
OMRON

Opto–Switch

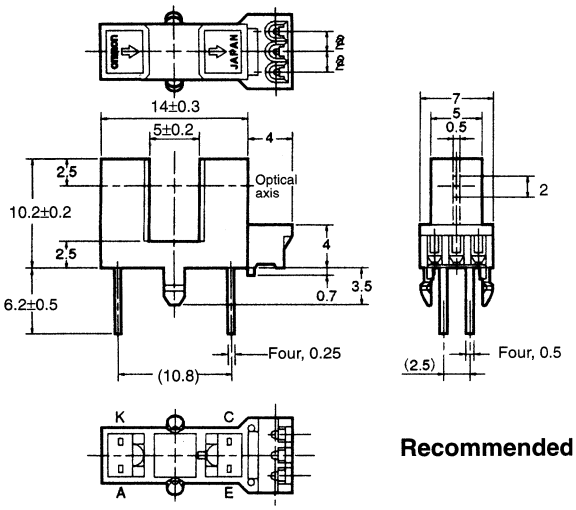
EE–SX1080

Transmissive

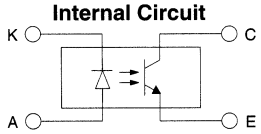
- Phototransistor output.
- General-purpose model with a 5-mm-wide slot.
- Location spigots allow firm fixing to PCB.
- Incorporates lead wire holders.
- High resolution with a 0.5mm aperture.



Dimensions



Internal Circuit

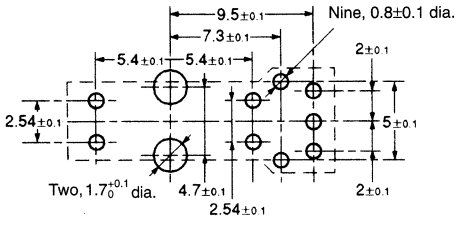


Terminal No.	Name
A	Anode
K	Cathode
C	Collector
E	Emitter

Unless otherwise specified, the tolerances are as shown below.

Dimensions	Tolerance
3 mm max.	±0.3
3 < mm ≤ 6	±0.375
6 < mm ≤ 10	±0.45
10 < mm ≤ 18	±0.55
18 < mm ≤ 30	±0.65

Recommended Mounting Holes



PCB thickness t = 1.6 mm

Specifications

■ Absolute Maximum Ratings (Ta = 25°C)

Item		Symbol	Rated value
Emitter	Forward current	I_F	50 mA (see note 1)
	Pulse forward current	I_{FP}	1 A (see note 2)
	Reverse voltage	V_R	4 V
Detector	Collector–Emitter voltage	V_{CEO}	30 V
	Emitter–Collector voltage	V_{ECO}	---
	Collector current	I_C	20 mA
	Collector dissipation	P_C	100 mW (see note 1)
Ambient temperature	Operating	Topr	–25°C to 85°C
	Storage	Tstg	–30°C to 100°C
	Soldering	Tsol	260°C

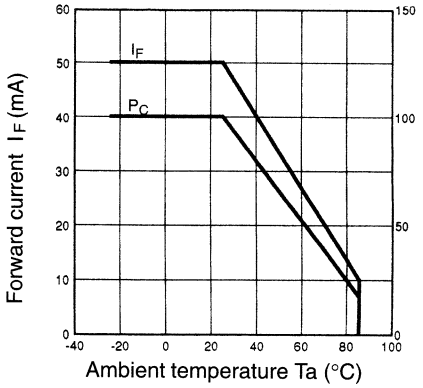
Note: 1. Refer to the temperature rating chart if the ambient temperature exceeds 25°C.
2. The pulse width is 10 μs maximum with a frequency of 100 Hz.

■ Electrical and Optical Characteristics (Ta = 25°C)

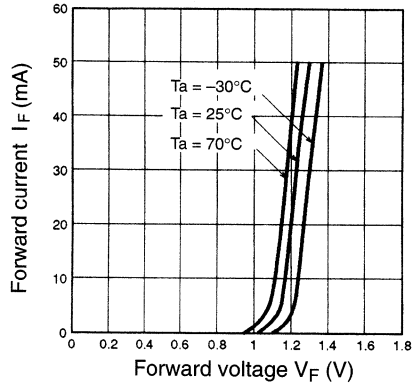
Item		Symbol	Value	Condition
Emitter	Forward voltage	V_F	1.2 V typ., 1.5 V max.	I_F = 30 mA
	Reverse current	I_R	0.01 μA typ., 10 μA max.	V_R = 4 V
	Peak emission wavelength	λ_P	940 nm typ.	I_F = 20 mA
Detector	Light current	I_L	0.5 mA min., 14 mA max.	I_F = 20 mA, V_{CE} = 10 V
	Dark current	I_D	2 nA typ., 200 nA max.	V_{CE} = 10 V, 0 ℓx
	Leakage current	I_{LEAK}	---	---
	Collector–Emitter saturated voltage	V_{CE} (sat)	0.1 V typ., 0.4 V max.	I_F = 20 mA, I_L = 0.1 mA
	Peak spectral sensitivity wavelength	λ_P	850 nm typ.	V_{CE} = 10 V
Rising time		tr	4 μs typ.	V_{CC} = 5 V, R_L = 100 Ω, I_L = 5 mA
Falling time		tf	4 μs typ.	V_{CC} = 5 V, R_L = 100 Ω, I_L = 5 mA

Engineering Data

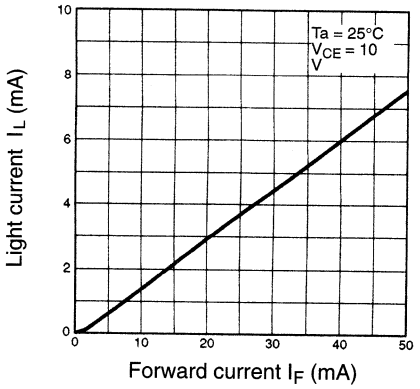
Forward Current vs. Collector Dissipation Temperature Rating



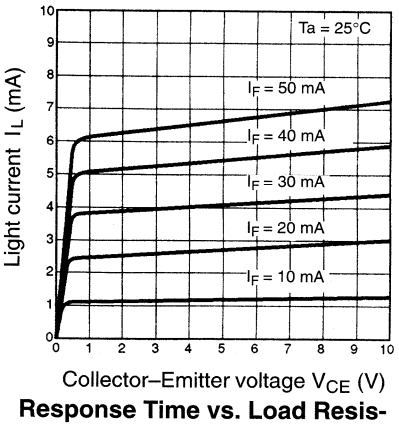
Forward Current vs. Forward Voltage Characteristics (Typical)



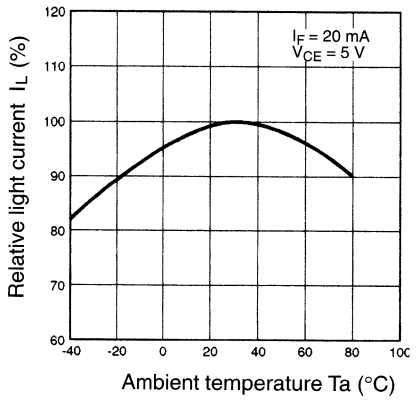
Light Current vs. Forward Current Characteristics (Typical)



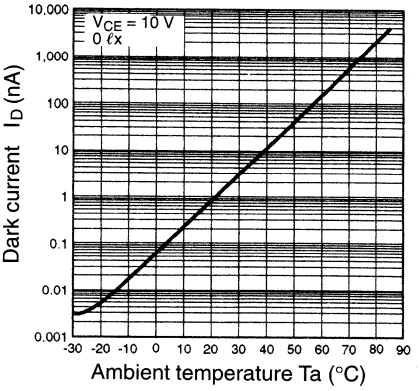
Light Current vs. Collector–Emitter Voltage Characteristics (Typical)



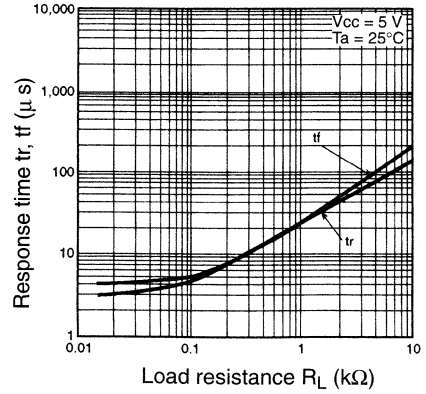
Relative Light Current vs. Ambient Temperature Characteristics (Typical)



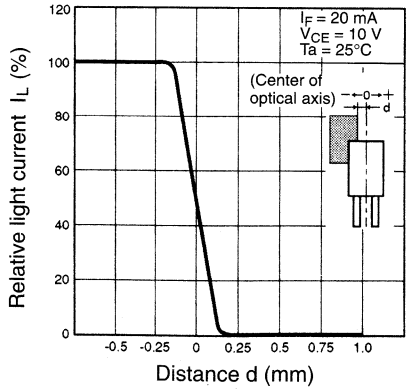
Dark Current vs. Ambient Temperature Characteristics (Typical)



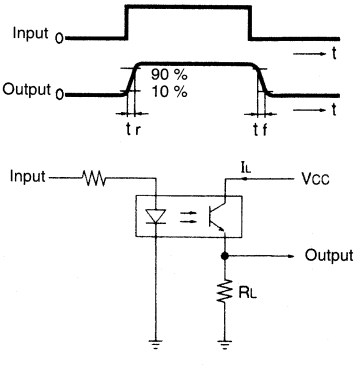
Response Time vs. Load Resistance Characteristics (Typical)



Sensing Position Characteristics (Typical)



Response Time Measurement Circuit



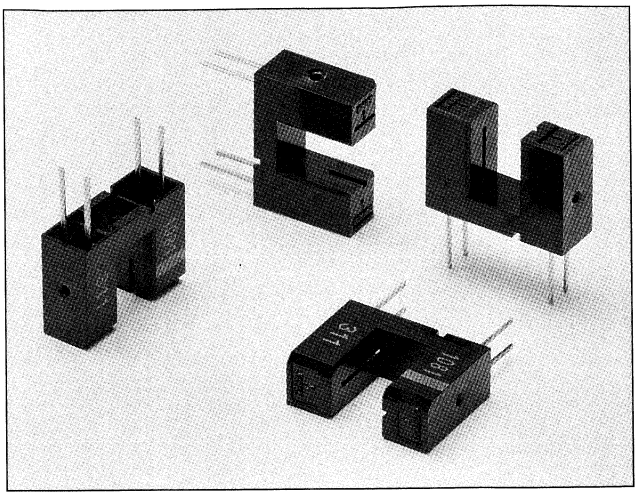
OMRON

Opto–Switch

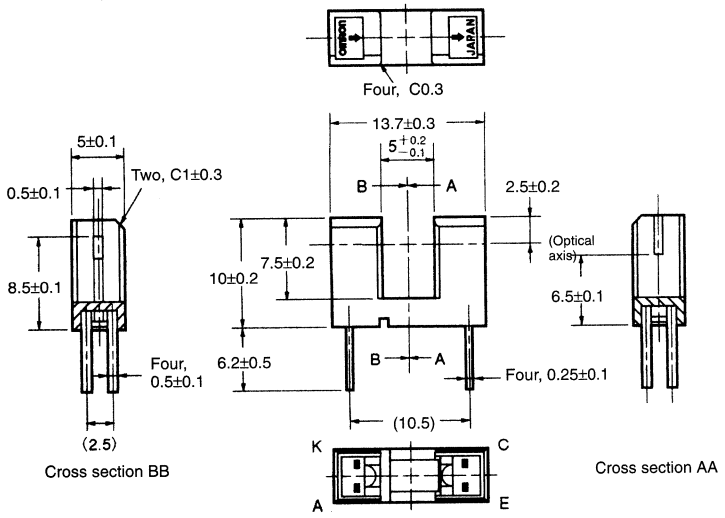
EE–SX1081

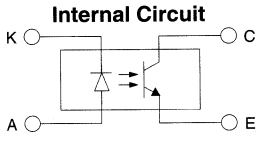
Transmissive

- Phototransistor output.
- General-purpose model with a 5-mm-wide slot.
- PCB mounting type.
- High resolution with a 0.5-mm-wide aperture.



Dimensions





Terminal No.	Name
A	Anode
K	Cathode
C	Collector
E	Emitter

Unless otherwise specified, the tolerances are as shown below.

Dimensions	Tolerance
3 mm max.	±0.3
3 < mm ≤ 6	±0.375
6 < mm ≤ 10	±0.45
10 < mm ≤ 18	±0.55
18 < mm ≤ 30	±0.65

Specifications

■ Absolute Maximum Ratings (Ta = 25°C)

Item		Symbol	Rated value
Emitter	Forward current	I_F	50 mA (see note 1)
	Pulse forward current	I_{FP}	1 A (see note 2)
	Reverse voltage	V_R	4 V
Detector	Collector–Emitter voltage	V_{CEO}	30 V
	Emitter–Collector voltage	V_{ECO}	---
	Collector current	I_C	20 mA
	Collector dissipation	P_C	100 mW (see note 1)
Ambient temperature	Operating	Topr	–25°C to 85°C
	Storage	Tstg	–30°C to 100°C
	Soldering	Tsol	260°C

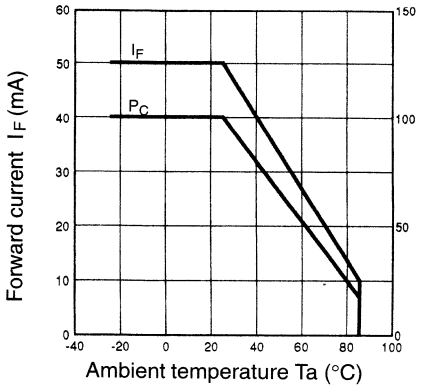
Note: 1. Refer to the temperature rating chart if the ambient temperature exceeds 25°C.
2. The pulse width is 10 μs maximum with a frequency of 100 Hz.

■ Electrical and Optical Characteristics (Ta = 25°C)

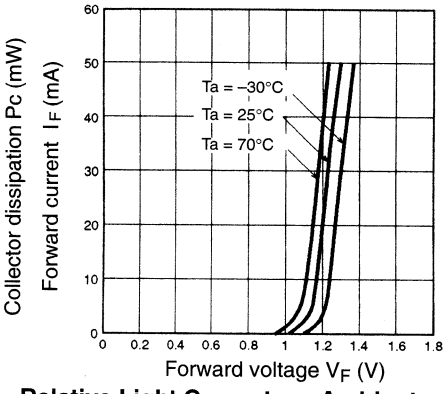
Item		Symbol	Value	Condition
Emitter	Forward voltage	V_F	1.2 V typ., 1.5 V max.	I_F = 30 mA
	Reverse current	I_R	0.01 μA typ., 10 μA max.	V_R = 4 V
	Peak emission wavelength	λ_P	940 nm typ.	I_F = 20 mA
Detector	Light current	I_L	0.5 mA min., 14 mA max.	I_F = 20 mA, V_{CE} = 10 V
	Dark current	I_D	2 nA typ., 200 nA max.	V_{CE} = 10 V, 0 ℓx
	Leakage current	I_{LEAK}	---	---
	Collector–Emitter saturated voltage	V_{CE} (sat)	0.1 V typ., 0.4 V max.	I_F = 20 mA, I_L = 0.1 mA
	Peak spectral sensitivity wavelength	λ_P	850 nm typ.	V_{CE} = 10 V
Rising time		tr	4 μs typ.	V_{CC} = 5 V, R_L = 100 Ω, I_L = 5 mA
Falling time		tf	4 μs typ.	V_{CC} = 5 V, R_L = 100 Ω, I_L = 5 mA

Engineering Data

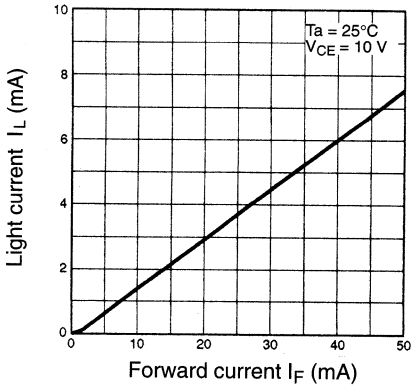
Forward Current vs. Collector Dissipation Temperature Rating



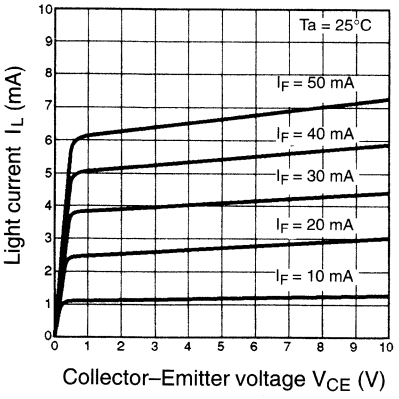
Forward Current vs. Forward Voltage Characteristics (Typical)



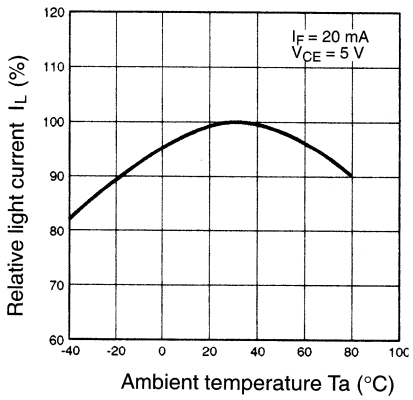
Light Current vs. Forward Current Characteristics (Typical)



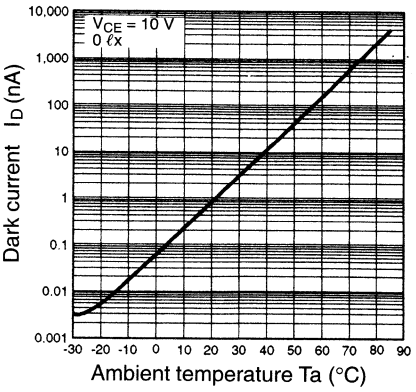
Light Current vs. Collector–Emitter Voltage Characteristics (Typical)



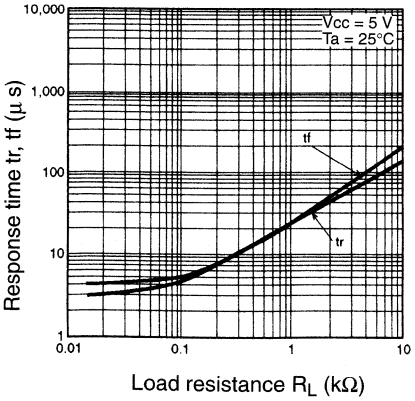
Relative Light Current vs. Ambient Temperature Characteristics (Typical)



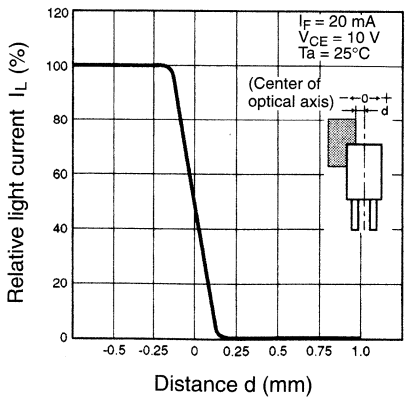
Dark Current vs. Ambient Temperature Characteristics (Typical)



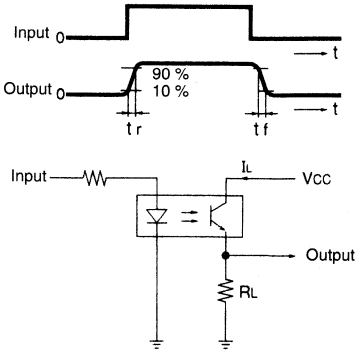
Response Time vs. Load Resistance Characteristics (Typical)



Sensing Position Characteristics (Typical)



Response Time Measurement Circuit



Opto-Switches

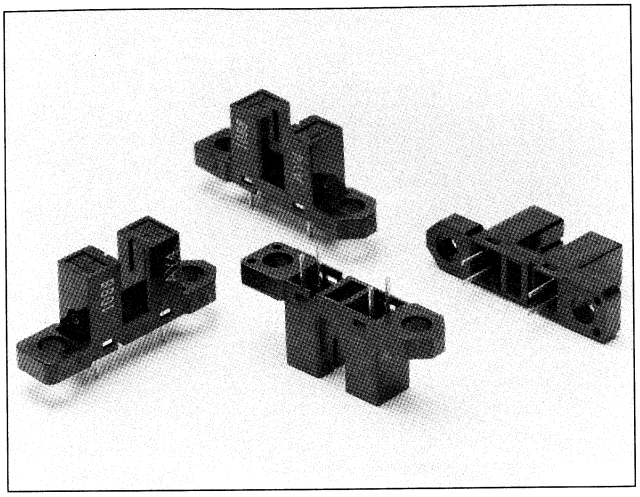
OMRON

Opto–Switch

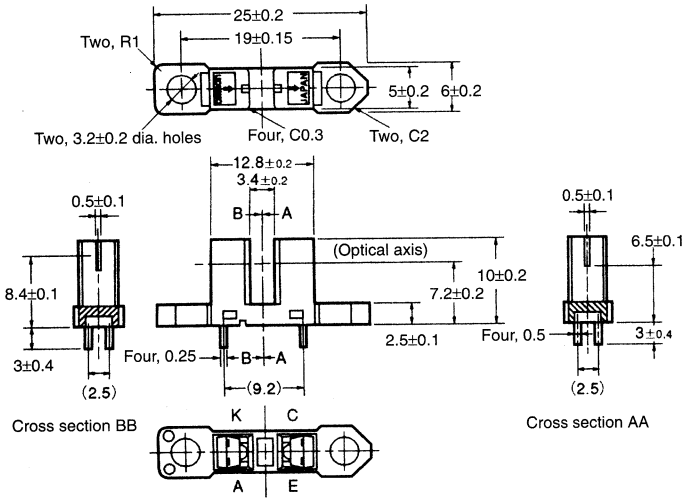
EE–SX1088

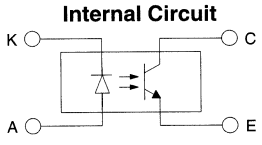
Transmissive

- Phototransistor output.
- General-purpose model with a 3.4-mm-wide slot.
- Mounts to PCBs or connectors.
- High resolution with a 0.5-mm-wide aperture.
- OMRON's XK8-series Connectors can be connected without soldering. Contact OMRON for information on obtaining XK8-series Connectors.



Dimensions





Terminal No.	Name
A	Anode
K	Cathode
C	Collector
E	Emitter

Unless otherwise specified, the tolerances are as shown below.

Dimensions	Tolerance
3 mm max.	±0.3
3 < mm ≤ 6	±0.375
6 < mm ≤ 10	±0.45
10 < mm ≤ 18	±0.55
18 < mm ≤ 30	±0.65

Specifications

■Absolute Maximum Ratings (Ta = 25°C)

Item		Symbol	Rated value
Emitter	Forward current	I_F	50 mA (see note 1)
	Pulse forward current	I_{FP}	1 A (see note 2)
	Reverse voltage	V_R	4 V
Detector	Collector–Emitter voltage	V_{CEO}	30 V
	Emitter–Collector voltage	V_{ECO}	---
	Collector current	I_C	20 mA
	Collector dissipation	P_C	100 mW (see note 1)
Ambient temperature	Operating	Topr	–25°C to 85°C
	Storage	Tstg	–30°C to 100°C
	Soldering	Tsol	260°C

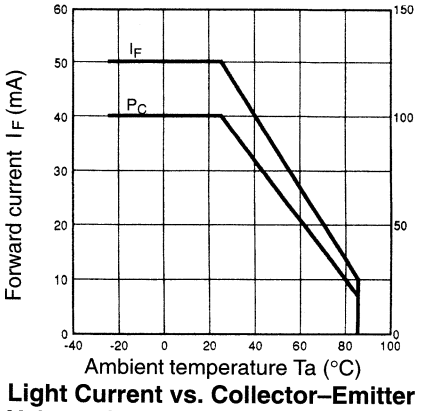
Note: 1. Refer to the temperature rating chart if the ambient temperature exceeds 25°C.
2. The pulse width is 10 μs maximum with a frequency of 100 Hz.

■ Electrical and Optical Characteristics (Ta = 25°C)

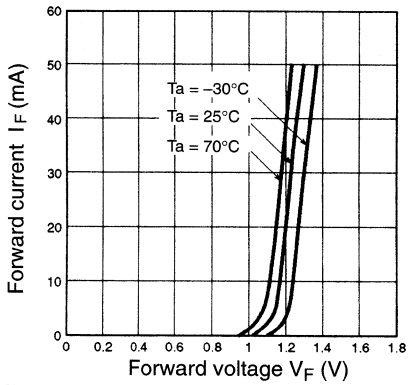
Item		Symbol	Value	Condition
Emitter	Forward voltage	V_F	1.2 V typ., 1.5 V max.	I_F = 30 mA
	Reverse current	I_R	0.01 μA typ., 10 μA max.	V_R = 4 V
	Peak emission wavelength	λ_P	940 nm typ.	I_F = 20 mA
Detector	Light current	I_L	0.5 mA min., 14 mA max.	I_F = 20 mA, V_{CE} = 10 V
	Dark current	I_D	2 nA typ., 200 nA max.	V_{CE} = 10 V, 0 ℓx
	Leakage current	I_{LEAK}	---	---
	Collector–Emitter saturated voltage	V_{CE} (sat)	0.15 V typ., 0.4 V max.	I_F = 20 mA, I_L = 0.1 mA
	Peak spectral sensitivity wavelength	λ_P	850 nm typ.	V_{CE} = 10 V
Rising time		tr	4 μs typ.	V_{CC} = 5 V, R_L = 100 Ω, I_L = 5 mA
Falling time		tf	4 μs typ.	V_{CC} = 5 V, R_L = 100 Ω, I_L = 5 mA

Engineering Data

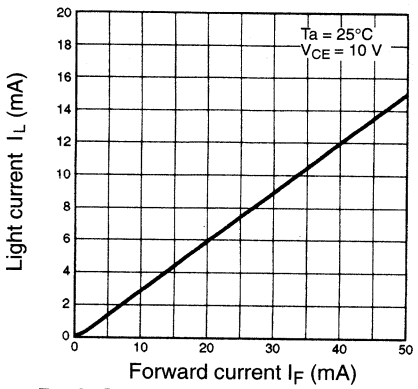
Forward Current vs. Collector Dissipation Temperature Rating



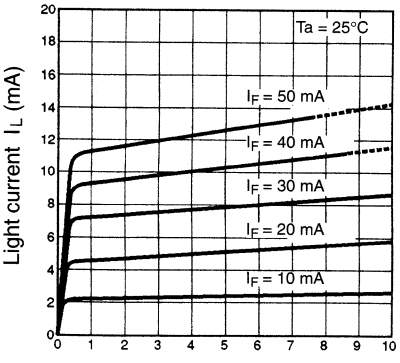
Forward Current vs. Forward Voltage Characteristics (Typical)



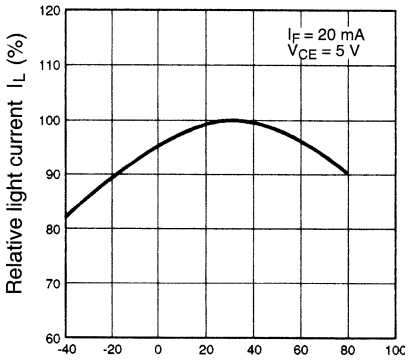
Light Current vs. Forward Current Characteristics (Typical)



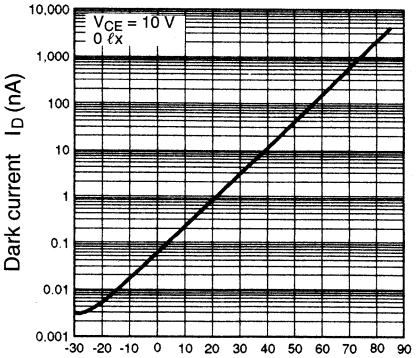
Light Current vs. Collector–Emitter Voltage Characteristics (Typical)



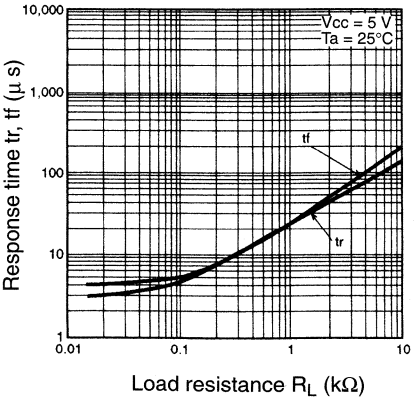
Relative Light Current vs. Ambient Temperature Characteristics (Typical)



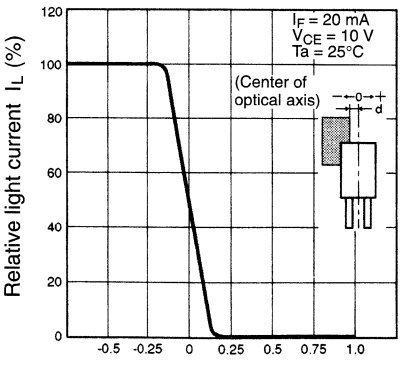
Dark Current vs. Ambient Temperature Characteristics (Typical)



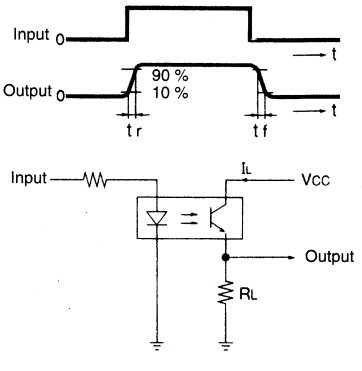
Response Time vs. Load Resistance Characteristics (Typical)



Sensing Position Characteristics (Typical)



Response Time Measurement Circuit



Opto-Switches

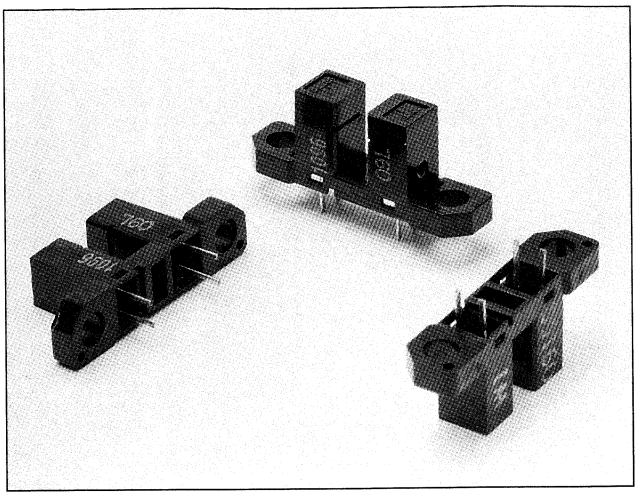
OMRON

Opto–Switch

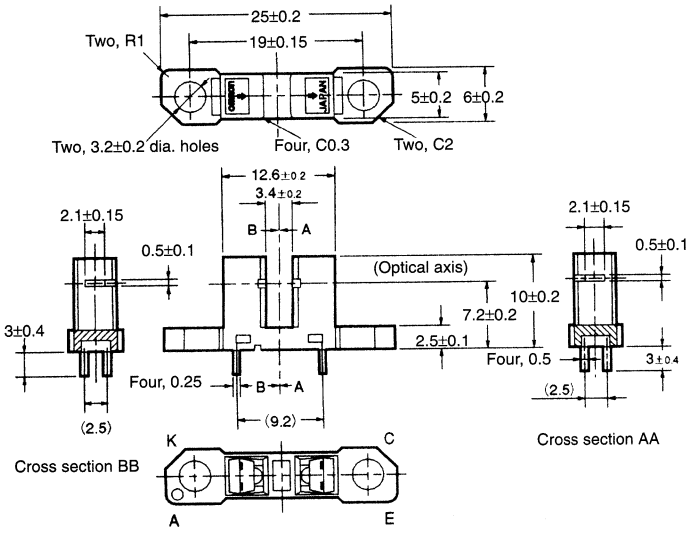
EE–SX1096

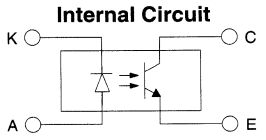
Transmissive

- General-purpose model with a 3.4-mm-wide slot.
- Mounts to PCBs or to connectors.
- High resolution with a 0.5-mm-wide aperture.
- Incorporating a horizontal sensing aperture.
- OMRON's XK8-series Connectors can be connected without soldering. Contact OMRON for information on obtaining XK8-series Connectors.



Dimensions





Terminal No.	Name
A	Anode
K	Cathode
C	Collector
E	Emitter

Unless otherwise specified, the tolerances are as shown below.

Dimensions	Tolerance
3 mm max.	±0.3
3 < mm ≤ 6	±0.375
6 < mm ≤ 10	±0.45
10 < mm ≤ 18	±0.55
18 < mm ≤ 30	±0.65

Specifications

■ Absolute Maximum Ratings (Ta = 25°C)

Item		Symbol	Rated value
Emitter	Forward current	I_F	50 mA (see note 1)
	Pulse forward current	I_{FP}	1 A (see note 2)
	Reverse voltage	V_R	4 V
Detector	Collector–Emitter voltage	V_{CEO}	30 V
	Emitter–Collector voltage	V_{ECO}	---
	Collector current	I_C	20 mA
	Collector dissipation	P_C	100 mW (see note 1)
Ambient temperature	Operating	Topr	–25°C to 85°C
	Storage	Tstg	–30°C to 100°C
	Soldering	Tsol	260°C

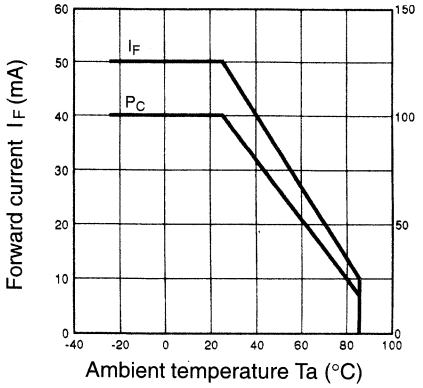
Note: 1. Refer to the temperature rating chart if the ambient temperature exceeds 25°C.
2. The pulse width is 10 μs maximum with a frequency of 100 Hz.

■ Electrical and Optical Characteristics (Ta = 25°C)

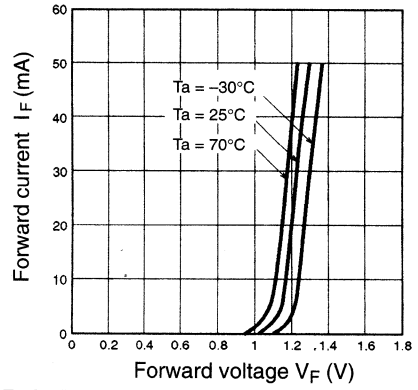
Item		Symbol	Value	Condition
Emitter	Forward voltage	V_F	1.2 V typ., 1.5 V max.	I_F = 30 mA
	Reverse current	I_R	0.01 μA typ., 10 μA max.	V_R = 4 V
	Peak emission wavelength	λ_P	940 nm typ.	I_F = 20 mA
Detector	Light current	I_L	0.5 mA min., 14 mA max.	I_F = 20 mA, V_{CE} = 10 V
	Dark current	I_D	2 nA typ., 200 nA max.	V_{CE} = 10 V, 0 ℓx
	Leakage current	I_{LEAK}	---	---
	Collector–Emitter saturated voltage	V_{CE} (sat)	0.1 V typ., 0.4 V max.	I_F = 20 mA, I_L = 0.1 mA
	Peak spectral sensitivity wavelength	λ_P	850 nm typ.	V_{CE} = 10 V
Rising time		tr	4 μs typ.	V_{CC} = 5 V, R_L = 100 Ω, I_L = 5 mA
Falling time		tf	4 μs typ.	V_{CC} = 5 V, R_L = 100 Ω, I_L = 5 mA

Engineering Data

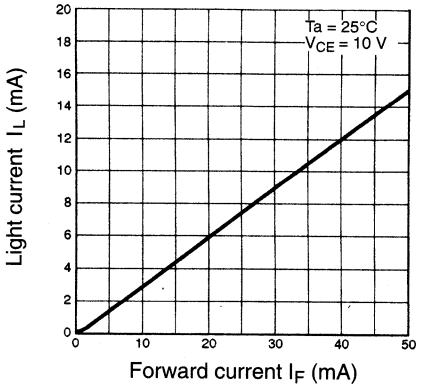
Forward Current vs. Collector Dissipation Temperature Rating



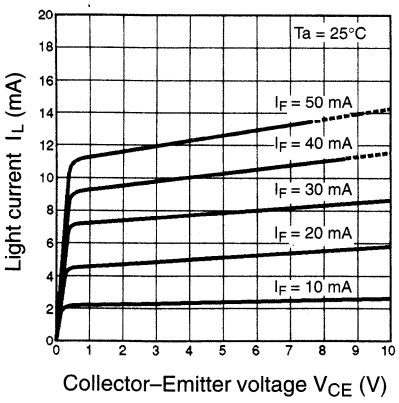
Forward Current vs. Forward Voltage Characteristics (Typical)



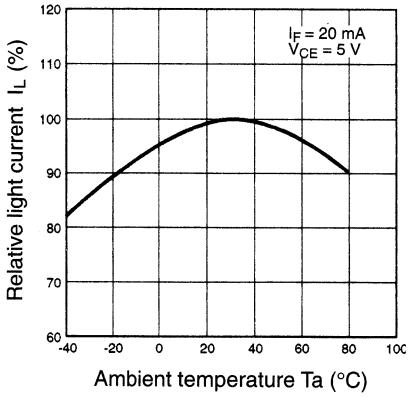
Light Current vs. Forward Current Characteristics (Typical)



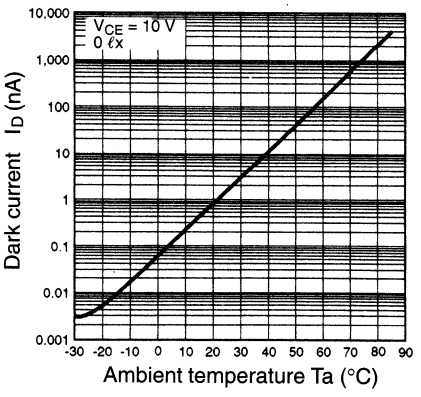
Light Current vs. Collector–Emitter Voltage Characteristics (Typical)



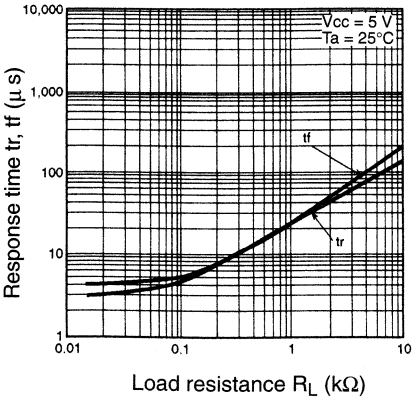
Relative Light Current vs. Ambient Temperature Characteristics (Typical)



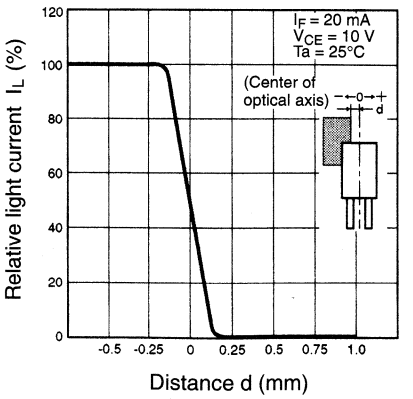
Dark Current vs. Ambient Temperature Characteristics (Typical)



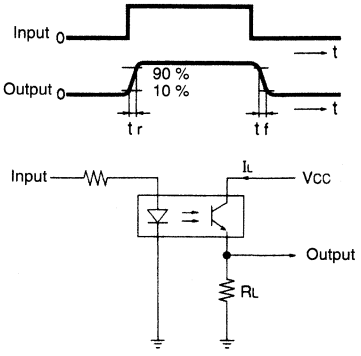
Response Time vs. Load Resistance Characteristics (Typical)



Sensing Position Characteristics (Typical)



Response Time Measurement Circuit

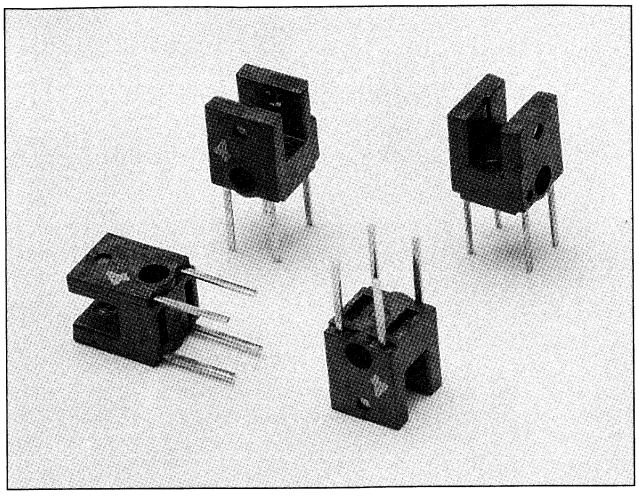


OMRON

Opto–Switch

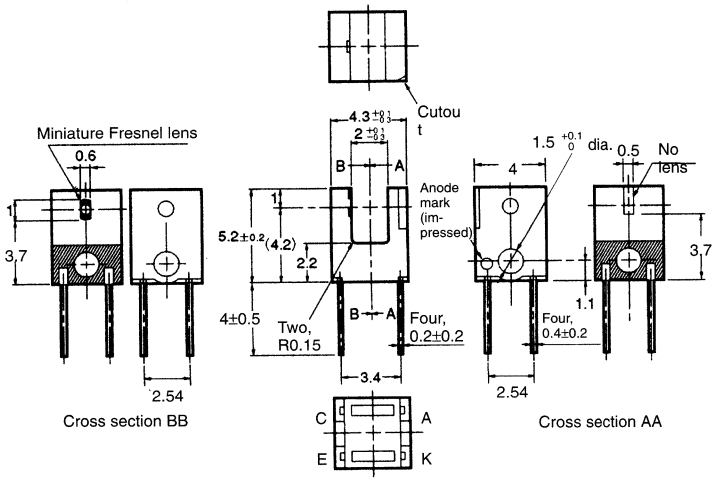
EE–SX1101

Transmissive

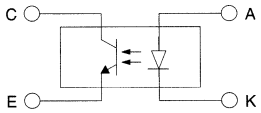


- Phototransistor output.
- Ultra compact size of 4.3 x 4 x 5mm (WxDxH).
- Incorporates a 2mm slot despite compact overall size.
- Uses latest in micro fresnel lens technology to maximise efficiency.
- PCB mounting type.
- High resolution with a 0.5-mm-wide aperture.
- A light current (I_L) of 0.4 mA minimum with a forward current (I_F) of 10 mA.

Dimensions



Internal Circuit



Terminal No.	Name
A	Anode
K	Cathode
C	Collector
E	Emitter

Unless otherwise specified, the tolerances are ±0.1.

Specifications

■ Absolute Maximum Ratings (Ta = 25°C)

Item		Symbol	Rated value
Emitter	**Forward current**	I_F	50 mA (see note 1)
	Pulse forward current	I_{FP}	1 A (see note 2)
	Reverse voltage	V_R	4 V
Detector	**Collector–Emitter voltage**	V_{CEO}	30 V
	Emitter–Collector voltage	V_{ECO}	---
	Collector current	I_C	20 mA
	Collector dissipation	P_C	75 mW (see note 1)
Ambient temperature	**Operating**	Topr	–40°C to 85°C
	Storage	Tstg	–40°C to 100°C
	Soldering	Tsol	260°C

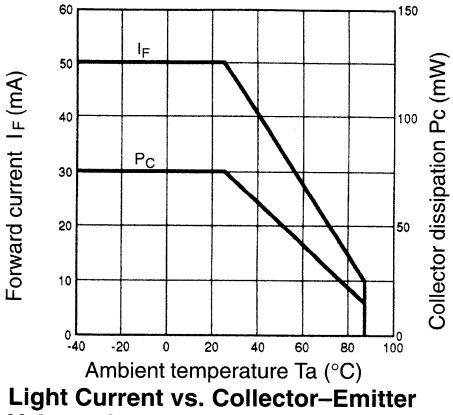
Note: 1. Refer to the temperature rating chart if the ambient temperature exceeds 25°C.
2. The pulse width is 10 μs maximum with a frequency of 100 Hz.

■ Electrical and Optical Characteristics (Ta = 25°C)

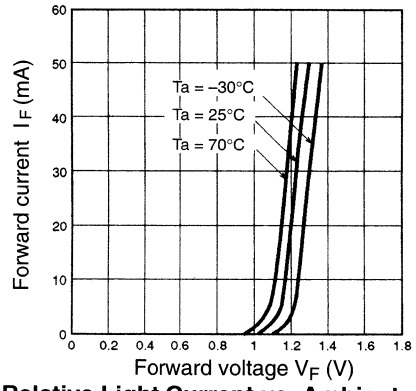
Item		Symbol	Value	Condition
Emitter	Forward voltage	V_F	1.2 V typ., 1.4 V max.	I_F = 20 mA
	Reverse current	I_R	0.01 μA typ., 10 μA max.	V_R = 4 V
	Peak emission wavelength	λ_P	940 nm typ.	I_F = 20 mA
Detector	Light current	I_L	0.4 mA min.	I_F = 10 mA, V_{CE} = 5 V
	Dark current	I_D	2 nA typ., 100 nA max.	V_{CE} = 20 V, 0 ℓx
	Leakage current	I_{LEAK}	---	---
	Collector–Emitter saturated voltage	V_{CE} (sat)	0.4 V max.	I_F = 20 mA, I_L = 0.1 mA
	Peak spectral sensitivity wavelength	λ_P	850 nm typ.	V_{CE} = 5 V
Rising time		tr	30 μs typ., 150 μs max.	V_{CC} = 5 V, R_L = 1 kΩ, I_L = 100 μA
Falling time		tf	30 μs typ., 150 μs max.	V_{CC} = 5 V, R_L = 1 kΩ, I_L = 100 μA

Engineering Data

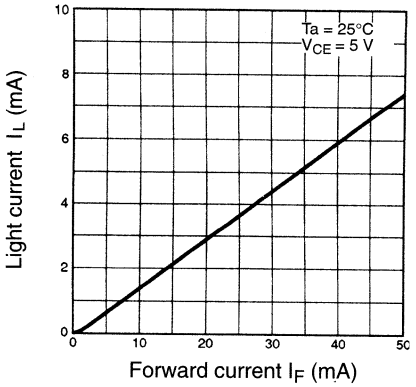
Forward Current vs. Collector Dissipation Temperature Rating



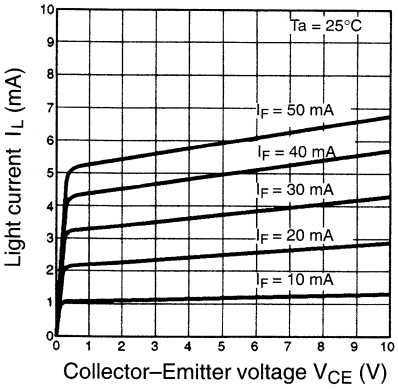
Forward Current vs. Forward Voltage Characteristics (Typical)



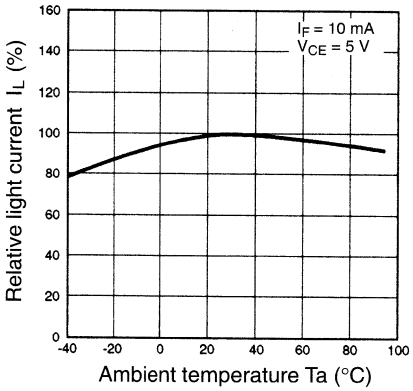
Light Current vs. Forward Current Characteristics (Typical)



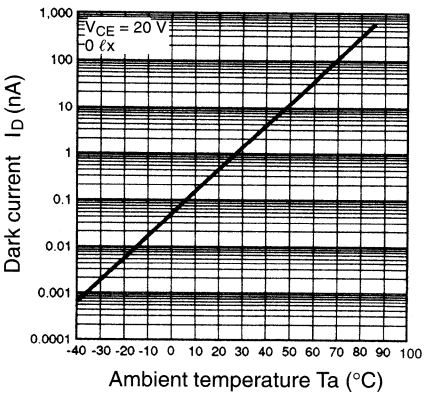
Light Current vs. Collector–Emitter Voltage Characteristics (Typical)



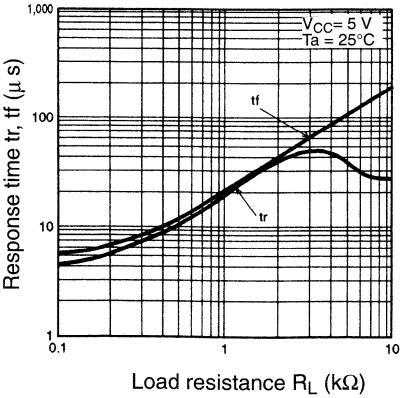
Relative Light Current vs. Ambient Temperature Characteristics (Typical)



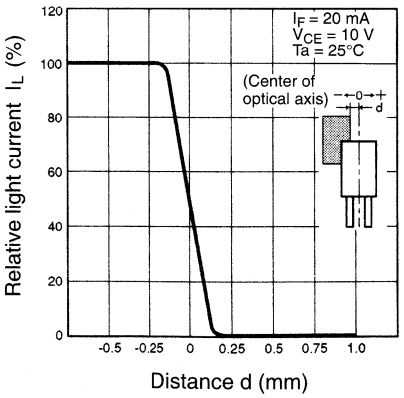
Dark Current vs. Ambient Temperature Characteristics (Typical)



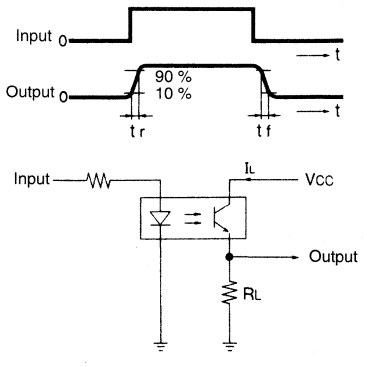
Response Time vs. Load Resistance Characteristics (Typical)



Sensing Position Characteristics (Typical)



Response Time Measurement Circuit



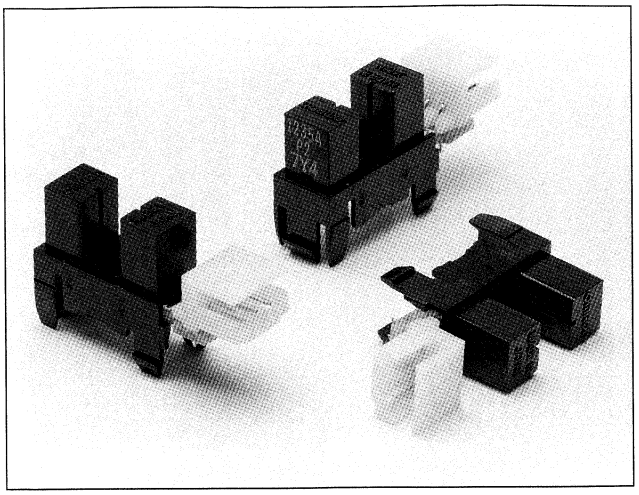
OMRON

Opto–Switch

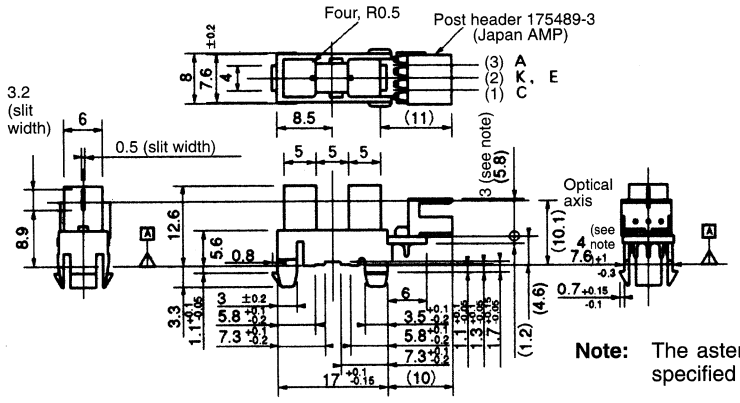
EE–SX1235A–P2

Transmissive

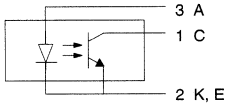
- Phototransistor output.
- Snap-in mounting mechanism for easy mounting and dismounting.
- Compatible with 1.0-, 1.2- and 1.6-mm-thick PCBs.
- High resolution with a 0.5-mm-wide aperture.
- 5-mm-wide slot.
- Connects to Japan AMP's CT-series connectors.



Dimensions



Internal Circuit



Terminal No.	Name
A	Anode
C	Collector
K, E	Cathode, Emitter

Unless otherwise specified, the tolerances are as shown below.

Dimensions	Tolerance
3 mm max.	±0.3
3 < mm ≤ 6	±0.375
6 < mm ≤ 10	±0.45
10 < mm ≤ 18	±0.55
18 < mm ≤ 30	±0.65

Recommended Connectors:
Japan AMP 173977-3 (insulation displacement-type connector)
175778-3 (crimp-type connector)
179228-3 (crimp-type connector)

For recommended mounting holes see EE–SX4235–P2 on page 402

Specifications

■ Absolute Maximum Ratings (Ta = 25°C)

Item		Symbol	Rated value
Emitter	Forward current	I_F	50 mA (see note)
	Pulse forward current	I_{FP}	---
	Reverse voltage	V_R	4 V
Detector	Collector–Emitter voltage	V_{CEO}	30 V
	Emitter–Collector voltage	V_{ECO}	5 V
	Collector current	I_C	20 mA
	Collector dissipation	P_C	100 mW (see note)
Ambient temperature	Operating	Topr	–25°C to 95°C
	Storage	Tstg	–40°C to 100°C
	Soldering	Tsol	---

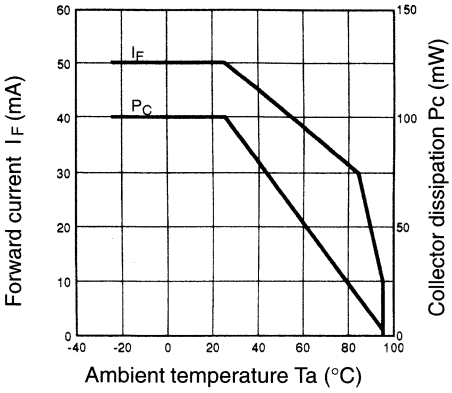
Note: Refer to the temperature rating chart if the ambient temperature exceeds 25°C.

■ Electrical and Optical Characteristics (Ta = 25°C)

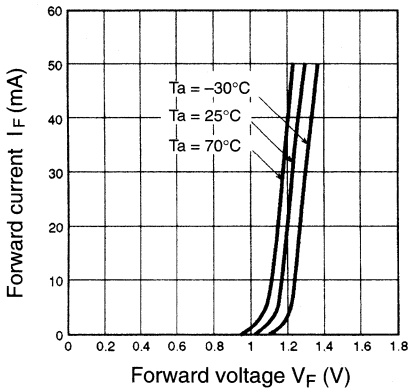
Item		Symbol	Value	Condition
Emitter	Forward voltage	V_F	1.2 V typ., 1.5 V max.	I_F = 30 mA
	Reverse current	I_R	0.01 μA typ., 10 μA max.	V_R = 4 V
	Peak emission wavelength	λ_P	940 nm typ.	I_F = 30 mA
Detector	Light current	I_L	0.6 mA min., 14 mA max.	I_F = 20 mA, V_{CE} = 5 V
	Dark current	I_D	200 nA max.	V_{CE} = 10 V, 0 ℓx
	Leakage current	I_{LEAK}	---	---
	Collector–Emitter saturated voltage	V_{CE} (sat)	0.1 V typ., 0.4 V max.	I_F = 20 mA, I_L = 0.3 mA
	Peak spectral sensitivity wavelength	λ_P	850 nm typ.	V_{CE} = 5 V
Rising time		tr	8 μs typ.	V_{CC} = 5 V, R_L = 100 Ω, I_L = 1 mA
Falling time		tf	8 μs typ.	V_{CC} = 5 V, R_L = 100 Ω, I_L = 1 mA

Engineering Data

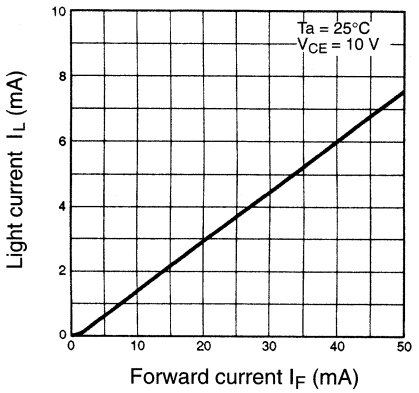
Forward Current vs. Collector Dissipation Temperature Rating



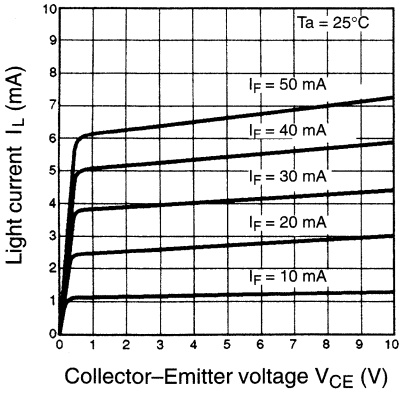
Forward Current vs. Forward Voltage Characteristics (Typical)



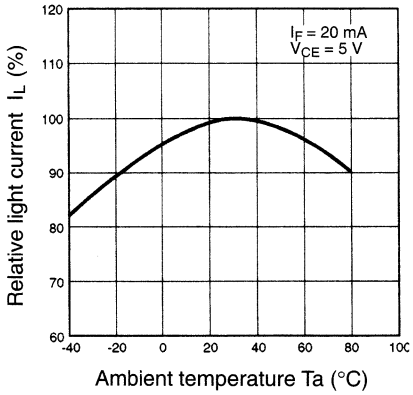
Light Current vs. Forward Current Characteristics (Typical)



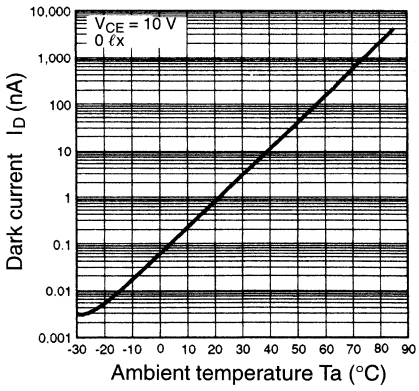
Light Current vs. Collector–Emitter Voltage Characteristics (Typical)



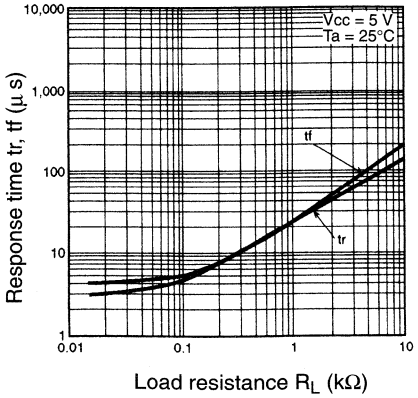
Relative Light Current vs. Ambient Temperature Characteristics (Typical)



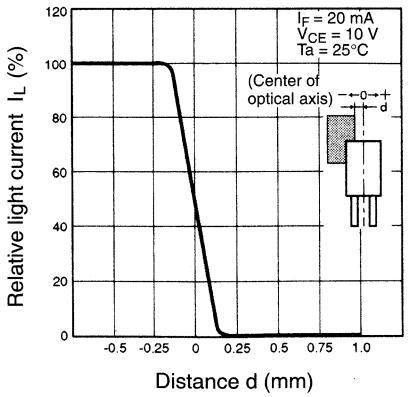
Dark Current vs. Ambient Temperature Characteristics (Typical)



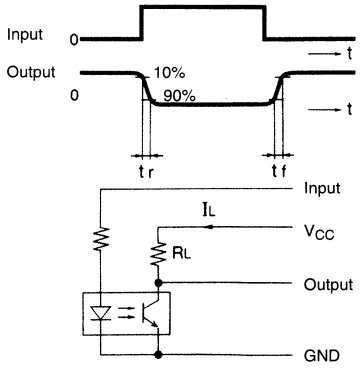
Response Time vs. Load Resistance Characteristics (Typical)



Sensing Position Characteristics (Typical)



Response Time Measurement Circuit



Opto-Switches

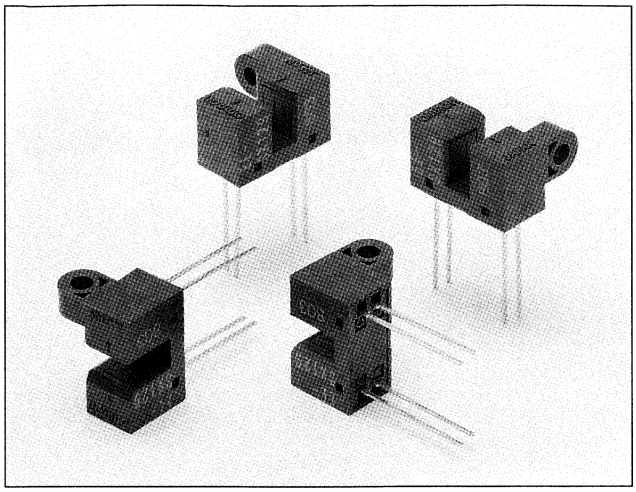
OMRON

Opto–Switch

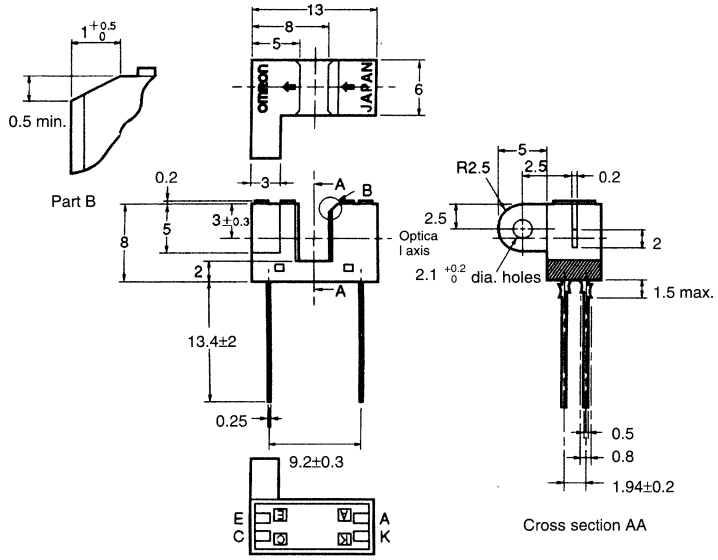
EE–SX129

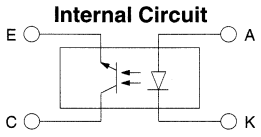
Transmissive

- Phototransistor output.
- High-resolution model allows detection of objects as small as 0.2mm in diameter.
- PCB mounting type.
- Compact model with 3mm slot width.
- Screw mounting flange.



Dimensions





Terminal No.	Name
A	Anode
K	Cathode
C	Collector
E	Emitter

Unless otherwise specified, the tolerances are as shown below.

Dimensions	Tolerance
3 mm max.	±0.3
3 < mm ≤ 6	±0.375
6 < mm ≤ 10	±0.45
10 < mm ≤ 18	±0.55
18 < mm ≤ 30	±0.65

Specifications

■ Absolute Maximum Ratings (Ta = 25°C)

Item		Symbol	Rated value
Emitter	**Forward current**	I_F	50 mA (see note 1)
	Pulse forward current	I_{FP}	1 A (see note 2)
	Reverse voltage	V_R	4 V
Detector	**Collector–Emitter voltage**	V_{CEO}	30 V
	Emitter–Collector voltage	V_{ECO}	---
	Collector current	I_C	20 mA
	Collector dissipation	P_C	100 mW (see note 1)
Ambient temperature	**Operating**	Topr	–25°C to 85°C
	Storage	Tstg	–40°C to 100°C
	Soldering	Tsol	260°C

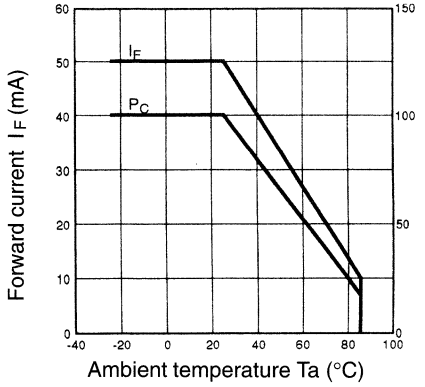
Note: 1. Refer to the temperature rating chart if the ambient temperature exceeds 25°C.
2. The pulse width is 10 μs maximum with a frequency of 100 Hz.

■ Electrical and Optical Characteristics (Ta = 25°C)

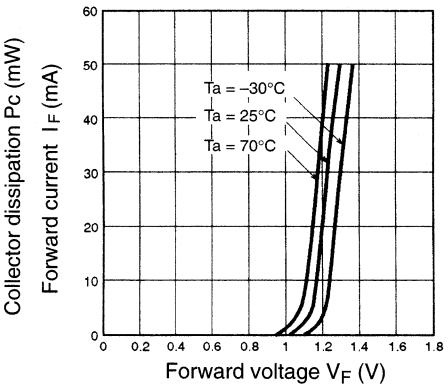
Item		Symbol	Value	Condition
Emitter	Forward voltage	V_F	1.2 V typ., 1.5 V max.	I_F = 30 mA
	Reverse current	I_R	0.01 μA typ., 10 μA max.	V_R = 4 V
	Peak emission wavelength	λ_P	920 nm typ.	I_F = 20 mA
Detector	Light current	I_L	0.2 mA min.	I_F = 20 mA, V_{CE} = 10 V
	Dark current	I_D	2 nA typ., 200 nA max.	V_{CE} = 10 V, 0 ℓx
	Leakage current	I_{LEAK}	---	---
	Collector–Emitter saturated voltage	V_{CE} (sat)	---	---
	Peak spectral sensitivity wavelength	λ_P	850 nm typ.	V_{CE} = 10 V
Rising time		tr	4 μs typ.	V_{CC} = 5 V, R_L = 100 Ω, I_L = 5 mA
Falling time		tf	4 μs typ.	V_{CC} = 5 V, R_L = 100 Ω, I_L = 5 mA

Engineering Data

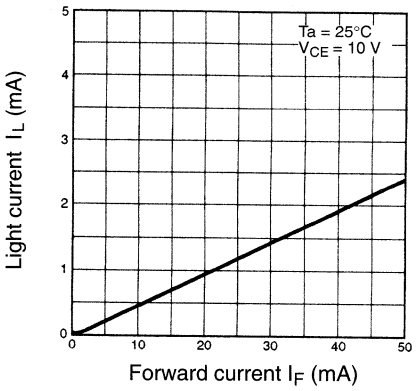
Forward Current vs. Collector Dissipation Temperature Rating



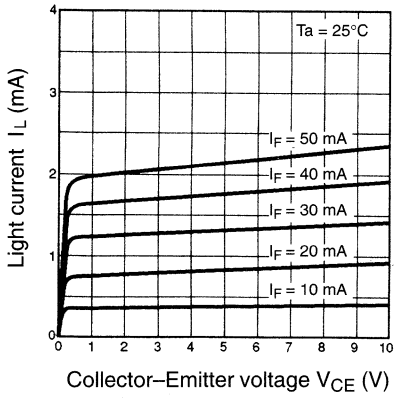
Forward Current vs. Forward Voltage Characteristics (Typical)



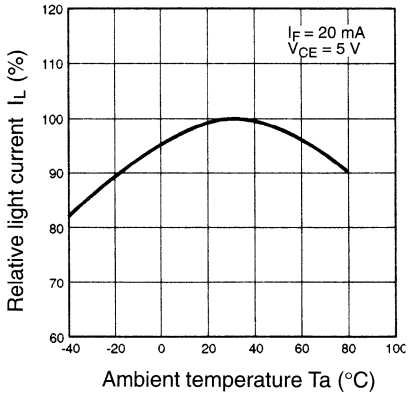
Light Current vs. Forward Current Characteristics (Typical)



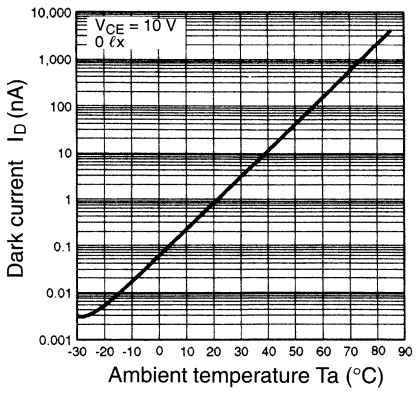
Light Current vs. Collector–Emitter Voltage Characteristics (Typical)



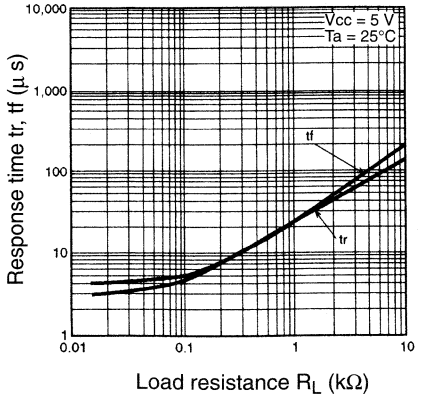
Relative Light Current vs. Ambient Temperature Characteristics (Typical)



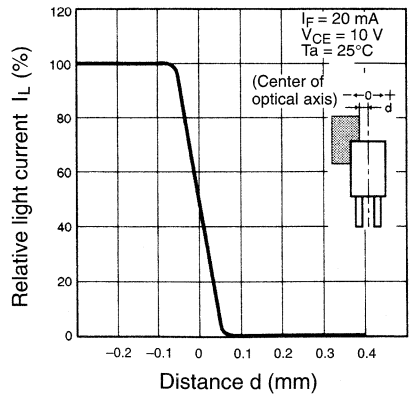
Dark Current vs. Ambient Temperature Characteristics (Typical)



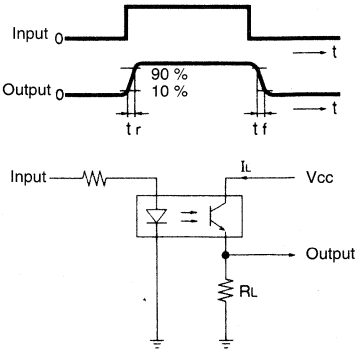
Response Time vs. Load Resistance Characteristics (Typical)



Sensing Position Characteristics (Typical)



Response Time Measurement Circuit



Opto-Switches

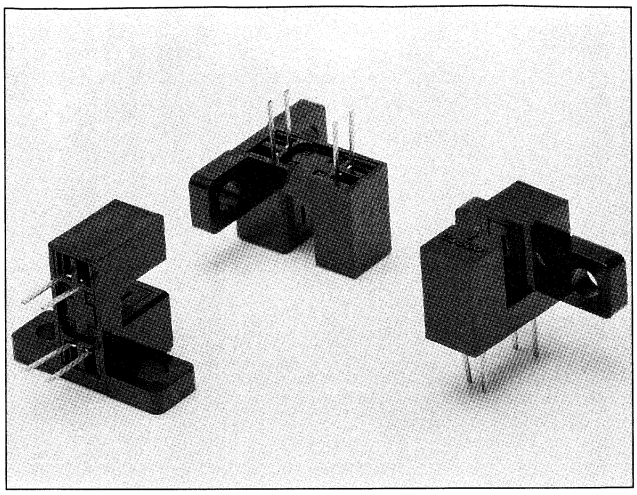
OMRON

Opto–Switch

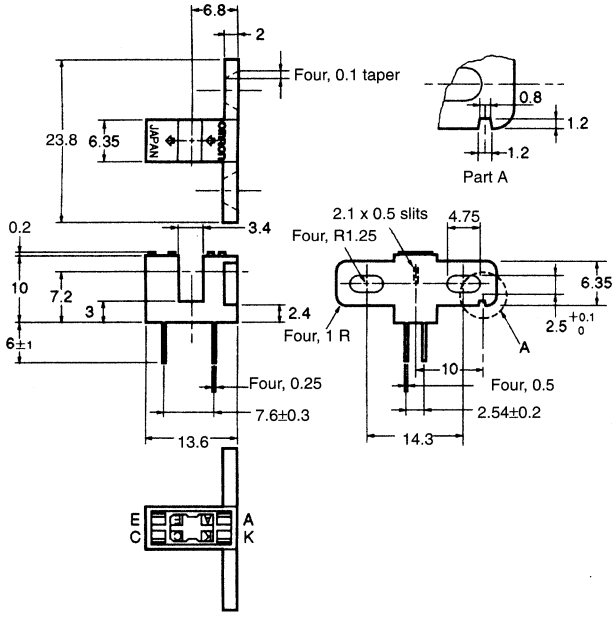
EE–SX138

Transmissive

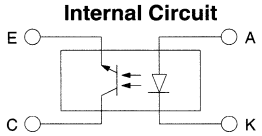
- Phototransistor output.
- General-purpose model with a 3.4-mm-wide slot.
- PCB mounting type.
- High resolution with a 0.5-mm-wide aperture.
- Screw-mounting possible.



Dimensions



Internal Circuit



Terminal No.	Name
A	Anode
K	Cathode
C	Collector
E	Emitter

Unless otherwise specified, the tolerances are as shown below.

Dimensions	Tolerance
3 mm max.	±0.2
3 < mm ≤ 6	±0.24
6 < mm ≤ 10	±0.29
10 < mm ≤ 18	±0.35
18 < mm ≤ 30	±0.42

Specifications

■ Absolute Maximum Ratings (Ta = 25°C)

Item		Symbol	Rated value
Emitter	Forward current	I_F	50 mA (see note 1)
	Pulse forward current	I_{FP}	1 A (see note 2)
	Reverse voltage	V_R	4 V
Detector	Collector–Emitter voltage	V_{CEO}	30 V
	Emitter–Collector voltage	V_{ECO}	---
	Collector current	I_C	20 mA
	Collector dissipation	P_C	100 mW (see note 1)
Ambient temperature	Operating	Topr	–25°C to 85°C
	Storage	Tstg	–40°C to 100°C
	Soldering	Tsol	260°C

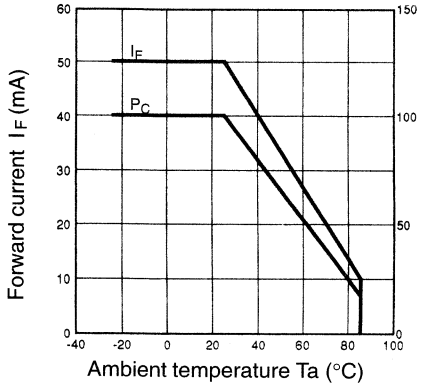
Note: 1. Refer to the temperature rating chart if the ambient temperature exceeds 25°C.
2. The pulse width is 10 μs maximum with a frequency of 100 Hz.

■ Electrical and Optical Characteristics (Ta = 25°C)

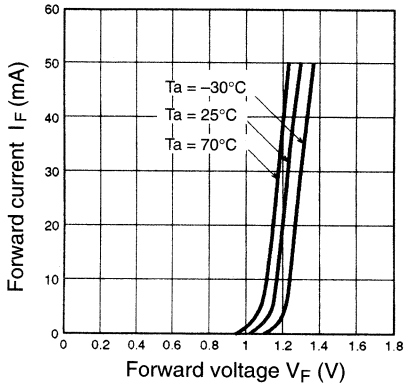
Item		Symbol	Value	Condition
Emitter	Forward voltage	V_F	1.2 V typ., 1.5 V max.	I_F = 30 mA
	Reverse current	I_R	0.01 μA typ., 10 μA max.	V_R = 4 V
	Peak emission wavelength	λ_P	940 nm typ.	I_F = 20 mA
Detector	Light current	I_L	1.9 mA min., 14 mA max.	I_F = 20 mA, V_{CE} = 10 V
	Dark current	I_D	2 nA typ., 200 nA max.	V_{CE} = 10 V, 0 ℓx
	Leakage current	I_{LEAK}	---	---
	Collector–Emitter saturated voltage	V_{CE} (sat)	0.1 V typ., 0.4 V max.	I_F = 20 mA, I_L = 0.1 mA
	Peak spectral sensitivity wavelength	λ_P	850 nm typ.	V_{CE} = 10 V
Rising time		tr	4 μs typ.	V_{CC} = 5 V, R_L = 100 Ω, I_L = 5 mA
Falling time		tf	4 μs typ.	V_{CC} = 5 V, R_L = 100 Ω, I_L = 5 mA

Engineering Data

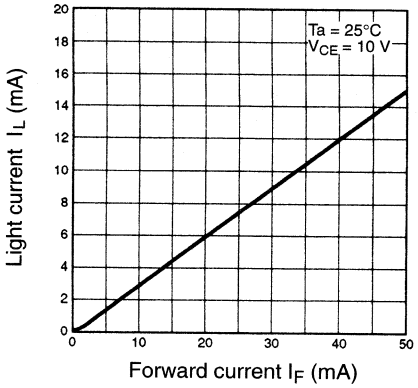
Forward Current vs. Collector Dissipation Temperature Rating



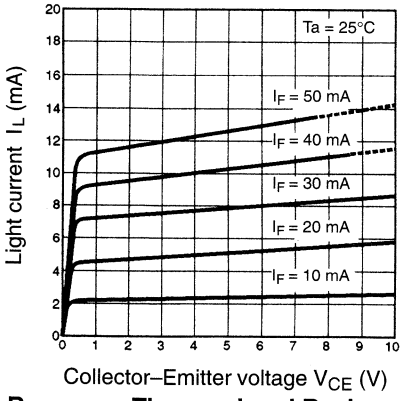
Forward Current vs. Forward Voltage Characteristics (Typical)



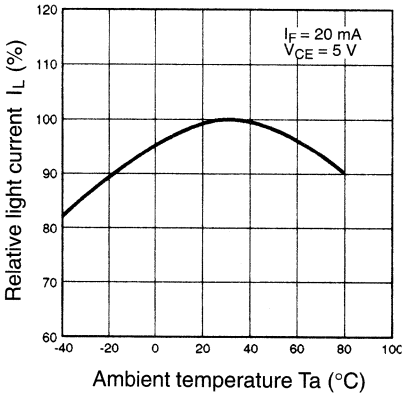
Light Current vs. Forward Current Characteristics (Typical)



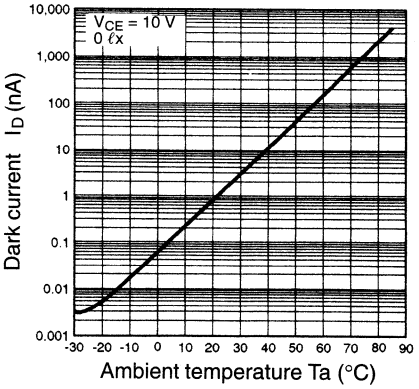
Light Current vs. Collector–Emitter Voltage Characteristics (Typical)



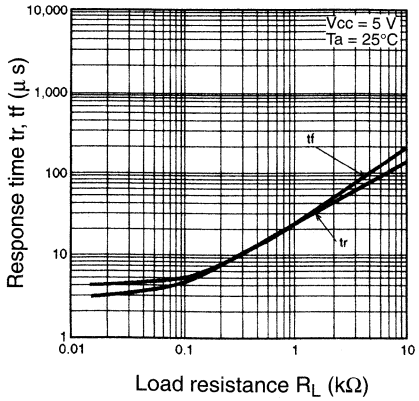
Relative Light Current vs. Ambient Temperature Characteristics (Typical)



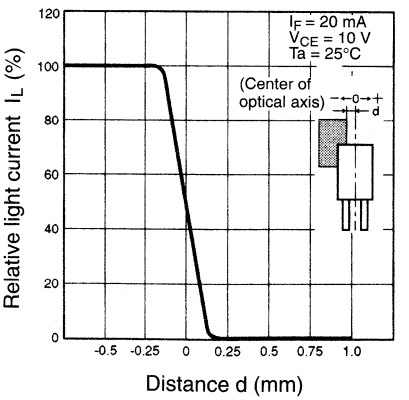
Dark Current vs. Ambient Temperature Characteristics (Typical)



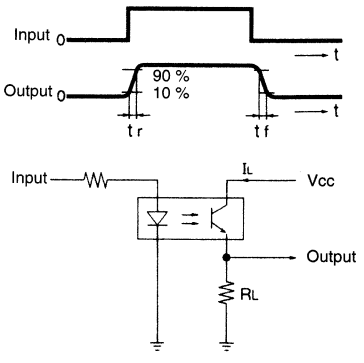
Response Time vs. Load Resistance Characteristics (Typical)



Sensing Position Characteristics (Typical)



Response Time Measurement Circuit



Opto-Switches

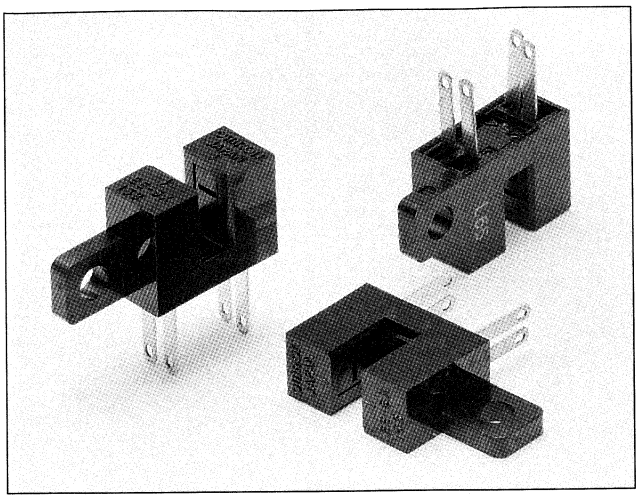
OMRON

Opto–Switch

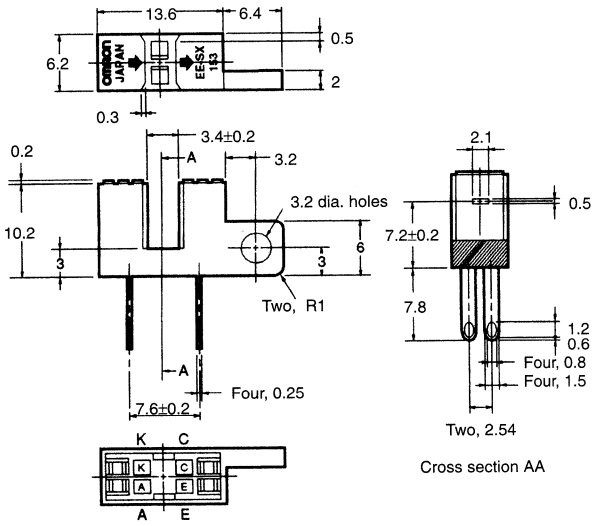
EE–SX153

Transmissive

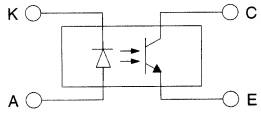
- Phototransistor output.
- General-purpose model with a 3.4-mm-wide slot.
- High resolution with a 0.5-mm-wide aperture.
- Incorporates solder connections.
- Horizontal sensing aperture.
- Screw-mounting possible.



