PHILIPS

Data handbook

PHILIPS Electronic components and materials

Semiconductors

Part 8 June 1981

Photosensitive diodes and transistors

Light emitting diodes

Displays

Photocouplers

Infrared sensitive devices

Photoconductive devices

SEMICONDUCTORS

PART 8 — JUNE 1981

DEVICES FOR OPTOELECTRONICS

DATA HANDBOOK SYSTEM

Our Data Handbook System is a comprehensive source of information on electronic components, sub-assemblies and materials; it is made up of four series of handbooks each comprising several parts.

ELECTRON TUBES	BLUE
SEMICONDUCTORS	RED
INTEGRATED CIRCUITS	PURPLE
COMPONENTS AND MATERIALS	GREEN

The several parts contain all pertinent data available at the time of publication, and each is revised and reissued periodically.

Where ratings or specifications differ from those published in the preceding edition they are pointed out by arrows. Where application information is given it is advisory and does not form part of the product specification.

If you need confirmation that the published data about any of our products are the latest available, please contact our representative. He is at your service and will be glad to answer your inquiries.

ELECTRON TUBES (BLUE SERIES)

Starting in 1980, new part numbers and corresponding codes are being introduced. The former code of the preceding issue is given in brackets under the new code.

Part 1	February 1980	T1 02-80 (ET1a 12-75)	**Tubes for r.f. heating**
Part 2	April 1980	T2 04-80 (ET1b 08-77)	**Transmitting tubes for communications**
Part 2b	May 1978	ET2b 05-78	**Microwave semiconductors and components** Gunn, Impatt and noise diodes, mixer and detector diodes, backward diodes, varactor diodes, Gunn oscillators, sub-assemblies, circulators and isolators.
Part 3	June 1980	T3 06-80 (ET2a 11-77)	**Klystrons, travelling-wave tubes, microwave diodes**
Part 3	January 1975	ET3 01-75	**Special Quality tubes, miscellaneous devices**
Part 4	September 1980	T4 09-80 (ET2a 11-77)	**Magnetrons**
Part 5a	October 1979	ET5a 10-79	**Cathode-ray tubes** Instrument tubes, monitor and display tubes, C.R. tubes for special applications.
Part 6	July 1980	T6 07-80 (ET6 01-77)	**Geiger-Müller tubes**
Part 7a	March 1977	ET7a 03-77	**Gas-filled tubes** Thyratrons, industrial rectifying tubes, ignitrons, high-voltage rectifying tubes.
Part 7b	May 1979	ET7b 05-79	**Gas-filled tubes** Segment indicator tubes, indicator tubes, switching diodes, dry reed contact units.
Part 8	July 1979	ET8 07-79	**Picture tubes and components** Colour TV picture tubes, black and white TV picture tubes, monitor tubes, components for colour television, components for black and white television.
Part 9	June 1980	T9 06-80 (ET9 03-78)	**Photo and electron multipliers** Photomultiplier tubes, phototubes, single channel electron multipliers, channel electron multiplier plates.
Part 10	May 1981	T10 05-81 (ET5b 12-78)	**Camera tubes and accessories, image intensifiers**

SEMICONDUCTORS (RED SERIES)

Starting in 1980, new part numbers and corresponding codes are being introduced. The former code of the preceding issue is given in brackets under the new code.

Part 1	**March 1980**	**S1 03-80** **(SC1b 05-77)**	**Diodes** Small-signal germanium diodes, small-signal silicon diodes, special diodes, voltage regulator diodes (< 1,5 W), voltage reference diodes, tuner diodes, rectifier diodes
Part 2	**May 1980**	**S2 05-80** **(SC1a 08-78)**	**Power diodes, thyristors, triacs** Rectifier diodes, voltage regulator diodes (> 1,5 W), rectifier stacks, thyristors, triacs
Part 2	**June 1979**	**SC2 06-79**	**Low-frequency power transistors**
Part 3	**January 1978**	**SC3 01-78**	**High-frequency, switching and field-effect transistors***
Part 3	**April 1980**	**S3 04-80** **(SC2 11-77, partly)** **(SC3 01-78, partly)**	**Small-signal transistors**
Part 4a	**December 1978**	**SC4a 12-78**	**Transmitting transistors and modules**
Part 5	**October 1980**	**S5 10-80** **(SC3 01-78)**	**Field-effect transistors**
Part 7	**December 1980**	**S7 12-80** **(SC4c 07-78)**	**Discrete semiconductors for hybrid circuits**
Part 8	**April 1980**	**S8 06-81** **(SC4b 09-78)**	**Devices for optoelectronics** Photosensitive diodes and transistors, light-emitting diodes, displays, photocouplers, infrared sensitive devices, photoconductive devices

* Wideband transistors will be transferred to S10. The old book SC3 01-78 should be kept until then.

INTEGRATED CIRCUITS (PURPLE SERIES)

Starting in 1980, new part numbers and corresponding codes are being introduced. The former code of the preceding issue is given in brackets under the new code. Books with the purple cover will replace existing red covered editions as each is revised.

Part 1	**May 1980**	**IC1 05-80** **(SC5b 03-77)**	**Bipolar ICs for radio and audio equipment**
Part 2	**May 1980**	**IC2 05-80** **(SC5b 03-77)**	**Bipolar ICs for video equipment**
Part 5a	**November 1976**	**SC5a 11-76**	**Professional analogue integrated circuits**
Part 4	**October 1980**	**IC4 10-80** **(SC6 10-77)**	**Digital integrated circuits** LOCMOS HE4000B family
Part 6b	**August 1979**	**SC6b 08-79**	**ICs for digital systems in radio and television receivers**

Signetics integrated circuits

Bipolar and MOS memories 1979
Bipolar and MOS microprocessors 1978
Analogue circuits 1979
Logic - TTL 1978

COMPONENTS AND MATERIALS (GREEN SERIES)

Starting in 1980, new part numbers and corresponding codes are being introduced. The former code of the preceding issue is given in brackets under the new code.

Part 1	**July 1979**	**CM1 07-79**	**Assemblies for industrial use** PLC modules, high noise immunity logic FZ/30 series, NORbits 60-series, 61-series, 90-series, input devices, hybrid integrated circuits, peripheral devices
Part 3a	**September 1978**	**CM3a 09-78**	**FM tuners, television tuners, surface acoustic wave filters**
Part 3	**January 1981**	**C3 01-81** **(CM3b 10-78)**	**Loudspeakers**
Part 4a	**November 1978**	**CM4a 11-78**	**Soft Ferrites** Ferrites for radio, audio and television, beads and chokes, Ferroxcube potcores and square cores, Ferroxcube transformer cores
Part 4b	**February 1979**	**CM4b 02-79**	**Piezoelectric ceramics, permanent magnet materials**
Part 6	**May 1981**	**C6 05-81** **(CM6 04-77)**	**Electric motors and accessories** Permanent magnet synchronous motors, stepping motors, direct current motors
Part 7a	**January 1979**	**CM7a 01-79**	**Assemblies** Circuit blocks 40-series and CSA70 (L), counter modules 50-series, input/output devices
Part 8	**June 1979**	**CM8 06-79**	**Variable mains transformers**
Part 9	**August 1979**	**CM9 08-79**	**Piezoelectric quartz devices** Quartz crystal units, temperature compensated crystal oscillators
Part 10	**October 1980**	**C10 10-80**	**Connectors**
Part 11	**December 1979**	**CM11 12-79**	**Non-linear resistors** Voltage dependent resistors (VDR), light dependent resistors (LDR), negative temperature coefficient thermistors (NTC), positive temperature coefficient thermistors (PTC)
Part 12	**November 1979**	**CM12 11-79**	**Variable resistors and test switches**
Part 13	**December 1979**	**CM13 12-79**	**Fixed resistors**
Part 14	**April 1980**	**C14 04-80** **(CM2b 02-78)**	**Electrolytic and solid capacitors**
Part 15	**May 1980**	**C15 05-80** **(CM2b 02-78)**	**Film capacitors, ceramic capacitors, variable capacitors**

INDEX OF TYPE NUMBERS

Data Handbooks S1 to S8

The inclusion of a type number in this publication does not necessarily imply its availability.

type no.	book	section	type no.	book	section	type no.	book	section
AA119	S1	PC	BAS21	S7	Mm	BB110G	S1	T
AAZ13	S1	GB	BAT17	S7	Mm	BB119	S1	T
AAZ15	S1	GB	BAT18	S7	Mm	BB204B	S1	T
AAZ17	S1	GB	BAV10	S1	WD	BB204G	S1	T
AAZ18	S1	GB	BAV18	S1	WD	BB212	S1	T
BA182	S1	T	BAV19	S1	WD	BB405B	S1	T
BA220	S1	WD	BAV20	S1	WD	BB405G	S1	T
BA221	S1	WD	BAV21	S1	WD	BBY31	S7	Mm
BA223	S1	T	BAV45	S1	Sp	BBY40	S7	Mm
BA243	S1	T	BAV70	S7	Mm	BC107	S3	Sm
BA244	S1	T	BAV99	S7	Mm	BC108	S3	Sm
BA280	S1	T	BAW56	S7	Mm	BC109	S3	Sm
BA314	S1	Vrg	BAW62	S1	WD	BC140	S3	Sm
BA315	S1	Vrg	BAX12	S1	WD	BC141	S3	Sm
BA316	S1	WD	BAX12A	S1	WD	BC146	S3	Sm
BA317	S1	WD	BAX13	S1	WD	BC147	S3	Sm
BA318	S1	WD	BAX14A	S1	WD	BC148	S3	Sm
BA379	S1	T	BAX16	S1	WD	BC149	S3	Sm
BA482	S1	T	BAX17	S1	WD	BC157	S3	Sm
BA483	S1	T	BAX18A	S1	WD	BC158	S3	Sm
BAS11	S1	WD	BB105B	S1	T	BC159	S3	Sm
BAS16	S7	Mm	BB105G	S1	T	BC160	S3	Sm
BAS17	S7	Mm	BB106	S1	T	BC161	S3	Sm
BAS19	S7	Mm	BB109G	S1	T	BC177	S3	Sm
BAS20	S7	Mm	BB110B	S1	T	BC178	S3	Sm

GB = Germanium gold bonded diodes
Mm = Microminiature semiconductors for hybrid circuits
PC = Germanium point contact diodes
Sm = Small-signal transistors
Sp = Special diodes
T = Tuner diodes
Vrg = Voltage regulator diodes
WD = Silicon whiskerless diodes

* = series
FET = Field-effect transistors
Mm = Microminiature semiconductors for hybrid circuits

P = Low-frequency power transistors

Sm = Small-signal transistors

FET = Field-effect transistors
HFSW = High-frequency and switching transistors
Mm = Microminiature semiconductors for hybrid circuits
P = Low-frequency power transistors

PDT = Photodiodes or transistors
Sm = Small-signal transistors
Th = Thyristors
Tra = Transmitting transistors and modules

type no.	book	section	type no.	book	section	type no.	book	section
BSR31	S7	Mm	BSX21	S3	Sm	BU207A	SC2	P
BSR32	S7	Mm	BSX45	S3	Sm	BU208A	SC2	P
BSR33	S7	Mm	BSX46	S3	Sm	BU209A	SC2	P
BSR40	S7	Mm	BSX47	S3	Sm	BU326	SC2	P
BSR41	S7	Mm	BSX59	S3	Sm	BU326A	SC2	P
BSR42	S7	Mm	BSX60	S3	Sm	BU426	SC2	P
BSR43	S7	Mm	BSX61	S3	Sm	BU426A	SC2	P
BSR50	S3	Sm	BSY95A	S3	Sm	BU433	SC2	P
BSR51	S3	Sm	BT136 *	S2	Tri	BUW84	SC2	P
BSR52	S3	Sm	BT137 *	S2	Tri	BUW85	SC2	P
BSR56	S7	Mm	BT138 *	S2	Tri	BUX80	SC2	P
BSR57	S7	Mm	BT139 *	S2	Tri	BUX81	SC2	P
BSR58	S7	Mm	BT151 *	S2	Th	BUX82	SC2	P
BSR60	S3	Sm	BT152 *	S2	Th	BUX83	SC2	P
BSR61	S3	Sm	BT153	S2	Th	BUX84	SC2	P
BSR62	S3	Sm	BT154	S2	Th	BUX85	SC2	P
BSS38	S3	Sm	BTW23 *	S2	Th	BUX86	SC2	P
BSS50	S3	Sm	BTW24 *	S2	Th	BUX87	SC2	P
BSS51	S3	Sm	BTW30S*	S2	Th	BY126M	S1	R
BSS52	S3	Sm	BTW31W*	S2	Th	BY127M	S1	R
BSS60	S3	Sm	BTW33 *	S2	Th	BY164	S2	R
BSS61	S3	Sm	BTW34 *	S2	Tri	BY179	S2	R
BSS62	S3	Sm	BTW38 *	S2	Th	BY184	S1	R
BSS63;R	S7	Mm	BTW40 *	S2	Th	BY206	S1	R
BSS64;R	S7	Mm	BTW41 *	S2	Tri	BY207	S1	R
BSS68	S3	Sm	BTW42 *	S2	Th	BY208 *	S1	R
BSV15	S3	Sm	BTW43 *	S2	Tri	BY210	S1	R
BSV16	S3	Sm	BTW45 *	S2	Th	BY223	S2	R
BSV17	S3	Sm	BTW47 *	S2	Th	BY224 *	S2	R
BSV52;R	S7	Mm	BTW92 *	S2	Th	BY225 *	S2	R
BSV64	S3	Sm	BTX18 *	S2	Th	BY226	S1	R
BSV78	S5	FET	BTX94 *	S2	Tri	BY227	S1	R
BSV79	S5	FET	BTY79 *	S2	Th	BY228	S1	R
BSV80	S5	FET	BTY87 *	S2	Th	BY229 *	S2	R
BSV81	S5	FET	BTY91 *	S2	Th	BY256	S2	R
BSW66A	S3	Sm	BU126	SC2	P	BY257	S2	R
BSW67A	S3	Sm	BU133	SC2	P	BY260 *	S2	R
BSW68A	S3	Sm	BU204	SC2	P	BY261 *	S2	R
BSX19	S3	Sm	BU205	SC2	P	BY277 *	S2	R
BSX20	S3	Sm	BU206	SC2	P	BY409	S1	R

* = series
D = Displays
FET = Field-effect transistors
LED = Light-emitting diodes
Mm = Microminiature semiconductors for hybrid circuits
P = Low-frequency power transistors

PhC = Photocouplers
R = Rectifier diodes
Sm = Small-signal transistors
Th = Thyristors
Tri = Triacs
TS = Transient suppressor diodes
Vrf = Voltage reference diodes
Vrg = Voltage regulator diodes
WD = Silicon whiskerless diodes

* = series
A = Accessories
DH = Diecast heatsinks
FET = Field-effect transistors
GB = Germanium gold bonded diodes
HE = Heatsink extrusions
HFSW = High-frequency and switching transistors
I = Infrared devices
LED = Light-emitting diodes

type no.	book	section
2N1893	S3	Sm
2N2218	S3	Sm
2N2218A	S3	Sm
2N2219	S3	Sm
2N2219A	S3	Sm
2N2221	S3	Sm
2N2221A	S3	Sm
2N2222	S3	Sm
2N2222A	S3	Sm
2N2297	S3	Sm
2N2368	S3	Sm
2N2369	S3	Sm
2N2369A	S3	Sm
2N2483	S3	Sm
2N2484	S3	Sm
2N2904	S3	Sm
2N2904A	S3	Sm
2N2905	S3	Sm
2N2905A	S3	Sm
2N2906	S3	Sm
2N2906A	S3	Sm
2N2907	S3	Sm
2N2907A	S3	Sm
2N3019	S3	Sm
2N3020	S3	Sm
2N3053	S3	Sm
2N3055	SC2	P
2N3375	SC4a	Tra
2N3439	S3	Sm
2N3440	S3	Sm
2N3442	SC2	P
2N3553	SC4a	Tra
2N3632	SC4a	Tra
2N3822	S5	FET
2N3823	S5	FET
2N3866	SC4a	Tra
2N3903	S3	Sm
2N3904	S3	Sm
2N3924	SC4a	Tra
2N3926	SC4a	Tra
2N3927	SC4a	Tra
2N3966	S5	FET
2N4030	S3	Sm
2N4031	S3	Sm
2N4032	S3	Sm
2N4033	S3	Sm
2N4091	S5	FET
2N4092	S5	FET
2N4093	S5	FET
2N4123	S3	Sm
2N4124	S3	Sm
2N4347	SC2	P
2N4391	S5	FET
2N4392	S5	FET
2N4393	S5	FET
2N4427	SC4a	Tra
2N4856	S5	FET
2N4857	S5	FET
2N4858	S5	FET
2N4859	S5	FET
2N4860	S5	FET
2N4861	S5	FET
2N5415	S3	Sm
2N5416	S3	Sm
61SV	S8	I
368BPY	S8	PDT
56201c	SC2	A
56201d	SC2	A
56201j	SC2	A
56230	S2	HE
56231	S2	HE
56233	S2	A
56234	S2	A
56245	S3,4a	A
56246	S2,S3	A
56253	S2	DH
56256	S2	DH
56261a	SC2	A
56262A	S2	A
56264A	S2	A
56268	S2	DH
56271	S2	DH
56278	S2	DH
56280	S2	DH
56290	S2	HE
56293	S2	HE
56295	S2	A
56312	S2	DH
56313	S2	DH
56314	S2	DH
56315	S2	DH
56316	S2	A
56317	S2	A
56318	S2	DH
56319	S2	DH
56326	SC2	A
56333	SC2	A
56334	S2	DH
56339	SC2	A
56348	S2	DH
56349	S2	DH
56350	S2	DH
56352	SC2	A
56353	SC2	A
56354	SC2	A
56359b	SC2	A
56359c	SC2	A
56359d	SC2	A
56360a	SC2	A
56363	S2,SC2	A
56364	S2,SC2	A
56366	S2	A
56367	S2,SC2	A
56368a	SC2	A
56368b	SC2	A
56369	S2,SC2	A
56378	SC2	A
56379	SC2	A

P = Low-frequency power transistors
PC = Germanium point contact diodes
PDT = Photodiodes or transistors
Ph = Photoconductive devices
R = Rectifier diodes
Sm = Small-signal transistors
St = Rectifier stacks
Tra = Transmitting transistors and modules
Vrf = Voltage reference diodes
WD = Silicon whiskerless diodes

MAINTENANCE TYPE LIST

The type numbers listed below are included in this handbook except for those marked with an asterisk. Detailed information will be supplied on request.

* BPX47A	ORP60	RPY82
CNY48	ORP61	RPY84
CNY52	ORP62	RPY85
CNY53	ORP66	61SV
CNY57	ORP68	
CNY57A	ORP69	

GENERAL

PRO ELECTRON TYPE DESIGNATION CODE FOR SEMICONDUCTOR DEVICES

This type designation code applies to discrete semiconductor devices – as opposed to integrated circuits –, multiples of such devices and semiconductor chips.

A basic type number consists of:

TWO LETTERS FOLLOWED BY A SERIAL NUMBER

FIRST LETTER

The first letter gives information about the material used for the active part of the devices.

A. GERMANIUM or other material with band gap of 0,6 to 1,0 eV.
B. SILICON or other material with band gap of 1,0 to 1,3 eV.
C. GALLIUM-ARSENIDE or other material with band gap of 1,3 eV or more.
R. COMPOUND MATERIALS (e.g. Cadmium-Sulphide).

SECOND LETTER

The second letter indicates the function for which the device is primarily designed.

A. DIODE; signal, low power
B. DIODE; variable capacitance
C. TRANSISTOR; low power, audio frequency ($R_{th\ j\text{-}mb} > 15\ ^{o}C/W$)
D. TRANSISTOR; power, audio frequency ($R_{th\ j\text{-}mb} \leqslant 15\ ^{o}C/W$)
E. DIODE; tunnel
F. TRANSISTOR; low power, high frequency ($R_{th\ j\text{-}mb} > 15\ ^{o}C/W$)
G. MULTIPLE OF DISSIMILAR DEVICES – MISCELLANEOUS; e.g. oscillator
H. DIODE; magnetic sensitive
L. TRANSISTOR; power, high frequency ($R_{th\ j\text{-}mb} \leqslant 15\ ^{o}C/W$)
N. PHOTO-COUPLER
P. RADIATION DETECTOR; e.g. high sensitivity phototransistor
Q. RADIATION GENERATOR; e.g. light-emitting diode (LED)
R. CONTROL AND SWITCHING DEVICE; e.g. thyristor, low power ($R_{th\ j\text{-}mb} > 15\ ^{o}C/W$)
S. TRANSISTOR; low power, switching ($R_{th\ j\text{-}mb} > 15\ ^{o}C/W$)
T. CONTROL AND SWITCHING DEVICE; e.g. thyristor, power ($R_{th\ j\text{-}mb} \leqslant 15\ ^{o}C/W$)
U. TRANSISTOR; power, switching ($R_{th\ j\text{-}mb} \leqslant 15\ ^{o}C/W$)
X. DIODE: multiplier, e.g. varactor, step recovery
Y. DIODE; rectifying, booster
Z. DIODE; voltage reference or regulator (transient suppressor diode, with third letter W)

SERIAL NUMBER

Three figures, running from 100 to 999, for devices primarily intended for consumer equipment.
One letter (Z, Y, X, etc.) and two figures, running from 10 to 99, for devices primarily intended for industrial/professional equipment.
This letter has no fixed meaning except W, which is used for transient suppressor diodes.

VERSION LETTER

It indicates a minor variant of the basic type either electrically or mechanically. The letter never has a fixed meaning, except letter R, indicating reverse voltage, e.g. collector to case or anode to stud.

SUFFIX

Sub-classification can be used for devices supplied in a wide range of variants called associated types. Following sub-coding suffixes are in use:

1. VOLTAGE REFERENCE and VOLTAGE REGULATOR DIODES: *ONE LETTER and ONE NUMBER*
   The LETTER indicates the nominal tolerance of the Zener (regulation, working or reference) voltage
   A. 1% (according to IEC 63: series E96)
   B. 2% (according to IEC 63: series E48)
   C. 5% (according to IEC 63: series E24)
   D. 10% (according to IEC 63: series E12)
   E. 20% (according to IEC 63: series E6)
   The number denotes the typical operating (Zener) voltage related to the nominal current rating for the whole range.
   The letter 'V' is used instead of the decimal point.

2. TRANSIENT SUPPRESSOR DIODES: *ONE NUMBER*
   The NUMBER indicates the maximum recommended continuous reversed (stand-off) voltage V_R. The letter 'V' is used as above.

3. CONVENTIONAL and CONTROLLED AVALANCHE RECTIFIER DIODES and THYRISTORS: *ONE NUMBER*
   The NUMBER indicates the rated maximum repetitive peak reverse voltage (V_{RRM}) or the rated repetitive peak off-state voltage (V_{DRM}), whichever is the lower. Reversed polarity is indicated by letter R, immediately after the number.

4. RADIATION DETECTORS: *ONE NUMBER,* preceded by a hyphen (–)
   The NUMBER indicates the depletion layer in μm. The resolution is indicated by a version LETTER.

5. ARRAY OF RADIATION DETECTORS and GENERATORS: *ONE NUMBER,* preceded by a stroke (/).
   The NUMBER indicates how many basic devices are assembled into the array.

RATING SYSTEMS

The rating systems described are those recommended by the International Electrotechnical Commission (IEC) in its Publication 134.

DEFINITIONS OF TERMS USED

Electronic device. An electronic tube or valve, transistor or other semiconductor device.

Note
This definition excludes inductors, capacitors, resistors and similar components.

Characteristic. A characteristic is an inherent and measurable property of a device. Such a property may be electrical, mechanical, thermal, hydraulic, electro-magnetic, or nuclear, and can be expressed as a value for stated or recognized conditions. A characteristic may also be a set of related values, usually shown in graphical form.

Bogey electronic device. An electronic device whose characteristics have the published nominal values for the type. A bogey electronic device for any particular application can be obtained by considering only those characteristics which are directly related to the application.

Rating. A value which establishes either a limiting capability or a limiting condition for an electronic device. It is determined for specified values of environment and operation, and may be stated in any suitable terms.

Note
Limiting conditions may be either maxima or minima.

Rating system. The set of principles upon which ratings are established and which determine their interpretation.

Note
The rating system indicates the division of responsibility between the device manufacturer and the circuit designer, with the object of ensuring that the working conditions do not exceed the ratings.

ABSOLUTE MAXIMUM RATING SYSTEM

Absolute maximum ratings are limiting values of operating and environmental conditions applicable to any electronic device of a specified type as defined by its published data, which should not be exceeded under the worst probable conditions.

These values are chosen by the device manufacturer to provide acceptable serviceability of the device, taking no responsibility for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the device under consideration and of all other electronic devices in the equipment.

The equipment manufacturer should design so that, initially and throughout life, no absolute maximum value for the intended service is exceeded with any device under the worst probable operating conditions with respect to supply voltage variation, equipment component variation, equipment control adjustment, load variations, signal variation, environmental conditions, and variations in characteristics of the device under consideration and of all other electronic devices in the equipment.

DESIGN MAXIMUM RATING SYSTEM

Design maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electronic device of a specified type as defined by its published data, and should not be exceeded under the worst probable conditions.

These values are chosen by the device manufacturer to provide acceptable serviceability of the device, taking responsibility for the effects of changes in operating conditions due to variations in the characteristics of the electronic device under consideration.

The equipment manufacturer should design so that, initially and throughout life, no design maximum value for the intended service is exceeded with a bogey device under the worst probable operating conditions with respect to supply voltage variation, equipment component variation, variation in characteristics of all other devices in the equipment, equipment control adjustment, load variation, signal variation and environmental conditions.

DESIGN CENTRE RATING SYSTEM

Design centre ratings are limiting values of operating and environmental conditions applicable to a bogey electronic device of a specified type as defined by its published data, and should not be exceeded under normal conditions.

These values are chosen by the device manufacturer to provide acceptable serviceability of the device in average applications, taking responsibility for normal changes in operating conditions due to rated supply voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all electronic devices.

The equipment manufacturer should design so that, initially, no design centre value for the intended service is exceeded with a bogey electronic device in equipment operating at the stated normal supply voltage.

LETTER SYMBOLS FOR TRANSISTORS AND SIGNAL DIODES

based on IEC Publication 148

LETTER SYMBOLS FOR CURRENTS, VOLTAGES AND POWERS

Basic letters

The basic letters to be used are:

I, i = current
V, v = voltage
P, p = power.

Lower-case basic letters shall be used for the representation of instantaneous values which vary with time.
In all other instances upper-case basic letters shall be used.

Subscripts

A, a	Anode terminal
(AV), (av)	Average value
B, b	Base terminal, for MOS devices: Substrate
(BR)	Breakdown
C, c	Collector terminal
D, d	Drain terminal
E, e	Emitter terminal
F, f	Forward
G, g	Gate terminal
K, k	Cathode terminal
M, m	Peak value
O, o	As third subscript: The terminal not mentioned is open circuited
R, r	As first subscript: Reverse. As second subscript: Repetitive. As third subscript: With a specified resistance between the terminal not mentioned and the reference terminal.
(RMS), (rms)	R.M.S. value
S, s	As first or second subscript: Source terminal (for FETS only) As second subscript: Non-repetitive (not for FETS) As third subscript: Short circuit between the terminal not mentioned and the reference terminal
X, x	Specified circuit
Z, z	Replaces R to indicate the actual working voltage, current or power of voltage reference and voltage regulator diodes.

Note: No additional subscript is used for d.c. values.

Upper-case subscripts shall be used for the indication of:

a) continuous (d.c.) values (without signal)

Example I_B

b) instantaneous total values

Example i_B

c) average total values

Example $I_{B(AV)}$

d) peak total values

Example I_{BM}

e) root-mean-square total values

Example $I_{B(RMS)}$

Lower-case subscripts shall be used for the indication of values applying to the varying component alone:

a) instantaneous values

Example i_b

b) root-mean-square values

Example $I_{b(rms)}$

c) peak values

Example I_{bm}

d) average values

Example $I_{b(av)}$

Note: If more than one subscript is used, subscript for which both styles exist shall either be all upper-case or all lower-case.

Additional rules for subscripts

Subscripts for currents

Transistors: If it is necessary to indicate the terminal carrying the current, this should be done by the first subscript (conventional current flow from the external circuit into the terminal is positive).

Examples: I_B, i_B, i_b, I_{bm}

Diodes: To indicate a forward current (conventional current flow into the anode terminal) the subscript F or f should be used; for a reverse current (conventional current flow out of the anode terminal) the subscript R or r should be used.

Examples: I_F, I_R, i_F, $I_{f(rms)}$

Subscripts for voltages

Transistors: If it is necessary to indicate the points between which a voltage is measured, this should be done by the first two subscripts. The first subscript indicates the terminal at which the voltage is measured and the second the reference terminal or the circuit node. Where there is no possibility of confusion, the second subscript may be omitted.

Examples: V_{BE}, v_{BE}, v_{be}, V_{bem}

Diodes: To indicate a forward voltage (anode positive with respect to cathode), the subscript F or f should be used; for a reverse voltage (anode negative with respect to cathode) the subscript R or r should be used.

Examples: V_F, V_R, v_F, V_{rm}

Subscripts for supply voltages or supply currents

Supply voltages or supply currents shall be indicated by repeating the appropriate terminal subscript.

Examples: V_{CC}, I_{EE}

Note: If it is necessary to indicate a reference terminal, this should be done by a third subscript

Example : V_{CCE}

Subscripts for devices having more than one terminal of the same kind

If a device has more than one terminal of the same kind, the subscript is formed by the appropriate letter for the terminal followed by a number; in the case of multiple subscripts, hyphens may be necessary to avoid misunderstanding.

Examples: I_{B2} = continuous (d.c.) current flowing into the second base terminal

V_{B2-E} = continuous (d.c.) voltage between the terminals of second base and emitter

Subscripts for multiple devices

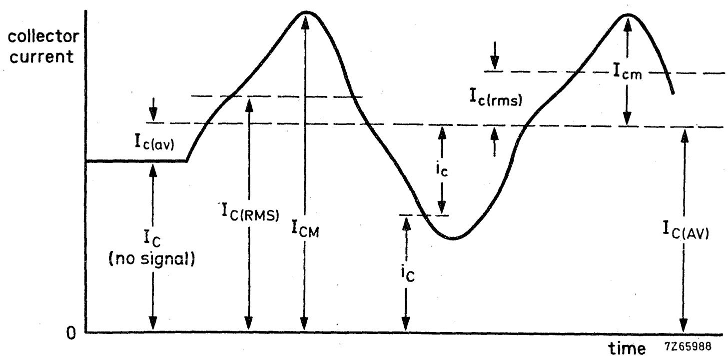
For multiple unit devices, the subscripts are modified by a number preceding the letter subscript; in the case of multiple subscripts, hyphens may be necessary to avoid misunderstanding.

Examples: I_{2C} = continuous (d.c.) current flowing into the collector terminal of the second unit

V_{1C-2C} = continuous (d.c.) voltage between the collector terminals of the first and the second unit.

Application of the rules

The figure below represents a transistor collector current as a function of time. It consists of a continuous (d.c.) current and a varying component.



LETTER SYMBOLS FOR ELECTRICAL PARAMETERS

Definition

For the purpose of this Publication, the term "electrical parameter" applies to four-pole matrix parameters, elements of electrical equivalent circuits, electrical impedances and admittances, inductances and capacitances.

Basic letters

The following is a list of the most important basic letters used for electrical parameters of semiconductor devices.

B, b = susceptance; imaginary part of an admittance

C = capacitance

G, g = conductance; real part of an admittance

H, h = hybrid parameter

L = inductance

R, r = resistance; real part of an impedance

X, x = reactance; imaginary part of an impedance

Y, y = admittance;

Z, z = impedance;

Upper-case letters shall be used for the representation of:

a) electrical parameters of external circuits and of circuits in which the device forms only a part;

b) all inductances and capacitances.

Lower-case letters shall be used for the representation of electrical parameters inherent in the device (with the exception of inductances and capacitances).

Subscripts

General subscripts

The following is a list of the most important general subscripts used for electrical parameters of semiconductor devices:

F, f	= forward; forward transfer
I, i (or 1)	= input
L, 1	= load
O, o (or 2)	= output
R, r	= reverse; reverse transfer
S, s	= source

Examples: Z_S, h_f, h_F

The upper-case variant of a subscript shall be used for the designation of static (d.c.) values.

Examples : h_{FE} = static value of forward current transfer ratio in common-emitter configuration (d.c. current gain)

R_E = d.c. value of the external emitter resistance.

Note: The static value is the slope of the line from the origin to the operating point on the appropriate characteristic curve, i.e. the quotient of the appropriate electrical quantities at the operating point.

The lower-case variant of a subscript shall be used for the designation of small-signal values.

Examples: h_{fe} = small-signal value of the short-circuit forward current transfer ratio in common-emitter configuration

$Z_e = R_e + jX_e$ = small-signal value of the external impedance

Note: If more than one subscript is used, subscripts for which both styles exist shall either be all upper-case or all lower-case

Examples: h_{FE}, y_{RE}, h_{fe}

Subscripts for four-pole matrix parameters

The first letter subscript (or double numeric subscript) indicates input, output, forward transfer or reverse transfer

Examples: h_i (or h_{11})
h_o (or h_{22})
h_f (or h_{21})
h_r (or h_{12})

A further subscript is used for the identification of the circuit configuration. When no confusion is possible, this further subscript may be omitted.

Examples: h_{fe} (or h_{21e}), h_{FE} (or h_{21E})

Distinction between real and imaginary parts

If it is necessary to distinguish between real and imaginary parts of electrical parameters, no additional subscripts should be used. If basic symbols for the real and imaginary parts exist, these may be used.

Examples: $Z_i = R_i + jX_i$
$y_{fe} = g_{fe} + jb_{fe}$

If such symbols do not exist or if they are not suitable, the following notation shall be used:

Examples: Re (h_{ib}) etc. for the real part of h_{ib}
Im (h_{ib}) etc. for the imaginary part of h_{ib}

DEFINITIONS FOR OPTOELECTRONIC DEVICES ACCORDING TO IEC 306

DEFINITIONS AND UNITS OF RADIATION AND LIGHT QUANTITIES

Radiant flux, radiant power ϕ, P, (ϕ_e)

This is the power emitted, transferred or received as radiation, i.e. the radiant energy (dQ_e) emitted per second.

$$\phi_e = \frac{dQ_e}{dt} \qquad \text{unit: watt, W}$$

Radiant intensity I_e, I

For a source of given direction, the radiant intensity is the radiant power leaving the source, or an element of the source, in an element of solid angle (Ω) containing the given direction, divided by that element of solid angle.

$$I_e = \frac{d\phi_e}{d\Omega} \qquad \text{unit: watt per steradian, W/sr}$$

Irradiance E, (E_e)

At a point on a surface, the irradiance is the radiant power incident on an element of the surface containing the point divided by the area (A) of that element.

$$E = \frac{d\phi_e}{dA} \qquad \text{unit: watt per square metre, W/m}^2$$

Light

This is radiation capable of stimulating the eye. Exceptions to this definition are made where necessary in the data sheets, e.g. dark and light currents of a phototransistor and light rise time of a near-infrared light emitting diode.

Luminous flux ϕ, (ϕ_v)

The luminous flux $d\phi$ of a source of luminous intensity I_v in an element of solid angle of $d\Omega$, is given by:

$$d\phi = I_v . d\Omega \qquad \text{unit: lumen, lm}$$

Lumen

This is the luminous flux radiating from a point source of uniform luminous intensity of 1 candela, contained within a solid angle of 1 steradian.

$$1 \text{ lm} = 1 \text{ cd.sr}$$

Luminous intensity I_v, (I)

For a source of given direction, the luminous intensity is the luminous flux leaving the source, or an element of the source, in an element of solid angle (Ω) containing the given direction, divided by that element of solid angle.

$$I_v = \frac{d\phi_v}{d\Omega} \qquad \text{unit: candela, cd}$$

Candela

This is the luminous intensity, in the perpendicular direction, of a surface of 1/600 000 square metre of a black body at the temperature of freezing platinum under a pressure of 101 325 pascal.

Illuminance E_v, (E)

At a point on a surface, the illuminance is the luminous flux incident on an element of the surface containing the point, divided by the area (A) of that element.

$$E_v = \frac{d\phi_v}{dA} \qquad \text{unit: lux, lx}$$

Lux lx

This is the illumination produced when 1 lumen of flux falls on a surface of area 1 square metre. It will be seen that an illumination of 1 lx is produced on a area of 1 square metre at a distance of 1 metre from a point source of 1 candela.

Distribution temperature T_d

This is the temperature of a black body at which the spectral radiation distribution of the radiator under consideration, in a given wavelength range, is proportional or approximately proportional to the spectral radiation distribution of the black body. If the wavelength range given includes visible radiation, then the distribution temperature corresponds to the colour temperature.

Colour temperature T_c

The colour temperature of a radiator is the temperature of a black body which has the same, or approximately the same, spectral radiation distribution in the visible range as the radiator under consideration.

DEFINITIONS OF ELECTRICAL QUANTITIES

Photocurrent I_{ph}

This is the change in output current from the photocathode due to incident radiation.

Dark current I_d

This is the current flowing in a photoelectric device in the absence of illumination.

Dark current equivalent radiation E_d

This is the incident radiation required to give a d.c. signal output current equal to the dark current.

Quantum efficiency

This is the ratio of the number of emitted photoelectrons to the number of incident photons. Quantum efficiency (Q.E.) at a given wavelength of incident radiation may be calculated as follows:

$$\text{Q.E.} = \frac{\text{constant} \times S_k}{\lambda}$$

where S_k = spectral sensitivity (A/W) at wavelength λ
λ = wavelength of incident radiation (nm)

constant $= \frac{hc}{e} = 1{,}24 \times 10^3$ W.nm/A

h = Planck's constant ($6{,}6256 \times 10^{-34}$ js)
c = velocity of electromagnetic waves in vacuo = $2{,}997925 \times 10^8$ m/s
e = elementary charge = $1{,}60210 \times 10^{-19}$ coulomb or $4{,}80298 \times 10^{-19}$ e.s.u.

Saturation voltage V_{CEsat}

This is the lowest operating voltage which causes no change in photocurrent when this voltage is increased with constant radiation.

Saturation current I_{CEsat}

This is the output current of a photosensitive device which is not changed by an increase of either:

a. the irradiance under constant operating conditions, or,
b. the operating voltage under constant irradiance.

Thermal resistance

This is the ratio of temperature rise to power dissipation or

$$R_{th\ j\text{-}a} = \frac{T_j - T_{amb}}{P_{tot}}$$

The thermal resistance is also the reciprocal of the derating factor.

Pulsed operation

Under these conditions higher peak power dissipation is possible. In general, the shorter the pulse and lower the frequency, the lower is the temperature that the junction reaches.

By analogy with thermal resistance:

$$Z_{th\ j\text{-}a} = \frac{T_j - T_{amb}}{P_{tot}}$$

DEFINITIONS OF SENSITIVITY

These definitions apply more directly to photocathode sensitivity. For devices in which it is necessary to define the anode (overall) sensitivity, the signal output current should be considered instead of the photocurrent.

Actinity of radiation Z

This is the ratio of the sensitivity to a given radiation to the sensitivity to a reference radiation.

Radiant sensitivity S_R

This may be expressed as either:

a. the ratio of the photocurrent of the device to the incident radiant power, expressed in amperes per watt (A/W), or,
b. the ratio of the photocurrent of the device to the incident irradiance, expressed in amperes per watt per square metre ($A/W/m^2$).

Absolute spectral sensitivity $s(\lambda)$

This is the radiant sensitivity for monochromatic radiation of a stated wavelength.

Relative spectral sensitivity $s(\lambda)_{rel}$

This is the ratio of the radiant sensitivity at a particular wavelength to the radiant sensitivity at a reference wavelength, usually the wavelength of maximum reponse.

Note
For non-linear detectors, it is necessary to refer to constant photocurrent at all wavelengths.

Luminous sensitivity S_L

This may be expressed as either:

a. the ratio of the photocurrent of the device to the incident luminous flux, expressed in amperes per lumen (A/lm), or,
b. the ratio of the photocurrent of the device to the incident illuminance, expressed in amperes per lux (A/lx).

Dynamic sensitivity S_D

Under stated operating conditions, this is the ratio of the variation of the photocurrent of the device to the initiating small variation in the incident radiant or luminous power.

Note
Distinction is made between luminous dynamic sensitivity and radiant sensitivity.

Spectral sensitivity characteristics

This is the relationship, usually shown in graphical form, between the wavelength and the absolute or relative spectral sensitivity.

Absolute spectral sensitivity characteristics

This is the relationship, usually shown in graphical form, between the wavelength and the absolute spectral sensitivity.

Relative spectral sensitivity characteristics

This is the relationship between wavelength and the relative spectral sensitivity.

Quantum efficiency characteristic

This is the relationship, usually shown in graphical form, between the wavelength and the quantum efficiency.

DEFINITIONS OF TIME QUANTITIES

Rise time t_r

This is the time required for the photocurrent to rise from a stated low percentage to a stated higher percentage of the maximum value when a steady state of radiation is instantaneously applied. It is usual to consider the 10% and 90% levels (see Figs 1 and 2).

Fall time t_f

This is the time required for the photocurrent to fall from a stated high percentage to a stated lower percentage of the maximum value when the steady state of radiation is instantaneously removed.

It is usual to consider the 90% and 10% levels (see Figs 1 and 2).

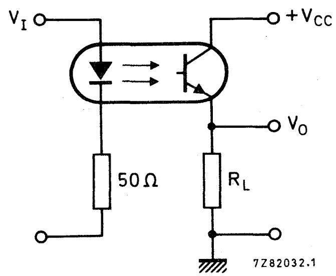


Fig. 1 Switching circuit.

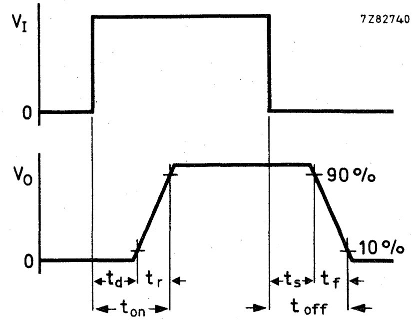


Fig. 2 Waveforms.

DEFINITIONS AND UNITS OF INFRARED SENSITIVE DEVICES

Emissivity

This is the ratio of the radiant exitance of a thermal radiator to that of a black body radiator at the same temperature.

Absolute refractive index n

This is the ratio of the velocity of light in vacuo to that in a particular medium. For most practical purposes the velocity of light in vacuo can be replaced by that in air.

Detectivity

This is the signal-to-noise ratio per unit radiant power. Thus it is the reciprocal of the N.E.P. Care must be exercised when considering detectivity as this term has also been used in the definitions of D*.

unit: 1/watts (1/W)

D*

This is an independent figure of merit which is defined as the r.m.s. signal-to-noise ratio in a 1 Hz bandwidth per unit r.m.s. incident radiant power per square root of detector area. Unless otherwise stated, it is assumed that the detector field of view is hemispherical (2π steradian).

unit: $cm\sqrt{Hz}/W$

Wave number

This is the reciprocal of the wavelength in centimetres. $(\frac{1}{\lambda})$

N.E.P. (Noise Equivalent Power)

This is the r.m.s. value of the incident, chopped, radiant power necessary to produce an r.m.s. signal to r.m.s. noise ratio of unity. The r.m.s. noise refers to the value calculated for unit square root bandwidth $V/\sqrt{Hz}$.

unit: $W/\sqrt{Hz}$

Responsivity

This is the ratio of the r.m.s. signal in volts to the r.m.s. value of the incident, chopped, radiant power.

unit: V/W

Noise equivalent irradiation

This is the value of incident radiation which, when modulated in a stated manner, produces a signal output power equal to the noise power, both of which are in a stated bandwidth.

Radiance L_e

This is the radiant intensity (I_e) at a point on a surface and in a given direction, of an element of that surface, divided by the area of the orthogonal projection of the element on a plane perpendicular to the given direction.

unit: watt per steradian square metre, W/sr.m^2

Radiant exitance (radiant emittance) M_e

At a point on a surface, this is the radiant power leaving an element of that surface, divided by the area of the element.

$$M_e = \frac{d\phi_e}{dA}$$ unit: watt per square metre, W/m^2

Luminous exitance (luminous emittance) M_v

At a point on a surface, this is the luminous flux leaving an element of that surface, divided by the area of that element.

$$M_v = \frac{d\phi_v}{dA}$$ unit: lumen per square metre, lm/m^2

Luminance L_v

This is the luminous intensity (I_v) at a point on a surface and in a given direction, of an element of that surface divided by the area of the orthogonal projection of the element on a plane perpendicular to the given direction.

unit: candela per square metre, cd/m^2

Steradian sr (see Fig. 3)

This is the solid angle subtended at the centre of a sphere by an element of the surface area equal to the square of the radius of the sphere. There are, therefore, 4π steradians in a complete sphere.

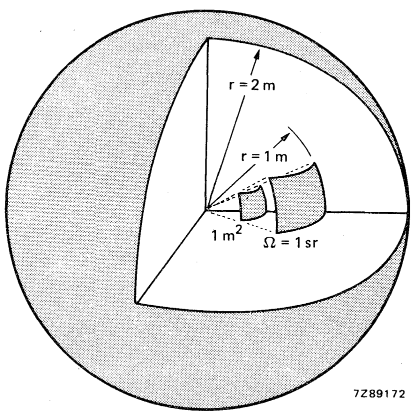


Fig. 3.

GENERAL SAFETY RECOMMENDATIONS OPTOELECTRONIC DEVICES

1. GENERAL

When properly used and handled, optoelectronic devices do not constitute a risk to health or environment. Modern high technology materials have been used in the manufacture of these devices to ensure optimum performance. Some of these materials are toxic in certain circumstances. Mechanical or electrical damage is unlikely to give rise to any hazard, but toxic vapours may be generated if the devices are heated to destruction and it is important that the following recommendations are observed.

Care should be taken to ensure that all personnel who may handle, use or dispose of these products are aware of the necessary precautions.

Individual product data sheets will indicate whether any specific hazards are likely to be present.

2. DISPOSAL

These devices should be disposed of in accordance with the relevant legislation; in the United Kingdom disposal should therefore be carried out in accordance with the Deposit of Poisonous Waste Act 1972 and the Control of Pollution Act 1974, or with the latest legislation.

3. FIRE

Optoelectronic devices themselves, when used within the specified limits, do not present a fire hazard.

Devices can contain arsenic, beryllium, cadmium, lead, mercury, selenium, tellurium or similar hazardous materials or compounds, which, if exposed to high temperatures may emit toxic or noxious fumes.

Most packaging materials are flammable and care should be taken in the disposal of such materials, some of which will emit toxic fumes if burned.

4. HANDLING

Care must be exercised with those devices incorporating glass or plastic. If these devices are broken, precautions must be taken against the following hazards that may arise:

Broken glass or ceramic. Protective clothing such as gloves should be worn.

Contamination from toxic materials and vapours. In particular, skin contact and inhalation must be avoided.

Access to live contacts which may be at high potential. Devices must be isolated from the mains supply prior to their removal.

5. BERYLLIUM COMPOUNDS

Beryllium oxide dust is toxic if inhaled or if particles enter a cut or an abrasion. At all times avoid handling beryllium oxide ceramics; if they are touched, the hands must be washed thoroughly with soap and water. Do nothing to beryllium oxide ceramics that may produce dust or fumes.

Care should be taken upon eventual disposal that they are not thrown out with general industrial waste. Users seeking disposal of devices incorporating beryllium oxide ceramics should first take advice from the manufacturer's service department.

This potential hazard is present at all times from receipt to disposal of devices.

6. CADMIUM COMPOUNDS

Cadmium compounds are toxic. In the event of accidental breakage, cadmium dust may be released. Gloves should be worn and the dust should be mopped up with a damp cloth. Upon disposal, the cloth should be sealed in a plastic bag and the hands washed thoroughly with soap and water.

Controlled disposal of devices containing cadmium compounds should be conducted in the open air or in a well ventilated area.
Inhalation of cadmium dust must be avoided.

This potential hazard is present, if breakage occurs, at all times from receipt to disposal of devices.

7. OTHER COMPOUNDS

Other compounds, such as those containing arsenic, indium, lead, lithium, selenium, tantalum, tellurium etc., may be toxic by ingestion or inhalation.

PHOTOSENSITIVE DIODES AND TRANSISTORS

SILICON PHOTOTRANSISTOR

N-P-N silicon phototransistor in epoxy resin encapsulation intended for optical coupling and encoding. The base is inaccessible. Combination with LED CQY58A is recommended.

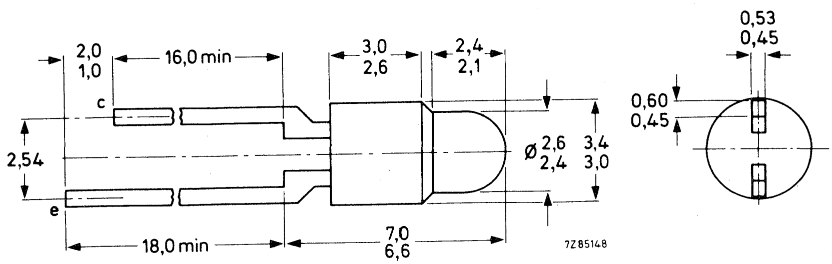
QUICK REFERENCE DATA

Collector-emitter voltage		V_{CEO}	max.	50	V
Collector current (d.c.)		I_C	max.	25	mA
Total power dissipation up to T_{amb} = 25 °C		P_{tot}	max.	100	mW
Collector dark current V_{CE} = 30 V; E = 0		$I_{CEO(D)}$	<	100	nA
Collector light current V_{CE} = 5 V; E_e = 1 mW/cm^2; λ_{pk} = 930 nm	**BPW22A-I**	$I_{CEO(L)}$	>	1,5	mA
	BPW22A-II	$I_{CEO(L)}$	>	5	mA
Wavelength at peak response		λ_{pk}	typ.	800	nm

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOD-53D.



RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage	V_{CEO}	max.	50	V
Emitter-collector voltage	V_{ECO}	max.	7	V
Collector current				
d.c.	I_C	max.	25	mA
peak value	I_{CM}	max.	50	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	100	mW
Storage temperature	T_{stg}	−55 to + 100		°C
Junction temperature	T_j	max.	100	°C
Lead soldering temperature				
> 3,5 mm from the body; t_{sld} < 7 s	T_{sld}	max.	240	°C

THERMAL RESISTANCE

From junction to ambient, device mounted on printed-circuit board	$R_{th\ j\text{-}a}$	=	750	°C/W

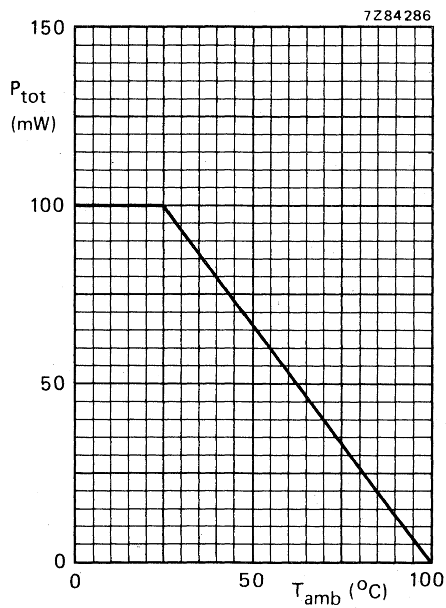


Fig. 2 Power derating curve versus ambient temperature.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector dark current V_{CE} = 30 V; E = 0		$I_{CEO(D)}$	<	100 nA
Collector light current V_{CE} = 5 V; E_e = 1 mW/cm²; λ_{pk} = 930 nm	**BPW22A-I**	$I_{CEO(L)}$		1,5 to 8 mA
	BPW22A-II	$I_{CEO(L)}$		5 to 25 mA
Collector-emitter saturation voltage I_C = 1 mA; E_e = 1 mW/cm²; λ_{pk} = 930 nm		V_{CEsat}	<	0,4 V
Wavelength at peak response		λ_{pk}	typ.	800 nm
Bandwidth at half height		$B_{50\%}$	typ.	400 nm
Beamwidth between half sensitivity directions		$\alpha_{50\%}$	typ.	± 10°
Switching times (see Figs 3, 4, 9 and 10)				
I_{Con} = 2 mA; V_{CC} = 5 V; R_E = 100 Ω; T_{amb} = 25 °C				
turn-on time		t_{on}	typ.	3 μs
turn-off time		t_{off}	typ.	3 μs
I_{Con} = 2 mA; V_{CC} = 5 V; R_E = 1 kΩ; T_{amb} = 25 °C				
turn-on time		t_{on}	typ.	12,0 μs
turn-off time		t_{off}	typ.	12,5 μs

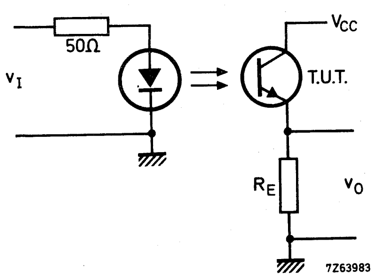


Fig. 3 Switching circuit with light emitting diode CQY58A. T.U.T. = BPW22A.

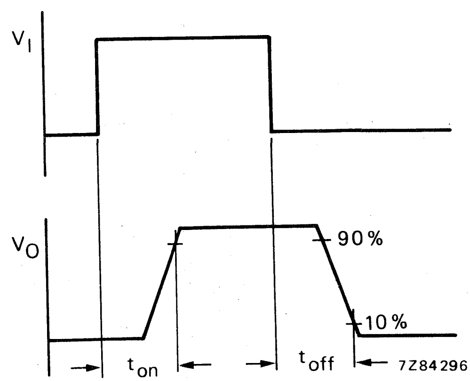


Fig. 4 Input and output switching waveforms.

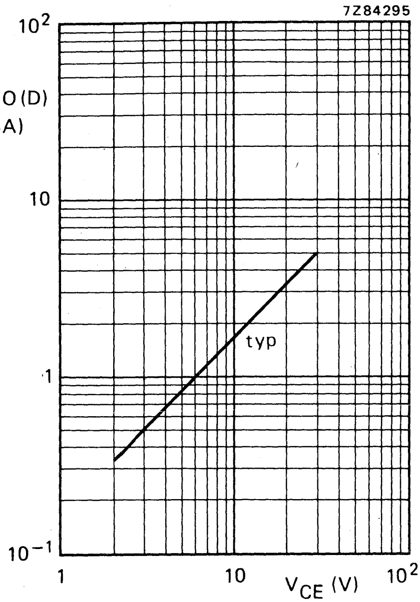


Fig. 5 E = 0; T_j = 25 °C.

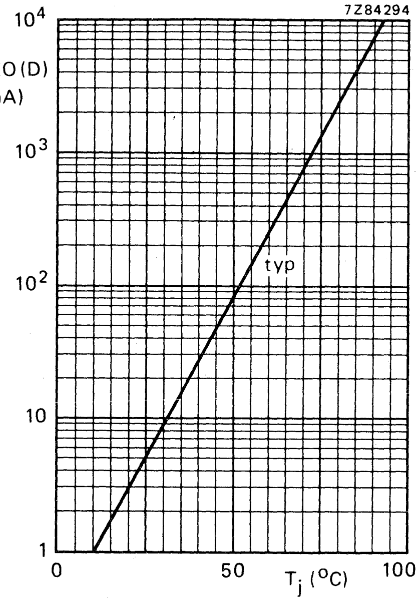


Fig. 6 E = 0; V_{CE} = 30 V.

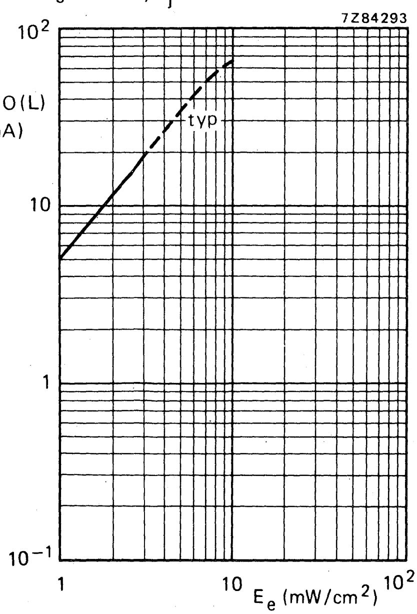


Fig. 7 GaAs source: λ_{pk} = 930 nm; V_{CE} = 5 V; T_j = 25 °C.

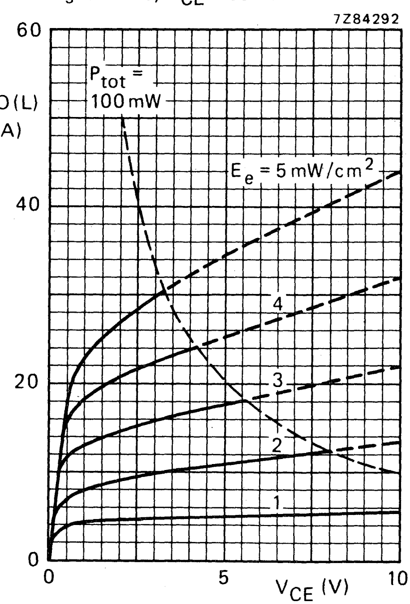


Fig. 8 λ_{pk} = 930 nm; T_j = 25 °C; typical values.

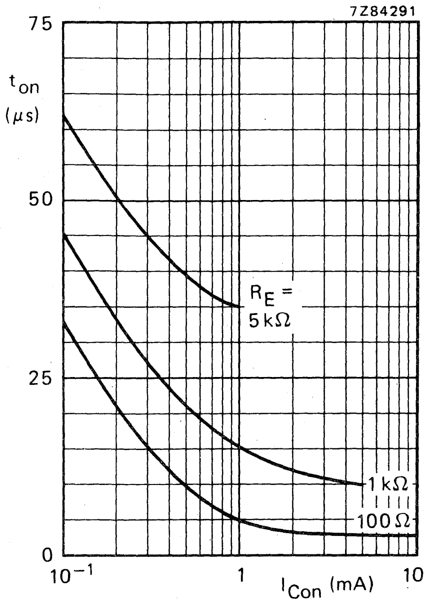


Fig. 9 V_{CC} = 5 V; T_{amb} = 25 °C; typical values; see also Figs 3 and 4.

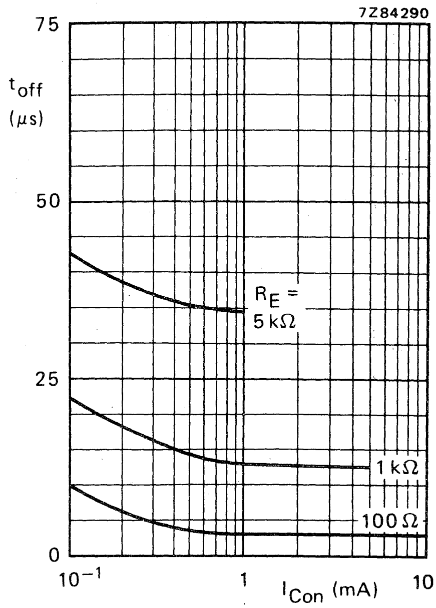


Fig. 10 V_{CC} = 5 V; T_{amb} = 25 °C; typical values; see also Figs 3 and 4.

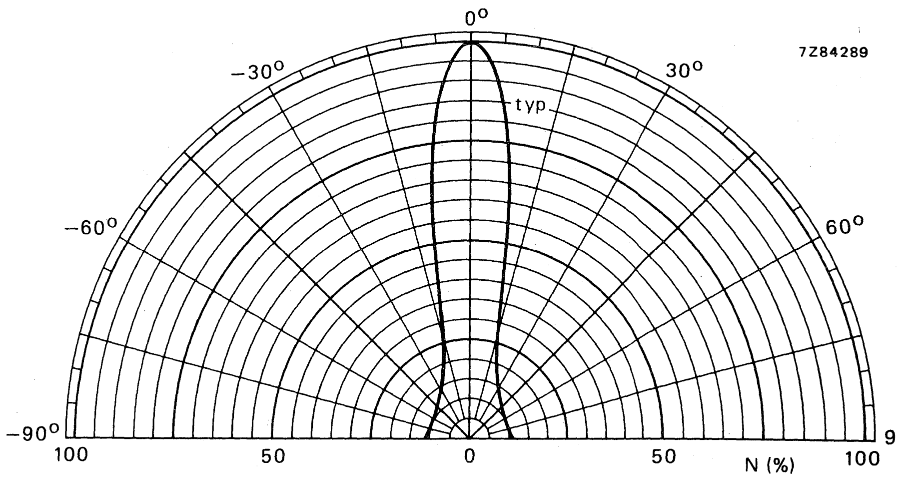


Fig. 11.

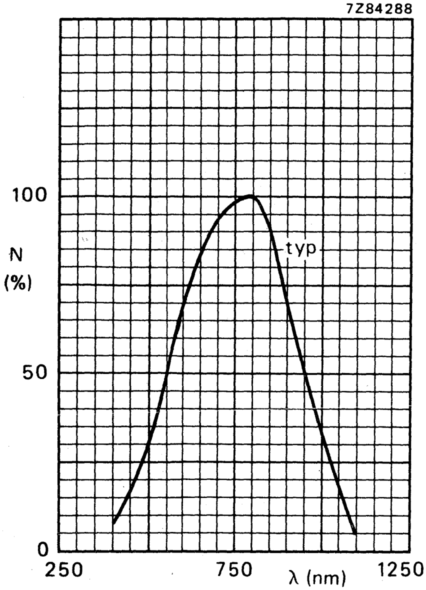


Fig. 12 Spectral response.

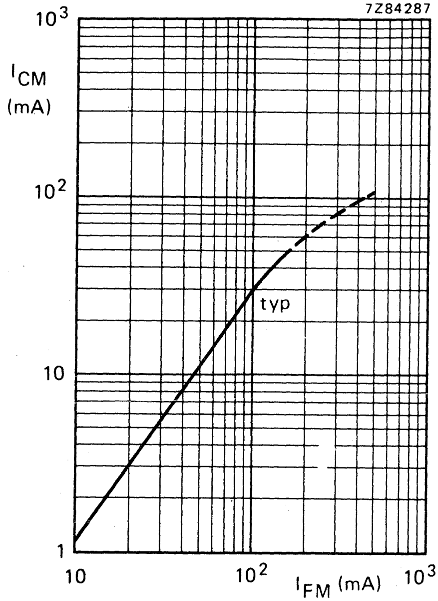


Fig. 13 V_{CE} = 5 V; t_p (I_{FM}) = 10 μs; T = 1 ms; d* = 10 mm; T_{amb} = 25 °C.

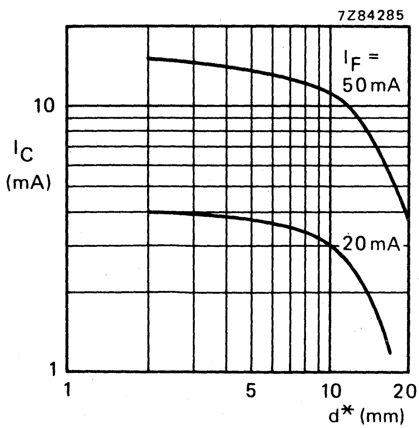


Fig. 14 V_{CE} = 5 V; T_{amb} = 25 °C; typical values.

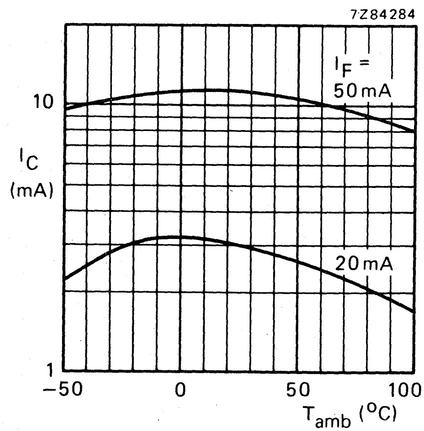


Fig. 15 V_{CE} = 5 V; d* = 10 mm; typical values.

* d = shortest free distance of mechanical on-axis when BPW22A is coupled with CQY58A.

SILICON PHOTO P.I.N. DIODE FOR FIBRE-OPTIC COMMUNICATIONS

The sensitive area is coupled to a step index optical fibre (core diameter of 200 μm).

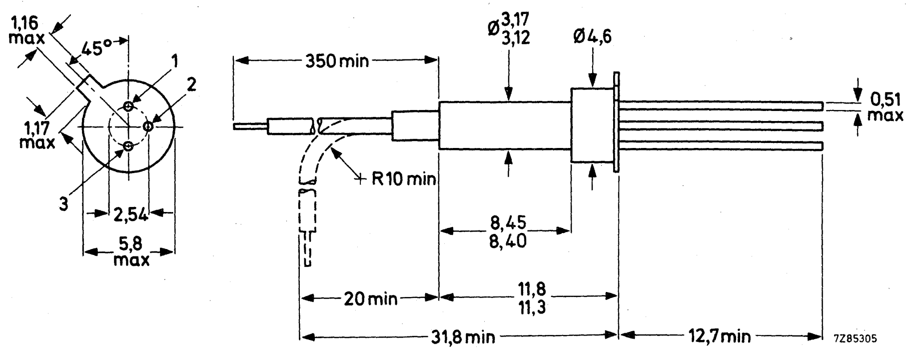
QUICK REFERENCE DATA

Continuous reverse voltage	V_R	max.	50	V
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300	mW
Junction temperature	T_j	max.	100	°C
Dark reverse current V_R = 10 V	$I_{R(D)}$	<	250	pA
Wavelength at peak response	λ_{pk}	typ.	750	nm
Core diameter of optical fibre	ϕ_{core}	typ.	200	μm

MECHANICAL DATA

Dimensions in mm

Fig. 1.



Connections

1. anode
2. not connected
3. cathode

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Continuous reverse voltage	V_R	max.	50 V
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300 mW
Storage temperature	T_{stg}	−40 to + 100 °C	
Junction temperature	T_j	max.	100 °C
Lead soldering temperature > 1,5 mm from the seating plane; t_{sld} < 10 s	T_{sld}	max.	260 °C

CHARACTERISTICS

T_j = 25 °C

Dark reverse current V_R = 10 V	$I_{R(D)}$	<	250 pA
Light reverse current V_R = 10 V; E_e = 1 mW/cm²; λ = 830 nm	$I_{R(L)}$	>	75 nA
		typ.	100 nA
Wavelength at peak response	λ_{pk}	typ.	750 nm
Diode capacitance at f = 1 MHz V_R = 10 V	C_d	typ.	2 pF
		<	3 pF
Noise equivalent power 830 nm; 1000 Hz; 1 Hz	N.E.P.	typ.	2×10^{-14} W/$\sqrt{Hz}$
Light switching times with R_A = 50 Ω Rise time and fall time	t_r, t_f	<	1 ns

Optical data

Numerical aperture	NA	typ.	0,17
Core diameter	ϕ_{core}	typ.	200 μm

SILICON PHOTO P.I.N. DIODE FOR FIBRE-OPTIC COMMUNICATIONS

A small light guide (core diameter of 600 μm) achieves the optical coupling with the sensitive area.
The BPW45 is designed to be the active component of either a BNC, TNC or RIM-SMA optical photoreceiver.

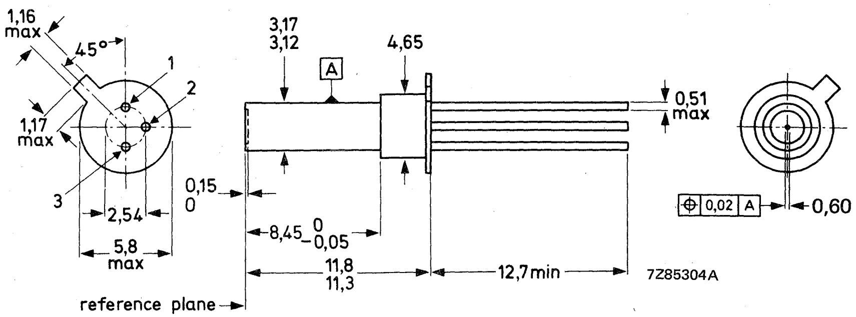
QUICK REFERENCE DATA

Continuous reverse voltage	V_R	max.	50	V
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300	mW
Junction temperature	T_j	max.	100	°C
Dark reverse current V_R = 10 V	$I_{R(D)}$	<	2	nA
Wavelength at peak response	λ_{pk}	typ.	750	nm
Core diameter of light guide	ϕ_{core}	typ.	600	μm

MECHANICAL DATA

Dimensions in mm

Fig. 1.



Connections

1. anode
2. not connected
3. cathode

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Continuous reverse voltage	V_R	max.	50 V
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300 mW
Storage temperature	T_{stg}		−40 to + 100 °C
Junction temperature	T_j	max.	100 °C
Lead soldering temperature > 1,5 mm from the seating plane; t_{sld} < 10 s	T_{sld}	max.	260 °C

CHARACTERISTICS

T_j = 25 °C

Dark reverse current V_R = 10 V	$I_{R(D)}$	<	2 nA
Light reverse current V_R = 10 V; E_e = 1 mW/cm²; λ = 830 nm	$I_{R(L)}$	>	0,75 μA
		typ.	1 μA
Wavelength at peak response	λ_{pk}	typ.	750 nm
Diode capacitance at f = 1 MHz V_R = 10 V	C_d	typ.	8 pF
		<	20 pF
Noise equivalent power 830 nm; 1000 Hz; 1 Hz	N.E.P.	typ.	7×10^{-14} W/$\sqrt{Hz}$
Light switching times with R_A = 50 Ω Rise time and fall time	t_r,t_f	<	1 ns

Optical data

Numerical aperture	NA	typ.	0,57
Core diameter of light guide	ϕ_{core}	typ.	600 μm

SILICON PHOTO P-I-N DIODE

Silicon photo p-i-n diode in a plastic envelope with an infrared filter.

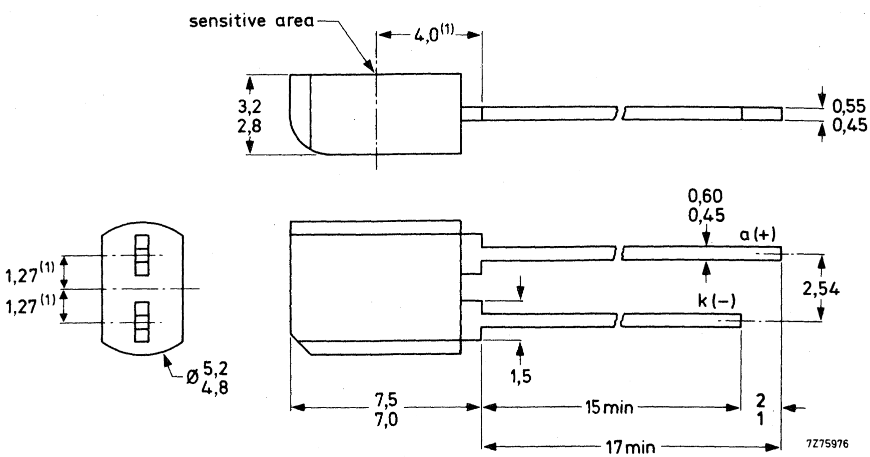
QUICK REFERENCE DATA

Continuous reverse voltage	V_R	max.	32	V
Total power dissipation up to T_{amb} = 47,5 °C	P_{tot}	max.	150	mW
Junction temperature	T_j	max.	100	°C
Dark reverse current V_R = 10 V; E_e = 0	$I_{R(D)}$	<	30	nA
Light reverse current V_R = 5 V; E_e = 1 mW/cm²; λ = 930 nm	$I_{R(L)}$	>	30	μA
Wavelength at peak response V_R = 5 V	λ_{pk}	typ.	930	nm
Sensitive area	A	typ.	5	mm²

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOD-67.



(1) Reference for the positional tolerance of the sensitive area.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Continuous reverse voltage	V_R	max.	32 V
Total power dissipation up to T_{amb} = 47,5 °C	P_{tot}	max.	150 mW
Storage temperature	T_{stg}	−30 to + 100 °C	
Junction temperature	T_j	max.	100 °C
Lead soldering temperature up to the seating plane; $t_{sld} < 10$ s	T_{sld}	max.	260 °C

THERMAL RESISTANCE

From junction to ambient in free air	$R_{th\ j\text{-}a}$	=	350 °C/W

CHARACTERISTICS

T_j = 25 °C

Dark reverse current V_R = 10 V; E_e = 0	$I_{R(D)}$	typ.	2 nA
		<	30 nA
Light reverse current V_R = 5 V; E_e = 1 mW/cm²; λ = 930 nm	$I_{R(L)}$	>	30 µA
		typ.	45 µA
Reverse voltage I_R = 0,1 mA; E_e = 0	V_R	>	32 V
Wavelength at peak response V_R = 5 V	λ_{pk}	typ.	930 nm
Diode capacitance V_R = 3 V	C_d	typ.	17 pF
		<	30 pF
V_R = 0	C_d	typ.	50 pF
Light switching times (see Figs 2 and 3) Rise time and fall time V_{KK} = 10 V; R_A = 1 kΩ	t_r, t_f	typ.	50 ns

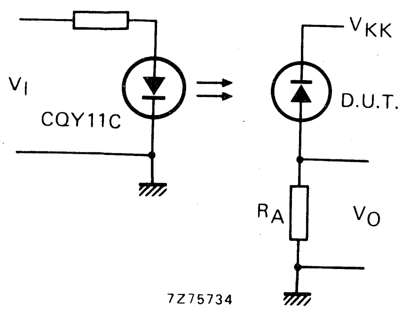


Fig. 2 Switching circuit.

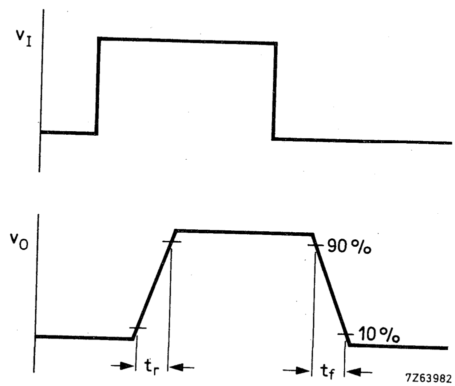


Fig. 3 Input and output switching waveforms.

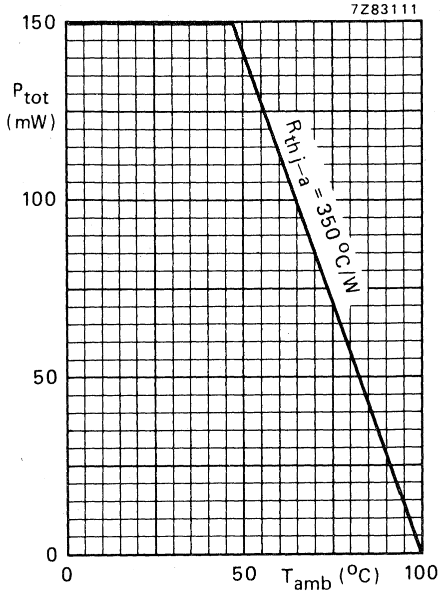


Fig. 4 Maximum permissible power dissipation as a function of temperature.

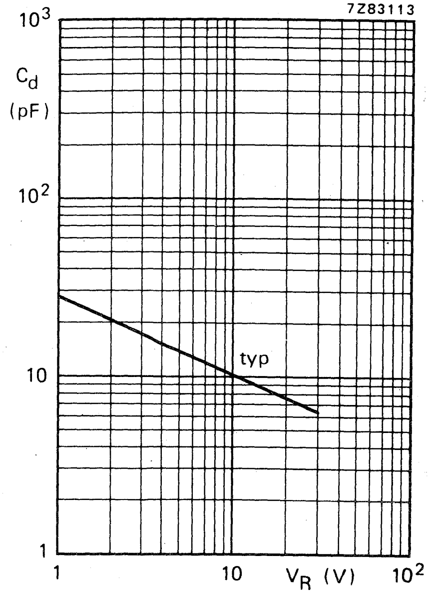


Fig. 5 T_{amb} = 25 ^oC.

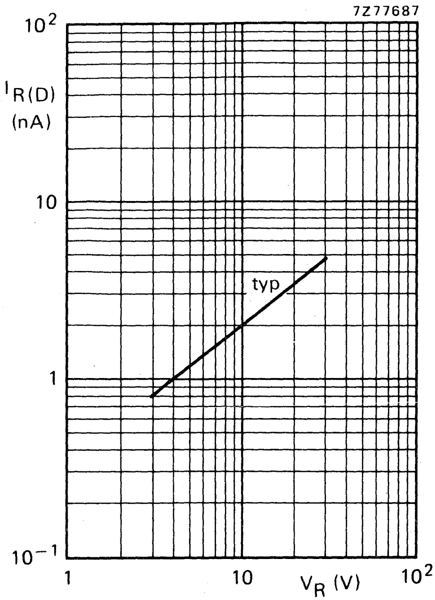


Fig. 6 E = 0; T_{amb} = 25 °C.

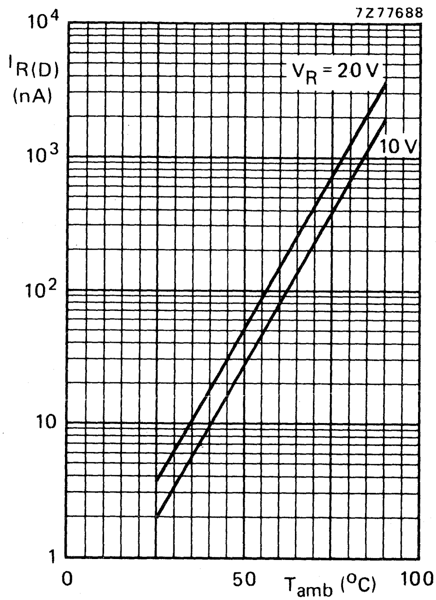


Fig. 7 E = 0; typical values.

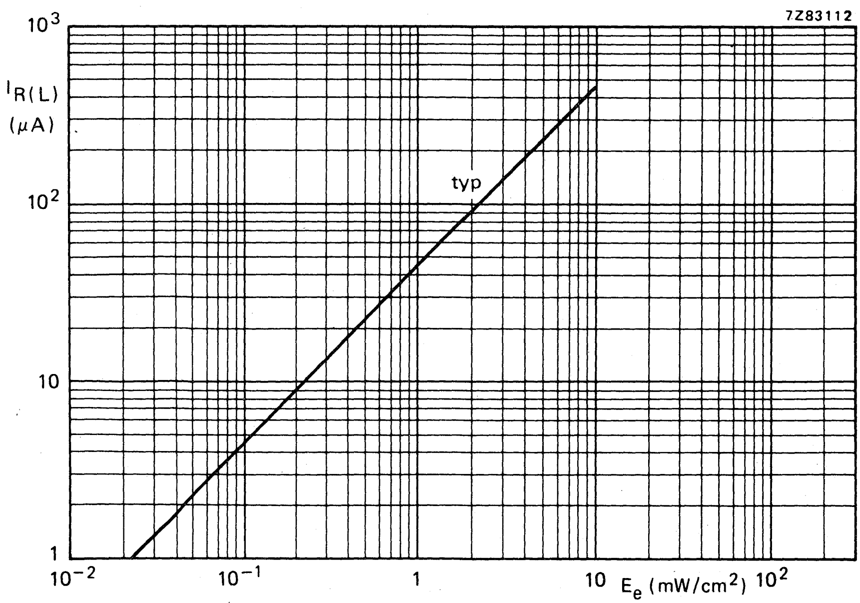


Fig. 8 V_R = 5 V; λ = 930 nm; T_{amb} = 25 °C.

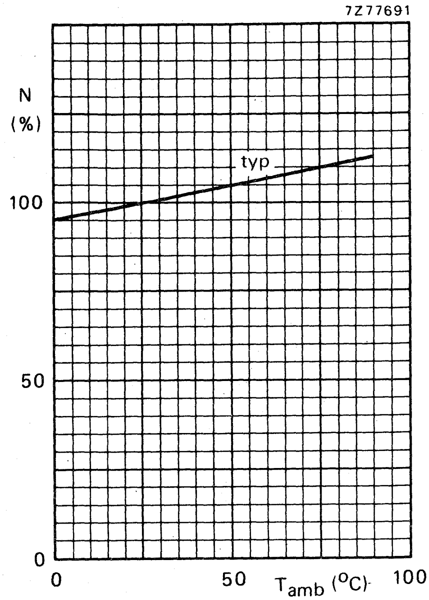


Fig. 9 E_e = 1 mW/cm²; λ = 930 nm.

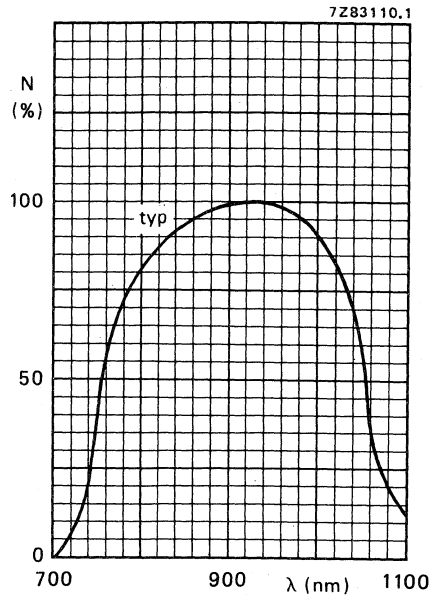


Fig. 10 V_R = 5 V; T_{amb} = 25 °C.

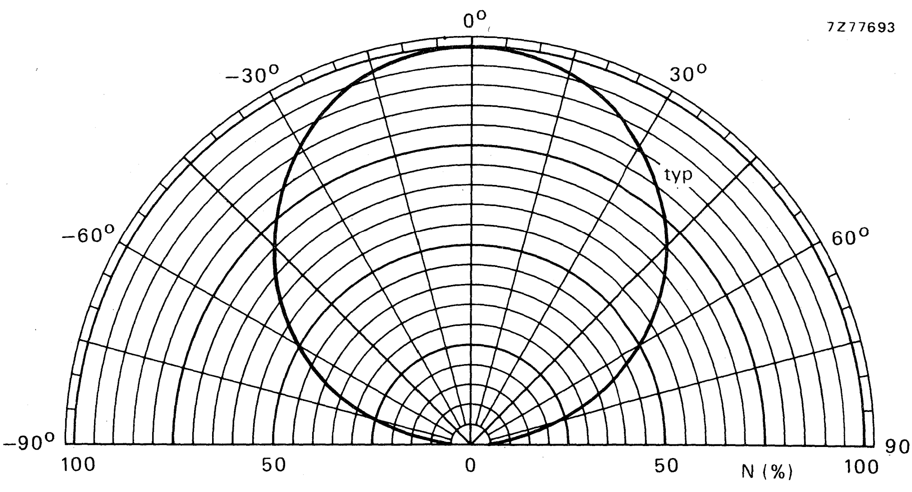


Fig. 11.

SILICON PLANAR EPITAXIAL PHOTOTRANSISTORS

General purpose n-p-n silicon phototransistors in TO-18.
The BPX25 has a lens, the BPX29 has a plane window.

QUICK REFERENCE DATA

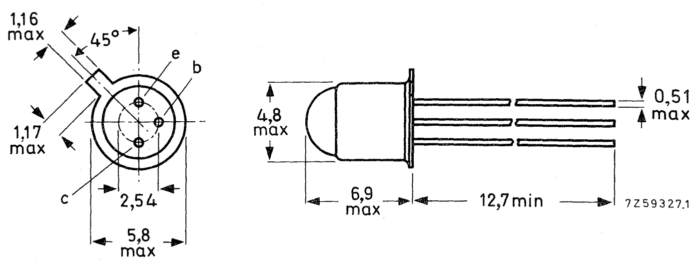
Collector-emitter voltage (open base)	V_{CEO}	max.	32		V
Collector current (peak value)	I_{CM}	max.	200		mA
Junction temperature	T_j	max.	150		^oC
Collector dark current $I_B = 0$; $V_{CE} = 24$ V	$I_{CEO(D)}$	<	500		nA
			BPX25	BPX29	
Collector light current $I_B = 0$; $V_{CE} = 6$ V; at 1000 lx	$I_{CEO(L)}$	typ.	13	0,8	mA
Wavelength at peak response	λ_{pk}	typ.	800		nm

MECHANICAL DATA

Dimensions in mm

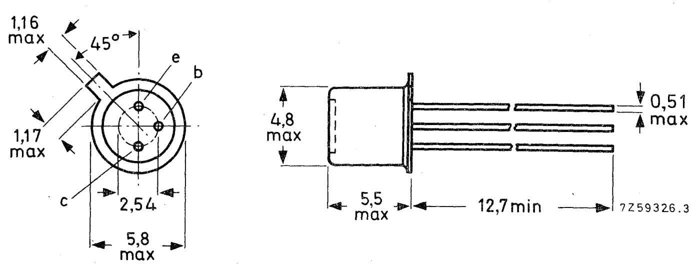
BPX25

TO-18, except for lens
Collector connected to case



BPX29

TO-18, except for window
Collector connected to case



RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

Voltages

Collector-base voltage (open emitter)	V_{CBO}	max.	32	V
Collector-emitter voltage (open base)	V_{CEO}	max.	32	V
Emitter-base voltage (open collector)	V_{EBO}	max.	5	V

Current

Collector current (d.c.)	I_C	max.	100	mA
Collector current (peak value)	I_{CM}	max.	200	mA

Power dissipation

Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300	mW

Temperatures

Storage temperature	T_{stg}		−65 to + 150	°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to ambient in free air	$R_{th\ j\text{-}a}$	=	0,4	°C/mW
From junction to case	$R_{th\ j\text{-}c}$	=	0,15	°C/mW

CHARACTERISTICS T_{amb} = 25 °C unless otherwise specified

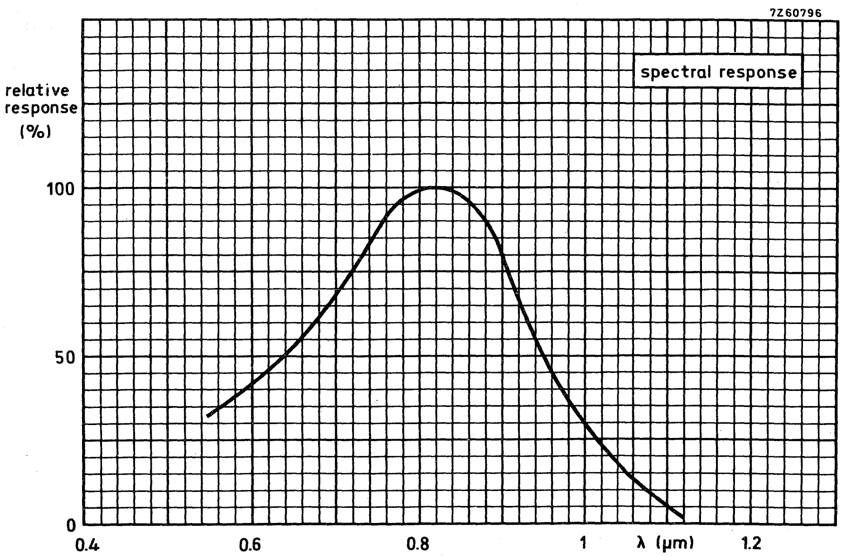
Collector dark current

$I_B = 0$; V_{CE} = 24 V	$I_{CEO(D)}$	typ.	100	nA
		<	500	nA
$I_B = 0$; V_{CE} = 24 V; T_{amb} = 100 °C	$I_{CEO(D)}$	typ.	15	µA
		<	100	µA

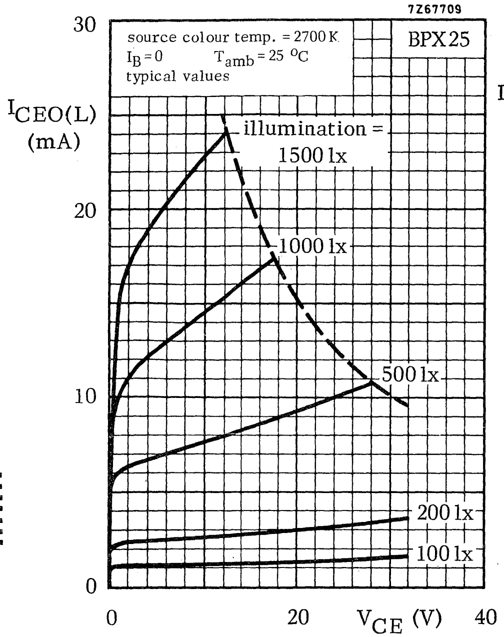
			BPX25	BPX29	
Collector light current					
$I_B = 0$; V_{CE} = 6 V; tungsten filament lamp source with T_c = 2700 K; E_v = 1000 lx (7,7 mW/cm²)	$I_{CEO(L)}$	>	5	0,25	mA
		typ.	13	0,8	mA
D.C. current gain					
I_C = 2 mA; V_{CE} = 6 V	h_{FE}	typ.	500	500	
Cut-off frequency					
Source: modulated GaAs; 0,4 mW/cm² Load : optimum (50 Ω); V_{CE} = 24 V	f_{co}	typ.	200	150	kHz

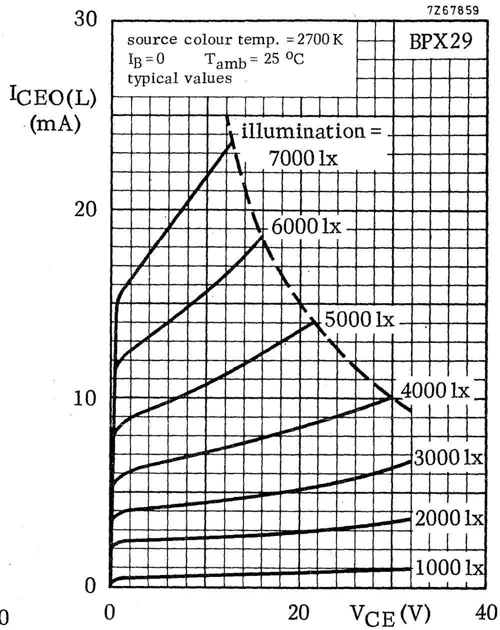
CHARACTERISTICS (continued)

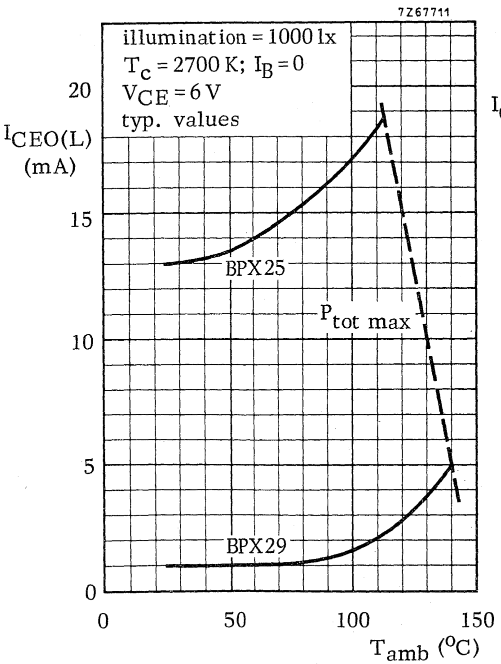
			BPX25	BPX29	
Switching times 1)					
Delay time	t_d	typ.	1,0	2,5	μs
		<	3,0	5,0	μs
Rise time	t_r	typ.	1,5	2,5	μs
		<	3,0	5,0	μs
Storage time	t_s	typ.	0,2	0,2	μs
		<	0,4	0,4	μs
Fall time	t_f	typ.	1,5	3,5	μs
		<	4,0	8,0	μs
Wavelength at peak response	λ_{pk}	typ.	800	800	nm

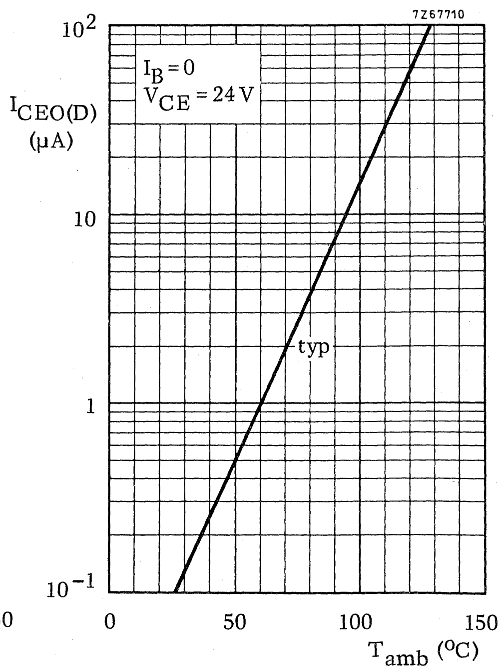


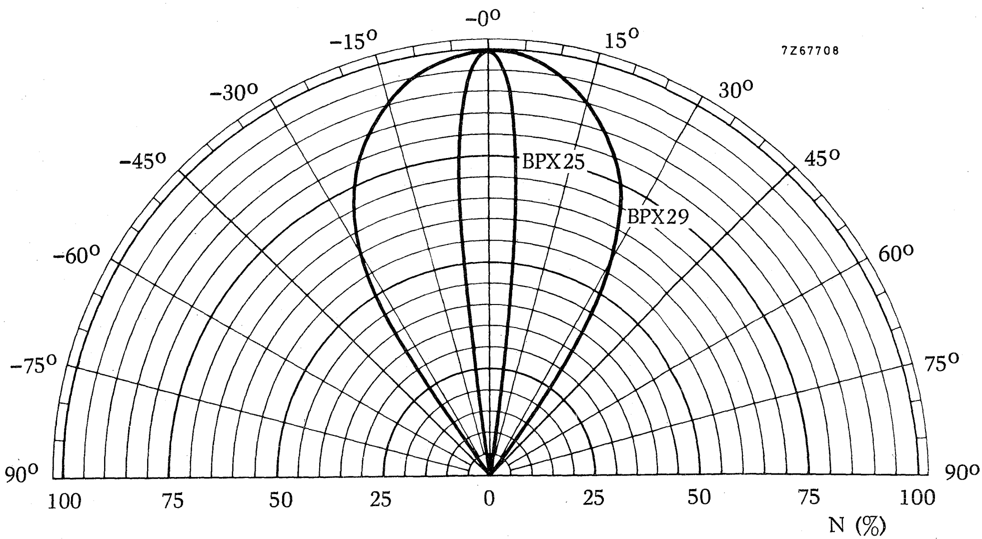
1) Source: modulated GaAs: 0,4 mW/cm^2
Load: optimum (50 Ω)
V_{CE} = 24 V
Improved switching times can be obtained by a quiescent bias current.
I.e. I_B = 2 μA: t_d < 0,2 μs.


7Z67709
source colour temp. = 2700 K
I_B = 0 T_{amb} = 25 °C
typical values
BPX25
$I_{CEO(L)}$ (mA)
illumination = 1500 lx
1000 lx
500 lx
200 lx
100 lx
V_{CE} (V)


7Z67859
source colour temp. = 2700 K
I_B = 0 T_{amb} = 25 °C
typical values
BPX29
$I_{CEO(L)}$ (mA)
illumination = 7000 lx
6000 lx
5000 lx
4000 lx
3000 lx
2000 lx
1000 lx
V_{CE} (V)


7Z67711
illumination = 1000 lx
T_c = 2700 K; I_B = 0
V_{CE} = 6 V
typ. values
$I_{CEO(L)}$ (mA)
BPX25
$P_{tot\ max}$
BPX29
T_{amb} (°C)


7Z67710
I_B = 0
V_{CE} = 24 V
$I_{CEO(D)}$ (μA)
typ
T_{amb} (°C)


-0°
-15°
15°
7Z67708
-30°
30°
-45°
45°
BPX25
BPX29
-60°
60°
-75°
75°
90°
90°
100
75
50
25
0
25
50
75
100
N (%)

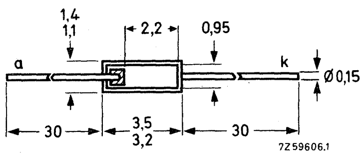
SILICON PLANAR PHOTODIODE

Unencapsulated photodiode for general purpose applications.

QUICK REFERENCE DATA				
Reverse voltage	V_R	max.	18	V
Luminous sensitivity V_R = 15 V; E = 1000 lx	N	typ.	14	nA/lx
Dark reverse current at V_R = 15 V	I_d	<	0,5	μA
Wavelength at peak response	λ_{pk}	typ.	800	nm

MECHANICAL DATA

Dimensions in mm



Slice thickness 0,27 mm

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

Voltage				
Reverse voltage	V_R	max.	18	V
Currents				
Forward current	I_F	max.	5	mA
Dark reverse current	I_R	max.	2	mA
Temperatures				
Storage temperature	T_{stg}	−65 to + 125		°C
Junction temperature	T_j	max.	125	°C

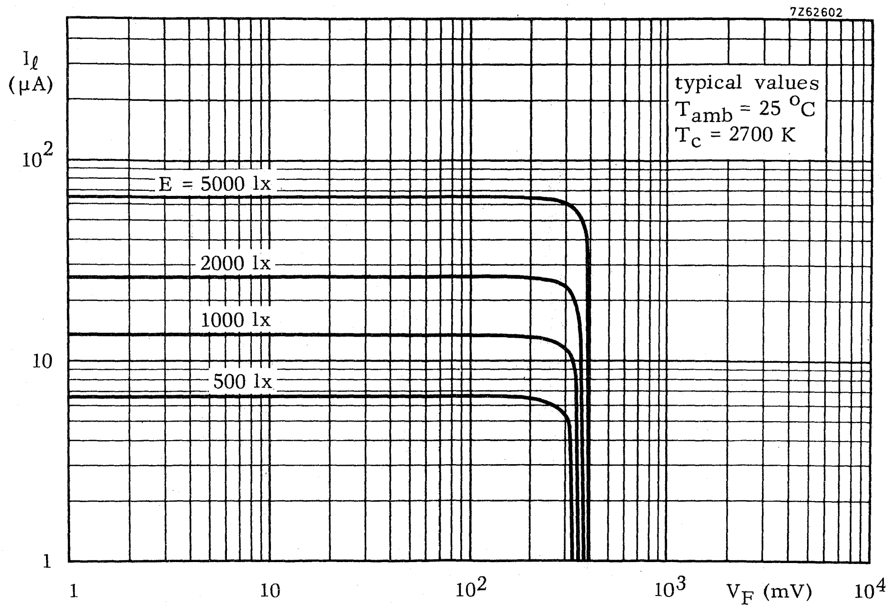
THERMAL RESISTANCE

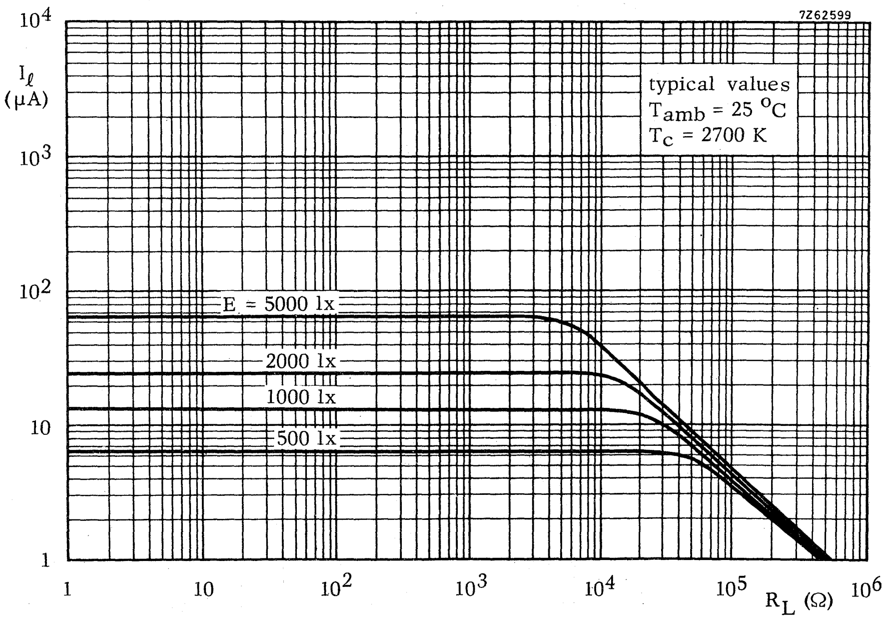
From junction to ambient in free air	$R_{th\ j-a}$	=	0,5	°C/mW

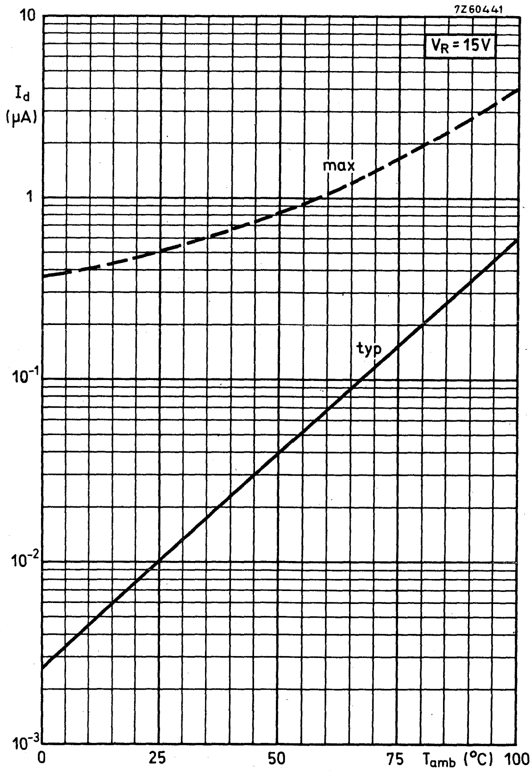
CHARACTERISTICS T_{amb} = 25 °C unless otherwise specified

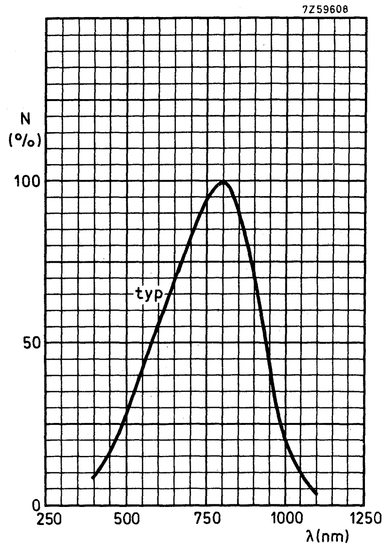
Dark reverse current				
V_R = 15 V	I_d	typ.	0,01	µA
		<	0,5	µA
V_R = 15 V; T_{amb} = 100 °C	I_d	typ.	0,6	µA
		<	4,0	µA
Photovoltaic mode				
E = 1000 lx; T_c = 2700 K (equivalent to 7,7 mW/cm²)				
Light reverse current; V = 0	I_1	>	10	µA
		typ.	13	µA
Forward voltage; I = 0	V_F	>	330	mV
		typ.	350	mV
Luminous sensitivity with external voltage [1]				
V_R = 15 V; E = 1000 lx; T_c = 2700 K (equivalent to 7,7 mW/cm²)	N	>	10,5	nA/lx
		typ.	14	nA/lx
Wavelength at peak response	λ_{pk}	typ.	800	nm
Diode capacitance; f = 500 kHz				
V_R = 15 V	C_d	typ.	90	pF
V_R = 0	C_d	typ.	300	pF
Cut-off frequency (modulated GaAs source)	f_{co}	typ.	500	kHz

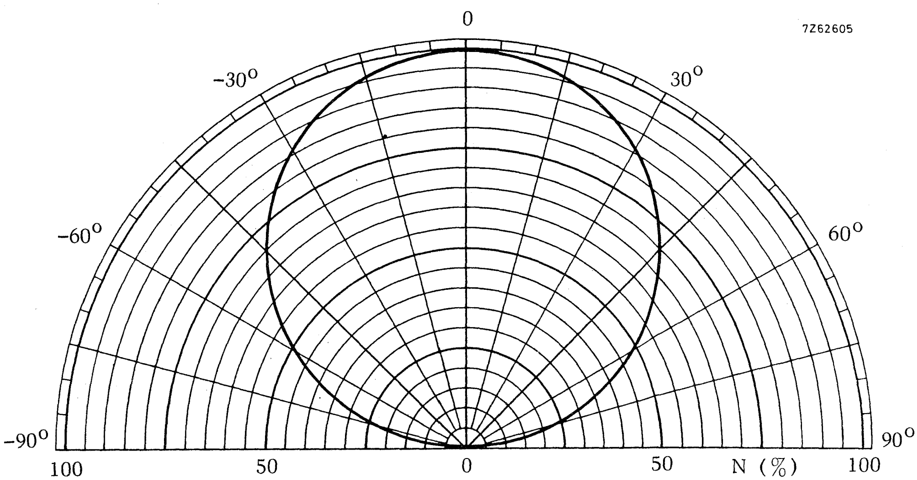
1) The value of light current increases with temperature by an amount approximately equal to the increase in dark current.


7Z62602
I_ℓ (µA)
10^2
10
1
1
10
10^2
10^3
V_F (mV)
10^4
typical values
T_{amb} = 25 °C
T_c = 2700 K
E = 5000 lx
2000 lx
1000 lx
500 lx


7Z62599
10^4
I_ℓ (µA)
10^3
10^2
10
1
1
10
10^2
10^3
10^4
10^5
R_L (Ω)
10^6
typical values
T_{amb} = 25 °C
T_c = 2700 K
E = 5000 lx
2000 lx
1000 lx
500 lx


7Z60441
$V_R = 15V$
I_d (μA)
10
1
10^{-1}
10^{-2}
10^{-3}
max
typ
0
25
50
75
T_{amb} (°C)
100


7Z59608
N
(%)
100
50
0
250
500
750
1000
1250
λ(nm)
typ


0
7Z62605
−30°
30°
−60°
60°
−90°
90°
100
50
0
50
N (%)
100

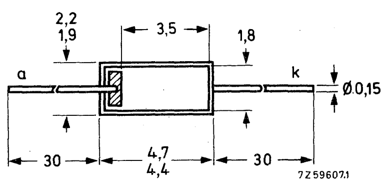
SILICON PLANAR PHOTODIODE

Unencapsulated photodiode for general purpose applications.

QUICK REFERENCE DATA				
Reverse voltage	V_R	max.	18	V
Luminous sensitivity V_R = 15 V; E = 1000 lx	N	typ.	40	nA/lx
Dark reverse current at V_R = 15 V	I_d	<	1	μA
Wavelength at peak response	λ_{pk}	typ.	800	nm

MECHANICAL DATA

Dimensions in mm



Slice thickness 0,27 mm

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

Voltage				
Reverse voltage	V_R	max.	18	V
Currents				
Forward current	I_F	max.	10	mA
Dark reverse current	I_R	max.	5	mA
Temperatures				
Storage temperature	T_{stg}	-65 to + 125		^oC
Junction temperature	T_j	max.	125	^oC

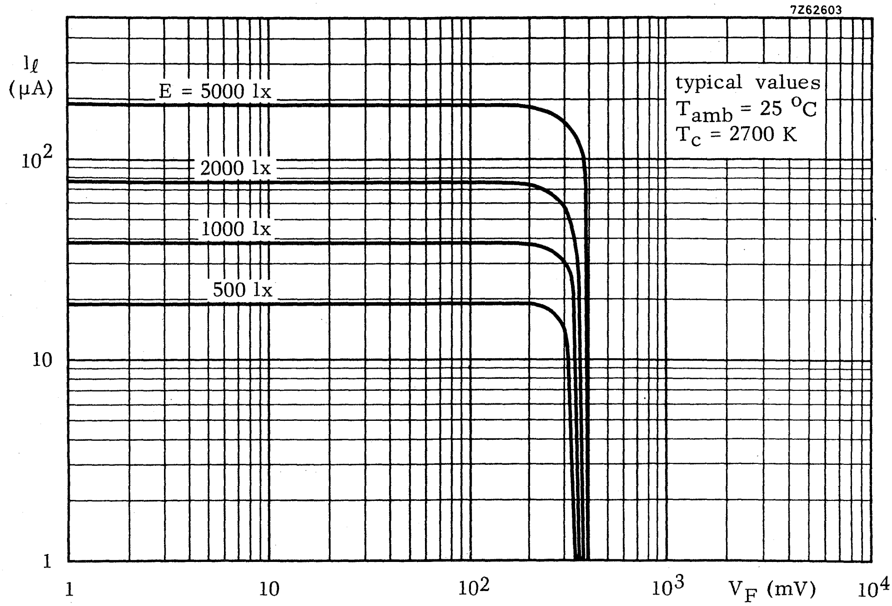
THERMAL RESISTANCE

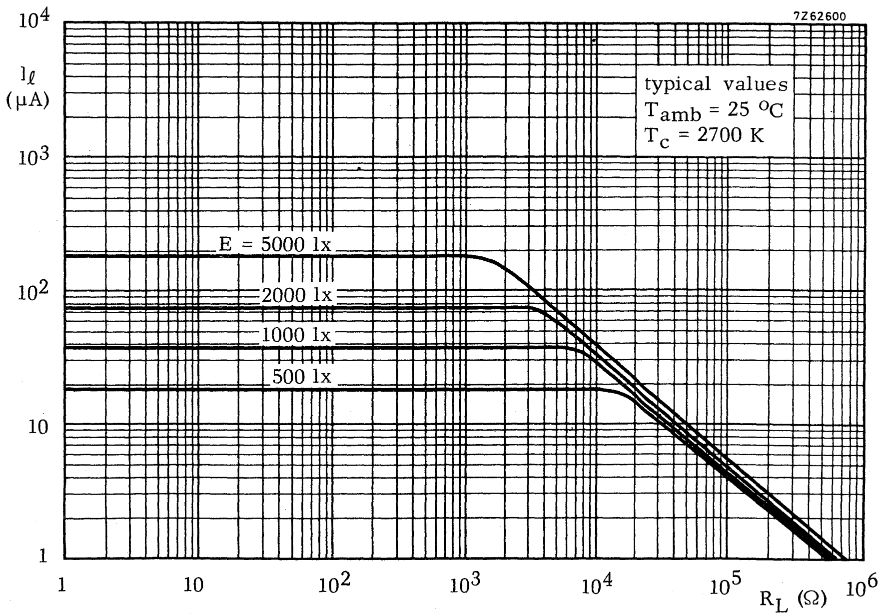
From junction to ambient in free air	$R_{th\ j-a}$	=	0,5	$^oC/mW$

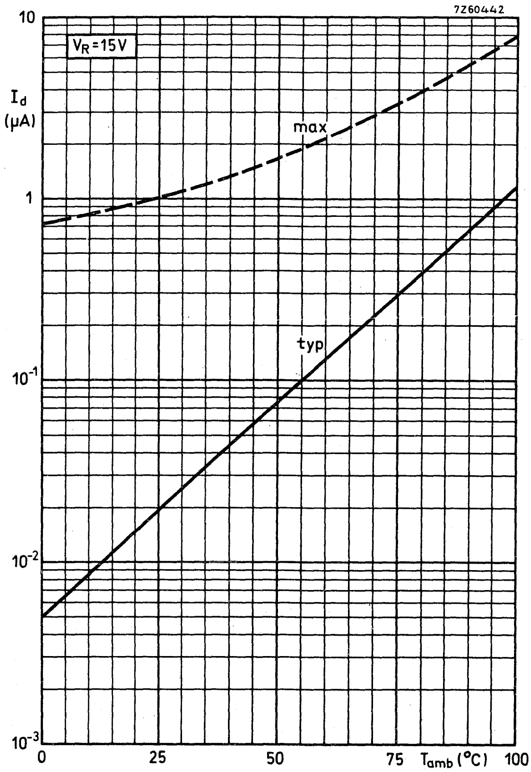
CHARACTERISTICS T_{amb} = 25 ^oC unless otherwise specified

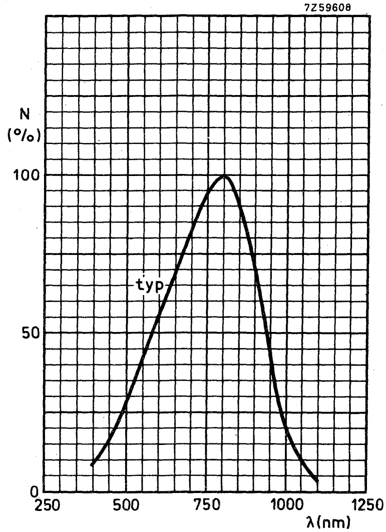
Dark reverse current				
V_R = 15 V	I_d	typ. <	0,02 1,0	μA μA
V_R = 15 V; T_{amb} = 100 ^oC	I_d	typ. <	1,2 8,0	μA μA
Photovoltaic mode				
E = 1000 lx; T_c = 2700 K (equivalent to 7,7 mW/cm^2)				
Light reverse current; V = 0	I_1	> typ.	30 38	μA μA
Forward voltage; I = 0	V_F	> typ.	330 350	mV mV
Luminous sensitivity with external voltage 1)				
V_R = 15 V; E = 1000 lx; T_c = 2700 K (equivalent to 7,7 mW/cm^2)	N	> typ.	31 40	nA/lx nA/lx
Wavelength at peak response	λ_{pk}	typ.	800	nm
Diode capacitance; f = 500 kHz				
V_R = 15 V	C_d	typ.	250	pF
V_R = 0	C_d	typ.	800	pF
Cut-off frequency (modulated GaAs source)	f_{co}	typ.	500	kHz

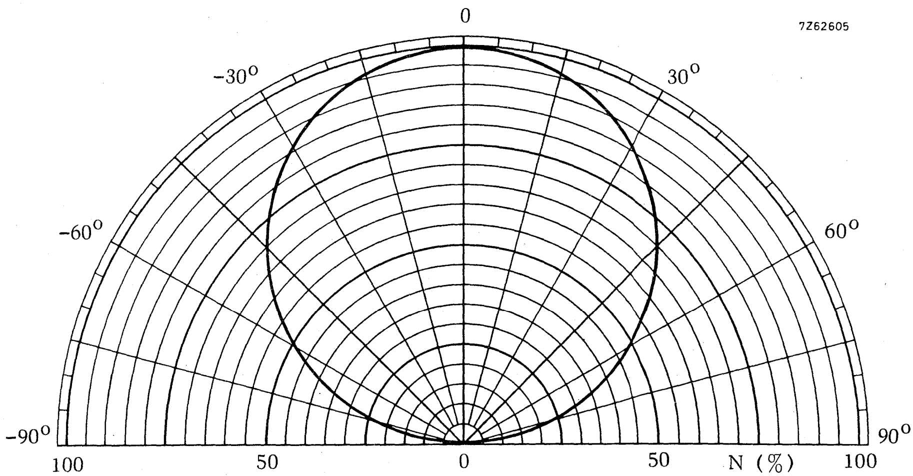
1) The value of light current increases with temperature by an amount approximately equal to the increase in dark current.


7Z62603
I_ℓ (μA)
E = 5000 lx
2000 lx
1000 lx
500 lx
typical values
T_{amb} = 25 °C
T_c = 2700 K
10^2
10
1
1
10
10^2
10^3
V_F (mV)
10^4


7Z62600
I_ℓ (μA)
typical values
T_{amb} = 25 °C
T_c = 2700 K
E = 5000 lx
2000 lx
1000 lx
500 lx
10^4
10^3
10^2
10
1
1
10
10^2
10^3
10^4
10^5
R_L (Ω)
10^6


7Z60442
V_R = 15V
I_d (μA)
10
1
10^{-1}
10^{-2}
10^{-3}
max
typ
0
25
50
75
T_{amb} (°C)
100


7Z59608
N
(%)
100
50
0
250
500
750
1000
1250
λ(nm)
typ


0
7Z62605
-30°
30°
-60°
60°
-90°
90°
100
50
0
50
N (%)
100

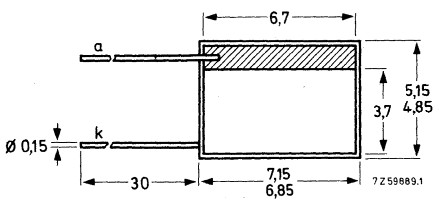
SILICON PLANAR PHOTODIODE

Unencapsulated photodiode for general purpose applications.

QUICK REFERENCE DATA				
Reverse voltage	V_R	max.	12	V
Luminous sensitivity V_R = 10 V; E = 1000 lx	N	typ.	150	nA/lx
Dark reverse current at V_R = 10 V	I_d	<	5	μA
Wavelength at peak response	λ_{pk}	typ.	800	nm

MECHANICAL DATA

Dimensions in mm



Slice thickness 0,27 mm

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

Voltage

Reverse voltage	V_R	max.	12	V

Currents

Forward current	I_F	max.	50	mA
Dark reverse current	I_R	max.	20	mA

Temperatures

Storage temperature	T_{stg}	-65 to + 125		°C
Junction temperature	T_j	max.	125	°C

THERMAL RESISTANCE

From junction to ambient in free air	$R_{th\ j-a}$	=	0,3	°C/mW

CHARACTERISTICS T_{amb} = 25 °C unless otherwise specified

Dark reverse current

V_R = 10 V	I_d	typ.	0,1	μA
		<	5,0	μA
V_R = 10 V; T_{amb} = 100 °C	I_d	typ.	6,0	μA
		<	40	μA

Photovoltaic mode

E = 1000 lx; T_c = 2700 K (equivalent to 7,7 mW/cm^2)

Light reverse current; V = 0	I_l	>	110	μA
		typ.	140	μA
Forward voltage; I = 0	V_F	>	330	mV
		typ.	350	mV

Luminous sensitivity with external voltage [1])

V_R = 10 V; E = 1000 lx; T_c = 2700 K (equivalent to 7,7 mW/cm^2)	N	>	120	nA/lx
		typ.	150	nA/lx

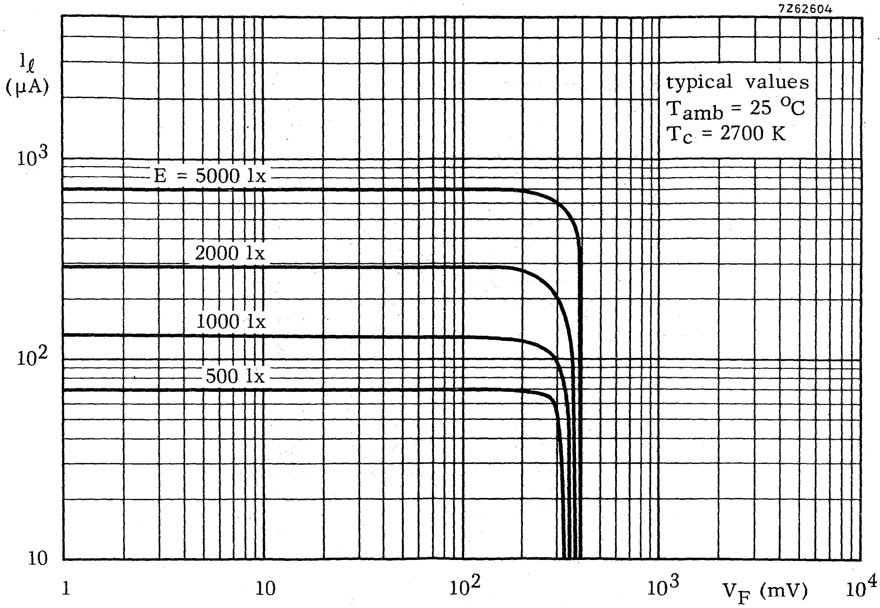
Wavelength at peak response	λ_{pk}	typ.	800	nm

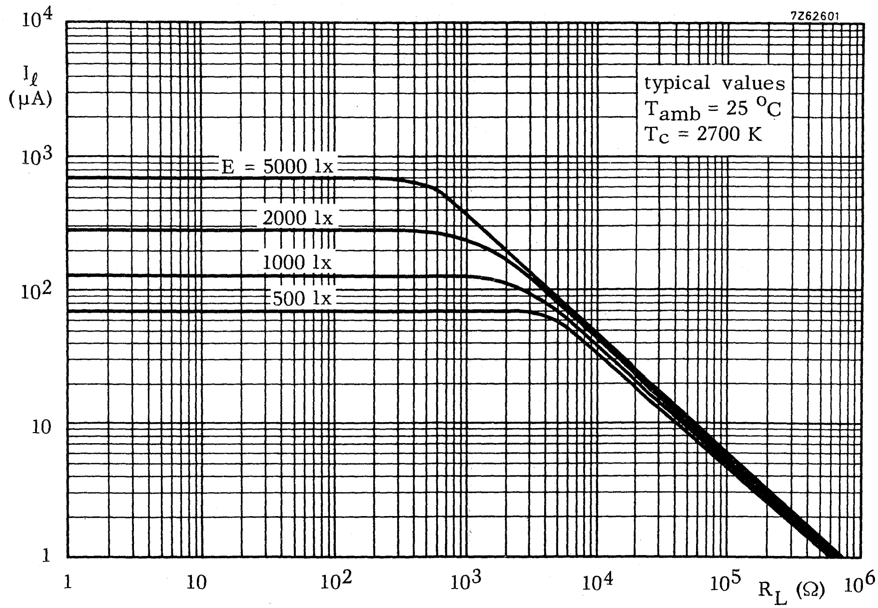
Diode capacitance; f = 500 kHz

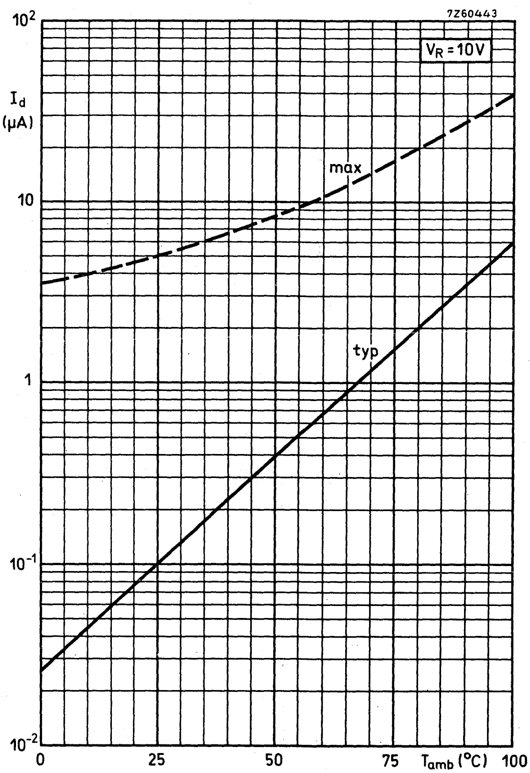
V_R = 10 V	C_d	typ.	1000	pF
V_R = 0	C_d	typ.	3000	pF

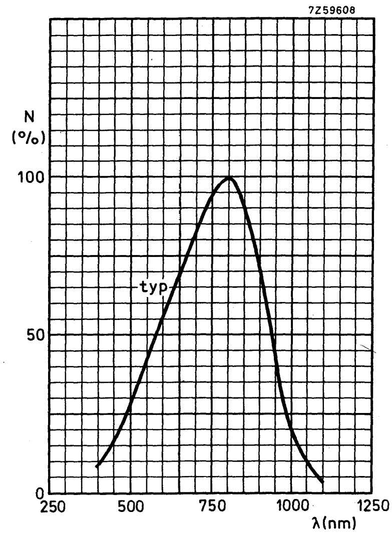
Cut-off frequency (modulated GaAs source)	f_{co}	typ.	500	kHz

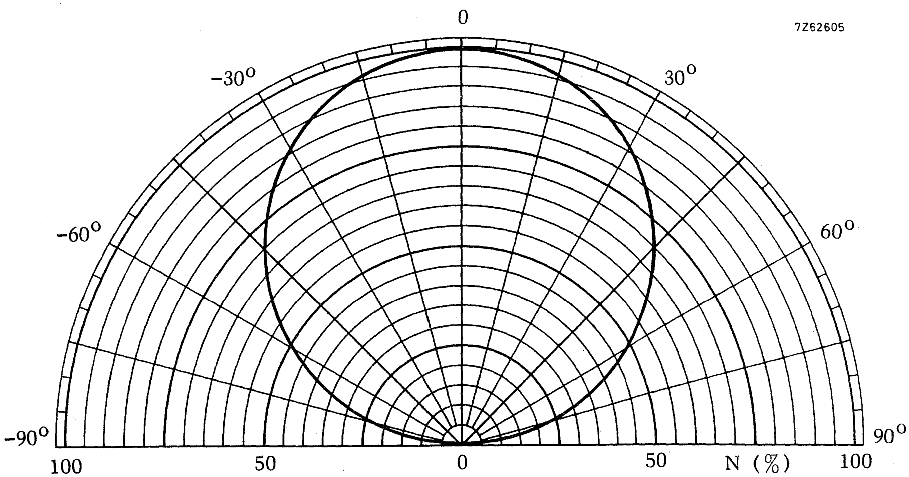
[1]) The value of light current increases with temperature by an amount approximately equal to the increase in dark current.


7Z62604
I_ℓ
(μA)
typical values
T_{amb} = 25 °C
T_c = 2700 K
E = 5000 lx
2000 lx
1000 lx
500 lx
10^3
10^2
10
1
10
10^2
10^3
V_F (mV)
10^4


7Z62601
10^4
I_ℓ
(μA)
typical values
T_{amb} = 25 °C
T_c = 2700 K
10^3
E = 5000 lx
2000 lx
1000 lx
500 lx
10^2
10
1
1
10
10^2
10^3
10^4
10^5
R_L (Ω)
10^6


7Z60443
$V_R = 10V$
I_d (μA)
10^2
10
1
10^{-1}
10^{-2}
max
typ
0
25
50
75
T_{amb} (°C)
100


7Z59608
N
(%)
100
50
0
typ
250
500
750
1000
1250
λ(nm)


0
7Z62605
-30°
30°
-60°
60°
-90°
90°
100
50
0
50
N (%)
100

TERRESTRIAL SOLAR MODULE

Module for direct conversion of solar energy into electrical energy. The module contains 18 series-connected solar cells of 100 mm diameter, moulded in transparent resin and mounted between two glass plates. The transparent structure ensures low heating by solar radiation, which maintains efficiency.

The module is suitable for use under severe environmental conditions.

QUICK REFERENCE DATA

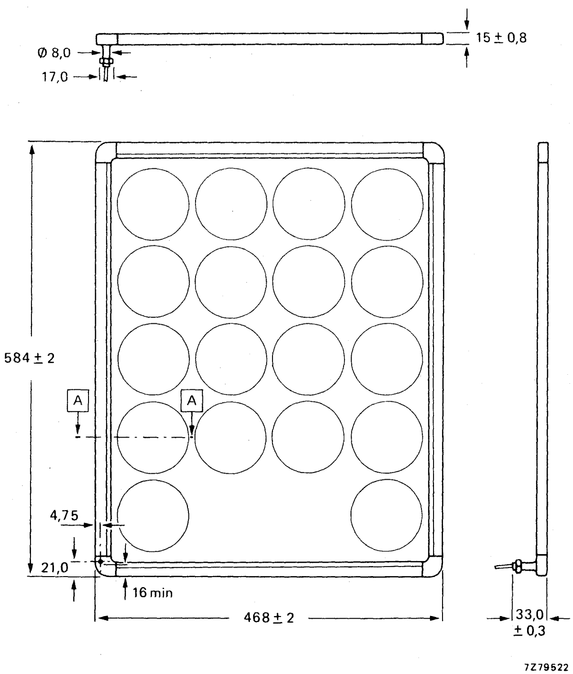
At E_e = 1 kW/m^2 (irradiance from the sun at sea level) and T_j = 25 ^oC:

Optimum output power at 8,2 V	P_{Lopt}	typ.	16,5	W
Output voltage at optimum operation	V_{opt}	typ.	8,2	V
Output current at optimum operation	I_{opt}	typ.	2,01	A
Dimensions	584 mm x 468 mm x 15			mm

MECHANICAL DATA

Dimensions in mm

Fig. 1 For mechanical detail see Fig. 2.



Panel thickness	15	mm
Cable:		
length	2	m *
diameter	5,5	mm
collar diameter	17	mm
core diameter (two wires)	1,8	mm
Polarity indications:		
black = –		
red = +		
Mass	4,0	kg

* Voltage drop 150 mV/m.

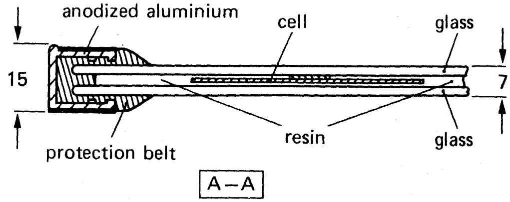


Fig. 2.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Storage temperature	T_{stg}	−40 to + 85	°C
Operating junction temperature	T_j	max. 100	°C

CHARACTERISTICS at E_e = 1 kW/m² (irradiance from the sun at sea level; A.M. 1)

Junction temperature	T_j	=	0	25	60	°C
Optimum output power	P_{Lopt}	typ.	18,5	16,5	13,7	W
Output voltage at optimum operation	V_{opt}	typ.	9,5	8,2	7,1	V
Output current at optimum operation	I_{opt}	typ.	1,95	2,01	1,93	A
Open circuit voltage	V_{oc}	typ.	11,4	10,5	9,2	V
Short-circuit current	I_{sc}	typ.	2,07	2,10	2,14	A

Temperature coefficient of open-circuit voltage — $-dV_{oc}/dT$ typ. 36 mV/°C

Typical operation BPX47B/18 coupled to a **6 V battery**

Irradiance from the sun	E_e	=	1	kW/m²
Operating voltage (6 V nominal lead-acid battery; end of charge voltage 6,6 V; + 0,8 V for blocking diode)	V	=	7,4	V

At an irradiance of 1 kW/m² the cell temperature rise is 15 °C

At an ambient temperature of 45 °C (cell temperature = 45 + 15 = 60 °C) the module can supply a current of 1,83 A to the load.

ENVIRONMENTAL TESTS

The modules are subjected to the following IEC tests and some additional tests:

Test	In accordance with	Conditions	
Cold	IEC 68-2-1, test Ab	Temperature: –40 °C, duration: 16 h	
Rapid change of temperature	IEC 68-2-14, test Na	Low temperature:	–40 °C
		High temperature:	+ 85 °C
		Number of cycles:	10
		Duration of exposures:	30 min
Dry heat	IEC 68-2-2, test Bb	Temperature:	+ 85 °C
		Duration:	16 h
Composite temperature/ humidity cyclic test	IEC 68-2-38, test Z/AD	10 cycles, + 25 °C, + 65 °C, –10 °C	

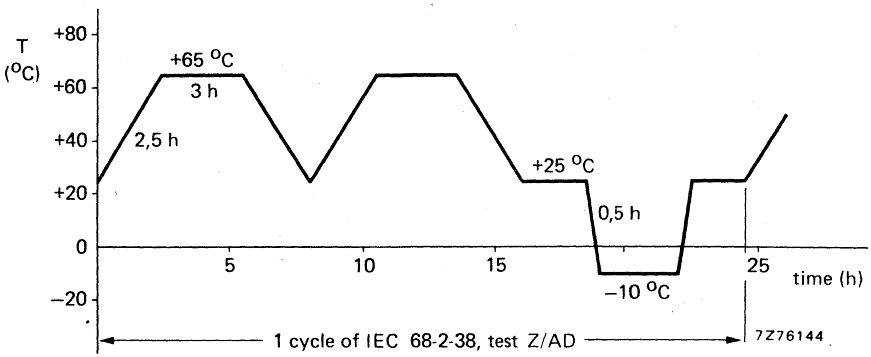


Fig. 3.

Test	In accordance with	Conditions	
Salt mist	IEC 68-2-11, test Ka	Temperature:	+ 35 °C
		Duration:	48 h
Wind	–	Pressure equivalent to an air velocity of 280 km/h	
Sand blown	AIR 7.303		
Frost with water	–	High temperature:	+ 25 °C
		Low temperature:	–40 °C
		Duration:	16 h

MOUNTING INSTRUCTIONS

1. The solar panel should be mounted in a metal frame in such a way that only its four metal sides are used for clamping and **not** the rubber corners. The panel should be electrically insulated from the mounting frame to prevent corrosion.
2. Installation should allow at least a 0,5 m space behind the panel to permit a free circulation of air for cooling.
3. The panel should not be installed above hot objects such as roofs.
4. Diode protection is imperative in the series connection of a chain of panels to prevent voltage inversion due to partial shadowing effects.

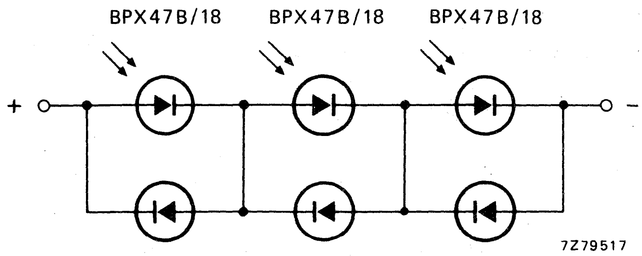


Fig. 4.

5. If series-connected chains are joined in parallel and diode protected, a matrix interconnection is necessary.

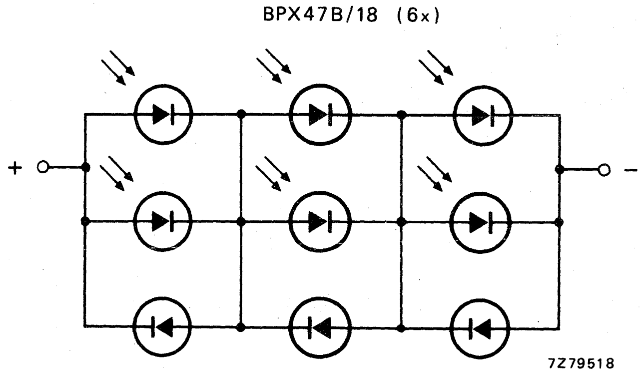


Fig. 5.

6. A charge regulator containing a series protection diode must be used when connecting panels to a lead-acid battery.

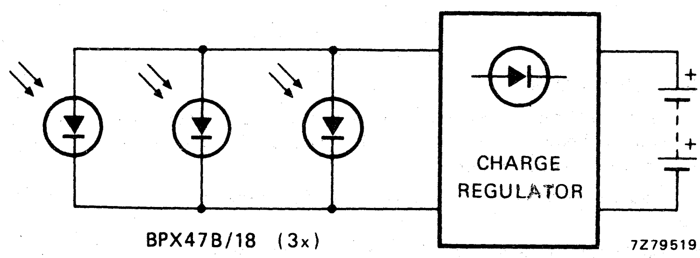


Fig. 6.

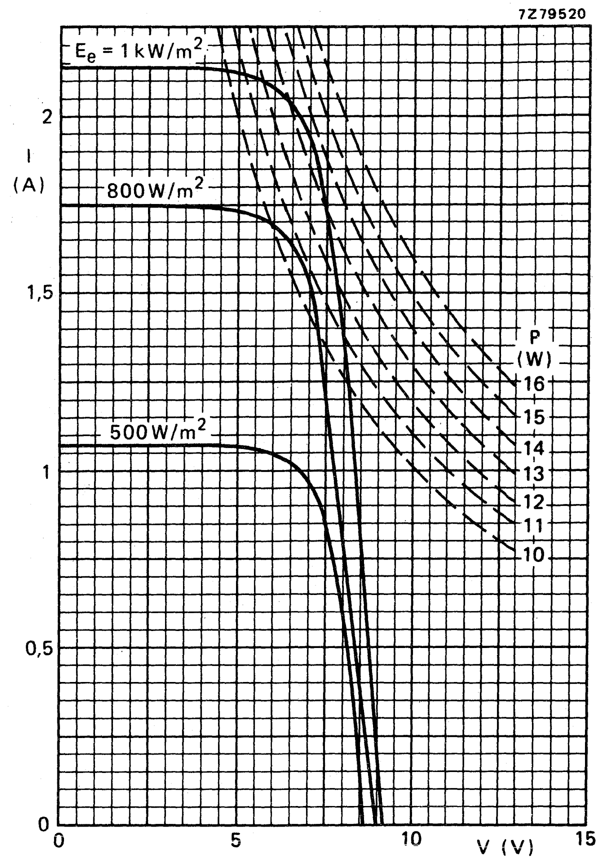


Fig. 7 T_j = 60 °C; typical values.

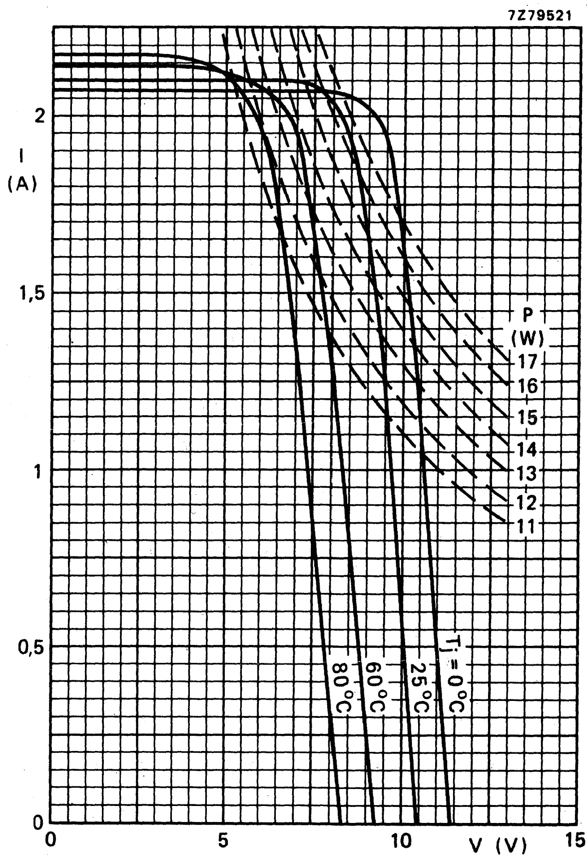


Fig. 8 E_e = 1 kW/m² (A.M. 1); typical values.

TERRESTRIAL SOLAR MODULE

Module for direct conversion of solar energy into electrical energy. The module contains 20 series-connected solar cells of 100 mm diameter, moulded in transparent resin and mounted between two glass plates. The transparent structure ensures low heating by solar radiation, which maintains efficiency.

The module is suitable for use under severe environmental conditions.

QUICK REFERENCE DATA

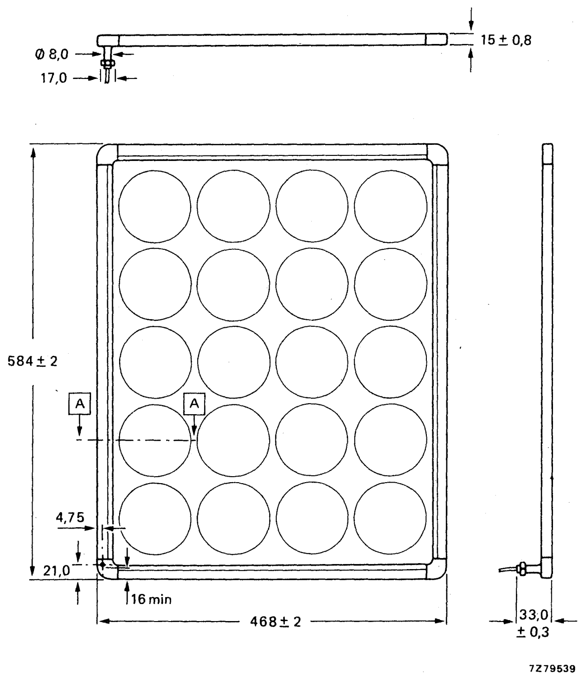
At E_e = 1 kW/m^2 (irradiance from the sun at sea level) and T_j = 25 °C:

Optimum output power at 9,1 V	P_{Lopt}	typ.	18,3	W
Output voltage at optimum operation	V_{opt}	typ.	9,1	V
Output current at optimum operation	I_{opt}	typ.	2,01	A
Dimensions	584 mm x 468 mm x 15 mm			

MECHANICAL DATA

Dimensions in mm

Fig. 1 For mechanical detail see Fig. 2.



Panel thickness	15	mm
Cable:		
length	2	m *
diameter	5,5	mm
collar diameter	17	mm
core diameter (two wires)	1,8	mm
Polarity indications:		
black = –		
red = +		
Mass	4,0	kg

* Voltage drop 150 mV/m.

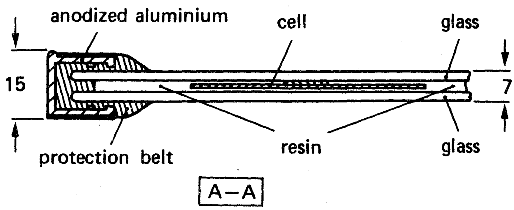


Fig. 2.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Storage temperature	T_{stg}	–40 to + 85 °C
Operating junction temperature	T_j	max. 100 °C

CHARACTERISTICS at E_e = 1 kW/m² (irradiance from the sun at sea level; A.M. 1)

Junction temperature	T_j	=	0	25	60	°C
Optimum output power	P_{Lopt}	typ.	20,6	18,3	15,5	W
Output voltage at optimum operation	V_{opt}	typ.	10,6	9,1	8,4	V
Output current at optimum operation	I_{opt}	typ.	1,95	2,01	1,93	A
Open circuit voltage	V_{oc}	typ.	12,7	11,6	10,2	V
Short-circuit current	I_{sc}	typ.	2,07	2,10	2,14	A

Temperature coefficient of open-circuit voltage	$-dV_{oc}/dT$	typ.	36 mV/°C

Typical operation BPX47B/20 coupled to a 6 V battery

Irradiance from the sun	E_e	=	1 kW/m²
Operating voltage (6 V nominal lead-acid battery; end of charge voltage 6,6 V; + 0,8 V for blocking diode and 0,8 V overvoltage)	V	=	8,2 V
At an irradiance of 1 kW/m² the cell temperature rise is			15 °C

At an ambient temperature of 45 °C (cell temperature = 45 + 15 = 60 °C) the module can supply a current of 1,83 A to the load.

ENVIRONMENTAL TESTS

The modules are subjected to the following IEC tests and some additional tests:

Test	In accordance with	Conditions
Cold	IEC 68-2-1, test Ab	Temperature: −40 °C, duration: 16 h
Rapid change of temperature	IEC 68-2-14, test Na	Low temperature: −40 °C High temperature: +85 °C Number of cycles: 10 Duration of exposures: 30 min
Dry heat	IEC 68-2-2, test Bb	Temperature: +85 °C Duration: 16 h
Composite temperature/ humidity cyclic test	IEC 68-2-38, test Z/AD	10 cycles, + 25 °C, + 65 °C, −10 °C

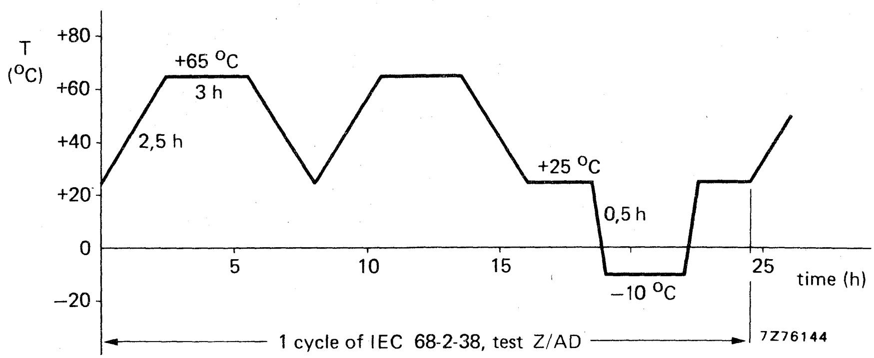


Fig. 3.

Test	In accordance with	Conditions
Salt mist	IEC 68-2-11, test Ka	Temperature: +35 °C Duration: 48 h
Wind	–	Pressure equivalent to an air velocity of 280 km/h
Sand blown	AIR 7.303	
Frost with water	–	High temperature: +25 °C Low temperature: −40 °C Duration: 16 h

MOUNTING INSTRUCTIONS

1. The solar panel should be mounted in a metal frame in such a way that only its four metal sides are used for clamping and not the rubber corners. The panel should be electrically insulated from the mounting frame to prevent corrosion.
2. Installation should allow at least a 0,5 m space behind the panel to permit a free circulation of air for cooling.
3. The panel should not be installed above hot objects such as roofs.
4. Diode protection is imperative in the series connection of a chain of panels to prevent voltage inversion due to partial shadowing effects.

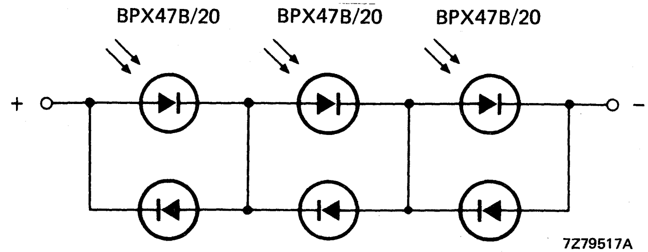


Fig. 4.

5. If series-connected chains are joined in parallel and diode protected, a matrix interconnection is necessary.

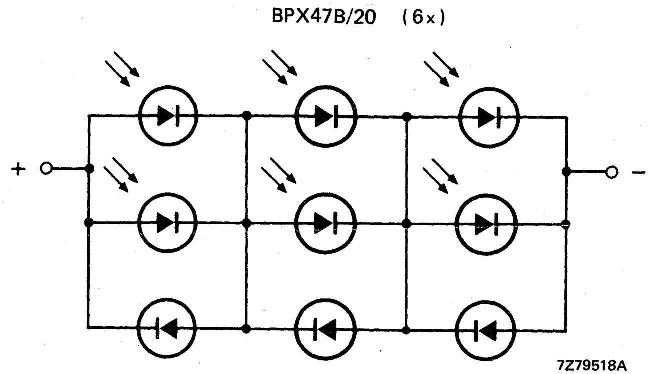


Fig. 5.

6. A charge regulator containing a series protection diode must be used when connecting panels to a lead-acid battery.

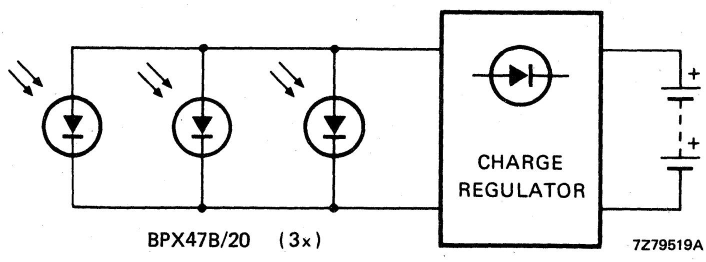


Fig. 6.

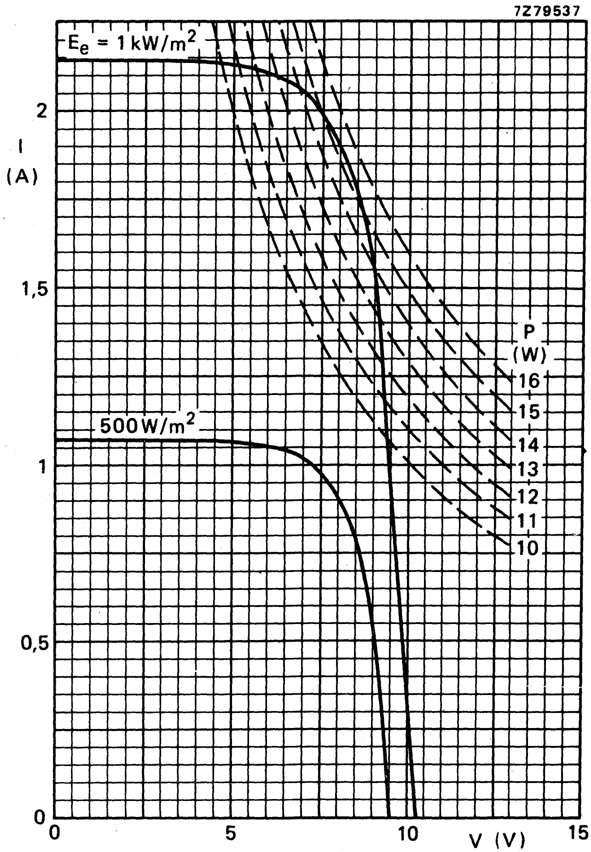


Fig. 7 T_j = 60 °C; typical values.

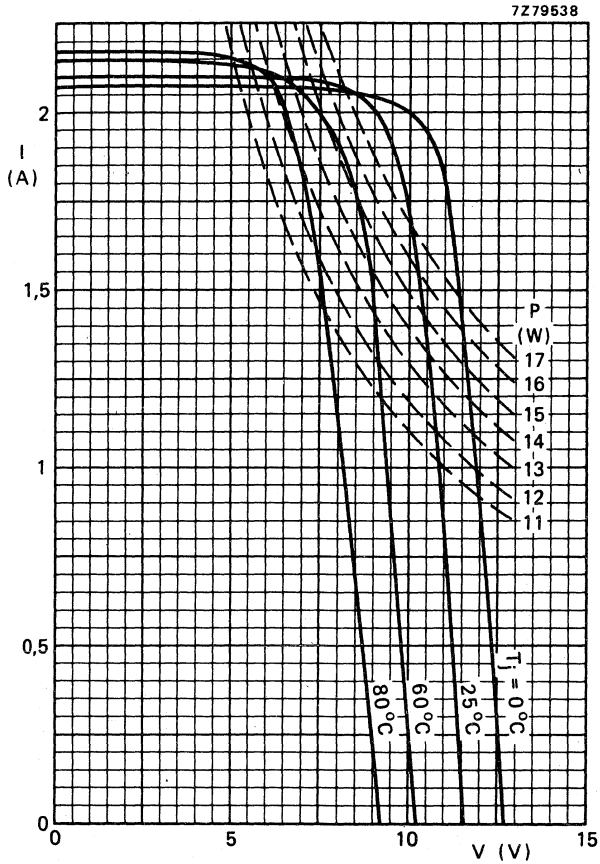


Fig. 8 E_e = 1 kW/m² (A.M. 1); typical values.

TERRESTRIAL SOLAR MODULE

Module for direct conversion of solar energy into electrical energy. The module contains 36 series-connected solar cells of 100 mm diameter, moulded in transparent resin and mounted between two glass plates. The transparent structure ensures low heating by solar radiation, which maintains efficiency.

The module, suitable for use under severe environmental conditions, is mounted in a rigid aluminium self-supporting frame.

QUICK REFERENCE DATA

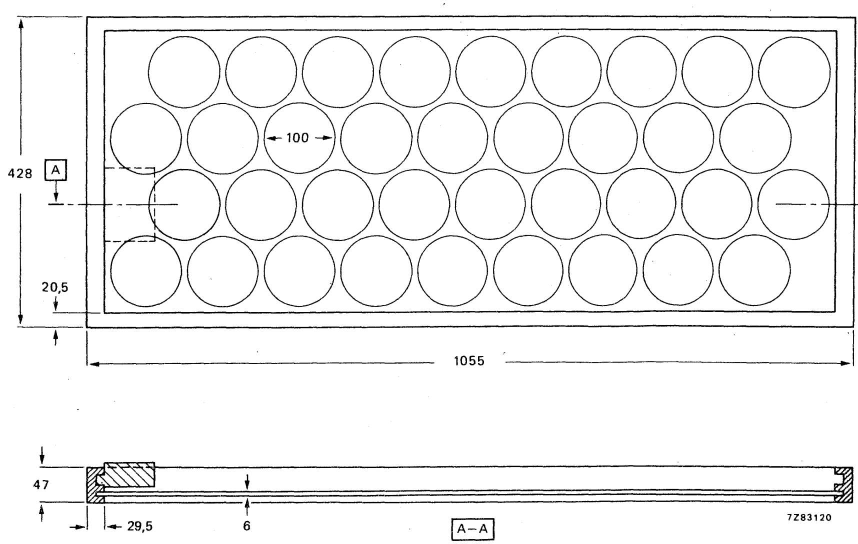
At E_e = 1 kW/m^2 (irradiance from the sun at sea level) and T_j = 25 °C:

Optimum output power at 16,4 V	P_{Lopt}	typ.	33,0	W
Output voltage at optimum operation	V_{opt}	typ.	16,4	V
Output current at optimum operation	I_{opt}	typ.	2,01	A
Dimensions			1055 mm x 428 mm x 47	mm

MECHANICAL DATA

Dimensions in mm

Fig. 1 See also Fig. 8.



Self-supporting structure

Connection box dimensions: 98 mm x 64 mm x 35 mm

Mass: typ. 9,5 kg

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Storage temperature	T_{stg}	–40 to + 85	°C
Operating junction temperature	T_j	max. 100	°C

CHARACTERISTICS at E_e = 1 kW/m² (irradiance from the sun at sea level; A.M. 1,5)

Junction temperature	T_j	=	0	25	60	°C
Optimum output power	P_{Lopt}	typ.	37	33	27,6	W
Output voltage at optimum operation	V_{opt}	typ.	19	16,4	14,3	V
Output current at optimum operation	I_{opt}	typ.	1,95	2,01	1,93	A
Open-circuit voltage	V_{oc}	typ.	22,8	21,2	18,4	V
Short-circuit current	I_{sc}	typ.	2,07	2,10	2,14	A

Temperature coefficient of open-circuit voltage	$-dV_{oc}/dT$	typ.	72	mV/°C

Typical operation BPX47C/36 coupled to a 12 V battery

Irradiance from the sun	E_e	=	1	kW/m²
Operating voltage (12 V nominal lead-acid battery; end of charge voltage 13,5 V; + 0,8 V for blocking diode)	V	=	14,3	V

At an irradiance of 1 kW/m² the cell temperature rise is 15 °C

At an ambient temperature of 45 °C (cell temperature = 45 + 15 = 60 °C) the module can supply a current of 1,83 A to the load.

ENVIRONMENTAL TESTS

The modules are subjected to the following IEC tests and some additional tests:

Test	In accordance with	Conditions	
Cold	IEC 68-2, test Ab	Temperature: –40 °C, duration 16 h	
Rapid change of temperature	IEC 68-2-14, test Na	Low temperature:	–40 °C
		High temperature:	+85 °C
		Number of cycles:	10
		Duration of exposures:	30 min
Dry heat	IEC 68-2-2, test Bb	Temperature:	+85 °C
		Duration:	16 h
Composite temperature/ humidity cyclic test	IEC 68-2-38, test Z/AD	10 cycles, + 25 °C, + 65 °C, –10 °C	

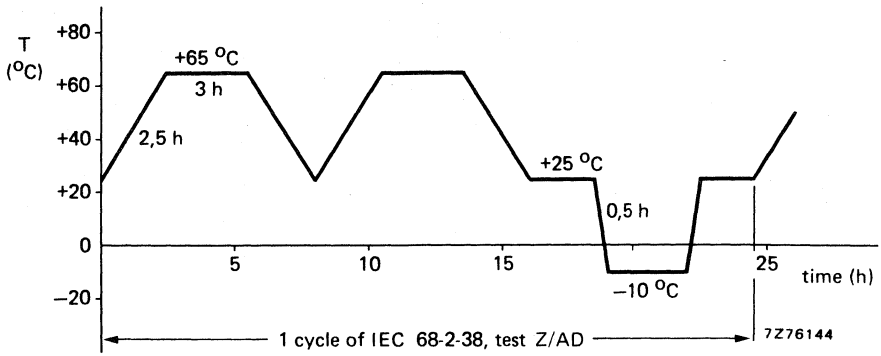


Fig. 2.

Test	In accordance with	Conditions	
Salt mist	IEC 68-2-11, test Ka	Temperature:	+ 35 °C
		Duration:	48 h
Wind	–	Pressure equivalent to an air velocity of 280 km/h	
Sand blown	AIR 7.303		
Frost with water	–	High temperature:	+ 25 °C
		Low temperature:	–40 °C
		Duration:	16 h

MOUNTING INSTRUCTIONS

1. The module is equiped with mounting screw positions.
2. Installation shoufd allow at leats a 0,5 m space behind the panel to permit a free circulation of air for cooling.
3. The panel should not be installed above hot objects such as roofs.
4. Diode protection is imperative in the series connection of a chain of panels to prevent voltage inversion due to partial shadowing effects.

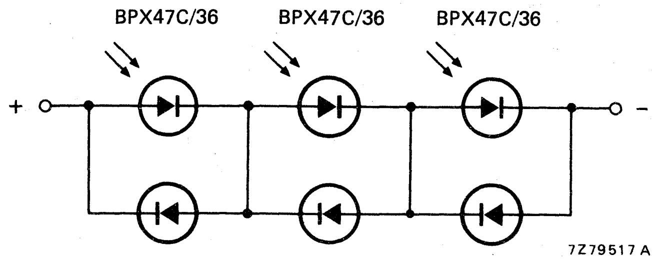


Fig. 3.

5. If series-connected chains are joined in parallel and diode protected, a matrix interconnection is necessary.

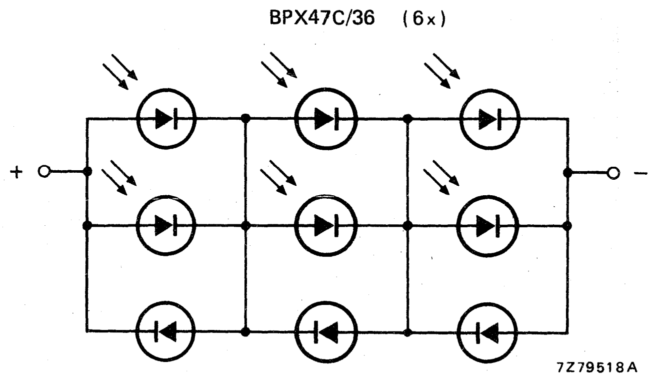


Fig. 4.

6. A charge regulator containing a series protection diode must be used when connecting panels to a lead-acid battery.

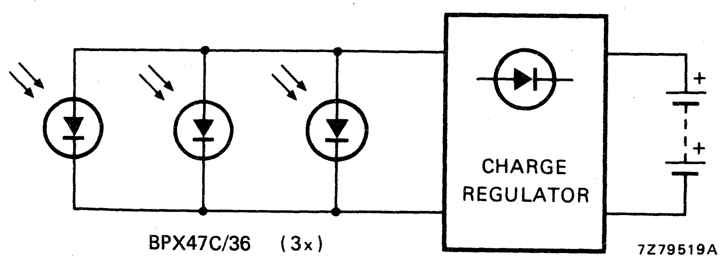


Fig. 5.

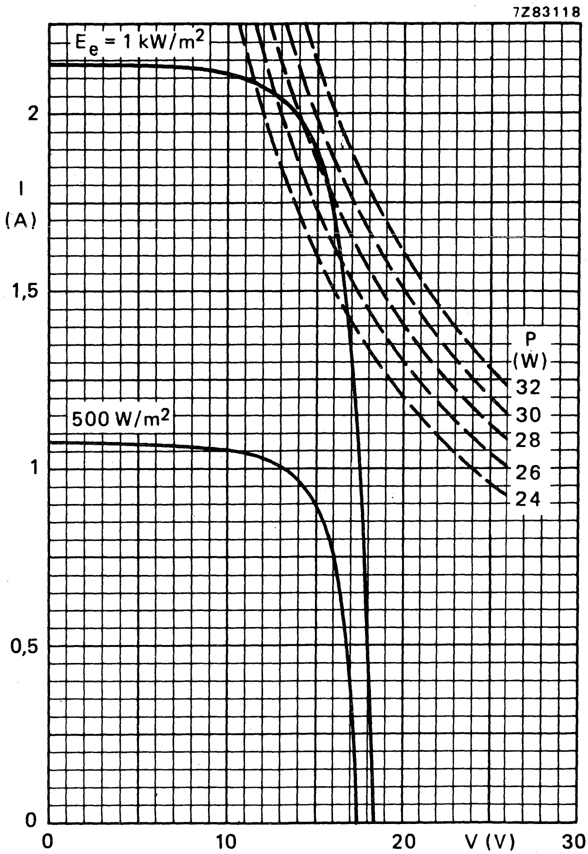


Fig. 6 T_j = 60 °C; typical values.

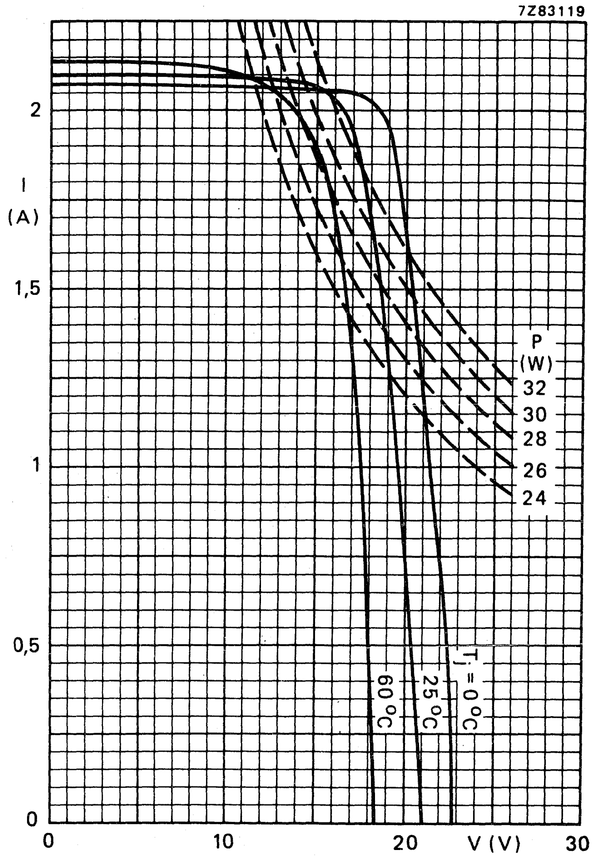
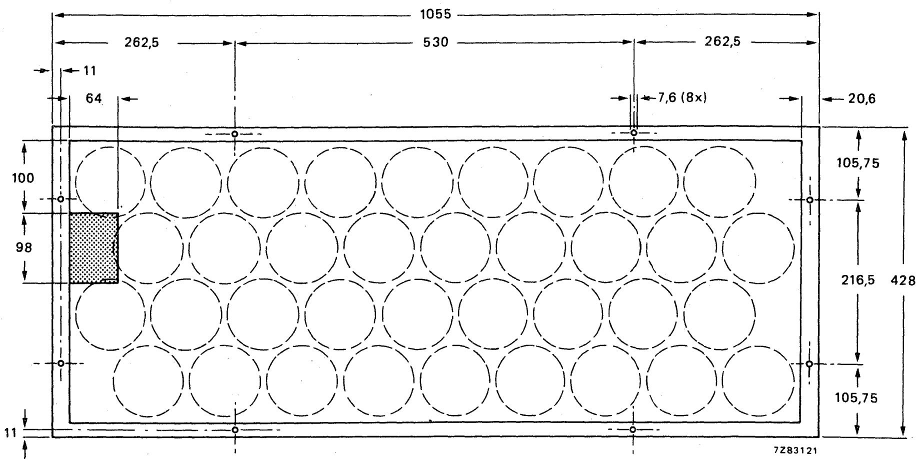


Fig. 7 E_e = 1 kW/m² (A.M. 1); typical values.



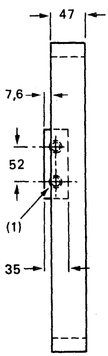


Fig. 8 Right side view.

(1) Feed-through for cable of 11 mm thickness (PG11).

PHOTOTRANSISTOR

General purpose n-p-n silicon phototransistor with a glass lens. Inaccessable base.

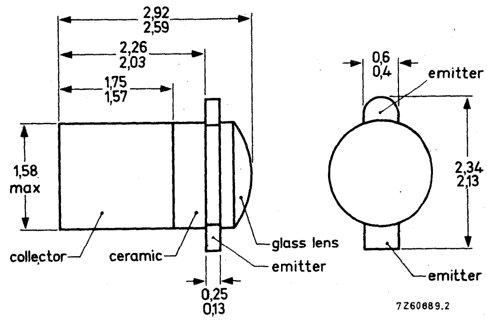
QUICK REFERENCE DATA

Collector-emitter voltage		V_{CEO}	max.	50 V
Collector current (d.c.)		I_C	max.	20 mA
Junction temperature		T_j	max.	150 °C
Collector dark (cut-off) current V_{CE} = 30 V		I_d	<	25 nA
Collector light (cut-off) current V_{CE} = 5 V; E_e = 20 mW/cm²	**BPX71**	I_ℓ		0,5 to 15 mA
	BPX71-203	I_ℓ		4 to 8 mA
	BPX71-204	I_ℓ		7 to 15 mA
Wavelength at peak response		λ_{pk}	typ.	800 nm
Angle between half-sensitivity directions		$\alpha_{50\%}$	typ.	40°

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-71A (DO-31).



RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage	V_{CEO}	max.	50 V
Emitter-collector voltage	V_{ECO}	max.	7 V
Collector current			
d.c.	I_C	max.	20 mA
(peak value); $t_p \leqslant 50\ \mu s$; $\delta \leqslant 0,1$	I_{CM}	max.	50 mA
Total power dissipation			
up to $T_{amb} = 50\ ^oC$	P_{tot}	max.	50 mW
up to $T_{mb} = 55\ ^oC$	P_{tot}	max.	100 mW
Storage temperature	T_{stg}		−65 to +150 ^oC
Junction temperature	T_j	max.	150 ^oC

THERMAL RESISTANCE

From junction to ambient in free air	$R_{th\ j\text{-}a}$	=	2000 $^oC/W$
From junction to mounting base	$R_{th\ j\text{-}mb}$	=	950 $^oC/W$

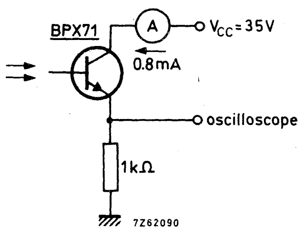
CHARACTERISTICS

$T_{amb} = 25\ ^oC$ unless otherwise specified

Collector dark (cut-off) current				
$V_{CE} = 30$ V		I_d	<	25 nA
$V_{CE} = 30$ V; $T_{amb} = 100\ ^oC$		I_d	<	100 μA
→ Collector light (cut-off) current				
$V_{CE} = 5$; tungsten filament lamp source with colour temperature 2856 K				
$E_e = 4{,}75\ mW/cm^2$		I_ℓ	typ.	1 mA
$E_e = 20\ mW/cm^2$	BPX71	I_ℓ		0,5 to 15 mA
	BPX71-203	I_ℓ		4 to 8 mA
	BPX71-204	I_ℓ		7 to 15 mA

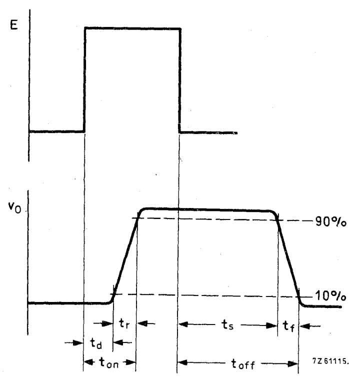
CHARACTERISTICS (continued)

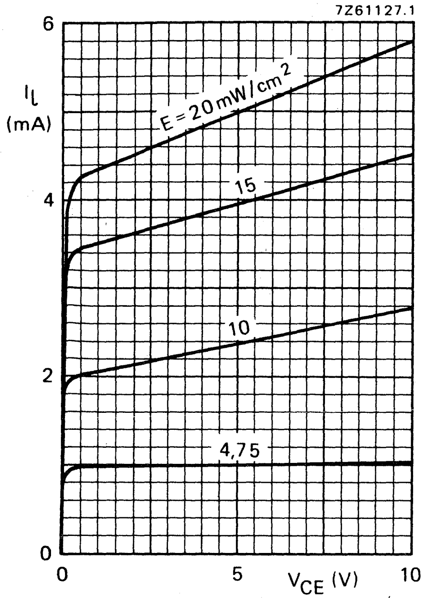
Breakdown voltages				
Collector-emitter voltage $E = 0$; $I_C = 0,5$ mA	$V_{(BR)CEO}$	>	50	V
Emitter-collector voltage $E = 0$; $I_C = 0,1$ mA	$V_{(BR)ECO}$	>	7	V
Collector-emitter light saturation voltage				
$I_C = 0,4$ mA; $E_e = 20$ mW/cm^2; $T_c = 2856$ K	V_{CEsat}	typ.	150	mV
		<	400	mV
Wavelength at peak response	λ_{pk}	typ.	800	nm
Bandwidth at half height	$B_{50\%}$	typ.	400	nm
Switching times				
$I_{Con} = 0,8$ mA; $V_{CC} = 35$ V; $R_L = 1$ kΩ				
Delay time	t_d	typ.	2,0	µs
		<	20	µs
Rise time	t_r	typ.	3,0	µs
		<	30	µs
Storage time	t_s	typ.	0,1	µs
		<	2,0	µs
Fall time	t_f	typ.	2,5	µs
		<	20	µs



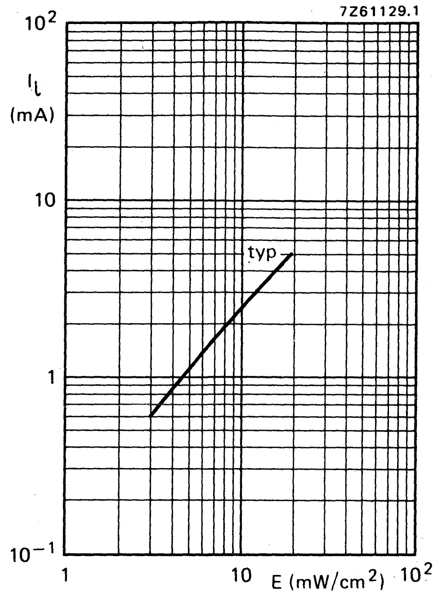
Light input pulse:

$t_r = t_f = 20$ ns
$t_p = 20$ µs
$f = 500$ Hz
$\lambda = 800$ nm

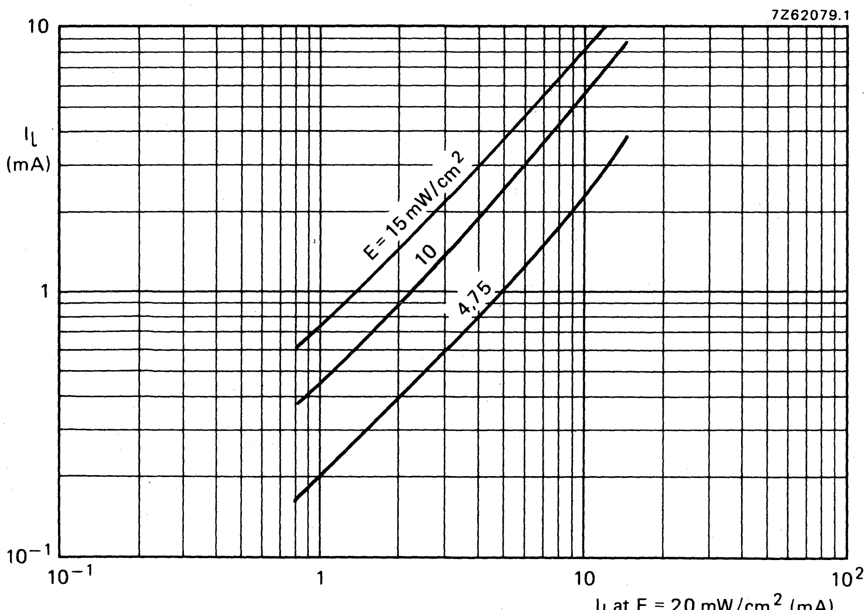




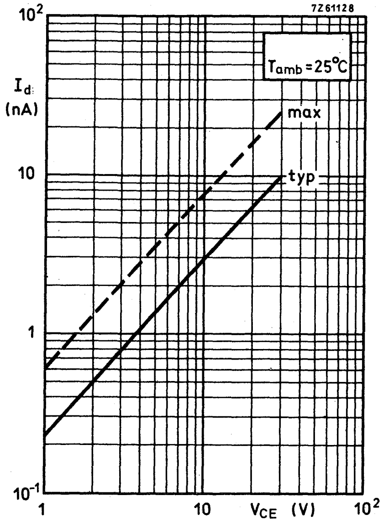
Typical values; T_{amb} = 25 °C.

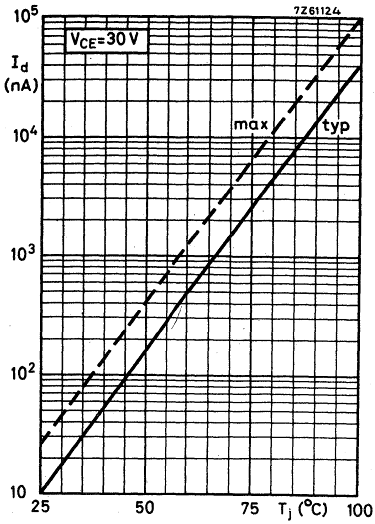


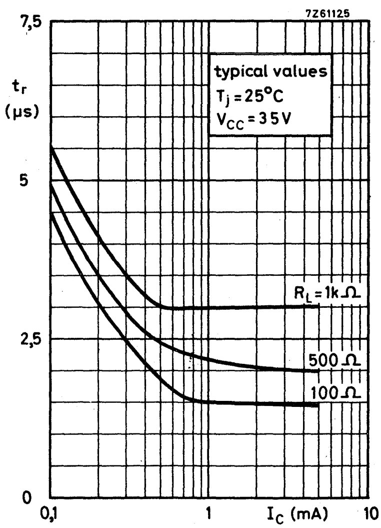
V_{CE} = 5 V; T_{amb} = 25 °C.

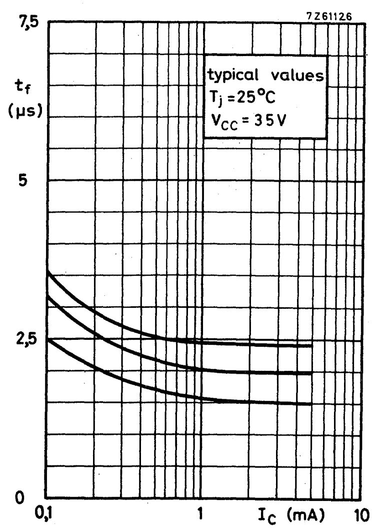


V_{CE} = 5 V; T_{amb} = 25 °C.


7Z61128
$T_{amb} = 25\,^{\circ}C$
I_d (nA)
max
typ
10^2
10
1
10^{-1}
1
10
V_{CE} (V)
10^2

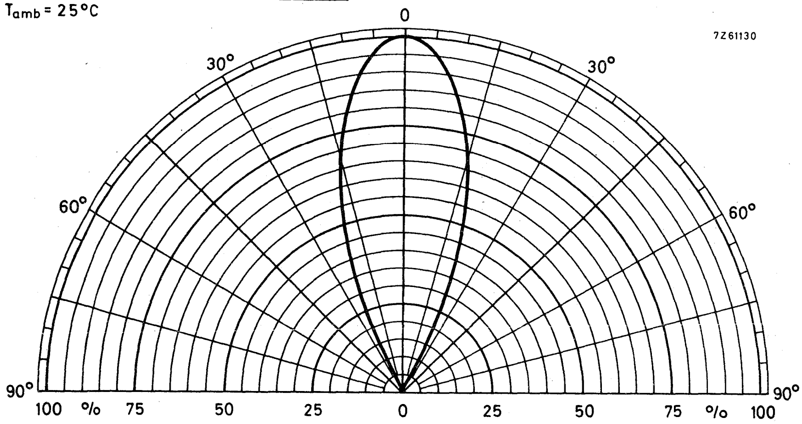

7Z61124
$V_{CE} = 30$ V
I_d (nA)
max
typ
10^5
10^4
10^3
10^2
10
25
50
75
T_j (°C)
100

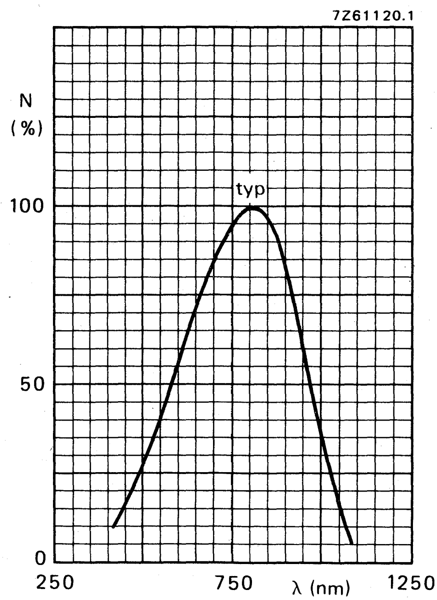

7Z61125
typical values
$T_j = 25\,^{\circ}C$
$V_{CC} = 35$ V
t_r (μs)
$R_L = 1k\Omega$
500 Ω
100 Ω
7,5
5
2,5
0
0,1
1
I_C (mA)
10


7Z61126
typical values
$T_j = 25\,^{\circ}C$
$V_{CC} = 35$ V
t_f (μs)
7,5
5
2,5
0
0,1
1
I_C (mA)
10

polar response of relative sensitivity

$T_{amb} = 25\,°C$





PHOTOTRANSISTOR

General purpose n-p-n silicon phototransistor with a plastic lens.

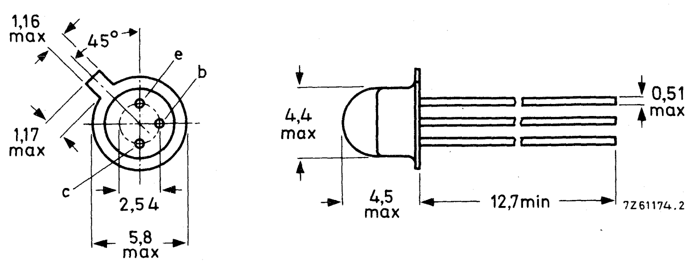
QUICK REFERENCE DATA

Collector-emitter voltage (open base)		V_{CEO}	max.	30 V
Collector current (d.c.)		I_C	max.	25 mA
Junction temperature		T_j	max.	125 °C
Collector dark (cut-off) current V_{CE} = 20 V		I_d	<	100 nA
Collector light (cut-off) current V_{CE} = 5 V; E_v = 1000 lx (E_e = 4,75 mW/cm²)	**BPX72**	I_ℓ		500 to 3000 µA
	BPX72D	I_ℓ		850 to 2000 µA
	BPX72E	I_ℓ		1400 to 3000 µA
	BPX72F	I_ℓ		2400 to 5000 µA
Wavelength at peak response		λ_{pk}	typ.	800 nm
Angle between half-sensitivity directions		$\alpha_{50\%}$	typ.	120°

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-70A.



Maximum lead diameter is guaranteed only for 12,7 mm.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)	V_{CBO}	max.	40 V
Collector-emitter voltage (open base)	V_{CEO}	max.	30 V
Emitter-collector voltage (open base)	V_{ECO}	max.	6 V
Collector current			
d.c.	I_C	max.	25 mA
(peak value); $t_p \leq 50\ \mu s$; $\delta \leq 0{,}1$	I_{CM}	max.	50 mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	180 mW
Storage temperature	T_{stg}	−40 to +125	°C
Junction temperature	T_j	max.	125 °C

THERMAL RESISTANCE

From junction to ambient in free air	$R_{th\ j\text{-}a}$	=	550 °C/W

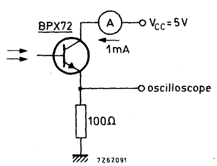
CHARACTERISTICS

I_B = 0; T_{amb} = 25 °C unless otherwise specified

Collector dark (cut-off) current				
V_{CE} = 20 V		I_d	typ.	10 nA
			<	100 nA
V_{CE} = 20 V; T_j = 100 °C		I_d	typ.	10 μA
			<	100 μA
→ Collector light (cut-off) current				
V_{CE} = 5 V; tungsten filament lamp source with colour temperature 2856 K				
E_v = 1000 lx (E_e = 4,75 mW/cm²)	**BPX72**	I_ℓ		500 to 3000 μA
	BPX72D	I_ℓ		850 to 2000 μA
	BPX72E	I_ℓ		1400 to 3000 μA
	BPX72F	I_ℓ		2400 to 5000 μA
E_v = 2500 lx (E_e = 12 mW/cm²)		I_ℓ	typ.	3000 μA

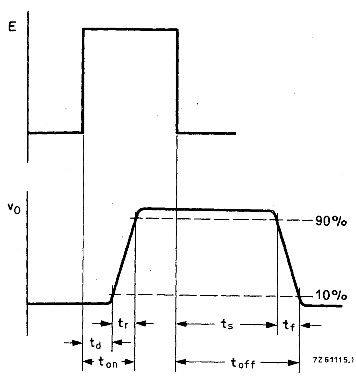
CHARACTERISTICS (continued)

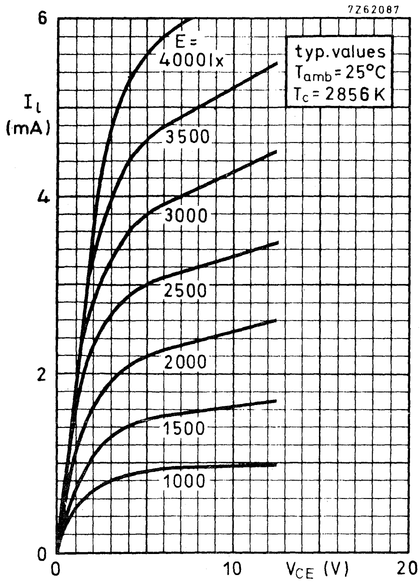
Breakdown voltages				
Collector-base voltage E = 0; I_C = 0, 1 mA	$V_{(BR)CBO}$	>	40	V
Collector-emitter voltage E = 0; I_C = 1 mA	$V_{(BR)CEO}$	>	30	V
Emitter-collector voltage E = 0; I_C = 0, 1 mA	$V_{(BR)ECO}$	>	6	V
Collector capacitance				
$I_E = I_e = 0$; V_{CB} = 20 V	C_c	typ.	3, 5	pF
Wavelength at peak response	λ_{pk}	typ.	800	nm
Bandwidth at half height	$B_{50\%}$	typ.	300	nm
Switching times				
I_{Con} = 1 mA; V_{CC} = 5 V; R_L = 100 Ω				
Delay time	t_d	typ. <	3, 0 6, 0	µs µs
Rise time	t_r	typ. <	6, 0 20	µs µs
Storage time	t_s	typ. <	1, 5 3, 0	µs µs
Fall time	t_f	typ. <	4, 0 20	µs µs

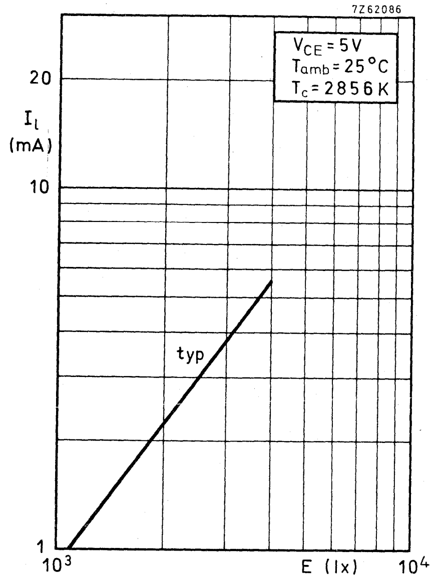


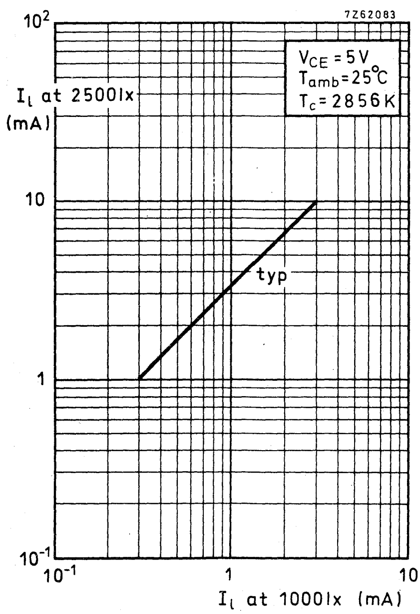
Light input pulse:

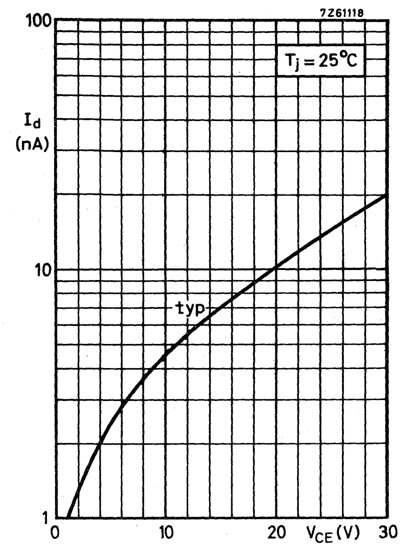
$t_r = t_f$ = 20 ns
t_p = 20 µs
f = 500 Hz
λ = 800 nm

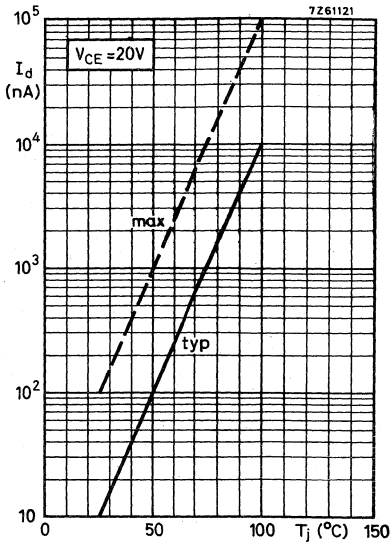


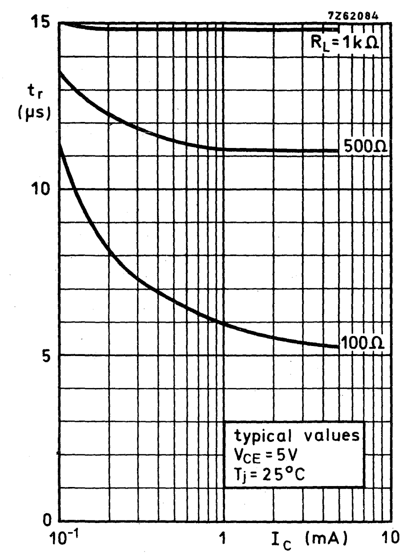

7Z62087
typ. values
T_{amb} = 25°C
T_c = 2856 K
E = 4000 lx
3500
3000
2500
2000
1500
1000
I_l (mA)
6
4
2
0
0
10
20
V_{CE} (V)

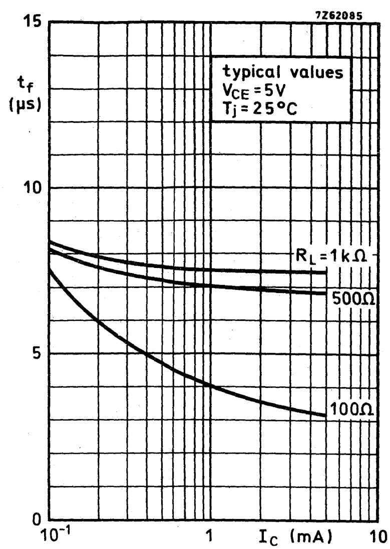

7Z62086
V_{CE} = 5 V
T_{amb} = 25 °C
T_c = 2856 K
I_l (mA)
20
10
1
typ
10^3
E (lx)
10^4


7Z62083
V_{CE} = 5 V
T_{amb} = 25°C
T_c = 2856 K
I_l at 2500 lx (mA)
10^2
10
1
10^{-1}
typ
10^{-1}
1
10
I_l at 1000 lx (mA)

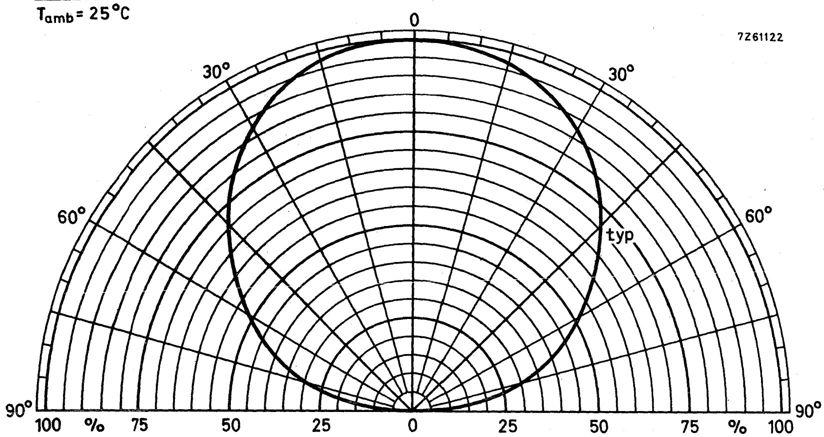

7Z61118
100
10
1
I_d
(nA)
T_j = 25°C
typ
0
10
20
V_CE (V)
30

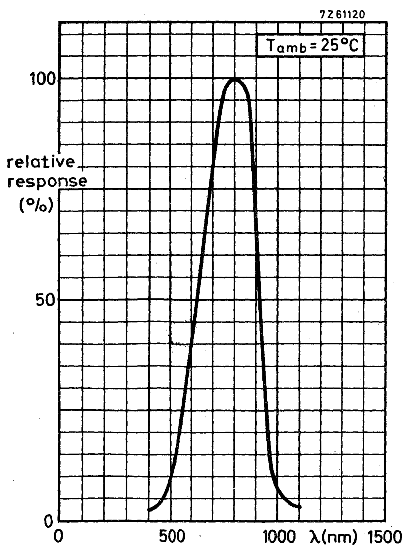

7Z61121
10^5
10^4
10^3
10^2
10
I_d
(nA)
V_CE = 20V
max
typ
0
50
100
T_j (°C)
150

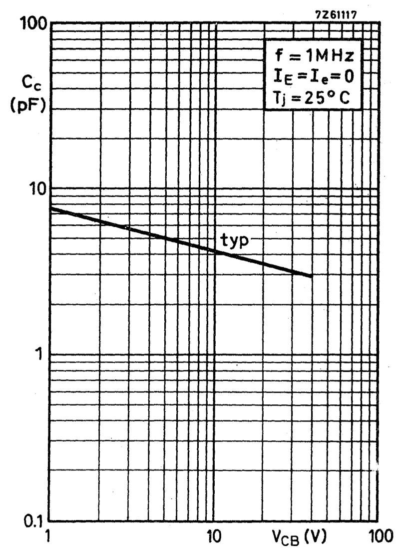

7Z62084
15
10
5
0
t_r
(μs)
R_L = 1 kΩ
500Ω
100Ω
typical values
V_CE = 5V
T_j = 25°C
10^-1
1
I_C (mA)
10


7Z62085
15
10
5
0
t_f
(μs)
typical values
V_CE = 5V
T_j = 25°C
R_L = 1 kΩ
500Ω
100Ω
10^-1
1
I_C (mA)
10

polar response of relative sensitivity







SILICON PLANAR EPITAXIAL PHOTOTRANSISTOR

N-P-N phototransistor designed for use as detector. Clear epoxy encapsulation.

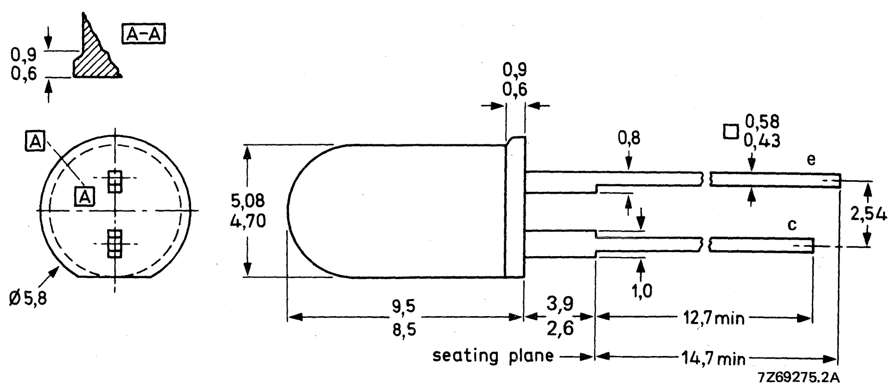
QUICK REFERENCE DATA

Collector-emitter voltage (open base)	V_{CEO}	max.	30	V
Collector current (d.c.)	I_C	max.	25	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	100	mW
Collector light (cut-off) current V_{CE} = 5 V; E = 1 mW/cm^2; λ = 930 nm	$I_{CEO(L)}$	>	3	mA
Wavelength at peak response	λ_{pk}	typ.	800	nm

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOD-63 (except distance between base and seating plane).



RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage (open base)	V_{CEO}	max.	30 V
Emitter-collector voltage (open base)	V_{ECO}	max.	5 V
Collector current (d.c.)	I_C	max.	25 mA
Collector current (peak value) t_p = 50 μs; δ = 0,1	I_{CM}	max.	50 mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	100 mW
Storage temperature	T_{stg}	−40 to	+100 °C
Junction temperature	T_j	max.	100 °C
Lead soldering temperature up to the seating plane; t_{sld} < 10 s	T_{sld}	max.	240 °C

THERMAL RESISTANCE

From junction to ambient	$R_{th\ j\text{-}a}$	=	750 °C/W
From junction to ambient, device mounted on a printed-circuit board	$R_{th\ j\text{-}a}$	=	500 °C/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector dark (cut-off) current V_{CE} = 20 V		$I_{CEO(D)}$	<	100 nA
Collector light (cut-off) current* V_{CE} = 5 V; E = 1 mW/cm²; λ = 930 nm	**BPX95C-1**	$I_{CEO(L)}$		3 to 15 mA
	BPX95C-2	$I_{CEO(L)}$	>	10 mA
Collector-emitter saturation voltage* I_C = 2 mA; E = 1 mW/cm²; λ = 930 nm		V_{CEsat}	<	0,4 V
Wavelength at peak response		λ_{pk}	typ.	800 nm
Bandwidth at half height		$B_{50\%}$	typ.	400 nm
Angle between half-sensitivity directions		$\alpha_{50\%}$	typ.	20°
Receiving area			typ.	1 mm²

* Measured with a tungsten linear filament lamp and an interference filter at λ = 930 nm.

Switching times (see Figs 2, 3, 4 and 5)

I_{Con} = 2 mA; V_{CC} = 5 V; R_E = 100 Ω; T_{amb} = 25 °C

Light current turn-on time	t_{on}	typ.	3 μs
Light current turn-off time	t_{off}	typ.	3 μs

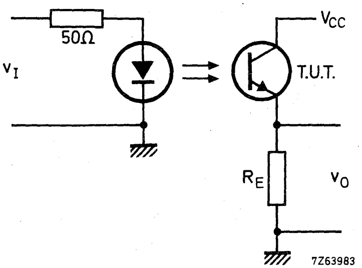


Fig. 2 Switching circuit.

Pulse generator:
f = 500 Hz
t_p = 20 μs
t_r = t_f = 20 ns

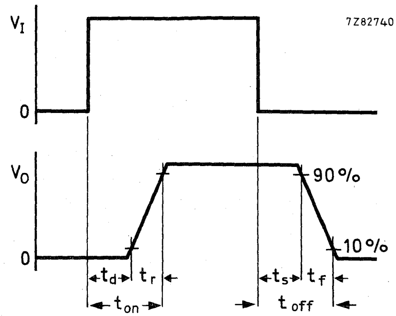


Fig. 3 Input and output switching waveforms.

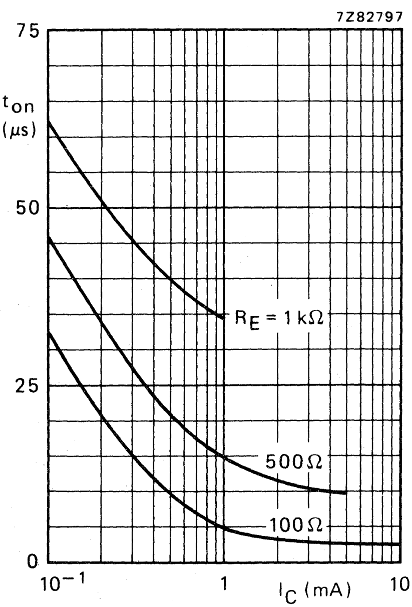


Fig. 4 V_{CC} = 5 V; T_{amb} = 25 °C; typ. values.

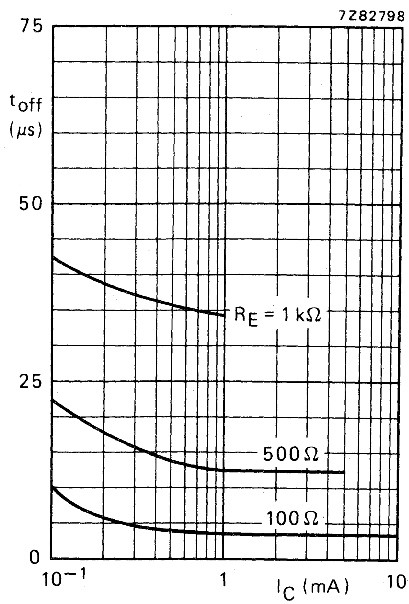


Fig. 5 V_{CC} = 5 V; T_{amb} = 25 °C; typ. values.

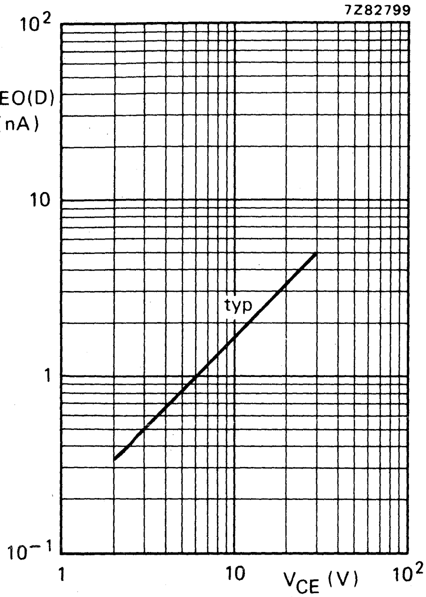


Fig. 6 $T_j = 25\ ^oC$.

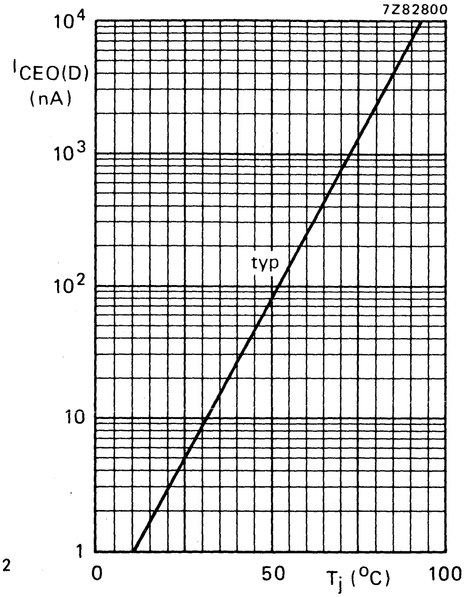


Fig. 7 $V_{CE} = 30$ V.

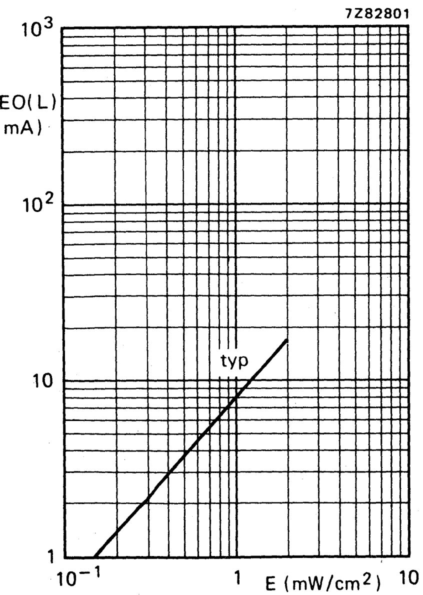


Fig. 8 $V_{CE} = 5$ V; $\lambda = 930$ nm; $T_j = 25\ ^oC$.

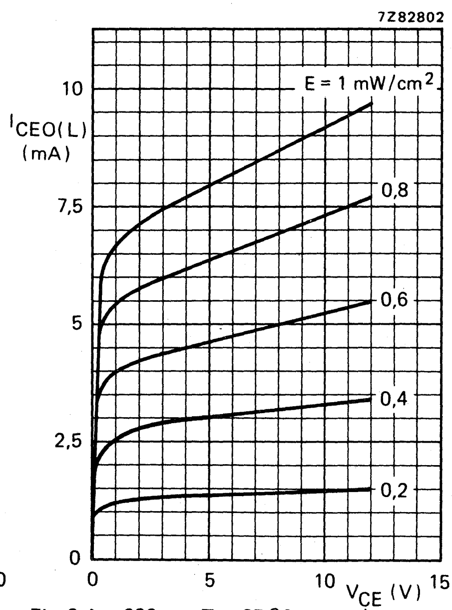


Fig. 9 $\lambda = 930$ nm; $T_j = 25\ ^oC$; typ. values.

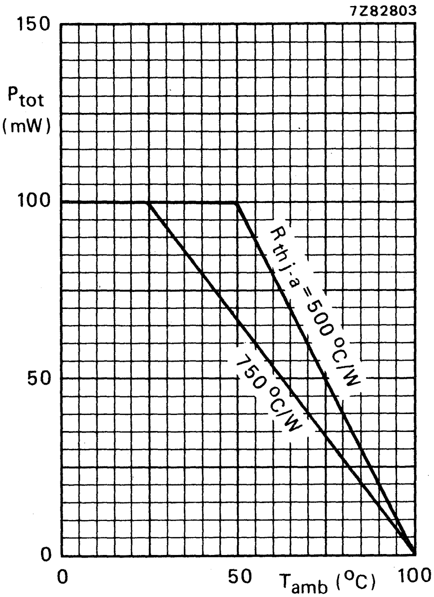


Fig. 10 Total power dissipation as a function of ambient temperature.

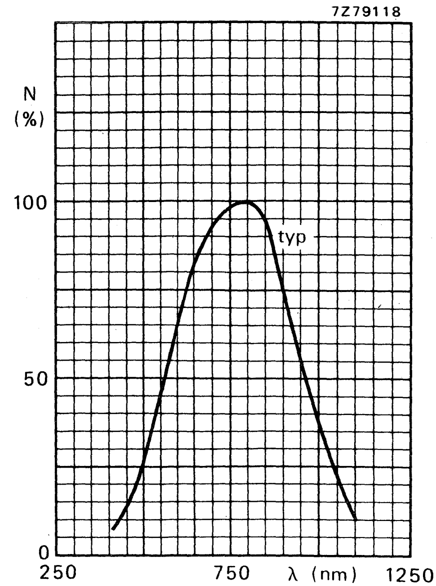


Fig. 11 Spectral response.

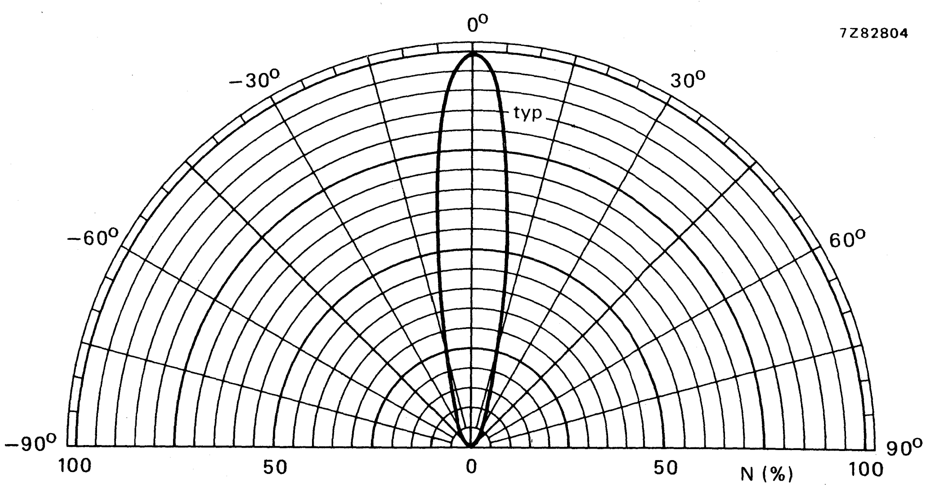


Fig. 12.

SILICON AVALANCHE PHOTODIODE FOR FIBRE-OPTIC COMMUNICATIONS

Type 1 Silicon avalanche photodiode in a hermetically sealed modified TO-18 envelope coupled directly to a graded-index optical quartz glass fibre.

The device features high coupling and quantum efficiency, extremely fast response time and very low noise characteristics. The characteristics of this photodiode make it useful in a wide variety of applications in fibre-optic communications as well as in laser detection, ranging, high-sensitivity measurements, high-speed switching and transit-time measurements.

Type 2 A separate silicon avalanche (photo) diode in a hermetically "dark sealed" TO-18 envelope, to be used as a reference diode, with corresponding "dark electrical" behaviour.

QUICK REFERENCE DATA

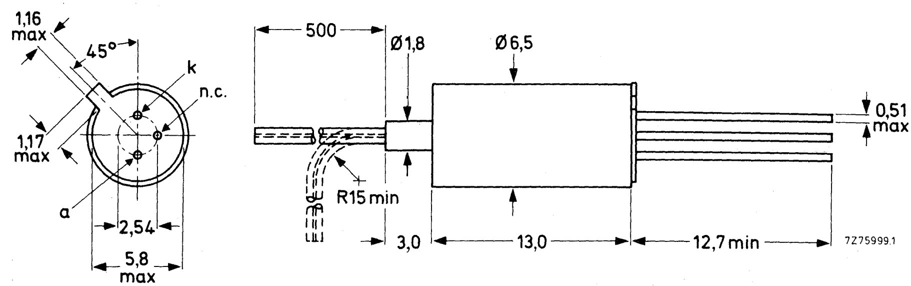
Reverse dark avalanche breakdown voltage $I_{R(D)} = 1\ \mu A$	$V_{(BR)R}$	typ.	200 V
Reach-through voltage	$V_{(RT)R}$	typ.	140 V
Dark reverse current $V_{R(D)} = 0{,}8\ V_{(BR)R}$	$I_{R(D)}$	typ.	5 nA
Wavelength at peak response	λ_{pk}	typ.	800 nm
Quantum efficiency $V_R > V_{(RT)R}$; $\lambda = 800$ nm	η_λ	typ.	90 %
Responsivity $V_R > V_{(RT)R}$; $\lambda = 800$ nm; M = 100	R	typ.	60 A/W
Diode capacitance $V_{R(D)} > V_{(RT)R}$	C_d	typ.	1,3 pF
Pulse response FWHM M = 50 to 100	σ	typ.	0,44 ns
Effective noise factor (see page 6)	k_{eff}	typ.	0,02
Diameter active area	ϕ		350 μm

MECHANICAL DATA

Dimensions in mm

Fig. 1 TO-18 (modified).

Anode connected to case



RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Forward current (d.c.)	I_F	max.	10 mA
Total power dissipation up to T_{amb} = 90 °C	P_{tot}	max.	100 mW
Storage temperature			
Avalanche photodiode with fibre	T_{stg}		0 to +90 °C
Reference diode	T_{stg}		−25 to + 125 °C
Junction temperature	T_j	max.	125 °C

THERMAL RESISTANCE

From junction to ambient in free air	$R_{th\ j\text{-}a}$	=	350 °C/W
From junction to case	$R_{th\ j\text{-}c}$	=	100 °C/W

CHARACTERISTICS (measured on crystal)

T_j = 25 °C

Dark reverse currents			
$V_{R(D)}$ = 0,8 $V_{(BR)R}$; surface	$I_{R(D)}$	typ. <	5 nA 30 nA
$V_{R(D)}$ = 0,8 $V_{(BR)R}$; bulk (unmultiplied)	$I_{R(D)b}$	typ.	20 pA
Reverse dark avalanche breakdown voltage			
$I_{R(D)}$ = 1 μA	$V_{(BR)R}$	typ.	200 V 165 to 245 V
Reach-through voltage	$V_{(RT)R}$	typ.	140 V
Forward voltage			
I_F = 1 mA	V_F	typ.	600 mV
Temperature coefficient of reverse voltage at M = 100	$\frac{\Delta V_R}{T_{amb}}$	typ.	0,6 V/°C
Wavelength at peak response	λ_{pk}	typ.	800 nm
Multiplication operating range	M		20 to 120
Responsivity			
$V_R > V_{(RT)R}$; λ = 800 nm; M = 100	R	typ.	60 A/W
→ Quantum efficiency			
$V_R > V_{(RT)R}$; λ = 800 nm	η_λ	typ.	90 %
Effective noise factor (see page 6)			
Excess noise factor F ≈ 2 + k_{eff} M−1/M up to M = 120	k_{eff}	typ. <	0,020 0,025
Noise equivalent power			
M = 50; η = 0,90; λ = 800 nm $I_{R(D)d}$ = 20 pA; k_{eff} = 0,02	N.E.P.	typ.	7,6 x 10^{-15} $W/\sqrt{Hz}$
Diode capacitance (≈ 0,7 pF TO-18 envelope included)			
$V_{R(D)} > V_{(RT)R}$	C_d	typ.	1,3 pF
Pulse response FWHM*			
M = 50 to 100; λ = 850 nm; R_L = 50Ω; σ_{opt} ≈ 100 ps FWHM	σ	typ.	0,44 ns

* FWHM means full width half maximum.

OPTICAL DATA

Graded-index optical quartz glass fibre

Numerical aperture on-axis	NA	typ.	0,21	
			0,20 to 0,22	
Core diameter	ϕ_{core}	typ.	50	μm
			48 to 52	μm
Cladding diameter	$\phi_{cladding}$	typ.	125	μm
			123 to 127	μm
Primary coating thickness		typ.	5	μm
Secondary coating diameter	$\phi_{coating}$	typ.	0,9	mm
Coupling efficiency	$\eta_{coupling}$	>	85	%

Note 1

$\eta_{a.p.d.} = \eta_{\lambda} \times \eta_{coupling}$

η_{λ} = quantum efficiency

$\eta_{coupling}$ = optical coupling efficiency for the assembled envelope, from the free end of the avalanche photodiode fibre to the active area of the crystal.

Note 2

On special request the same crystals on TO-18 headers can be delivered with flat or lens windows. Also optical glass-fibres of deviating specifications can be mounted (e.g. ϕ_{core} = 50 μm; $\phi_{cladding}$ = 100 μm).

DEVELOPMENT SAMPLE DATA

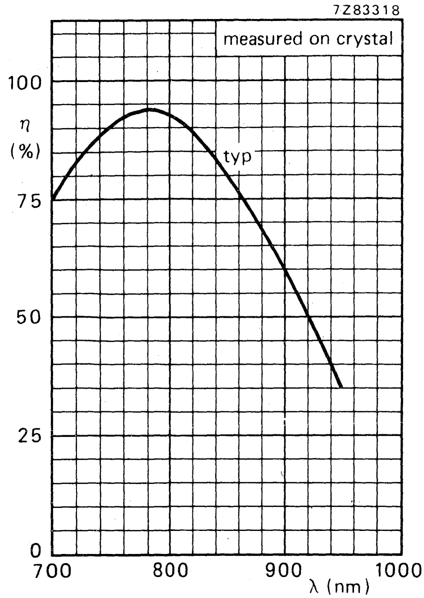


Fig. 2 Quantum efficiency versus wavelength; $V_R > V_{(RT)R}$.

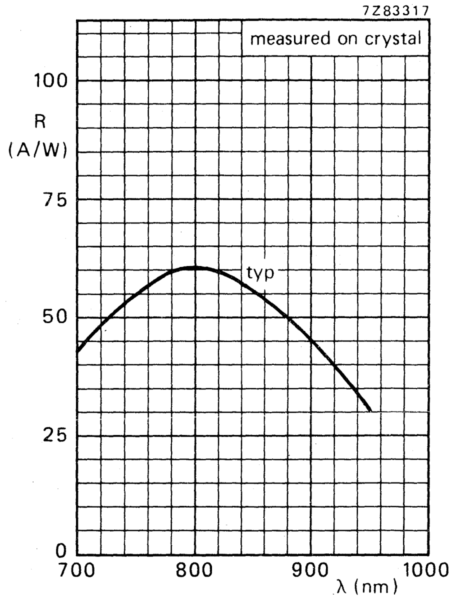


Fig. 3 Responsivity (M = 100) versus wavelength; $V_R > V_{(RT)R}$.

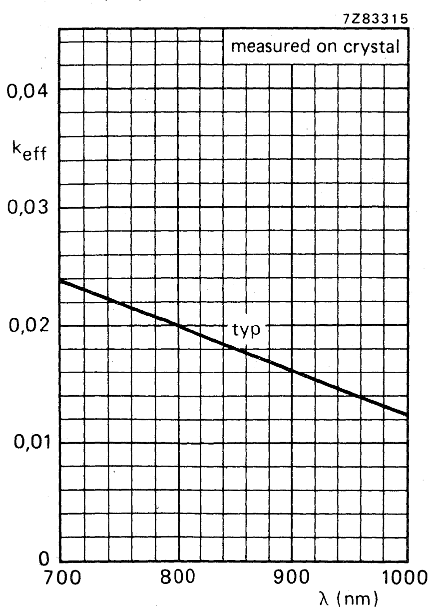


Fig. 4 Effective noise factor versus wavelength.

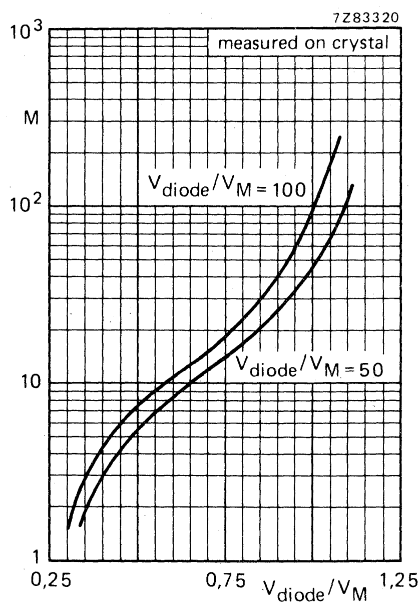


Fig. 5 Multiplication versus normalized voltage.

DEVELOPMENT SAMPLE DATA

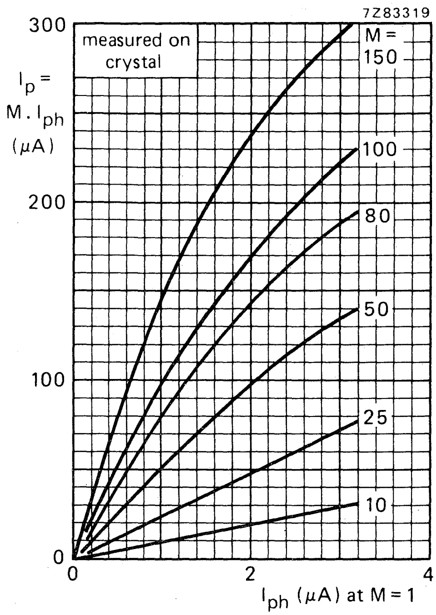


Fig. 6 Multiplied photocurrent versus primary photocurrent; typical values.

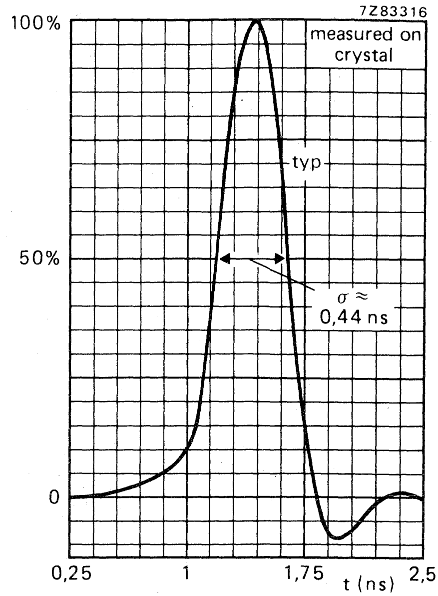


Fig. 7 Pulse response on a lightpulse $\sigma_{opt} \approx$ 100 ps FWHM versus time; λ = 850 nm; M = 50 to 100.

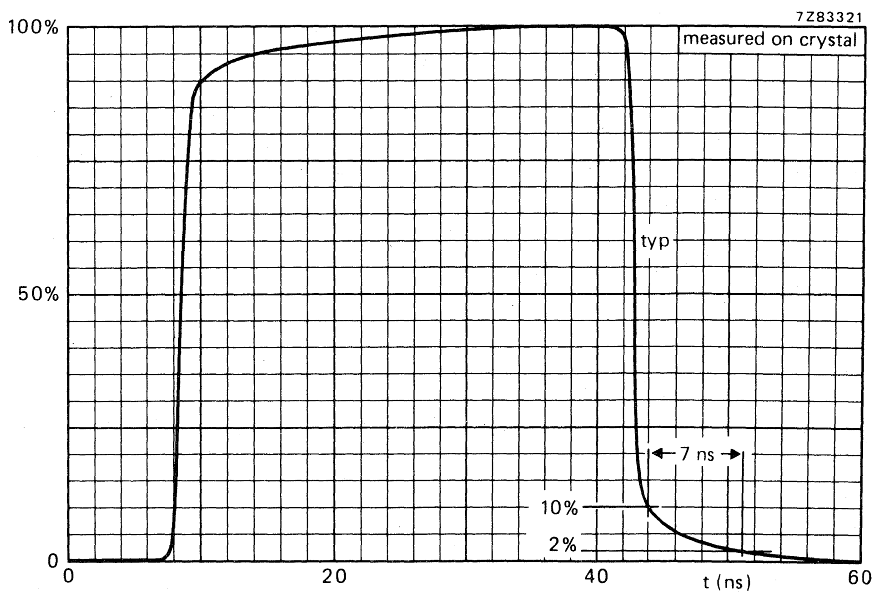


Fig. 8 Step response versus time; λ = 850 nm; M = 50.

Explanation of the effective noise factor (k_{eff}), noise equivalent power (N.E.P.) and signal to noise ratio (S/N).

The excess noise factor F is expressed by $F = \frac{\langle M^2 \rangle}{\langle M \rangle^2}$ in which:

$\langle M^2 \rangle$ = the mean square gain
$\langle M \rangle^2$ = the average gain squared

$\langle M^2 \rangle > \langle M \rangle^2$.

F is the ratio of the actual noise to that which would exist when all generated pairs are multiplied by exactly M.

$F \approx 2 + k_{eff} M - \frac{1}{M}$ in which:

k_{eff}, the effective noise factor, is a weighted ionization rate ratio of holes and electrons.

The mean square noise current for the avalanche photodiode is given by

$\langle i_n{}^2 \rangle = 2\,qB \left\{ M^2 F\,(I_b + I_{ph}) + I_s \right\} \approx 2\,qBM^2FI_{ph}$ in which:

q = electronic charge 1,602 x 10^{-19} (C)
B = bandwidth (Hz)
I_b = $I_{R(D)b}$ bulk dark reverse current; M = 1 (unmultiplied); (A)
I_{ph} = photocurrent; M = 1 (unmultiplied); (A)
I_s = surface dark reverse current; (A).

$$\text{N.E.P.}\ (W/\sqrt{Hz}) = \frac{\text{noise current without signal, } I_{ph} = 0\ (A/\sqrt{Hz})}{\text{responsivity (A/W)}}$$

$$\text{N.E.P.}\ (W/\sqrt{Hz}) = \frac{i_n/\sqrt{B}\ (\text{without signal, } I_{ph} = 0);\ (A/\sqrt{Hz})}{R_m\ (A/W)}$$

$$S/N = \frac{\text{responsivity (A/W) x N.E.P. } (W/\sqrt{Hz})}{\text{noise current without signal, } I_{ph} = 0\ (A/\sqrt{Hz})} = 1$$

$$S/N = \frac{R_m\ (A/W) \text{ x N.E.P. } (W/\sqrt{Hz})}{i_n/\sqrt{B}\ (\text{without signal, } I_{ph} = 0);\ (A/\sqrt{Hz})} = 1$$

$$R_m = \frac{m}{100} \times R_M = 100$$

LIGHT EMITTING DIODES

DOUBLE HETEROSTRUCTURE AlGaAs LASER

The CQL10 is designed for reading applications such as: data retrieval, video-audio disc applications, optical memories, security systems, etc.

This device is mounted in hermetic encapsulation SOT-148 specificly designed for easy alignment in an optical read or write system. The copper heatsink is circular and precision engineered with a diameter accuracy of + 0, −9 μm. Laserstripe and mechanical axis coincide within 50 μm.

The CQL10 is standard equipped with a photo p-i-n diode, optically coupled to the rear emitting facet of the laser. This fast-responding (less than 20 ns) photodiode can be used either as a signal detector for read-out or alternatively as a sensor to control the laser radiant output level. The ultra-flat top window (flat within two fringes) guarantees an unperturbed beam wavefront.

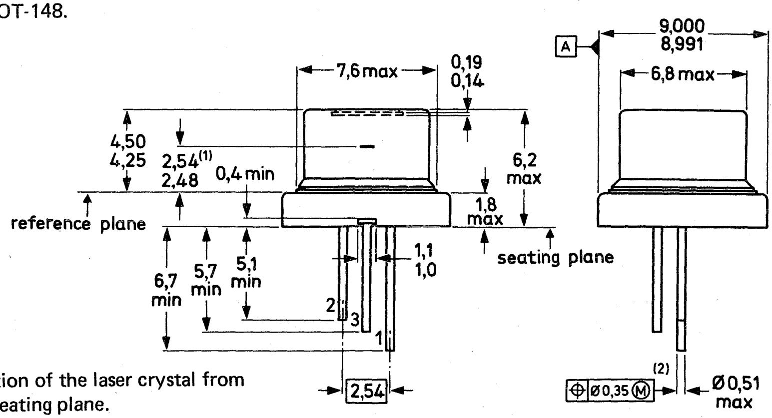
QUICK REFERENCE DATA

Threshold current at T_h = 60 °C	I_{th}	typ.	150	mA
C.W. radiant output power at $I_F = I_{th}$ + 15 mA; up to T_h = 60 °C	ϕ_e	typ.	5	mW
Wavelength at peak emission	λ_{pk}	typ.	780	nm

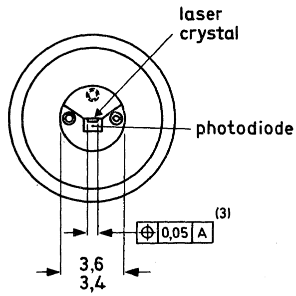
MECHANICAL DATA

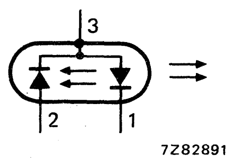
Dimensions in mm

Fig. 1 SOT-148.



(1) Position of the laser crystal from the seating plane.
(2) Positional accuracy of the leads applies within a zone which lies between 0,55 and 1,05 mm below the seating plane.
(3) Positional accuracy of the crystal with respect to the flange diameter.





LASER

The double heterostructure stripe laser operates in single transverse mode (TE_{00}) over the full power range. The structure is designed to operate c.w. 5 mW up to relatively high temperatures (60 °C heatsink temperature) and a wavelength of 780 nm which makes reading standard Video Long Play records a possible application.

CHARACTERISTICS

Threshold current at T_h = 30 °C	I_{th}	typ.	120 mA
Threshold current at T_h = 60 °C	I_{th}	typ. <	150 mA 200 mA
Radiant output power up to T_h = 60 °C	ϕ_e	<	10 mW
C.W. radiant output power at $I_F = I_{th}$ + 15 mA; up to T_h = 60 °C	ϕ_e	typ.	5 mW
Forward voltage drop at ϕ_e = 5 mW; up to T_h = 60 °C	V_F	typ.	2,5 V
Wavelength at peak emission	λ_{pk}	typ.	780 nm
Spectral width at half intensity	$\Delta\lambda$	typ.	4 nm
Beamwidth between half intensity directions (FWHM)			
perpendicular to the junction plane	$\alpha_{50\%}$	typ.	60°
parallel to the junction plane	$\alpha_{50\%}$	typ.	34°
Near fieldwidth at the mirror		typ.	6-7 µm
Astigmatism (distance between focal lines)	A	typ. <	25 µm 40 µm

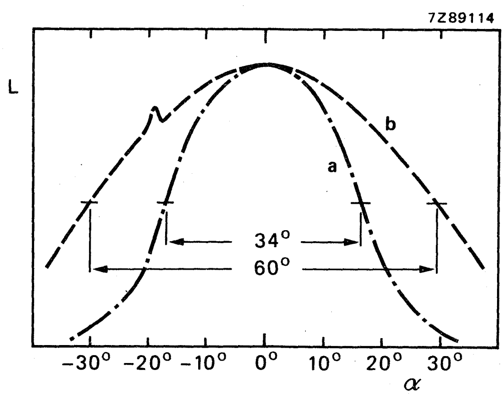


Fig. 2 Far-field pattern.

a. parallel to the junction plane
b. perpendicular to the junction plane.

PHOTODIODE

RATINGS

Reverse voltage	V_R	max.	30 V

CHARACTERISTICS

Luminous sensitivity at $V_R = 15$ V	N	typ.	0,5 A/W
Dark reverse current at $V_R = 15$ V	$I_{R(D)}$	<	10 nA
Capacitance at $V_R = 0$	C_d	<	5 pF

TEMPERATURES (both laser and photodiode)

C.W. operation	T_h	0 to 60 °C
Storage	T_{stg}	−55 to 100 °C

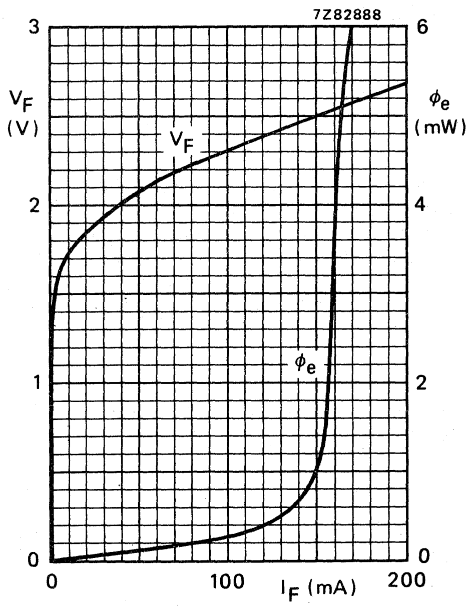


Fig. 3 Forward voltage drop (V_F) and radiant output power (ϕ_e) of laser diode as a function of forward current. $T_h = 60$ °C; typical values.

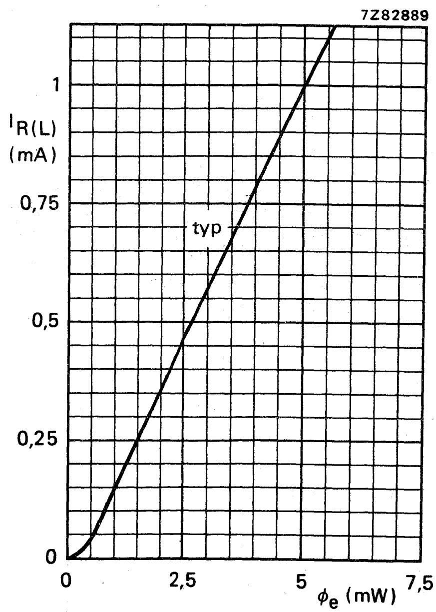


Fig. 4 Reverse current of photodiode as a function of radiant output power (ϕ_e). V_R (photodiode) = 15 V; $T_h = 60$ °C.

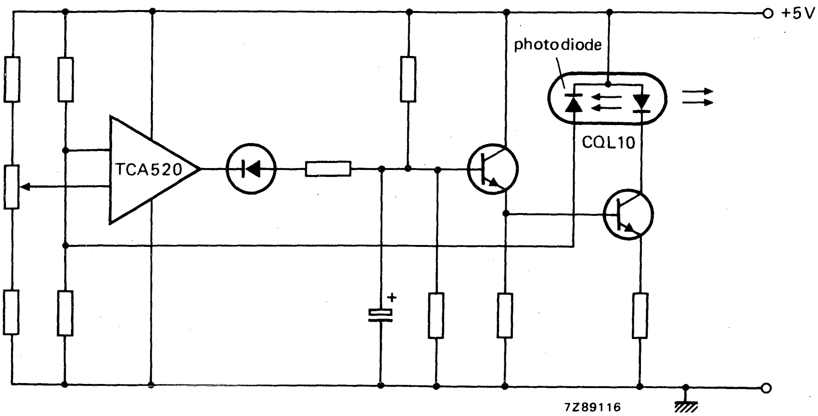


Fig. 5 Recommended control circuit.

OPERATING PRECAUTIONS

Semiconductor lasers in general are easily damaged by overdriving and transients. Electrically seen the laser diode is a very reliable device and can easily withstand current surges of several amperes. Optically, however, the diode laser is more susceptible to damage because of the extremely high optical flux density passing through both facets, while in operation. By overdriving or transients to the laser, even for pulses in the nanosecond region, the optical flux density can rise to unacceptable values (10 to 100 MW/cm^2) causing gradual or catastrophic degradation of the laser facets. Current transients should therefore be carefully avoided, it decreases the laser life time.

CAUTION

Aluminium gallium arsenide lasers emit radiation which is invisible to the human eye. When in use, do not look directly into the device. Direct viewing of laser light at close ranges, especially in conjunction with collimating lenses, may cause eye damage.

The device meets the requirements of safety class 3B of the international standard code.

LIGHT EMITTING DIODES

Light emitting diodes in flat plastic stackable envelopes.

The **CQW10** emits visible super-red light (GaAsP), the **CQW11** green light (GaP) and the **CQW12** yellow light (GaAsP) when forward biased.

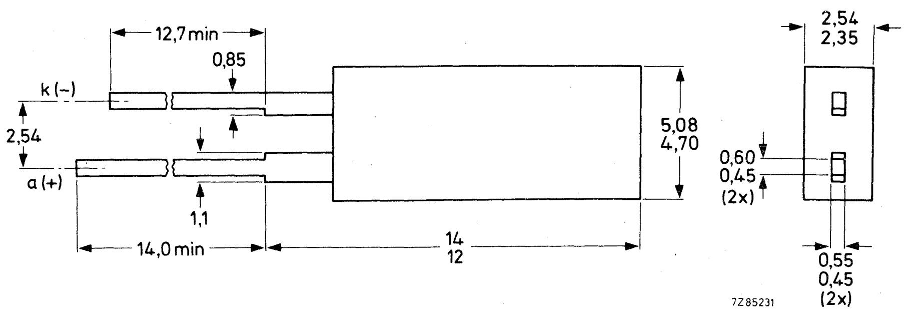
QUICK REFERENCE DATA

Continuous reverse voltage		V_R	max.	5	V
Forward current (d.c.)		I_F	max.	20	mA
Total power dissipation up to T_{amb} = 25 °C		P_{tot}	max.	60	mW
Luminous intensity (on-axis) at I_F = 10 mA		I_v	>	0,5	mcd
Wavelength at peak emission	**CQW10**	λ_{pk}	typ.	630	nm
	CQW11	λ_{pk}	typ.	560	nm
	CQW12	λ_{pk}	typ.	590	nm
Beamwidth between half-intensity directions		$\alpha_{50\%}$	typ.	100°	

MECHANICAL DATA

Dimensions in mm

Fig. 1.



RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Continuous reverse voltage		V_R	max.	5 V
Forward current				
d.c.		I_F	max.	20 mA
peak value; t_p = 1 ms; f = 300 Hz		I_{FM}	max.	60 mA
peak value; t_p = 1 μs; δ = 0,033		I_{FM}	max.	1000 mA
Total power dissipation up to T_{amb} = 55 ^oC		P_{tot}	max.	60 mW
Storage temperature		T_{stg}	−55 to + 100 ^oC	
Junction temperature		T_j	max.	100 ^oC
Lead soldering temperature up to 1,5 mm of the seating plane; $t_{sld} < 7$ s		T_{sld}	max.	230 ^oC

THERMAL RESISTANCE

From junction to ambient in free air		$R_{th\ j\text{-}a}$	=	750 $^oC/W$

CHARACTERISTICS

T_j = 25 ^oC

Forward voltage I_F = 10 mA		V_F	typ.	2,1 V
			<	3 V
Reverse current V_R = 5 V		I_R	<	100 μA
Diode capacitance V_R = 0; f = 1 MHz		C_d	typ.	35 pF
Luminous intensity (on-axis) I_F = 10 mA		I_v	>	0,5 mcd
			typ.	1,5 mcd
Wavelength at peak emission	**CQW10**	λ_{pk}	typ.	630 nm
	CQW11	λ_{pk}	typ.	560 nm
	CQW12	λ_{pk}	typ.	590 nm
Beamwidth between half-intensity directions		$\alpha_{50\%}$	typ.	100^o

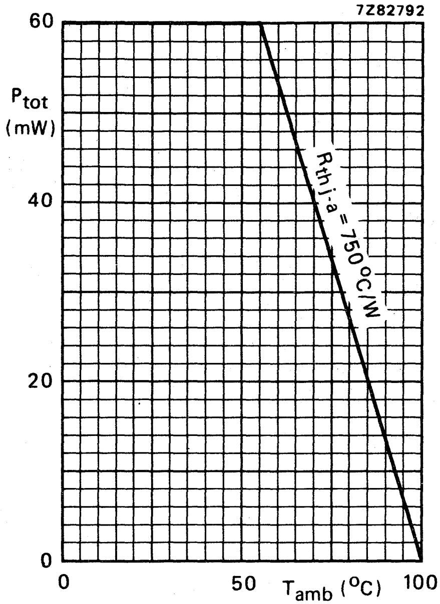


Fig. 2 Maximum permissible total power dissipation versus ambient temperature.

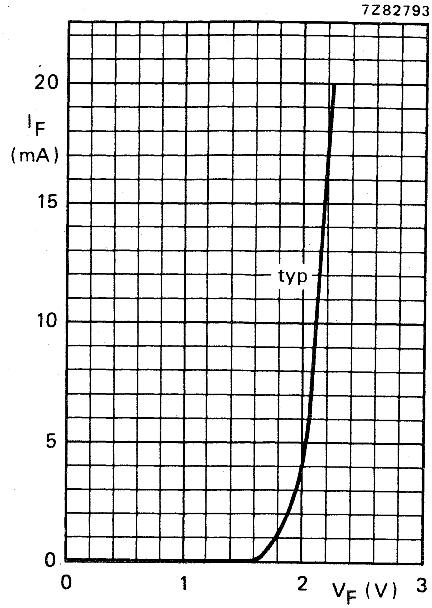


Fig. 3 T_j = 25 °C.

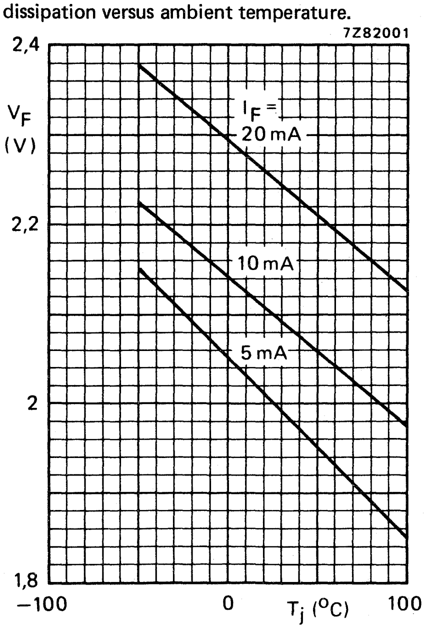


Fig. 4 Typical values.

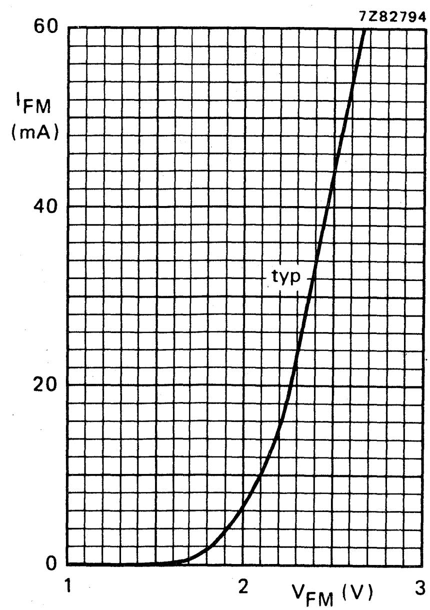


Fig. 5 t_p = 50 μs; T = 5 ms; T_j = 25 °C.

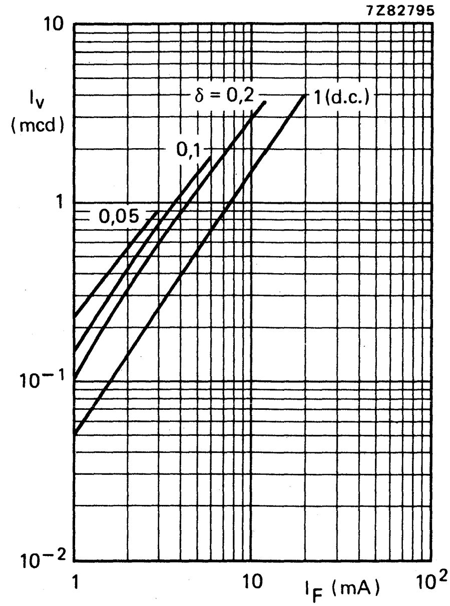


Fig. 6 Typical values; $T_j = 25\ ^oC$.

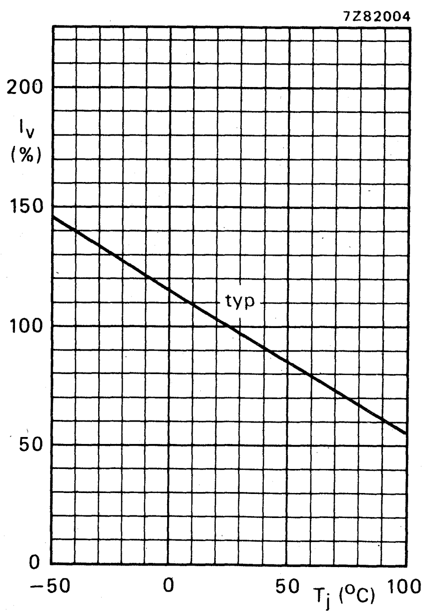


Fig. 7 $I_F = 10$ mA.

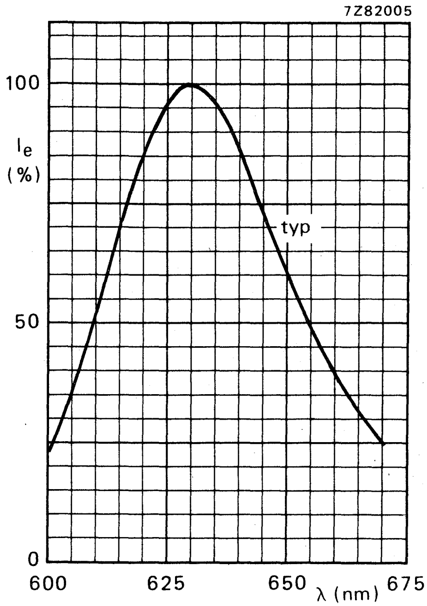


Fig. 8 **CQW10.**

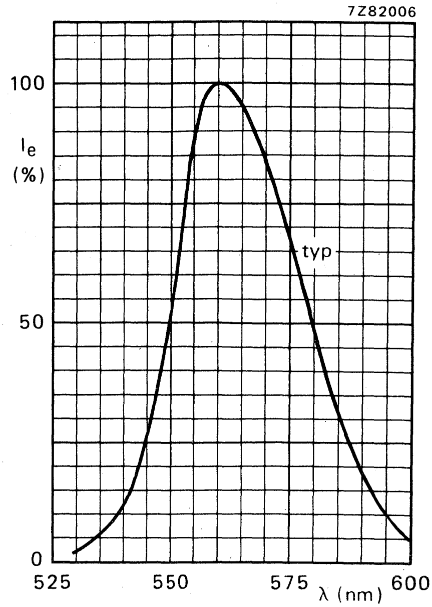


Fig. 9 **CQW11.**

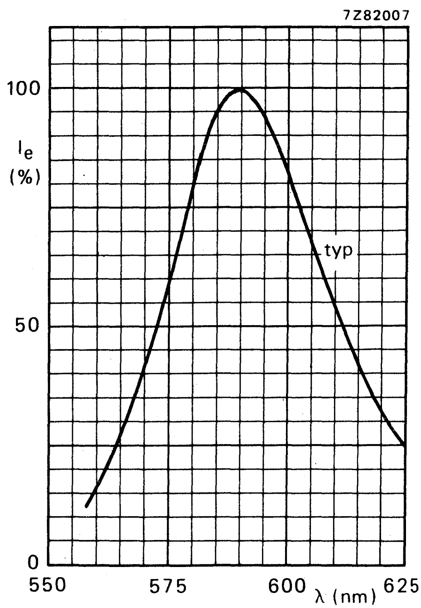


Fig. 10 **CQW12.**

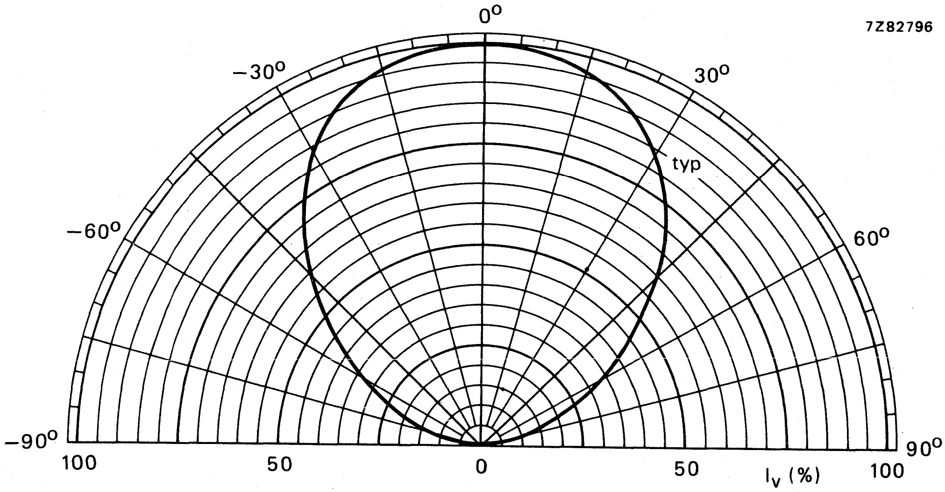


Fig. 11.

LIGHT EMITTING DIODES

Light emitting diodes in flat plastic stackable envelopes with rectangular lens (2,5 mm x 5 mm). The **CQX10** emits visible super-red light (GaAsP), the **CQX11** green light (GaP) and the **CQX12** yellow light (GaAsP) when forward biased.

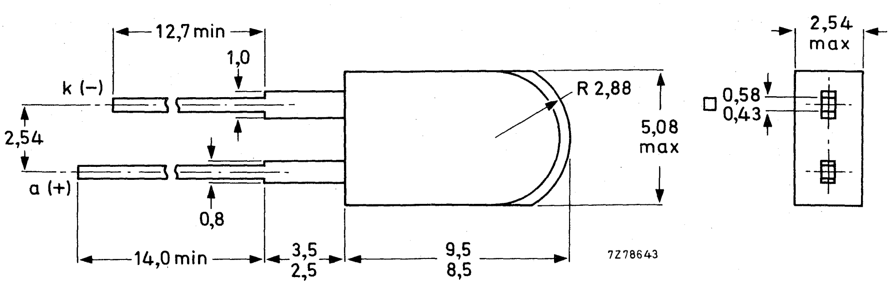
QUICK REFERENCE DATA

Continuous reverse voltage		V_R	max.	5 V
Forward current (d.c.)		I_F	max.	30 mA
Total power dissipation up to T_{amb} = 25 °C		P_{tot}	max.	120 mW
Luminous intensity (on-axis)				
I_F = 10 mA	**CQX..-I**	I_v	>	0,7 mcd
	CQX..-II	I_v		1,0 to 2,2 mcd
	CQX..-III	I_v		2,6 to 3,5 mcd
	CQX..-IV	I_v	>	3,0 mcd
Wavelength at peak emission	**CQX10**	λ_{pk}	typ.	630 nm
	CQX11	λ_{pk}	typ.	560 nm
	CQX12	λ_{pk}	typ.	590 nm
Beamwidth between half-intensity directions in the plane of the connections		$\alpha_{50\%}$	typ.	50°

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOD-65.



RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Continuous reverse voltage	V_R	max.	5	V
Forward current (d.c.)	I_F	max.	30	mA
Non-repetitive peak forward current, $t_p = 10\ \mu s$	I_{FSM}	max.	1000	mA
Total power dissipation up to $T_{amb} = 25\ ^oC$	P_{tot}	max.	120	mW
Storage temperature	T_{stg}		−55 to +100	^oC
Junction temperature	T_j	max.	100	^oC
Lead soldering temperature up to the seating plane; $t_{sld} < 10$ s	T_{sld}	max.	260	^oC

THERMAL RESISTANCE

From junction to ambient

in free air	$R_{th\ j\text{-}a}$	=	625	$^oC/W$
mounted on a printed-circuit board	$R_{th\ j\text{-}a}$	=	500	$^oC/W$

CHARACTERISTICS

$T_j = 25\ ^oC$ unless otherwise specified

Forward voltage $I_F = 10$ mA		V_F	typ.	2,1	V
			<	3	V
Reverse current $V_R = 5$ V		I_R	<	100	μA
Diode capacitance $V_R = 0$; f = 1 MHz		C_d	typ.	35	pF
→ Luminous intensity (on-axis) $I_F = 10$ mA	**CQX...-I**	I_v	>	0,7	mcd
	CQX...-II	I_v		1,0 to 2,2	mcd
	CQX...-III	I_v		1,6 to 3,5	mcd
	CQX...-IV	I_v	>	3,0	mcd
Wavelength at peak emission	**CQX10**	λ_{pk}	typ.	630	nm
	CQX11	λ_{pk}	typ.	560	nm
	CQX12	λ_{pk}	typ.	590	nm
Beamwidth between half-intensity directions in the plane of the connections		$\alpha_{50\%}$	typ.	50^o	
in the plane perpendicular to the connections		$\alpha_{50\%}$	typ.	40^o	

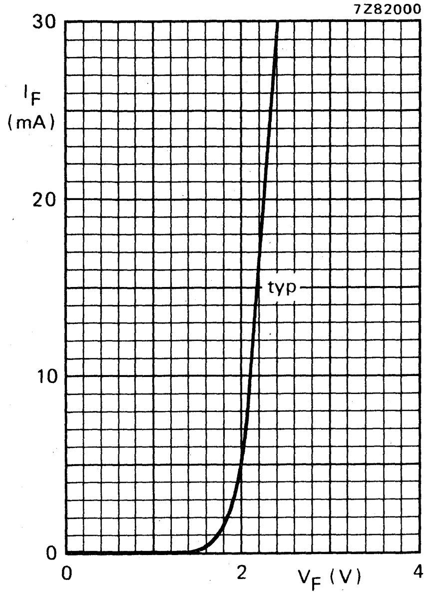


Fig. 2 T_j = 25 °C.

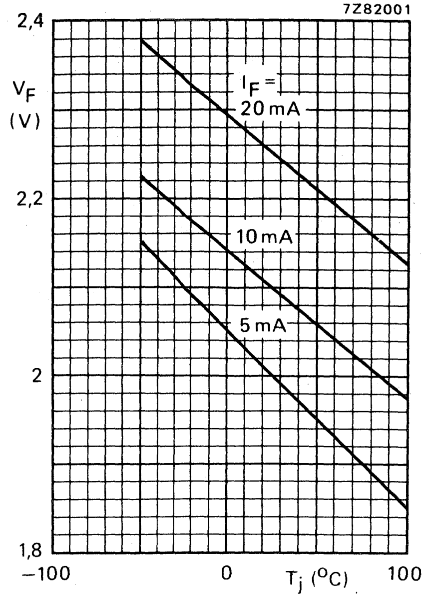


Fig. 3 Typical values.

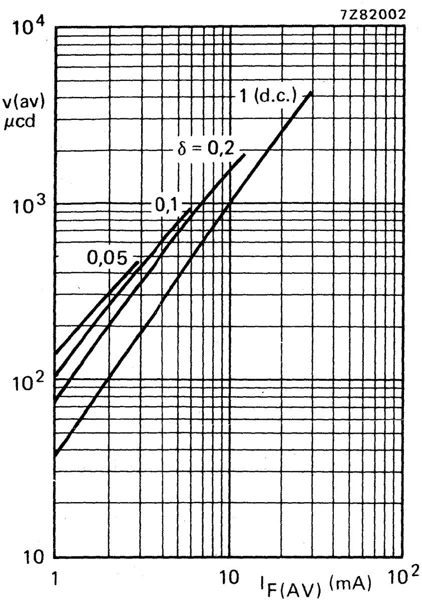


Fig. 4 **CQX10**; typical values; T_j = 25 °C.

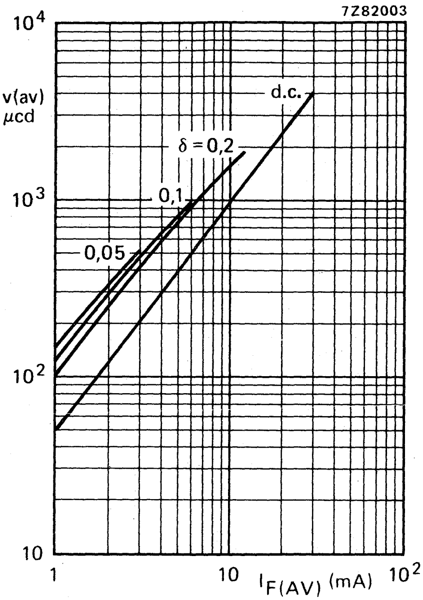


Fig. 5 **CQX11; CQX12**; typical values; T_j = 25 °C.

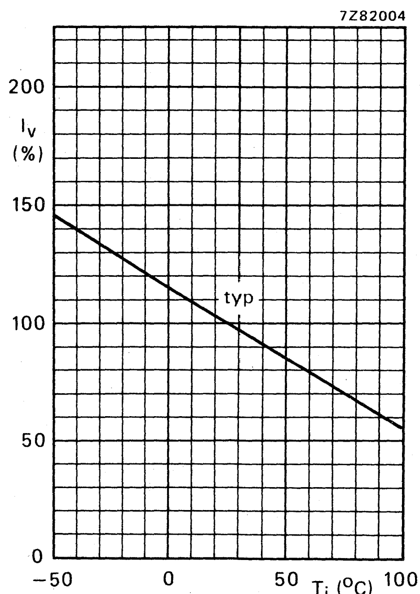


Fig. 6 I_F = 10 mA.

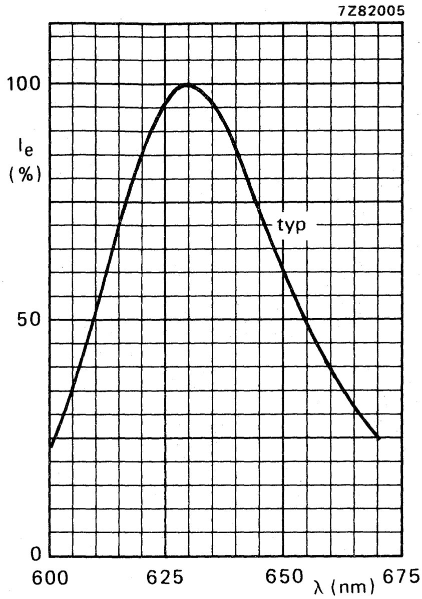


Fig. 7 **CQX10.**

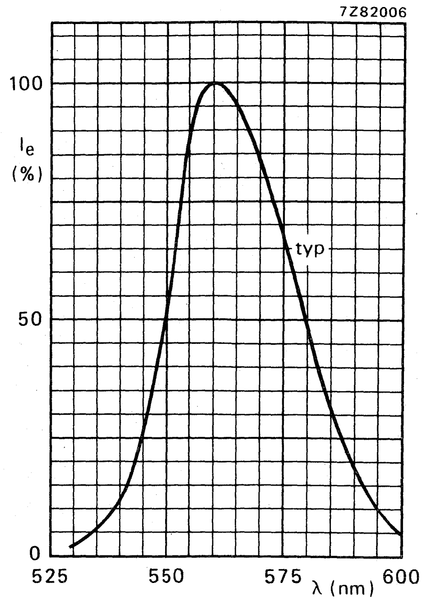


Fig. 8 **CQX11.**

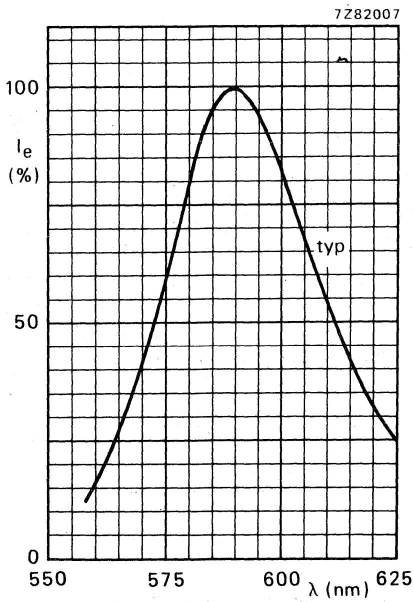


Fig. 9 **CQX12.**

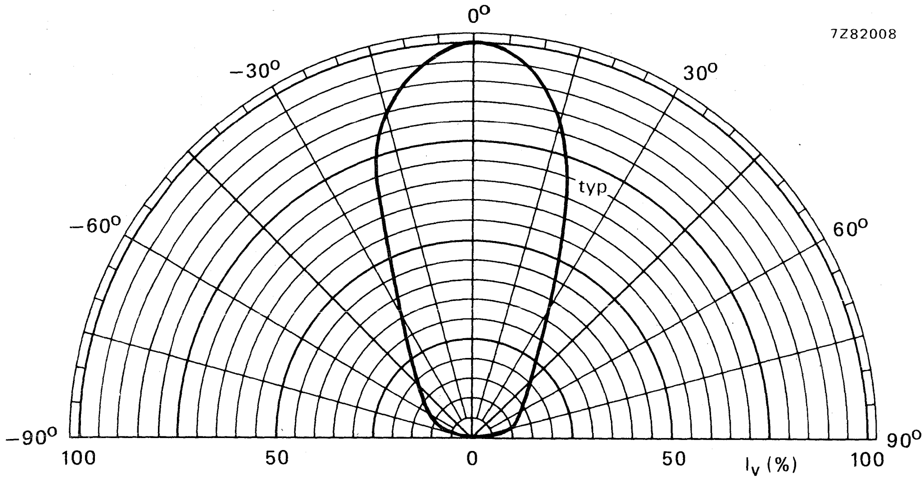


Fig. 10 Spacial distribution in the plane of the connections.

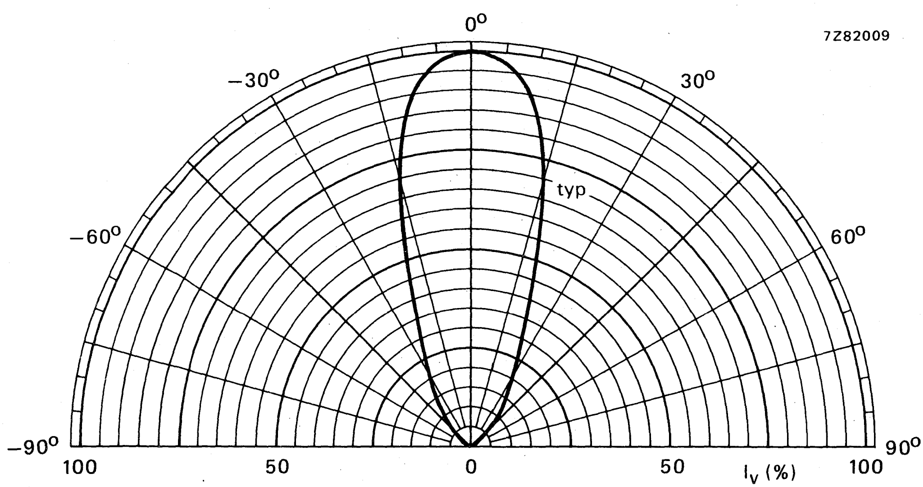


Fig. 11 Spacial distribution in the plane perpendicular to the connections.

HIGH-EFFICIENCY GaAsP RED LIGHT EMITTING DIODE

Gallium arsenide phosphide light emitting diode which emits visible super-red light. Red, light-diffusing plastic envelope.

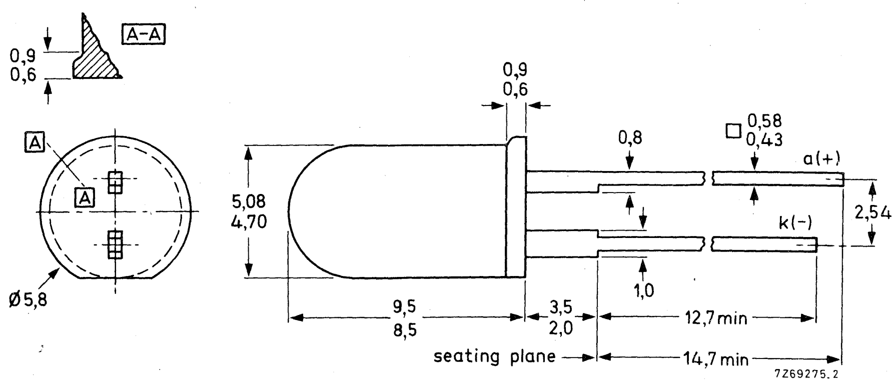
QUICK REFERENCE DATA

Continuous reverse voltage		V_R	max.	3	V
Forward current (d.c.)		I_F	max.	20	mA
Total power dissipation up to T_{amb} = 55 °C		P_{tot}	max.	60	mW
Luminous intensity (on-axis) at I_F = 10 mA	**CQX51-I**	I_V	1,6 to	4,2	mcd
	CQX51-II	I_V	3 to	7	mcd
	CQX51-III	I_V	5 to	11	mcd
Wavelength at peak emission		λ_{pk}	typ.	630	nm
Beamwidth between half-intensity directions		$\alpha_{50\%}$	typ.	55°	

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOD-63.



Accessories for panel mounting (panel thickness < 4 mm)

Plastic clip and ring
  black type RTC757
  colourless type RTC758

Hole diameter
  6,4 mm for panel thickness < 3 mm
  6,5 mm for panel thickness > 3 mm

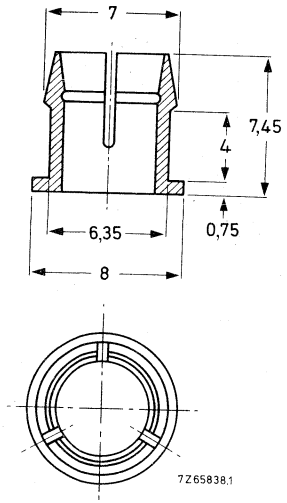


Fig. 2.

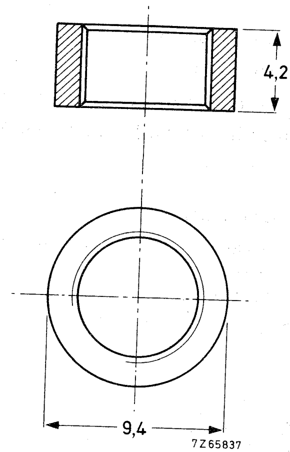


Fig. 3.

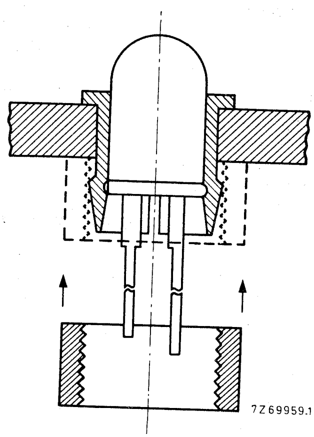


Fig. 4.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Continuous reverse voltage	V_R	max.	3 V
Forward current (d.c.)	I_F	max.	20 mA
Forward current (peak value)			
t_p = 1 ms; δ = 0,33	I_{FM}	max.	60 mA
t_p = 1 μs ; f = 300 Hz	I_{FM}	max.	1000 mA
Total power dissipation up to T_{amb} = 55 °C	P_{tot}	max.	60 mW
Storage temperature	T_{stg}		−55 to + 100 °C
Junction temperature	T_j	max.	100 °C
Lead soldering temperature > 1,5 mm from the seating plane; t_{sld} < 7 s	T_{sld}	max.	230 °C

THERMAL RESISTANCE

From junction to ambient in free air	$R_{th\ j\text{-}a}$	=	750 °C/W
mounted on a printed-circuit board	$R_{th\ j\text{-}a}$	=	500 °C/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Forward voltage I_F = 10 mA		V_F	typ.	2,1 V
			<	3 V
Reverse current V_R = 3 V		I_R	<	100 μA
Diode capacitance V_R = 0; f = 1 MHz		C_d	typ.	35 pF
Luminous intensity (on-axis) I_F = 10 mA	**CQX51-I**	I_v		1,6 to 4,2 mcd
	CQX51-II	I_v		3 to 7 mcd
	CQX51-III	I_v		5 to 11 mcd
Wavelength at peak emission		λ_{pk}	typ.	630 nm
Beamwidth between half-intensity directions		$\alpha_{50\%}$	typ.	55°

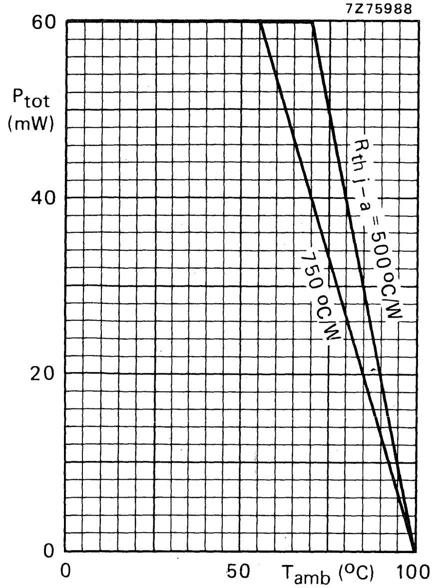


Fig. 5 Maximum permissible power dissipation as a function of ambient temperature.

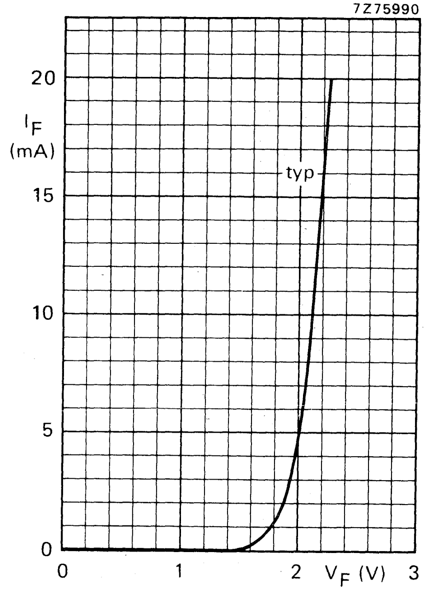


Fig. 6 T_j = 25 °C.

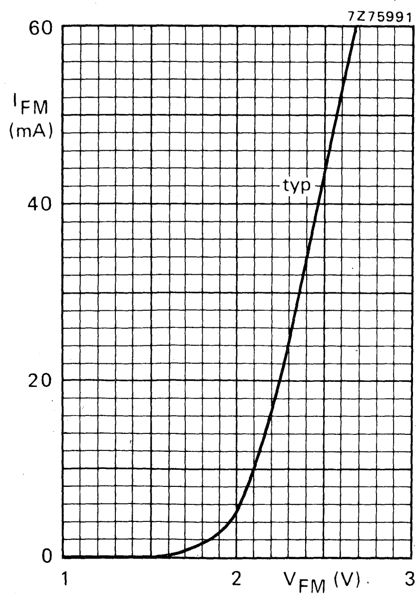


Fig. 7 t_p = 50 μs; T = 5 ms; T_j = 25 °C.

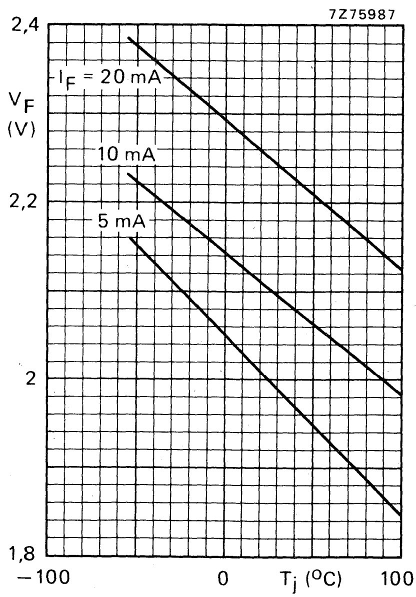


Fig. 8 Typical values.

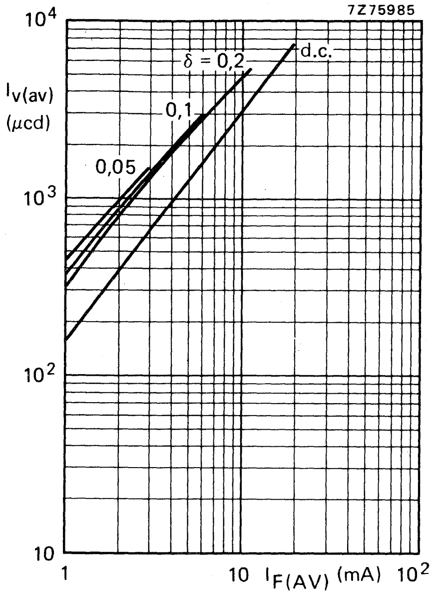


Fig. 9 Typical values; T_j = 25 °C.

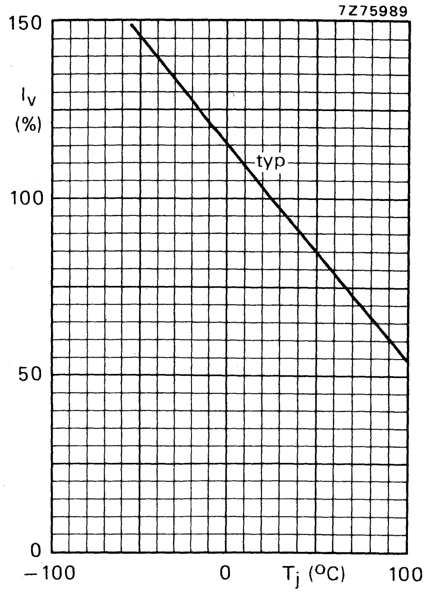


Fig. 10 I_F = 10 mA.

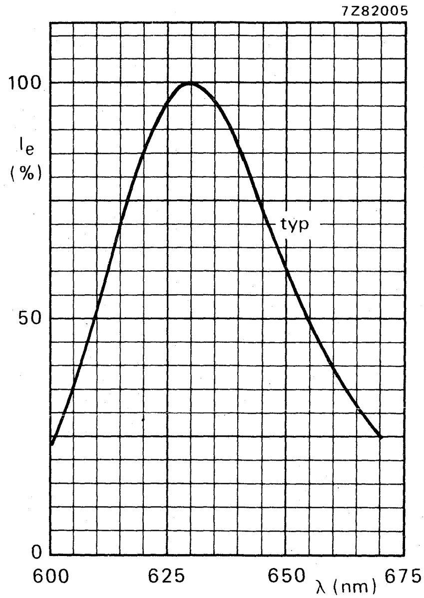

7Z82005
100
I_e
(%)
typ
50
0
600
625
650
λ (nm)
675

Fig. 11.

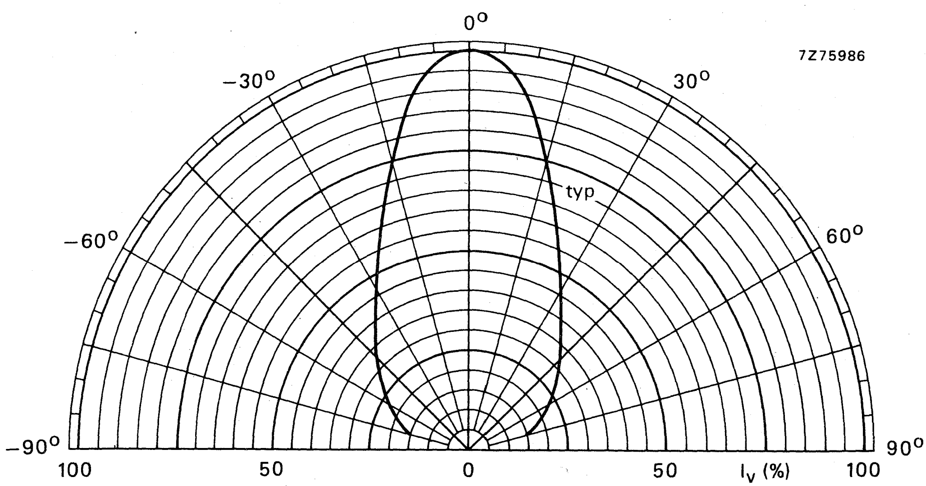

0°
7Z75986
−30°
30°
typ
−60°
60°
−90°
90°
100
50
0
50
I_v (%)
100

Fig. 12.

HIGH-EFFICIENCY GaAsP RED LIGHT EMITTING DIODE

Gallium arsenide phosphide light emitting diode which emits visible super-red light when forward biased. Plastic envelope with colourless epoxy lens.

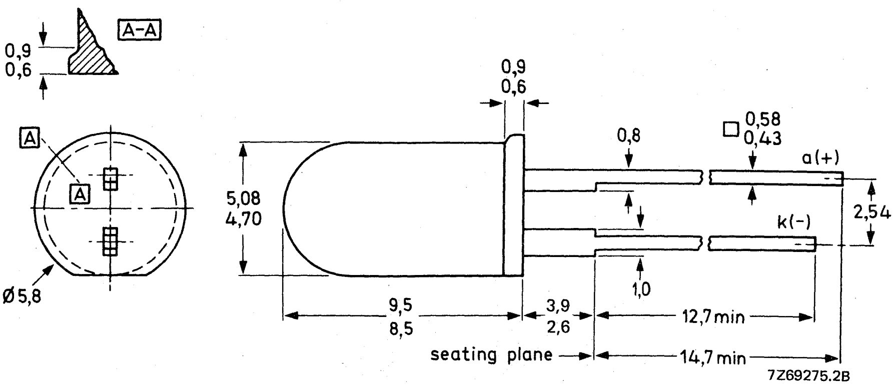
QUICK REFERENCE DATA

Continuous reverse voltage	V_R	max.	5	V
Forward current (d.c.)	I_F	max.	20	mA
Total power dissipation up to T_{amb} = 55 °C	P_{tot}	max.	60	mW
Luminous intensity (on-axis) at I_F = 10 mA	I_v	>	15	mcd
Wavelength at peak emission	λ_{pk}	typ.	630	nm
Beamwidth between half-intensity directions	$\alpha_{50\%}$	typ.	20°	

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOD-63 (except distance between base and seating plane).



Accessories for panel mounting (panel thickness < 4 mm)

Plastic clip and ring
  black type RTC757
  colourless type RTC758

Hole diameter
  6,4 mm for panel thickness < 3 mm
  6,5 mm for panel thickness > 3 mm

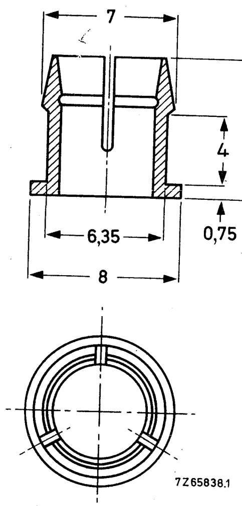


Fig. 2.

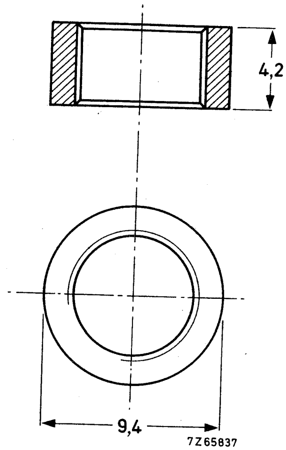


Fig. 3.

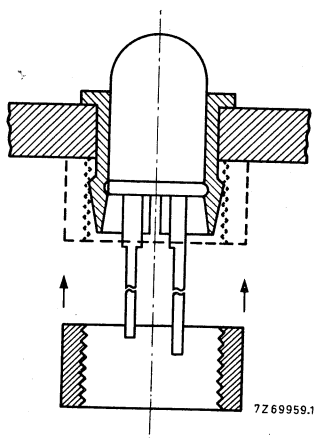


Fig. 4.

DEVELOPMENT SAMPLE DATA

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Continuous reverse voltage	V_R	max.	5 V
Forward current (d.c.)	I_F	max.	20 mA
Forward current (peak value)			
t_p = 1 ms; δ = 0,33	I_{FM}	max.	60 mA
t_p = 1 μs ; f = 300 Hz	I_{FM}	max.	1000 mA
Total power dissipation up to T_{amb} = 55 °C	P_{tot}	max.	60 mW
Storage temperature	T_{stg}		−55 to + 100 °C
Junction temperature	T_j	max.	100 °C
Lead soldering temperature > 1,5 mm from the seating plane; t_{sld} < 7 s	T_{sld}	max.	230 °C

THERMAL RESISTANCE

From junction to ambient in free air	$R_{th\ j\text{-}a}$	=	750 °C/W
mounted on a printed-circuit board	$R_{th\ j\text{-}a}$	=	500 °C/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Forward voltage I_F = 10 mA	V_F	typ.	2,1 V
		<	3 V
Reverse current V_R = 5 V	I_R	<	100 μA
Diode capacitance V_R = 0; f = 1 MHz	C_d	typ.	35 pF
Luminous intensity (on-axis) I_F = 10 mA	I_v	>	15 mcd
		typ.	20 mcd
Wavelength at peak emission	λ_{pk}	typ.	630 nm
Beamwidth between half-intensity directions	$\alpha_{50\%}$	typ.	20°

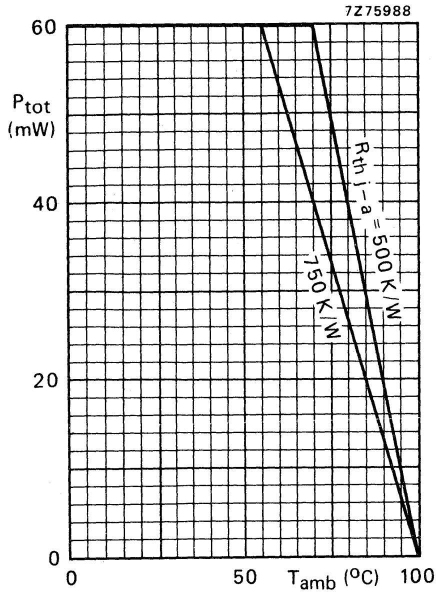


Fig. 5 Maximum permissible power dissipation as a function of ambient temperature.

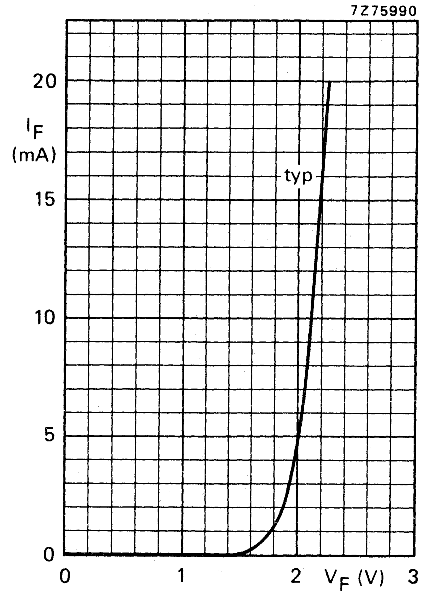


Fig. 6 T_j = 25 °C.

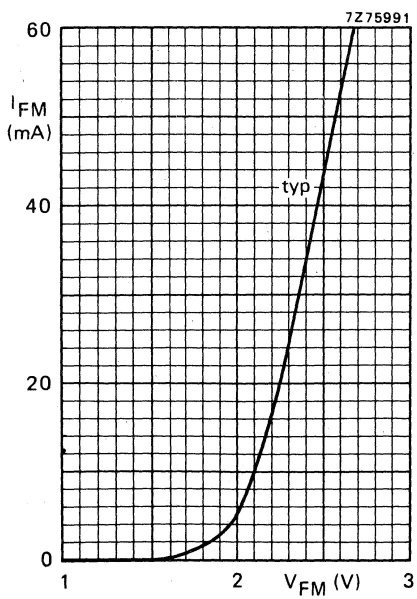


Fig. 7 t_p = 50 μs; T = 5 ms; T_j = 25 °C.

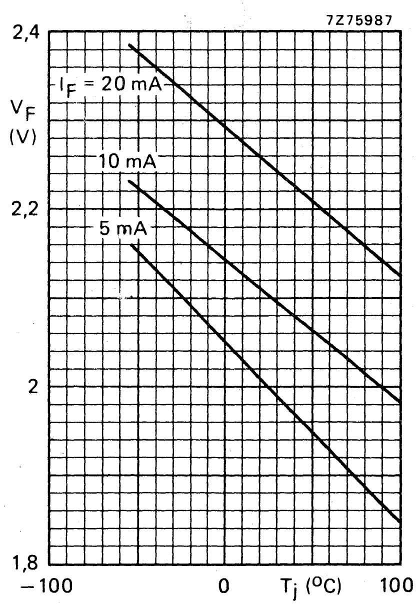


Fig. 8 Typical values.

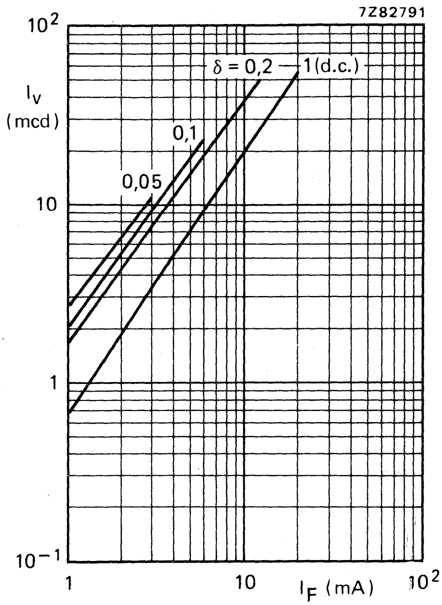


Fig. 9 Typical values; T_j = 25 °C.

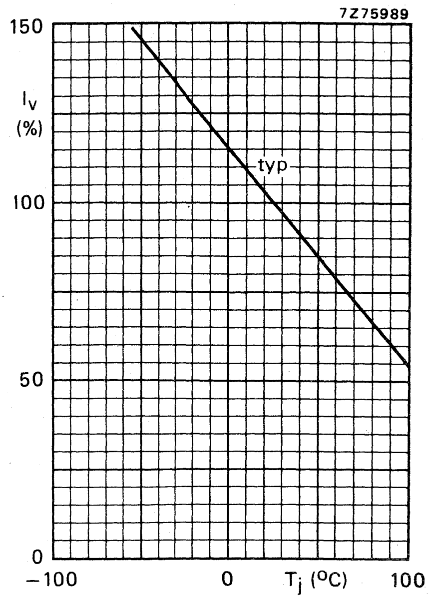


Fig. 10 I_F = 10 mA.

DEVELOPMENT SAMPLE DATA

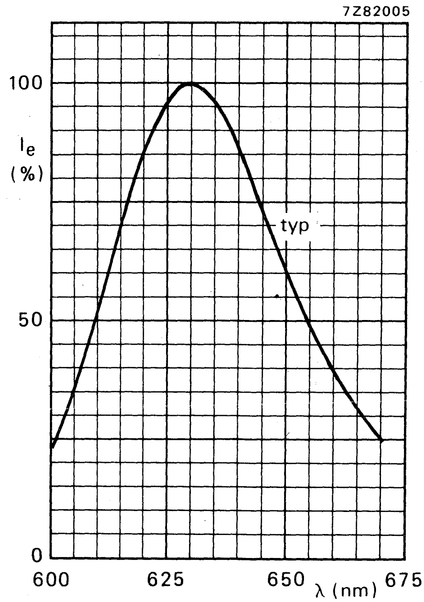

7Z82005
100
50
0
I_e
(%)
typ
600
625
650
675
λ (nm)

Fig. 11.

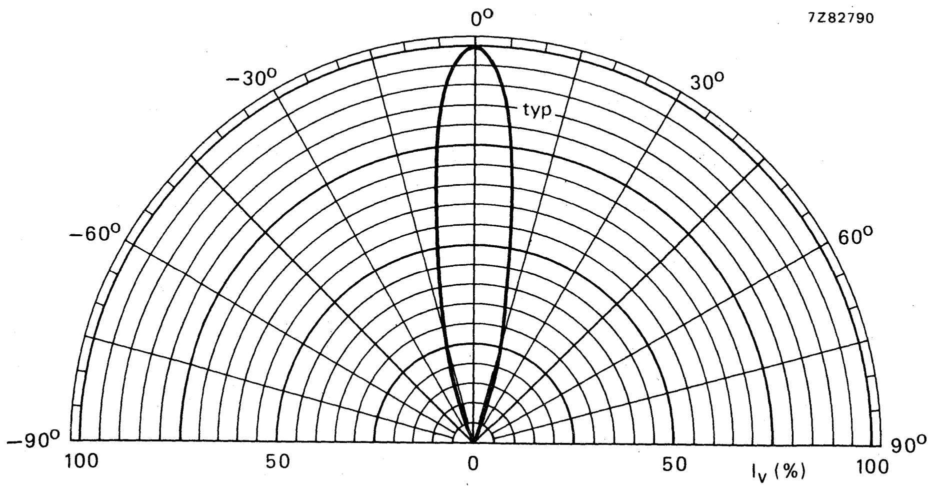

7Z82790
0°
−30°
30°
−60°
60°
−90°
90°
typ
100
50
0
50
100
I_v (%)

Fig. 12.

LIGHT EMITTING DIODES

Light emitting diodes which emit super-red light (for the CQX55 to 58), green light (for the CQX65 to 68) and yellow light (for the CQX75 to 78) when forward biased.

QUICK REFERENCE DATA

Continuous reverse voltage		V_R	max.	5	V
Forward current (d.c.)		I_F	max.	30	mA
Total power dissipation up to T_{amb} = 25 °C		P_{tot}	max.	120	mW
Luminous intensity (on-axis) I_F = 10 mA		I_v	>	0,5	mcd
			typ.	1,0	mcd
Wavelength at peak emission I_F = 10 mA	**CQX55 to 58**	λ_{pk}	typ.	630	nm
	CQX65 to 68	λ_{pk}	typ.	560	nm
	CQX75 to 78	λ_{pk}	typ.	590	nm

MECHANICAL DATA

Dimensions in mm

Fig. 1a SOD-63C applicable to **CQX55/65/75.**

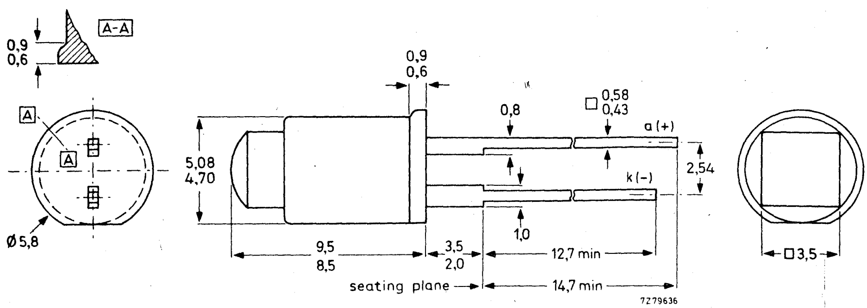


Fig. 1b SOD-63T applicable to **CQX56/66/76.**

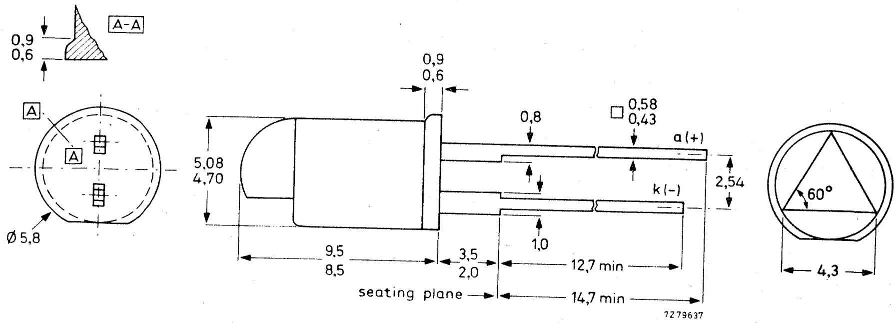


Fig. 1c SOD-63P applicable to **CQX57/67/77.**

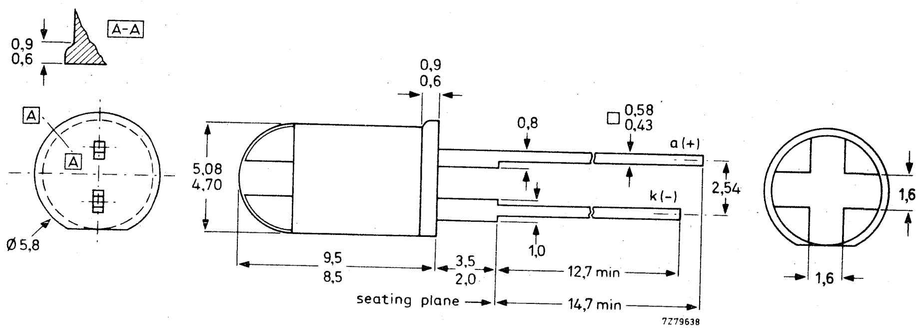
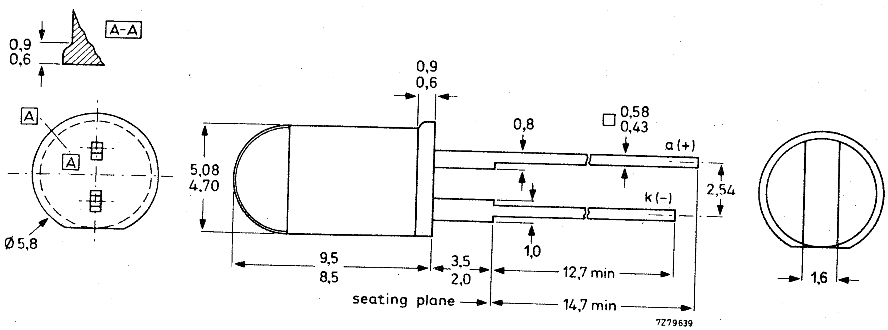


Fig. 1d SOD-63M applicable to **CQX58/68/78.**



RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Continuous reverse voltage	V_R	max.	5	V
Forward current (d.c.)	I_F	max.	30	mA
Non-repetitive peak forward current (t_p = 10 μs)	I_{FSM}	max.	1000	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	120	mW
Storage temperature	T_{stg}	−55 to + 100		°C
Junction temperature	T_j	max.	100	°C
Lead soldering temperature up to the seating plane; t_{sld} < 10 s	T_{sld}	max.	260	°C

THERMAL RESISTANCE

From junction to ambient in free air	$R_{th\ j\text{-}a}$	=	625	°C/W

CHARACTERISTICS

T_j = 25 °C

Forward voltage I_F = 10 mA		V_F	typ.	2,1	V
			<	3,0	V
Reverse current V_R = 5 V		I_R	<	100	μA
Diode capacitance V_R = 0; f = 1 MHz		C_d	typ.	35	pF
Luminous intensity (on-axis) I_F = 10 mA		I_v	>	0,5	mcd
			typ.	1,0	mcd
Wavelength at peak emission I_F = 10 mA	**CQX55 to 58**	λ_{pk}	typ.	630	nm
	CQX65 to 68	λ_{pk}	typ.	560	nm
	CQX75 to 78	λ_{pk}	typ.	590	nm

DEVELOPMENT SAMPLE DATA

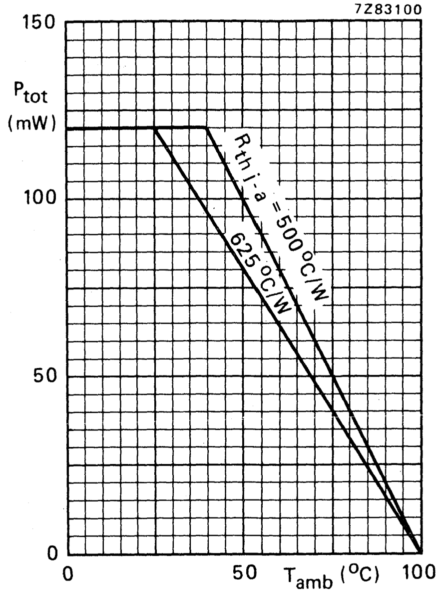


Fig. 2 Power/temperature derating curves.

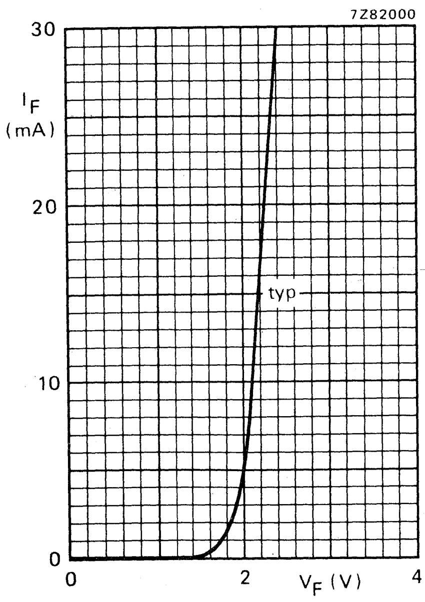


Fig. 3 T_j = 25 °C.

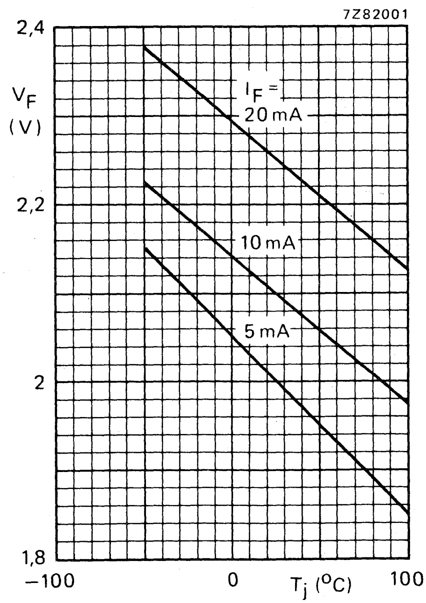


Fig. 4 Typical values.

DEVELOPMENT SAMPLE DATA

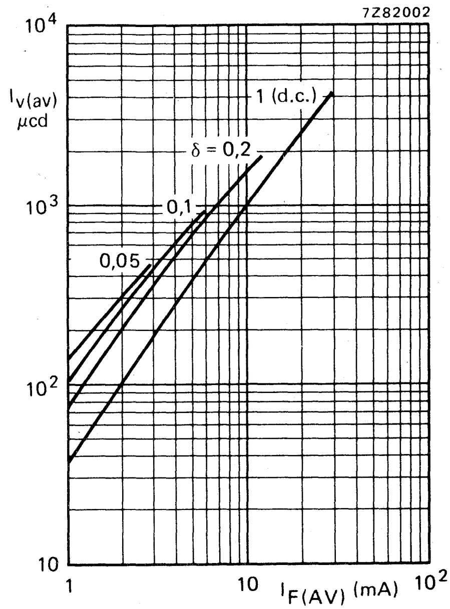


Fig. 5 **CQX55 to 58**; typ. values; T_j = 25 °C.

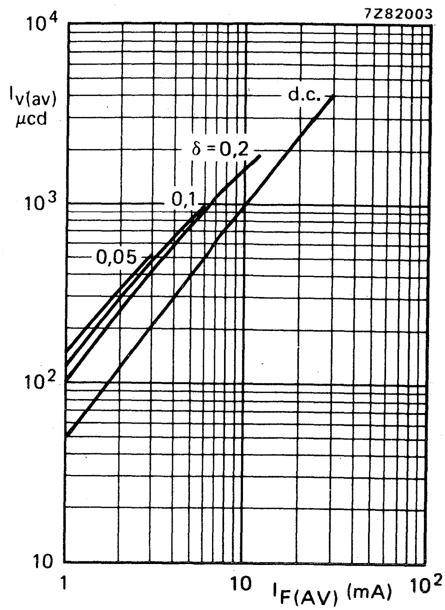


Fig. 6 **CQX65 to 68**; **CQX75 to 78**; typical values; T_j = 25 °C.

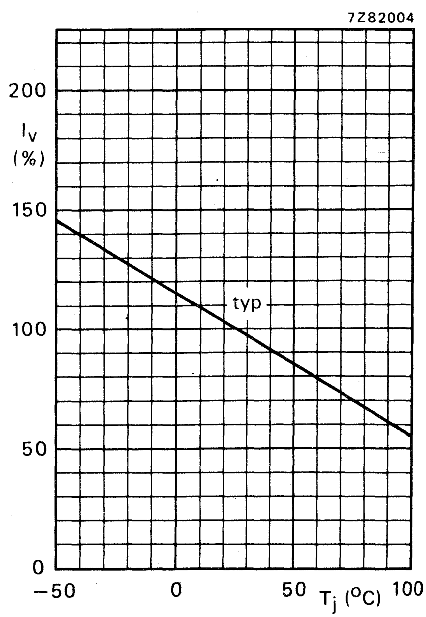


Fig. 7 I_F = 10 mA.

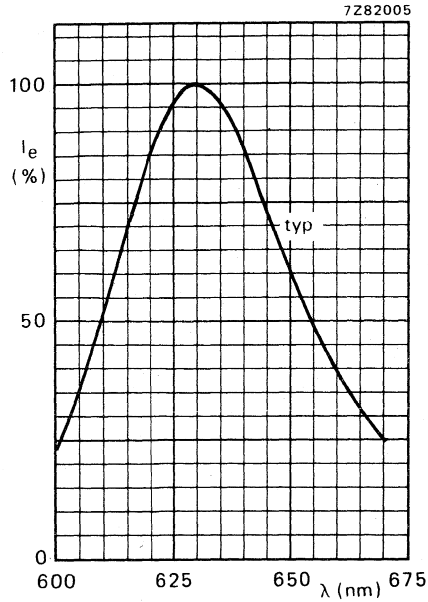


Fig. 8 **CQX55 to 58.**

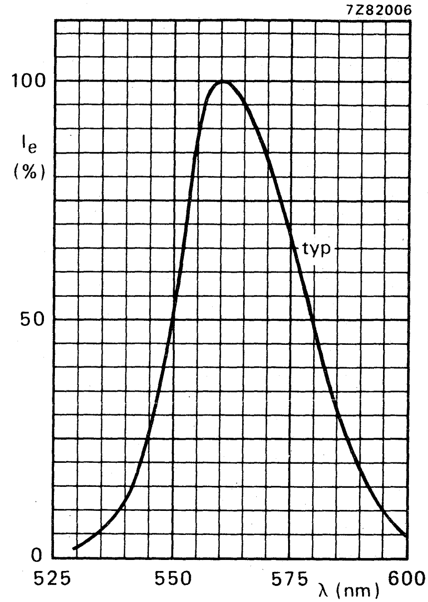


Fig. 9 **CQX65 to 68.**

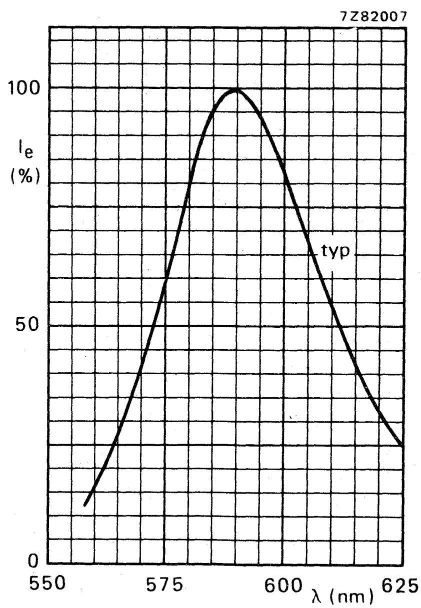


Fig. 10 **CQX75 to 78.**

GaALAs LEDs FOR FIBRE-OPTIC COMMUNICATIONS

A small light guide (core diameter of 200 μm) achieves the optical coupling with the emitting junction. They are designed to be active component of either a BNC, TNC or a RIM-SMA optical emitter.

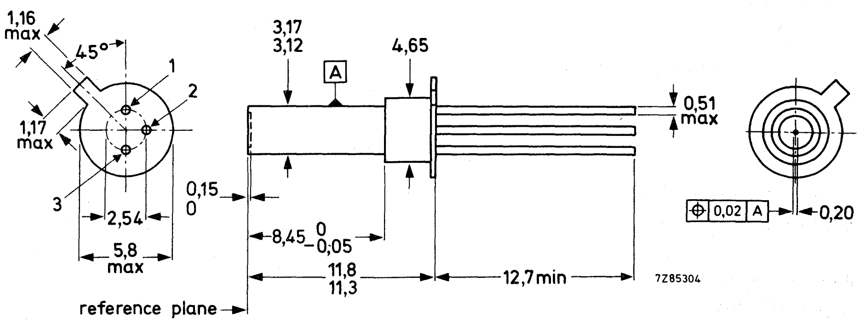
QUICK REFERENCE DATA

Continuous reverse voltage		V_R	max.	5	V
Forward current (d.c.)		I_F	max.	100	mA
Total power dissipation up to T_{amb} = 25 °C		P_{tot}	max.	220	mW
Radiant intensity (on-axis)					
I_F = 50 mA	CQX60	I_e	>	250	μW/sr
	CQX61	I_e	>	125	μW/sr
Wavelength at peak emission		λ_{pk}	typ.	830	nm

MECHANICAL DATA

Dimensions in mm

Fig. 1.



Connections

1. anode
2. anode
3. cathode

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Continuous reverse voltage	V_R	max.	5 V
Forward current			
d.c.	I_F	max.	100 mA
(peak value); t_p = 10 μs; δ = 0,1	I_{FM}	max.	300 mA
Total power dissipation up to T_{amb} = 25 °C, device mounted on printed-circuit board	P_{tot}	max.	220 mW
Storage temperature	T_{stg}		−40 to + 100 °C
Junction temperature	T_j	max.	100 °C
Lead soldering temperature → $>$ 1,5 mm from the seating plane; t_{sld} $<$ 10 s	T_{sld}	max.	260 °C

THERMAL RESISTANCE

From junction to ambient in free air device mounted on printed-circuit board	$R_{th\ j\text{-}a}$	=	340 °C/W

CHARACTERISTICS

T_j = 25 °C

Forward voltage I_F = 50 mA		V_F	typ.	1,7 V
			$<$	2,0 V
Reverse current V_R = 5 V		I_R	$<$	100 μA
Radiant intensity (on-axis) I_F = 50 mA	**CQX60**	I_e	$>$	250 μW/sr
			typ.	350 μW/sr
	CQX61	I_e	$>$	125 μW/sr
			typ.	200 μW/sr
Wavelength at peak emission		λ_{pk}	typ.	830 nm
Bandwidth at half height	**CQX60**	$B_{50\%}$	typ.	30 nm
	CQX61	$B_{50\%}$	typ.	50 nm
Light switching times I_{Fon} = 100 mA				
Rise time and fall time	**CQX60**	t_r, t_f	typ.	30 ns
			$<$	40 ns
Rise time and fall time	**CQX61**	t_r, t_f	typ.	10 ns
			$<$	15 ns

Optical data

Numerical aperture	NA	typ.	0,57
Core diameter of light guide	ϕ_{core}	typ.	200 μm

Calculation of the optical power coupled into a fibre

The optical power coupled into the link fibre is calculated from the radiant intensity on the axis of the output light guide:

$$P = \pi I_e (NA)^2$$
$$(\mu W) \quad (\mu W/sr)$$

I_e : radiant intensity on-axis
NA: Numerical aperture of the link fibre

The assumptions to make this calculation valid are:

1. The numerical aperture of the link fibre is not larger than the numerical aperture of the output light guide of the component.
2. The core diameter of the link fibre is not smaller than the output light guide.

GaALAs LEDs FOR FIBRE-OPTIC COMMUNICATIONS

The emitting junction is coupled to a step index optical fibre. (core diameter of 200 μm).

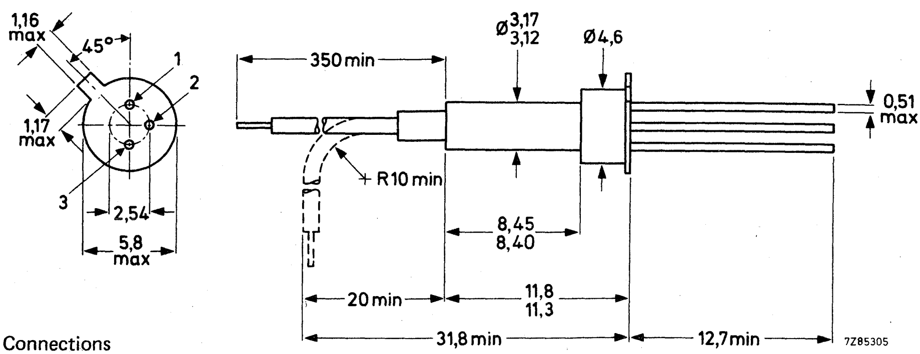
QUICK REFERENCE DATA

Continuous reverse voltage		V_R	max.	5	V
Forward current (d.c.)		I_F	max.	100	mA
Total power dissipation up to T_{amb} = 25 °C		P_{tot}	max.	220	mW
Radiant intensity (on-axis)					
I_F = 50 mA	CQX62	I_e	>	250	μW/sr
	CQX63	I_e	>	125	μW/sr
Wavelength at peak emission		λ_{pk}	typ.	830	nm

MECHANICAL DATA

Dimensions in mm

Fig. 1.



Connections
1. anode
2. anode
3. cathode

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Continuous reverse voltage	V_R	max.	5 V
Forward current			
d.c.	I_F	max.	100 mA
(peak value); t_p = 10 μs; δ = 0,1	I_{FM}	max.	300 mA
Total power dissipation up to T_{amb} = 25 °C device mounted on printed-circuit board	P_{tot}	max.	220 mW
Storage temperature	T_{stg}		−40 to + 100 °C
Junction temperature	T_j	max.	100 °C
Lead soldering temperature → > 1,5 mm from the seating plane; t_{sld} < 10 s	T_{sld}	max.	260 °C

THERMAL RESISTANCE

From junction to ambient in free air device mounted on printed-circuit board	$R_{th\ j\text{-}a}$	=	340 °C/W

→ CHARACTERISTICS

T_j = 25 °C

Forward voltage I_F = 50 mA		V_F	typ.	1,8 V
			<	2,0 V
Reverse current V_R = 5 V		I_R	<	100 μA
Radiant intensity (on-axis) I_F = 50 mA	**CQX62**	I_e	>	250 μW/sr
			typ.	350 μW/sr
	CQX63	I_e	>	125 μW/sr
			typ.	200 μW/sr
Wavelength at peak emission		λ_{pk}	typ.	830 nm
Bandwidth at half height	**CQX62**	$B_{50\%}$	typ.	30 nm
	CQX63	$B_{50\%}$	typ.	50 nm
Light switching times I_{Fon} = 100 mA Rise time and fall time	**CQX62**	t_r, t_f	typ.	30 ns
			<	40 ns
Rise time and fall time	**CQX63**	t_r, t_f	typ.	10 ns
			<	15 ns

Optical data

Numerical aperture	NA	typ.	0,17
Core diameter	ϕ_{core}	typ.	200 μm

Calculation of the optical power coupled into a fibre

The optical power coupled into the link fibre is calculated from the radiant intensity on the axis of the output light guide:

$$P = \pi I_e (NA)^2$$
$$(\mu W) \quad (\mu W/sr)$$

I_e : radiant intensity on-axis
NA: Numerical aperture of the link fibre

The assumptions to make this calculation valid are:

1. The numerical aperture of the link fibre is not larger than the numerical aperture of the output light guide of the component.
2. The core diameter of the link fibre is not smaller than the output light guide.

HIGH-EFFICIENCY GaP GREEN LIGHT EMITTING DIODE

Gallium phosphide light emitting diode which emits green light when forward biased. Plastic envelope with colourless epoxy lens.

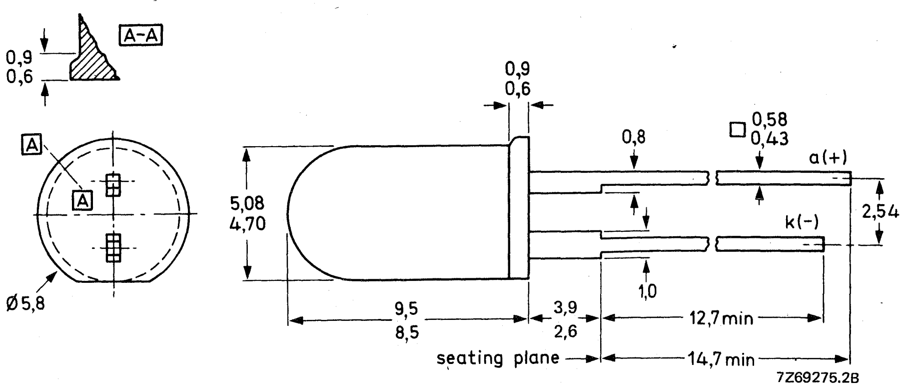
QUICK REFERENCE DATA

Continuous reverse voltage	V_R	max.	5 V
Forward current (d.c.)	I_F	max.	20 mA
Total power dissipation up to T_{amb} = 55 °C	P_{tot}	max.	60 mW
Luminous intensity (on-axis) at I_F = 10 mA	I_V	>	15 mcd
Wavelength at peak emission	λ_{pk}	typ.	560 nm
Beamwidth between half-intensity directions	$\alpha_{50\%}$	typ.	20°

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOD-63 (except distance between base and seating plane).



Accessories for panel mounting (panel thickness < 4 mm)

Plastic clip and ring
black type RTC757
colourless type RTC758

Hole diameter
6,4 mm for panel thickness < 3 mm
6,5 mm for panel thickness > 3 mm

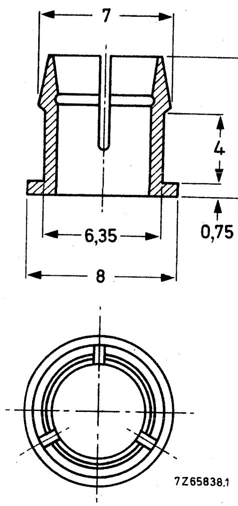


Fig. 2

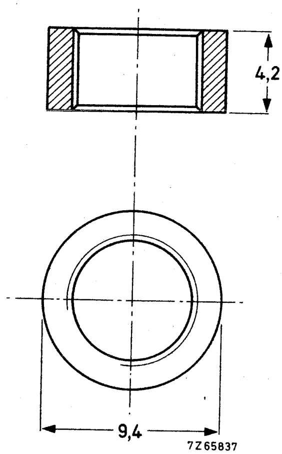


Fig. 3.

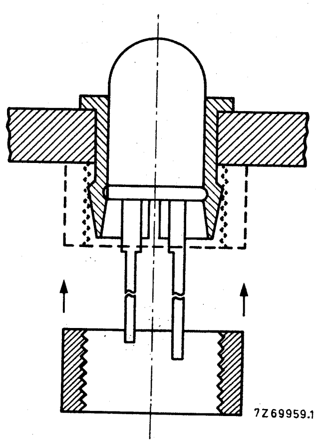


Fig. 4.

DEVELOPMENT SAMPLE DATA

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Continuous reverse voltage	V_R	max.	5 V
Forward current (d.c.)	I_F	max.	20 mA
Forward current (peak value)			
t_p = 1 ms; δ = 0,33	I_{FM}	max.	60 mA
t_p = 1 μs ; f = 300 Hz	I_{FM}	max.	1000 mA
Total power dissipation up to T_{amb} = 55 °C	P_{tot}	max.	60 mW
Storage temperature	T_{stg}	−55 to	+100 °C
Junction temperature	T_j	max.	100 °C
Lead soldering temperature			
> 1,5 mm from the seating plane; t_{sld} < 7 s	T_{sld}	max.	230 °C

THERMAL RESISTANCE

From junction to ambient			
in free air	$R_{th\ j\text{-}a}$	=	750 °C/W
mounted on a printed-circuit board	$R_{th\ j\text{-}a}$	=	500 °C/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Forward voltage			
I_F = 10 mA	V_F	typ.	2,1 V
		<	3 V
Reverse current			
V_R = 5 V	I_R	<	100 μA
Diode capacitance			
V_R = 0; f = 1 MHz	C_d	typ.	35 pF
Luminous intensity (on-axis)			
I_F = 10 mA	I_v	>	15 mcd
		typ.	20 mcd
Wavelength at peak emission	λ_{pk}	typ.	560 nm
Beamwidth between half-intensity directions	$\alpha_{50\%}$	typ.	20°

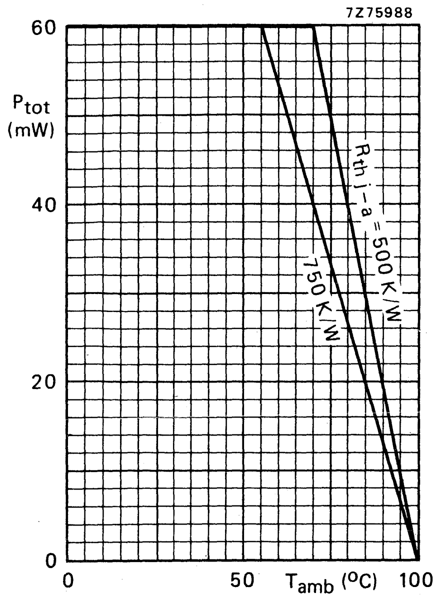


Fig. 5 Maximum permissible power dissipation as a function of ambient temperature.

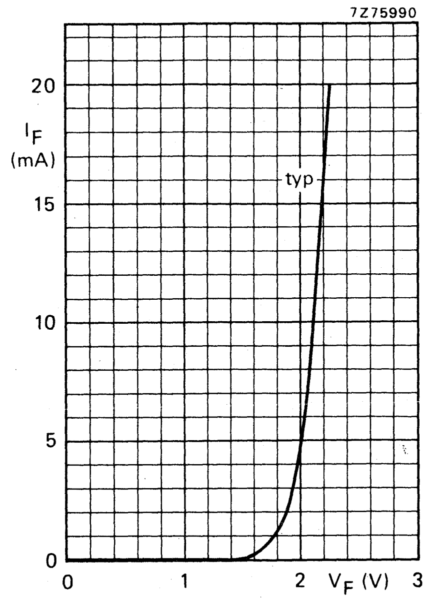


Fig. 6 $T_j = 25\ ^oC$.

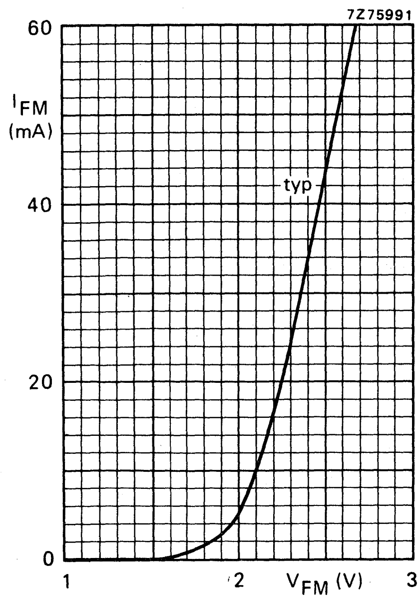


Fig. 7 $t_p = 50\ \mu s$; T = 5 ms; $T_j = 25\ ^oC$.

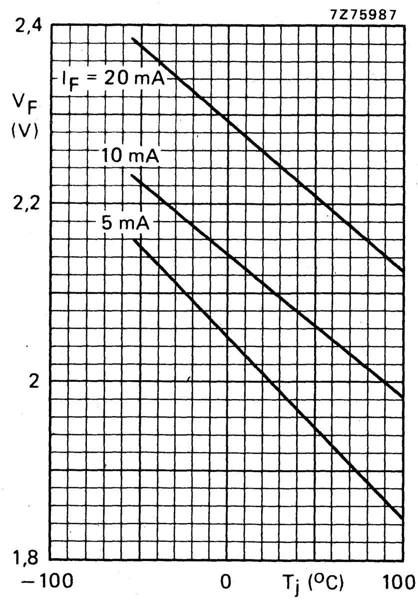


Fig. 8 Typical values.

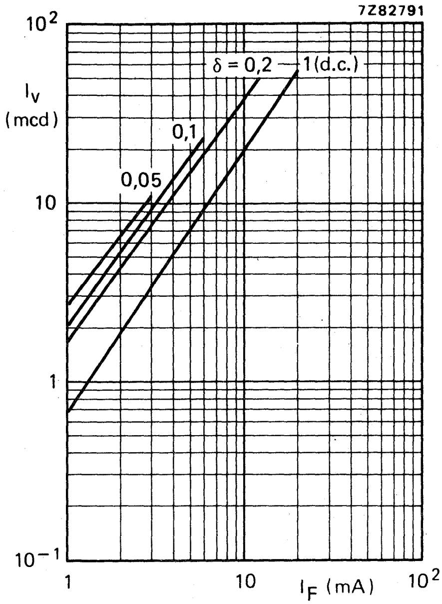


Fig. 9 Typical values; T_j = 25 °C.

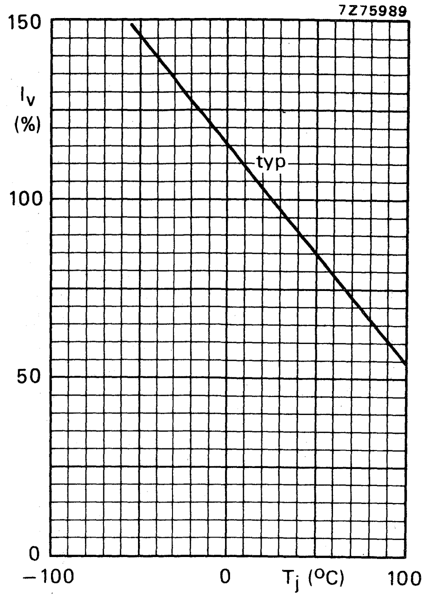


Fig. 10 I_F = 10 mA.

DEVELOPMENT SAMPLE DATA

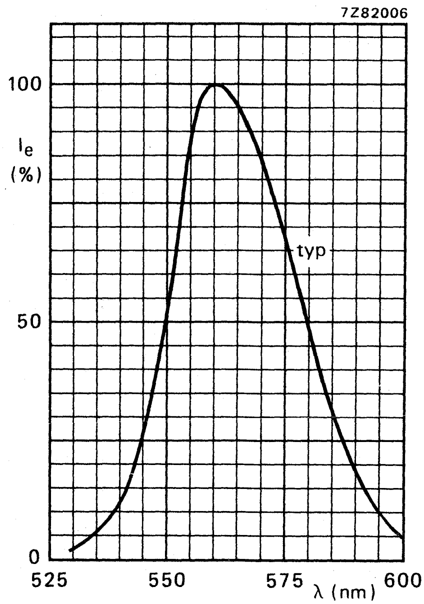

7Z82006
100
I_e
(%)
typ
50
0
525
550
575
λ (nm)
600

Fig. 11.

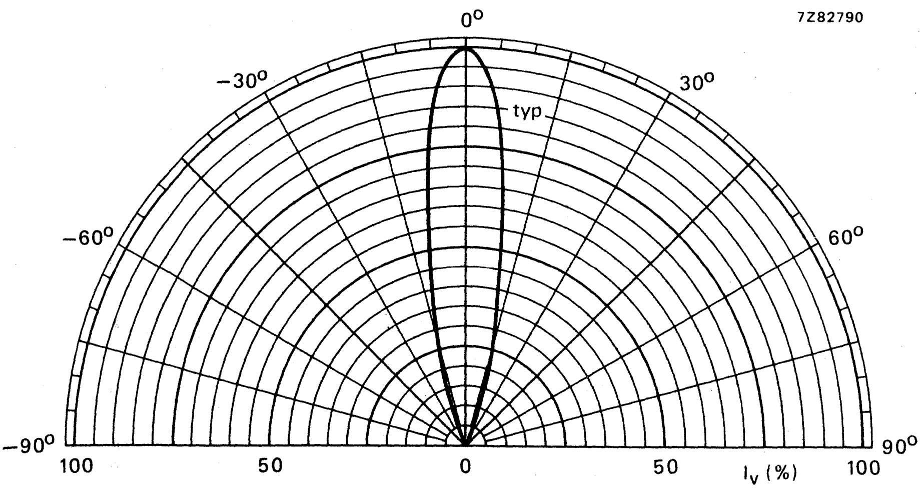

0°
7Z82790
−30°
30°
typ
−60°
60°
−90°
90°
100
50
0
50
I_v (%)
100

Fig. 12.

LIGHT EMITTING DIODES

For data of these diodes please refer to types CQX55 to 58.

HIGH-EFFICIENCY GaAsP YELLOW LIGHT EMITTING DIODE

Gallium arsenide phosphide light emitting diode which emits yellow light when forward biased. Plastic envelope with colourless epoxy lens.

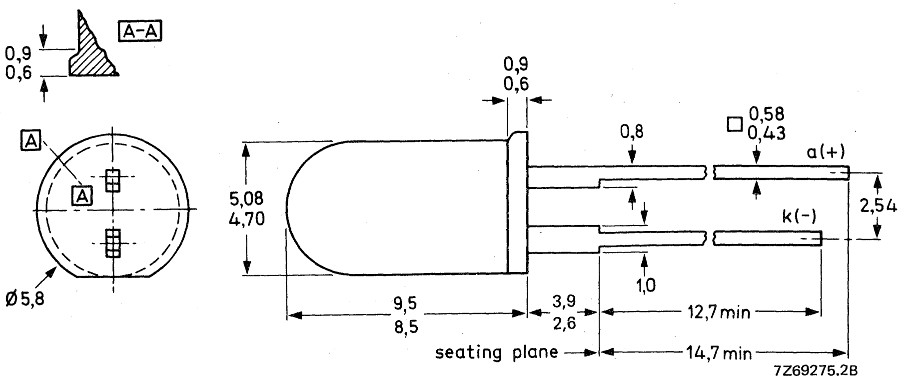
QUICK REFERENCE DATA

Continuous reverse voltage	V_R	max.	5	V
Forward current (d.c.)	I_F	max.	20	mA
Total power dissipation up to T_{amb} = 55 °C	P_{tot}	max.	60	mW
Luminous intensity (on-axis) at I_F = 10 mA	I_V	>	15	mcd
Wavelength at peak emission	λ_{pk}	typ.	590	nm
Beamwidth between half-intensity directions	$\alpha_{50\%}$	typ.	20°	

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOD-63 (except distance between base and seating plane).



Accessories for panel mounting (panel thickness < 4 mm)

Plastic clip and ring
black type RTC757
colourless type RTC758

Hole diameter
6,4 mm for panel thickness < 3 mm
6,5 mm for panel thickness > 3 mm

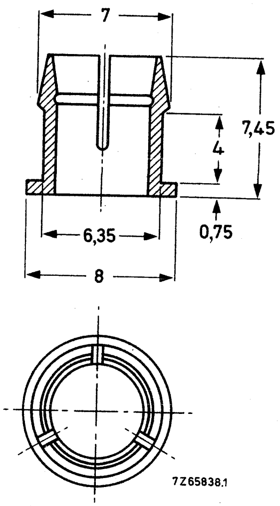


Fig. 2.

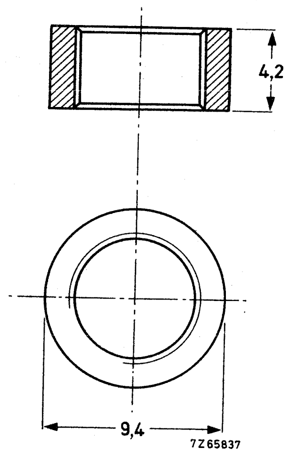


Fig. 3.

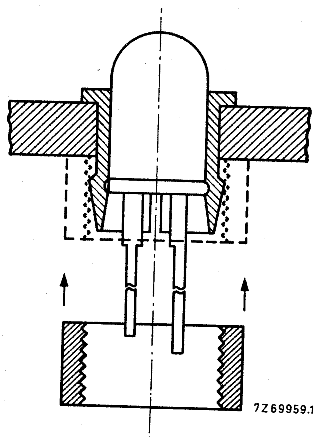


Fig. 4.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Continuous reverse voltage	V_R	max.	5 V
Forward current (d.c.)	I_F	max.	20 mA
Forward current (peak value)			
t_p = 1 ms; δ = 0,33	I_{FM}	max.	60 mA
t_p = 1 μs ; f = 300 Hz	I_{FM}	max.	1000 mA
Total power dissipation up to T_{amb} = 55 °C	P_{tot}	max.	60 mW
Storage temperature	T_{stg}	−55 to	+100 °C
Junction temperature	T_j	max.	100 °C
Lead soldering temperature			
$>$ 1,5 mm from the seating plane; $t_{sld} < 7$ s	T_{sld}	max.	230 °C

THERMAL RESISTANCE

From junction to ambient			
in free air	$R_{th\ j\text{-}a}$	=	750 °C/W
mounted on a printed-circuit board	$R_{th\ j\text{-}a}$	=	500 °C/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Forward voltage			
I_F = 10 mA	V_F	typ.	2,1 V
		<	3 V
Reverse current			
V_R = 5 V	I_R	<	100 μA
Diode capacitance			
V_R = 0; f = 1 MHz	C_d	typ.	35 pF
Luminous intensity (on-axis)			
I_F = 10 mA	I_v	>	15 mcd
		typ.	20 mcd
Wavelength at peak emission	λ_{pk}	typ.	590 nm
Beamwidth between half-intensity directions	$\alpha_{50\%}$	typ.	20°

DEVELOPMENT SAMPLE DATA

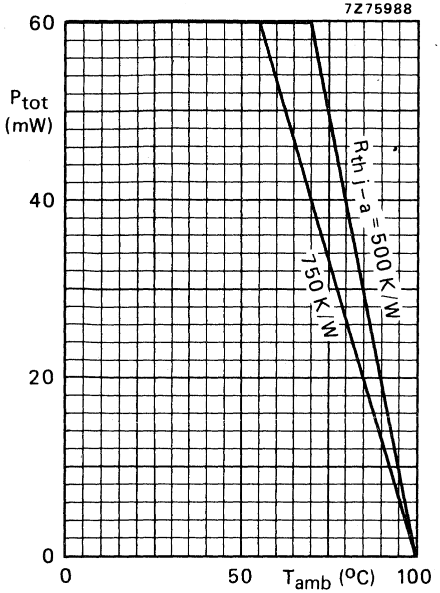


Fig. 5 Maximum permissible power dissipation as a function of ambient temperature.

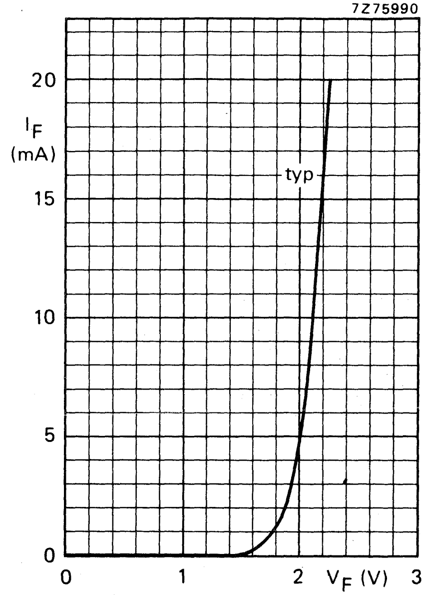


Fig. 6 T_j = 25 °C.

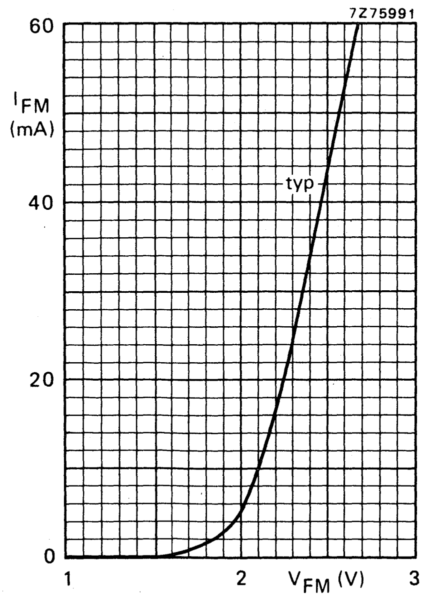


Fig. 7 t_p = 50 μs; T = 5 ms; T_j = 25 °C.

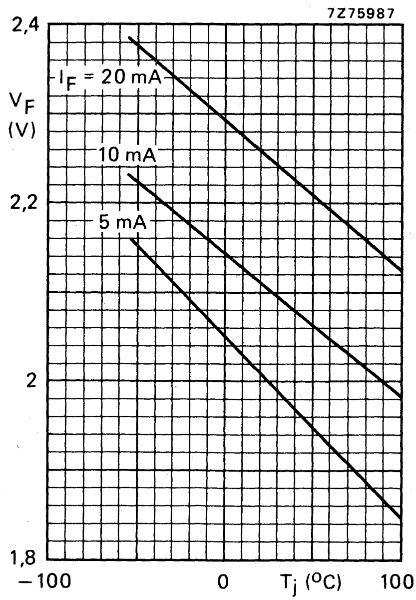


Fig. 8 Typical values.

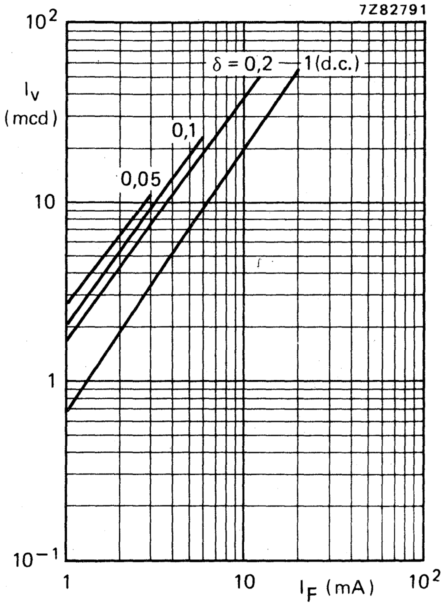


Fig. 9 Typical values; T_j = 25 °C.

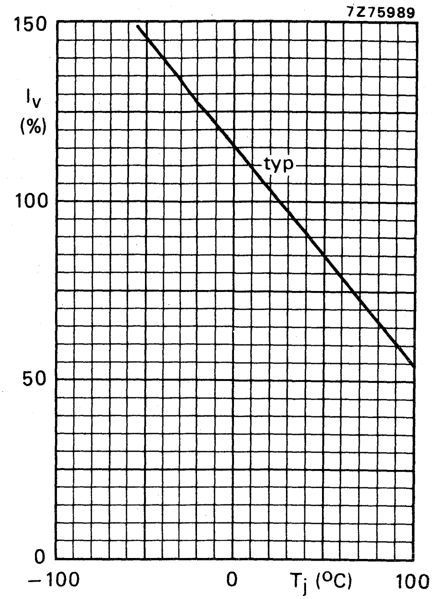


Fig. 10 I_F = 10 mA.

DEVELOPMENT SAMPLE DATA

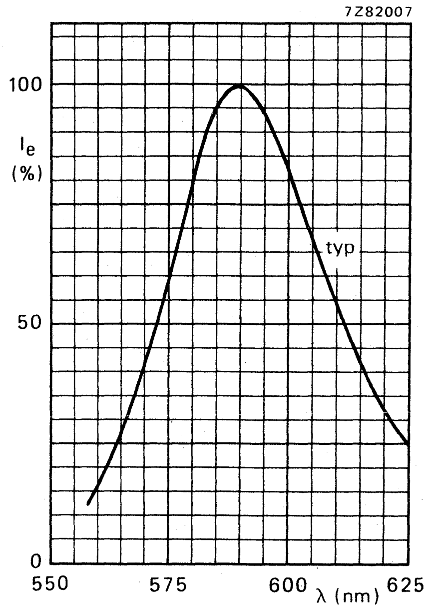

7Z82007
100
I_e
(%)
typ
50
0
550
575
600
λ (nm)
625

Fig. 11.

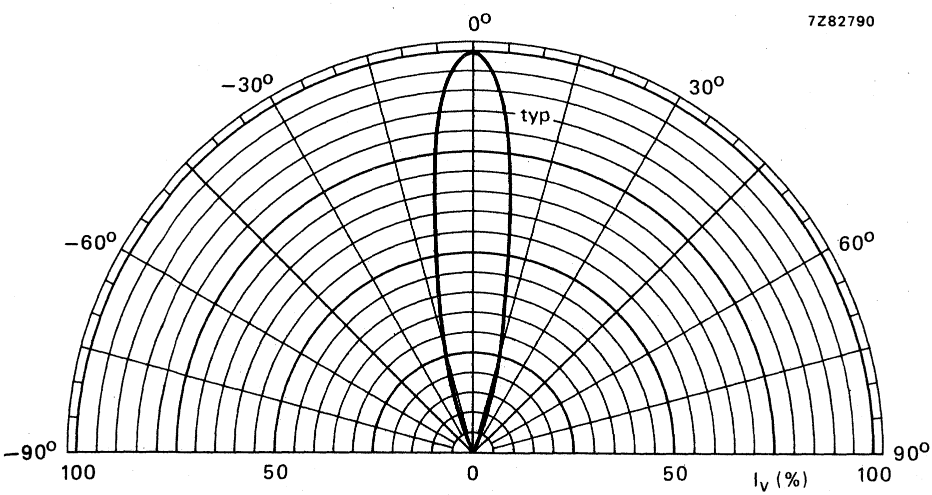

0°
7Z82790
−30°
30°
typ
−60°
60°
−90°
90°
100
50
0
50
I_v (%)
100

Fig. 12.

LIGHT EMITTING DIODES

For data of these diodes please refer to types CQX55 to 58.

GaAs LIGHT EMITTING DIODE

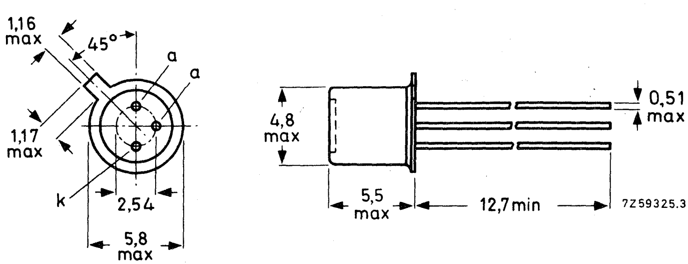
Gallium arsenide light emitting diode intended for optical coupling and encoding. It emits radiation in the near infrared when forward biased. The diode is provided with a flat glass window.

QUICK REFERENCE DATA				
Continuous reverse voltage	V_R	max.	2	V
Forward current (d.c.)	I_F	max.	30	mA
Forward current (peak value) t_p = 100 μs; δ = 0,1	I_{FM}	max.	200	mA
Total power dissipation up to T_{amb} = 95 °C	P_{tot}	max.	50	mW
Total radiant power at I_F = 20 mA	ϕ_e	>	60	μW
		typ.	100	μW
Radiant intensity (on-axis) at I_F = 20 mA	I_e	typ.	64	μW/sr
Light rise time at $I_{F\ on}$ = 20 mA	t_r	<	100	ns
Light fall time at $I_{F\ on}$ = 20 mA	t_f	<	100	ns
Wavelength at peak emission	λ_{pk}	typ.	880	nm
Thermal resistance from junction to ambient	$R_{th\ j-a}$	=	0,6	°C/mW

MECHANICAL DATA

Dimensions in mm

TO-18, except for window



Max. lead diameter is guaranteed only for 12,7 mm

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

Voltage

Continuous reverse voltage	V_R	max.	2	V

Current

Forward current (d.c.)	I_F	max.	30	mA
Forward current (peak value) t_p = 100 μs; δ = 0,1	I_{FM}	max.	200	mA

Power dissipation

Total power dissipation up to T_{amb} = 95 °C	P_{tot}	max.	50	mW

Temperature

Storage temperature	T_{stg}		−55 to + 150	°C
Operating junction temperature	T_j	max.	125	°C

THERMAL RESISTANCE

From junction to ambient in free air	$R_{th\ j\text{-}a}$	=	0,6	°C/mW
From junction to case	$R_{th\ j\text{-}c}$	=	0,22	°C/mW

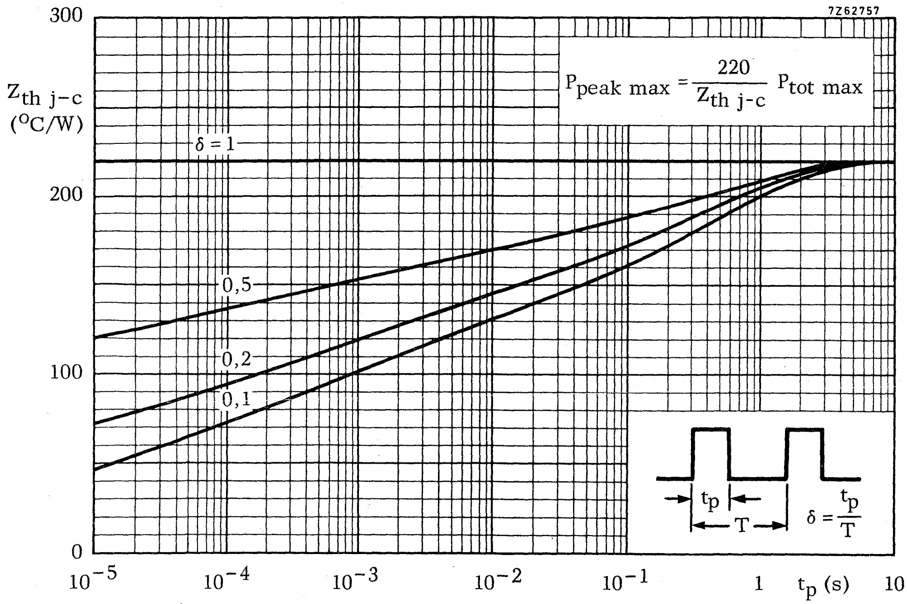
CHARACTERISTICS T_{amb} = 25 °C unless otherwise specified

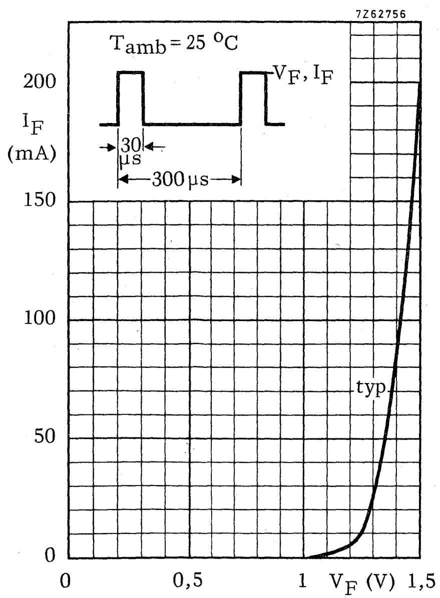
Forward voltage at I_F = 30 mA	V_F	typ.	1,3	V
		<	1,6	V
I_{FM} = 0,2 A	V_F	typ.	1,5	V
Reverse current at V_R = 2 V	I_R	<	0,5	mA
Diode capacitance at f = 1 MHz; V_R = 0	C_d	typ.	65	pF

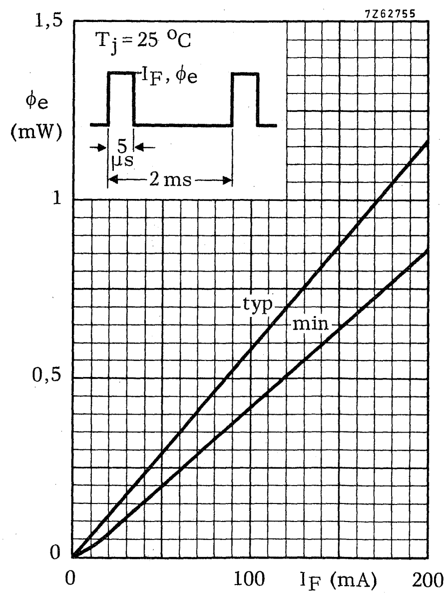
CHARACTERISTICS (continued) T_{amb} = 25 °C unless otherwise specified

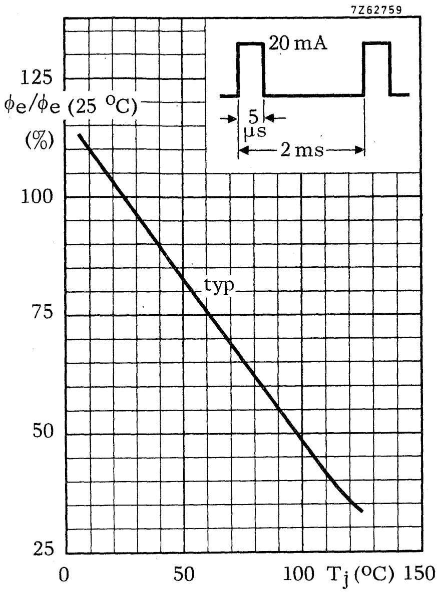
Radiant output power at I_F = 20 mA	ϕ_e	>	60	µW
		typ.	100	µW
I_F = 20 mA; T_j = 100 °C	ϕ_e	typ.	50	µW
I_F = 200 mA 1)	ϕ_e	typ.	1, 16	mW
Radiant intensity (on-axis) at I_F = 20 mA	I_e	typ.	64	µW/sr
Radiance at I_F = 20 mA	L_e	typ.	1, 6	mW/mm^2sr
I_F = 200 mA 1)	L_e	typ.	15	mW/mm^2sr
Emissive area	A_e	typ.	0, 04	mm^2
Wavelength at peak emission	λ_{pk}	typ.	880	nm
Bandwidth at half height	$\Delta\lambda$	typ.	40	nm
Light rise time at I_{Fon} = 20 mA	t_r	typ.	30	ns
		<	100	ns
Light fall time at I_{Fon} = 20 mA	t_f	typ.	30	ns
		<	100	ns

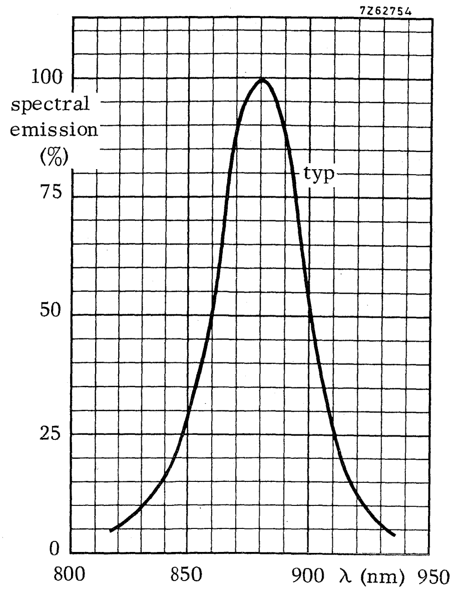
1) t_p = 100 µs; δ = 0, 1.

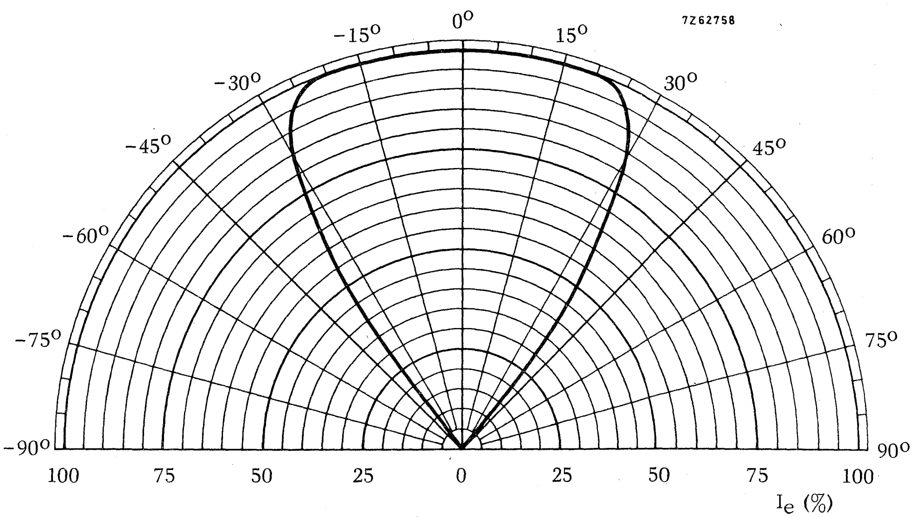

7Z62757
300
200
100
0
$Z_{th\ j-c}$
(°C/W)
δ = 1
0,5
0,2
0,1
$P_{peak\ max} = \frac{220}{Z_{th\ j-c}} P_{tot\ max}$
t_p
T
$\delta = \frac{t_p}{T}$
10^{-5}
10^{-4}
10^{-3}
10^{-2}
10^{-1}
1
t_p (s)
10


7Z62756
T_{amb} = 25 °C
V_F, I_F
30 µs
300 µs
200
150
100
50
0
I_F
(mA)
typ
0
0,5
1
V_F (V)
1,5


7Z62755
T_j = 25 °C
I_F, ϕ_e
5 µs
2 ms
1,5
1
0,5
0
ϕ_e
(mW)
typ
min
0
100
I_F (mA)
200


7Z62759
20 mA
5 μs
2 ms
125
ϕ_e/ϕ_e (25 °C)
(%)
100
75
50
25
typ
0
50
100
T_j (°C)
150


7Z62754
100
spectral emission (%)
75
50
25
0
typ
800
850
900
λ (nm)
950


7Z62758
0°
−15°
15°
−30°
30°
−45°
45°
−60°
60°
−75°
75°
−90°
90°
100
75
50
25
0
25
50
75
100
I_e (%)

GALLIUM ARSENIDE LIGHT EMITTING DIODE

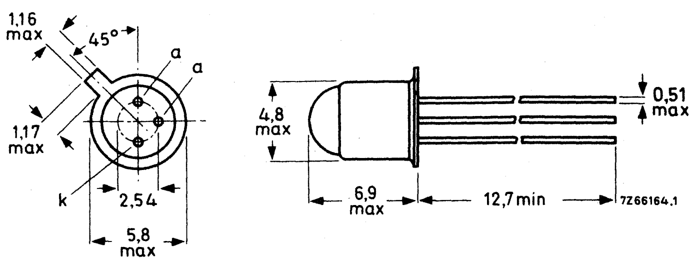
Gallium arsenide light emitting diode intended for optical coupling and encoding. It emits radiation in the near infrared when forward biased. Suitable for combination with photo-transistor BPX25 or BPX72.

QUICK REFERENCE DATA				
Continuous reverse voltage	V_R	max.	2	V
Forward current (d.c.)	I_F	max.	30	mA
Forward current (peak value)	I_{FM}	max.	200	mA
Total power dissipation up to T_{amb} = 95 °C	P_{tot}	max.	50	mW
Total radiant power at I_F = 20 mA	ϕ_e	typ.	50	µW
Radiant intensity (on-axis) at I_F = 20 mA	I_e	typ.	1,25	mW/sr
Light rise time at I_{Fon} = 20 mA	t_r	<	100	ns
Light fall time at I_{Fon} = 20 mA	t_f	<	100	ns
Wavelength at peak emission	λ_{pk}	typ.	880	nm
Thermal resistance from junction to ambient	$R_{th\ j-a}$	=	0,6	°C/mW

MECHANICAL DATA

Dimensions in mm

TO-18, except for lens



RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

Voltage				
Continuous reverse voltage	V_R	max.	2	V
Current				
Forward current (d.c.)	I_F	max.	30	mA
Forward current (peak value) t_p = 100 µs; δ = 0,1	I_{FM}	max.	200	mA
Power dissipation				
Total power dissipation up to T_{amb} = 95 °C	P_{tot}	max.	50	mW
Temperature				
Storage temperature	T_{stg}		−55 to + 150	°C
Junction temperature	T_j	max.	125	°C

THERMAL RESISTANCE

From junction to ambient in free air	$R_{th\ j-a}$	=	0,6	°C/mW
From junction to case	$R_{th\ j-c}$	=	0,22	°C/mW

CHARACTERISTICS T_{amb} = 25 °C unless otherwise specified

Forward voltage				
I_F = 30 mA	V_F	typ.	1,3	V
		<	1,6	V
I_{FM} = 200 mA	V_F	typ.	1,5	V
Reverse current				
V_R = 2 V	I_R	<	0,5	mA
Diode capacitance				
V_R = 0; f = 20 MHz	C_d	typ.	25	pF
Total radiant power				
I_F = 20 mA	ϕ_e	typ.	50	µW
Radiant intensity (on-axis)				
I_F = 20 mA	I_e	typ.	1,25	mW/sr

CHARACTERISTICS (continued)

Mean irradiance

on a receiving area with D = 2 mm at a distance a = 10 mm and at I_F = 20 mA, measured as below	E_e	>	0,28	mW/cm^2
		typ.	0,50	mW/cm^2 1)

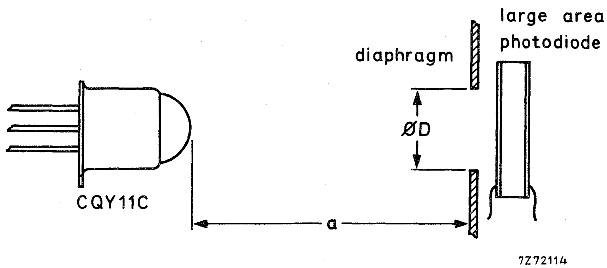
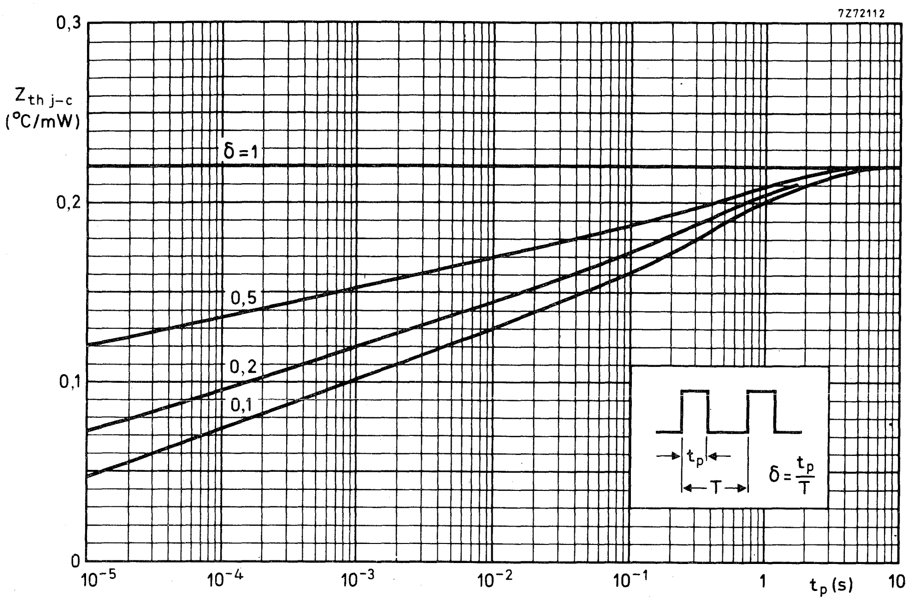
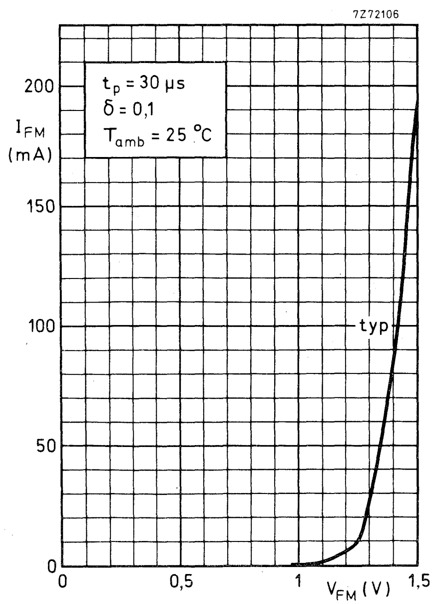


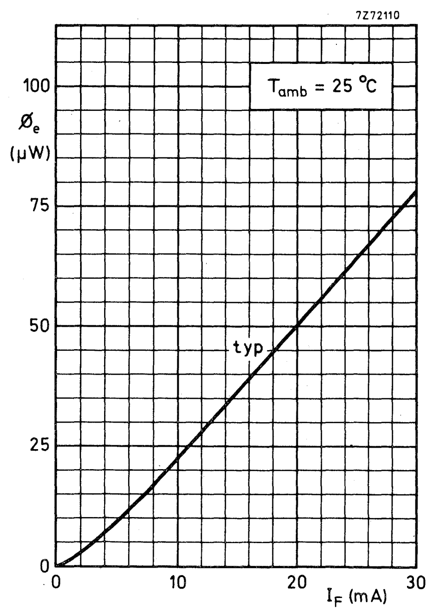
Fig. 1

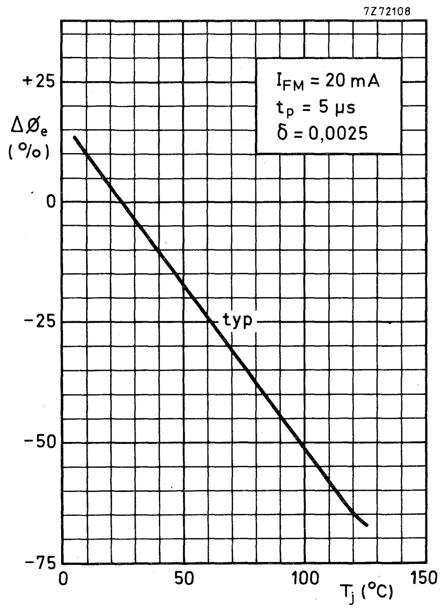
Decrease of radiant power with temperature	$\frac{\Delta\phi_e}{\Delta T_j}$	typ.	0,7	%/°C
Cross section of the radiant beam between 0 to 10 mm from the lens	A_{beam}	typ.	7	mm^2
Angle between optical and mechanical axis			6^o	
Wavelength at peak emission	λ_{pk}	typ.	880	nm
Bandwidth at half height	$B_{50\%}$	typ.	40	nm
Light rise time at I_{Fon} = 20 mA	t_r	typ.	30	ns
		<	100	ns
Light fall time at I_{Fon} = 20 mA	t_f	typ.	30	ns
		<	100	ns

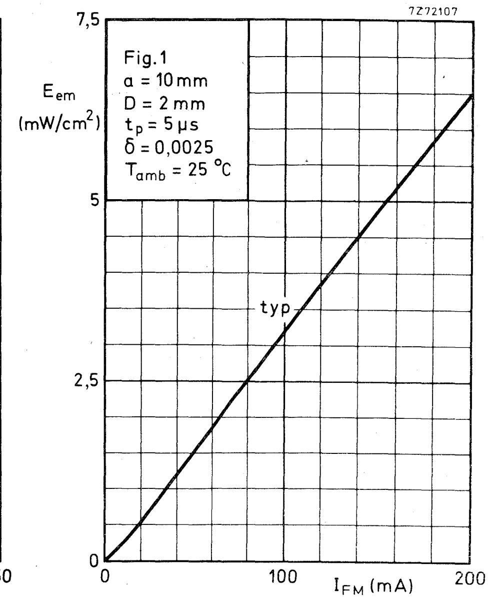
1) This corresponds typically with $I_{CEO(L)}$ = 0,4 mA in a phototransistor BPX25 and with 200 μA in a phototransistor BPX72.

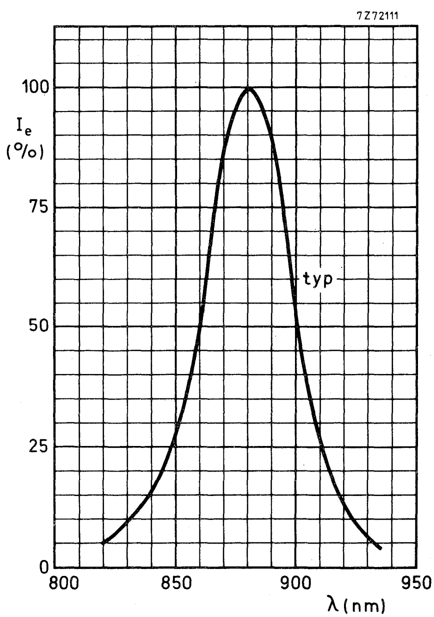

7Z72112
0,3
$Z_{th\ j-c}$
(°C/mW)
δ = 1
0,2
0,5
0,2
0,1
0,1
0
t_p
T
$\delta = \frac{t_p}{T}$
10^{-5}
10^{-4}
10^{-3}
10^{-2}
10^{-1}
1
t_p (s)
10

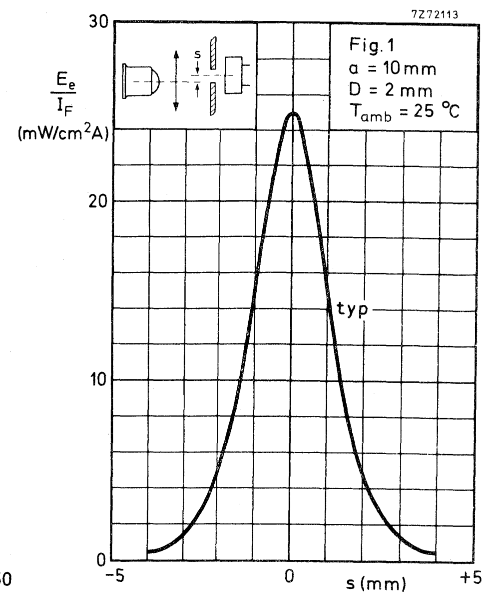

7Z72106
t_p = 30 μs
δ = 0,1
T_{amb} = 25 °C
200
I_{FM}
(mA)
150
100
typ
50
0
0
0,5
1
V_{FM} (V)
1,5

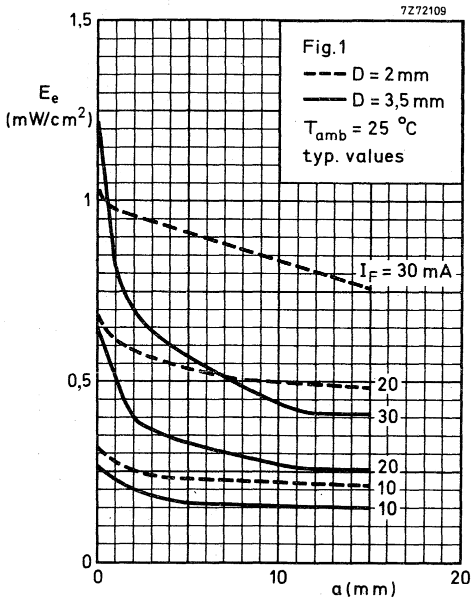

7Z72110
T_{amb} = 25 °C
100
$\varnothing_e$
(μW)
75
50
typ
25
0
0
10
20
I_F (mA)
30

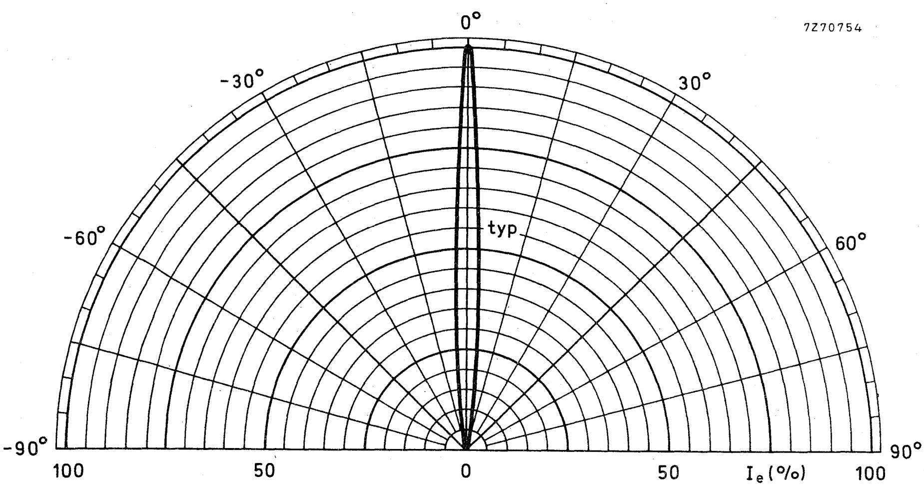

7Z72108
I_{FM} = 20 mA
t_p = 5 μs
δ = 0,0025
$\Delta \varnothing_e$ (%)
+25
0
−25
−50
−75
typ
0
50
100
150
T_j (°C)


7Z72107
Fig. 1
a = 10 mm
D = 2 mm
t_p = 5 μs
δ = 0,0025
T_{amb} = 25 °C
E_{em} (mW/cm²)
7,5
5
2,5
0
typ
0
100
200
I_{FM} (mA)


7Z72111
I_e (%)
100
75
50
25
0
typ
800
850
900
950
λ (nm)


7Z72113
s
Fig. 1
a = 10 mm
D = 2 mm
T_{amb} = 25 °C
$\frac{E_e}{I_F}$ (mW/cm²A)
30
20
10
0
typ
−5
0
+5
s (mm)


7Z72109
Fig.1
D = 2 mm
D = 3,5 mm
T_{amb} = 25 °C
typ. values
E_e (mW/cm²)
1,5
1
0,5
0
I_F = 30 mA
20
30
20
10
10
0
10
20
a (mm)


7Z70754
0°
-30°
30°
-60°
60°
-90°
90°
typ
100
50
0
50
I_e (%)
100

GaAsP RED LIGHT EMITTING DIODE

Gallium arsenide phosphide light emitting diode which emits visible red light when forward biased. Red, light-diffusing plastic envelope.

It has been designed for high-density arrays.

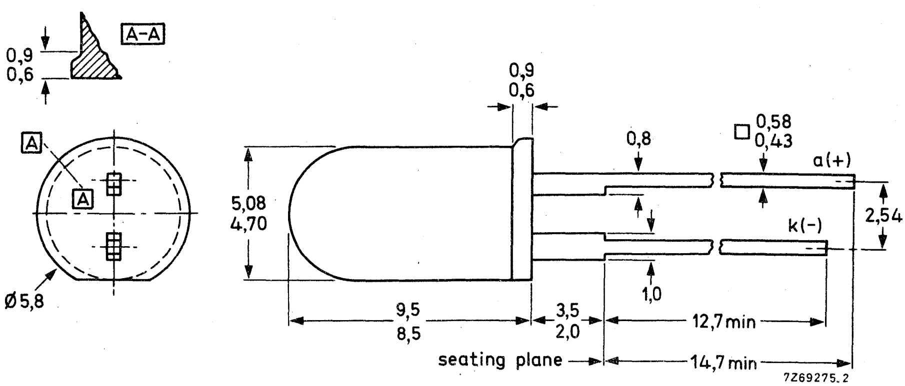
QUICK REFERENCE DATA

Continuous reverse voltage		V_R	max.	3	V
Forward current (d.c.)		I_F	max.	50	mA
Total power dissipation up to T_{amb} = 37,5 °C		P_{tot}	max.	100	mW
Luminous intensity (on-axis)					
I_F = 20 mA	**CQY24B-I**	I_v	>	0,7	mcd
	CQY24B-II	I_v		1,0 to 2,2	mcd
	CQY24B-III	I_v		1,6 to 3,5	mcd
	CQY24B-IV	I_v	>	3,0	mcd
Wavelength at peak emission		λ_{pk}	typ.	650	nm
Beamwidth between half-intensity directions		$\alpha_{50\%}$	typ.	55°	

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOD-63.



Accessories for panel mounting (panel thickness < 4 mm)

Plastic clip and ring
  black type RTC757
  colourless type RTC758

Hole diameter
  6,4 mm for panel thickness < 3 mm
  6,5 mm for panel thickness > 3 mm

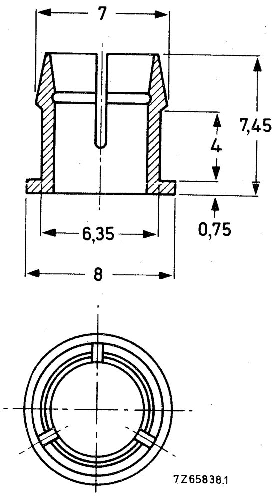


Fig. 2.

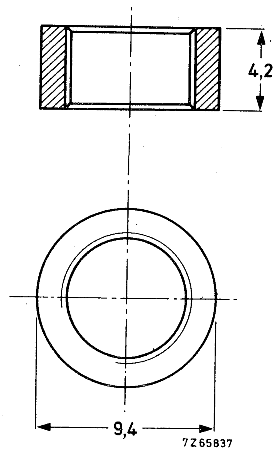


Fig. 3.

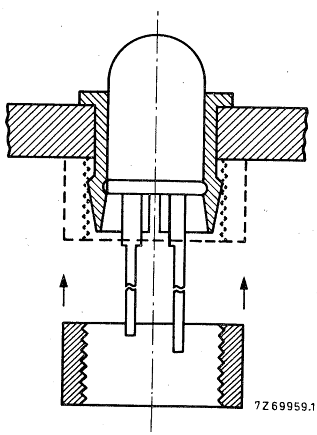


Fig. 4.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Continuous reverse voltage	V_R	max.	3 V
Forward current (d.c.)	I_F	max.	50 mA
Forward current (peak value) $t_p = 1\ \mu s$; f = 300 Hz	I_{FM}	max.	1000 mA
Total power dissipation up to T_{amb} = 37,5 °C	P_{tot}	max.	100 mW
Storage temperature	T_{stg}	−55 to + 100 °C	
Junction temperature	T_j	max.	100 °C
Lead soldering temperature up to seating plane; $t_{sld} < 10$ s	T_{sld}	max.	260 °C

THERMAL RESISTANCE

From junction to ambient in free air	$R_{th\ j\text{-}a}$	=	625 °C/W
mounted on a printed-circuit board	$R_{th\ j\text{-}a}$	=	500 °C/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Forward voltage I_F = 20 mA		V_F	typ.	1,7 V
			<	2 V
Negative temperature coefficient of V_F I_F = 20 mA		$\frac{-\Delta V_F}{\Delta T_j}$	typ.	1,6 mV/°C
I_F = 2 mA		$\frac{-\Delta V_F}{\Delta T_j}$	typ.	2 mV/°C
Reverse current V_R = 3 V		I_R	<	100 μA
Diode capacitance V_R = 0; f = 1 MHz		C_d	typ.	60 pF
Luminous intensity (on-axis) I_F = 20 mA	**CQY24B-I**	I_v	>	0,7 mcd
	CQY24B-II	I_v		1,0 to 2,2 mcd
	CQY24B-III	I_v		1,6 to 3,5 mcd
	CQY24B-IV	I_v	>	3,0 mcd
Wavelength at peak emission		λ_{pk}	typ.	650 nm
Bandwidth at half height		$B_{50\%}$	typ.	20 nm
Beamwidth between half-intensity directions		$\alpha_{50\%}$	typ.	55°

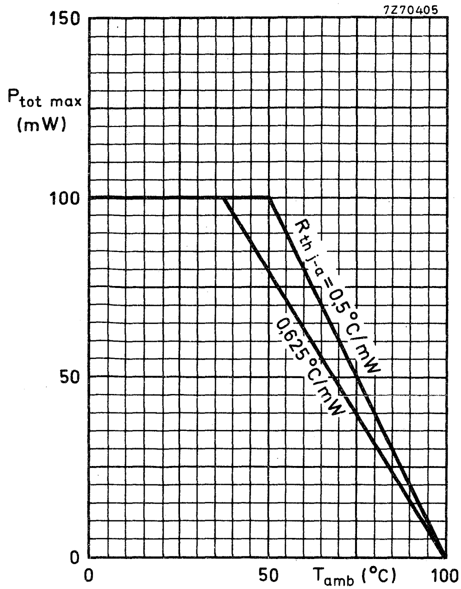


Fig. 5.

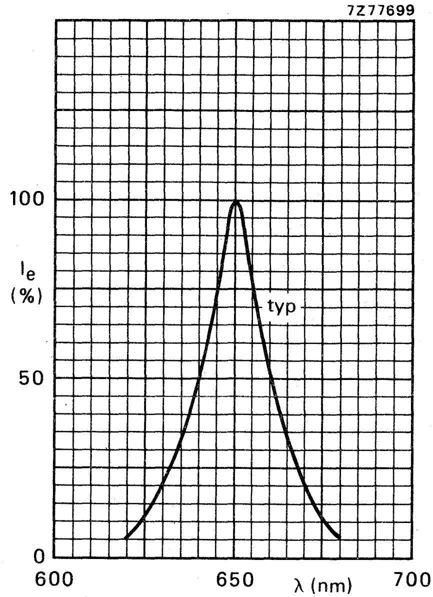


Fig. 6.

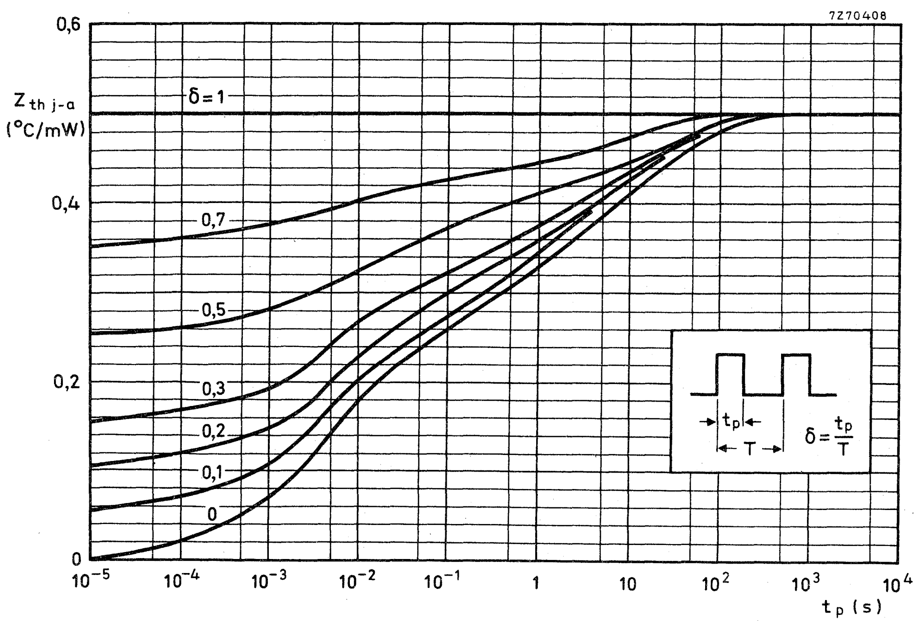


Fig. 7.