Dimensions



Internal Circuit



Terminal No.	Name
A	Anode
K	Cathode
C	Collector
E	Emitter

Unless otherwise specified, the tolerances are as shown below.

Dimensions	Tolerance
3 mm max.	±0.3
3 < mm ≤ 6	±0.375
6 < mm ≤ 10	±0.45
10 < mm ≤ 18	±0.55
18 < mm ≤ 30	±0.65

Specifications

■ Absolute Maximum Ratings (Ta = 25°C)

Item		Symbol	Rated value
Emitter	Forward current	I_F	50 mA (see note 1)
	Pulse forward current	I_{FP}	1 A (see note 2)
	Reverse voltage	V_R	4 V
Detector	Collector–Emitter voltage	V_{CEO}	30 V
	Emitter–Collector voltage	V_{ECO}	---
	Collector current	I_C	20 mA
	Collector dissipation	P_C	100 mW (see note 1)
Ambient temperature	Operating	Topr	–25°C to 85°C
	Storage	Tstg	–30°C to 100°C
	Soldering	Tsol	260°C

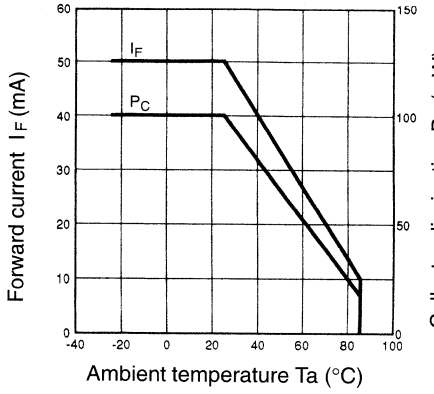
Note: 1. Refer to the temperature rating chart if the ambient temperature exceeds 25°C.
2. The pulse width is 10 μs maximum with a frequency of 100 Hz.

■ Electrical and Optical Characteristics (Ta = 25°C)

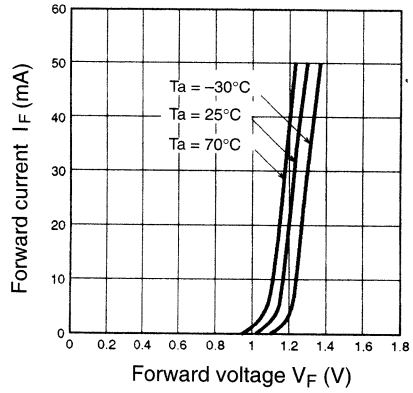
Item		Symbol	Value	Condition
Emitter	Forward voltage	V_F	1.2 V typ., 1.5 V max.	I_F = 30 mA
	Reverse current	I_R	0.01 μA typ., 10 μA max.	V_R = 4 V
	Peak emission wavelength	λ_P	940 nm typ.	I_F = 20 mA
Detector	Light current	I_L	0.5 mA min., 14 mA max.	I_F = 20 mA, V_{CE} = 10 V
	Dark current	I_D	2 nA typ., 200 nA max.	V_{CE} = 10 V, 0 ℓx
	Leakage current	I_{LEAK}	---	---
	Collector–Emitter saturated voltage	V_{CE} (sat)	0.1 V typ., 0.4 V max.	I_F = 20 mA, I_L = 0.1 mA
	Peak spectral sensitivity wavelength	λ_P	850 nm typ.	V_{CE} = 10 V
Rising time		tr	4 μs typ.	V_{CC} = 5 V, R_L = 100 Ω, I_L = 5 mA
Falling time		tf	4 μs typ.	V_{CC} = 5 V, R_L = 100 Ω, I_L = 5 mA

Engineering Data

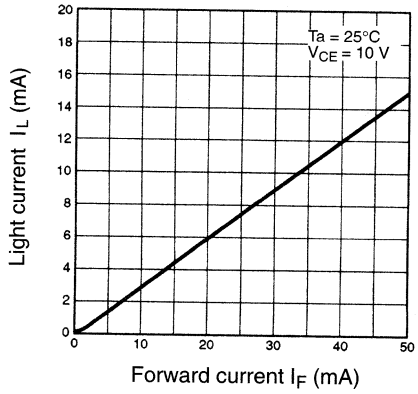
Forward Current vs. Collector Dissipation Temperature Rating



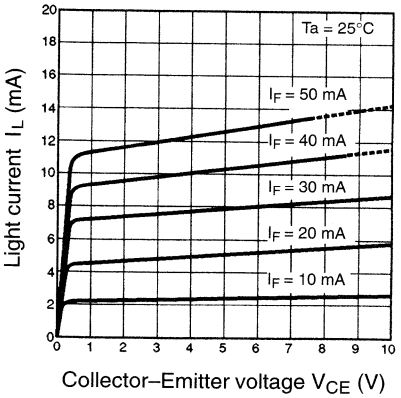
Forward Current vs. Forward Voltage Characteristics (Typical)



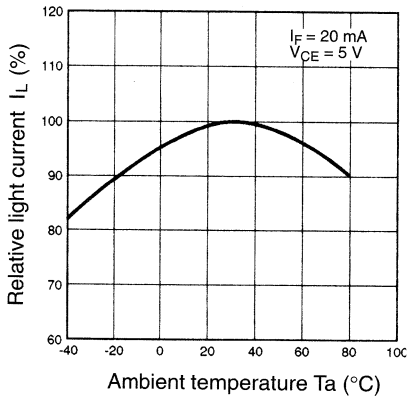
Light Current vs. Forward Current Characteristics (Typical)



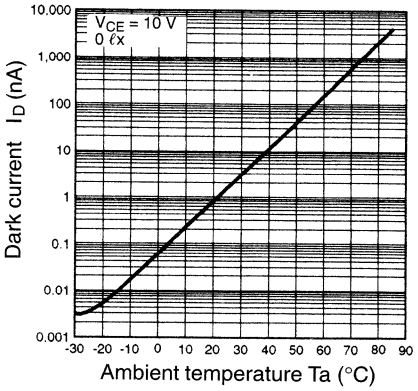
Light Current vs. Collector–Emitter Voltage Characteristics (Typical)



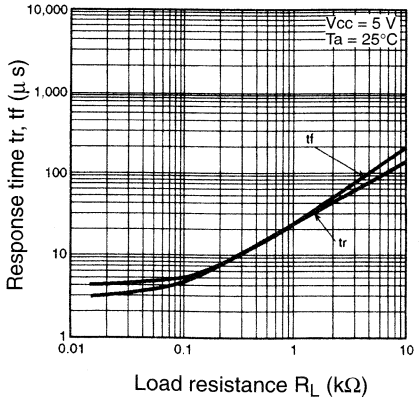
Relative Light Current vs. Ambient Temperature Characteristics (Typical)



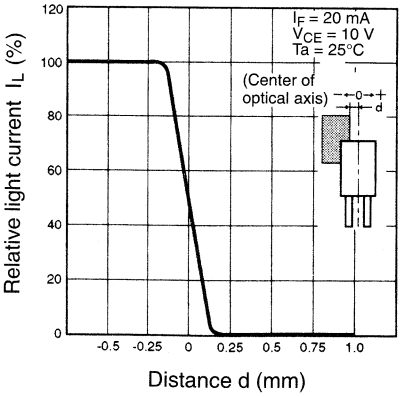
Dark Current vs. Ambient Temperature Characteristics (Typical)



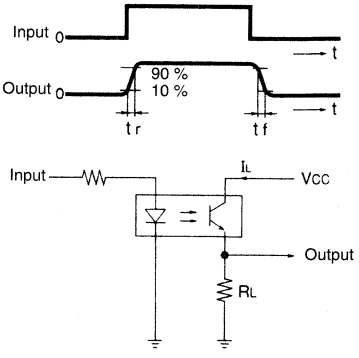
Response Time vs. Load Resistance Characteristics (Typical)



Sensing Position Characteristics (Typical)



Response Time Measurement Circuit



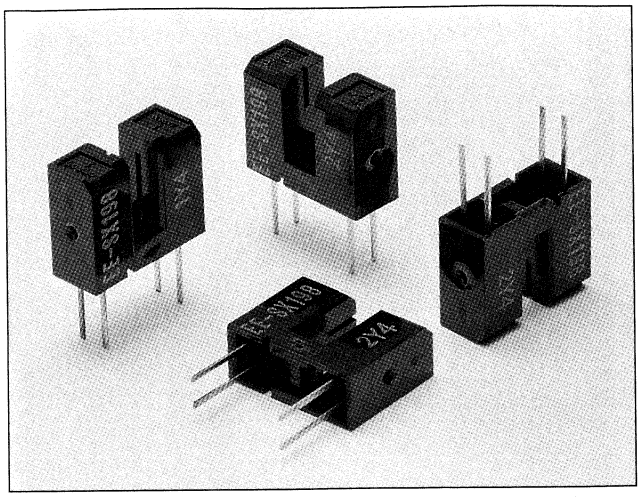
OMRON

Opto–Switch

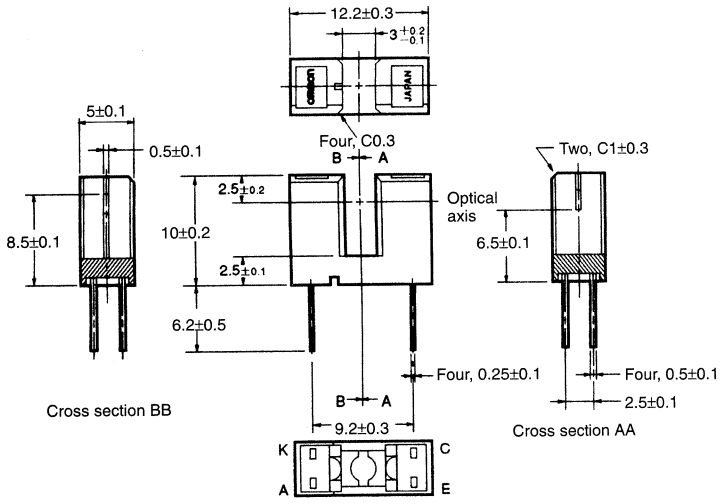
EE–SX198

Transmissive

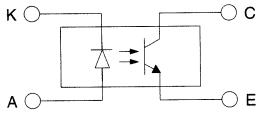
- Phototransistor output.
- General-purpose model with a 3-mm-wide slot.
- PCB mounting type.
- High resolution with a 0.5-mm-wide aperture.



Dimensions



Internal Circuit



Terminal No.	Name
A	Anode
K	Cathode
C	Collector
E	Emitter

Unless otherwise specified, the tolerances are ±0.2.

Specifications

■ Absolute Maximum Ratings (Ta = 25°C)

Item		Symbol	Rated value
Emitter	Forward current	I_F	50 mA (see note 1)
	Pulse forward current	I_{FP}	1 A (see note 2)
	Reverse voltage	V_R	4 V
Detector	Collector–Emitter voltage	V_{CEO}	30 V
	Emitter–Collector voltage	V_{ECO}	---
	Collector current	I_C	20 mA
	Collector dissipation	P_C	100 mW (see note 1)
Ambient temperature	Operating	Topr	–25°C to 85°C
	Storage	Tstg	–30°C to 100°C
	Soldering	Tsol	260°C

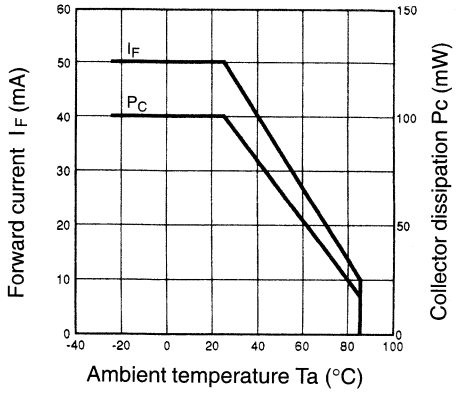
Note: 1. Refer to the temperature rating chart if the ambient temperature exceeds 25°C.
2. The pulse width is 10 μs maximum with a frequency of 100 Hz.

■ Electrical and Optical Characteristics (Ta = 25°C)

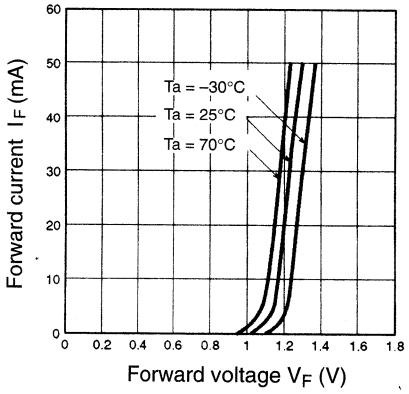
Item		Symbol	Value	Condition
Emitter	Forward voltage	V_F	1.2 V typ., 1.4 V max.	I_F = 20 mA
	Reverse current	I_R	0.01 μA typ., 10 μA max.	V_R = 4 V
	Peak emission wavelength	λ_P	940 nm typ.	I_F = 20 mA
Detector	Light current	I_L	0.5 mA min., 14 mA max.	I_F = 20 mA, V_{CE} = 5 V
	Dark current	I_D	2 nA typ., 100 nA max.	V_{CE} = 20 V, 0 ℓx
	Leakage current	I_{LEAK}	---	---
	Collector–Emitter saturated voltage	V_{CE} (sat)	0.1 V typ., 0.4 V max.	I_F = 40 mA, I_L = 0.5 mA
	Peak spectral sensitivity wavelength	λ_P	850 nm typ.	V_{CE} = 10 V
Rising time		tr	4 μs typ.	V_{CC} = 5 V, R_L = 100 Ω, I_L = 5 mA
Falling time		tf	4 μs typ.	V_{CC} = 5 V, R_L = 100 Ω, I_L = 5 mA

Engineering Data

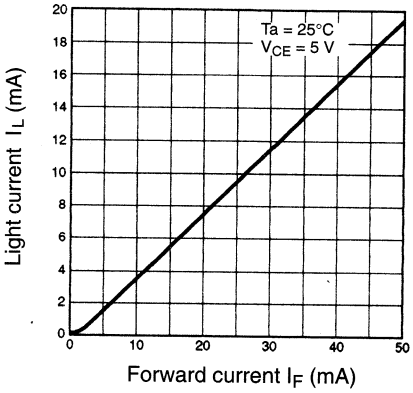
Forward Current vs. Collector Dissipation Temperature Rating



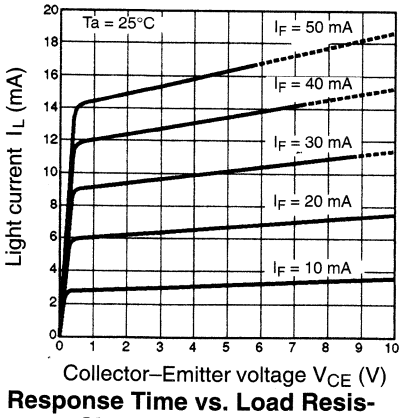
Forward Current vs. Forward Voltage Characteristics (Typical)



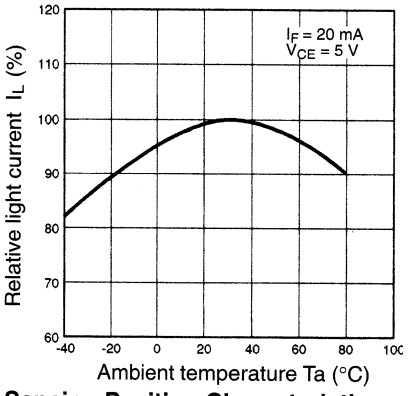
Light Current vs. Forward Current Characteristics (Typical)



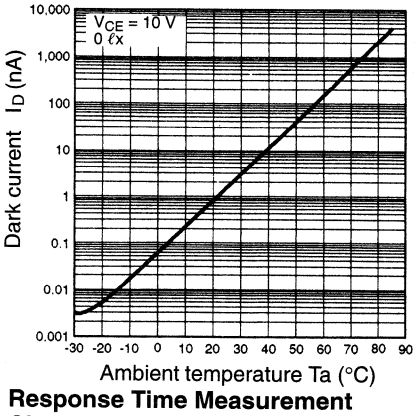
Light Current vs. Collector–Emitter Voltage Characteristics (Typical)



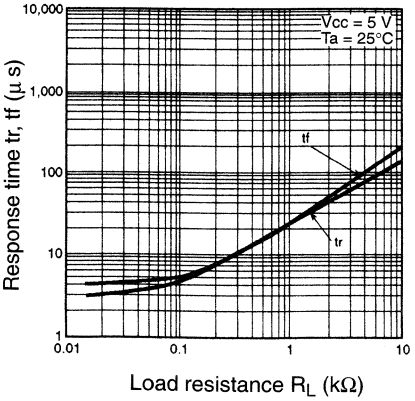
Relative Light Current vs. Ambient Temperature Characteristics (Typical)



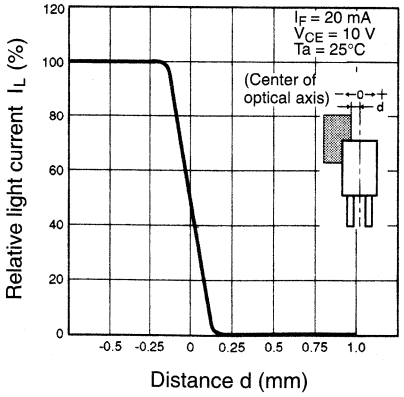
Dark Current vs. Ambient Temperature Characteristics (Typical)



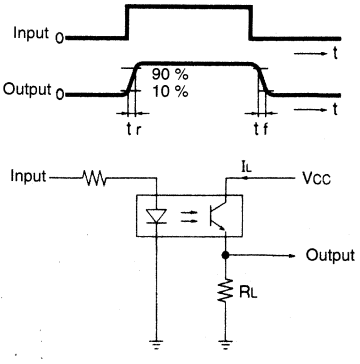
Response Time vs. Load Resistance Characteristics (Typical)



Sensing Position Characteristics (Typical)



Response Time Measurement Circuit



Opto-Switches

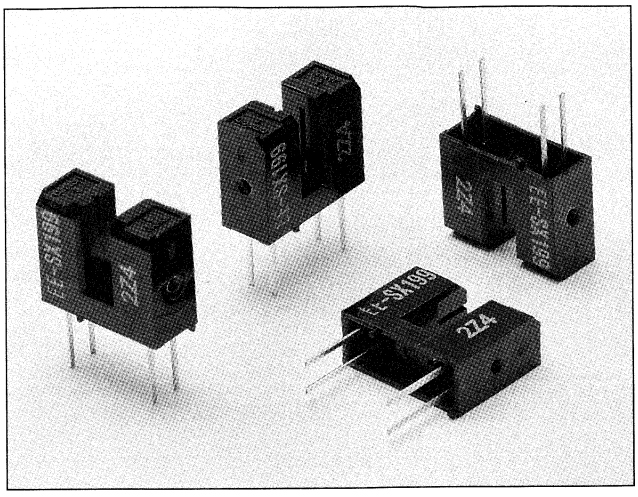
OMRON

Opto–Switch

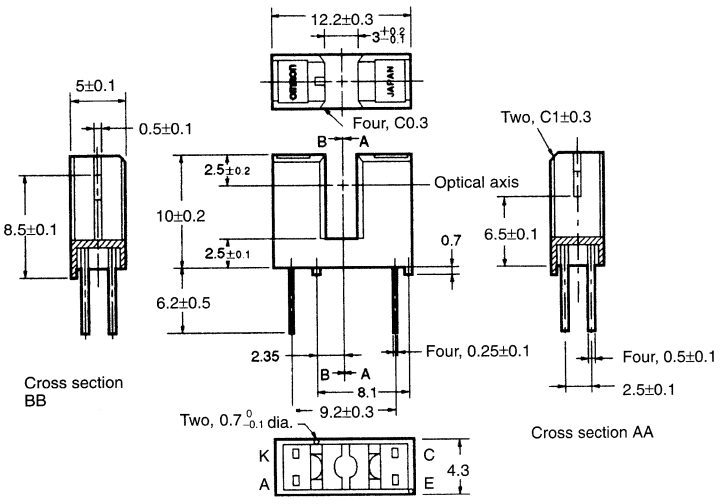
EE–SX199

Transmissive

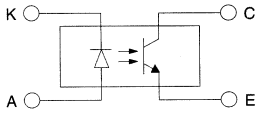
- Phototransistor output.
- General-purpose model with a 3-mm-wide slot.
- PCB mounting type.
- High resolution with a 0.5-mm-wide aperture.
- Incorporating location pins to prevent mis–orientation



Dimensions



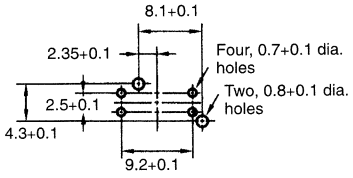
Internal Circuit



Terminal No.	Name
A	Anode
K	Cathode
C	Collector
E	Emitter

Unless otherwise specified, the tolerances are ±0.2.

PCB Mounting



Specifications

■ Absolute Maximum Ratings (Ta = 25°C)

Item		Symbol	Rated value
Emitter	Forward current	I_F	50 mA (see note 1)
	Pulse forward current	I_{FP}	1 A (see note 2)
	Reverse voltage	V_R	4 V
Detector	Collector–Emitter voltage	V_{CEO}	30 V
	Emitter–Collector voltage	V_{ECO}	---
	Collector current	I_C	20 mA
	Collector dissipation	P_C	100 mW (see note 1)
Ambient temperature	Operating	Topr	–25°C to 85°C
	Storage	Tstg	–30°C to 100°C
	Soldering	Tsol	260°C

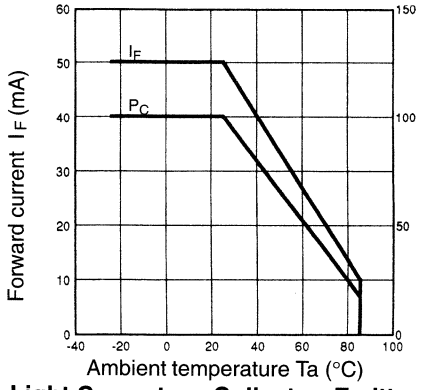
Note: 1. Refer to the temperature rating chart if the ambient temperature exceeds 25°C.
2. The pulse width is 10 μs maximum with a frequency of 100 Hz.

■ Electrical and Optical Characteristics (Ta = 25°C)

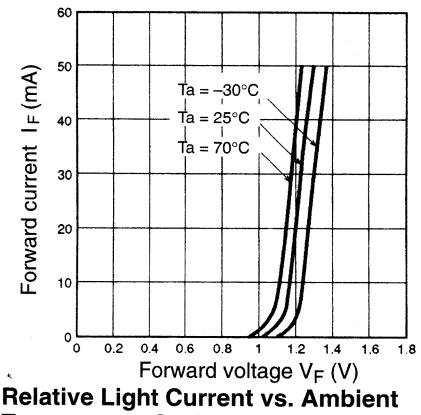
Item		Symbol	Value	Condition
Emitter	Forward voltage	V_F	1.2 V typ., 1.4 V max.	I_F = 30 mA
	Reverse current	I_R	0.01 μA typ., 10 μA max.	V_R = 4 V
	Peak emission wavelength	λ_P	940 nm typ.	I_F = 20 mA
Detector	Light current	I_L	0.5 mA min., 14 mA max.	I_F = 20 mA, V_{CE} = 5 V
	Dark current	I_D	2 nA typ., 100 nA max.	V_{CE} = 20 V, 0 ℓx
	Leakage current	I_{LEAK}	---	---
	Collector–Emitter saturated voltage	V_{CE} (sat)	0.1 V typ., 0.4 V max.	I_F = 40 mA, I_L = 0.5 mA
	Peak spectral sensitivity wavelength	λ_P	850 nm typ.	V_{CE} = 10 V
Rising time		tr	4 μs typ.	V_{CC} = 5 V, R_L = 100 Ω, I_L = 5 mA
Falling time		tf	4 μs typ.	V_{CC} = 5 V, R_L = 100 Ω, I_L = 5 mA

Engineering Data

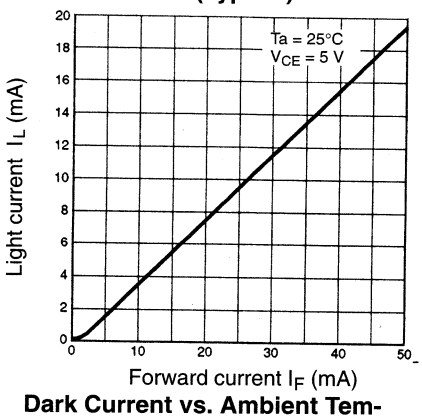
Forward Current vs. Collector Dissipation Temperature Rating



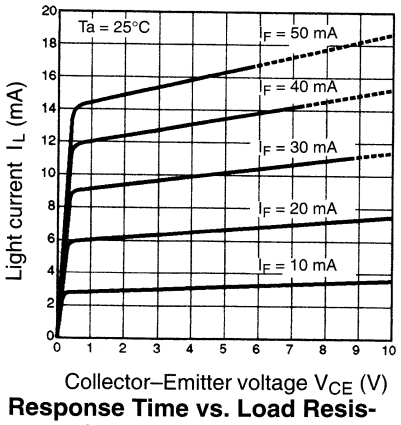
Forward Current vs. Forward Voltage Characteristics (Typical)



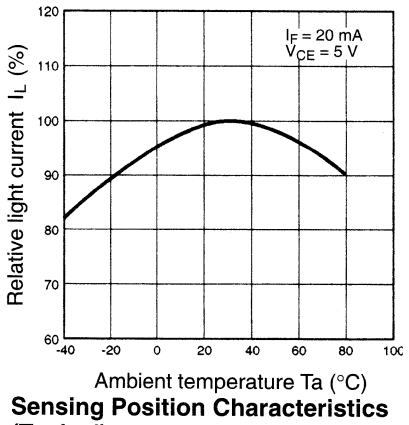
Light Current vs. Forward Current Characteristics (Typical)



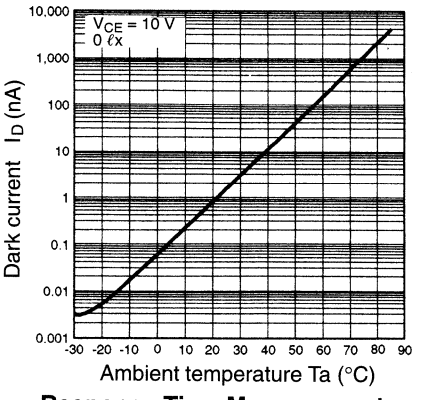
Light Current vs. Collector–Emitter Voltage Characteristics (Typical)



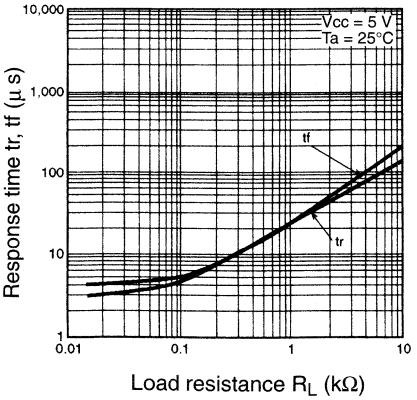
Relative Light Current vs. Ambient Temperature Characteristics (Typical)



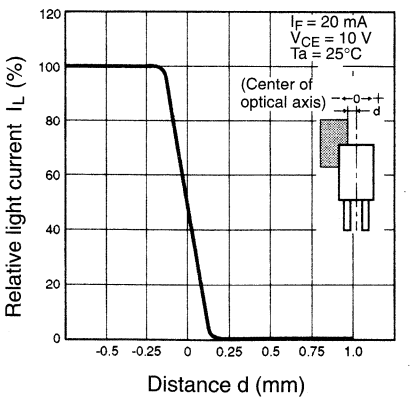
Dark Current vs. Ambient Temperature Characteristics (Typical)



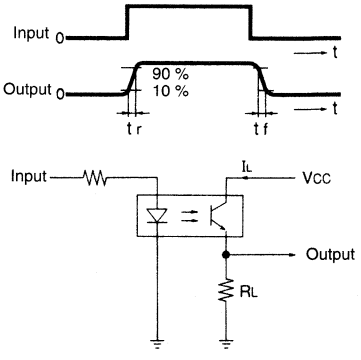
Response Time vs. Load Resistance Characteristics (Typical)



Sensing Position Characteristics (Typical)



Response Time Measurement Circuit



Opto-Switches

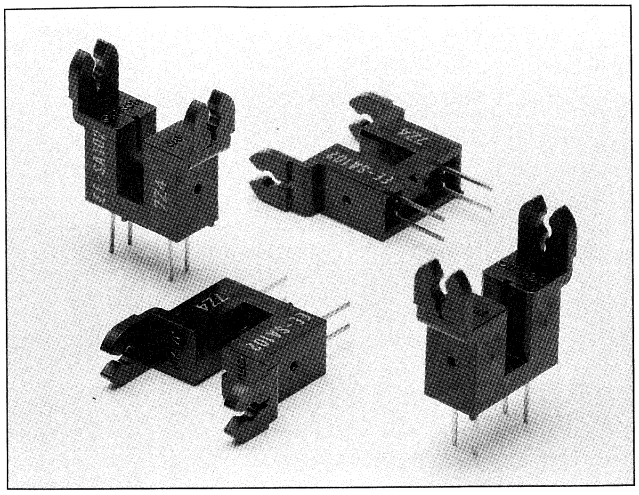
OMRON

Opto–Switch

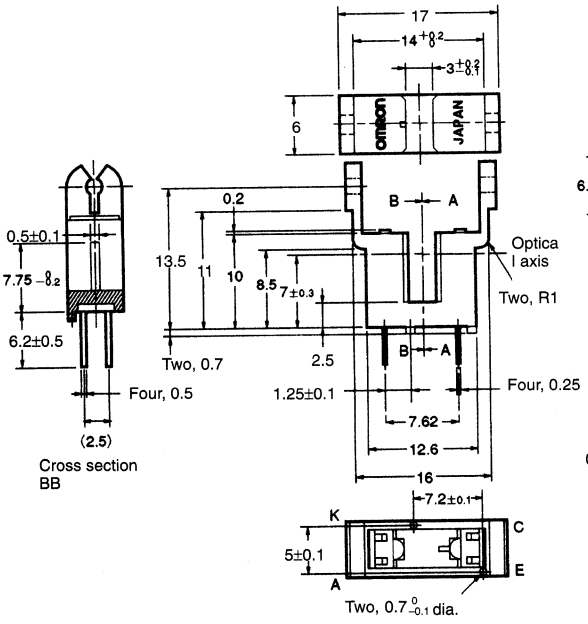
EE–SA102

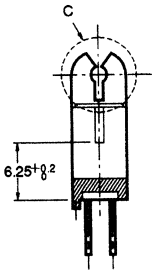
Actuator Mounted

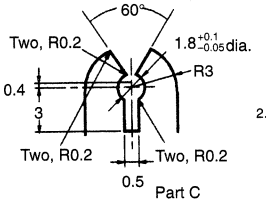
- Phototransistor output.
- Designed to incorporate external actuator.
- 3mm slot width.
- PCB mounting type.
- High resolution with a 0.5-mm-wide aperture.



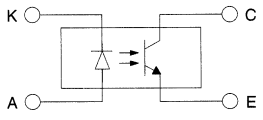
Dimensions







Internal Circuit



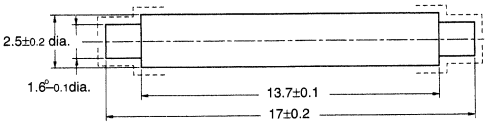
Terminal No.	Name
A	Anode
K	Cathode
C	Collector
E	Emitter

Unless otherwise specified, the tolerances are ±0.2.

Actuator Dimensions

Note: 1. Make sure that the portions marked with dotted lines have no burrs.

2. The material of the actuator must be selected by considering the infrared permeability of the actuator.



Specifications

■ Absolute Maximum Ratings (Ta = 25°C)

Item		Symbol	Rated value
Emitter	Forward current	I_F	50 mA (see note 1)
	Pulse forward current	I_{FP}	1 A (see note 2)
	Reverse voltage	V_R	4 V
Detector	Collector–Emitter voltage	V_{CEO}	30 V
	Emitter–Collector voltage	V_{ECO}	---
	Collector current	I_C	20 mA
	Collector dissipation	P_C	100 mW (see note 1)
Ambient temperature	Operating	Topr	–25°C to 85°C
	Storage	Tstg	–30°C to 100°C
	Soldering	Tsol	260°C

Note: 1. Refer to the temperature rating chart if the ambient temperature exceeds 25°C.

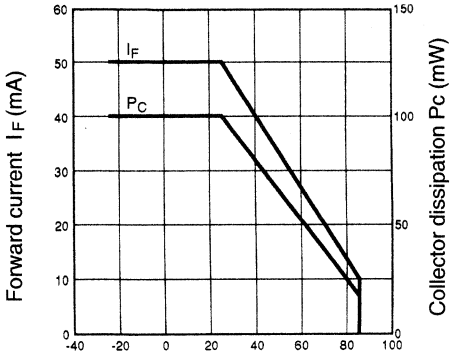
2. The pulse width is 10 μs maximum with a frequency of 100 Hz.

■ Electrical and Optical Characteristics (Ta = 25°C)

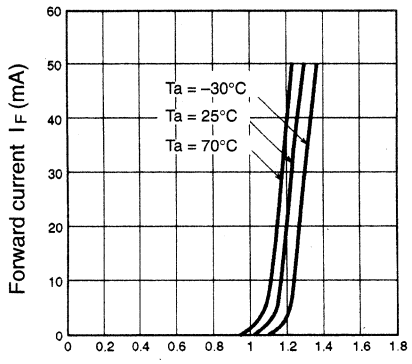
Item		Symbol	Value	Condition
Emitter	Forward voltage	V_F	1.2 V typ., 1.5 V max.	I_F = 30 mA
	Reverse current	I_R	0.01 μA typ., 10 μA max.	V_R = 4 V
	Peak emission wavelength	λ_P	940 nm typ.	I_F = 20 mA
Detector	Light current	I_L	0.5 mA min., 14 mA max.	I_F = 20 mA, V_{CE} = 10 V
	Dark current	I_D	2 nA typ., 200 nA max.	V_{CE} = 10 V, 0 ℓx
	Leakage current	I_{LEAK}	---	---
	Collector–Emitter saturated voltage	V_{CE} (sat)	0.1 V typ., 0.4 V max.	I_F = 20 mA, I_L = 0.1 mA
	Peak spectral sensitivity wavelength	λ_P	850 nm typ.	V_{CE} = 10 V
Rising time		tr	4 μs typ.	V_{CC} = 5 V, R_L = 100 Ω, I_L = 5 mA
Falling time		tf	4 μs typ.	V_{CC} = 5 V, R_L = 100 Ω, I_L = 5 mA

Engineering Data

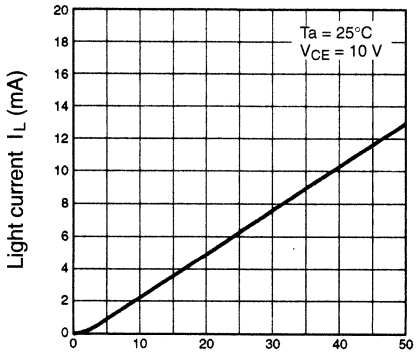
Forward Current vs. Collector Dissipation Temperature Rating



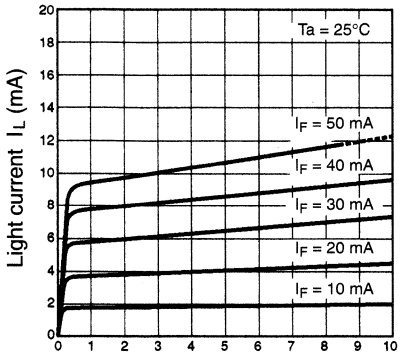
Forward Current vs. Forward Voltage Characteristics (Typical)



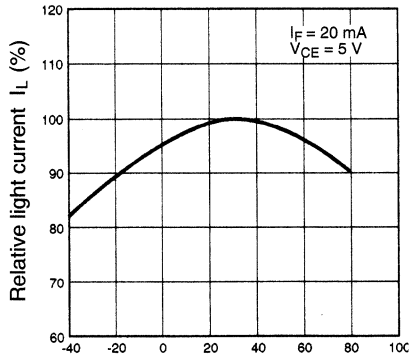
Light Current vs. Forward Current Characteristics (Typical)



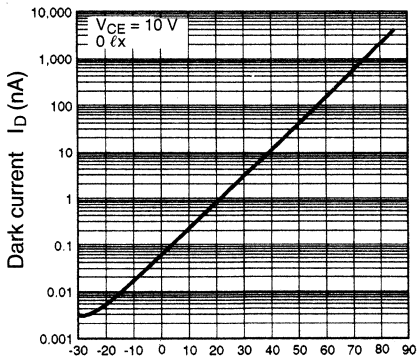
Light Current vs. Collector–Emitter Voltage Characteristics (Typical)



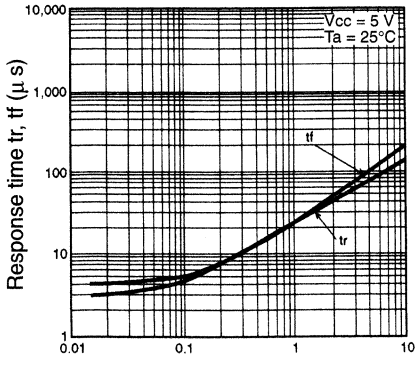
Relative Light Current vs. Ambient Temperature Characteristics (Typical)



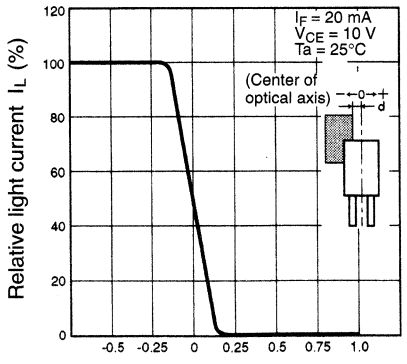
Dark Current vs. Ambient Temperature Characteristics (Typical)



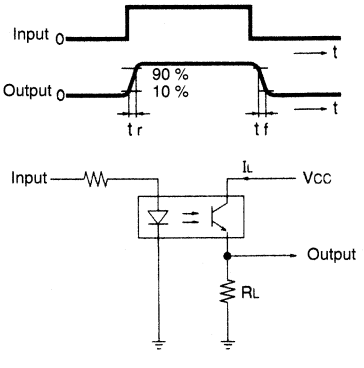
Response Time vs. Load Resistance Characteristics (Typical)



Sensing Position Characteristics (Typical)



Response Time Measurement Circuit



Opto-Switches

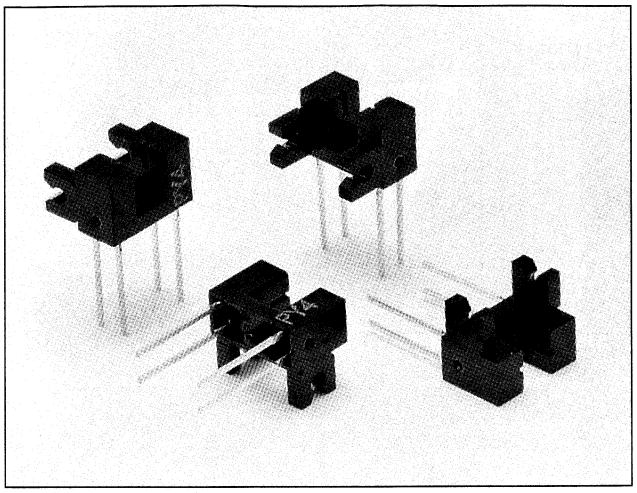
OMRON

Opto–Switch

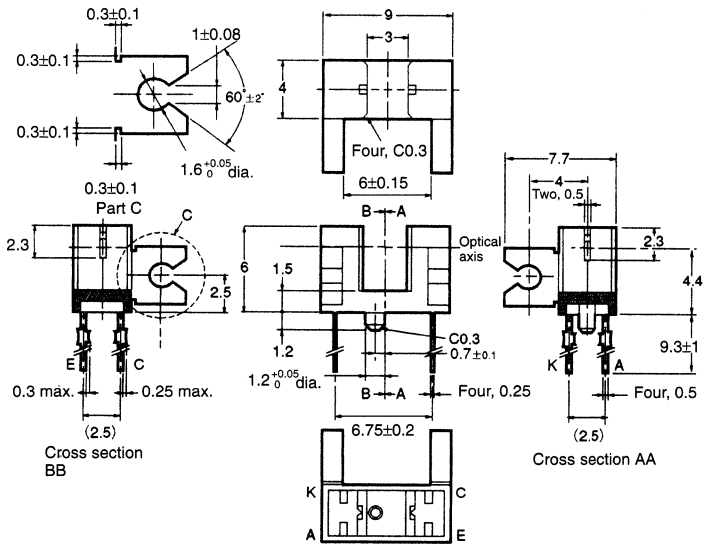
EE–SA103

Actuator Mounted

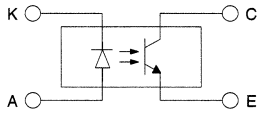
- Phototransistor output.
- Designed to incorporate an external actuator.
- PCB mounting type.
- High resolution with a 0.5-mm-wide aperture.
- Designed to incorporate external actuator.
- 3mm slot width.



Dimensions



Internal Circuit



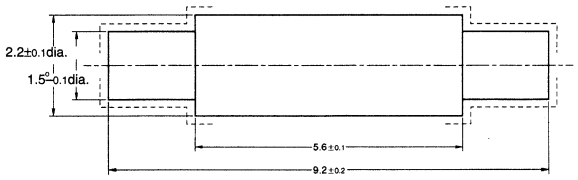
Terminal No.	Name
A	Anode
K	Cathode
C	Collector
E	Emitter

Unless otherwise specified, the tolerances are ±0.2mm.

Actuator Dimensions

Note: 1. Make sure that the portions marked with dotted lines have no burrs.

2. The material of the actuator must be selected by considering the infrared permeability of the actuator.



Specifications

■ Absolute Maximum Ratings (Ta = 25°C)

Item		Symbol	Rated value
Emitter	Forward current	I_F	50 mA (see note 1)
	Pulse forward current	I_{FP}	1 A (see note 2)
	Reverse voltage	V_R	4 V
Detector	Collector–Emitter voltage	V_{CEO}	30 V
	Emitter–Collector voltage	V_{ECO}	---
	Collector current	I_C	20 mA
	Collector dissipation	P_C	100 mW (see note 1)
Ambient temperature	Operating	Topr	–25°C to 85°C
	Storage	Tstg	–30°C to 100°C
	Soldering	Tsol	260°C

Note: 1. Refer to the temperature rating chart if the ambient temperature exceeds 25°C.

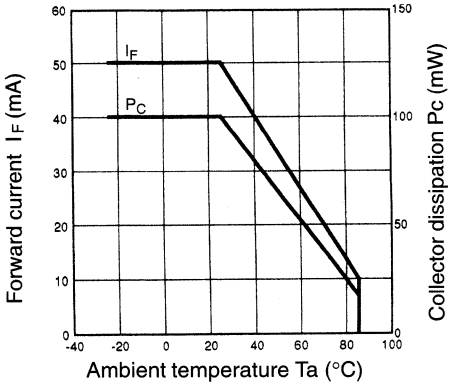
2. The pulse width is 10 μs maximum with a frequency of 100 Hz.

■ Electrical and Optical Characteristics (Ta = 25°C)

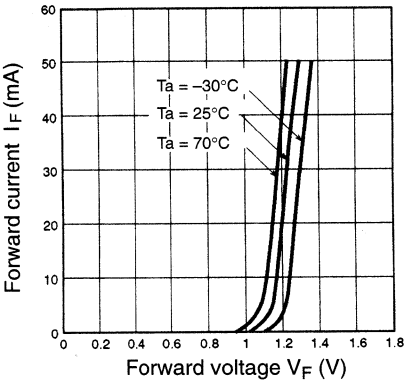
Item		Symbol	Value	Condition
Emitter	Forward voltage	V_F	1.2 V typ., 1.5 V max.	I_F = 30 mA
	Reverse current	I_R	0.01 μA typ., 10 μA max.	V_R = 4 V
	Peak emission wavelength	λ_P	940 nm typ.	I_F = 20 mA
Detector	Light current	I_L	0.5 mA min., 14 mA max.	I_F = 20 mA, V_{CE} = 10 V
	Dark current	I_D	2 nA typ., 200 nA max.	V_{CE} = 10 V, 0 ℓx
	Leakage current	I_{LEAK}	---	---
	Collector–Emitter saturated voltage	V_{CE} (sat)	0.1 V typ., 0.4 V max.	I_F = 20 mA, I_L = 0.1 mA
	Peak spectral sensitivity wavelength	λ_P	850 nm typ.	V_{CE} = 10 V
Rising time		tr	4 μs typ.	V_{CC} = 5 V, R_L = 100 Ω, I_L = 5 mA
Falling time		tf	4 μs typ.	V_{CC} = 5 V, R_L = 100 Ω, I_L = 5 mA

Engineering Data

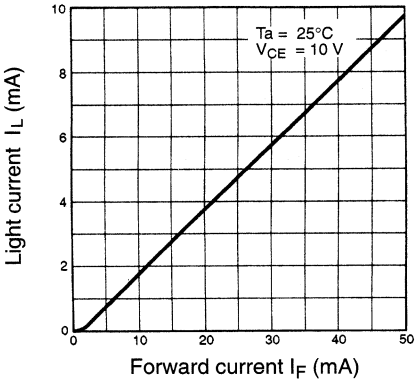
Forward Current vs. Collector Dissipation Temperature Rating



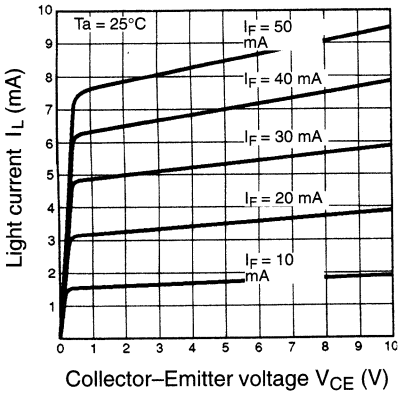
Forward Current vs. Forward Voltage Characteristics (Typical)



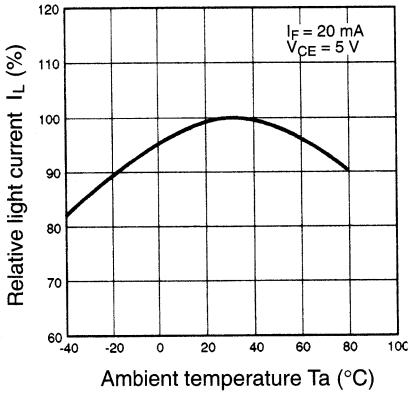
Light Current vs. Forward Current Characteristics (Typical)



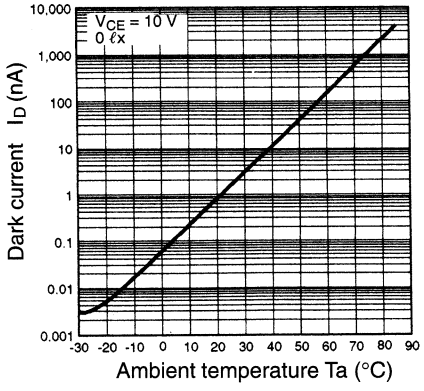
Light Current vs. Collector–Emitter Voltage Characteristics (Typical)



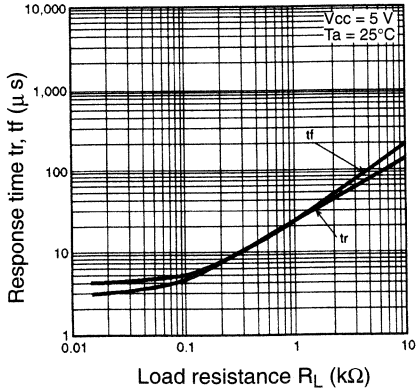
Relative Light Current vs. Ambient Temperature Characteristics (Typical)



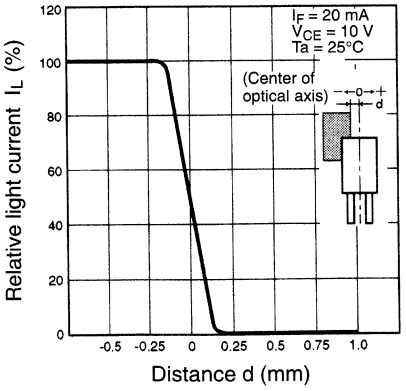
Dark Current vs. Ambient Temperature Characteristics (Typical)



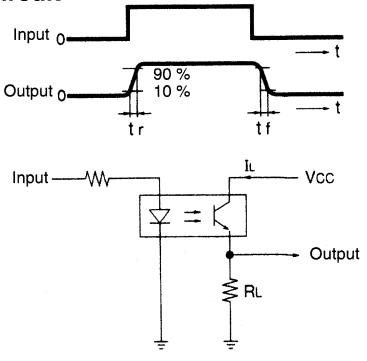
Response Time vs. Load Resistance Characteristics (Typical)



Sensing Position Characteristics (Typical)



Response Time Measurement Circuit



Opto-Switches

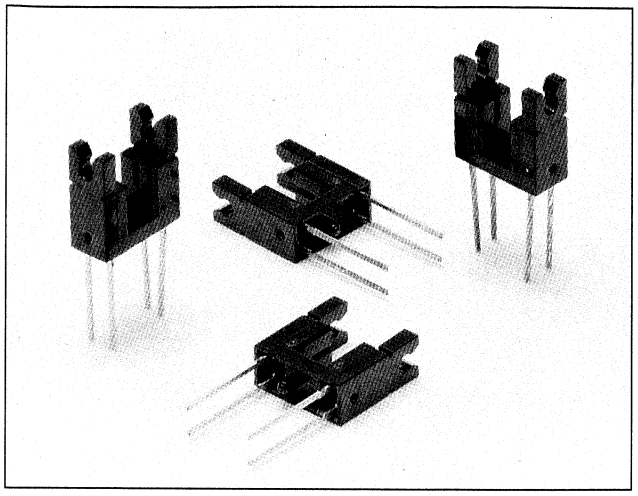
OMRON

Opto–Switch

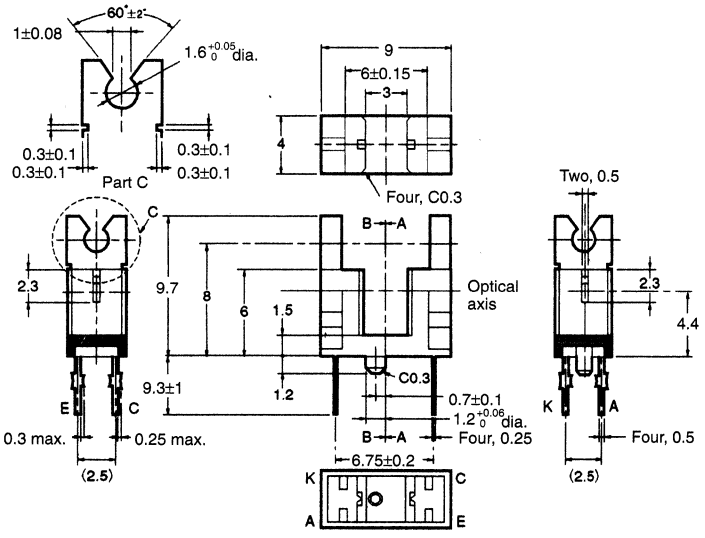
EE–SA104

Actuator Mounted

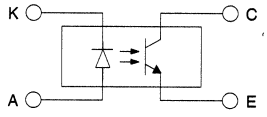
- Phototransistor output.
- Designed to incorporate external actuator.
- 3mm slot width.
- PCB mounting type.
- High resolution with a 0.5-mm-wide aperture.



Dimensions



Internal Circuit



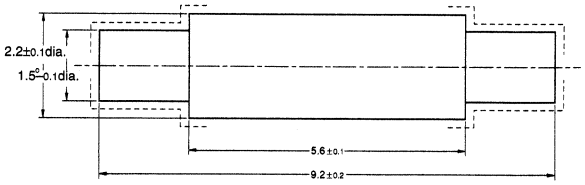
Terminal No.	Name
A	Anode
K	Cathode
C	Collector
E	Emitter

Unless otherwise specified, the tolerances are ±0.2mm.

Actuator Dimensions

Note: 1. Make sure that the portions marked with dotted lines have no burrs.

2. The material of the actuator must be selected by considering the infrared permeability of the actuator.



Specifications

■ Absolute Maximum Ratings (Ta = 25°C)

Item		Symbol	Rated value
Emitter	Forward current	I_F	50 mA (see note 1)
	Pulse forward current	I_{FP}	1 A (see note 2)
	Reverse voltage	V_R	4 V
Detector	Collector–Emitter voltage	V_{CEO}	30 V
	Emitter–Collector voltage	V_{ECO}	---
	Collector current	I_C	20 mA
	Collector dissipation	P_C	100 mW (see note 1)
Ambient temperature	Operating	Topr	–25°C to 85°C
	Storage	Tstg	–30°C to 100°C
	Soldering	Tsol	260°C

Note: 1. Refer to the temperature rating chart if the ambient temperature exceeds 25°C.

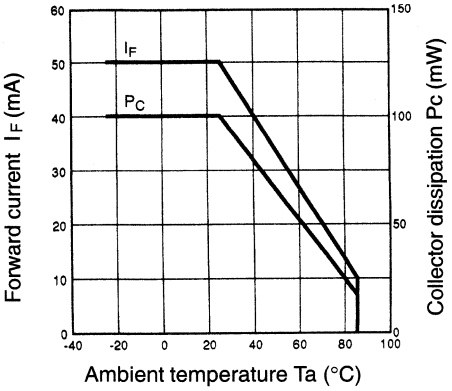
2. The pulse width is 10 μs maximum with a frequency of 100 Hz.

■ Electrical and Optical Characteristics (Ta = 25°C)

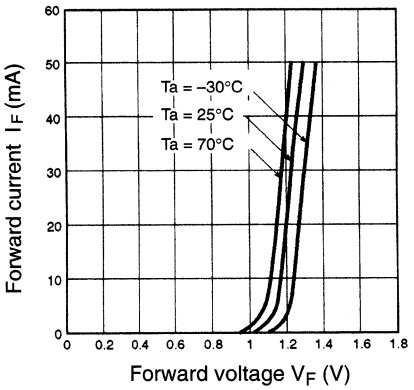
Item		Symbol	Value	Condition
Emitter	Forward voltage	V_F	1.2 V typ., 1.5 V max.	I_F = 30 mA
	Reverse current	I_R	0.01 μA typ., 10 μA max.	V_R = 4 V
	Peak emission wavelength	λ_P	940 nm typ.	I_F = 20 mA
Detector	Light current	I_L	0.5 mA min., 14 mA max.	I_F = 20 mA, V_{CE} = 10 V
	Dark current	I_D	2 nA typ., 200 nA max.	V_{CE} = 10 V, 0 ℓx
	Leakage current	I_{LEAK}	---	---
	Collector–Emitter saturated voltage	V_{CE} (sat)	0.1 V typ., 0.4 V max.	I_F = 20 mA, I_L = 0.1 mA
	Peak spectral sensitivity wavelength	λ_P	850 nm typ.	V_{CE} = 10 V
Rising time		tr	4 μs typ.	V_{CC} = 5 V, R_L = 100 Ω, I_L = 5 mA
Falling time		tf	4 μs typ.	V_{CC} = 5 V, R_L = 100 Ω, I_L = 5 mA

Engineering Data

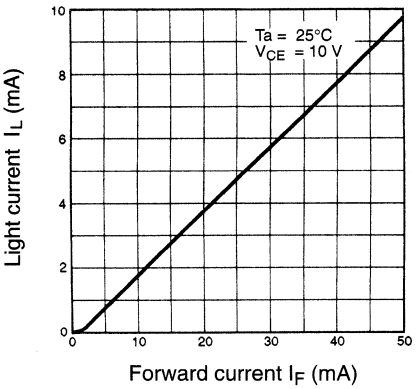
Forward Current vs. Collector Dissipation Temperature Rating



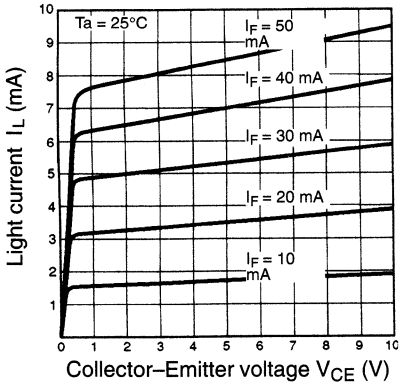
Forward Current vs. Forward Voltage Characteristics (Typical)



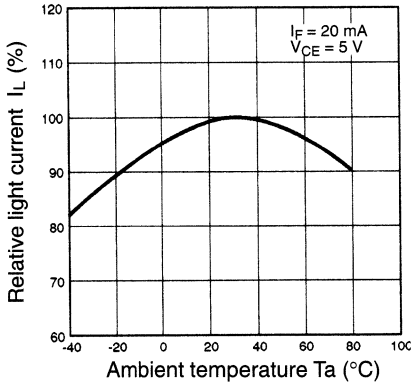
Light Current vs. Forward Current Characteristics (Typical)



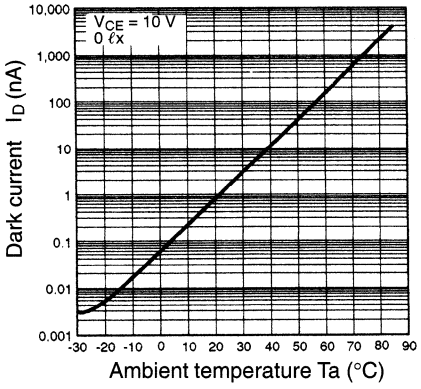
Light Current vs. Collector–Emitter Voltage Characteristics (Typical)



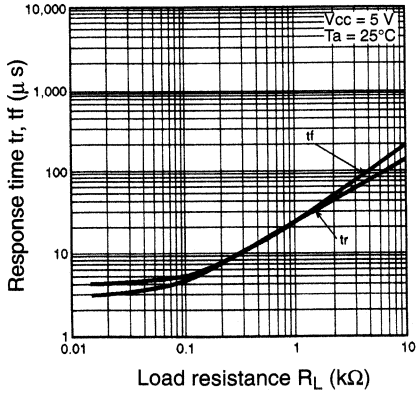
Relative Light Current vs. Ambient Temperature Characteristics (Typical)



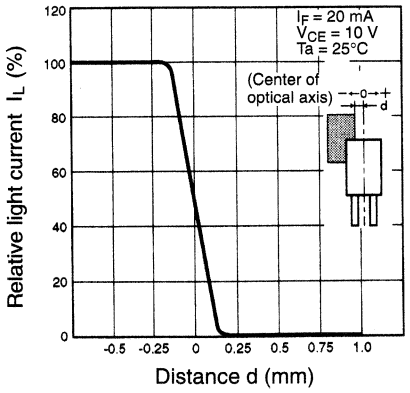
Dark Current vs. Ambient Temperature Characteristics (Typical)



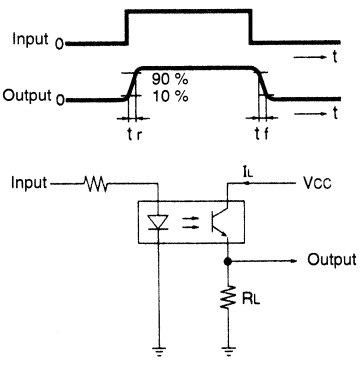
Response Time vs. Load Resistance Characteristics (Typical)



Sensing Position Characteristics (Typical)



Response Time Measurement Circuit



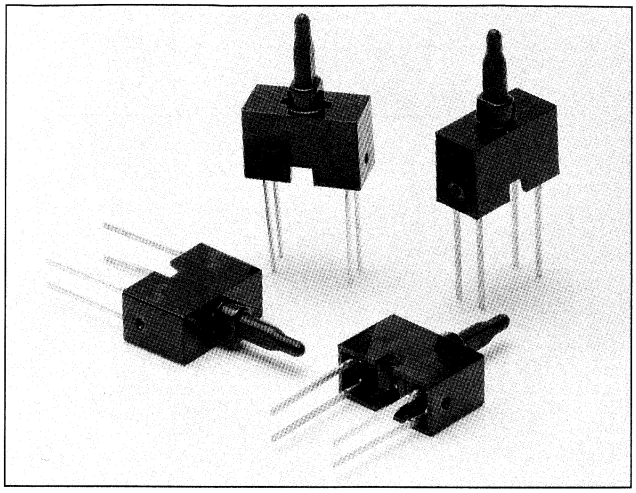
OMRON

Opto–Switch

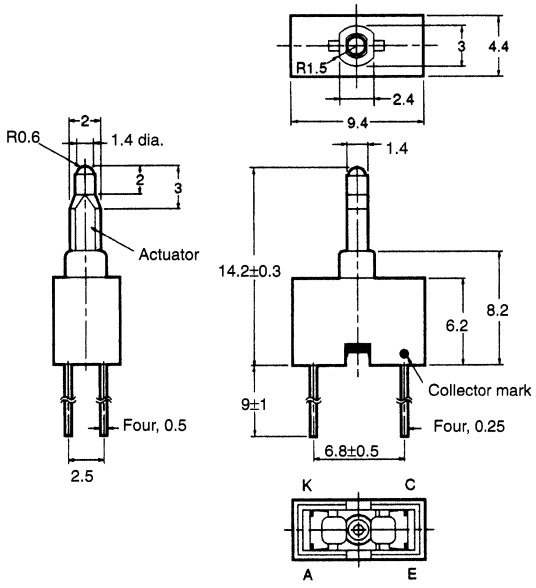
EE–SA105

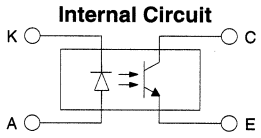
Actuator

- Phototransistor output.
- Incorporates built–in actuator.
- Small size allows use in confined spaces.
- No mechanical contacts ensure long life expectancy.
- Low operating force (15gf (0.15N)).



Dimensions





Terminal No.	Name
A	Anode
K	Cathode
C	Collector
E	Emitter

Unless otherwise specified, the tolerances are as shown below.

Dimensions	Tolerance
3 mm max.	±0.3
3 < mm ≤ 6	±0.375
6 < mm ≤ 10	±0.45
10 < mm ≤ 18	±0.55
18 < mm ≤ 30	±0.65

Specifications

■ Absolute Maximum Ratings (Ta = 25°C)

Item		Symbol	Rated value
Emitter	**Forward current**	I_F	50 mA (see note 1)
	Pulse forward current	I_{FP}	1 A (see note 2)
	Reverse voltage	V_R	4 V
Detector	**Collector–Emitter voltage**	V_{CEO}	30 V
	Emitter–Collector voltage	V_{ECO}	5 V
	Collector current	I_C	20 mA
	Collector dissipation	P_C	100 mW (see note 1)
Ambient temperature	**Operating**	Topr	–25°C to 70°C
	Storage	Tstg	–40°C to 100°C
	Soldering	Tsol	260°C

Note: 1. Refer to the temperature rating chart if the ambient temperature exceeds 25°C.
2. The pulse width is 10 μs maximum with a frequency of 100 Hz.

■ Electrical and Optical Characteristics (Ta = 25°C)

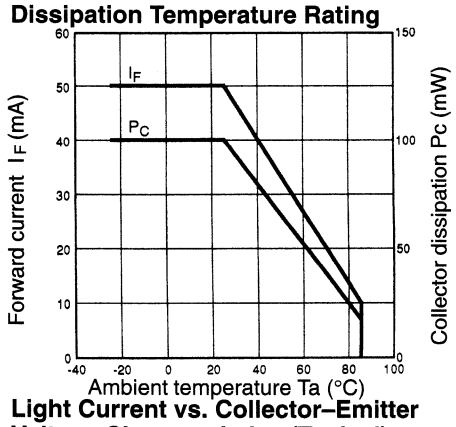
Item		Symbol	Value	Condition
Emitter	Forward voltage	V_F	1.2 V typ., 1.5 V max.	I_F = 30 mA
	Reverse current	I_R	0.01 μA typ., 10 μA max.	V_R = 4 V
	Peak emission wavelength	λ_P	940 nm typ.	I_F = 20 mA
Detector	Light current	I_L	0.5 mA min.	I_F = 20 mA, V_{CE} = 5 V at free position (FP)
	Dark current	I_D	2 nA typ., 200 nA max.	V_{CE} = 10 V, 0 ℓx
	Leakage current	I_{LEAK}	10 μA max.	I_F = 20 mA, V_{CE} = 5 V at operating position (OP)
	Collector–Emitter saturated voltage	V_{CE} (sat)	0.15 V typ., 0.4 V max.	I_F = 20 mA, I_L = 0.1 mA
	Peak spectral sensitivity wavelength	λ_P	850 nm typ.	V_{CE} = 10 V
Rising time		tr	---	---
Falling time		tf	---	---

■ Mechanical Characteristics

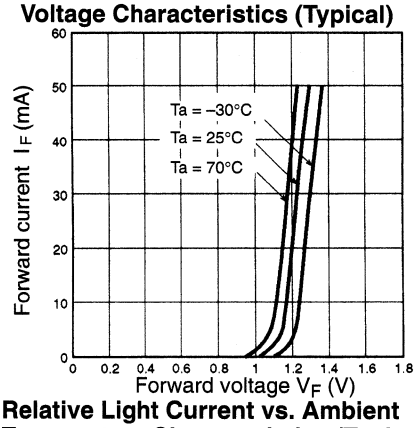
Actuator operation (I_F = 20 mA, V_{CE} = 5 V) (see note 1)	Free position (FP): 14.2±0.3 mm Operating position (OP): 13.0 mm min. Total travel position (TTP): 12.1 mm max.
Operating force (see note 2)	15 gf (0.15 N) max.
Mechanical life expectancy	500,000 operations min. (The actuator traveling from its FP to FP via TTP is regarded as one operation.)

Engineering Data

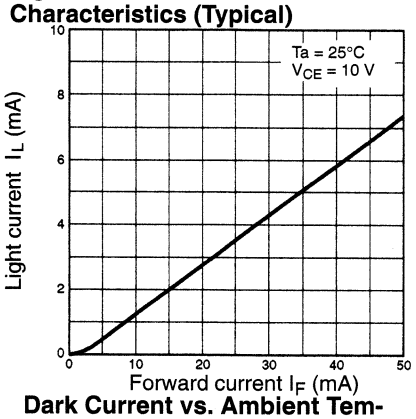
Forward Current vs. Collector Dissipation Temperature Rating



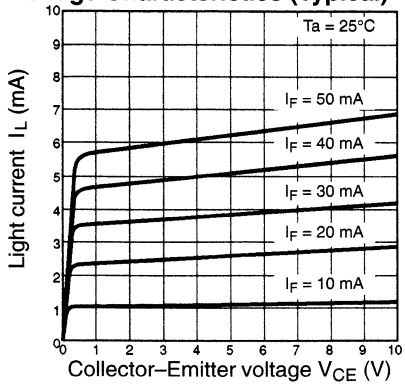
Forward Current vs. Forward Voltage Characteristics (Typical)



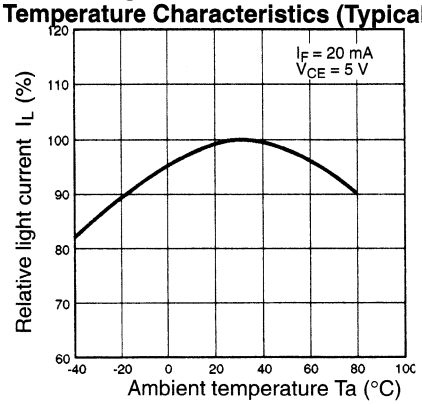
Light Current vs. Forward Current Characteristics (Typical)



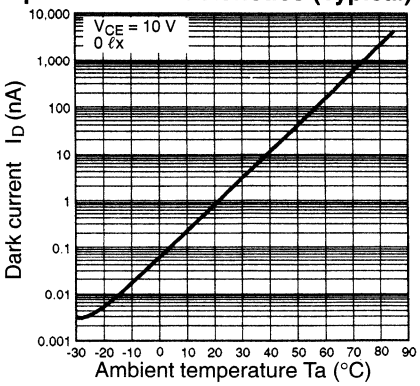
Light Current vs. Collector–Emitter Voltage Characteristics (Typical)



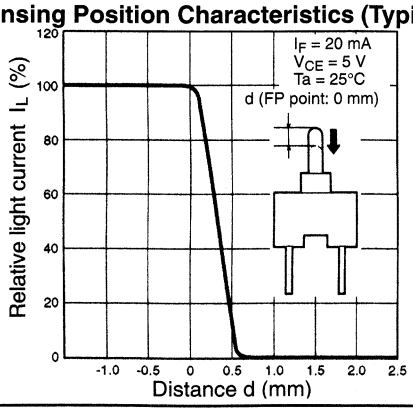
Relative Light Current vs. Ambient Temperature Characteristics (Typical)



Dark Current vs. Ambient Temperature Characteristics (Typical)



Sensing Position Characteristics (Typical)

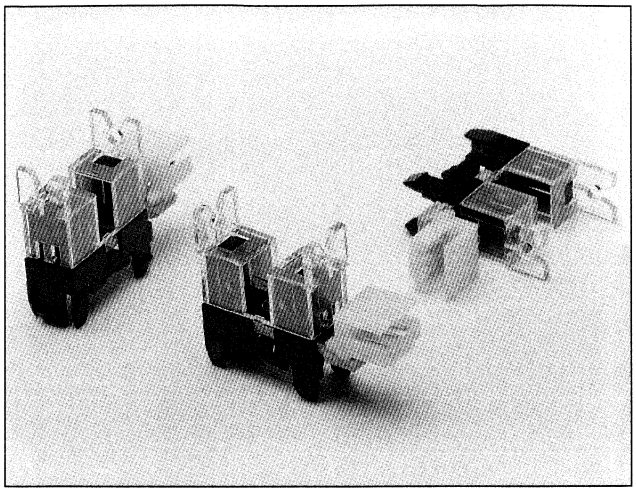


OMRON

Opto–Switch

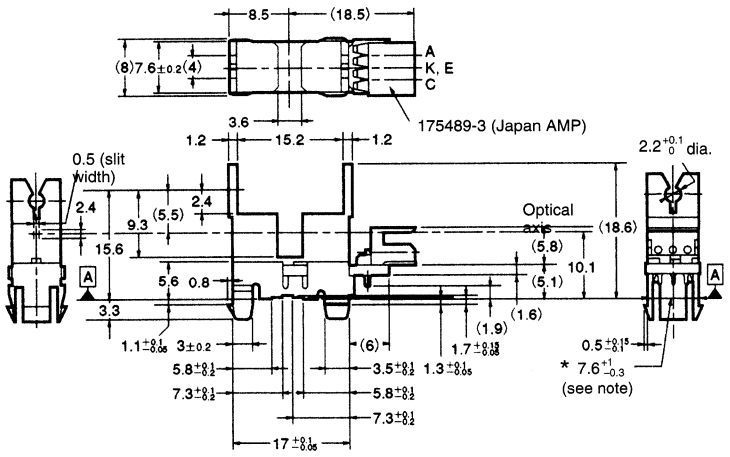
EE–SA107–P2

Actuator Mounted



- Phototransistor output.
- Designed to incorporate external actuator.
- 3.6mm slot width.
- Snap-in mounting model.
- Mountable to 1.0-, 1.2- and 1.6-mm-thick boards.
- Connects to Japan AMP's CT-series connectors.

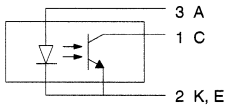
Dimensions



Note: The asterisked dimension is specified by datum A only.

Recommended Connectors:
Japan AMP 173977-3 (insulation displacement-type connector)
175778-3 (crimp-type connector)
179228-3 (crimp-type connector)

Internal Circuit

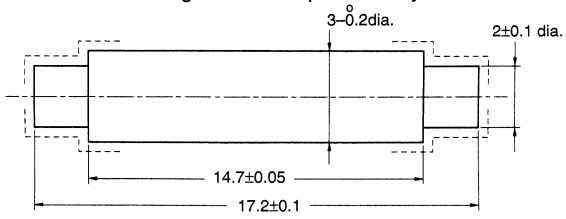


Terminal No.	Name
A	Anode
C	Collector
K, E	Cathode, Emitter

Unless otherwise specified, the tolerances are ±0.2mm.

Actuator Dimensions

Note: 1. Make sure that the portions marked with dotted lines have no burrs.
2. The material of the actuator must be selected by considering the infrared permeability of the actuator.



For recommended mounting holes see EE–SX407–P2 on page 408

Specifications

■ Absolute Maximum Ratings (Ta = 25°C)

Item		Symbol	Rated value
Emitter	Forward current	I_F	50 mA (see note)
	Pulse forward current	I_{FP}	---
	Reverse voltage	V_R	4 V
Detector	Collector–Emitter voltage	V_{CEO}	30 V
	Emitter–Collector voltage	V_{ECO}	5 V
	Collector current	I_C	20 mA
	Collector dissipation	P_C	100 mW (see note 1)
Ambient temperature	Operating	Topr	–25°C to 85°C
	Storage	Tstg	–40°C to 85°C
	Soldering	Tsol	---

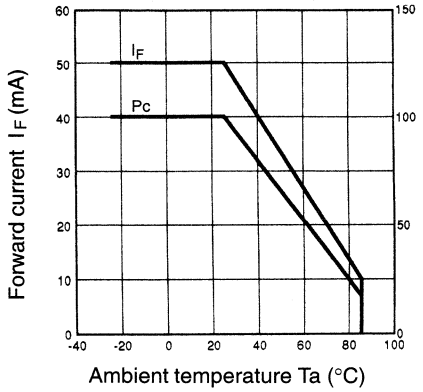
Note: Refer to the temperature rating chart if the ambient temperature exceeds 25°C.

■ Electrical and Optical Characteristics (Ta = 25°C)

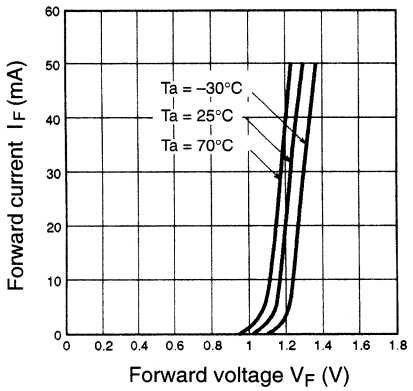
Item		Symbol	Value	Condition
Emitter	Forward voltage	V_F	1.2 V typ., 1.5 V max.	I_F = 30 mA
	Reverse current	I_R	0.01 μA typ., 10 μA max.	V_R = 4 V
	Peak emission wavelength	λ_P	940 nm typ.	I_F = 30 mA
Detector	Light current	I_L	0.5 mA min., 14 mA max.	I_F = 20 mA, V_{CE} = 5 V
	Dark current	I_D	200 nA max.	V_{CE} = 10 V, 0 ℓx
	Leakage current	I_{LEAK}	---	---
	Collector–Emitter saturated voltage	V_{CE} (sat)	0.1 V typ., 0.4 V max.	I_F = 20 mA, I_L = 0.3 mA
	Peak spectral sensitivity wavelength	λ_P	850 nm typ.	V_{CE} = 5 V
Rising time		tr	8 μs typ.	V_{CC} = 5 V, R_L = 100 Ω, I_L = 1 mA
Falling time		tf	8 μs typ.	V_{CC} = 5 V, R_L = 100 Ω, I_L = 1 mA

Engineering Data

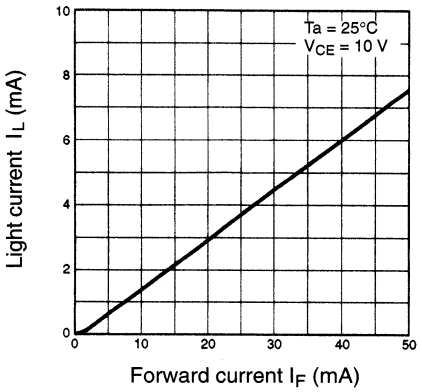
Forward Current vs. Collector Dissipation Temperature Rating



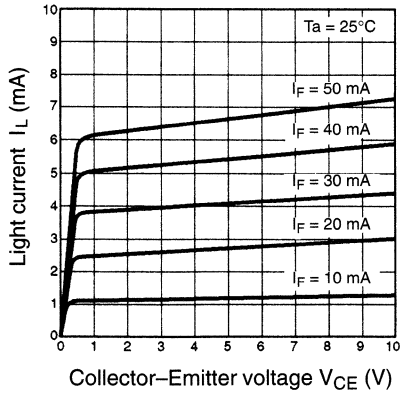
Forward Current vs. Forward Voltage Characteristics (Typical)



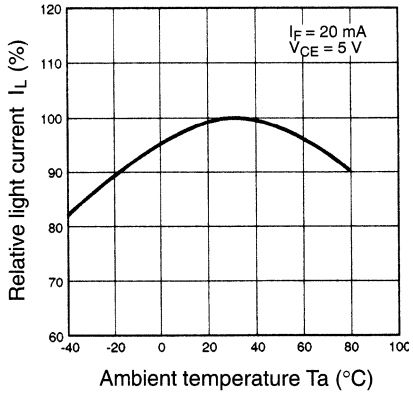
Light Current vs. Forward Current Characteristics (Typical)



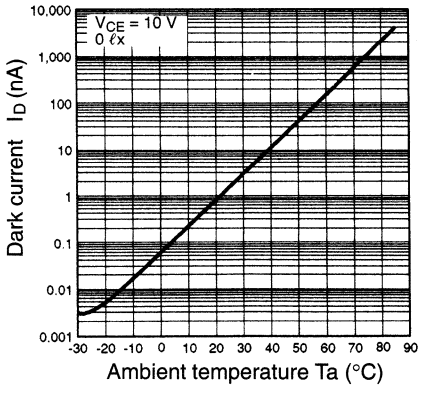
Light Current vs. Collector–Emitter Voltage Characteristics (Typical)



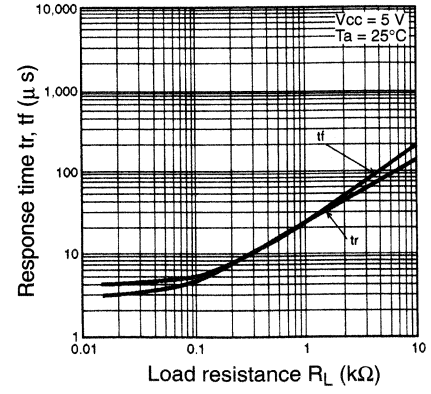
Relative Light Current vs. Ambient Temperature Characteristics (Typical)



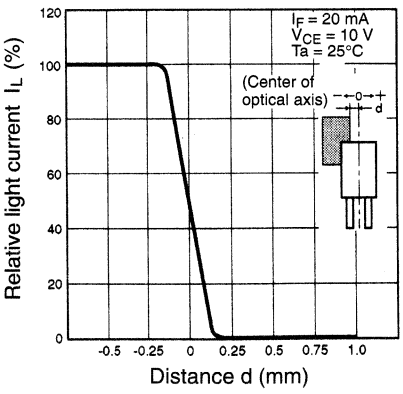
Dark Current vs. Ambient Temperature Characteristics (Typical)



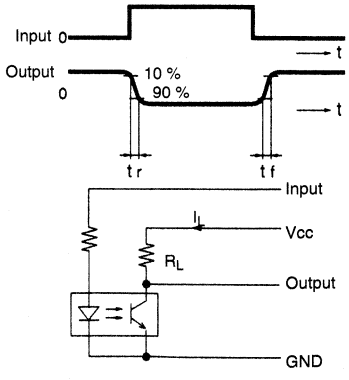
Response Time vs. Load Resistance Characteristics (Typical)



Sensing Position Characteristics (Typical)



Response Time Measurement Circuit



Opto-Switches

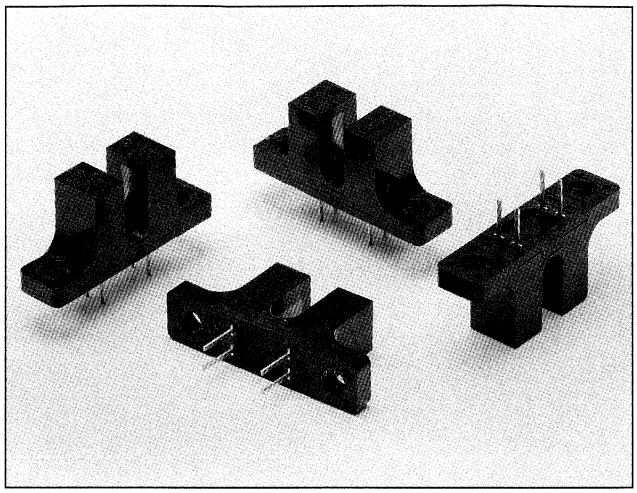
OMRON

Opto–Switch

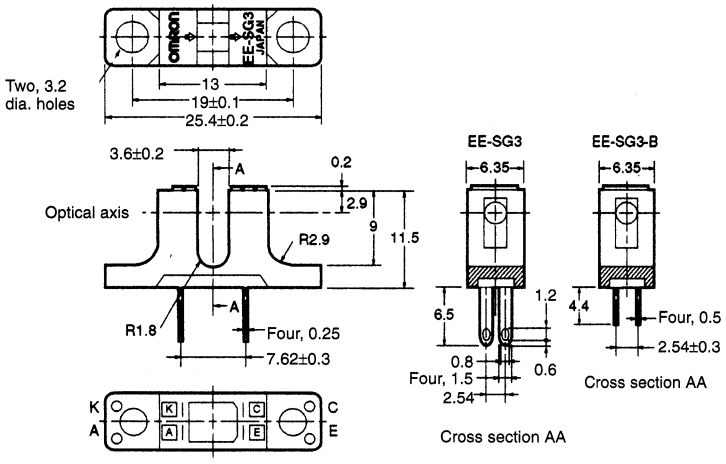
EE–SG3(–B)

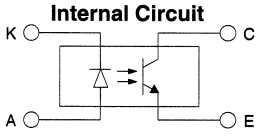
Transmissive

- Phototransistor output.
- IR transmissive aperture reduces effect of ambient light.
- No aperture opening prevents ingress of airborne contaminants.
- Solder terminal model (EE-SG3).
- PCB terminal model (EE-SG3-B).



Dimensions





Terminal No.	Name
A	Anode
K	Cathode
C	Collector
E	Emitter

Unless otherwise specified, the tolerances are as shown below.