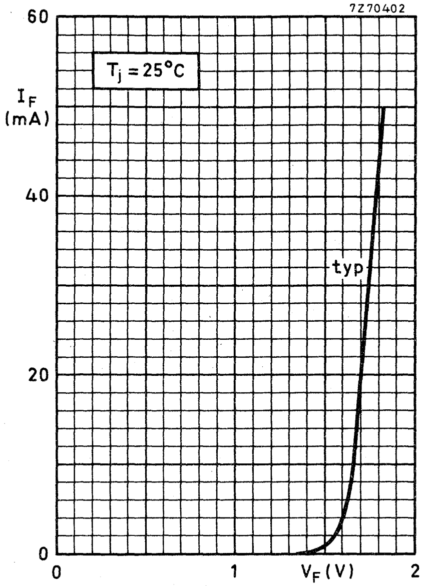


Fig. 8.

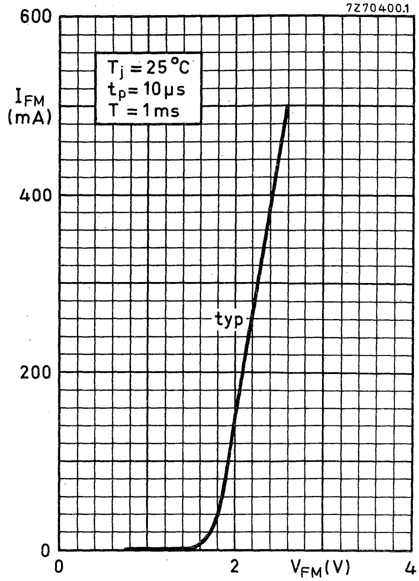


Fig. 9.

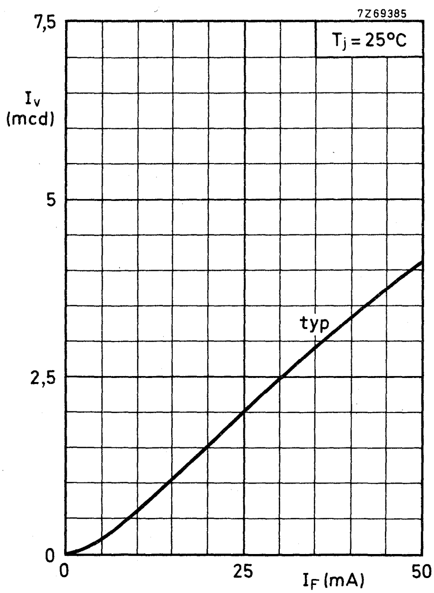


Fig. 10.

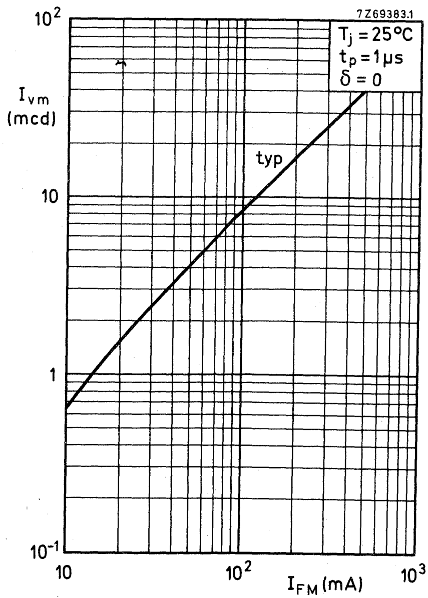


Fig. 11.

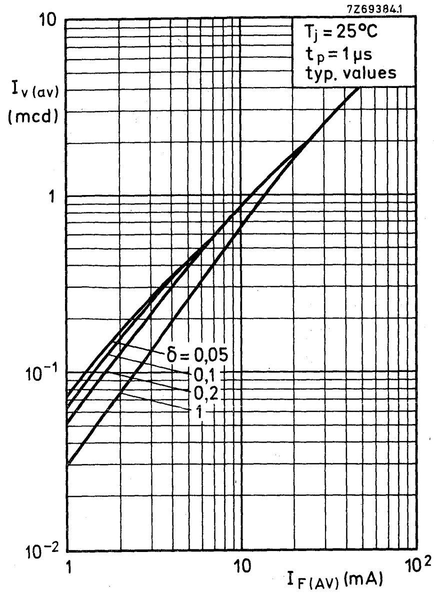


Fig. 12.

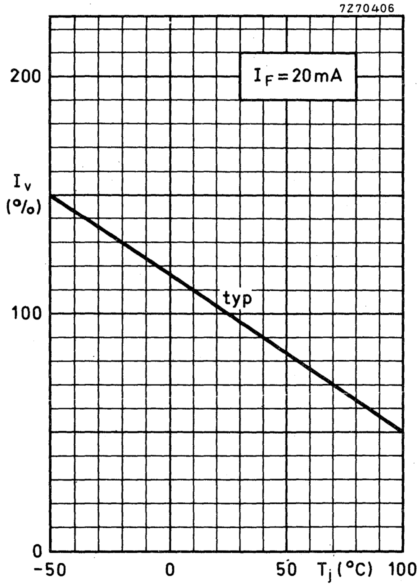


Fig. 13.

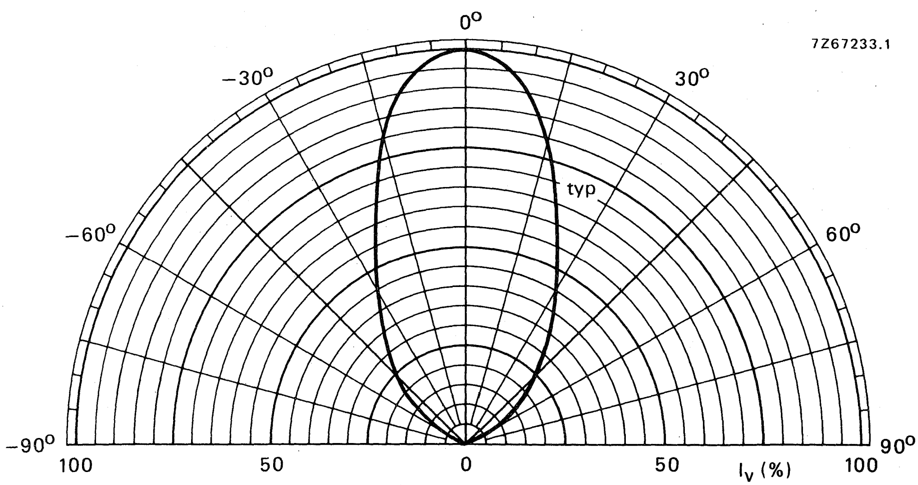


Fig. 14.

GaAs LIGHT EMITTING DIODES

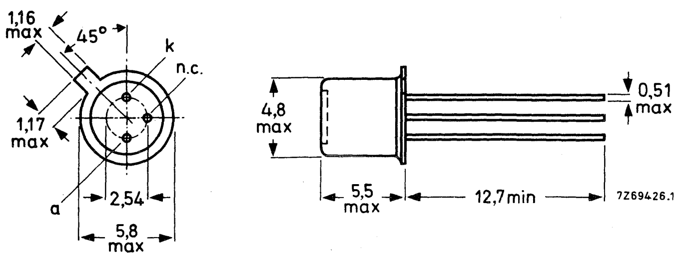
Epitaxial gallium arsenide light emitting diodes intended for optical coupling and encoding. They emit radiation in the near infrared when forward biased. Envelopes like TO-18. Suitable for combination with phototransistors BPX25 and BPX72.

QUICK REFERENCE DATA					
Continuous reverse voltage		V_R	max.	2	V
Forward current (d.c.)		I_F	max.	100	mA
Total power dissipation up to T_{amb} = 25 °C		P_{tot}	max.	150	mW
Radiant intensity (on-axis) at I_F = 50 mA	CQY49B	I_e	>	0,3	mW/sr
	CQY49C	I_e	>	3	mW/sr
Wavelength at peak emission		λ_{pk}	typ.	930	nm
Thermal resistance from junction to ambient		$R_{th\ j-a}$	=	0,665	°C/mW

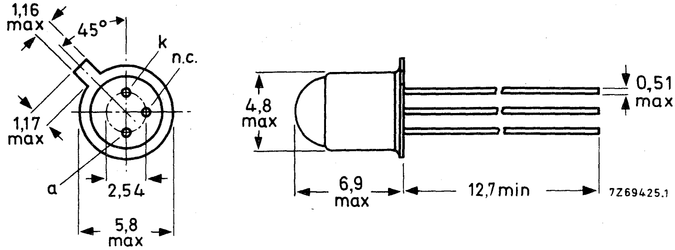
MECHANICAL DATA

Dimensions in mm

CQY49B : TO-18 except for window



CQY49C : TO-18 except for lens



RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

Voltage

Continuous reverse voltage	V_R	max.	2	V

Current

Forward current (d.c.)	I_F	max.	100	mA
Forward current (peak value) $t_p < 10\ \mu s$; $\delta < 0,01$	I_{FM}	max.	1	A

Power dissipation

Total power dissipation up to $T_{amb} = 25\ ^oC$	P_{tot}	max.	150	mW

Temperature

Storage temperature	T_{stg}		−40 to + 100	^oC
Operating junction temperature	T_j	max.	125	^oC
Lead soldering temperature > 1,5 mm from the body; $t_{sld} < 10$ s	T_{sld}	max.	260	^oC

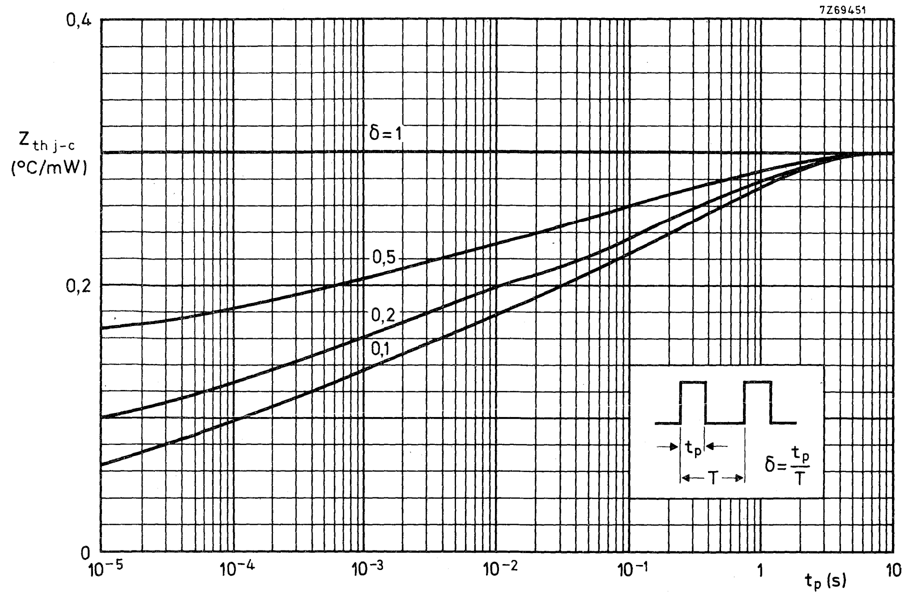
THERMAL RESISTANCE

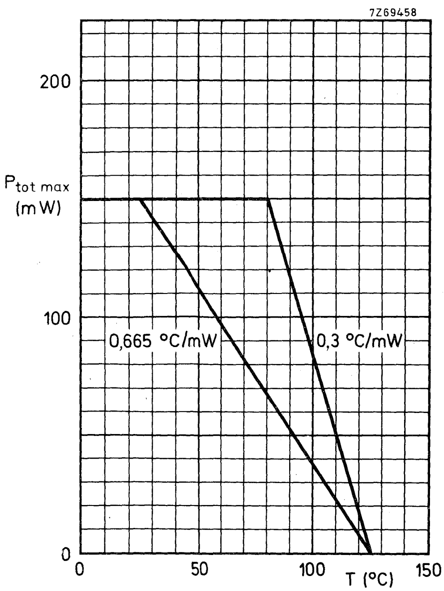
From junction to ambient in free air	$R_{th\ j\text{-}a}$	=	0,665	^oC/mW
From junction to case	$R_{th\ j\text{-}c}$	=	0,3	^oC/mW

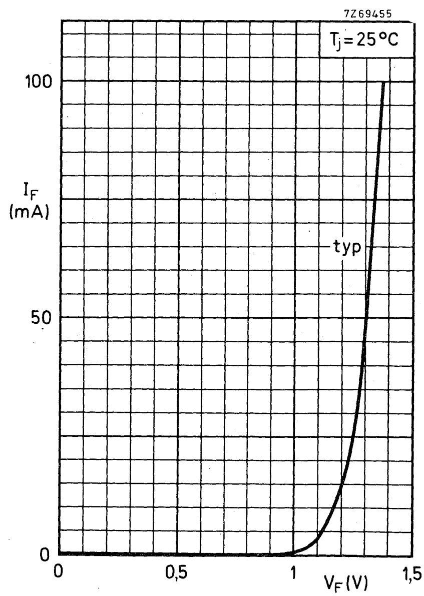
CHARACTERISTICS

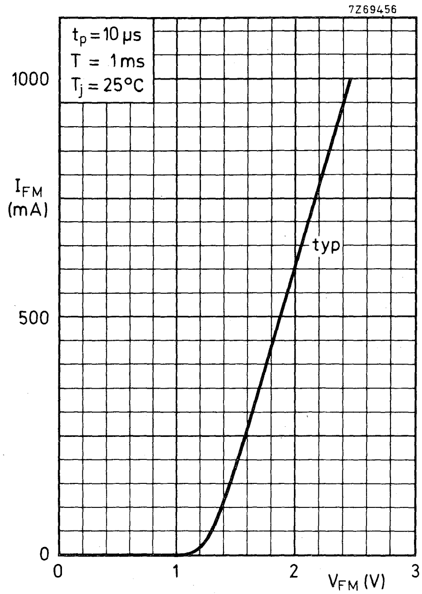
T_j = 25 °C unless otherwise specified

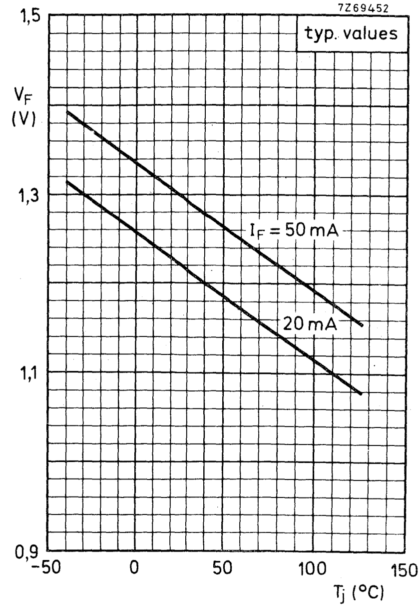
			CQY49B	CQY49C	
Forward voltage at I_F = 50 mA	V_F	typ.	1,3		V
		<	1,5		V
Reverse current at V_R = 2 V	I_R	<	100		μA
Diode capacitance					
V_R = 0; f = 1 MHz	C_d	typ.	55		pF
Radiant intensity (on-axis) at I_F = 50 mA	I_e	>	0,3	3	mW/sr
		typ.	0,5	5	mW/sr
Wavelength at peak emission	λ_{pk}	typ.	930		nm
Bandwidth at half height	$B_{50\%}$	typ.	50		nm
Beamwidth between half-intensity directions	$\alpha_{50\%}$	typ.	80°	15°	
Angle between optical and mechanical axis		typ.	–	6°	
Switching times					
I_{Fon} = 50 mA; t_p = 2 μs; f = 45 kHz					
Light rise time	t_r	typ.	600		ns
Light fall time	t_f	typ.	350		ns

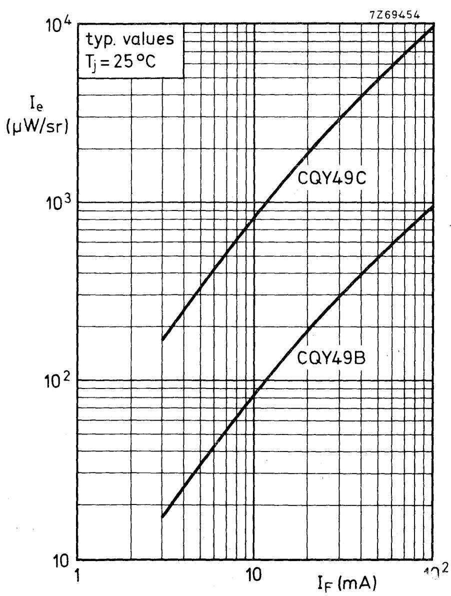

7Z69451
0,4
0,2
0
$Z_{th\ j-c}$ (°C/mW)
δ = 1
0,5
0,2
0,1
t_p
T
$δ = \frac{t_p}{T}$
10^{-5}
10^{-4}
10^{-3}
10^{-2}
10^{-1}
1
10
t_p (s)

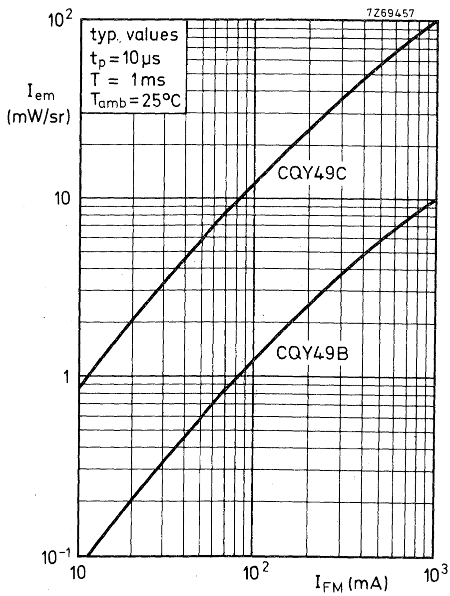

7Z69458
200
100
0
$P_{tot\ max}$ (mW)
0,665 °C/mW
0,3 °C/mW
0
50
100
150
T (°C)

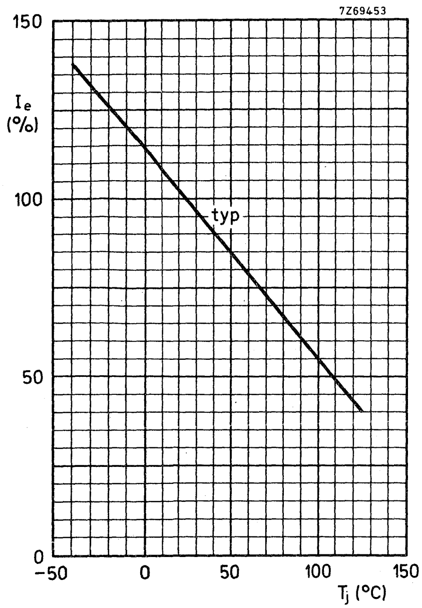

7Z69455
$T_j = 25\ °C$
100
50
0
I_F (mA)
typ
0
0,5
1
1,5
V_F (V)

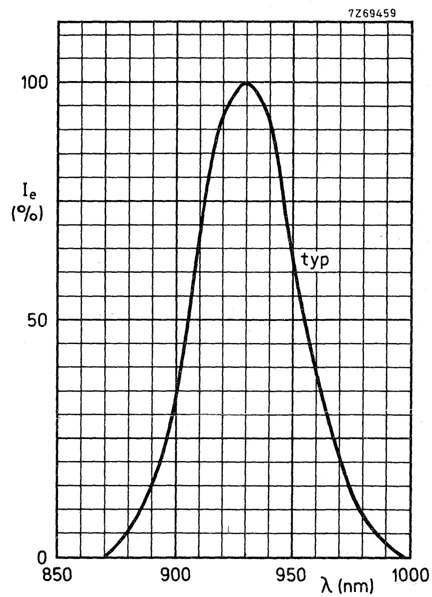

7Z69456
$t_p = 10\ \mu s$
T = 1 ms
$T_j = 25\,°C$
I_{FM}
(mA)
1000
500
0
typ
0
1
2
3
V_{FM} (V)

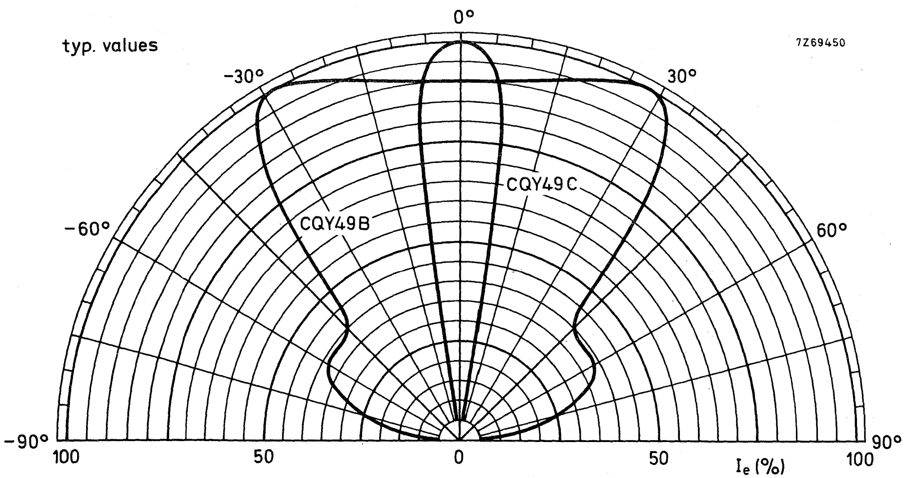

7Z69452
typ. values
V_F
(V)
1,5
1,3
1,1
0,9
$I_F = 50$ mA
20 mA
−50
0
50
100
150
T_j (°C)


7Z69454
typ. values
$T_j = 25\,°C$
I_e
(μW/sr)
10^4
10^3
10^2
10
CQY49C
CQY49B
1
10
10^2
I_F (mA)


7Z69457
typ. values
$t_p = 10\ \mu s$
T = 1 ms
$T_{amb} = 25\,°C$
I_{em}
(mW/sr)
10^2
10
1
10^{-1}
CQY49C
CQY49B
10
10^2
10^3
I_{FM} (mA)


7Z69453
150
I_e
(%)
100
typ
50
0
−50
0
50
100
150
T_j (°C)


7Z69459
100
I_e
(%)
typ
50
0
850
900
950
λ (nm)
1000


0°
typ. values
7Z69450
−30°
30°
CQY49C
CQY49B
−60°
60°
−90°
90°
100
50
0
50
I_e (%)
100

GaAs LIGHT EMITTING DIODES

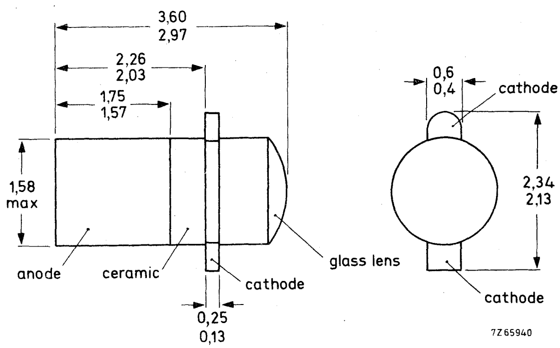
Gallium arsenide light emitting diodes which emit near-infrared light when forward biased. Ceramic-metal envelope with glass lens like BPX71, suitable for matrix layout on printed circuit boards. In conjunction with BPX71 also suitable for punched card reading.

QUICK REFERENCE DATA					
Continuous reverse voltage	V_R	max.	2		V
Forward current (d.c.)	I_F	max.	100		mA
Total power dissipation up to T_{amb} = 25 ^oC mounted on printed circuit board	P_{tot}	max.	150		mW
			CQY50	CQY52	
Total radiant power at I_F = 20 mA	ϕ_e	>	160	400	μW
Radiant intensity (on-axis) at I_F = 20 mA	I_e	>	180	450	μW/sr
Wavelength at peak emission	λ_{pk}	typ.	930		nm

MECHANICAL DATA

Dimensions in mm

DO-31 except for length



RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

Voltage				
Continuous reverse voltage	V_R	max.	2	V
Current				
Forward current (d.c.)	I_F	max.	100	mA
Forward current (peak value) t_p = 10 μs; δ = 0,01	I_{FM}	max.	500	mA
Temperature				
Storage temperature	T_{stg}		−65 to +150	^oC
Operating junction temperature	T_j	max.	125	^oC
Power dissipation				
Total power dissipation up to T_{amb} = 25 ^oC device mounted on p.c. board [1]	P_{tot}	max.	150	mW

THERMAL RESISTANCE

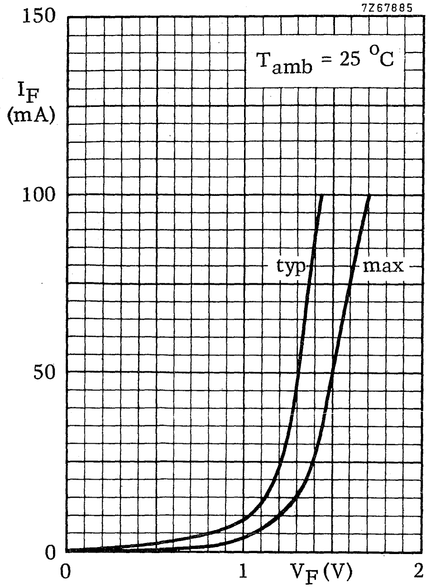
From junction to ambient, device mounted on p.c. board [1]	$R_{th\ j\text{-}a}$	=	0,66	^oC/mW

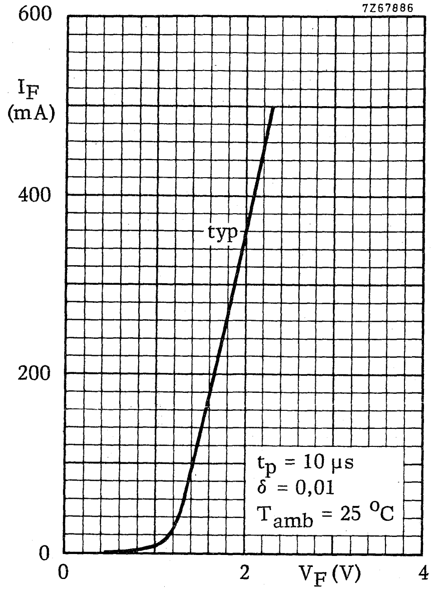
[1]) With copper islands of 6 x 2 mm on both sides of 1,6 mm glass-epoxy printed circuit board; thickness of copper 35 μm.

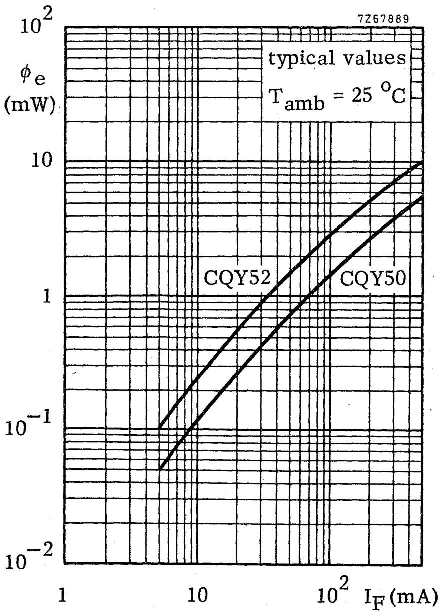
CHARACTERISTICS

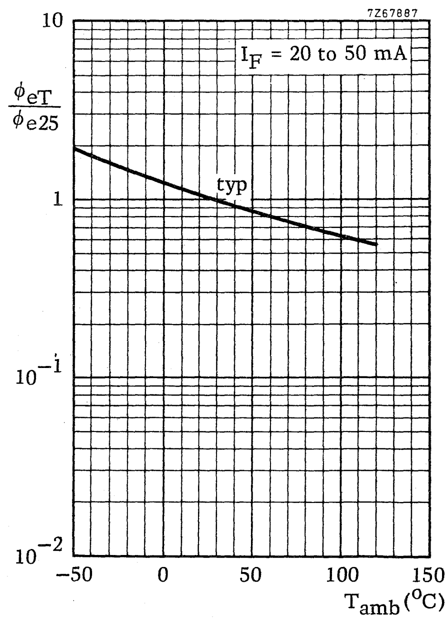
$T_{amb} = 25\ ^{o}C$ unless otherwise specified

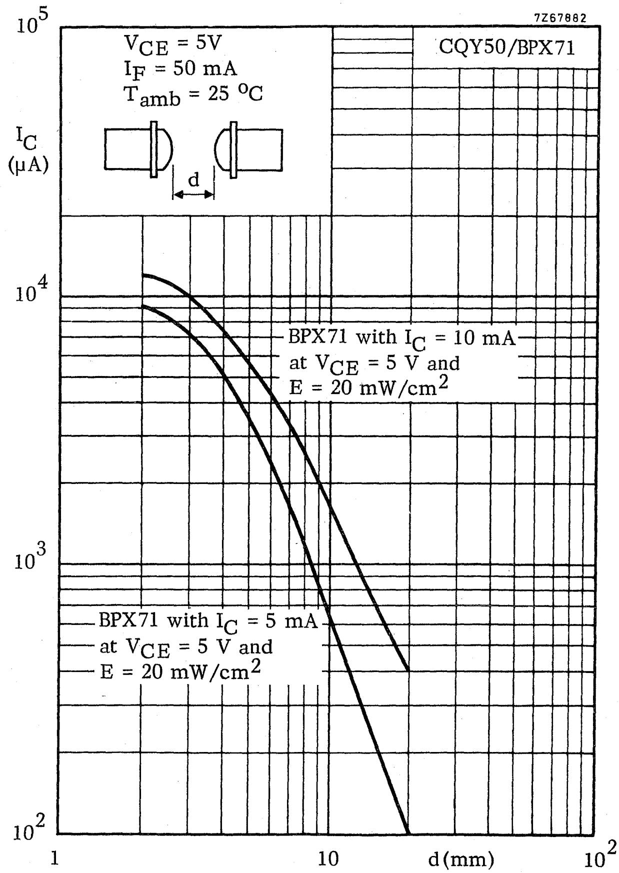
			CQY50	CQY52	
Forward voltage					
$I_F = 50$ mA	V_F	typ.	1,3	1,3	V
		<	1,5	1,5	V
$I_F = 500$ mA; $t_p = 10$ µs; $\delta = 0{,}01$	V_F	typ.	2,3	2,3	V
Reverse current					
$V_R = 2$ V	I_R	<	100	100	µA
Diode capacitance					
$V_R = 0$; f = 1 MHz	C_d	typ.	45	45	pF
Total radiant power					
$I_F = 20$ mA	ϕ_e	>	160	400	µW
$I_F = 50$ mA	ϕ_e	typ.	700	1500	µW
Radiant intensity (on-axis)					
$I_F = 20$ mA	I_e	>	180	450	µW/sr
Wavelength at peak emission	λ_{pk}	typ.	930	930	nm
Bandwidth at half height	$B_{50\%}$	typ.	40	40	nm
Beamwidth between half-intensity directions	$\alpha_{50\%}$	typ.	35^{o}	35^{o}	
Switching times					
$I_{Fon} = 20$ mA; $t_p = 2$ µs; f = 45 kHz					
Light rise time	t_r	typ.	600	600	ns
Light fall time	t_f	typ.	350	350	ns

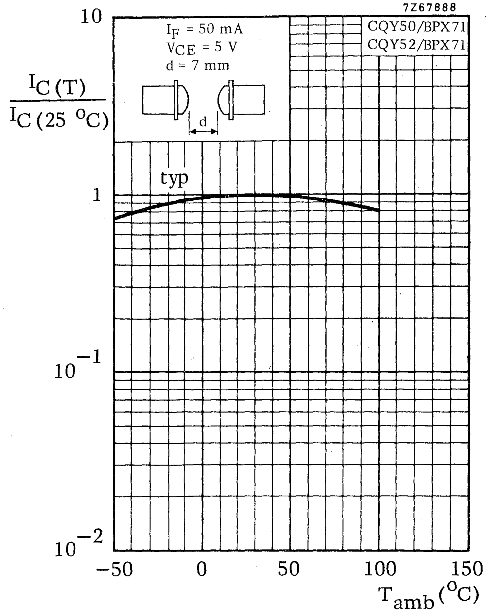

7Z67885
T_{amb} = 25 °C
I_F (mA)
150
100
50
0
typ
max
0
1
2
V_F (V)

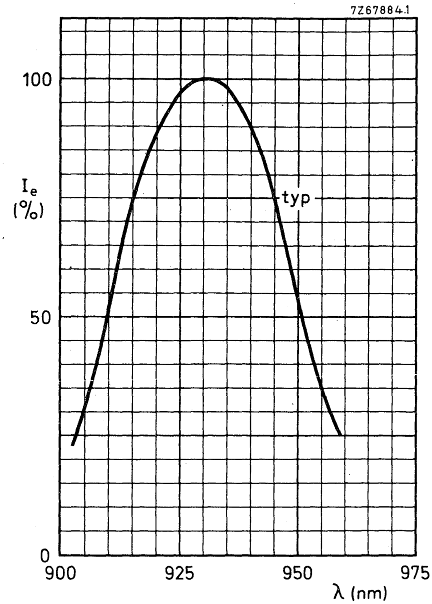

7Z67886
I_F (mA)
600
400
200
0
typ
t_p = 10 µs
δ = 0,01
T_{amb} = 25 °C
0
2
4
V_F (V)

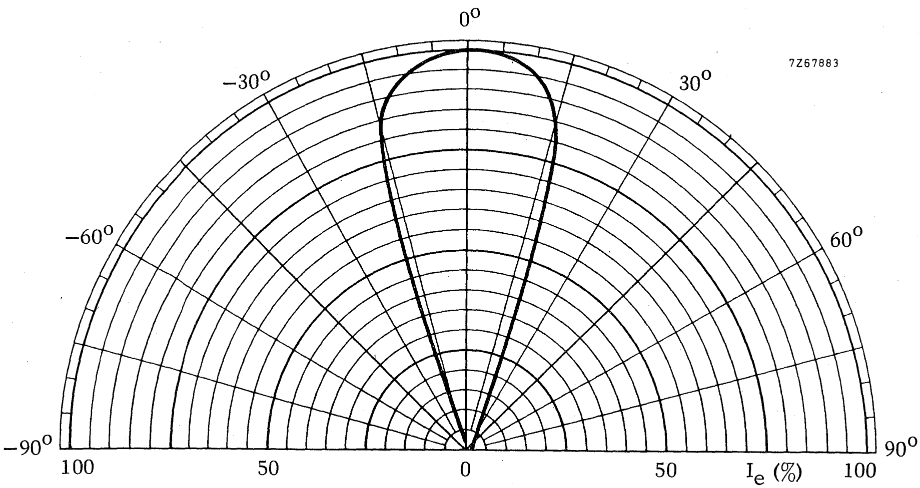

7Z67889
ϕ_e (mW)
typical values
T_{amb} = 25 °C
10^2
10
1
10^{-1}
10^{-2}
CQY52
CQY50
1
10
10^2
I_F (mA)


7Z67887
I_F = 20 to 50 mA
$\frac{\phi_{eT}}{\phi_{e25}}$
10
1
10^{-1}
10^{-2}
typ
−50
0
50
100
150
T_{amb} (°C)


7Z67882
CQY50/BPX71
VCE = 5V
IF = 50 mA
Tamb = 25 °C
IC
(μA)
d
BPX71 with IC = 10 mA
at VCE = 5 V and
E = 20 mW/cm2
BPX71 with IC = 5 mA
at VCE = 5 V and
E = 20 mW/cm2
10^5
10^4
10^3
10^2
1
10
d(mm)
10^2


7Z67888
I_F = 50 mA
V_{CE} = 5 V
d = 7 mm
d
CQY50/BPX71
CQY52/BPX71
$\frac{I_C(T)}{I_C(25\ ^oC)}$
typ
10
1
10^{-1}
10^{-2}
−50
0
50
100
150
T_{amb} (^{o}C)


7Z67884.1
I_e (%)
100
50
0
typ
900
925
950
975
λ (nm)


0°
−30°
30°
7Z67883
−60°
60°
−90°
90°
100
50
0
50
I_e (%)
100

GaAsP RED LIGHT EMITTING DIODE

Gallium arsenide phosphide light emitting diode which emits visible red light when forward biased. The envelope is of light-diffusing red plastic, and has been designed for high-density arrays.

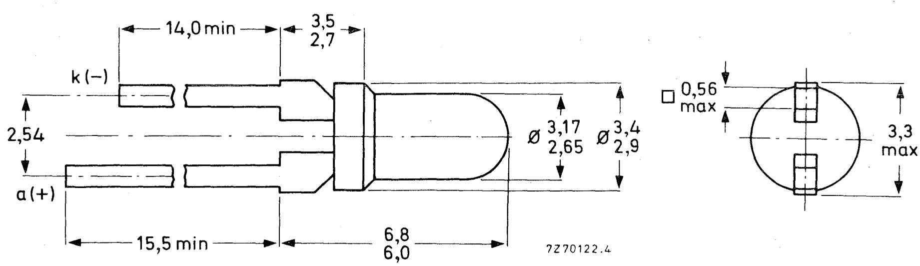
QUICK REFERENCE DATA

Continuous reverse voltage		V_R	max.	3	V
Forward current (d.c.)		I_F	max.	50	mA
Total power dissipation up to T_{amb} = 37,5 °C		P_{tot}	max.	100	mW
Luminous intensity (on-axis)					
I_F = 20 mA	CQY54	I_v	>	0,3	mcd
	CQY54-I	I_v		0,7 to 1,6	mcd
	CQY54-II	I_v		1 to 2,2	mcd
	CQY54-III	I_v	>	1,6	mcd
Wavelength at peak emission		λ_{pk}	typ.	650	nm
Beamwidth between half-intensity directions		$\alpha_{50\%}$	typ.	80°	

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOD-53C.



RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Continuous reverse voltage	V_R	max.	3	V
Forward current (d.c.)	I_F	max.	50	mA
Forward current (peak value) $t_p = 1\ \mu s$; f = 300 Hz	I_{FM}	max.	1000	mA
Storage temperature	T_{stg}	−55 to +100		^oC
Junction temperature	T_j	max.	100	^oC
Total power dissipation up to T_{amb} = 37,5 ^oC	P_{tot}	max.	100	mW

THERMAL RESISTANCE

From junction to ambient, in free air	$R_{th\ j\text{-}a}$	=	0,625	$^oC/mW$
mounted on a p.c. board	$R_{th\ j\text{-}a}$	=	0,500	$^oC/mW$

CHARACTERISTICS

$T_j = 25\ ^oC$

Forward voltage $I_F = 20$ mA		V_F	typ.	1,7 V
			<	2,0 V
Negative temperature coefficient of V_F $I_F = 20$ mA		$\frac{-\Delta V_F}{\Delta T_j}$	typ.	1,6 mV/^{o}C
		$\frac{-\Delta V_F}{\Delta T_j}$	typ.	2 mV/^{o}C
Reverse current $V_R = 3$ V		I_R	<	100 μA
Luminous intensity (on-axis) $I_F = 20$ mA	CQY54	I_v	>	0,3 mcd
	CQY54-I	I_v		0,7 to 1,6 mcd
	CQY54-II	I_v		1 to 2,2 mcd
	CQY54-III	I_v	>	1,6 mcd
Diode capacitance $V_R = 0$; F = 1 MHz		C_d	typ.	60 pF
Wavelength at peak emission		λ_{pk}	typ.	650 nm
Bandwidth at half height		$B_{50\%}$	typ.	20 nm
Beamwidth between half-intensity directions		$\alpha_{50\%}$	typ.	80^o

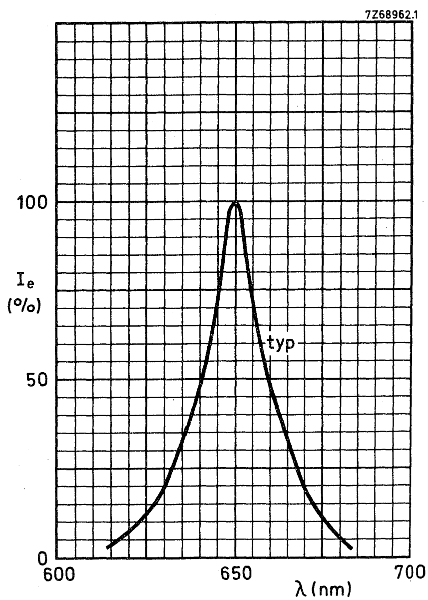
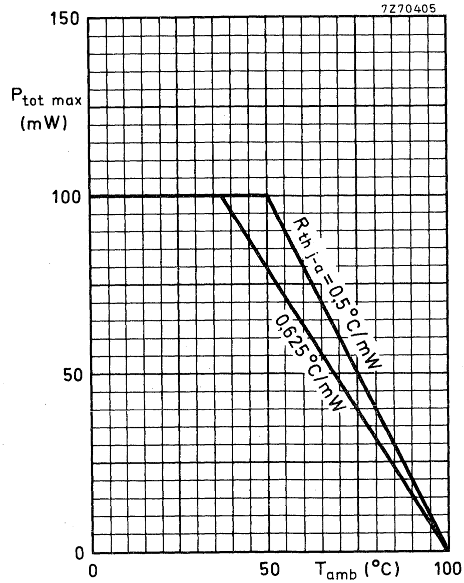
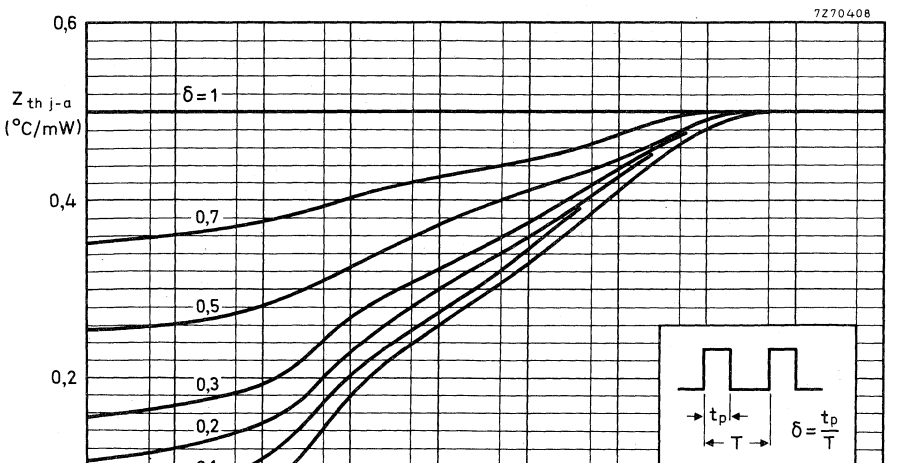
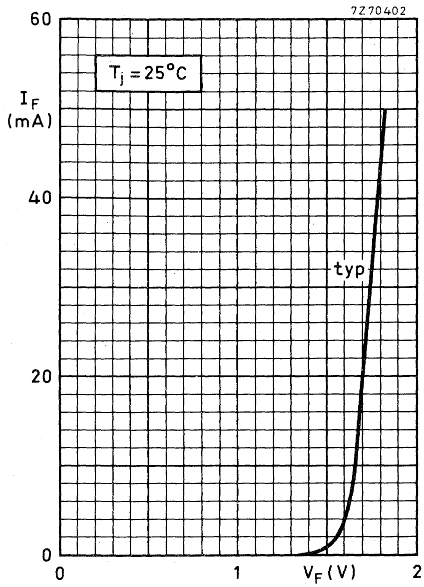
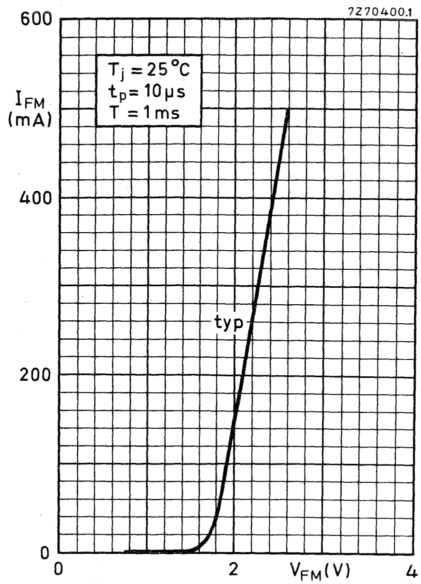


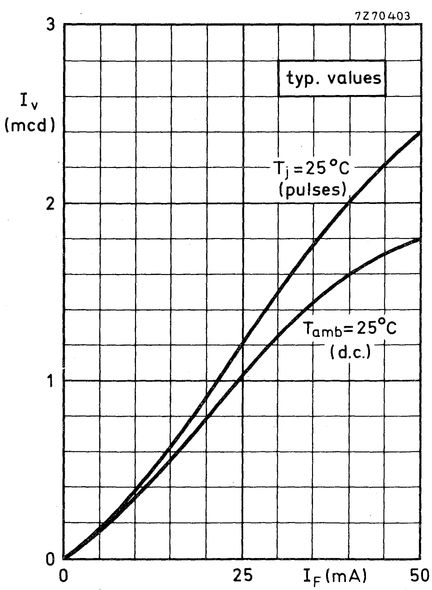
Fig. 2.

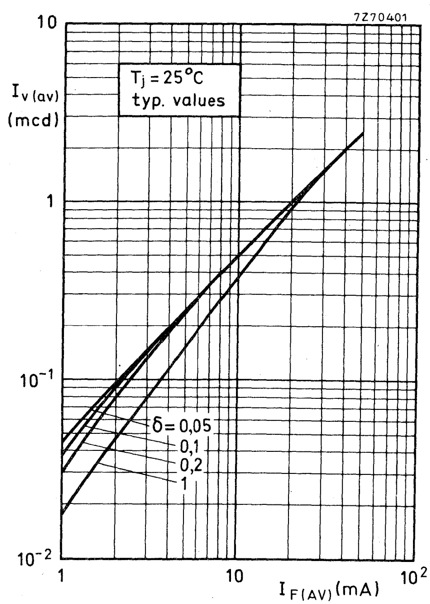

7Z70405
150
$P_{tot\ max}$
(mW)
100
50
0
0
50
T_{amb} (°C)
100
$R_{th\ j-a}$ = 0,5 °C/mW
0,625 °C/mW

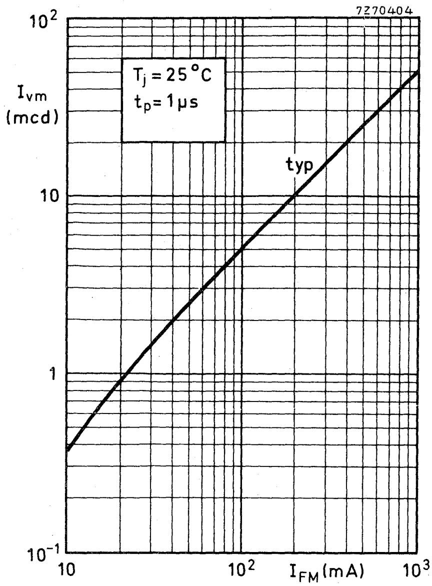

7Z70408
0,6
$Z_{th\ j-a}$
(°C/mW)
0,4
0,2
0
δ = 1
0,7
0,5
0,3
0,2
0,1
0
t_p
T
$\delta = \frac{t_p}{T}$
10^{-5}
10^{-4}
10^{-3}
10^{-2}
10^{-1}
1
10
10^2
10^3
10^4
t_p (s)

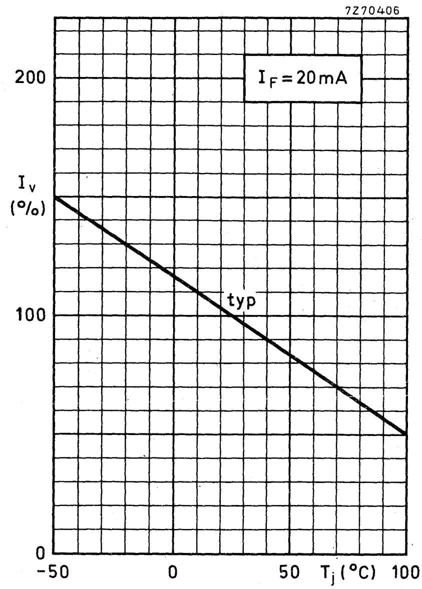

7Z70402
$T_j = 25\,^\circ C$
I_F (mA)
60
40
20
0
typ
0
1
V_F (V)
2

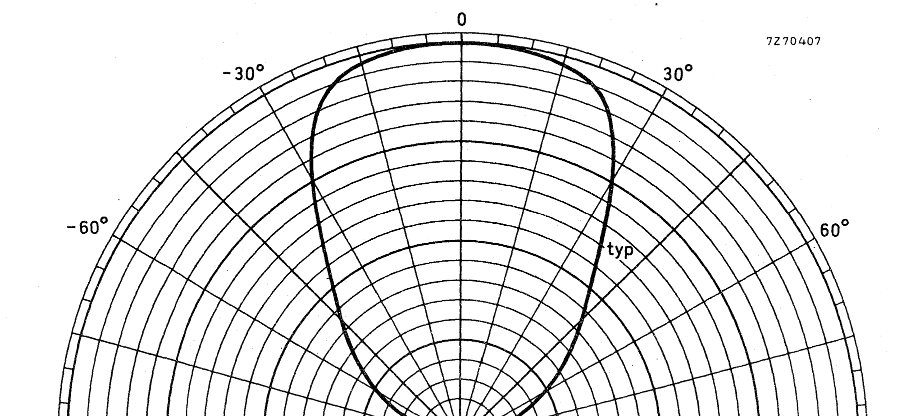

7Z70400.1
$T_j = 25\,^\circ C$
$t_p = 10\,\mu s$
$T = 1\,ms$
I_{FM} (mA)
600
400
200
0
typ
0
2
V_{FM} (V)
4


7Z70403
typ. values
I_v (mcd)
3
2
1
0
$T_j = 25\,^\circ C$ (pulses)
$T_{amb} = 25\,^\circ C$ (d.c.)
0
25
I_F (mA)
50


7Z70401
$T_j = 25\,^\circ C$
typ. values
$I_{v\,(av)}$ (mcd)
10
1
10^{-1}
10^{-2}
$\delta = 0,05$
0,1
0,2
1
1
10
$I_{F(AV)}$ (mA)
10^2


7Z70404
$T_j = 25\,°C$
$t_p = 1\,\mu s$
I_{vm} (mcd)
typ
10^2
10
1
10^{-1}
10
10^2
I_{FM} (mA)
10^3


7Z70406
$I_F = 20\,mA$
I_v (%)
typ
200
100
0
−50
0
50
T_j (°C)
100


0
7Z70407
−30°
30°
−60°
60°
typ
−90°
90°
100
50
0
50
I_v (%)
100

GaAs LIGHT EMITTING DIODE

Diffused planar light emitting diode intended for optical coupling and encoding. It emits radiation in the near infrared when forward biased. Infrared translucent epoxy encapsulation (dark blue). Combination with phototransistor BPW22A is recommended.

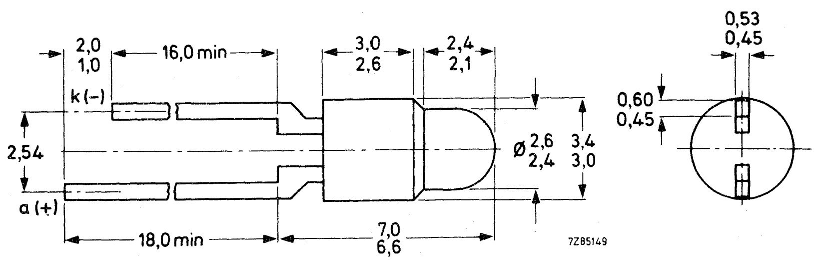
QUICK REFERENCE DATA

Continuous reverse voltage	V_R	max.	5	V
Forward current (d.c.)	I_F	max.	50	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	100	mW
Radiant intensity (on-axis) at I_F = 20 mA	I_e	>	1	mW/sr
Wavelength at peak emission	λ_{pk}	typ.	930	nm

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOD-53D.



RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Continuous reverse voltage	V_R	max.	5	V
Forward current				
d.c.	I_F	max.	50	mA
(peak value); t_p = 10 μs; δ = 0,01	I_{FM}	max.	200	mA
Total power dissipation up to T_{amb} = 25 °C (see Fig. 2)	P_{tot}	max.	100	mW
Storage temperature	T_{stg}	−55 to + 100		°C
Junction temperature	T_j	max.	100	°C
Lead soldering temperature				
> 3,5 mm from the body; t_{sld} < 7 s	T_{sld}	max.	260	°C

THERMAL RESISTANCE

From junction to ambient, device mounted on a printed-circuit board	$R_{th\ j\text{-}a}$	=	750	°C/W

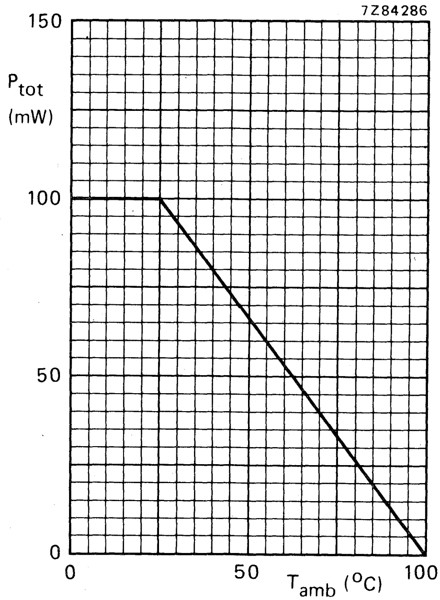


Fig. 2 Power derating curve versus ambient temperature.

CHARACTERISTICS

T_j = 25 °C

Forward voltage I_F = 20 mA		V_F	typ. <	1,2 V 1,5 V
Reverse current V_R = 5 V		I_R	<	100 μA
Diode capacitance V_R = 0; f = 1 MHz		C_d	typ.	40 pF
Total radiant power I_F = 20 mA		ϕ_e	typ.	1 mW
Radiant intensity (on-axis) I_F = 20 mA	**CQY58A-I**	I_e	> <	1 mW/sr 5 mW/sr
	CQY58A-II	I_e	>	3 mW/sr
Wavelength at peak emission		λ_{pk}	typ.	930 nm
Bandwidth at half height		$B_{50\%}$	typ.	50 nm
Beamwidth between half-intensity directions I_F = 20 mA		$\alpha_{50\%}$	typ.	± 10°
Switching times I_{Fon} = 20 mA Light rise time		t_r	typ.	3 μs
Light fall time		t_f	typ.	3 μs

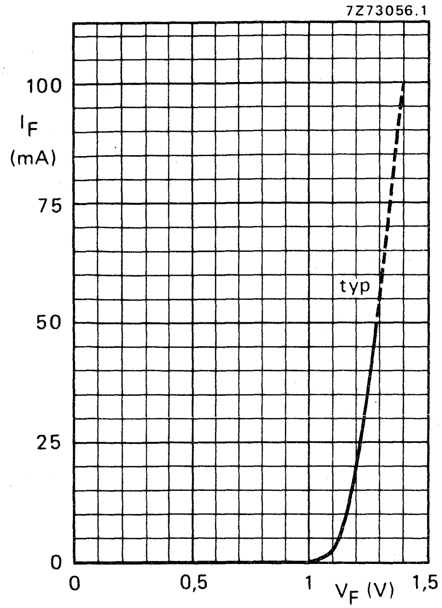


Fig. 3 T_{amb} = 25 °C.

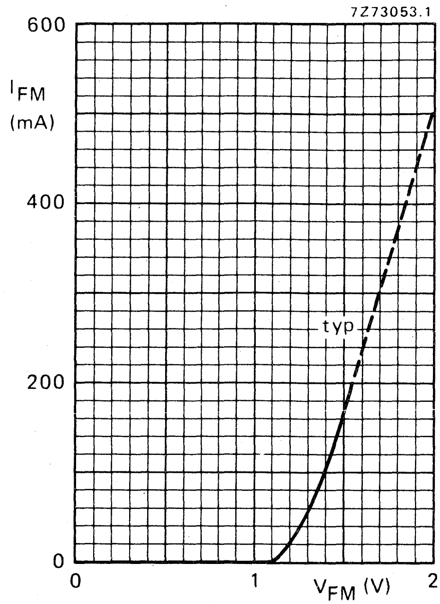


Fig. 4 t_p = 10 μs; T = 1 ms; T_{amb} = 25 °C.

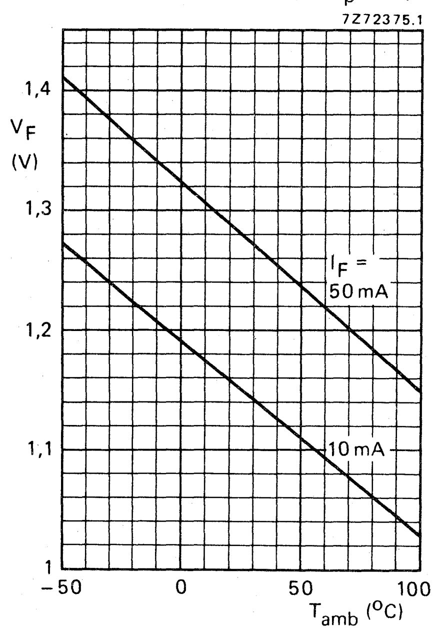


Fig. 5 Typical values.

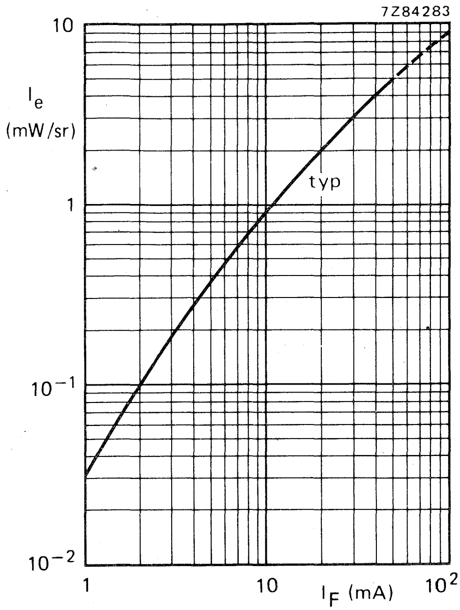


Fig. 6 T_{amb} = 25 °C.

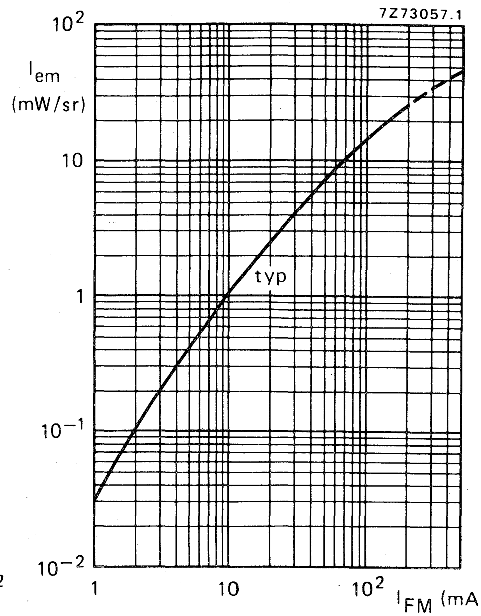


Fig. 7 t_p = 10 μs; T = 1 ms; T_{amb} = 25 °C.

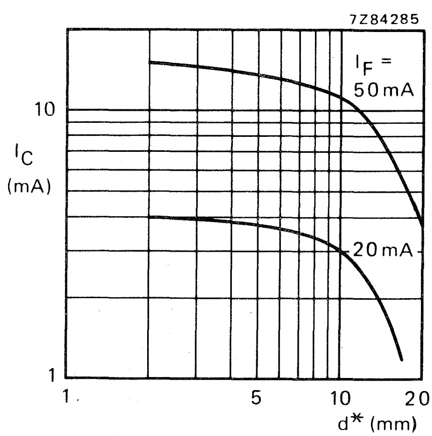


Fig. 8 V_{CE} = 5 V; T_{amb} = 25 °C;
typical values.

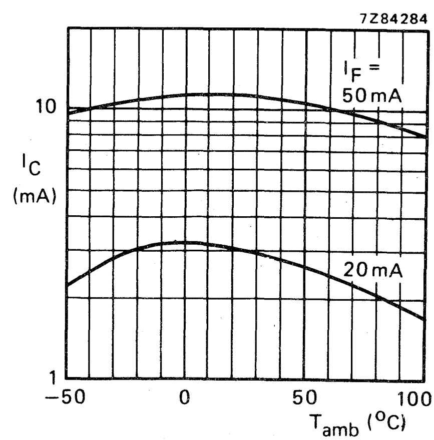


Fig. 9 V_{CE} = 5 V; d* = 10 mm;
typical values.

* d = shortest free distance of mechanical on-axis when BPW22A is coupled with CQY58A.

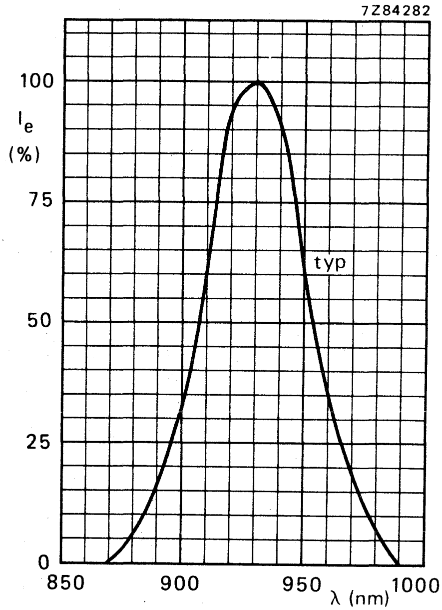


Fig. 10 Spectral response.

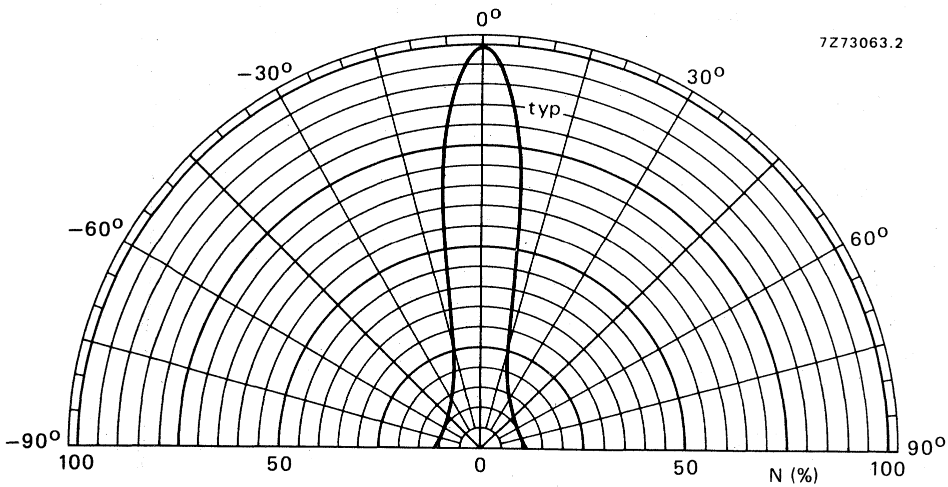


Fig. 11.

GaAs LIGHT EMITTING DIODE

Epitaxial gallium arsenide light emitting diode intended for remote-control applications. It emits radiation in the near infrared when forward biased. Infrared translucent epoxy encapsulation (dark blue).

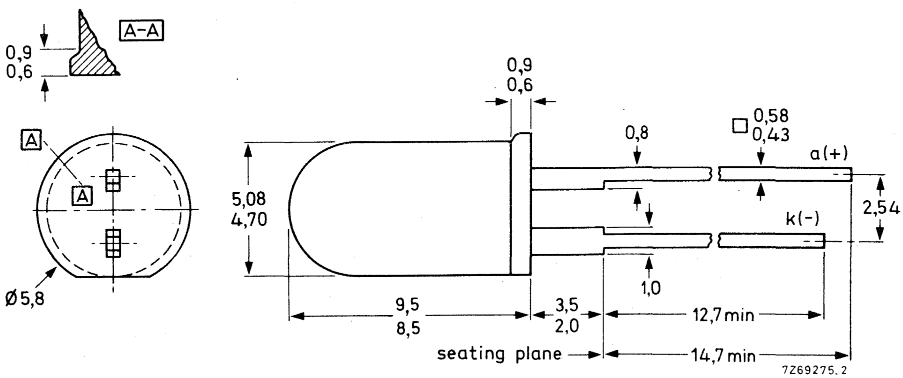
QUICK REFERENCE DATA

Continuous reverse voltage		V_R	max.	5	V
Forward current (d.c.)		I_F	max.	130	mA
Total power dissipation up to T_{amb} = 25 °C		P_{tot}	max.	215	mW
Junction temperature		T_j	max.	100	°C
Radiant intensity (on-axis) at I_F = 100 mA	**CQY89A**	I_e	>	9	mW/sr
	CQY89A-1	I_e		9 to 20	mW/sr ←
	CQY89A-2	I_e	>	15	mW/sr
Wavelength at peak emission		λ_{pk}	typ.	930	nm

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOD-63.



RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Continuous reverse voltage	V_R	max.	5 V
Forward current (d.c.)	I_F	max.	130 mA
Forward current (peak value) $t_p \leqslant 50\ \mu s$; $\delta = 0,05$	I_{FM}	max.	1000 mA
Non-repetitive peak forward current ($t_p \leqslant 10\ \mu s$)	I_{FSM}	max.	2500 mA
Total power dissipation up to $T_{amb} = 25\ ^oC$	P_{tot}	max.	215 mW
Storage temperature	T_{stg}		−55 to + 100 °C
Junction temperature	T_j	max.	100 °C
Lead soldering temperature up to the seating plane; $t_{sld} < 10$ s	T_{sld}	max.	260 °C

THERMAL RESISTANCE

From junction to ambient mounted on a printed-circuit board	$R_{th\ j-a}$	=	0,35 K/mW

CHARACTERISTICS

$T_j = 25\ ^oC$ unless otherwise specified

Forward voltage $I_F = 100$ mA		V_F	typ.	1,4 V
			<	1,6 V
$I_{FM} = 1500$ mA; $t_p = 20\ \mu s$; $\delta = 0,033$		V_{FM}	typ.	2,4 V
Reverse current $V_R = 5$ V		I_R	<	100 μA
Diode capacitance $V_R = 0$; f = 1 MHz		C_d	typ.	40 pF
Total radiant power $I_F = 100$ mA		ϕ_e	>	7 mW
			typ.	12 mW
Decrease of radiant power with temperature $I_F = 100$ mA		$\frac{\Delta\phi_e}{\Delta T_j}$	typ.	1 %/K
Radiant intensity (on-axis) $I_F = 100$ mA	**CQY89A**	I_e	>	9 mW/sr
			typ.	15 mW/sr
→	**CQY89A-1**	I_e		9 to 20 mW/sr
	CQY89A-2	I_e	>	15 mW/sr
Wavelength at peak emission $I_F = 100$ mA		λ_{pk}	typ.	930 nm
Bandwidth at half height $I_F = 100$ mA		$B_{50\%}$	typ.	50 nm
Beamwidth between half-intensity directions $I_F = 100$ mA		$\alpha_{50\%}$	typ.	40°

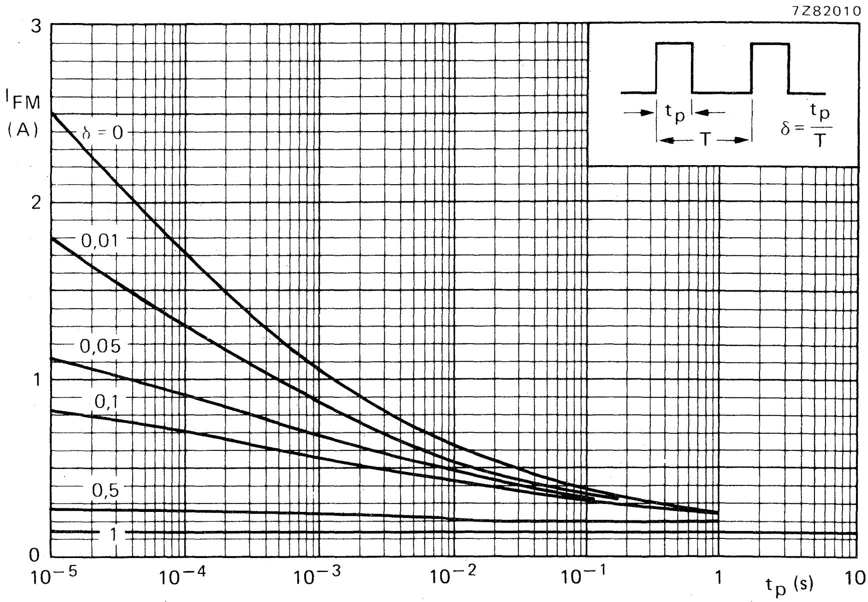


Fig. 2 T_{amb} = 25 °C; $T_{j\,peak}$ = 100 °C.

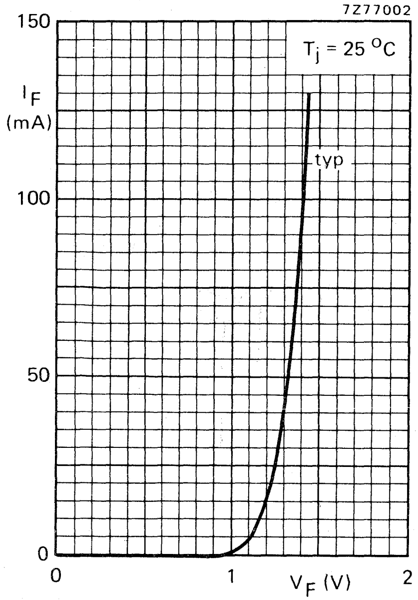


Fig. 3.

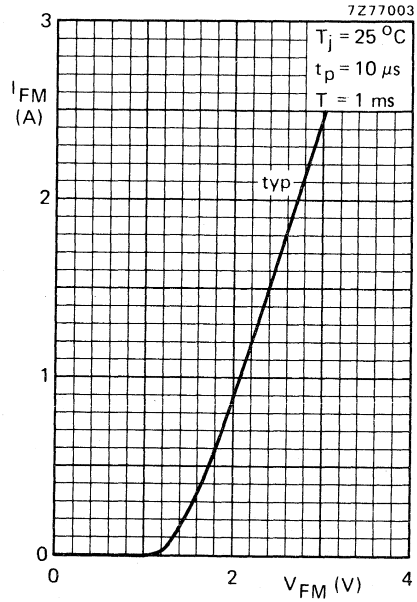


Fig. 4.

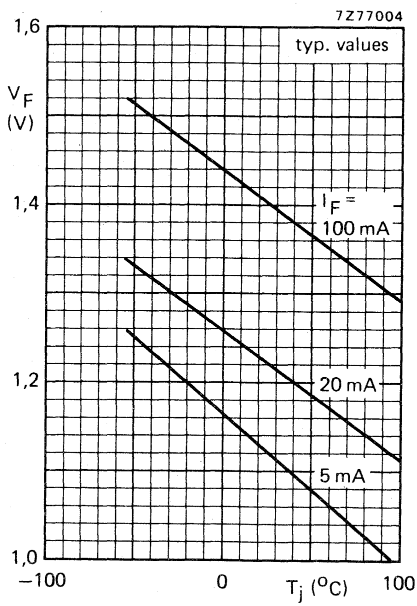


Fig. 5.

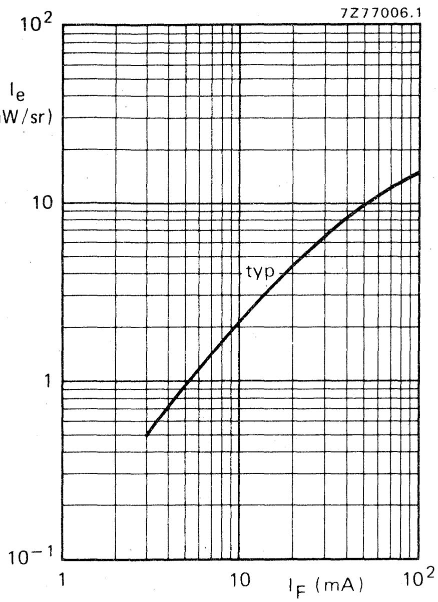


Fig. 6 T_j = 25 °C.

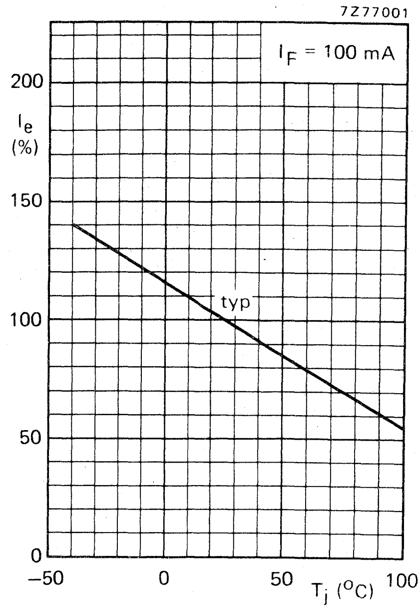


Fig. 7.

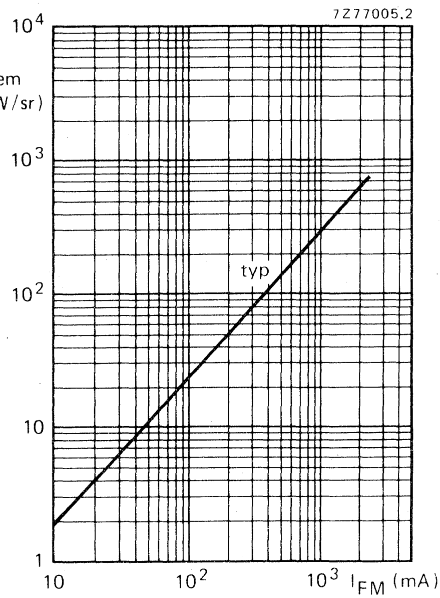


Fig. 8 T_{amb} = 25 °C; t_p = 10 μs; T = 1 ms.

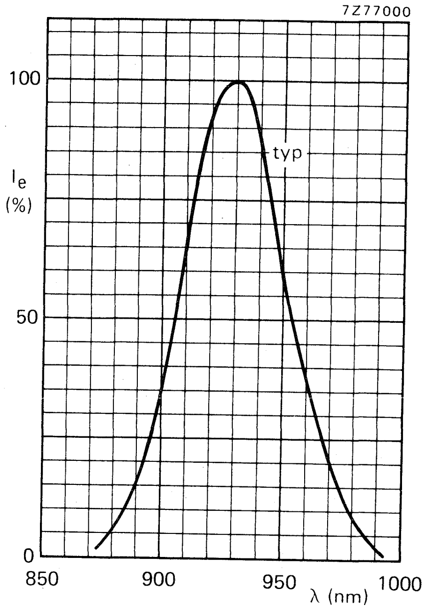

7Z77000
100
50
0
I_e (%)
typ
850
900
950
1000
λ (nm)

Fig. 9.

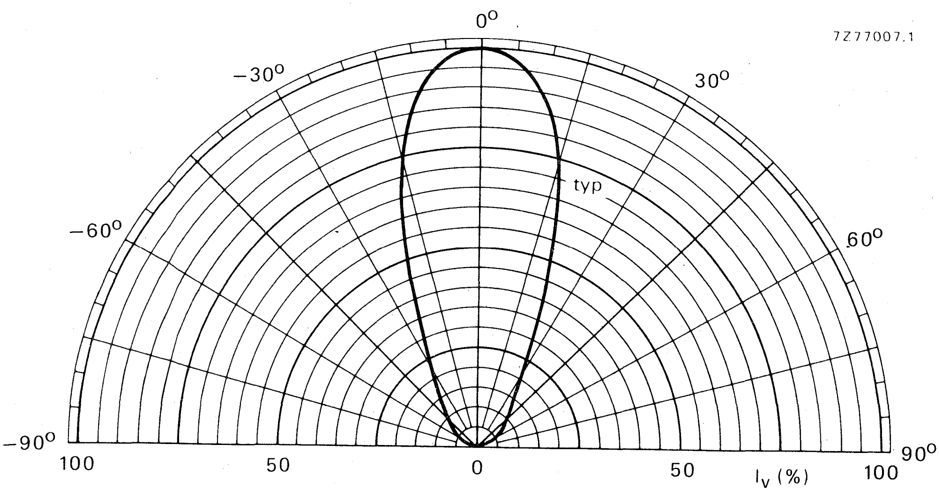

7Z77007.1
0°
−30°
30°
−60°
60°
−90°
90°
typ
100
50
0
50
100
I_v (%)

Fig. 10.

GaP GREEN LIGHT EMITTING DIODE

Gallium phosphide light emitting diode which emits green light when forward biased. Green, light-diffusing plastic envelope.

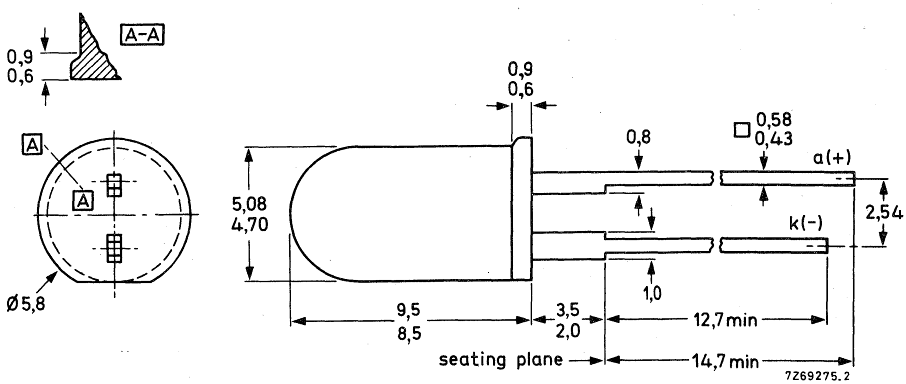
QUICK REFERENCE DATA

Continuous reverse voltage		V_R	max.	3 V
Forward current (d.c.)		I_F	max.	20 mA
Total power dissipation up to T_{amb} = 55 °C		P_{tot}	max.	60 mW
Luminous intensity (on-axis)				
I_F = 10 mA	**CQY94-I**	I_V	>	0,7 mcd
	CQY94-II	I_V	1,0 to	2,2 mcd
	CQY94-III	I_V	1,6 to	3,5 mcd
	CQY94-IV	I_V	>	3,0 mcd
Wavelength at peak emission		λ_{pk}	typ.	560 nm
Beamwidth between half-intensity directions		$\alpha_{50\%}$	typ.	60°

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOD-63.



RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Continuous reverse voltage	V_R	max.	3	V
Forward current (d.c.)	I_F	max.	20	mA
Forward current (peak value)				
$t_p < 1$ ms; $f < 300$ Hz	I_{FM}	max.	60	mA
$t_p < 1$ μs ; $f < 300$ Hz	I_{FM}	max.	1000	mA
Total power dissipation up to T_{amb} = 55 ^oC	P_{tot}	max.	60	mW
Storage temperature	T_{stg}	max.	100	^oC
Junction temperature	T_j	−55 to + 100		^oC
Lead soldering temperature				
> 1,5 mm from the seating plane; $t_{sld} < 7$ s	T_{sld}	max.	230	^oC

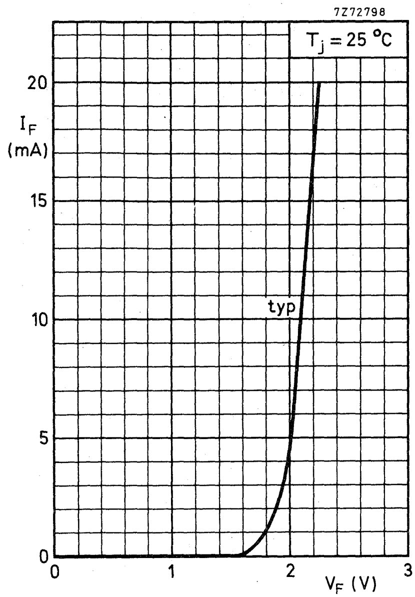
THERMAL RESISTANCE

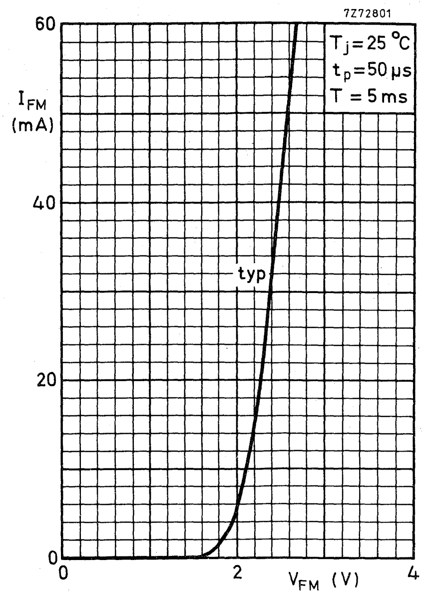
From junction to ambient				
in free air	$R_{th\ j\text{-}a}$	=	750	$^oC/W$
mounted on a printed-circuit board	$R_{th\ j\text{-}a}$	=	500	$^oC/W$

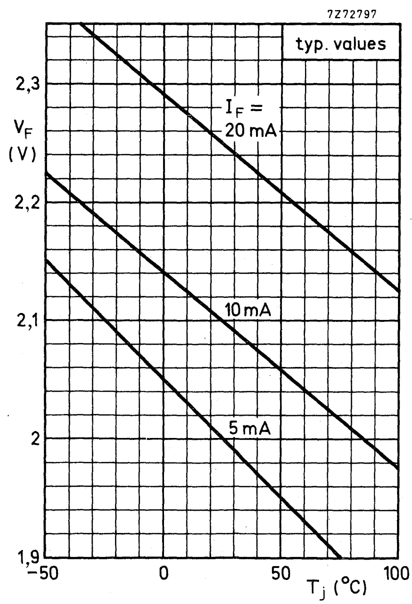
CHARACTERISTICS

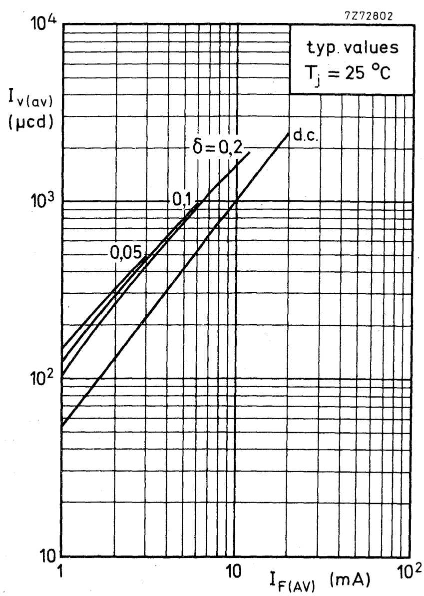
T_j = 25 ^oC unless otherwise specified

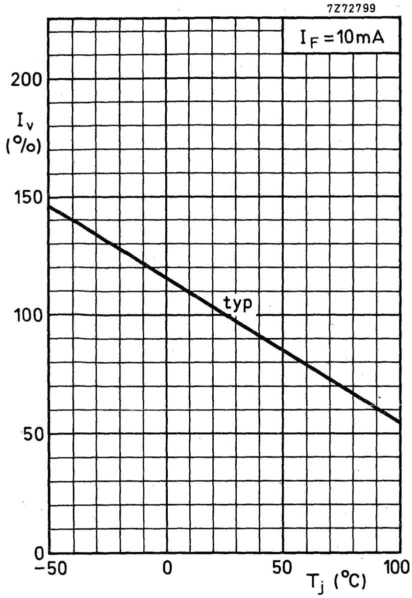
Forward voltage					
I_F = 10 mA		V_F	typ.	2,1	V
			<	3	V
Reverse current					
V_R = 3 V		I_R	<	100	μA
Diode capacitance					
V_R = 0; f = 1 MHz		C_d	typ.	35	pF
→ Luminous intensity (on-axis)					
I_F = 10 mA	**CQY94-I**	I_v	>	0,7	mcd
	CQY94-II	I_v		1,0 to 2,2	mcd
	CQY94-III	I_v		1,6 to 3,5	mcd
	CQY94-IV	I_v	>	3,0	mcd
Wavelength at peak emission		λ_{pk}	typ.	560	nm
Bandwidth at half height		$B_{50\%}$	typ.	30	nm
Beamwidth between half-intensity directions		$\alpha_{50\%}$	typ.	60^o	

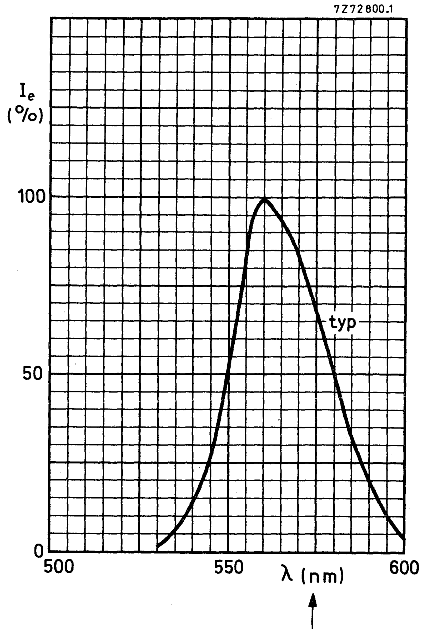

7Z72798
$T_j = 25\ ^\circ C$
20
I_F
(mA)
15
10
5
0
typ
0
1
2
3
V_F (V)

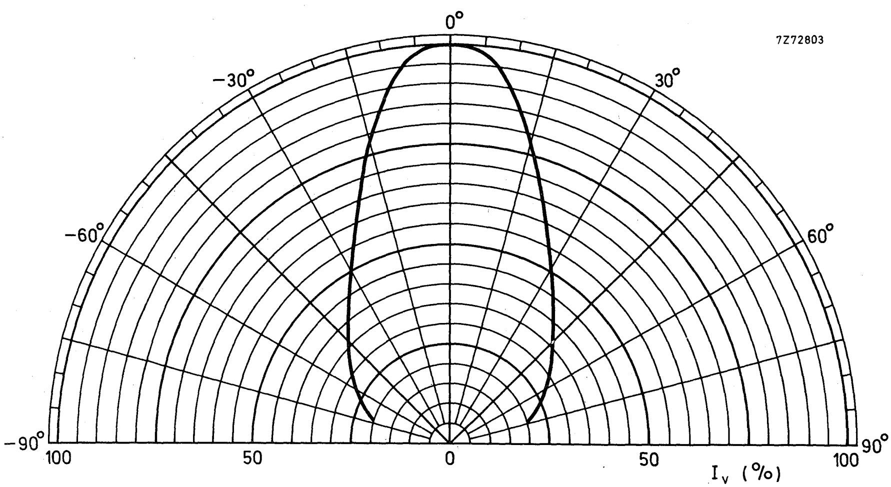

7Z72801
60
$T_j = 25\ ^\circ C$
$t_p = 50\ \mu s$
T = 5 ms
I_{FM}
(mA)
40
typ
20
0
0
2
V_{FM} (V)
4


7Z72797
typ. values
2,3
V_F
(V)
2,2
2,1
2
1,9
I_F =
20 mA
10 mA
5 mA
−50
0
50
100
T_j (°C)


7Z72802
10^4
typ. values
$T_j = 25\ ^\circ C$
$I_{v(av)}$
(µcd)
d.c.
δ = 0,2
10^3
0,1
0,05
10^2
10
1
10
$I_{F(AV)}$ (mA)
10^2


7Z72799
$I_F = 10mA$
200
I_v
(%)
150
100
50
0
typ
−50
0
50
100
T_j (°C)


7Z72800.1
I_e
(%)
100
50
0
typ
500
550
600
λ (nm)


0°
7Z72803
−30°
30°
−60°
60°
−90°
90°
100
50
0
50
100
I_v (%)

GaP GREEN LIGHT EMITTING DIODE

Gallium phosphide light emitting diode which emits green light when forward biased. Green, light-diffusing plastic envelope.

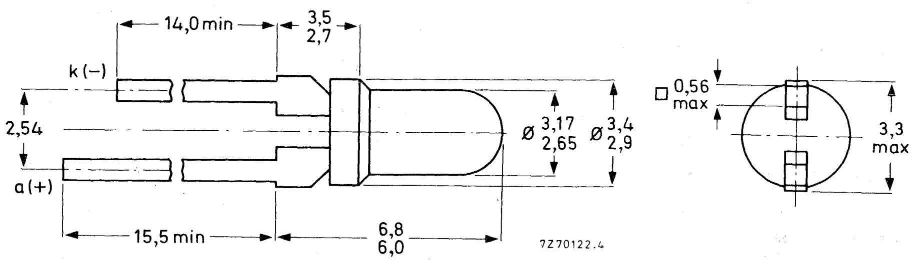
QUICK REFERENCE DATA

Continuous reverse voltage		V_R	max.	3	V
Forward current (d.c.)		I_F	max.	20	mA
Total power dissipation up to T_{amb} = 55 °C		P_{tot}	max.	60	mW
Luminous intensity (on-axis) at I_F = 10 mA	CQY95	I_v	>	0,3	mcd
	CQY95-I	I_v	0,7 to	1,6	mcd
	CQY95-II	I_v	1,0 to	2,2	mcd
	CQY95-III	I_v	>	1,6	mcd
Wavelength at peak emission		λ_{pk}	typ.	560	nm
Beamwidth between half-intensity directions		$\alpha_{50\%}$	typ.	60°	

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOD-53C.



RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Continuous reverse voltage	V_R	max.	3	V
Forward current (d.c.)	I_F	max.	20	mA
Forward current (peak value)				
$t_p < 1$ ms; $f < 300$ Hz	I_{FM}	max.	60	mA
$t_p < 1$ μs ; $f < 300$ Hz	I_{FM}	max.	1000	mA
Total power dissipation up to T_{amb} = 55 °C	P_{tot}	max.	60	mW
Storage temperature	T_{stg}	−55 to + 100		°C
Junction temperature	T_j	max.	100	°C
Lead soldering temperature > 3 mm from the seating plane; $t_{sld} < 7$ s	T_{sld}	max.	230	°C

THERMAL RESISTANCE

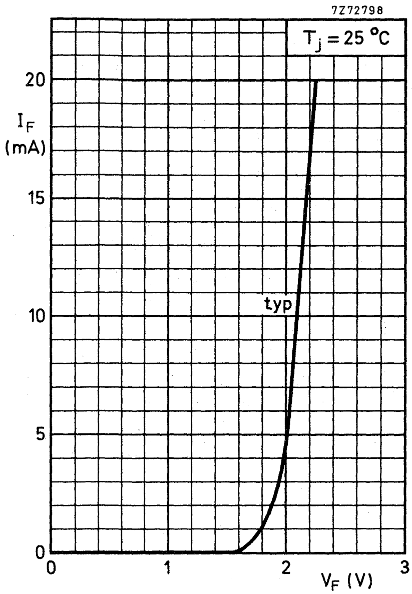
From junction to ambient

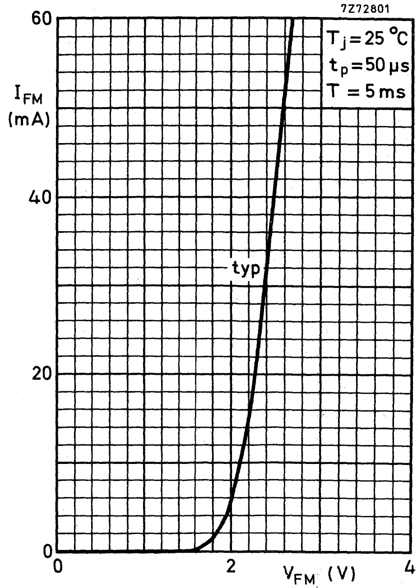
in free air	$R_{th\ j\text{-}a}$	=	0,75	°C/mW
mounted on a printed-circuit board	$R_{th\ j\text{-}a}$	=	0,5	°C/mW

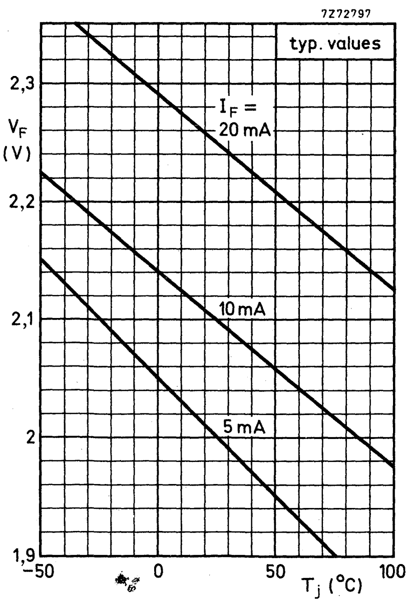
CHARACTERISTICS

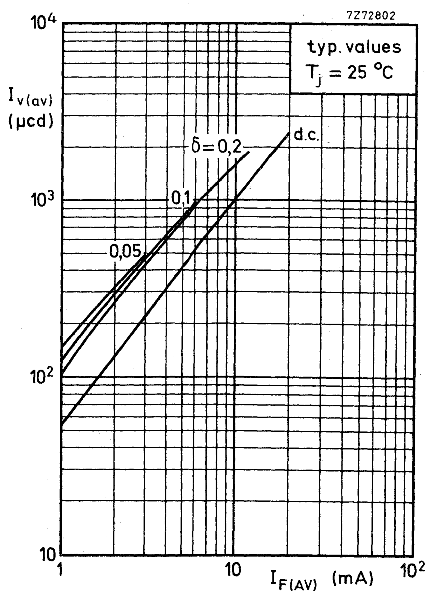
T_j = 25 °C unless otherwise specified

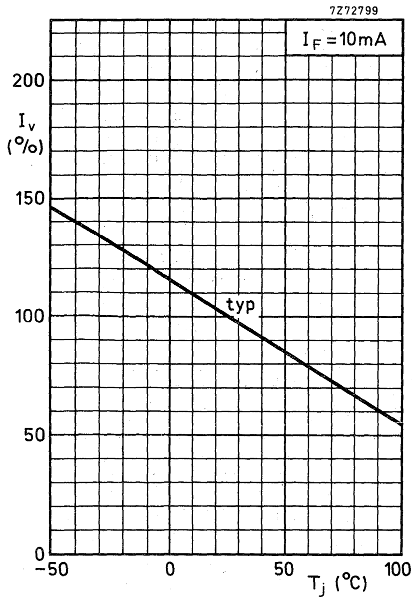
Forward voltage I_F = 10 mA		V_F	typ.	2,1	V
			$<$	3	V
Reverse current V_R = 3 V		I_R	$<$	100	μA
Diode capacitance V_R = 0; f = 1 MHz		C_d	typ.	35	pF
Luminous intensity (on-axis) I_F = 10 mA	CQY95	I_v	$>$	0,3	mcd
	CQY95-I	I_v		0,7 to 1,6	mcd
	CQY95-II	I_v		1,0 to 2,2	mcd
	CQY95-III	I_v	$>$	1,6	mcd
Wavelength at peak emission		λ_{pk}	typ.	560	nm
Bandwidth at half height		$B_{50\%}$	typ.	30	nm
Beamwidth between half-intensity directions		$\alpha_{50\%}$	typ.	60°	

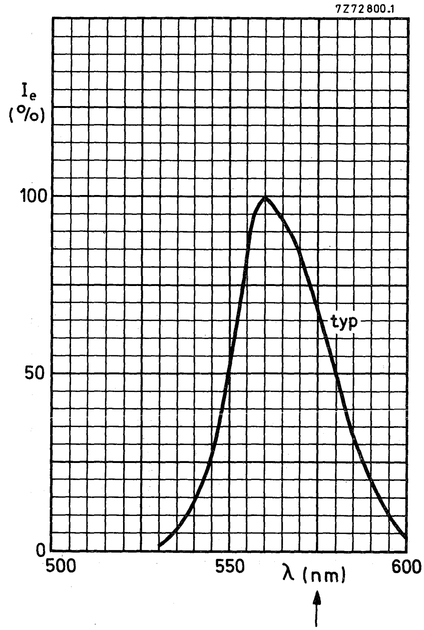

7Z72798
$T_j = 25$ °C
I_F (mA)
20
15
10
5
0
typ
0
1
2
3
V_F (V)

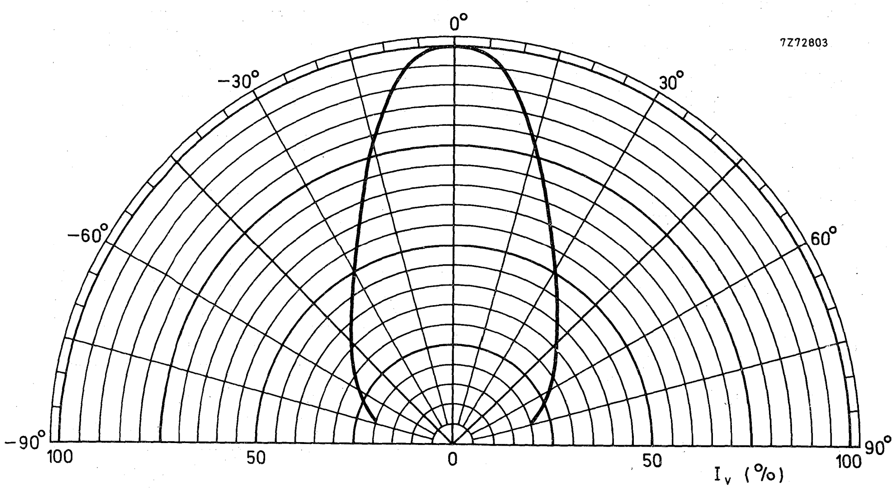

7Z72801
$T_j = 25$ °C
$t_p = 50$ μs
T = 5 ms
I_{FM} (mA)
60
40
20
0
typ
0
2
4
V_{FM} (V)


7Z72797
typ. values
V_F (V)
2,3
2,2
2,1
2
1,9
I_F = 20 mA
10 mA
5 mA
−50
0
50
100
T_j (°C)


7Z72802
typ. values
T_j = 25 °C
$I_{v(av)}$ (μcd)
10^4
10^3
10^2
10
δ = 0,2
0,1
0,05
d.c.
1
10
10^2
$I_{F(AV)}$ (mA)


7Z72799
$I_F = 10 mA$
I_v (%)
200
150
100
50
0
typ
−50
0
50
100
T_j (°C)


7Z72800.1
I_e (%)
100
50
0
typ
500
550
600
λ (nm)


7Z72803
0°
−30°
30°
−60°
60°
−90°
90°
100
50
0
50
100
I_v (%)

GaAsP YELLOW LIGHT EMITTING DIODE

Gallium arsenide phosphide light emitting diode which emits yellow light when forward biased.
Yellow, light-diffusing plastic envelope.

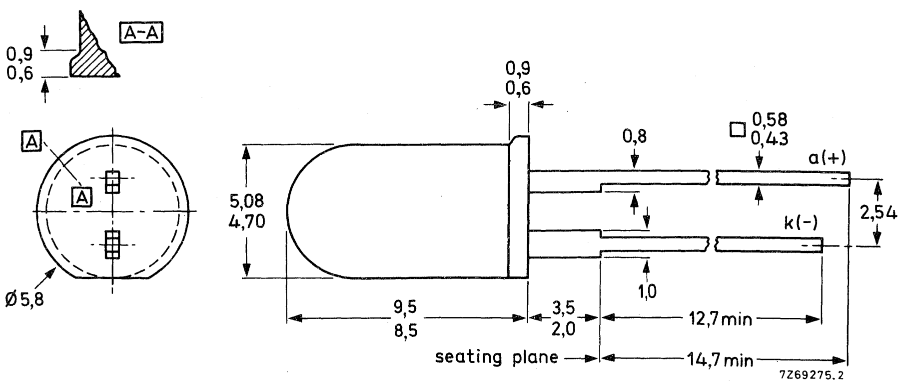
QUICK REFERENCE DATA

Continuous reverse voltage		V_R	max.	3	V
Forward current (d.c.)		I_F	max.	20	mA
Total power dissipation up to T_{amb} = 55 °C		P_{tot}	max.	60	mW
Luminous intensity (on-axis)					
I_F = 10 mA	**CQY96-I**	I_V	>	0,7	mcd
	CQY96-II	I_V	1,0 to	2,2	mcd
	CQY96-III	I_V	1,6 to	3,5	mcd
	CQY96-IV	I_V	>	3,0	mcd
Wavelength at peak emission		λ_{pk}	typ.	590	nm
Beamwidth between half-intensity directions		$\alpha_{50\%}$	typ.	60°	

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOD-63.



RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Continuous reverse voltage	V_R	max.	3 V
Forward current (d.c.)	I_F	max.	20 mA
Forward current (peak value)			
$t_p < 1$ ms; $f < 300$ Hz	I_{FM}	max.	60 mA
$t_p < 1$ μs ; $f < 300$ Hz	I_{FM}	max.	1000 mA
Total power dissipation up to T_{amb} = 55 °C	P_{tot}	max.	60 mW
Storage temperature	T_{stg}	−55 to + 100 °C	
Junction temperature	T_j	max.	100 °C
Lead soldering temperature			
> 1,5 mm from the seating plane; $t_{sld} < 7$ s	T_{sld}	max.	230 °C

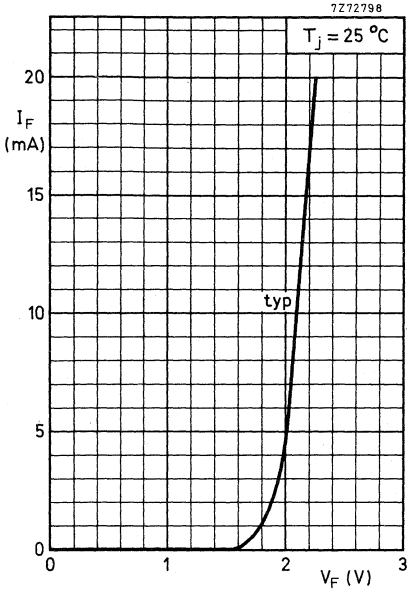
THERMAL RESISTANCE

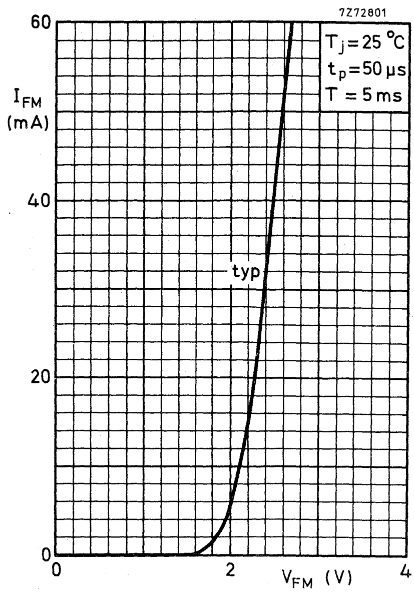
From junction to ambient			
in free air	$R_{th\ j\text{-}a}$	=	750 °C/W
mounted on a printed board	$R_{th\ j\text{-}a}$	=	500 °C/W

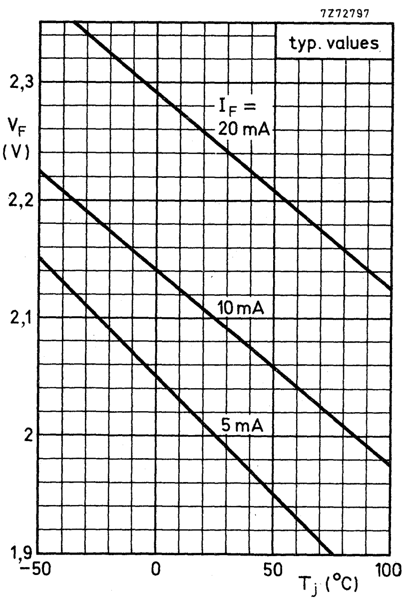
CHARACTERISTICS

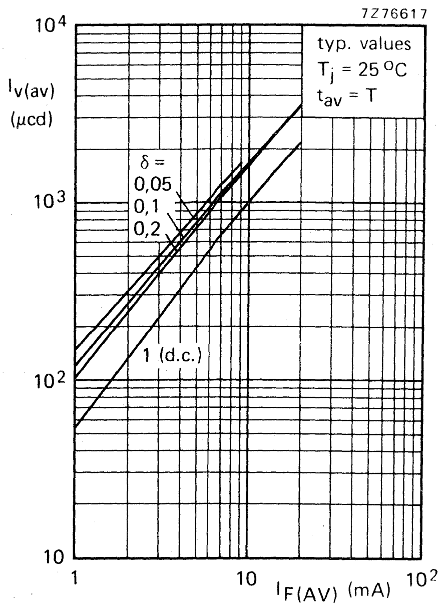
T_j = 25 °C unless otherwise specified

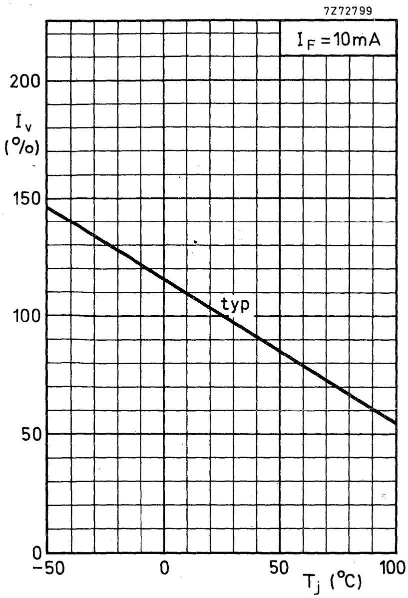
Forward voltage				
I_F = 10 mA		V_F	typ.	2,1 V
			<	3 V
Reverse current				
V_R = 3 V		I_R	<	100 μA
Diode capacitance				
V_R = 0; f = 1 MHz		C_d	typ.	35 pF
→ Luminous intensity (on-axis)				
I_F = 10 mA	**CQY96-I**	I_v	>	0,7 mcd
	CQY96-II	I_v		1,0 to 2,2 mcd
	CQY96-III	I_v		1,6 to 3,5 mcd
	CQY96-IV	I_v	>	3,0 mcd
Wavelength at peak emission		λ_{pk}	typ.	590 nm
Bandwidth at half height		$B_{50\%}$	typ.	38 nm
Beamwidth between half-intensity directions		$\alpha_{50\%}$	typ.	60°

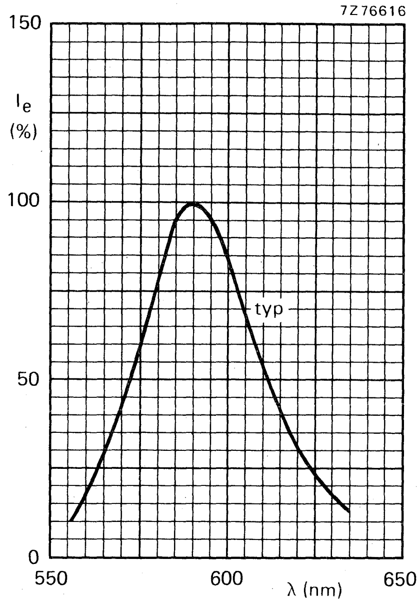

7Z72798
$T_j = 25\ ^{o}C$
20
I_F
(mA)
15
10
5
0
typ
0
1
2
3
V_F (V)

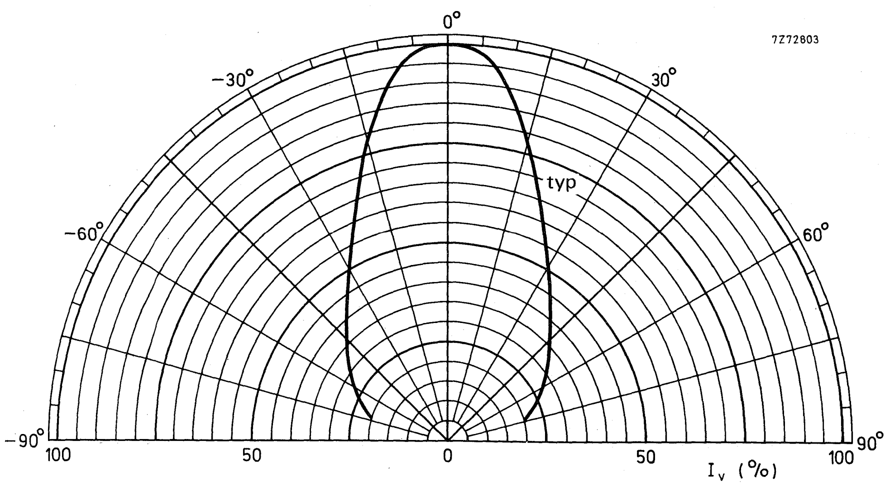

7Z72801
60
$T_j=25\ ^{o}C$
$t_p=50\ \mu s$
T = 5 ms
I_{FM}
(mA)
40
typ
20
0
0
2
V_{FM} (V)
4


7Z72797
typ. values
2,3
V_F
(V)
I_F =
20 mA
2,2
2,1
10 mA
2
5 mA
1,9
−50
0
50
100
T_j (°C)


7Z76617
10^4
typ. values
T_j = 25 °C
t_{av} = T
$I_{v(av)}$
(μcd)
δ =
0,05
0,1
0,2
10^3
1 (d.c.)
10^2
10
1
10
$I_{F(AV)}$ (mA)
10^2


7Z72799
$I_F = 10$ mA
200
I_v
(%)
150
100
50
0
typ
−50
0
50
100
T_j (°C)


7Z76616
150
I_e
(%)
100
50
0
typ
550
600
650
λ (nm)


7Z72803
0°
−30°
30°
−60°
60°
−90°
90°
typ
100
50
0
50
100
I_v (%)

GaAsP YELLOW LIGHT EMITTING DIODE

Gallium arsenide phosphide light emitting diode which emits yellow light when forward biased.
Yellow, light-diffusing plastic envelope.

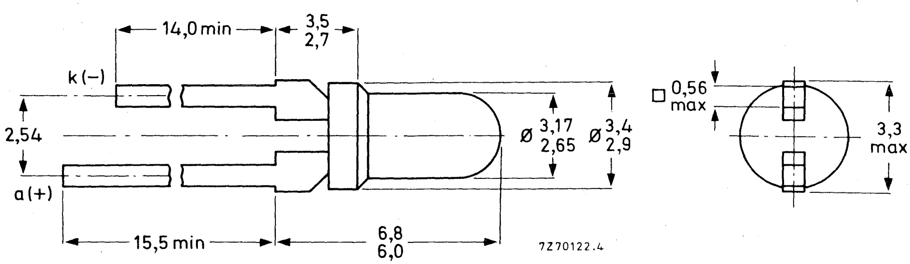
QUICK REFERENCE DATA

Continuous reverse voltage		V_R	max.	3	V
Forward current (d.c.)		I_F	max.	20	mA
Total power dissipation up to T_{amb} = 55 °C		P_{tot}	max.	60	mW
Luminous intensity (on-axis) at I_F = 10 mA	CQY97	I_v	>	0,3	mcd
	CQY97-I	I_v	0,7 to	1,6	mcd
	CQY97-II	I_v	1,0 to	2,2	mcd
	CQY97-III	I_v	>	1,6	mcd
Wavelength at peak emission		λ_{pk}	typ.	590	nm
Beamwidth between half-intensity directions		$\alpha_{50\%}$	typ.	60°	

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOD-53C.



RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Continuous reverse voltage	V_R	max.	3 V
Forward current (d.c.)	I_F	max.	20 mA
Forward current (peak value)			
$t_p < 1$ ms; $f < 300$ Hz	I_{FM}	max.	60 mA
$t_p < 1$ μs ; $f < 300$ Hz	I_{FM}	max.	1000 mA
Total power dissipation up to $T_{amb} = 55$ °C	P_{tot}	max.	60 mW
Storage temperature	T_{stg}		−55 to + 100 °C
Junction temperature	T_j	max.	100 °C
Lead soldering temperature			
> 3 mm from the seating plane; $t_{sld} < 7$ s	T_{sld}	max.	230 °C

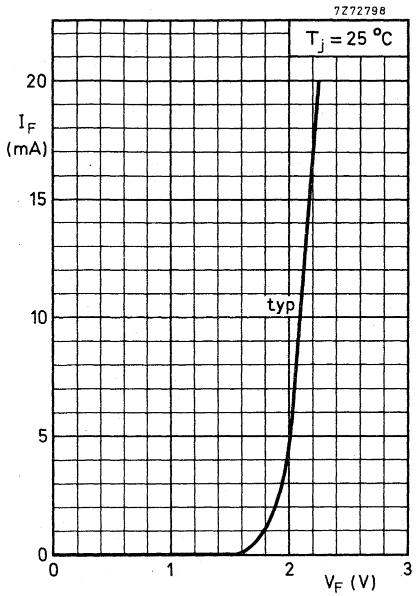
THERMAL RESISTANCE

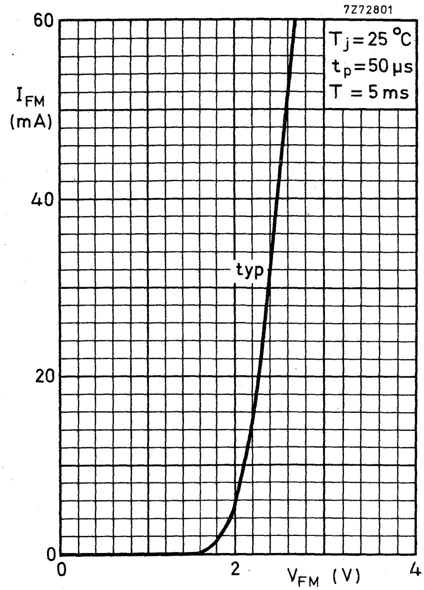
From junction to ambient			
in free air	$R_{th\ j\text{-}a}$	=	0,75 °C/mW
mounted on a printed board	$R_{th\ j\text{-}a}$	=	0,5 °C/mW

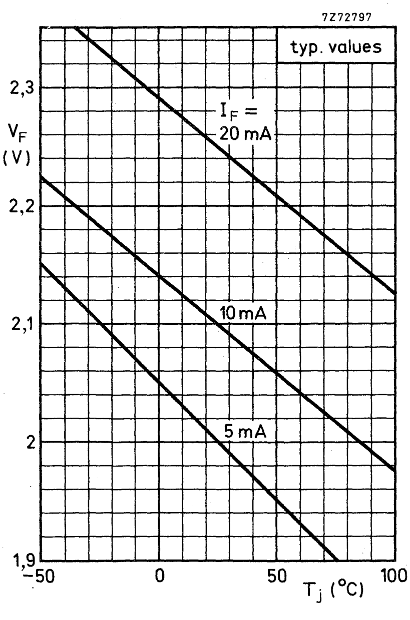
CHARACTERISTICS

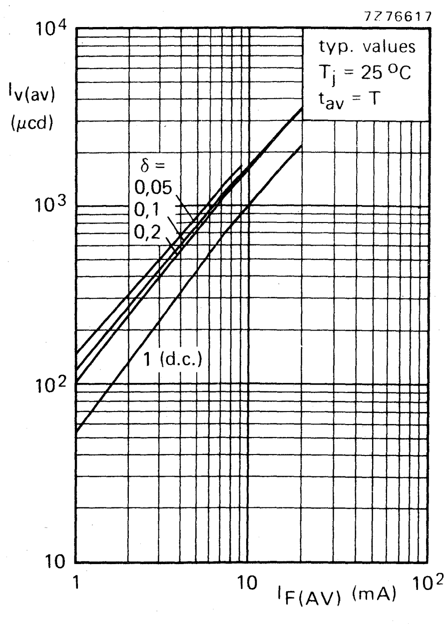
$T_j = 25$ °C unless otherwise specified

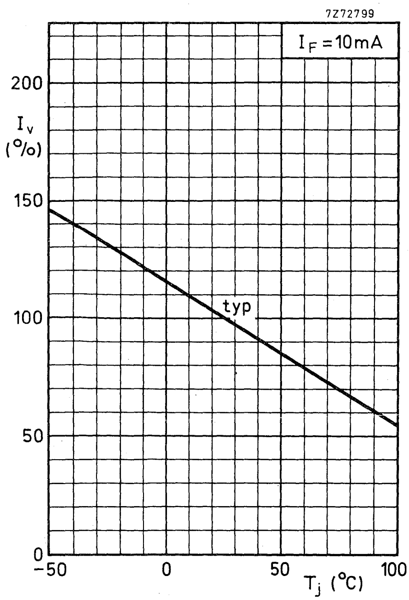
Forward voltage				
$I_F = 10$ mA		V_F	typ.	2,1 V
			<	3 V
Reverse current				
$V_R = 3$ V		I_R	<	100 μA
Diode capacitance				
$V_R = 0$; $f = 1$ MHz		C_d	typ.	35 pF
Luminous intensity (on-axis)				
$I_F = 10$ mA	CQY97	I_v	>	0,3 mcd
	CQY97-I	I_v		0,7 to 1,6 mcd
	CQY97-II	I_v		1,0 to 2,2 mcd
	CQY97-III	I_v	>	1,6 mcd
Wavelength at peak emission		λ_{pk}	typ.	590 nm
Bandwidth at half height		$B_{50\%}$	typ.	38 nm
Beamwidth between half-intensity directions		$\alpha_{50\%}$	typ.	60°

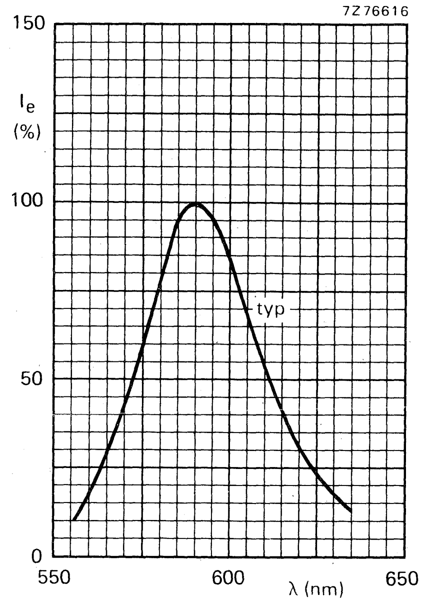

7Z72798
$T_j = 25\ ^\circ C$
I_F (mA)
20
15
10
5
0
0
1
2
3
V_F (V)
typ

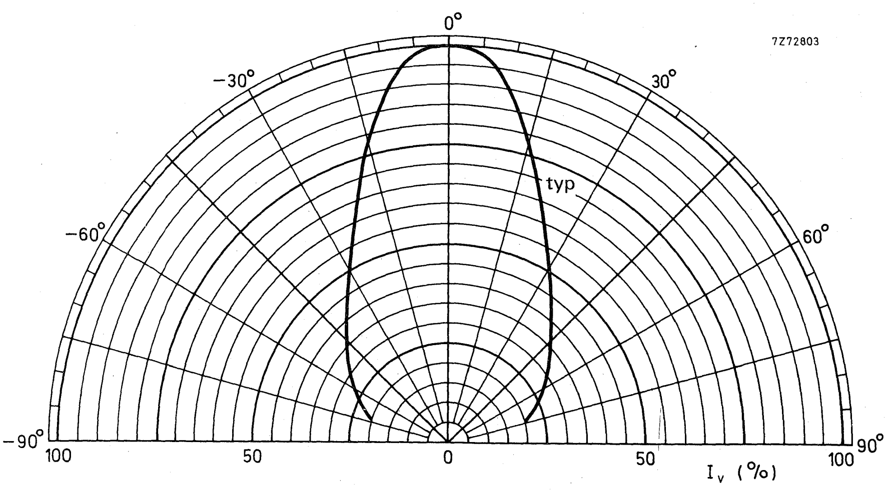

7Z72801
$T_j = 25\ ^\circ C$
$t_p = 50\ \mu s$
$T = 5\ ms$
I_{FM} (mA)
60
40
20
0
0
2
4
V_{FM} (V)
typ


7Z72797
typ. values
V_F (V)
2,3
2,2
2,1
2
1,9
−50
0
50
100
T_j (°C)
I_F = 20 mA
10 mA
5 mA


7Z76617
typ. values
$T_j = 25\ ^\circ C$
$t_{av} = T$
$I_{v(av)}$ (μcd)
10^4
10^3
10^2
10
1
10
10^2
$I_{F(AV)}$ (mA)
δ =
0,05
0,1
0,2
1 (d.c.)


7Z72799
$I_F = 10 mA$
200
I_v
(%)
150
100
typ
50
0
−50
0
50
100
T_j (°C)


7Z76616
150
I_e
(%)
100
typ
50
0
550
600
650
λ (nm)


0°
7Z72803
−30°
30°
typ
−60°
60°
−90°
90°
100
50
0
50
100
I_v (%)

DISPLAYS

1½-DIGIT RED LED DISPLAY

The display has the following features:

- One and a half 12,7 mm (½") high red colour digits readout display.
- GaP type red light emitting crystal with low power consumption.
- Series connection for low current consumption.
- Wide operating segment current (d.c.) range from 1 mA to 20 mA.
- Each segment performs a diffused and uniform display with high contrast through filtering function of lens cap.
- Highly legible arabic numerals with wide viewing angle.
- Solid state reliability and long operational life.
- The SAB3064 is recommended as driver circuit.

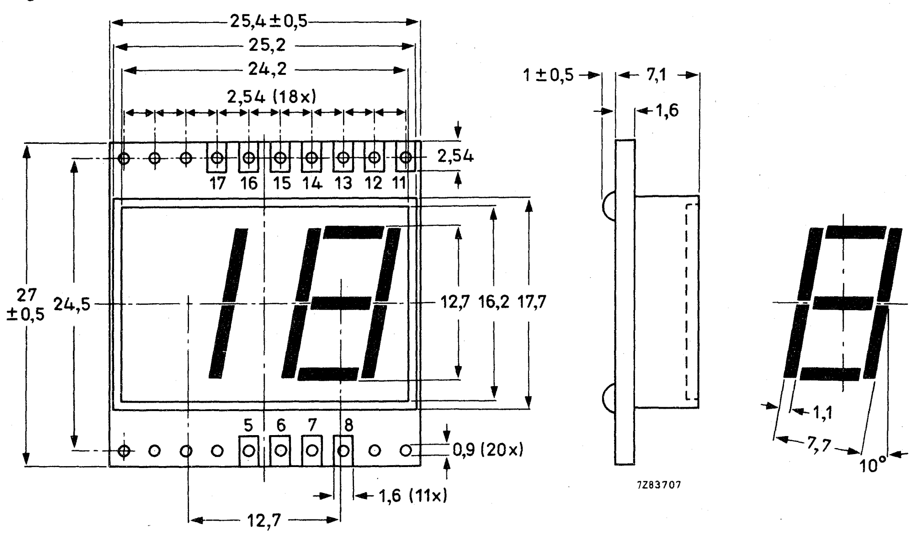
QUICK REFERENCE DATA

Continuous reverse voltage	V_R	max.	3	V
Forward current (d.c.) per segment	I_F	max.	20	mA
Luminous intensity (of segment, normal to surface) I_F = 5 mA	I_v	typ.	100	μcd
Wavelength at peak emission	λ_{pk}	typ.	700	nm

MECHANICAL DATA

Dimensions in mm

Fig. 1.



NOTE
Tolerance ± 0,25 mm unless otherwise specified.

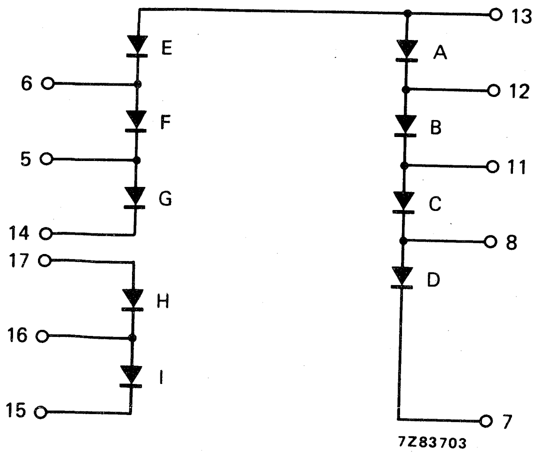


Fig. 2 Circuit diagram.

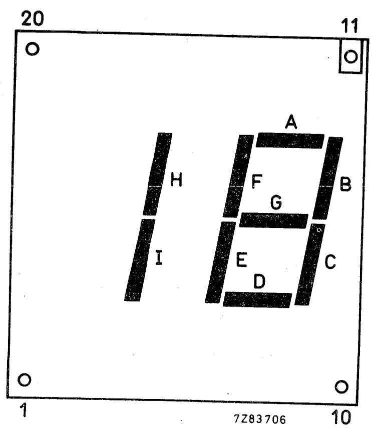


Fig. 3 Indication of segments per digit.
(See also terminal connection table below).

TERMINAL CONNECTION TABLE (see Figs 1, 2 and 3)

address	segment	cathode terminal number	anode terminal number
unit digit	A	12	13
	B	11	12
	C	8	11
	D	7	8
	E	6	13
	F	5	6
	G	14	5
10 s digit	H	16	17
	I	15	16

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Continuous reverse voltage	V_R	max.	3	V
Forward current (d.c.) per segment	I_F	max.	20	mA
Storage temperature	T_{stg}	−40 to + 75		^oC
Operating junction temperature	T_j	−20 to + 60		^oC
Soldering temperature at 3 mm from reflector edge; $t_{sld} \leqslant 3$ s	T_{sld}	max.	260	^oC

CHARACTERISTICS (single segment)

$T_{amb} = 25\ ^oC$

Forward voltage $I_F = 10$ mA	V_F	typ.	2,0	V
			1,7 to 2,3	V
Reverse current $V_R = 3$ V	I_R	<	5	μA
Luminous intensity (normal to surface) $I_F = 5$ mA	I_v	typ.	100	μcd
$I_F = 10$ mA	I_v	>	100	μcd
		typ.	160	μcd
Intensity matching ratio $I_F = 5$ mA		<	2,5	
Wavelength at peak emission $I_F = 5$ mA	λ_{pk}	typ.	700	nm
Bandwidth at half height $I_F = 5$ mA	$B_{50\%}$	typ.	100	nm

DEVELOPMENT SAMPLE DATA

NOTES

Avoid immersing the whole display in liquid.

Avoid contact with chlorinated solvents. Recommended cleaning solvents for flux and stain contamination, Freon TE or TF and methyl alcohol.

Except for the printed-wiring board, avoid heating the display above 75 ^oC.

2-DIGIT SUPER-RED LED DISPLAYS

The displays have the following features:

- Two 12,7 mm (½") high super-red colour digits readout display.
- Configuration in dynamic multiplex drive connections.
- Wide operating segment current (d.c.) range from 1 mA to 20 mA.
- Each segment performs a diffused and uniform display with high contrast through filtering function of lens cap.
- Highly legible arabic numerals with wide viewing angle.
- Solid state reliability and long operational life.

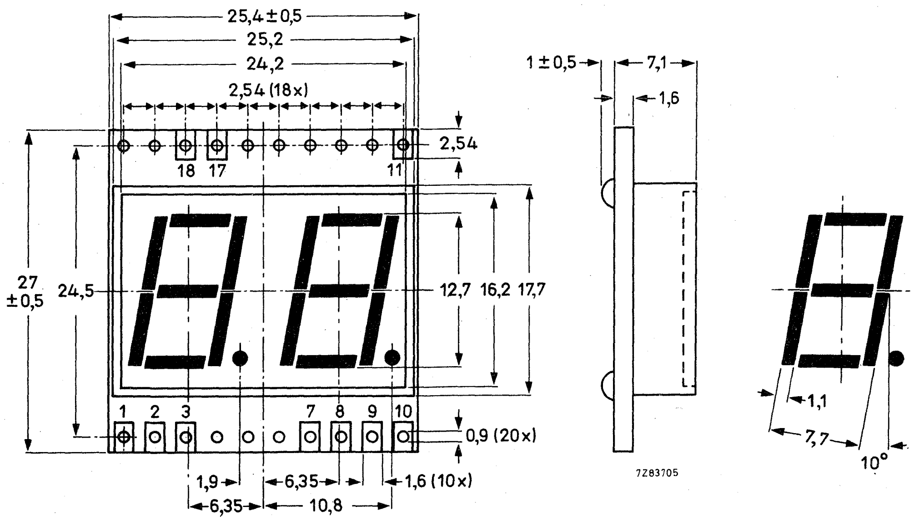
QUICK REFERENCE DATA

Continuous reverse voltage	V_R	max.	3	V
Forward current (d.c.) per segment	I_F	max.	20	mA
Luminous intensity (of segment, normal to surface) $I_F = 5$ mA	I_v	typ.	50	μcd
Wavelength at peak emission	λ_{pk}	typ.	630	nm

MECHANICAL DATA

Dimensions in mm

Fig. 1.



NOTE
Tolerance ± 0,25 mm unless otherwise specified.

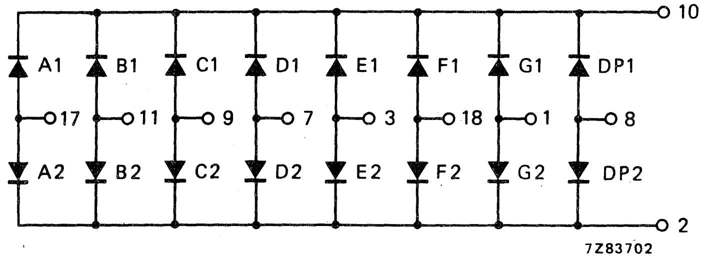


Fig. 2a Circuit diagram **CQ216X** (common cathode).

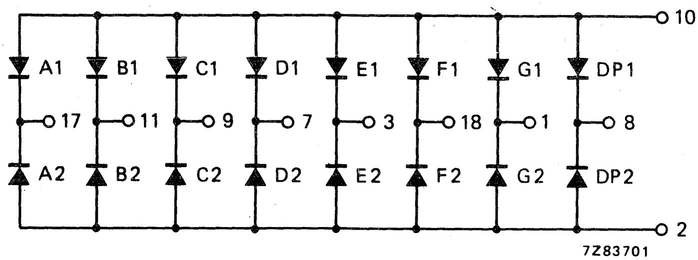


Fig. 2b Circuit diagram **CQ216Y** (common anode).

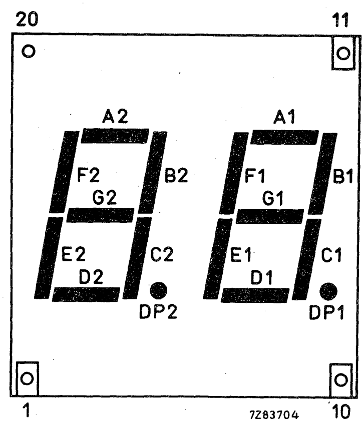


Fig. 3 Indication of segments per digit. (See also connection table on next page.)

DEVELOPMENT SAMPLE DATA

TERMINAL CONNECTION TABLE (see Figs 1, 2a, 2b and 3)

address	segment	terminal number	address	segment	terminal number
10s digit	A2	17	unit digit	A1	17
	B2	11		B1	11
	C2	9		C1	9
	D2	7		D1	7
	E2	3		E1	3
	F2	18		F1	18
	G2	1		G1	1
	DP2	8		DP1	8
	common	2		common	10

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Continuous reverse voltage	V_R	max.	3 V
Forward current (d.c.) per segment	I_F	max.	20 mA
Storage temperature	T_{stg}	−40 to + 75 °C	
Operating junction temperature	T_j	−20 to + 60 °C	
Soldering temperature at 3 mm from reflector edge; $t_{sld} \leqslant 3$ s	T_{sld}	max.	260 °C

CHARACTERISTICS (single segment)

$T_{amb} = 25$ °C

Forward voltage $I_F = 10$ mA	V_F	typ.	1,9 V
			1,6 to 2,2 V
Reverse current $V_R = 3$ V	I_R	<	5 μA
Luminous intensity (normal to surface) $I_F = 5$ mA	I_v	typ.	50 μcd
$I_F = 10$ mA	I_v	>	70 μcd
		typ.	100 μcd
Intensity matching ratio $I_F = 5$ mA		<	2,5
Wavelength at peak emission $I_F = 5$ mA	λ_{pk}	typ.	630 nm
Bandwidth at half height $I_F = 5$ mA	$B_{50\%}$	typ.	100 nm

NOTES

Avoid immersing the whole display in liquid.

Avoid contact with chlorinated solvents. Recommended cleaning solvents for flux and stain contamination, Freon TE or TF and methyl alcohol.

Except for the printed-wiring board, avoid heating the display above 75 °C.

4-DIGIT LED CLOCK DISPLAYS

The displays, primarily designed for applications where compactness is of prime importance, have the following features:

- Four 15 mm high red colour digit readout clock display.
- Common anode or cathode configuration for use in static drive connections.
- Wide operating segment current (d.c.) range from 5 mA to 20 mA.
- Each segment performs a diffused and uniform display with high contrast.
- Display with dull surface free from undesirable glare or reflections.
- Highly legible arabic numerals with wide viewing angle.
- Display format available for 12 or 24 hours.
- Solid state reliability and long operational life.

QUICK REFERENCE DATA

Continuous reverse voltage	V_R	max.	3	V
Forward current (d.c.) per segment	I_F	max.	20	mA
Luminous intensity (of segment, normal to surface) I_F = 5 mA	I_v	typ.	200	μcd
Wavelength at peak emission	λ_{pk}	typ.	700	nm

7Z85306

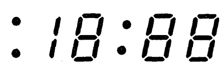
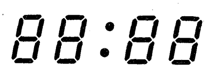
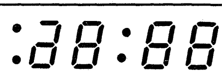
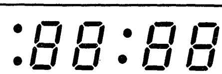
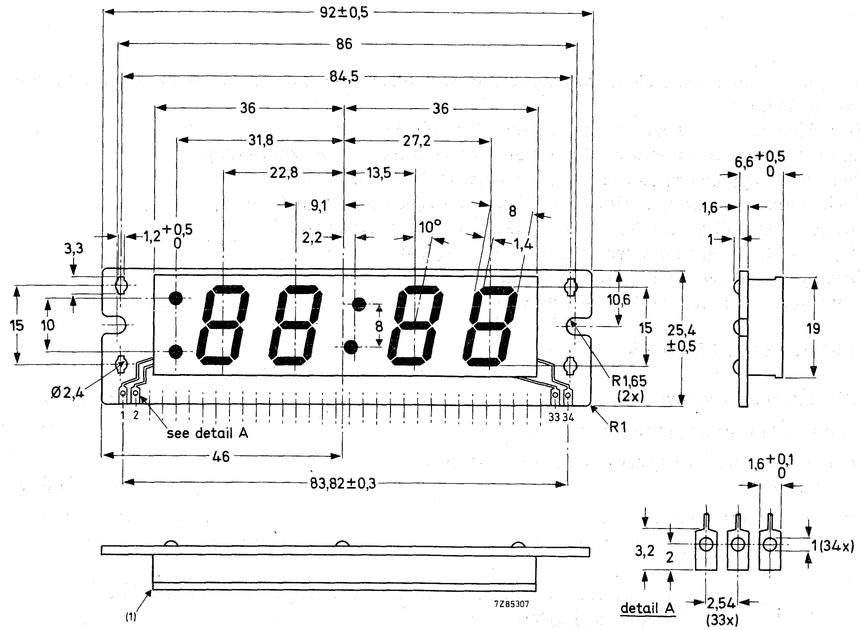
TYPE NUMBER		FULLY DISPLAYED FONT
common cathode	common anode	
CQ327	CQ327R	
CQ330	CQ330R	
CQ331	CQ331R	
CQ332	CQ332R	

Fig. 1.

MECHANICAL DATA

Dimensions in mm

Fig. 2.



(1) Slip-out tolerance with light diffusing film and reflector is + 0,5 mm at each side.

NOTE
Tolerance ± 0,25 mm unless otherwise specified.

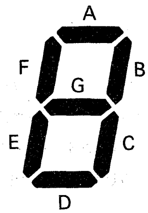


Fig. 3 Indication of segments per digit. (See also Fig. 2 and terminal connection table.)

TERMINAL CONNECTION TABLE (see Figs 2 and 3)

terminal number	address		**CQ327 CQ327R**	**CQ330 CQ330R**	**CQ331 CQ331R**	**CQ332 CQ332R**
1	common		common for all segments, colon and dots			
2	p.m. dot		c	n.c.	c	c
3	a.m. dot		c	n.c.	c	c
4	A	**10s hour digit**	n.c.	c	c	c
5	F		n.c.	c	n.c.	c
6	G		n.c.	c	c	c
7	E		n.c.	c	c	c
8	D		n.c.	c	c	c
9	C		c	c	c	c
10	B		c	c	c	c
11	F	**unit hour digit**	c	c	c	c
12	G		c	c	c	c
13	A		c	c	c	c
14	B		c	c	c	c
15	E		c	c	c	c
16	D		c	c	c	c
17	C		c	c	c	c
18	upper dot of colon		c	c	c	c
19	lower dot of colon		c	c	c	c
20	F	**10s minute digit**	c	c	c	c
21	G		c	c	c	c
22	A		c	c	c	c
23	B		c	c	c	c
24	D		c	c	c	c
25	E		c	c	c	c
26	C		c	c	c	c
27	F	**unit minute digit**	c	c	c	c
28	G		c	c	c	c
29	A		c	c	c	c
30	B		c	c	c	c
31	E		c	c	c	c
32	D		c	c	c	c
33	C		c	c	c	c
34	common		common for all segments, colon and dots			

DEVELOPMENT SAMPLE DATA

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Continuous reverse voltage	V_R	max.	3 V
Forward current (d.c.) per segment	I_F	max.	20 mA
Storage temperature	T_{stg}		−40 to + 75 °C
Operating junction temperature	T_j		−20 to + 60 °C
Soldering temperature at 3 mm from reflector edge; $t_{sld} \leqslant 3$ s	T_{sld}	max.	260 °C

CHARACTERISTICS (single segment)

$T_{amb} = 25$ °C

Forward voltage $I_F = 10$ mA	V_F	typ.	2,0 V
			1,7 to 2,3 V
Reverse current $V_R = 3$ V	I_R	<	5 μA
Luminous intensity (normal to surface) $I_F = 5$ mA	I_v	typ.	200 μcd
$I_F = 10$ mA	I_v	>	200 μcd
		typ.	400 μcd
Intensity matching ratio $I_F = 5$ mA		<	2,5
Wavelength at peak emission $I_F = 5$ mA	λ_{pk}	typ.	700 nm
Bandwidth at half height $I_F = 5$ mA	$B_{50\%}$	typ.	100 nm

NOTES

Avoid immersing the whole display in liquid.

Avoid contact with chlorinated solvents. Recommended cleaning solvents for flux and stain contamination, Freon TE or TF and methyl alcohol.

Except for the printed-wiring board, avoid heating the display above 75 °C.

4-DIGIT LED CLOCK DISPLAYS

The displays, with the overall dimensions 33,5 mm x 90 mm, have the following features:

- Four 15 mm high red colour digit readout clock display.
- Common anode or cathode configuration for use in static drive connections.
- Wide operating segment current (d.c.) range from 5 mA to 20 mA.
- Each segment performs a diffused and uniform display with high contrast through filtering function of lens cap.
- Highly legible arabic numerals with wide viewing angle.
- Display format available for 12 or 24 hours.
- Solid state reliability and long operational life.

QUICK REFERENCE DATA

Continuous reverse voltage	V_R	max.	3	V
Forward current (d.c.) per segment	I_F	max.	20	mA
Luminous intensity (of segment, normal to surface) I_F = 5 mA	I_v	typ.	100	μcd
Wavelength at peak emission	λ_{pk}	typ.	700	nm

7Z75887.1

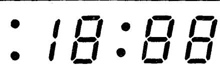
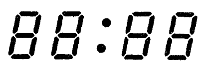
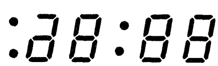
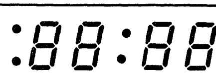
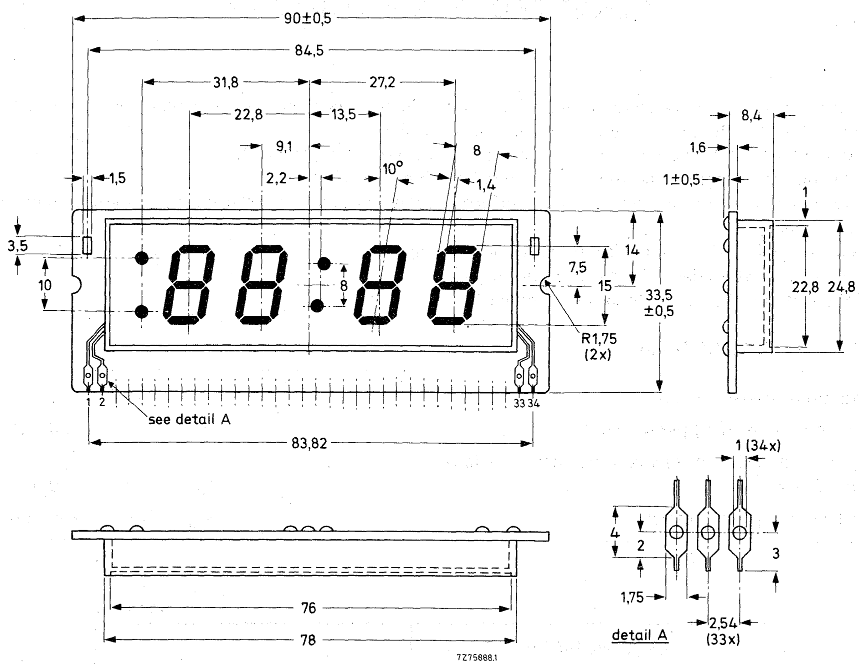
TYPE NUMBER		FULLY DISPLAYED FONT
common cathode	common anode	
CQ427	CQ427R	
CQ430	CQ430R	
CQ431	CQ431R	
CQ432	CQ432R	

Fig. 1.

MECHANICAL DATA

Dimensions in mm

Fig. 2.



NOTE
Tolerance ± 0,25 mm unless otherwise specified.

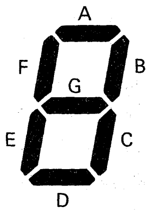


Fig. 3 Indication of segments per digit. (See also Fig. 2 and terminal connection table.)

TERMINAL CONNECTION TABLE (see Figs 2 and 3)

terminal number	address		**CQ427 CQ427R**	**CQ430 CQ430R**	**CQ431 CQ431R**	**CQ432 CQ432R**
1	common		common for all segments, colon and dots			
2	p.m. dot		c	n.c.	c	c
3	a.m. dot		c	n.c.	c	c
4	A	**10s hour digit**	n.c.	c	c	c
5	F		n.c.	c	n.c.	c
6	G		n.c.	c	c	c
7	E		n.c.	c	c	c
8	D		n.c.	c	c	c
9	C		c	c	c	c
10	B		c	c	c	c
11	F	**unit hour digit**	c	c	c	c
12	G		c	c	c	c
13	A		c	c	c	c
14	B		c	c	c	c
15	E		c	c	c	c
16	D		c	c	c	c
17	C		c	c	c	c
18	upper dot of colon		c	c	c	c
19	lower dot of colon		c	c	c	c
20	F	**10s minute digit**	c	c	c	c
21	G		c	c	c	c
22	A		c	c	c	c
23	B		c	c	c	c
24	D		c	c	c	c
25	E		c	c	c	c
26	C		c	c	c	c
27	F	**unit minute digit**	c	c	c	c
28	G		c	c	c	c
29	A		c	c	c	c
30	B		c	c	c	c
31	E		c	c	c	c
32	D		c	c	c	c
33	C		c	c	c	c
34	common		common for all sefments, colon and dots			

DEVELOPMENT SAMPLE DATA

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Continuous reverse voltage	V_R	max.	3 V
Forward current (d.c.) per segment	I_F	max.	20 mA
Storage temperature	T_{stg}		−40 to + 75 °C
Operating junction temperature	T_j		−20 to + 60 °C
Soldering temperature at 3 mm from reflector edge; $t_{sld} \leq 3$ s	T_{sld}	max.	260 °C

CHARACTERISTICS (single segment)

$T_{amb} = 25$ °C

Forward voltage $I_F = 10$ mA	V_F	typ.	2,0 V
			1,7 to 2,3 V
Reverse current $V_R = 3$ V	I_R	<	5 μA
Luminous intensity (normal to surface) $I_F = 5$ mA	I_v	typ.	100 μcd
$I_F = 10$ mA	I_v	>	100 μcd
		typ.	160 μcd
Intensity matching ratio $I_F = 5$ mA		<	2,5
Wavelength at peak emission $I_F = 5$ mA	λ_{pk}	typ.	700 nm
Bandwidth at half height $I_F = 5$ mA	$B_{50\%}$	typ.	100 nm

NOTES

Avoid immersing the whole display in liquid.

Avoid contact with chlorinated solvents. Recommended cleaning solvents for flux and stain contamination, Freon TE or TF and methyl alcohol.

Except for the printed-wiring board, avoid heating the display above 75 °C.

PHOTOCOUPLERS

HIGH-VOLTAGE PHOTOCOUPLER

Optically coupled isolator consisting of an infrared emitting GaAs diode and a silicon n-p-n phototransistor without accessible base.

Features of this product:
- very high isolation voltage of 10 kV (d.c.).
- working voltage of 10 kV (d.c.).

QUICK REFERENCE DATA

Diode				
Continuous reverse voltage	V_R	max.	5	V
Forward current				
d.c.	I_F	max.	100	mA
(peak value); t_p = 10 μs; δ = 0,1	I_{FM}	max.	1000	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	100	mW
Transistor				
Collector-emitter voltage (open base)	V_{CEO}	max.	30	V
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	100	mW
Photocoupler				
Output/input d.c. current transfer ratio I_F = 10 mA; V_{CE} = 0,4 V; (I_B = 0)	I_C/I_F	>	0,2	
Collector cut-off current (dark) V_{CC} = 10 V; working voltage (d.c.) = 10 kV diode: I_F = 0 (see also Fig. 4)	I_{CEW}	<	200	nA
Isolation voltage (d.c.)	V_{IO}	>	10	kV

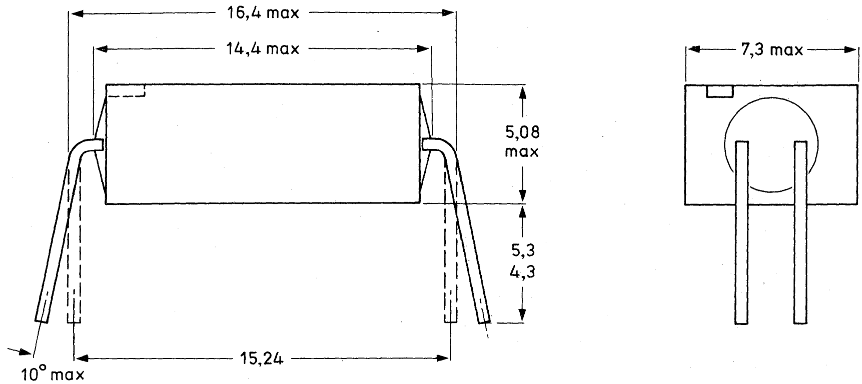
MECHANICAL DATA

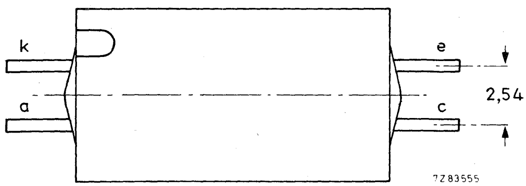
See Fig. 1.

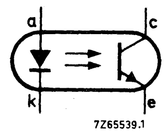
MECHANICAL DATA

Dimensions in mm

Fig. 1







RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Diode

Continuous reverse voltage	V_R	max.	5	V
Forward current				
d.c.	I_F	max.	100	mA
(peak value); t_p = 10 μs; δ – 0,1	I_{FM}	max.	1000	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	100	mW

Transistor

Collector-emitter voltage (open base)	V_{CEO}	max.	30	V
Emitter-collector voltage (open base)	V_{ECO}	max.	7	V
Collector current				
d.c.	I_C	max.	25	mA
peak value	I_{CM}	max.	50	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	100	mW

DEVELOPMENT SAMPLE DATA

Photocoupler

Storage temperature	T_{stg}	−55 to + 100	°C
Junction temperature	T_j	max. 100	°C
Lead soldering temperature up to the seating plane; $t_{sld} < 10$ s	T_{sld}	max. 260	°C

THERMAL RESISTANCE

From junction to ambient in free air

diode	$R_{th\,j\text{-}a}$	= 750	°C/W
transistor	$R_{th\,j\text{-}a}$	= 750	°C/W

CHARACTERISTICS

$T_j = 25$ °C unless otherwise specified

Diode

Forward voltage $I_F = 10$ mA	V_F	typ.	1,2	V
		<	1,5	V
Reverse current $V_R = 5$ V	I_R	<	100	μA

Transistor

Collector cut-off current (dark) $V_{CE} = 10$ V	I_{CEO}	typ.	5	nA
		<	50	nA

Photocoupler ($I_B = 0$)*

Output/input d.c. current transfer ratio $I_F = 10$ mA; $V_{CE} = 0,4$ V	I_C/I_F	>	0,2	
Collector-emitter saturation voltage $I_F = 10$ mA; $I_C = 2$ mA	V_{CEsat}	typ.	0,4	V
Isolation voltage, d.c. value	V_{IO}	>	10	kV
Capacitance between input and output $I_F = 0$; $V = 0$; $f = 1$ MHz	C_{io}	typ.	1	pF
Insulation resistance between input and output $\pm V_{IO} = 1$ kV	r_{IO}	>	10^{11}	Ω
		typ.	10^{12}	Ω

* Where the phototransistor receives light from the diode the O (for open base) has been omitted from the symbols.

Switching times (see Figs 2 and 3)

I_{Con} = 2 mA; V_{CC} = 20 V; R_L = 100 Ω

Rise time	t_r	typ.	3 μs
Fall time	t_f	typ.	2,5 μs

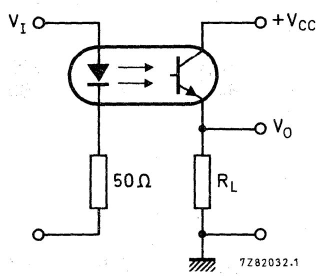


Fig. 2 Switching circuit.

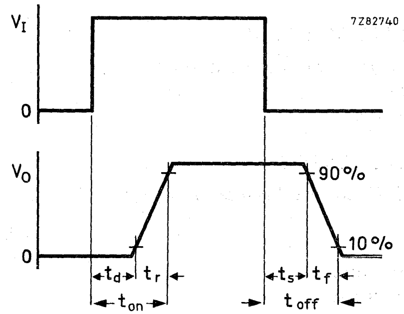


Fig. 3 Waveforms.

Collector cut-off current (dark) see Fig. 4

V_{CC} = 10 V; working voltage (d.c.) = 10 kV — I_{CEW} < 200 nA*

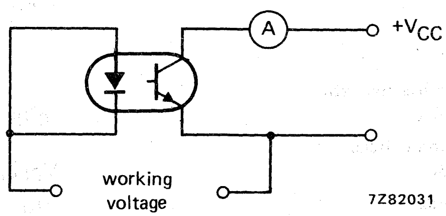


Fig. 4.

* As quality assurance (on a sample basis), these parameters are covered by a 1000 h reliability test.

DEVELOPMENT SAMPLE DATA

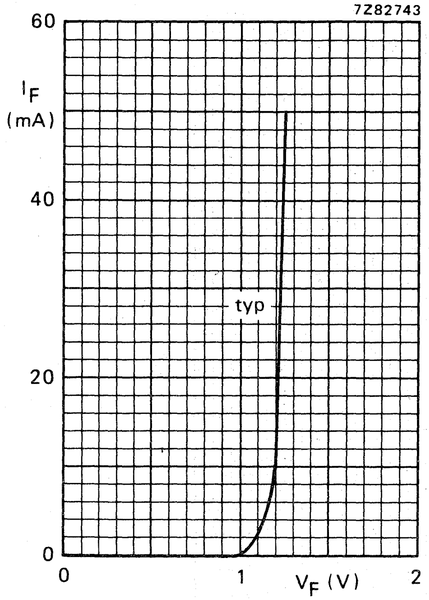


Fig. 5 T_j = 25 °C.

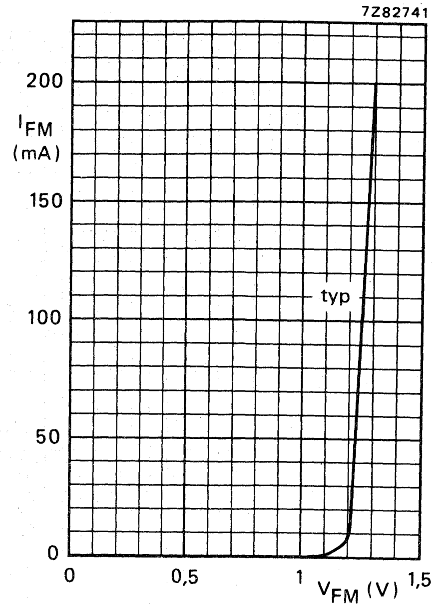


Fig. 6 T_{amb} = 25 °C; t_p = 10 μs; T = 1 ms.

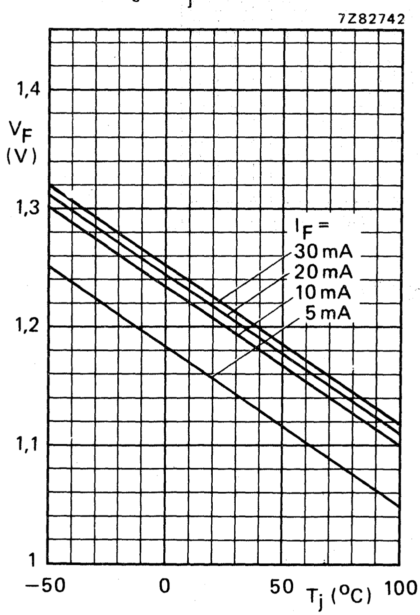


Fig. 7 Typical values.

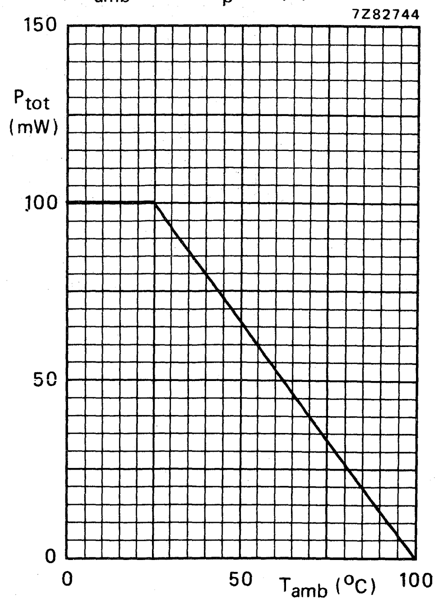


Fig. 8 Power derating curve for diode and transistor versus ambient temperature.

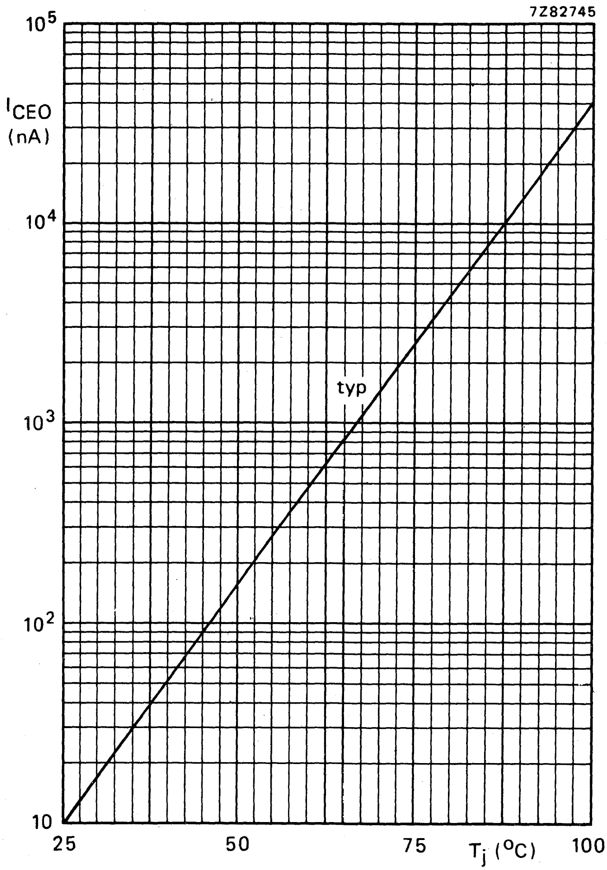


Fig. 9 $I_F = 0$; $V_{CE} = 20$ V.

DEVELOPMENT SAMPLE DATA

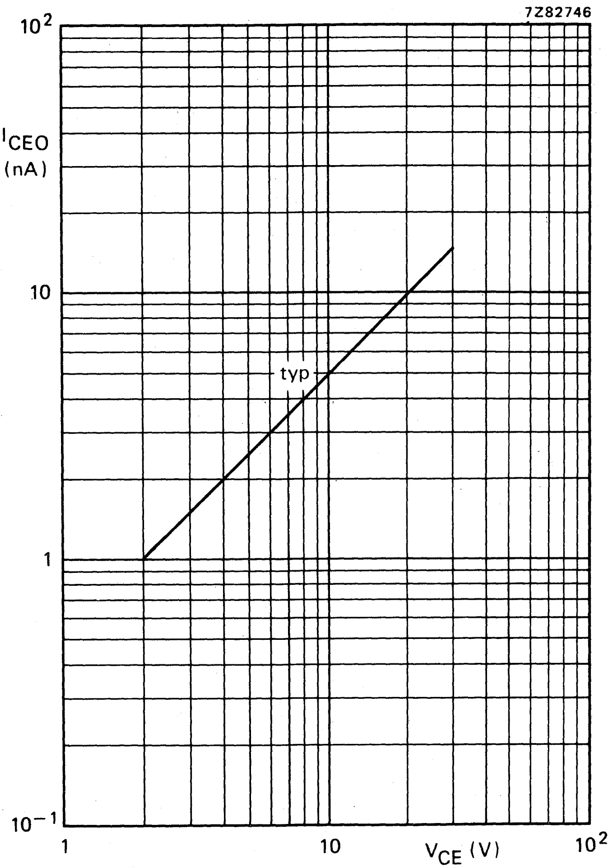


Fig. 10 $I_F = 0$; $T_j = 25$ °C.

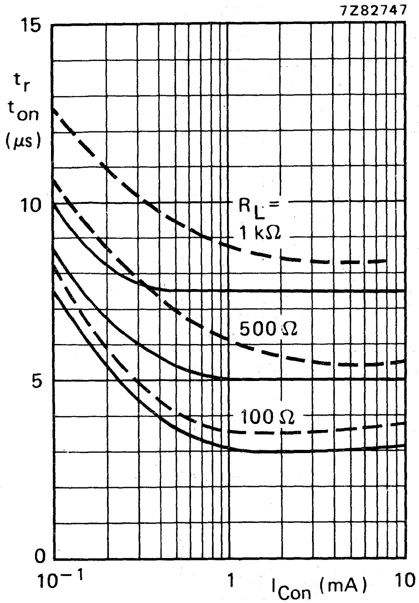


Fig. 11 —— t_r; – – – t_{on}; $I_B = 0$; $V_{CC} = 20$ V; $T_{amb} = 25$ °C; typical values. See also Fig. 13.

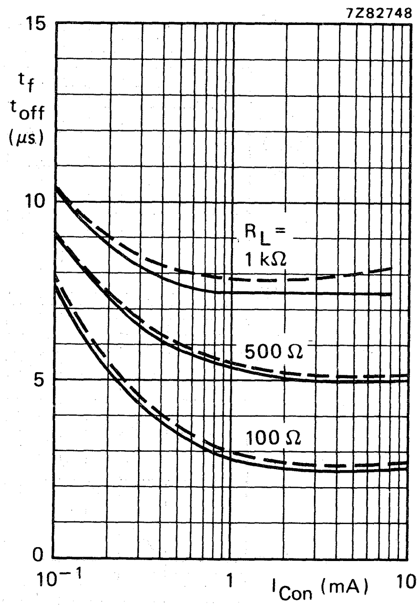


Fig. 12 —— t_f; – – – t_{off}; $I_B = 0$; $V_{CC} = 20$ V; $T_{amb} = 25$ °C; typical values. See also Fig. 13.

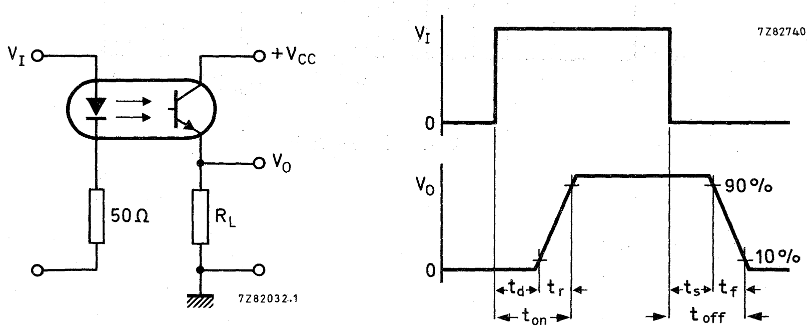


Fig. 13 Switching circuit and waveforms.

PHOTOCOUPLERS

Optically coupled isolators consisting of an infrared emitting GaAs diode and a silicon n-p-n phototransistor with accessible base. Plastic envelopes. Suitable for TTL integrated circuits.

Features of these products:

- high output/input d.c. current transfer ratio;
- low saturation voltage;
- high isolation voltage of 3 kV (r.m.s.) and 4,4 kV (d.c.);
- working voltage 1,5 kV.

QUICK REFERENCE DATA

Diode					
Continuous reverse voltage		V_R	max.	3	V
Forward current					
d.c.		I_F	max.	100	mA
(peak value); t_p = 10 μs; δ = 0,1		I_{FM}	max.	3000	mA
Total power dissipation up to T_{amb} = 25 °C		P_{tot}	max.	200	mW
Transistor					
Collector-emitter voltage (open base)		V_{CEO}	max.	30	V
Total power dissipation up to T_{amb} = 25 °C		P_{tot}	max.	200	mW
Photocoupler					
Output/input d.c. current transfer ratio					
I_F = 10 mA; V_{CE} = 0,4 V; (I_B = 0)	**CNX35**	I_C/I_F	>	0,4	
	CNX36	I_C/I_F	>	0,8	
Collector cut-off current (dark)					
V_{CC} = 10 V; working voltage (d.c.) = 1,5 kV					
diode: I_F = 0 (see also Fig. 2)		I_{CEW}	<	200	nA
Isolation voltage (d.c.)					
t = 1 min		V_{IO}	>	4,4	kV

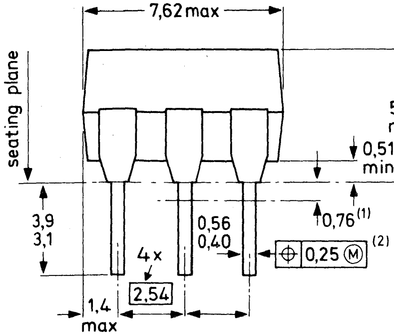
MECHANICAL DATA

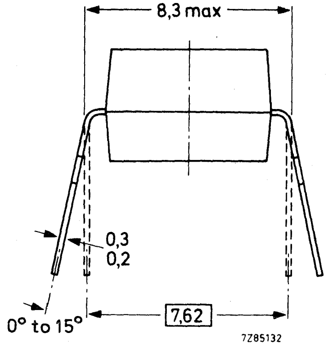
SOT-90 (see Fig. 1)

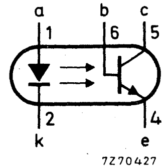
MECHANICAL DATA

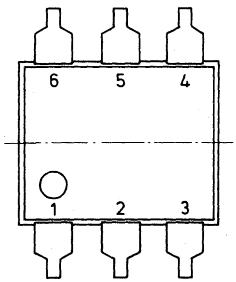
Dimensions in mm

Fig. 1 SOT-90.









⊕ Positional accuracy.

Ⓜ Maximum Material Condition.

(1) Lead spacing tolerances apply from seating plane to the line indicated.

(2) Centre-lines of all leads are within ± 0,125 mm of the nominal position shown; in the worst case, the spacing between any two leads may deviate from nominal by ± 0,25 mm.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Diode				
Continuous reverse voltage	V_R	max.	3	V
Forward current				
d.c.	I_F	max.	100	mA
(peak value); t_p = 10 μs; δ = 0,1	I_{FM}	max.	3000	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	200	mW
Transistor				
Collector-emitter voltage (open base)	V_{CEO}	max.	30	V
Collector-base voltage (open emitter)	V_{CBO}	max.	70	V
Emitter-collector voltage (open base)	V_{ECO}	max.	7	V
Collector current (d.c.)	I_C	max.	100	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	200	mW

Photocoupler

Storage temperature	T_{stg}		−55 to + 150 °C
Operating junction temperature	T_j	max.	125 °C
Lead soldering temperature up to the seating plane; $t_{sld} < 10$ s	T_{sld}	max.	260 °C

THERMAL RESISTANCE

From junction to ambient in free air			
diode	$R_{th\ j\text{-}a}$	=	500 °C/W
transistor	$R_{th\ j\text{-}a}$	=	500 °C/W
From junction to ambient, device mounted on a printed-circuit board			
diode	$R_{th\ j\text{-}a}$	=	400 °C/W
transistor	$R_{th\ j\text{-}a}$	=	400 °C/W

CHARACTERISTICS

$T_j = 25$ °C unless otherwise specified

Diode				
Forward voltage $I_F = 10$ mA		V_F	typ.	1,15 V
		V_F	<	1,5 V
Reverse current $V_R = 3$ V		I_R	<	10 μA
Transistor (diode: $I_F = 0$)				
Collector cut-off current (dark) $V_{CE} = 10$ V		I_{CEO}	typ.	2 nA
		I_{CEO}	<	50 nA
$V_{CE} = 10$ V; $T_{amb} = 70$ °C		I_{CEO}	<	10 μA
$V_{CB} = 10$ V		I_{CBO}	<	20 nA
Photocoupler ($I_B = 0$)*				
Output/input d.c. current transfer ratio $I_F = 10$ mA; $V_{CE} = 5$ V		I_C/I_F	typ.	1,5
	CNX35	I_C/I_F		0,4 to 1,6
$I_F = 10$ mA; $V_{CE} = 0,4$ V	CNX36	I_C/I_F	>	0,8
Collector-emitter saturation voltage $I_F = 10$ mA; $I_C = 2$ mA		V_{CEsat}	typ.	0,15 V
$I_F = 10$ mA; $I_C = 4$ mA		V_{CEsat}	typ.	0,19 V
Isolation voltage, d.c. value **		V_{IO}	>	4,4 kV ←

* Where the phototransistor receives light from the diode the O (for open base) has been omitted from the symbols.
** Tested with a d.c. voltage for 1 minute between shorted input leads and shorted output leads.

Collector cut-off current (light) at T_{amb} = 0 °C to 70 °C			
V_F = 0,8 V; V_{CE} = 15 V	$I_{CE(L)}$	<	15 μA
I_F = 2 mA; V_{CE} = 0,4 V	$I_{CE(L)}$	>	150 μA
Collector capacitance at f = 1 MHz $I_E = I_e = 0$; V_{CB} = 10 V	C_c	typ.	4,5 pF
Capacitance between input and output I_F = 0; V = 0; f = 1 MHz	C_{io}	typ.	0,6 pF
Insulation resistance between input and output ± V_{IO} = 1 kV	r_{IO}	> typ.	10^{10} Ω 10^{12} Ω
Switching times (see Figs 2 and 3)			
I_{Con} = 2 mA; V_{CC} = 5 V; R_L = 100 Ω			
Turn-on time	t_{on}	typ.	3 μs
Turn-off time	t_{off}	typ.	3 μs
I_{Con} = 2 mA; V_{CC} = 5 V; R_L = 1 kΩ			
Turn-on time	t_{on}	typ.	12 μs
Turn-off time	t_{off}	typ.	12,5 μs

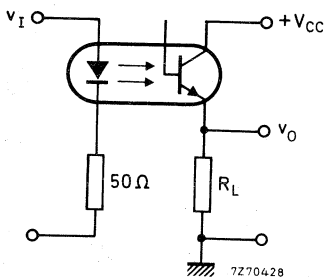


Fig. 2 Switching circuit.

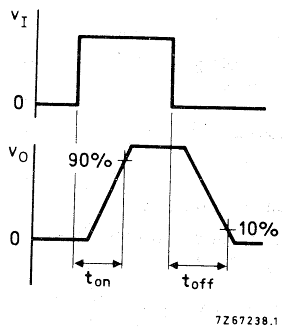


Fig. 3 Waveforms.

Collector cut-off current (dark) see Fig. 4			
V_{CC} = 10 V; working voltage (d.c.) = 1,5 kV	I_{CEW}	<	200 nA *
V_{CC} = 10 V; working voltage (d.c.) = 1,5 kV; T_j = 70 °C	I_{CEW}	<	100 μA *

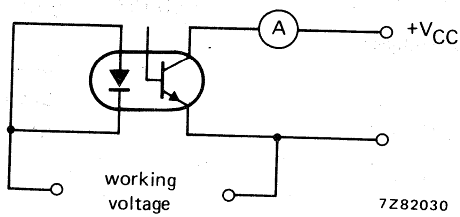


Fig. 4.

*As quality assurance (on a sample basis), these parameters are covered by a 1000 h reliability test.

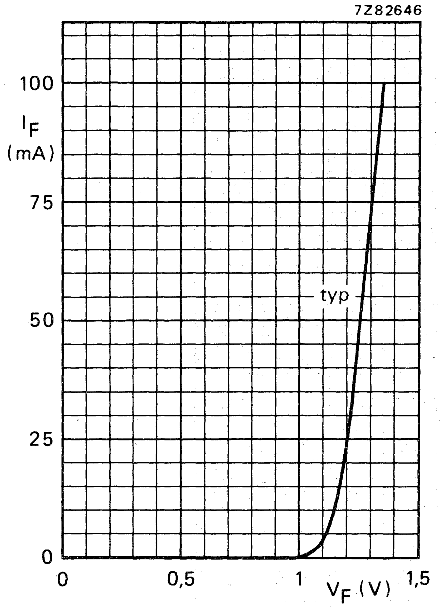


Fig. 5 T_{amb} = 25 °C.

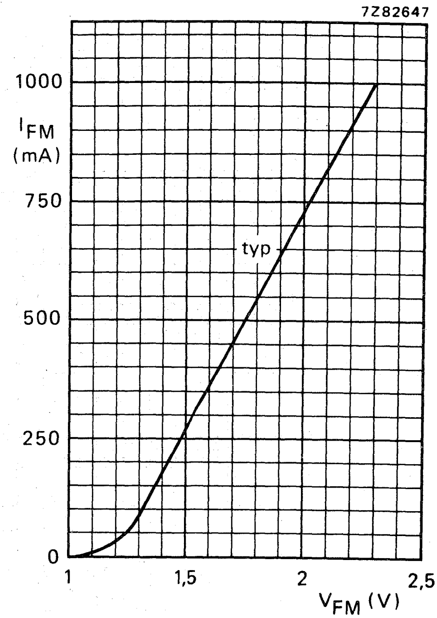


Fig. 6 T_{amb} = 25 °C; t_p = 10 μs; T = 1 ms.

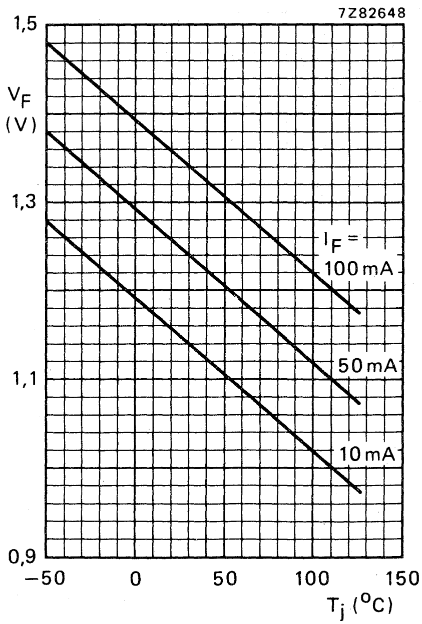


Fig. 7 Typical values.

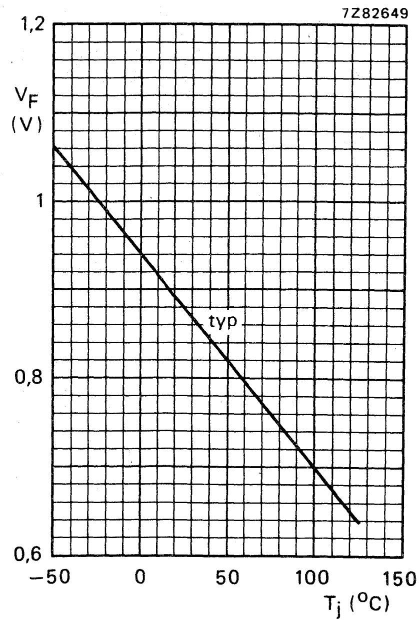


Fig. 8 I_F = 50 μA.

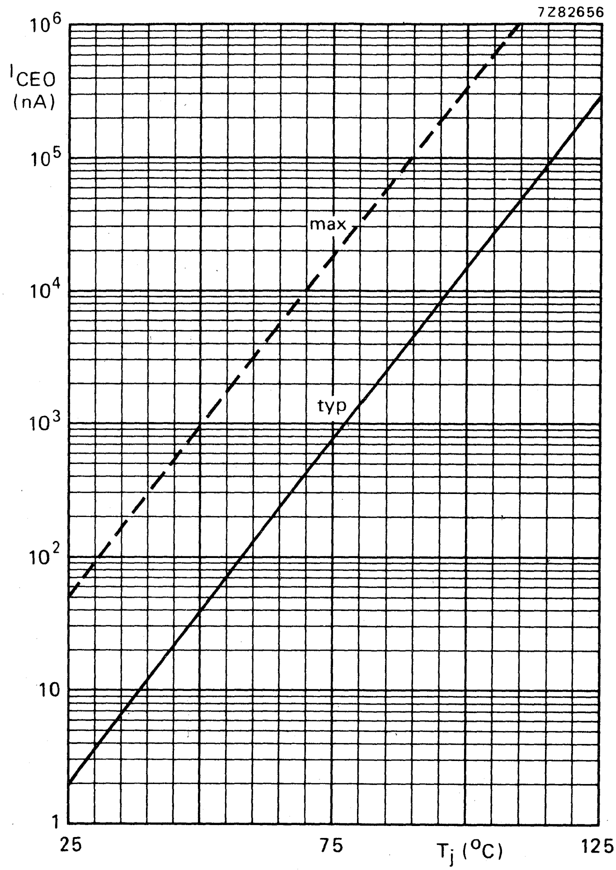


Fig. 9 $I_F = 0$; $V_{CE} = 10$ V.

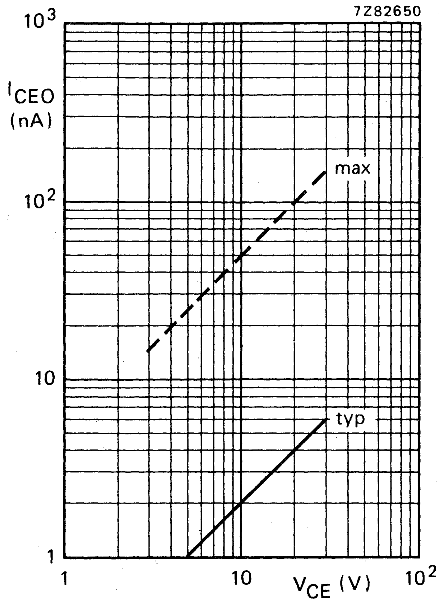


Fig. 10 $I_F = 0$; $T_j = 25\ ^oC$.

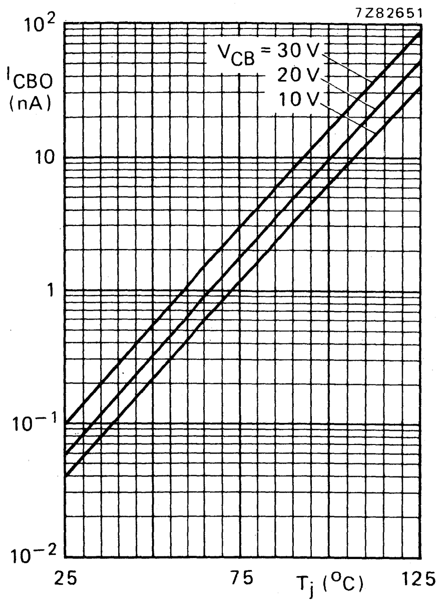


Fig. 11 Typical values.

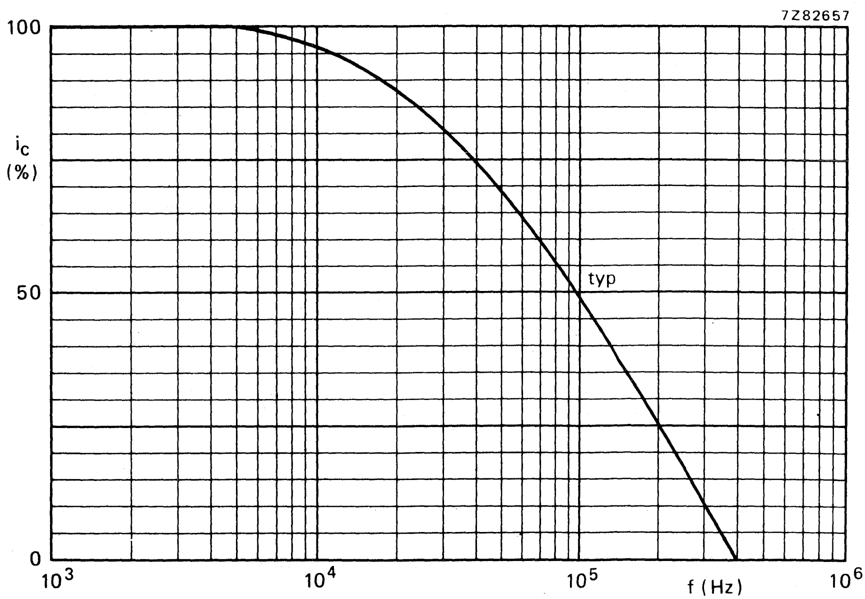


Fig. 12 $I_B = 0$; $I_C = 2$ mA; $V_{CC} = 5$ V; $R_L = 1\ k\Omega$; $T_{amb} = 25\ ^oC$.

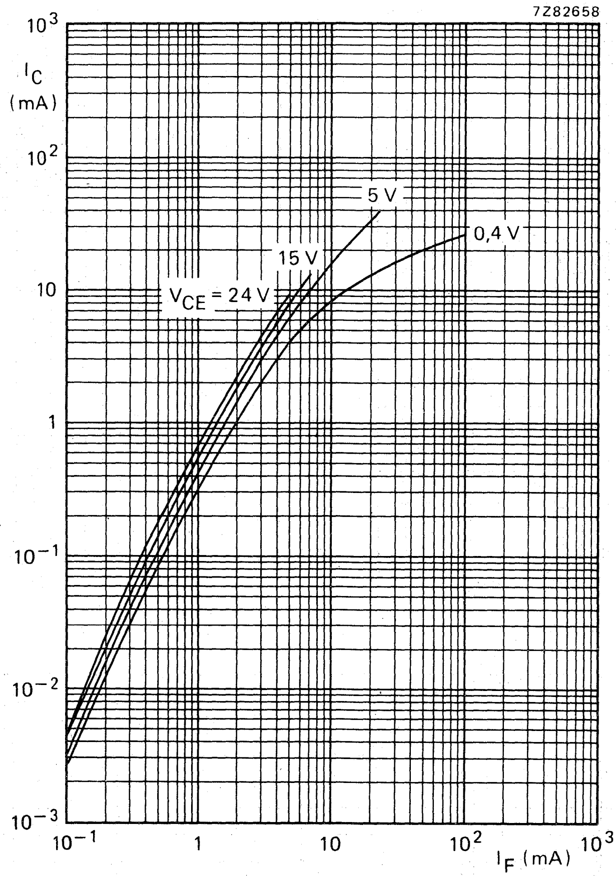


Fig. 13 T_{amb} = 25 °C, typical values.

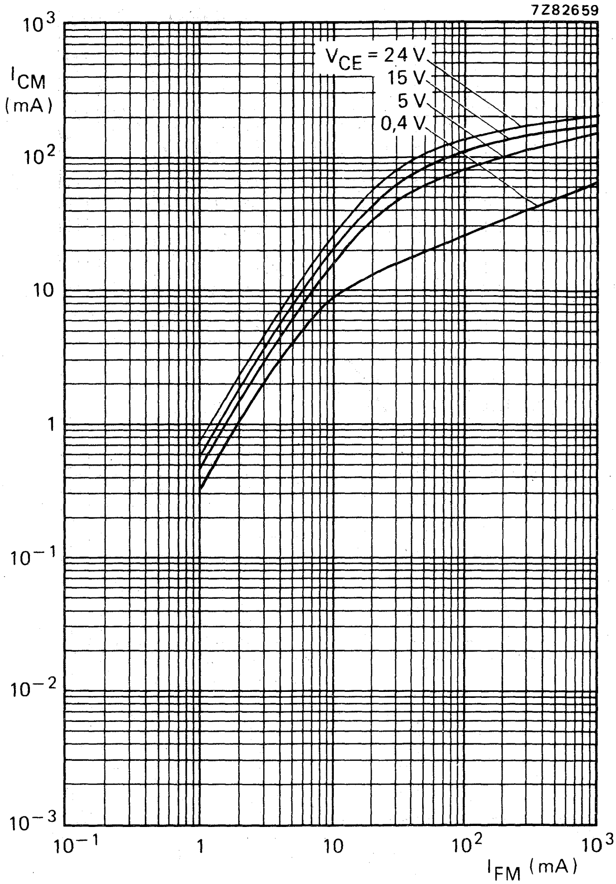


Fig. 14 T_{amb} = 25 °C; t_p = 10 µs; T = 1 ms; typical values.

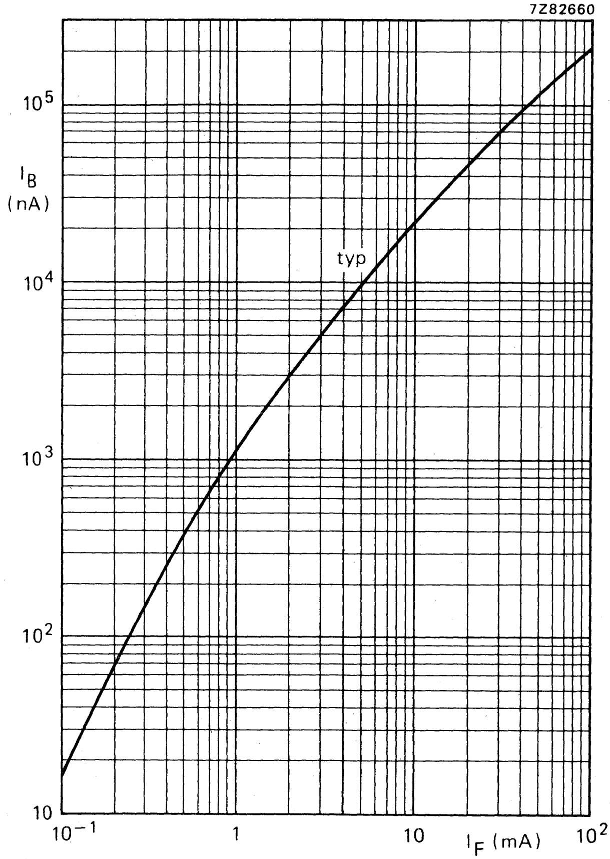


Fig. 15 V_{CB} = 5 V; T_{amb} = 25 °C.

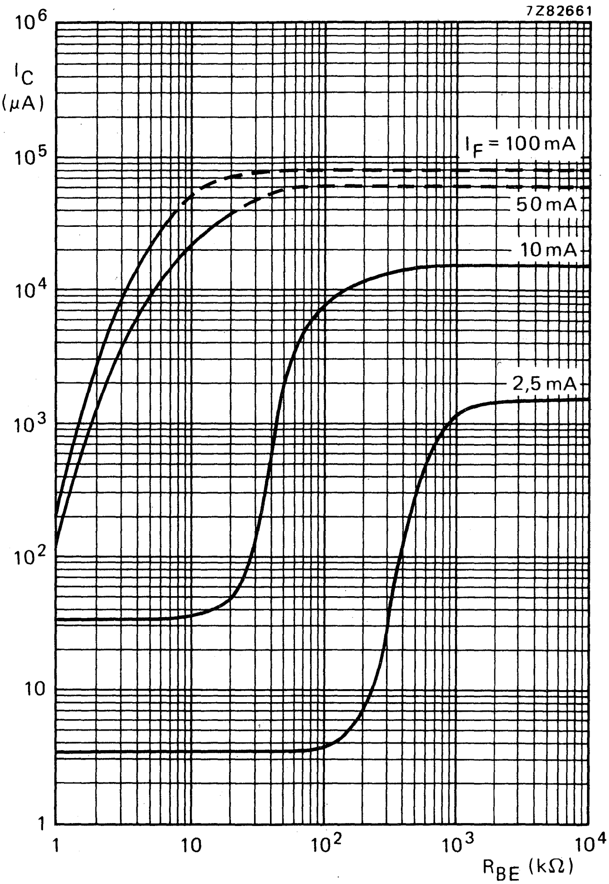


Fig. 16 $I_B = 0$; $V_{CE} = 5$ V; $T_{amb} = 25$ °C; typical values.

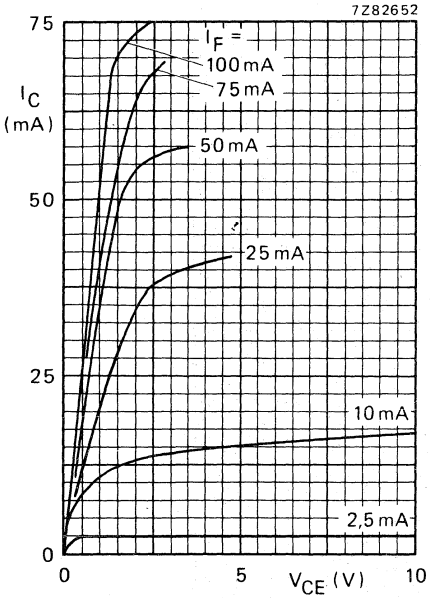


Fig. 17 T_{amb} = 25 °C; typical values.

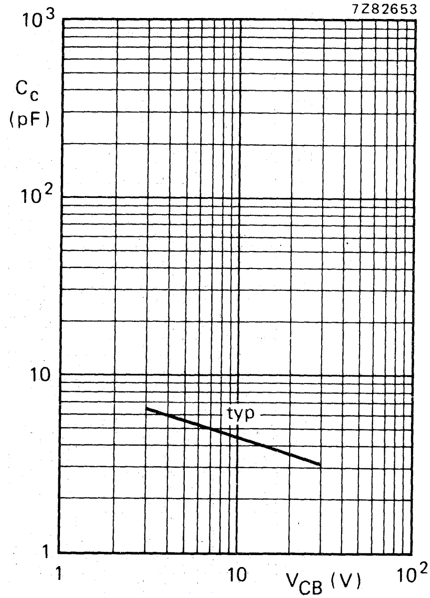


Fig. 18 f = 1 MHz; T_{amb} = 25 °C.

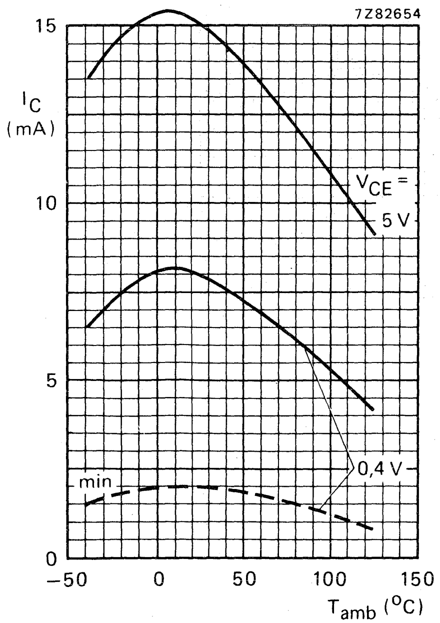


Fig. 19 I_B = 0; I_F = 10 mA; ——— typ. values.

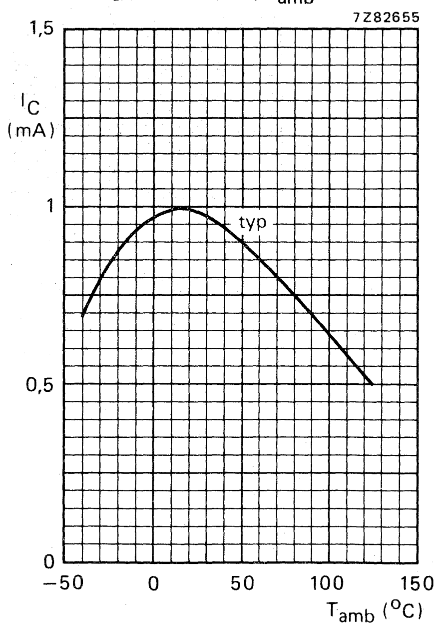


Fig. 20 I_F = 2 mA; V_{CE} = 0,4 V.

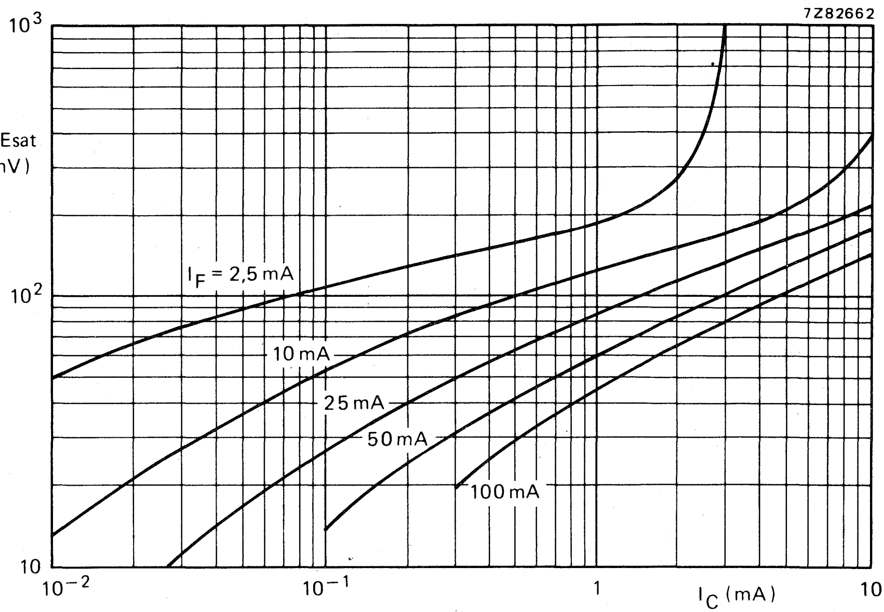


Fig. 21 $I_B = 0$; $T_{amb} = 25\ ^oC$; typical values.

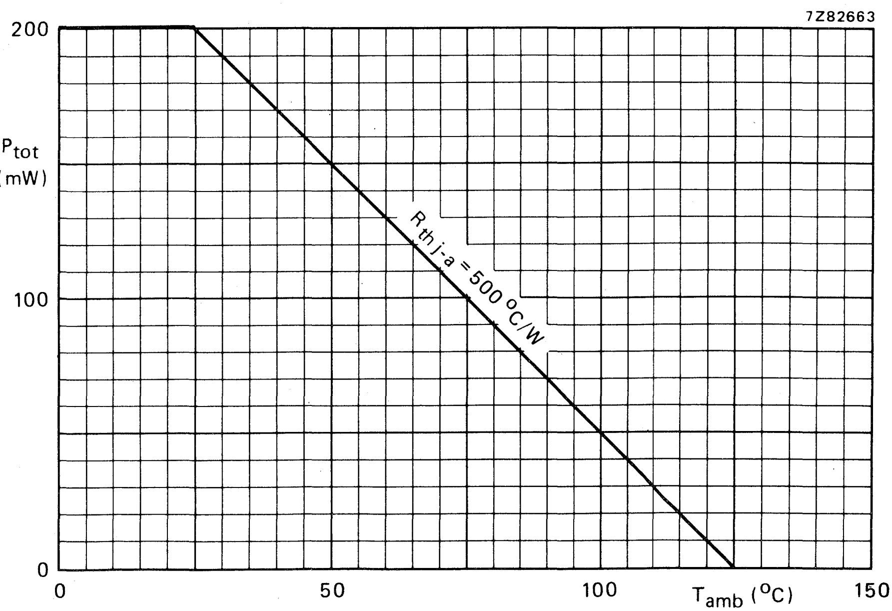


Fig. 22 Max. permissible power dissipation for diode and transistor versus ambient temperature.

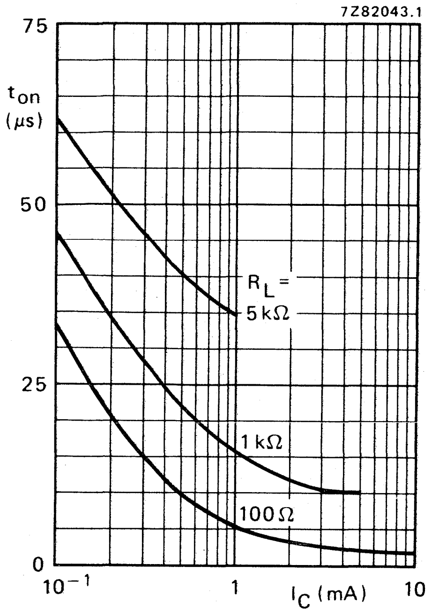


Fig. 23 $I_B = 0$; $V_{CC} = 5$ V; $T_{amb} = 25$ °C; typical values. (See also Fig. 25.)

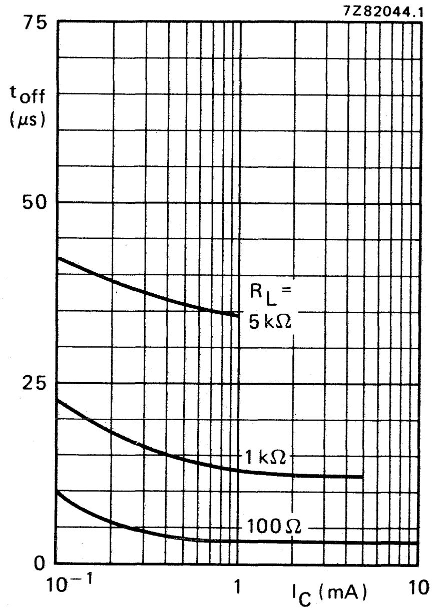


Fig. 24 $I_B = 0$; $V_{CC} = 5$ V; $T_{amb} = 25$ °C; typical values. (See also Fig. 25.)

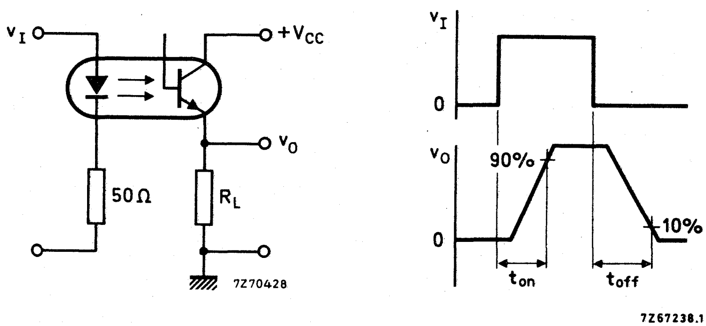


Fig. 25 Switching circuit and waveforms.

PHOTOCOUPLER

Optically coupled isolator consisting of an infrared emitting GaAs diode and a silicon n-p-n phototransistor with accessible base. Plastic envelope. Suitable for TTL integrated circuits.

Features of these products:

- high output/input d.c. current transfer ratio;
- low saturation voltage;
- high isolation voltage of 3 kV (r.m.s.) and 4,3 kV (d.c.);
- working voltage 1,5 kV.

QUICK REFERENCE DATA

Diode			
Continuous reverse voltage	V_R	max.	3 V
Forward current			
d.c.	I_F	max.	100 mA
(peak value); t_p = 10 μs; δ = 0,1	I_{FM}	max.	1000 mA
Total power dissipation up to T_{amb} = 25 ^oC	P_{tot}	max.	150 mW
Transistor			
Collector-emitter voltage (open base)	V_{CEO}	max.	80 V
Total power dissipation up to T_{amb} = 25 ^oC	P_{tot}	max.	200 mW
Photocoupler			
Output/input d.c. current transfer ratio			
I_F = 10 mA; V_{CE} = 10 V; (I_B = 0)	I_C/I_F		0,7 to 2,1
Collector cut-off current (dark)			
V_{CC} = 10 V; working voltage (d.c.) = 1,5 kV diode; I_F = 0 (see also Fig. 4)	I_{CEW}	<	200 nA
Isolation voltage (d.c.)			
t = 1 min	V_{IO}	>	4,3 kV ←

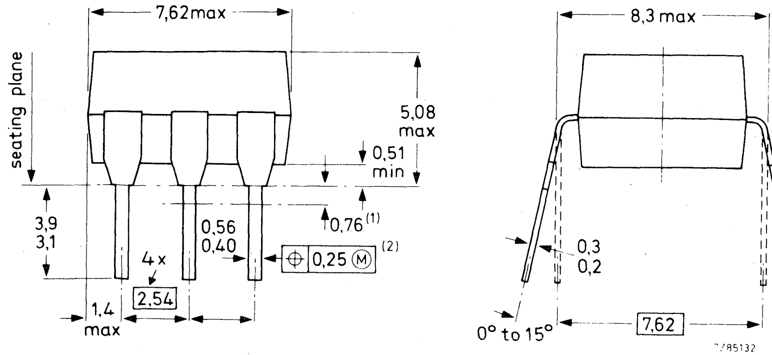
MECHANICAL DATA

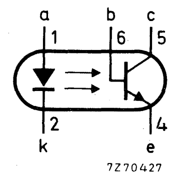
SOT-90 (see Fig. 1).

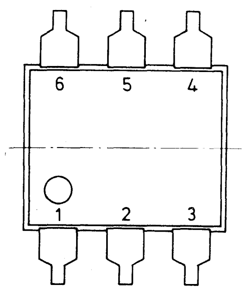
MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-90.







⌖ Positional accuracy.

Ⓜ Maximum Material Condition.

(1) Lead spacing tolerances apply from seating plane to the line indicated.

(2) Centre-lines of all leads are within ±0,125 mm of the nominal position shown; in the worst case, the spacing between any two leads may deviate from nominal by ±0,25 mm.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Diode			
Continuous reverse voltage	V_R	max.	3 V
Forward current			
d.c.	I_F	max.	100 mA
(peak value); t_p = 10 μs; δ = 0,1	I_{FM}	max.	1000 mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	150 mW
Transistor			
Collector-base voltage (open emitter)	V_{CBO}	max.	120 V
Collector-emitter voltage (open base)	V_{CEO}	max.	80 V
Emitter-collector voltage (open base)	V_{ECO}	max.	7 V
Collector current (d.c.)	I_C	max.	100 mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	200 mW

Photocoupler

Storage temperature	T_{stg}	−55 to +150	°C
Operating junction temperature	T_j	max. 125	°C
Lead soldering temperature up to the seating plane; $t_{sld} < 10$ s	T_{sld}	max. 260	°C

THERMAL RESISTANCE

From junction to ambient in free air			
diode	$R_{th\ j\text{-}a}$	= 650	°C/W
transistor	$R_{th\ j\text{-}a}$	= 500	°C/W
From junction to ambient, device mounted on a printed-circuit board			
diode	$R_{th\ j\text{-}a}$	= 600	°C/W
transistor	$R_{th\ j\text{-}a}$	= 400	°C/W

CHARACTERISTICS

$T_j = 25$ °C unless otherwise specified

Diode				
Forward voltage $I_F = 10$ mA	V_F	typ.	1,2	V
		<	1,5	V
Reverse current $V_R = 3$ V	I_R	<	10	μA
Transistor (diode: $I_F = 0$)				
Collector cut-off current (dark) $V_{CE} = 10$ V	I_{CEO}	typ.	5	nA
		<	50	nA
$V_{CE} = 10$ V; $T_{amb} = 70$ °C	I_{CEO}	<	10	μA
$V_{CB} = 10$ V; $T_{amb} = 25$ °C	I_{CBO}	<	20	nA
Photocoupler ($I_B = 0$) *				
Output/input d.c. current transfer ratio				
$I_F = 10$ mA; $V_{CE} = 10$ V	I_C/I_F		0,7 to 2,1	
$I_F = 16$ mA; $V_{CE} = 0,4$ V	I_C/I_F	>	0,5	
Collector-emitter saturation voltage $I_F = 16$ mA; $I_C = 2$ mA	V_{CEsat}	typ.	0,2	V
		<	0,4	V
Isolation voltage, d.c. value **	V_{IO}	>	4,3	kV

* Where the phototransistor receives light from the diode the O (for open base) has been omitted from the symbols.

** Tested with a d.c. voltage for 1 minute between shorted input leads and shorted output leads.

Collector capacitance at f = 1 MHz $I_E = I_e = 0$; $V_{CB} = 10$ V	C_c	typ.	6 pF
Capacitance between input and output $I_F = 0$; V = 0; f = 1 MHz	C_{io}	typ.	0,6 pF
Insulation resistance between input and output $\pm V_{IO} = 1$ kV	r_{IO}	> typ.	10^{10} Ω 10^{12} Ω
Switching times (see Figs 2 and 3) $I_{Con} = 4$ mA; $V_{CC} = 5$ V; $R_L = 100$ Ω			
Turn-on time	t_{on}	typ.	5 μs
Turn-off time	t_{off}	typ.	5 μs

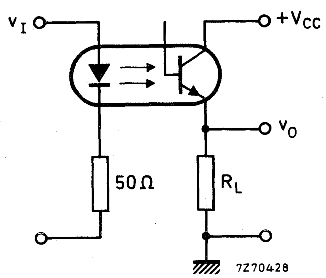


Fig. 2 Switching circuit.

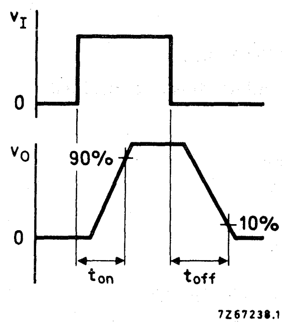


Fig. 3 Waveforms.

Collector cut-off current (dark) see Fig. 4			
$V_{CC} = 10$ V; working voltage (d.c.) = 1,5 kV	I_{CEW}	<	200 nA *
$V_{CC} = 10$ V; working voltage (d.c.) = 1,5 kV; $T_j = 70$ °C	I_{CEW}	<	100 μA *

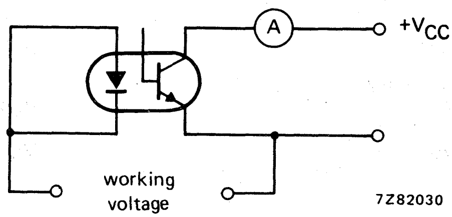


Fig. 4.

* As quality assurance (on a sample basis), these parameters are covered by a 1000 h reliability test.

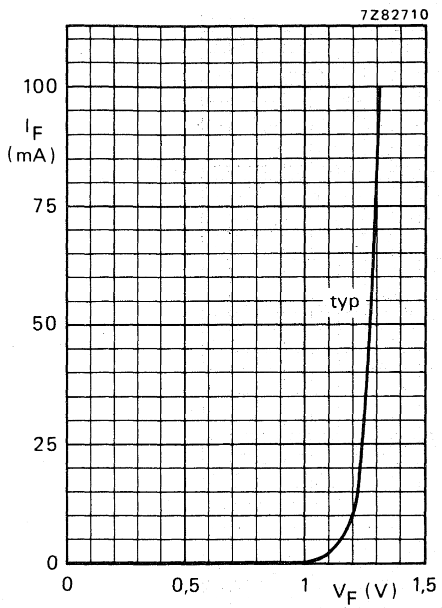


Fig. 5 T_{amb} = 25 °C.

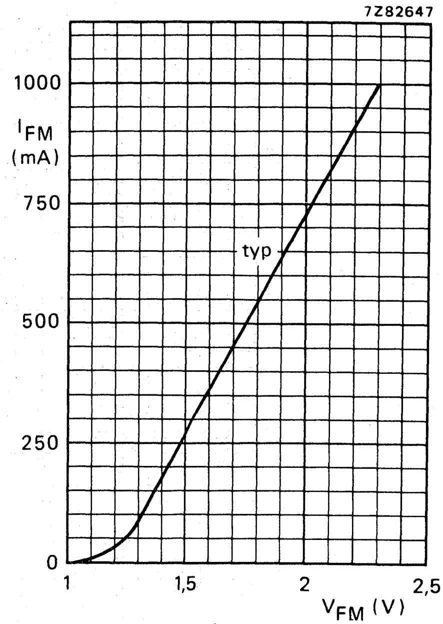


Fig. 6 T_{amb} = 25 °C; t_p = 10 μs; T = 1 ms.

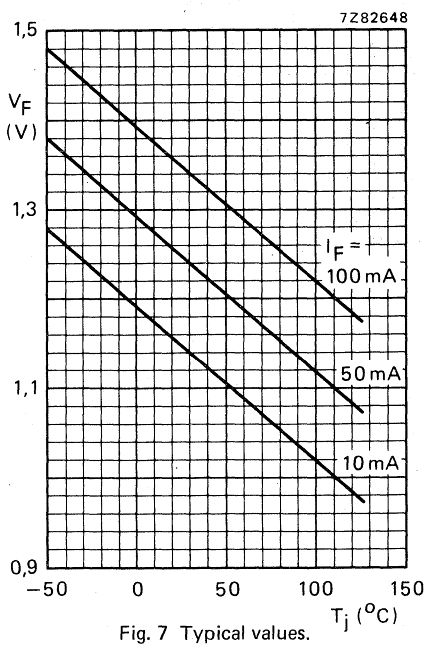


Fig. 7 Typical values.

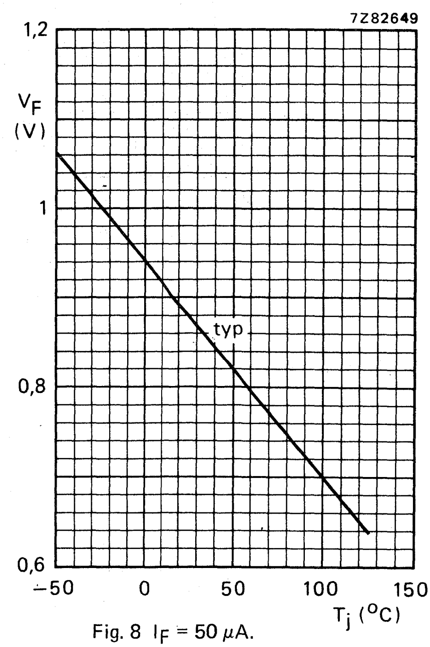


Fig. 8 I_F = 50 μA.

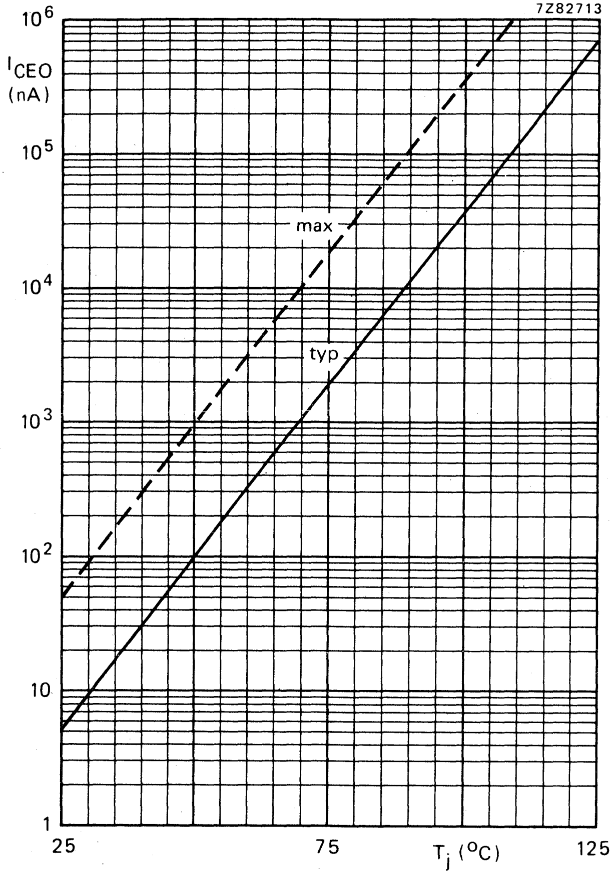


Fig. 9 $I_F = 0$; $V_{CE} = 10$ V.

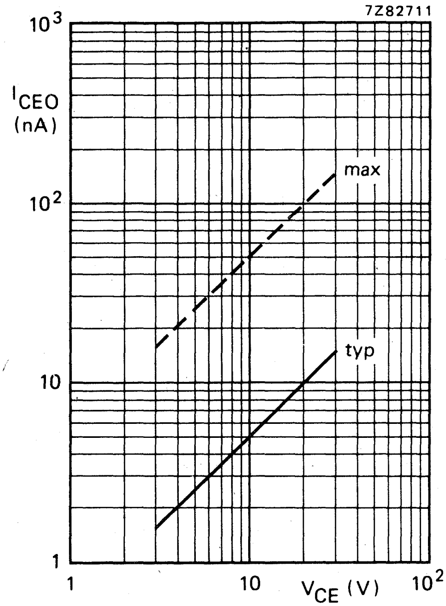


Fig. 10 $I_F = 0$; $T_j = 25\ ^oC$.

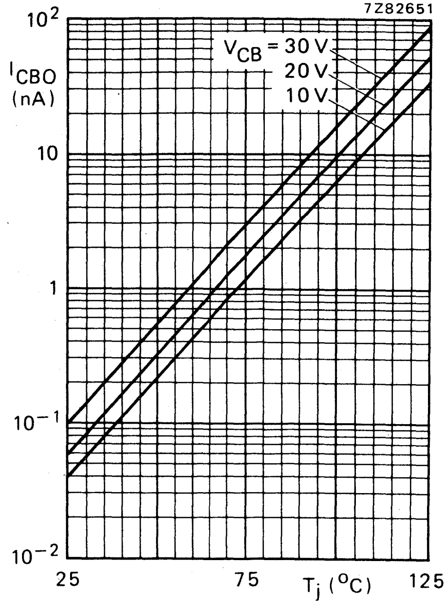


Fig. 11 Typical values.

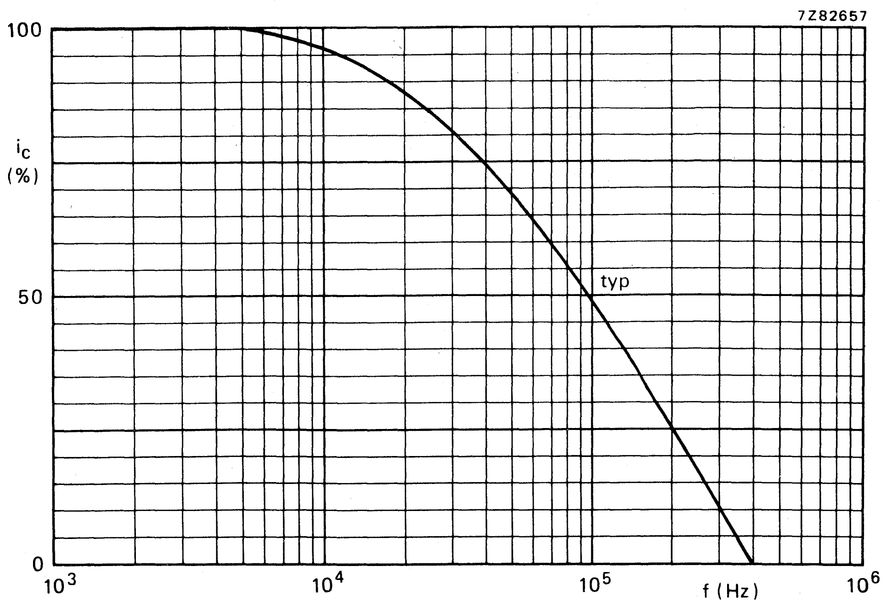


Fig. 12 $I_B = 0$; $I_C = 2$ mA; $V_{CC} = 5$ V; $R_L = 1\ k\Omega$; $T_{amb} = 25\ ^oC$.

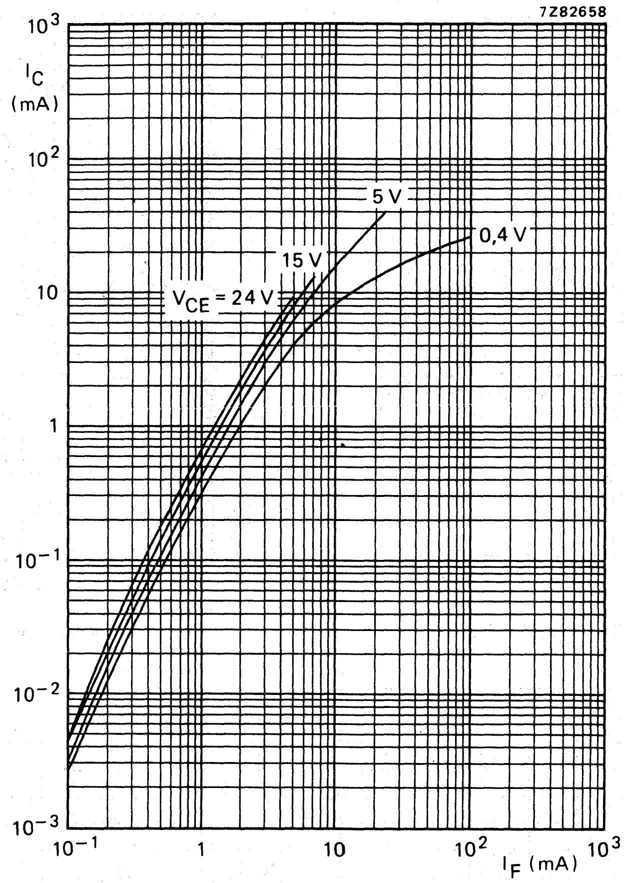


Fig. 13 T_{amb} = 25 °C, typical values.

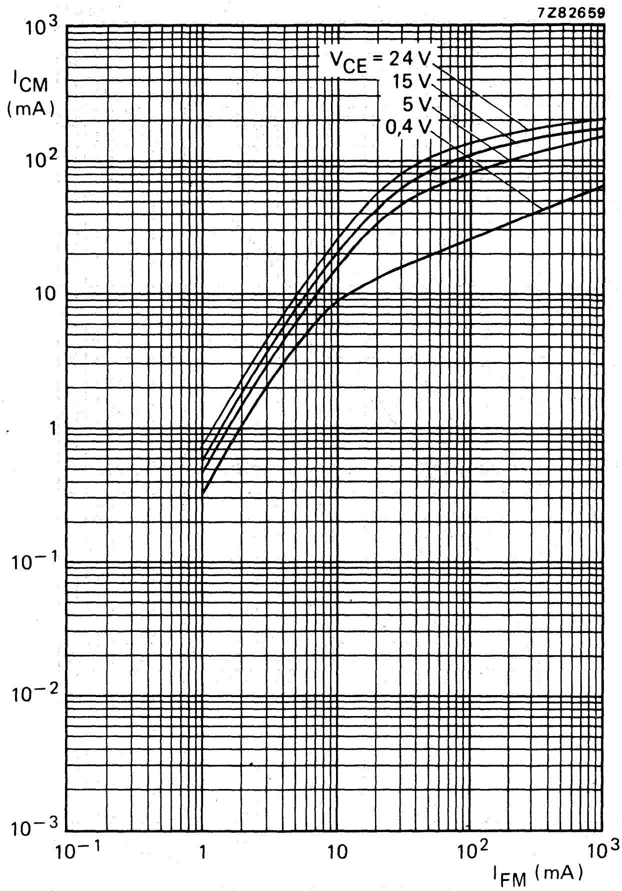


Fig. 14 $T_{amb} = 25\ ^oC$; $t_p = 10\ \mu s$; $T = 1$ ms; typical values.

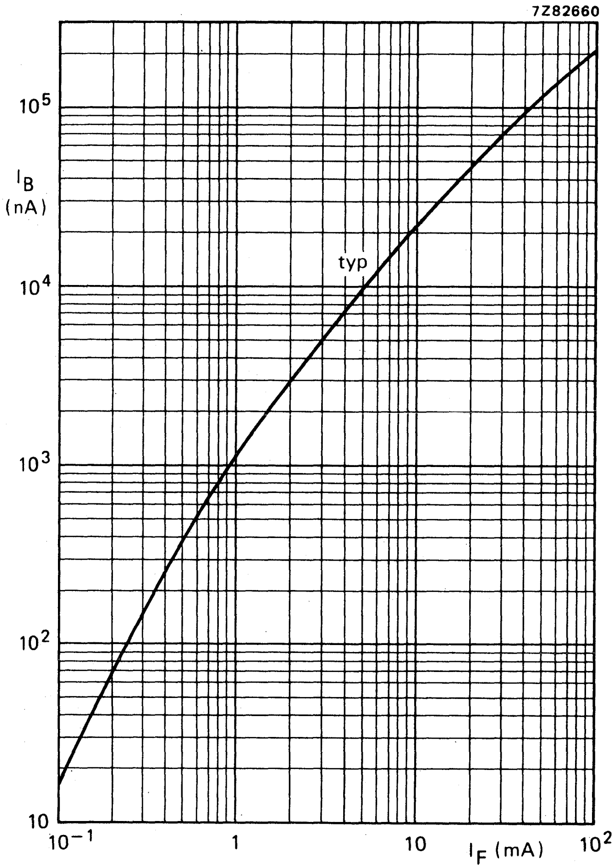


Fig. 15 V_{CB} = 5 V; T_{amb} = 25 °C.

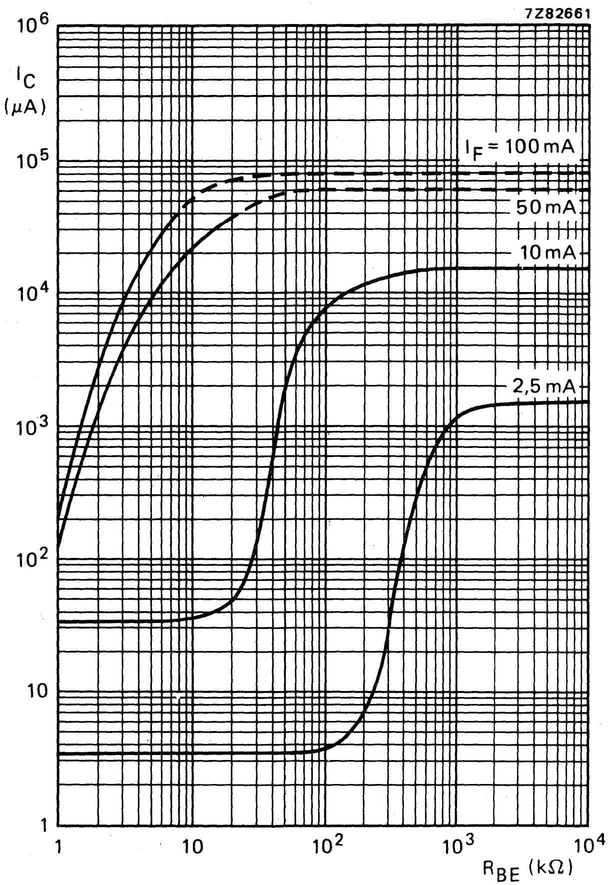


Fig. 16 $I_B = 0$; $V_{CE} = 5$ V; $T_{amb} = 25$ °C; typical values.

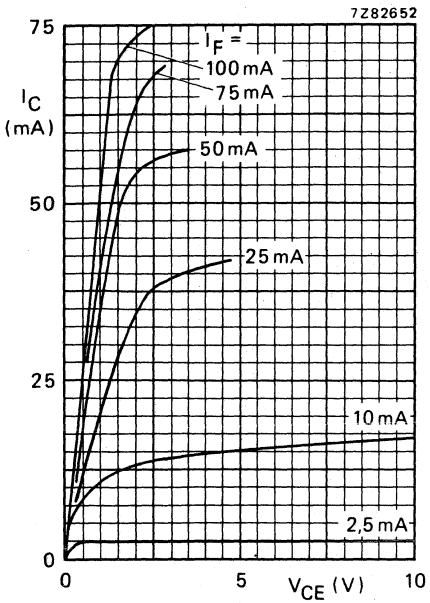


Fig. 17 T_{amb} = 25 °C; typical values.

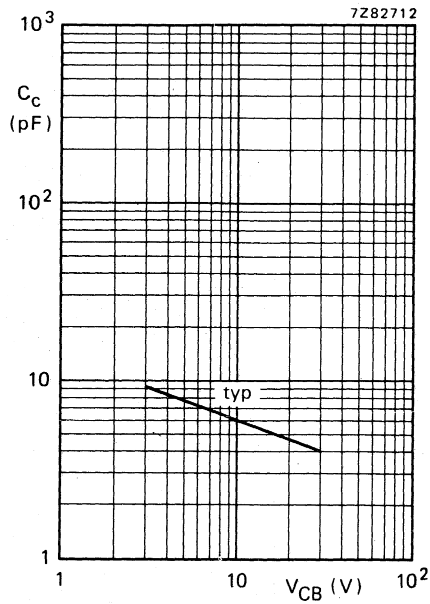


Fig. 18 f = 1 MHz; T_{amb} = 25 °C.

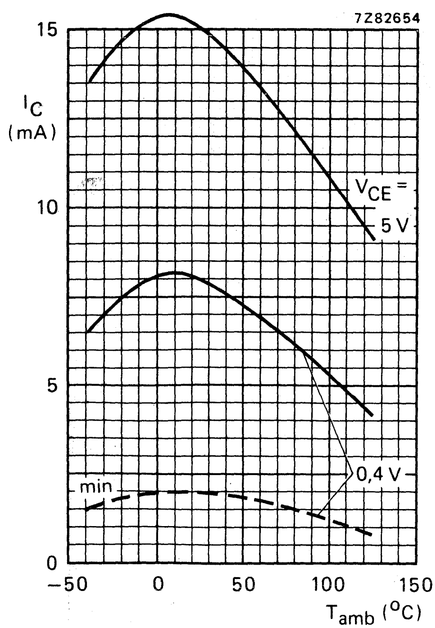


Fig. 19 I_B = 0; I_F = 10 mA; ——— typ. values.

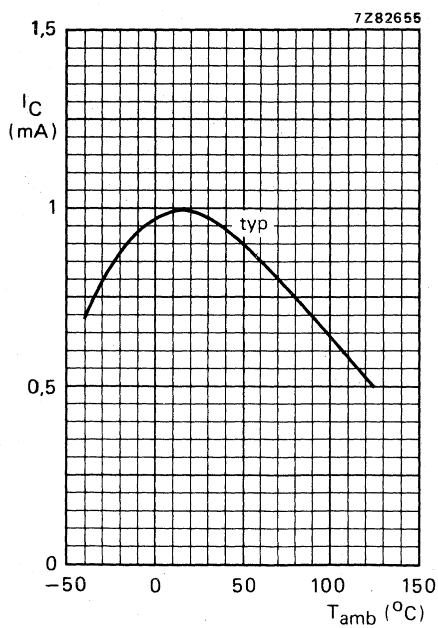


Fig. 20 I_F = 2 mA; V_{CE} = 0,4 V.

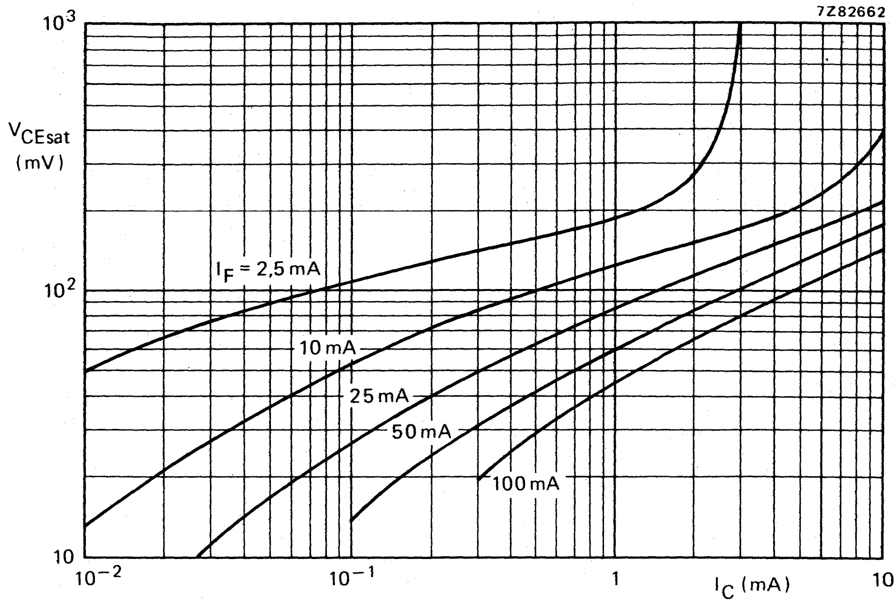


Fig. 21 $I_B = 0$; $T_{amb} = 25\ ^oC$; typical values.

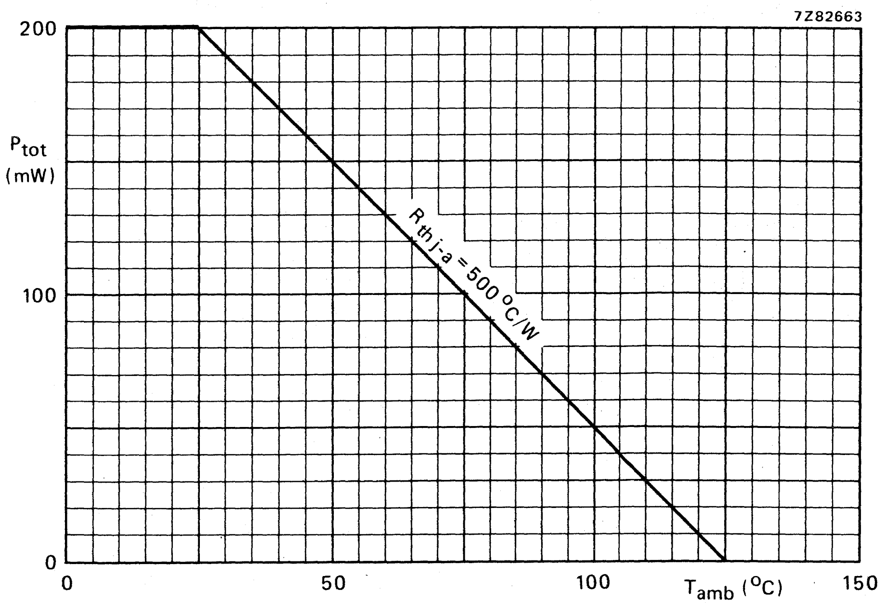


Fig. 22 Max. permissible power dissipation for total device versus ambient temperature.

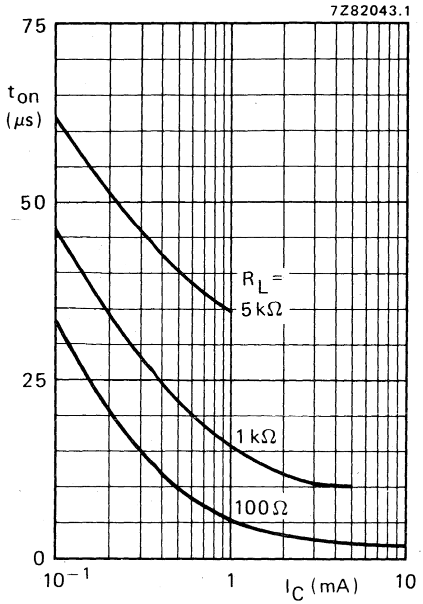


Fig. 23 $I_B = 0$; $V_{CC} = 5$ V; $T_{amb} = 25$ °C; typical values. (See also Fig. 25.)

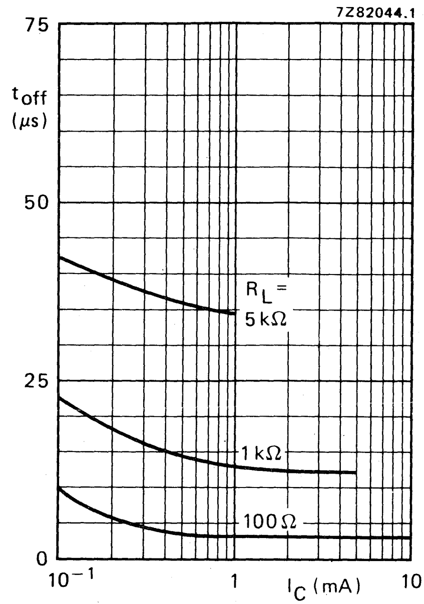


Fig. 24 $I_B = 0$; $V_{CC} = 5$ V; $T_{amb} = 25$ °C; typical values. (See also Fig. 25.)

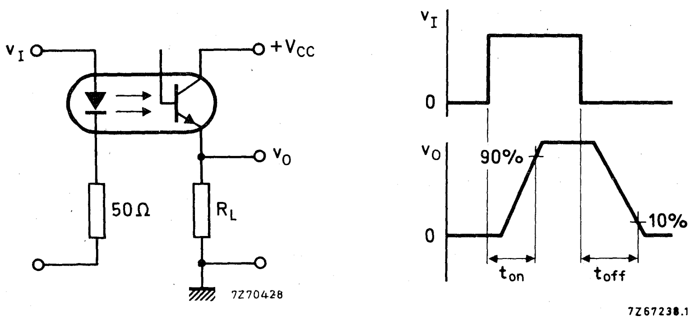


Fig. 25 Switching circuit and waveforms.

PHOTOCOUPLER

Optically coupled isolator consisting of an infrared emitting GaAs diode and a silicon n-p-n Darlington phototransistor. Plastic 6 lead dual-in line envelope. Suitable for TTL integrated circuits.

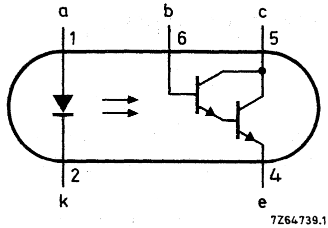
QUICK REFERENCE DATA				
Diode				
Continuous reverse voltage	V_R	max.	3	V
Forward current (d.c.)	I_F	max.	60	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	100	mW
Transistor				
Collector-emitter voltage (open base)	V_{CEO}	max.	30	V
Collector cut-off current (dark) V_{CE} = 10 V; diode: I_F = 0	I_{CEO}	<	100	nA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	150	mW
Photocoupler				
Output/input d.c. current transfer ratio I_F = 10 mA; I_B = 0; V_{CE} = 1 V	I_C/I_F	>	6	
Collector-emitter saturation voltage I_F = 5 mA; I_B = 0; I_C = 10 mA	V_{CEsat}	<	0,8	V
I_F = 10 mA; I_B = 0; I_C = 60 mA	V_{CEsat}	<	1,0	V
Isolation voltage, r.m.s. value	$V_{IO(RMS)}$	>	1500	V

MECHANICAL DATA See page 2.

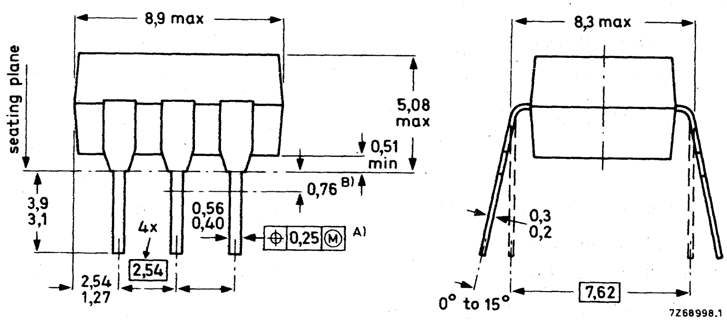
MECHANICAL DATA

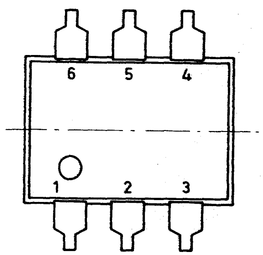
Dimensions in mm

SOT-90



3 = n.c.





A) Centre lines of all leads are within ±0, 127 mm of the nominal positions shown: in the worst case, the spacing between adjacent leads may deviate from nominal by ±0, 254 mm.

B) Tolerances of note A within this distance.

⊕ Locational truth

Ⓜ Maximum Material Condition

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

Diode

Continuous reverse voltage	V_R	max.	3	V
Forward current (d.c.)	I_F	max.	60	mA
Forward current (peak value) $t_p < 10\ \mu s$; f = 300 Hz	I_{FM}	max.	3	A
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	100	mW
Junction temperature	T_j	max.	100	°C

Transistor

Collector-emitter voltage (open base)	V_{CEO}	max.	30	V
Collector-base voltage (open emitter)	V_{CBO}	max.	30	V
Emitter-base voltage (open collector)	V_{EBO}	max.	6	V
Collector current (d.c.)	I_C	max.	100	mA
Collector current (peak value) $t_p < 100\ \mu s$; T = 1 ms	I_{CM}	max.	150	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	150	mW
Junction temperature	T_j	max.	100	°C

Photocoupler

Storage temperature	T_{stg}	−55 to +100	°C

THERMAL RESISTANCE

From junction to ambient in free air			
- diode	$R_{th\ j\text{-}a}$	0,75	°C/mW
- transistor	$R_{th\ j\text{-}a}$	0,5	°C/mW
From junction to ambient device mounted on a p.c. board			
- diode	$R_{th\ j\text{-}a}$	0,6	°C/mW
- transistor	$R_{th\ j\text{-}a}$	0,4	°C/mW

CHARACTERISTICS

Diode T_j = 25 °C

Forward voltage, I_F = 10 mA	V_F	typ. <	1,2 1,5	V V	
Reverse current, V_R = 3 V	I_R	<	10	μA	
Diode capacitance, V_R = 0; f = 1 MHz	C_d	typ.	80	pF	

Transistor (diode : I_F = 0) T_j = 25 °C

Collector cut-off current (dark)					
V_{CE} = 10 V	I_{CEO}	<	100	nA	

Photocoupler (I_B = 0, T_{amb} = 25 °C unless otherwise specified) [1]

Output/input d.c. current transfer ratio					
I_F = 10 mA; V_{CE} = 1 V	I_C/I_F	>	6		[2]
Collector-emitter saturation voltage					
I_F = 5 mA; I_C = 10 mA	V_{CEsat}	<	0,8	V	
I_F = 10 mA; I_C = 60 mA	V_{CEsat}	<	1	V	
Isolation voltage, r.m.s. value	$V_{IO(RMS)}$	>	1500	V	[3]
Capacitance between input and output I_F = 0; V = 0; f = 1 MHz	C_{io}	typ.	1	pF	

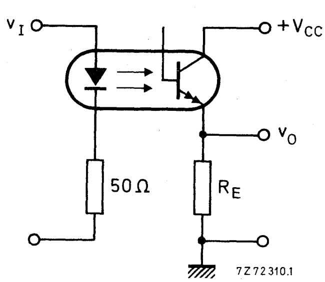
1) Where the phototransistor receives light from the diode, the O (for open terminal) has been omitted from the symbols.

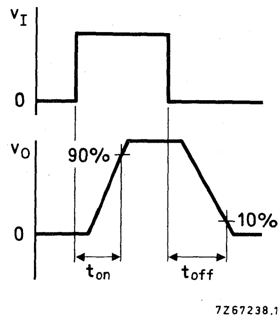
2) Aging of the light-emitting diode reduces the transfer ratio at a rate proportional to current and operating time. In circuits that operate for long periods, therefore, the duty factor of the couplers should be kept as low as possible. This can often be done with the aid of an inverter.

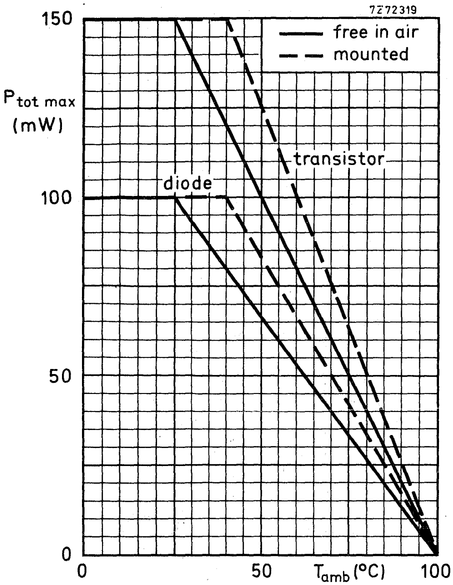
3) Tested with a 50 Hz a.c. voltage for 1 minute between shorted input leads and shorted output leads.