Dimensions	Tolerance
3 mm max.	±0.3
3 < mm ≤ 6	±0.375
6 < mm ≤ 10	±0.45
10 < mm ≤ 18	±0.55
18 < mm ≤ 30	±0.65

Specifications

■ Absolute Maximum Ratings (Ta = 25°C)

Item		Symbol	Rated value
Emitter	**Forward current**	I_F	50 mA (see note 1)
	Pulse forward current	I_{FP}	1 A (see note 2)
	Reverse voltage	V_R	4 V
Detector	**Collector–Emitter voltage**	V_{CEO}	30 V
	Emitter–Collector voltage	V_{ECO}	---
	Collector current	I_C	20 mA
	Collector dissipation	P_C	100 mW (see note 1)
Ambient temperature	**Operating**	Topr	–25°C to 85°C
	Storage	Tstg	–30°C to 100°C
	Soldering	Tsol	260°C

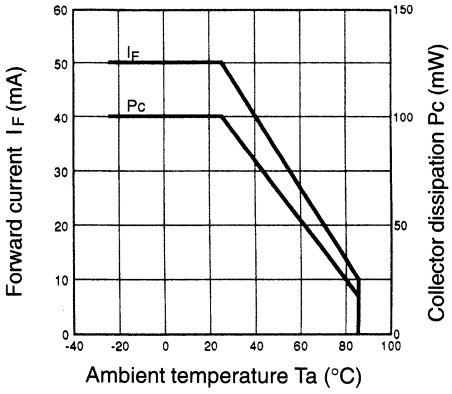
Note: 1. Refer to the temperature rating chart if the ambient temperature exceeds 25°C.
2. The pulse width is 10 μs maximum with a frequency of 100 Hz.

■ Electrical and Optical Characteristics (Ta = 25°C)

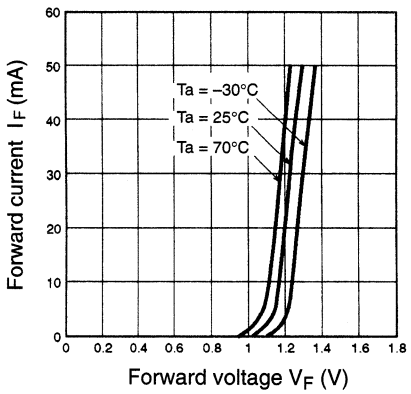
Item		Symbol	Value	Condition
Emitter	Forward voltage	V_F	1.2 V typ., 1.5 V max.	I_F = 30 mA
	Reverse current	I_R	0.01 μA typ., 10 μA max.	V_R = 4 V
	Peak emission wavelength	λ_P	940 nm typ.	I_F = 20 mA
Detector	Light current	I_L	2 mA min., 40 mA max.	I_F = 15 mA, V_{CE} = 10 V
	Dark current	I_D	2 nA typ., 200 nA max.	V_{CE} = 10 V, 0 ℓx
	Leakage current	I_{LEAK}	---	---
	Collector–Emitter saturated voltage	V_{CE} (sat)	0.1 V typ., 0.4 V max.	I_F = 30 mA, I_L = 1 mA
	Peak spectral sensitivity wavelength	λ_P	850 nm typ.	V_{CE} = 10 V
Rising time		tr	4 μs typ.	V_{CC} = 5 V, R_L = 100 Ω, I_L = 5 mA
Falling time		tf	4 μs typ.	V_{CC} = 5 V, R_L = 100 Ω, I_L = 5 mA

■ Engineering Data

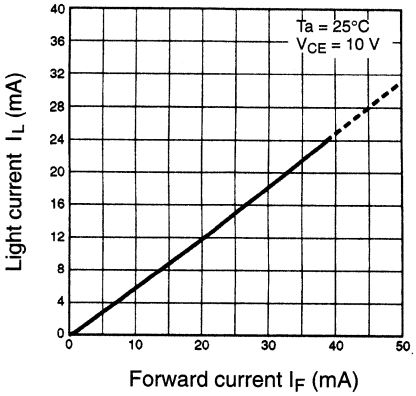
Forward Current vs. Collector Dissipation Temperature Rating



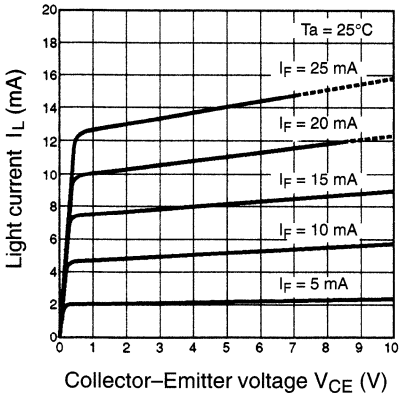
Forward Current vs. Forward Voltage Characteristics (Typical)



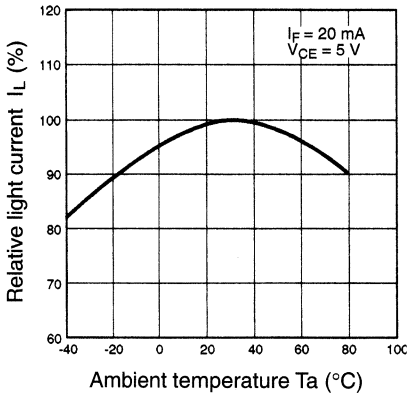
Light Current vs. Forward Current Characteristics (Typical)



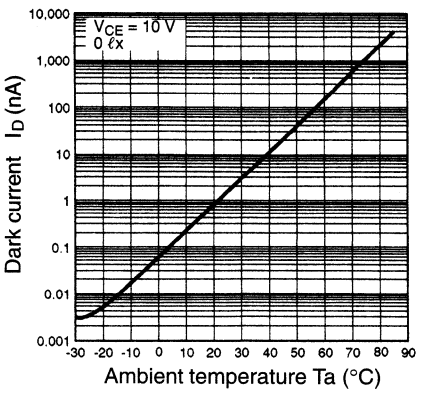
Light Current vs. Collector–Emitter Voltage Characteristics (Typical)



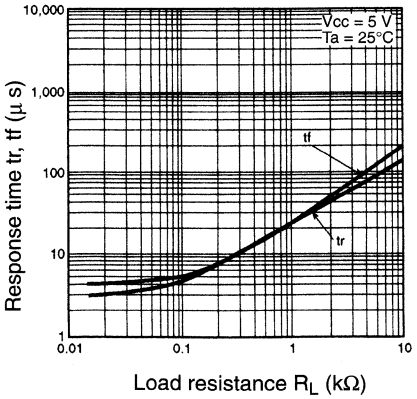
Relative Light Current vs. Ambient Temperature Characteristics (Typical)



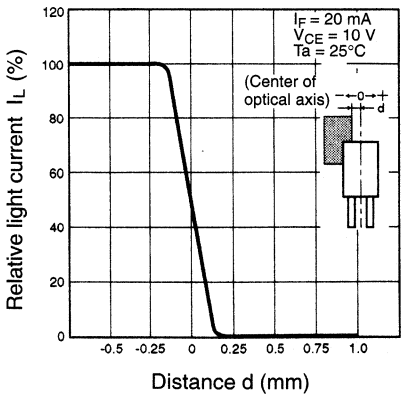
Dark Current vs. Ambient Temperature Characteristics (Typical)



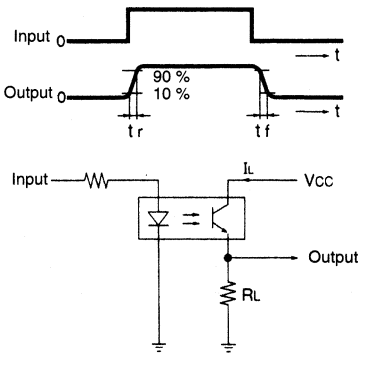
Response Time vs. Load Resistance Characteristics (Typical)



Sensing Position Characteristics (Typical)



Response Time Measurement Circuit



Opto-Switches

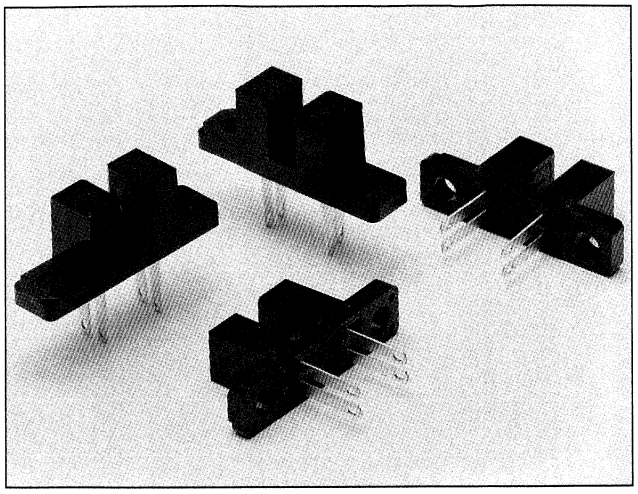
OMRON

Opto–Switch

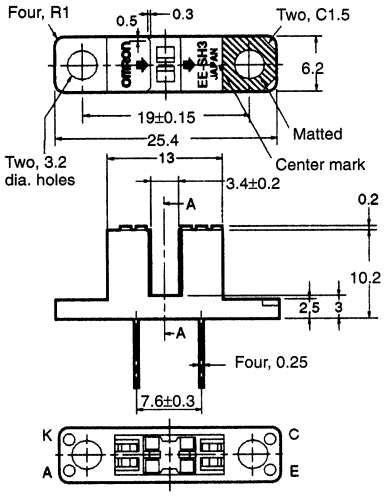
EE–SH3

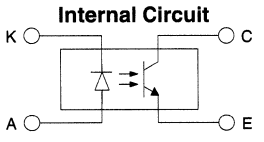
Transmissive

- Phototransistor output.
- High-resolution model with a 0.2-mm-wide or 0.5-mm-wide sensing aperture, high-sensitivity model with a 1-mm-wide sensing aperture, and model with a horizontal sensing aperture are available.
- Solder terminal models:
  EE-SH3/-SH3-CS/-SH3-DS/-SH3-GS
- PCB terminal models:
  EE-SH3-B/-SH3-C/-SH3-D/-SH3-G
- Incorporating mounting tabs.



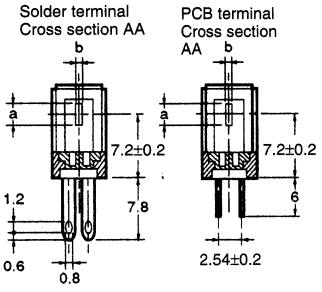
Dimensions





Terminal No.	Name
A	Anode
K	Cathode
C	Collector
E	Emitter

Model	Slit (a x b)
EE-SH3(-B)	2.1 x 0.5
EE-SH3-C(S)	2.1 x 1.0
EE-SH3-D(S)	2.1 x 0.2
EE-SH3-G(S)	0.5 x 2.1



Unless otherwise specified, the tolerances are as shown below.

Dimensions	Tolerance
3 mm max.	±0.2
3 < mm ≤ 6	±0.24
6 < mm ≤ 10	±0.29
10 < mm ≤ 18	±0.35
18 < mm ≤ 30	±0.42

Specifications

■ Absolute Maximum Ratings (Ta = 25°C)

Item		Symbol	Rated value
Emitter	Forward current	I_F	50 mA (see note 1)
	Pulse forward current	I_{FP}	1 A (see note 2)
	Reverse voltage	V_R	4 V
Detector	Collector–Emitter voltage	V_{CEO}	30 V
	Emitter–Collector voltage	V_{ECO}	---
	Collector current	I_C	20 mA
	Collector dissipation	P_C	100 mW (see note 1)
Ambient temperature	Operating	Topr	–25°C to 85°C
	Storage	Tstg	–30°C to 100°C
	Soldering	Tsol	260°C

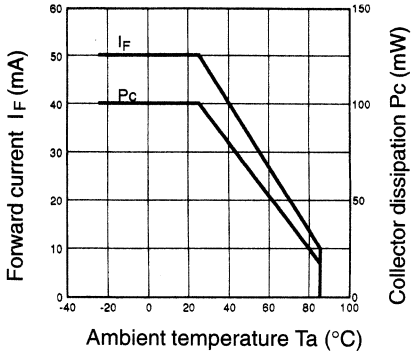
Note: 1. Refer to the temperature rating chart if the ambient temperature exceeds 25°C.
2. The pulse width is 10 μs maximum with a frequency of 100 Hz.

■ Electrical and Optical Characteristics (Ta = 25°C)

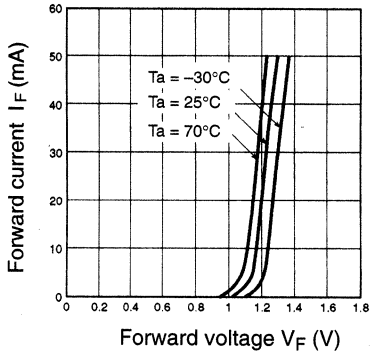
Item		Symbol	Value				Condition
			EE-SH3(-B)	EE-SH3-C(S)	EE-SH3-D(S)	EE-SH3-G(S)	
Emitter	Forward voltage	V_F	1.2 V typ., 1.5 V max.				I_F = 30 mA
	Reverse current	I_R	0.01 μA typ., 10 μA max.				V_R = 4 V
	Peak emission wavelength	λ_P	940 nm typ.				I_F = 20 mA
Detector	Light current	I_L	0.5 to 14 mA typ.	1 to 28 mA typ.	0.1 mA min.	0.5 to 14 mA	I_F = 20 mA, V_{CE} = 10 V
	Dark current	I_D	2 nA typ., 200 nA max.				V_{CE} = 10 V, 0 ℓx
	Leakage current	I_{LEAK}	---				---
	Collector–Emitter saturated voltage	V_{CE} (sat)	0.1 V typ., 0.4 V max.				I_F = 20 mA, I_L = 0.1 mA
Detector	Peak spectral sensitivity wavelength	λ_P	850 nm typ.				V_{CE} = 10 V
Rising time		tr	4 μs typ.				V_{CC} = 5 V, R_L = 100 Ω, I_L = 5 mA
Falling time		tf	4 μs typ.				

Engineering Data

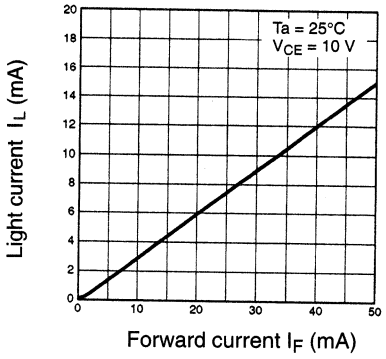
Forward Current vs. Collector Dissipation Temperature Rating



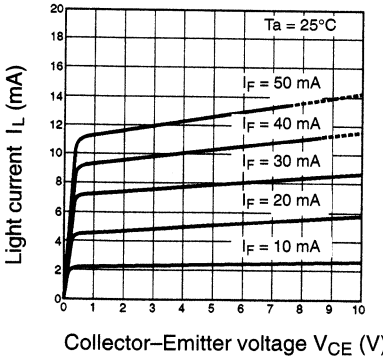
Forward Current vs. Forward Voltage Characteristics (Typical)



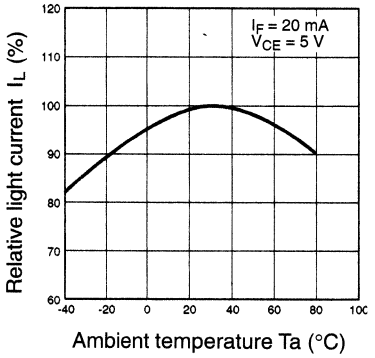
Light Current vs. Forward Current Characteristics (Typical)



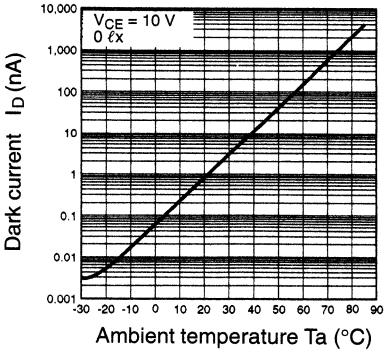
Light Current vs. Collector–Emitter Voltage Characteristics (EE-SH3(-B))



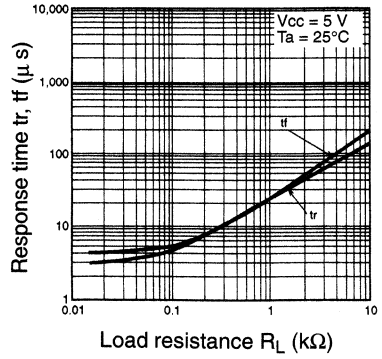
Relative Light Current vs. Ambient Temperature Characteristics (Typical)



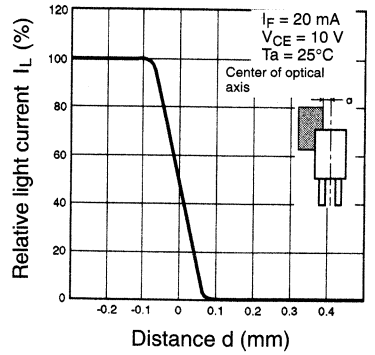
Dark Current vs. Ambient Temperature Characteristics (Typical)



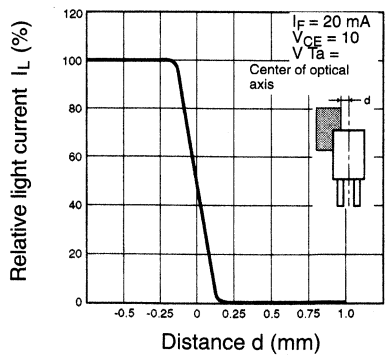
Response Time vs. Load Resistance Characteristics (Typical)



Sensing Position Characteristics (EE-SH3-D(S))

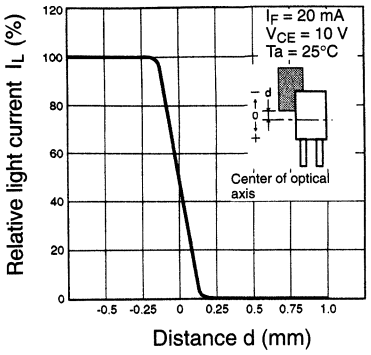


Sensing Position Characteristics (EE-SH3(-B))

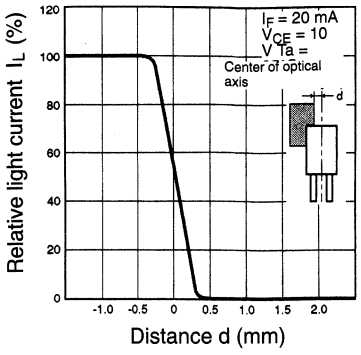


Opto-Switches

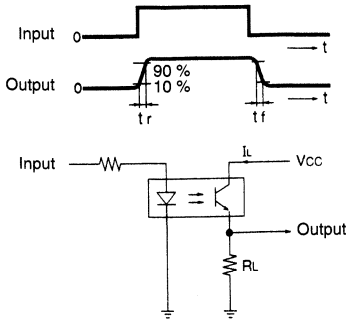
Sensing Position Characteristics (EE-SH3-G(S))



Sensing Position Characteristics (EE-SH3-C(S))



Response Time Measurement Circuit



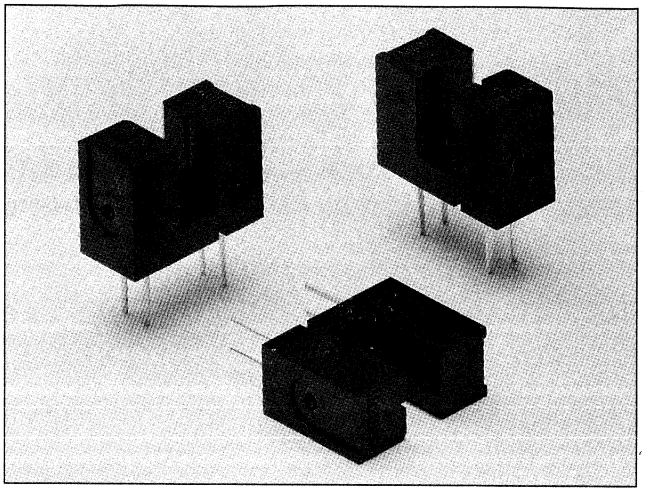
OMRON

Opto–Switch

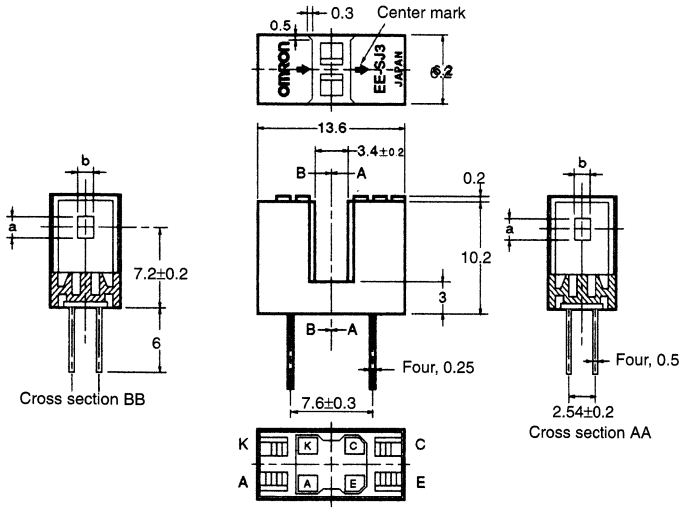
EE–SJ3

Transmissive

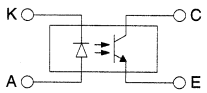
- Phototransistor output.
- High-resolution model with a 0.2-mm-wide sensing aperture; EE–SJ3D
- High sensitivity model; EE–SJ3–C
- Horizontal sensing aperture model; EE–SJ3–G
- PCB mounting.



Dimensions



Internal Circuit



Terminal No.	Name
A	Anode
K	Cathode
C	Collector
E	Emitter

Unless otherwise specified, the tolerances are as shown below.

Dimensions	Tolerance
3 mm max.	±0.2
3 < mm ≤ 6	±0.24
6 < mm ≤ 10	±0.29
10 < mm ≤ 18	±0.35
18 < mm ≤ 30	±0.42

Model	Slit (a x b)
EE-SJ3-C	2.1 x 1.0
EE-SJ3-D	2.1 x 0.2
EE-SJ3-G	0.5 x 2.1

Specifications

■ Absolute Maximum Ratings (Ta = 25°C)

Item		Symbol	Rated value
Emitter	Forward current	I_F	50 mA (see note 1)
	Pulse forward current	I_{FP}	1 A (see note 2)
	Reverse voltage	V_R	4 V
Detector	Collector–Emitter voltage	V_{CEO}	30 V
	Emitter–Collector voltage	V_{ECO}	---
	Collector current	I_C	20 mA
	Collector dissipation	P_C	100 mW (see note 1)
Ambient temperature	Operating	Topr	–25°C to 85°C
	Storage	Tstg	–30°C to 100°C
	Soldering	Tsol	260°C

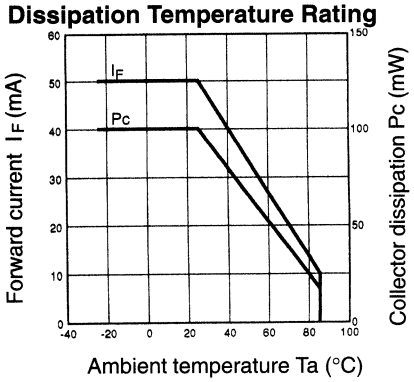
Note: 1. Refer to the temperature rating chart if the ambient temperature exceeds 25°C.
2. The pulse width is 10 μs maximum with a frequency of 100 Hz.

■ Electrical and Optical Characteristics (Ta = 25°C)

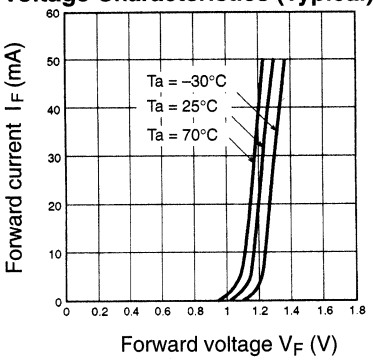
Item		Symbol	Value			Condition
			EE-SJ3-C	EE-SJ3-D	EE-SJ3-G	
Emitter	Forward voltage	V_F	1.2 V typ., 1.5 V max.			I_F = 30 mA
	Reverse current	I_R	0.01 μA typ., 10 μA max.			V_R = 4 V
	Peak emission wavelength	λ_P	940 nm typ.			I_F = 20 mA
Detector	Light current	I_L	1 to 28 mA typ.	0.1 mA min.	0.5 to 14 mA	I_F = 20 mA, V_{CE} = 10 V
	Dark current	I_D	2 nA typ., 200 nA max.			V_{CE} = 10 V, 0 ℓx
	Leakage current	I_{LEAK}	---			---
	Collector–Emitter saturated voltage	V_{CE} (sat)	0.1 V typ., 0.4 V max.			I_F = 20 mA, I_L = 0.1 mA
	Peak spectral sensitivity wavelength	λ_P	850 nm typ.			V_{CE} = 10 V
Rising time		tr	4 μs typ.			V_{CC} = 5 V, R_L = 100 Ω, I_L = 5 mA
Falling time		tf	4 μs typ.			

■ Engineering Data

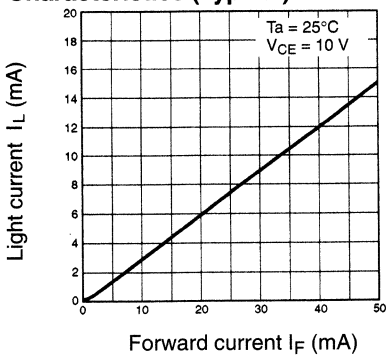
Forward Current vs. Collector Dissipation Temperature Rating



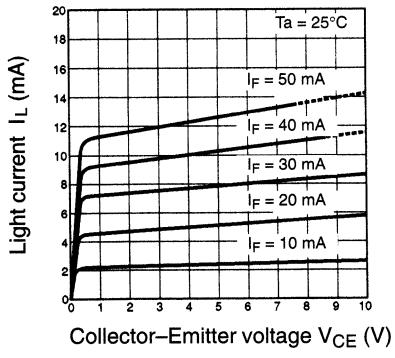
Forward Current vs. Forward Voltage Characteristics (Typical)



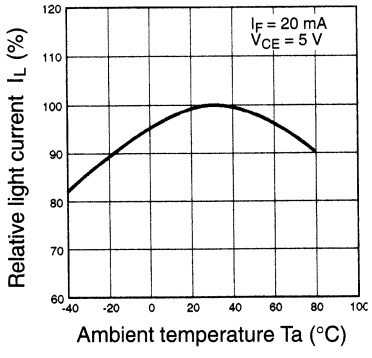
Light Current vs. Forward Current Characteristics (Typical)



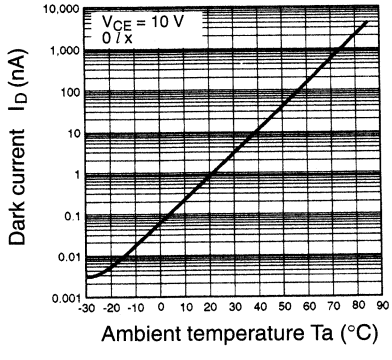
Light Current vs. Collector–Emitter Voltage Characteristics (EE-SJ3-G)



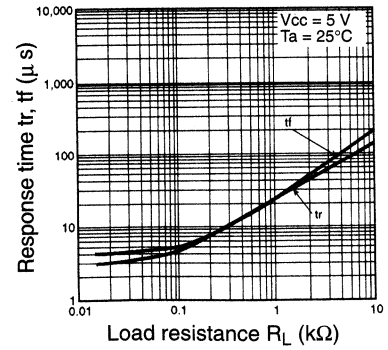
Relative Light Current vs. Ambient Temperature Characteristics (Typical)



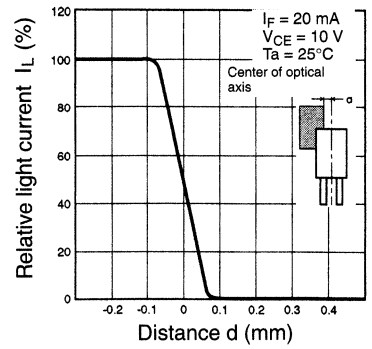
Dark Current vs. Ambient Temperature Characteristics (Typical)



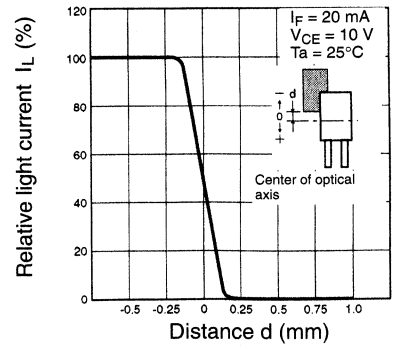
Response Time vs. Load Resistance Characteristics (Typical)



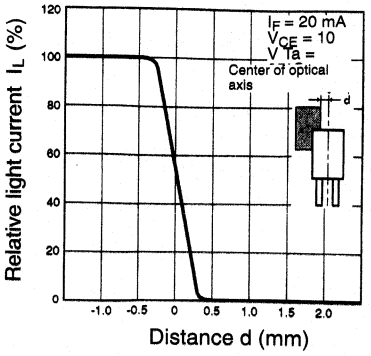
Sensing Position Characteristics (EE-SJ3-D)



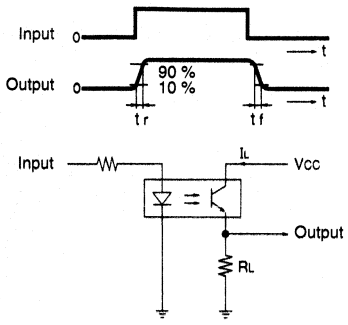
Sensing Position Characteristics (EE-SJ3-G)



Sensing Position Characteristics (EE-SJ3-C)



Response Time Measurement Circuit



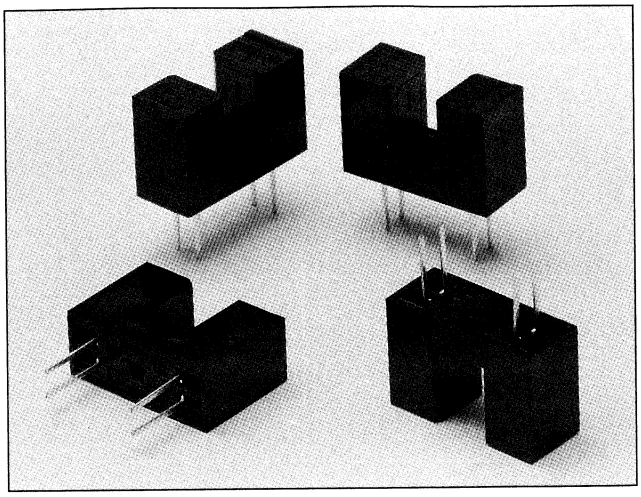
OMRON

Opto–Switch

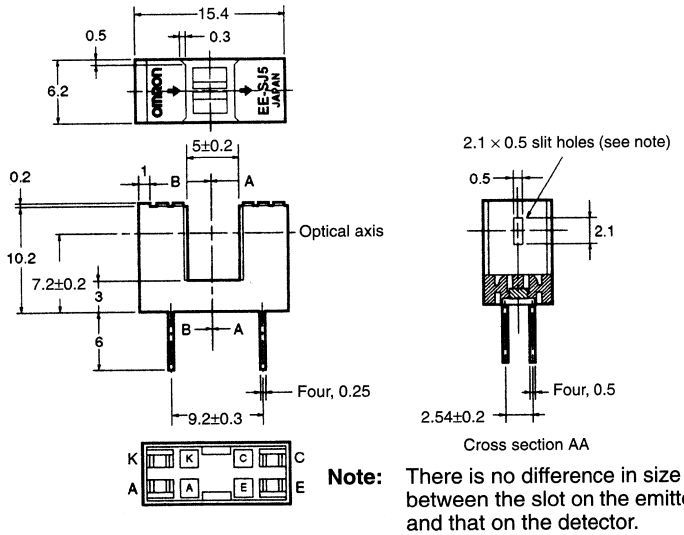
EE–SJ5–B

Transmissive

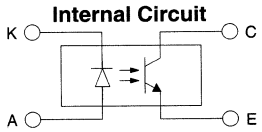
- Phototransistor output.
- General-purpose model with a 5-mm-wide slot.
- PCB mounting type.
- High resolution with a 0.5-mm-wide aperture.
- Compact size allows use in small equipment.



Dimensions



Note: There is no difference in size between the slot on the emitter and that on the detector.



Terminal No.	Name
A	Anode
K	Cathode
C	Collector
E	Emitter

Unless otherwise specified, the tolerances are as shown below.

Dimensions	Tolerance
3 mm max.	±0.3
3 < mm ≤ 6	±0.375
6 < mm ≤ 10	±0.45
10 < mm ≤ 18	±0.55
18 < mm ≤ 30	±0.65

Specifications

■ Absolute Maximum Ratings (Ta = 25°C)

Item		Symbol	Rated value
Emitter	Forward current	I_F	50 mA (see note 1)
	Pulse forward current	I_{FP}	1 A (see note 2)
	Reverse voltage	V_R	4 V
Detector	Collector–Emitter voltage	V_{CEO}	30 V
	Emitter–Collector voltage	V_{ECO}	---
	Collector current	I_C	20 mA
	Collector dissipation	P_C	100 mW (see note 1)
Ambient temperature	Operating	Topr	–25°C to 85°C
	Storage	Tstg	–30°C to 100°C
	Soldering	Tsol	260°C

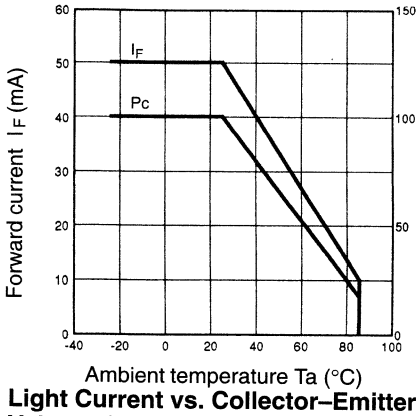
Note: 1. Refer to the temperature rating chart if the ambient temperature exceeds 25°C.
2. The pulse width is 10 μs maximum with a frequency of 100 Hz.

■ Electrical and Optical Characteristics (Ta = 25°C)

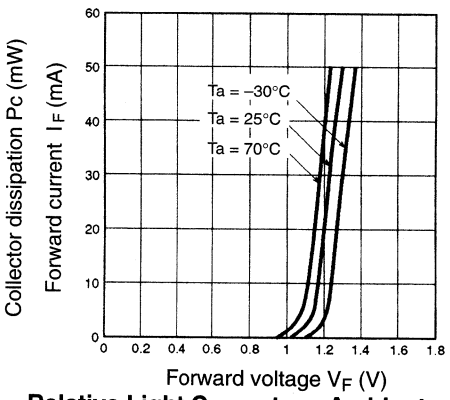
Item		Symbol	Value	Condition
Emitter	Forward voltage	V_F	1.2 V typ., 1.5 V max.	I_F = 30 mA
	Reverse current	I_R	0.01 μA typ., 10 μA max.	V_R = 4 V
	Peak emission wavelength	λ_P	940 nm typ.	I_F = 20 mA
Detector	Light current	I_L	0.5 mA min., 14 mA max.	I_F = 20 mA, V_{CE} = 10 V
	Dark current	I_D	2 nA typ., 200 nA max.	V_{CE} = 10 V, 0 ℓx
	Leakage current	I_{LEAK}	---	---
	Collector–Emitter saturated voltage	V_{CE} (sat)	0.1 V typ., 0.4 V max.	I_F = 20 mA, I_L = 0.1 mA
	Peak spectral sensitivity wavelength	λ_P	850 nm typ.	V_{CE} = 10 V
Rising time		tr	4 μs typ.	V_{CC} = 5 V, R_L = 100 Ω, I_L = 5 mA
Falling time		tf	4 μs typ.	V_{CC} = 5 V, R_L = 100 Ω, I_L = 5 mA

Engineering Data

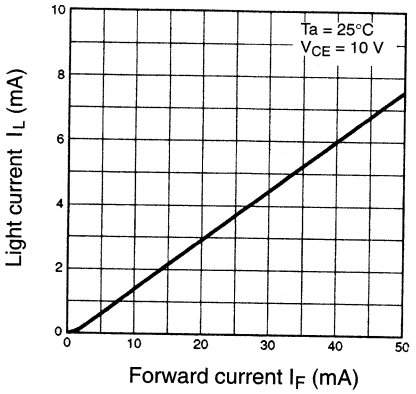
Forward Current vs. Collector Dissipation Temperature Rating



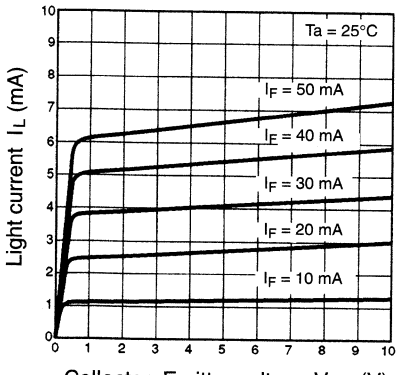
Forward Current vs. Forward Voltage Characteristics (Typical)



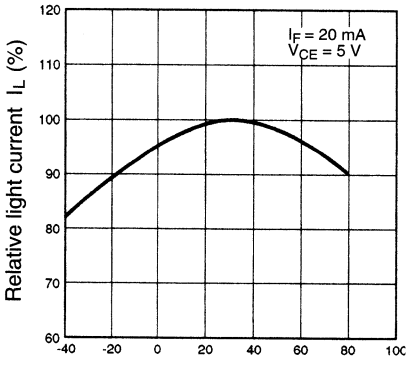
Light Current vs. Forward Current Characteristics (Typical)



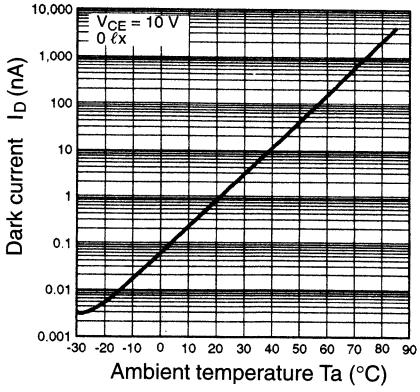
Light Current vs. Collector–Emitter Voltage Characteristics (Typical)



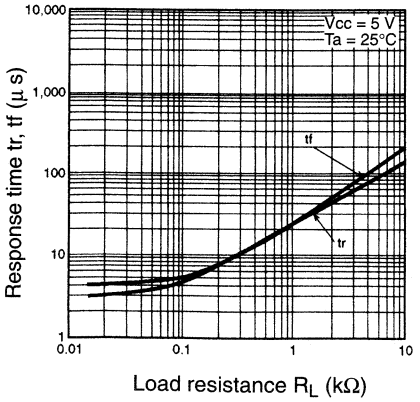
Relative Light Current vs. Ambient Temperature Characteristics (Typical)



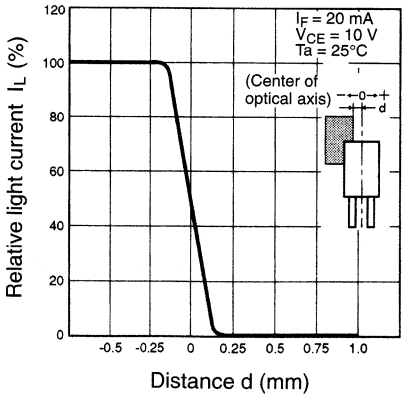
Dark Current vs. Ambient Temperature Characteristics (Typical)



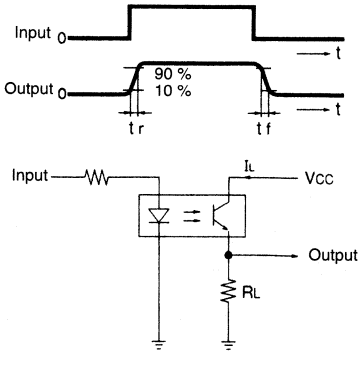
Response Time vs. Load Resistance Characteristics (Typical)



Sensing Position Characteristics (Typical)



Response Time Measurement Circuit



Opto-Switches

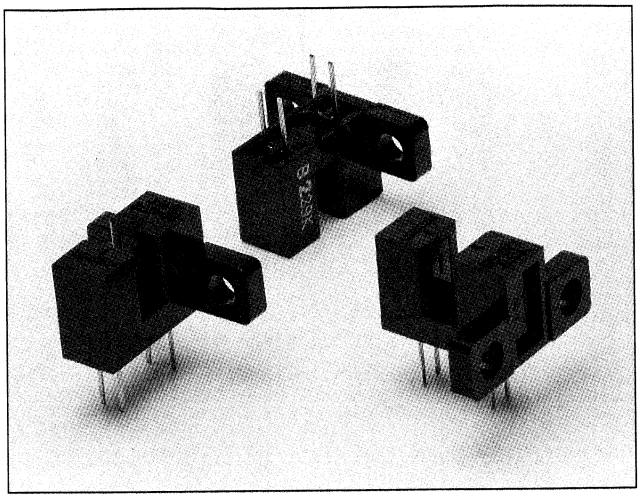
OMRON

Opto–Switch

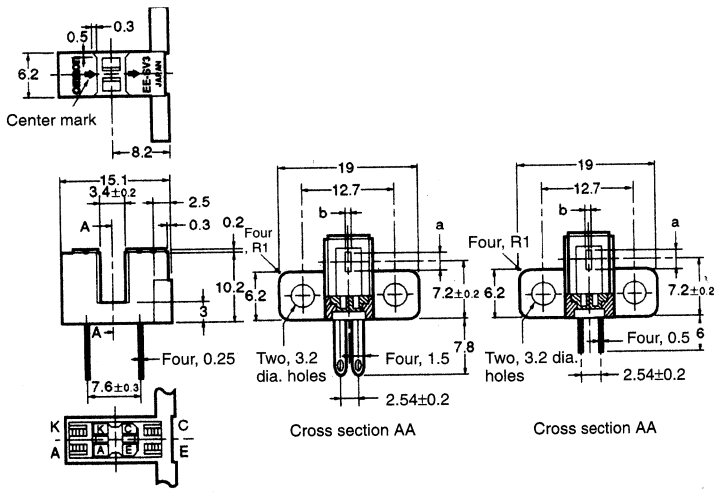
EE–SV3

Transmissive

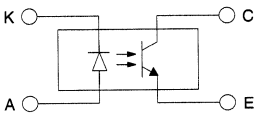
- Phototransistor output.
- High-resolution model with a 0.2-mm-wide or 0.5-mm-wide sensing aperture, high-sensitivity model with a 1-mm-wide sensing aperture, and model with a horizontal sensing aperture are available.
- Solder terminal models:
  EE-SV3/-SV3-CS/-SV3-DS/-SV3-GS
- PCB terminal models
  EE-SV3-B/-SV3-C/-SV3-D/-SV3-G
- Incorporating horizontal mounting tabs.



Dimensions



Internal Circuit



Terminal No.	Name
A	Anode
K	Cathode
C	Collector
E	Emitter

Unless otherwise specified, the tolerances are as shown below.

Dimensions	Tolerance
3 mm max.	±0.2
3 < mm ≤ 6	±0.24
6 < mm ≤ 10	±0.29
10 < mm ≤ 18	±0.35
18 < mm ≤ 30	±0.42

Model	Slit (a x b)
EE-SV3(-B)	2.1 x 0.5
EE-SV3-C(S)	2.1 x 1.0
EE-SV3-D(S)	2.1 x 0.2
EE-SV3-G(S)	0.5 x 2.1

Specifications

■ Absolute Maximum Ratings (Ta = 25°C)

Item		Symbol	Rated value
Emitter	Forward current	I_F	50 mA (see note 1)
	Pulse forward current	I_{FP}	1 A (see note 2)
	Reverse voltage	V_R	4 V
Detector	Collector–Emitter voltage	V_{CEO}	30 V
	Emitter–Collector voltage	V_{ECO}	---
	Collector current	I_C	20 mA
	Collector dissipation	P_C	100 mW (see note 1)
Ambient temperature	Operating	Topr	–25°C to 85°C
	Storage	Tstg	–30°C to 100°C
	Soldering	Tsol	260°C

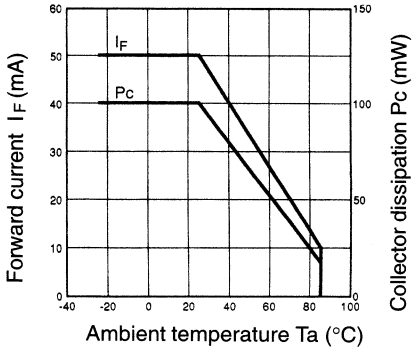
Note: 1. Refer to the temperature rating chart if the ambient temperature exceeds 25°C.
2. The pulse width is 10 μs maximum with a frequency of 100 Hz.

■ Electrical and Optical Characteristics (Ta = 25°C)

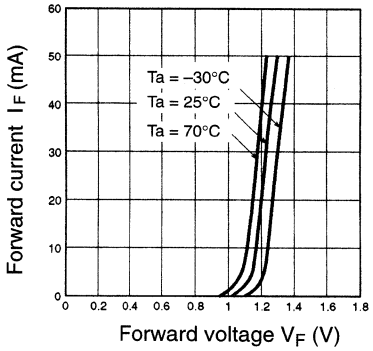
Item		Symbol	Value				Condition
			EE-SV3(-B)	EE-SV3-C(S)	EE-SV3-D(S)	EE-SV3-G(S)	
Emitter	Forward voltage	V_F	1.2 V typ., 1.5 V max.				I_F = 30 mA
	Reverse current	I_R	0.01 μA typ., 10 μA max.				V_R = 4 V
	Peak emission wavelength	λ_P	940 nm typ.				I_F = 20 mA
Detector	Light current	I_L	0.5 to 14 mA	1 to 28 mA	0.1 mA min.	0.5 to 14 mA	I_F = 20 mA, V_{CE} = 10 V
	Dark current	I_D	2 nA typ., 200 nA max.				V_{CE} = 10 V, 0 ℓx
	Leakage current	I_{LEAK}	---				---
	Collector–Emitter saturated voltage	V_{CE} (sat)	0.1 V typ., 0.4 V max.				I_F = 20 mA, I_L = 0.1 mA
	Peak spectral sensitivity wavelength	λ_P	850 nm typ.				V_{CE} = 10 V
Rising time		tr	4 μs typ.				V_{CC} = 5 V, R_L = 100 Ω, I_L = 5 mA
Falling time		tf	4 μs typ.				

Engineering Data

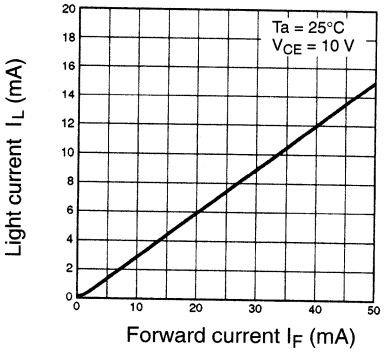
Forward Current vs. Collector Dissipation Temperature Rating



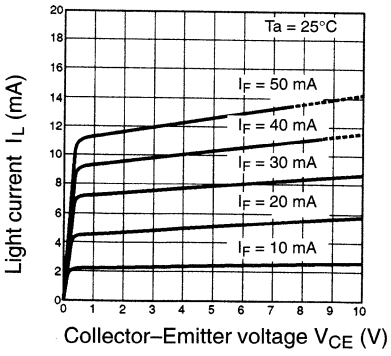
Forward Current vs. Forward Voltage Characteristics (Typical)



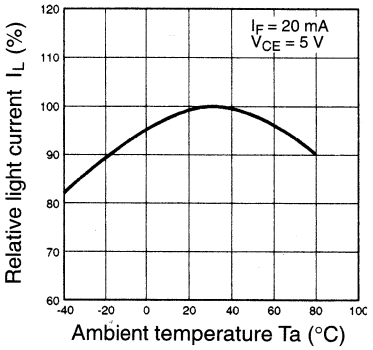
Light Current vs. Forward Current Characteristics (Typical)



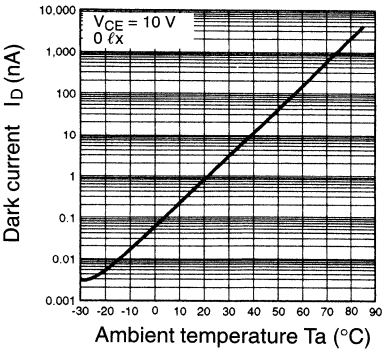
Light Current vs. Collector–Emitter Voltage Characteristics (EE-SV3(-B))



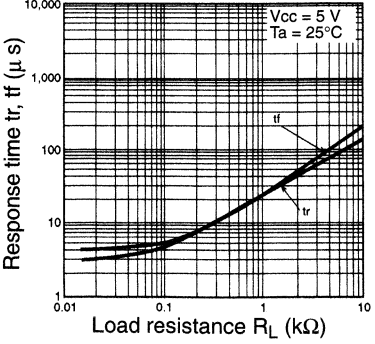
Relative Light Current vs. Ambient Temperature Characteristics (Typical)



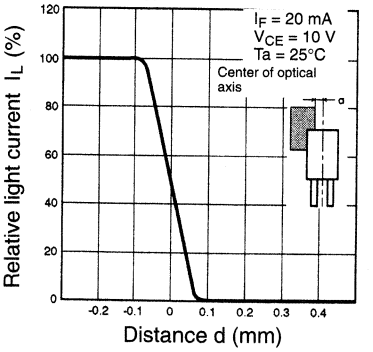
Dark Current vs. Ambient Temperature Characteristics (Typical)



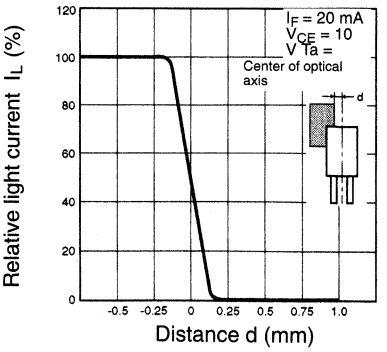
Response Time vs. Load Resistance Characteristics (Typical)



Sensing Position Characteristics (EE-SV3-D(S))

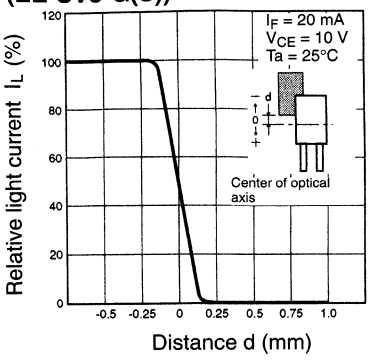


Sensing Position Characteristics (EE-SV3(-B))

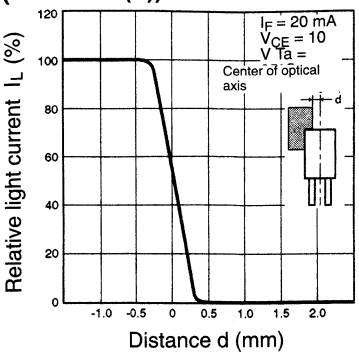


Opto-Switches

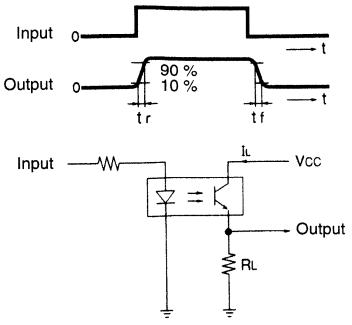
Sensing Position Characteristics (EE-SV3-G(S))



Sensing Position Characteristics (EE-SV3-C(S))



Response Time Measurement Circuit



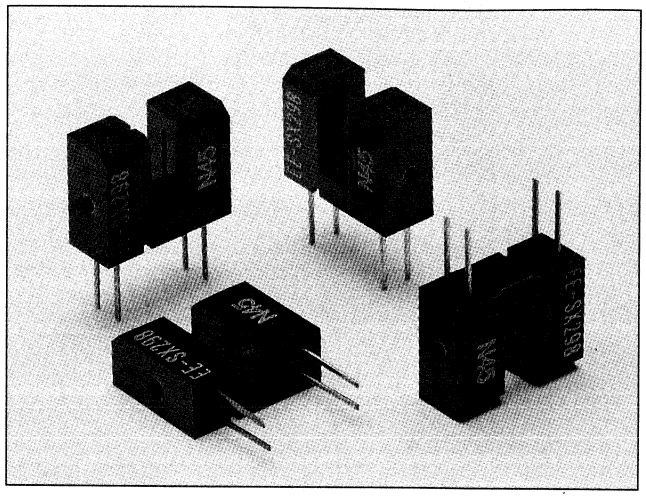
OMRON

Opto–Switch

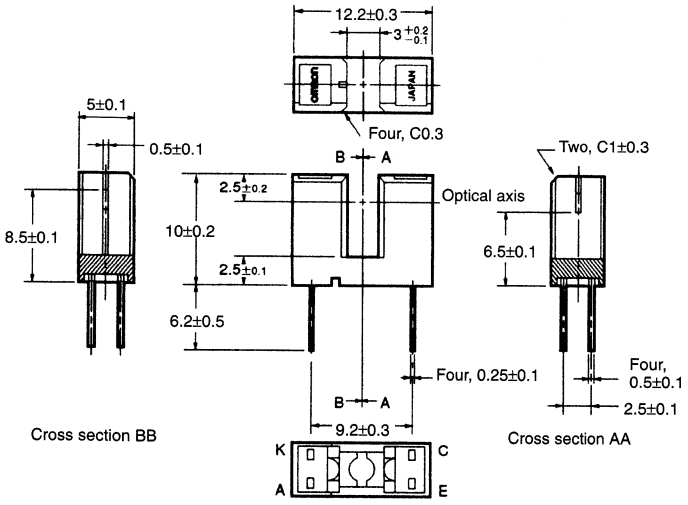
EE–SX298

Transmissive

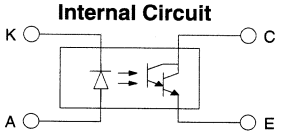
- Photo–Darlington output.
- General-purpose model with a 3-mm-wide slot.
- PCB mounting type.
- High resolution with a 0.5-mm-wide aperture.
- Best suited to drive CMOS IC.



Dimensions



Internal Circuit



Terminal No.	Name
A	Anode
K	Cathode
C	Collector
E	Emitter

Unless otherwise specified, the tolerances are ±0.2.

Specifications

■ Absolute Maximum Ratings (Ta = 25°C)

Item		Symbol	Rated value
Emitter	Forward current	I_F	50 mA (see note 1)
	Pulse forward current	I_{FP}	1 A (see note 2)
	Reverse voltage	V_R	4 V
Detector	Collector–Emitter voltage	V_{CEO}	35 V
	Emitter–Collector voltage	V_{ECO}	---
	Collector current	I_C	20 mA
	Collector dissipation	P_C	100 mW (see note 1)
Ambient temperature	Operating	Topr	–25°C to 85°C
	Storage	Tstg	–30°C to 100°C
	Soldering	Tsol	260°C

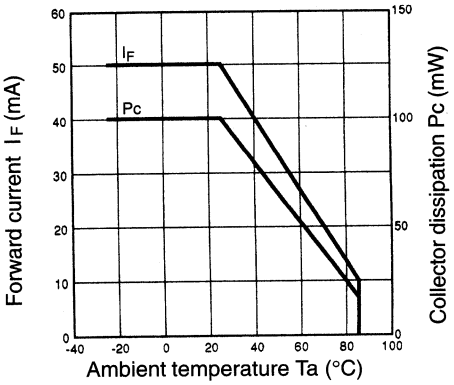
Note: 1. Refer to the temperature rating chart if the ambient temperature exceeds 25°C.
2. The pulse width is 10 μs maximum with a frequency of 100 Hz.

■ Electrical and Optical Characteristics (Ta = 25°C)

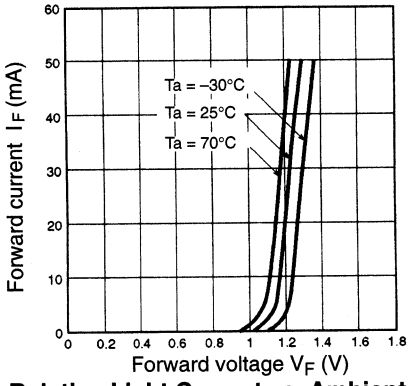
Item		Symbol	Value	Condition
Emitter	Forward voltage	V_F	1.2 V typ., 1.4 V max.	I_F = 20 mA
	Reverse current	I_R	0.01 μA typ., 10 μA max.	V_R = 4 V
	Peak emission wavelength	λ_P	940 nm typ.	I_F = 20 mA
Detector	Light current	I_L	0.5 mA min., 20 mA max.	I_F = 1 mA, V_{CE} = 2 V
	Dark current	I_D	2 nA typ., 1,000 nA max.	V_{CE} = 10 V, 0 ℓx
	Leakage current	I_{LEAK}	---	---
	Collector–Emitter saturated voltage	V_{CE} (sat)	0.75 V typ., 1.0 V max.	I_F = 2 mA, I_L = 0.5 mA
	Peak spectral sensitivity wavelength	λ_P	780 nm typ.	V_{CE} = 5 V
Rising time		tr	70 μs typ.	V_{CC} = 5 V, R_L = 100 Ω, I_L = 10 mA
Falling time		tf	70 μs typ.	V_{CC} = 5 V, R_L = 100 Ω, I_L = 10 mA

Engineering Data

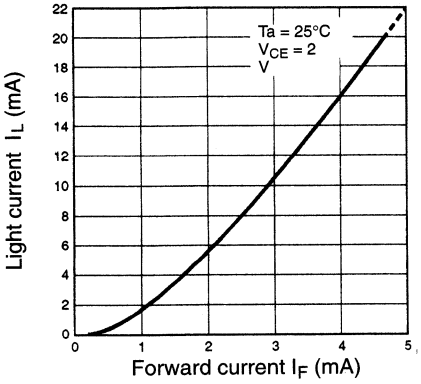
Forward Current vs. Collector Dissipation Temperature Rating



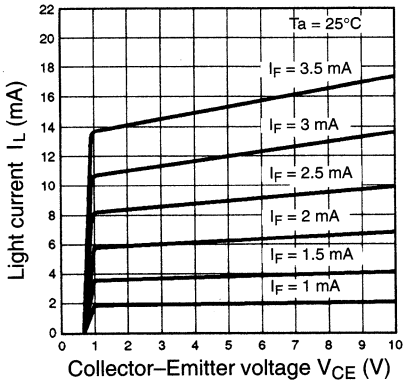
Forward Current vs. Forward Voltage Characteristics (Typical)



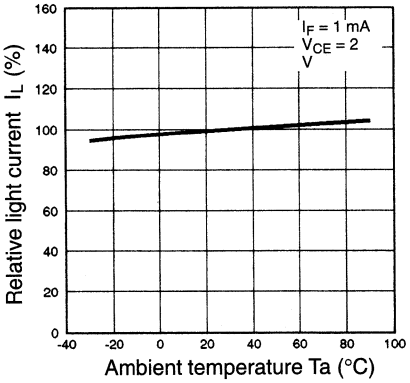
Light Current vs. Forward Current Characteristics (Typical)



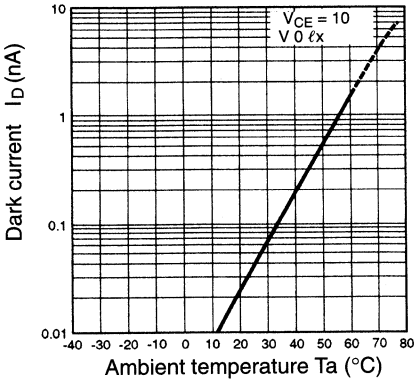
Light Current vs. Collector–Emitter Voltage Characteristics (Typical)



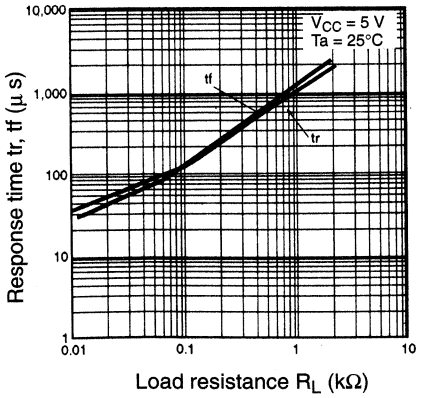
Relative Light Current vs. Ambient Temperature Characteristics (Typical)



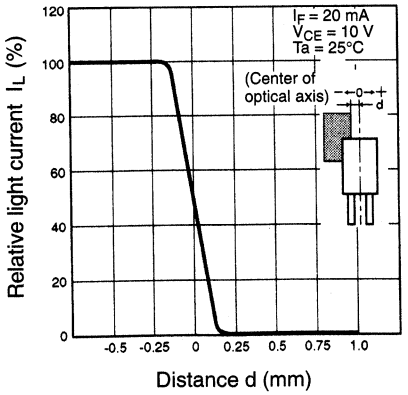
Dark Current vs. Ambient Temperature Characteristics (Typical)



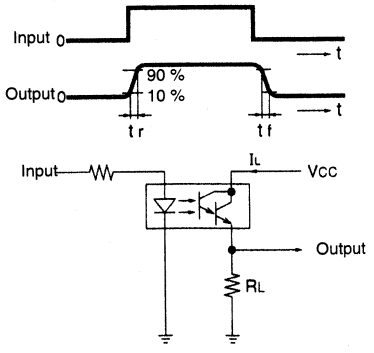
Response Time vs. Load Resistance Characteristics (Typical)



Sensing Position Characteristics (Typical)



Response Time Measurement Circuit



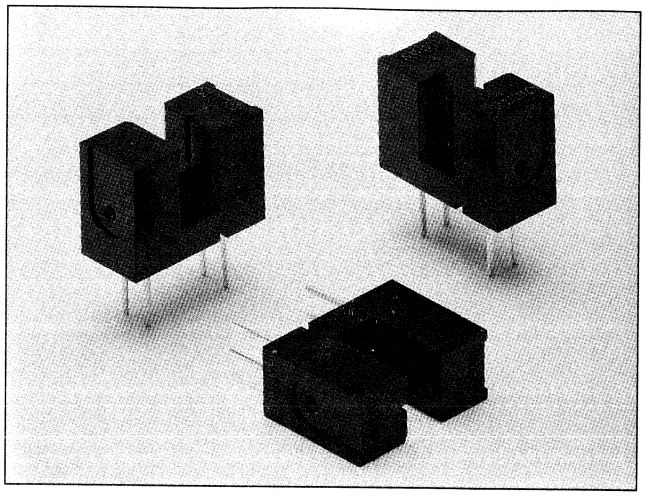
OMRON

Opto–Switch

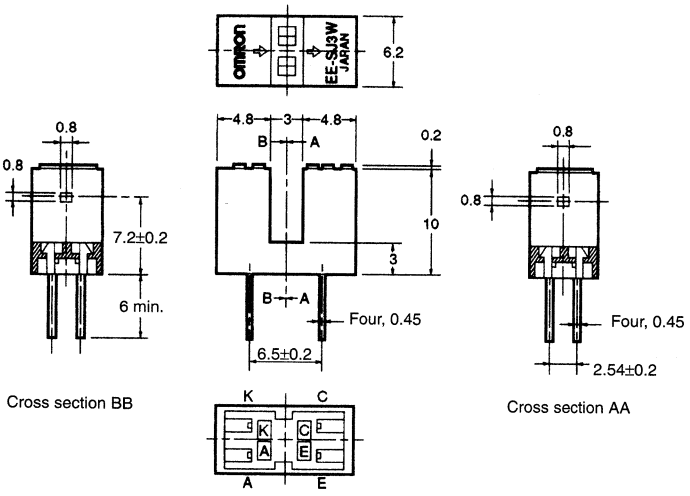
EE–SJ3W–B

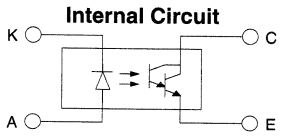
Transmissive

- Photo–Darlington output.
- General-purpose model with a 3-mm-wide slot.
- PCB mounting type.
- Incorporating a visible red light LED as Emitter.
- 1.5mA output (Min) with only 3mA forward LED current.



Dimensions





Terminal No.	Name
A	Anode
K	Cathode
C	Collector
E	Emitter

Unless otherwise specified, the tolerances are as shown below.

Dimensions	Tolerance
3 mm max.	±0.3
3 < mm ≤ 6	±0.375
6 < mm ≤ 10	±0.45
10 < mm ≤ 18	±0.55
18 < mm ≤ 30	±0.65

Specifications

■ Absolute Maximum Ratings (Ta = 25°C)

Item		Symbol	Rated value
Emitter	Forward current	I_F	15 mA (see note 1)
	Pulse forward current	I_{FP}	---
	Reverse voltage	V_R	4 V
Detector	Collector–Emitter voltage	V_{CEO}	24 V
	Emitter–Collector voltage	V_{ECO}	---
	Collector current	I_C	20 mA
	Collector dissipation	P_C	75 mW (see note 1)
Ambient temperature	Operating	Topr	–20°C to 60°C
	Storage	Tstg	–20°C to 80°C
	Soldering	Tsol	260°C

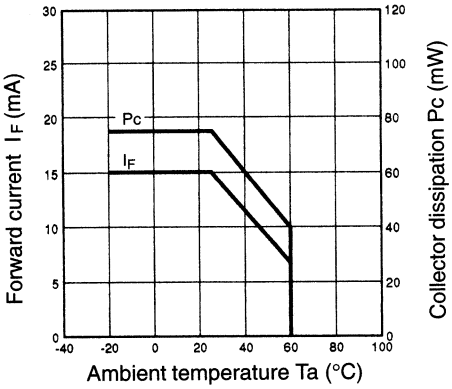
Note: 1. Refer to the temperature rating chart if the ambient temperature exceeds 25°C.
2. The pulse width is 10 μs maximum with a frequency of 100 Hz.

■ Electrical and Optical Characteristics (Ta = 25°C)

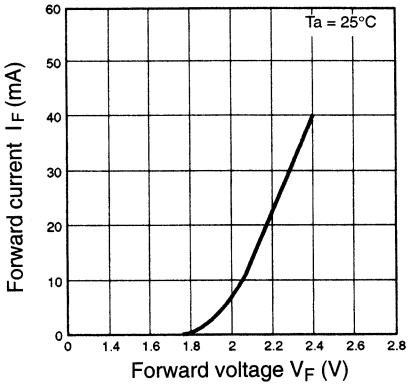
Item		Symbol	Value	Condition
Emitter	Forward voltage	V_F	2.0 V typ., 2.6 V max.	I_F = 15 mA
	Reverse current	I_R	0.01 μA typ., 5 μA max.	V_R = 4 V
	Peak emission wavelength	λ_P	700 nm typ.	I_F = 3 mA
Detector	Light current	I_L	1.5 mA min., 120 mA max.	I_F = 3 mA, V_{CE} = 10 V
	Dark current	I_D	20 nA typ., 250 nA max.	V_{CE} = 10 V, 0 ℓx
	Leakage current	I_{LEAK}	---	---
	Collector–Emitter saturated voltage	V_{CE} (sat)	0.9 V typ.	I_F = 3 mA, I_L = 0.5 mA
	Peak spectral sensitivity wavelength	λ_P	800 nm typ.	V_{CE} = 10 V
Rising time		tr	180 μs typ.	V_{CC} = 5 V, R_L = 100 Ω, I_L = 10 mA
Falling time		tf	60 μs typ.	V_{CC} = 5 V, R_L = 100 Ω, I_L = 10 mA

Engineering Data

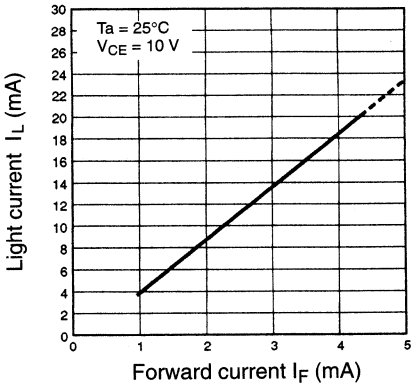
Forward Current vs. Collector Dissipation Temperature Rating



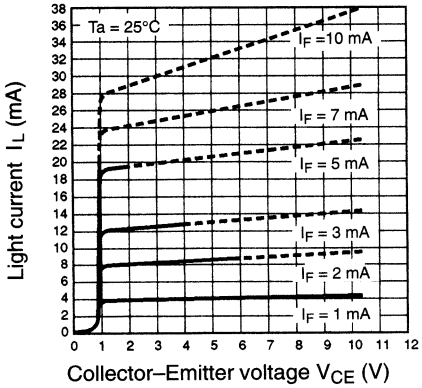
Forward Current vs. Forward Voltage Characteristics (Typical)



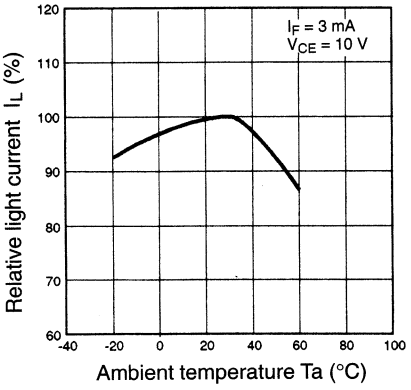
Light Current vs. Forward Current Characteristics (Typical)



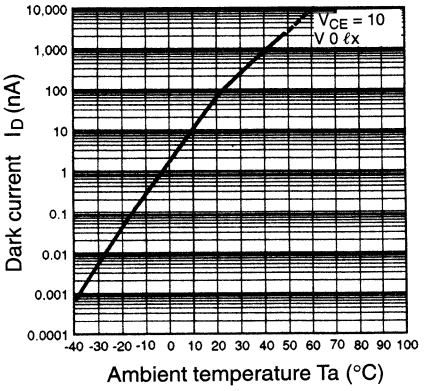
Light Current vs. Collector–Emitter Voltage Characteristics (Typical)



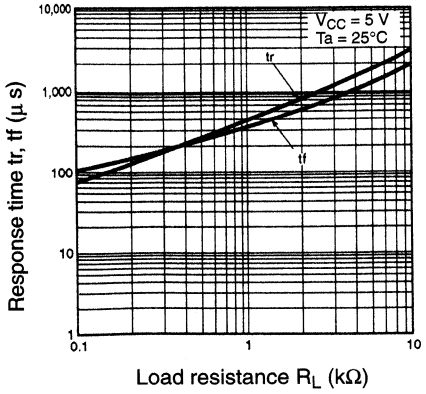
Relative Light Current vs. Ambient Temperature Characteristics (Typical)



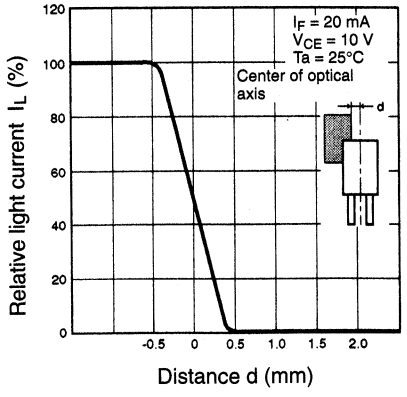
Dark Current vs. Ambient Temperature Characteristics (Typical)



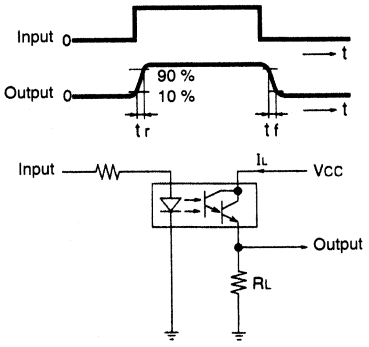
Response Time vs. Load Resistance Characteristics (Typical)



Sensing Position Characteristics (Typical)



Response Time Measurement Circuit



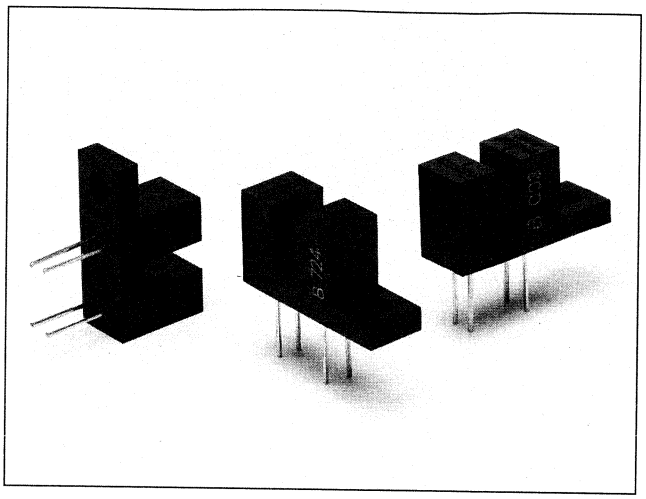
OMRON

Opto–Switch

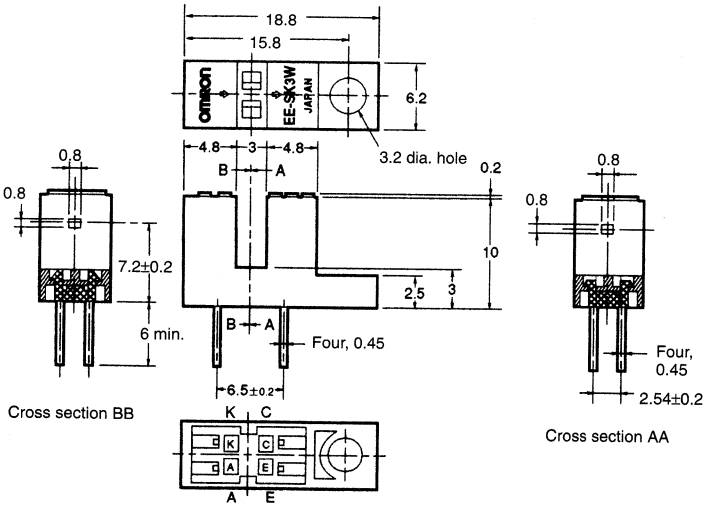
EE–SK3W–B

Transmissive

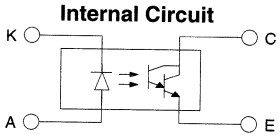
- Photo–Darlington output.
- General-purpose model with a 3-mm-wide slot.
- PCB mounting type.
- Incorporating a visible red light LED as emitter.
- 1.5mA output (Min) with only 3mm forward LED current.
- Includes screw fixing tab.



Dimensions



Internal Circuit



Terminal No.	Name
A	Anode
K	Cathode
C	Collector
E	Emitter

Unless otherwise specified, the tolerances are as shown below.

Dimensions	Tolerance
3 mm max.	±0.3
3 < mm ≤ 6	±0.375
6 < mm ≤ 10	±0.45
10 < mm ≤ 18	±0.55
18 < mm ≤ 30	±0.65

Specifications

■ Absolute Maximum Ratings (Ta = 25°C)

Item		Symbol	Rated value
Emitter	Forward current	I_F	15 mA (see note 1)
	Pulse forward current	I_{FP}	---
	Reverse voltage	V_R	4 V
Detector	Collector–Emitter voltage	V_{CEO}	24 V
	Emitter–Collector voltage	V_{ECO}	---
	Collector current	I_C	20 mA
	Collector dissipation	P_C	75 mW (see note 1)
Ambient temperature	Operating	Topr	–20°C to 60°C
	Storage	Tstg	–20°C to 80°C
	Soldering	Tsol	260°C

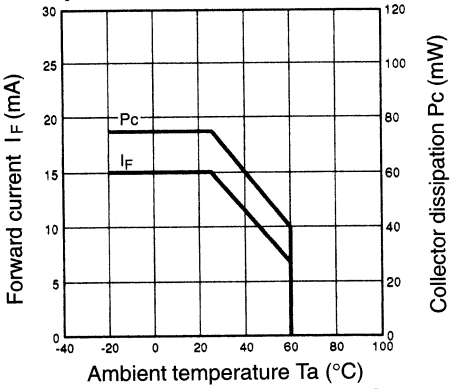
Note: 1. Refer to the temperature rating chart if the ambient temperature exceeds 25°C.
2. The pulse width is 10 μs maximum with a frequency of 100 Hz.

■ Electrical and Optical Characteristics (Ta = 25°C)

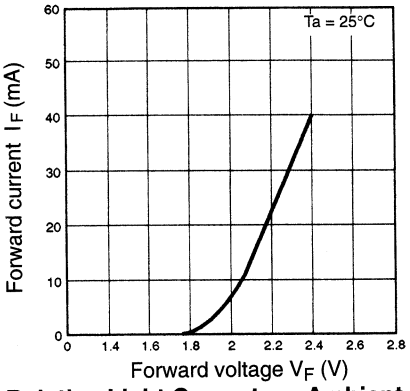
Item		Symbol	Value	Condition
Emitter	Forward voltage	V_F	2.0 V typ., 2.6 V max.	I_F = 15 mA
	Reverse current	I_R	0.01 μA typ., 5 μA max.	V_R = 4 V
	Peak emission wavelength	λ_P	700 nm typ.	I_F = 3 mA
Detector	Light current	I_L	1.5 mA min., 120 mA max.	I_F = 3 mA, V_{CE} = 10 V
	Dark current	I_D	2 nA typ., 250 nA max.	V_{CE} = 10 V, 0 ℓx
	Leakage current	I_{LEAK}	---	---
	Collector–Emitter saturated voltage	V_{CE} (sat)	0.9 V typ.	I_F = 3 mA, I_L = 0.5 mA
	Peak spectral sensitivity wavelength	λ_P	800 nm typ.	V_{CE} = 10 V
Rising time		tr	180 μs typ.	V_{CC} = 5 V, R_L = 100 Ω, I_L = 10 mA
Falling time		tf	60 μs typ.	V_{CC} = 5 V, R_L = 100 Ω, I_L = 10 mA

Engineering Data

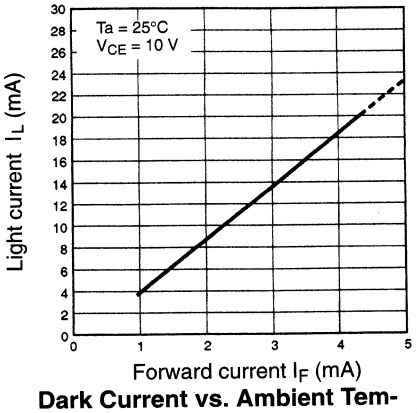
Forward Current vs. Collector Dissipation Temperature Rating



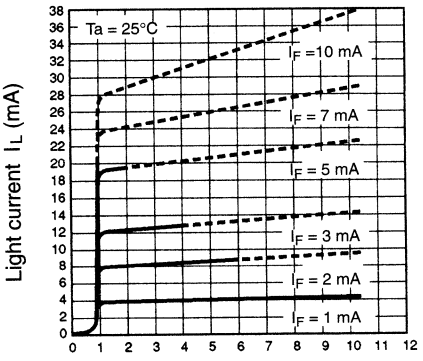
Forward Current vs. Forward Voltage Characteristics (Typical)



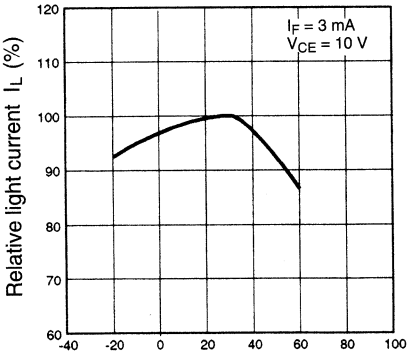
Light Current vs. Forward Current Characteristics (Typical)



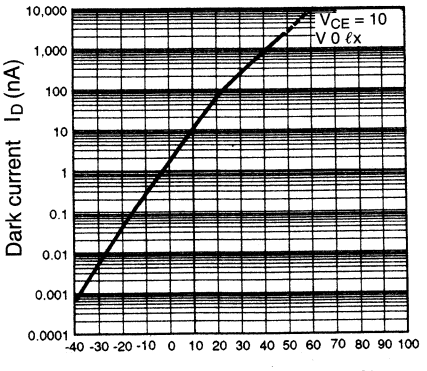
Light Current vs. Collector–Emitter Voltage Characteristics (Typical)



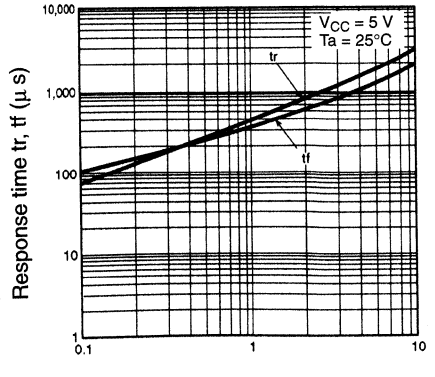
Relative Light Current vs. Ambient Temperature Characteristics (Typical)



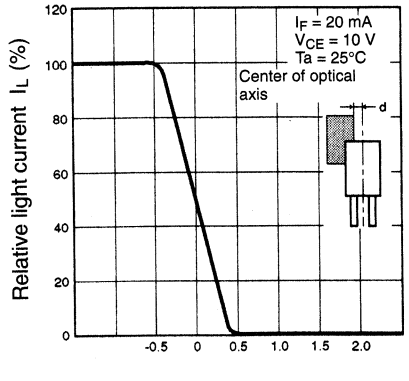
Dark Current vs. Ambient Temperature Characteristics (Typical)



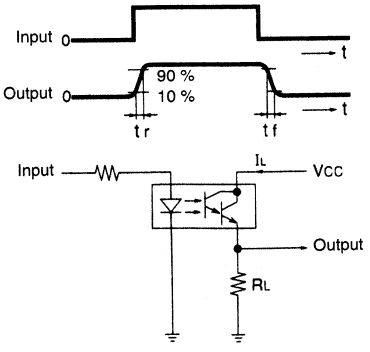
Response Time vs. Load Resistance Characteristics (Typical)



Sensing Position Characteristics (Typical)



Response Time Measurement Circuit



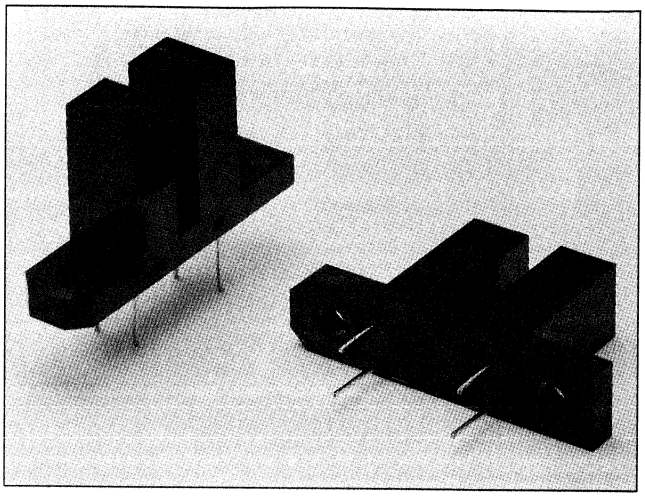
OMRON

Opto–Switch

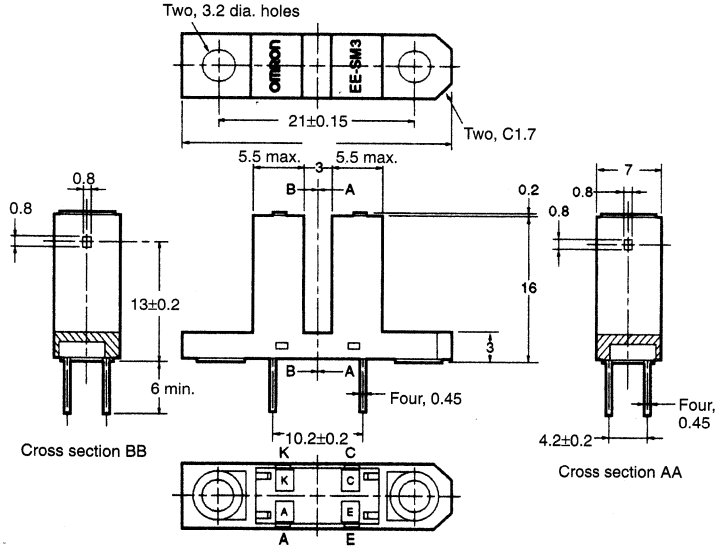
EE–SM3

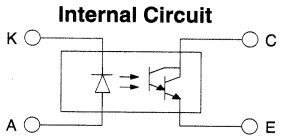
Transmissive

- Photo–Darlington output.
- General-purpose model with a 3-mm-wide slot.
- PCB mounting type.
- Incorporating a visible red LED as emitter.
- Features a high (13mm) optical axis.
- Screw mounting tabs.