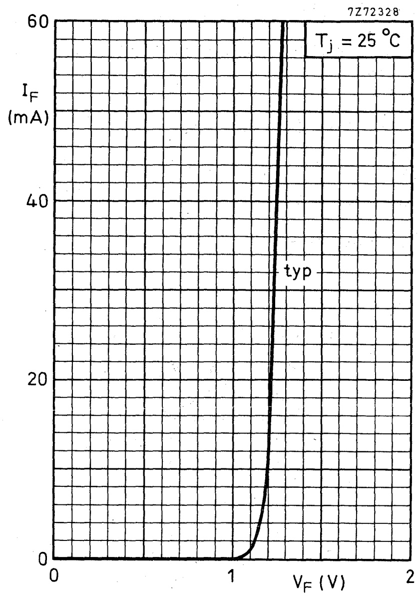
CHARACTERISTICS (continued) T_{amb} = 25 °C, unless otherwise specified

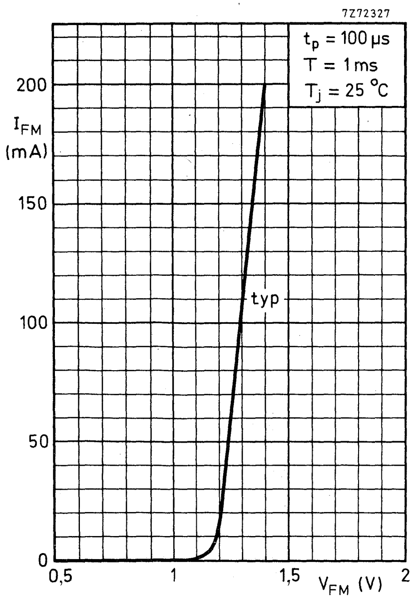
Insulation resistance between input and output				
V_{IO} = 1500 V	r_{IO}	typ.	10^{11}	Ω
Switching times (circuit below)				
I_{Con} = 10 mA; V_{CC} = 10 V; R_E = 100 Ω				
Turn-on time	t_{on}	typ.	68	µs
Turn-off time	t_{off}	typ.	37	µs

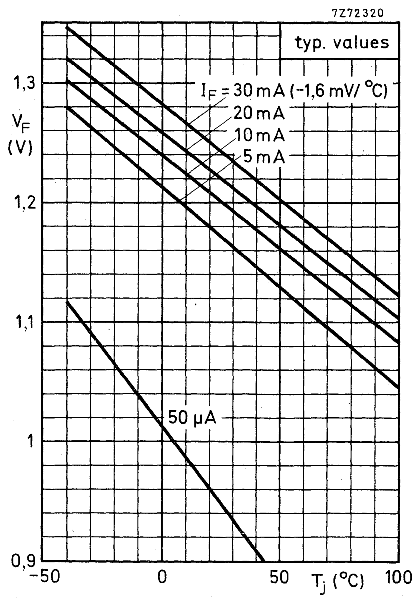


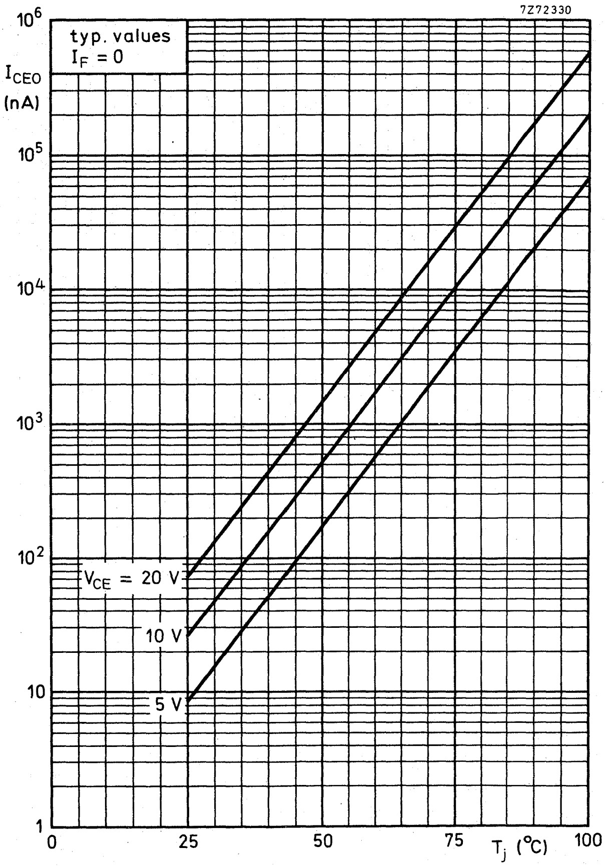


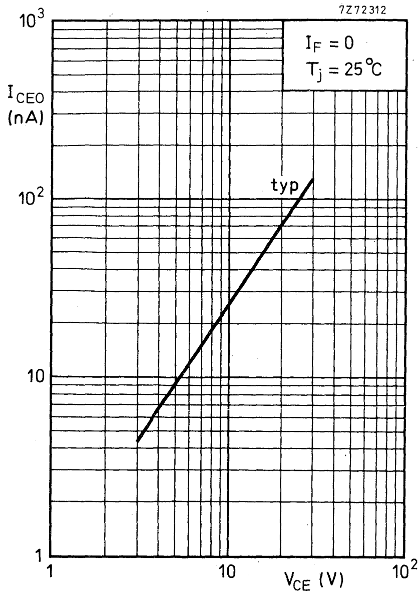

7Z72319
free in air
mounted
$P_{tot\ max}$ (mW)
transistor
diode
T_{amb} (°C)
150
100
50
0
0
50
100

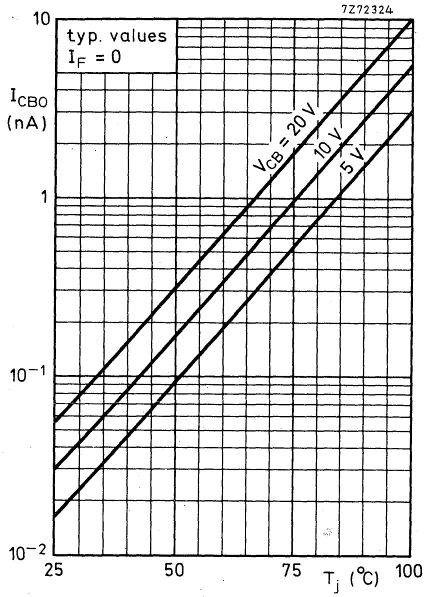

7Z72328
T_j = 25 °C
I_F (mA)
typ
V_F (V)
60
40
20
0
0
1
2

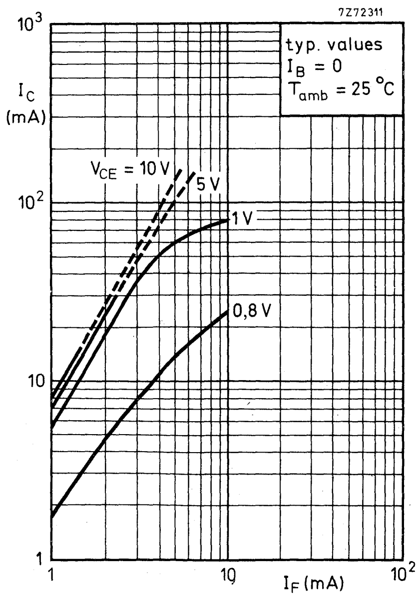

7Z72327
t_p = 100 μs
T = 1 ms
T_j = 25 °C
I_{FM} (mA)
typ
V_{FM} (V)
200
150
100
50
0
0,5
1
1,5
2

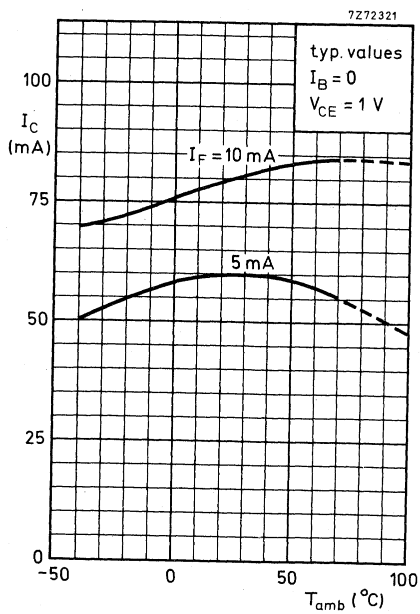

7Z72320
typ. values
I_F = 30 mA (−1,6 mV/ °C)
20 mA
10 mA
5 mA
50 μA
V_F (V)
T_j (°C)
1,3
1,2
1,1
1
0,9
−50
0
50
100

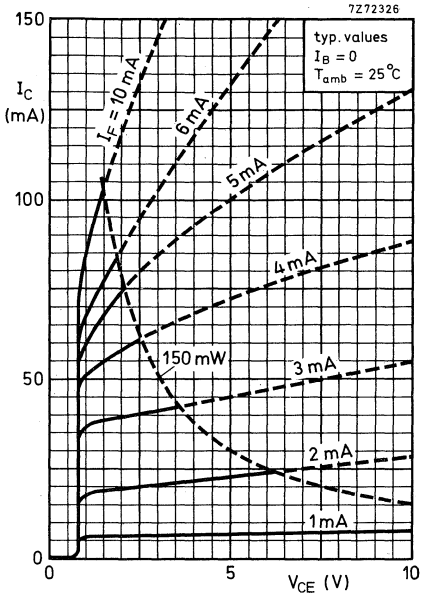

7Z72330
typ. values
$I_F = 0$
I_{CEO}
(nA)
10^6
10^5
10^4
10^3
10^2
10
1
V_{CE} = 20 V
10 V
5 V
0
25
50
75
T_j (°C)
100

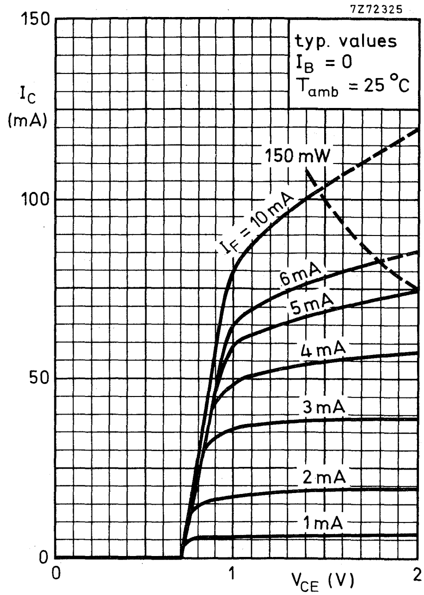

7Z72312
$I_F = 0$
$T_j = 25\,^{\circ}C$
I_{CEO} (nA)
typ
10^3
10^2
10
1
1
10
10^2
V_{CE} (V)

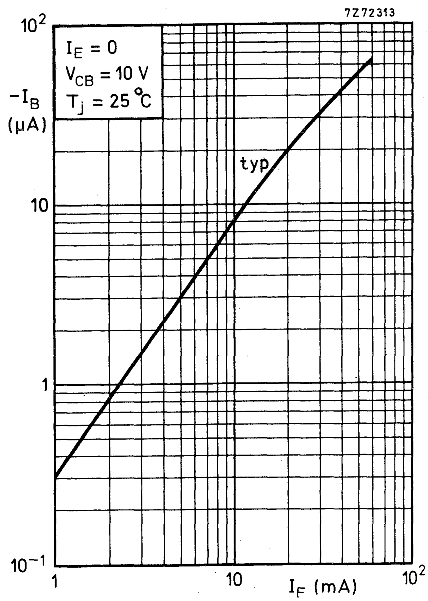

7Z72324
typ. values
$I_F = 0$
I_{CBO} (nA)
$V_{CB} = 20$ V
10 V
5 V
10
1
10^{-1}
10^{-2}
25
50
75
100
T_j (°C)

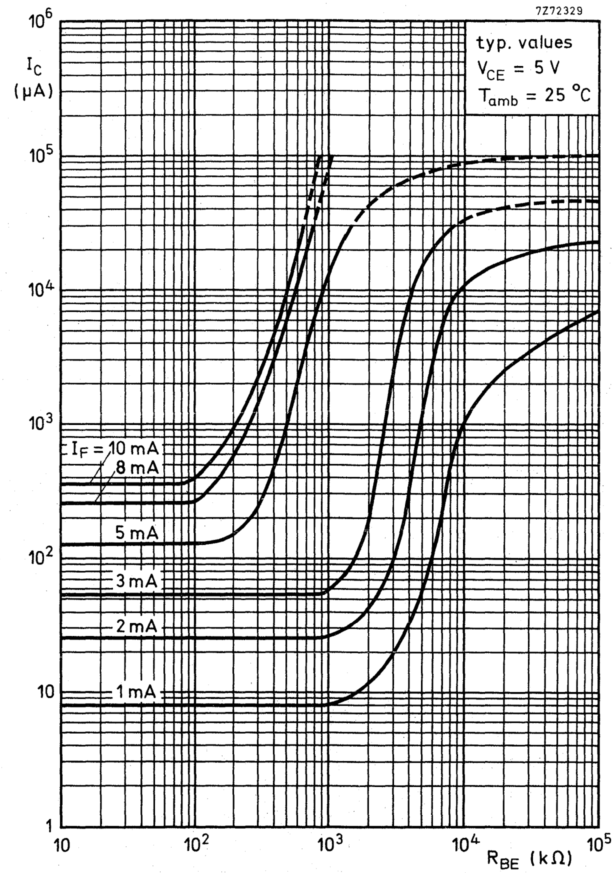

7Z72311
typ. values
$I_B = 0$
$T_{amb} = 25\,^{\circ}C$
I_C (mA)
$V_{CE} = 10$ V
5 V
1 V
0,8 V
10^3
10^2
10
1
1
10
10^2
I_F (mA)

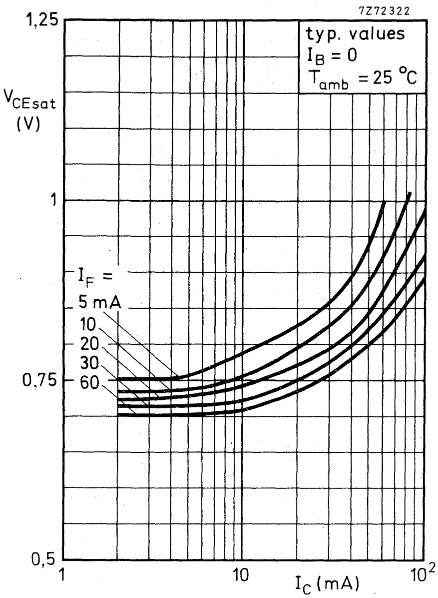

7Z72321
typ. values
$I_B = 0$
$V_{CE} = 1$ V
I_C (mA)
$I_F = 10$ mA
5 mA
100
75
50
25
0
−50
0
50
100
T_{amb} (°C)

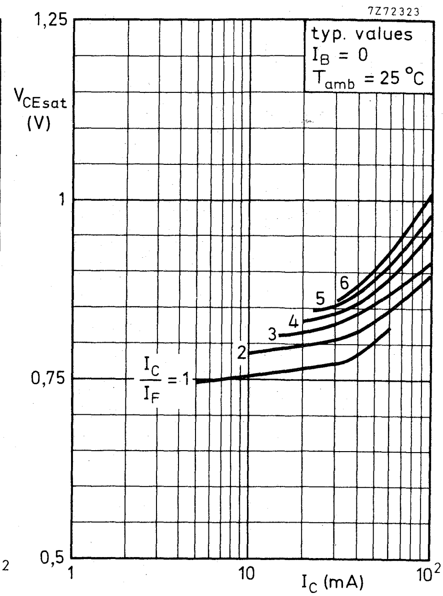

7Z72326
typ. values
$I_B = 0$
$T_{amb} = 25\,^{\circ}C$
I_C (mA)
150
100
50
0
$I_F = 10$ mA
6 mA
5 mA
4 mA
3 mA
2 mA
1 mA
150 mW
0
5
10
V_{CE} (V)

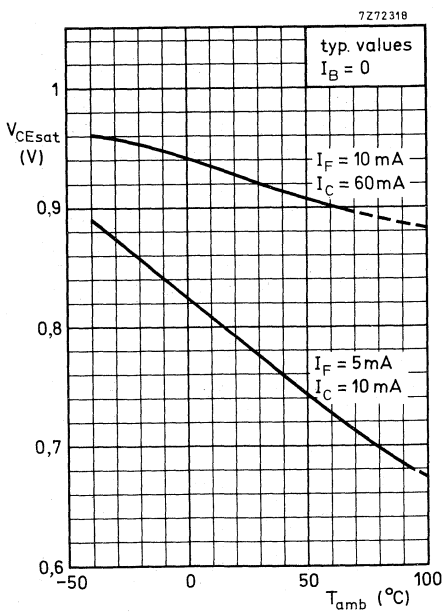

7Z72325
typ. values
$I_B = 0$
$T_{amb} = 25\,^{\circ}C$
I_C (mA)
150
100
50
0
150 mW
$I_F = 10$ mA
6 mA
5 mA
4 mA
3 mA
2 mA
1 mA
0
1
2
V_{CE} (V)

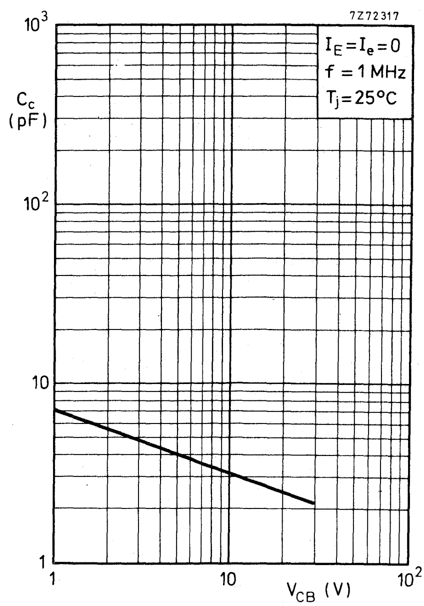

7Z72313
$I_E = 0$
$V_{CB} = 10$ V
$T_j = 25\,^{\circ}C$
$-I_B$ (μA)
10^2
10
1
10^{-1}
typ
1
10
10^2
I_F (mA)

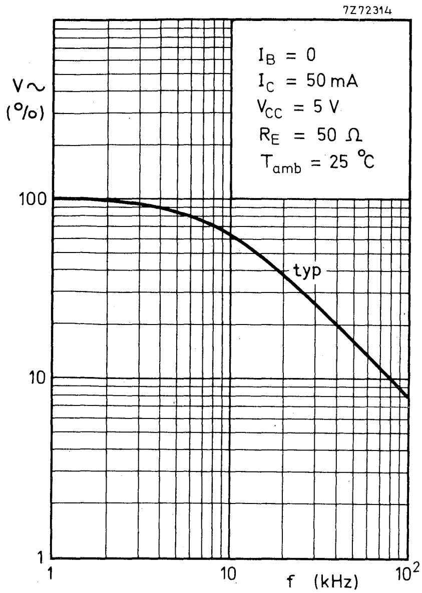

7Z72329
typ. values
V_{CE} = 5 V
T_{amb} = 25 °C
I_C (μA)
10^6
10^5
10^4
10^3
10^2
10
1
I_F = 10 mA
8 mA
5 mA
3 mA
2 mA
1 mA
10
10^2
10^3
10^4
10^5
R_{BE} (kΩ)

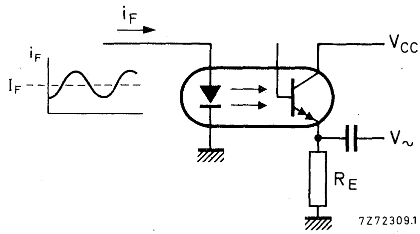

7Z72322
typ. values
$I_B = 0$
$T_{amb} = 25\ ^\circ C$
V_{CEsat} (V)
1,25
1
0,75
0,5
$I_F =$
5 mA
10
20
30
60
1
10
10^2
I_C (mA)

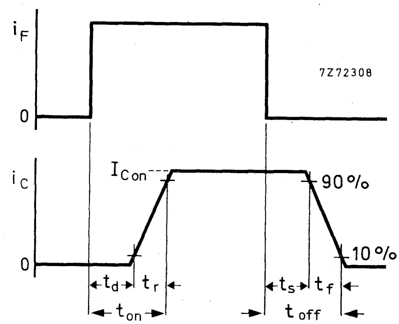

7Z72323
typ. values
$I_B = 0$
$T_{amb} = 25\ ^\circ C$
V_{CEsat} (V)
1,25
1
0,75
0,5
$\frac{I_C}{I_F} = 1$
2
3
4
5
6
1
10
10^2
I_C (mA)

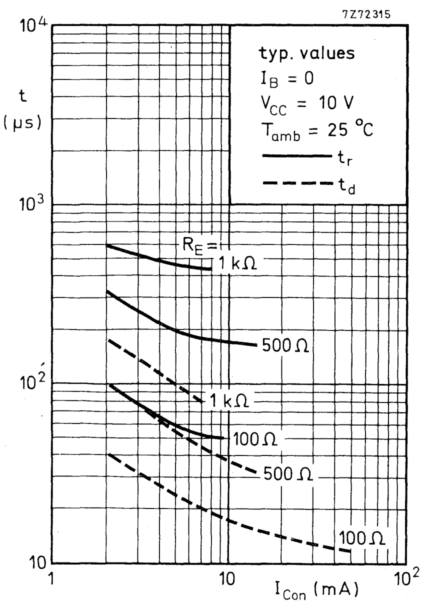

7Z72318
typ. values
$I_B = 0$
V_{CEsat} (V)
1
0,9
0,8
0,7
0,6
$I_F = 10\ mA$
$I_C = 60\ mA$
$I_F = 5\ mA$
$I_C = 10\ mA$
−50
0
50
100
T_{amb} (°C)

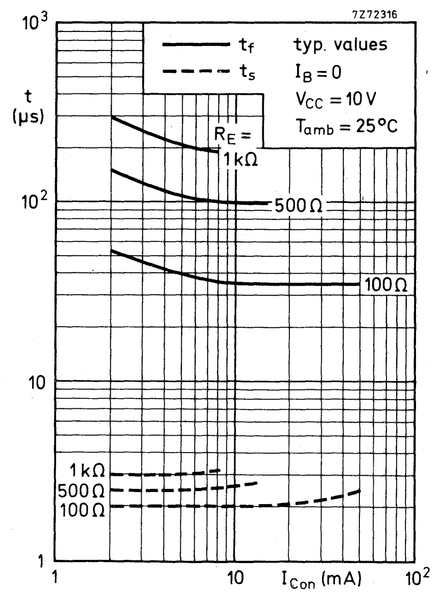

7Z72317
$I_E = I_e = 0$
f = 1 MHz
$T_j = 25\ ^\circ C$
C_c (pF)
10^3
10^2
10
1
1
10
10^2
V_{CB} (V)


7Z72314
I_B = 0
I_C = 50 mA
V_{CC} = 5 V
R_E = 50 Ω
T_{amb} = 25 °C
V~ (%)
typ
f (kHz)


i_F
I_F
V_{CC}
V~
R_E
7Z72309.1


i_F
7Z72308
i_C
I_{Con}
90 %
10 %
t_d
t_r
t_s
t_f
t_{on}
t_{off}


7Z72315
typ. values
I_B = 0
V_{CC} = 10 V
T_{amb} = 25 °C
t_r
t_d
t (µs)
R_E =
1 kΩ
500 Ω
1 kΩ
100 Ω
500 Ω
100 Ω
I_{Con} (mA)


7Z72316
t_f
t_s
typ. values
I_B = 0
V_{CC} = 10 V
T_{amb} = 25 °C
t (µs)
R_E =
1 kΩ
500 Ω
100 Ω
1 kΩ
500 Ω
100 Ω
I_{Con} (mA)

PHOTOCOUPLER

Optically coupled isolator consisting of an infrared emitting GaAs diode and a silicon n-p-n phototransistor with accessible base. Hermetically encapsulated in a metal envelope. The CNY50 is intended for professional applications.

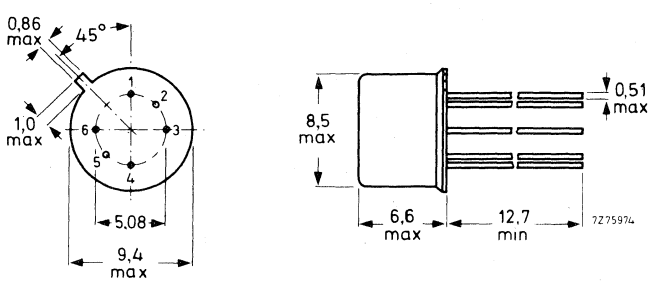
QUICK REFERENCE DATA

Diode					
Continuous reverse voltage		V_R	max.	3	V
Forward current					
d.c.		I_F	max.	100	mA
(peak value); t_p = 300 μs; δ = 0,02		I_{FM}	max.	3000	mA
Total power dissipation up to T_{amb} = 75 ^oC		P_{tot}	max.	150	mW
Transistor					
Collector-emitter voltage (open base)		V_{CEO}	max.	35	V
Total power dissipation up to T_{amb} = 75 ^oC		P_{tot}	max.	150	mW
Photocoupler					
Output/input d.c. current transfer ratio					
I_F = 10 mA; V_{CE} = 0,4 V; (I_B = 0)	**CNY50-1**	I_C/I_F	>	0,25	
	CNY50-2	I_C/I_F	>	0,40	
Collector cut-off current (dark)					
V_{CC} = 15 V; working voltage (d.c.) = 1 kV					
diode: I_F = 0 (see also Fig. 2)		I_{CEW}	<	200	nA
Isolation voltage(d.c.)		V_{IO}	>	1	kV

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-104B.



Pinning
1 emitter
2 base
3 collector
4 anode
5 internal connection
6 cathode

Maximum lead diameter guaranteed only for 12,7 mm.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Diode

Continuous reverse voltage	V_R	max.	3	V
Forward current				
d.c.	I_F	max.	100	mA
(peak value); t_p = 300 μs; δ = 0,02	I_{FM}	max.	3000	mA
Total power dissipation up to T_{amb} = 75 °C (see Fig. 2)	P_{tot}	max.	150	mW
Operating junction temperature	T_j	max.	125	°C

Transistor

Collector-base voltage (open emitter)	V_{CBO}	max.	70	V
Collector-emitter voltage (open base)	V_{CEO}	max.	35	V
Emitter-collector voltage (open base)	V_{ECO}	max.	7	V
Collector current (d.c.)	I_C	max.	100	mA
Total power dissipation up to T_{amb} = 75 °C	P_{tot}	max.	150	mW
Operating junction temperature	T_j	max.	125	°C

Photocoupler

Total power dissipation up to T_{amb} = 75 °C	P_{tot}	max.	300	mW
Storage temperature	T_{stg}	−65 to + 150		°C
Operating ambient temperature	T_{amb}	−40 to + 85		°C

THERMAL RESISTANCE

From junction to ambient in free air

diode	$R_{th\ j\text{-}a}$	=	330	°C/W
transistor	$R_{th\ j\text{-}a}$	=	330	°C/W

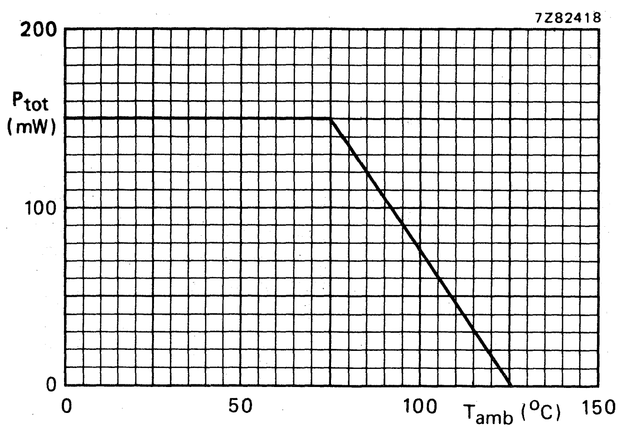


Fig. 2 Power/temperature derating curve for diode and transistor.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Diode

Forward voltage				
I_F = 2 mA; T_{amb} = 0 °C to 70 °C		V_F	<	1,2 V
I_F = 10 mA		V_F	typ. <	1,15 V 1,50 V
Reverse current				
V_R = 3 V		I_R	typ. <	1 μA 100 μA
Diode capacitance				
V_R = 0; f = 1 MHz		C_d	typ.	75 pF
Transistor (diode: I_F = 0)				
Collector-base breakdown voltage				
open emitter; I_C = 0,1 mA		$V_{(BR)CBO}$	>	70 V
Collector-emitter breakdown voltage				
open base; I_C = 1 mA		$V_{(BR)CEO}$	>	35 V
Emitter-collector breakdown voltage				
open base; I_E = 0,1 mA		$V_{(BR)ECO}$	>	7 V
Collector cut-off current (dark)				
I_E = 0; V_{CB} = 10 V		I_{CBO}	<	20 nA
I_B = 0; V_{CE} = 20 V		I_{CEO}	typ. <	5 nA 100 nA
I_B = 0; V_{CE} = 20 V; T_{amb} = 70 °C		I_{CEO}	<	10 μA
D.C. current gain				
I_C = 10 mA; V_{CE} = 5 V		h_{FE}	typ.	600
Photocoupler (I_B = 0)*				
Collector cut-off current (light)				
V_F = 0,8 V; V_{CE} = 15 V; T_{amb} = 0 °C to 70 °C	**CNY50-1**	I_C	<	15 μA
I_F = 2 mA; V_{CE} = 0,4 V; T_{amb} = 0 °C to 70 °C	**CNY50-2**	I_C	<	150 μA
Output/input d.c. current transfer ratio				
I_F = 10 mA; V_{CE} = 0,4 V	**CNY50-1**	I_C/I_F	typ. 0,25 to 1,0	0,4
	CNY50-2	I_C/I_F	typ. 0,40 to 1,6	0,8
Collector cut-off current (dark) see Fig. 3				
V_{CC} = 15 V; working voltage (d.c.) = 1 kV				
T_j = 25 °C		I_{CEW}	<	200 nA
T_j = 70 °C		I_{CEW}	<	100 μA

* Where the phototransistor receives light from the diode the O (for open base) has been omitted from the symbols.

Isolation voltage, d.c. value measured between shorted input leads and shorted output leads	V_{IO}	>	1 kV
Capacitance between input and output $I_F = 0$; $V = 0$; $f = 1$ MHz	C_{io}	typ.	1 pF
Insulation resistance between input and output $\pm V_{IO} = 500$ V	r_{IO}	> typ.	100 GΩ 1000 GΩ

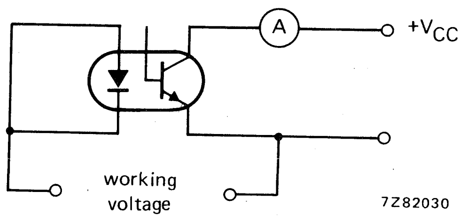


Fig. 3.

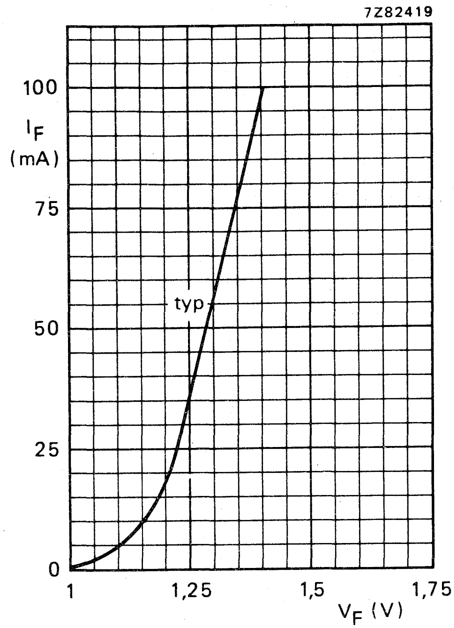


Fig. 4 T_{amb} = 25 °C.

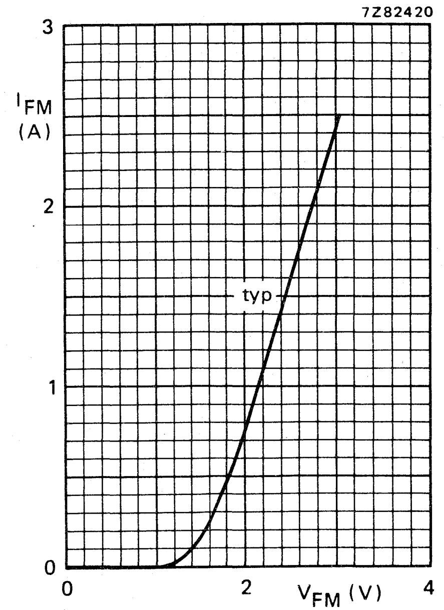


Fig. 5 T_{amb} = 25 °C; t_p = 10 μs; δ = 0,01.

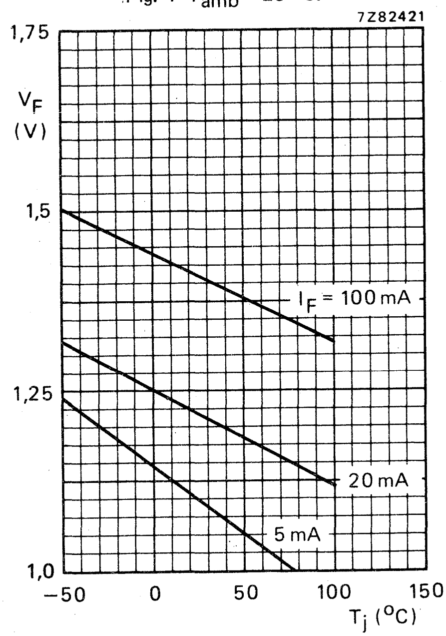


Fig. 6 Typical values.

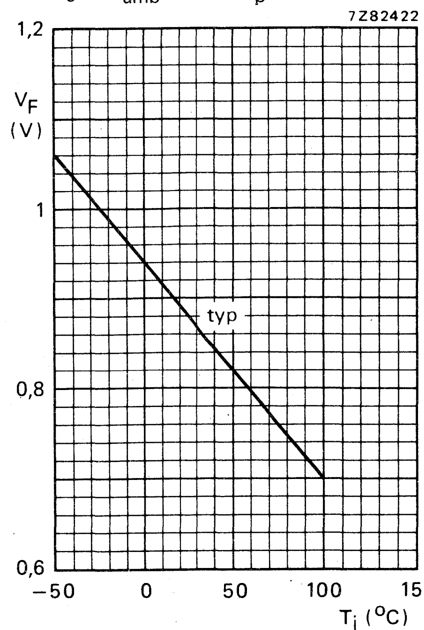


Fig. 7 I_F = 50 μA.

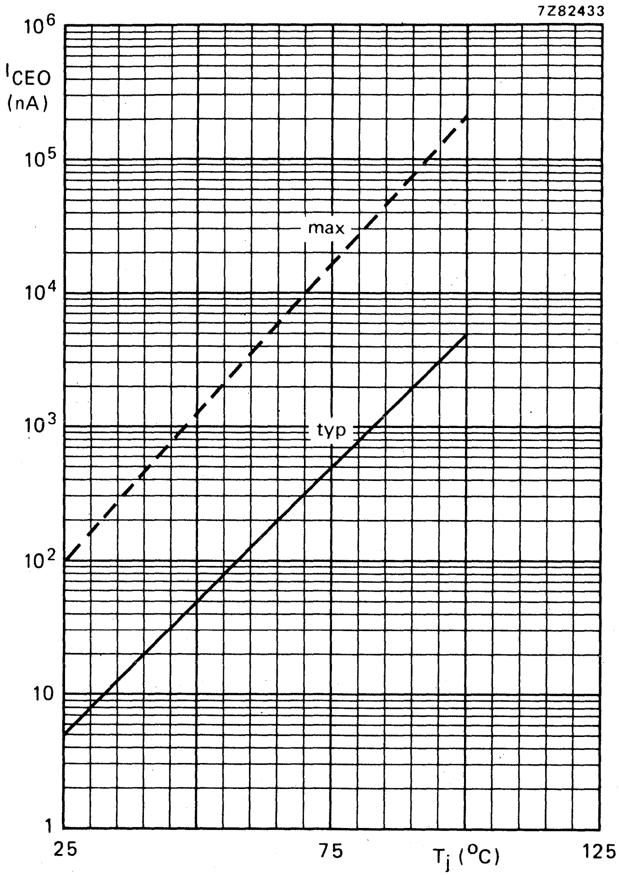


Fig. 8 $I_F = 0$; $V_{CE} = 20$ V.

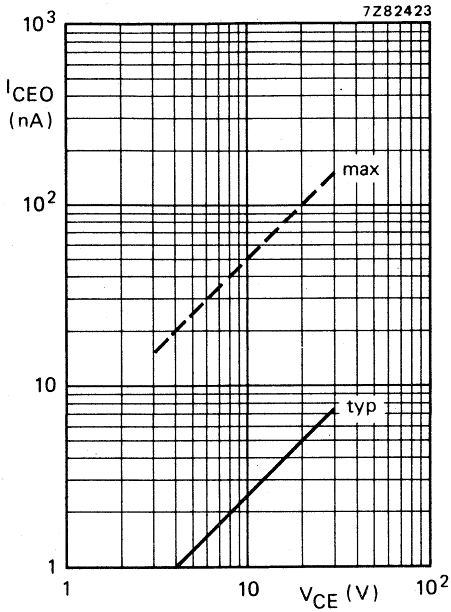


Fig. 9 $I_F = 0$; $T_j = 25\ ^oC$.

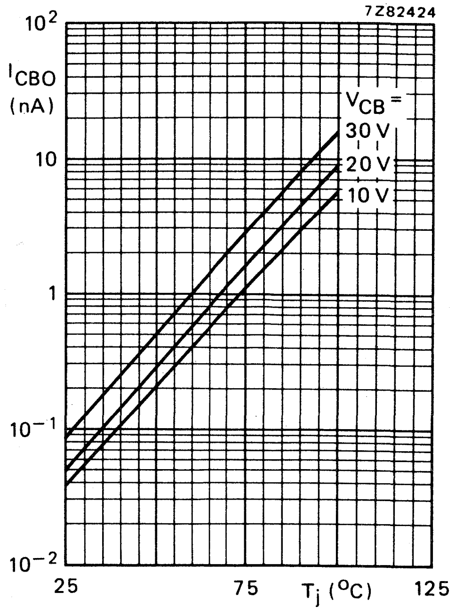


Fig. 10 $I_F = 0$; typical values.

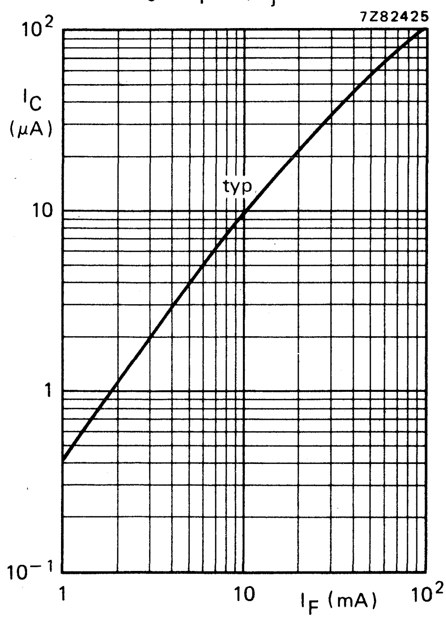


Fig. 11 $I_E = 0$; $V_{CB} = 5$ V; $T_{amb} = 25\ ^oC$.

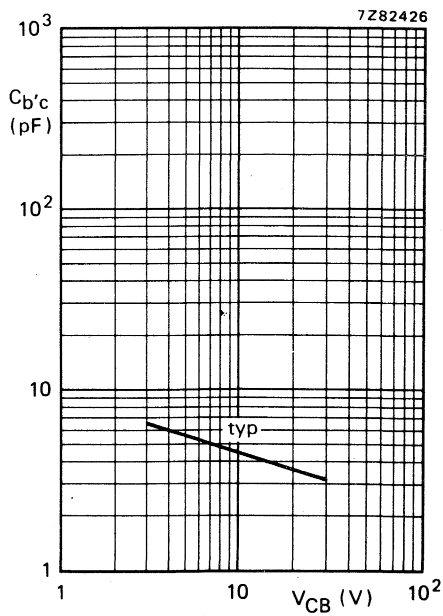


Fig. 12 f = 1 MHz; $T_{amb} = 25\ ^oC$.

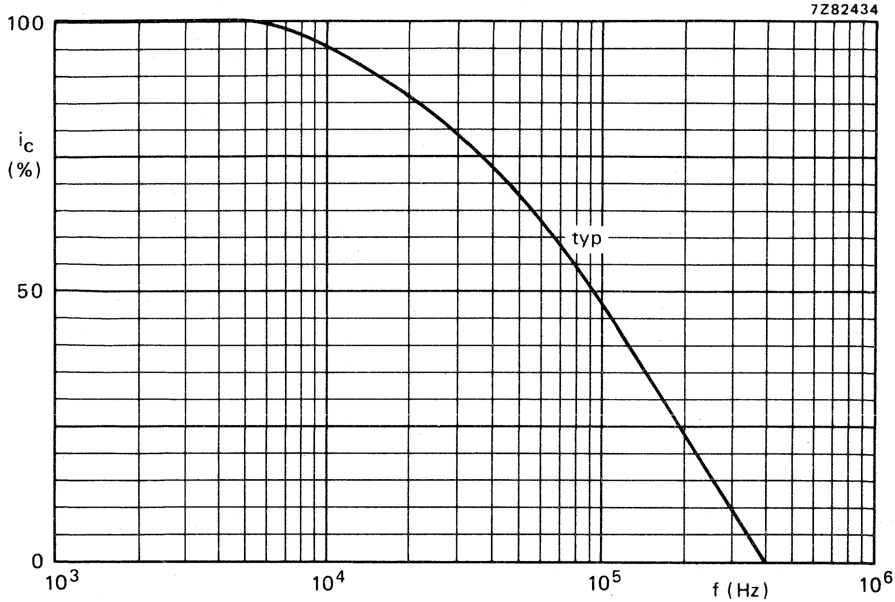


Fig. 13 $I_B = 0$; $I_C = 2$ mA; $V_{CC} = 5$ V; $R_L = 1$ kΩ; $T_{amb} = 25$ °C.

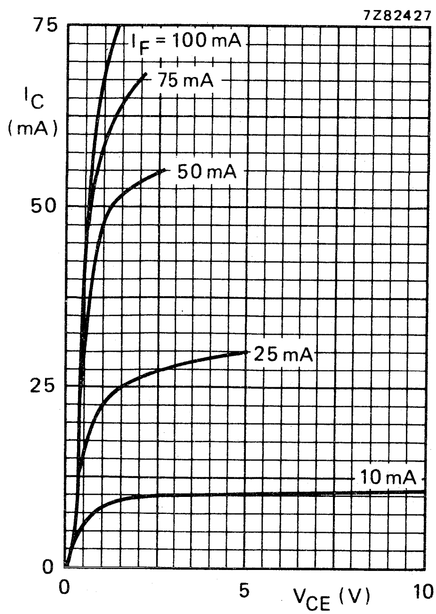


Fig. 14 $T_{amb} = 25$ °C; typical values.

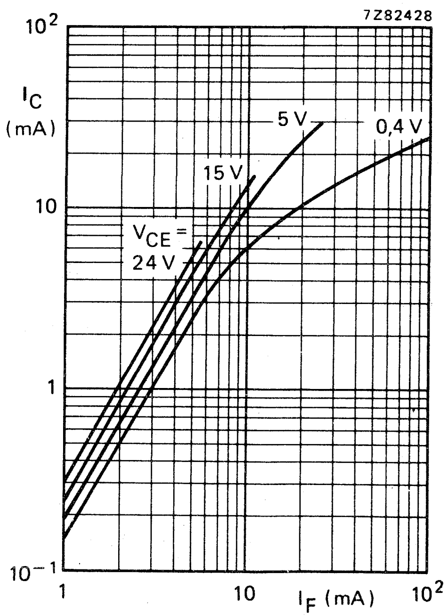


Fig. 15 $T_{amb} = 25$ °C; typical values.

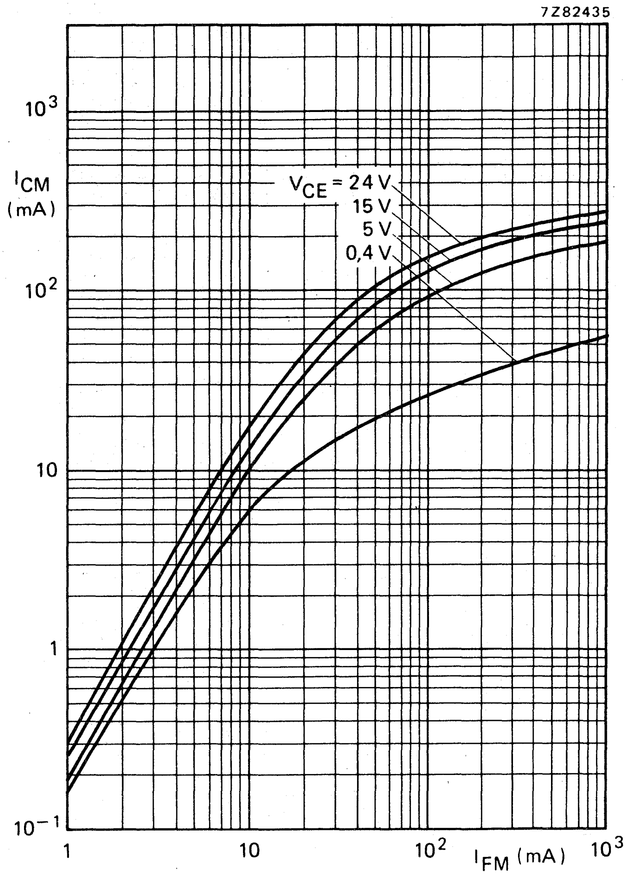


Fig. 16 T_{amb} = 25 °C; t_p = 10 μs; δ = 0,01; typical values.

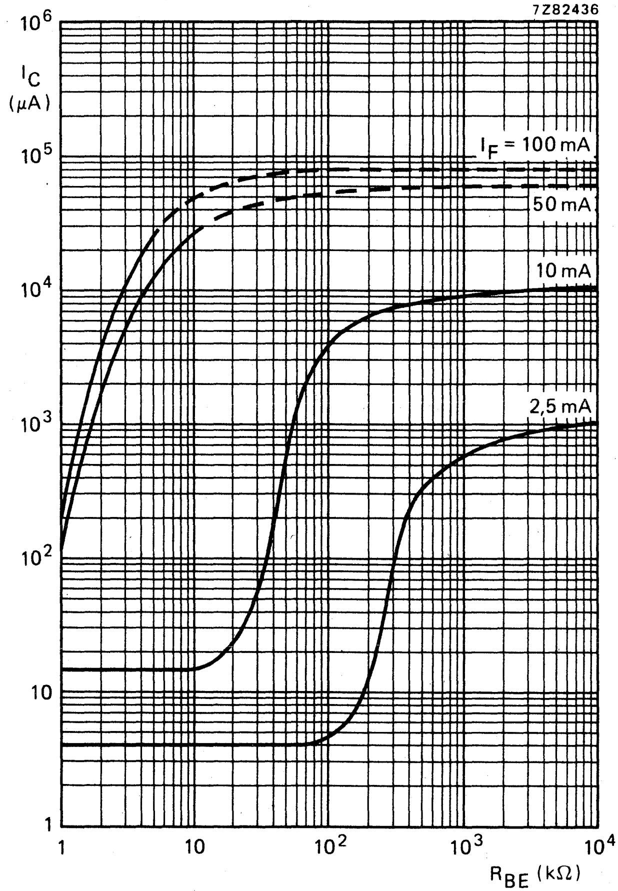


Fig. 17 $I_B = 0$; $V_{CE} = 5$ V; $T_{amb} = 25$ °C; typical values.

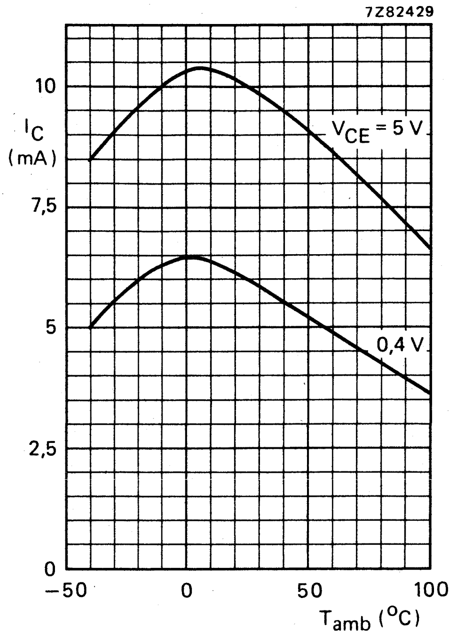


Fig. 18 $I_B = 0$; $I_F = 10$ mA; typical values.

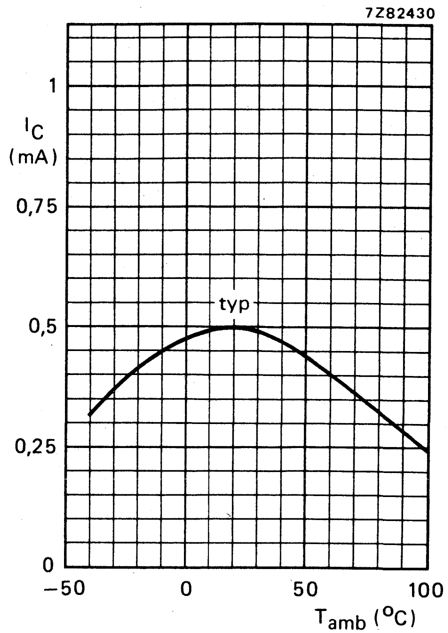


Fig. 19 $I_B = 0$; $I_F = 2$ mA; $V_{CE} = 0{,}4$ V.

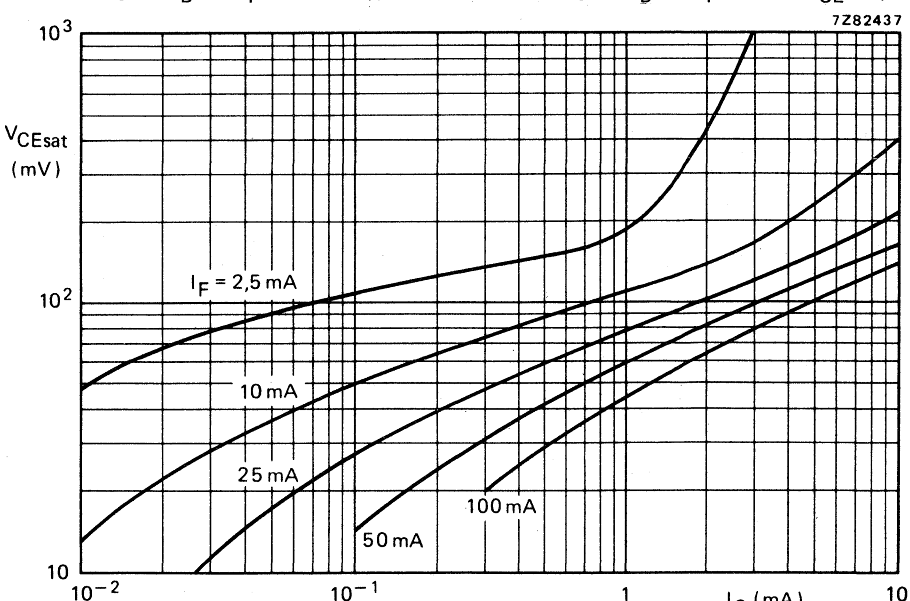


Fig. 20 $I_B = 0$; $T_{amb} = 25$ °C; typical values.

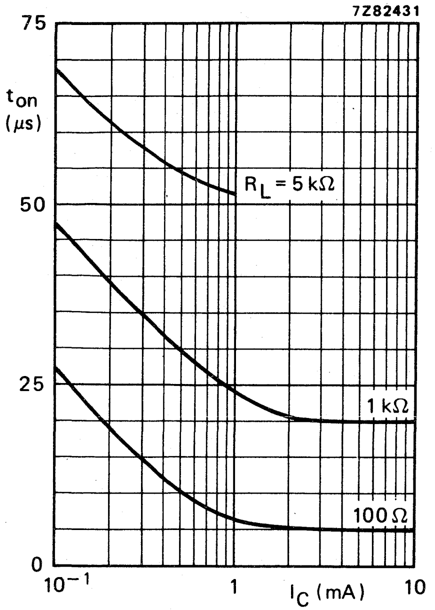


Fig. 21 $I_B = 0$; $V_{CC} = 5$ V; $T_{amb} = 25$ °C; typical values. (See Fig. 23).

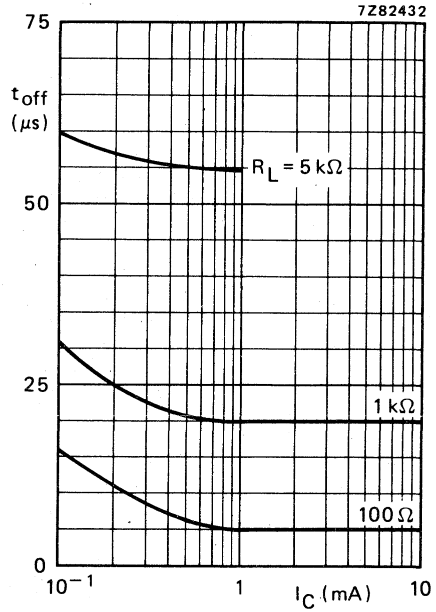


Fig. 22 $I_B = 0$; $V_{CC} = 5$ V; $T_{amb} = 25$ °C; typical values. (See Fig. 23).

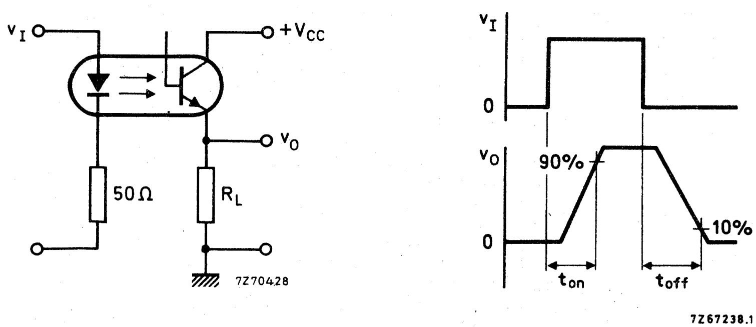


Fig. 23 Switching circuit and waveforms.

PHOTOCOUPLERS

Optically coupled isolators consisting of an infrared emitting GaAs diode and a silicon n-p-n phototransistor with accessible base. Plastic envelopes. Suitable for TTL integrated circuits.

Features of these products:

- high output/input d.c. current transfer ratio;
- low saturation voltage;
- high isolation voltage
  CNY52 3,75 kV (r.m.s.) and 5,3 kV (d.c.);
  CNY53 3 kV (r.m.s.) and 4,3 kV (d.c.);
- working voltage 1,5 kV.

QUICK REFERENCE DATA

			CNY52	CNY53	
Diode					
Continuous reverse voltage	V_R	max.	3	3	V
Forward current					
d.c.	I_F	max.	100	100	mA
(peak value); t_p = 10 μs; δ = 0,1	I_{FM}	max.	1000	1000	mA
Total power dissipation up to T_{amb} = 25 ^oC	P_{tot}	max.	150	150	mW
Transistor					
Collector-emitter voltage (open base)	V_{CEO}	max.	50	30	V
Total power dissipation up to T_{amb} = 25 ^oC	P_{tot}	max.	200	200	mW
Photocoupler					
Output/input d.c. current transfer ratio					
I_F = 10 mA; V_{CE} = 0,4 V; (I_B = 0)	I_C/I_F	>	0,25	0,50	
Collector cut-off current (dark)					
V_{CC} = 10 V; working voltage (d.c.) = 1,5 kV					
diode: I_F = 0 (see also Fig. 2)	I_{CEW}	<	200	200	nA
Isolation voltage (d.c.)					
t = 1 min	V_{IO}	>	5,3	4,3	kV

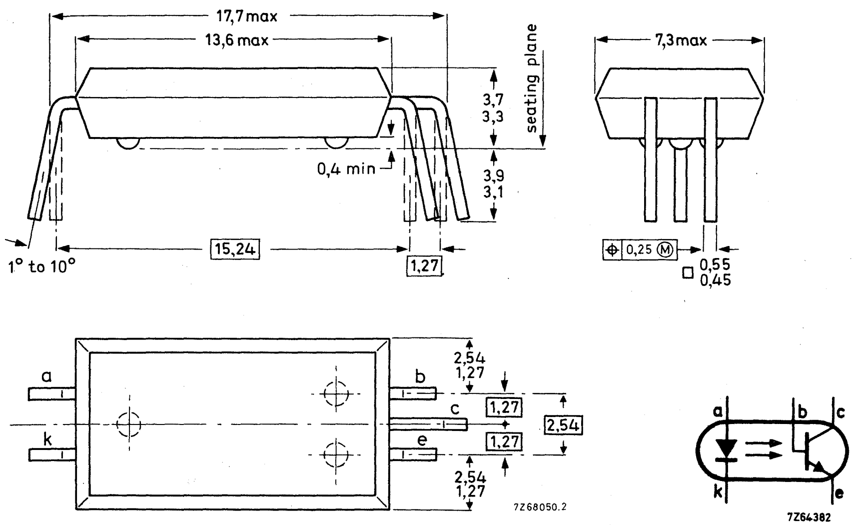
MECHANICAL DATA

SOT-91A (see Fig. 1)

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-91A.



⊕ Positional accuracy.

Ⓜ Maximum material condition.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Diode

Continuous reverse voltage		V_R	max.	3 V
Forward current				
d.c.		I_F	max.	100 mA
(peak value); t_p = 10 μs; δ = 0,1		I_{FM}	max.	1000 mA
Total power dissipation up to T_{amb} = 25 ^oC		P_{tot}	max.	150 mW
Operating junction temperature		T_j	max.	125 ^oC

Transistor

Collector-emitter voltage (open base)	CNY52	V_{CEO}	max.	50 V
	CNY53	V_{CEO}	max.	30 V
Collector-base voltage (open emitter)		V_{CBO}	max.	50 V
Emitter-collector voltage (open base)		V_{ECO}	max.	7 V

Collector current (d.c.)	I_C	max.	100	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	200	mW
Operating junction temperature	T_j	max.	125	°C

Photocoupler

Storage temperature	T_{stg}	−55 to +150		°C
Lead soldering temperature up to the seating plane; $t_{sld} < 10$ s	T_{sld}	max.	260	°C

THERMAL RESISTANCE

From junction to ambient in free air				
diode	$R_{th\ j\text{-}a}$	=	0,65	°C/mW
transistor	$R_{th\ j\text{-}a}$	=	0,5	°C/mW
From junction to ambient, device mounted on a printed-circuit board				
diode	$R_{th\ j\text{-}a}$	=	0,6	°C/mW
transistor	$R_{th\ j\text{-}a}$	=	0,4	°C/mW

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Diode

Forward voltage I_F = 10 mA	V_F	typ.	1,2	V
		<	1,5	V
Reverse current V_R = 3 V	I_R	<	10	μA

Transistor (diode: $I_F = 0$)

Collector cut-off current (dark) V_{CE} = 10 V	I_{CEO}	typ.	5	nA
		<	100	nA
V_{CE} = 10 V; T_{amb} = 70 °C	I_{CEO}	<	10	μA
V_{CB} = 10 V	I_{CBO}	<	20	nA

Photocoupler ($I_B = 0$)*

Output/input d.c. current transfer ratio I_F = 10 mA; V_{CE} = 0,4 V	**CNY52**	I_C/I_F	>	0,25
			typ.	0,50
	CNY53	I_C/I_F	>	0,5
			typ.	1,0

Collector cut-off current (dark) see Fig. 2				
V_{CC} = 10 V; working voltage (d.c.) = 1,5 kV	I_{CEW}	<	200	nA
V_{CC} = 10 V; working voltage (d.c.) = 1,5 kV; T_j = 70 °C	I_{CEW}	<	100	μA

* Where the phototransistor receives light from the diode the O (for open base) has been omitted from the symbols.

			CNY52	CNY53	
Collector-emitter saturation voltage					
I_F = 10 mA; I_C = 2 mA	V_{CEsat}	typ.	0,17	–	V
		<	0,40	–	V
I_F = 10 mA; I_C = 4 mA	V_{CEsat}	typ.	–	0,17	V
		<	–	0,40	V
→ Isolation voltage, d.c. value*	V_{IO}	>	5,3	4,3	kV
Capacitance between input and output I_F = 0; V = 0; f = 1 MHz	C_{io}	typ.	0,6	0,6	pF
Insulation resistance between input and output $\pm V_{IO}$ = 1 kV	r_{IO}	>	10^{10}	10^{10}	Ω
		typ.	10^{12}	10^{12}	Ω
Switching times (see Figs 3 and 4)					
I_{Con} = 2 mA; V_{CC} = 5 V; R_L = 100 Ω					
Turn-on time	t_{on}	typ.	3	–	μs
Turn-off time	t_{off}	typ.	3	–	μs
I_{Con} = 4 mA; V_{CC} = 5 V; R_L = 100 Ω					
Turn-on time	t_{on}	typ.	–	5	μs
Turn-off time	t_{off}	typ.	–	5	μs

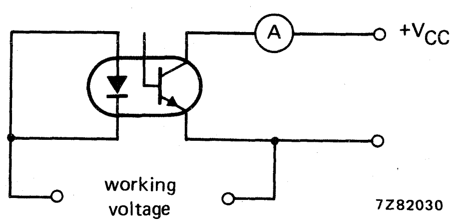


Fig. 2.

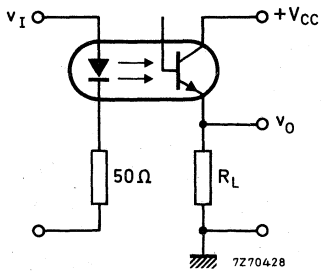


Fig. 3 Switching circuit.

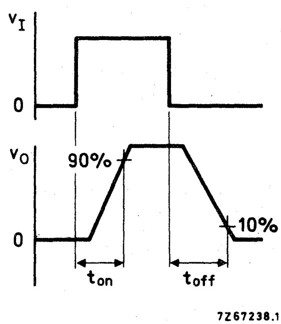


Fig. 4 Waveforms.

* Tested with a d.c. voltage for 1 minute between shorted input leads and shorted output leads.

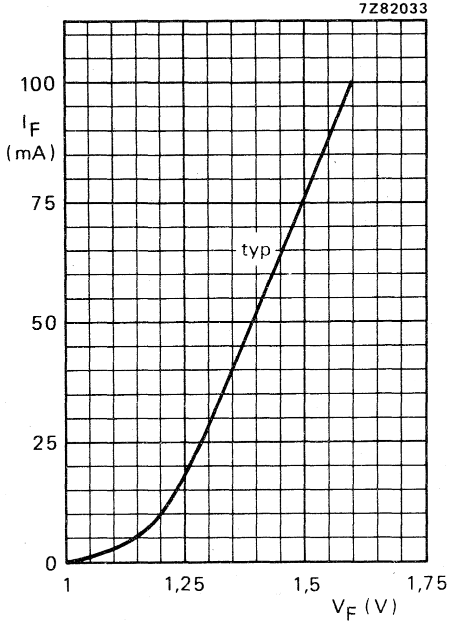


Fig. 5 T_{amb} = 25 °C.

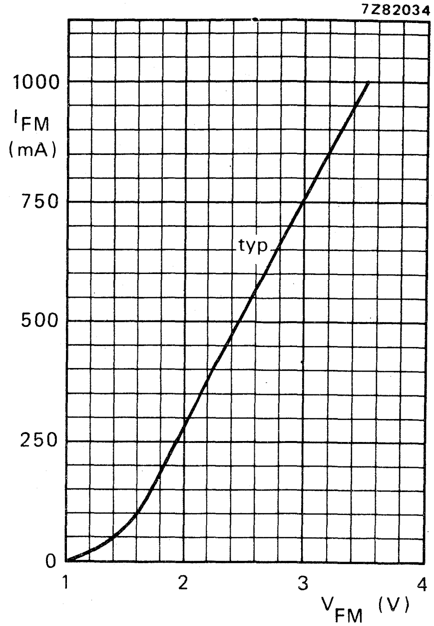


Fig. 6 T_{amb} = 25 °C; t_p = 10 μs; T = 1 ms.

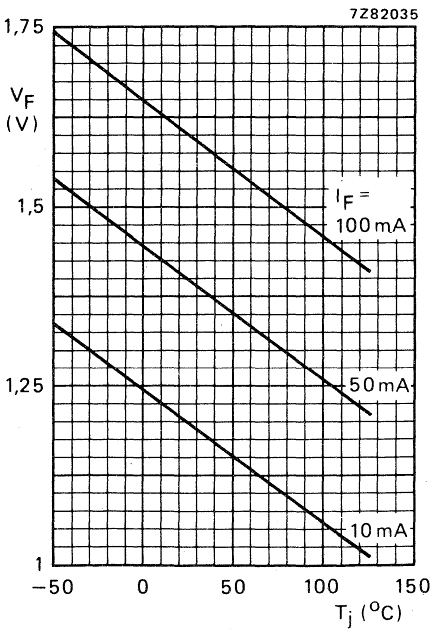


Fig. 7 Typical values.

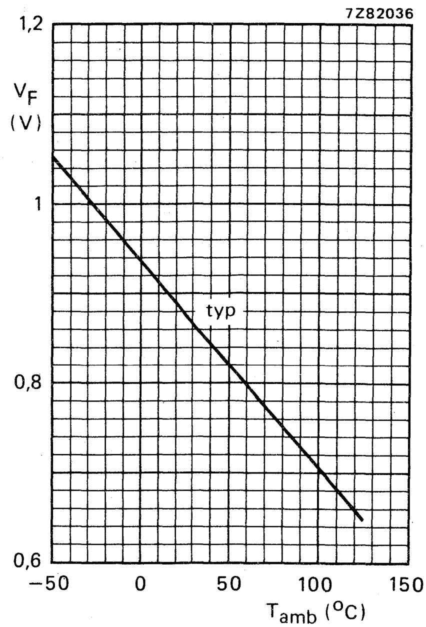


Fig. 8 I_F = 50 μA.

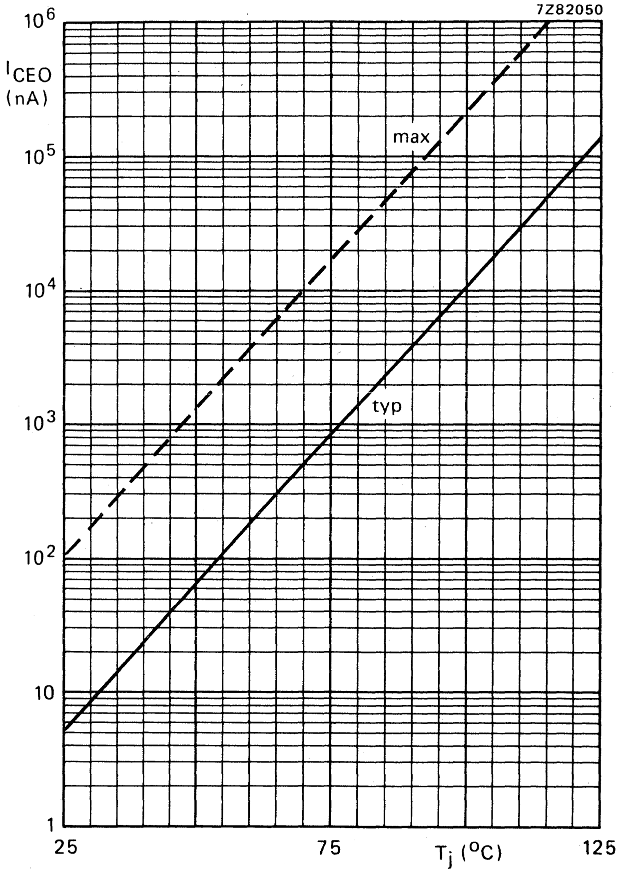


Fig. 9 $I_F = 0$; $V_{CE} = 10$ V.

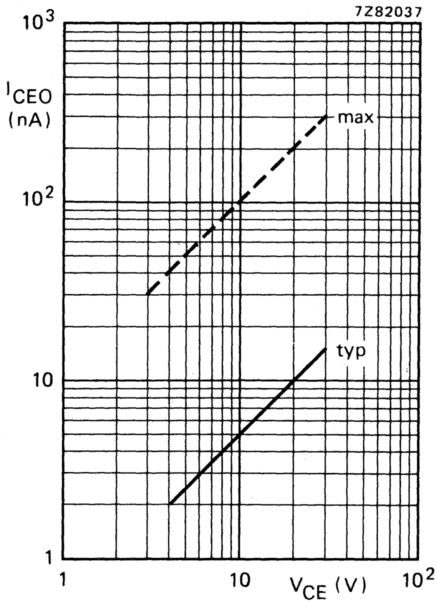


Fig. 10 $I_F = 0$; $T_j = 25$ °C.

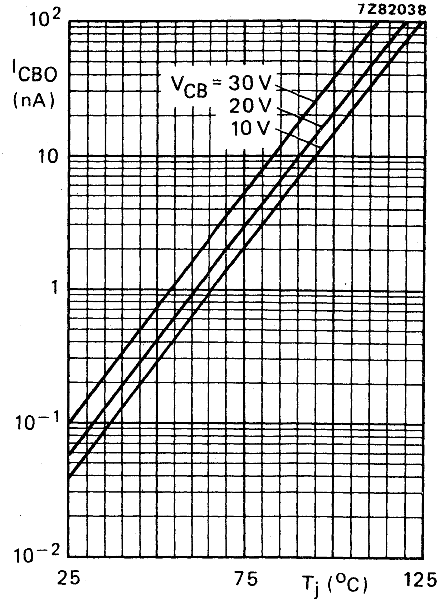


Fig. 11 $I_F = 0$; Typical values.

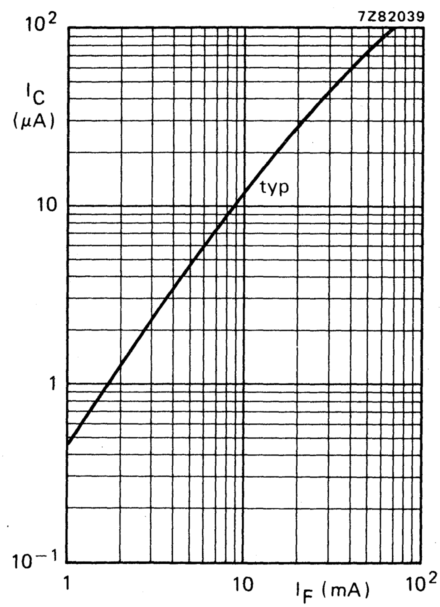


Fig. 12. $I_E = 0$; $V_{CB} = 5$ V; $T_{amb} = 25$ °C.

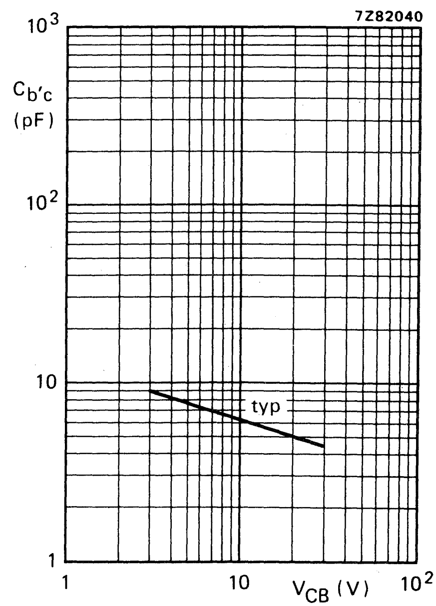


Fig. 13 f = 1 MHz; $T_j = 25$ °C.

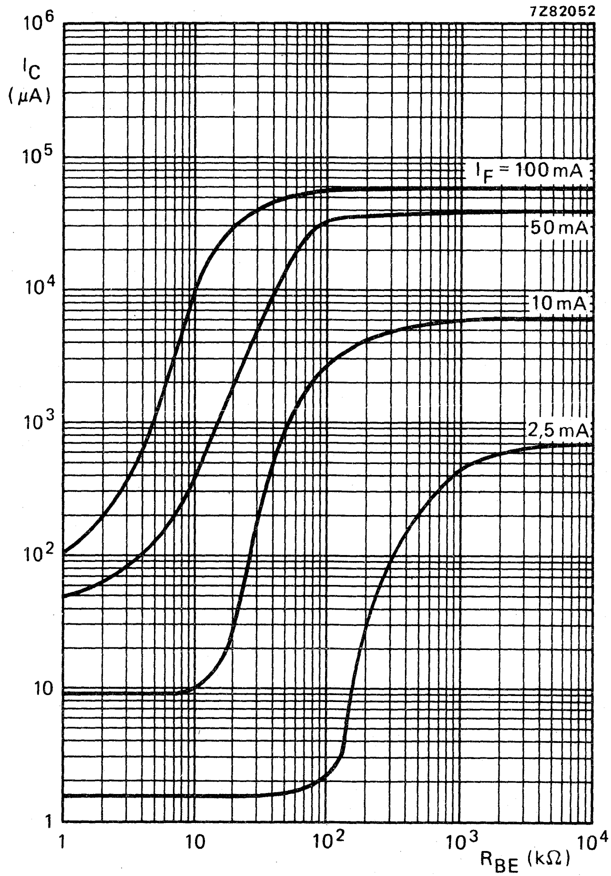


Fig. 14 **CNY52**; $I_B = 0$; $V_{CE} = 5$ V; $T_{amb} = 25$ °C; typical values.

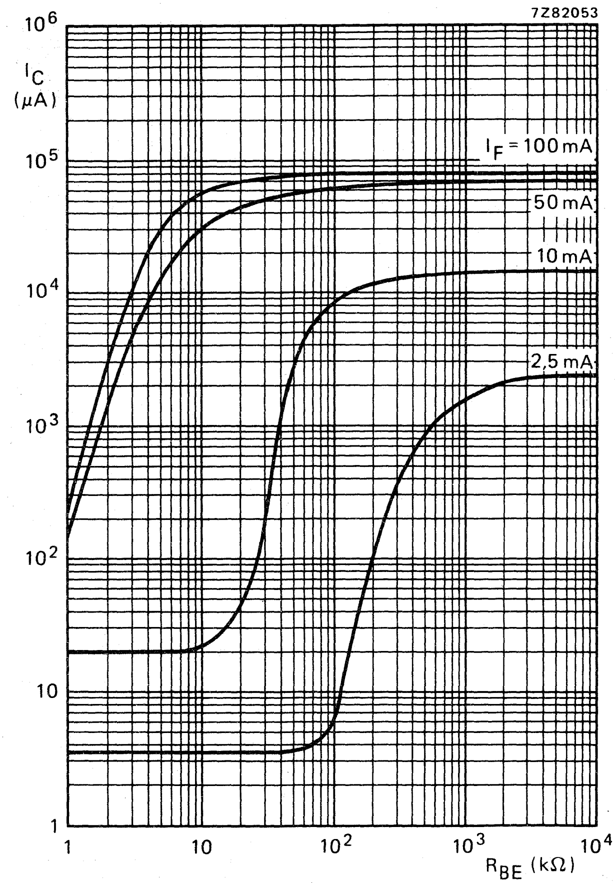


Fig. 15 **CNY53**; $I_B = 0$; $V_{CE} = 5$ V; $T_{amb} = 25$ °C; typical values.

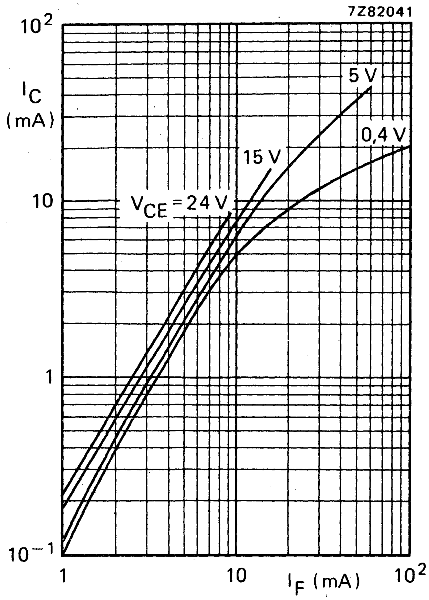


Fig. 16 **CNY52**; T_{amb} = 25 °C; typical values.

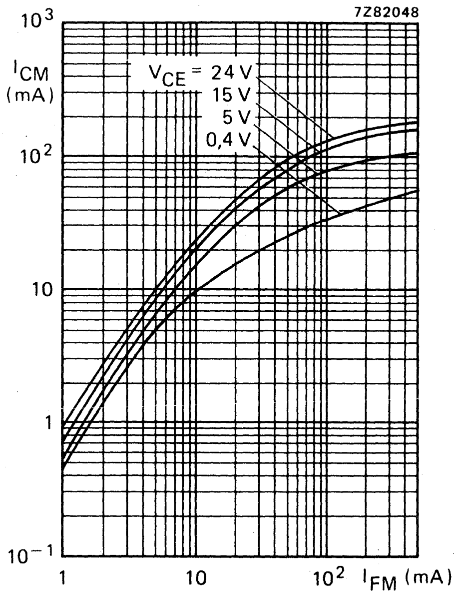


Fig. 17 **CNY53**; T_{amb} = 25 °C; t_p = 10 μs; T = 1 ms; typical values.

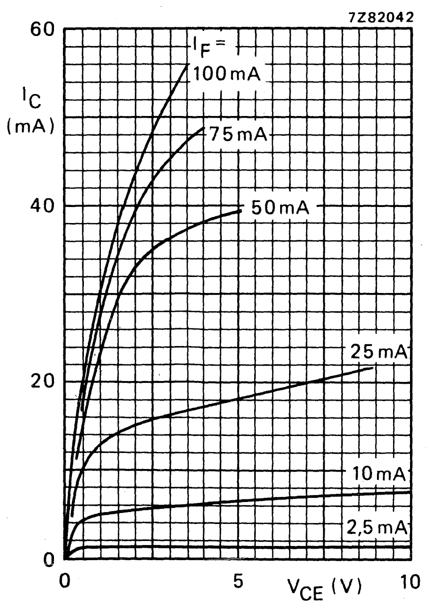


Fig. 18 **CNY52**; T_{amb} = 25 °C; typical values.

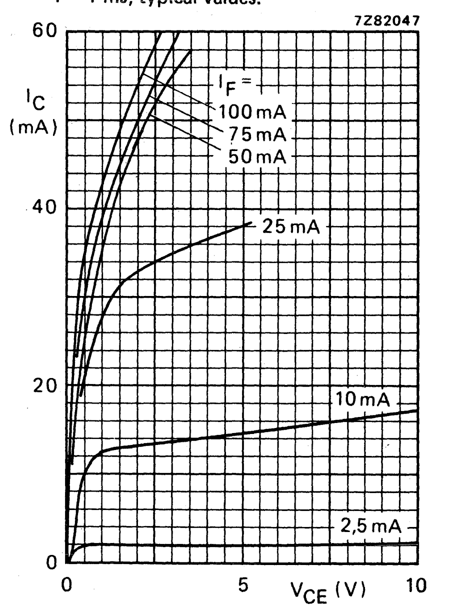


Fig. 19 **CNY53**; T_{amb} = 25 °C; Typical values.

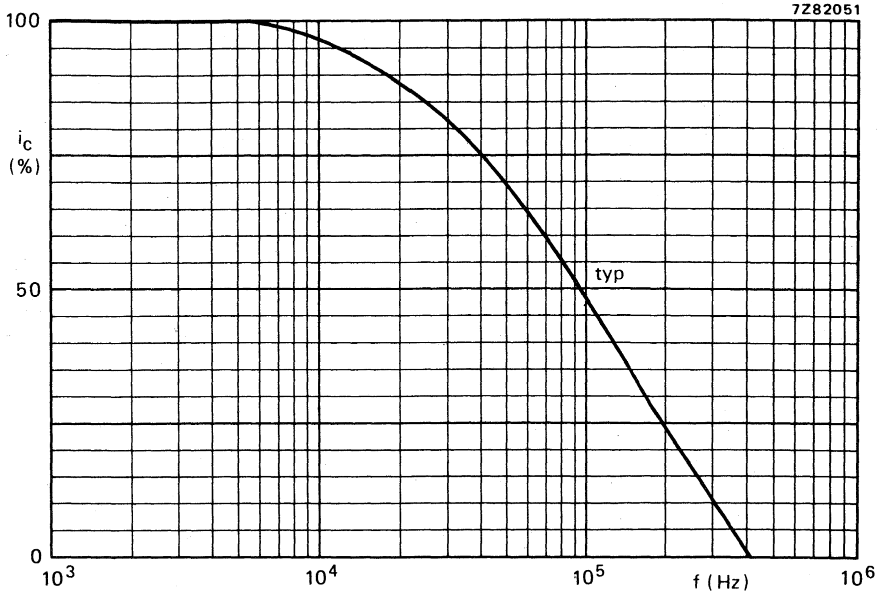


Fig. 20 $I_B = 0$; $I_C = 2$ mA; $V_{CC} = 5$ V; $R_L = 1$ kΩ; $T_{amb} = 25$ °C.

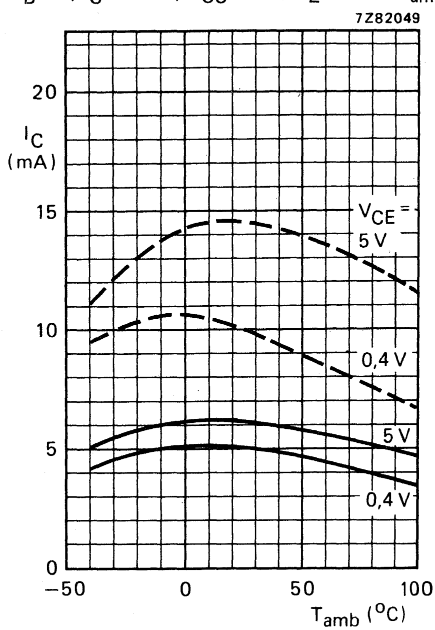


Fig. 21 —— **CNY52**; ---- **CNY53**; $I_B = 0$; $I_F = 10$ mA; typical values.

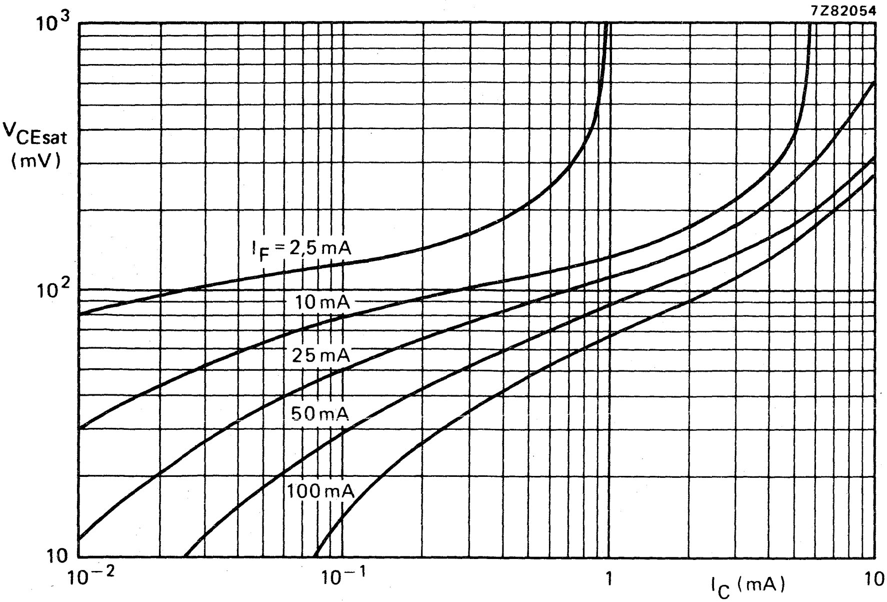


Fig. 22 **CNY52**; $I_B = 0$; $T_{amb} = 25\ ^oC$; typical values.

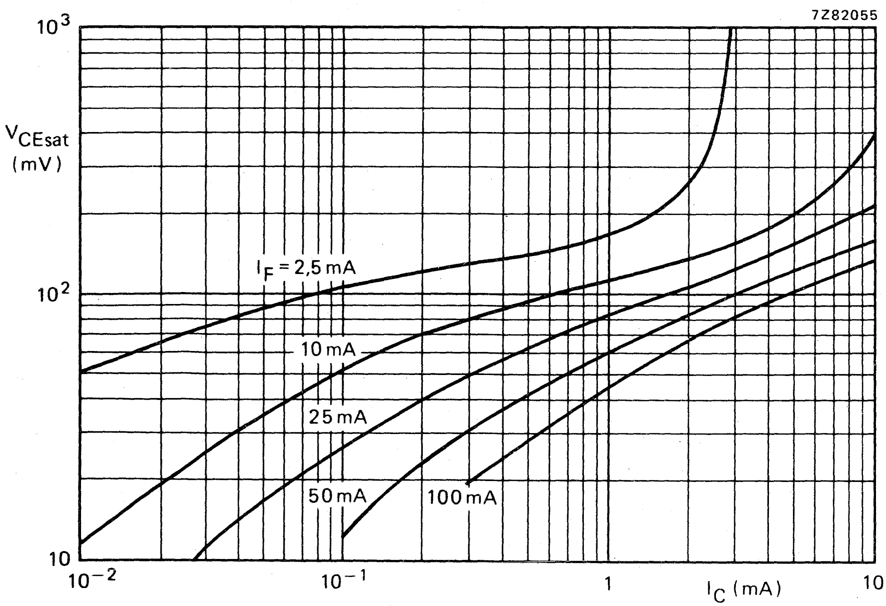


Fig. 23 **CNY53**; $I_B = 0$; $T_{amb} = 25\ ^oC$; typical values.

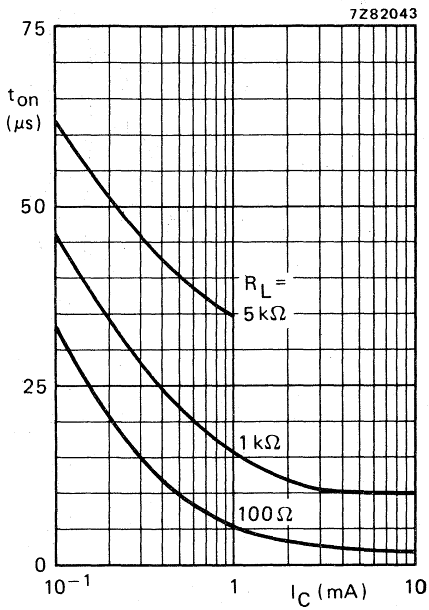


Fig. 24 **CNY52**; I_B = 0; V_{CC} = 5 V; T_{amb} = 25 °C; typical values. (See also Fig. 26.)

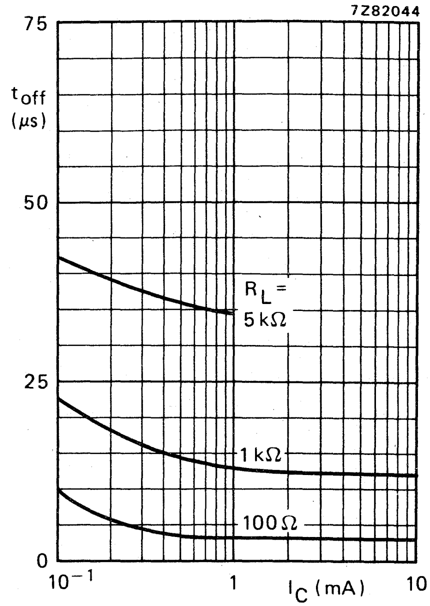


Fig. 25 **CNY52**; I_B = 0; V_{CC} = 5 V; T_{amb} = 25 °C; typical values. (See also Fig. 26.)

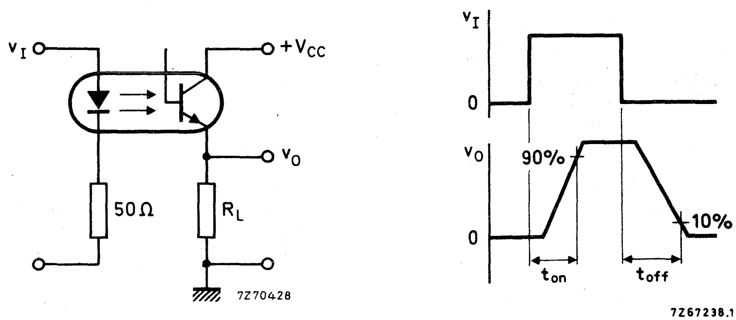


Fig. 26 Switching circuit and waveforms.

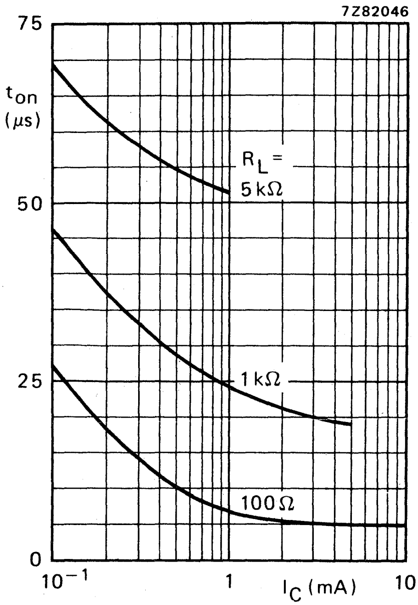


Fig. 27 **CNY53**; $I_B = 0$; $V_{CC} = 5$ V;
$T_{amb} = 25\ ^oC$; typical values.
(See also Fig. 29.)

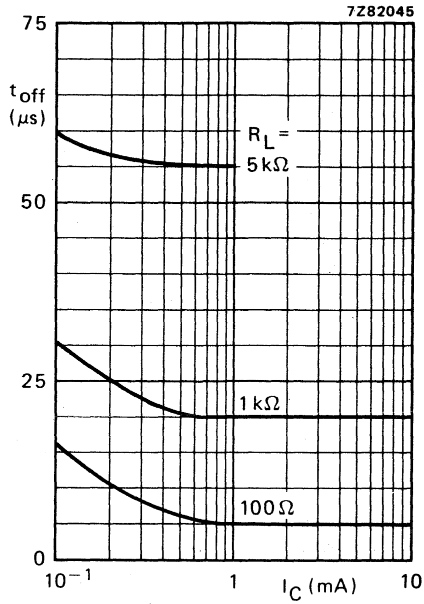


Fig. 28 **CNY53**; $I_B = 0$; $V_{CC} = 5$ V;
$T_{amb} = 25\ ^oC$; typical values.
(See also Fig. 29.)

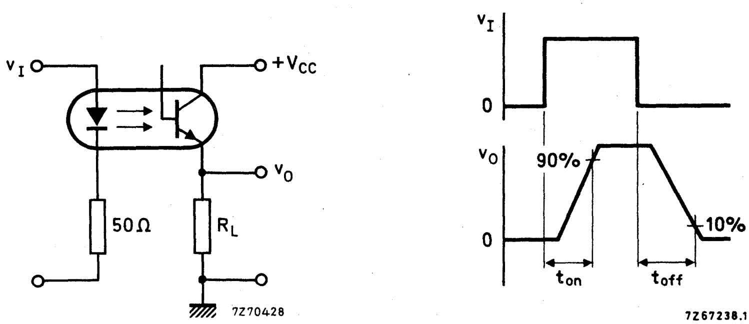


Fig. 29 Switching circuit and waveforms.

PHOTOCOUPLERS

Optically coupled isolators consisting of an infrared emitting GaAs diode and a silicon n-p-n phototransistor with accessible base. Plastic envelopes. Suitable for TTL integrated circuits.

Features of these products:

- high output/input d.c. current transfer ratio;
- low saturation voltage;
- high isolation voltage of 3 kV (r.m.s.) and 4,3 kV (d.c.);
- working voltage 1,5 kV.

QUICK REFERENCE DATA

Diode				
Continuous reverse voltage		V_R	max.	3 V
Forward current				
d.c.		I_F	max.	100 mA
(peak value); t_p = 10 μs; δ = 0,1		I_{FM}	max.	1000 mA
Total power dissipation up to T_{amb} = 25 °C		P_{tot}	max.	150 mW
Transistor				
Collector-emitter voltage (open base)		V_{CEO}	max.	30 V
Total power dissipation up to T_{amb} = 25 °C		P_{tot}	max.	200 mW
Photocoupler				
Output/input d.c. current transfer ratio I_F = 10 mA; V_{CE} = 0,4 V; (I_B = 0)	**CNY57**	I_C/I_F	>	0,2
	CNY57A	I_C/I_F	>	0,4
Collector cut-off current (dark) V_{CC} = 10 V; working voltage (d.c.) = 1,5 kV diode: I_F = 0 (see also Fig. 2)		I_{CEW}	<	200 nA
Isolation voltage (d.c.) t = 1 min		V_{IO}	>	4,3 kV

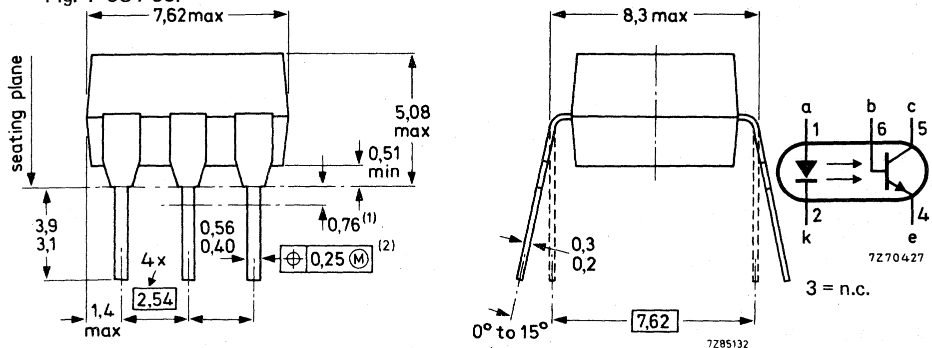
MECHANICAL DATA

SOT-90 (see Fig. 1)

MECHANICAL DATA

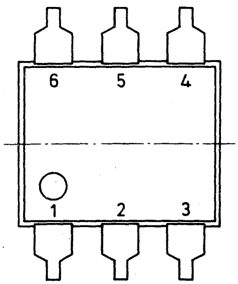
Dimensions in mm

Fig. 1 SOT-90.



⊕ Positional accuracy.

Ⓜ Maximum material condition.



(1) Lead spacing tolerances apply from seating plane to the line indicated.

(2) Centre-lines of all leads are within ± 0,125 mm of the nominal position shown; in the worst case, the spacing between any two leads may deviate from nominal by ± 0,25 mm.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Diode				
Continuous reverse voltage	V_R	max.	3	V
Forward current				
d.c.	I_F	max.	100	mA
(peak value); t_p = 10 μs; δ = 0,1	I_{FM}	max.	1000	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	150	mW
Operating junction temperature	T_j	max.	125	°C
Transistor				
Collector-emitter voltage (open base)	V_{CEO}	max.	30	V
Collector-base voltage (open emitter)	V_{CBO}	max.	50	V
Emitter-collector voltage (open base)	V_{ECO}	max.	7	V

Collector current (d.c.)	I_C	max.	100 mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	200 mW
Operating junction temperature	T_j	max.	125 °C

Photocoupler

Storage temperature	T_{stg}		−55 to + 150 °C
Lead soldering temperature up to the seating plane; t_{sld} < 10 s	T_{sld}	max.	260 °C

THERMAL RESISTANCE

From junction to ambient in free air			
diode	$R_{th\ j\text{-}a}$	=	0,65 °C/mW
transistor	$R_{th\ j\text{-}a}$	=	0,5 °C/mW
From junction to ambient, device mounted on a printed-circuit board			
diode	$R_{th\ j\text{-}a}$	=	0,6 °C/mW
transistor	$R_{th\ j\text{-}a}$	=	0,4 °C/mW

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Diode

Forward voltage		typ.	1,2 V
I_F = 10 mA	V_F	<	1,5 V
Reverse current V_R = 3 V	I_R	<	10 μA

Transistor (diode: I_F = 0)

Collector cut-off current (dark)		typ.	5 nA
V_{CE} = 10 V	I_{CEO}	<	100 nA
V_{CE} = 10 V; T_{amb} = 70 °C	I_{CEO}	<	10 μA
V_{CB} = 10 V	I_{CBO}	<	20 nA

Photocoupler (I_B = 0)*

Output/input d.c. current transfer ratio			typ.	0,5
I_F = 10 mA; V_{CE} = 0,4 V	**CNY57**	I_C/I_F		0,2 to 0,8
			>	0,4
	CNY57A	I_C/I_F	typ.	1,0

Collector cut-off current (dark) see Fig. 2			
V_{CC} = 10 V; working voltage (d.c.) = 1,5 kV	I_{CEW}	<	200 nA
V_{CC} = 10 V; working voltage (d.c.) = 1,5 kV; T_j = 70 °C	I_{CEW}	<	100 μA

* Where the phototransistor receives light from the diode the O (for open base) has been omitted from the symbols.

			CNY57	CNY57A	
Collector-emitter saturation voltage					
I_F = 10 mA; I_C = 2 mA	V_{CEsat}	typ.	0,17	–	V
		<	0,40	–	V
I_F = 10 mA; I_C = 4 mA	V_{CEsat}	typ.	–	0,17	V
		<	–	0,40	V
→ Isolation voltage, d.c. value*	V_{IO}	>	4,3	4,3	kV
Capacitance between input and output I_F = 0; V = 0; f = 1 MHz	C_{io}	typ.	0,6	0,6	pF
Insulation resistance between input and output ± V_{IO} = 1 kV	r_{IO}	>	10^{10}	10^{10}	Ω
		typ.	10^{12}	10^{12}	Ω
Switching times (see Figs 3 and 4)					
I_{Con} = 2 mA; V_{CC} = 5 V; R_L = 100 Ω					
Turn-on time	t_{on}	typ.	3	–	μs
Turn-off time	t_{off}	typ.	3	–	μs
I_{Con} = 4 mA; V_{CC} = 5 V; R_L = 100 Ω					
Turn-on time	t_{on}	typ.	–	5	μs
Turn-off time	t_{off}	typ.	–	5	μs

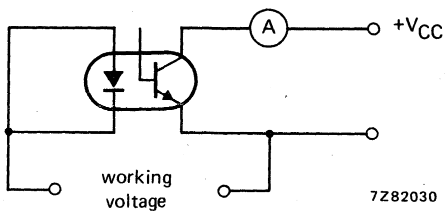


Fig. 2.

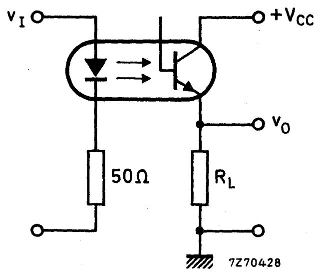


Fig. 3 Switching circuit.

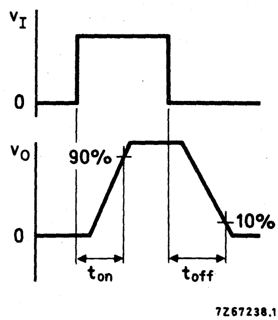


Fig. 4 Waveforms.

* Tested with a d.c. voltage for 1 minute between shorted input leads and shorted output leads.

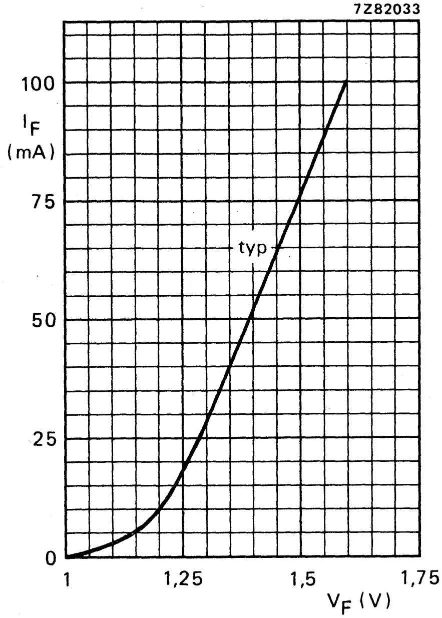


Fig. 5 T_{amb} = 25 °C.

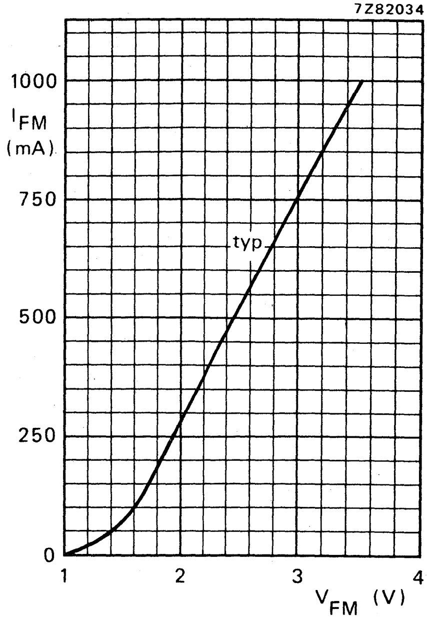


Fig. 6 T_{amb} = 25 °C; t_p = 10 μs; T = 1 ms.

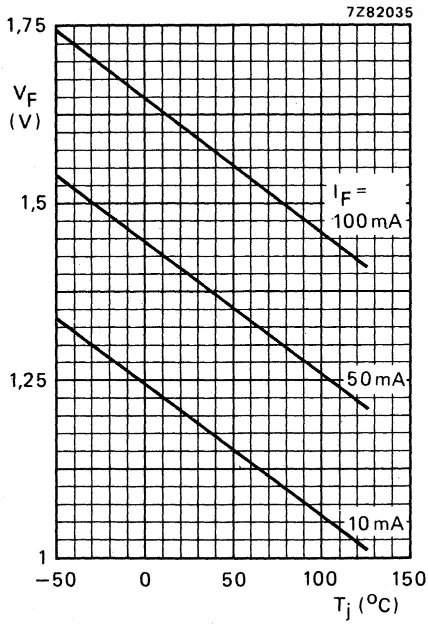


Fig. 7 Typical values.

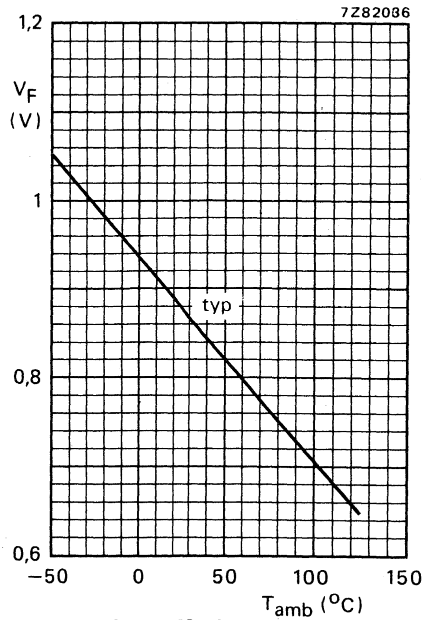


Fig. 8 I_F = 50 μA.

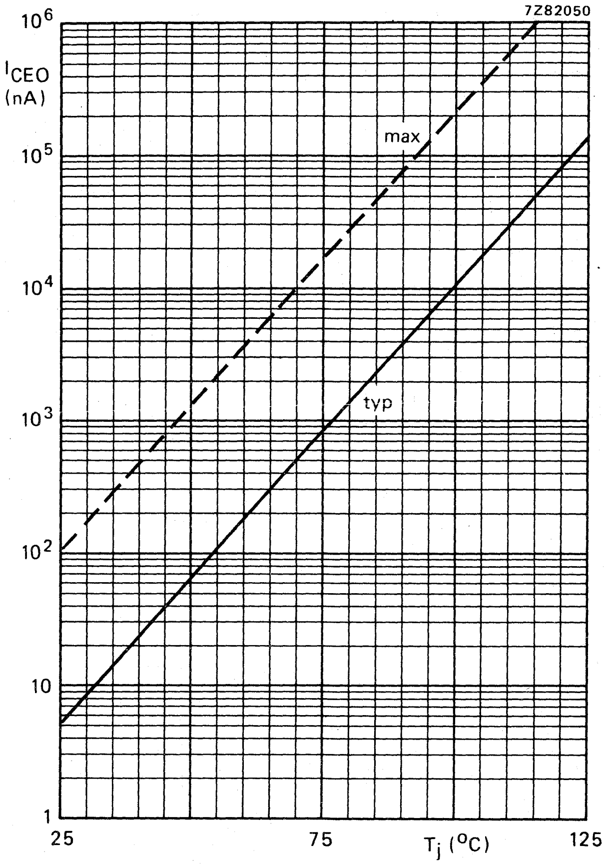


Fig. 9 $I_F = 0$; $V_{CE} = 10$ V.

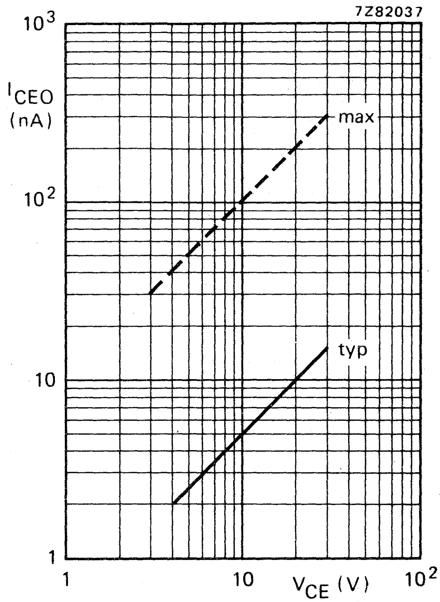


Fig. 10 $I_F = 0$; $T_j = 25\ ^oC$.

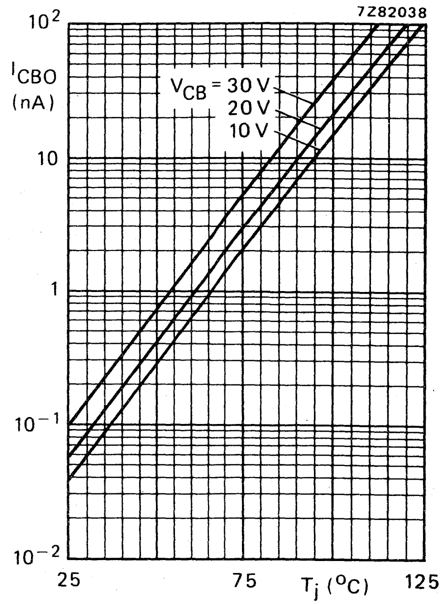


Fig. 11 $I_F = 0$; typical values.

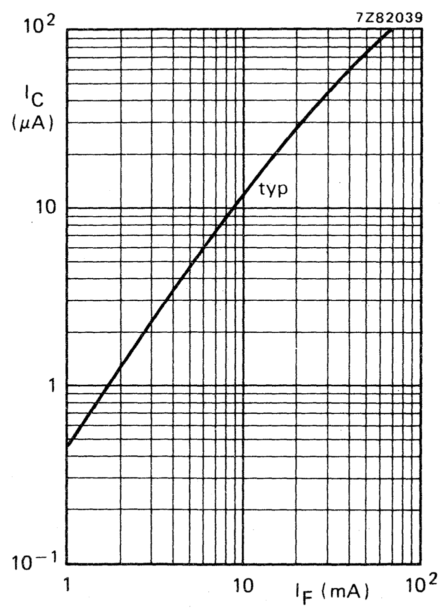


Fig. 12 $I_E = 0$; $V_{CB} = 5$ V; $T_{amb} = 25\ ^oC$.

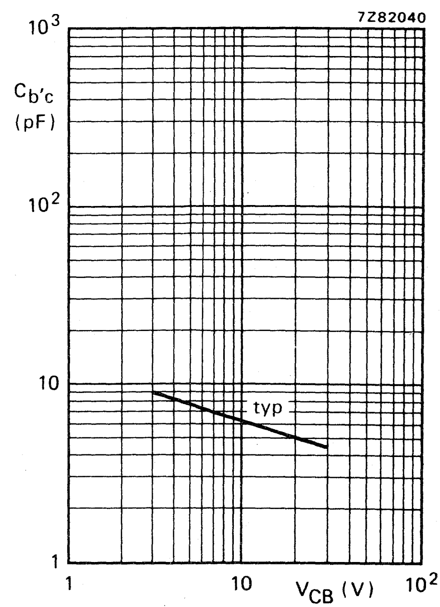


Fig. 13 f = 1 MHz; $T_j = 25\ ^oC$.

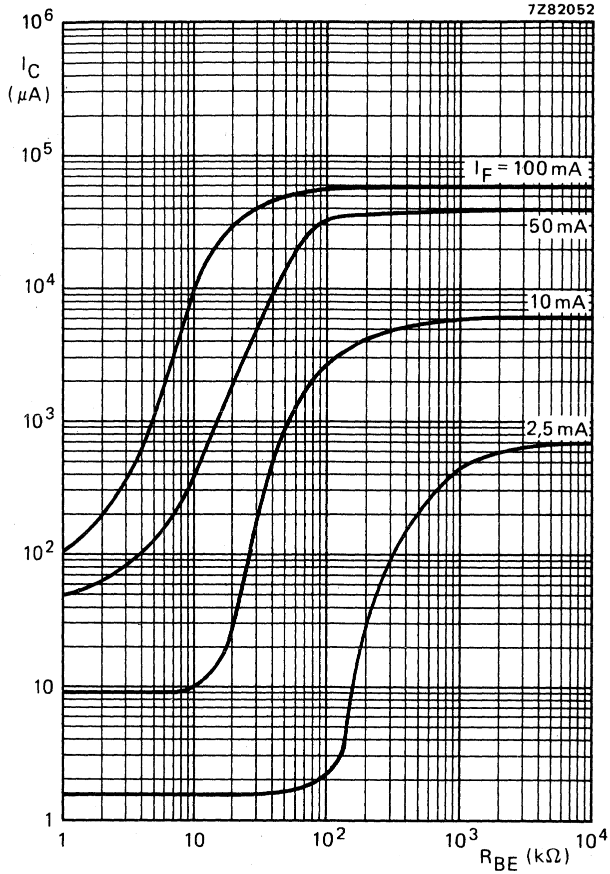


Fig. 14 **CNY57**; $I_B = 0$; $V_{CE} = 5$ V; $T_{amb} = 25$ °C; typical values.

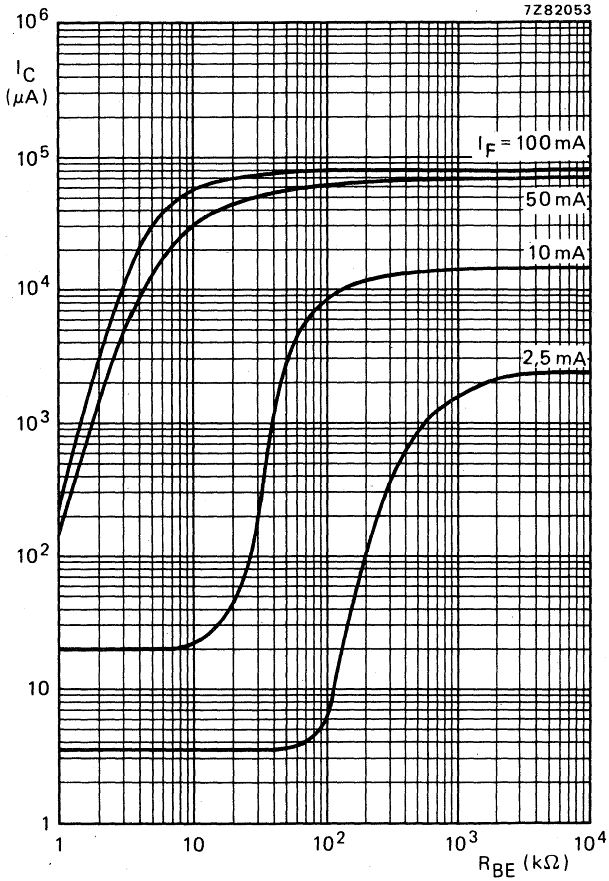


Fig. 15 **CNY57A**; $I_B = 0$; $V_{CE} = 5$ V; $T_{amb} = 25$ °C; typical values.

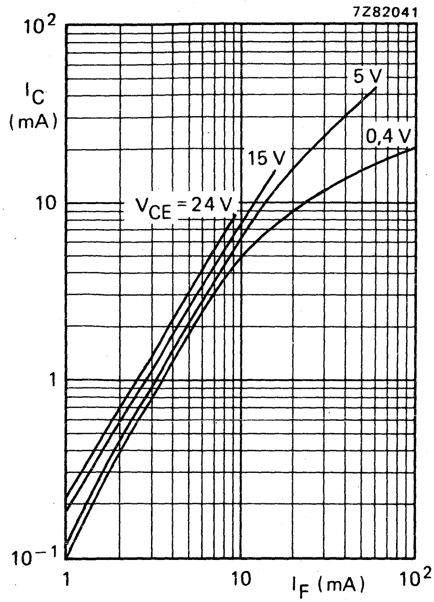


Fig. 16 **CNY57**; T_{amb} = 25 °C; typical values.

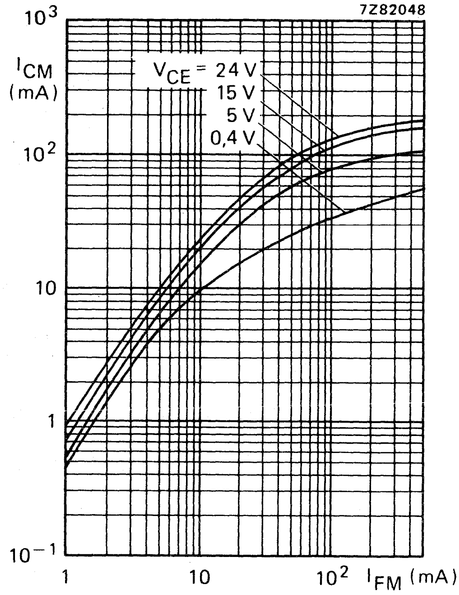


Fig. 17 **CNY57A**; T_{amb} = 25 °C; t_p = 10 μs; T = 1 ms; typical values.

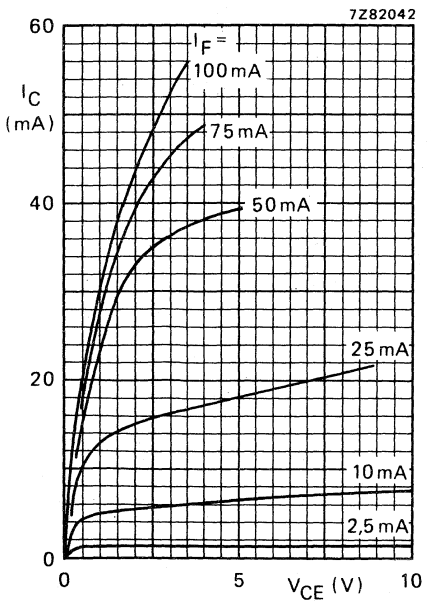


Fig. 18 **CNY57**; T_{amb} = 25 °C; typical values.

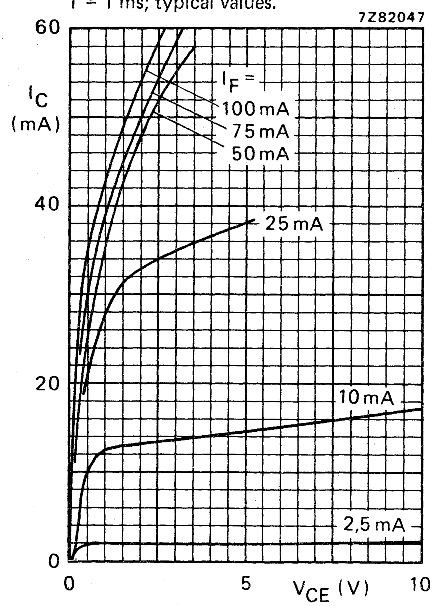


Fig. 19 **CNY57A**; T_{amb} = 25 °C; typical values.

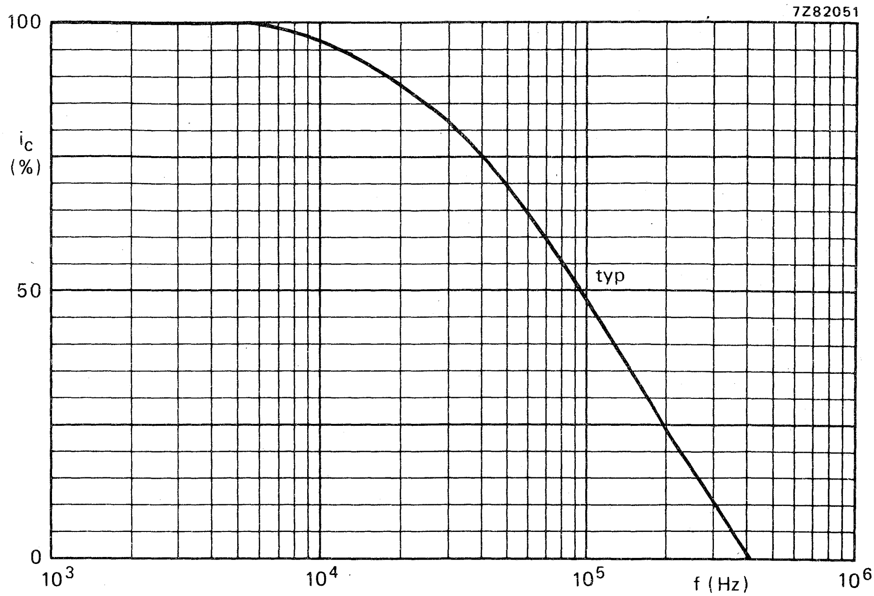


Fig. 20 $I_B = 0$; $I_C = 2$ mA; $V_{CC} = 5$ V; $R_L = 1$ kΩ; $T_{amb} = 25$ °C.

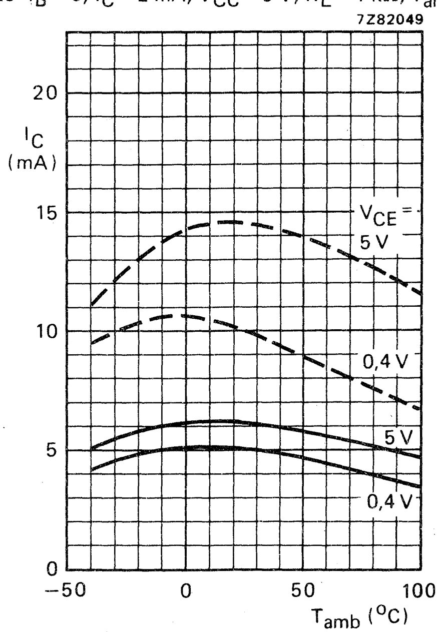


Fig. 21 ——— **CNY57;** – – – **CNY57A;** $I_B = 0$; $I_F = 10$ mA; typical values.

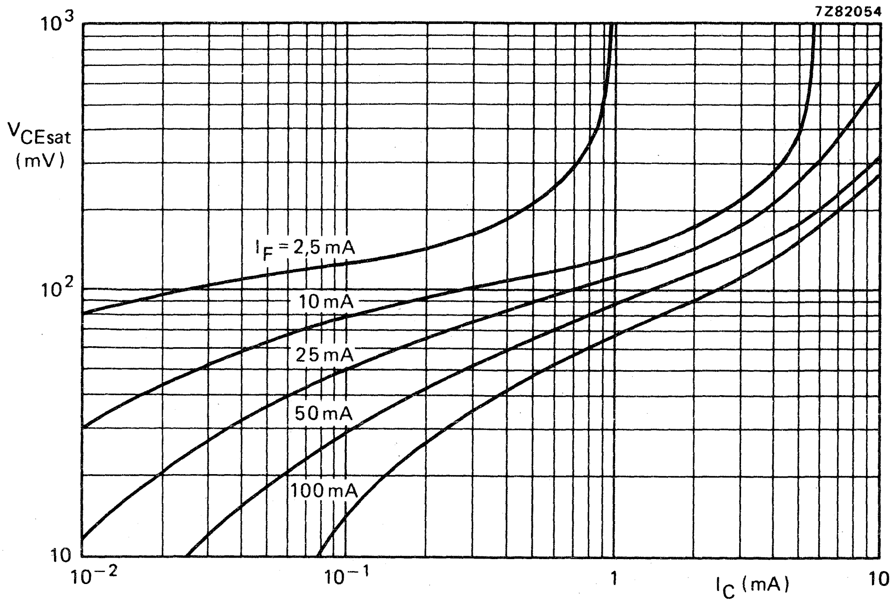


Fig. 22 **CNY57;** $I_B = 0$; $T_{amb} = 25\ ^oC$; typical values.

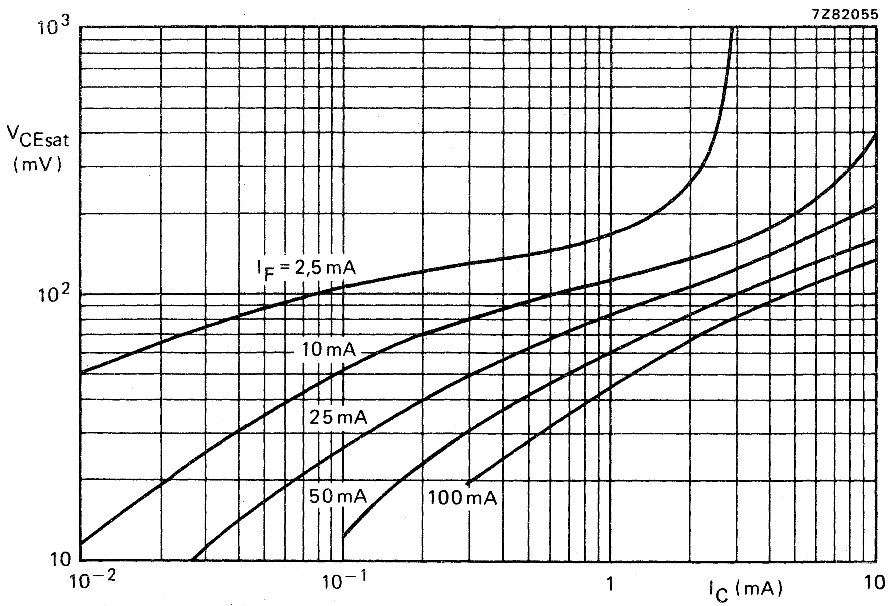


Fig. 23 **CNY57A;** $I_B = 0$; $T_{amb} = 25\ ^oC$; typical values.

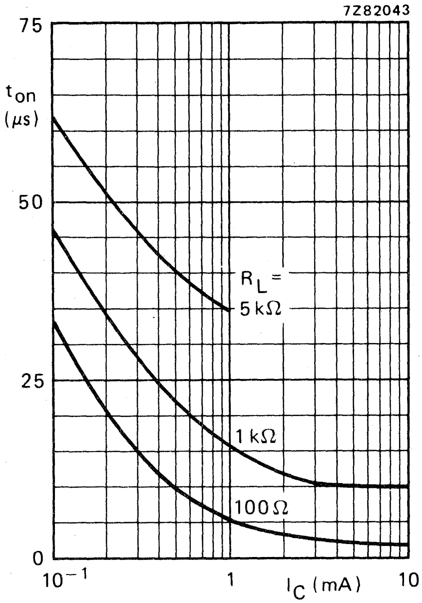


Fig. 24 **CNY57;** $I_B = 0$; $V_{CC} = 5$ V; $T_{amb} = 25$ °C; typical values. (See also Fig. 26.)

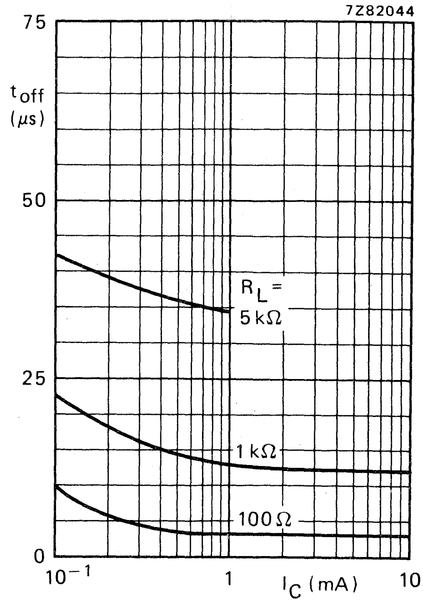


Fig. 25 **CNY57;** $I_B = 0$; $V_{CC} = 5$ V; $T_{amb} = 25$ °C; typical values. (See also Fig. 26.)

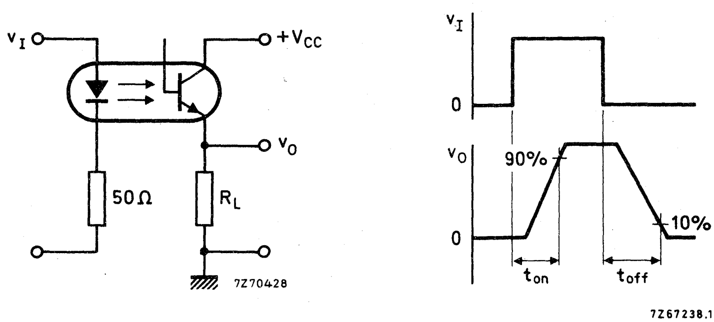


Fig. 26 Switching circuit and waveforms.

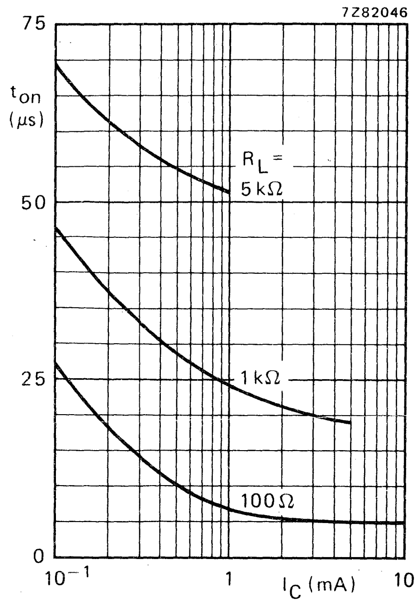


Fig. 27 **CNY57A**; $I_B = 0$; $V_{CC} = 5$ V; $T_{amb} = 25$ °C; typical values. (See also Fig. 29.)

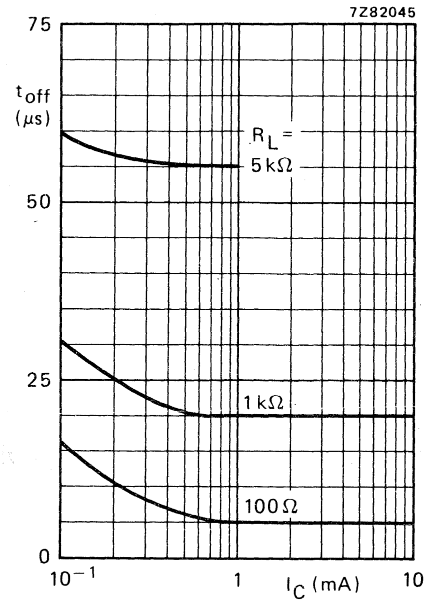


Fig. 28 **CNY57A**; $I_B = 0$; $V_{CC} = 5$ V; $T_{amb} = 25$ °C; typical values. (See also Fig. 29.)

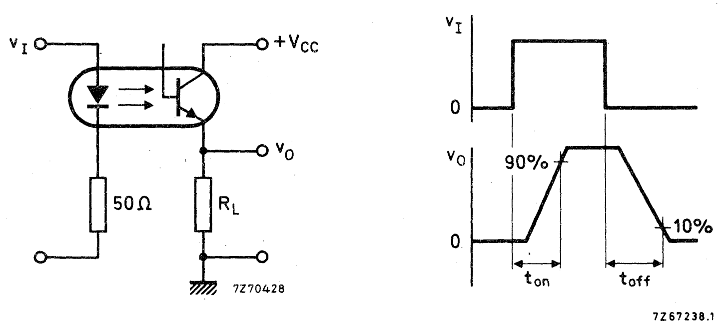


Fig. 29 Switching circuit and waveforms.

PHOTOCOUPLERS

Optically coupled isolators consisting of an infrared emitting GaAs diode and a silicon n-p-n photo-transistor without accessible base. Plastic envelopes. Suitable for TTL integrated circuits.