Dimensions





Terminal No.	Name
A	Anode
K	Cathode
C	Collector
E	Emitter

Unless otherwise specified, the tolerances are as shown below.

Dimensions	Tolerance
3 mm max.	±0.3
3 < mm ≤ 6	±0.375
6 < mm ≤ 10	±0.45
10 < mm ≤ 18	±0.55
18 < mm ≤ 30	±0.65

Specifications

■ Absolute Maximum Ratings (Ta = 25°C)

Item		Symbol	Rated value
Emitter	Forward current	I_F	15 mA (see note 1)
	Pulse forward current	I_{FP}	---
	Reverse voltage	V_R	4 V
Detector	Collector–Emitter voltage	V_{CEO}	24 V
	Emitter–Collector voltage	V_{ECO}	---
	Collector current	I_C	20 mA
	Collector dissipation	P_C	75 mW (see note 1)
Ambient temperature	Operating	Topr	–20°C to 60°C
	Storage	Tstg	–20°C to 80°C
	Soldering	Tsol	260°C

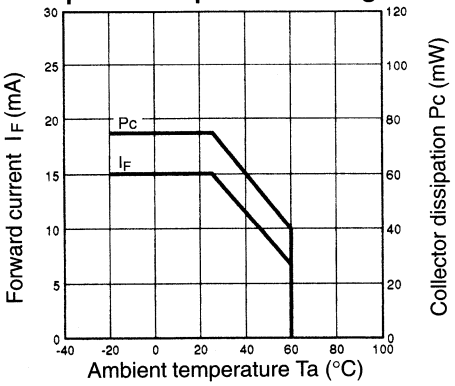
Note: 1. Refer to the temperature rating chart if the ambient temperature exceeds 25°C.
2. The pulse width is 10 μs maximum with a frequency of 100 Hz.

■ Electrical and Optical Characteristics (Ta = 25°C)

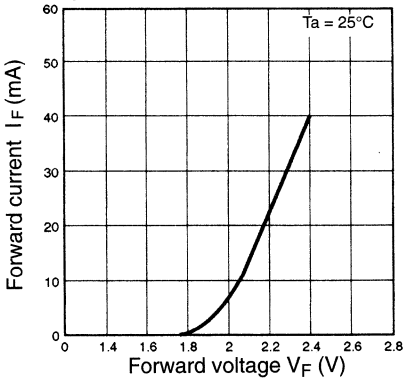
Item		Symbol	Value	Condition
Emitter	Forward voltage	V_F	2.0 V typ., 2.6 V max.	I_F = 15 mA
	Reverse current	I_R	0.01 μA typ., 5 μA max.	V_R = 4 V
	Peak emission wavelength	λ_P	700 nm typ.	I_F = 3 mA
Detector	Light current	I_L	1.5 mA min., 120 mA max.	I_F = 3 mA, V_{CE} = 10 V
	Dark current	I_D	2 nA typ., 250 nA max.	V_{CE} = 10 V, 0 ℓx
	Leakage current	I_{LEAK}	---	---
	Collector–Emitter saturated voltage	V_{CE} (sat)	0.9 V typ.	I_F = 3 mA, I_L = 0.5 mA
	Peak spectral sensitivity wavelength	λ_P	750 nm typ.	V_{CE} = 10 V
Rising time		tr	180 μs typ.	V_{CC} = 5 V, R_L = 100 Ω, I_L = 10 mA
Falling time		tf	60 μs typ.	V_{CC} = 5 V, R_L = 100 Ω, I_L = 10 mA

Engineering Data

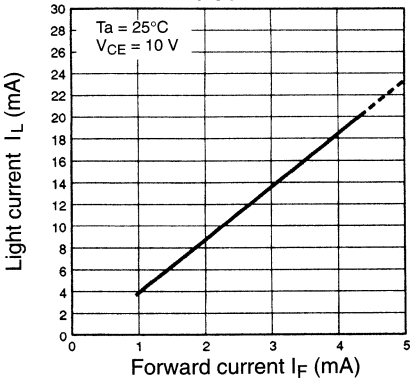
Forward Current vs. Collector Dissipation Temperature Rating



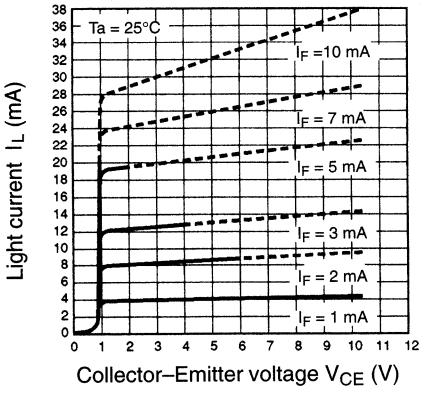
Forward Current vs. Forward Voltage Characteristics (Typical)



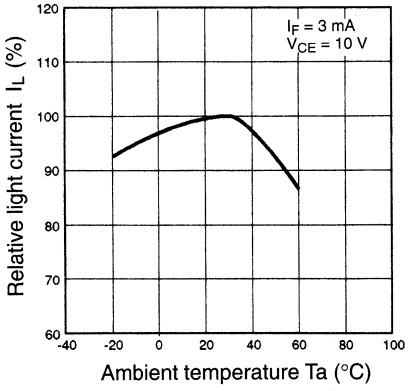
Light Current vs. Forward Current Characteristics (Typical)



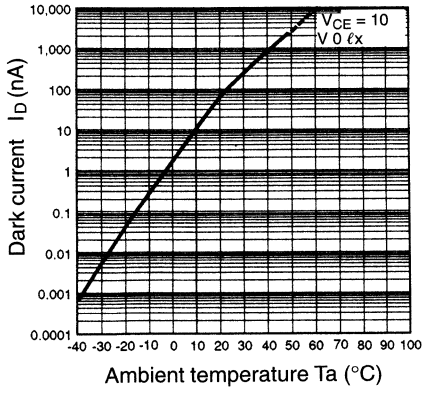
Light Current vs. Collector–Emitter Voltage Characteristics (Typical)



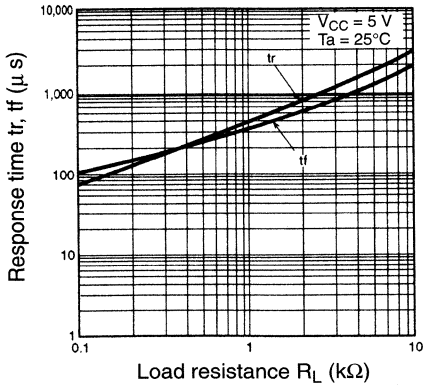
Relative Light Current vs. Ambient Temperature Characteristics (Typical)



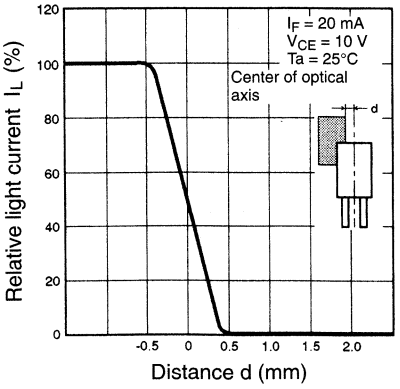
Dark Current vs. Ambient Temperature Characteristics (Typical)



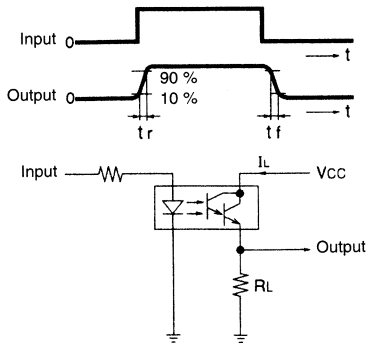
Response Time vs. Load Resistance Characteristics (Typical)



Sensing Position Characteristics (Typical)



Response Time Measurement Circuit



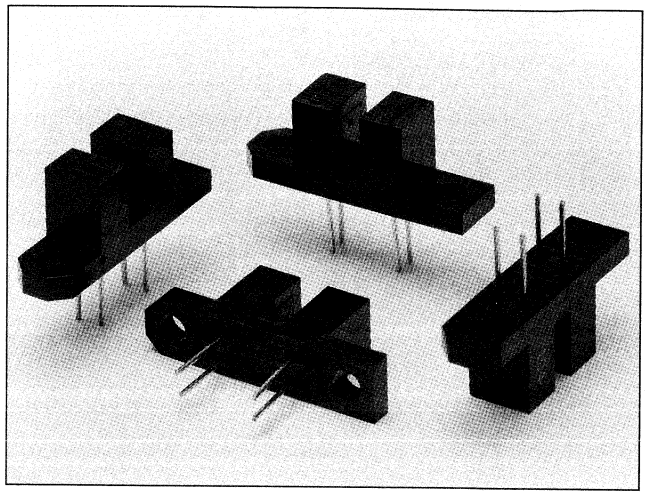
OMRON

Opto–Switch

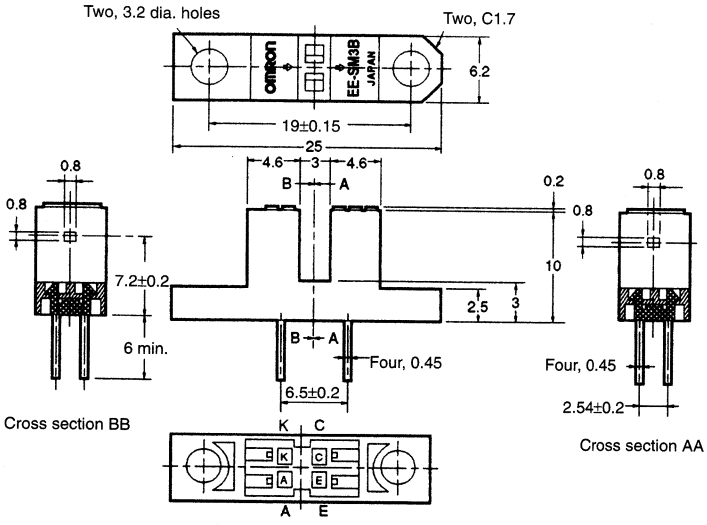
EE–SM3B

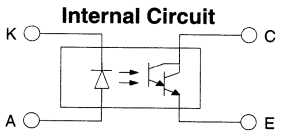
Transmissive

- Photo–Darlington output.
- General-purpose model with a 3-mm-wide slot.
- PCB mounting type.
- Incorporating a visible red LED emitter.
- Screw fixing tabs.



Dimensions





Terminal No.	Name
A	Anode
K	Cathode
C	Collector
E	Emitter

Unless otherwise specified, the tolerances are as shown below.

Dimensions	Tolerance
3 mm max.	±0.3
3 < mm ≤ 6	±0.375
6 < mm ≤ 10	±0.45
10 < mm ≤ 18	±0.55
18 < mm ≤ 30	±0.65

Specifications

■ Absolute Maximum Ratings (Ta = 25°C)

Item		Symbol	Rated value
Emitter	Forward current	I_F	15 mA (see note 1)
	Pulse forward current	I_{FP}	---
	Reverse voltage	V_R	4 V
Detector	Collector–Emitter voltage	V_{CEO}	24 V
	Emitter–Collector voltage	V_{ECO}	---
	Collector current	I_C	20 mA
	Collector dissipation	P_C	75 mW (see note 1)
Ambient temperature	Operating	Topr	–20°C to 60°C
	Storage	Tstg	–20°C to 80°C
	Soldering	Tsol	260°C

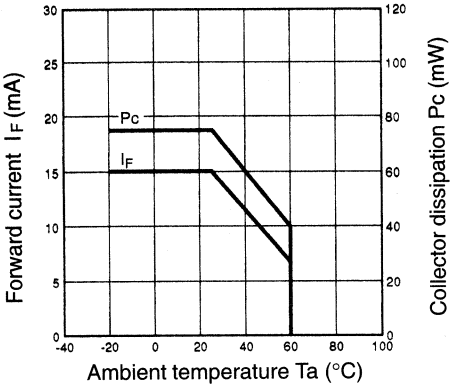
Note: 1. Refer to the temperature rating chart if the ambient temperature exceeds 25°C.
2. The pulse width is 10 μs maximum with a frequency of 100 Hz.

■ Electrical and Optical Characteristics (Ta = 25°C)

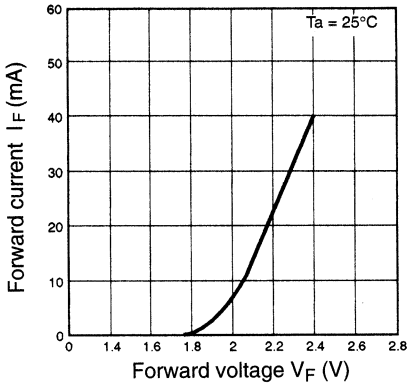
Item		Symbol	Value	Condition
Emitter	Forward voltage	V_F	2.0 V typ., 2.6 V max.	I_F = 15 mA
	Reverse current	I_R	0.01 μA typ., 5 μA max.	V_R = 4 V
	Peak emission wavelength	λ_P	700 nm typ.	I_F = 3 mA
Detector	Light current	I_L	1.5 mA min., 120 mA max.	I_F = 3 mA, V_{CE} = 10 V
	Dark current	I_D	2 nA typ., 250 nA max.	V_{CE} = 10 V, 0 ℓx
	Leakage current	I_{LEAK}	---	---
	Collector–Emitter saturated voltage	V_{CE} (sat)	0.9 V typ.	I_F = 3 mA, I_L = 0.5 mA
	Peak spectral sensitivity wavelength	λ_P	800 nm typ.	V_{CE} = 10 V
Rising time		tr	180 μs typ.	V_{CC} = 5 V, R_L = 100 Ω, I_L = 10 mA
Falling time		tf	60 μs typ.	V_{CC} = 5 V, R_L = 100 Ω, I_L = 10 mA

Engineering Data

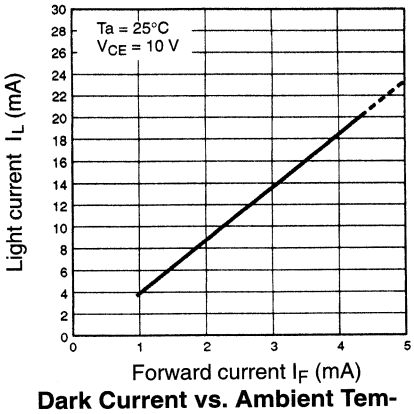
Forward Current vs. Collector Dissipation Temperature Rating



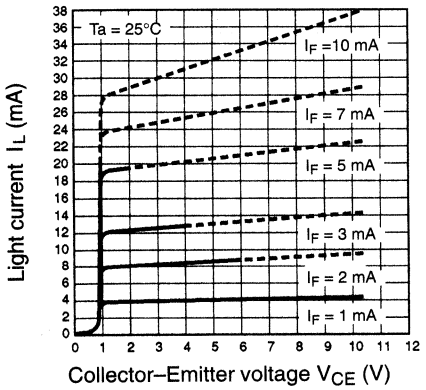
Forward Current vs. Forward Voltage Characteristics (Typical)



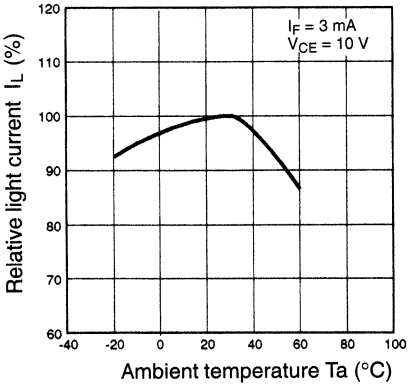
Light Current vs. Forward Current Characteristics (Typical)



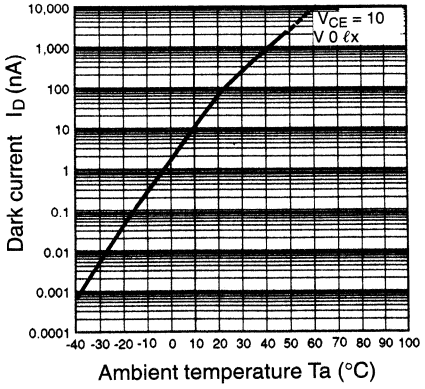
Light Current vs. Collector–Emitter Voltage Characteristics (Typical)



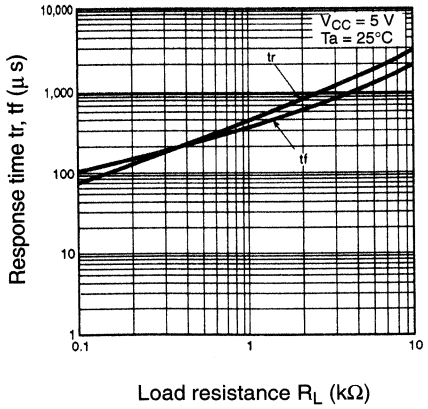
Relative Light Current vs. Ambient Temperature Characteristics (Typical)



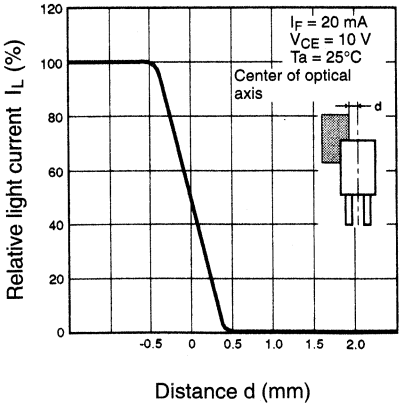
Dark Current vs. Ambient Temperature Characteristics (Typical)



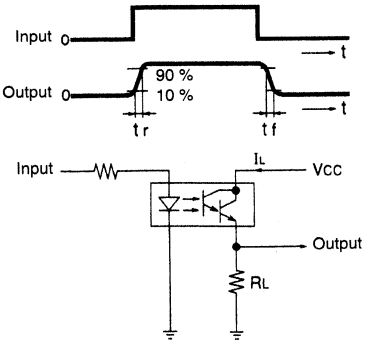
Response Time vs. Load Resistance Characteristics (Typical)



Sensing Position Characteristics (Typical)



Response Time Measurement Circuit



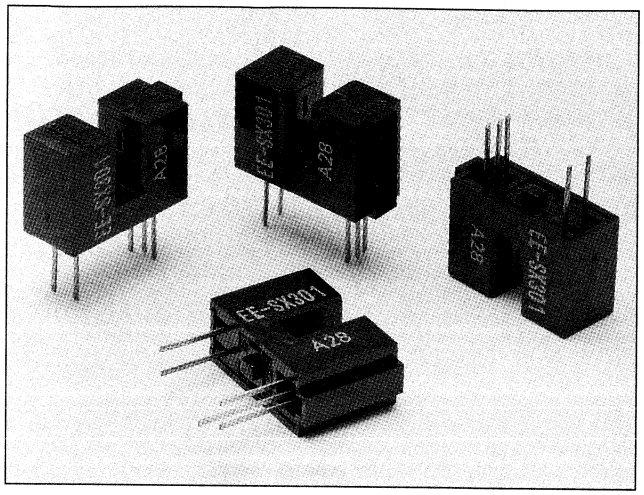
OMRON

Opto–Switch

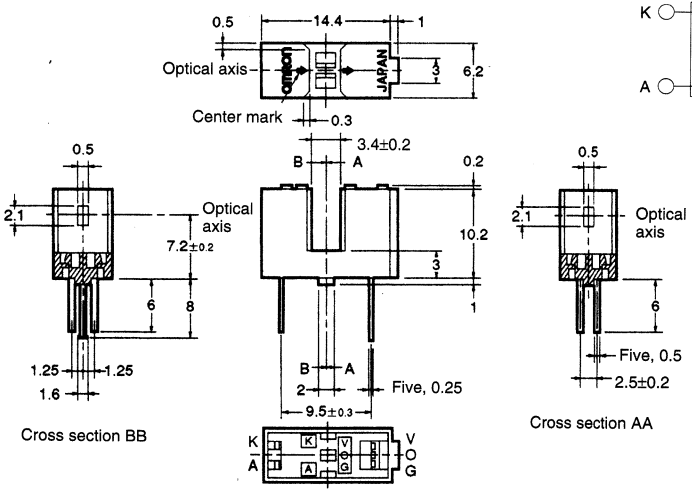
EE–SX301 / EE–SX401

Transmissive

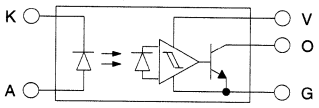
- Incorporates a photo–IC chip with a built-in detector element and amplifier.
- Detector element has built-in temperature compensation circuit.
- A wide supply voltage range: 4.5 to 16 VDC
- Directly connects to C-MOS and TTL.
- High resolution with a 0.5-mm-wide sensing aperture.
- Dark ON model (EE-SX301)
- Light ON model (EE-SX401)



Dimensions



Internal Circuit



Terminal No.	Name
A	Anode
K	Cathode
V	Supply voltage (Vcc)
O	Output (OUT)
G	Ground (GND)

Unless otherwise specified, the tolerances are as shown below.

Dimensions	Tolerance
3 mm max.	±0.3
3 < mm ≤ 6	±0.375
6 < mm ≤ 10	±0.45
10 < mm ≤ 18	±0.55
18 < mm ≤ 30	±0.65

Specifications

■ Absolute Maximum Ratings (Ta = 25°C)

Item		Symbol	Rated value
Emitter	Forward current	I_F	50 mA (see note)
	Reverse voltage	V_R	4 V
Detector	Supply voltage	V_{CC}	16 V
	Output voltage	V_{OUT}	28 V
	Output current	I_{OUT}	16 mA
	Permissible output dissipation	P_{OUT}	250 mW (see note)
Ambient temperature	Operating	Topr	–40°C to 75°C
	Storage	Tstg	–40°C to 85°C
	Soldering	Tsol	260°C

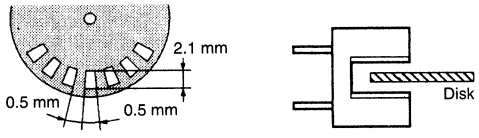
Note: Refer to the temperature rating chart if the ambient temperature exceeds 25°C.

■ Electrical and Optical Characteristics (Ta = 25°C)

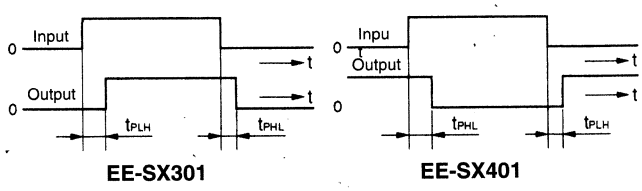
Item		Symbol	Value	Condition
Emitter	Forward voltage	V_F	1.2 V typ., 1.5 V max.	I_F = 20 mA
	Reverse current	I_R	0.01 μA typ., 10 μA max.	V_R = 4 V
	Peak emission wavelength	λ_P	940 nm typ.	I_F = 20 mA
Detector	Low-level output voltage	V_{OL}	0.12 V typ., 0.4 V max.	Vcc = 4.5 to 16 V, I_{OL} = 16 mA, I_F = 0 mA (EE-SX301), I_F = 8 mA (EE-SX401)
	High-level output voltage	V_{OH}	15 V min.	Vcc = 16 V, R_L = 1 kΩ, I_F = 8 mA (EE-SX301), I_F = 0 mA (EE-SX401)
	Current consumption	I_{CC}	3.2 mA typ., 10 mA max.	Vcc = 16 V
	Peak spectral sensitivity wavelength	λ_P	870 nm typ.	V_{CC} = 4.5 to 16 V
LED current when output is OFF		I_{FT}	3 mA typ., 8 mA max.	V_{CC} = 4.5 to 16 V
LED current when output is ON				
Hysteresis		ΔH	15% typ.	V_{CC} = 4.5 to 16 V (see note 1)
Response frequency		f	3,000 P.P.S min.	V_{CC} = 4.5 to 16 V, I_F = 15 mA, I_{OL} = 16 mA (see note 2)
Response delay time		t_{PLH} (t_{PHL})	3 μs typ.	V_{CC} = 4.5 to 16 V, I_F = 15 mA, I_{OL} = 16 mA (see note 3)
Response delay time		t_{PHL} (t_{PLH})	20 μs typ.	V_{CC} = 4.5 to 16 V, I_F = 15 mA, I_{OL} = 16 mA (see note 3)

Note: 1. Hysteresis denotes the difference in forward LED current value, expressed in percentage, calculated from the respective forward LED currents when the photo IC is turned from ON to OFF and when the photo IC is turned from OFF to ON.

2. The value of the response frequency is measured by rotating the disk as shown below. (P.P.S = pulse/s)



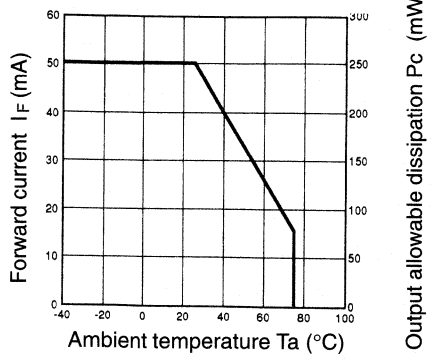
3. The following illustrations show the definition of response delay time.



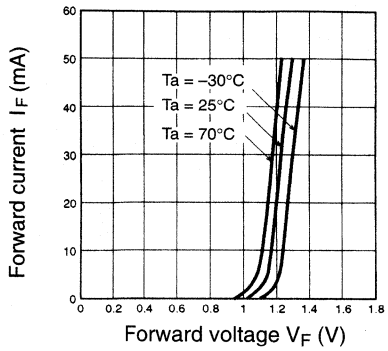
Engineering Data

Note: The values in the parentheses apply to the EE-SX401.

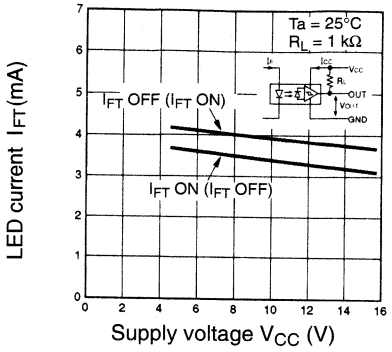
Forward Current vs. Collector Dissipation Temperature Rating



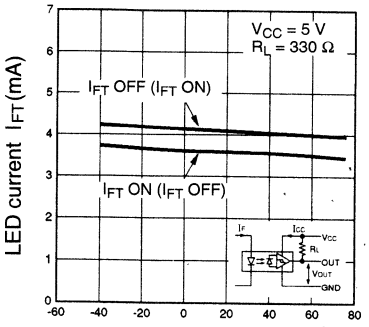
Forward Current vs. Forward Voltage Characteristics (Typical)



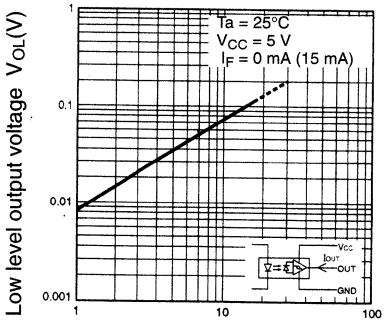
LED Current vs. Supply Voltage (Typical)



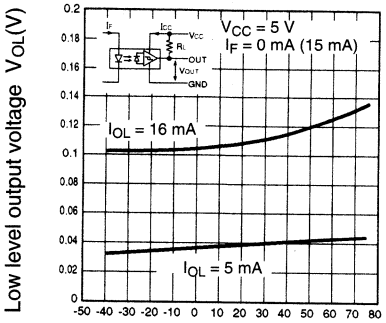
LED Current vs. Ambient Temperature Characteristics (Typical)



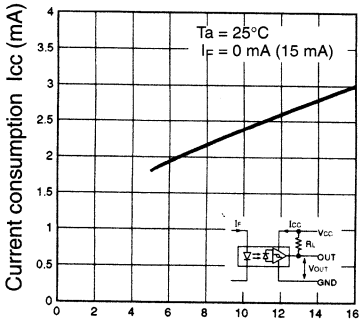
Low-level Output Voltage vs. Output Current (Typical)



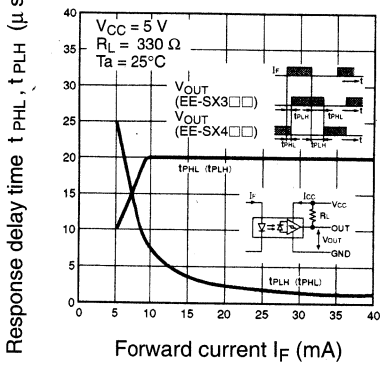
Low-level Output Voltage vs. Ambient Temperature Characteristics (Typical)



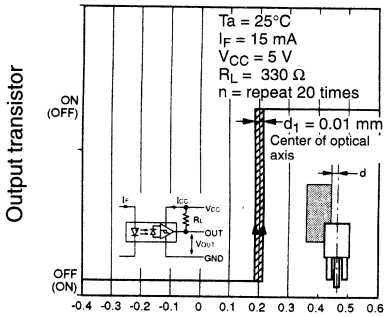
Current Consumption vs. Supply Voltage (Typical)



Response Delay Time vs. Forward Current (Typical)



Repeat Sensing Position Characteristics (Typical)



Opto-Switches

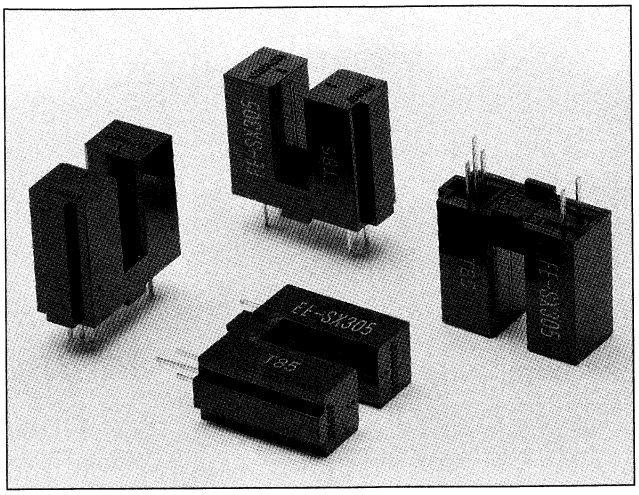
OMRON

Opto–Switch

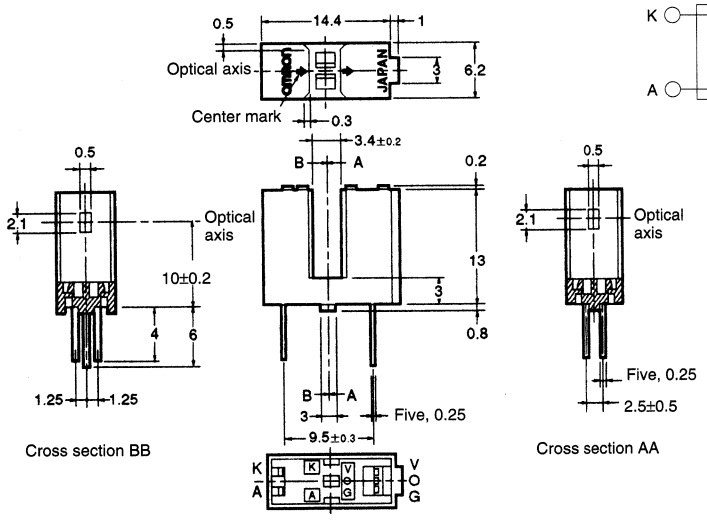
EE–SX305 / EE–SX405

Transmissive

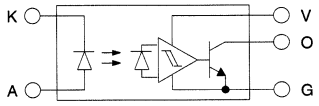
- Incorporates a photo–IC chip with a built-in detector element and amplifier.
- Detector element has built-in temperature compensation circuit.
- A wide supply voltage range: 4.5 to 16 VDC
- Directly connects to C-MOS and TTL.
- High resolution with a 0.5-mm-wide sensing aperture.
- Dark ON model (EE-SX305)
- Light ON model (EE-SX405)



Dimensions



Internal Circuit



Terminal No.	Name
A	Anode
K	Cathode
V	Supply voltage (Vcc)
O	Output (OUT)
G	Ground (GND)

Unless otherwise specified, the tolerances are as shown below.

Dimensions	Tolerance
3 mm max.	±0.3
3 < mm ≤ 6	±0.375
6 < mm ≤ 10	±0.45
10 < mm ≤ 18	±0.55
18 < mm ≤ 30	±0.65

Specifications

■ Absolute Maximum Ratings (Ta = 25°C)

Item		Symbol	Rated value
Emitter	**Forward current**	I_F	50 mA (see note)
	Reverse voltage	V_R	4 V
Detector	**Supply voltage**	V_{CC}	16 V
	Output voltage	V_{OUT}	28 V
	Output current	I_{OUT}	16 mA
	Permissible output dissipation	P_{OUT}	250 mW (see note)
Ambient temperature	**Operating**	Topr	–40°C to 75°C
	Storage	Tstg	–40°C to 85°C
	Soldering	Tsol	260°C

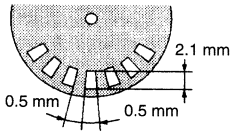
Note: Refer to the temperature rating chart if the ambient temperature exceeds 25°C.

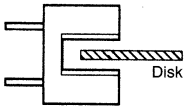
■ Electrical and Optical Characteristics (Ta = 25°C)

Item		Symbol	Value	Condition
Emitter	Forward voltage	V_F	1.2 V typ., 1.5 V max.	I_F = 20 mA
	Reverse current	I_R	0.01 μA typ., 10 μA max.	V_R = 4 V
	Peak emission wavelength	λ_P	940 nm typ.	I_F = 20 mA
Detector	Low-level output voltage	V_{OL}	0.12 V typ., 0.4 V max.	Vcc = 4.5 to 16 V, I_{OL} = 16 mA, I_F = 0 mA (EE-SX305), I_F = 8 mA (EE-SX405)
	High-level output voltage	V_{OH}	15 V min.	Vcc = 16 V, R_L = 1 kΩ, I_F = 8 mA (EE-SX305), I_F = 0 mA (EE-SX405)
	Current consumption	I_{CC}	3.2 mA typ., 10 mA max.	Vcc = 16 V
	Peak spectral sensitivity wavelength	λ_P	870 nm typ.	V_{CC} = 4.5 to 16 V
LED current when output is OFF		I_{FT}	3 mA typ., 8 mA max.	V_{CC} = 4.5 to 16 V
LED current when output is ON				
Hysteresis		ΔH	15% typ.	V_{CC} = 4.5 to 16 V (see note 1)
Response frequency		f	3,000 P.P.S min.	V_{CC} = 4.5 to 16 V, I_F = 15 mA, I_{OL} = 16 mA (see note 2)
Response delay time		t_{PLH} (t_{PHL})	3 μs typ.	V_{CC} = 4.5 to 16 V, I_F = 15 mA, I_{OL} = 16 mA (see note 3)
Response delay time		t_{PHL} (t_{PLH})	20 μs typ.	V_{CC} = 4.5 to 16 V, I_F = 15 mA, I_{OL} = 16 mA (see note 3)

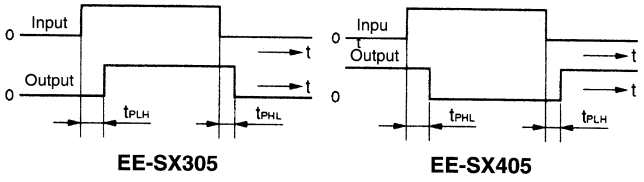
Note: 1. Hysteresis denotes the difference in forward LED current value, expressed in percentage, calculated from the respective forward LED currents when the photo IC is turned from ON to OFF and when the photo IC is turned from OFF to ON.

2. The value of the response frequency is measured by rotating the disk as shown below. (P.P.S = pulse/s)





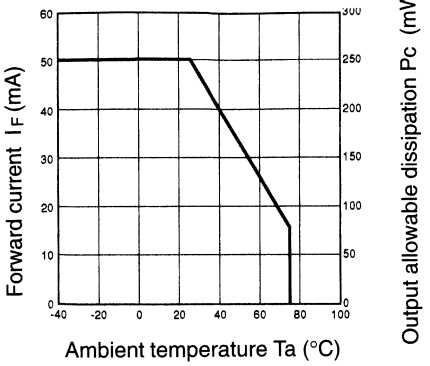
3. The following illustrations show the definition of response delay time.



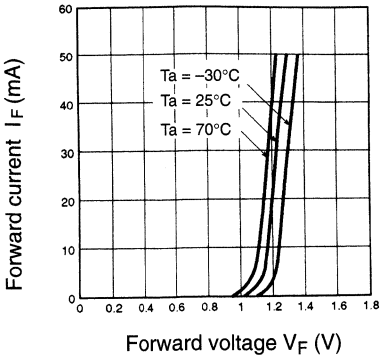
Engineering Data

Note: The values in the parentheses apply to the EE-SX405.

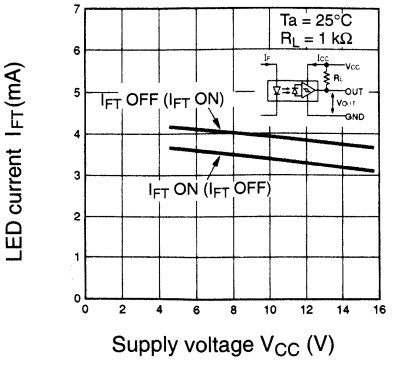
Forward Current vs. Collector Dissipation Temperature Rating



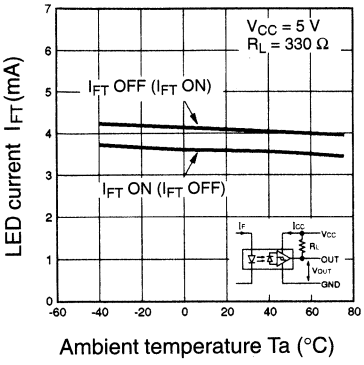
Forward Current vs. Forward Voltage Characteristics (Typical)



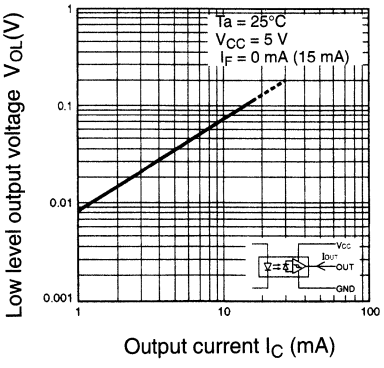
LED Current vs. Supply Voltage (Typical)



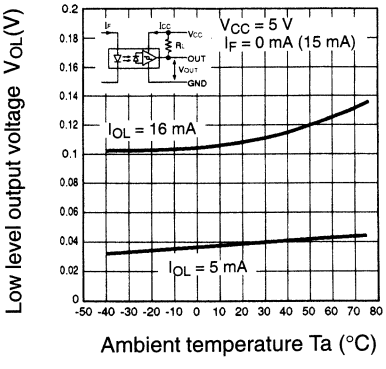
LED Current vs. Ambient Temperature Characteristics (Typical)



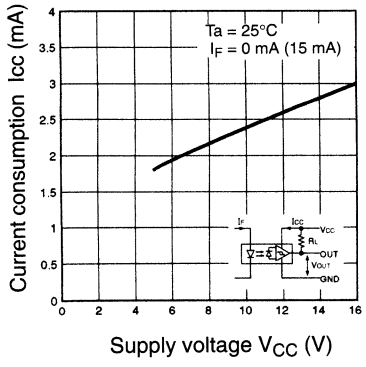
Low-level Output Voltage vs. Output Current (Typical)



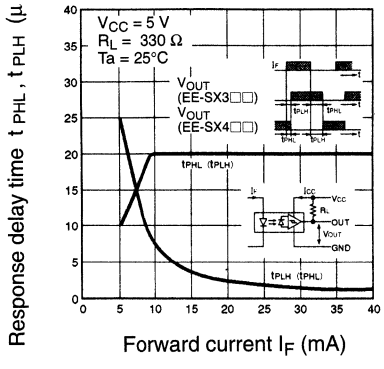
Low-level Output Voltage vs. Ambient Temperature Characteristics (Typical)



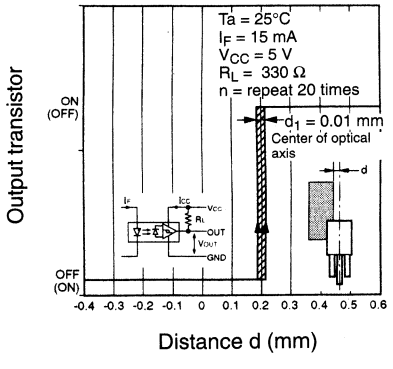
Current Consumption vs. Supply Voltage (Typical)



Response Delay Time vs. Forward Current (Typical)



Repeat Sensing Position Characteristics (Typical)



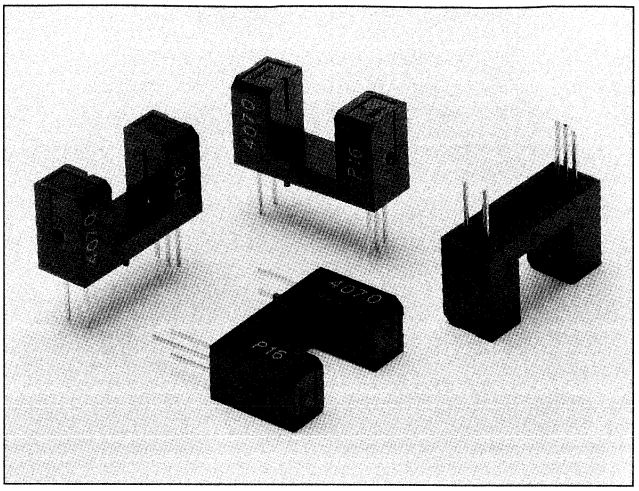
OMRON

Opto–Switch

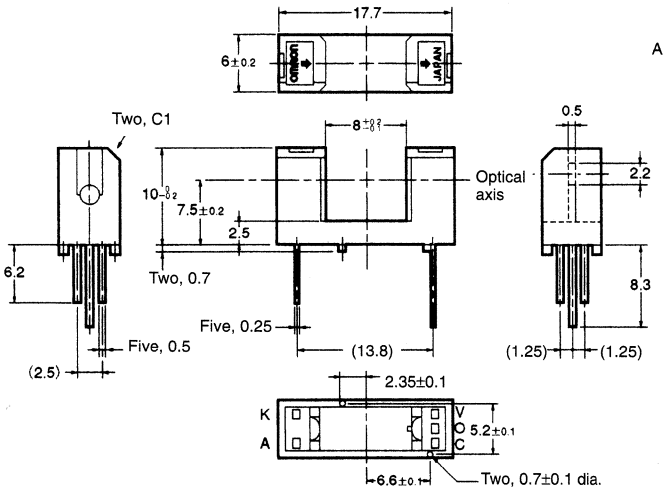
EE–SX3070 / EE–SX4070

Transmissive

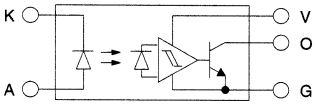
- Incorporates a photo–IC chip with a built-in detector element and amplifier.
- Detector element has built-in temperature compensation circuit.
- A wide supply voltage range: 4.5 to 16 VDC
- Directly connects to C-MOS and TTL.
- High resolution with a 0.5-mm-wide sensing aperture.
- 8mm wide slot.
- Dark ON model (EE-SX3070)
- Light ON model (EE-SX4070)



Dimensions



Internal Circuit



Terminal No.	Name
A	Anode
K	Cathode
V	Supply voltage (Vcc)
O	Output (OUT)
G	Ground (GND)

Unless otherwise specified, the tolerances are as shown below.

Dimensions	Tolerance
3 mm max.	±0.3
3 < mm ≤ 6	±0.375
6 < mm ≤ 10	±0.45
10 < mm ≤ 18	±0.55
18 < mm ≤ 30	±0.65

Specifications

■ Absolute Maximum Ratings (Ta = 25°C)

Item		Symbol	Rated value
Emitter	Forward current	I_F	50 mA (see note)
	Reverse voltage	V_R	4 V
Detector	Supply voltage	V_{CC}	16 V
	Output voltage	V_{OUT}	28 V
	Output current	I_{OUT}	16 mA
	Permissible output dissipation	P_{OUT}	250 mW (see note)
Ambient temperature	Operating	Topr	–40°C to 75°C
	Storage	Tstg	–40°C to 85°C
	Soldering	Tsol	260°C

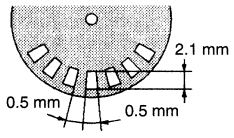
Note: Refer to the temperature rating chart if the ambient temperature exceeds 25°C.

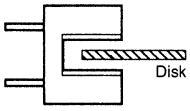
■ Electrical and Optical Characteristics (Ta = 25°C)

Item		Symbol	Value	Condition
Emitter	Forward voltage	V_F	1.2 V typ., 1.5 V max.	I_F = 20 mA
	Reverse current	I_R	0.01 μA typ., 10 μA max.	V_R = 4 V
	Peak emission wavelength	λ_P	940 nm typ.	I_F = 20 mA
Detector	Low-level output voltage	V_{OL}	0.12 V typ., 0.4 V max.	Vcc = 4.5 to 16 V, I_{OL} = 16 mA, I_F = 0 mA (EE-SX3070), I_F = 10 mA (EE-SX4070)
	High-level output voltage	V_{OH}	15 V min.	Vcc = 16 V, R_L = 1 kΩ, I_F = 10 mA (EE-SX3070), I_F = 0 mA (EE-SX4070)
	Current consumption	I_{CC}	3.2 mA typ., 10 mA max.	Vcc = 16 V
	Peak spectral sensitivity wavelength	λ_P	870 nm typ.	V_{CC} = 4.5 to 16 V
LED current when output is OFF		I_{FT}	10 mA max.	V_{CC} = 4.5 to 16 V
LED current when output is ON				
Hysteresis		ΔH	15% typ.	V_{CC} = 4.5 to 16 V (see note 1)
Response frequency		f	3,000 P.P.S min.	V_{CC} = 4.5 to 16 V, I_F = 20 mA, I_{OL} = 16 mA (see note 2)
Response delay time		t_{PLH} (t_{PHL})	3 μs typ.	V_{CC} = 4.5 to 16 V, I_F = 20 mA, I_{OL} = 16 mA (see note 3)
Response delay time		t_{PHL} (t_{PLH})	20 μs typ.	V_{CC} = 4.5 to 16 V, I_F = 20 mA, I_{OL} = 16 mA (see note 3)

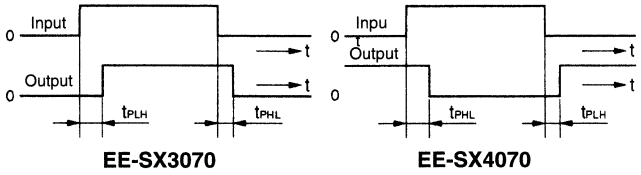
Note: 1. Hysteresis denotes the difference in forward LED current value, expressed in percentage, calculated from the respective forward LED currents when the photo IC is turned from ON to OFF and when the photo IC is turned from OFF to ON.

2. The value of the response frequency is measured by rotating the disk as shown below. (P.P.S = pulse/s)





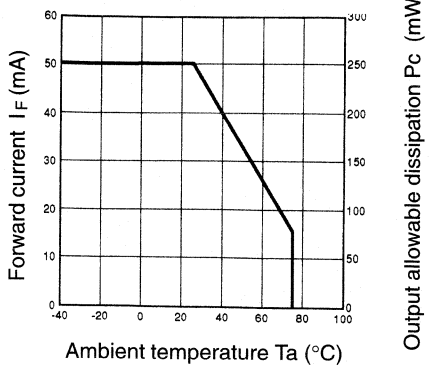
3. The following illustrations show the definition of response delay time.



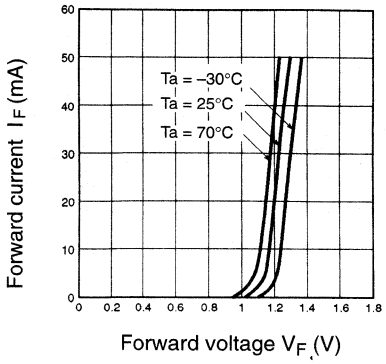
Engineering Data

Note: The values in the parentheses apply to the EE-SX4070.

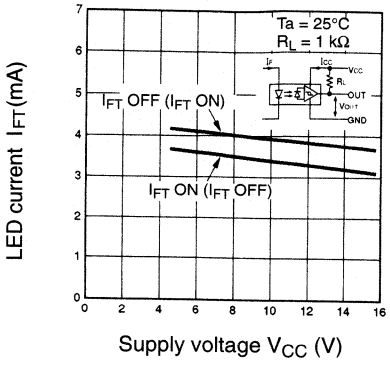
Forward Current vs. Collector Dissipation Temperature Rating



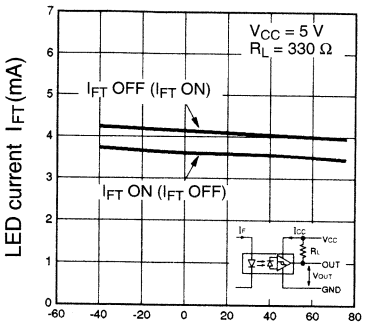
Forward Current vs. Forward Voltage Characteristics (Typical)



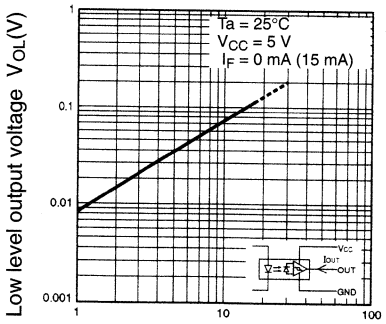
LED Current vs. Supply Voltage (Typical)



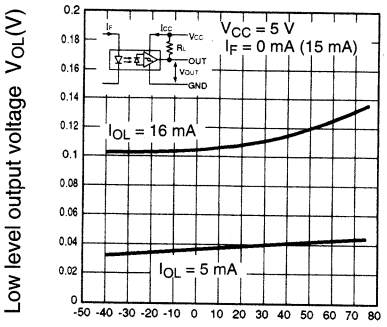
LED Current vs. Ambient Temperature Characteristics (Typical)



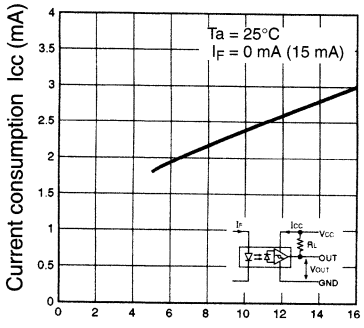
Low-level Output Voltage vs. Output Current (Typical)



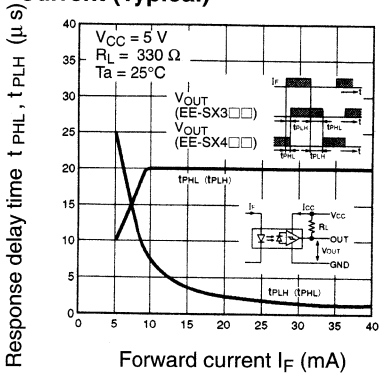
Low-level Output Voltage vs. Ambient Temperature Characteristics (Typical)



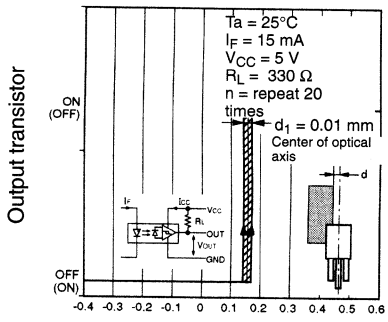
Current Consumption vs. Supply Voltage (Typical)



Response Delay Time vs. Forward Current (Typical)



Repeat Sensing Position Characteristics (Typical)



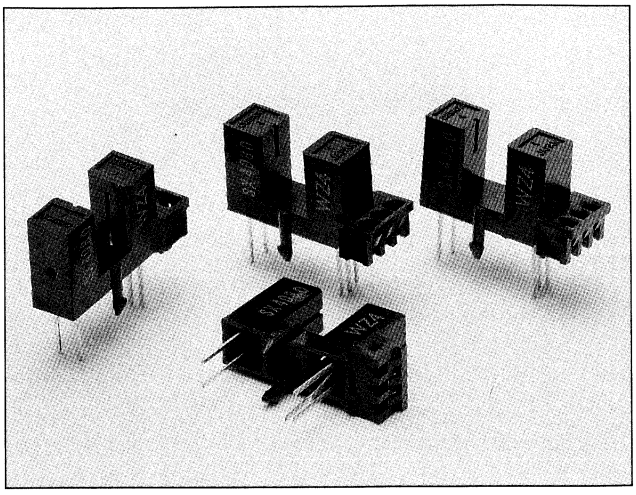
OMRON

Opto–Switch

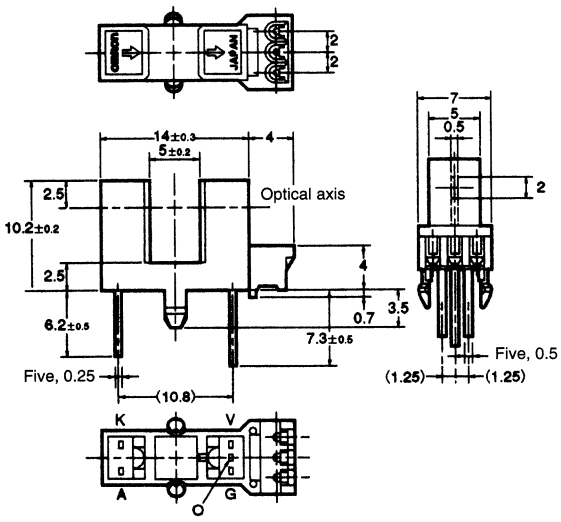
EE–SX3080 / EE–SX4080

Transmissive

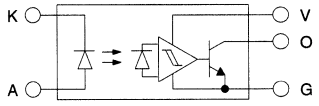
- Incorporates a photo–IC chip with a built-in detector element and amplifier.
- A wide supply voltage range: 4.5 to 16 VDC
- Directly connects to C-MOS and TTL.
- High resolution with a 0.5-mm-wide sensing aperture.
- Dark ON model (EE-SX3080)
- Light ON model (EE-SX4080)
- Incorporates lead wire holders and body holders and thus mounts to PCBs with ease.



Dimensions



Internal Circuit



Terminal No.	Name
A	Anode
K	Cathode
V	Supply voltage (Vcc)
O	Output (OUT)
G	Ground (GND)

Unless otherwise specified, the tolerances are as shown below.

Dimensions	Tolerance
3 mm max.	±0.3
3 < mm ≤ 6	±0.375
6 < mm ≤ 10	±0.45
10 < mm ≤ 18	±0.55
18 < mm ≤ 30	±0.65

Specifications

■ Absolute Maximum Ratings (Ta = 25°C)

Item		Symbol	Rated value
Emitter	Forward current	I_F	50 mA (see note)
	Reverse voltage	V_R	4 V
Detector	Supply voltage	V_{CC}	16 V
	Output voltage	V_{OUT}	28 V
	Output current	I_{OUT}	16 mA
	Permissible output dissipation	P_{OUT}	250 mW (see note)
Ambient temperature	Operating	Topr	–40°C to 75°C
	Storage	Tstg	–40°C to 85°C
	Soldering	Tsol	260°C

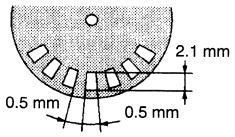
Note: Refer to the temperature rating chart if the ambient temperature exceeds 25°C.

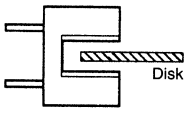
■ Electrical and Optical Characteristics (Ta = 25°C)

Item		Symbol	Value	Condition
Emitter	Forward voltage	V_F	1.2 V typ., 1.5 V max.	I_F = 20 mA
	Reverse current	I_R	0.01 μA typ., 10 μA max.	V_R = 4 V
	Peak emission wavelength	λ_P	940 nm typ.	I_F = 20 mA
Detector	Low-level output voltage	V_{OL}	0.12 V typ., 0.4 V max.	Vcc = 4.5 to 16 V, I_{OL} = 16 mA, I_F = 0 mA (EE-SX3080), I_F = 8 mA (EE-SX4080)
	High-level output voltage	V_{OH}	15 V min.	Vcc = 16 V, R_L = 1 kΩ, I_F = 8 mA (EE-SX3080), I_F = 0 mA (EE-SX4080)
	Current consumption	I_{CC}	3.2 mA typ., 10 mA max.	Vcc = 16 V
	Peak spectral sensitivity wavelength	λ_P	870 nm typ.	V_{CC} = 4.5 to 16 V
LED current when output is OFF		I_{FT}	8 mA max.	V_{CC} = 4.5 to 16 V
LED current when output is ON				
Hysteresis		ΔH	15% typ.	V_{CC} = 4.5 to 16 V (see note 1)
Response frequency		f	3,000 P.P.S min.	V_{CC} = 4.5 to 16 V, I_F = 15 mA, I_{OL} = 16 mA (see note 2)
Response delay time		t_{PLH} (t_{PHL})	3 μs typ.	V_{CC} = 4.5 to 16 V, I_F = 15 mA, I_{OL} = 16 mA (see note 3)
Response delay time		t_{PHL} (t_{PLH})	20 μs typ.	V_{CC} = 4.5 to 16 V, I_F = 15 mA, I_{OL} = 16 mA (see note 3)

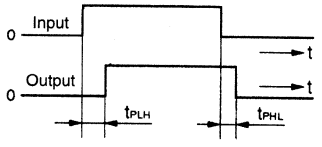
Note: 1. Hysteresis denotes the difference in forward LED current value, expressed in percentage, calculated from the respective forward LED currents when the photo IC is turned from ON to OFF and when the photo IC is turned from OFF to ON.

2. The value of the response frequency is measured by rotating the disk as shown below. (P.P.S = pulse/s)

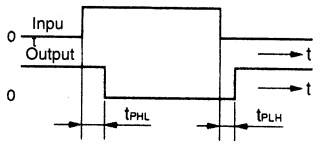




3. The following illustrations show the definition of response delay time.



EE-SX3080



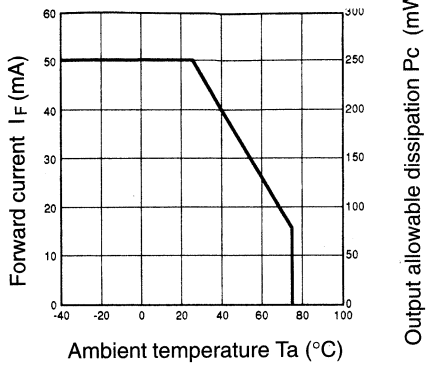
EE-SX4080

Opto-Switches

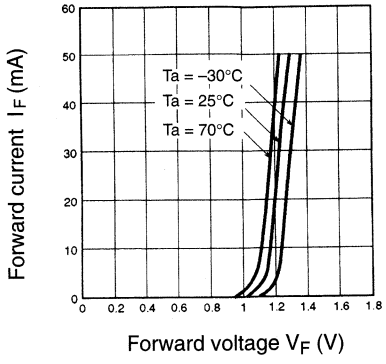
Engineering Data

Note: The values in the parentheses apply to the EE-SX4080.

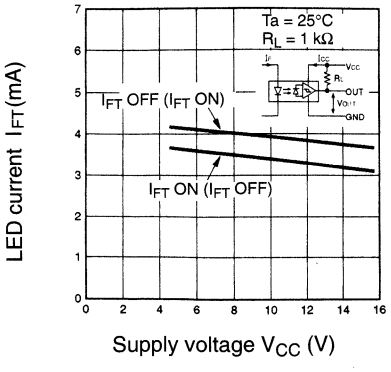
Forward Current vs. Collector Dissipation Temperature Rating



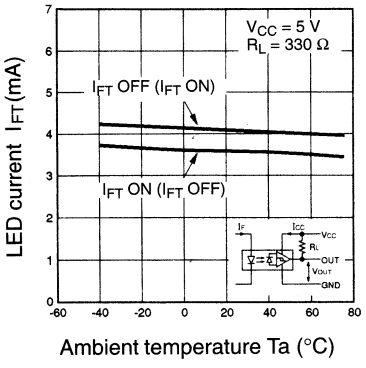
Forward Current vs. Forward Voltage Characteristics (Typical)



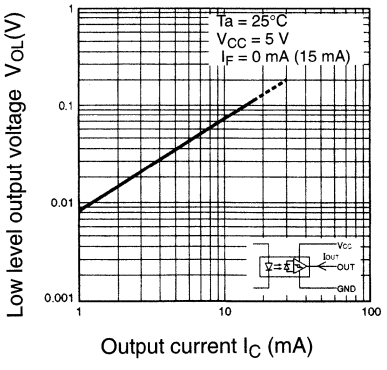
LED Current vs. Supply Voltage (Typical)



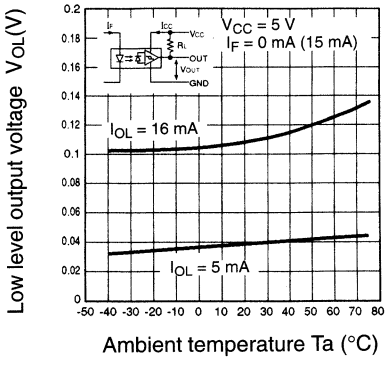
LED Current vs. Ambient Temperature Characteristics (Typical)



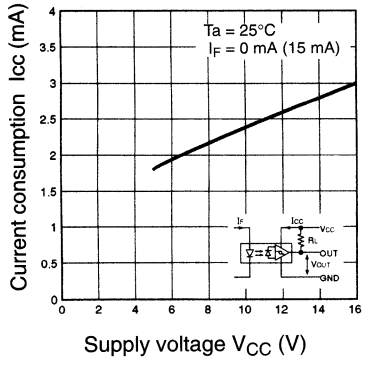
Low-level Output Voltage vs. Output Current (Typical)



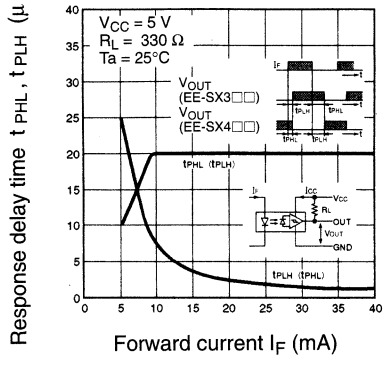
Low-level Output Voltage vs. Ambient Temperature Characteristics (Typical)



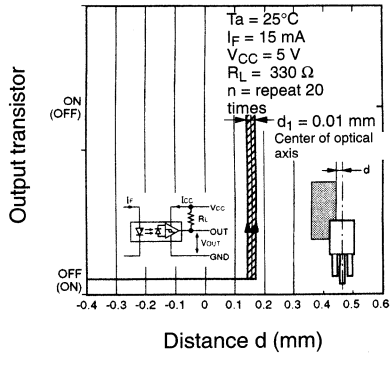
Current Consumption vs. Supply Voltage (Typical)



Response Delay Time vs. Forward Current (Typical)



Repeat Sensing Position Characteristics (Typical)



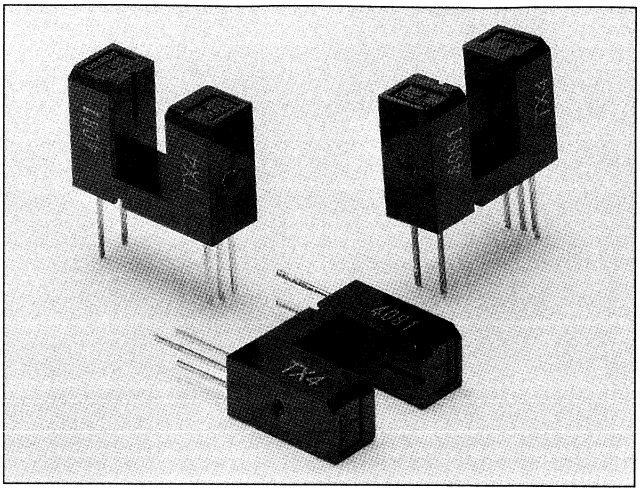
OMRON

Opto–Switch

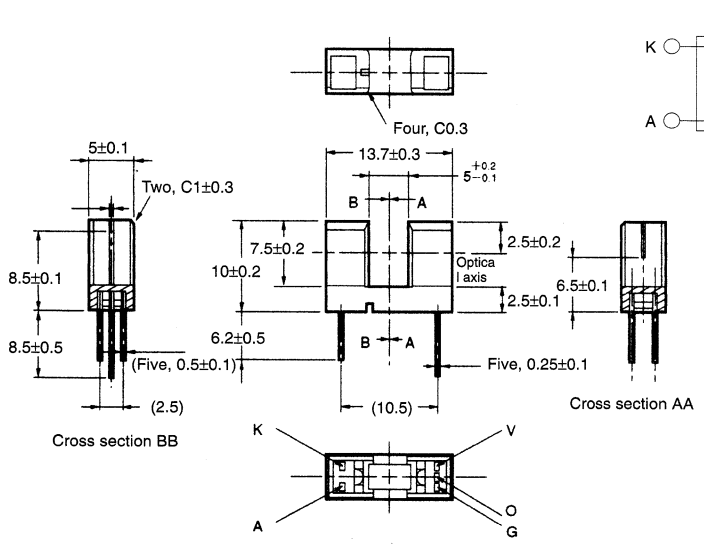
EE–SX3081 / EE–SX4081

Transmissive

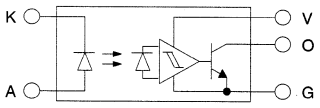
- Incorporates a photo–IC chip with a built-in detector element and amplifier.
- Detector element has built-in temperature compensation circuit.
- A wide supply voltage range: 4.5 to 16 VDC
- Directly connects to C-MOS and TTL.
- High resolution with a 0.5-mm-wide sensing aperture.
- Dark ON model (EE-SX3081)
- Light ON model (EE-SX4081)



Dimensions



Internal Circuit



Terminal No.	Name
A	Anode
K	Cathode
V	Supply voltage (Vcc)
O	Output (OUT)
G	Ground (GND)

Unless otherwise specified, the tolerances are as shown below.

Dimensions	Tolerance
3 mm max.	±0.3
3 < mm ≤ 6	±0.375
6 < mm ≤ 10	±0.45
10 < mm ≤ 18	±0.55
18 < mm ≤ 30	±0.65

Specifications

■ Absolute Maximum Ratings (Ta = 25°C)

Item		Symbol	Rated value
Emitter	Forward current	I_F	50 mA (see note)
	Reverse voltage	V_R	4 V
Detector	Supply voltage	V_{CC}	16 V
	Output voltage	V_{OUT}	28 V
	Output current	I_{OUT}	16 mA
	Permissible output dissipation	P_{OUT}	250 mW (see note)
Ambient temperature	Operating	Topr	–40°C to 75°C
	Storage	Tstg	–40°C to 85°C
	Soldering	Tsol	260°C

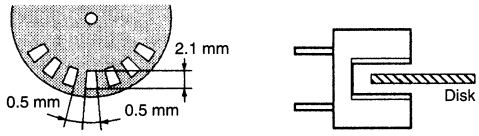
Note: Refer to the temperature rating chart if the ambient temperature exceeds 25°C.

■ Electrical and Optical Characteristics (Ta = 25°C)

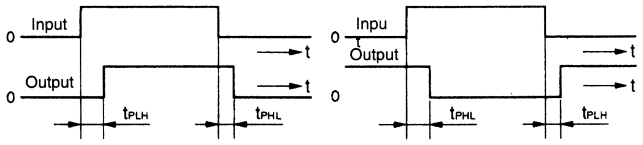
Item		Symbol	Value	Condition
Emitter	Forward voltage	V_F	1.2 V typ., 1.5 V max.	I_F = 20 mA
	Reverse current	I_R	0.01 μA typ., 10 μA max.	V_R = 4 V
	Peak emission wavelength	λ_P	940 nm typ.	I_F = 20 mA
Detector	Low-level output voltage	V_{OL}	0.12 V typ., 0.4 V max.	Vcc = 4.5 to 16 V, I_{OL} = 16 mA, I_F = 0 mA (EE-SX3081), I_F = 8 mA (EE-SX4081)
	High-level output voltage	V_{OH}	15 V min.	Vcc = 16 V, R_L = 1 kΩ, I_F = 8 mA (EE-SX3081), I_F = 0 mA (EE-SX4081)
	Current consumption	I_{CC}	3.2 mA typ., 10 mA max.	Vcc = 16 V
	Peak spectral sensitivity wavelength	λ_P	870 nm typ.	V_{CC} = 4.5 to 16 V
LED current when output is OFF		I_{FT}	8 mA max.	V_{CC} = 4.5 to 16 V
LED current when output is ON				
Hysteresis		ΔH	15% typ.	V_{CC} = 4.5 to 16 V (see note 1)
Response frequency		f	3,000 P.P.S min.	V_{CC} = 4.5 to 16 V, I_F = 20 mA, I_{OL} = 16 mA (see note 2)
Response delay time		t_{PLH} (t_{PHL})	3 μs typ.	V_{CC} = 4.5 to 16 V, I_F = 20 mA, I_{OL} = 16 mA (see note 3)
Response delay time		t_{PHL} (t_{PLH})	20 μs typ.	V_{CC} = 4.5 to 16 V, I_F = 20 mA, I_{OL} = 16 mA (see note 3)

Note: 1. Hysteresis denotes the difference in forward LED current value, expressed in percentage, calculated from the respective forward LED currents when the photo IC is turned from ON to OFF and when the photo IC is turned from OFF to ON.

2. The value of the response frequency is measured by rotating the disk as shown below. (P.P.S = pulse/s)



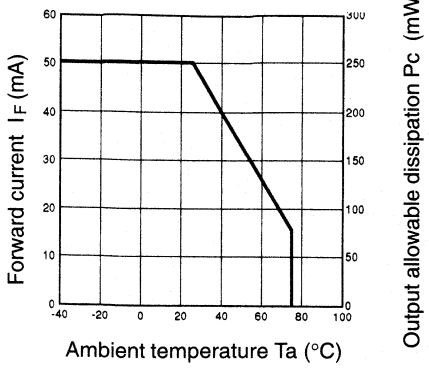
3. The following illustrations show the definition of response delay time.



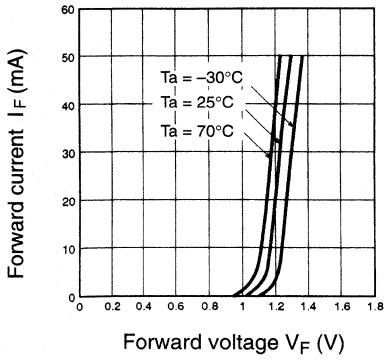
Engineering Data

Note: The values in the parentheses apply to the EE-SX4081.

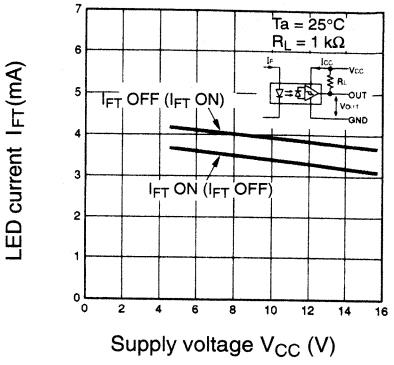
Forward Current vs. Collector Dissipation Temperature Rating



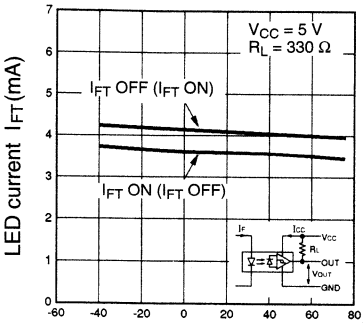
Forward Current vs. Forward Voltage Characteristics (Typical)



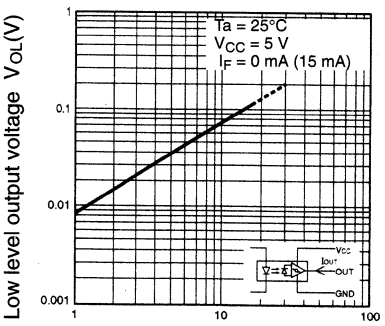
LED Current vs. Supply Voltage (Typical)



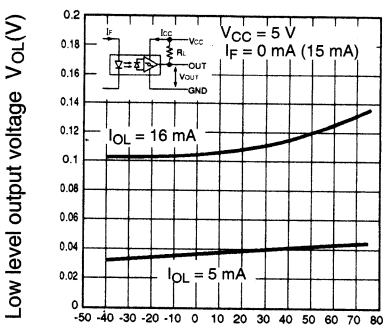
LED Current vs. Ambient Temperature Characteristics (Typical)



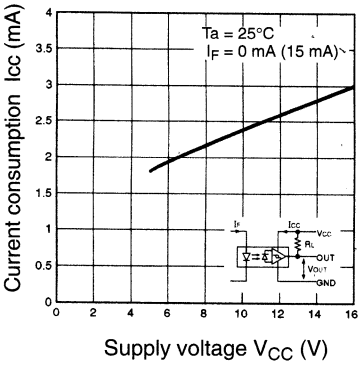
Low-level Output Voltage vs. Output Current (Typical)



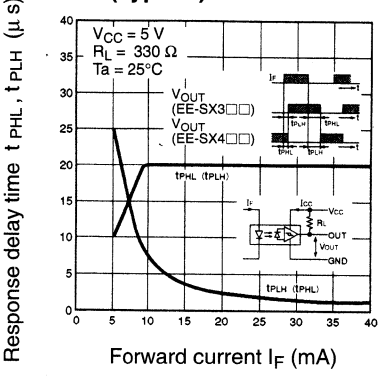
Low-level Output Voltage vs. Ambient Temperature Characteristics (Typical)



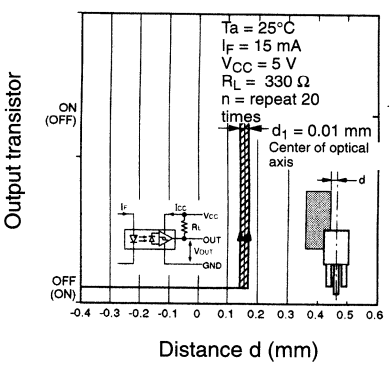
Current Consumption vs. Supply Voltage (Typical)



Response Delay Time vs. Forward Current (Typical)



Repeat Sensing Position Characteristics (Typical)



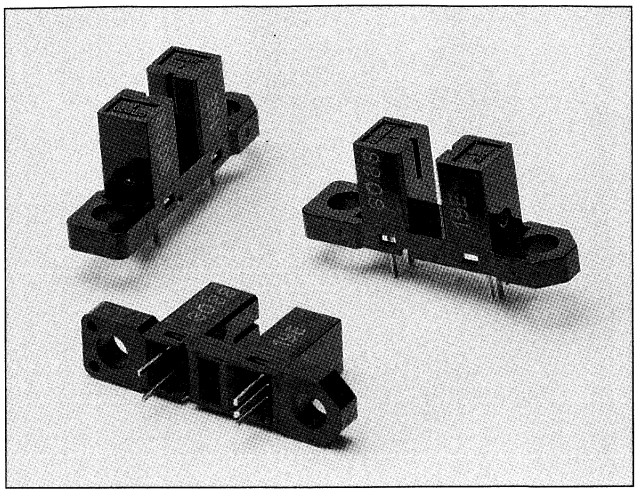
Opto-Switches

OMRON

Opto–Switch

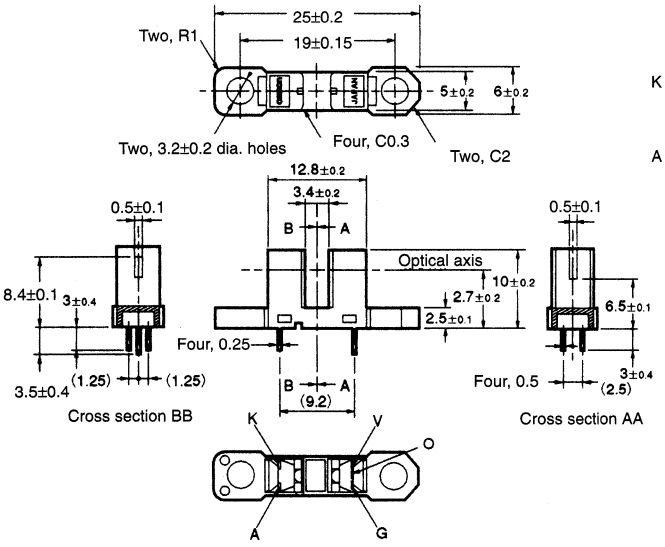
EE–SX3088 EE–SX4088

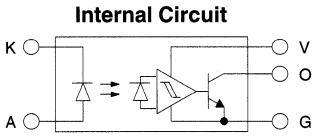
Transmissive



- Incorporates a photo–IC chip with a built-in detector element and amplifier.
- A wide supply voltage range: 4.5 to 16 VDC
- Directly connects to C-MOS and TTL.
- High resolution with a 0.5-mm-wide sensing aperture.
- Dark ON model (EE-SX3088)
- Light ON model (EE-SX4088)
- OMRON's XK8-series Connectors can be connected to the lead wires without a PCB. Contact OMRON for information on obtaining XK8-series Connectors.

Dimensions





Terminal No.	Name
A	Anode
K	Cathode
V	Supply voltage (Vcc)
O	Output (OUT)
G	Ground (GND)

Unless otherwise specified, the tolerances are as shown below.

Dimensions	Tolerance
3 mm max.	±0.3
3 < mm ≤ 6	±0.375
6 < mm ≤ 10	±0.45
10 < mm ≤ 18	±0.55
18 < mm ≤ 30	±0.65

Specifications

■ Absolute Maximum Ratings (Ta = 25°C)

Item		Symbol	Rated value
Emitter	**Forward current**	I_F	50 mA (see note)
	Reverse voltage	V_R	4 V
Detector	**Supply voltage**	V_{CC}	16 V
	Output voltage	V_{OUT}	28 V
	Output current	I_{OUT}	16 mA
	Permissible output dissipation	P_{OUT}	250 mW (see note)
Ambient temperature	**Operating**	Topr	–40°C to 75°C
	Storage	Tstg	–40°C to 85°C
	Soldering	Tsol	260°C

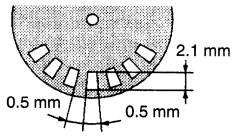
Note: Refer to the temperature rating chart if the ambient temperature exceeds 25°C.

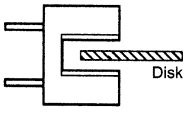
■ Electrical and Optical Characteristics (Ta = 25°C)

Item		Symbol	Value	Condition
Emitter	Forward voltage	V_F	1.2 V typ., 1.5 V max.	I_F = 20 mA
	Reverse current	I_R	0.01 μA typ., 10 μA max.	V_R = 4 V
	Peak emission wavelength	λ_P	---	---
Detector	Low-level output voltage	V_{OL}	0.12 V typ., 0.4 V max.	Vcc = 4.5 to 16 V, I_{OL} = 16 mA, I_F = 0 mA (EE-SX3088), I_F = 5 mA (EE-SX4088)
	High-level output voltage	V_{OH}	15 V min.	Vcc = 16 V, R_L = 1 kΩ, I_F = 5 mA (EE-SX3088), I_F = 0 mA (EE-SX4088)
	Current consumption	I_{CC}	3.2 mA typ., 10 mA max.	Vcc = 16 V
	Peak spectral sensitivity wavelength	λ_P	---	---
LED current when output is OFF		I_{FT}	2 mA typ., 5 mA max.	V_{CC} = 4.5 to 16 V
LED current when output is ON				
Hysteresis		ΔH	15% typ.	V_{CC} = 4.5 to 16 V (see note 1)
Response frequency		f	3,000 P.P.S min.	V_{CC} = 4.5 to 16 V, I_F = 15 mA, I_{OL} = 16 mA (see note 2)
Response delay time		t_{PLH} (t_{PHL})	3 μs typ.	V_{CC} = 4.5 to 16 V, I_F = 15 mA, I_{OL} = 16 mA (see note 3)
Response delay time		t_{PHL} (t_{PLH})	20 μs typ.	V_{CC} = 4.5 to 16 V, I_F = 15 mA, I_{OL} = 16 mA (see note 3)

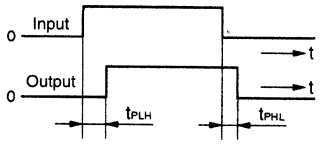
Note: 1. Hysteresis denotes the difference in forward LED current value, expressed in percentage, calculated from the respective forward LED currents when the photo IC is turned from ON to OFF and when the photo IC is turned from OFF to ON.

2. The value of the response frequency is measured by rotating the disk as shown below. (P.P.S = pulse/s)

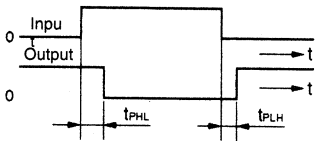




3. The following illustrations show the definition of response delay time. The value in the parentheses applies to the EE-SX4088.



EE-SX3088

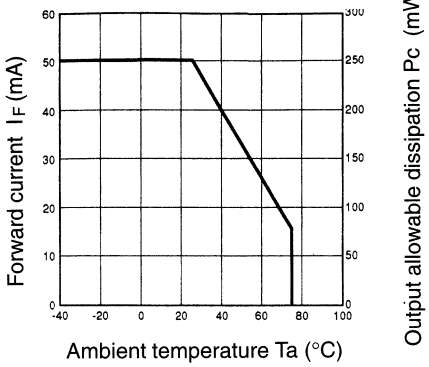


EE-SX4088

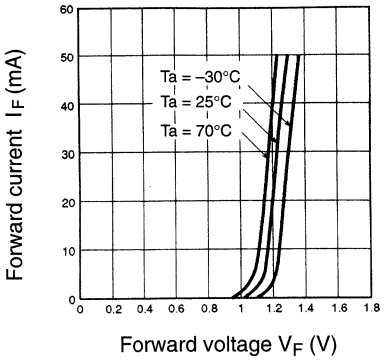
Engineering Data

Note: The values in the parentheses apply to the EE-SX4088.

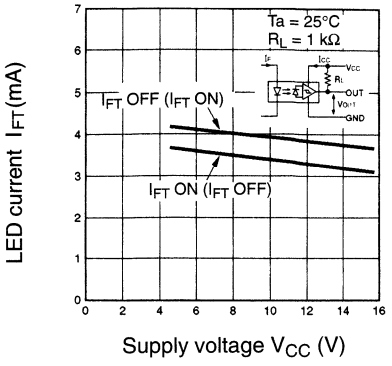
Forward Current vs. Collector Dissipation Temperature Rating



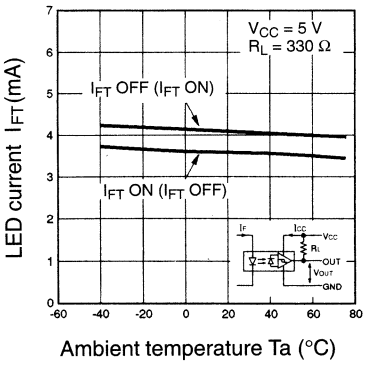
Forward Current vs. Forward Voltage Characteristics (Typical)



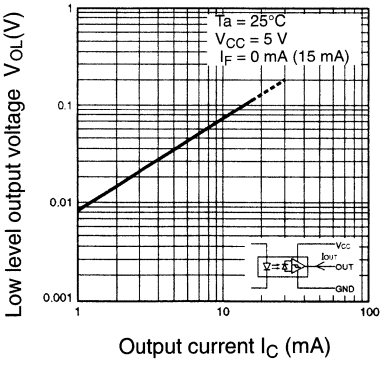
LED Current vs. Supply Voltage (Typical)



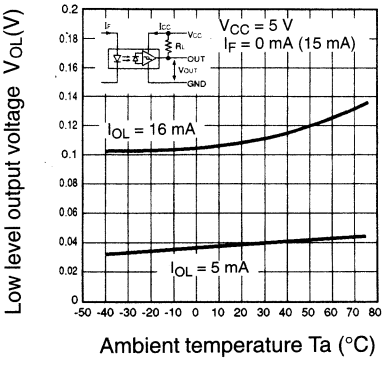
LED Current vs. Ambient Temperature Characteristics (Typical)



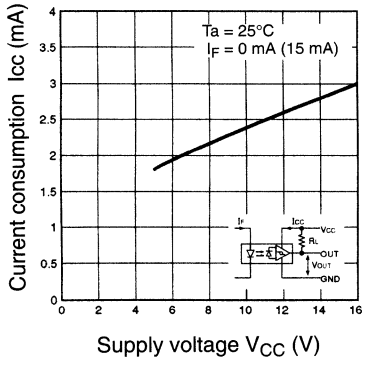
Low-level Output Voltage vs. Output Current (Typical)



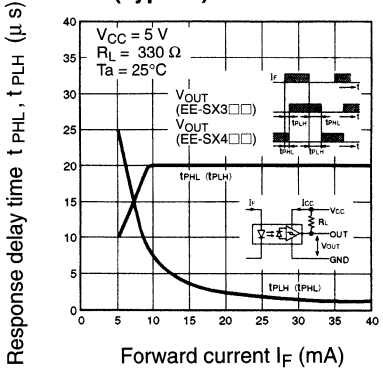
Low-level Output Voltage vs. Ambient Temperature Characteristics (Typical)



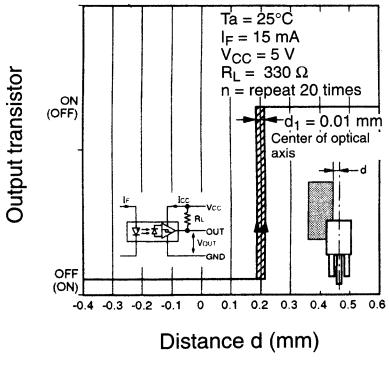
Current Consumption vs. Supply Voltage (Typical)



Response Delay Time vs. Forward Current (Typical)



Repeat Sensing Position Characteristics (Typical)



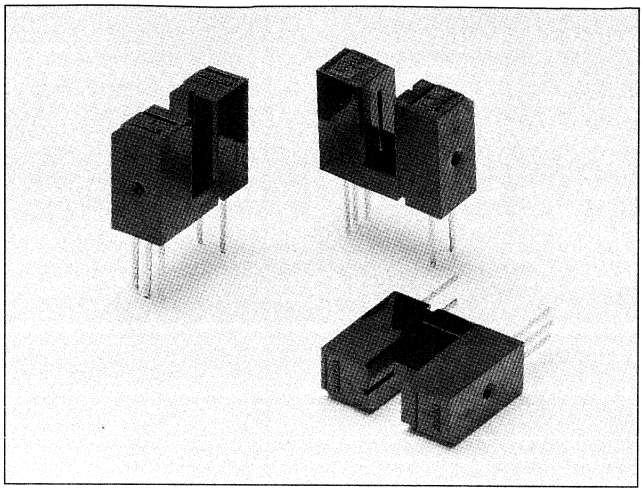
OMRON

Opto–Switch

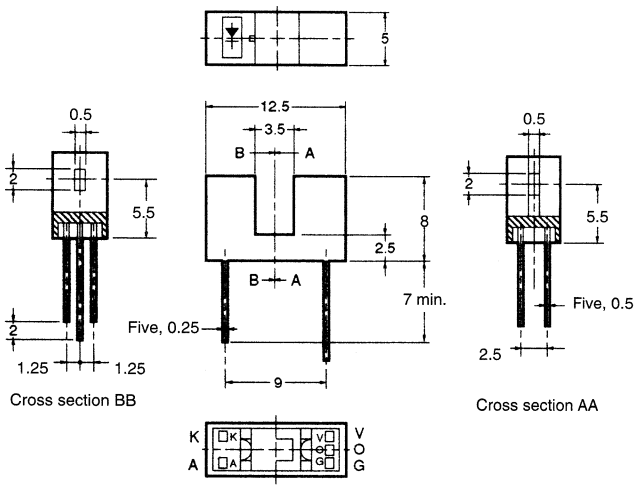
EE–SX384 / EE–SX484

Transmissive

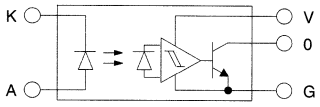
- Incorporates a photo–IC chip with a built-in detector element and amplifier.
- Detector element has built-in temperature compensation circuit.
- A wide supply voltage range: 4.5 to 16 VDC
- Directly connects to C-MOS and TTL.
- High resolution with a 0.5-mm-wide sensing aperture.
- Dark ON model (EE-SX384)
- Light ON model (EE-SX484)



Dimensions



Internal Circuit



Terminal No.	Name
A	Anode
K	Cathode
V	Supply voltage (Vcc)
O	Output (OUT)
G	Ground (GND)

Unless otherwise specified, the tolerances are ±0.2.

Specifications

■ Absolute Maximum Ratings (Ta = 25°C)

Item		Symbol	Rated value
Emitter	Forward current	I_F	50 mA (see note)
	Reverse voltage	V_R	4 V
Detector	Supply voltage	V_{CC}	16 V
	Output voltage	V_{OUT}	28 V
	Output current	I_{OUT}	16 mA
	Permissible output dissipation	P_{OUT}	250 mW (see note)
Ambient temperature	Operating	Topr	–40°C to 75°C
	Storage	Tstg	–40°C to 85°C
	Soldering	Tsol	260°C

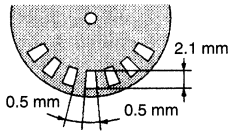
Note: Refer to the temperature rating chart if the ambient temperature exceeds 25°C.

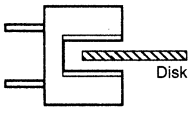
■ Electrical and Optical Characteristics (Ta = 25°C)

Item		Symbol	Value	Condition
Emitter	Forward voltage	V_F	1.2 V typ., 1.5 V max.	I_F = 20 mA
	Reverse current	I_R	0.01 μA typ., 10 μA max.	V_R = 4 V
	Peak emission wavelength	λ_P	940 nm typ.	I_F = 20 mA
Detector	Low-level output voltage	V_{OL}	0.12 V typ., 0.4 V max.	Vcc = 4.5 to 16 V, I_{OL} = 16 mA, I_F = 0 mA (EE-SX384), I_F = 8 mA (EE-SX484)
	High-level output voltage	V_{OH}	15 V min.	Vcc = 16 V, R_L = 1 kΩ, I_F = 8 mA (EE-SX384), I_F = 0 mA (EE-SX484)
	Current consumption	I_{CC}	3.2 mA typ., 10 mA max.	Vcc = 16 V
	Peak spectral sensitivity wavelength	λ_P	870 nm typ.	V_{CC} = 4.5 to 16 V
LED current when output is OFF		I_{FT}	3 mA typ., 8 mA max.	V_{CC} = 4.5 to 16 V
LED current when output is ON				
Hysteresis		ΔH	15% typ.	V_{CC} = 4.5 to 16 V (see note 1)
Response frequency		f	3,000 P.P.S min.	V_{CC} = 4.5 to 16 V, I_F = 15 mA, I_{OL} = 16 mA (see note 2)
Response delay time		t_{PLH} (t_{PHL})	3 μs typ.	V_{CC} = 4.5 to 16 V, I_F = 15 mA, I_{OL} = 16 mA (see note 3)
Response delay time		t_{PHL} (t_{PLH})	20 μs typ.	V_{CC} = 4.5 to 16 V, I_F = 15 mA, I_{OL} = 16 mA (see note 3)

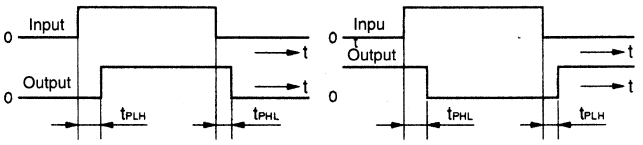
Note: 1. Hysteresis denotes the difference in forward LED current value, expressed in percentage, calculated from the respective forward LED currents when the photo IC is turned from ON to OFF and when the photo IC is turned from OFF to ON.

2. The value of the response frequency is measured by rotating the disk as shown below. (P.P.S = pulse/s)





3. The following illustrations show the definition of response delay time. The value in the parentheses applies to the EE-SX484.

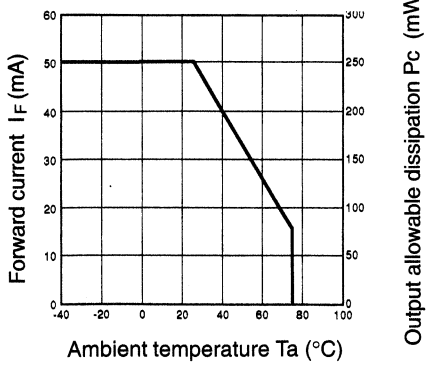


EE-SX384 EE-SX484

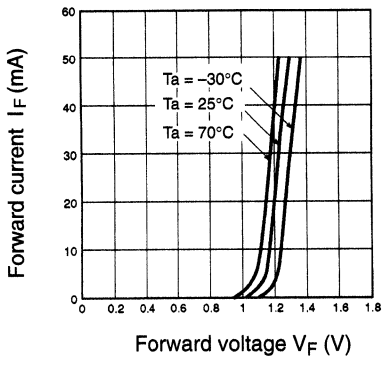
Engineering Data

Note: The values in the parentheses apply to the EE-SX484.

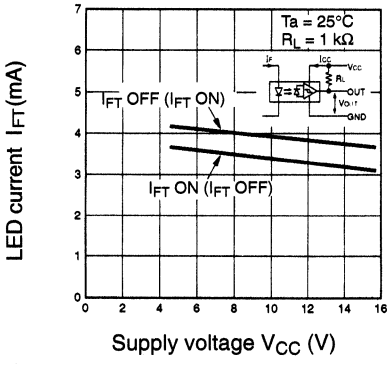
Forward Current vs. Collector Dissipation Temperature Rating



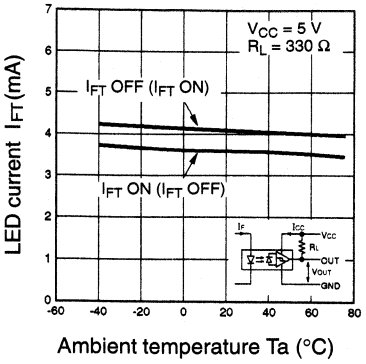
Forward Current vs. Forward Voltage Characteristics (Typical)



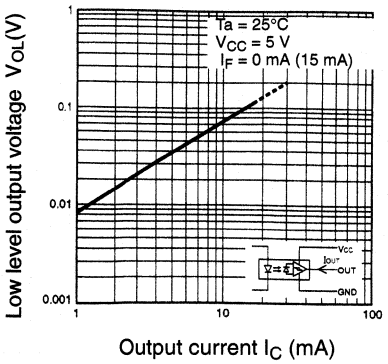
LED Current vs. Supply Voltage (Typical)



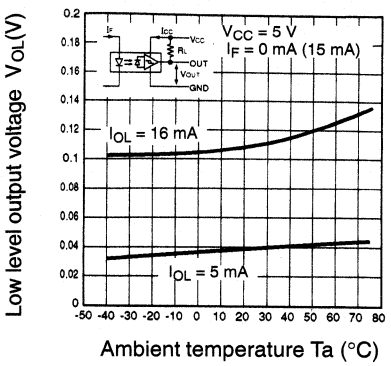
LED Current vs. Ambient Temperature Characteristics (Typical)



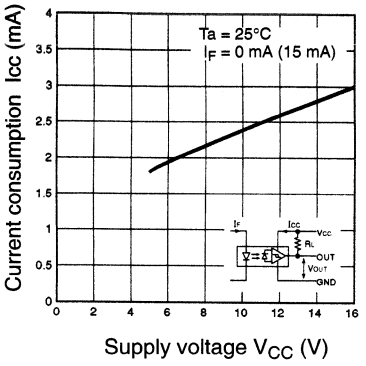
Low-level Output Voltage vs. Output Current (Typical)



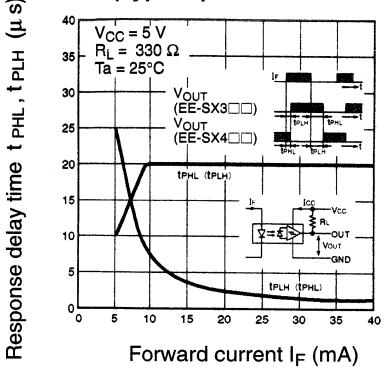
Low-level Output Voltage vs. Ambient Temperature Characteristics (Typical)



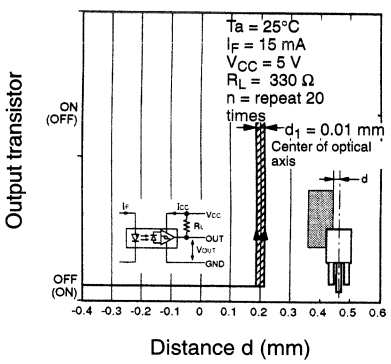
Current Consumption vs. Supply Voltage (Typical)



Response Delay Time vs. Forward Current (Typical)



Repeat Sensing Position Characteristics (Typical)



Opto-Switches

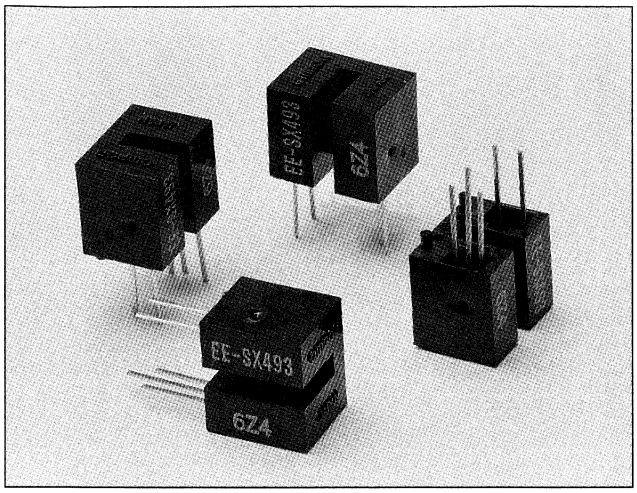
OMRON

Opto–Switch

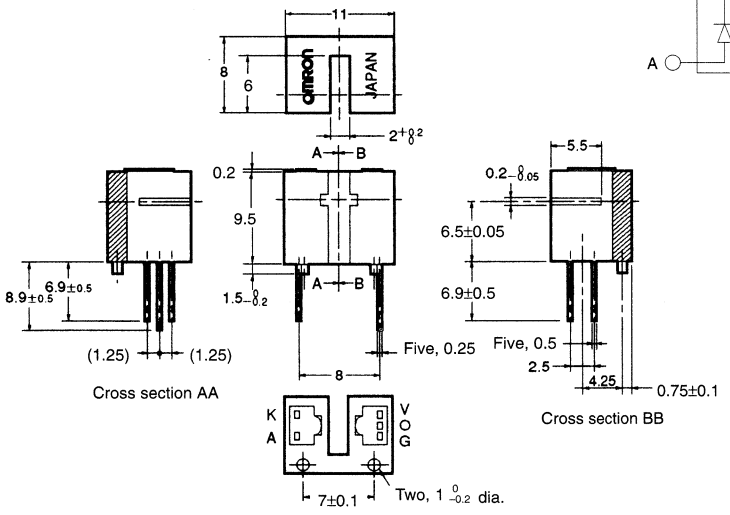
EE–SX493

Transmissive

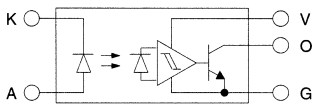
- Incorporates a photo–IC chip with a built-in detector element and amplifier.
- Detector element has built-in temperature compensation circuit.
- A wide supply voltage range: 4.5 to 16 VDC
- Directly connects to C-MOS and TTL.
- Allows highly precise sensing with a 0.2-mm-wide sensing aperture.
- Vertical slot arrangement.
- Incorporates PCB location pips.



Dimensions



Internal Circuit



Terminal No.	Name
A	Anode
K	Cathode
V	Supply voltage (Vcc)
O	Output (OUT)
G	Ground (GND)

Unless otherwise specified, the tolerances are as shown below.

Dimensions	Tolerance
3 mm max.	±0.125
3 < mm ≤ 6	±0.150
6 < mm ≤ 10	±0.180
10 < mm ≤ 18	±0.215
18 < mm ≤ 30	±0.260

Specifications

■ Absolute Maximum Ratings (Ta = 25°C)

Item		Symbol	Rated value
Emitter	Forward current	I_F	50 mA (see note)
	Reverse voltage	V_R	4 V
Detector	Supply voltage	V_{CC}	16 V
	Output voltage	V_{OUT}	28 V
	Output current	I_{OUT}	16 mA
	Permissible output dissipation	P_{OUT}	250 mW (see note)
Ambient temperature	Operating	Topr	–40°C to 60°C
	Storage	Tstg	–40°C to 85°C
	Soldering	Tsol	260°C

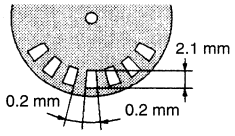
Note: Refer to the temperature rating chart if the ambient temperature exceeds 25°C.

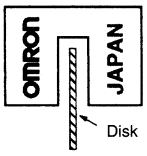
■ Electrical and Optical Characteristics (Ta = 25°C)

Item		Symbol	Value	Condition
Emitter	Forward voltage	V_F	1.2 V typ., 1.5 V max.	I_F = 20 mA
	Reverse current	I_R	0.01 μA typ., 10 μA max.	V_R = 4 V
	Peak emission wavelength	λ_P	940 nm typ.	I_F = 20 mA
Detector	Low-level output voltage	V_{OL}	0.12 V typ., 0.4 V max.	Vcc = 4.5 to 16 V, I_{OL} = 16 mA, I_F = 15 mA
	High-level output voltage	V_{OH}	15 V min.	Vcc = 16 V, R_L = 1 kΩ, I_F = 0 mA
	Current consumption	I_{CC}	5 mA typ., 10 mA max.	Vcc = 16 V
	Peak spectral sensitivity wavelength	λ_P	870 nm typ.	V_{CC} = 4.5 to 16 V
LED current when output is OFF		I_{FT}	10 mA typ., 15 mA max.	V_{CC} = 4.5 to 16 V
LED current when output is ON				
Hysteresis		ΔH	15% typ.	V_{CC} = 4.5 to 16 V (see note 1)
Response frequency		f	3,000 P.P.S min.	V_{CC} = 4.5 to 16 V, I_F = 15 mA, I_{OL} = 16 mA (see note 2)
Response delay time		t_{PLH} (t_{PHL})	3 μs typ.	V_{CC} = 4.5 to 16 V, I_F = 15 mA, I_{OL} = 16 mA (see note 3)
Response delay time		t_{PHL} (t_{PLH})	20 μs typ.	V_{CC} = 4.5 to 16 V, I_F = 15 mA, I_{OL} = 16 mA (see note 3)

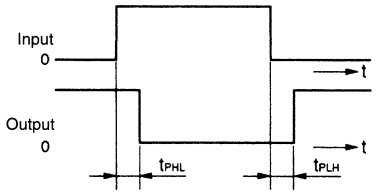
Note: 1. Hysteresis denotes the difference in forward LED current value, expressed in percentage, calculated from the respective forward LED currents when the photo IC is turned from ON to OFF and when the photo IC is turned from OFF to ON.

2. The value of the response frequency is measured by rotating the disk as shown below. (P.P.S = pulse/s)



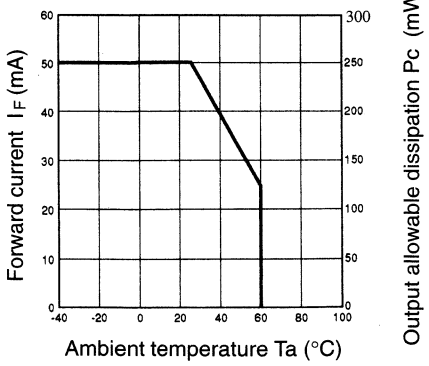


3. The following illustrations show the definition of response delay time.

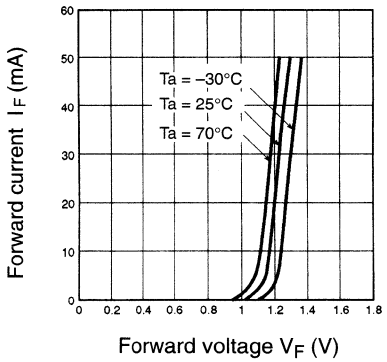


Engineering Data

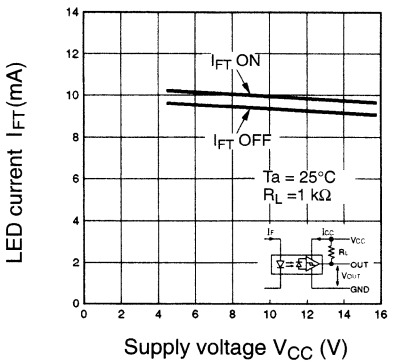
Forward Current vs. Collector Dissipation Temperature Rating



Forward Current vs. Forward Voltage Characteristics (Typical)

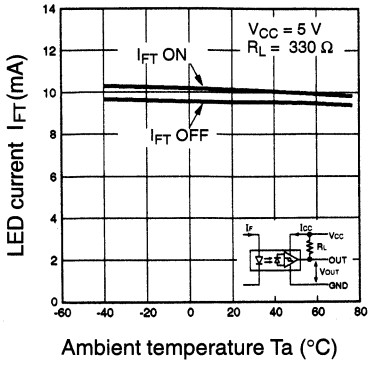


LED Current vs. Supply Voltage (Typical)

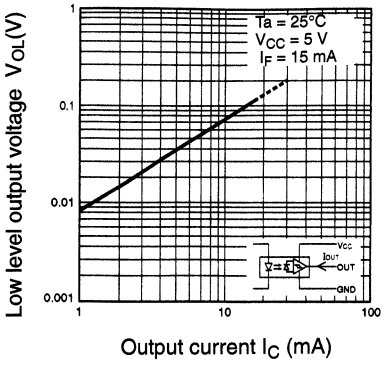


Opto-Switches

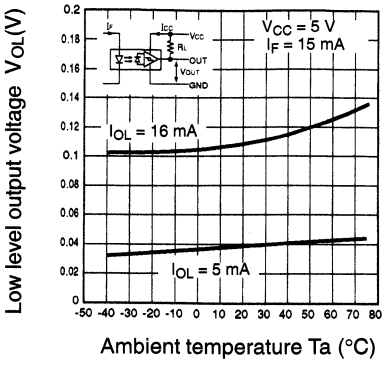
LED Current vs. Ambient Temperature Characteristics (Typical)



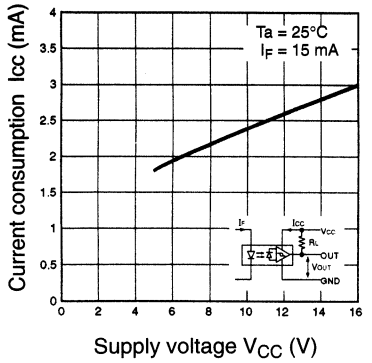
Low-level Output Voltage vs. Output Current (Typical)



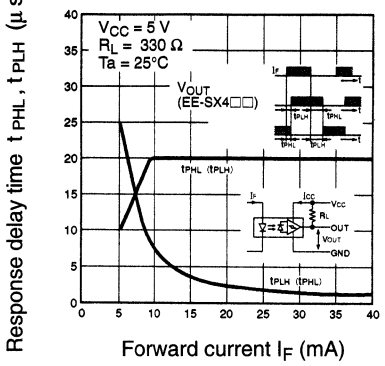
Low-level Output Voltage vs. Ambient Temperature Characteristics (Typical)



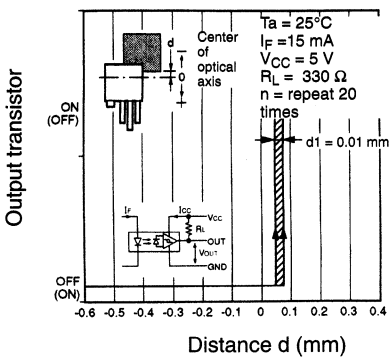
Current Consumption vs. Supply Voltage (Typical)



Response Delay Time vs. Forward Current (Typical)



Repeat Sensing Position Characteristics (Typical)



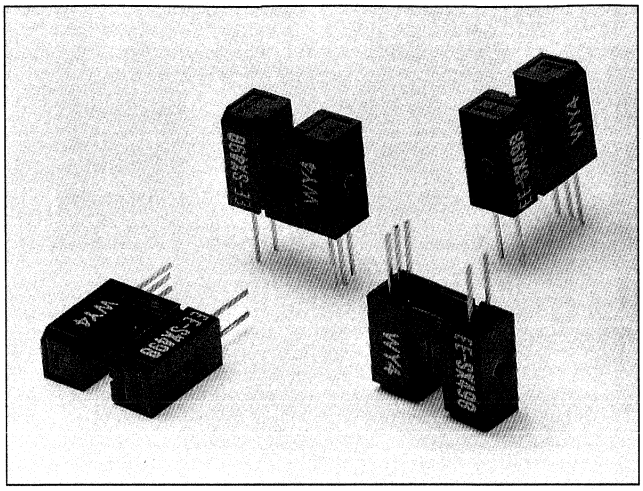
OMRON

Opto–Switch

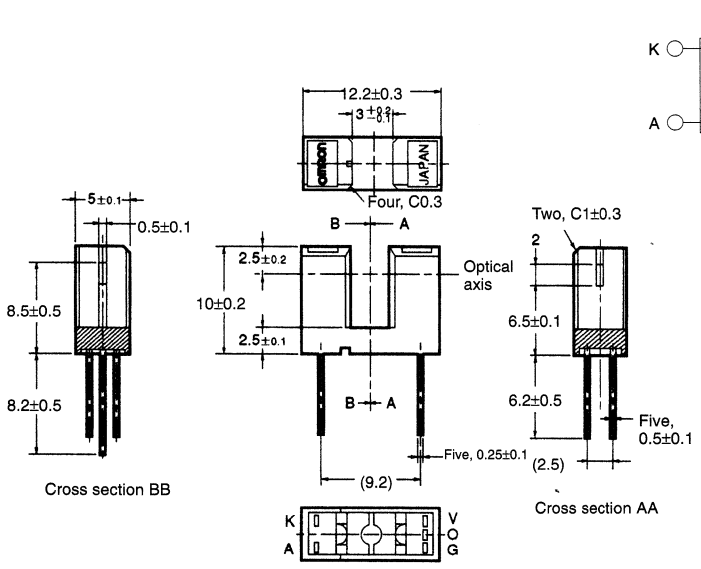
EE–SX398 / EE–SX498

Transmissive

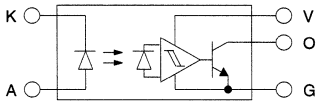
- Incorporates a photo–IC chip with a built-in detector element and amplifier.
- Incorporates a detector element with a built-in temperature compensation circuit.
- A wide supply voltage range: 4.5 to 16 VDC
- Directly connects to C-MOS and TTL.
- High resolution with a 0.5-mm-wide sensing aperture.
- Dark ON model (EE-SX398)
- Light ON model (EE-SX498)



Dimensions



Internal Circuit



Terminal No.	Name
A	Anode
K	Cathode
V	Supply voltage (Vcc)
O	Output (OUT)
G	Ground (GND)

Unless otherwise specified, the tolerances are as shown below.

Dimensions	Tolerance
3 mm max.	±0.3
3 < mm ≤ 6	±0.375
6 < mm ≤ 10	±0.45
10 < mm ≤ 18	±0.55
18 < mm ≤ 30	±0.65

Specifications

■ Absolute Maximum Ratings (Ta = 25°C)

Item		Symbol	Rated value
Emitter	Forward current	I_F	50 mA (see note)
	Reverse voltage	V_R	4 V
Detector	Supply voltage	V_{CC}	16 V
	Output voltage	V_{OUT}	28 V
	Output current	I_{OUT}	16 mA
	Permissible output dissipation	P_{OUT}	250 mW (see note)
Ambient temperature	Operating	Topr	–40°C to 75°C
	Storage	Tstg	–40°C to 85°C
	Soldering	Tsol	260°C

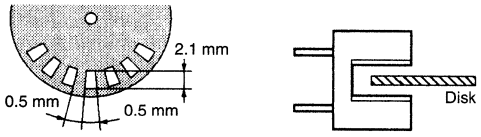
Note: Refer to the temperature rating chart if the ambient temperature exceeds 25°C.

■ Electrical and Optical Characteristics (Ta = 25°C)

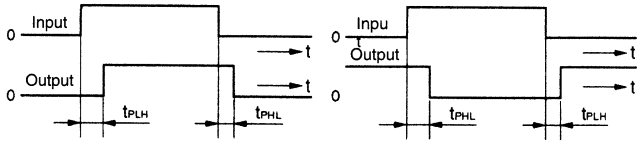
Item		Symbol	Value	Condition
Emitter	Forward voltage	V_F	1.2 V typ., 1.5 V max.	I_F = 20 mA
	Reverse current	I_R	0.01 μA typ., 10 μA max.	V_R = 4 V
	Peak emission wavelength	λ_P	940 nm typ.	I_F = 20 mA
Detector	Low-level output voltage	V_{OL}	0.12 V typ., 0.4 V max.	Vcc = 4.5 to 16 V, I_{OL} = 16 mA, I_F = 0 mA (EE-SX398), I_F = 5 mA (EE-SX498)
	High-level output voltage	V_{OH}	15 V min.	Vcc = 16 V, R_L = 1 kΩ, I_F = 5 mA (EE-SX398), I_F = 0 mA (EE-SX498)
	Current consumption	I_{CC}	3.2 mA typ., 10 mA max.	Vcc = 16 V
	Peak spectral sensitivity wavelength	λ_P	870 nm typ.	V_{CC} = 4.5 to 16 V
LED current when output is OFF		I_{FT}	2 mA typ., 5 mA max.	V_{CC} = 4.5 to 16 V
LED current when output is ON				
Hysteresis		ΔH	15% typ.	V_{CC} = 4.5 to 16 V (see note 1)
Response frequency		f	3,000 P.P.S min.	V_{CC} = 4.5 to 16 V, I_F = 15 mA, I_{OL} = 16 mA (see note 2)
Response delay time		t_{PLH} (t_{PHL})	3 μs typ.	V_{CC} = 4.5 to 16 V, I_F = 15 mA, I_{OL} = 16 mA (see note 3)
Response delay time		t_{PHL} (t_{PLH})*	20 μs typ.	V_{CC} = 4.5 to 16 V, I_F = 15 mA, I_{OL} = 16 mA (see note 3)

Note: 1. Hysteresis denotes the difference in forward LED current value, expressed in percentage, calculated from the respective forward LED currents when the photo IC is turned from ON to OFF and when the photo IC is turned from OFF to ON.

2. The value of the response frequency is measured by rotating the disk as shown below. (P.P.S = pulse/s)



3. The following illustrations show the definition of response delay time. The value in the parentheses applies to the EE-SX498.

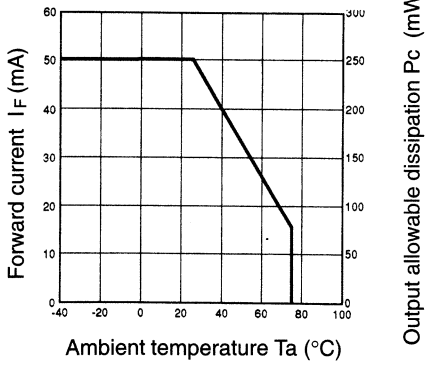


EE-SX398 EE-SX498

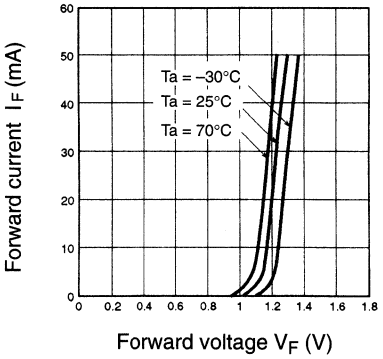
Engineering Data

Note: The values in the parentheses apply to the EE-SX498.

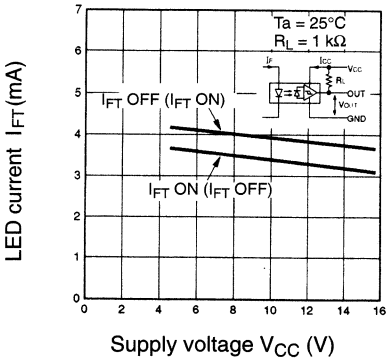
Forward Current vs. Collector Dissipation Temperature Rating



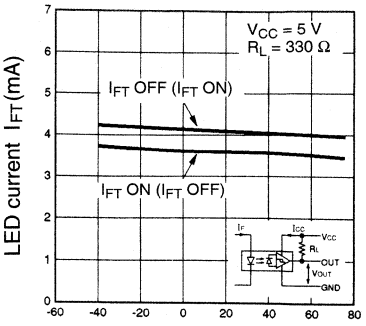
Forward Current vs. Forward Voltage Characteristics (Typical)



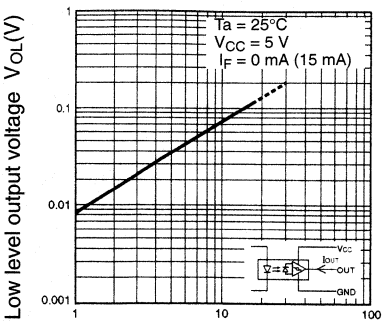
LED Current vs. Supply Voltage (Typical)



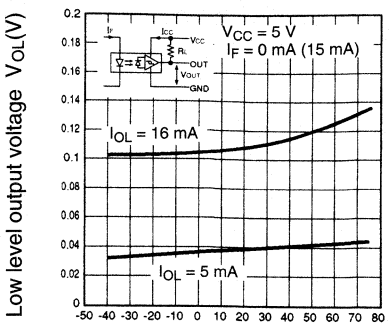
LED Current vs. Ambient Temperature Characteristics (Typical)



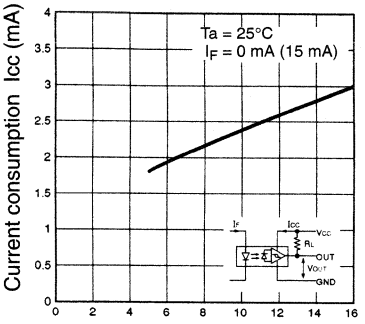
Low-level Output Voltage vs. Output Current (Typical)



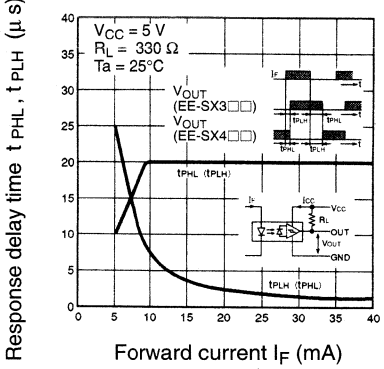
Low-level Output Voltage vs. Ambient Temperature Characteristics (Typical)



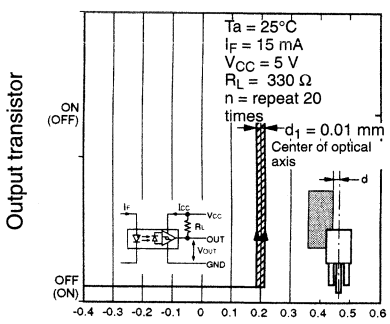
Current Consumption vs. Supply Voltage (Typical)



Response Delay Time vs. Forward Current (Typical)



Repeat Sensing Position Characteristics (Typical)



Opto-Switches

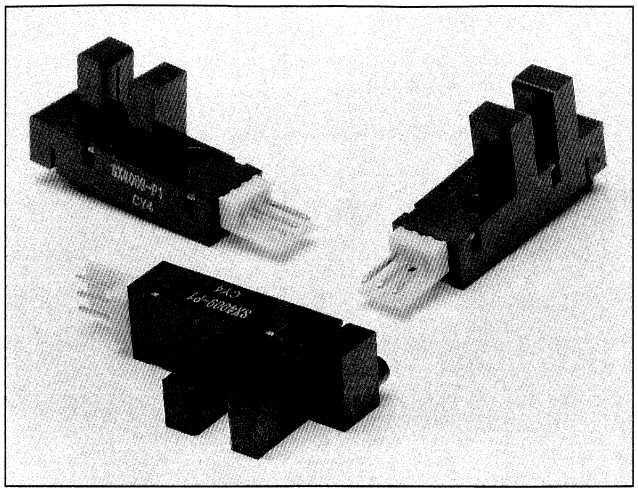
OMRON

Opto–Switch

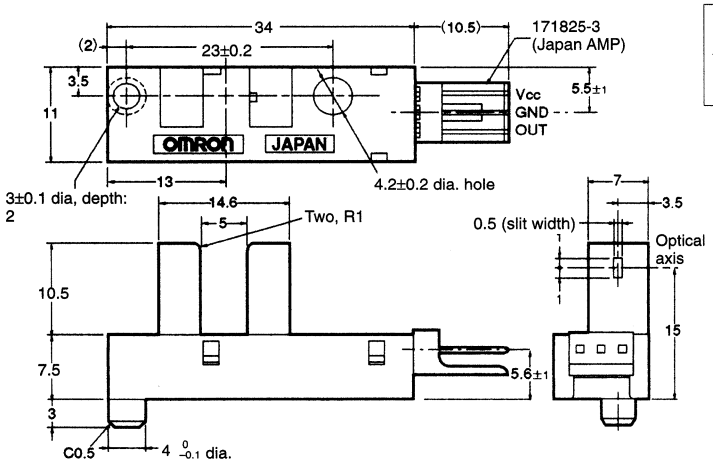
EE–SX4009–P1

Transmissive

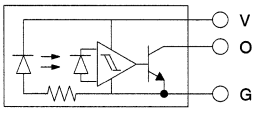
- Incorporates a photo–IC chip with a built-in detector element and amplifier.
- Incorporates a detector element with a built–in temperature compensation circuit.
- Easy to install with screw fixing.
- Connects to Omron EE–1005 and AMP's EI series connectors.



Dimensions



Internal Circuit



Terminal No.	Name
V	Supply voltage (Vcc)
O	Output (OUT)
G	Ground (GND)

Unless otherwise specified, the tolerances are as shown below.

Dimensions	Tolerance
4 mm max.	±0.2
4 < mm ≤ 16	±0.3
16 < mm ≤ 63	±0.5

Recommended Connectors:
Japan AMP 171822-3 (crimp-type connector)
172142-3 (crimp-type connector)
OMRON EE-1005 (with harness)

Specifications

■ Absolute Maximum Ratings (Ta = 25°C)

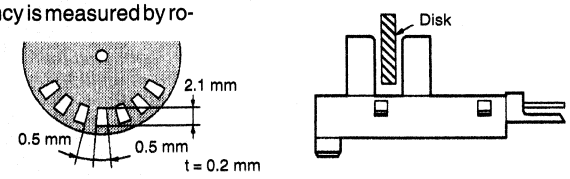
Item	Symbol	Rated value
Supply voltage	V_{CC}	10 V
Output voltage	V_{OUT}	28 V
Output current	I_{OUT}	16 mA
Permissible output dissipation	P_{OUT}	250 mW (see note)
Operating temperature	Topr	–25°C to 75°C
Storage temperature	Tstg	–40°C to 85°C
Soldering temperature	Tsol	---

Note: Refer to the temperature rating chart if the ambient temperature exceeds 25°C.

■ Electrical and Optical Characteristics (Ta = 25°C)

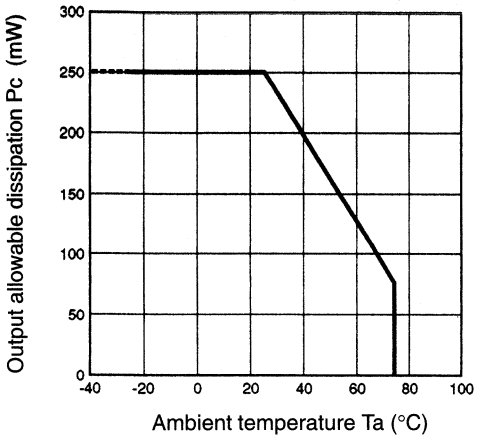
Item	Symbol	Value	Condition
Current consumption	I_{CC}	3.0 mA max.	With and without incident
Low-level output voltage	V_{OL}	0.3 V max.	I_{OUT} = 16 mA with incident
High-level output voltage	V_{OH}	(V_{CC} x 0.9) V min.	V_{OUT} = V_{CC} without incident, R_L = 47 kΩ
Response frequency	f	3 kHz min.	V_{OUT} = V_{CC}, R_L = 47 kΩ (see note)

Note: The value of the response frequency is measured by rotating the disk as shown below.

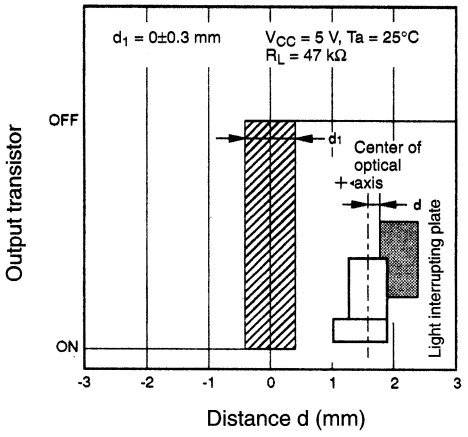


Engineering Data

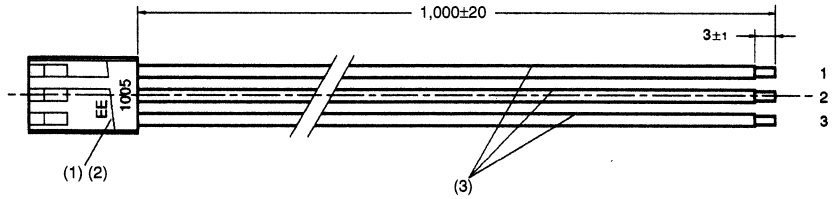
Output Allowable Dissipation vs. Ambient Temperature Characteristics



Sensing Position Characteristics (Typical)



EE-1005 Connector



No.	Name	Model	Quantity	Maker
1	Receptacle housing	171822-3	1	Japan AMP
2	Receptacle contact	170262-1	3	Japan AMP
3	Lead wire	UL1007 AWG24	3	---

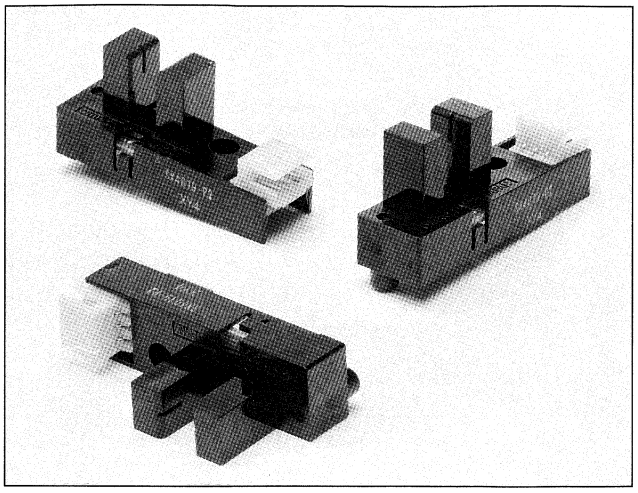
OMRON

Opto–Switch

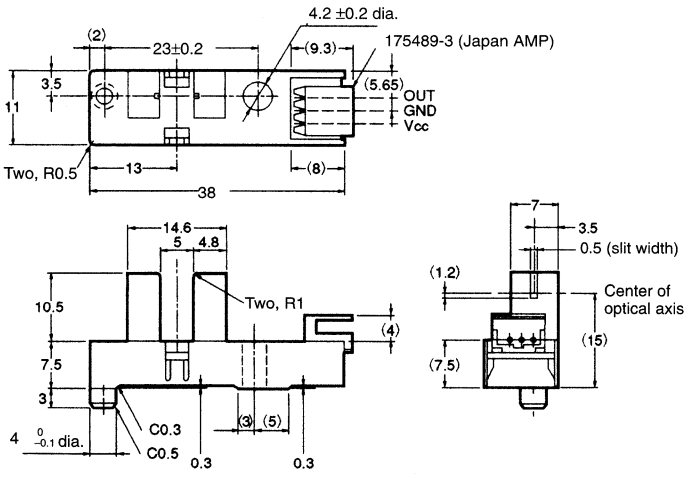
EE–SX4019–P2

Transmissive

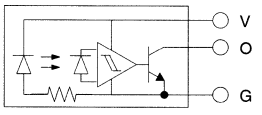
- Incorporates a photo–IC chip with a built–in detector element and amplifier.
- Detector element has built–in temperature compensation circuit.
- Screw-mounting model.
- High resolution with a 0.5-mm-wide sensing aperture.
- With a 5-mm-wide slot.
- Photo IC output signals directly connect to C-MOS and TTL.
- Connects to Japan AMP's CT-series connectors.



Dimensions



Internal Circuit



Terminal No.	Name
V	Supply voltage (Vcc)
O	Output (OUT)
G	Ground (GND)

Unless otherwise specified, the tolerances are as shown below.

Dimensions	Tolerance
3 mm max.	±0.3
3 < mm ≤ 6	±0.375
6 < mm ≤ 10	±0.45
10 < mm ≤ 18	±0.55
18 < mm ≤ 30	±0.65

Recommended Connectors:
Japan AMP 175778-3 (crimp-type connector)
173977-3 (press-fit connector)

Specifications

■ Absolute Maximum Ratings (Ta = 25°C)

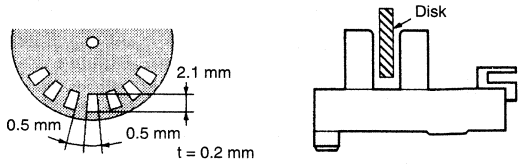
Item	Symbol	Rated value
Supply voltage	V_{CC}	7 V
Output voltage	V_{OUT}	28 V
Output current	I_{OUT}	16 mA
Permissible output dissipation	P_{OUT}	250 mW (see note)
Operating temperature	Topr	–20°C to 75°C
Storage temperature	Tstg	–40°C to 85°C
Soldering temperature	Tsol	---

Note: Refer to the temperature rating chart if the ambient temperature exceeds 25°C.

■ Electrical and Optical Characteristics (Ta = 25°C)

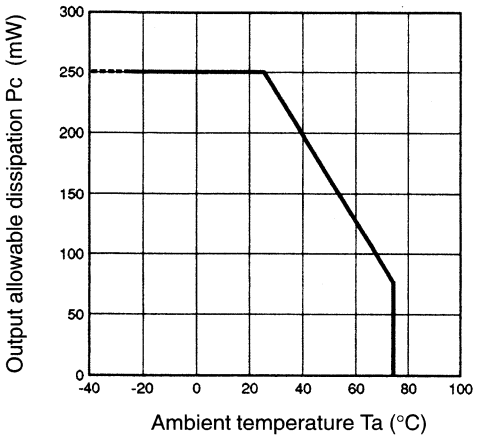
Item	Symbol	Value	Condition
Current consumption	I_{CC}	3.0 mA max.	With and without incident
Low-level output voltage	V_{OL}	0.3 V max.	I_{OUT} = 16 mA with incident
High-level output voltage	V_{OH}	(V_{CC} x 0.9) V min.	V_{OUT} = V_{CC} without incident, R_L = 47 kΩ
Response frequency	f	3 kHz min.	V_{OUT} = V_{CC}, R_L = 47 kΩ (see note)

Note: The value of the response frequency is measured by rotating the disk as shown below.

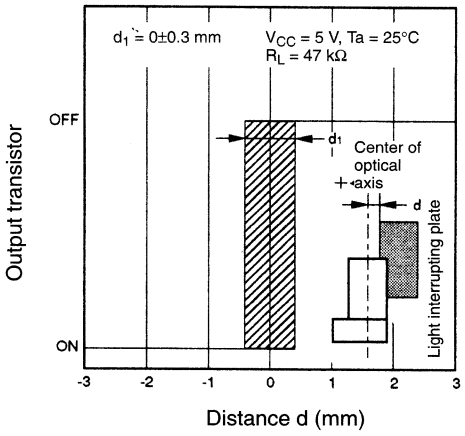


■ Engineering Data

Output Allowable Dissipation vs. Ambient Temperature Characteristics



Sensing Position Characteristics (Typical)



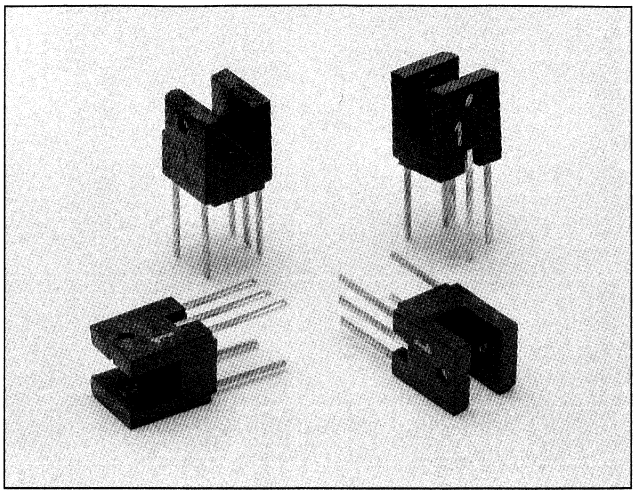
OMRON

Opto–Switch

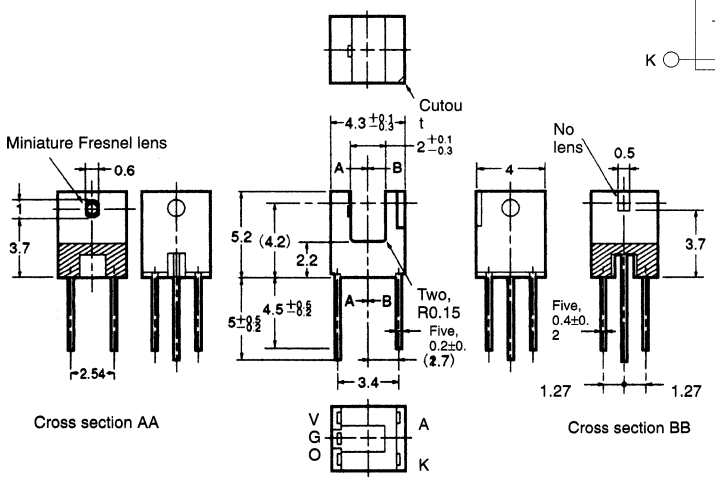
EE–SX4101

Transmissive

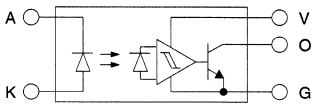
- Incorporates a photo–IC chip with a built–in detector element and amplifier.
- Detector element has built–in temperature compensation circuit.
- Ultra miniature size.
- Photo IC output model.
- Operates at a V_{CC} of 2.2 to 7 V.
- High-speed response.



Dimensions



Internal Circuit



Terminal No.	Name
A	Anode
K	Cathode
V	Supply voltage (Vcc)
O	Output (OUT)
G	Ground (GND)

Unless otherwise specified, the tolerances are ±0.1.

Specifications

■ Absolute Maximum Ratings (Ta = 25°C)

Item		Symbol	Rated value
Emitter	**Forward current**	I_F	50 mA (see note)
	Reverse voltage	V_R	4 V
Detector	**Supply voltage**	V_{CC}	9 V
	Output voltage	V_{OUT}	17 V
	Output current	I_{OUT}	8 mA
	Permissible output dissipation	P_{OUT}	80 mW (see note)
Ambient temperature	**Operating**	Topr	–25°C to 85°C
	Storage	Tstg	–40°C to 100°C
	Soldering	Tsol	260°C

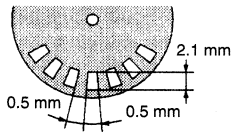
Note: Refer to the temperature rating chart if the ambient temperature exceeds 25°C.

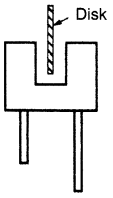
■ Electrical and Optical Characteristics (Ta = 25°C)

Item		Symbol	Value	Condition
Emitter	Forward voltage	V_F	1.2 V typ., 1.4 V max.	I_F = 20 mA
	Reverse current	I_R	0.01 μA typ., 10 μA max.	V_R = 4 V
	Peak emission wavelength	λ_P	940 nm typ.	I_F = 20 mA
Detector	Power supply voltage	V_{CC}	2.2 V min., 7 V max.	---
	Low-level output voltage	V_{OL}	0.12 V typ., 0.4 V max.	Vcc = 2.2 to 7 V, I_{OL} = 8 mA, I_F = 5 mA
	High-level output voltage	V_{OH}	10 V max.	Vcc = 2.2 tp 7 V, I_F = 0 mA, V_O = 17 V
	Current consumption	I_{CC}	2.3 mA typ., 4 mA max.	Vcc = 7 V
	Peak spectral sensitivity wavelength	λ_P	870 mm typ.	Vcc = 2.2 to 7 V
LED current when output is ON		I_{FT}	1.1 mA typ., 2.5 mA max.	V_{CC} = 2.2 to 7 V
Hysteresis		ΔH	21% typ.	V_{CC} = 2.2 to 7 V (see note 1)
Response frequency		f	3 kHs min.	V_{CC} = 2.2 to 7 V, I_F = 5 mA, I_{OL} = 8 mA (see note 2)
Response delay time		t_{PLH} (t_{PHL})	5 μs typ.	V_{CC} = 2.2 to 7 V, I_F = 5 mA, I_{OL} = 8 mA (see note 3)
Response delay time		t_{PHL} (t_{PLH})	18 μs typ.	V_{CC} = 2.2 to 7 V, I_F = 5 mA, I_{OL} = 8 mA (see note 3)

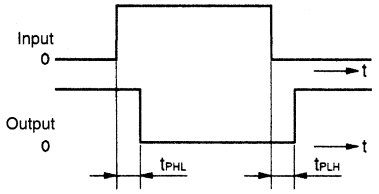
Note: 1. Hysteresis denotes the difference in forward LED current value, expressed in percentage, calculated from the respective forward LED currents when the photo IC is turned from ON to OFF and when the photo IC is turned from OFF to ON.

2. The value of the response frequency is measured by rotating the disk as shown below. (P.P.S = pulse/s)



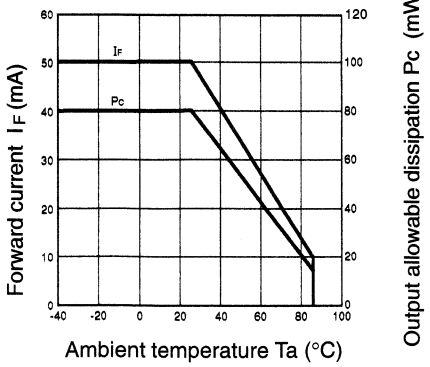


3. The following illustrations show the definition of response delay time.

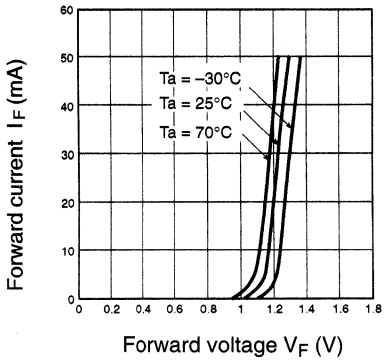


Engineering Data

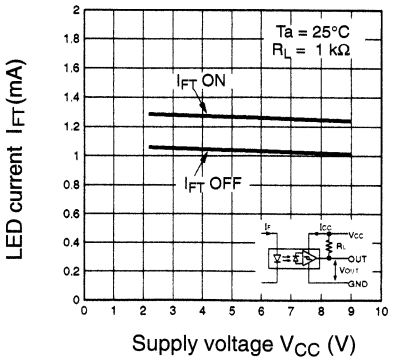
Forward Current vs. Collector Dissipation Temperature Rating



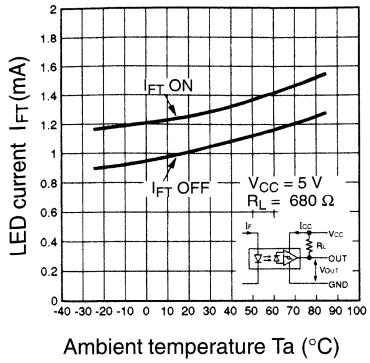
Forward Current vs. Forward Voltage Characteristics (Typical)



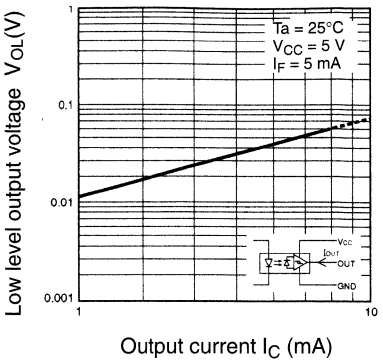
LED Current vs. Supply Voltage (Typical)



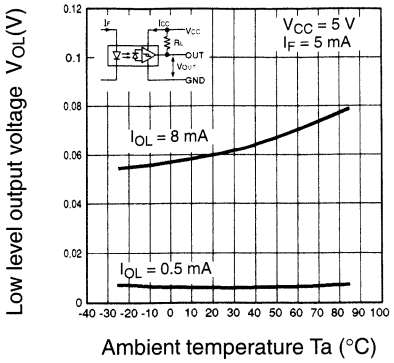
LED Current vs. Ambient Temperature Characteristics (Typical)



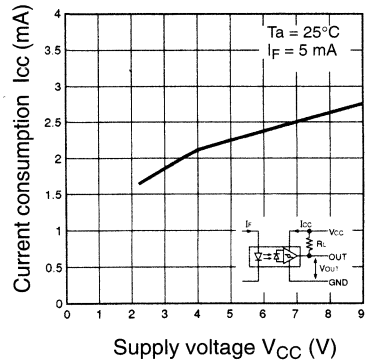
Low-level Output Voltage vs. Output Current (Typical)



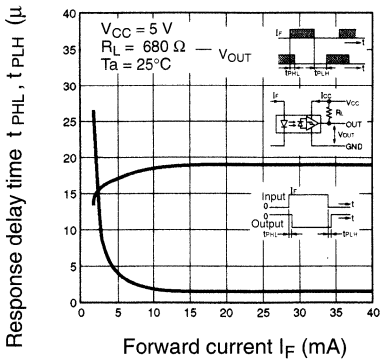
Low-level Output Voltage vs. Ambient Temperature Characteristics (Typical)



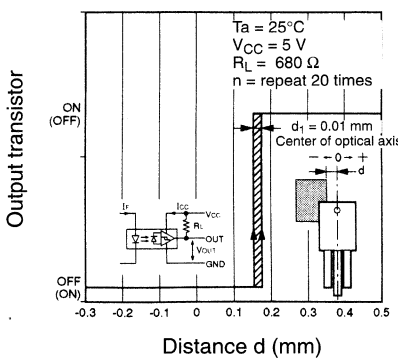
Current Consumption vs. Supply Voltage (Typical)



Response Delay Time vs. Forward Current (Typical)



Repeat Sensing Position Characteristics (Typical)



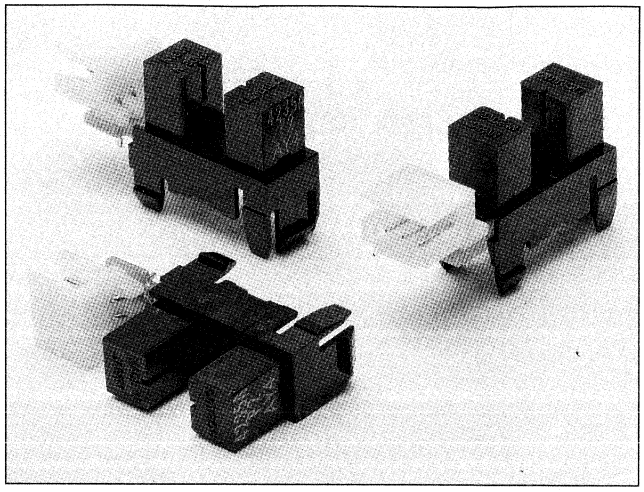
OMRON

Opto–Switch

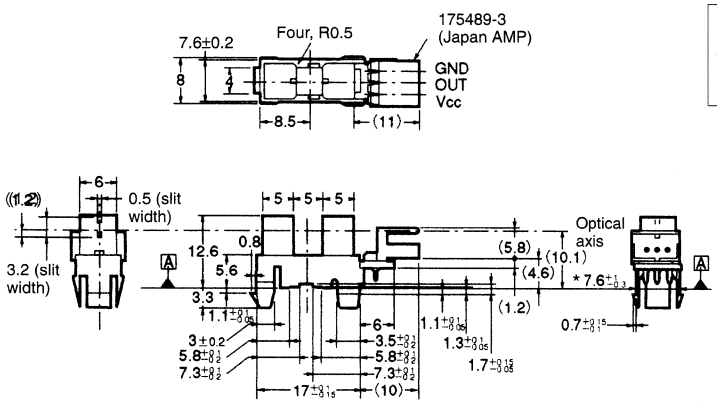
EE–SX4235A–P2

Transmissive

- Photo–IC output.
- Snap-in mounting model.
- Mounts to 1.0-, 1.2- and 1.6-mm-thick panels.
- High resolution with a 0.5-mm-wide sensing aperture.
- With a 5-mm-wide slot.
- Photo IC output signals directly connect to C-MOS and TTL.
- Connects to Japan AMP's CT-series connectors.

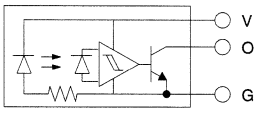


Dimensions



Note: The asterisked dimension is specified by datum A only.

Internal Circuit



Terminal No.	Name
V	Supply voltage (Vcc)
O	Output (OUT)
G	Ground (GND)

Unless otherwise specified, the tolerances are as shown below.

Dimensions	Tolerance
3 mm max.	±0.3
3 < mm ≤ 6	±0.375
6 < mm ≤ 10	±0.45
10 < mm ≤ 18	±0.55
18 < mm ≤ 30	±0.65

Recommended Connectors:
Japan AMP 175778-3 (crimp-type connector)
173977-3 (press-fit connector)

Specifications

■ Absolute Maximum Ratings (Ta = 25°C)

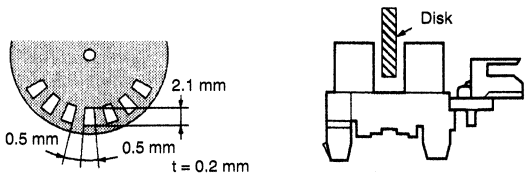
Item	Symbol	Rated value
Supply voltage	V_{CC}	7 V
Output voltage	V_{OUT}	28 V
Output current	I_{OUT}	16 mA
Permissible output dissipation	P_{OUT}	250 mW (see note)
Operating temperature	Topr	–25°C to 75°C
Storage temperature	Tstg	–40°C to 85°C
Soldering temperature	Tsol	---

Note: Refer to the temperature rating chart if the ambient temperature exceeds 25°C.

■ Electrical and Optical Characteristics (Ta = 25°C, V_{CC} = 5 V)

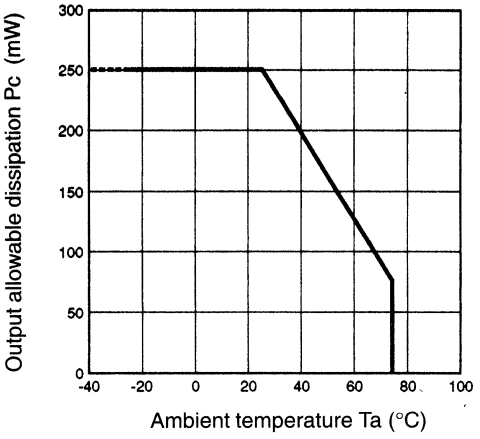
Item	Symbol	Value	Condition
Current consumption	I_{CC}	16.5 mA max.	With and without incident
Low-level output voltage	V_{OL}	0.35 V max.	I_{OUT} = 16 mA with incident
High-level output voltage	V_{OH}	(V_{CC} x 0.9) V min.	V_{OUT} = V_{CC} without incident, R_L = 47 kΩ
Response frequency	f	3 kHz min.	V_{OUT} = V_{CC}, R_L = 47 kΩ (see note)

Note: The value of the response frequency is measured by rotating the disk as shown below.

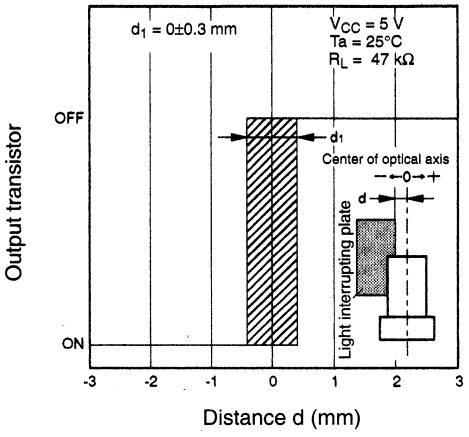


Engineering Data

Output Allowable Dissipation vs. Ambient Temperature Characteristics

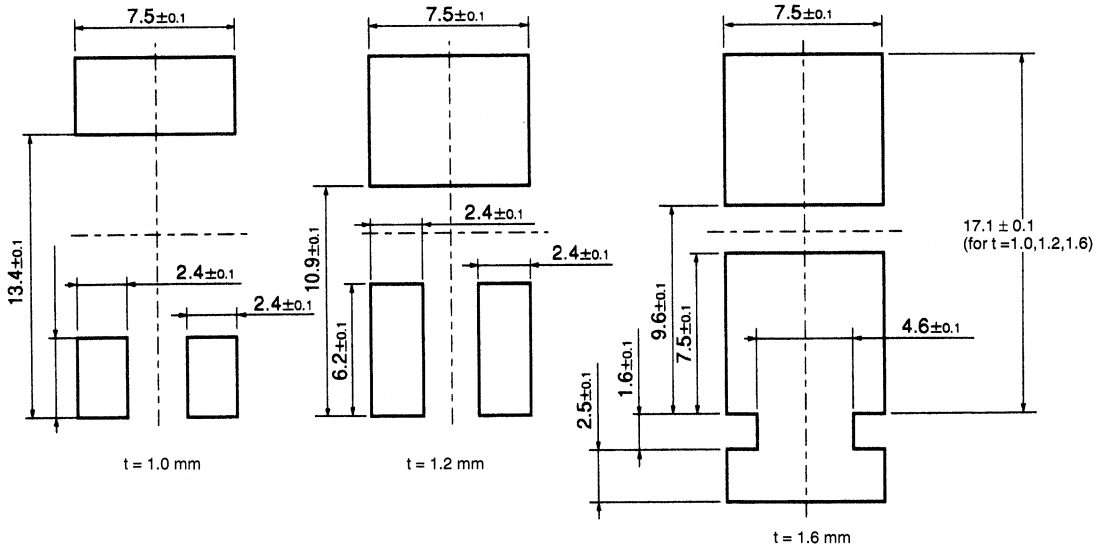


Sensing Position Characteristics (Typical)



■ Recommended Mounting Holes

(also applies to EE-SX1235A-P2)



- When mounting the Opto-Switch to a panel with a hole opened by pressing, make sure that the hole has no burrs. The mounting strength will decrease if the hole has burrs.
- When mounting the Opto-Switch to a panel with a hole opened by pressing, be sure to mount on the pressing side of the panel.
- The mounting strength of the Opto-Switch will increase if it is mounted to a panel with a hole that is only a little larger than the size of the Opto-Switch, in which case, however, it will be difficult to mount the Opto-Switch to the panel. The mounting strength of the Opto-Switch will decrease if the mounted to a panel with a hole that is comparatively larger than the size of the Opto-Switch, in which case, however, it will be easy to mount the Opto-Switch to the panel. When mounting the Opto-Switch to a panel, open an appropriate hole according to the application.
- After mounting the to any panel, make sure that the Opto-Switch does not wobble.
- When mounting the Opto-Switch to a molding with a hole, make sure that the edges of the hole are sharp enough, otherwise the Opto-Switch may fall out.

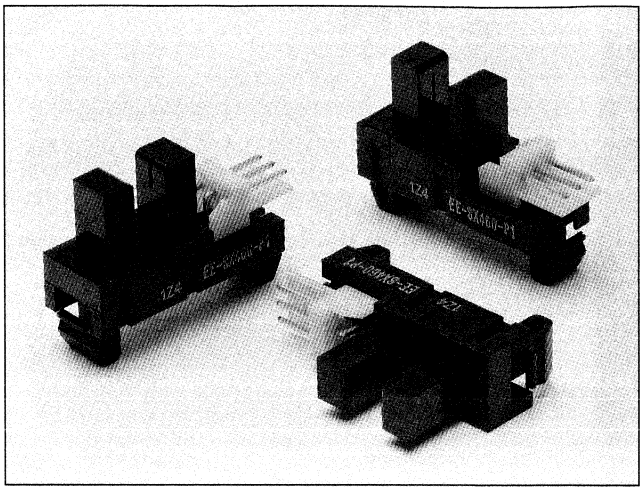
OMRON

Opto–Switch

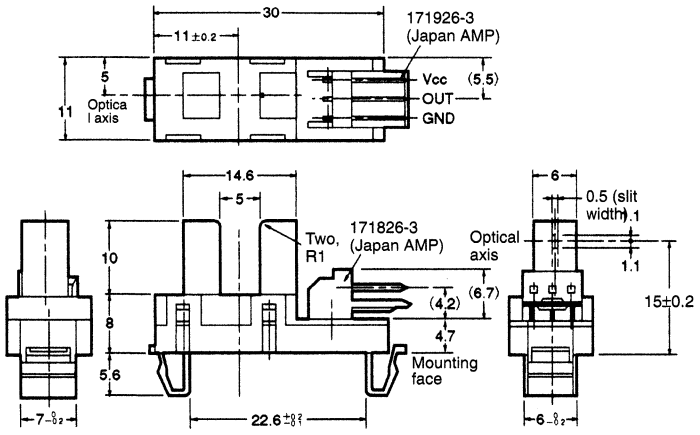
EE–SX460–P1

Transmissive

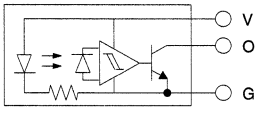
- Photo–IC output.
- Snap-in mounting model.
- Mounts to 0.8- to 1.6-mm-thick panels.
- With a 5-mm-wide slot.
- Photo IC output signals directly connect to C-MOS and TTL.
- Connects to Omron EE–I005 and AMP's EI series connectors



Dimensions



Internal Circuit



Terminal No.	Name
V	Supply voltage (Vcc)
O	Output (OUT)
G	Ground (GND)

Unless otherwise specified, the tolerances are as shown below.

Dimensions	Tolerance
3 mm max.	±0.3
3 < mm ≤ 6	±0.375
6 < mm ≤ 10	±0.45
10 < mm ≤ 18	±0.55
18 < mm ≤ 30	±0.65

Recommended Connectors:
Japan AMP 171822-3 (crimp-type connector)
172142-3 (crimp-type connector)
OMRON EE-1005 (with harness)

Specifications

■ Absolute Maximum Ratings (Ta = 25°C)

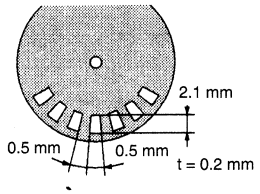
Item	Symbol	Rated value
Supply voltage	V_{CC}	10 V
Output voltage	V_{OUT}	28 V
Output current	I_{OUT}	16 mA
Permissible output dissipation	P_{OUT}	250 mW (see note)
Operating temperature	Topr	–20°C to 75°C
Storage temperature	Tstg	–40°C to 85°C
Soldering temperature	Tsol	---

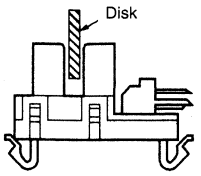
Note: Refer to the temperature rating chart if the ambient temperature exceeds 25°C.

■ Electrical and Optical Characteristics (Ta = 25°C, V_{CC} = 5 V±10%)

Item	Symbol	Value	Condition
Current consumption	I_{CC}	30 mA max.	With and without incident
Low-level output voltage	V_{OL}	0.3 V max.	I_{OUT} = 16 mA with incident
High-level output voltage	V_{OH}	(V_{CC} x 0.9) V min.	V_{OUT} = V_{CC} without incident, R_L = 47 kΩ
Response frequency	f	3 kHz min.	V_{OUT} = V_{CC}, R_L = 47 kΩ (see note)

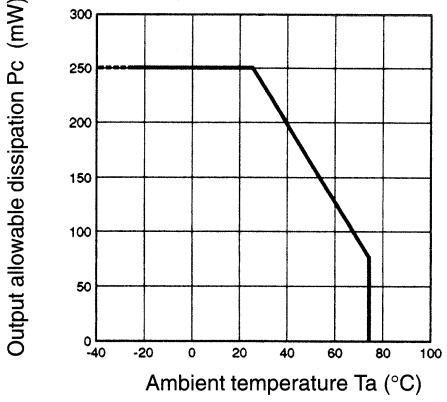
Note: The value of the response frequency is measured by rotating the disk as shown below.



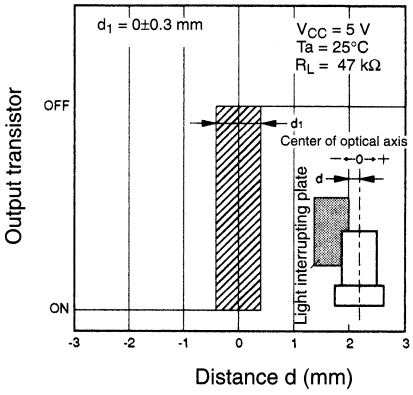


Engineering Data

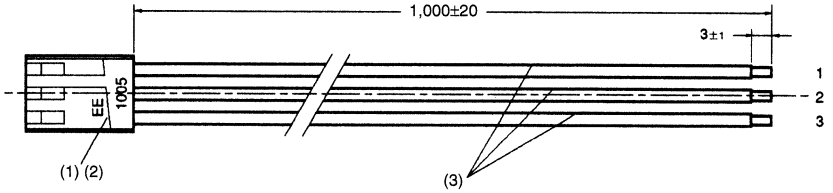
Output Allowable Dissipation vs. Ambient Temperature Characteristics



Sensing Position Characteristics (Typical)



EE-1005 Connector

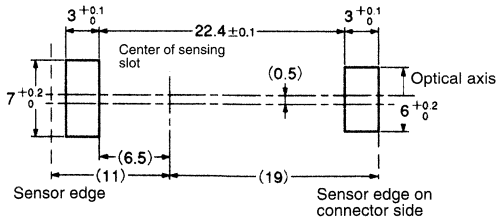


No.	Name	Model	Quantity	Maker
1	Receptacle housing	171822-3	1	Japan AMP
2	Receptacle contact	170262-1	3	Japan AMP
3	Lead wire	UL1007 AWG24	3	---

Wiring

Connector circuit no.	Lead wire color
1	Red
2	Orange
3	Yellow

■ Recommended Mounting Hole Dimensions and Mounting and Dismounting Method



The Opto-Switch can be mounted to 0.8- to 1.6-mm-thick panels.

Refer to the above mounting hole dimensions and open the mounting holes in the panel to which the Opto-Switch will be mounted.

Insert into the holes the Opto-Switch's mounting portions with a force of three to five kilograms but do not press in the Opto-Switch at one time. The Opto-Switch can be easily mounted by inserting the mounting portions halfway and then slowly pressing the Opto-Switch onto the panel.

Dismounting is achieved by either hand (below panel), or screwdriver (above panel).

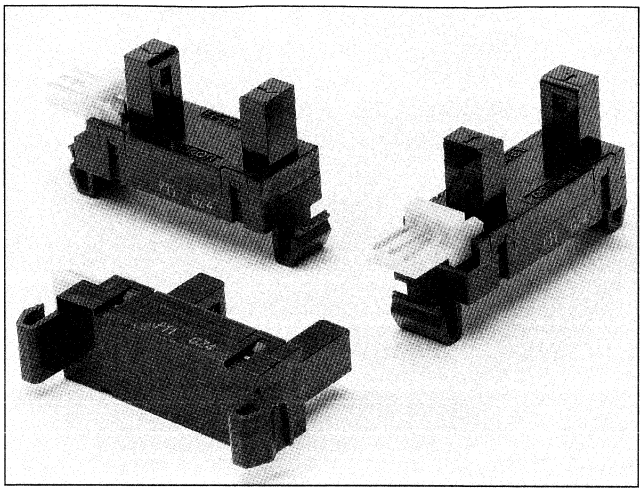
OMRON

Opto–Switch

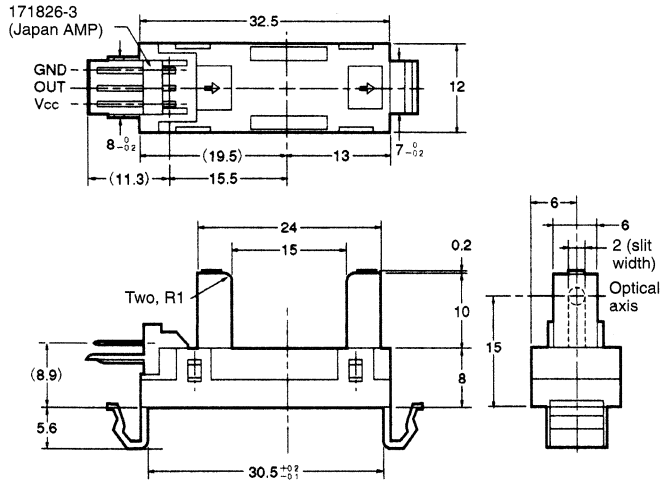
EE–SX461–P11

Transmissive

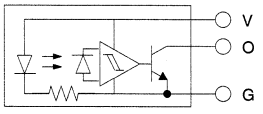
- Photo–IC output.
- Snap–in-mounting model.
- Mounts to 0.8- to 1.6-mm-thick panels.
- High resolution with a 0.5-mm-wide sensing aperture.
- With a 15-mm-wide slot.
- Photo IC output signals directly connect to C-MOS and TTL.
- Connects to Japan AMP's EI-series connectors.



Dimensions



Internal Circuit



Terminal No.	Name
V	Supply voltage (Vcc)
O	Output (OUT)
G	Ground (GND)

Unless otherwise specified, the tolerances are as shown below.

Dimensions	Tolerance
3 mm max.	±0.3
3 < mm ≤ 6	±0.375
6 < mm ≤ 10	±0.45
10 < mm ≤ 18	±0.55
18 < mm ≤ 30	±0.65

Recommended Connectors:
Japan AMP 171822-3 (crimp-type connector)
172142-3 (crimp-type connector)
OMRON EE-1005 (with harness)

Specifications

■ Absolute Maximum Ratings (Ta = 25°C)

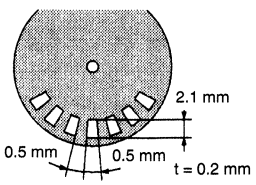
Item	Symbol	Rated value
Supply voltage	V_{CC}	7 V
Output voltage	V_{OUT}	28 V
Output current	I_{OUT}	16 mA
Permissible output dissipation	P_{OUT}	250 mW (see note)
Operating temperature	Topr	–20°C to 75°C
Storage temperature	Tstg	–40°C to 85°C
Soldering temperature	Tsol	---

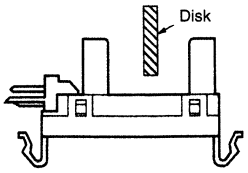
Note: Refer to the temperature rating chart if the ambient temperature exceeds 25°C.

■ Electrical and Optical Characteristics (Ta = 25°C, V_{CC} = 5 V±10%)

Item	Symbol	Value	Condition
Current consumption	I_{CC}	35 mA max.	With and without incident
Low-level output voltage	V_{OL}	0.3 V max.	I_{OUT} = 16 mA with incident
High-level output voltage	V_{OH}	(V_{CC} x 0.9) V min.	V_{OUT} = V_{CC} without incident, R_L = 47 kΩ
Response frequency	f	3 kHz min.	V_{OUT} = V_{CC}, R_L = 47 kΩ (see note)

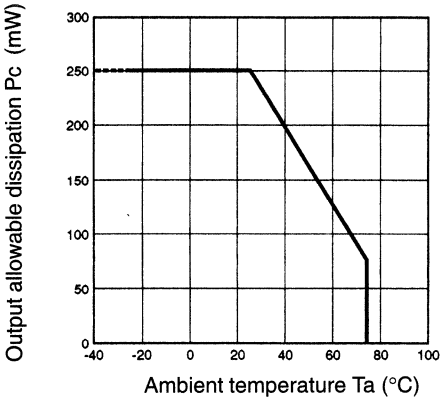
Note: The value of the response frequency is measured by rotating the disk as shown below.