Features of these products:

- high output/input d.c. current transfer ratio;
- low saturation voltage;
- a high isolation voltage
  CNY62 3,75 kV (r.m.s.) and 5,3 kV (d.c.);
  CNY63 3 kV (r.m.s.) and 4,3 kV (d.c.);
- working voltage 1,5 kV.

QUICK REFERENCE DATA

			CNY62	CNY63	
Diode					
Continuous reverse voltage	V_R	max.	3	3	V
Forward current					
d.c.	I_F	max.	100	100	mA
(peak value); t_p = 10 μs; δ = 0,1	I_{FM}	max.	1000	1000	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	150	150	mW
Transistor					
Collector-emitter voltage (open base)	V_{CEO}	max.	50	30	V
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	200	200	mW
Photocoupler					
Output/input d.c. current transfer ratio					
I_F = 10 mA; V_{CE} = 0,4 V; (I_B = 0)	I_C/I_F	>	0,25	0,50	
Collector cut-off current (dark)					
V_{CC} = 10 V; working voltage (d.c.) = 1,5 kV					
diode: I_F = 0 (see also Fig. 2)	I_{CEW}	<	200	200	nA
Isolation voltage (d.c.)					
t = 1 min	V_{IO}	>	5,3	4,3	kV

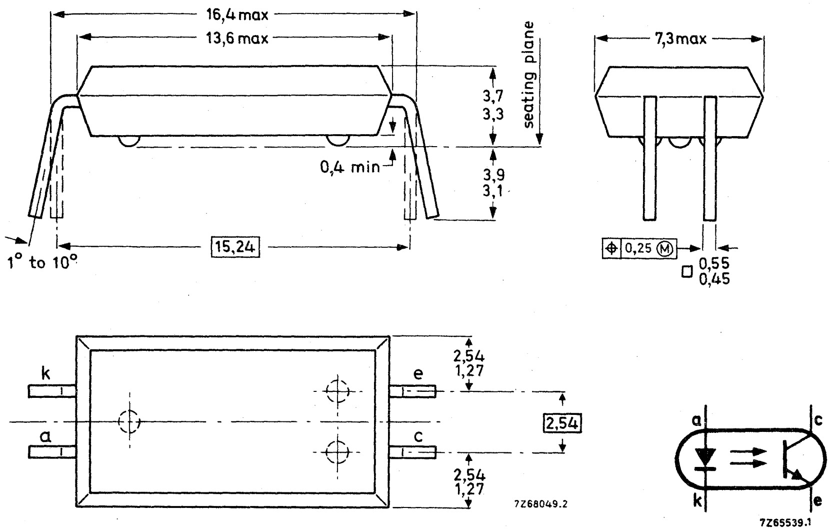
MECHANICAL DATA

SOT-91B (see Fig. 1)

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-91B.



⌖ Positional accuracy.

Ⓜ Maximum material condition.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Diode

Continuous reverse voltage		V_R	max.	3 V
Forward current				
d.c.		I_F	max.	100 mA
(peak value); t_p = 10 μs; δ = 0,1		I_{FM}	max.	1000 mA
Total power dissipation up to T_{amb} = 25 °C		P_{tot}	max.	150 mW
Operating junction temperature		T_j	max.	125 °C

Transistor

Collector-emitter voltage (open base)	**CNY62**	V_{CEO}	max.	50 V
	CNY63	V_{CEO}	max.	30 V
Emitter-collector voltage (open base)		V_{ECO}	max.	7 V
Collector current (d.c.)		I_C	max.	100 mA

Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	200 mW
Operating junction temperature	T_j	max.	125 °C

Photocoupler

Storage temperature	T_{stg}		−55 to +150 °C
Lead soldering temperature up to the seating plane; t_{sld} < 10 s	T_{sld}	max.	260 °C

THERMAL RESISTANCE

From junction to ambient in free air			
diode	$R_{th\ j\text{-}a}$	=	0,65 °C/mW
transistor	$R_{th\ j\text{-}a}$	=	0,5 °C/mW
From junction to ambient, device mounted on a printed-circuit board			
diode	$R_{th\ j\text{-}a}$	=	0,6 °C/mW
transistor	$R_{th\ j\text{-}a}$	=	0,4 °C/mW

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Diode

Forward voltage I_F = 10 mA		V_F	typ.	1,2 V
			<	1,5 V
Reverse current V_R = 3 V		I_R	<	10 µA

Transistor (diode: I_F = 0)

Collector cut-off current (dark) V_{CE} = 10 V		I_{CEO}	typ.	5 nA
			<	100 nA
V_{CE} = 10 V; T_{amb} = 70 °C		I_{CEO}	<	10 µA

Photocoupler (I_B = 0)*

Output/input d.c. current transfer ratio I_F = 10 mA; V_{CE} = 0,4 V	CNY62	I_C/I_F	>	0,25
			typ.	0,50
	CNY63	I_C/I_F	>	0,5
			typ.	1,0
Collector cut-off current (dark) see Fig. 2				
V_{CC} = 10 V; working voltage (d.c.) = 1,5 kV		I_{CEW}	<	200 nA
V_{CC} = 10 V; working voltage (d.c.) = 1,5 kV; T_j = 70 °C		I_{CEW}	<	100 µA

* Where the phototransistor receives light from the diode the O (for open base) has been omitted from the symbols.

			CNY62	CNY63	
Collector-emitter saturation voltage $I_F = 10$ mA; $I_C = 2$ mA	V_{CEsat}	typ.	0,17	–	V
		<	0,40	–	V
$I_F = 10$ mA; $I_C = 4$ mA	V_{CEsat}	typ.	–	0,17	V
		<		0,40	V
→ Isolation voltage, d.c. value*	V_{IO}	>	5,3	4,3	kV
Capacitance between input and output $I_F = 0$; $V = 0$; $f = 1$ MHz	C_{io}	typ.	0,6	0,6	pF
Insulation resistance between input and output $\pm V_{IO} = 1$ kV	r_{IO}	>	10^{10}	10^{10}	Ω
		typ.	10^{12}	10^{12}	Ω
Switching times (see Figs 3 and 4) $I_{Con} = 2$ mA; $V_{CC} = 5$ V; $R_L = 100\ \Omega$					
Turn-on time	t_{on}	typ.	3	–	μs
Turn-off time	t_{off}	typ.	3	–	μs
$I_{Con} = 4$ mA; $V_{CC} = 5$ V; $R_L = 100\ \Omega$					
Turn-on time	t_{on}	typ.	–	5	μs
Turn-off time	t_{off}	typ.	–	5	μs

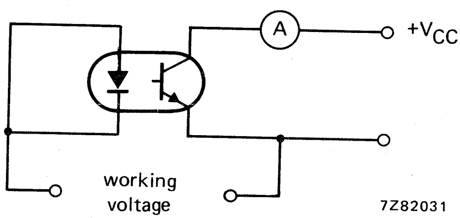


Fig. 2.

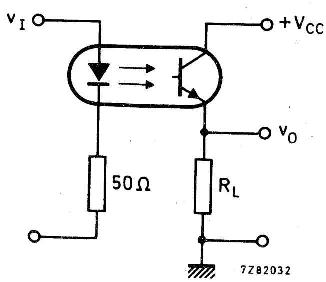


Fig. 3 Switching circuit.

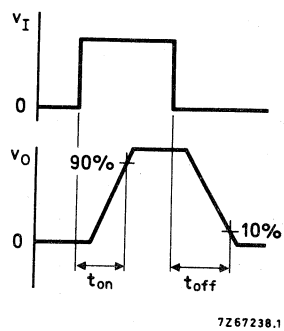


Fig. 4 Waveforms.

* Tested with a d.c. voltage for 1 minute between shorted input leads and shorted output leads.

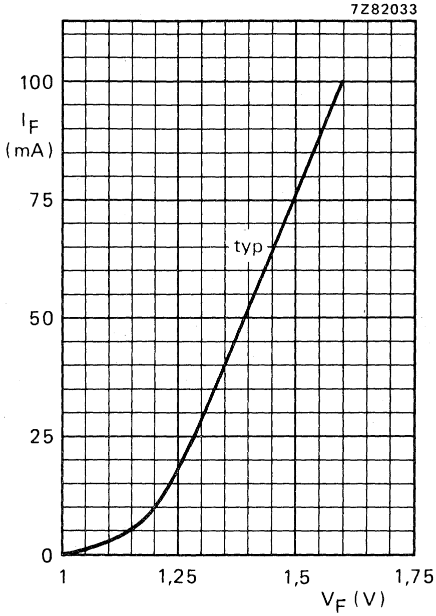


Fig. 5 T_{amb} = 25 °C.

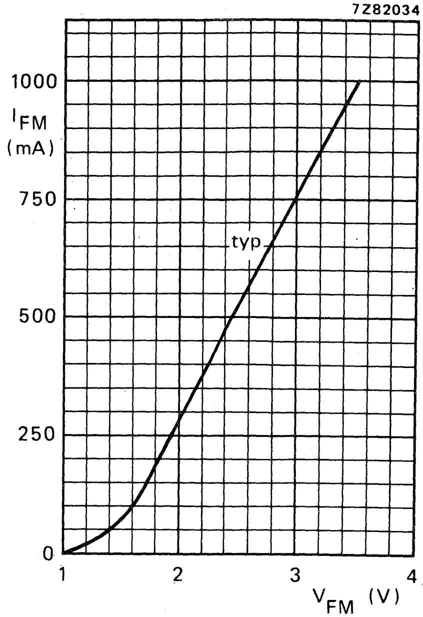


Fig. 6 T_{amb} = 25 °C; t_p = 10 μs; T = 1 ms.

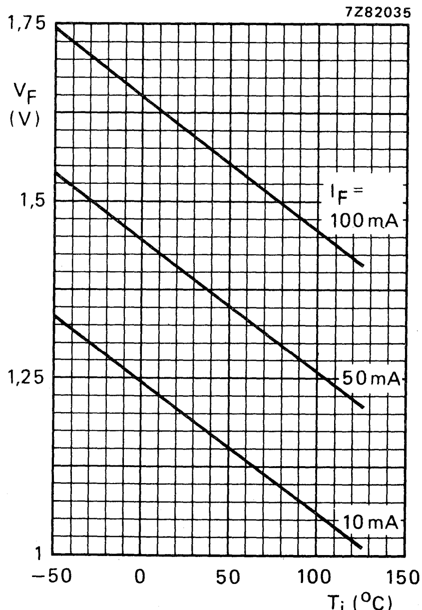


Fig. 7 Typical values.

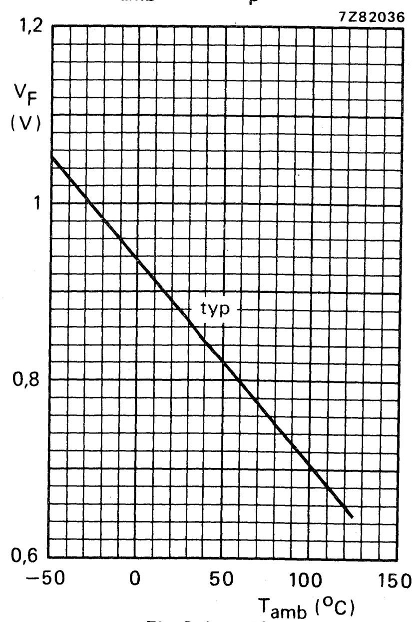


Fig. 8 I_F = 50 μA.

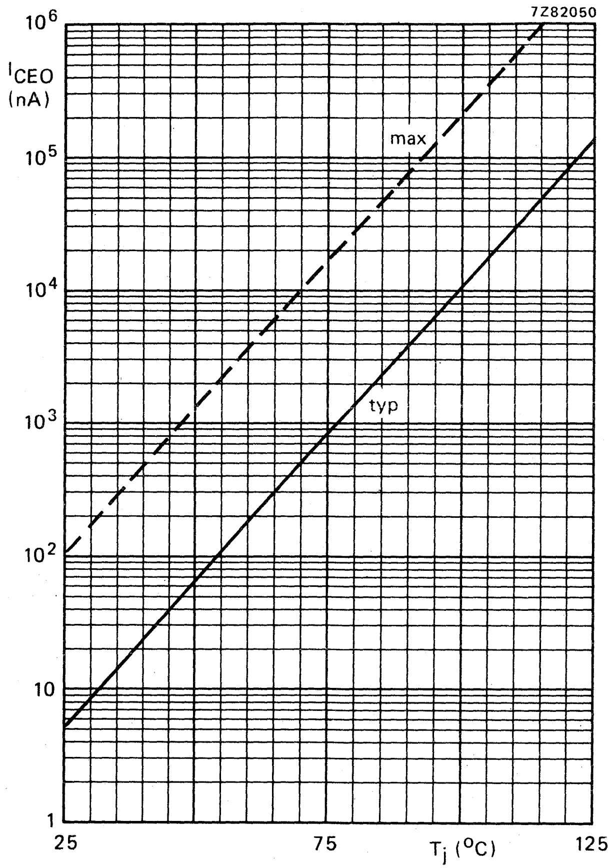


Fig. 9 $I_F = 0$; $V_{CE} = 10$ V.

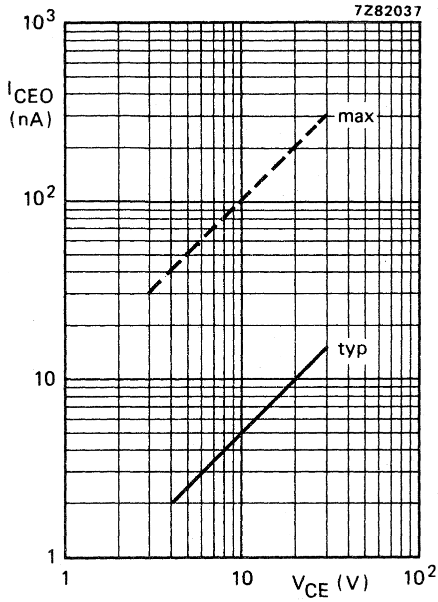


Fig. 10 $I_F = 0$; $T_j = 25$ °C.

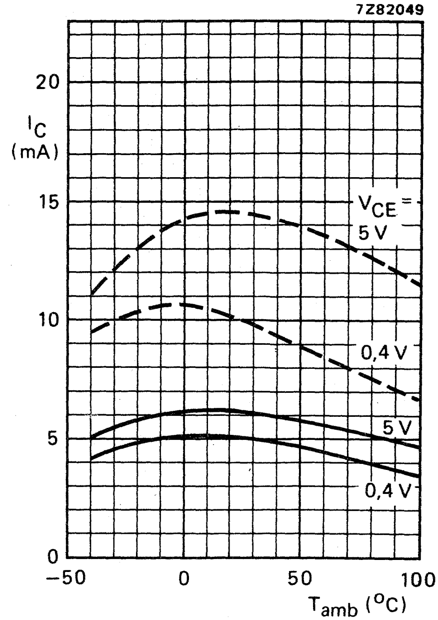


Fig. 11 $I_B = 0$; $I_F = 10$ mA;
—— **CNY62**; ---- **CNY63**; typical values.

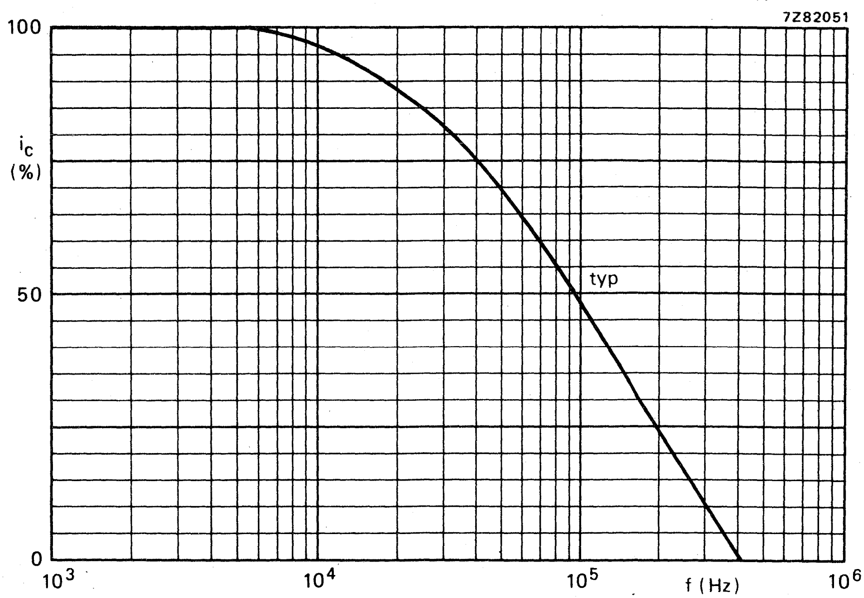


Fig. 12 $I_B = 0$; $I_C = 2$ mA; $V_{CC} = 5$ V; $R_L = 1$ kΩ; $T_{amb} = 25$ °C.

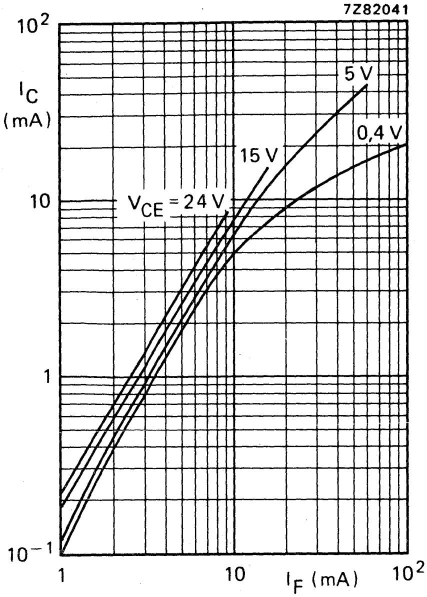


Fig. 13 **CNY62**; T_{amb} = 25 °C; typical values.

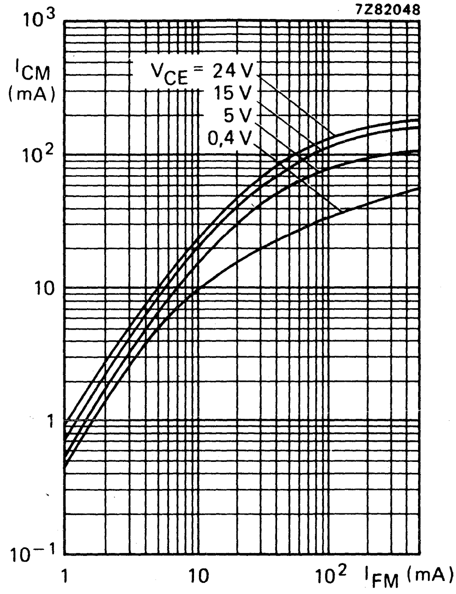


Fig. 14 **CNY63**; T_{amb} = 25 °C; t_p = 10 μs; T = 1 ms; typical values.

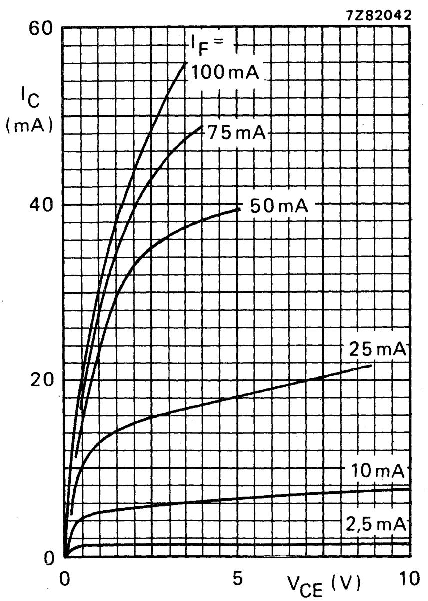


Fig. 15 **CNY62**; T_{amb} = 25 °C; typical values.

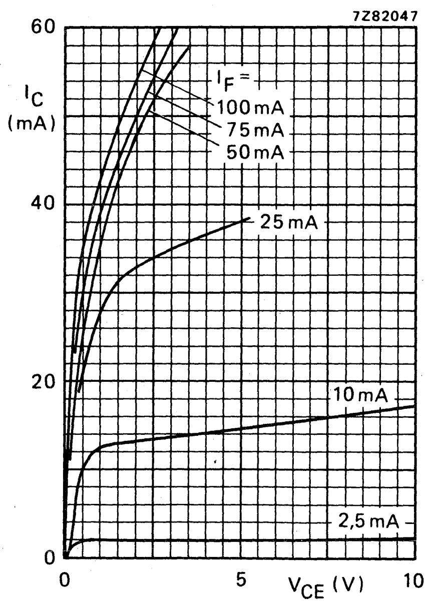


Fig. 16 **CNY63**; T_{amb} = 25 °C; typical values.

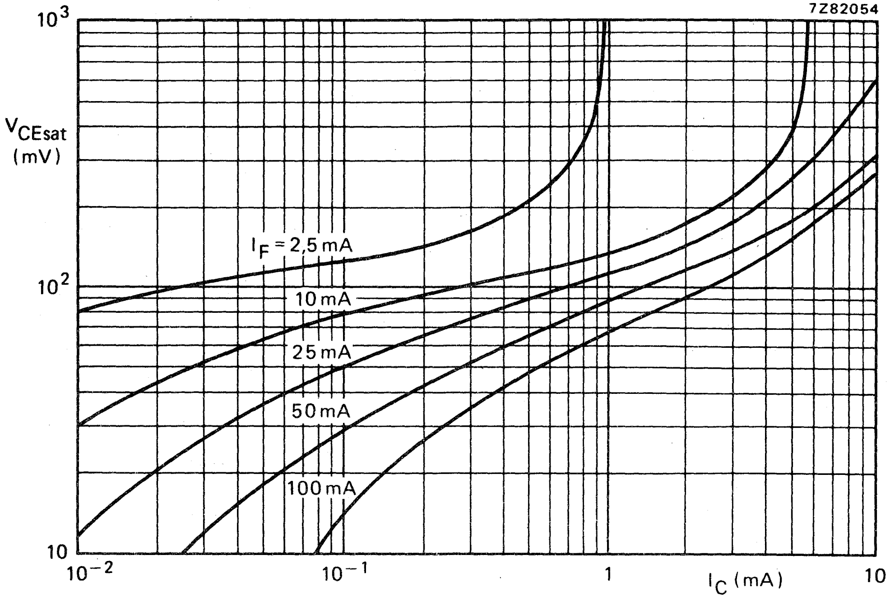


Fig. 17 **CNY62**; $I_B = 0$; $T_{amb} = 25\ ^oC$; typical values.

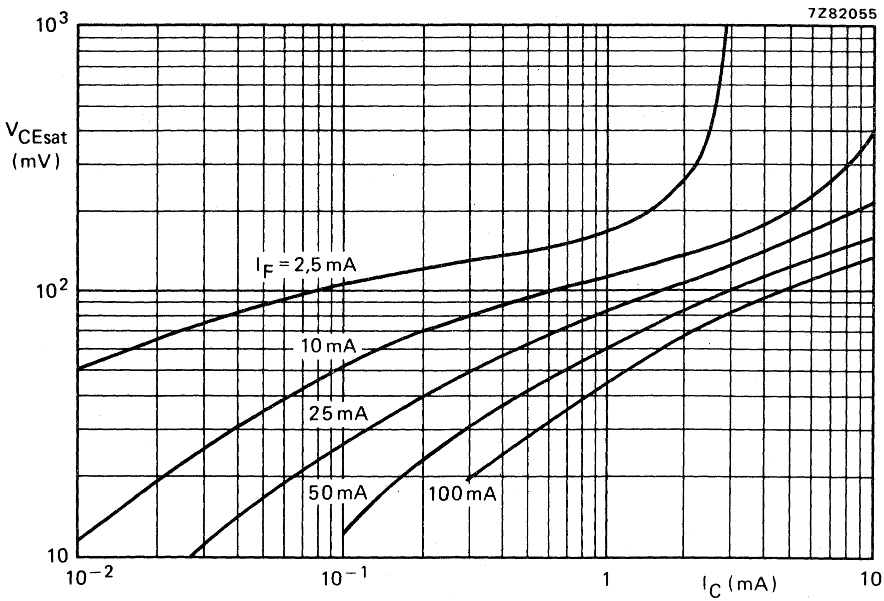


Fig. 18 **CNY63**; $I_B = 0$; $T_{amb} = 25\ ^oC$; typical values.

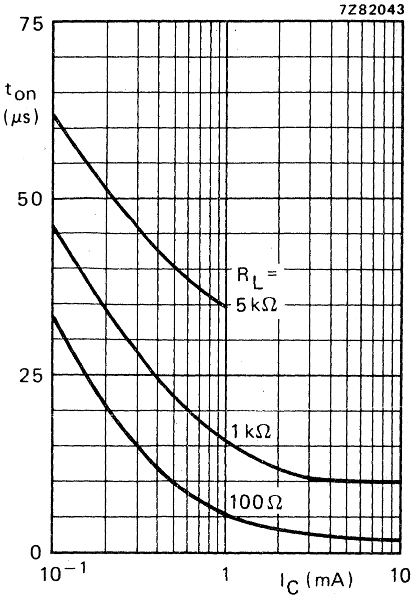


Fig. 19 **CNY62**; I_B = 0; V_{CC} = 5 V; T_{amb} = 25 °C; typical values. (See also Fig. 21.)

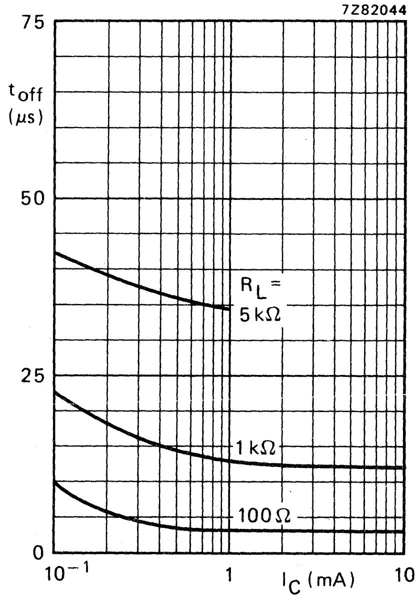


Fig. 20 **CNY62**; I_B = 0; V_{CC} = 5 V; T_{amb} = 25 °C; typical values. (See also Fig. 21.)

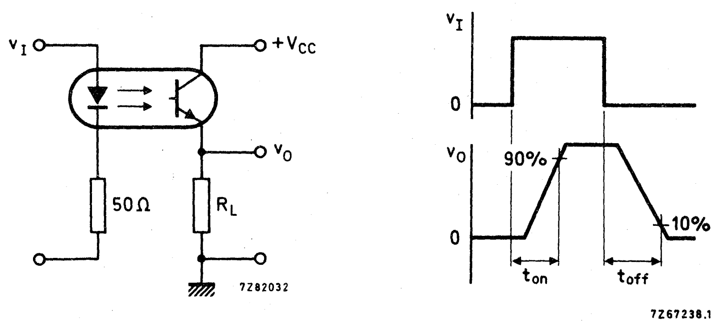


Fig. 21 Switching circuit and waveforms.

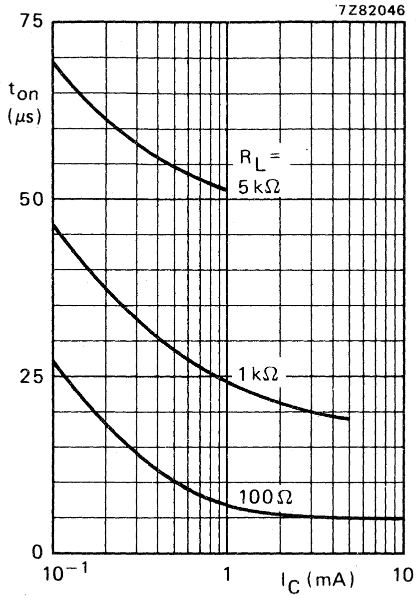


Fig. 22 **CNY63**; I_B = 0; V_{CC} = 5 V; T_{amb} = 25 °C; typical values. (See also Fig. 24.)

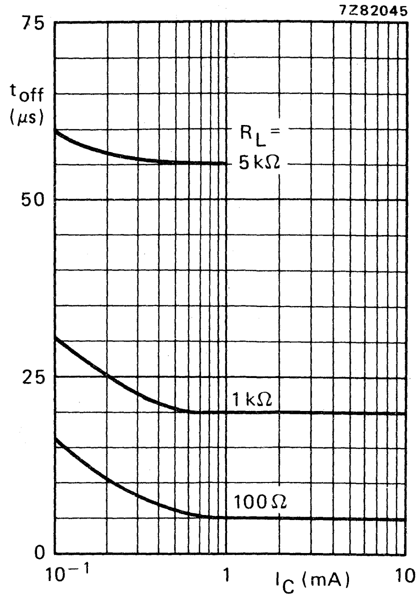
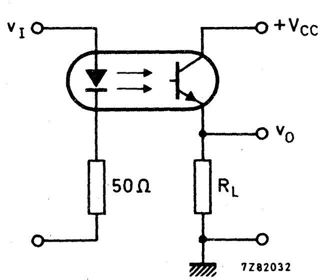


Fig. 23 **CNY63**; I_B = 0; V_{CC} = 5 V; T_{amb} = 25 °C; typical values. (See also Fig. 24.)



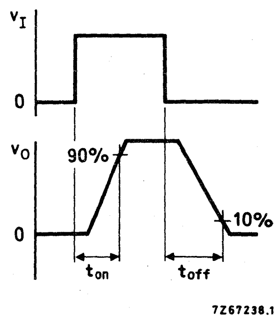


Fig. 24 Switching circuit and waveforms.

INFRARED SENSITIVE DEVICES

PYROELECTRIC INFRARED DETECTORS

This is an infrared sensitive device, combined with a pre-amplifier which is stabilized to overcome d.c. drift due to thermal changes. It is sealed in a low-profile TO-5 can with a choice of window.

QUICK REFERENCE DATA

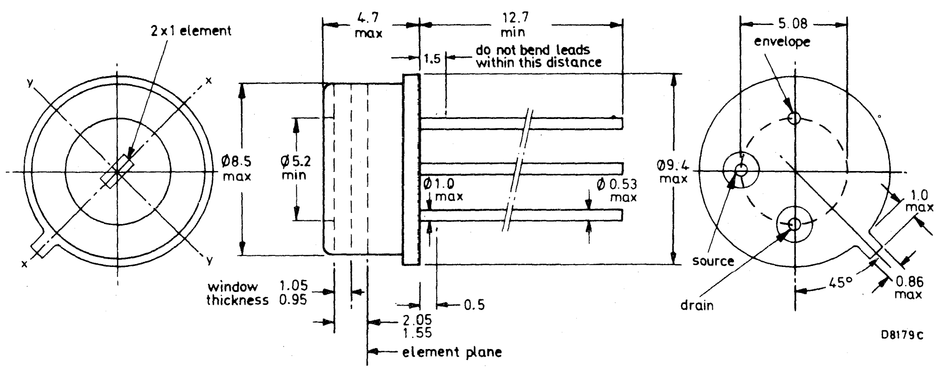
		RPY86	RPY87	
Spectral response		6.5 ± 0.5 to > 14	1.0 to > 15	μm
Responsivity		(10 μm, 10)	(6 μm, 10)	
	typ.	600	500	VW^{-1}
Noise Equivalent Power (N.E.P.),		(10 μm, 10, 1)	(6 μm, 10, 1)	
	typ.	0.9×10^{-9}	1.05×10^{-9}	$WHz^{-1/2}$
Element dimensions		2 x 1		mm
Field of view	typ.	112		degrees
Operating voltage		9		V
Optimum operating frequency range		0.1 to 1000		Hz

This data must be read in conjunction with GENERAL SAFETY RECOMMENDATIONS — OPTOELECTRONIC DEVICES

MECHANICAL DATA

Dimensions in mm

SOT-49E (low profile TO-5)



PRODUCT SAFETY

Modern high technology materials have been used in the manufacture of this device to ensure high performance. Some of these materials are toxic in certain circumstances. Mechanical or electrical damage is unlikely to give rise to any hazard, but toxic vapours may be generated if the device is heated to destruction. Disposal of large quantities should therefore be carried out in accordance with the Deposit of Poisonous Waste Act 1972 and the Control of Pollution Act 1974, or with the latest legislation.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC134)

Operating voltage up to 100 °C	max.	30	V
Temperature, operating	max.	+100	°C
	min.	−40	°C
Temperature, storage	max.	+100	°C
	min.	−40	°C

SOLDERING

1. When making soldered connections to the leads, a thermal shunt must be used.
2. It is essential that any mains operated soldering iron should be both screened and earthed. Failure to observe these precautions could lead to the introduction of line voltage and possible damage to the device.

CHARACTERISTICS (at 25 ± 3 °C and with recommended test circuit)

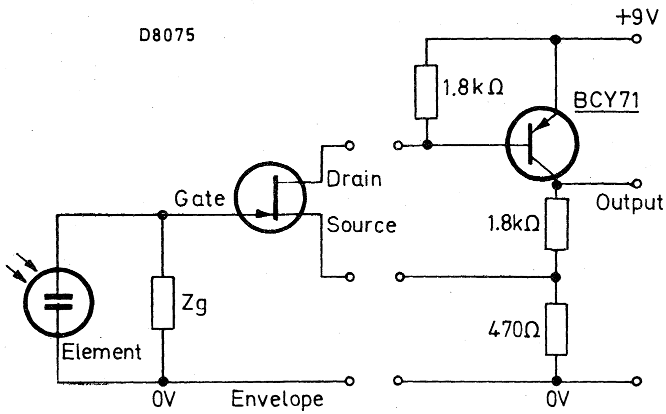
RPY86	min.	typ.	max.	
N.E.P. (500 K, 10, 1)	–	2.0×10^{-9}	–	$WHz^{-1/2}$
N.E.P. (10 µm, 10, 1) notes 1 and 4	–	0.9×10^{-9}	3×10^{-9}	$WHz^{-1/2}$
Responsivity (500 K, 10)	–	430	–	VW^{-1}
Responsivity (10 µm, 10) notes 1 and 4	425	600	–	VW^{-1}
Spectral response	6.5 ± 0.5	–	> 14	µm
Field of view note 2	–	112	–	degrees
Operating voltage note 3	8	9	10	V

RPY87				
N.E.P. (500 K, 10, 1) or (6 µm, 10, 1), notes 1 and 4	–	1.05×10^{-9}	3×10^{-9}	$WHz^{-1/2}$
Responsivity (500 K, 10) or (6 µm, 10), notes 1 and 4	376	500	–	VW^{-1}
Spectral response	1	–	> 15	µm
Field of view note 2	–	112	–	degrees
Operating voltage note 3	8	9	10	V

Notes

1. These characteristics apply throughout the spectral response range.
2. Field of view to 50% of the maximum responsivity level.
3. The detector will operate outside the quoted range but may have a degraded performance.
4. For performance as a function of frequency and temperature, see pages 6 to 9.

TEST CIRCUIT



OPERATING NOTES

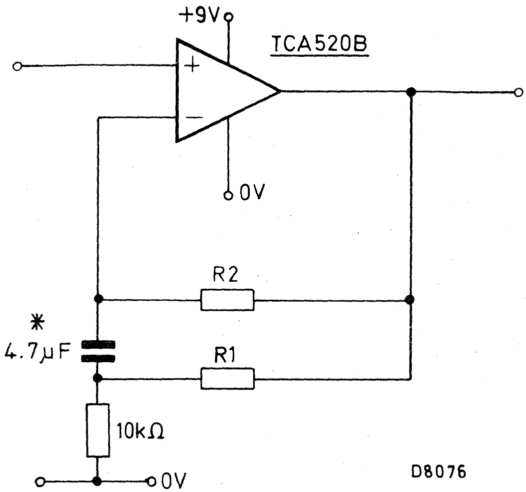
1. The detector may be supplied with a black plastic cap to protect the window. This cap must be removed before operation.
2. The case potential must not be allowed to become positive with respect to the other two terminals.
3 The shape of the electrical output waveform is the integral of the incident radiation waveform.
4. It is inadvisable to operate the detector at mains related frequencies.
5. To avoid the possibility of optical microphony, the detector must be firmly mounted.
6. Use recommended circuit for low noise operation.
7. An increase in temperature of the element will produce a negative going signal at the output.
8. For simplicity of operation, a source follower may be used where noise is not a problem. This may be achieved with a 22 kΩ resistor between source and envelope with the positive supply taken to the drain terminal. This will give a voltage gain of approximately 0.9.

DEFINITIONS

1. N.E.P. (Noise Equivalent Power), $WHz^{-½}$
   This is the r.m.s. value of the incident, chopped, radiant power necessary to produce an r.m.s. signal to r.m.s. noise ratio of unity. The r.m.s. noise refers to the value calculated for unit square root bandwidth $VHz^{-½}$
2. Responsivity, VW^{-1}
   This is the ratio of the r.m.s. signal in volts to the r.m.s. value of the incident, chopped, radiant power.

APPLICATION INFORMATION

1. Optional additional stage for extra gain

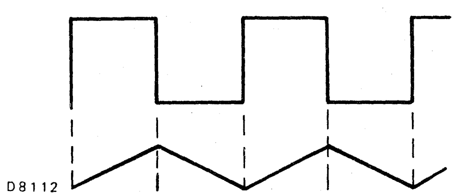


Recommended component values for various gains

Gain x	R_1 kΩ	R_2 MΩ
50	560	5.6
20	220	2.2
10	100	1.0

*this capacitor must be a low leakage type e.g. our 344 series

2. The pyroelectric element may be considered as a capacitor whose charge state changes with temperature. It also behaves as a normal capacitor, i.e. its voltage changes with charge. Thus a change of temperature results in a change of charge. It can be seen that, for a given change in amplitude of incident radiation, the resulting change in temperature will decrease as the chopping frequency increases. Thus the voltage change will also decrease with frequency. In addition, there is a 90° phase lag between the thermal and electrical signals. The voltage signal therefore becomes the integral of the radiation signal.



3. Temperature slew

The FET used with a pyroelectric detector requires a gate leakage resistor to earth in parallel with the element. This stabilizes its working point. The pyroelectric voltage appearing across this resistor is proportional to the rate of change of temperature.
To ensure a low level of noise current from this resistor, its value should be of the order of 3×10^{10} Ω.
When the temperature slew rate is 1 ^{o}C/minute, the pyroelectric voltage produced is 1 volt. In a system which is designed to sense microvolts, this is almost certain to cause overload and any a.c. signal superimposed on this d.c. shift will be lost.
Our detectors incorporate a bleed system which acts progressively on the d.c. shift caused by temperature slew. The law is logarithmic.
Thus a slew rate of 0.1 ^{o}C/minute may produce an offset across the sensing element of 200 millivolts, 1 ^{o}C/minute 280 millivolts and 10 ^{o}C/minute 360 millivolts.

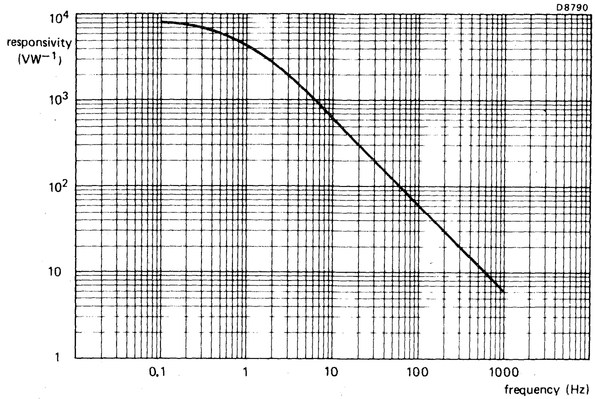
MECHANICAL AND ENVIRONMENTAL STANDARDS

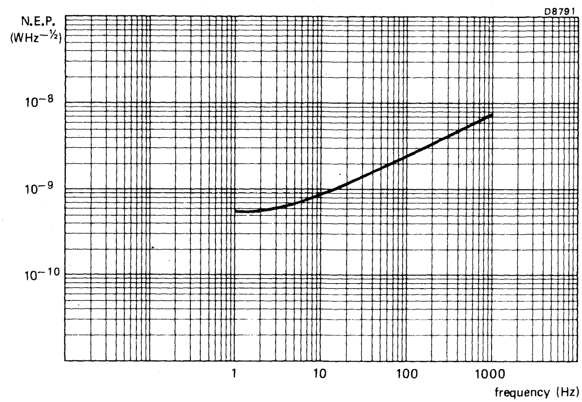
As part of the Quality Assurance programme, the detectors are assessed at regular intervals against the requirements of the following IEC standards. The frequency of testing and the limits and conditions for the pre- and post-test measurements are based on those stipulated for the CECC 50 000 series of approved transistors.

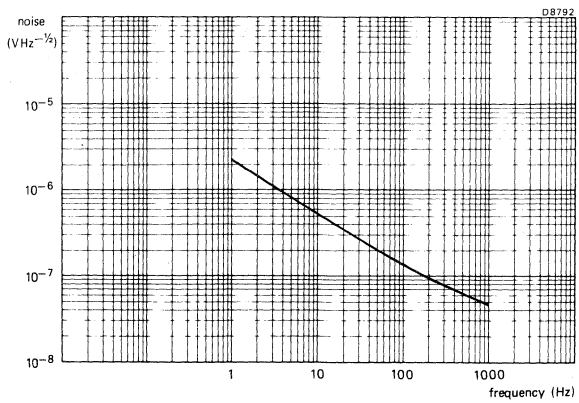
			note
IEC 68-2-3	Test Ca	Moisture Resistance, steady state	1
68-2-20	Test T	Solderability	1
68-2-21	Test Ub	Lead Fatigue	1
68-2-1	Test A	Low Temperature Storage	2
68-2-2	Test Ba	High Temperature Storage	2
68-2-14	Test Nb	Change of Temperature (10 cycles)	2
68-2-6	Test Fc (B4)	Vibration, swept frequency	2
68-2-7	Test Ga	Acceleration, steady state	2
68-2-27	Test Ea	Shock	2
68-2-20	Test T	Resistance to Solder Heat	3

Notes

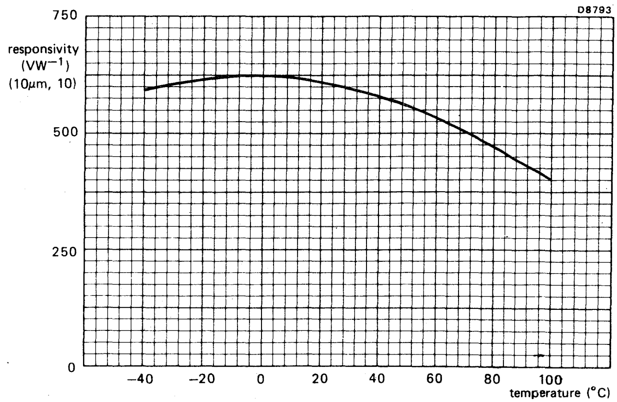
1. The detectors are checked on a production batch release principle at approximately weekly intervals. This is equivalent to group B.
2. The detectors are checked at quarterly intervals; the storage tests to 2000 hours. This is equivalent to group C.
3. This is an annual check.

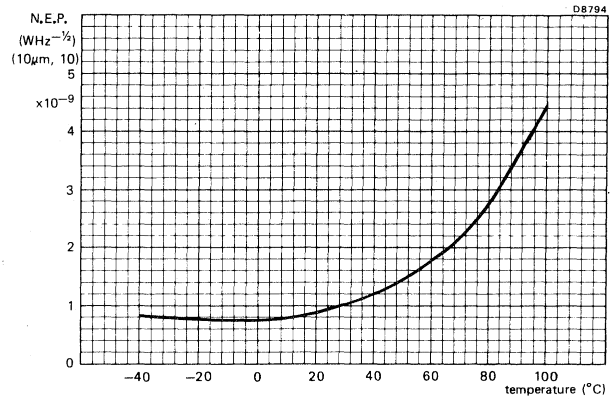


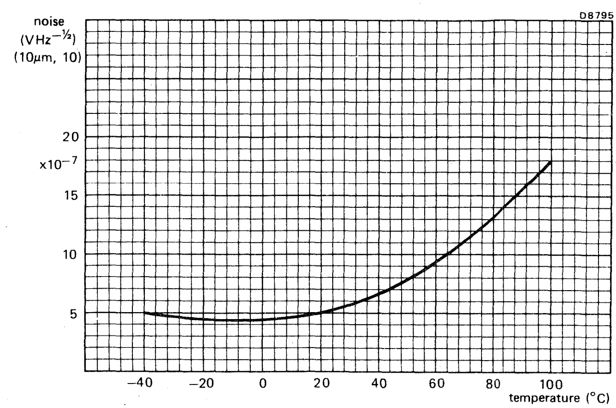




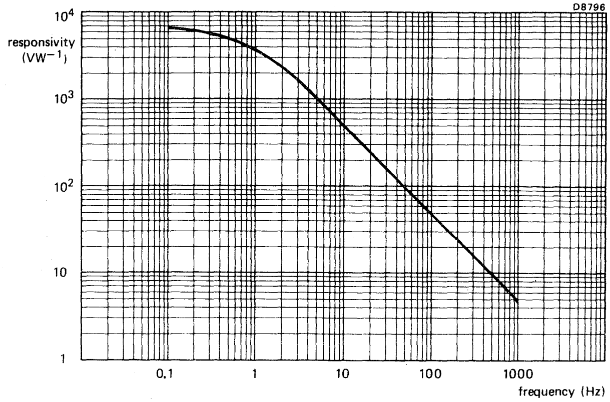
RPY86, typical responsivity, N.E.P., and noise as a function of frequency

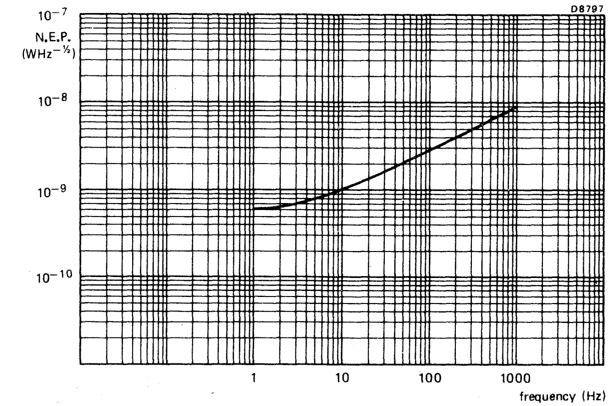


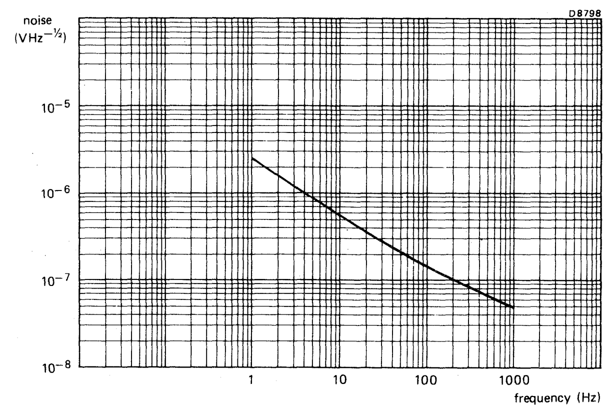




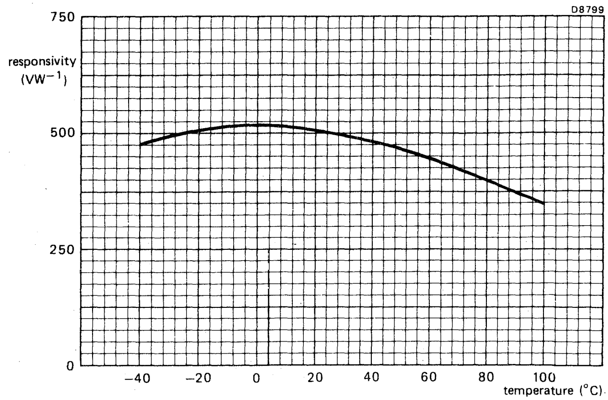
RPY86, typical responsivity, N.E.P., and noise as a function of temperature

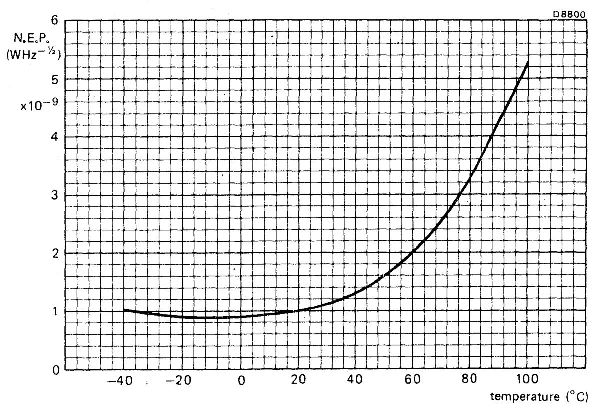


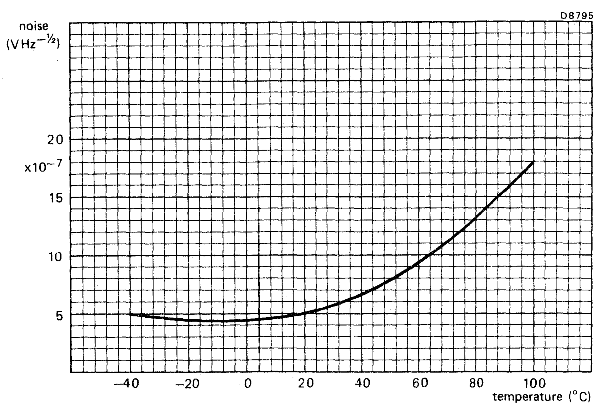




RPY87, typical responsivity, N.E.P., and noise as a function of frequency

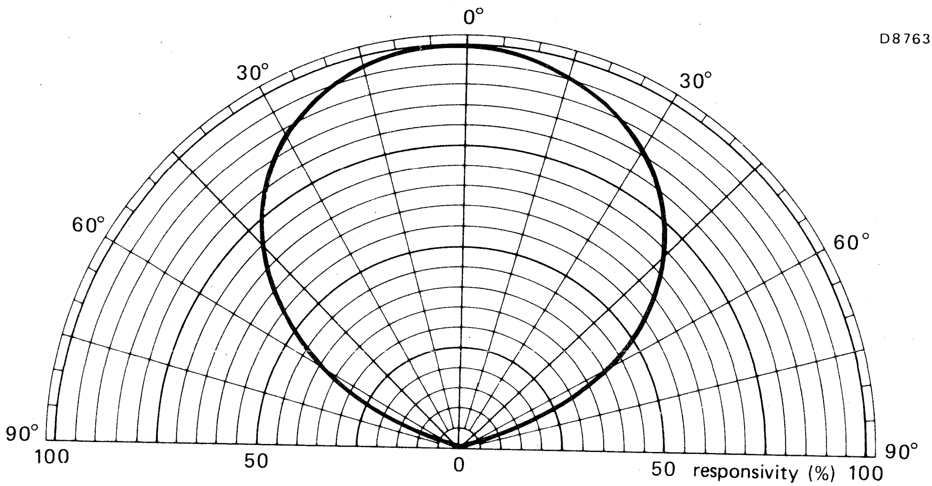




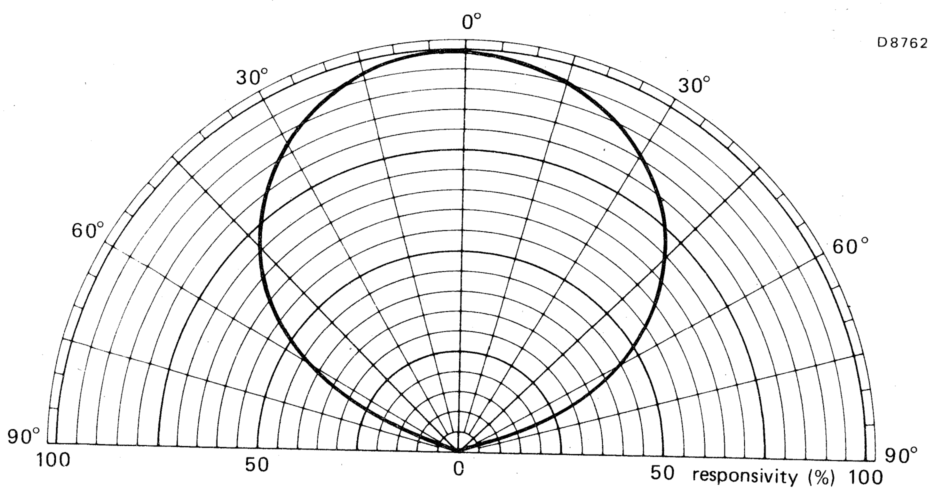


RPY87, typical responsivity, N.E.P., and noise as a function of temperature

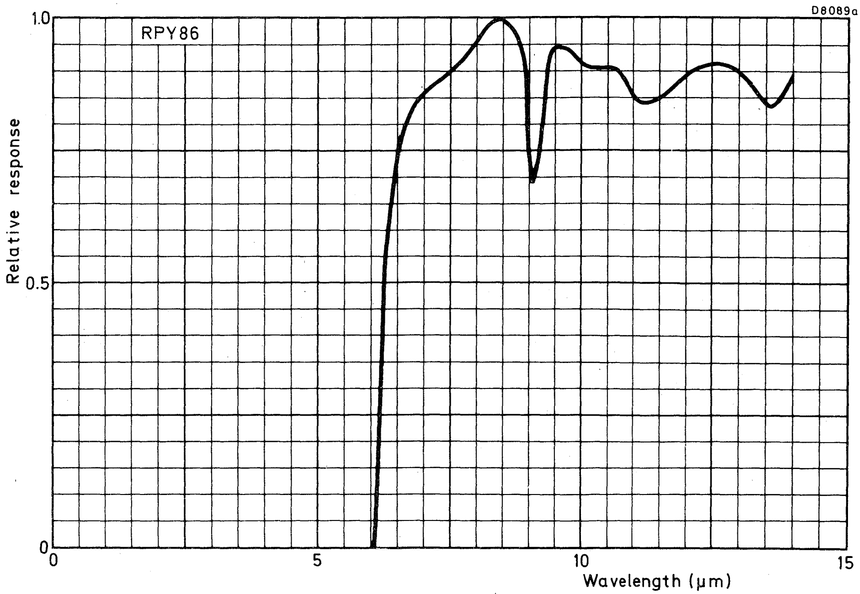
POLAR DIAGRAMS

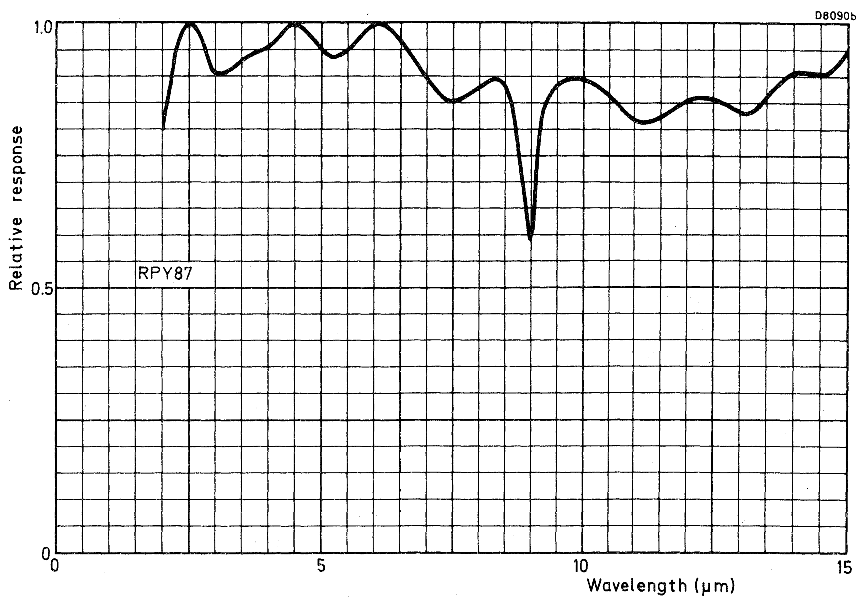


Typical field of view in x-x plane (see mechanical data)



Typical field of view in y-y plane (see mechanical data)





Typical window transmission characteristics

PYROELECTRIC INFRARED DETECTORS

This is an infrared sensitive device, combined with a pre-amplifier which is stabilized to overcome d.c. drift due to thermal changes. It is sealed in a low-profile TO-5 can with a choice of window.

QUICK REFERENCE DATA

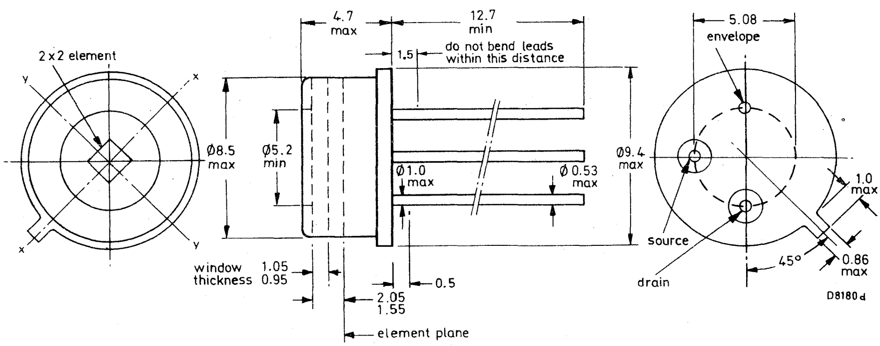
		RPY88	RPY89	
Spectral response		6.5 ± 0.5 to > 14	1.0 to > 15	μm
Responsivity		(10 μm, 10)	(6 μm, 10)	
	typ.	300	250	VW^{-1}
Noise Equivalent Power (N.E.P.)*		(10 μm, 10, 1)	(6 μm, 10, 1)	
	typ.	1.65×10^{-9}	2.0×10^{-9}	$WHz^{-½}$
Element dimensions		2 x 2		mm
Field of view	typ.	112		degrees
Operating voltage		9		V
Optimum operating frequency range		0.1 to 1000		Hz

This data must be read in conjunction with GENERAL SAFETY RECOMMENDATIONS – OPTOELECTRONIC DEVICES

MECHANICAL DATA

Dimensions in mm

SOT-49E (low profile TO-5)



PRODUCT SAFETY

Modern high technology materials have been used in the manufacture of this device to ensure high performance. Some of these materials are toxic in certain circumstances. Mechanical or electrical damage is unlikely to give rise to any hazard, but toxic vapours may be generated if the device is heated to destruction. Disposal of large quantities should therefore be carried out in accordance with the Deposit of Poisonous Waste Act 1972 and the Control of Pollution Act 1974, or with the latest legislation.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC134)

Operating voltage up to 100 °C	max.	30	V
Temperature, operating	max.	+100	°C
	min.	−40	°C
Temperature, storage	max.	+100	°C
	min.	−40	°C

SOLDERING

1. When making soldered connections to the leads, a thermal shunt must be used.
2. It is essential that any mains operated soldering iron used should be both screened and earthed. Failure to observe these precautions could lead to the introduction of line voltage and possible damage to the device.

CHARACTERISTICS (at 25 ± 3 °C and with recommended test circuit)

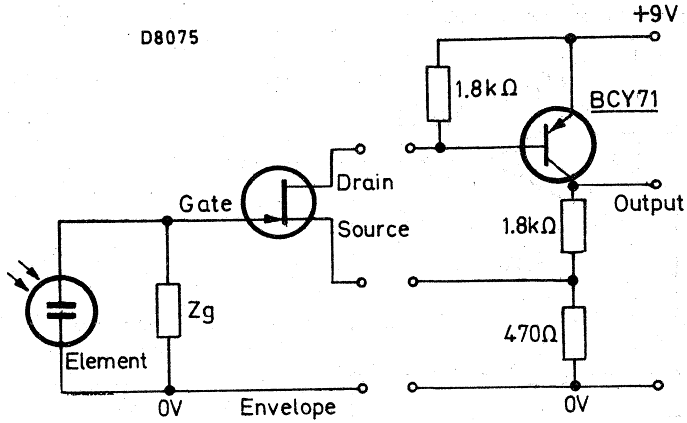
RPY88	min.	typ.	max.	
N.E.P. (500 K, 10, 1)	—	3.0×10^{-9}	—	$WHz^{-½}$
N.E.P. (10 μm, 10, 1) notes 1 and 4	—	1.65×10^{-9}	3×10^{-9}	$WHz^{-½}$
Responsivity (500 K, 10)	—	215	—	VW^{-1}
Responsivity (10 μm, 10) notes 1 and 4	212	300	—	VW^{-1}
Spectral response	6.5 ± 0.5	—	> 14	μm
Field of view note 2	—	112	—	degrees
Operating voltage note 3	8	9	10	V

RPY89				
N.E.P. (500 K, 10, 1) or (6 μm, 10, 1), notes 1 and 4	—	2.0×10^{-9}	3×10^{-9}	$WHz^{-½}$
Responsivity (500 K, 10) or (6 μm, 10), notes 1 and 4	188	250	—	VW^{-1}
Spectral response	1	—	> 15	μm
Field of view note 2	—	112	—	degrees
Operating voltage note 3	8	9	10	V

Notes

1. These characteristics apply throughout the spectral response range.
2. Field of view to 50% of the maximum responsivity level.
3. The detector will operate outside the quoted range but may have a degraded performance.
4. For performance as a function of frequency and temperature, see pages 6 to 9.

TEST CIRCUIT



OPERATING NOTES

1. The detector may be supplied with a black plastic cap to protect the window. This cap must be removed before operation.
2. The case potential must not be allowed to become positive with respect to the other two terminals.
3. The shape of the electrical output waveform is the integral of the incident radiation waveform.
4. It is inadvisable to operate the detector at mains related frequencies.
5. To avoid the possibility of optical microphony, the detector must be firmly mounted.
6. Use recommended circuit for low noise operation.
7. An increase in temperature of the element will produce a negative going signal at the output;
8. For simplicity of operation, a source follower may be used where noise is not a problem. This may be achieved with a 22 kΩ resistor between source and envelope with the positive supply taken to the drain terminal. This will give a voltage gain of approximately 0.9.

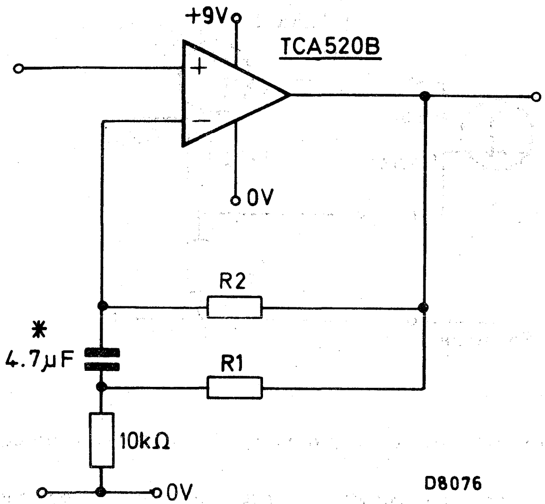
DEFINITIONS

1. N.E.P. (Noise Equivalent Power), $WHz^{-\frac{1}{2}}$
   This is the r.m.s. value of the incident, chopped, radiant power necessary to produce an r.m.s. signal to r.m.s. noise ratio of unity. The r.m.s. noise refers to the value calculated for unit square root bandwidth $VHz^{-\frac{1}{2}}$

2. Responsivity, VW^{-1}
   This is the ratio of the r.m.s. signal in volts to the r.m.s. value of the incident, chopped radiant power.

APPLICATION INFORMATION

1. Optional additional stage for extra gain

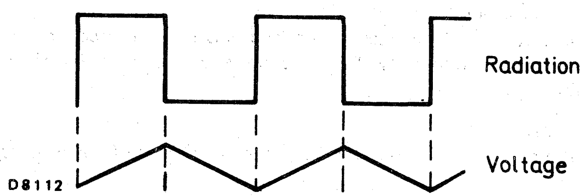


Recommended component values for various gains

Gain x	R_1 kΩ	R_2 MΩ
50	560	5.6
20	220	2.2
10	100	1.0

*this capacitor must be a low leakage type e.g. our 344 series.

2. The pyroelectric element may be considered as a capacitor whose charge state changes with temperature. It also behaves as a normal capacitor, i.e. its voltage changes with charge. Thus a change of temperature results in a change of charge. It can be seen that, for a given change in amplitude of incident radiation, the resulting change in temperature will decrease as the chopping frequency increases. Thus the voltage change will also decrease with frequency. In addition, there is a 90^{o} phase lag between the thermal and electrical signals. The voltage signal therefore becomes the integral of the radiation signal.



3. Temperature slew

The FET used with a pyroelectric detector requires a gate leakage resistor to earth in parallel with the element. This stabilizes its working point. The pyroelectric voltage appearing across this resistor is proportional to the rate of change of temperature.
To ensure a low level of noise current from this resistor, its value should be of the order of 3×10^{10} Ω.
When the temperature slew rate is 1 °C/minute, the pyroelectric voltage produced is 1 volt. In a system which is designed to sense microvolts, this is almost certain to cause overload and any a.c. signal superimposed on this d.c. shift will be lost.
Our detectors incorporate a bleed system which acts progressively on the d.c. shift caused by temperature slew. The law is logarithmic.
Thus a slew rate of 0.1 °C/minute may produce an offset across the sensing element of 200 millivolts, 1 °C/minute 280 millivolts and 10 °C/minute 360 millivolts.

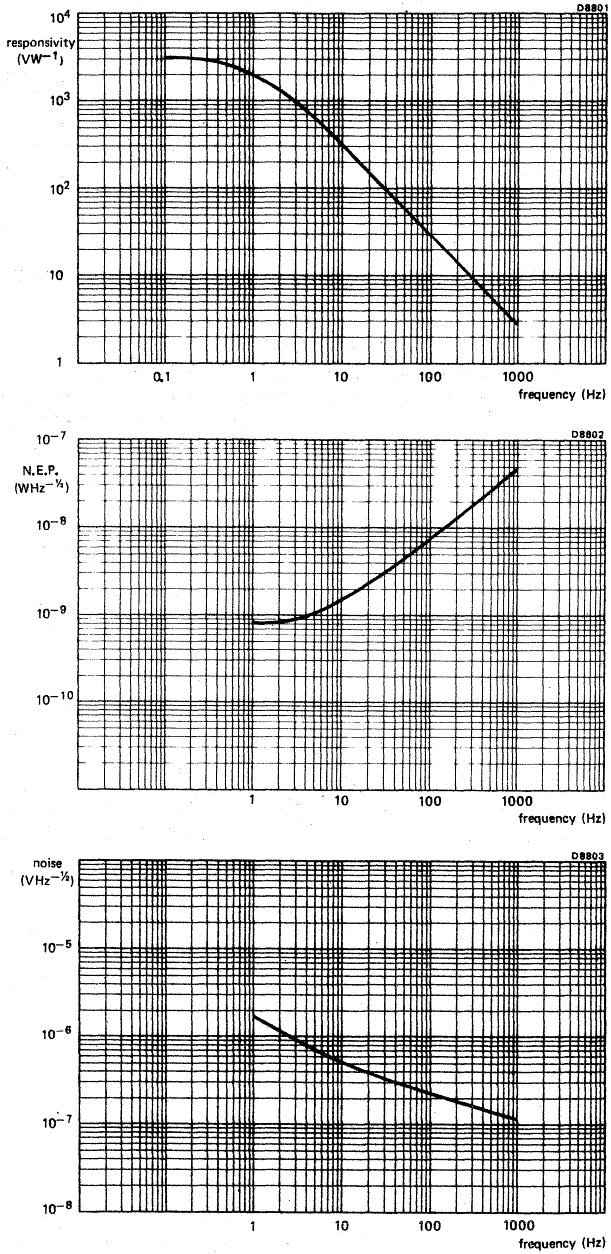
MECHANICAL AND ENVIRONMENTAL STANDARDS

As part of the Quality Assurance programme, the detectors are assessed at regular intervals against the requirements of the following IEC standards. The frequency of testing and the limits and conditions for the pre- and post-test measurements are based on those stipulated for the CECC 50 000 series of approved transistors.

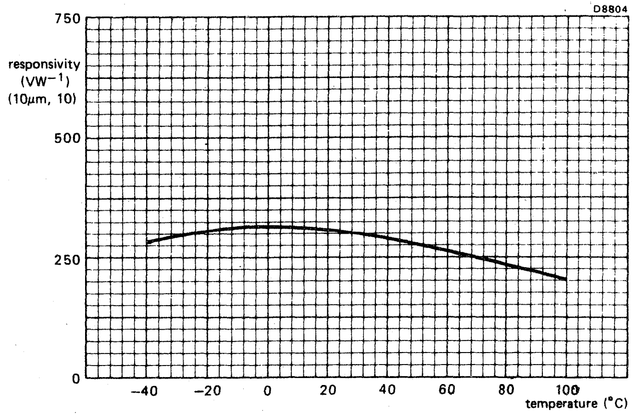
			note
IEC 68-2-3	Test Ca	Moisture Resistance, steady state	1
68-2-20	Test T	Solderability	1
68-2-21	Test Ub	Lead Fatigue	1
68-2-1	Test A	Low Temperature Storage	2
68-2-2	Test Ba	High Temperature Storage	2
68-2-14	Test Nb	Change of Temperature (10 cycles)	2
68-2-6	Test Fc (B4)	Vibration, swept frequency	2
68-2-7	Test Ga	Acceleration, steady state	2
68-2-27	Test Ea	Shock	2
68-2-20	Test T	Resistance to Solder Heat	3

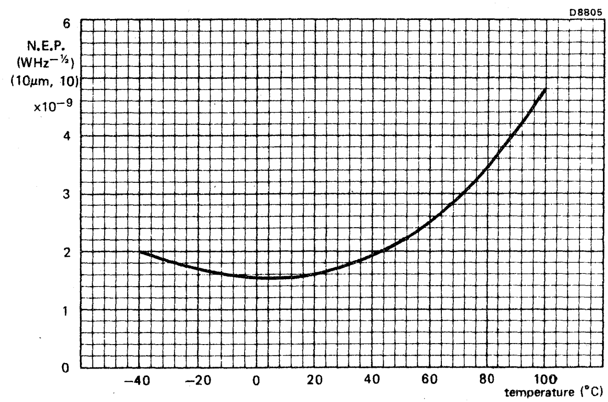
Notes

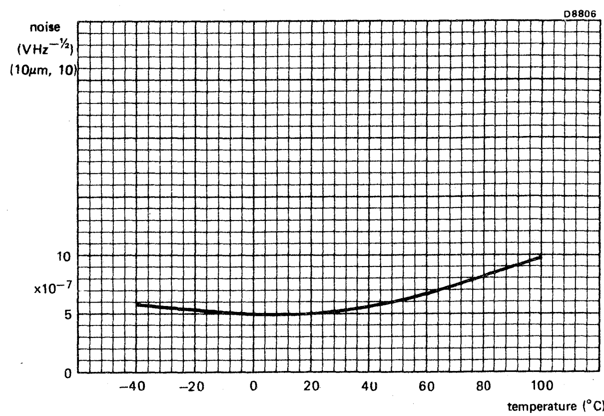
1. The detectors are checked on a production batch release principle at approximately weekly intervals. This is equivalent to group B.
2. The detectors are checked at quarterly intervals; the storage tests to 2000 hours. This is equivalent to group C.
3. This is an annual check.



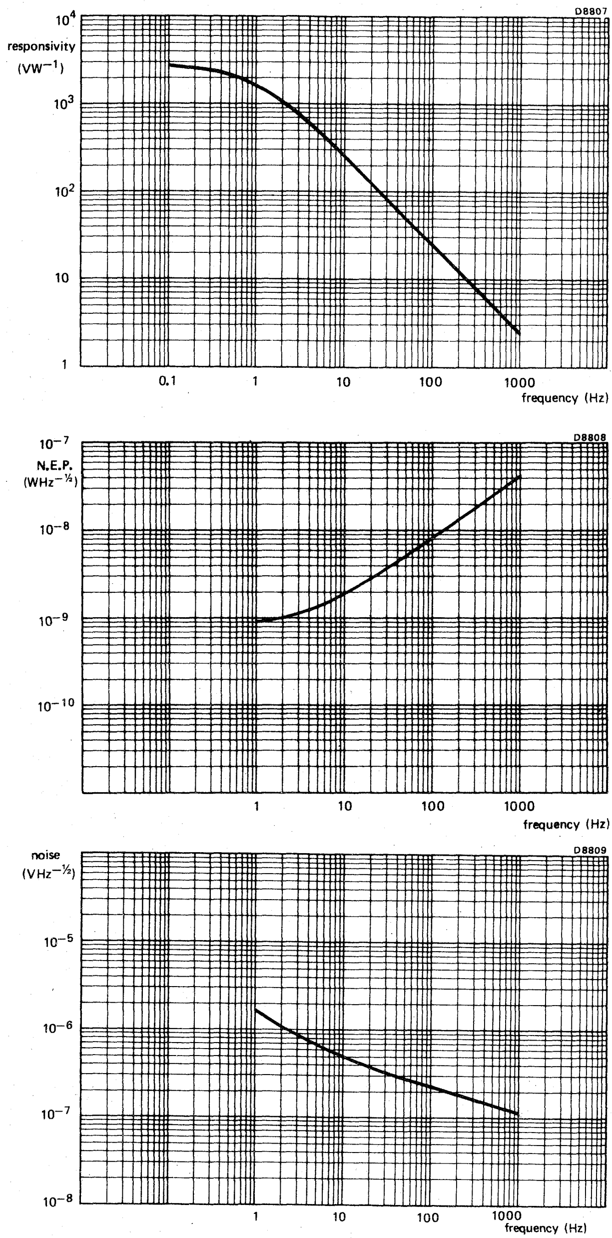
RPY88, typical responsivity,N.E.P., and noise as a function of frequency



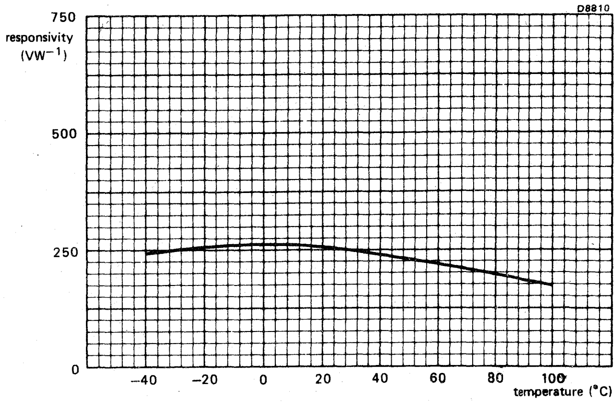


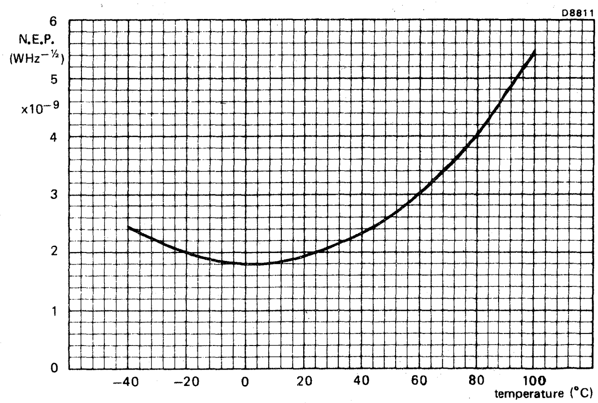


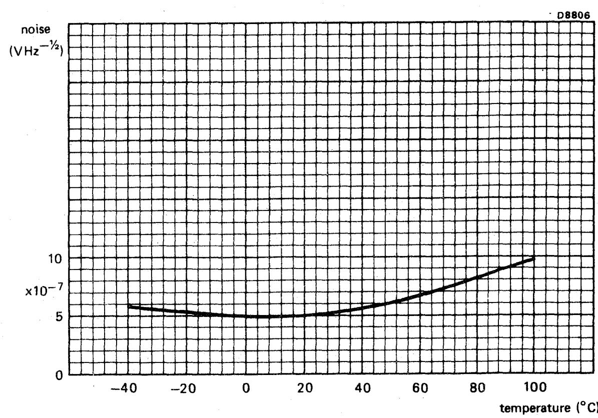
RPY88, typical responsivity, N.E.P., and noise as a function of temperature



RPY89, typical responsivity, N.E.P., and noise as a function of frequency

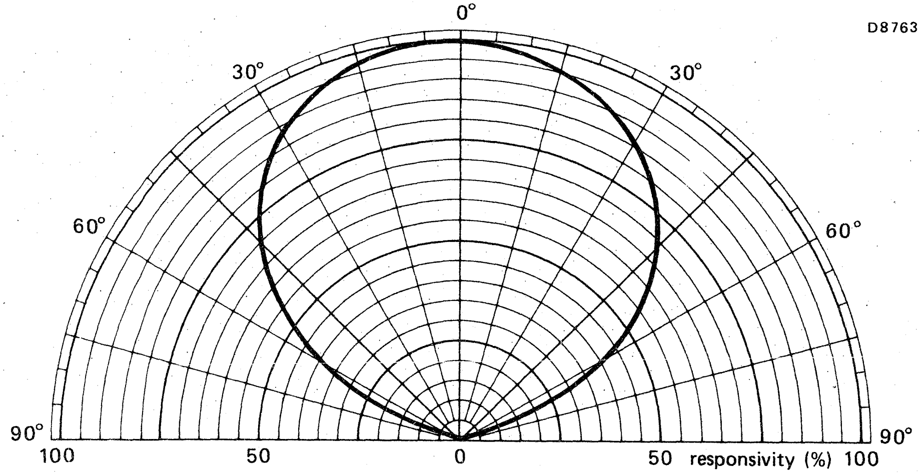




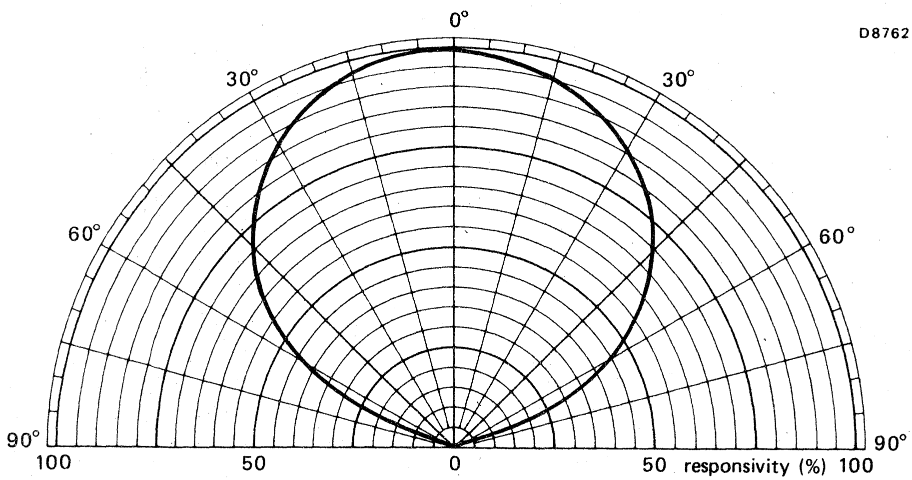


RPY89, typical responsivity, N.E.P., and noise as a function of temperature

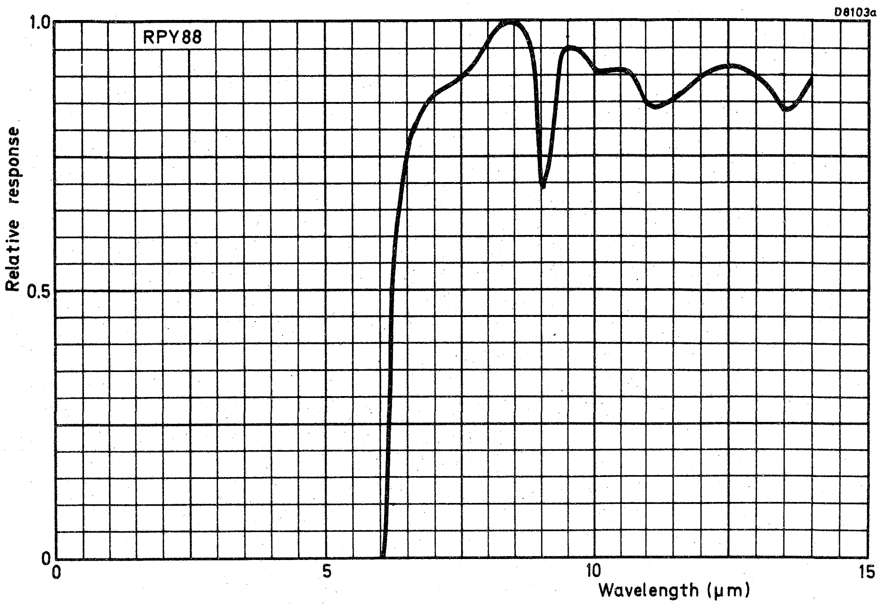
POLAR DIAGRAMS

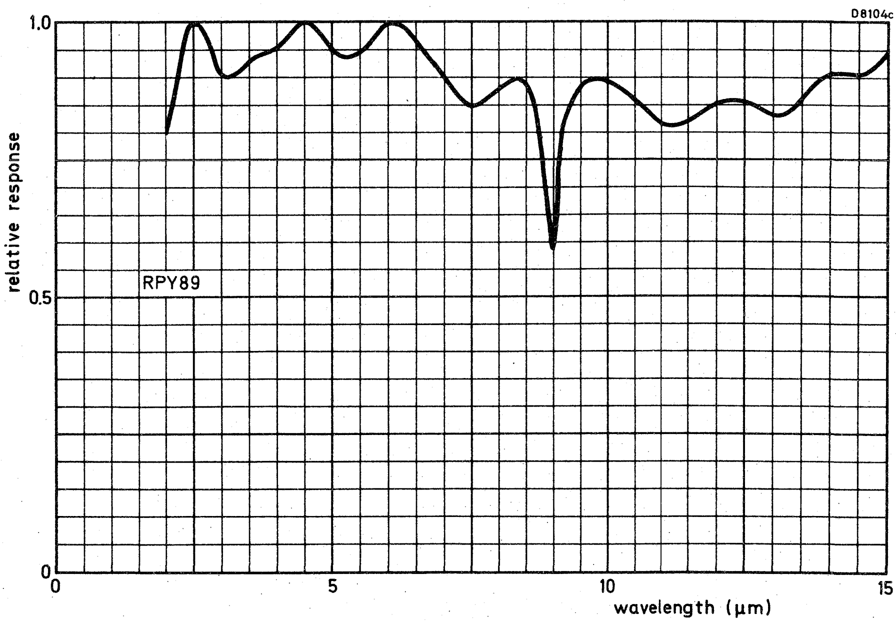


Typical field of view in x-x plane (see mechanical data)



Typical field of view in y-y plane (see mechanical data)





Typical window transmission characteristics

LATGS PYROELECTRIC INFRARED DETECTORS

This series of pyroelectric infrared detectors is designed to replace conventional bolometers. The sensitive material is L-alanine doped triglycine sulphate* (LATGS) which operates at room temperature and has a good broadband performance. Each device has a 2.0 x 0.5 mm sensitive area and is available with a selection of window materials giving a range of spectral performance. A pre-amplifer with short circuit protection is incorporated.

QUICK REFERENCE DATA

	Window material	Spectral response µm	Window description
RPY90A	caesium iodide	1 to 70	transparent, hygroscopic, soft
RPY90C	KRS-5	1 to 40	non-hygroscopic, toxic
RPY90D	silicon (AR coated – optimized for 8 to 14 µm use).	1.2 to 15	non-hygroscopic
RPY90E	sapphire	1 to 6.5	transparent, non-hygroscopic

N.E.P.** (500K, 10, 1)	RPY90A	typ.	1.0×10^{-10}	$WHz^{-½}$
Responsivity (500K, 10)	RPY90A	typ.	8.0×10^{3}	VW^{-1}
Recommended operating voltage			9	V
Operating frequency range			10 to 1000	Hz
Optimum operating temperature range			–20 to +45	°C
Field of view			> 60	degrees

This data must be read in conjunction with GENERAL SAFETY RECOMMENDATIONS – OPTOELECTRONIC DEVICES

PRODUCT SAFETY

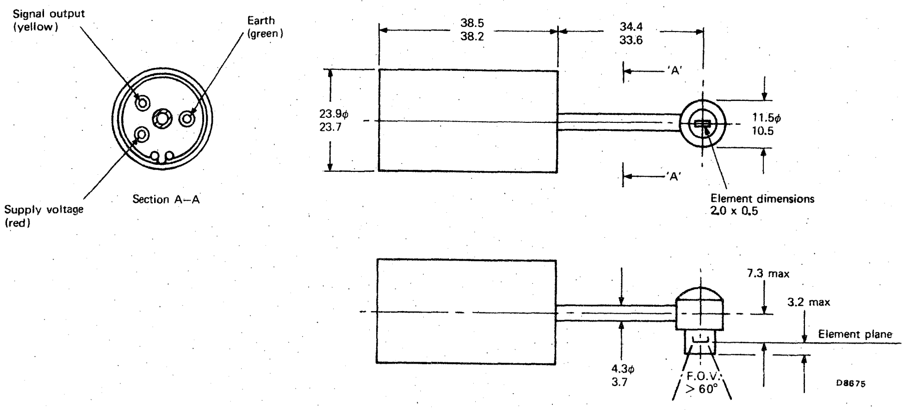
Modern high technology materials have been used in the manufacture of this device to ensure high performance. Some of these materials are toxic in certain circumstances. Mechanical or electrical damage is unlikely to give rise to any hazard, but toxic vapours may be generated if the device is heated to destruction. Disposal of large quantities should therefore be carried out in accordance with the Deposit of Poisonous Waste Act 1972 and the Control of Pollution Act 1974, or with the latest legislation.

* LATGS cuts off below $\lambda = 1$ µm, where incident energy is no longer absorbed.

** Noise Equivalent Power

MECHANICAL DATA

Dimensions in mm



Three female connectors are supplied with each device to fit Sealectro feed throughs type no. FT SM 14.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC134).

Supply voltage	max.	+18	V
Supply current	max.	10	mA
Ambient operating temperature		−20 to +45	°C
Storage temperature		−20 to +55	°C

CHARACTERISTICS at T_{amb} = 20 °C, using a 500 K black body source

		RPY90A	C	D	E		
N.E.P. (500 K, 10, 1)	typ.	1.0	1.3	1.6	3.0	$\times 10^{-10}$	$WHz^{-½}$
	<	1.5	2.0	2.4	4.5	$\times 10^{-10}$	$WHz^{-½}$
Responsivity (500 K, 10)*	typ.	8.0	6.2	5.0	2.7	$\times 10^{3}$	VW^{-1}
Noise per unit bandwidth at 10 Hz	typ.	0.8	0.8	0.8	0.8		$\mu VHz^{-½}$
Output voltage (d.c.level)	>	2	2	2	2		V
	typ.	3	3	3	3		V
	<	8	8	8	8		V
Output impedance	<	4	4	4	4		kΩ
Element dimensions		all types: 2.0 x 0.5					mm
Field of view		all types: > 60					degrees
Operating voltage range		all types: 8 to 10					V
Supply current		all types: up to 10					mA

*These detectors can also be supplied with an integral frequency compensated amplifier similar to that described under Application Information. This would, for example, increase the responsivity by up to x 100 with an amplifier designed to give a flat response to 20 Hz.

OPERATING NOTES

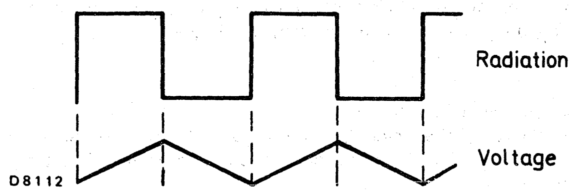
1. The detector is supplied with a black plastic cap to protect the window. This cap must be removed before operation.
2. The shape of the electrical output waveform is the integral of the incident radiation waveform.
3. It is inadvisable to operate the detector at mains related frequencies.
4. To avoid the possibility of optical microphony, the detector must be firmly mounted.
5. An increase in temperature of the element will produce a negative going signal at the output.
6. Provided that the operating voltage does not exceed 10 V, the maximum time for the output to be short-circuited (to the supply or common rail) is unlimited.

DEFINITIONS

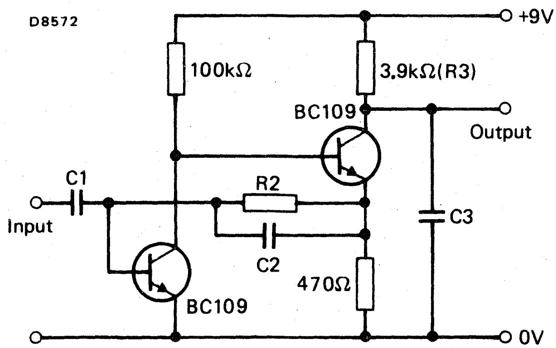
1. N.E.P. (Noise Equivalent Power), $WHz^{-1/2}$
   This is the r.m.s. value of the incident, chopped, radiant power necessary to produce an r.m.s. signal to r.m.s. noise ratio of unity. The r.m.s. noise refers to the value calculated for unit square root bandwidth $VHz^{-1/2}$.
2. Responsivity VW^{-1}
   This is the ratio of the r.m.s. signal in volts to the r.m.s. value of the incident, chopped, radiant power.

APPLICATION INFORMATION

1. The pyroelectric element may be considered as a capacitor whose charge state changes with temperature. It also behaves as a normal capacitor, i.e. its voltage changes with charge. Thus a change of temperature results in a change of voltage. It can be seen that, for a given change in amplitude of incident radiation, the resulting change in temperature will decrease as the chopping frequency increases. Thus the voltage change will also decrease with frequency. In addition, there is a 90° phase lag between the thermal and electrical signals. The voltage signal therefore becomes the integral of the radiation signal.



2. Frequency compensating amplifier
The following circuit is designed to be connected directly to the detector output and may be used to compensate for the falling responsivity characteristic with frequency. It is a simple 'virtual earth' amplifier which uses a series input capacitor to provide increasing current through the feedback resistor R_2 with increasing frequency. The time constants R_2 C_2 and R_3 C_3 are chosen to coincide with R_1 C_1, where R_1 is the output impedance of the detector (< 4.0 kΩ).

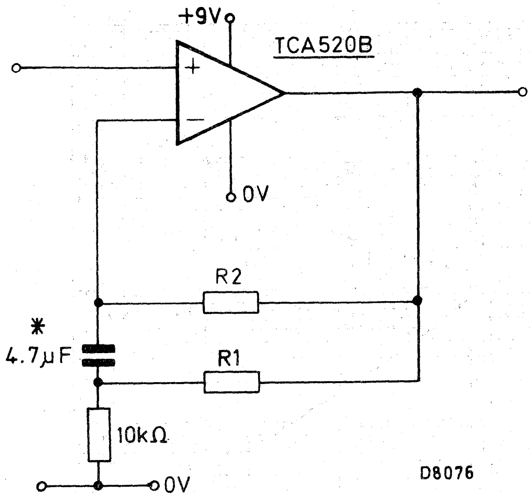


The table below gives recommended component values for various roll-off frequencies (approx. −3 dB point).

Frequency Hz	C_1 C_3 nF	R_2 kΩ	C_2 nF
30	680	330	10
300	68	220	1.5
600	33	330	0.47
1500	15	68	1.0
3000	15	82	0.47
4500	4.7	68	0.33

With this circuit the original shape of the radiation waveform is restored at the output for chopping frequencies sensibly lower than the roll-off frequency.

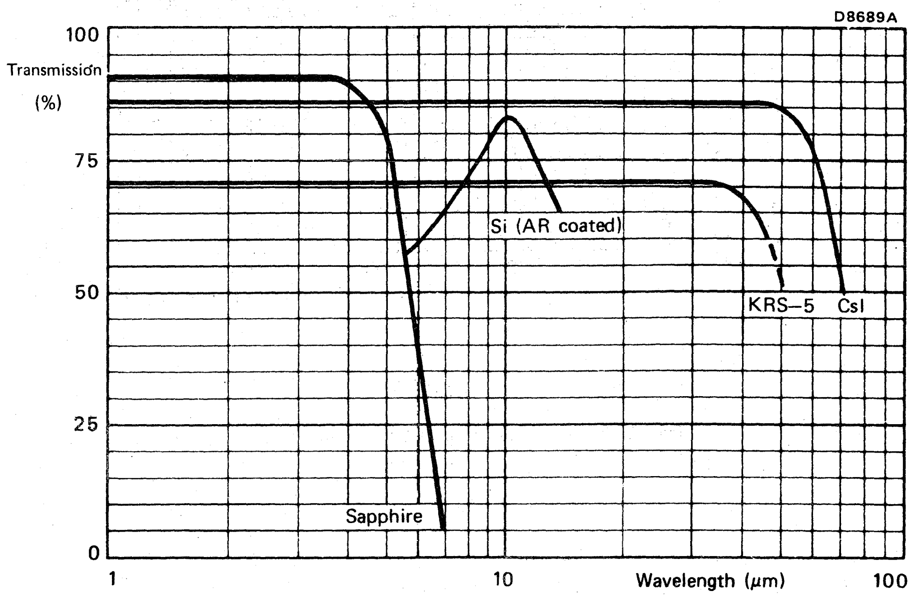
3. Additional stage for extra gain which may be connected directly to the detector output or to the output of the frequency compensating amplifier.



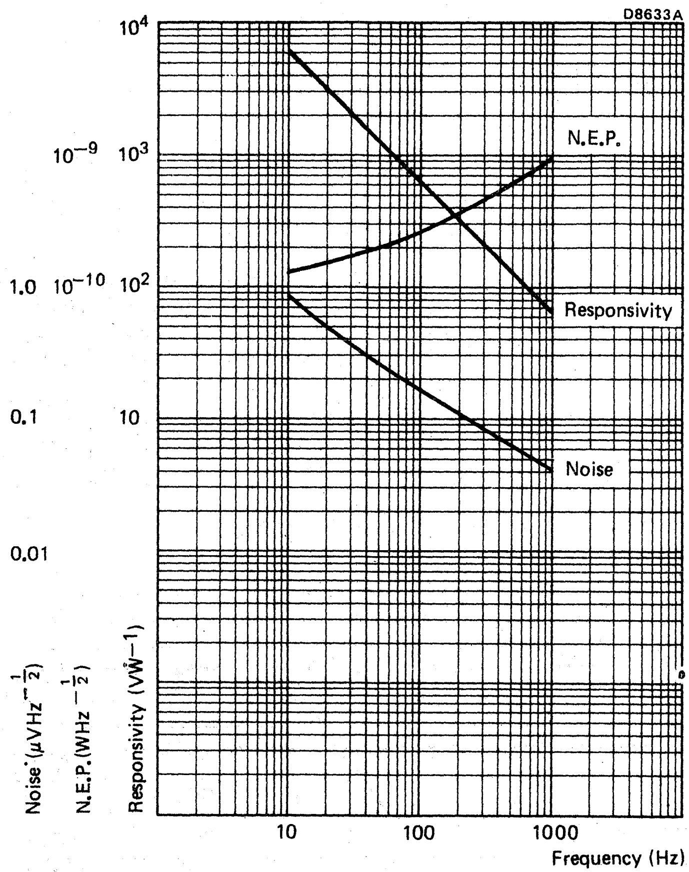
Recommended component values for various gains

Gain x	R_1 kΩ	R_2 MΩ
50	560	5.6
20	220	2.2
10	100	1.0

*this capacitor must be a low leakage type, e.g. our 344 series

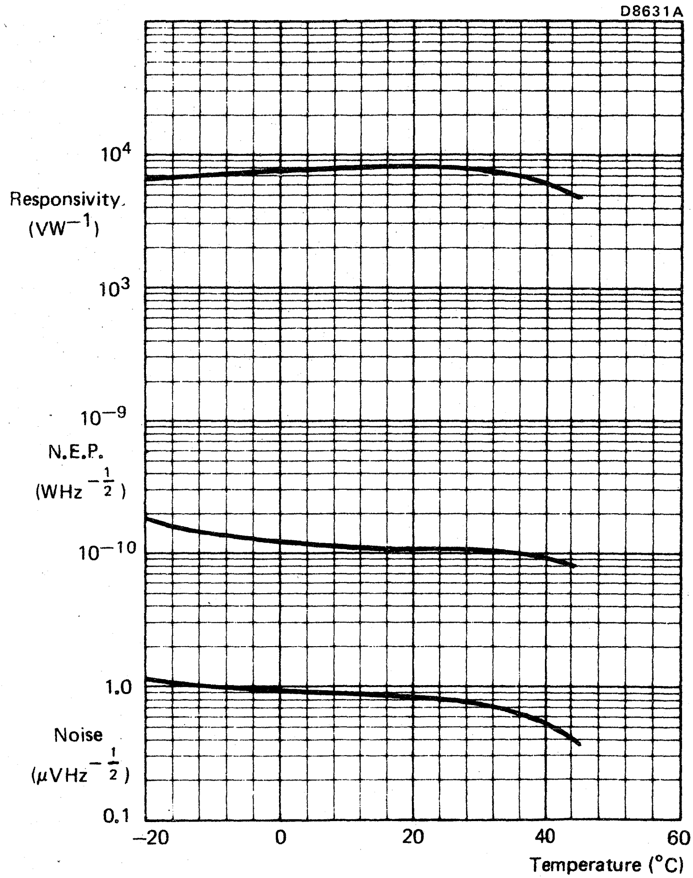


Typical window transmission characteristics.



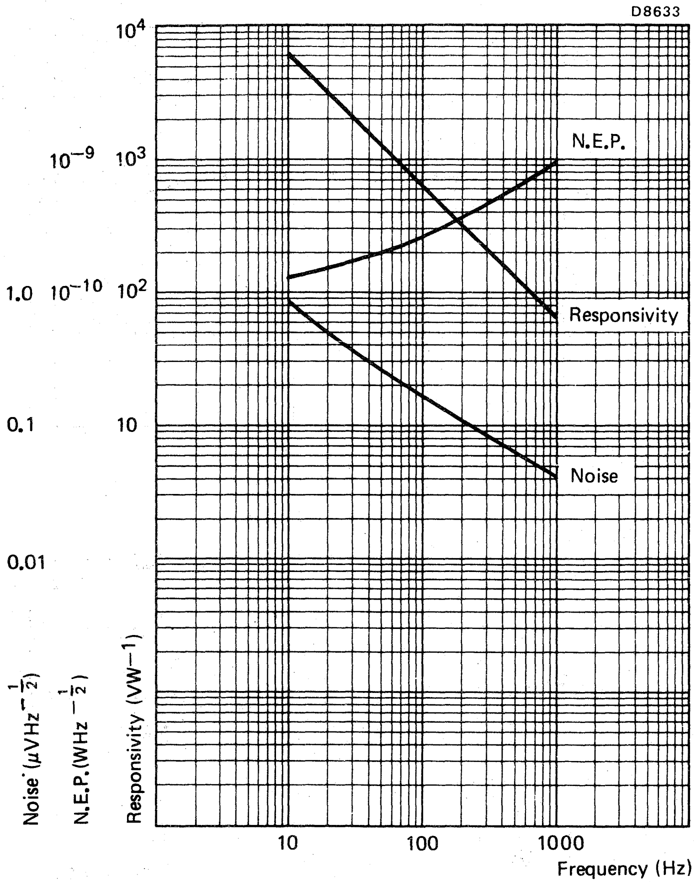
RPY90A

Typical 500 K black body performance as a function of frequency



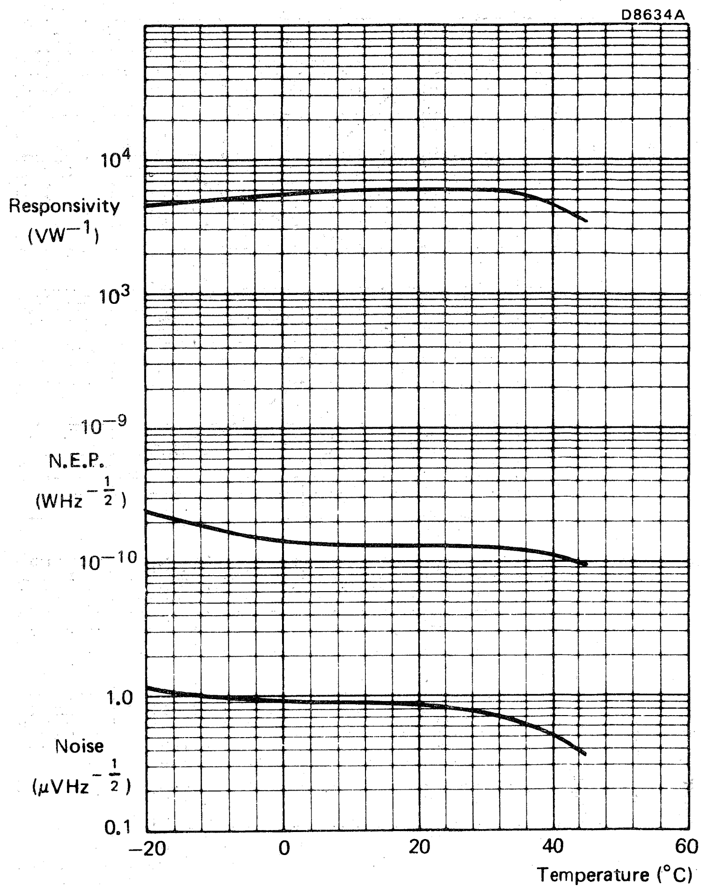
RPY90A

Typical 500 K black body performance as a function of temperature



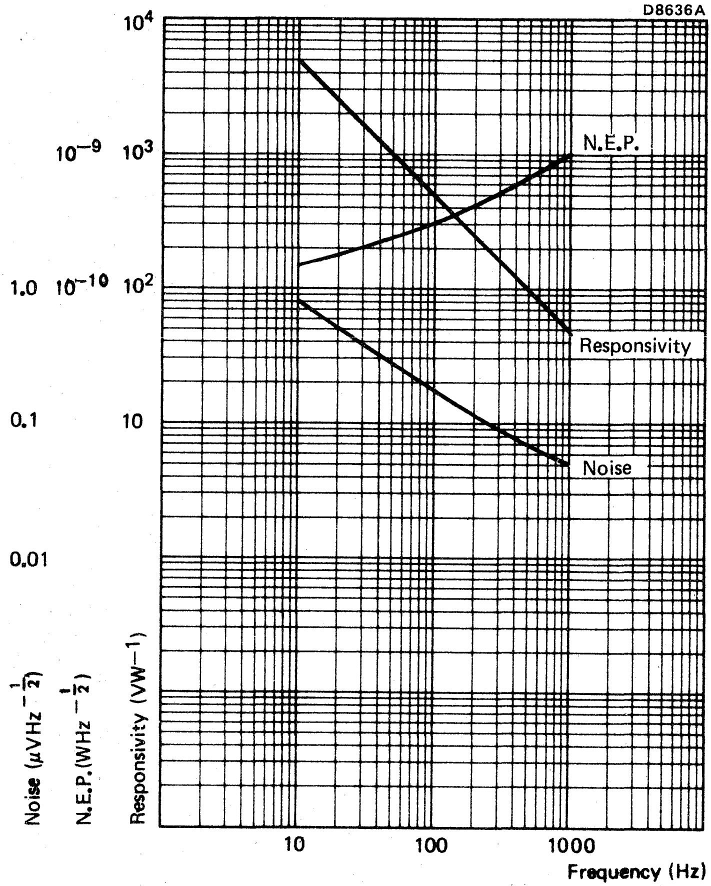
RPY90C

Typical 500 K black body performance as a function of frequency



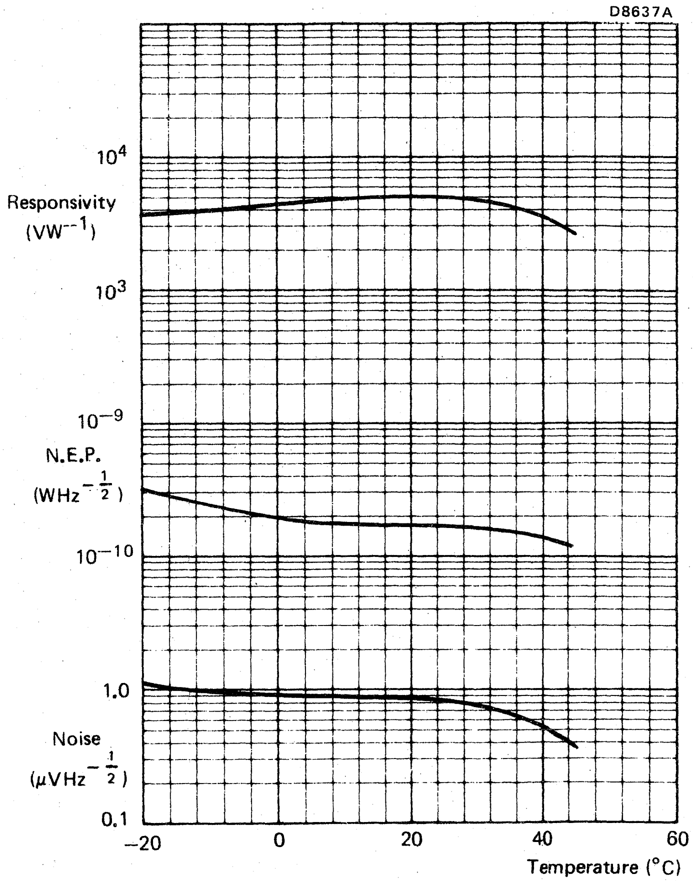
RPY90C

Typical 500 K black body performance as a function of temperature



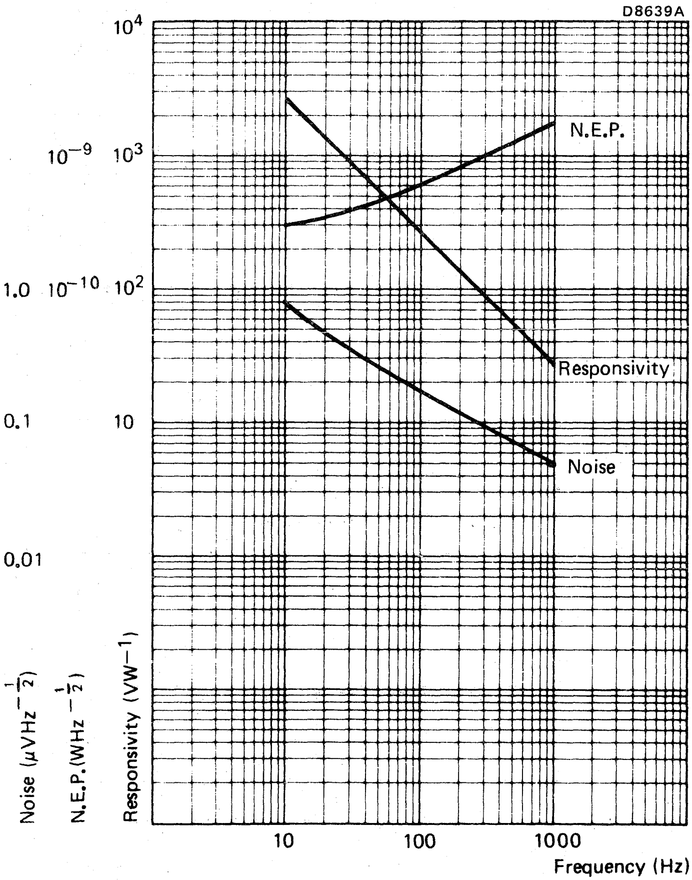
RPY90D

Typical 500 K black body performance as a function of frequency



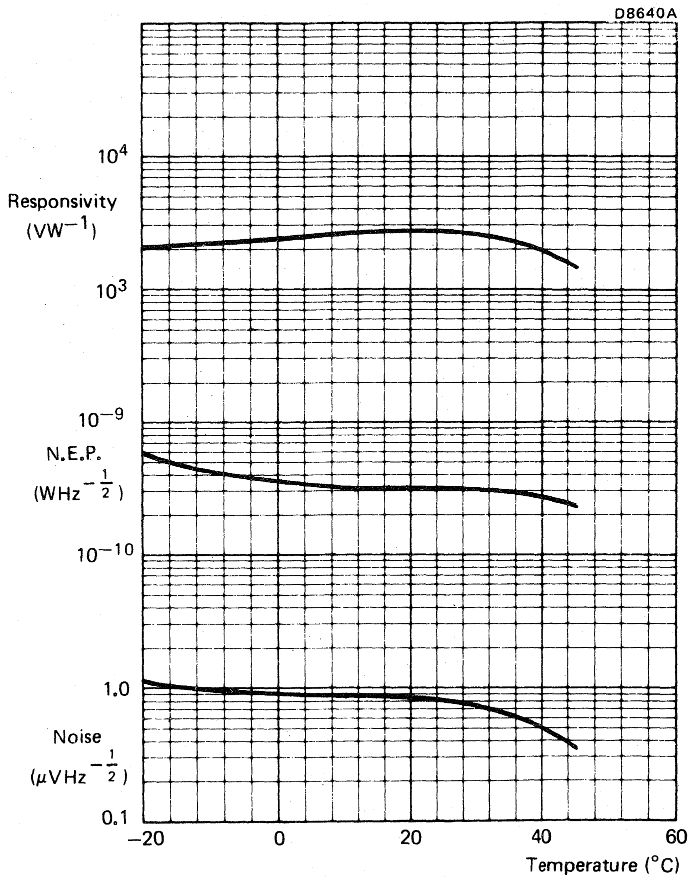
RPY90D

Typical 500 K black body performance as a function of temperature



RPY90E

Typical 500 K black body performance as a function of frequency



RPY90E

Typical 500K black body performance as a function of temperature

LATGS PYROELECTRIC INFRARED DETECTORS

This series of pyroelectric infrared detectors is designed to replace conventional bolometers. The sensitive material is L-alanine doped triglycine sulphate* (LATGS) which operates at room temperature and has a good broadband performance. Each device has a 2.75 x 1.25 mm sensitive area and is available with a selection of window materials giving a range of spectral performance. A pre-amplifier with short circuit protection is incorporated.

QUICK REFERENCE DATA

	Window material	Spectral response µm	Window description
RPY91A	caesium iodide	1 to 70	transparent, hygroscopic, soft
RPY91C	KRS-5	1 to 40	non-hygroscopic, toxic
RPY91D	silicon (AR coated— optimized for 8 to 14 µm use).	1.2 to 15	non-hygroscopic
RPY91E	sapphire	1 to 6.5	transparent, non-hygroscopic

N.E.P.** (500K, 10, 1)	RPY91A typ.	1.5×10^{-10}	$WHz^{-½}$
Responsivity (500K, 10)	RPY91A typ.	6.5×10^{3}	VW^{-1}
Recommended operating voltage		9	V
Operating frequency range		10 to 1000	Hz
Optimum operating temperature range		−20 to +45	°C
Field of view		> 60	degrees

This data must be read in conjunction with GENERAL SAFETY RECOMMENDATIONS – OPTOELECTRONIC DEVICES

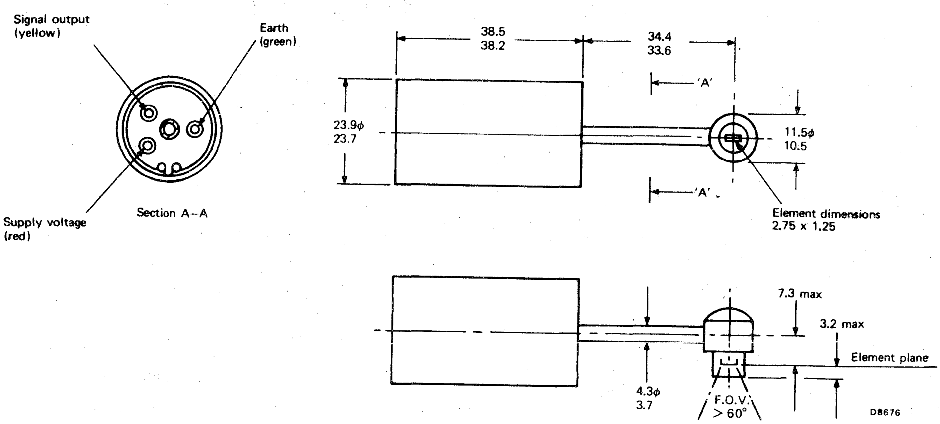
PRODUCT SAFETY

Modern high technology materials have been used in the manufacture of this device to ensure high performance. Some of these materials are toxic in certain circumstances. Mechanical or electrical damage is unlikely to give rise to any hazard, but toxic vapours may be generated if the device is heated to destruction. Disposal of large quantities should therefore be carried out in accordance with the Deposit of Poisonous Waste Act 1972 and the Control of Pollution Act 1974, or with the latest legisation.

* LATGS cuts off below λ = 1 µm, where incident energy is no longer absorbed.

** Noise Equivalent Power

MECHANICAL DATA Dimensions in mm



Three female connectors are supplied with each device to fit Sealectro feed throughs type no. FT SM 14.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC134)

Supply voltage	max.	+18	V
Supply current	max.	10	mA
Ambient operating temperature		−20 to +45	°C
Storage temperature		−20 to +55	°C

CHARACTERISTICS at T_{amb} = 20 °C, using a 500 K black body source

		RPY91A	C	D	E		
N.E.P. (500 K, 10, 1)	typ.	1.5	2.0	2.5	4.5	$\times 10^{-10}$	$WHz^{-½}$
	$<$	3.0	4.0	5.0	9.0	$\times 10^{-10}$	$WHz^{-½}$
Responsivity (500 K, 10)*	typ.	6.5	5.0	4.0	2.3	$\times 10^3$	VW^{-1}
Noise per unit bandwidth at 10 Hz	typ.	1.0	1.0	1.0	1.0		$\mu VHz^{-½}$
Output voltage (d.c. level)	$>$	4	4	4	4		V
	typ.	6	6	6	6		V
	$<$	8	8	8	8		V
Output impedance	$<$	4	4	4	4		kΩ
Element dimensions		all types: 2.75 x 1.25					mm
Field of view		all types: $>$ 60					degrees
Operating voltage range		all types: 8 to 10					V
Supply current		all types: up to 10					mA

*These detectors can also be supplied with an integral frequency compensated amplifier similar to that described under Application Information. This would, for example, increase the responsivity by up to x 100 with an amplifier designed to give a flat response to 20 Hz.

OPERATING NOTES

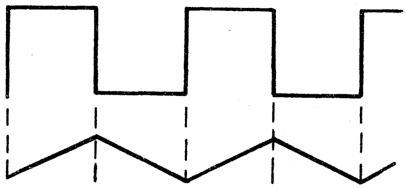
1. The detector is supplied with a black plastic cap to protect the window. This cap must be removed before operation
2. The shape of the electrical output waveform is the integral of the incident radiation waveform.
3. It is inadvisable to operate the detector at mains related frequencies.
4. To avoid the possibility of optical microphony, the detector must be firmly mounted.
5. An increase in temperature of the element will produce a negative going signal at the output.
6. Provided that the operating voltage does not exceed 10 V, the maximum time for the output to be short-circuited (to the supply or common rail) is unlimited.

DEFINITIONS

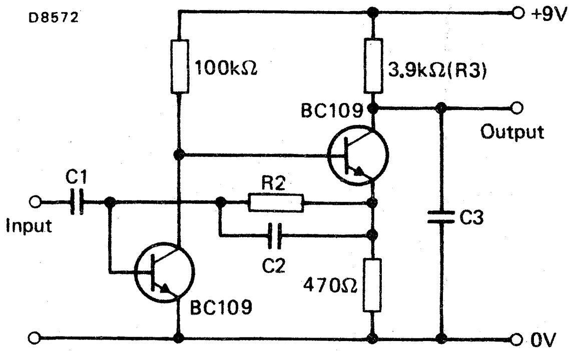
1. N.E.P. (Noise Equivalent Power) $WHz^{-1/2}$
   This is the r.m.s. value of the incident, chopped, radiant power necessary to produce an r.m.s. signal to r.m.s. noise ratio of unity. The r.m.s. noise refers to the value calculated for unit square root bandwidth $VHz^{-1/2}$.
2. Responsivity VW^{-1}
   This is the ratio of the r.m.s. signal in volts to the r.m.s. value of the incident, chopped, radiant power.

APPLICATION INFORMATION

1. The pyroelectric element may be considered as a capacitor whose charge state changes with temperature. It also behaves as a normal capacitor, i.e. its voltage changes with charge. Thus a change of temperature results in a change of voltage. It can be seen that, for a given change in amplitude of incident radiation, the resulting change in temperature will decrease as the chopping frequency increases. Thus the voltage change will also decrease with frequency. In addition, there is a 90° phase lag between the thermal and electrical signals. The voltage signal therefore becomes the integral of the radiation signal.



2. Frequency compensating amplifier
The following circuit is designed to be connected directly to the detector output and may be used to compensate for the falling responsivity characteristic with frequency. It is a simple 'virtual earth' amplifier which uses a series input capacitor to provide increasing current through the feedback resistor R_2 with increasing frequency. The time constants R_2 C_2 and R_3 C_3 are chosen to coincide with R_1 C_1, where R_1 is the output impedance of the detector (< 4.0 kΩ).

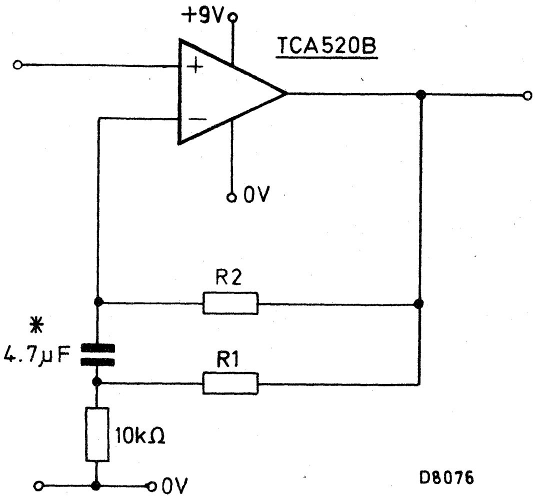


The table below gives recommended component values for various roll-off frequencies (approx. –3 dB point).

Frequency Hz	C_1 C_3 nF	R_2 kΩ	C_2 nF
30	680	330	10
300	68	220	1.5
600	33	330	0.47
1500	15	68	1.0
3000	15	82	0.47
4500	4.7	68	0.33

With this circuit the original shape of the radiation waveform is restored at the output for chopping frequencies sensibly lower than the roll-off frequency.

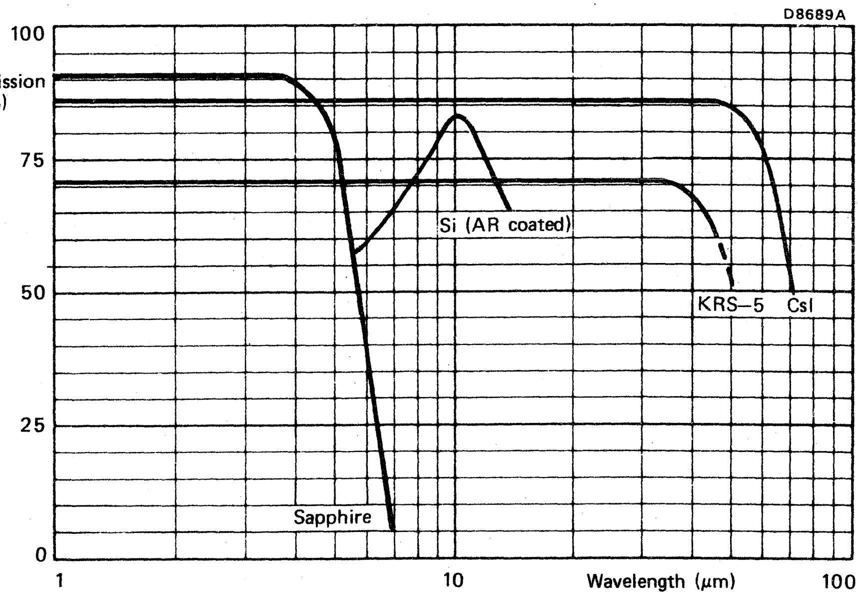
3. Additional stage for extra gain which may be connected directly to the detector output or to the output of the frequency compensating amplifer.



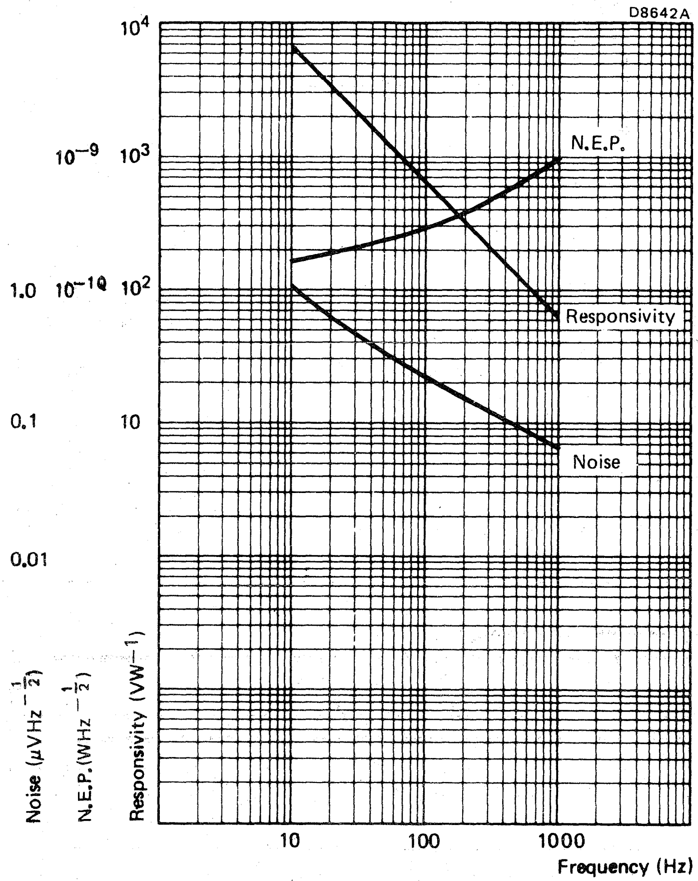
Recommended component values for various gains

Gain x	R_1 kΩ	R_2 MΩ
50	560	5.6
20	220	2.2
10	100	1.0

*this capacitor must be a low leakage type, e.g. our 344 series

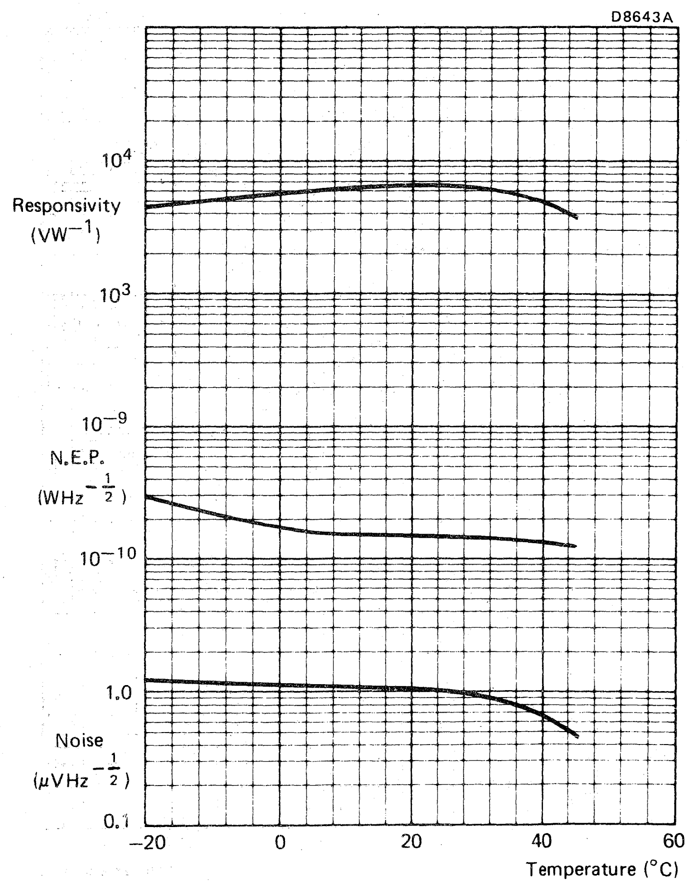


Typical window transmission characteristics.