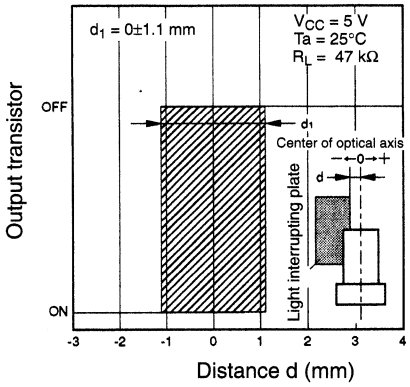


Engineering Data

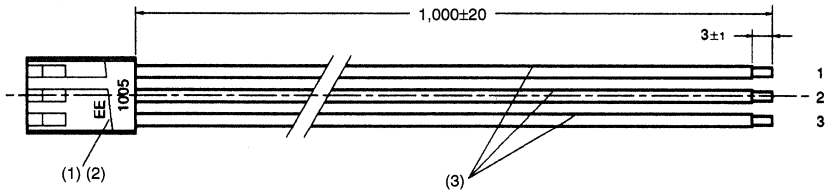
Output Allowable Dissipation vs. Ambient Temperature Characteristics



Sensing Position Characteristics (Typical)



EE-1005 Connector

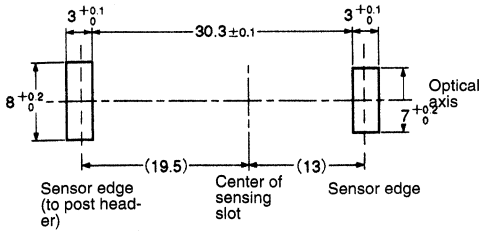


No.	Name	Model	Quantity	Maker
1	Receptacle housing	171822-3	1	Japan AMP
2	Receptacle contact	170262-1	3	Japan AMP
3	Lead wire	UL1007 AWG24	3	---

Wiring

Connector circuit no.	Lead wire color
1	Red
2	Orange
3	Yellow

■ Recommended Mounting Hole Dimensions and Mounting and Dismounting Method



The Opto-Switch can be mounted to 0.8- to 1.6-mm-thick panels.

Refer to the above mounting hole dimensions and open the mounting holes in the panel to which the Opto-Switch will be mounted.

Insert into the holes the Opto-Switch's mounting portions with a force of three to five kilograms but do not press in the Opto-Switch at one time. The Opto-Switch can be easily mounted by inserting the mounting portions halfway and then slowly pressing the Opto-Switch onto the panel.

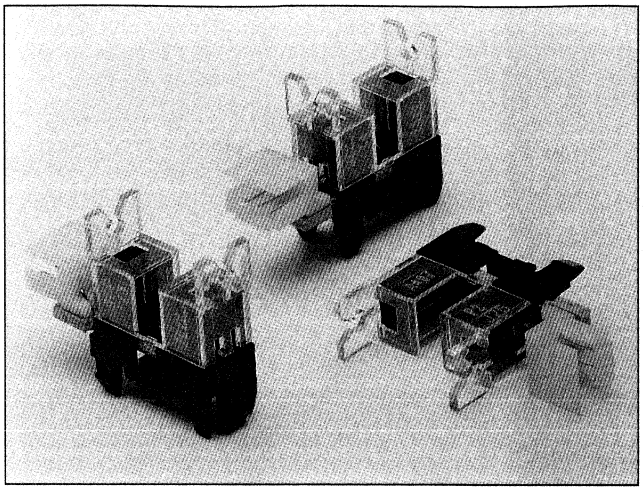
Dismounting is achieved by either hand (below panel) or by screwdriver (above panel).

OMRON

Opto–Switch

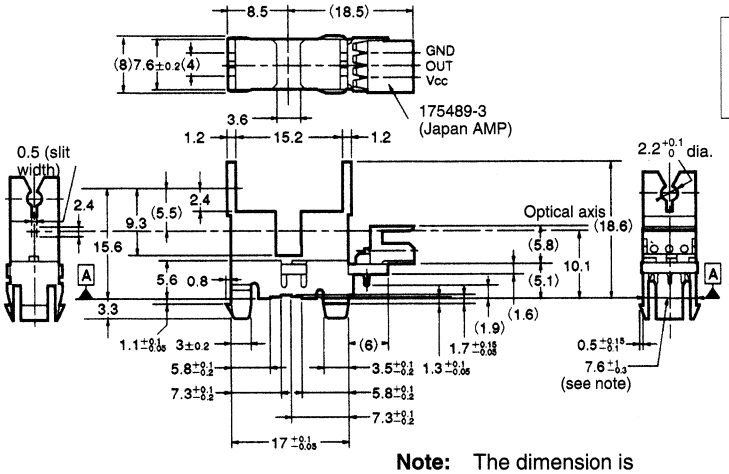
EE–SA407–P2

Actuator Mounted



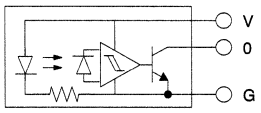
- Photo–IC output.
- A custom actuator can be attached.
- Snap-in mounting model.
- Mounts to 1.0-, 1.2- and 1.6-mm-thick panels.
- High resolution with a 0.5-mm-wide sensing aperture.
- With a 5-mm-wide slot.
- Photo IC output signals directly connect to logic circuit and TTL.
- Connects to Japan AMP's CT-series connectors.

Dimensions



Note: The dimension is specified by datum A only.

Internal Circuit



Terminal No.	Name
V	Supply voltage (Vcc)
O	Output (OUT)
G	Ground (GND)

Unless otherwise specified, the tolerances are as shown below.

Dimensions	Tolerance
3 mm max.	±0.3
3 < mm ≤ 6	±0.375
6 < mm ≤ 10	±0.45
10 < mm ≤ 18	±0.55
18 < mm ≤ 30	±0.65

Recommended Connectors:
Japan AMP 175778-3 (crimp-type connector)
173977-3 (press-fit connector)

Specifications

■ Absolute Maximum Ratings (Ta = 25°C)

Item	Symbol	Rated value
Supply voltage	V_{CC}	7 V
Output voltage	V_{OUT}	28 V
Output current	I_{OUT}	16 mA
Permissible output dissipation	P_{OUT}	250 mW (see note)
Operating temperature	Topr	–20°C to 75°C
Storage temperature	Tstg	–40°C to 85°C
Soldering temperature	Tsol	---

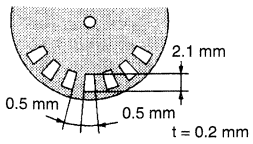
Note: Refer to the temperature rating chart if the ambient temperature exceeds 25°C.

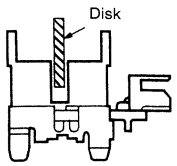
■ Electrical and Optical Characteristics (Ta = 25°C)

Item	Symbol	Value	Condition
Current consumption	I_{CC}	16.5 mA max.	With and without incident
Low-level output voltage	V_{OL}	0.35 V max.	I_{OUT} = 16 mA with incident
High-level output voltage	V_{OH}	(V_{CC} x 0.9) V min.	V_{OUT} = V_{CC} without incident, R_L = 47 kΩ
Response frequency	f	3 kHz min.	V_{OUT} = V_{CC}, R_L = 47 kΩ (see note)

Opto-Switches

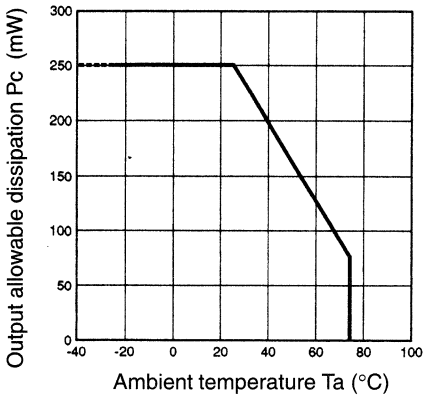
Note: The value of the response frequency is measured by rotating the disk as shown below.



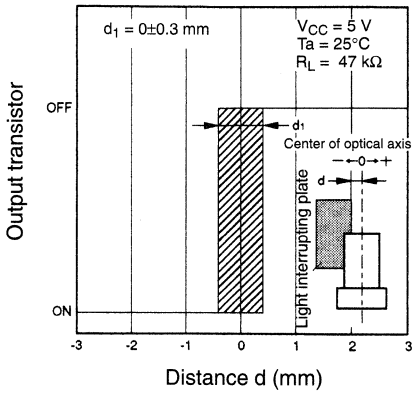


Engineering Data

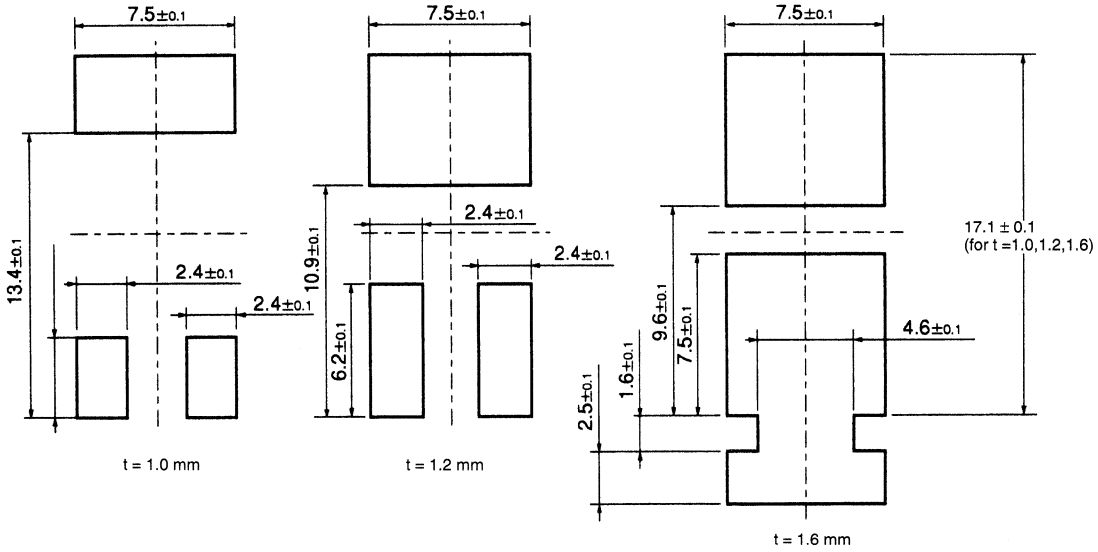
Output Allowable Dissipation vs. Ambient Temperature Characteristics



Sensing Position Characteristics (Typical)

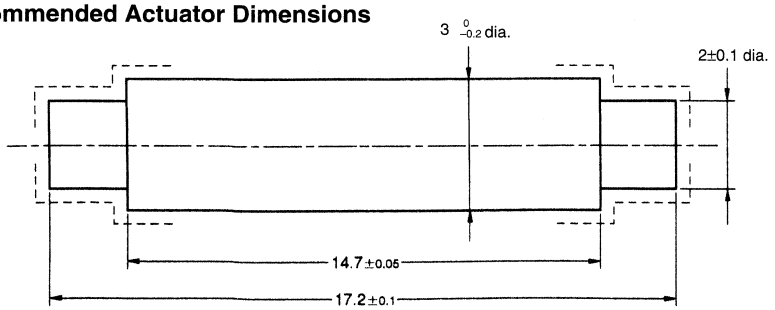


■ Recommended Mounting Holes



- When mounting the Opto–Switch to a panel with a hole opened by pressing, make sure that the hole has no burrs. The mounting strength will decrease if the hole has burrs.
- When mounting the Opto–Switch to a panel with a hole opened by pressing, be sure to mount on the pressing side of the panel.
- The mounting strength of the Opto–Switch will increase if it is mounted to a panel with a hole that is only a little larger than the size of the Opto–Switch, in which case, however, it will be difficult to mount the Opto–Switch to the panel. The mounting strength of the Opto–Switch will decrease if mounted to a panel with a hole that is comparatively larger than the size of the Opto–Switch, in which case, however, it will be easy to mount the Opto–Switch to the panel. When mounting to a panel, open an appropriate hole for the Opto–Switch according to the application.
- After mounting the Opto–Switch to any panel, make sure that it does not wobble.
- When mounting the to a molding with a hole, make sure that the edges of the hole are sharp enough, otherwise the Opto–Switch may come fall out.

Recommended Actuator Dimensions



Note:
1. Make sure that the portions marked with dotted lines have no burrs.
2. The material of the actuator must be selected by considering the infrared permeability of the actuator.

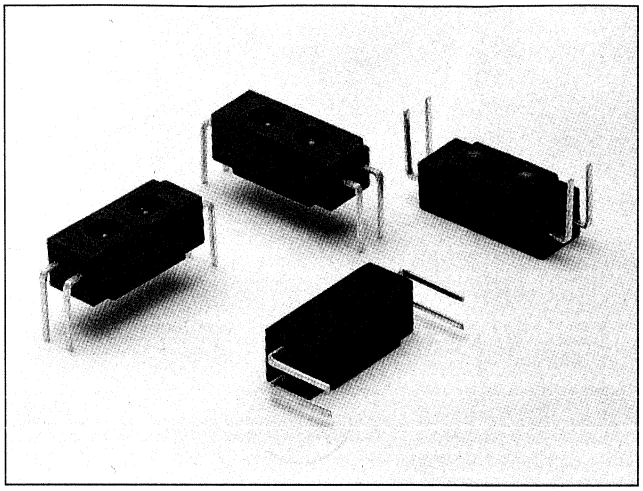
OMRON

Opto–Switch

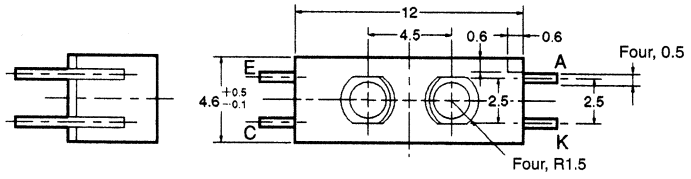
EE–SY110

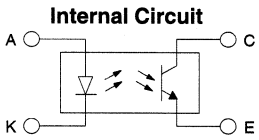
Reflective

- Phototransistor output.
- Optimum sensing distance 5mm.
- Low profile model at only 4.8mm high.

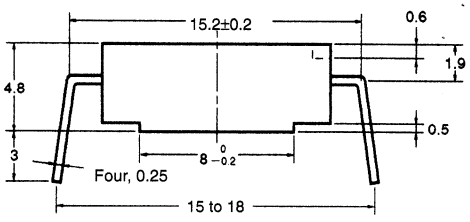


Dimensions





Terminal No.	Name
A	Anode
K	Cathode
C	Collector
E	Emitter



Unless otherwise specified, the tolerances are as shown below.

Dimensions	Tolerance
3 mm max.	±0.2
3 < mm ≤ 6	±0.24
6 < mm ≤ 10	±0.29
10 < mm ≤ 18	±0.35
18 < mm ≤ 30	±0.42

Specifications

■ Absolute Maximum Ratings (Ta = 25°C)

Item		Symbol	Rated value
Emitter	Forward current	I_F	50 mA (see note 1)
	Pulse forward current	I_{FP}	1 A (see note 2)
	Reverse voltage	V_R	4 V
Detector	Collector–Emitter voltage	V_{CEO}	30 V
	Emitter–Collector voltage	V_{ECO}	---
	Collector current	I_C	20 mA
	Collector dissipation	P_C	100 mW (see note 1)
Ambient temperature	Operating	Topr	–40°C to 85°C
	Storage	Tstg	–40°C to 85°C
	Soldering	Tsol	260°C

Note: 1. Refer to the temperature rating chart if the ambient temperature exceeds 25°C.
2. The pulse width is 10 μs maximum with a frequency of 100 Hz.

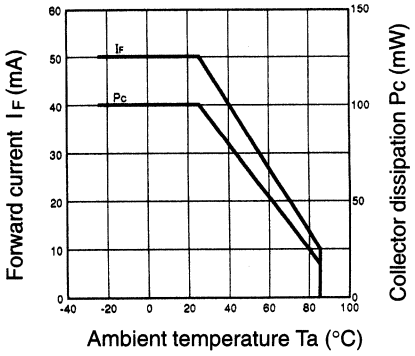
■ Electrical and Optical Characteristics (Ta = 25°C)

Item		Symbol	Value	Condition
Emitter	Forward voltage	V_F	1.2 V typ., 1.5 V max.	I_F = 30 mA
	Reverse current	I_R	0.01 μA typ., 10 μA max.	V_R = 4 V
	Peak emission wavelength	λ_P	940 nm typ.	I_F = 20 mA
Detector	Light current	I_L	200 μA min., 2,000 μA max.	I_F = 20 mA, V_{CE} = 10 V White paper with a reflection ratio of 90%, d = 5 mm (see note)
	Dark current	I_D	2 nA typ., 200 nA max.	V_{CE} = 10 V, 0 ℓx
	Leakage current	I_{LEAK}	2 μA max.	I_F = 20 mA, V_{CE} = 10 V with no reflection
	Collector–Emitter saturated voltage	V_{CE} (sat)	---	---
	Peak spectral sensitivity wavelength	λ_P	850 nm typ.	V_{CE} = 10 V
Rising time		tr	30 μs typ.	V_{CC} = 5 V, R_L = 1 kΩ, I_L = 1 mA
Falling time		tf	30 μs typ.	V_{CC} = 5 V, R_L = 1 kΩ, I_L = 1 mA

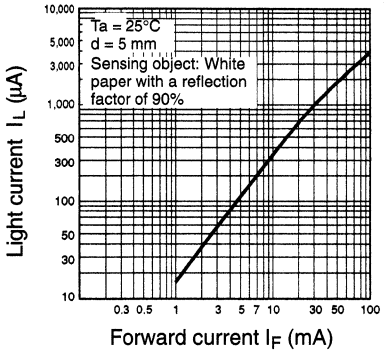
Note: The letter "d" indicates the distance between the top surface of the sensor and the sensing object.

Engineering Data

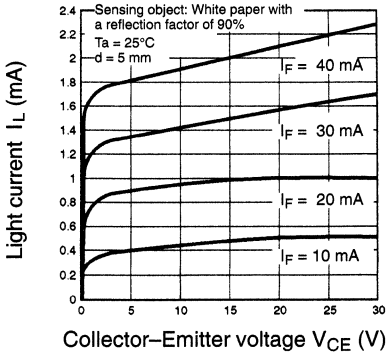
Forward Current vs. Collector Dissipation Temperature Rating



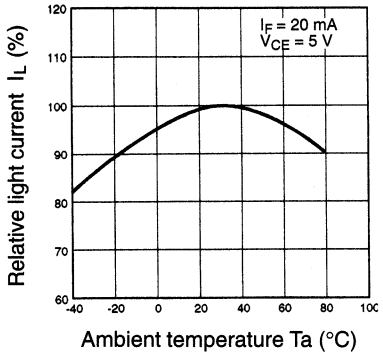
Light Current vs. Forward Current Characteristics (Typical)



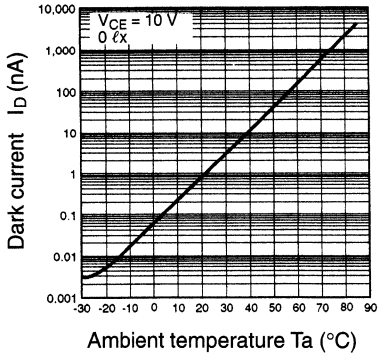
Light Current vs. Collector–Emitter Voltage Characteristics (Typical)



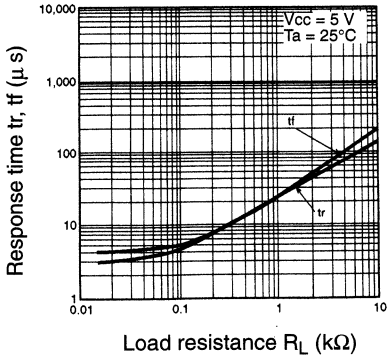
Relative Light Current vs. Ambient Temperature Characteristics (Typical)



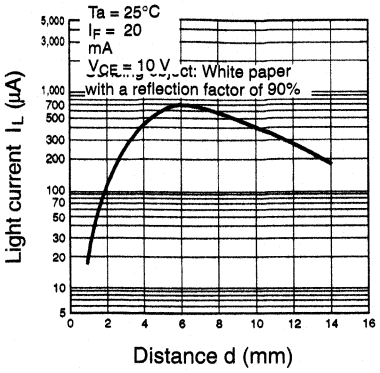
Dark Current vs. Ambient Temperature Characteristics (Typical)



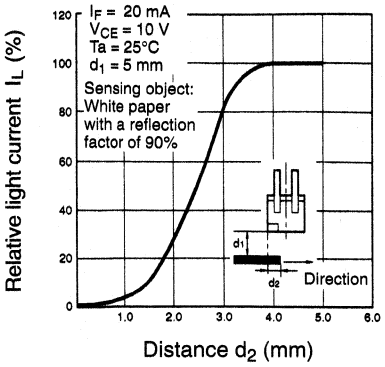
Response Time vs. Load Resistance Characteristics (Typical)



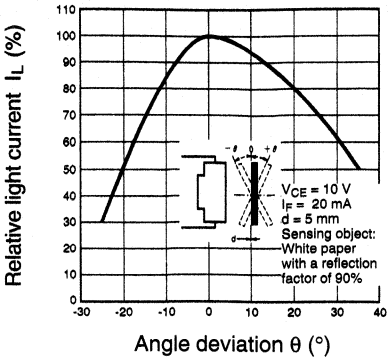
Sensing Distance Characteristics (Typical)



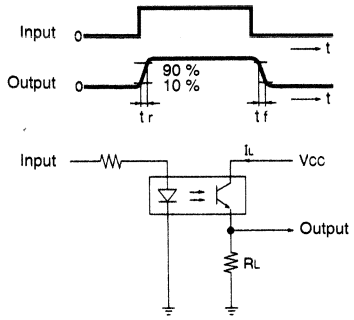
Sensing Position Characteristics (Typical)



Sensing Angle Characteristics (Typical)



Response Time Measurement Circuit



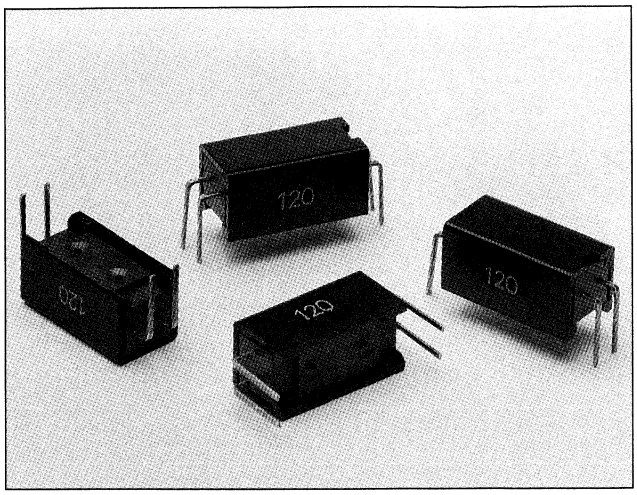
OMRON

Opto–Switch

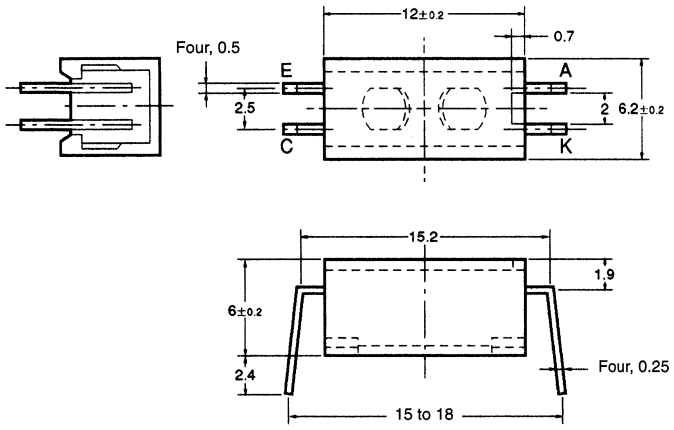
EE–SY113

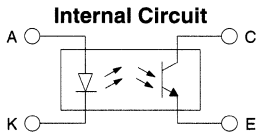
Reflective

- Phototransistor output.
- Optimum sensing distance 4.4mm.
- Incorporates combined dust cover and filter to reduce effect of external visible light.



Dimensions





Terminal No.	Name
A	Anode
K	Cathode
C	Collector
E	Emitter

Unless otherwise specified, the tolerances are as shown below.

Dimensions	Tolerance
3 mm max.	±0.3
3 < mm ≤ 6	±0.375
6 < mm ≤ 10	±0.45
10 < mm ≤ 18	±0.55
18 < mm ≤ 30	±0.65

■ Absolute Maximum Ratings (Ta = 25°C)

Item		Symbol	Rated value
Emitter	**Forward current**	I_F	50 mA (see note 1)
	Pulse forward current	I_{FP}	1 A (see note 2)
	Reverse voltage	V_R	4 V
Detector	**Collector–Emitter voltage**	V_{CEO}	30 V
	Emitter–Collector voltage	V_{ECO}	---
	Collector current	I_C	20 mA
	Collector dissipation	P_C	100 mW (see note 1)
Ambient temperature	**Operating**	Topr	–40°C to 80°C
	Storage	Tstg	–40°C to 85°C
	Soldering	Tsol	260°C

Note: 1. Refer to the temperature rating chart if the ambient temperature exceeds 25°C.
2. The pulse width is 10 μs maximum with a frequency of 100 Hz.

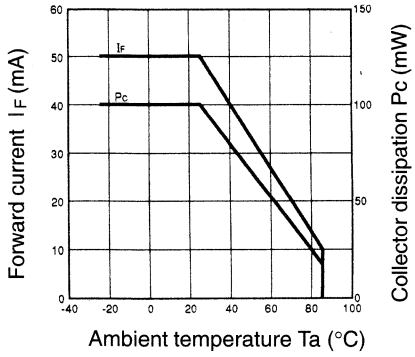
■ Electrical and Optical Characteristics (Ta = 25°C)

Item		Symbol	Value	Condition
Emitter	Forward voltage	V_F	1.2 V typ., 1.5 V max.	I_F = 30 mA
	Reverse current	I_R	0.01 μA typ., 10 μA max.	V_R = 4 V
	Peak emission wavelength	λ_P	940 nm typ.	I_F = 20 mA
Detector	Light current	I_L	160 μA min., 1,600 μA max.	I_F = 20 mA, V_{CE} = 10 V White paper with a reflection ratio of 90%, d = 4.4 mm (see note)
	Dark current	I_D	2 nA typ., 200 nA max.	V_{CE} = 10 V, 0 ℓx
	Leakage current	I_{LEAK}	2 μA max.	I_F = 20 mA, V_{CE} = 10 V with no reflection
	Collector–Emitter saturated voltage	V_{CE} (sat)	---	---
	Peak spectral sensitivity wavelength	λ_P	850 nm typ.	V_{CE} = 10 V
Rising time		tr	30 μs typ.	V_{CC} = 5 V, R_L = 1 kΩ, I_L = 1 mA
Falling time		tf	30 μs typ.	V_{CC} = 5 V, R_L = 1 kΩ, I_L = 1 mA

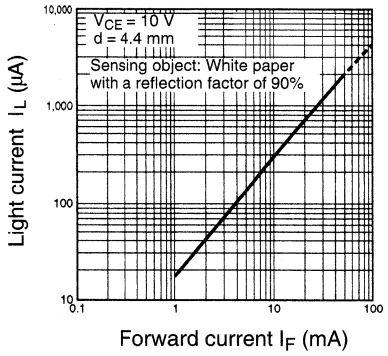
Note: The letter "d" indicates the distance between the top surface of the sensor and the sensing object.

Engineering Data

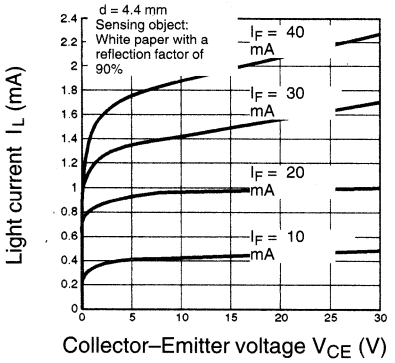
Forward Current vs. Collector Dissipation Temperature Rating



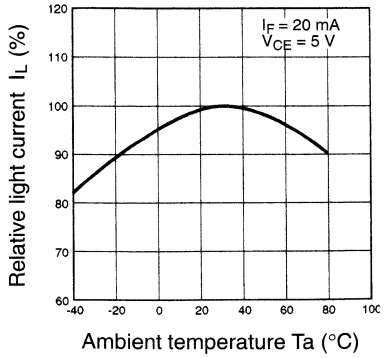
Light Current vs. Forward Current Characteristics (Typical)



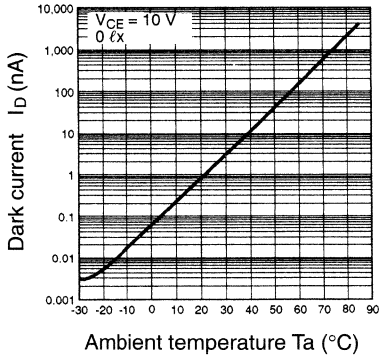
Light Current vs. Collector–Emitter Voltage Characteristics (Typical)



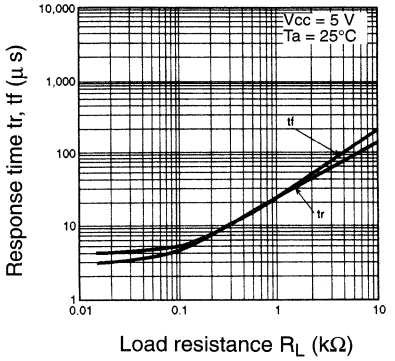
Relative Light Current vs. Ambient Temperature Characteristics (Typical)



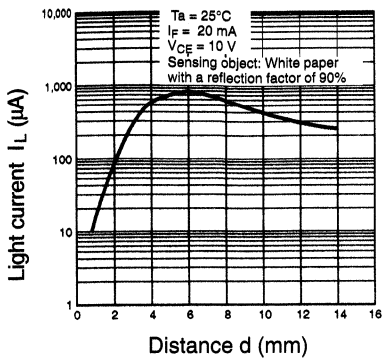
Dark Current vs. Ambient Temperature Characteristics (Typical)



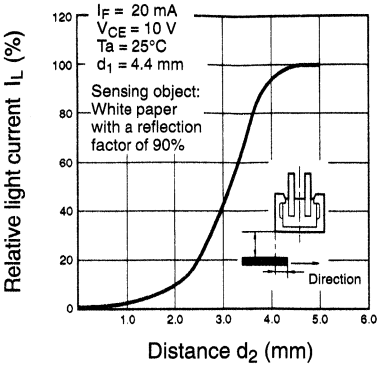
Response Time vs. Load Resistance Characteristics (Typical)



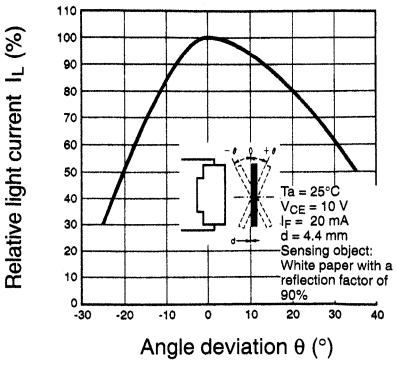
Sensing Distance Characteristics (Typical)



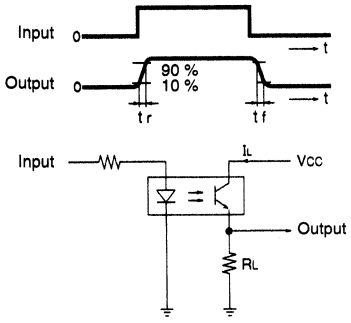
Sensing Position Characteristics (Typical)



Sensing Angle Characteristics (Typical)



Response Time Measurement Circuit



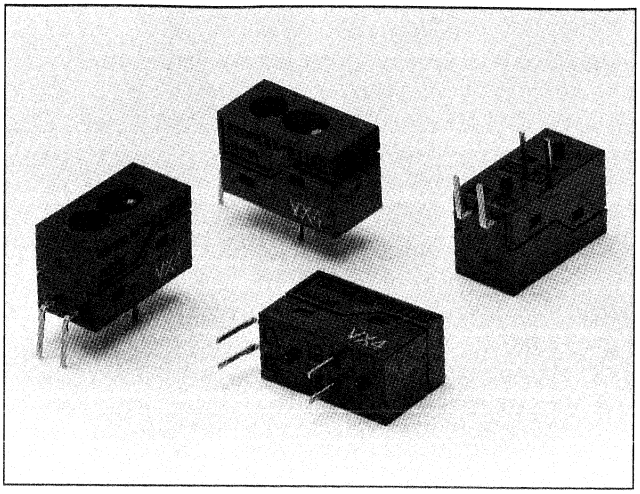
OMRON

Opto–Switch

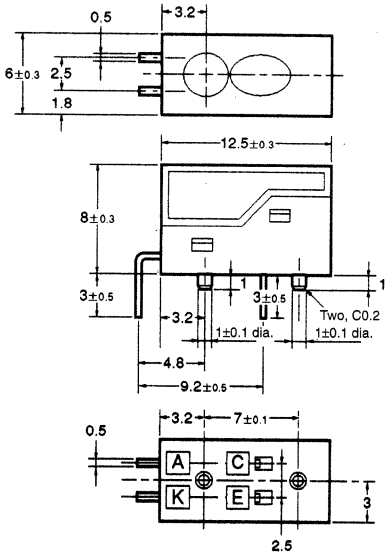
EE–SY169

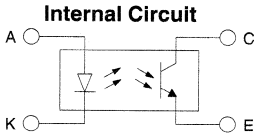
Reflective

- Phototransistor output.
- Optimum sensing distance 4mm.
- High-quality model with plastic lenses.
- Highly precise sensing range with a tolerance of ±0.6 mm horizontally and vertically.
- With a red LED sensing dyestuff-type inks.
- Converge reflective type.



Dimensions





Terminal No.	Name
A	Anode
K	Cathode
C	Collector
E	Emitter

Unless otherwise specified, the tolerances are as shown below.

Dimensions	Tolerance
3 mm max.	±0.3
3 < mm ≤ 6	±0.375
6 < mm ≤ 10	±0.45
10 < mm ≤ 18	±0.55
18 < mm ≤ 30	±0.65

Specifications

■ Absolute Maximum Ratings (Ta = 25°C)

Item		Symbol	Rated value
Emitter	Forward current	I_F	40 mA (see note 1)
	Pulse forward current	I_{FP}	300 mA (see note 2)
	Reverse voltage	V_R	3 V
Detector	Collector–Emitter voltage	V_{CEO}	30 V
	Emitter–Collector voltage	V_{ECO}	---
	Collector current	I_C	20 mA
	Collector dissipation	P_C	100 mW (see note 1)
Ambient temperature	Operating	Topr	0°C to 70°C
	Storage	Tstg	–20°C to 80°C
	Soldering	Tsol	260°C

Note: 1. Refer to the temperature rating chart if the ambient temperature exceeds 25°C.
2. The pulse width is 10 μs maximum with a frequency of 100 Hz.

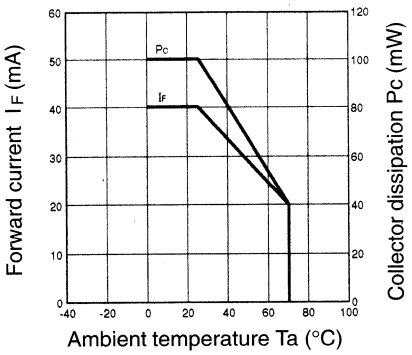
■ Electrical and Optical Characteristics (Ta = 25°C)

Item		Symbol	Value	Condition
Emitter	Forward voltage	V_F	1.85 V typ., 2.3 V max.	I_F = 20 mA
	Reverse current	I_R	0.01 μA typ., 10 μA max.	V_R = 3 V
	Peak emission wavelength	λ_P	660 nm typ.	I_F = 20 mA
Detector	Light current	I_L	160 μA min., 2,000 μA max.	I_F = 20 mA, V_{CE} = 5 V White paper with a reflection ratio of 90%, d = 4 mm (see note)
	Dark current	I_D	2 nA typ., 200 nA max.	V_{CE} = 5 V, 0 ℓx
	Leakage current	I_{LEAK}	2 μA max.	I_F = 20 mA, V_{CE} = 5 V with no reflection
	Collector–Emitter saturated voltage	V_{CE} (sat)	---	---
	Peak spectral sensitivity wavelength	λ_P	850 nm typ.	V_{CE} = 5 V
Rising time		tr	30 μs typ.	V_{CC} = 5 V, R_L = 1 kΩ, I_L = 1 mA
Falling time		tf	30 μs typ.	V_{CC} = 5 V, R_L = 1 kΩ, I_L = 1 mA

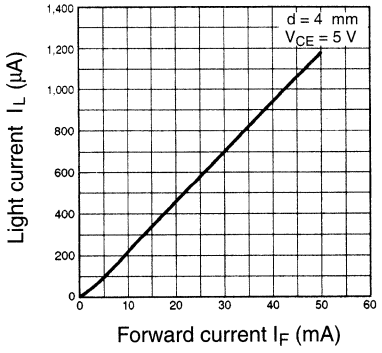
Note: The letter "d" indicates the distance between the top surface of the sensor and the sensing object.

Engineering Data

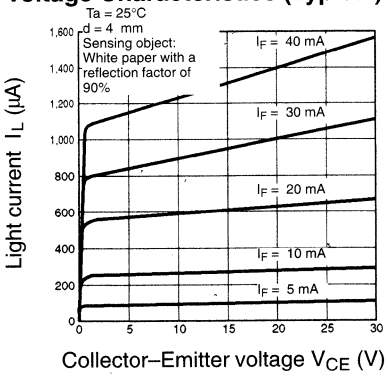
Forward Current vs. Collector Dissipation Temperature Rating



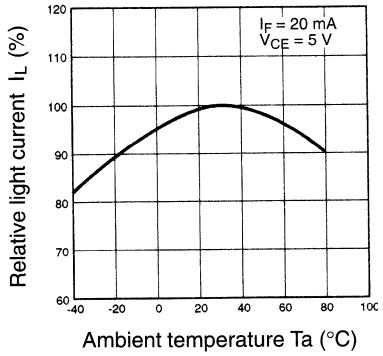
Light Current vs. Forward Current Characteristics (Typical)



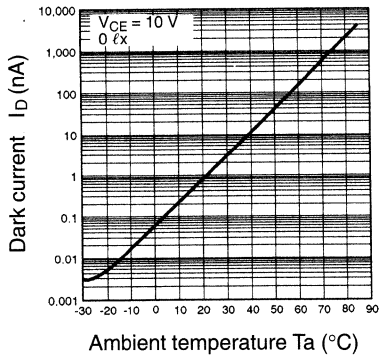
Light Current vs. Collector–Emitter Voltage Characteristics (Typical)



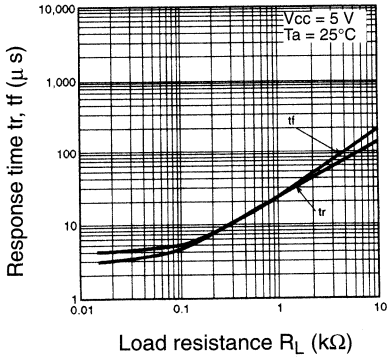
Relative Light Current vs. Ambient Temperature Characteristics (Typical)



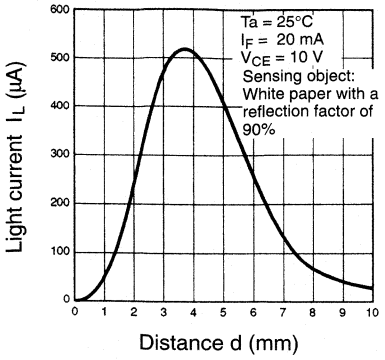
Dark Current vs. Ambient Temperature Characteristics (Typical)



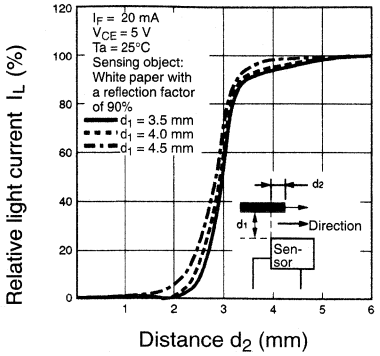
Response Time vs. Load Resistance Characteristics (Typical)



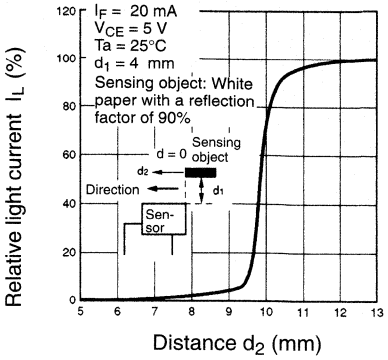
Sensing Distance Characteristics (Typical)



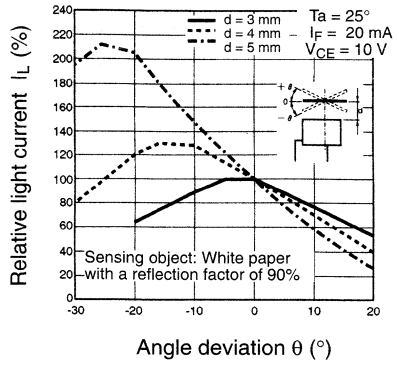
Sensing Position Characteristics (Typical)



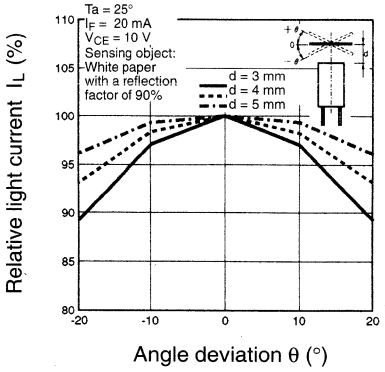
Sensing Position Characteristics (Typical)



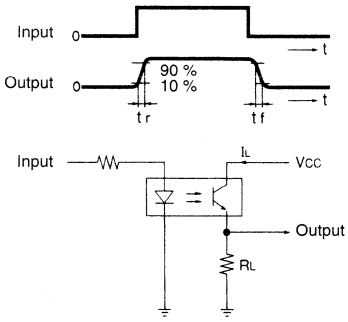
Sensing Angle Characteristics (Typical)



Sensing Angle Characteristics (Typical)



Response Time Measurement Circuit



Opto-Switches

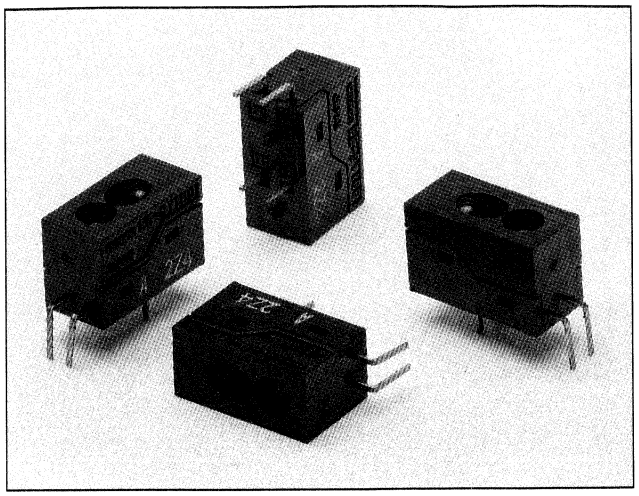
OMRON

Opto–Switch

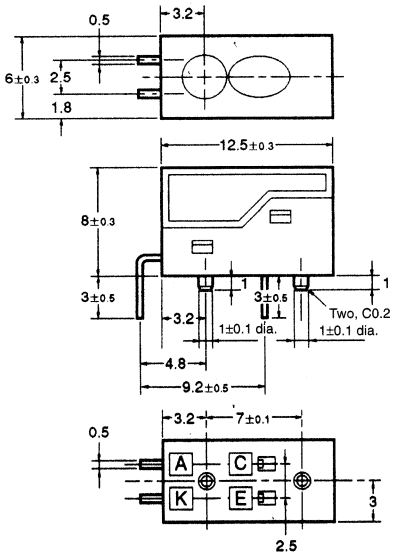
EE–SY169A

Reflective

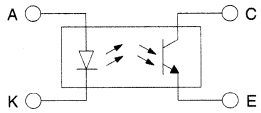
- Phototransistor output.
- Optimum sensing distance 4mm.
- High-quality model with plastic lenses.
- Highly precise sensing range with a tolerance of ±0.6 mm horizontally and vertically.
- Convergent reflective model.



Dimensions



Internal Circuit



Terminal No.	Name
A	Anode
K	Cathode
C	Collector
E	Emitter

Unless otherwise specified, the tolerances are as shown below.

Dimensions	Tolerance
3 mm max.	±0.3
3 < mm ≤ 6	±0.375
6 < mm ≤ 10	±0.45
10 < mm ≤ 18	±0.55
18 < mm ≤ 30	±0.65

Specifications

■ Absolute Maximum Ratings (Ta = 25°C)

Item		Symbol	Rated value
Emitter	Forward current	I_F	50 mA (see note 1)
	Pulse forward current	I_{FP}	1 A (see note 2)
	Reverse voltage	V_R	3 V
Detector	Collector–Emitter voltage	V_{CEO}	30 V
	Emitter–Collector voltage	V_{ECO}	---
	Collector current	I_C	20 mA
	Collector dissipation	P_C	100 mW (see note 1)
Ambient temperature	Operating	Topr	0°C to 70°C
	Storage	Tstg	–20°C to 80°C
	Soldering	Tsol	260°C

Note: 1. Refer to the temperature rating chart if the ambient temperature exceeds 25°C.
2. The pulse width is 10 μs maximum with a frequency of 100 Hz.

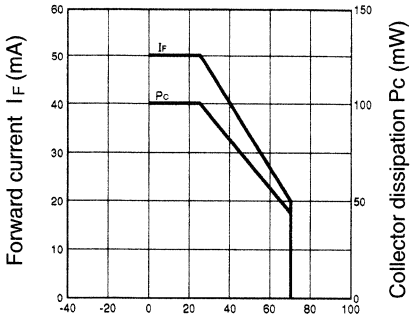
■ Electrical and Optical Characteristics (Ta = 25°C)

Item		Symbol	Value	Condition
Emitter	Forward voltage	V_F	1.5 V max.	I_F = 30 mA
	Reverse current	I_R	10 μA max.	V_R = 4 V
	Peak emission wavelength	λ_P	920 nm typ.	I_F = 20 mA
Detector	Light current	I_L	160 μA min., 2,000 μA max.	I_F = 20 mA, V_{CE} = 5 V White paper with a reflection ratio of 90%, d = 4 mm (see note)
	Dark current	I_D	2 nA typ., 200 nA max.	V_{CE} = 5 V, 0 ℓx
	Leakage current	I_{LEAK}	2 μA max.	I_F = 20 mA, V_{CE} = 5 V with no reflection
	Collector–Emitter saturated voltage	V_{CE} (sat)	---	---
	Peak spectral sensitivity wavelength	λ_P	850 nm typ.	V_{CE} = 5 V
Rising time		tr	30 μs typ.	V_{CC} = 5 V, R_L = 1 kΩ, I_L = 1 mA
Falling time		tf	30 μs typ.	V_{CC} = 5 V, R_L = 1 kΩ, I_L = 1 mA

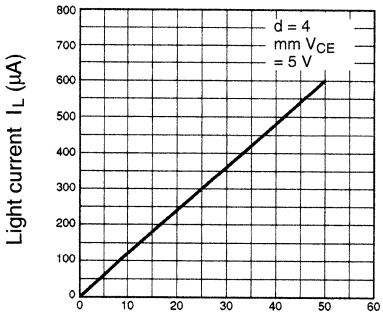
Note: The letter "d" indicates the distance between the top surface of the sensor and the sensing object.

Engineering Data

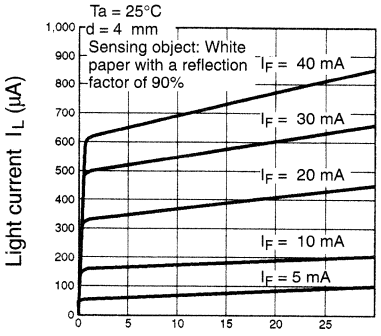
Forward Current vs. Collector Dissipation Temperature Rating



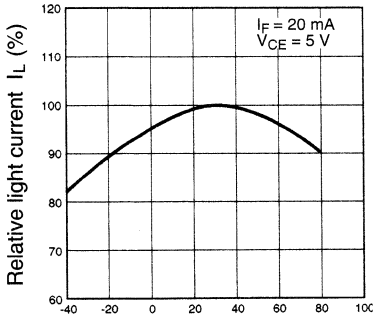
Light Current vs. Forward Current Characteristics (Typical)



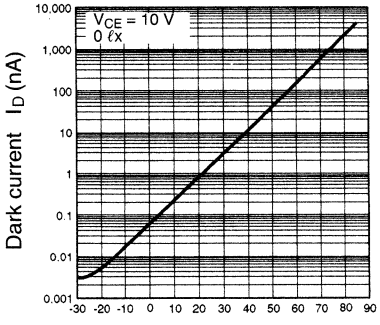
Light Current vs. Collector–Emitter Voltage Characteristics (Typical)



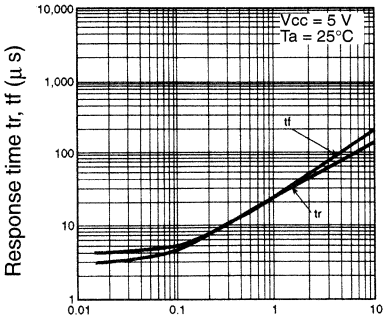
Relative Light Current vs. Ambient Temperature Characteristics (Typical)



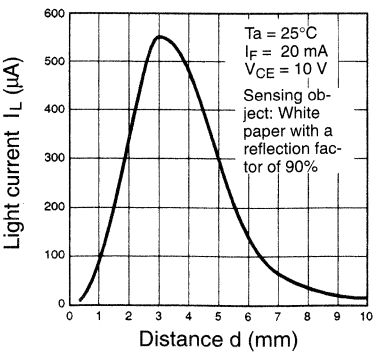
Dark Current vs. Ambient Temperature Characteristics (Typical)



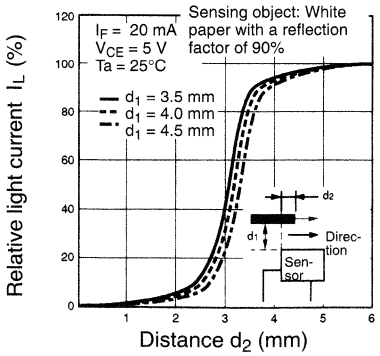
Response Time vs. Load Resistance Characteristics (Typical)



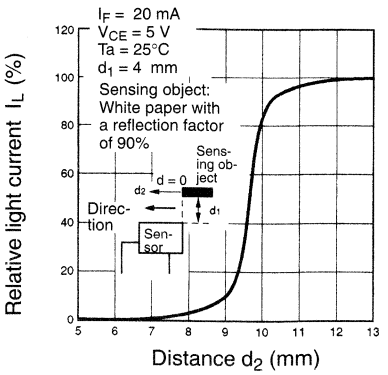
Sensing Distance Characteristics (Typical)



Sensing Position Characteristics (Typical)



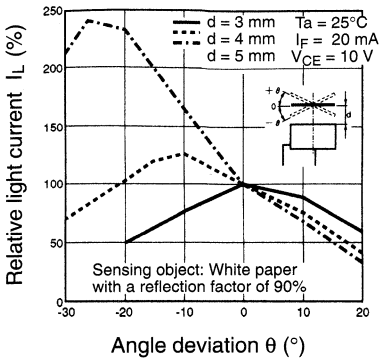
Sensing Position Characteristics (Typical)



Opto-Switches

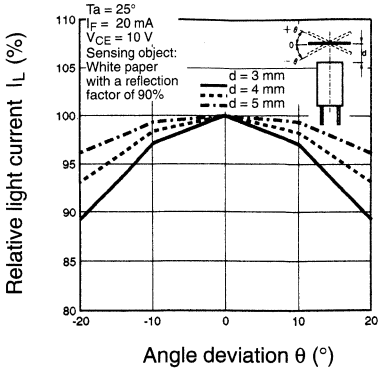
Distance d (mm)

Sensing Angle Characteristics (Typical)



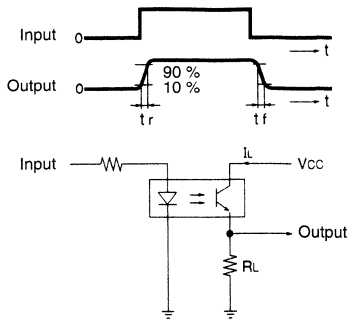
Distance d_2 (mm)

Sensing Angle Characteristics (Typical)



Distance d_2 (mm)

Response Time Measurement Circuit



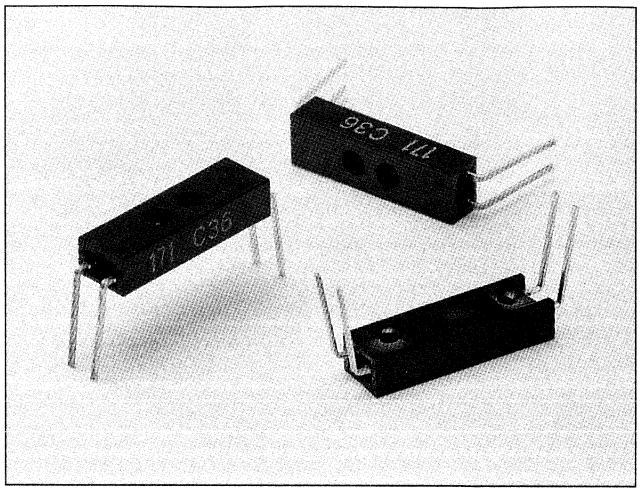
OMRON

Opto–Switch

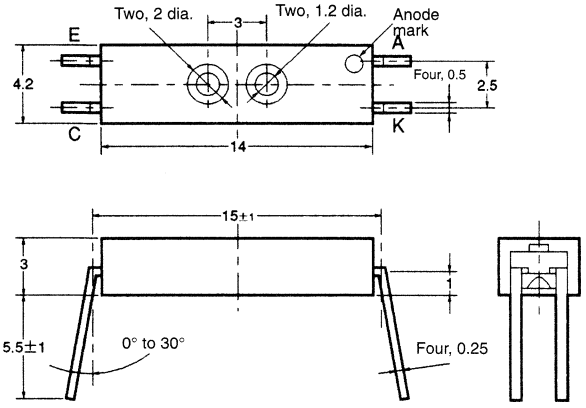
EE–SY171

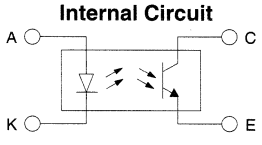
Reflective

- Phototransistor output.
- Optimum sensing distance 3.5mm.
- Extremely low profile design with an overall height of just 3mm.



Dimensions





Terminal No.	Name
A	Anode
K	Cathode
C	Collector
E	Emitter

Unless otherwise specified, the tolerances are as shown below.

Dimensions	Tolerance
3 mm max.	±0.3
3 < mm ≤ 6	±0.375
6 < mm ≤ 10	±0.45
10 < mm ≤ 18	±0.55
18 < mm ≤ 30	±0.65

Specifications

■ Absolute Maximum Ratings (Ta = 25°C)

Item		Symbol	Rated value
Emitter	Forward current	I_F	50 mA (see note 1)
	Pulse forward current	I_{FP}	1 A (see note 2)
	Reverse voltage	V_R	4 V
Detector	Collector–Emitter voltage	V_{CEO}	30 V
	Emitter–Collector voltage	V_{ECO}	---
	Collector current	I_C	20 mA
	Collector dissipation	P_C	100 mW (see note 1)
Ambient temperature	Operating	Topr	–40°C to 85°C
	Storage	Tstg	–40°C to 85°C
	Soldering	Tsol	260°C

Note: 1. Refer to the temperature rating chart if the ambient temperature exceeds 25°C.
2. The pulse width is 10 μs maximum with a frequency of 100 Hz.

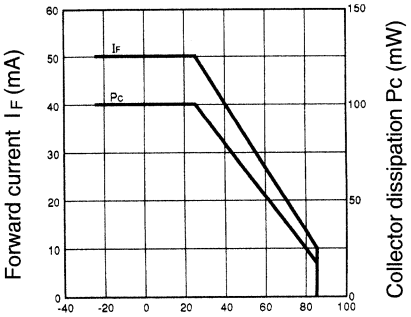
■ Electrical and Optical Characteristics (Ta = 25°C)

Item		Symbol	Value	Condition
Emitter	Forward voltage	V_F	1.2 V typ., 1.5 V max.	I_F = 30 mA
	Reverse current	I_R	0.01 μA typ., 10 μA max.	V_R = 4 V
	Peak emission wavelength	λ_P	940 nm typ.	I_F = 20 mA
Detector	Light current	I_L	50 μA min., 500 μA max.	I_F = 20 mA, V_{CE} = 10 V White paper with a reflection ratio of 90%, d = 3.5 mm (see note)
	Dark current	I_D	2 nA typ., 200 nA max.	V_{CE} = 10 V, 0 ℓx
	Leakage current	I_{LEAK}	200 μA max.	I_F = 20 mA, V_{CE} = 10 V with no reflection
	Collector–Emitter saturated voltage	V_{CE} (sat)	---	---
	Peak spectral sensitivity wavelength	λ_P	850 nm typ.	V_{CE} = 10 V
Rising time		tr	30 μs typ.	V_{CC} = 5 V, R_L = 1 kΩ, I_L = 1 mA
Falling time		tf	30 μs typ.	V_{CC} = 5 V, R_L = 1 kΩ, I_L = 1 mA

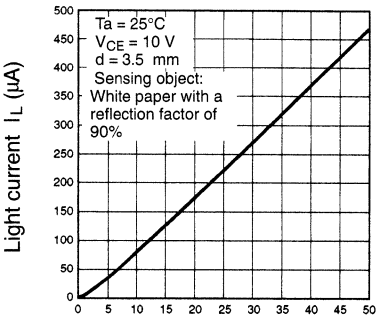
Note: The letter "d" indicates the distance between the top surface of the sensor and the sensing object.

Engineering Data

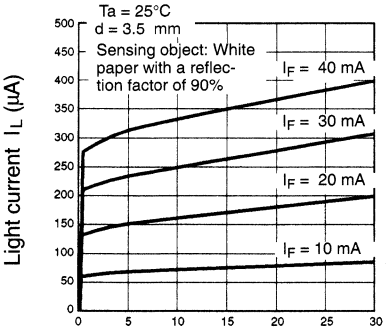
Forward Current vs. Collector Dissipation Temperature Rating



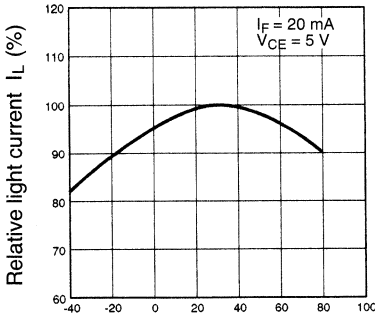
Light Current vs. Forward Current Characteristics (Typical)



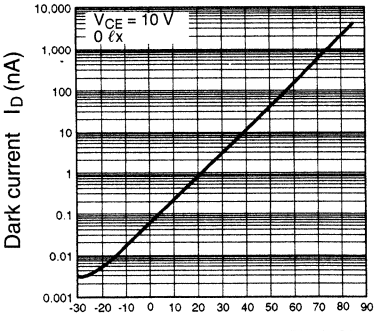
Light Current vs. Collector–Emitter Voltage Characteristics (Typical)



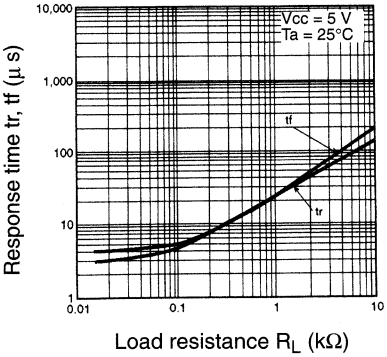
Relative Light Current vs. Ambient Temperature Characteristics (Typical)



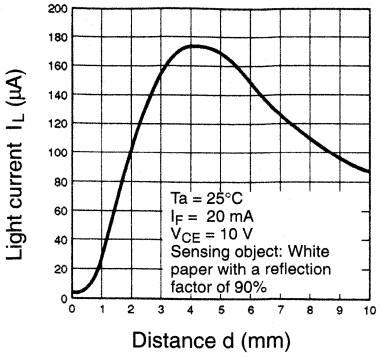
Dark Current vs. Ambient Temperature Characteristics (Typical)



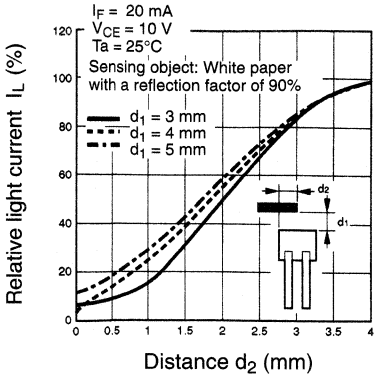
Response Time vs. Load Resistance Characteristics (Typical)



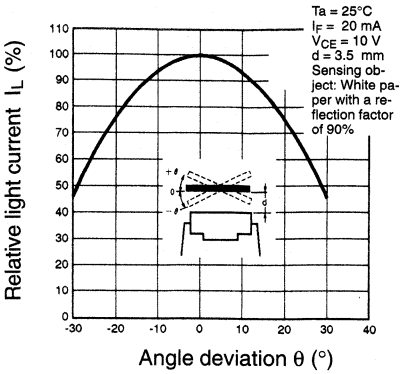
Sensing Distance Characteristics (Typical)



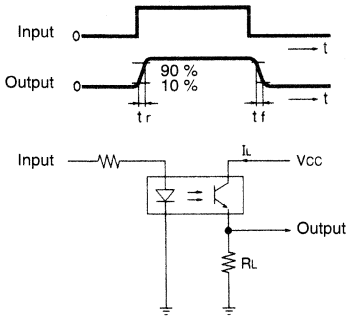
Sensing Position Characteristics (Typical)



Sensing Angle Characteristics (Typical)



Response Time Measurement Circuit



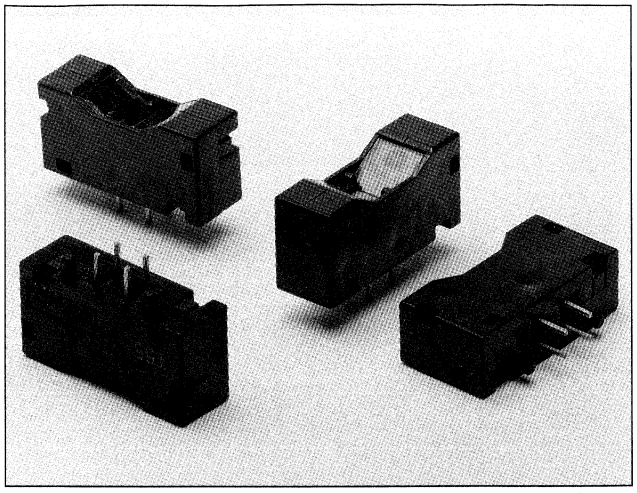
OMRON

Opto–Switch

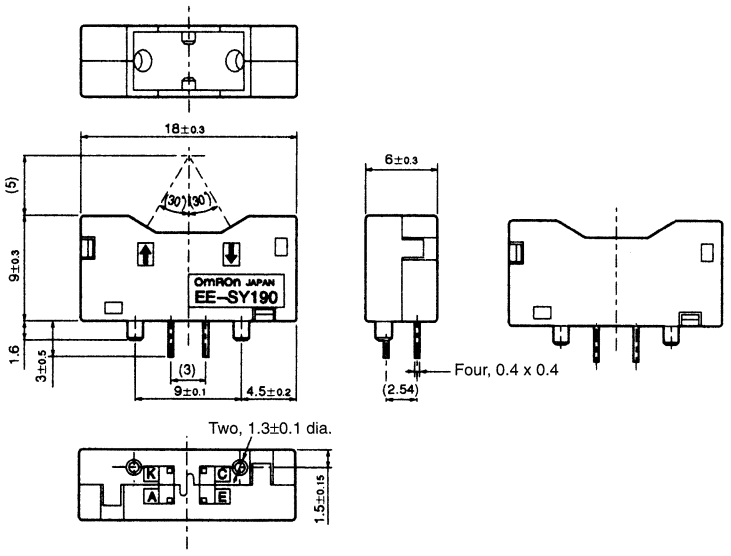
EE–SY190

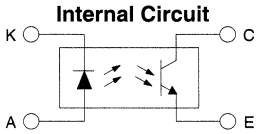
Reflective

- Phototransistor output.
- Uses latest in Fresnel lens technology to enhance sensing position characteristics.
- Convergent reflective model, the operation of which is hardly interfered by any background object.
- Sensing distance 5mm.
- Senses glossy OHP sheets.
- PCB-mounting model with top viewing sensor.
- Dust-tight model.



Dimensions





Terminal No.	Name
A	Anode
K	Cathode
C	Collector
E	Emitter

Unless otherwise specified, the tolerances are as shown below.

Dimensions	Tolerance
3 mm max.	±0.3
3 < mm ≤ 6	±0.375
6 < mm ≤ 10	±0.45
10 < mm ≤ 18	±0.55
18 < mm ≤ 30	±0.65

Specifications

■ Absolute Maximum Ratings (Ta = 25°C)

Item		Symbol	Rated value
Emitter	Forward current	I_F	50 mA (see note 1)
	Pulse forward current	I_{FP}	1 A (see note 2)
	Reverse voltage	V_R	4 V
Detector	Collector–Emitter voltage	V_{CEO}	30 V
	Emitter–Collector voltage	V_{ECO}	---
	Collector current	I_C	20 mA
	Collector dissipation	P_C	100 mW (see note 1)
Ambient temperature	Operating	Topr	–25°C to 85°C
	Storage	Tstg	–40°C to 100°C
	Soldering	Tsol	260°C

Note: 1. Refer to the temperature rating chart if the ambient temperature exceeds 25°C.
2. The pulse width is 10 μs maximum with a frequency of 100 Hz.

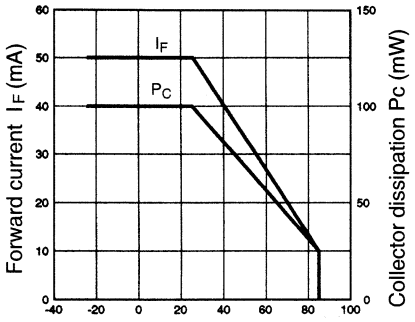
■ Electrical and Optical Characteristics (Ta = 25°C)

Item		Symbol	Value	Condition
Emitter	Forward voltage	V_F	1.2 V typ., 1.5 V max.	I_F = 20 mA
	Reverse current	I_R	10 μA max.	V_R = 4 V
	Peak emission wavelength	λ_P	940 nm typ.	I_F = 30 mA
Detector	Light current	I_L	50 μA min., 180 μA min., 600 μA max.	I_F = 20 mA, V_{CE} = 5 V White paper with a reflection ratio of 90%, d = 4.5 mm (see note)
	Dark current	I_D	2 nA typ., 200 nA max.	V_{CE} = 5 V, 0 ℓx
	Leakage current	I_{LEAK}	1 μA max.	I_F = 20 mA, V_{CE} = 5 V with no reflection
	Collector–Emitter saturated voltage	V_{CE} (sat)	---	---
	Peak spectral sensitivity wavelength	λ_P	850 nm typ.	V_{CE} = 5 V
Rising time		tr	30 μs typ.	V_{CC} = 5 V, R_L = 1 kΩ, I_L = 200 μA
Falling time		tf	30 μs typ.	V_{CC} = 5 V, R_L = 1 kΩ, I_L = 200 μA

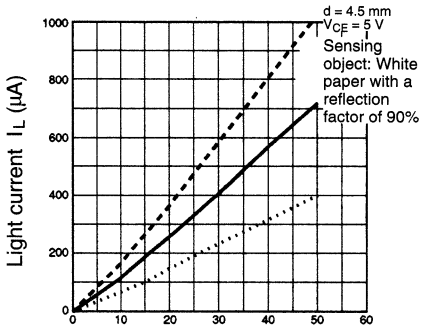
Note: The letter "d" indicates the distance between the top surface of the sensor and the sensing object.

Engineering Data

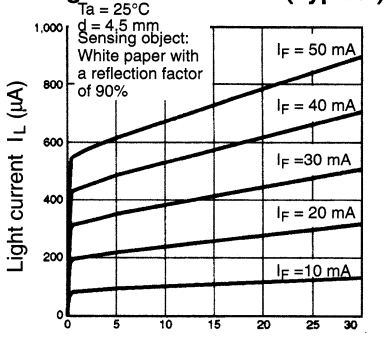
Forward Current vs. Collector Dissipation Temperature Rating



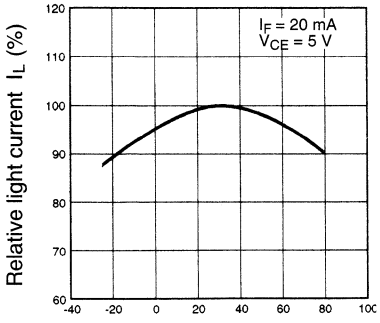
Light Current vs. Forward Current Characteristics (Typical)



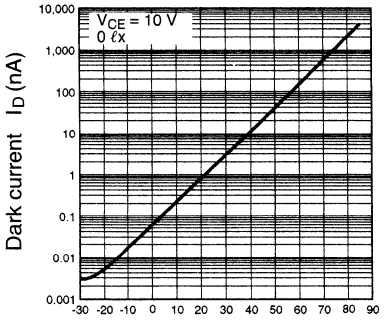
Light Current vs. Collector–Emitter Voltage Characteristics (Typical)



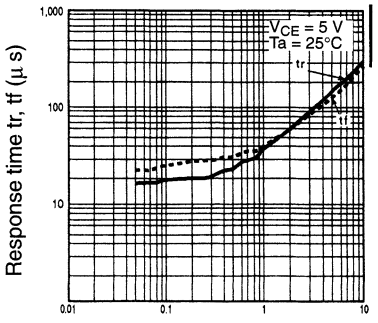
Relative Light Current vs. Ambient Temperature Characteristics (Typical)



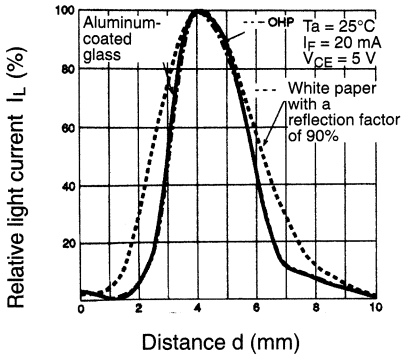
Dark Current vs. Ambient Temperature Characteristics (Typical)



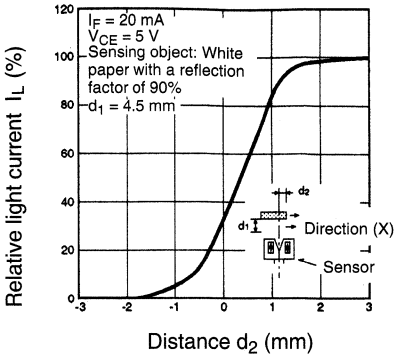
Response Time vs. Load Resistance Characteristics (Typical)



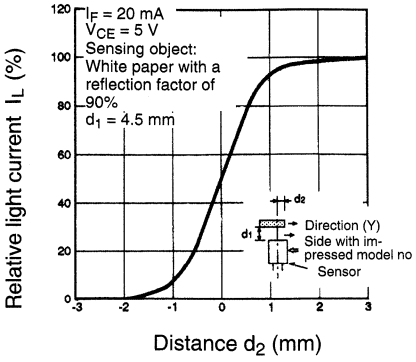
Sensing Distance Characteristics (Typical)



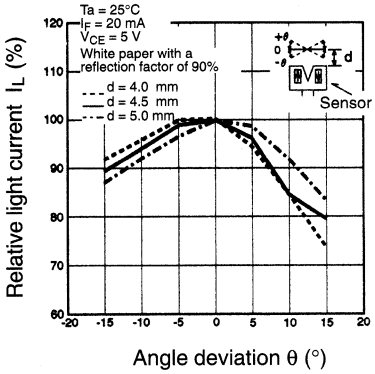
Sensing Position Characteristics X Direction (Typical)



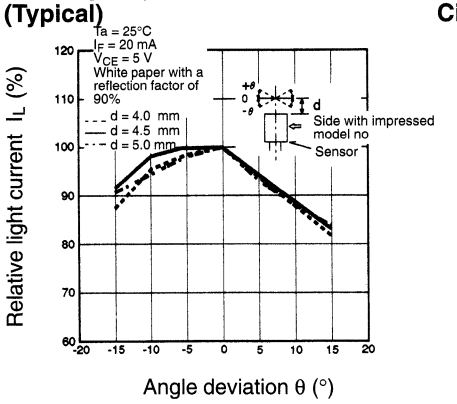
Sensing Position Characteristics Y Direction (Typical)



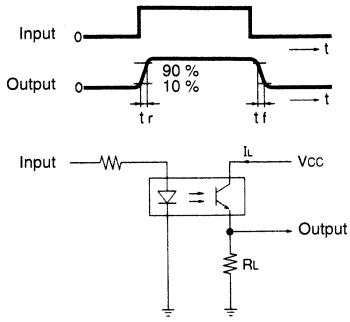
Sensing Angle Characteristics (Typical)



Sensing Angle Characteristics (Typical)



Response Time Measurement Circuit



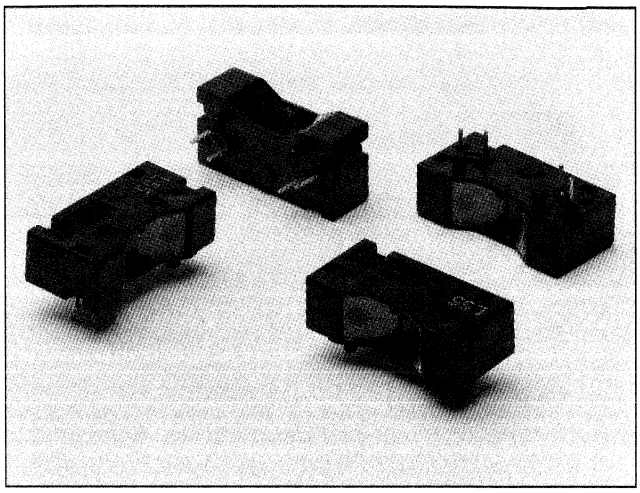
OMRON

Opto–Switch

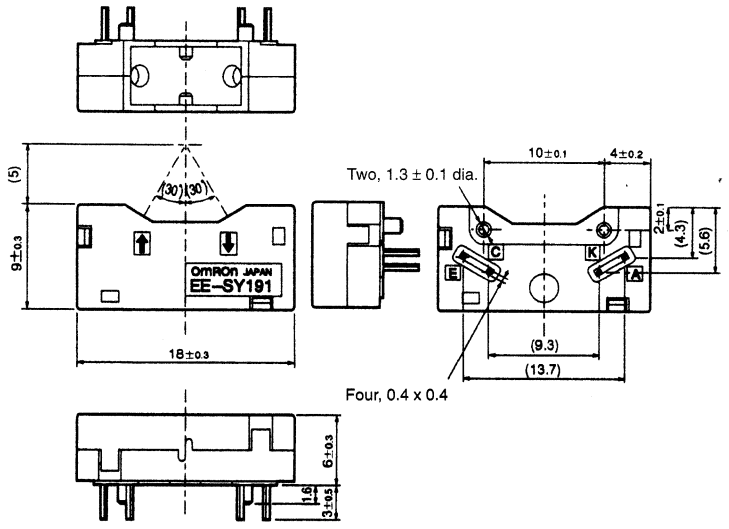
EE–SY191

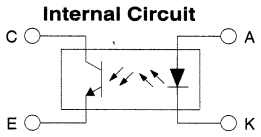
Reflective

- Phototransistor output.
- Uses latest in Fresnel lens technology to enhance sensing position characteristics.
- Convergent reflective model, the operation of which is hardly interfered by any background object.
- Sensing distance 5mm.
- Senses glossy OHP sheets.
- PCB-mounting model with side viewing sensor.
- Dust-tight model.



Dimensions





Terminal No.	Name
A	Anode
K	Cathode
C	Collector
E	Emitter

Unless otherwise specified, the tolerances are as shown below.

Dimensions	Tolerance
3 mm max.	±0.3
3 < mm ≤ 6	±0.375
6 < mm ≤ 10	±0.45
10 < mm ≤ 18	±0.55
18 < mm ≤ 30	±0.65

Specifications

■ Absolute Maximum Ratings (Ta = 25°C)

Item		Symbol	Rated value
Emitter	Forward current	I_F	50 mA (see note 1)
	Pulse forward current	I_{FP}	1 A (see note 2)
	Reverse voltage	V_R	4 V
Detector	Collector–Emitter voltage	V_{CEO}	30 V
	Emitter–Collector voltage	V_{ECO}	---
	Collector current	I_C	20 mA
	Collector dissipation	P_C	100 mW (see note 1)
Ambient temperature	Operating	Topr	–25°C to 85°C
	Storage	Tstg	–40°C to 100°C
	Soldering	Tsol	260°C

Note: 1. Refer to the temperature rating chart if the ambient temperature exceeds 25°C.
2. The pulse width is 10 μs maximum with a frequency of 100 Hz.

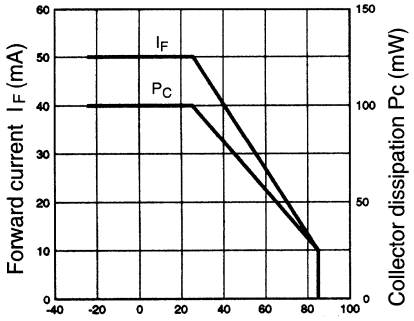
■ Electrical and Optical Characteristics (Ta = 25°C)

Item		Symbol	Value	Condition
Emitter	Forward voltage	V_F	1.2 V typ., 1.5 V max.	I_F = 20 mA
	Reverse current	I_R	10 μA max.	V_R = 4 V
	Peak emission wavelength	λ_P	940 nm typ.	I_F = 30 mA
Detector	Light current	I_L	50 μA min., 180 μA min., 600 μA max.	I_F = 20 mA, V_{CE} = 5 V White paper with a reflection ratio of 90%, d = 4.5 mm (see note)
	Dark current	I_D	2 nA typ., 200 nA max.	V_{CE} = 5 V, 0 ℓx
	Leakage current	I_{LEAK}	1 μA max.	I_F = 20 mA, V_{CE} = 5 V with no reflection
	Collector–Emitter saturated voltage	V_{CE} (sat)	---	---
	Peak spectral sensitivity wavelength	λ_P	850 nm typ.	V_{CE} = 5 V
Rising time		tr	30 μs typ.	V_{CC} = 5 V, R_L = 1 kΩ, I_L = 200 μA
Falling time		tf	30 μs typ.	V_{CC} = 5 V, R_L = 1 kΩ, I_L = 200 μA

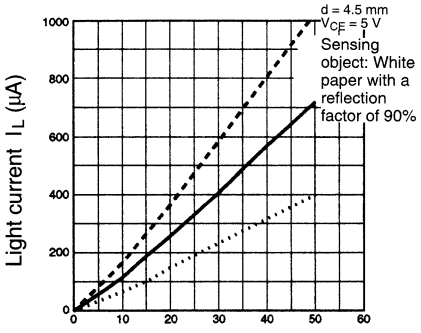
Note: The letter "d" indicates the distance between the top surface of the sensor and the sensing object.

Engineering Data

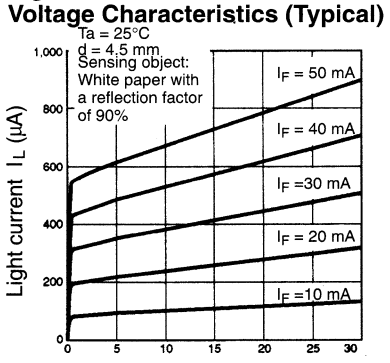
Forward Current vs. Collector Dissipation Temperature Rating



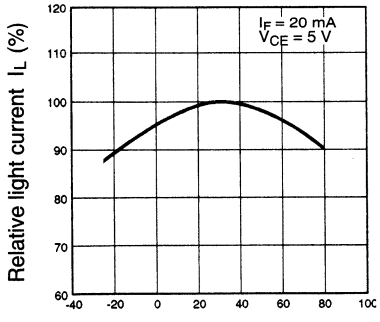
Light Current vs. Forward Current Characteristics (Typical)



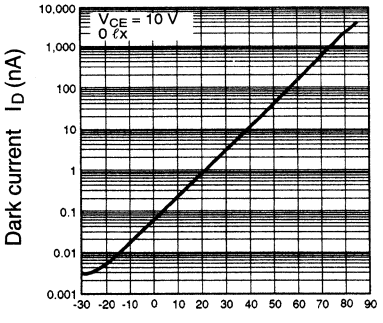
Light Current vs. Collector–Emitter Voltage Characteristics (Typical)



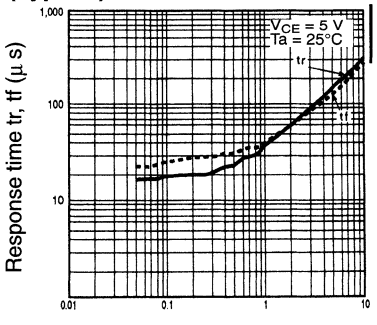
Relative Light Current vs. Ambient Temperature Characteristics (Typical)



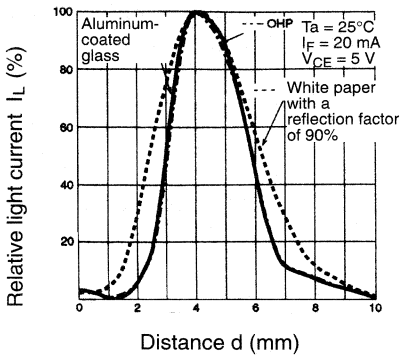
Dark Current vs. Ambient Temperature Characteristics (Typical)



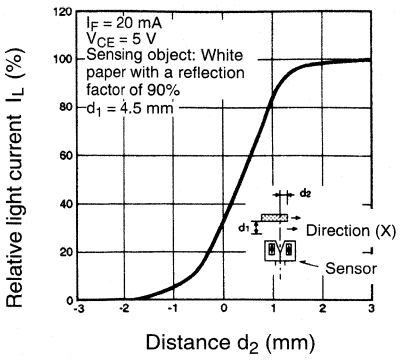
Response Time vs. Load Resistance Characteristics (Typical)



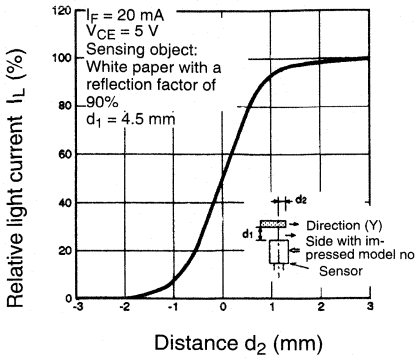
Sensing Distance Characteristics (Typical)



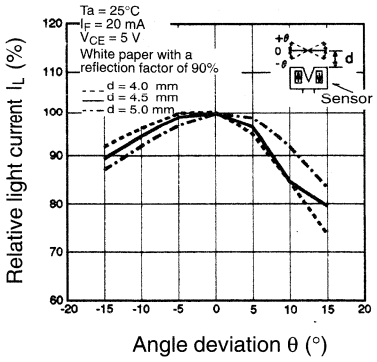
Sensing Position Characteristics X Direction (Typical)



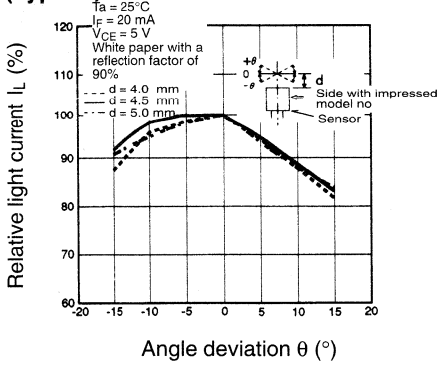
Sensing Position Characteristics Y Direction (Typical)



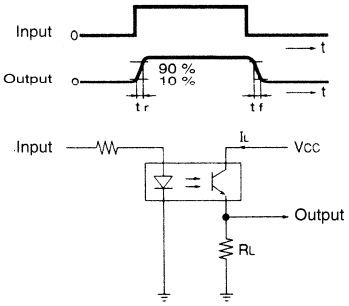
Sensing Angle Characteristics (Typical)



Sensing Angle Characteristics (Typical)



Response Time Measurement Circuit



Opto-Switches

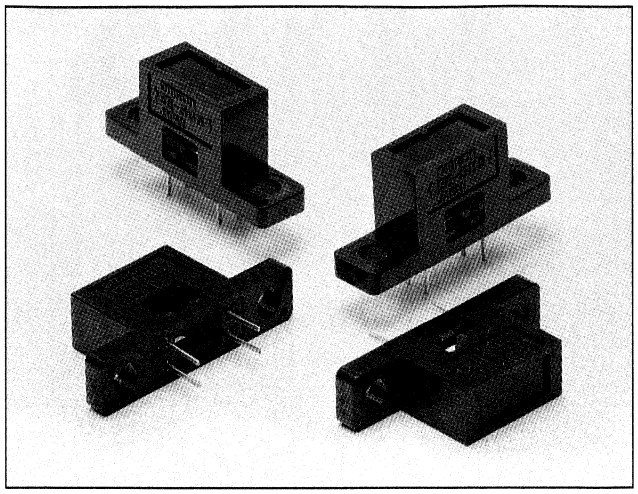
OMRON

Opto–Switch

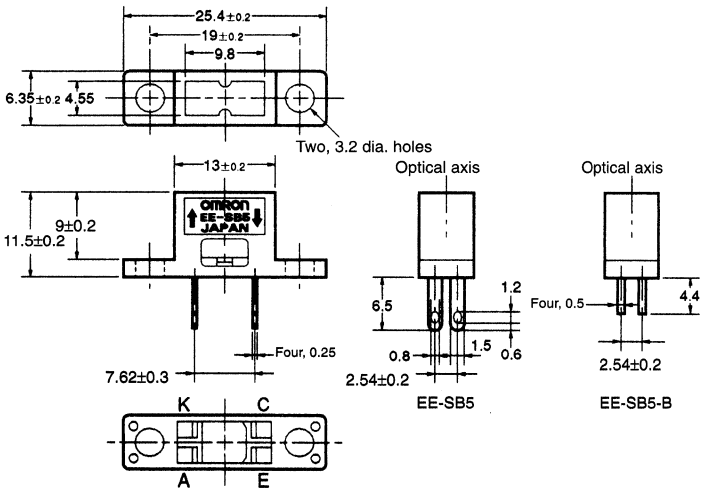
EE–SB5(–B)

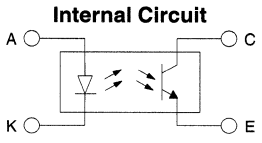
Reflective

- Phototransistor output.
- Sensing distance 5mm.
- Dust-tight construction.
- With a visible-light intercepting filter which allows objects to be sensed without being greatly influenced by the light radiated from fluorescent lamps.
- Mounted with M3 screws.
- Model with soldering terminals (EE-SB5).
- Model with PCB terminals (EE-SB5-B).



Dimensions





Terminal No.	Name
A	Anode
K	Cathode
C	Collector
E	Emitter

Unless otherwise specified, the tolerances are as shown below.

Dimensions	Tolerance
3 mm max.	±0.3
3 < mm ≤ 6	±0.375
6 < mm ≤ 10	±0.45
10 < mm ≤ 18	±0.55
18 < mm ≤ 30	±0.65

Specifications

■ Absolute Maximum Ratings (Ta = 25°C)

Item		Symbol	Rated value
Emitter	Forward current	I_F	50 mA (see note 1)
	Pulse forward current	I_{FP}	1 A (see note 2)
	Reverse voltage	V_R	4 V
Detector	Collector–Emitter voltage	V_{CEO}	30 V
	Emitter–Collector voltage	V_{ECO}	---
	Collector current	I_C	20 mA
	Collector dissipation	P_C	100 mW (see note 1)
Ambient temperature	Operating	Topr	–25°C to 80°C
	Storage	Tstg	–30°C to 80°C
	Soldering	Tsol	260°C

Note: 1. Refer to the temperature rating chart if the ambient temperature exceeds 25°C.
2. The pulse width is 10 μs maximum with a frequency of 100 Hz.

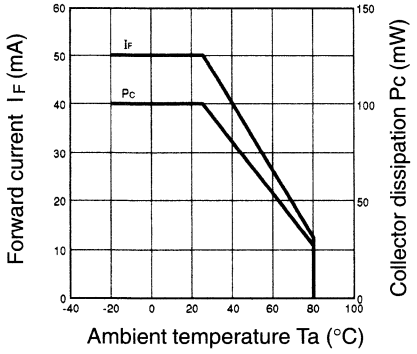
■ Electrical and Optical Characteristics (Ta = 25°C)

Item		Symbol	Value	Condition
Emitter	Forward voltage	V_F	1.2 V typ., 1.5 V max.	I_F = 30 mA
	Reverse current	I_R	0.01 μA typ., 10 μA max.	V_R = 4 V
	Peak emission wavelength	λ_P	940 nm typ.	I_F = 20 mA
Detector	Light current	I_L	200 μA min., 2,000 μA max.	I_F = 20 mA, V_{CE} = 10 V White paper with a reflection ratio of 90%, d = 5 mm (see note)
	Dark current	I_D	2 nA typ., 200 nA max.	V_{CE} = 10 V, 0 ℓx
	Leakage current	I_{LEAK}	2 μA max.	I_F = 20 mA, V_{CE} = 10 V with no reflection
	Collector–Emitter saturated voltage	V_{CE} (sat)	---	---
	Peak spectral sensitivity wavelength	λ_P	850 nm typ.	V_{CE} = 10 V
Rising time		tr	30 μs typ.	V_{CC} = 5 V, R_L = 1 kΩ, I_L = 1 mA
Falling time		tf	30 μs typ.	V_{CC} = 5 V, R_L = 1 kΩ, I_L = 1 mA

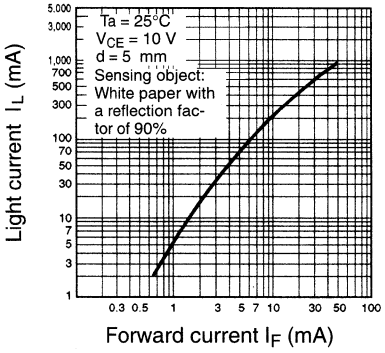
Note: The letter "d" indicates the distance between the top surface of the sensor and the sensing object.

Engineering Data

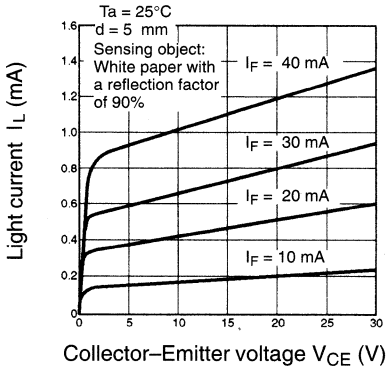
Forward Current vs. Collector Dissipation Temperature Rating



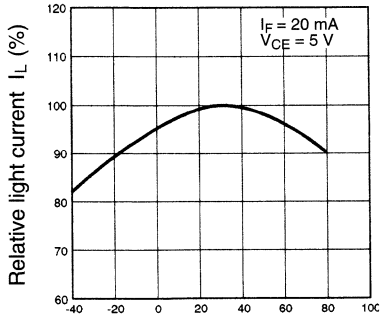
Light Current vs. Forward Current Characteristics (Typical)



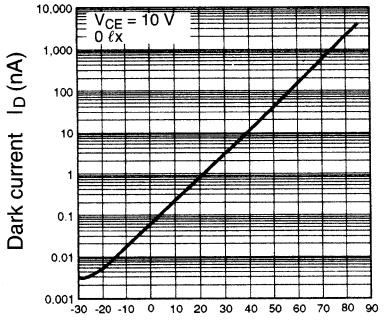
Light Current vs. Collector–Emitter Voltage Characteristics (Typical)



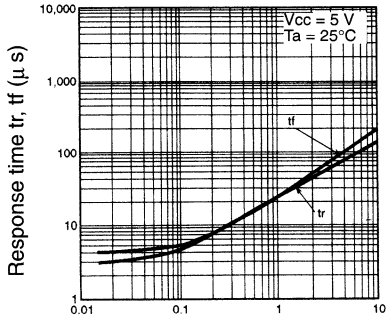
Relative Light Current vs. Ambient Temperature Characteristics (Typical)



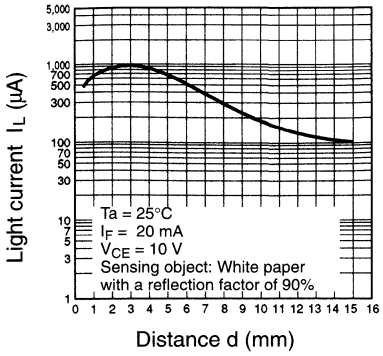
Dark Current vs. Ambient Temperature Characteristics (Typical)



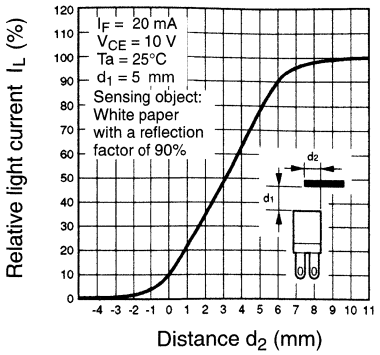
Response Time vs. Load Resistance Characteristics (Typical)



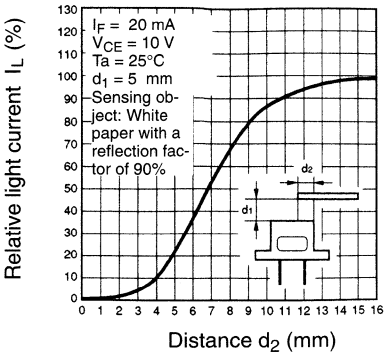
Sensing Distance Characteristics (Typical)



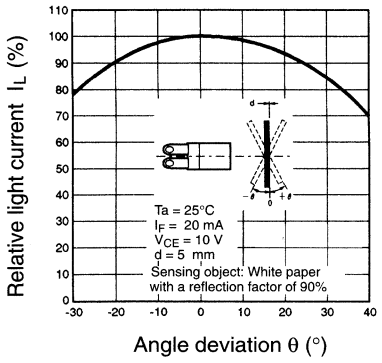
Sensing Position Characteristics (Typical)



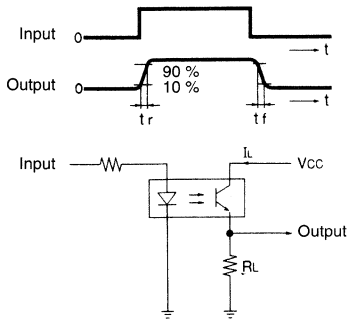
Sensing Position Characteristics (Typical)



Sensing Angle Characteristics (Typical)



Response Time Measurement Circuit



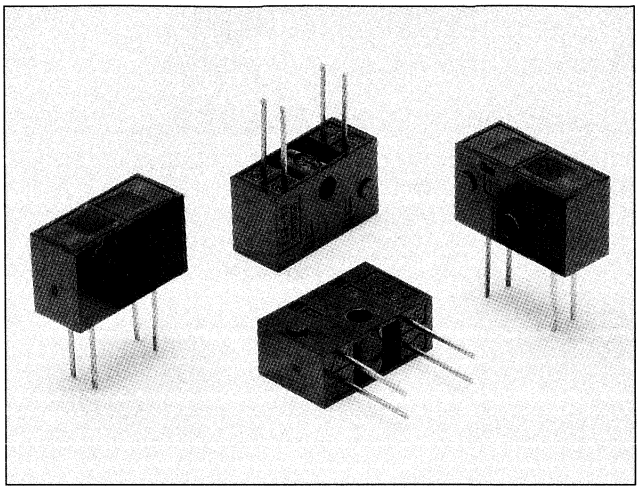
OMRON

Opto–Switch

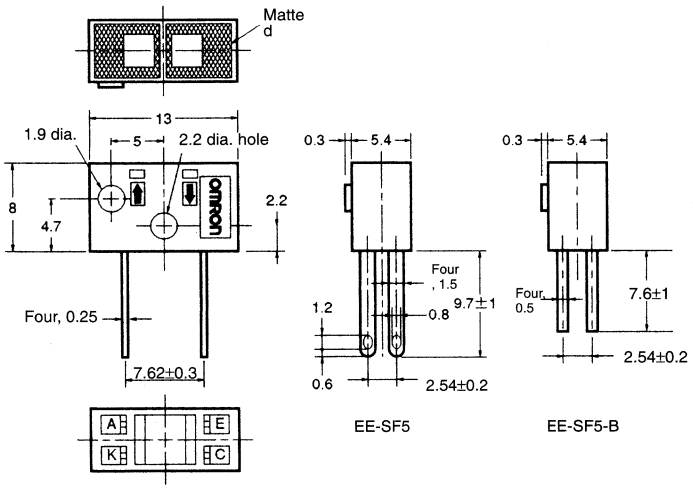
EE–SF5(–B)

Reflective

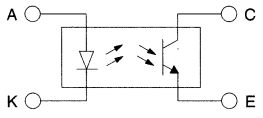
- Phototransistor output.
- Sensing distance 5mm.
- Dust-tight construction.
- With a visible-light intercepting filter which allows objects to be sensed without being greatly influenced by the light radiated from fluorescent lamps.
- Mounted with M2 screws.
- Model with soldering terminals (EE-SF5).
- Model with PCB terminals (EE-SF5-B).



Dimensions



Internal Circuit



Terminal No.	Name
A	Anode
K	Cathode
C	Collector
E	Emitter

Unless otherwise specified, the tolerances are as shown below.

Dimensions	Tolerance
3 mm max.	±0.3
3 < mm ≤ 6	±0.375
6 < mm ≤ 10	±0.45
10 < mm ≤ 18	±0.55
18 < mm ≤ 30	±0.65

■ Absolute Maximum Ratings (Ta = 25°C)

Item		Symbol	Rated value
Emitter	Forward current	I_F	50 mA (see note 1)
	Pulse forward current	I_{FP}	1 A (see note 2)
	Reverse voltage	V_R	4 V
Detector	Collector–Emitter voltage	V_{CEO}	30 V
	Emitter–Collector voltage	V_{ECO}	---
	Collector current	I_C	20 mA
	Collector dissipation	P_C	100 mW (see note 1)
Ambient temperature	Operating	Topr	–25°C to 80°C
	Storage	Tstg	–30°C to 80°C
	Soldering	Tsol	260°C

Note: 1. Refer to the temperature rating chart if the ambient temperature exceeds 25°C.
2. The pulse width is 10 μs maximum with a frequency of 100 Hz.

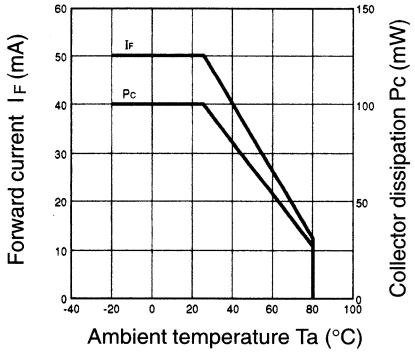
■ Electrical and Optical Characteristics (Ta = 25°C)

Item		Symbol	Value	Condition
Emitter	Forward voltage	V_F	1.2 V typ., 1.5 V max.	I_F = 30 mA
	Reverse current	I_R	0.01 μA typ., 10 μA max.	V_R = 4 V
	Peak emission wavelength	λ_P	940 nm typ.	I_F = 20 mA
Detector	Light current	I_L	200 μA min., 2,000 μA max.	I_F = 20 mA, V_{CE} = 10 V White paper with a reflection ratio of 90%, d = 5 mm (see note)
	Dark current	I_D	2 nA typ., 200 nA max.	V_{CE} = 10 V, 0 ℓx
	Leakage current	I_{LEAK}	2 μA max.	I_F = 20 mA, V_{CE} = 10 V with no reflection
	Collector–Emitter saturated voltage	V_{CE} (sat)	---	---
	Peak spectral sensitivity wavelength	λ_P	850 nm typ.	V_{CE} = 10 V
Rising time		tr	30 μs typ.	V_{CC} = 5 V, R_L = 1 kΩ, I_L = 1 mA
Falling time		tf	30 μs typ.	V_{CC} = 5 V, R_L = 1 kΩ, I_L = 1 mA

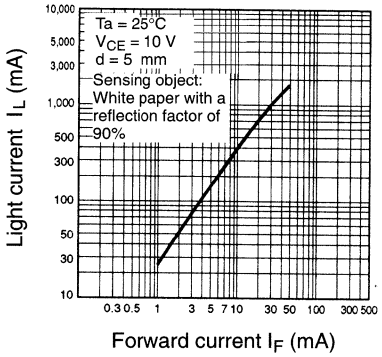
Note: The letter "d" indicates the distance between the top surface of the sensor and the sensing object.

Engineering Data

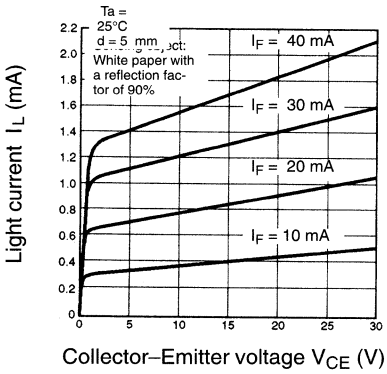
Forward Current vs. Collector Dissipation Temperature Rating



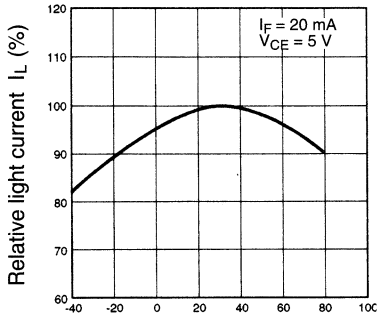
Light Current vs. Forward Current Characteristics (Typical)



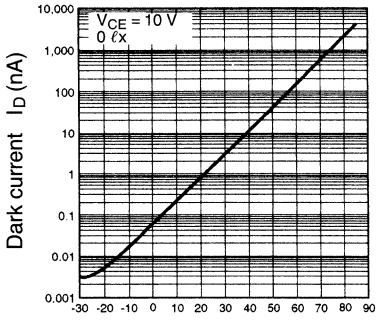
Light Current vs. Collector–Emitter Voltage Characteristics (Typical)



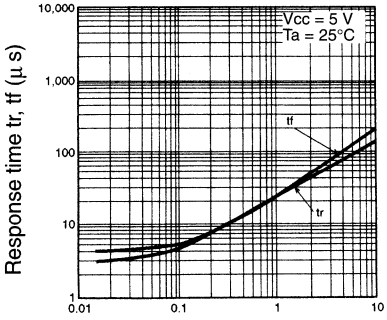
Relative Light Current vs. Ambient Temperature Characteristics (Typical)



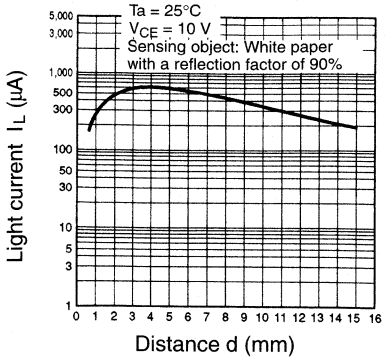
Dark Current vs. Ambient Temperature Characteristics (Typical)



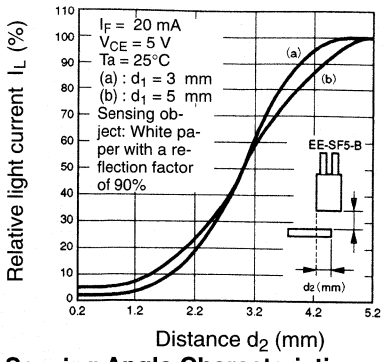
Response Time vs. Load Resistance Characteristics (Typical)



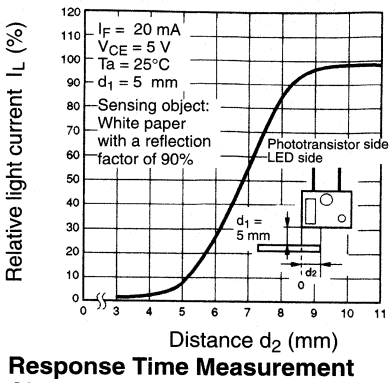
Sensing Distance Characteristics (Typical)



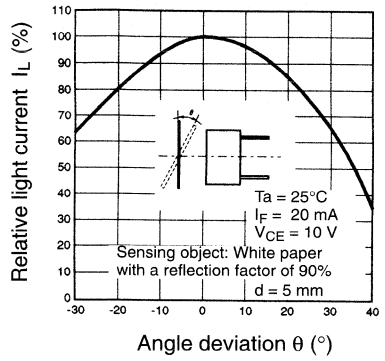
Sensing Position Characteristics (Typical)



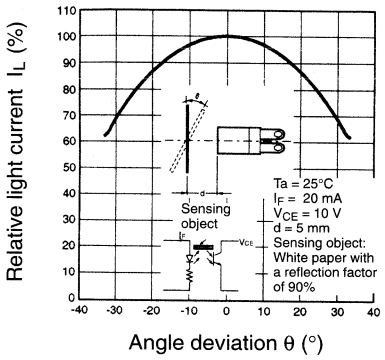
Sensing Position Characteristics (Typical)



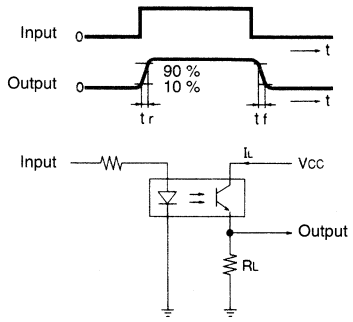
Sensing Angle Characteristics (Typical)



Sensing Angle Characteristics (Typical)



Response Time Measurement Circuit



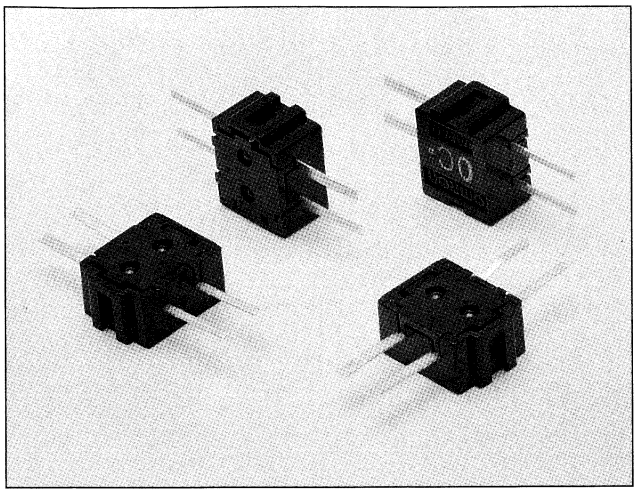
OMRON

Opto–Switch

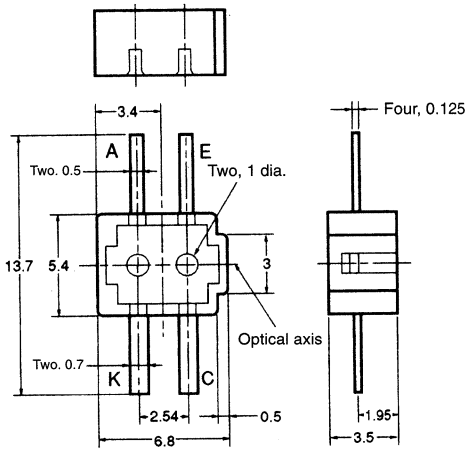
EE–SY201

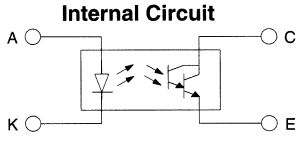
Reflective

- Photo–Darlington output.
- Sensing distance 4mm.
- The LED requires a forward current of only 5 mA.
- Red LED light source.
- Ideal for driving CMOS IC.
- Ideal for mounting directly to PCB tracking.



Dimensions





Terminal No.	Name
A	Anode
K	Cathode
C	Collector
E	Emitter

Unless otherwise specified, the tolerances are as shown below.

Dimensions	Tolerance
3 mm max.	±0.3
3 < mm ≤ 6	±0.375
6 < mm ≤ 10	±0.45
10 < mm ≤ 18	±0.55
18 < mm ≤ 30	±0.65

Specifications

■ Absolute Maximum Ratings (Ta = 25°C)

Item		Symbol	Rated value
Emitter	Forward current	I_F	15 mA (see note)
	Pulse forward current	I_{FP}	---
	Reverse voltage	V_R	4 V
Detector	Collector–Emitter voltage	V_{CEO}	24 V
	Emitter–Collector voltage	V_{ECO}	---
	Collector current	I_C	20 mA
	Collector dissipation	P_C	50 mW (see note)
Ambient temperature	Operating	Topr	–20°C to 60°C
	Storage	Tstg	–20°C to 80°C
	Soldering	Tsol	260°C

Note: Refer to the temperature rating chart if the ambient temperature exceeds 25°C.

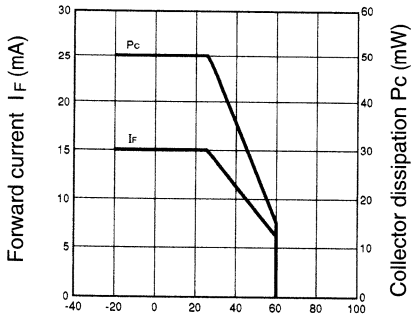
■ Electrical and Optical Characteristics (Ta = 25°C)

Item		Symbol	Value	Condition
Emitter	Forward voltage	V_F	2.0 V typ., 2.6 V max.	I_F = 15 mA
	Reverse current	I_R	0.01 μA typ., 5 μA max.	V_R = 4 V
	Peak emission wavelength	λ_P	700 nm typ.	I_F = 10 mA
Detector	Light current	I_L	0.3 μA min., 8.0 μA max.	I_F = 5 mA, V_{CE} = 10 V White paper with a reflection ratio of 90%, d = 4 mm (see note)
	Dark current	I_D	2 nA typ., 250 nA max.	V_{CE} = 10 V, 0 ℓx
	Leakage current	I_{LEAK}	---	---
	Collector–Emitter saturated voltage	V_{CE} (sat)	---	---
	Peak spectral sensitivity wavelength	λ_P	750 nm typ.	V_{CE} = 10 V
Rising time		tr	180 μs typ.	V_{CC} = 5 V, R_L = 100 Ω, I_L = 1 mA
Falling time		tf	60 μs typ.	V_{CC} = 5 V, R_L = 100 Ω, I_L = 1 mA

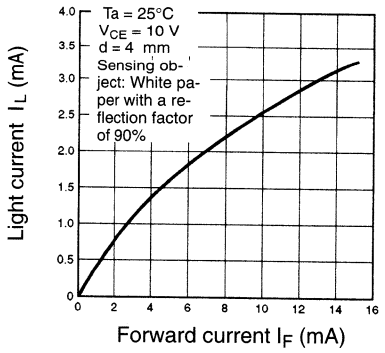
Note: The letter "d" indicates the distance between the top surface of the sensor and the sensing object.

Engineering Data

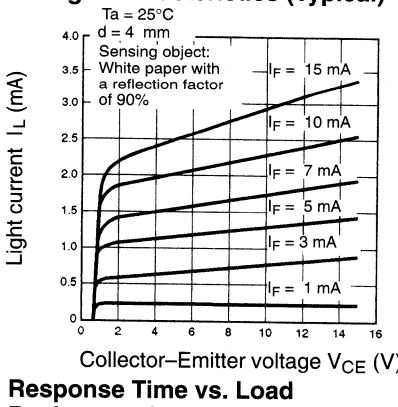
Forward Current vs. Collector Dissipation Temperature Rating



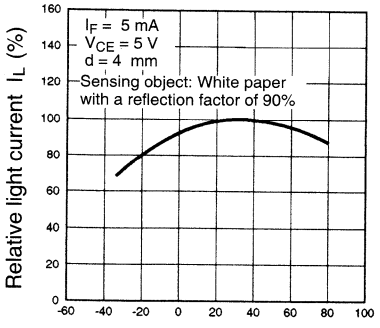
Light Current vs. Forward Current Characteristics (Typical)



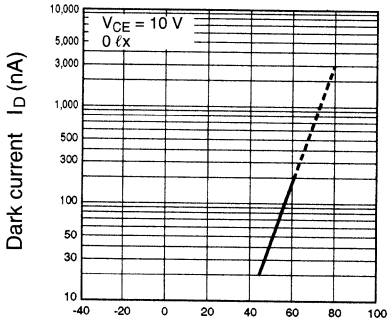
Light Current vs. Collector–Emitter Voltage Characteristics (Typical)



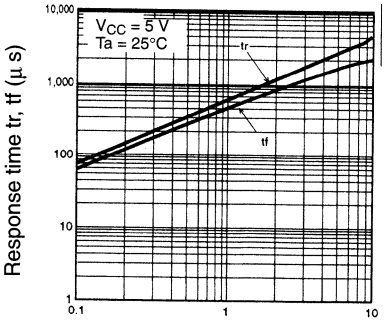
Relative Light Current vs. Ambient Temperature Characteristics (Typical)



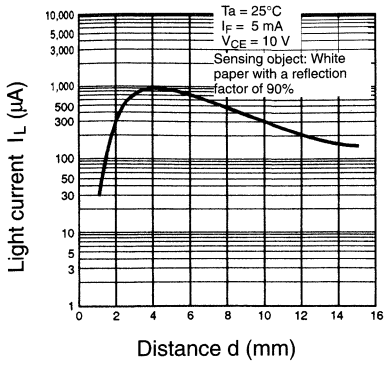
Dark Current vs. Ambient Temperature Characteristics (Typical)



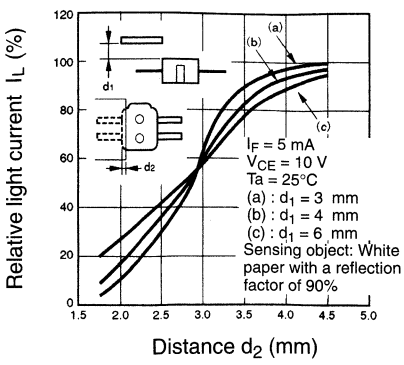
Response Time vs. Load Resistance Characteristics (Typical)



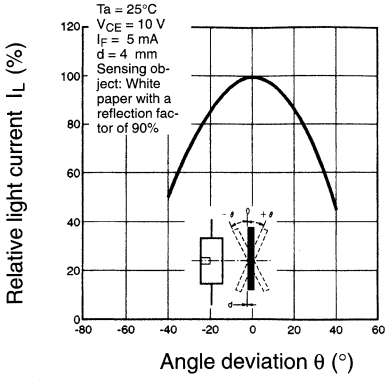
Sensing Distance Characteristics (Typical)



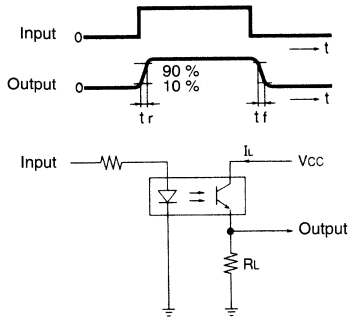
Sensing Position Characteristics (Typical)



Sensing Angle Characteristics (Typical)



Response Time Measurement Circuit



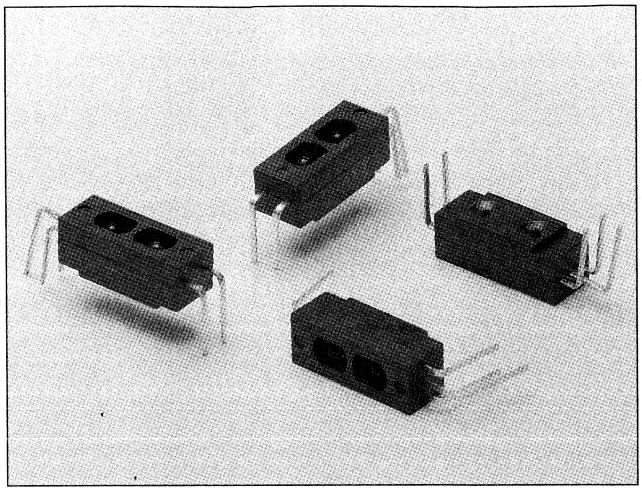
OMRON

Opto–Switch

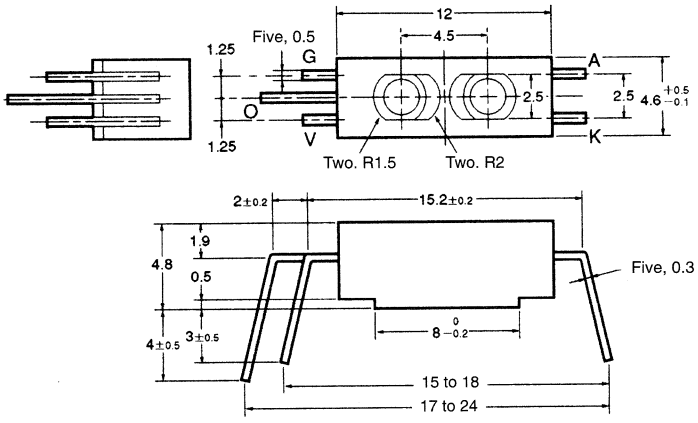
EE–SY310 / EE–SY410

Reflective

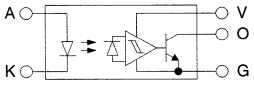
- Incorporates a photo–IC chip with a built-in detector element and amplifier.
- Detector element has built-in temperature compensation circuit.
- Sensing distance 5mm.
- A wide supply voltage range: 4.5 to 16 VDC
- Directly connects to C-MOS and TTL.
- Dark ON model (EE-SY310)
- Light ON model (EE-SY410)



Dimensions



Internal Circuit



Terminal No.	Name
A	Anode
K	Cathode
V	Supply voltage (Vcc)
O	Output (OUT)
G	Ground (GND)

Unless otherwise specified, the tolerances are as shown below.

Dimensions	Tolerance
3 mm max.	±0.2
3 < mm ≤ 6	±0.24
6 < mm ≤ 10	±0.29
10 < mm ≤ 18	±0.35
18 < mm ≤ 30	±0.42

Specifications

■ Absolute Maximum Ratings (Ta = 25°C)

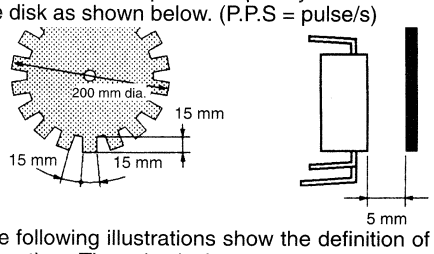
Item		Symbol	Rated value
Emitter	Forward current	I_F	50 mA (see note 1)
	Reverse voltage	V_R	4 V
	Pulse forward current	I_{FP}	1 A (see note 2)
Detector	Supply voltage	V_{CC}	16 V
	Output voltage	V_{OUT}	28 V
	Output current	I_{OUT}	16 mA
	Permissible output dissipation	P_{OUT}	250 mW (see note 1)
Ambient temperature	Operating	Topr	–40°C to 75°C
	Storage	Tstg	–40°C to 85°C
	Soldering	Tsol	260°C

Note: 1. Refer to the temperature rating chart if the ambient temperature exceeds 25°C.
2. The pulse width is 10 μs maximum with a frequency of 100 Hz.

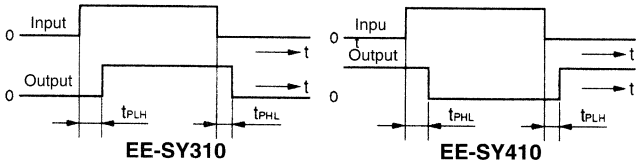
■ Electrical and Optical Characteristics (Ta = 25°C)

Item		Symbol	Value	Condition
Emitter	Forward voltage	V_F	1.2 V typ., 1.5 V max.	I_F = 20 mA
	Reverse current	I_R	0.01 μA typ., 10 μA max.	V_R = 4 V
	Peak emission wavelength	λ_P	920 nm typ.	I_F = 20 mA
Detector	Low-level output voltage	V_{OL}	0.12 V typ., 0.4 V max.	Vcc = 4.5 to 16 V, I_{OL} = 16 mA, Dark ON (EE-SY310), Light ON (EE-SY410) (see notes 1 and 2)
	High-level output voltage	V_{OH}	15 V min.	Vcc = 16 V, R_L = 1 kΩ, Light ON (EE-SY310), Dark ON (EE-SY410) (see notes 1 and 2)
	Current consumption	I_{CC}	3.2 mA typ., 10 mA max.	Vcc = 16 V
	Peak spectral sensitivity wavelength	λ_P	870 nm typ.	V_{CC} = 4.5 to 16 V
LED current when output is OFF		I_{FT}	6 mA typ., 15 mA max.	V_{CC} = 4.5 to 16 V
LED current when output is ON				
Hysteresis		ΔH	17% typ.	V_{CC} = 4.5 to 16 V
Response frequency		f	50 P.P.S min.	V_{CC} = 4.5 to 16 V, I_F = 15 mA, I_{OL} = 16 mA
Response delay time		t_{PLH} (t_{PHL})	3 μs typ.	V_{CC} = 4.5 to 16 V, I_F = 15 mA, I_{OL} = 16 mA
Response delay time		t_{PHL} (t_{PLH})	20 μs typ.	V_{CC} = 4.5 to 16 V, I_F = 15 mA, I_{OL} = 16 mA

Note:
1. The incident of the photo IC denotes the condition whereby the light reflected by white paper with a reflection factor of 90% at a sensing distance of 5 mm is received by the photo IC when the forward current (I_F) of the LED is 20 mA.
2. Sensing object: White paper with a reflection factor of 90% at a sensing distance of 5 mm.
3. Hysteresis denotes the difference in forward LED current value, expressed in percentage, calculated from the respective forward LED currents when the photo IC is turned from ON to OFF and when the photo IC is turned from OFF to ON.
4. The value of the response frequency is measured by rotating the disk as shown below. (P.P.S = pulse/s)



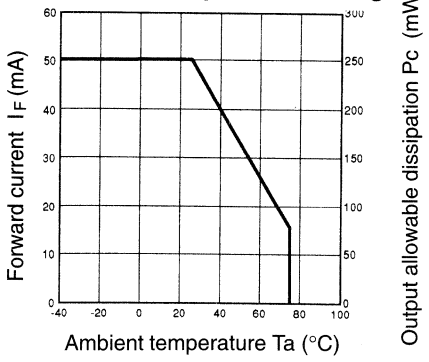
5. The following illustrations show the definition of response delay time. The value in the parentheses applies to the EE-SY410.



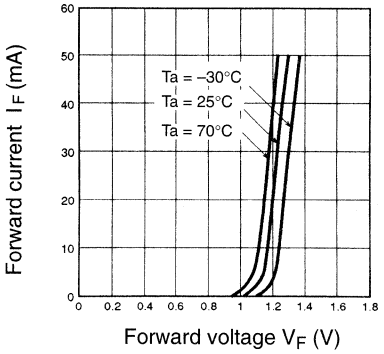
Engineering Data

Note: The values in the parentheses apply to the EE-SY410.

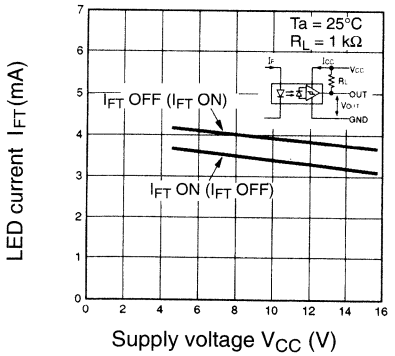
Forward Current vs. Collector Dissipation Temperature Rating



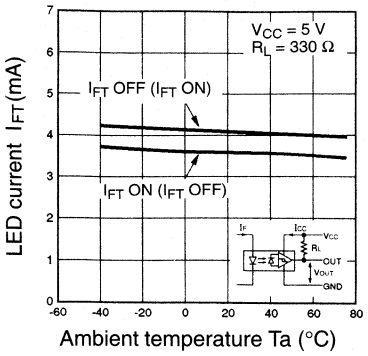
Forward Current vs. Forward Voltage Characteristics (Typical)



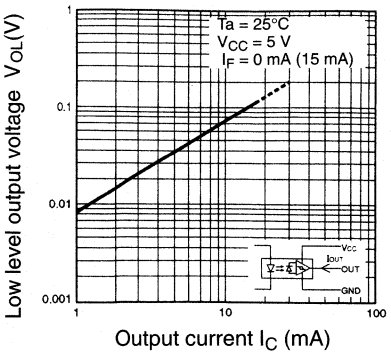
LED Current vs. Supply Voltage (Typical)



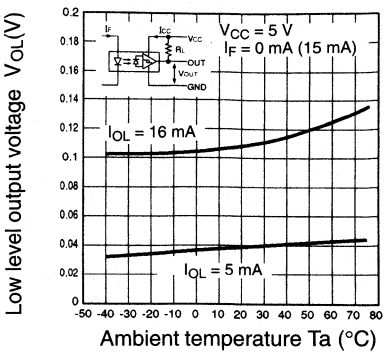
LED Current vs. Ambient Temperature Characteristics (Typical)



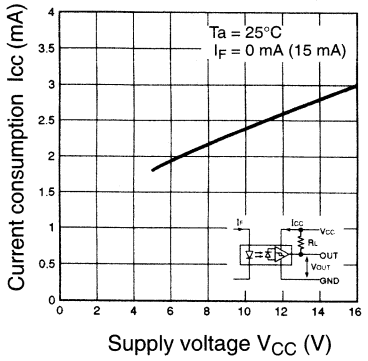
Low-level Output Voltage vs. Output Current (Typical)



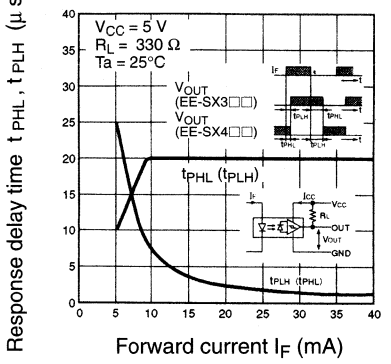
Low-level Output Voltage vs. Ambient Temperature Characteristics (Typical)



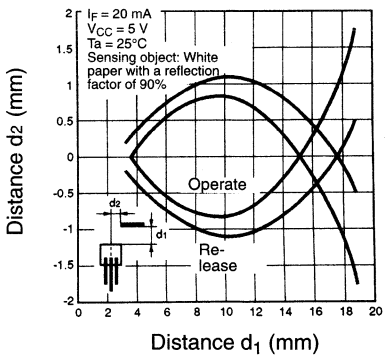
Current Consumption vs. Supply Voltage (Typical)



Response Delay Time vs. Forward Current (Typical)



Sensing Position Characteristics (Typical)



Opto-Switches

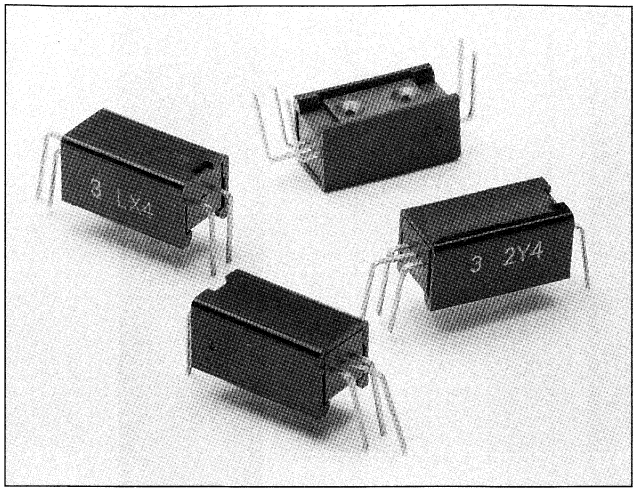
OMRON

Opto–Switch

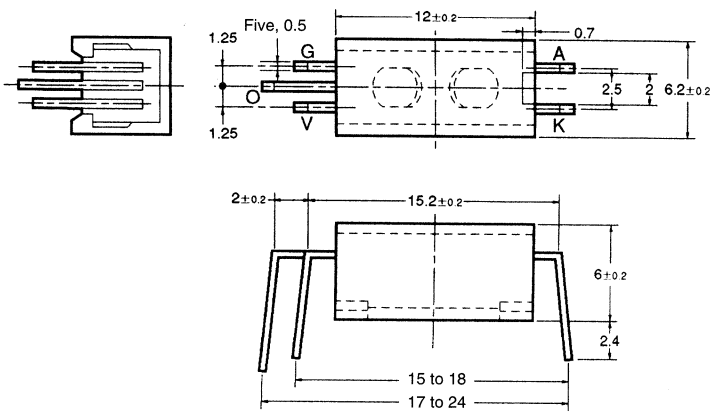
EE–SY313 / EE–SY413

Reflective

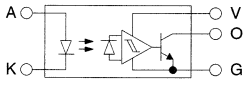
- Incorporates photo–IC chip with a built-in detector element and amplifier.
- Incorporates a detector element with built-in temperature compensation circuit.
- Sensing distance 4.4mm.
- Incorporates combined dust cover and filter to reduce effect of external visible light.
- A wide supply voltage range: 4.5 to 16 VDC
- Directly connects to C-MOS and TTL.
- Dark ON model (EE-SY313)
- Light ON model (EE-SY413)



Dimensions



Internal Circuit



Terminal No.	Name
A	Anode
K	Cathode
V	Supply voltage (Vcc)
O	Output (OUT)
G	Ground (GND)

Unless otherwise specified, the tolerances are as shown below.

Dimensions	Tolerance
3 mm max.	±0.3
3 < mm ≤ 6	±0.375
6 < mm ≤ 10	±0.45
10 < mm ≤ 18	±0.55
18 < mm ≤ 30	±0.65

Specifications

■ Absolute Maximum Ratings (Ta = 25°C)

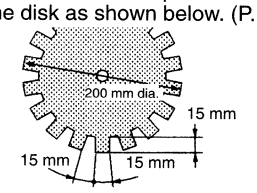
Item		Symbol	Rated value
Emitter	**Forward current**	I_F	50 mA (see note 1)
	Reverse voltage	V_R	4 V
	Pulse forward current	I_{FP}	1 A (see note 2)
Detector	**Supply voltage**	V_{CC}	16 V
	Output voltage	V_{OUT}	28 V
	Output current	I_{OUT}	16 mA
	Permissible output dissipation	P_{OUT}	250 mW (see note 1)
Ambient temperature	**Operating**	Topr	–40°C to 65°C
	Storage	Tstg	–40°C to 85°C
	Soldering	Tsol	260°C

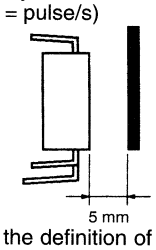
Note: 1. Refer to the temperature rating chart if the ambient temperature exceeds 25°C.
2. The pulse width is 10 μs maximum with a frequency of 100 Hz.

■ Electrical and Optical Characteristics (Ta = 25°C)

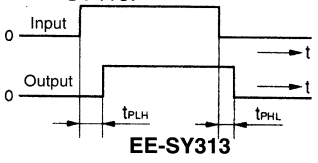
Item		Symbol	Value	Condition
Emitter	Forward voltage	V_F	1.2 V typ., 1.5 V max.	I_F = 20 mA
	Reverse current	I_R	0.01 μA typ., 10 μA max.	V_R = 4 V
	Peak emission wavelength	λ_P	920 nm typ.	I_F = 20 mA
Detector	Low-level output voltage	V_{OL}	0.12 V typ., 0.4 V max.	Vcc = 4.5 to 16 V, I_{OL} = 16 mA,Dark ON (EE-SY313), Light ON (EE-SY413) (see notes 1 and 2)
	High-level output voltage	V_{OH}	15 V min.	Vcc = 16 V, R_L = 1 kΩ, Light ON (EE-SY313), Dark ON (EE-SY413) (see notes 1 and 2)
	Current consumption	I_{CC}	3.2 mA typ., 10 mA max.	Vcc = 16 V
	Peak spectral sensitivity wavelength	λ_P	870 nm typ.	V_{CC} = 4.5 to 16 V
LED current when output is OFF		I_{FT}	10 mA typ., 20 mA max.	V_{CC} = 4.5 to 16 V
LED current when output is ON				
Hysteresis		ΔH	17% typ.	V_{CC} = 4.5 to 16 V
Response frequency		f	50 P.P.S min.	V_{CC} = 4.5 to 16 V, I_F = 20 mA, I_{OL} = 16 mA
Response delay time		t_{PLH} (t_{PHL})	3 μs typ.	V_{CC} = 4.5 to 16 V, I_F = 20 mA, I_{OL} = 16 mA
Response delay time		t_{PHL} (t_{PLH})	20 μs typ.	V_{CC} = 4.5 to 16 V, I_F = 20 mA, I_{OL} = 16 mA

Note:
1. The incident of the photo IC denotes the condition whereby the light reflected by white paper with a reflection factor of 90% at a sensing distance of 5 mm is received by the photo IC when the forward current (I_F) of the LED is 20 mA.
2. Sensing object: White paper with a reflection factor of 90% at a sensing distance of 5 mm.
3. Hysteresis denotes the difference in forward LED current value, expressed in percentage, calculated from the respective forward LED currents when the photo IC is turned from ON to OFF and when the photo IC is turned from OFF to ON.
4. The value of the response frequency is measured by rotating the disk as shown below. (P.P.S = pulse/s)

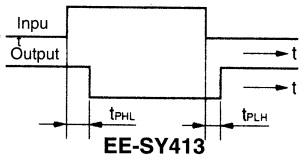




5. The following illustrations show the definition of response delay time. The value in the parentheses applies to the EE-SY413.



EE-SY313

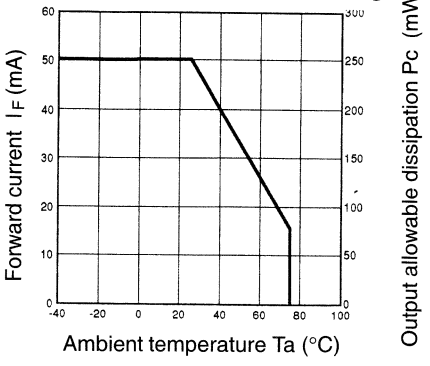


EE-SY413

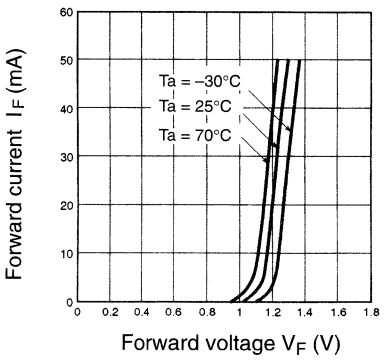
Engineering Data

Note: The values in the parentheses apply to the EE-SY413.

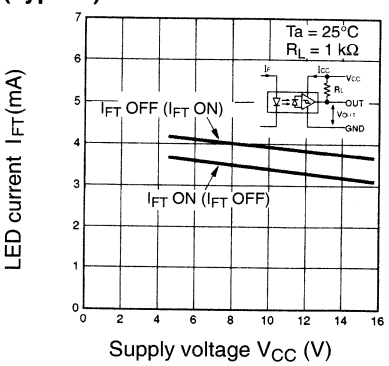
Forward Current vs. Collector Dissipation Temperature Rating



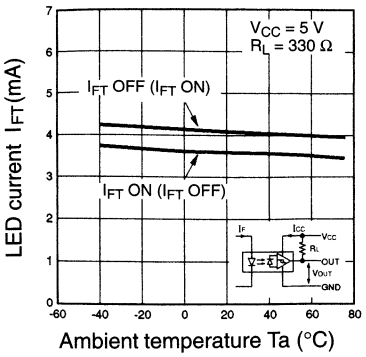
Forward Current vs. Forward Voltage Characteristics (Typical)



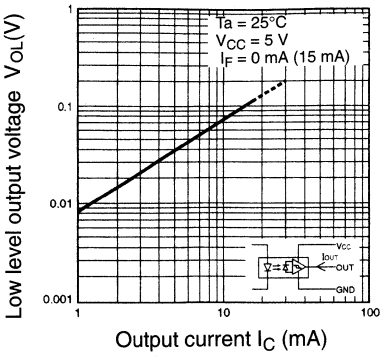
LED Current vs. Supply Voltage (Typical)



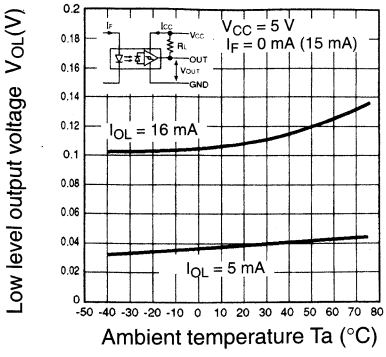
LED Current vs. Ambient Temperature Characteristics (Typical)



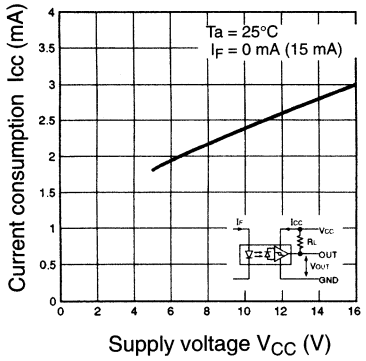
Low-level Output Voltage vs. Output Current (Typical)



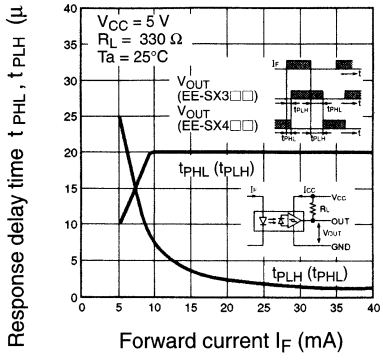
Low-level Output Voltage vs. Ambient Temperature Characteristics (Typical)



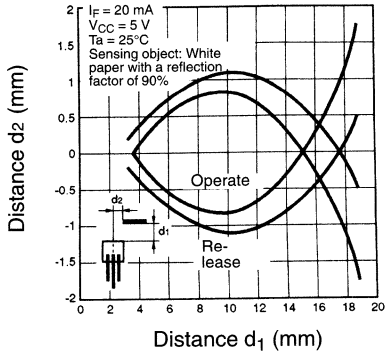
Current Consumption vs. Supply Voltage (Typical)



Response Delay Time vs. Forward Current (Typical)



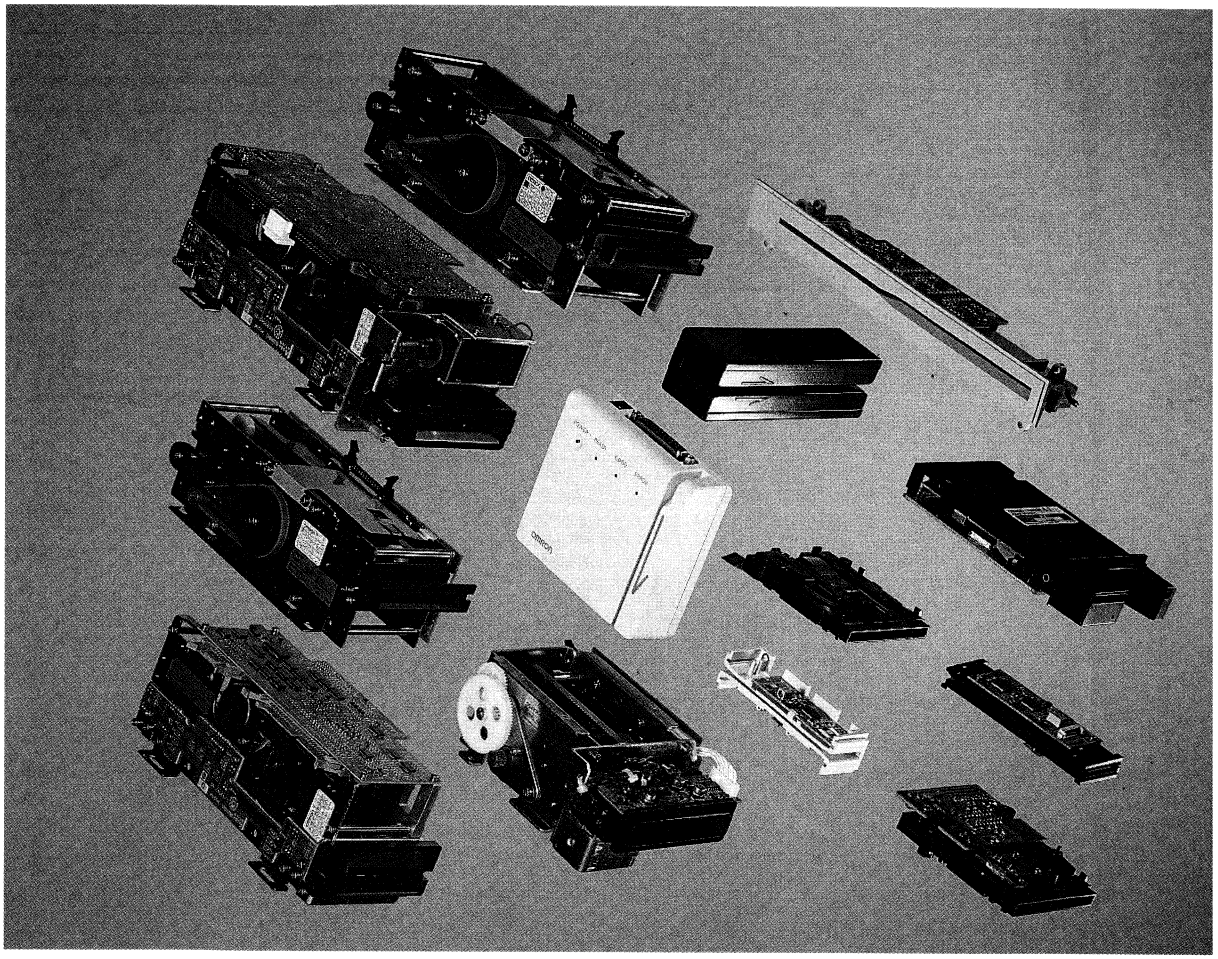
Sensing Position Characteristics (Typical)



SECTION 7

OMRON

Card Readers



Product	3S4YR–HSR	3S4YR–HNR	3S4YR–HZR	3S4YR–HMR	3S4YR–HKS	3S4YR–SBR	3S4YR–SCR
Non ISO track	–	–	–	–	–	–	–
Smart card ISO 7816	–	–	–	–	–	–	SCR OJ
Magnetic stripe read/write	read	read	read	read	read	read	–
Card position recognition	CLS signal	CLS signal	CLS signal	CLS signal	CLS signal	CLS signal	–
Power supply	5 VDC	5 VDC	5 VDC	5 VDC	12 VDC or 5VDC	5 VDC	–
I/O level	TTL	TTL	TTL	TTL	RS232	TTL	TTL
Card feed speed	100–1500 mm/sec.	100–1500 mm/sec.	100–1000 mm/sec.	100–1000 mm/sec.	100–1000 mm/sec.	100–1000 mm/sec.	–
Dimensions (mm)	L 100 H 32.5 W 32	L 90 H 26.5 W 28	L 78 H 25.2 W 23.3	L 214.4 H 36.1 W 34.5	L 100 H 32 W 110	L 87 H 21.5 W 60	L 78 H 14 W 60
Operating temperature (humidity)	–10°C to +55°C (10–90%)	–10°C to +55°C (10–90%)	–10°C to +55°C (10–90%)	–10°C to +55°C (10–90%)	0°C to +50°C (30–85%)	–10°C to +55°C (10–90%)	–25°C to +75°C (10–90%)
Interface RS232 RS485	option	option	option	option	RS232 inclusive	option	option
Recording method	–	–	–	–	–	–	–
Options	–	–	–	–	–	microswitch	microswitch
Page	448	450	452	454	456	458	460

Product	3S4YR–SFR–J	3S4YR–SFR–N	3S4YR–MKW–PC	3S4YR–MMW	3S4YR–MZW	3S4YR–MCR–N	3S4YR–MKF
Non ISO track	–	–	–	–	centre stripe	–	–
Smart card ISO 7816	SFRxJ	–	option	–	–	–	option
Magnetic stripe read/write	read/write (chip only)	read	read/write (HiCo option)	read/write	read/write	read motorised	read/write
Card position recognition	3 micro-switches	3 micro-switches	opto–sensor	opto–sensor	opto–sensor	3 micro-switches	opto–sensors
Power supply	12 VDC + 5 VDC	12 VDC + 5 VDC	24 VDC + 5 VDC	24 VDC	24 VDC	24 VDC	24 VDC
I/O level	TTL	TTL	TTL	TTL	TTL	TTL	RS232
Card feed speed	100–1000 mm/sec.	100–1000 mm/sec.	200 mm/sec.	300 mm/sec.	300 mm/sec.	300 mm/sec.	200 mm/sec.
Dimensions (mm)	L 120 H 19 W 60	L 120 H 19 W 60	L 222 H 98 W 92	L 211 H 90 W 65	L 211 H 90 W 65	L 100 H 62 W 90	L 222.8 H 89.8 W 105
Operating temperature (humidity)	–10°C to +55°C (10–95%)	–5°C to +55°C (10–95%)	–5°C to +55°C (10–90%)	0°C to +45°C (30–85%)	–0°C to +60°C (30–85%)	–5°C to +55°C (10–90%)	–5°C to +55°C (30–85%)
Interface RS232 RS485	option	option	option	–	–	option	RS232 inclusive
Recording method	–	–	ISO standard	ISO or adjustable F2F	ISO or adjustable F2F	–	ISO standard
Options	prepared for MM sensor	prepared for MM sensor	shutter, smart card, water mark, display, keypad	HiCo/LoCo versions	HiCo/LoCo versions	shutter	shutter, smart card
Page	462	462	464	466	468	470	472

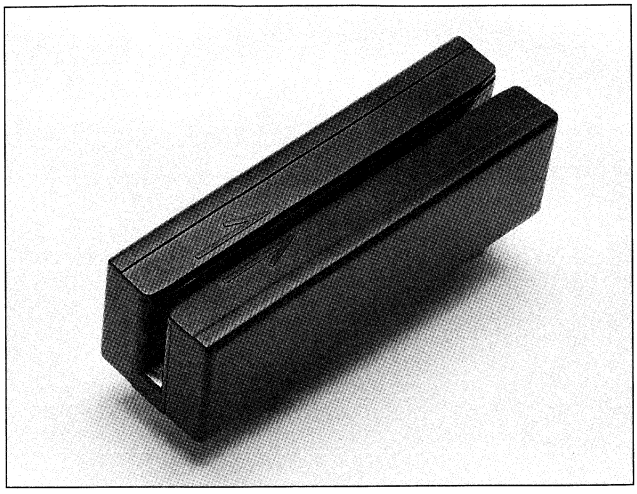
OMRON

Manual Swipe Magnetic Card Reader

3S4YR–HSR

Economical, Manually–Operated Card Swipe Reader

- Compact, rugged design.
- Wide operating temperature range.
- Stable operation with card swipe speed within a range of 10 to 150 cm/second.
- Choose enclosed or open housing card readers to match application.
- Single and double track readers available.
- TTL interface or RS232 interface.
- Screw–on cover.



Ordering Information

Track reading	Enclosure	Part Number
Track 1	Enclosed	3S4YR–HSR3
Track 2	Enclosed	3S4YR–HSR4
Track 3	Enclosed	3S4YR–HSR5
Track 1+2	Enclosed	3S4YR–HSR6
Track 2+3	Enclosed	3S4YR–HSR7
Track 2	Enclosed with RS232	HSR4RS232

Specifications

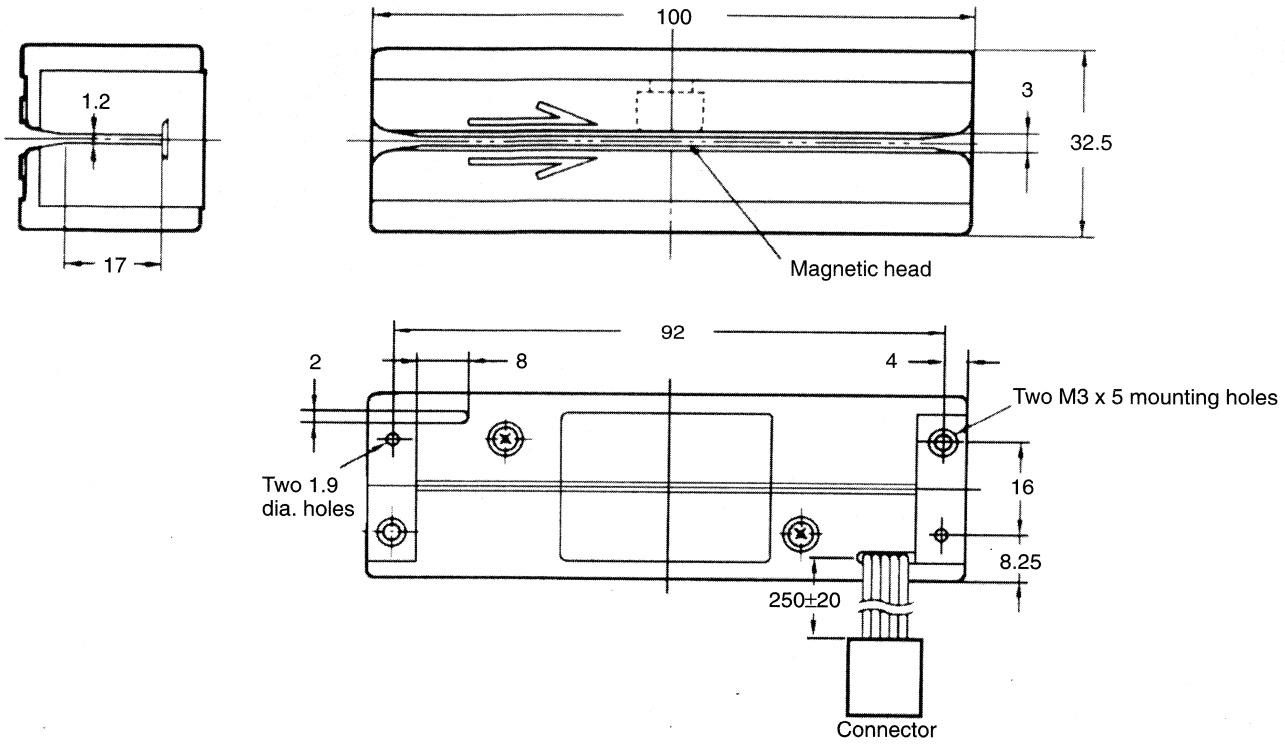
Part number		3S4YR–HSR
Recommended card type		Magnetic card: ISO 7810, 7811/1–5, 7812, 7813
Number of tracks		1 of 2, available in any combination
Recording method		F2F
Recording density		Track 1: 210 BPI Track 2: 75 BPI Track 3: 210 BPI
Memory capacity		Track 1: 7 bit x 79 characters max. Track 2: 5 bit x 40 characters max. Track 3: 5 bit x 107 characters max.
Card feeding speed		10 to 150 cm/second
Service life		Single track: 300,000 passes minimum Double track: 600,000 passes minimum
Operating power supply		5 VDC ± 10%
Current consumption		Single track: 25 mA Double track: 50 mA
Mounting location		Anywhere not directly subject to water or sunlight
Ambient temperature	Operation	–10°C to 55°C without condensation
	Storage	–30°C to 70°C
Ambient humidity	Operation	10% to 95% RH without condensation
	Storage	10% to 95% RH
Vibration		10 to 55 Hz, 2mm double amplitude, for 30 minutes in each of X, Y and Z directions
Shock		300m/sec^2 (30 G) in each of X,Y and Z directions
Dimensions	With cover	100 L x 32.5 W x 32 H mm
	Without cover	100 L x 27 W x 29.5 H mm
Weight		Approx. 90 g enclosed unit, 60 g open unit

Application Examples

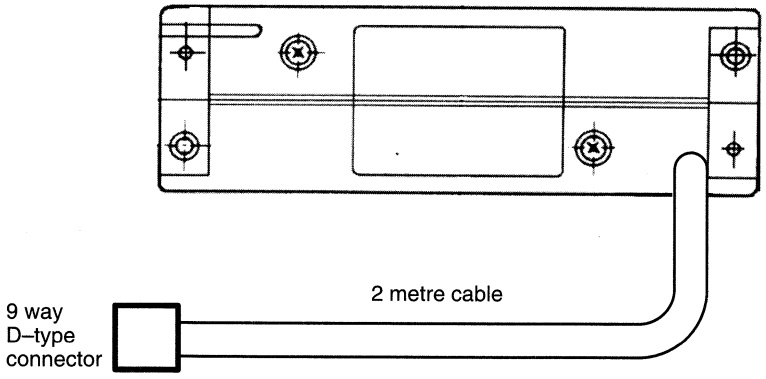
- Remote terminals for computers
- Credit card readers
- ID card checkers
- Electronic locks
- Automatic gate machines
- Point–of–sale (PoS) systems

Dimensions

3S4YR–HSR



HSR4RS232



Note: Unless otherwise specified, tolerance is ± 0.3

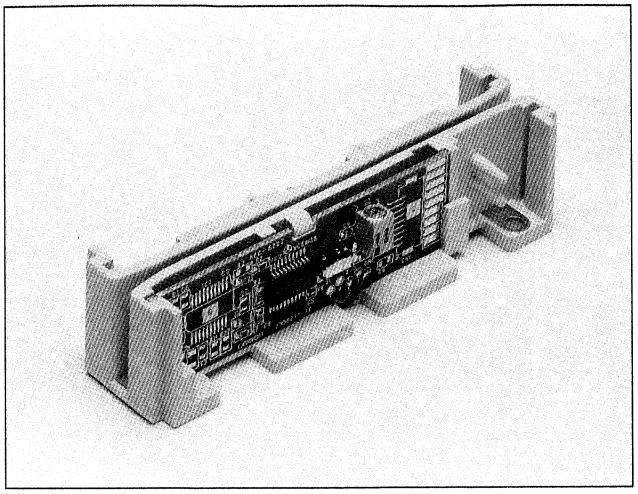
OMRON

Manual Swipe Magnetic Card Reader

3S4YR–HNR

Low Power, Compact, Manually Operated Card Reader

- Low power through use of CMOS circuitry.
- Lightweight and compact size.
- Stable operation with card swipe speed within a range of 10 to 150 cm/second.
- Single, double and triple track configurations.
- Solder pad or connector on PCB for customizing cable harness.
- TTL interface or RS232 interface.
- Snap–on cover.



Ordering Information

Track reading	Enclosure	I/O	Part Number
Track 1	Enclosed	Solder pad	3S4YR–HNR3
Track 2	Enclosed	Solder pad	3S4YR–HNR4
Track 2 / BPI switchable	Enclosed	Solder pad	3S4YR–HNR4U
Track 3	Enclosed	Solder pad	3S4YR–HNR5
Tracks 1 and 2	Enclosed	Solder pad	3S4YR–HNR6
Tracks 2 and 3	Enclosed	Solder pad	3S4YR–HNR7
Tracks 1, 2 and 3	Enclosed	Connector	3S4YR–HNR1N
Track 2	Enclosed	With RS232	HNR4–RS232
Tracks 1 and 2	Enclosed	With RS232	HNR6–RS232
Power supply	–	–	HNR–ADAPTOR

Note: For other track configurations, consult factory.

Specifications

Part number	**3S4YR–HNR**
Recommended card type	Magnetic card: ISO 7810, 7811/1–5, 7812, 7813
Number of tracks	1, 2 or 3; available in many combinations. See "Ordering Information"
Recording method	F2F
Recording density	Track 1: 210 BPI Track 2: 75 BPI Track 3: 210 BPI
Memory capacity	Track 1: 7 bit x 79 characters max. Track 2: 5 bit x 40 characters max. Track 3: 5 bit x 107 characters max.
Card feeding speed	10 to 150 cm/second
Service life of magnetic head	300,000 passes minimum
Operating power supply	+5 VDC ±10%

Part number	**3S4YR–HNR**
Current consumption	Single track: 5.0 mA max. Double track: 10.0 mA max. Triple track: 15.0 mA max.
Mounting location	Anywhere not directly subject to water or sunlight

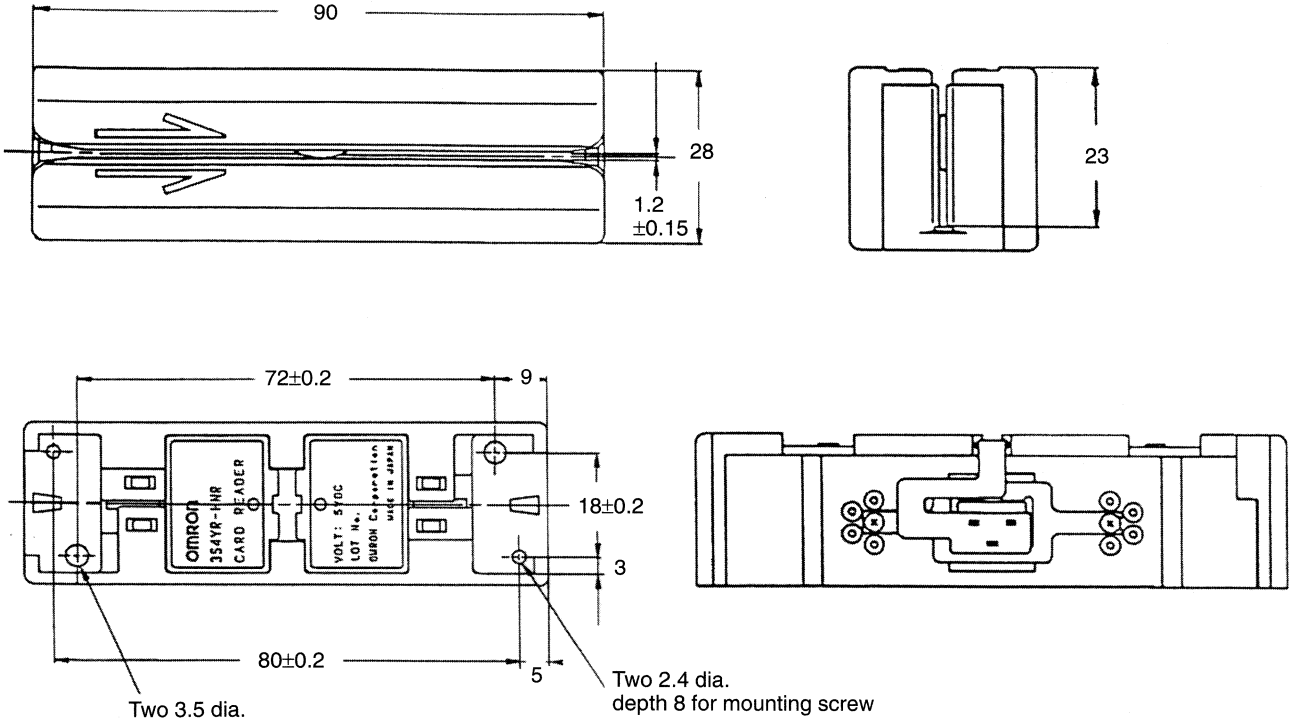
Ambient temperature	**Operation**	–10° to 55°C (14° to 131°F)
	Storage	–30° to 70°C (–22° to 158°F)
Ambient humidity	**Operation**	10% to 95% RH without condensation
	Storage	10% to 95% RH
Vibration		10 to 55 Hz, 2 mm double amplitude, for 30 minutes in X, Y and Z directions
Shock		300 m/sec^2 (30 G) in each of X, Y and Z directions
Dimensions	**With cover**	90 L x 28 W x 26.5 H mm
	Without cover	90 L x 24 W x 24 H mm
Weight		Approx. 40 g (1.42 oz.) enclosed; 25 g (0.89 oz.) no cover

Application Examples

- Credit card readers
- ID card checkers
- Electronic locks/Access control
- Automatic gate machines
- Point-of-sale systems (PoS)

Dimensions

3S4YR-HNR



Note: Unless otherwise specified, tolerance is ± 0.3

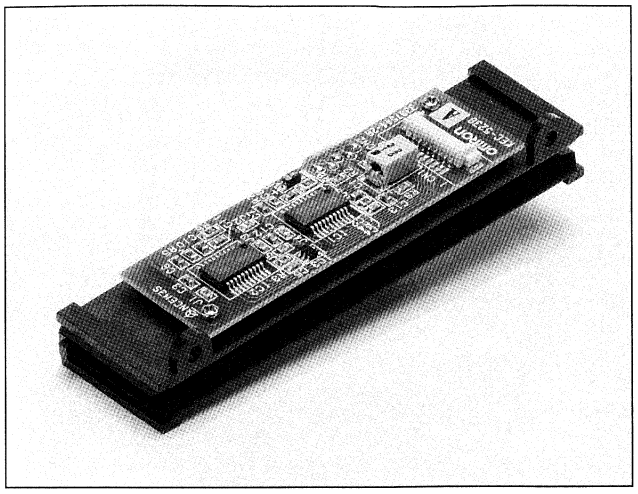
OMRON

Keyboard Swipe Card Reader

3S4YR–HZR

Reliably Handles Read/Write Function for Magnetic Cards

- Keyboard mountable swipe reader.
- Lightweight and compact size.
- Double track configuration for EFTPoS.
- TTL interface.



Ordering Information

Track reading	Enclosure	I/O	Part Number
Tracks 1 and 2	No cover	Connector	3S4YR–HZR601
Tracks 2 and 3	No cover	Connector	3S4YR–HZR701

Specifications

Part number		3S4YR–HZR
Recommended card type		Magnetic card: ISO 7810, 7811/1–5, 7812, 7813
Number of tracks		2, available in many combinations. See "Ordering Information"
Recording method		F2F
Recording density		Track 1: 210 BPI Track 2: 75 BPI Track 3: 210 BPI
Memory capacity		Track 1: 7 bit x 79 characters max. Track 2: 5 bit x 40 characters max. Track 3: 5 bit x 107 characters max.
Card feeding speed		10 to 100 cm/second
Service life of magnetic head		300,000 passes min.
Operating power supply		+5 VDC ± 10%
Current consumption		Double track: 10.0 mA max.
Mounting location		Anywhere not directly subject to water or sunlight
Ambient temperature	**Operation**	–10° to 55°C (14° to 131°F)
	Storage	–30° to 70°C (–22° to 158°F)
Ambient humidity	**Operation**	10% to 95% RH without condensation
	Storage	10% to 95% RH
Vibration		10 to 55 Hz, 2 mm double amplitude, for 30 minutes in X, Y and Z directions
Shock		300m/sec^2 (30 G) in each of X,Y and Z directions
Dimensions	**With cover**	n/a
	Without cover	90.2 L x 24 H x 24D mm
Weight		Approx. 26 g

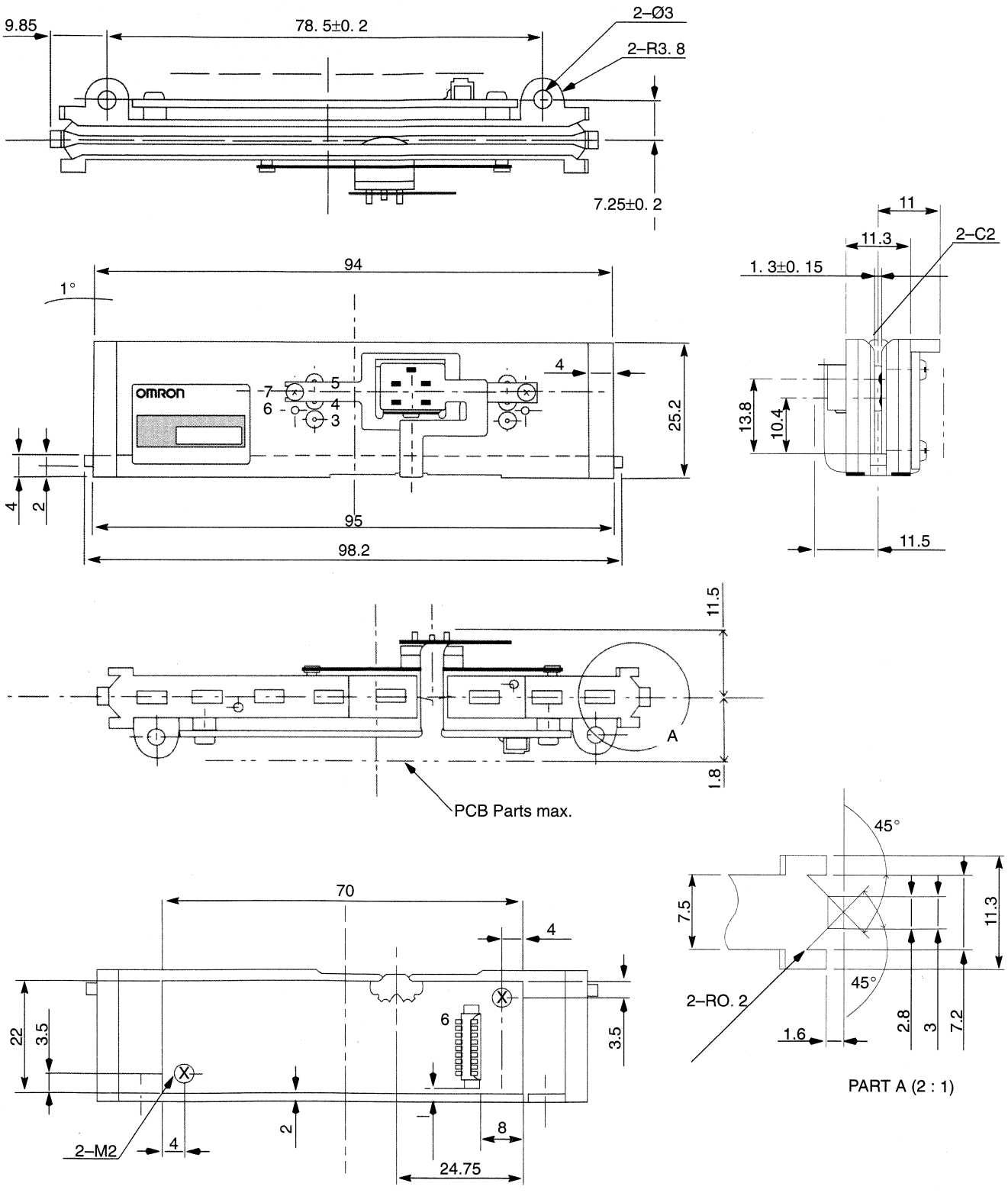
Application Examples

- Card ID/membership systems
- Credit card readers
- Point–of–sale systems (EFTPoS)

Dimensions

3S4YR–HZR

Fig. 1 Outline Dimension Drawing (3S4YR–HZR7–01)



Note: Unless otherwise specified, tolerance is ± 0.3

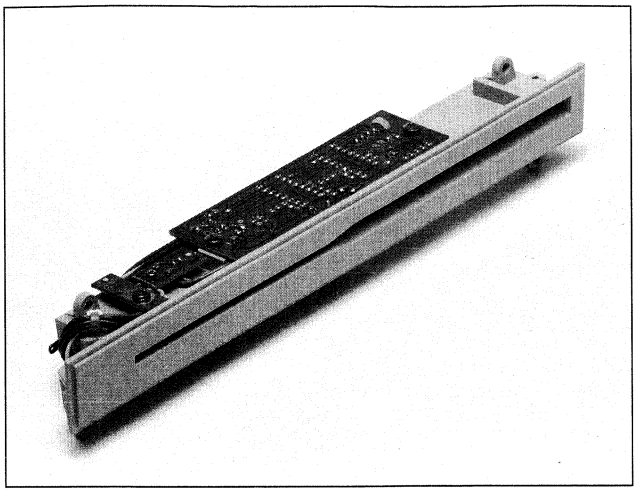
OMRON

Keyboard Swipe Card Reader

3S4YR–HMR

EFTPoS Keyboard Swipe Card Reader

- Long card guide.
- Track 2 and 3 designed for EFTPoS.
- Keyboard mounting holes.
- Card can remain in reader during EFTPoS transaction.
- TTL Interface.



Ordering Information

Track reading	Enclosure	Part Number
Tracks 2 and 3	No cover	3S4YR–HMR7N

Specifications

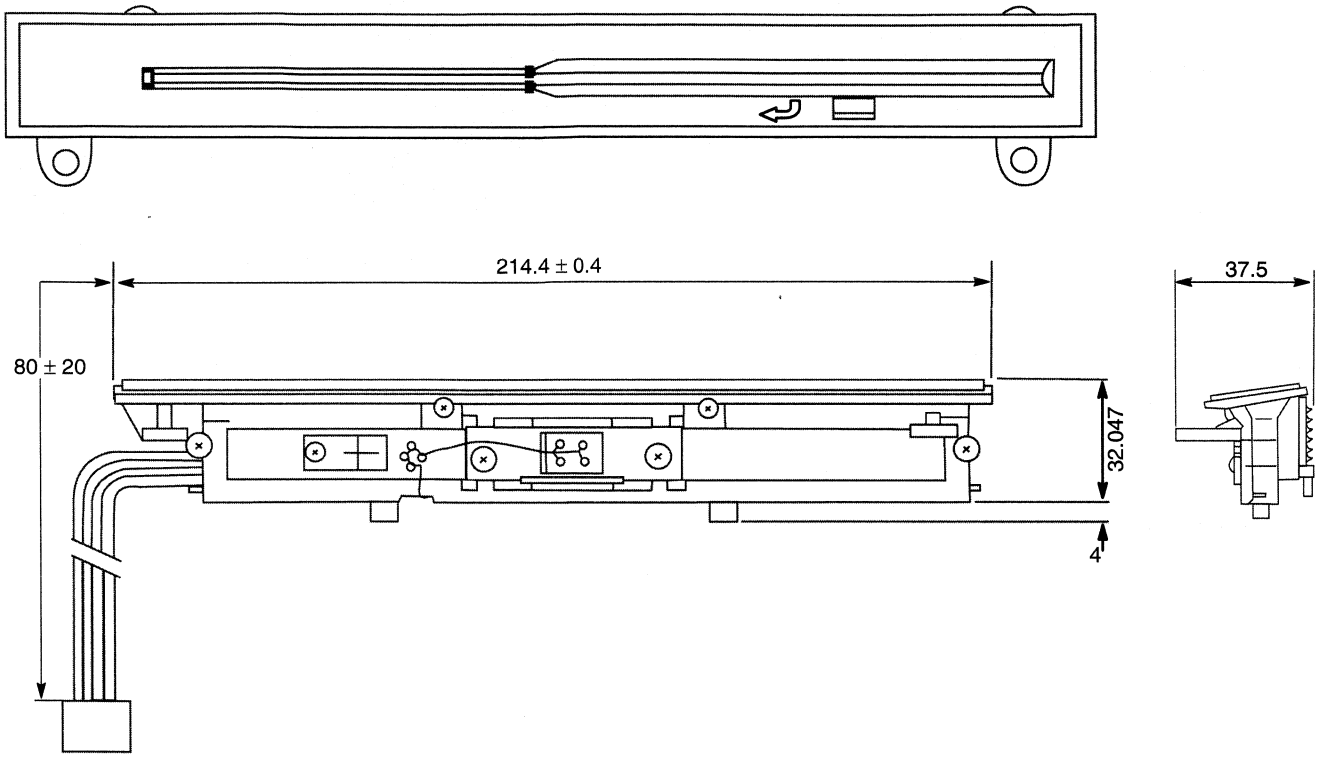
Part number		3S4YR–HMR
Recommended card type		Magnetic card: ISO 7810–7813
Number of tracks		2
Recording method		F2F
Recording density		Track 2: 75 BPI Track 3: 210 BPI
Memory capacity		Track 2: 5 bit x 40 characters max. Track 3: 5 bit x 107 characters max.
Card feeding speed		100 to 1,000 mm/second
Service life of magnetic head		600,000 passes min.
Operating power supply		+5 VDC ± 10%
Current consumption		60 mA max.
Mounting location		Indoor
Ambient temperature	**Operation**	–10° to 55°C (14° to 131° F)
	Storage	–30° to 70°C (–22° to 158°F)
Ambient humidity	**Operation**	10% to 95% RH without condensation
	Storage	10% to 95% RH
Vibration		10 to 55 Hz, 2 mm double amplitude, for 30 minutes in X, Y and Z directions
Shock		300 m/sec^2 (30 G) in each of X, Y and Z directions
Dimensions	**With cover**	n/a
	Without cover	214.4 W x 36 H x 34.5 D mm
Weight		110 g

Application Examples

- Card ID/membership systems
- Credit card readers
- Point–of–sale systems (EFTPoS)

Dimensions

3S4YR-HMR



Note: Unless otherwise specified, tolerance is ± 0.3

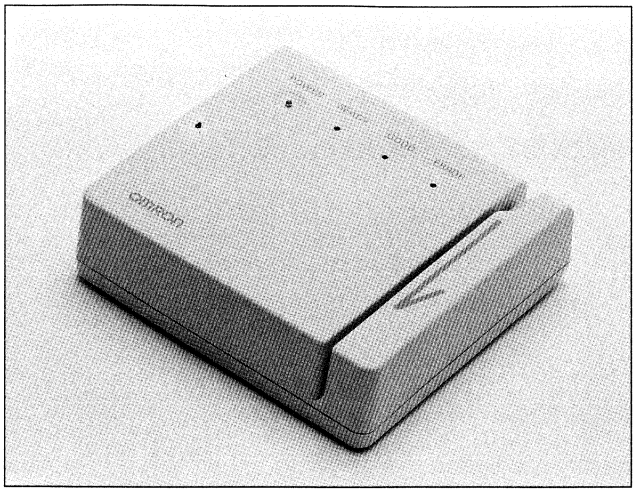
OMRON

Manual Swipe Card Reader

3S4YR–HKS

Swipe Reader with built–in RS232 Interface

- RS232 interface.
- Selectable communication parameters.
- External power supply required.
- 24–way D–type connector.
- Four status LEDs and electronic buzzer provides feedback to user.
- 1,000,000 pass head life.



Ordering Information

Part	Enclosure	I/O	Part Number
Track 2 reading	Enclosed	RS232 interface	3S4YR–HKS24N
Power supply			HKS Adaptor

Specifications

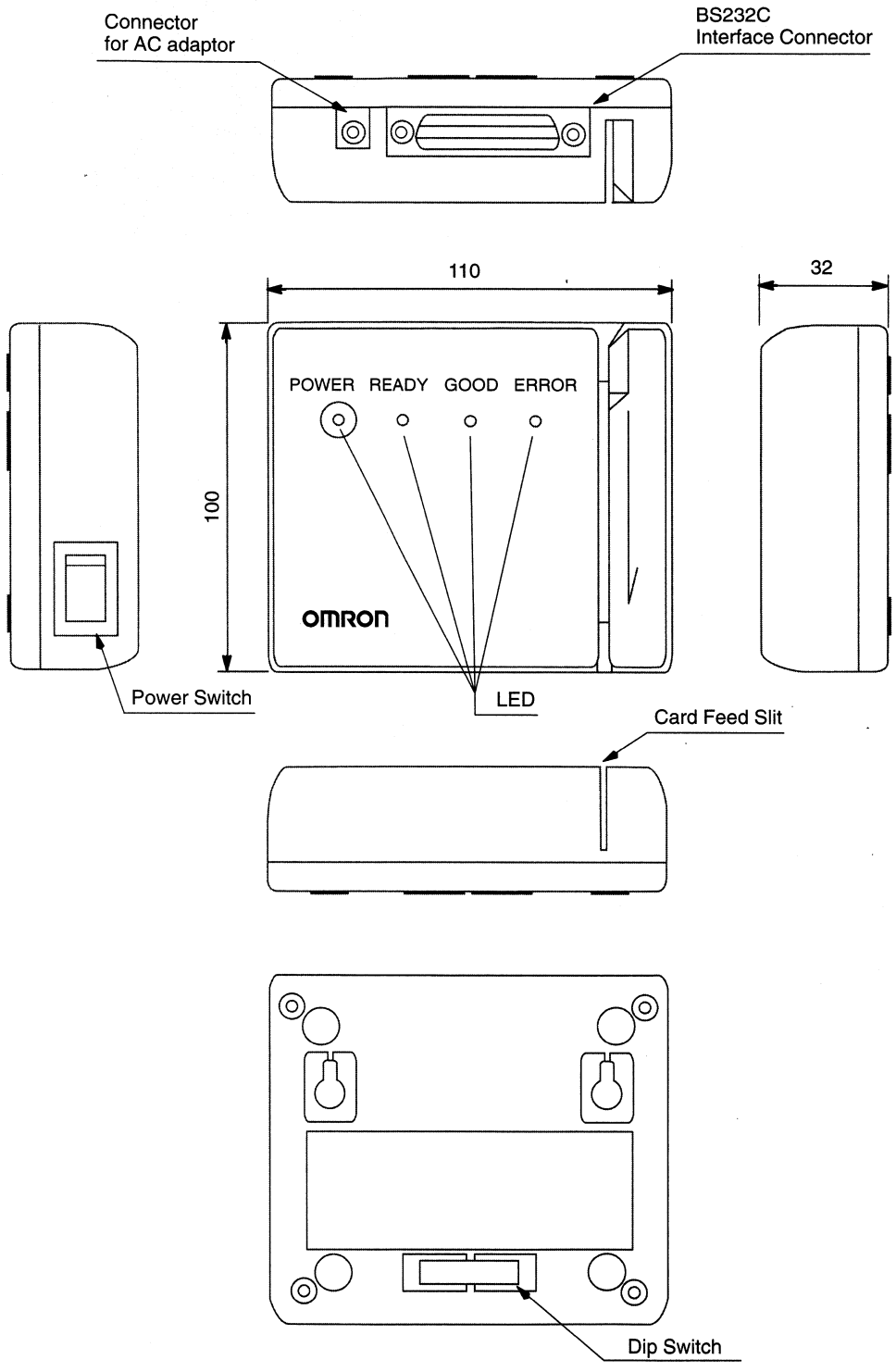
Part number		3S4YR–HKS
Recommended card type		Magnetic card: ISO 7810, 7811/1–5, 7812, 7813
Number of tracks		Track 2 only
Recording method		F2F
Recording density		Track 2: 75 BPI
Memory capacity		Track 2: 5 bit x 40 characters max.
Card feeding speed		10 to 100 cm/second
Service life of magnetic head		1,000,000 passes min.
Operating power supply		+12 VDC ± 10% (separate power supply available)
Current consumption		Single track: 300 mA max.
Mounting location		
Ambient temperature	**Operation**	0° to 50°C
	Storage	–15° to 70°C
Ambient humidity	**Operation**	30% to 85% RH without condensation
	Storage	20% to 90% RH
Vibration		10 to 150 Hz, 2 mm double amplitude, in X, Y and Z directions
Shock		n/a
Dimensions	**With cover**	110 W x 32 H x 100 D mm
	Without cover	n/a
Weight		200 g

Application Examples

- Card ID/membership systems
- Credit card readers
- Point-of-sale systems (EFTPoS)

Dimensions

3S4YR-HKS



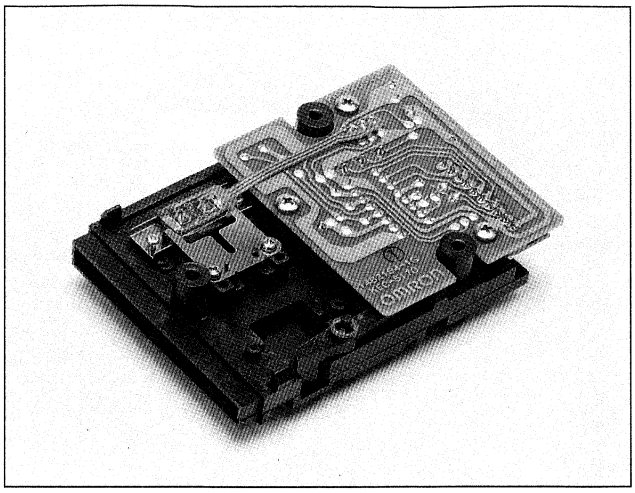
OMRON

Manual Swipe Magnetic Card Reader

3S4YR–SBR

Compact, Highly Reliable Insert Reader Reads 62% of Magnetic Track

- Microswitches incorporated for card detection.
- Reads 62% of magnetic track.
- Slim package.
- Wide operating temperature range.
- Housing compatible with SCR type for easy change to IC card.
- TTL interface.



Ordering Information

Track reading	Part Number
Tracks 1	3S4YR–SBR3–20
Track 2	3S4YR–SBR4–20
Track 3	3S4YR–SBR5–20
Tracks 1 and 2	3S4YR–SBR6–20
Tracks 2 and 3	3S4YR–SBR7–20
RS232 Interface – Track 2 only	MANUALRS232

Specifications

Part number		**3S4YR–SBR**
Recommended card type		Magnetic card: ISO 7810, 7811/1–5, 7812, 7813
Number of tracks		1 or 2; available in any combination
Recording method		F2F
Recording density		Track 1: 210 BPI Track 2: 75 BPI Track 3: 210 BPI
Memory capacity		Track 1: 7 bit x 79 characters max. Track 2: 5 bit x 40 characters max. Track 3: 5 bit x 107 characters max.
Card feeding speed		10 to 100 cm/second
Service life of magnetic head		Single track: 300,000 passes minimum Double track: 300,000 passes minimum
Operating power supply		+5 VDC ±10%
Current consumption		Single track: 25 mA max. Double track: 50 mA max.
Mounting location		Anywhere not directly subject to water or sunlight
Ambient temperature	**Operation**	–10° to 55°C (14° to 131°F)
	Storage	–20° to 70°C (–4° to 158°F)
Ambient humidity	**Operation**	10% to 95% RH without condensation
	Storage	10% to 95% RH
Vibration		10 to 55 Hz, 2 mm double amplitude, for 30 minutes in X, Y and Z directions

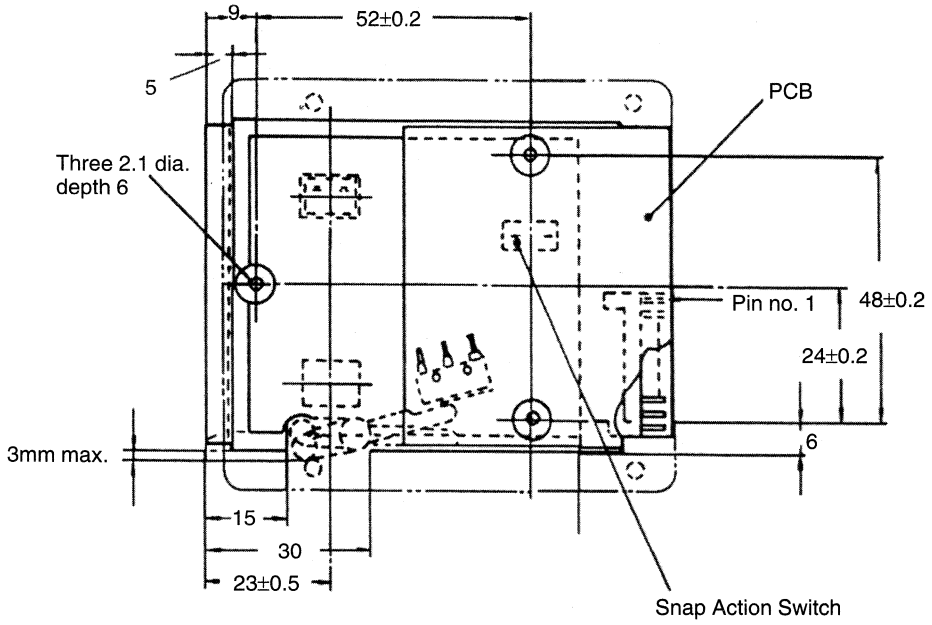
Part number	3S4YR-SBR
Shock	300 m/sec^2 (30 G) in each of X, Y and Z directions
Dimensions	87 L x 60 W x 21.5 H mm
Weight	Approx. 50 kg (1.8 oz.)

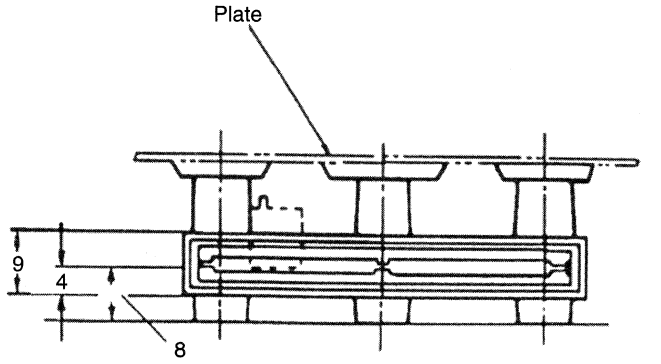
Application Examples

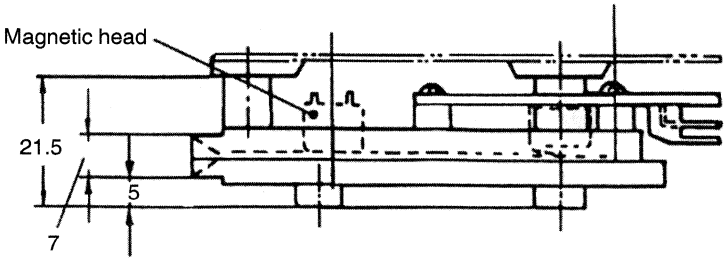
- Access control
- Time and attendance
- ID card checkers
- Electronic locks
- Remote terminals for computers
- Telephones
- Vending

Dimensions

3S4YR-SBR







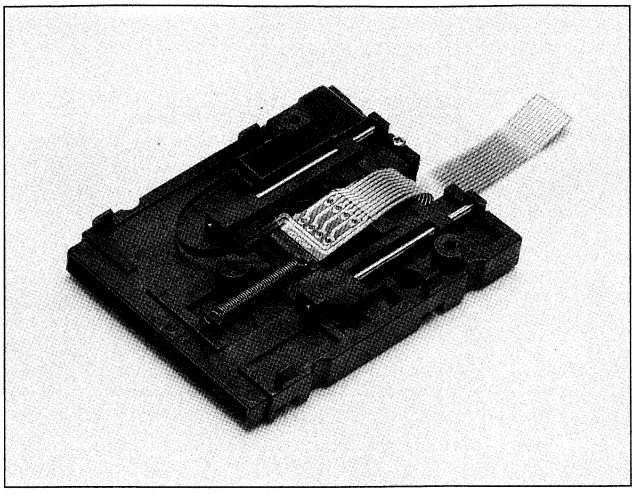
OMRON

Manual Insert IC Card Reader

3S4YR–SCR

Economical, Manual Insert IC Card Reader

- Slim profile for compact design.
- ISO 7816 chip location.
- Housing compatible with Omron's SBR type for easy conversion to magnetic cards.
- Wide operating temperature range.
- TTL interface.



Ordering Information

Type	Part Number
6–pin contact	3S4YR–SCR0J–001
8–pin contact	3S4YR–SCR0J–002

Specifications

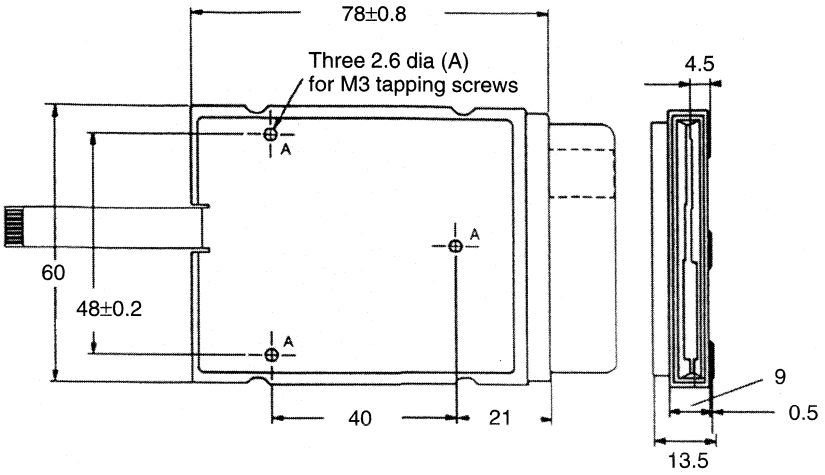
Part number		3S4YR–SCR
Recommended card type		IC card: ISO 7816
Contact resistance		500 mΩ max. between contact springs 1Ω max. between two FPC terminal tips
Card inserting force		1 kg max.
Card extracting force		Approx. 100 g to 500 g
Card feeding speed		100 cm/second max.
Service life		100,000 passes min.
Load voltage		Card set switch: 30 VDC max.
Current carrying capacity		Card set switch: 1 mA to 10 mA
Mounting location		Indoors
Ambient temperature	Operation	–25° to 75°C (–13° to 167°F) without condensation
	Storage	–40° to 85°C (–70° to 185°F)
Ambient humidity	Operation	10% to 95% RH without condensation
	Storage	10% to 95% RH
Vibration		30 to 200 Hz (3 G) for 25 minutes in each of X, Y and Z directions
Shock		400 m/sec^2 (40 G) in each of X, Y and Z directions
Dimensions		78 L x 60 W x 13.5 H mm
Weight		Approx. 40 kg (1.42 oz.)

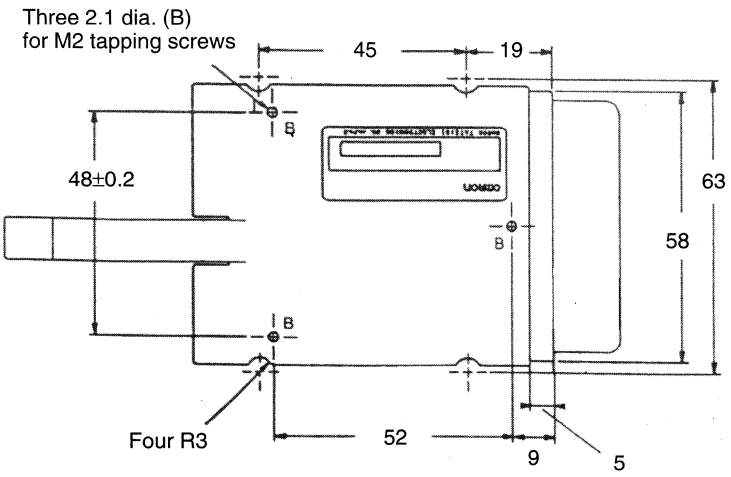
Application Examples

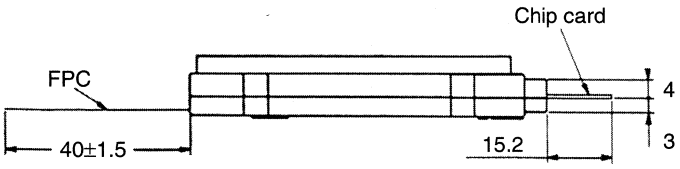
- ID control
- Access control
- Time and attendance control
- Telecommunications
- Vending Machines
- Data capturing
- Prepaid systems
- EFTPoS and Electronic Purse Systems

Dimensions

3S4YR-SCR







Note: Unless otherwise specified, tolerance is ± 0.3

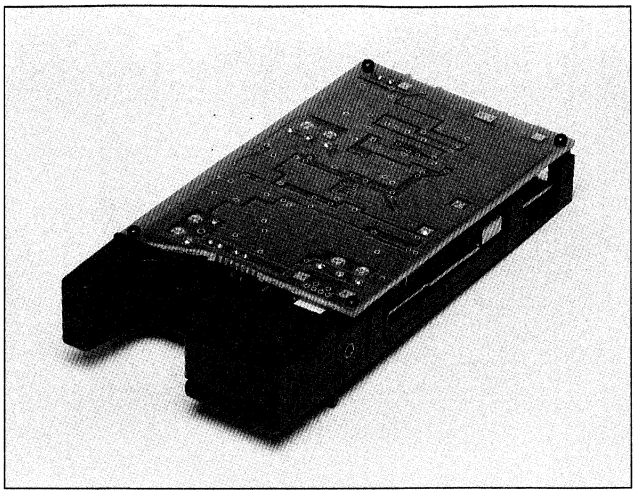
OMRON

Insert Magnetic/IC Card Reader

3S4YR–SFR–J/N

Compact Insert Reader with Magnetic and IC Card Interface

- Solenoid controlled lock to prevent card removal during read/write functions.
- Single, double or triple track configurations with IC card option.
- Reads 100% of magnetic track.
- Red and green LED for operation indicator.
- TTL interface.
- Double Solenoid option.
- ISO 7816 chip location.



Ordering Information

Track reading	IC Card	Part Number
None	Read/write	3S4YR–SFR0J
Track 1	Read/write	3S4YR–SFR3J
Track 1	None	3S4YR–SFR3N
Track 2	Read/write	3S4YR–SFR4J
Track 2	None	3S4YR–SFR4N
Track 3	Read/write	3S4YR–SFR5J
Track 3	None	3S4YR–SFR5N
Tracks 1 and 2	Read/write	3S4YR–SFR6J
Tracks 1 and 2	None	3S4YR–SFR6N
Tracks 2 and 3	Read/write	3S4YR–SFR7J
Tracks 2 and 3	None	3S4YR–SFR7N
Tracks 1, 2 and 3	Read/write	3S4YR–SFR1J
Tracks 1, 2 and 3	None	3S4YR–SFR1N
Track 2	Read/write with double solenoid	3S4YR–SFR4J–001

Specifications

Part number	**3S4YR–SFR–J/N**
Recommended card type	Magnetic card: ISO 7810–7813 IC card: ISO 7816/1, 2
Number of tracks	1, 2 or 3; available in many combinations, see "Ordering Information"
Recording method	F2F
Recording density	Track 1: 210 BPI Track 2: 75 BPI Track 3: 210 BPI
Memory capacity	Track 1: 7 bit x 79 characters max. Track 2: 5 bit x 40 characters max. Track 3: 5 bit x 107 characters max.
Card feeding speed	10 to 100 cm/second
Service life of magnetic head	300,000 passes min.
Service life of IC contact	500,000 passes min.
Operating power supply	5 VDC ± 5% logic; 12 VDC ±10% for solenoid

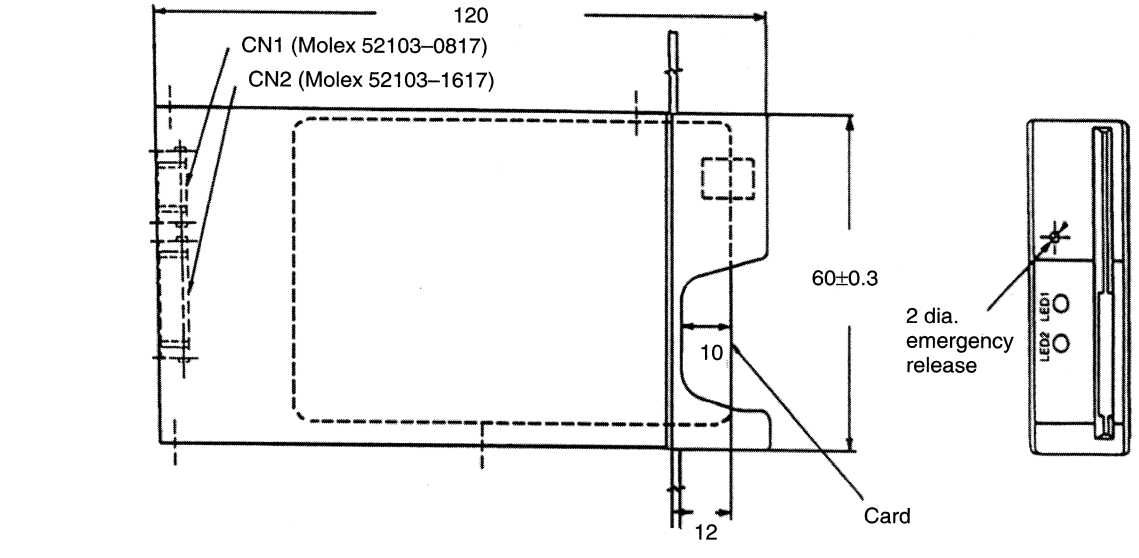
Part number		3S4YR–SFR–J/N
Current consumption		Logic: 70 mA max.
		Solenoid: 1.2 A max.
Mounting location		Anywhere not directly subject to water
Ambient temperature	Operation	–5° to 55°C (23° to 131°F)
	Storage	–20° to 65°C (–35° to 158°F)
Ambient humidity	Operation	10% to 90% RH without condensation
	Storage	10% to 95% RH
Vibration		10 to 50 Hz, 2 mm double amptitutde, for 30 minutes in X, Y and Z directions
Shock		300 m/sec^2 (30 G) in each of X, Y and Z directions
Dimensions		120 L x 60 W x 194 H mm
Weight		Approx. 100 kg (3.5 oz.)

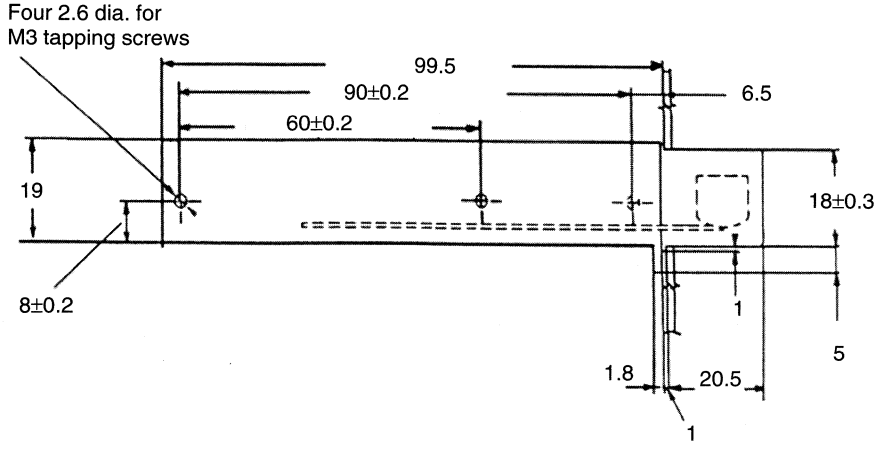
Application Examples

- Remote terminals for computers
- Credit card readers
- ID card checkers
- Electronic locks
- Automatic gate machines
- Point–of–sale systems (POS)
- ATMs
- Gas pump control
- Vending Machines
- EFTPOS and Electronic Purse Systems

Dimensions

3S4YR–SFR





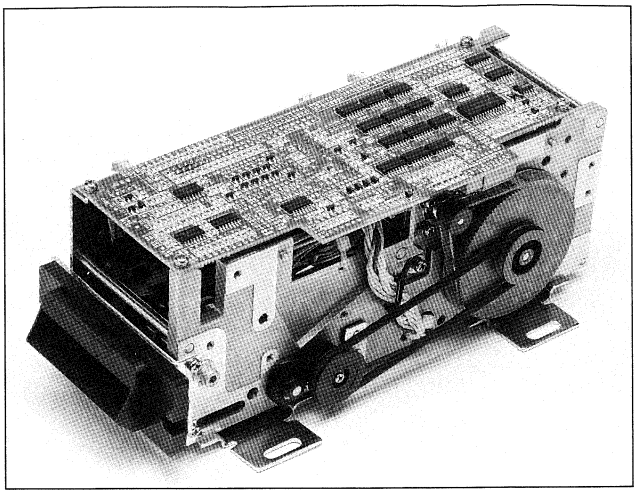
Note: Unless otherwise specified, tolerance is ± 0.3

OMRON

Motor Driven Card Reader/Writer

3S4YR–MKW–PC

Reliably Handles Read/Write Functions for Magnetic and IC Cards



- Metal shutter prevents tampering and incorrect card insertion.
- Durable 4-wheel, 2-belt drive.
- Roller and reader accommodates discrepancies in card thickness to accept warped or bent cards.
- Compact size and light weight allows easy installation in any terminal.
- Software–driven read/write function allows recognition of any type of ISO track.
- Watermark card reading capability.
- HiCo read/write capability available.
- TTL interface or RS232 Interface.
- IC card acceptor.

Ordering Information

Track read (R)/write (W)			Shutter function		IC card function		Part number
Track 1	Track 2	Track 3	Built in	Upgradeable	Built in	Upgradeable	
R/W	R/W	R/W	No	Yes	No	Yes	3S4YR–MKW1PC
R/W	–	–	No	Yes	No	Yes	3S4YR–MKW3PC
–	R/W	–	No	Yes	No	Yes	3S4YR–MKW4PC
–	–	R/W	No	Yes	No	Yes	3S4YR–MKW5PC
R/W	R/W	–	No	Yes	No	Yes	3S4YR–MKW6PC
–	R/W	R/W	No	Yes	No	Yes	3S4YR–MKW7PC
R/W HiCo	R/W HiCo	R/W HiCo	No	Yes	No	Yes	3S4YR–MKW1PCH
–	R/W HiCo	–	No	Yes	No	Yes	3S4YR–MKW4PCH

■ Options

Consult Omron Electronics Ltd for the following options:

- HiCo is available for most types
- MM sensor and watermark detection can be factory-installed
- RS232 Interface
- Magnetic card detection shutter
- IC card acceptor
- Complete encoding stations

Specifications

Part number	3S4YR–MKW–PC
Recommended card type	Magnetic card: ISO 7810–7813 IC card: ISO 7816/1, 2
Number of tracks	1, 2 or 3; available in many combinations, see "Ordering Information"
Recording method	F2F
Recording density	Track 1: 210 BPI Track 2: 75 BPI Track 3: 210 BPI
Memory capacity	Track 1: 7 bit x 79 characters max. Track 2: 5 bit x 40 characters max. Track 3: 5 bit x 107 characters max.
Card feeding speed	20 cm/second ±10%
Motor type	DC motor
Service life	1,200,000 passes min.

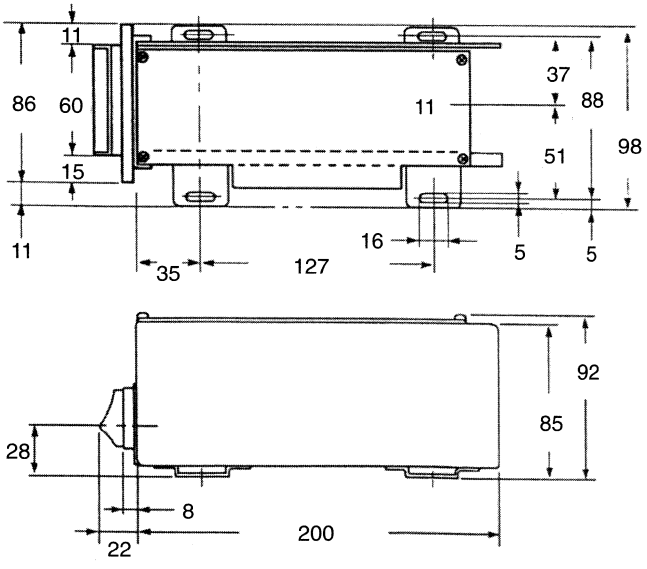
Part number		3S4YR-MKW-PC
Operating power supply	Amplifier	+24 VDC ±10%
	Motor	+24 VDC ±10%
	Control logic	+5 VDC ±5%
Current consumption	Amplifier	260 mA max.
	Motor	1,700 mA max.
	Control logic	330 mA max.
Mounting location		Anywhere not directly subject to water or rain
Ambient temperature	Operation	–5° to 55°C (23° to 131°F)
	Storage	–25° to 70°C (–13° to 158°F)
Ambient humidity	Operation	45% to 85% RH without condensation
	Storage	30% to 90% RH
Vibration		10 to 55 Hz, 2 mm double amplitude, for 30 minutes in X, Y and Z directions
Shock		300 m/sec^2 (30 G) in each of X, Y and Z directions
Dimensions	With shutter	247 L x 106 W x 92 H mm
	Without shutter	222 L x 98 W x 92 H mm
Weight		Approx. 1.9 kg (4.2 lbs.) when fully equipped

Application Examples

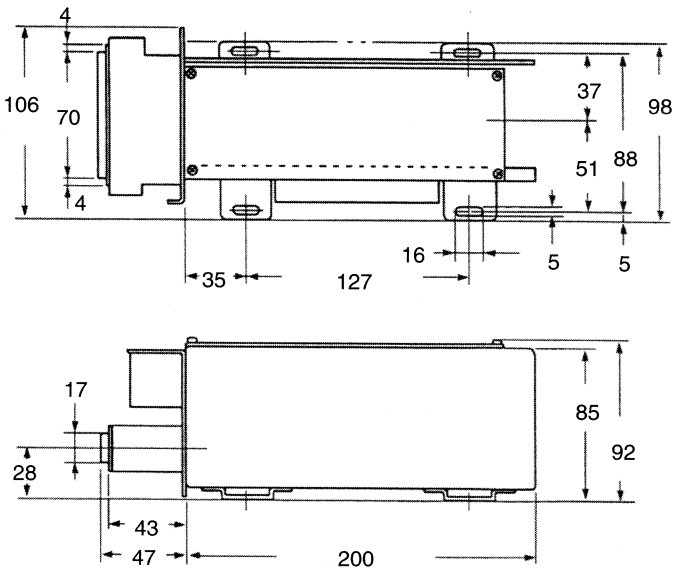
- Cash dispensers
- Automatic teller machines (ATM)
- POS terminals
- Credit card checkers
- Petrol vending systems
- ID card checkers
- Electronic lock system
- Medical patient system
- Health control system
- Customer loyalty schemes

Dimensions

3S4YR-MKW without shutter



3S4YR-MKW with shutter



Note: Unless otherwise specified, tolerance is ± 0.3

Card Readers

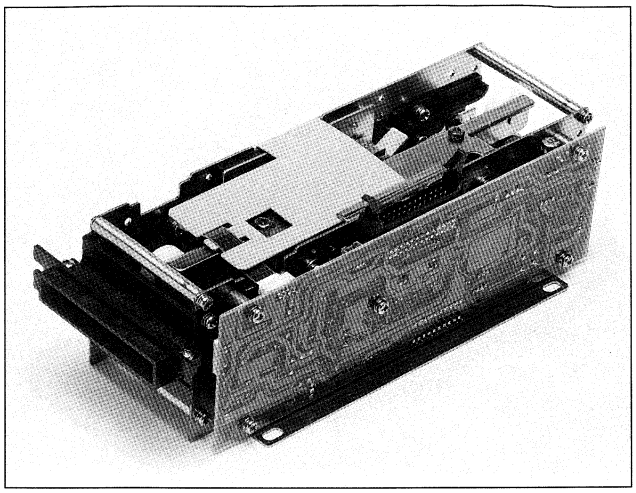
OMRON

Motor Driven Card Reader/Writer

3S4YR–MMW

Reliably Handles Read/Write Function for Magnetic Cards

- Single track read/write capability.
- Compact size and lightweight all installation in any terminal.
- TTL interface or RS232 interface.
- Selectable head position and BPI.



Ordering Information

Track reading (R)	Card writing (W)	Part Number
Track 1	Track 1	3S4YR–MMW3
Track 2	Track 2	3S4YR–MMW4
Track 3	Track 3	3S4YR–MMW5
Track 1, 2 and 3	Tracks 1, 2 and 3	3S4YR–MMW1
Track 2 HiCo	Track 2 HiCo	3S4YR–MMW4HT

Specifications

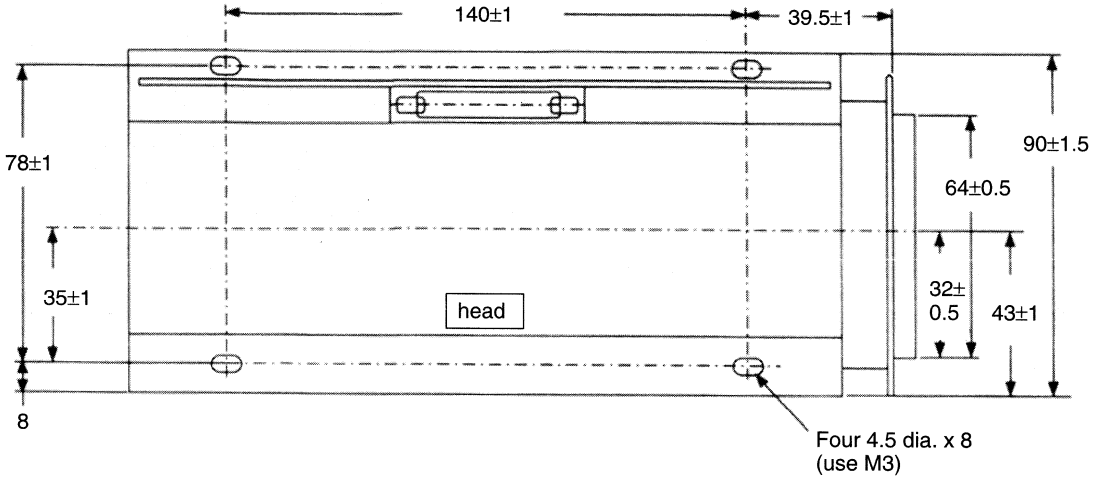
Part number		3S4YR–MMW
Recommended card type		Magnetic card: ISO 7810–7813
Number of tracks		1
Recording method		F2F
Recording density		Track 1: 210 BPI Track 2: 75 BPI Track 3: 210 BPI
Memory capacity		Track 1: 7 bit x 79 characters max. Track 2: 5 bit x 40 characters max. Track 3: 5 bit x 107 characters max.
Card feeding speed		30 cm/second ± 10%
Motor type		DC motor
Service life		500,000 passes
Operating power supply		24 VDC ± 10%
Current consumption		1.5 A max.
Mounting location		Indoor
Ambient temperature	**Operation**	0°C to 45°C (32° to 113°F)
	Storage	–15°C to 60°C (5° to 140°F)
Ambient humidity	**Operation**	35% to 85% RH without condensation
	Storage	20% to 90% RH
Vibration		10 to 150 Hz, 0.15 mm, for 8 minutes in X, Y and Z directions
Shock		200m/sec^2 (20 G) in each of X,Y and Z directions
Dimensions		211 L x 90 W x 65 H mm
Weight		Approx. 850 g (1.87 lbs.) when fully equipped

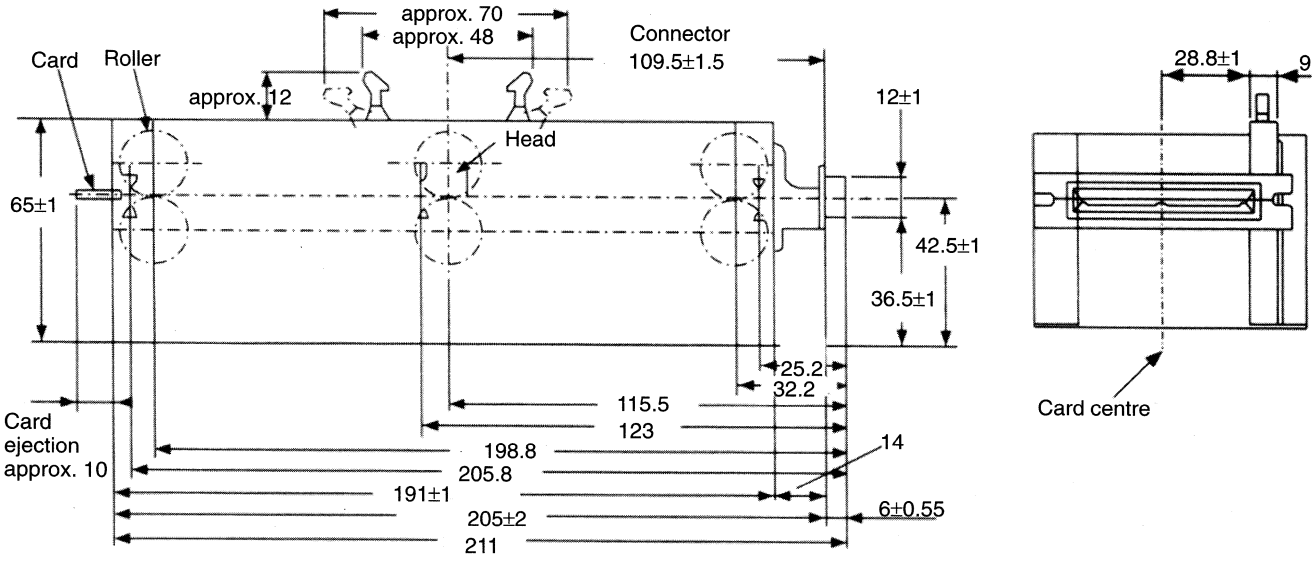
Application Examples

- Credit card readers
- ID card checkers
- Electronic lock systems
- Automatic gate machines
- Vending machines
- Customer loyalty schemes

Dimensions

3S4YR-MMW





Note: Unless otherwise specified, tolerance is ± 0.3

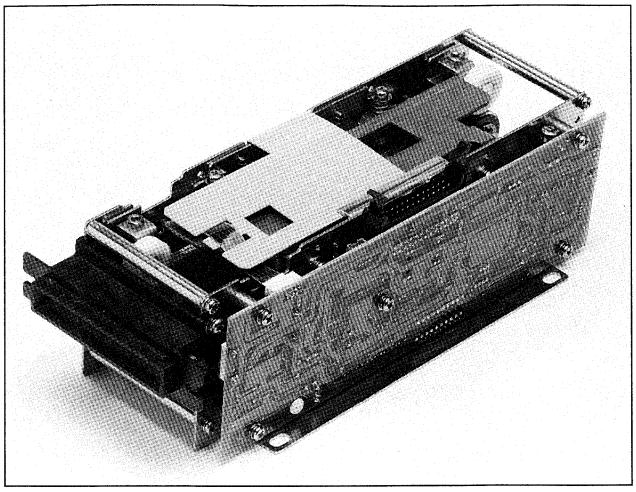
OMRON

Motor Driven Centre Stripe Card Reader/Writer

3S4YR–MZW

Reliably Handles Read/Write Function for Magnetic Cards

- Centre stripe bar for public transport applications.
- Single track read/write capability.
- Compact size and lightweight all installation in any terminal.
- TTL interface or RS232 interface.
- Selectable BPI.
- Paper and/or plastic cards.



Ordering Information

Track reading (R)	Card writing (W)	Part Number
Centre Track	Centre Track LoCo	3S4YR–MZW9T
Centre Track	Centre Track Lo/HiCo	3S4YR–MZW9HT

Specifications

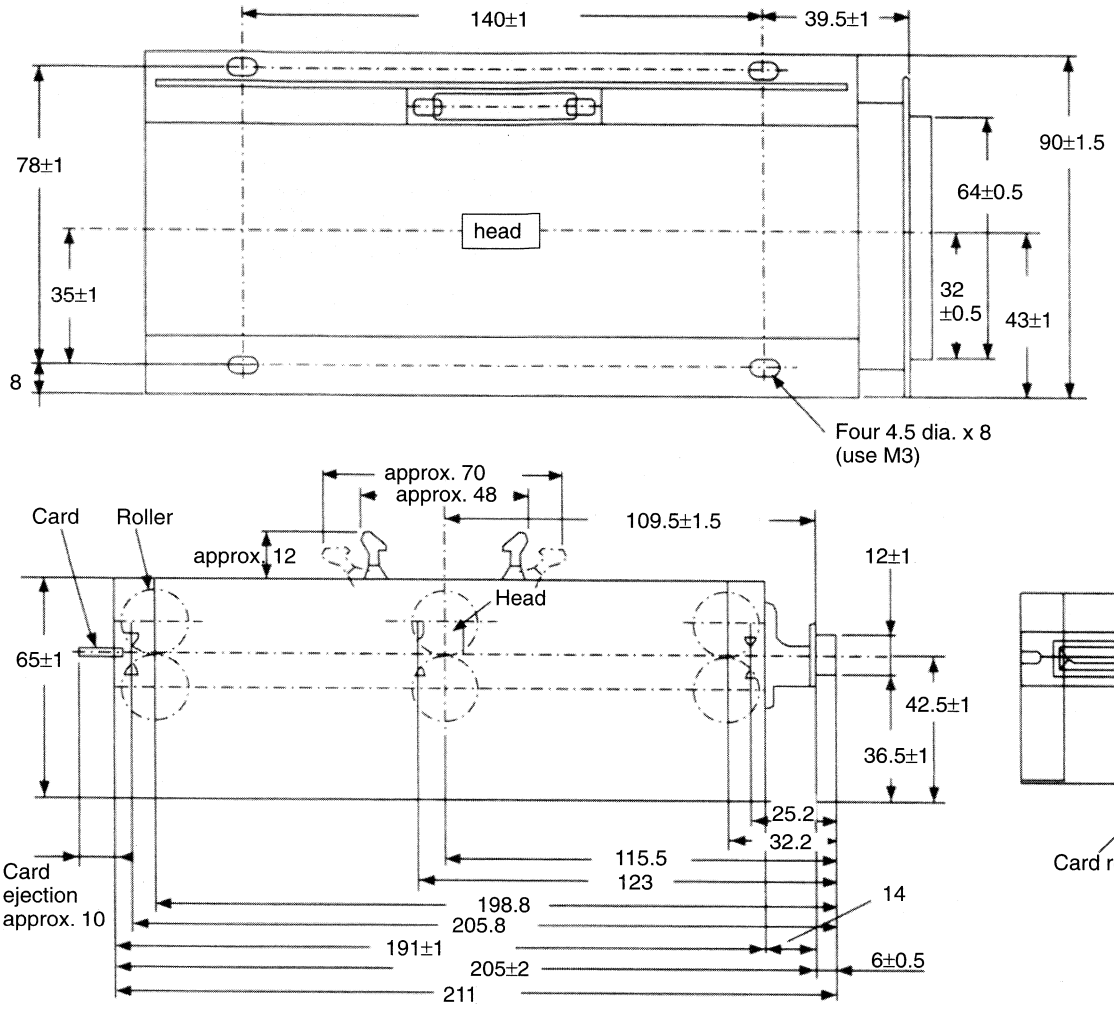
Part number		3S4YR–MZW
Recommended card type		Magnetic card:
Number of tracks		1
Recording method		F2F
Recording density		75 BPI/Selectable
Memory capacity		5 bit x 40 characters max./selectable
Card feeding speed		30 cm/second ± 10%
Motor type		DC motor
Service life		500,000 passes
Operating power supply		24 VDC ± 10%
Current consumption		1.5 A max.
Mounting location		Indoor
Ambient temperature	**Operation**	0°C to 45°C (32° to 113°F)
	Storage	–15°C to 60°C (5° to 140°F)
Ambient humidity	**Operation**	30% to 85% RH without condensation
	Storage	20% to 90% RH
Vibration		10 to 150 Hz, 0.15 mm, for 8 minutes in X, Y and Z directions
Shock		200m/sec^2 (20 G) in each of X,Y and Z directions
Dimensions		211 L x 90 W x 65 H mm
Weight		Approx. 850 g (1.87 lbs.) when fully equipped

Application Examples

- Automatic gate machines
- Vending machines
- Ticket machine
- Public transport systems

Dimensions

3S4YR-MZW



Note: Unless otherwise specified, tolerance is ± 0.3

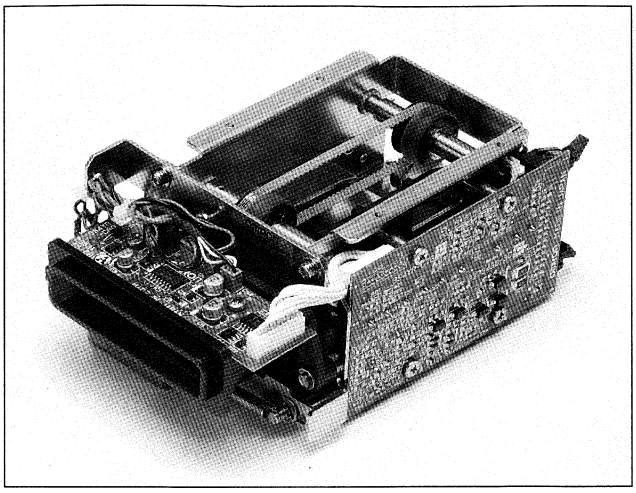
OMRON

Motor Driven Card Reader

3S4YR–MCR–N

Reliably Handles Read Function for Magnetic Cards

- Compact bank card reader
- Shutter available to prevent tampering and incorrect card insertion.
- Compact size and lightweight allow easy installation in any terminal.
- Capable of reading HiCo cards.
- Single and double track capability.
- Heavy duty construction for secure environment.
- TTL interface or RS232 interface.



Ordering Information

Track reading (R)	Part Number
Track 2	3S4YR–MCR4N
Tracks 1, 2 and 3	3S4YR–MCR1N

Specifications

Part number		3S4YR–MCR–N
Recommended card type		Magnetic card: ISO 7810–7813
Number of tracks		Track 2 or three track
Recording method		F2F
Recording density		Track 1: 210 BPI Track 2: 75 BPI Track 3: 210 BPI
Memory capacity		Track 1: 7 bit x 79 characters max. Track 2: 5 bit x 40 characters max. Track 3: 5 bit x 107 characters max.
Card feeding speed		300 ± 5mm/s
Motor type		DC motor
Service life		600,000 passes
Operating power supply		24 VDC ± 10%
Current consumption		20 – 40 mA max.
Mounting location		Indoor
Ambient temperature	**Operation**	–5°C to 55°C (23° to 113°F)
	Storage	–25°C to 70°C (–13° to 158°F)
Ambient humidity	**Operation**	45% to 85% RH without condensation
	Storage	20% to 90% RH
Vibration		10 to 55 Hz, 0.75 mm double amplitude in X, Y and Z directions
Shock		300m/sec^2 (30 G) in each of X,Y and Z directions
Dimensions	**With shutter**	147 L x 102.5 W x 62 D mm
	Without shutter	100 L x 90 W x 62 D mm
Weight		Approx. 600 g without shutter

Dimensions

3S4YR-MCR-N

Fig. 1 Dimensional Outline Drawing (without shutter unit)

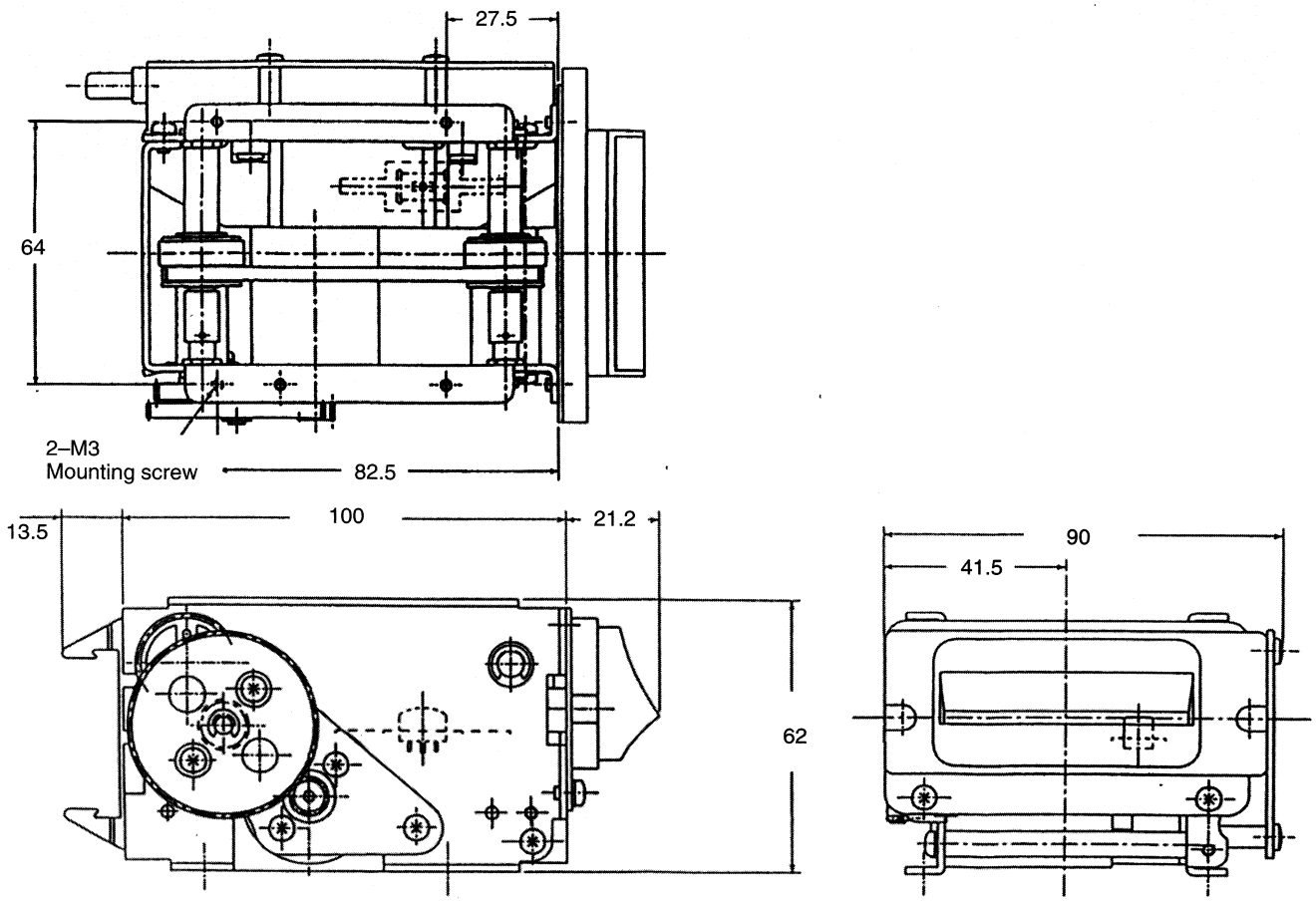
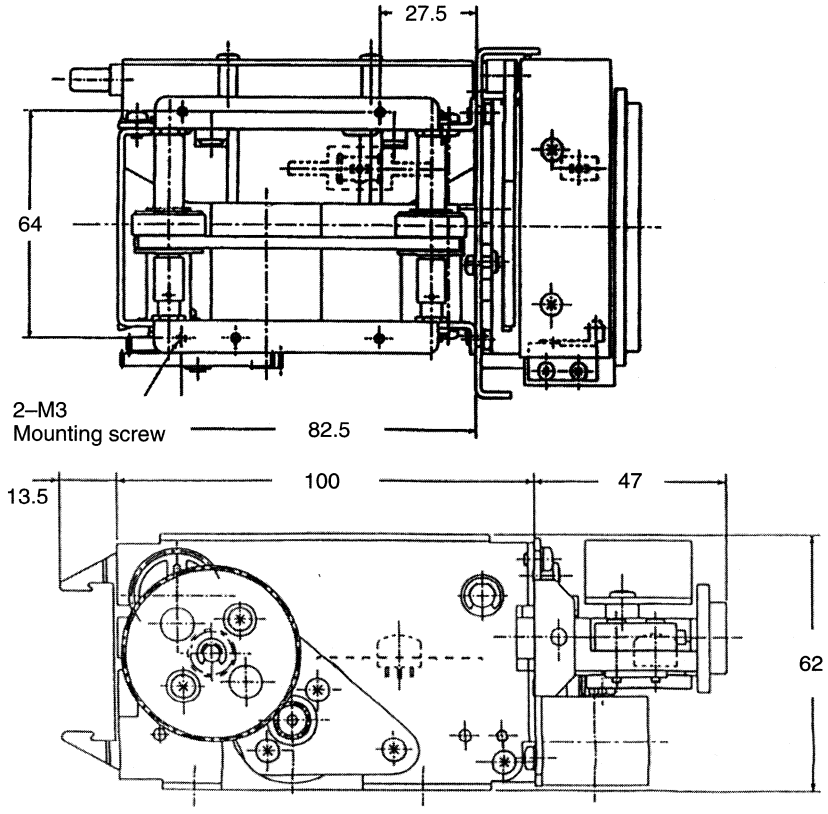


Fig. 2 Dimensional Outline Drawing (with shutter unit)

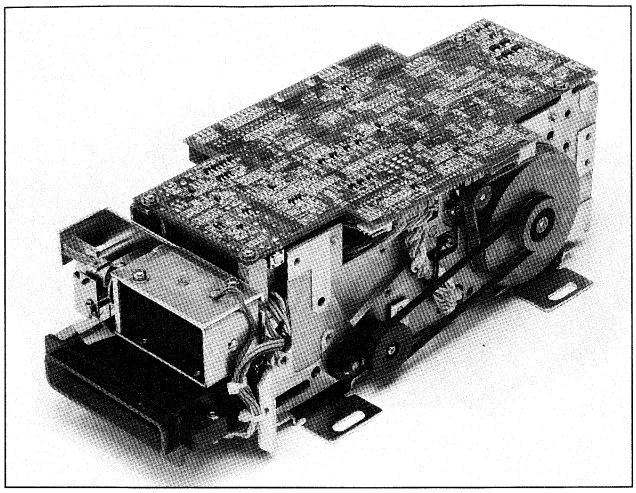


OMRON

Motor Driven Card Reader/Writer

3S4YR–MKF

With RS232 Interface, Reliably Handles Read/Write Functions for Magnetic and IC Cards



- Built–in RS323 interface.
- Metal shutter prevents tampering and incorrect card insertion.
- Durable 4-wheel, 2-belt drive.
- Roller and reader accommodates discrepancies in card thickness to accept warped or bent cards.
- Compact size and light weight allows easy installation in any terminal.
- Software–driven read/write function allows recognition of any type of ISO track.
- Watermark card reading capability.
- HiCo read/write capability available.
- IC card acceptor.

Ordering Information

Track read (R)/write (W)			Shutter function		IC card function		Part number
Track 1	Track 2	Track 3	Built in	Upgradeable	Built in	Upgradeable	
R/W	R/W	R/W	No	Yes	No	Yes	3S4YR–MKFW1PC
R/W	R/W	R/W	Yes	–	No	Yes	3S4YR–MKFW1PD
R/W	R/W	R/W	Yes	–	Yes	–	3S4YR–MKFW1XD

■ Options

Consult Omron Electronics Ltd for the following options:

- MM sensor and watermark detection can be factory-installed
- Magnetic card detection shutter
- IC card acceptor

Specifications

Part number		3S4YR–MKF
Recommended card type		Magnetic card: ISO 7810–7813 IC card: ISO 7816/1, 2
Number of tracks		1, 2 or 3; available in many combinations, see "Ordering Information"
Recording method		F2F
Recording density		Track 1: 210 BPI Track 2: 75 BPI Track 3: 210 BPI
Memory capacity		Track 1: 7 bit x 79 characters max. Track 2: 5 bit x 40 characters max. Track 3: 5 bit x 107 characters max.
Card feeding speed		20 cm/second ±10%
Motor type		DC motor
Service life		1,200,000 passes min.
Operating power supply	Amplifier	+24 VDC ±10%
	Motor	+24 VDC ±10%
	Control logic	+24 VDC ±10%

Part number		3S4YR–SFR
Current consumption	Amplifier	260 mA max.
	Motor	1,700 mA max.
	Control logic	330 mA max.
Mounting location		Anywhere not directly subject to water or rain
Ambient temperature	Operation	–5° to 55°C (23° to 131°F)
	Storage	–25° to 70°C (–13° to 158°F)
Ambient humidity	Operation	30% to 85% RH without condensation
	Storage	20% to 90% RH
Vibration		10 to 55 Hz, 2 mm double amplitude, for 30 minutes in X, Y and Z directions
Shock		300 m/sec^2 (30 G) in each of X, Y and Z directions
Dimensions	With shutter	247 L x 106 W x 87.5 H mm
	Without shutter	222 L x 98 W x 87.5 H mm
Weight		Approx. 1.9 kg (4.2 lbs.) when fully equipped

The Omron 3S4YR–MKF has the RS232 interference electronics built into the standard PCB. This is a modular jack plug with 8 connections.

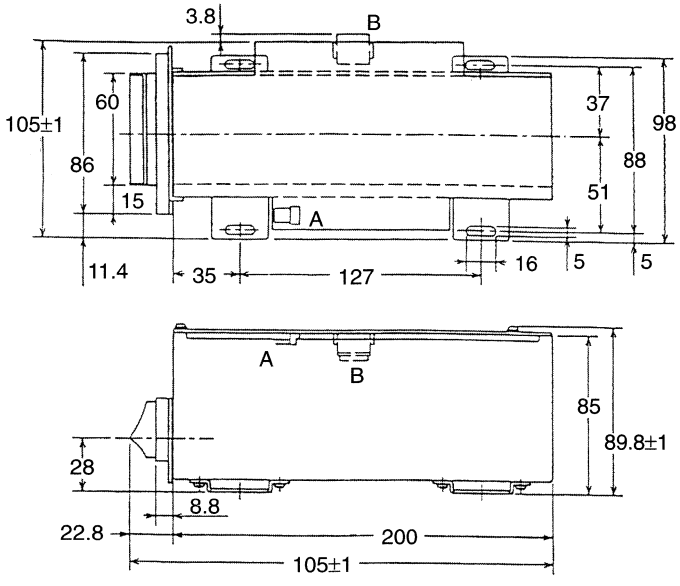
Pin number	Assigned Signal
1	DSR
2	Signal ground
3	DTR
4	CTS
5	RTS
6	RxD
7	TxD
8	Frame ground

Application Examples

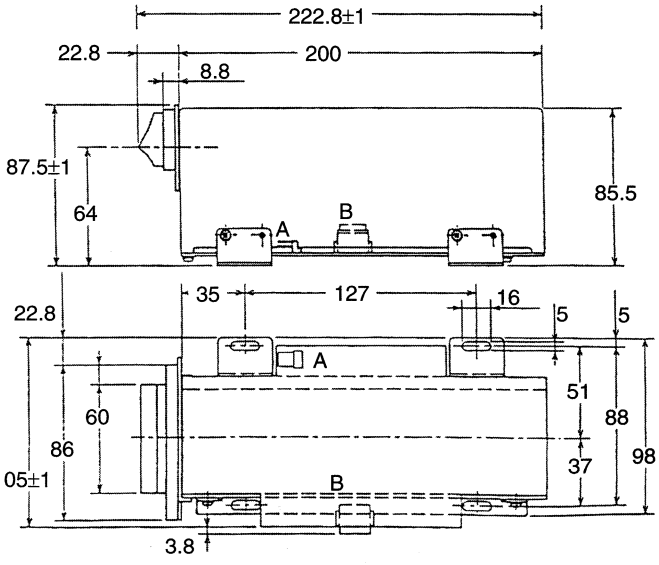
- Cash dispensers
- Automatic teller machines (ATM)
- POS terminals
- Credit card checkers
- Petrol vending systems
- ID card checkers
- Electronic lock system
- Medical patient system
- Health control system
- Customer loyalty schemes

Dimensions

3S4YR–MKF without shutter



3S4YR–MKF with shutter



Note: A: Power Connector
B: RS232C Interface connector

GENERAL CONDITIONS OF SALE

1. **BASIS OF THIS CONTRACT**

1.1 In these conditions 'Omron' means OMRON ELECTRONICS LIMITED of 1 Apsley Way, Staples Corner, London NW2 7HF, 'the Buyer' means the person named overleaf and 'the Goods' means the goods or services which Omron agrees in writing to supply to the Buyer. In relation to the provision of services, references to Goods shall be construed as references to services, references to sale as references to supply, references to delivery as references to the time for performance, and references to the quality of Goods as references to the quality of the services.

1.2 A contract under which Omron shall sell Goods to the Buyer shall only come into existence once Omron has received and accepted the Buyer's order and until acceptance Omron shall be under no obligation to the Buyer. A quotation issued by Omron shall only be valid for 30 days from its date.

1.3 The contract comprised by these terms and the details overleaf shall be the entire contract between Omron and the Buyer ('the Contract'). Any other terms, conditions or provisions whether proposed by the Buyer orally or in writing shall be of no effect and the sale of Goods by Omron to the Buyer shall not constitute acceptance of such other terms, conditions or provisions. The terms of this Contract shall override and supersede any previous negotiations, agreement or arrangement between Omron and the Buyer in relation to the supply of the Goods.

1.4 Unless specifically agreed in writing and signed by a director of Omron, information and advice given orally or contained in Omron's publicity material, advertisements and catalogues and in correspondence between Omron and the Buyer before the date of this Contract is given gratuitously and without responsibility on the part of Omron and shall not form part of this Contract.

1.5 Unless stated in this Contract or expressly agreed in writing and signed by a director of Omron, no term, condition, warranty or representation (whether express or implied by statute, law, custom or usage) as to the nature, quality or fitness or suitability for purpose of the Goods or their conformity with any description or sample is given by Omron, or shall form part of any contract between Omron and the Buyer.

1.6 The Buyer shall ensure that all Goods conform to the applicable Omron specification before incorporating them into any item.

2. **PRICES**

2.1 Omron may alter its quoted prices without notice both before and after acceptance of the Buyer's order and all Goods will be charged for at prices current at the date of despatch.

2.2 Prices quoted do not include any applicable VAT or other duties or taxes, packing, carriage, insurance or any other costs which may be chargeable in connection with the supply of the Goods to the Buyer which the Buyer shall pay in addition to the price.

2.3 The Buyer shall make full payment for the Goods as invoiced by Omron within 30 days of the date of invoice.

2.4 Omron shall have the right to invoice the Buyer for a partial delivery of the Goods.

2.5 If full payment is not made on the due date then interest shall thereafter be payable on the outstanding balance at the rate of 2 percent each month above the Barclays Bank plc minimum lending rate from time to time in force compounded monthly until payment.

2.6 The Buyer shall not be entitled to withhold payment of any invoice by reason of any right of set off or any claim or dispute with Omron, whether relating to the quality or performance of the Goods or otherwise.

2.7 Any advance payment made by the Buyer is a deposit and not a part payment.

2.8 Omron shall have the right to suspend performance of its obligations under this Contract if it reasonably believes that the Buyer will not make payment in accordance with this paragraph 2.

3. **DELIVERY**

3.1 Dates and times given for completion or delivery of Goods or of any stage or process are given as estimates only and shall not constitute a term or condition of any contract between Omron and the Buyer. Time shall not be of the essence. While Omron will use all reasonable endeavours to meet any time estimate, it reserves the right to amend any estimate without notification.

3.2 Omron will deliver the Goods in such batches or instalments as it considers expedient. Neither failure by Omron to deliver one or more batch or instalment, nor over or under delivery shall entitle the Buyer to reject those or subsequent deliveries, claim compensation or terminate this Contract.

3.3 The method of delivery shall be as quoted by Omron; but if this is not stated, then the Goods shall be delivered in accordance with sub–paragraph 3.4(b).

3.4 (a) If the Buyer agrees to collect or arrange for the collection of the Goods from any of Omron's premises ('the Premises') delivery shall be effected and risk but not title shall pass when the Goods are handed to the Buyer or its carrier at the Premises. Omron will notify the Buyer when the Goods are ready for collection and the Buyer shall collect the Goods within three working days of such notice.

(b) If Omron agrees to deliver the Goods to a place within the United Kingdom or Republic of Ireland nominated by the Buyer, Omron shall engage a carrier for this purpose and shall notify the Buyer of expected dates and times of despatch and delivery. Omron does not represent that the expected date or time of delivery will be met. Delivery shall be effected and risk but not title shall pass when delivery is tendered at the nominated place during normal working hours.

(c) The Buyer shall promptly notify Omron if Goods to be delivered in accordance with sub–paragraph (b) do not arrive within fourteen days of receipt of Omron's invoice relating to them.

(d) The Buyer shall carefully examine Goods delivered in accordance with sub–paragraph (b) on receipt and immediately notify to Omron, and within seven working days confirm in writing, details of any short delivery or defects reasonably discoverable on careful examination.

(e) Omron shall replace or, at its option, refund the purchase price of any defective or undelivered Goods falling within sub–paragraphs (c) or (d), but shall not be under any other liability to the Buyer in this respect. If Omron does not receive the notices referred to in sub–paragraphs (c) or (d), it shall be discharged from all liability (whether arising in negligence or otherwise) arising from such non–delivery, short delivery or defects.

(f) The Buyer shall not return any Goods to Omron unless Omron has first issued it with a return authorisation number.

3.5 If Omron agrees to supply Goods outside the United Kingdom or Republic of Ireland, the Buyer shall be bound by Omron's export terms, which are available on request.

4. **PROPERTY AND RISK**

4.1 The Goods shall remain the property and in absolute ownership of Omron until the Buyer has paid in full all amounts owed by the Buyer to Omron (including VAT) in respect of the Goods on any account under any transaction. Until such payment is made the Buyer holds the Goods as Omron's fiduciary agent and bailee and Omron may at any time request the return of any of the Goods which have not been paid for and which are in the possession or control of the Buyer.

4.2 The risk in the Goods will pass to the Buyer in accordance with paragraph 3 of this Contract irrespective of property in the Goods remaining with Omron.

4.3 The Buyer shall keep and store the Goods separately and so as to enable them to be identified as Omron's property. In particular the Buyer shall record the serial number of, and the invoice number relating to, each of the Goods.

4.4 The Buyer shall keep the Goods in good merchantable condition and at its own cost fully insure them on Omron's behalf for an amount which is not less than the price. The proceeds of this insurance shall be held on trust for Omron.

4.5 Subject to sub–paragraph 4.7 the Buyer may sell the Goods in the ordinary course of business at a price not less than the Contract price. However, although as between the parties to this Contract the Buyer shall sell as the fiduciary agent and bailee of Omron, as between the Buyer and its customer the Buyer alone (to the exclusion of Omron) shall bear all liabilities and obligations (contractual, tortious, statutory or otherwise) of a supplier or seller under or in connection with such sale and, subject to paragraphs 5 and 6 below, shall keep Omron indemnified accordingly.

4.6 The Buyer shall immediately notify Omron if it or its directors intend to present a petition for the making of an administration order or if it is aware of any such intention on the part of any of its creditors.

4.7 The Buyer's authority to possess or sell the Goods shall forthwith terminate upon the occurrence of any of the events referred to in sub–paragraph 8.1 (a) and (b).

4.8 Omron may repossess the Goods in accordance with sub–paragraph 4.5 and for this purpose the Buyer grants to Omron an irrevocable licence to enter the Buyer's premises or any other premises in the occupation or control of the Buyer where the Goods are or are believed by the Buyer to be located and remove the Goods. Even before the authority referred to in that paragraph has terminated, representatives of Omron may at any time enter such premises to inspect the Goods.

5. **GUARANTEE**

5.1 Omron guarantees, subject to sub–paragraphs 3.4 and 5.2, that for the period of twelve months from delivery all Goods will conform to the applicable Omron specification. Omron will provide a copy of the specification on request.

5.2 Omron shall at its option replace, repair or refund the purchase price of any Goods (which for the purpose of this paragraph 5 shall include any replacement Goods issued to the Buyer pursuant to this paragraph) proved to its reasonable satisfaction:

(i) to have been delivered short; or

(ii) not to conform to the applicable Omron specification ('defect');

provided in each case:

(a) the short delivery or defect is not one that the Buyer should have notified, or did notify, to Omron pursuant to sub–paragraph 3.4; and

(b) the Buyer as soon as reasonably practicable and in no event later than twelve months after delivery informs Omron of the alleged short delivery or defect and if requested by Omron returns the Goods, carriage paid; and

(c) no unauthorised repairs or alterations have been made to the defective Goods; and

(d) the Goods have been stored, installed, maintained and used in the proper environment, with reasonable care and the Buyer provides full information and documentation to verify compliance with these conditions.

5.3 Any defective Goods shall on replacement become Omron's property.

5.4 For any Goods to which the guarantee set out in this paragraph 5 does not or no longer applies, Omron will endeavour to provide servicing facilities at Omron's tariff and on Omron's terms from time to time in force.

6. **LIMITATION OF LIABILITY**

6.1 Without affecting Omron's liability at law for personal injury or death, Omron's liability to the Buyer for failure of the Goods to conform to the applicable Omron specification (whether caused by negligence or otherwise) shall be limited to the Buyer's loss arising from

(a) physical damage to tangible property other than the Goods; or

(b) loss of use of tangible property other than the Goods;

and shall not exceed £100000 in respect of claims made by the Buyer in any one period of twelve months beginning 1st May in any year.

6.2 Subject to 6.1, Omron shall not be liable to the Buyer for any loss, expense or damage of any kind (direct, indirect, financial or consequential and whether arising from negligence or otherwise) resulting from the supply of the Goods or from the Buyer's use, possession or resale of the Goods, or from any other act or omission of Omron.

7. **PROPRIETARY RIGHTS**

7.1 All copyright, patent, trade secret and other proprietary and intellectual property rights in the Goods, their packing and all information which Omron may provide to the Buyer or its agents shall (as between the parties) at all times remain vested in Omron, and the Buyer shall not acquire any intellectual property rights or (subject to paragraph 7.2) licence relating to the Goods; and may not copy or imitate the Goods.

7.2 Omron grants the Buyer a licence to use in conjunction with the Goods any computer software or firmware which forms part of the Goods.

7.3 The Buyer shall (both during and after completion of this Contract) treat as confidential all confidential information which Omron may make available to it and shall only use or disclose it as may be necessary to enable it to use or market the Goods.

8. **TERMINATION OF THIS CONTRACT**

8.1 Omron shall have the right to terminate this Contract immediately without affecting its accrued rights by giving notice to the Buyer if:

(a) the Buyer defaults in the payment on its due date of any sum under or pursuant to any transaction under this Contract or commits any continuing or serious breach of this Contract and fails to remedy such breach (if remediable) within 10 days of Omron's notice to do so; or

(b) any of the following events occurs:–

(i) distress or execution is levied against any of the Buyer's assets and is not paid or discharged within seven days; or a judgment against the Buyer remains unsatisfied for more than seven days; or a receiver is appointed with respect to any of the Buyer's assets; or

(ii) a petition is presented for the winding up of or for an administration order to be made in relation to the Buyer; or a resolution passed for the Buyer's winding up (other than a members' voluntary winding up for the purposes of amalgamation or reconstruction on terms approved in writing by Omron); or

(iii) the Buyer suspends or threatens to suspend payment of its debts or is deemed unable to pay its debts for the purposes of section 123 Insolvency Act 1986; or ceases or threatens to cease to carry on its business or any material part as a going concern; or as a result of any change in the powers, business or circumstances of the Buyer it is unlikely to be in a position to fulfil the Contract or any transaction pursuant to it; or

(iv) any event in a foreign jurisdiction analogous to, or comparable with, (i) to (iii) above; or

(c) at any time Omron has reasonable grounds to believe that any of the events mentioned in (a) and (b) above is likely to happen within a period of three months thereafter.

8.2 On termination of this Contract for any reason:

(a) Omron shall be discharged from any further liability to perform under the Contract;

(b) the Buyer shall pay Omron on demand for all work performed by Omron for the Buyer prior to termination; and

(c) Omron is granted an irrevocable licence to enter the Buyer's premises to recover any Goods or other materials which are Company's property.

9. **GENERAL**

9.1 This Contract shall in all respects be governed by English Law. The parties submit to the jurisdiction of the English courts.

9.2 The construction of this Contract is not to be affected by any heading. Any variation to this Contract shall only be binding if it is recorded in a document signed by a director of Omron.

9.3 Notices shall be given by hand to a director, or by being sent to a party's address by facsimile, telex or registered post and by airmail where appropriate. Each party shall promptly notify to the other in writing any change of address or of telex or facsimile numbers.

9.4 Omron shall not be liable in any way for any failure to perform its obligations or for loss, damage or delay incurred by the Buyer resulting from circumstances beyond Omron's reasonable control.

9.5 It is the Buyer's obligation to acquaint itself and to comply with all applicable requirements and restrictions imposed by governmental and other authorities or corporations relating to the possession, use, import, export or resale of the Goods.

9.6 Failure by Omron to exercise any of its rights shall not be a waiver or forfeiture of such rights.

(8375N)

OMRON

MECHANICAL KEYSWITCHES

DIP SWITCHES

MICROSWITCHES

LIGHTED PUSHBUTTON SWITCHES

RELAYS

OPTO-SWITCHES

CARD READERS

Cat. No.: C007-001

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LEADERS IN ELECTRONIC COMPONENTS