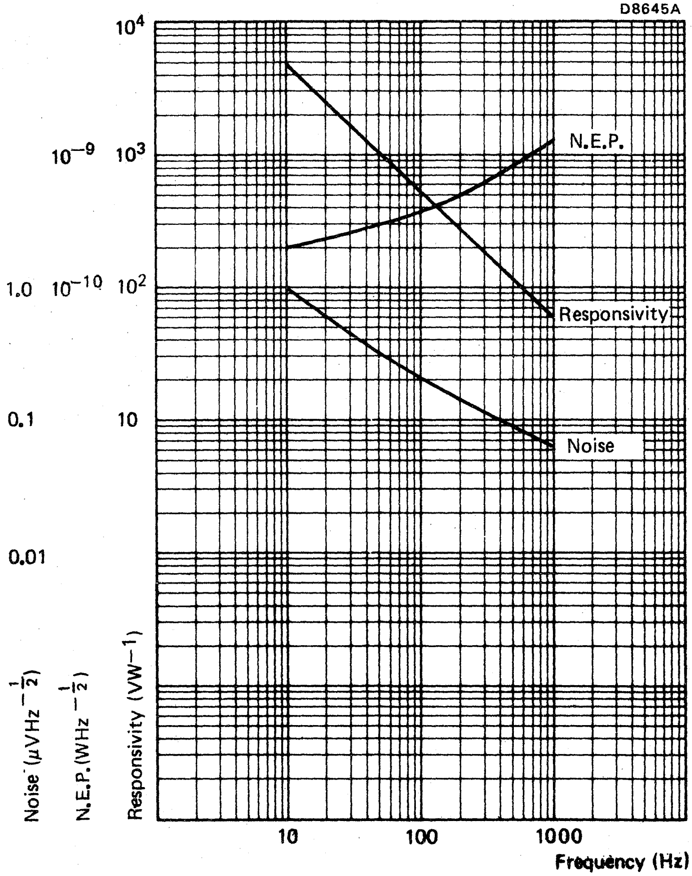
RPY91A

Typical 500K black body performance as a function of frequency



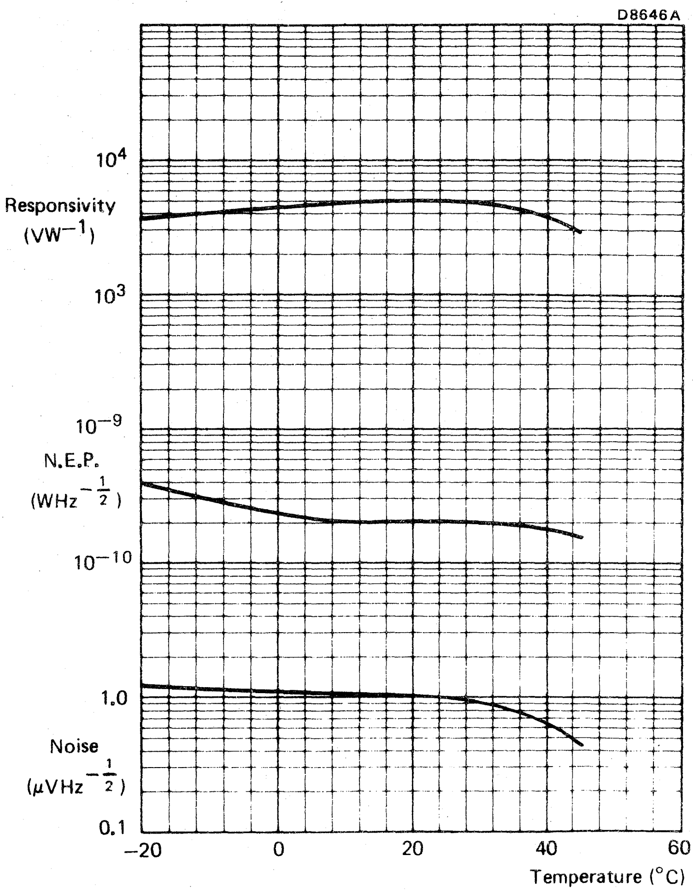
RPY91A

Typical 500K black body performance as a function of temperature



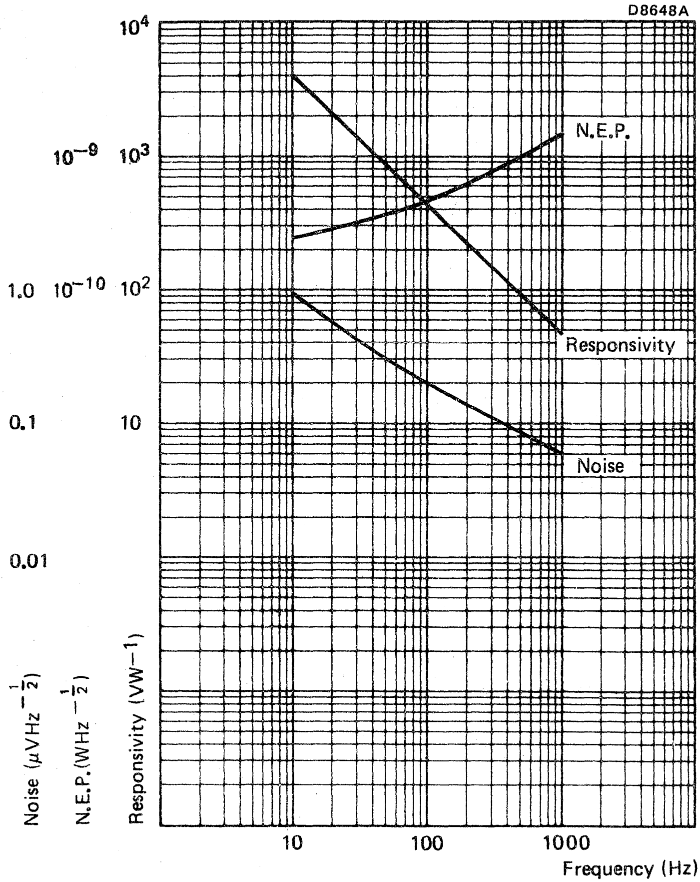
RPY91C

Typical 500K black body performance as a function of frequency



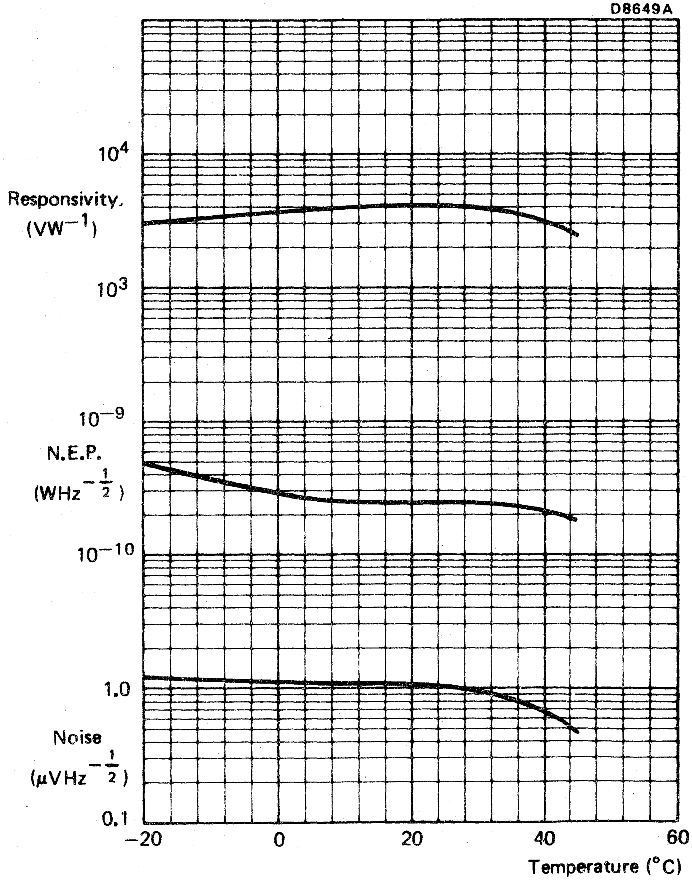
RPY91C

Typical 500K black body performance as a function of temperature



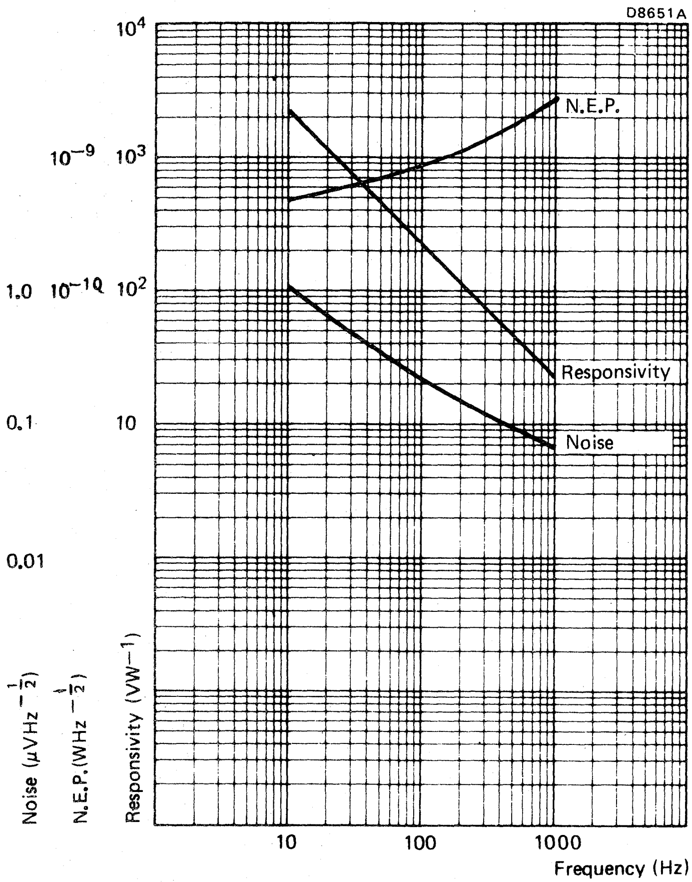
RPY91D

Typical 500K black body performance as a function of frequency



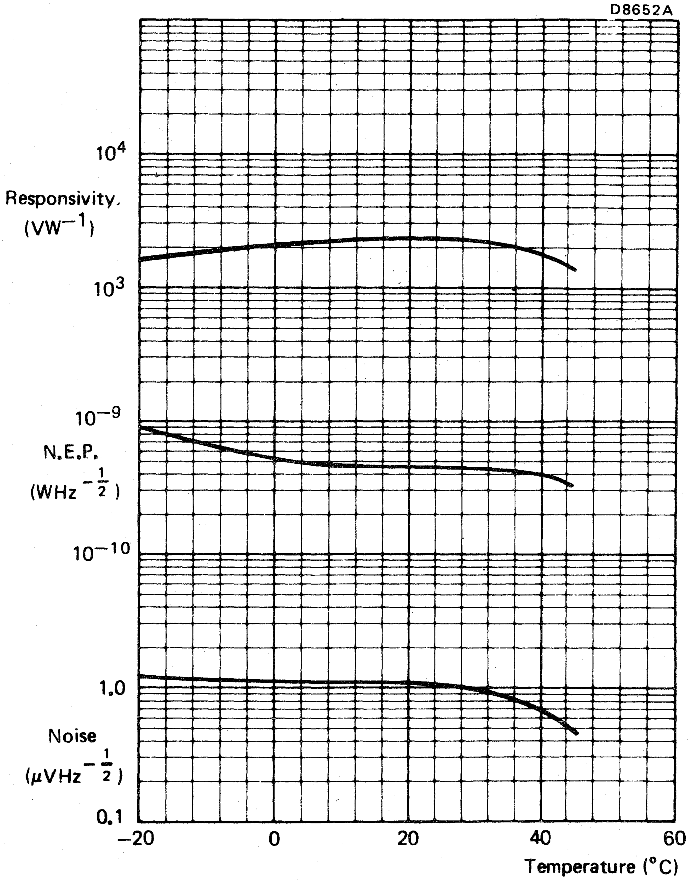
RPY91D

Typical 500K black body performance as a function of temperature



RPY91E

Typical 500K black body performance as a function of frequency



RPY91E

Typical 500K black body performance as a function of temperature

PYROELECTRIC INFRARED DETECTOR

This is an infrared sensitive device specifically designed for passive IR intruder alarms. It has differentially connected dual elements combined with a single impedance converting amplifier to provide immunity from common mode signals such as those generated by variations in ambient temperature, background radiation and acoustic noise.
The detector will give an output signal only when the radiation falling on the elements is unbalanced, as in a focused system.
It is sealed in a low profile TO-5 can with a window optically coated to restrict the response to wavelengths greater than 6.5 μm.

QUICK REFERENCE DATA

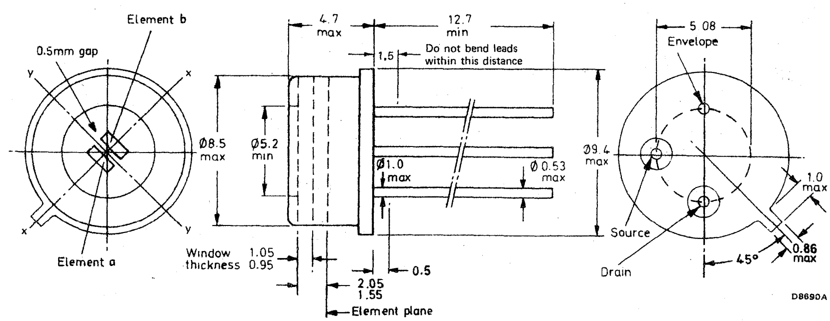
Spectral response		6.5 ± 0.5 to > 14	μm
Responsivity (10 μm, 10), each element	typ.	800	VW^{-1}
Noise Equivalent Power (N.E.P.), (10 μm, 10, 1), each element	typ.	1.4×10^{-9}	$WHz^{-1/2}$
Element dimensions, each element		2 x 0.75	mm
Element separation		0.5	mm
Field of view	typ.	112	degrees
Operating voltage		9	V
Optimum operating frequency range		0.1 to 1000	Hz

This data must be read in conjunction with GENERAL SAFETY RECOMMENDATIONS – OPTOELECTRONIC DEVICES

MECHANICAL DATA

Dimensions in mm

SOT-49E (low profile TO-5)



PRODUCT SAFETY

Modern high technology materials have been used in the manufacture of this device to ensure high performance. Some of these materials are toxic in certain circumstances. Mechanical or electrical damage is unlikely to give rise to any hazard, but toxic vapours may be generated if the device is heated to destruction. Disposal of large quantities should therefore be carried out in accordance with the Deposit of Poisonous Waste Act 1972 and the Control of Pollution Act 1974, or with the latest legislation.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC134)

Supply voltage	max.	30	V
Temperature, operation	max.	+50	°C
	min.	−40	°C
Temperature, storage	max.	+70	°C
	min.	−40	°C

SOLDERING

1. When making soldered connections to the leads, a thermal shunt must be used.
2. It is essential that any mains operated soldering iron used should be both screened and earthed. Failure to observe these precautions may lead to the introduction of line voltage and possible damage to the device.

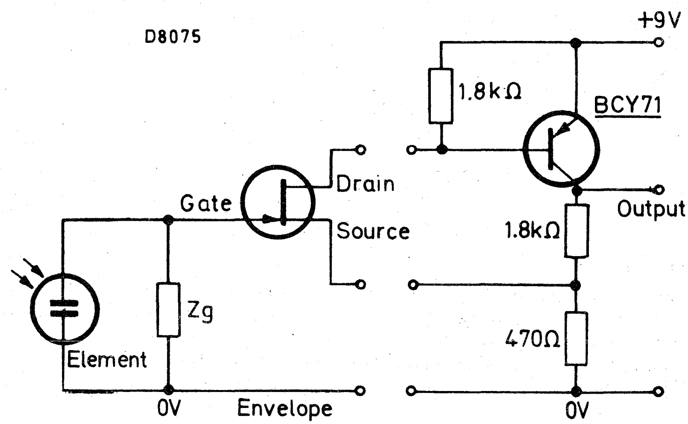
CHARACTERISTICS (at T_{amb} = 25 ± 3 °C and with the recommended test circuit)

	min.	typ.	max.	
N.E.P. (10 μm, 10, 1) notes 1 and 5	—	1.4×10^{-9}	3×10^{-9}	$WHz^{-1/2}$
Responsivity (10 μm, 10) notes 1 and 5	565	800	—	VW^{-1}
Element matching $\frac{(R_a - R_b)}{(R_a + R_b)} \times 100$ note 2	—	±2	± 10	%
Spectral response	6.5 ± 0.5	—	> 14	μm
Field of view note 3	—	112	—	degrees
Operating voltage note 4	8	9	10	V

Notes

1. Each element. These characteristics apply throughout the spectral response range.
2. Where R_a and R_b are the responsivities of the respective elements.
3. Field of view to 50% of the maximum responsivity level.
4. The detector will operate outside the quoted range but may have a degraded performance.
5. For performance as a function of frequency and temperature see pages 6 and 7.

TEST CIRCUIT



OPERATING NOTES

1. The detector may be supplied with a black plastic cap to protect the window. This cap must be removed before operation.
2. The case potential must not be allowed to become positive with respect to the other two terminals.
3. The shape of the electrical output waveform for each element is the integral of the incident radiation waveform.
4. It is inadvisable to operate the detector at mains related frequencies.
5. To avoid the possibility of optical microphony, the detector must be firmly mounted.
6. Use the recommended circuit for low noise operation.
7. An increase in temperature of element a will produce a negative going signal at the output. For element b, the corresponding output will be positive going.
8. For simplicity of operation, a source follower may be used where noise is not a problem. This may be achieved with a 22 kΩ resistor between source and envelope with the positive supply taken to the drain terminal. This will give a voltage gain of approximately 0.9.

DEFINITIONS

1. N.E.P. (Noise Equivalent Power), $WHz^{-1/2}$

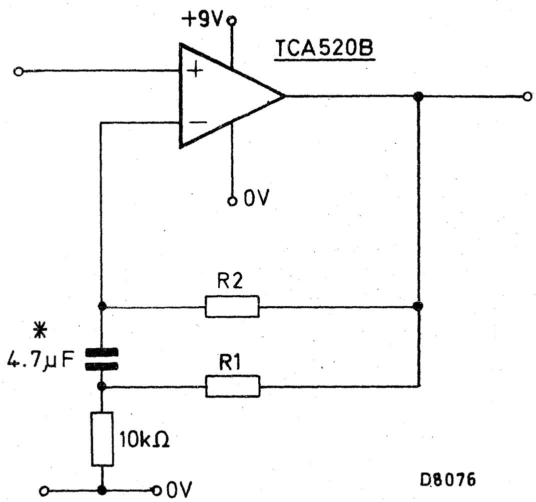
   This is the r.m.s. value of the incident, chopped, radiant power necessary to produce an r.m.s. signal to r.m.s. noise ratio of unity. The r.m.s. noise refers to the value calculated for unit square root bandwidth $VHz^{-1/2}$.

2. Responsivity, VW^{-1}

   This is the ratio of the r.m.s. signal in volts to the r.m.s. value of the incident, chopped, radiant power.

APPLICATION INFORMATION

1. Optional additional stage for extra gain.

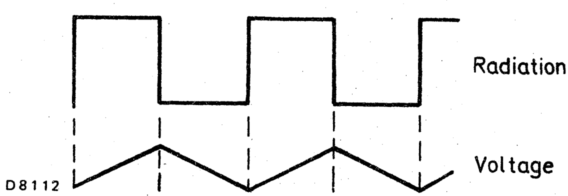


Recommended component values for various gains

Gain x	R_1 kΩ	R_2 MΩ
50	560	5.6
20	220	2.2
10	100	1.0

* this capacitor must be a low leakage type e.g. our 344 series.

2. The pyroelectric element may be considered as a capacitor whose charge state changes with temperature. It also behaves as a normal capacitor, i.e. its voltage changes with charge. Thus a change of temperature results in a change of charge. It can be seen that, for a given change in amplitude of incident radiation, the resulting change in temperature will decrease as the chopping frequency increases. Thus the voltage change will also decrease with frequency. In addition, there is a 90° phase lag between the thermal and electrical signals. The voltage signal therefore becomes the integral of the radiation signal.



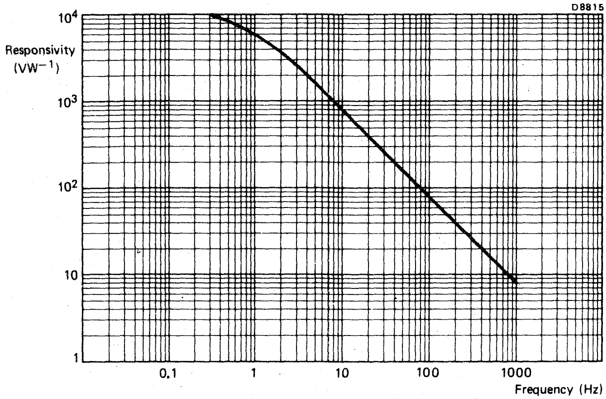
MECHANICAL AND ENVIRONMENTAL STANDARDS

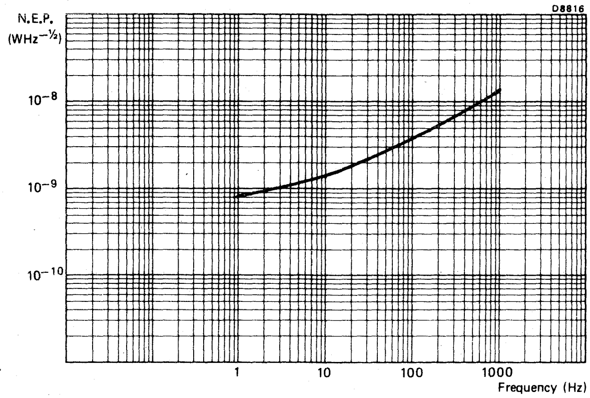
As part of the Quality Assurance programme, the detectors are assessed at regular intervals against the requirements of the following IEC standards. The frequency of testing and the limits and conditions for the pre- and post-test measurements are based on those stipulated for the CECC 50 000 series of approved transistors.

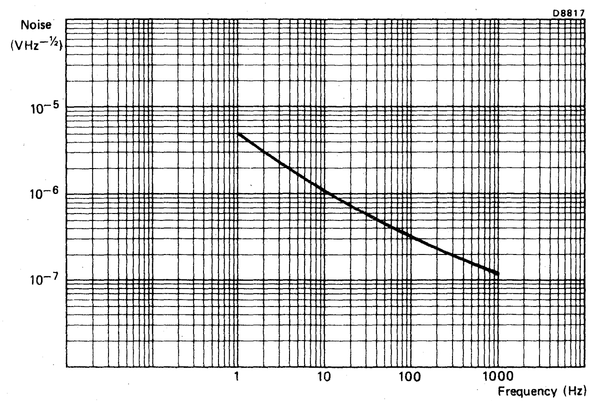
				note
IEC	68-2-3	Test Ca	Moisture Resistance, steady state	1
	68-2-20	Test T	Solderability	1
	68-2-21	Test Ub	Lead Fatigue	1
	68-2-1	Test A	Low Temperature Storage	2
	68-2-2	Test Ba	High Temperature Storage	2
	68-2-14	Test Nb	Change of Temperature (10 cycles)	2
	68-2-6	Test Fc (B4)	Vibration, swept frequency	2
	68-2-7	Test Ga	Acceleration, steady state	2
	68-2-27	Test Ea	Shock	2
	68-2-20	Test T	Resistance to Solder Heat	3

Notes

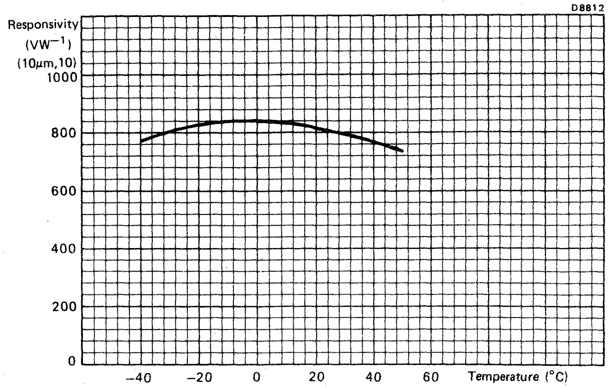
1. The detectors are checked on a production batch release principle at approximately weekly intervals. This is equivalent to group B.
2. The detectors are checked at quarterly intervals; the storage tests to 2000 hours. This is equivalent to group C.
3. This is an annual check.

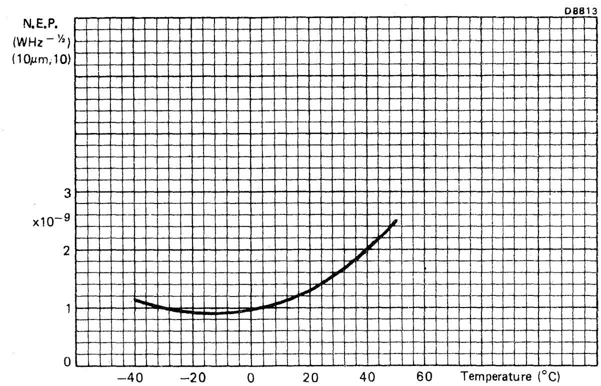


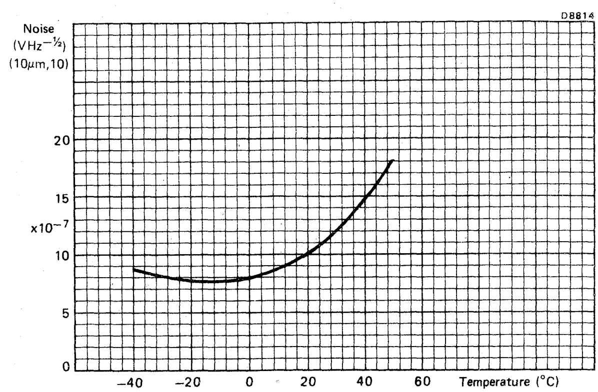




Typical responsivity, N.E.P., and noise as a function of frequency
(one element screened)

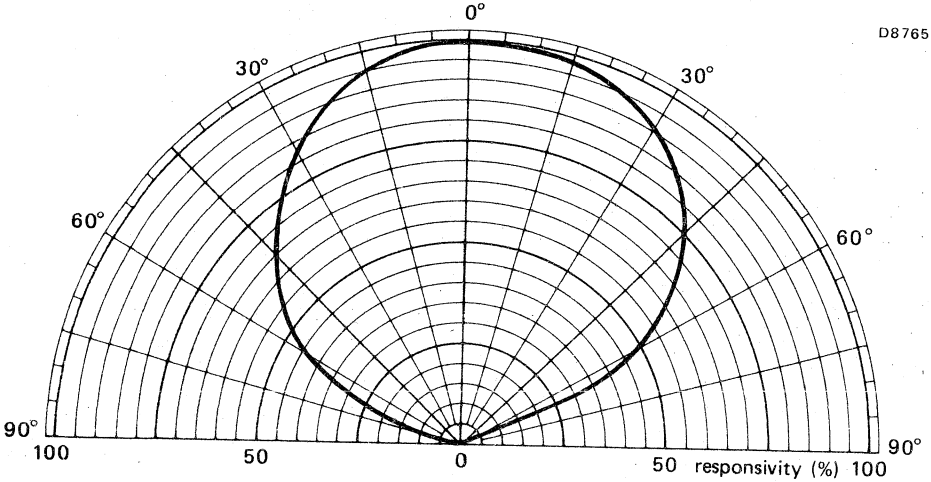




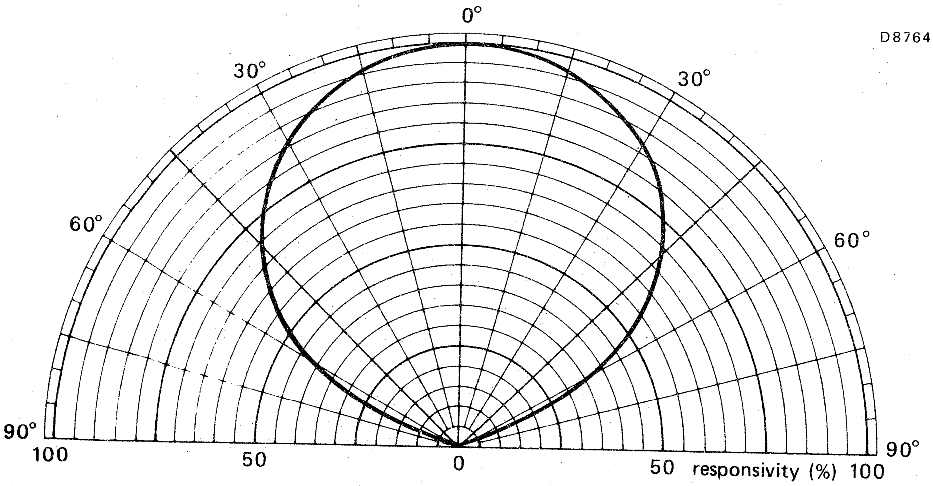


Typical responsivity, N.E.P., and noise as a function of temperature
(one element screened)

POLAR DIAGRAMS – ELEMENT a

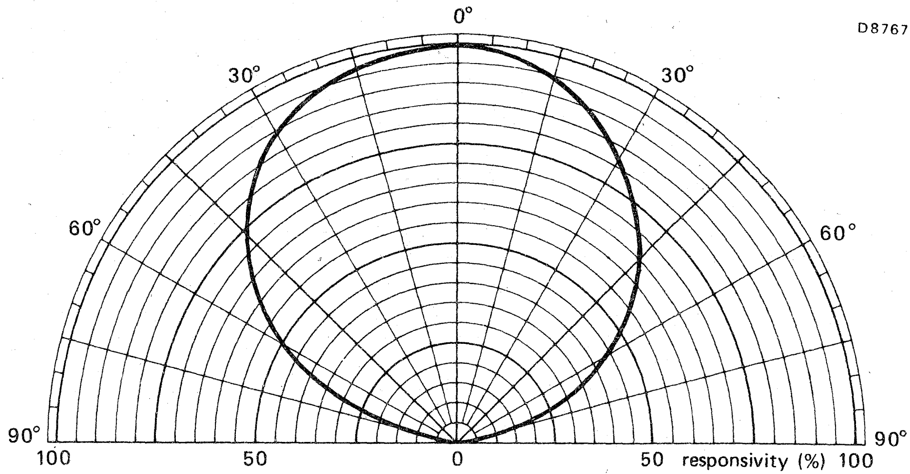


Typical field of view in x-x plane (see mechanical data)

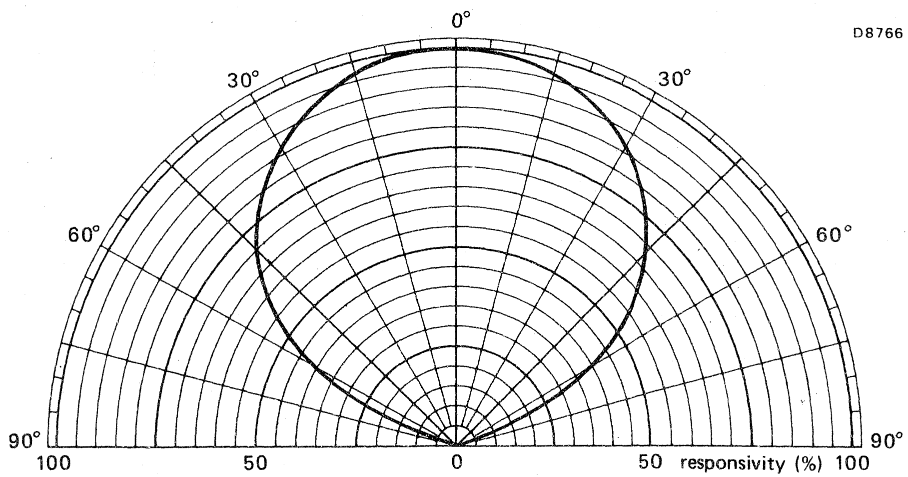


Typical field of view in y-y plane (see mechanical data)

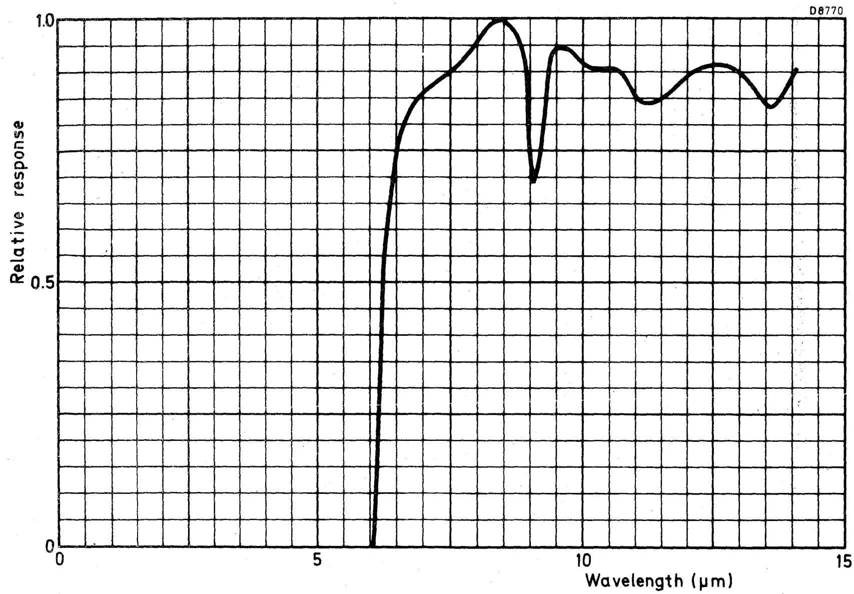
POLAR DIAGRAMS – ELEMENT b



Typical field of view in x-x plane (see mechanical data)



Typical field of view in y-y plane (see mechanical data)



Typical window transmission characteristic

PYROELECTRIC INFRARED DETECTOR

This is an infrared sensitive device, combined with a pre-amplifier which is stabilized to overcome d.c. drift due to thermal changes. It is sealed in a low-profile TO-5 can.

QUICK REFERENCE DATA

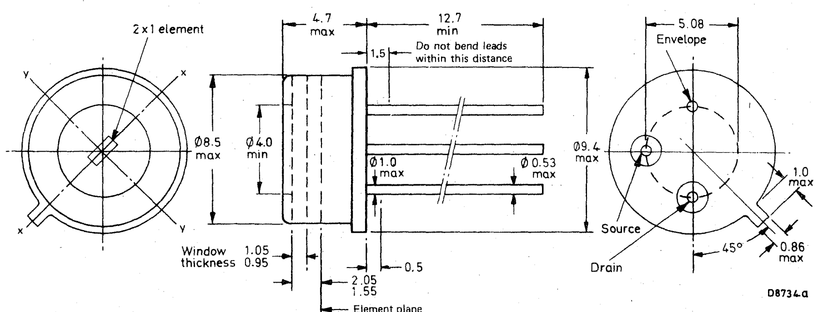
Spectral response		6.5 ± 0.5 to > 14	μm
Responsivity, (10 μm, 10)	typ.	130	VW^{-1}
Noise Equivalent Power (N.E.P.), (10 μm, 10, 1)	typ.	3.5×10^{-9}	$WHz^{-1/2}$
Element dimensions		2 x 1	mm
Field of view	typ.	104	degrees
Operating voltage		9	V
Optimum operating frequency range		0.1 to 1000	Hz

This data must be read in conjunction with GENERAL SAFETY RECOMMENDATIONS – OPTOELECTRONIC DEVICES

MECHANICAL DATA

Dimensions in mm

SOT-49F (low profile TO-5)



PRODUCT SAFETY

Modern high technology materials have been used in the manufacture of this device to ensure high performance. Some of these materials are toxic in certain circumstances. Mechanical or electrical damage is unlikely to give rise to any hazard, but toxic vapours may be generated if the device is heated to destruction. Disposal of large quantities should therefore be carried out in accordance with the Deposit of Poisonous Waste Act 1972 and the Control of Pollution Act 1974, or with the latest legislation.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC134)

Operating voltage at 100 °C	max.	30	V
Temperature, operating	max.	+60	°C
	min.	−40	°C
Temperature, storage	max.	+70	°C
	min.	−40	°C

SOLDERING

1. When making soldered connections to the leads, a thermal shunt must be used.
2. It is essential that any mains operated soldering iron used should be both screened and earthed. Failure to observe these precautions could lead to the introduction of line voltage and possible damage to the device.

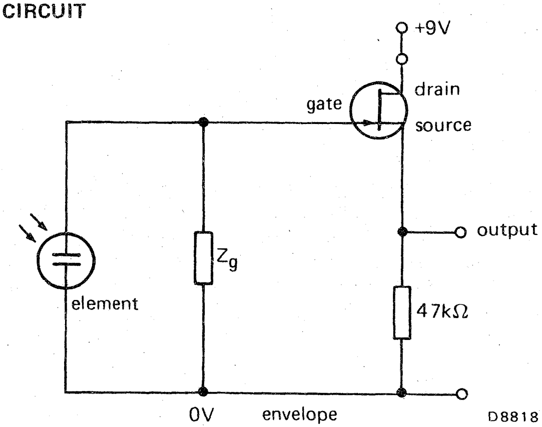
CHARACTERISTICS (at T_{amb} = 25 ± 3 °C and with the test circuit).

	min.	typ.	max.	
Responsivity (10 μm, 10), notes 1 and 4	—	130	—	VW^{-1}
N.E.P. (10 μm, 10, 1) notes 1 and 4	—	3.5×10^{-9}	9×10^{-9}	$WHz^{-1/2}$
Spectral response	6.5 ± 0.5	—	> 14	μm
Field of view, note 2	—	105	—	degrees
Operating voltage, note 3	8	9	10	V

Notes

1. These characteristics apply throughout the spectral response range.
2. Field of view to 50% of the maximum responsivity level.
3. The detector will operate outside the quoted range but may have a degraded performance.
4. For performance as a function of frequency and temperature, see pages 4 and 5.

TEST CIRCUIT



OPERATING NOTES

1. The case potential must not be allowed to become positive with respect to the other two terminals.
2. The shape of the electrical output waveform is the integral of the incident radiation waveform.
3. It is inadvisable to operate the detector at mains related frequencies.
4. To avoid the possibility of optical microphony, the detector must be firmly mounted.
5. An increase in temperature of the element will produce a negative going signal at the output.

DEFINITIONS

1. N.E.P. (Noise Equivalent Power), $WHz^{-1/2}$

   This is the r.m.s. value of the incident, chopped, radiant power necessary to produce an r.m.s. signal to r.m.s. noise ratio of unity. The r.m.s. noise refers to the value calculated for unit square root bandwidth $VHz^{-1/2}$.

2. Responsivity VW^{-1}

   This is the ratio of the r.m.s. signal in volts to the r.m.s. value of the incident, chopped, radiant power.

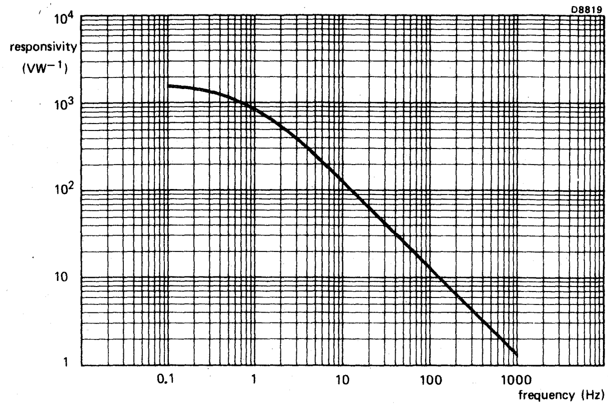
MECHANICAL AND ENVIRONMENTAL STANDARDS

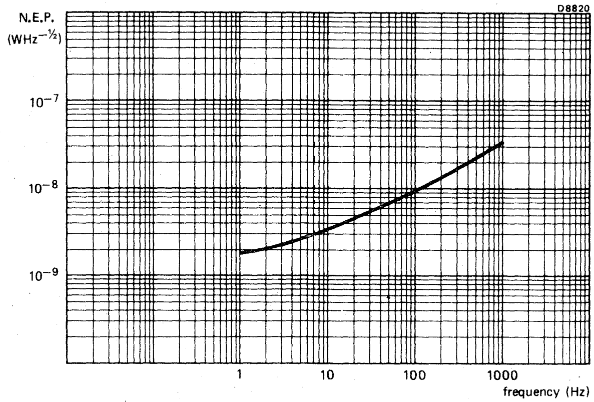
As part of the Quality Assurance programme, the detectors are assessed at regular intervals against the requirements of the following IEC standards. The frequency of testing and the limits and conditions for the pre- and post-test measurements are based on those stipulated for the CECC 50 000 series of approved transistors.

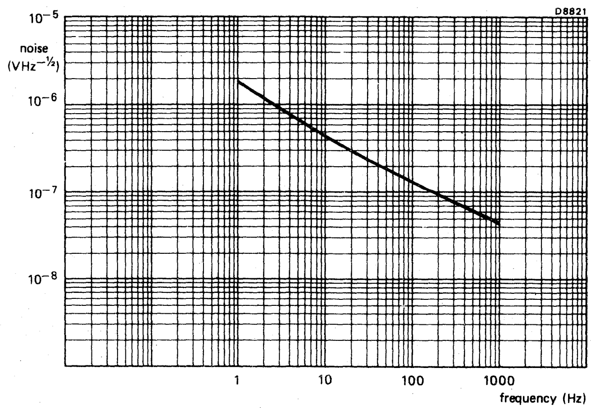
			note
IEC 68-2-3	Test Ca	Moisture Resistance, steady state	1
68-2-20	Test T	Solderability	1
68-2-21	Test Ub	Lead Fatigue	1
68-2-1	Test A	Low Temperature Storage	2
68-2-2	Test Ba	High Temperature Storage	2
68-2-14	Test Nb	Change of Temperature (10 cycles)	2
68-2-6	Test Fc (B4)	Vibration, swept frequency	2
68-2-7	Test Ga	Acceleration, steady state	2
68-2-27	Test Ea	Shock	2
68-2-20	Test T	Resistance to Solder Heat	3

Notes

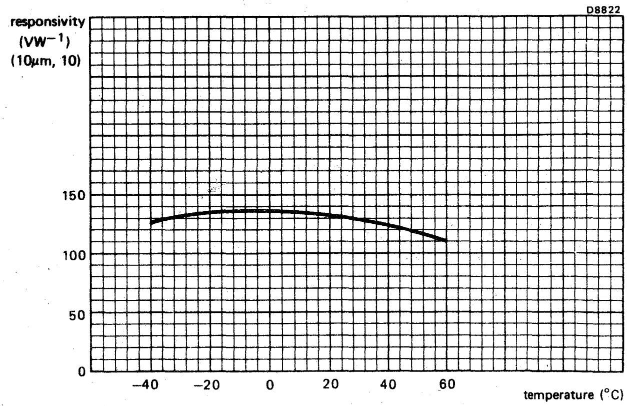
1. The detectors are checked on a production batch release principle at approximately weekly intervals. This is equivalent to group B .
2. The detectors are checked at quarterly intervals; the storage tests to 2000 hours. This is equivalent to group C.
3. This is an annual check.

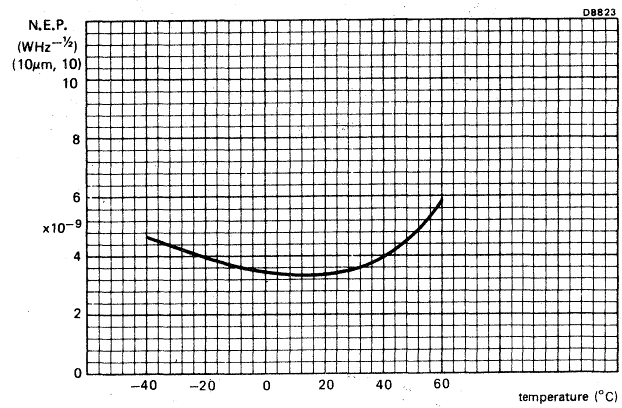


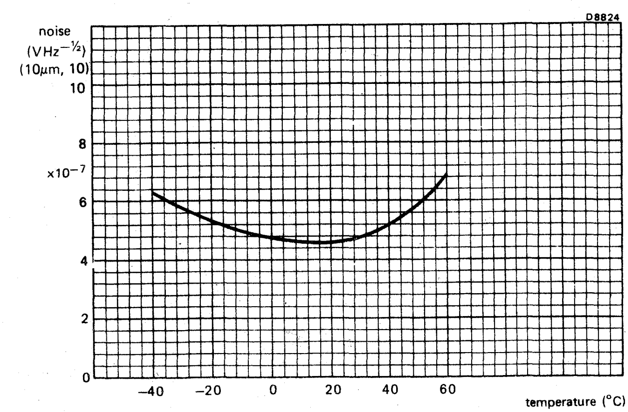




Typical responsivity, N.E.P., and noise as a function of frequency

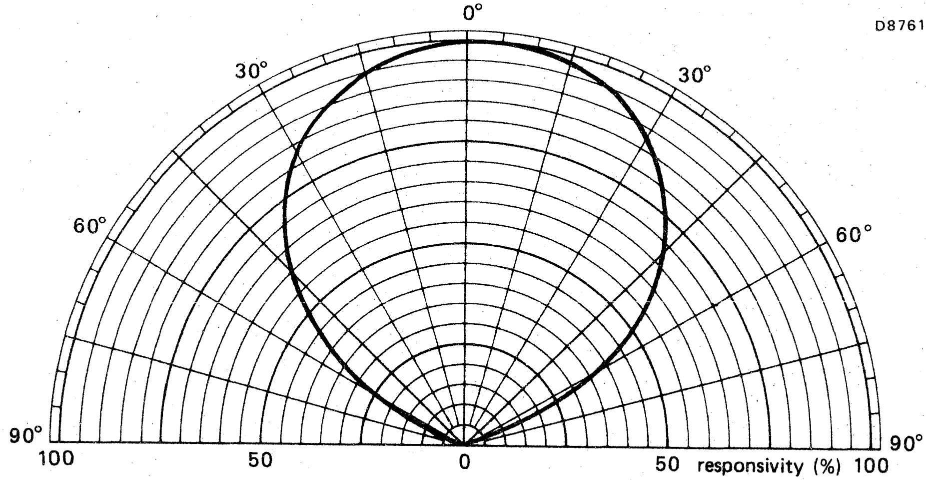




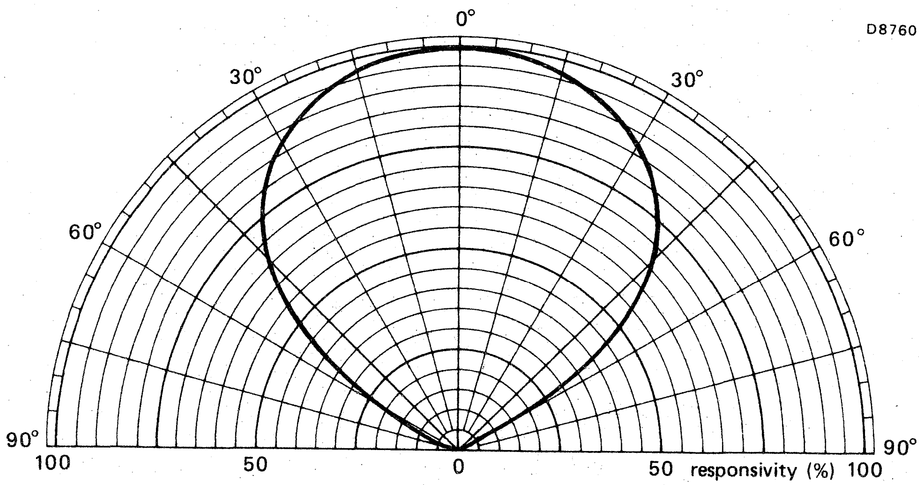


Typical responsivity, N.E.P., and noise as a function of temperature

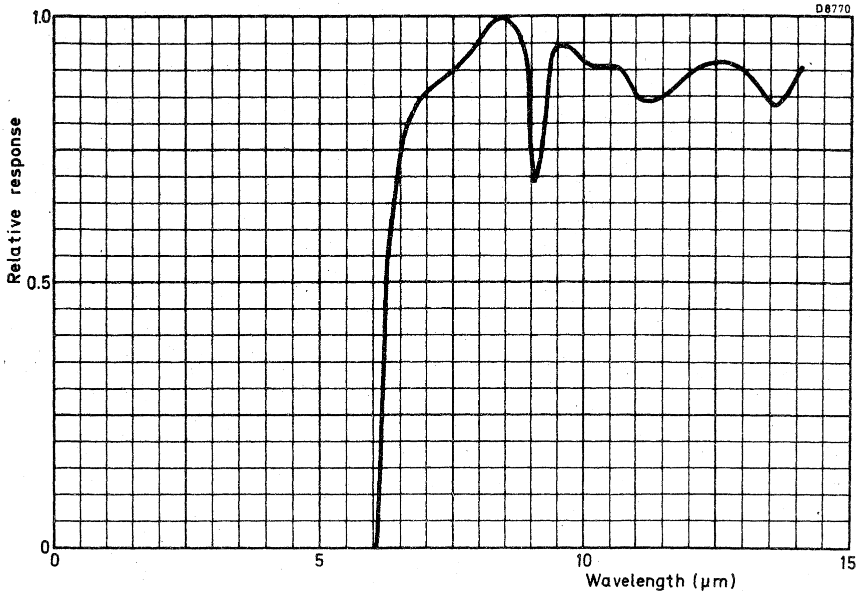
POLAR DIAGRAMS



Typical field of view in x-x plane (see mechanical data)



Typical field of view in y-y plane (see mechanical data)



Typical window transmission characteristic

PHOTOCONDUCTIVE CELL

Evaporated lead sulphide photoconductive cell with sensitive element mounted in a glass dewar, encapsulated in an envelope for room temperature operation.
Also available without envelope for cooled operation.
The cells are intended for use with pulsed or modulated radiation.

QUICK REFERENCE DATA				
Peak spectral response	λ_m		2,2	μm
Spectral response range	λ		0,3 to 3,5	μm
Internal resistance	r_i	typ.	1,5	MΩ
Responsivity (radiation 2,0 μm)		typ.	80	mV/μW
D^* (2,0 μm, 800 Hz, 1 Hz)		typ.	4×10^{10}	cm $\sqrt{Hz}$/W
Time constant		typ.	100	μs
Sensitive area			6,0 x 6,0	mm^2

MECHANICAL DATA

Dimensions in mm

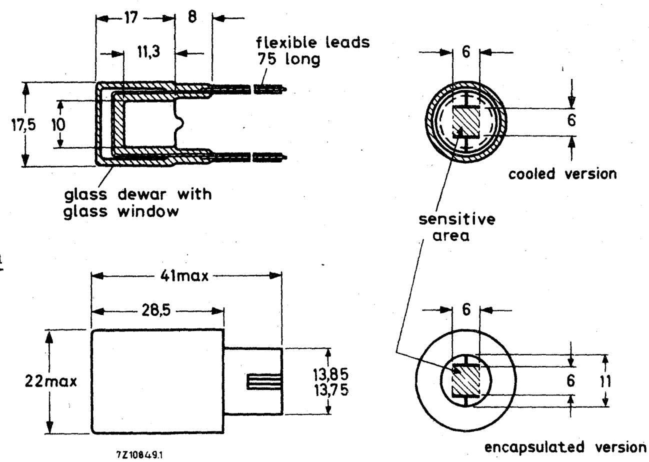
Fig. 1.

Cooled version

Code No.
9332 401 30

Encapsulated version

Code No.
9330 200 30



RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

Voltage (bidirectional)		V	max.	250	V
Current (bidirectional)		I	max.	0.5	mA
Temperatures					
Storage temperature	encapsulated version	T_{stg}		−55 to +60	°C
	cooled version	T_{stg}		−80 to +60	°C
Operating ambient temperature		T_{amb}	max.	60	°C

CHARACTERISTICS at T_{amb} = 20 °C (see note 1 on page 3)

Peak spectral response	λ_m		2.2	μm
Spectral response range	λ		0.3 to 3.5	μm
Internal resistance	r_i	typ.	1.5	MΩ
			1.0 to 4.0	MΩ
Time constant		typ.	100	μs
Noise voltage		typ.	8.5	μV

Performance

1. Black body source
   colour temperature : 500 K
   chopping frequency : 800 Hz
   bandwidth : 1 Hz

Responsivity	>	0.2	mV/μW
	typ.	1.3	mV/μW
D*	>	2.0×10^8	cm $\sqrt{Hz}$/W
	typ.	6.5×10^8	cm $\sqrt{Hz}$/W
N.E.P.	typ.	0.92	nW
	<	3.0	nW

2. Monochromatic source
   radiation : 2.0 μm
   chopping frequency: 800 Hz
   bandwidth : 1 Hz

Responsivity	typ.	80	mV/μW
D*	typ.	4×10^{10}	cm $\sqrt{Hz}$/W
N.E.P.	typ.	15	pW

NOTES

1. Test conditions

The characteristics are measured with the cell biased from a 200 V d.c. supply in series with a 1.0 MΩ load resistor. No correction is made for the loading effect of the 1.0 MΩ resistor, i.e. open circuit characteristics are not given.

The sensitive element is situated at a distance of 264 mm a black body source limited by an aperture of 3 mm. The radiation path is interrupted at 800 Hz by a chopper blade at ambient temperature. Under these conditions the r.m.s. power at the element (chopping factor 2.2) is 4.5 $\mu W/cm^2$.

Measurements of the detector output are made with an amplifier tuned to 800 Hz with a bandwidth of 50 Hz.

2. D^* and N.E.P.

These are figures of merit for the materials of detectors.
The detectivity D^* is defined in the expression:

$$D^* = \frac{\frac{V_s}{V_n}\sqrt{A(\Delta f)}}{W}$$

where: V_s = signal voltage across detector terminals
V_n = noise voltage across detector terminals
A = detector area
(Δf) = bandwidth of measuring amplifier
W = radiation power incident on detector sensitive element in r.m.s. watts.

The Noise Equivalent Power (N.E.P.) is related to D^* by the expression:

$$N.E.P. = \frac{\sqrt{A}}{D^*}$$

3. Time constant

Detector time constant figures are based on the response to a step function in the incident radiation. Quoted times indicate the interval between the moment the radiation is cut off and the output falling to 63% of its peak value.

4. Variation of performance with bias current.

Both signal and noise vary with current in this type of cell. At high currents the noise increases more rapidly than the signal, and therefore the signal-to-noise ratio has a peak value at some optimum current, which will vary slightly from cell to cell.

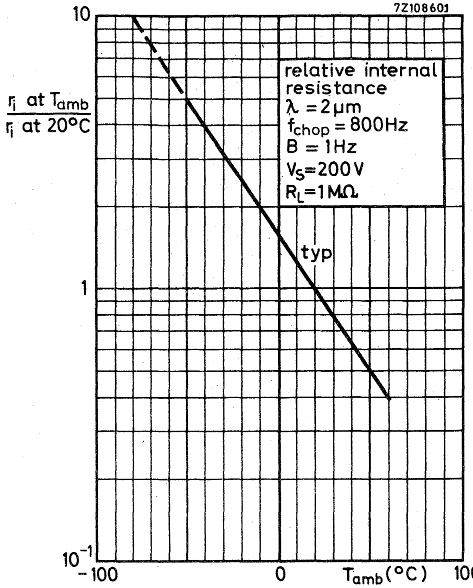
NOTES (continued)

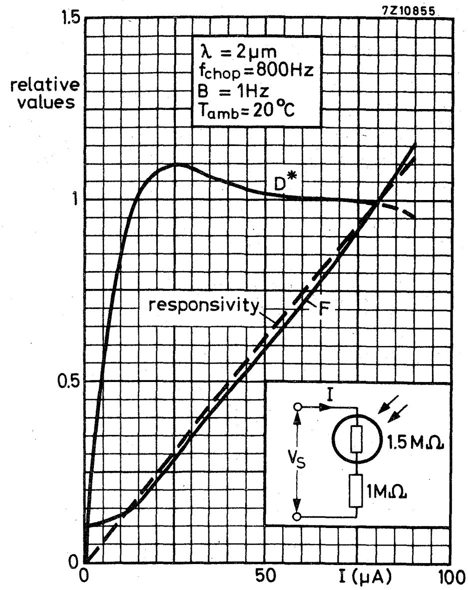
5. Effect of ambient radiation

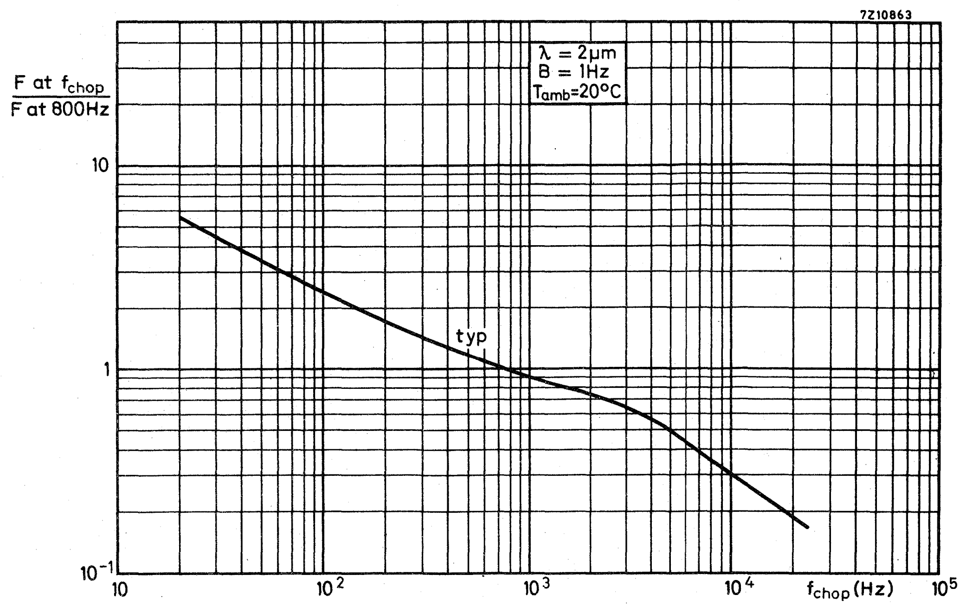
Care should be taken to avoid the incidence on the cell of appreciable radiation in the visible range. Such radiation will cause a decrease in the cell resistance and signal as long as the cell is kept cool. Normal daylight can cause this effect if seen for more than a few minutes. Precautions should be taken to prevent visible light reaching the sensitive element via the liquid nitrogen compartment.

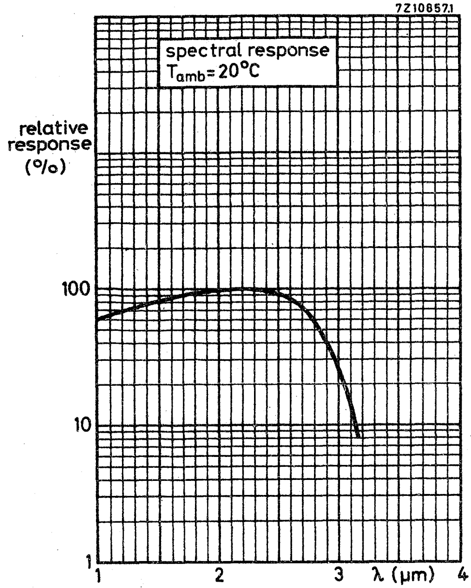
6. Warning

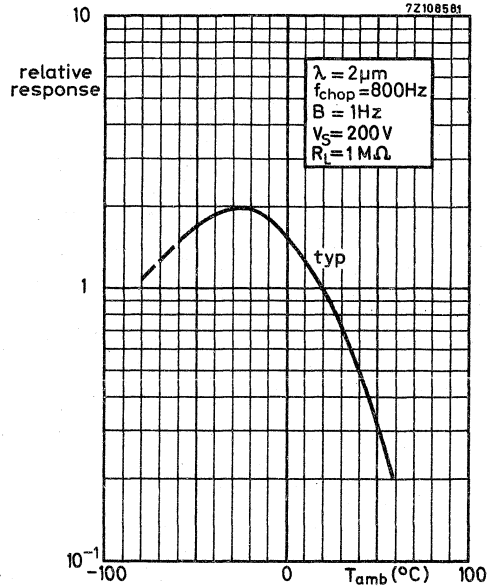
Care should be taken to ensure that the device is not allowed to reach room temperature while still biased.
The dewar vessel must always be completely dry before being refilled with liquid nitrogen. In very humid conditions, water vapour may condense at the top of the dewar vessel. Should this occur, the remaining liquid nitrogen should be allowed to boil off, the ice should be removed and precautions taken to avoid a recurrence.

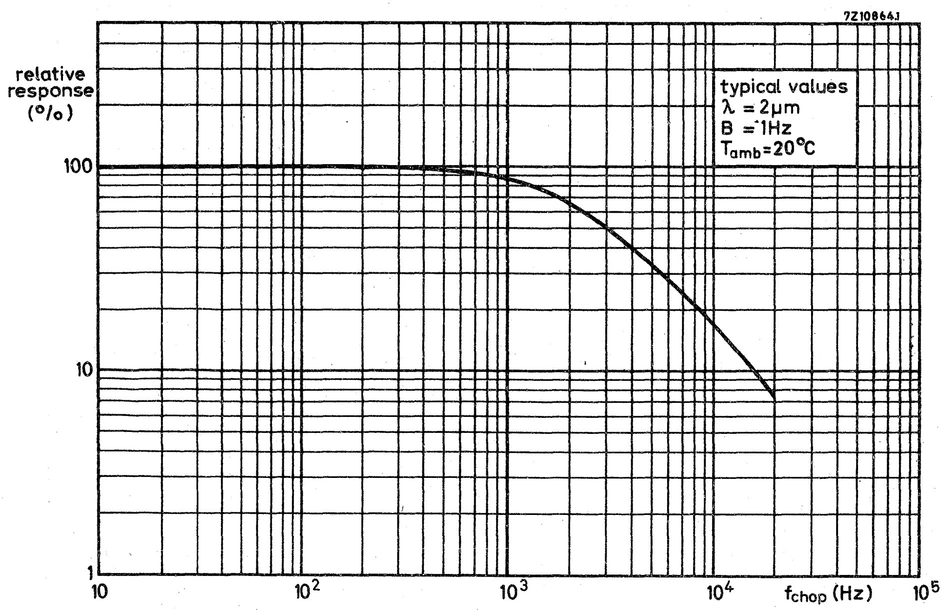

7Z108601
relative internal resistance
λ = 2 μm
fchop = 800 Hz
B = 1 Hz
VS = 200 V
RL = 1 MΩ
ri at Tamb / ri at 20 °C
typ
Tamb (°C)
10
1
10⁻¹
−100
0
100

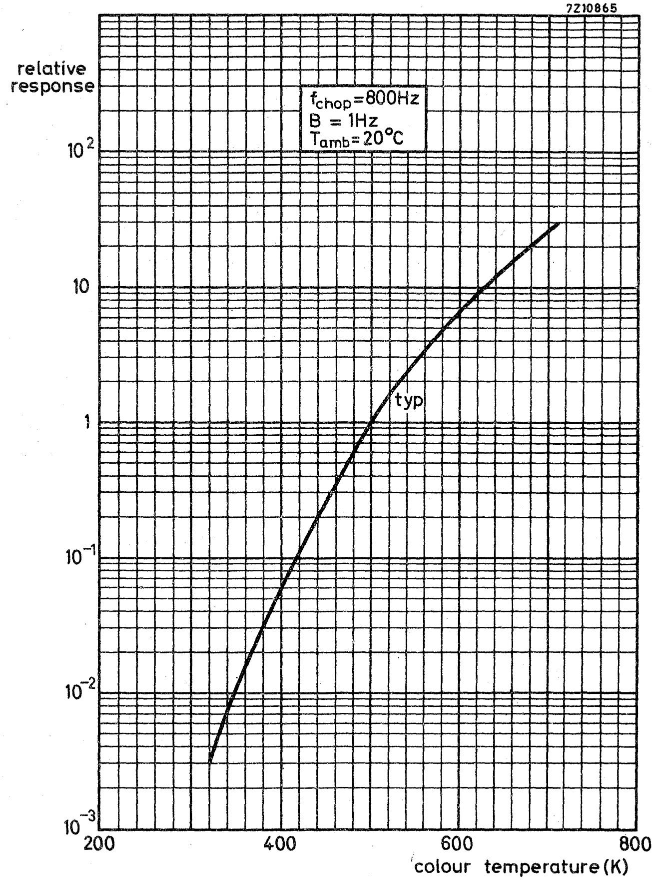

7Z10855
λ = 2 μm
fchop = 800 Hz
B = 1 Hz
Tamb = 20 °C
relative values
D*
responsivity
F
I
1.5 MΩ
VS
1 MΩ
I (μA)
1.5
1
0.5
0
0
50
100

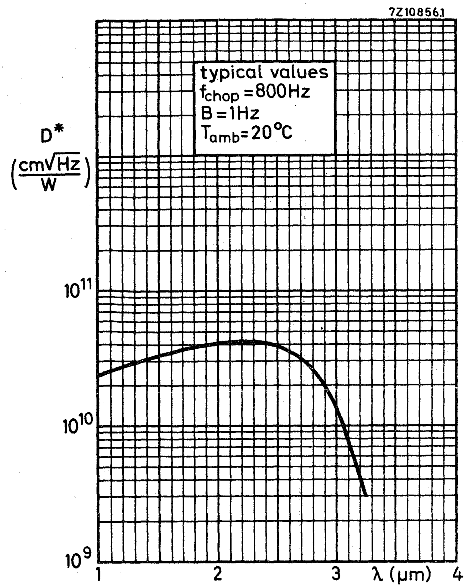

7Z10863
λ = 2 μm
B = 1 Hz
Tamb = 20 °C
F at fchop / F at 800 Hz
typ
fchop (Hz)
10
1
10⁻¹
10
10²
10³
10⁴
10⁵

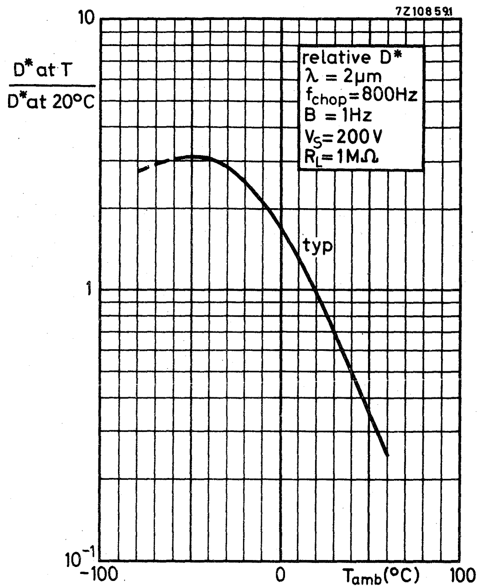

7Z10857.1
spectral response
T_{amb} = 20°C
relative response (%)
100
10
1
1
2
3
λ (μm)
4

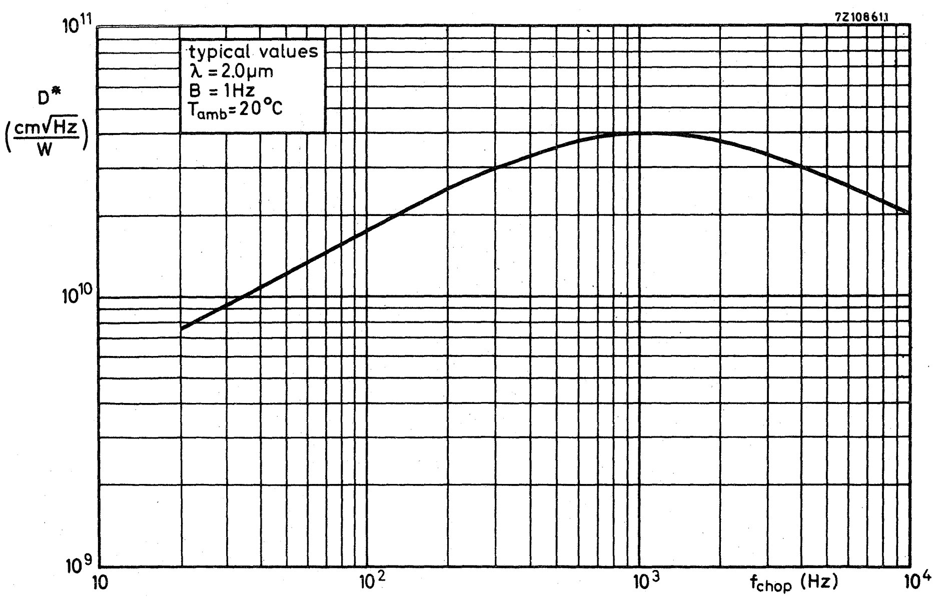

7Z10858.1
10
relative response
λ = 2μm
f_{chop} = 800Hz
B = 1Hz
V_S = 200 V
R_L = 1 MΩ
typ
1
10^{-1}
−100
0
T_{amb} (°C)
100

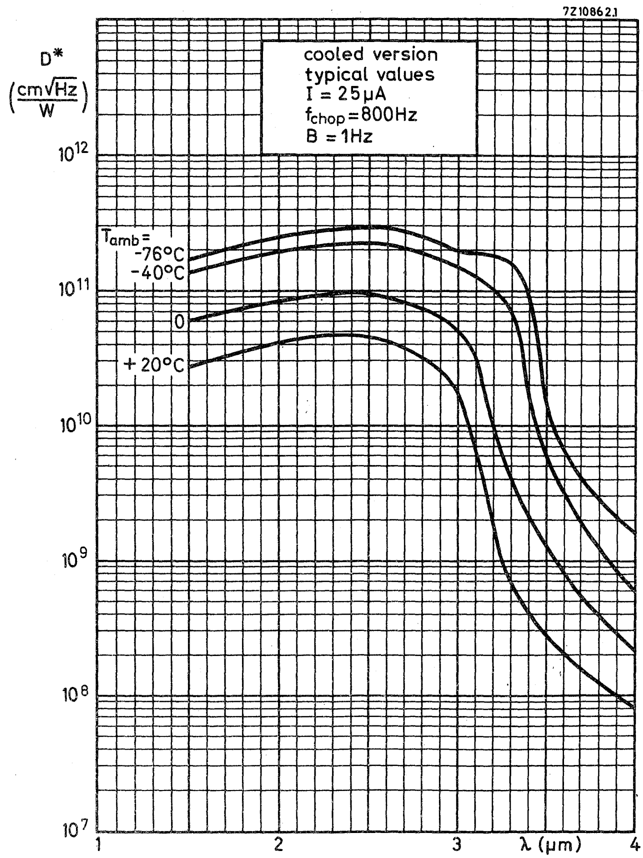

7Z10864.1
relative response (%)
typical values
λ = 2μm
B = 1Hz
T_{amb} = 20°C
100
10
1
10
10^2
10^3
10^4
f_{chop} (Hz)
10^5


7Z10865
relative response
f_{chop}=800Hz
B = 1Hz
T_{amb}=20°C
10^2
10
1
10^{-1}
10^{-2}
10^{-3}
typ
200
400
600
800
colour temperature (K)


7Z10856.1
typical values
f_{chop} = 800Hz
B = 1Hz
T_{amb} = 20°C
D*
(cm√Hz / W)
10^{11}
10^{10}
10^{9}
1
2
3
λ (μm)
4


7Z10859.1
10
D* at T / D* at 20°C
relative D*
λ = 2μm
f_{chop} = 800Hz
B = 1Hz
V_S = 200V
R_L = 1MΩ
typ
1
10^{-1}
−100
0
T_{amb} (°C)
100


7Z10861.1
10^{11}
typical values
λ = 2.0μm
B = 1Hz
T_{amb} = 20°C
D*
(cm√Hz / W)
10^{10}
10^{9}
10
10^{2}
10^{3}
f_{chop} (Hz)
10^{4}


7Z10862.1
cooled version
typical values
I = 25 µA
fchop = 800Hz
B = 1Hz
D*
(cm√Hz / W)
10¹²
10¹¹
10¹⁰
10⁹
10⁸
10⁷
Tamb =
-76°C
-40°C
0
+20°C
1
2
3
λ (µm)
4

PHOTOCONDUCTIVE DEVICES

LIST OF SYMBOLS

Cell voltage	V
Cell current	I
Illumination current	I_l
Initial illumination current	I_{lo}
Equilibrium illumination current	I_{le}
Dark current	I_d
Initial dark current	I_{do}
Equilibrium dark current	I_{de}
Illumination resistance	r_l
Initial illumination resistance	r_{lo}
Equilibrium illumination resistance	r_{le}
Dark resistance	r_d
Initial dark resistance	r_{do}
Equilibrium dark resistance	r_{de}
Current rise time	t_{ri}
Current decay time	t_{fi}
Pulse duration	t_p
Averaging time	t_{av}
Pulse repetition rate	p_{rr}
Illumination sensitivity	N
Illumination response	γ
Voltage response	α
Ambient temperature	T_{amb}
Thermal resistance	R_{th}
Temperature of CdS tablet	T_{tablet}
Colour temperature	T_c (T_K)
Dissipation	P
Illumination	E
Initial drift	D_o
Peak value (subscript)	M

GENERAL OPERATIONAL RECOMMENDATIONS
PHOTOCONDUCTIVE DEVICES

1. GENERAL

1.1 These application directions are valid for all types of photoconductive cells, unless otherwise stated on the individual technical data sheets.

1.2 A photoconductive device is a light-sensitive device whose resistance varies with the illumination on the device.

1.3 Where the term illumination is used in the following sections it shall be taken to mean the radiant energy which is normally used to excite the device.

1.4 Also in the following sections, history is taken to mean the duration of the specified conditions plus a sufficient description of previous conditions.

2. OPERATING CHARACTERISTICS

2.1 The data given on the individual technical data sheets are based on the devices being uniformly illuminated.

2.2 The illumination resistance is the ratio of the voltage across the device to the current through the device when illumination is applied to the device.

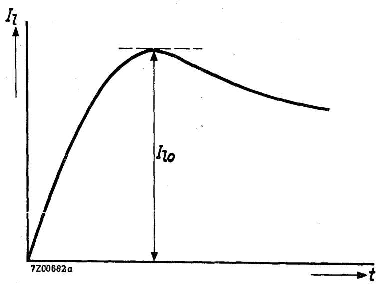
2.2.1 For a particular set of conditions the equilibrium illumination resistance is the illumination resistance after such a time under these conditions that the rate of change of the illumination resistance is less than 1% per 5 minutes.

2.2.2 For a particular set of conditions the initial illumination resistance is the first virtually constant value of the illumination resistance after a period of storage or other operating conditions.
The initial-illumination resistance usually occurs after a few seconds under the specified conditions.

2.3 The illumination current is the current which passes when a voltage and illumination are applied to the device.

2.3.1 For a particular set of conditions the equilibrium illumination current is the illumination current after such a time under these conditions that the rate of change of the illumination current is less than 1% per 5 minutes.

2.3.2 For a particular set of conditions the initial illumination current is the first virtually constant value of the illumination current after a period of storage or other operating conditions.
The initial illumination current usually occurs after a few seconds under the specified conditions.



2.4 The dark resistance is the resistance of the device in the absence of illumination.

2.4.1 For a particular set of conditions the equilibrium dark resistance is the dark resistance after such a time under these conditions that the rate of change of the dark resistance is less than 2% per 5 minutes.

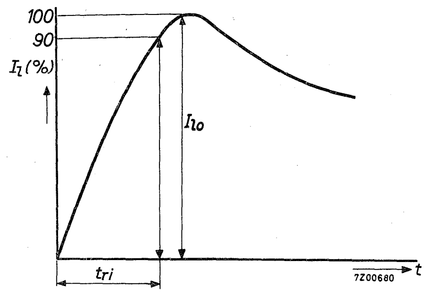
2.4.2 For a particular set of conditions the initial dark resistance is the dark resistance after a specified time under these conditions following a specified history.

2.5 The dark current is the current which passes when a voltage is applied to the device in the absence of illumination.

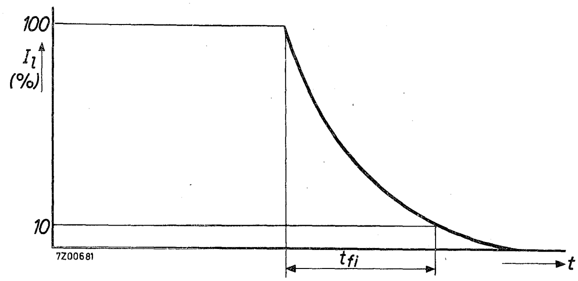
2.5.1 For a particular set of conditions the equilibrium dark current is the dark current after such a time under these conditions that the rate of change of the dark current is less than 2% per 5 minutes.

2.5.2 For a particular set of conditions the initial dark current is the dark current after a specified time under these conditions immediately following a specified history.

2.6.1 For a particular set of conditions and history the current rise time is the time taken for the current through the device to rise to 90% to its initial illumination current measured from the instant of starting the illumination.



2.6.2 For a particular set of conditions and history the current decay time is the time taken for the current through the device to fall to 10% of its value at the instant of stopping the illumination, measured from that instant.



2.7 The illumination sensitivity is the quotient of illumination current by the incident illumination.

2.8 The illumination resistance (current) temperature response is the relationship between the illumination resistance (current) and the ambient temperature of the device under constant illumination and voltage conditions.

2.9 For a particular set of conditions the initial drift is the difference between the equilibrium and initial illumination current, expressed as a percentage of the initial illumination current.

2.10 The illumination response is the relationship between the initial illumination resistance and the illumination, defined as $\frac{\Delta \log r_{lo}}{\Delta \log E}$

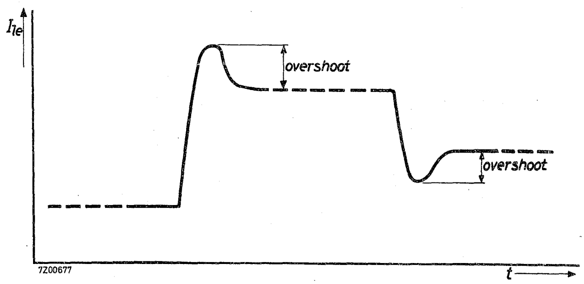
3. THERMAL DATA

3.1 Ambient temperature. The ambient temperature of a device is the temperature of the surrounding air of that device in its practical situation, which means that other elements in the same space or apparatus must have their normal maximum dissipation and that the same apparatus envelope must be used. This ambient temperature can normally be measured by using a mercury thermometer the mercury container of which has been blackened, placed at a distance of 5 mm from the envelope in the horizontal plane through the centre of the effective area of the CdS tablet.
It shall be exposed to substantially the same radiant energy as that incident on the CdS tablet.

3.2 The thermal resistance of a device is defined as the temperature difference between the hottest point of the device and the dissipating medium, divided by the power dissipated in the device.

4. OPERATIONAL NOTES

4.1 When a photoconductive device is subjected to a change of operating conditions there may be a transient change of current in excess of that due to the difference between the equilibrium illumination currents. This transient change is called overshoot.



4.2 Direct sunlight irradiation should be avoided.

5. MOUNTING

5.1 If no restrictions are made on the individual published data sheets, the device may be mounted in any position.

5.2 Most of the photoconductive devices may be soldered directly into the circuit, which is indicated on the individual published data sheets. However, the heat conducted to the seal of the device should be kept to a minimum by the use of a thermal shunt. If not otherwise indicated, the device may be dip-soldered at a solder temperature of 240 ^{o}C for a maximum of 10 seconds up to a point 5 mm from the seals.

6. STORAGE

It is recommended that the devices be stored in the dark. At any rate direct sunlight irradiation should be avoided.

7. LIMITING VALUES

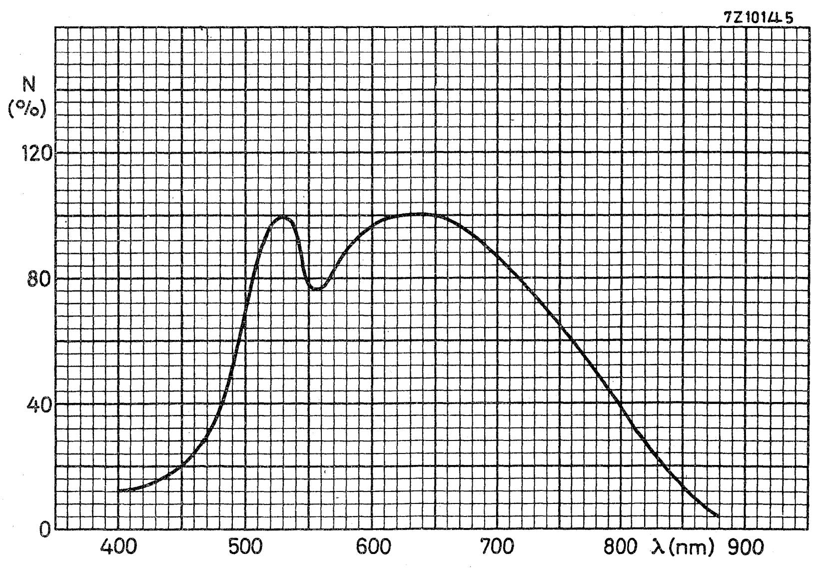
The limiting values of photoconductive devices are given in the absolute maximum rating system.

8. OUTLINE DIMENSIONS

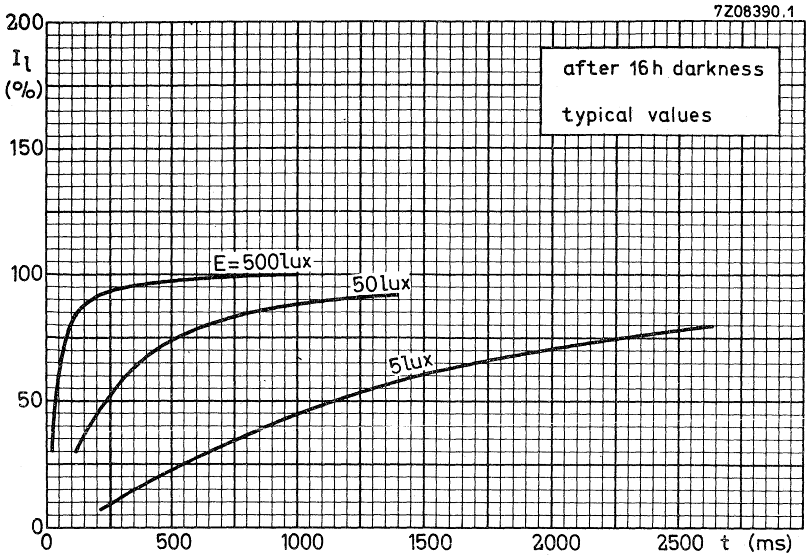
The outline dimensions are given in mm.

9. MECHANICAL ROBUSTNESS

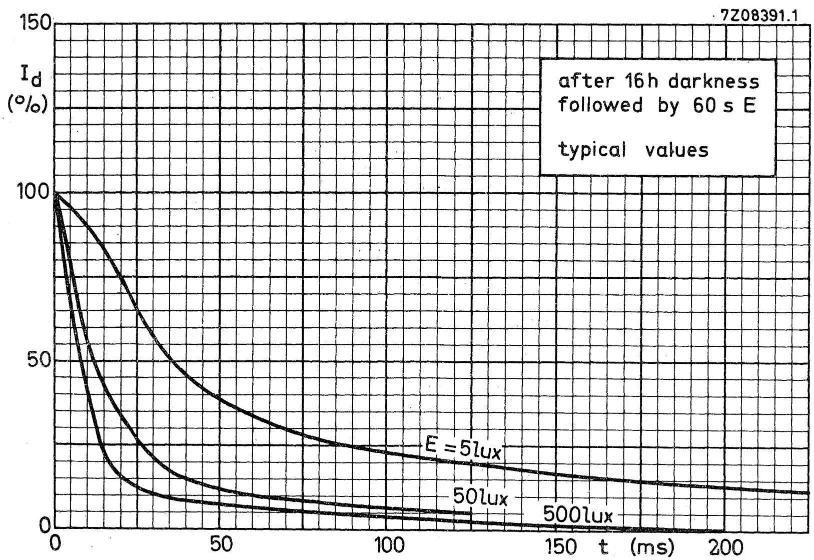
The conditions for shock and vibration given on the individual data sheets are intended only to give an indication of the mechanical quality of the device. It is not advisable to subject the device to such conditions.



Type D response curve



Current rise curves for cells with type D response curve



Current decay curves for cells with type D response curve

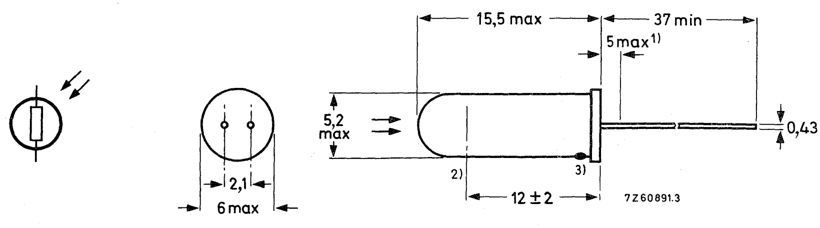
CADMIUM SULPHIDE PHOTOCONDUCTIVE CELLS

Top sensitive cadmium sulphide photoconductive cells in hermetically sealed all-glass envelope intended for on-off applications such as flame failure circuits, and for automatic brightness and contrast control in television receivers.
The cells are shock and vibration resistant.

QUICK REFERENCE DATA				
Power dissipation at T_{amb} = 25 °C	P	max.	70	mW
Cell voltage, d.c. and repetitive peak	V	max.	350	V
Cell resistance at 50 lx, 2700 K colour temperature, ORP60	r_{lo}	typ.	60	kΩ
ORP66	r_{lo}	<	55	kΩ
Spectral response, current rise and decay curves			type D	
Outline dimensions		max.	6 dia. x 15,5	mm

MECHANICAL DATA

Dimensions in mm



Soldering

The cell may be soldered directly into the circuit but heat conducted to the tablet should be kept to a minimum by the use of a thermal shunt. The cell may be dip-soldered at a solder temperature of 240 °C for maximum 10 s up to a point 5 mm from the seals.

---

1) Not tinned.
2) Sensitive surface.
3) Blue dot on ORP66.

ELECTRICAL DATA

General

The electrical properties of CdS cells are dependent on many factors such as illumination, colour temperature of the light source, voltage, current, temperature, total time of operation in the circuit and time of operation during the last 24 hours prior to the measurement. The following basic characteristics are therefore only check points of the electrical properties of these devices measured with defined values of the various conditions and at delivery.

Basic characteristics at T_{amb} = 25 °C, illumination with colour temperature of 2700 K and at delivery

			ORP60	ORP66	
Initial dark resistance measured at 300 V d.c. applied via 1 MΩ, 20 s after switching off the illumination	r_{do}	>	200	200	MΩ 1)
Initial illumination resistance measured at 30 V d.c., illumination = 50 lx, after 16 hrs in darkness 2)		>	37,5	-	kΩ
	r_{lo}	typ.	60	-	kΩ
		<	150	55	kΩ
Equilibrium illumination resistance measured at 30 V d.c., illumination = 50 lx, after 15 min under the measuring conditions		>	37,5	-	kΩ
	r_{le}	typ.	75	-	kΩ
		<	190	90	kΩ
Negative temperature response of illumination resistance		typ.	0,2		%/°C
		<	0,5		%/°C
Voltage response $\frac{\text{r at 0,5 V d.c.}}{\text{r at 30 V d.c.}}$	α	typ.	1,5		

1) The spread of the dark resistance is large and values higher than 1000 MΩ are possible for the initial dark resistance.

2) After 16 hours in darkness changes in the CdS material are still occurring but have only insignificant effect on the illumination resistance.

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

Cell voltage d.c. and repetitive peak	V	max.	350	V	
Cell voltage, pulse, $t_p \leq 5$ ms, $p_{rr} \leq$ once per minute	V_M	max.	500	V	
Power dissipation (t_{av} = 2 s) see graph P_{max}					
Power dissipation, pulse	P_M	max.	5 x P_{max}		
Illumination	E	max.	50 000	lx	
Temperature CdS tablet, operating	T_{tablet}	max.	85	°C	
Ambient temperature, storage and operation	T_{amb}	min.	−40	°C	
storage	T_{stg}	max.	50	°C	1)
operating	T_{amb}	max.	70	°C	

DESIGN CONSIDERATIONS

Apparatus with CdS cells should be designed so that changes in illumination resistance of the cells during life under rated load from −50 % to +100 % (typ. +50 % do not impair the circuit performance. Direct irradiation by sunlight should be avoided.

MECHANICAL ROBUSTNESS

An indication for the ruggedness of the device is the following:
Samples taken from normal production are submitted to shock and vibration tests mentioned below. More than 95 % of the devices pass these tests without perceptible damage.

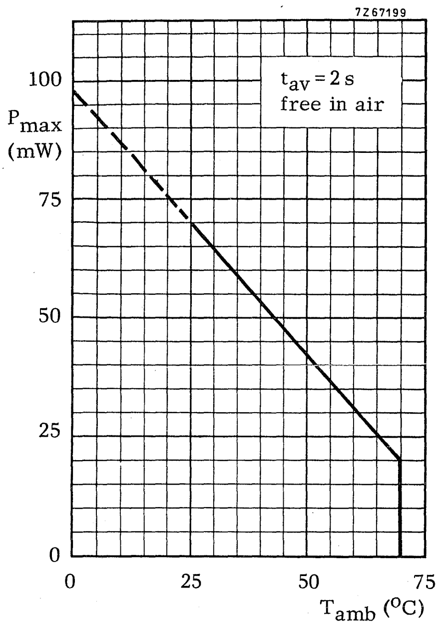
Shock

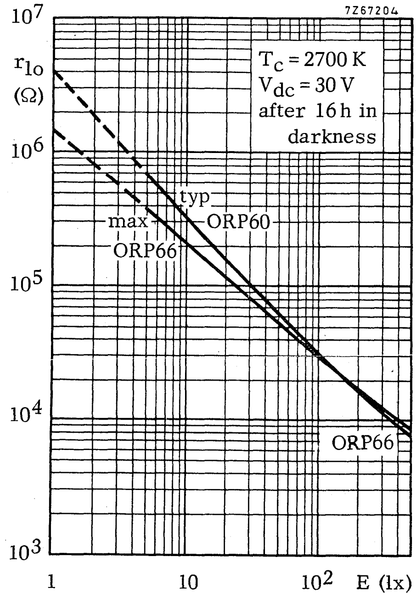
25 g_{peak}, 10 000 shocks in one of the three positions of the cell.

Vibration

2,5 g_{peak}, 50 Hz, during 32 hours in each of the three positions of the cell.

1) Operation of the cell counteracts the deteriorating effect of long periods at high temperature. The maximum operating temperature is therefore higher than the maximum storage temperature.


7Z67199
t_{av} = 2 s
free in air
P_{max}
(mW)
100
75
50
25
0
0
25
50
75
T_{amb} (°C)

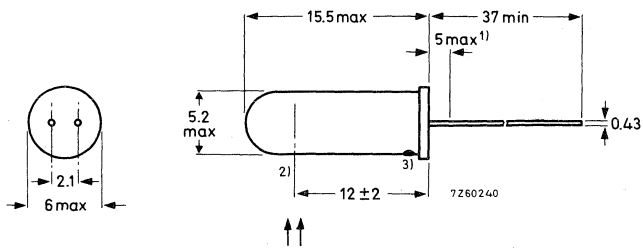

7Z67204
T_c = 2700 K
V_{dc} = 30 V
after 16 h in
darkness
r_{lo}
(Ω)
10^7
10^6
10^5
10^4
10^3
typ
max
ORP60
ORP66
ORP66
1
10
10^2
E (lx)

CADMIUM SULPHIDE PHOTOCONDUCTIVE CELLS

Side sensitive cadmium sulphide photoconductive cells in hermetically sealed all-glass envelope intended for on-off applications such as flame failure circuits, and for automatic brightness and contrast control in television receivers.
The cells are shock and vibration resistant.

QUICK REFERENCE DATA					
			ORP61	ORP62	
Power dissipation at T_{amb} = 25 °C	P	max.	70	100	mW
Cell voltage, d.c. and repetitive peak	V	max.	350	350	V
Cell resistance at 50 lx, 2700 K colour temperature	r_{10}	typ.	60	45	kΩ
Spectral response, current rise and decay curves			type D		
Outline dimensions		max.	6 dia. x 15,5 mm		

MECHANICAL DATA Dimensions in mm



Soldering

The cell may be soldered directly into the circuit but heat conducted to the tablet should be kept to a minimum by the use of a thermal shunt. The cell may be dipsoldered at a solder temperature of 240 °C for maximum 10 s up to a point 5 mm from the seals.

---

1) Not tinned
2) Centre of sensitive area
3) ORP61 brown dot; ORP62 red dot.

ELECTRICAL DATA

General

The electrical properties of CdS cells are dependent on many factors such as illumination, colour temperature of the light source, voltage, current, temperature, total time of operation in the circuit and time of operation during the last 24 hours prior to the measurement. The following basic characteristics are therefore only check points of the electrical properties of these devices measured with defined values of the various conditions and at delivery.

Basic characteristics at T_{amb} = 25 °C, illumination with colour temperature of 2700 K and at delivery.

			ORP61	ORP62	
Initial dark resistance measured at 300 V d.c. applied via 1 MΩ, 20 s after switching off the illumination	r_{do}	>	200	150	MΩ 1)
Initial illumination resistance measured at 30 V d.c., illumination = 50 lx, after 16 hrs in darkness 2)	r_{lo}	>	37,5	30	kΩ
		typ.	60	45	kΩ
		<	150	100	kΩ
Equilibrium illumination resistance measured at 30 V d.c., illumination = 50 lx, after 15 min under the measuring conditions	r_{le}	>	37,5	30	kΩ
		typ.	75	60	kΩ
		<	190	170	kΩ
Negative temperature response of illumination resistance		typ.	0,2	0,2	%/°C
		<	0,5	0,5	%/°C
Voltage response $\frac{\text{r at 0,5 V d.c.}}{\text{r at 30 V d.c.}}$	α	typ.	1,5	1,4	

1) The spread of the dark resistance is large and values higher than 1000 MΩ are possible for the initial dark resistance.

2) After 16 hours in darkness changes in the CdS material are still occurring but have only insignificant effect on the illumination resistance.

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

Cell voltage, d.c. and repetitive peak	V	max.	350	V	
Cell voltage, pulse, $t_p \leq 5$ ms, $P_{rr} \leq$ once per minute – ORP61	V_M	max.	500	V	
ORP62	V_M	max.	1000	V	
Power dissipation (t_{av} =2 s) see graph P_{max}					
Power dissipation, pulse	P_M	max.	5 x P_{max}		
Illumination	E	max.	50 000	lx	
Temperature CdS tablet, operating	T_{tablet}	max.	85	°C	
Ambient temperature, storage and operation	T_{amb}	min.	−40	°C	
storage	T_{stg}	max.	50	°C	1)
operating	T_{amb}	max.	70	°C	

DESIGN CONSIDERATIONS

Apparatus with CdS cells should be designed so that under rated load, during life, changes in illumination resistance - for ORP61 from −50 % to +100 % (typ. +50 %) and for ORP62 from −30 % to +70 % (typ. +40 %) - do not impair the circuit performance.
Direct irradiation by sunlight should be avoided.

MECHANICAL ROBUSTNESS

An indication for the ruggedness of the device is the following:
Samples taken from normal production are submitted to shock and vibration tests mentioned below. More than 95 % of the devices pass these tests without perceptible damage.

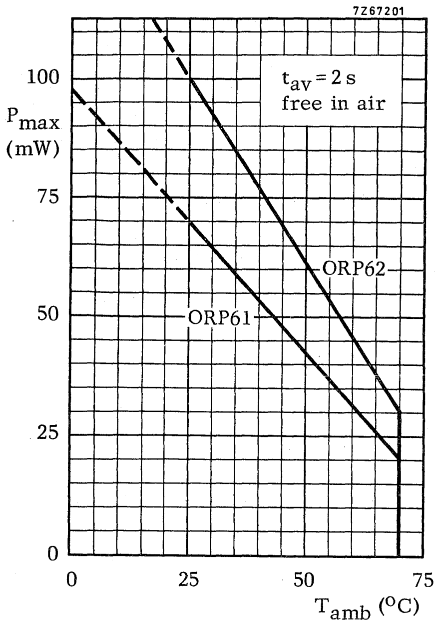
Shock

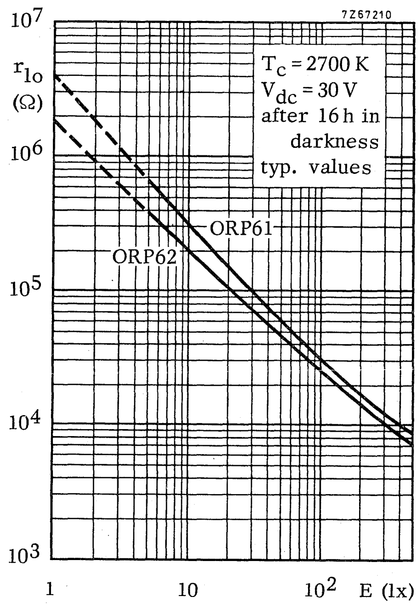
25 g_{peak}, 10 000 shocks in one of the three positions of the cell.

Vibration

2,5 g_{peak}, 50 Hz, during 32 hours in each of the three positions of the cell.

1) Operation of the cell counteracts the deteriorating effect of long periods at high temperature. The maximum operating temperature is therefore higher than the maximum storage temperature.


7Z67201
100
P_{max}
(mW)
75
50
25
0
0
25
50
75
T_{amb} (°C)
t_{av} = 2 s
free in air
ORP62
ORP61


7Z67210
10^7
r_{lo}
(Ω)
10^6
10^5
10^4
10^3
1
10
10^2
E (lx)
T_c = 2700 K
V_{dc} = 30 V
after 16 h in
darkness
typ. values
ORP61
ORP62

CADMIUM SULPHIDE PHOTOCONDUCTIVE CELL

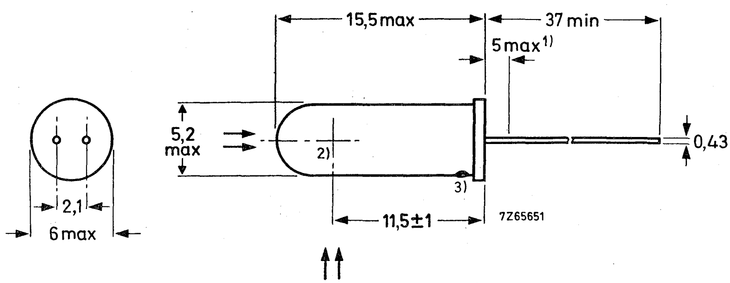
See data ORP60

CADMIUM SULPHIDE PHOTOCONDUCTIVE CELLS

Top and side sensitive cadmium sulphide photoconductive cells in hermetically sealed all-glass envelope intended for on-off applications such as flame failure circuits, and for automatic brightness and contrast control in television receivers.
The cells are shock and vibration resistant.

QUICK REFERENCE DATA				
Power dissipation at T_{amb} = 25 °C	P	max.	100	mW
Cell voltage, d.c. and repetitive peak	V	max.	350	V
Cell resistance at 50 lx,				
2700 K colour temperature, ORP68	r_{lo}	typ.	64	kΩ
ORP69	r_{lo}	typ.	30	kΩ
Spectral response, current rise and decay curves			type D	
Outline dimensions		max.	6 dia. x 15,5	mm

MECHANICAL DATA Dimensions in mm



Soldering

The cell may be soldered directly into the circuit but heat conducted to the tablet should be kept to a minimum by the use of a thermal shunt. The cell may be dipsoldered at a solder temperature of 240 °C for maximum 10 s up to a point 5 mm from the seals.

1) Not tinned.
2) Centre of sensitive area.
3) ORP68: gray dot; ORP69: white dot.

ELECTRICAL DATA

General

The electrical properties of CdS cells are dependent on many factors such as illumination, colour temperature of the light source, voltage, current, temperature, total time of operation in the circuit and the time of operation during the last 24 hours prior to the measurement. The following basic characteristics are therefore only check points of the electrical properties of these devices measured with defined values of the various conditions and at delivery.

Basic characteristics at T_{amb} = 25 °C, illumination with colour temperature of 2700 K and at delivery

			ORP68	ORP69	
Initial dark resistance measured with 300 V d.c. applied via 1 MΩ, 20 s after switching off the illumination	r_{do}	>	150	100	MΩ [1]
Initial illumination resistance measured at 30 V d.c., illumination = 50 lx, after 16 h in darkness [2] [3]	r_{lo}	>	30	20	kΩ
		typ.	46	30	kΩ
		<	100	60	kΩ
Equilibrium illumination resistance measured at 30 V d.c., illumination = 50 lx, after 15 min under the measuring conditions	r_{le}	>	30	27	kΩ
		typ.	60	46	kΩ
		<	170	115	kΩ
Negative temperature response of illumination resistance		typ.	0,2		%/°C
		<	0,5		%/°C
Voltage response $\frac{r \text{ at } 0,5 \text{ V d.c.}}{r \text{ at } 30 \text{ V d.c.}}$		typ.	1,4		

[1]) The spread of the dark resistance is large and values higher than 1000 MΩ are possible for the initial dark resistance.

[2]) After 16 hours in darkness changes in the CdS material are still occurring but have only insignificant effect on the illumination resistance.

[3]) Measured at top sensitivity.

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

Cell voltage, d.c. and repetitive peak	V	max.	350	V
Cell voltage, pulse, $t_p \leq 5$ ms,				
$p_{rr} \leq$ once per minute - ORP68	V_M	max.	1000	V
ORP69	V_M	max.	700	V
Power dissipation (t_{av} = 2 s) see graph P_{max}				
Power dissipation, pulse	P_M	max.	5 x P_{max}	
Illumination	E	max.	50 000	lx
Temperature of CdS tablet, operating	T_{tablet}	max.	+85	^oC
Ambient temperature, storage and operating	T_{amb}	min.	−40	^oC
storage	T_{stg}	max.	+50	^oC [1]
operating	T_{amb}	max.	+70	^oC

DESIGN CONSIDERATIONS

Apparatus with CdS cells should be so designed that changes in illumination resistance of the cells during life under rated load from −30 % to +70 % (typ. +40 %) do not impair the circuit performance. Direct irradiation by sunlight should be avoided.

MECHANICAL ROBUSTNESS

An indication of the ruggedness of the device is the following:
Samples taken from normal production are submitted to shock and vibration tests mentioned below. More than 95 % of the devices pass these tests without perceptible damage.

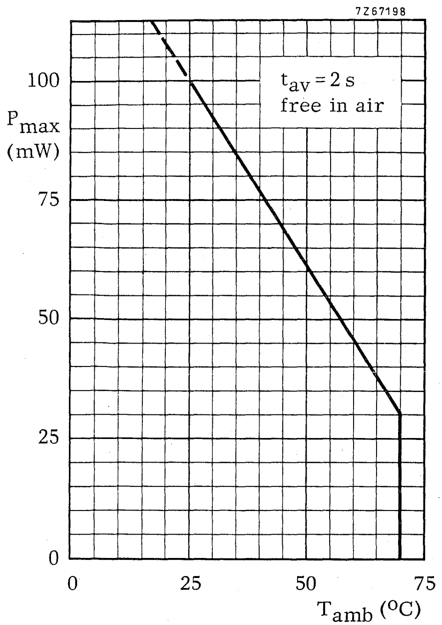
Shock

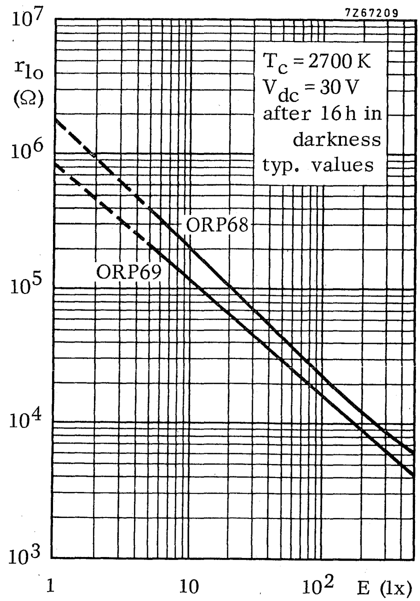
25 g_{peak}, 10 000 shocks in one of the three positions of the cell

Vibration

2,5 g_{peak}, 50 Hz, during 32 hours in each of the three positions of the cell.

[1]) Operation of the cell counteracts the deteriorating effect of long periods at high temperature. The maximum operating temperature is therefore higher than the maximum storage temperature.


7Z67198
t_{av} = 2 s
free in air
P_{max}
(mW)
100
75
50
25
0
0
25
50
75
T_{amb} (°C)


7Z67209
r_{lo}
(Ω)
10^7
10^6
10^5
10^4
10^3
T_c = 2700 K
V_{dc} = 30 V
after 16 h in
darkness
typ. values
ORP68
ORP69
1
10
10^2
E (lx)

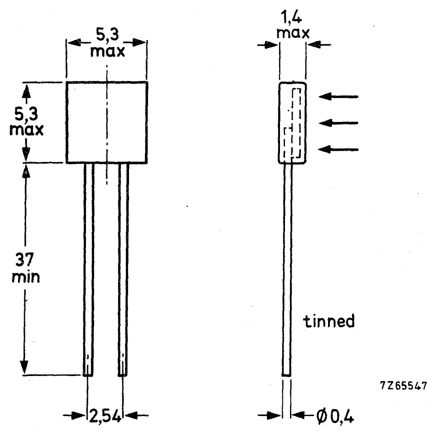
CADMIUM SULPHIDE PHOTOCONDUCTIVE DEVICE

Cadmium sulphide photoconductive device with side sensitivity in plastic encapsulation. The device consists of two cells connected in series and is intended for general applications.

QUICK REFERENCE DATA				
Power dissipation at $T_{amb} \leq 25\ ^{o}C$	P		100	mW
Voltage, d.c. and repetitive peak	V	max.	50	V
Resistance at 50 lux, $T_c = 2700\ ^{o}K$	r_{l_0}		600	Ω
Wavelengths at 50 % sensitivity	λ		500 and 675	nm
Outline dimensions		max.	5, 3 x 5, 3 x 1, 4	mm

MECHANICAL DATA

Dimensions in mm



Soldering

The device may be soldered direct into the circuit but heat conducted to the tablet should be kept to a minimum by the use of a thermal shunt.
It may be dip-soldered at a solder temperature of 270 °C for a maximum of 2 s up to a point 6 mm from the envelope.

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC134)

Cell voltage, d.c. and repetitive peak	V	max.	50	V
Cell voltage, P_{rr} ≤ once per minute, t_p ≤ 5 ms	V_M	max.	100	V
Power dissipation, t_{av} = 0,5 s, T_{amb} ≤ 25 °C	P	max.	100	mW
Cell current, d.c. and repetitive peak	I	max.	25	mA
Ambient temperature, storage and operating	T_{amb}	min.	−40	°C
storage	T_{stg}	max.	+50	°C
Temperature of CdS tablet	T_{tablet}	max.	+70	°C

THERMAL RESISTANCE

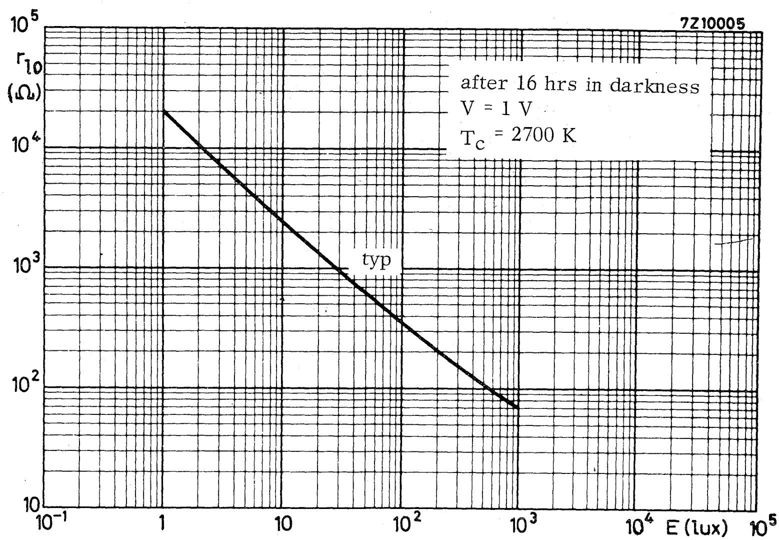
Thermal resistance from CdS tablet to ambient	$R_{th\ t-a}$	=	0,45	°C/mW

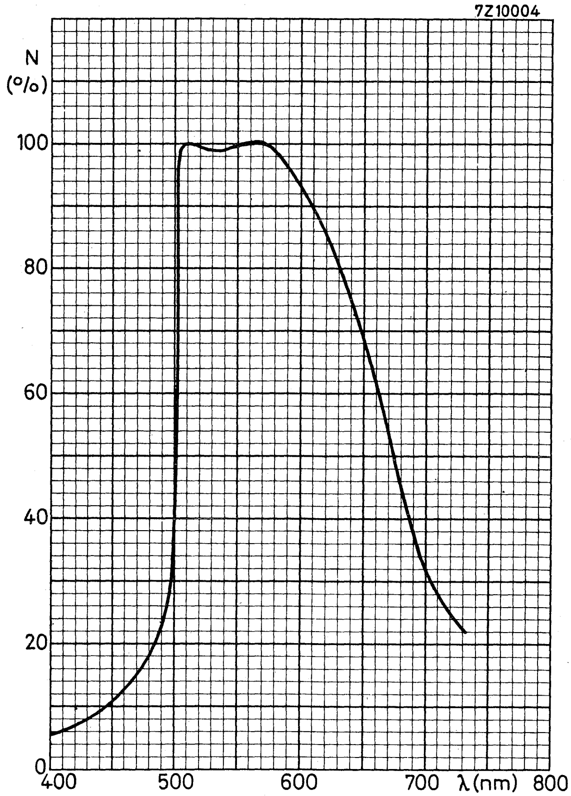
CHARACTERISTICS

Initial dark resistance, measured with 50 V d.c. applied via 1 MΩ, 20 s after switching off the illumination	r_{do}	>	200	kΩ
Initial ilumination resistance measured at 1 V d.c., illumination 50 lx, T_c = 2700 K	r_{lo}	typ.	0,6	kΩ
			0,35-1,4	kΩ
Initial drift	D_o	typ.	0	%
F 4700 (= $\frac{r_l \text{ at } 4700\text{ K}}{r_l \text{ at } 2856\text{ K}}$ at constant illumination and using a Davis-Gibson filter)		typ.	1,2	

OPERATING NOTES

1. The device consits of two photoconductive cells connected in series. The resistance of the device is mainly governed by the resistance of that cell receiving the lower luminous flux.
   If it is required for any application that the device is partly shaded, the shadow line should be perpendicular to the axis of the device.
2. For optimum heat dissipation use the shortest permissible lead length.


7Z10005
10^5
r_{10}
(Ω)
10^4
10^3
10^2
10
after 16 hrs in darkness
V = 1 V
T_c = 2700 K
typ
10^{-1}
1
10
10^2
10^3
10^4
E (lux)
10^5


7Z10004
N
(%)
100
80
60
40
20
0
400
500
600
700
λ(nm)
800

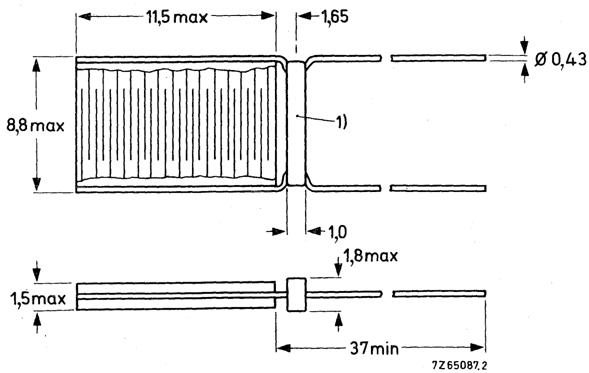
CADMIUM SULPHIDE PHOTOCONDUCTIVE CELL

Side sensitive cadmium sulphide photoconductive cell protected by a lacquer coating. The device withstands the steady state damp heat test of IEC Publication 68-2-3 (test Ca: severity 56 days).

QUICK REFERENCE DATA				
Power dissipation at T_{amb} = 25 °C	P	max.	0,30	W
Cell voltage, d.c. and repetitive peak	V	max.	100	V
Cell resistance at 50 lx, 2700 K colour temperature	r_{10}		950	Ω
Spectral response, current rise and decay curves		type D		
Outline dimensions		max.	11,5 x 8,8 x 1,5	mm

MECHANICAL DATA

Dimensions in mm



Soldering

The cell may be soldered directly into the circuit but heat conducted to the tablet should be kept to a minimum by the use of a thermal shunt. The cell may be dipsoldered at a solder temperature of 240 °C for maximum 10 s up to a point 5 mm from the stress relief band.

Mounting

The cell is not insulated electrically and should be mounted accordingly.

Notice

If the cell is to be encapsulated, request manufacturer's instructions.

1) Stress relief band.

ELECTRICAL DATA

General

The electrical properties of CdS cells are dependent on many factors such as illumination, colour temperature of the light source, voltage, current, temperature, total time of operation in the circuit and time of operation during the last 24 hours prior to the measurement. The following basic characteristics are therefore only check points of the electrical properties of these devices measured with defined values of the various conditions and at delivery.

Basic characteristics at T_{amb} = 25 °C, illumination with colour temperature of 2700 K and at delivery

Initial dark resistance measured with 100 V d.c. applied via 1 MΩ, 20 s after switching off the illumination	r_{do}	>	6	MΩ [1]
Equilibrium dark resistance measured with 100 V d.c. applied via 1 MΩ, 30 minutes after switching off the illumination	r_{de}	>	50	MΩ [1]
Initial illumination resistance measured at 10 V d.c., illumination = 50 lx, after 16 hrs in darkness [2]	r_{lo}		560 to 2800	Ω
		typ.	950	Ω
Equilibrium illumination resistance measured at 10 V d.c., illumination = 50 lx, after 15 min under the measuring conditions	r_{le}		560 to 3800	Ω
		typ.	1200	Ω
Negative temperature response of illumination resistance		<	0,5	%/°C
		typ.	0,2	%/°C
Voltage response $\frac{\text{r at 0,5 V d.c.}}{\text{r at 10 V d.c.}}$	α	typ.	1,05	

[1] The spread of the dark resistance is large and values higher than 100 MΩ and 1000 MΩ are possible for the initial dark resistance and the equilibrium dark resistance respecitively.

[2] After 16 hours in darkness changes in the CdS material are still occurring but have only insignificant effect on the illumination resistance.

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

Cell voltage, d.c. and repetitive peak	V	max.	100	V
Cell voltage, pulse, $t_p \leq 5$ ms, $p_{rr} \leq$ once per minute	V_M	max.	250	V
Power dissipation (t_{av} = 2 s) see graph P_{max}				
Power dissipation, pulse	P_M	max.	$5xP_{max}$	
Cell current, d.c. and repetitive peak	I	max.	100	mA
Illumination	E	max.	50 000	lx
Temperature CdS tablet, operating	T_{tablet}	max.	+85	°C
Ambient temperature, storage and operation	T_{amb}	min.	−40	°C
storage	T_{stg}	max.	+50	°C 1)
operating	T_{amb}	max.	+70	°C

DESIGN CONSIDERATIONS

Apparatus with CdS cells should be designed so that changes in illumination resistance of the cells during life under rated load from −30 % to +70 % (typ. +40 %) do not impair the circuit performance. Direct sunlight irradiation should be avoided.

CLIMATIC DATA

The device withstands the damp heat test Ca (steady state) of IEC Publication 68-2-3: severity 56 days, under no-load conditions or under continuous load conditions such that the tablet temperature is ≥ 5 °C above ambient temperature.

MECHANICAL ROBUSTNESS

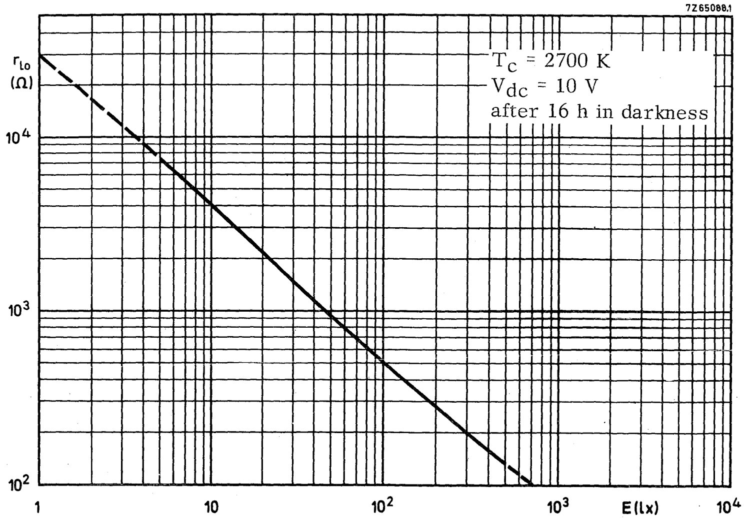
Tensile test

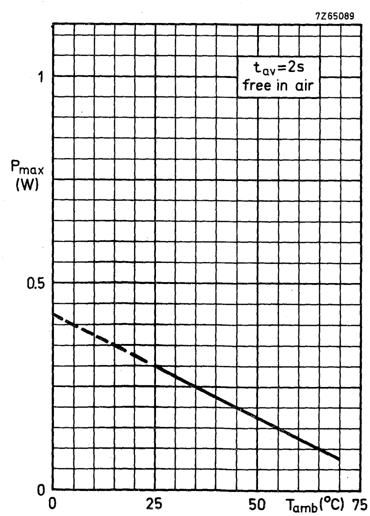
The device withstands the tensile test of IEC Publication 68-2-21, Test Ua: loading weight 500 g.

Pull test

The device withstands the following test: The leads are bent outwards over an angle of 90° at 2 mm from the stress relief band; a pulling force of 500 g is then applied at the end of the leads.

1) Operation of the cell counteracts the deteriorating effect of long periods at high temperature. The maximum operating temperature is therefore higher than the maximum storage temperature.


7Z65088.1
r_{Lo} (Ω)
10^4
10^3
10^2
1
10
10^2
10^3
E (lx)
10^4
T_c = 2700 K
V_{dc} = 10 V
after 16 h in darkness

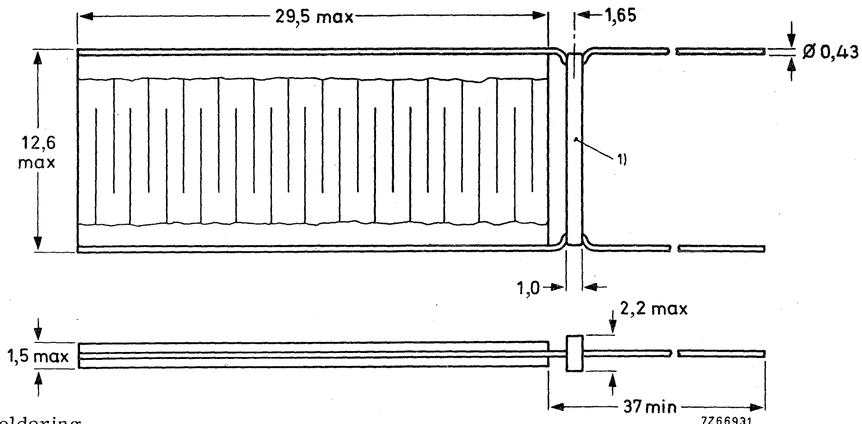

7Z65089
P_{max} (W)
1
0.5
0
0
25
50
T_{amb} (°C)
75
t_{av}=2s
free in air

CADMIUM SULPHIDE PHOTOCONDUCTIVE CELL

Side sensitive cadmium sulphide photoconductive cell protected by a lacquer coating. The device withstands the steady state damp heat test of IEC publication 68-2-3 (test Ca: severity 56 days).

QUICK REFERENCE DATA				
Power dissipation at T_{amb} = 25 °C	P	max.	0,75	W
Cell voltage, d.c. and repetitive peak	V	max.	400	V
Cell resistance at 50 lx, 2700 K colour temperature	r_{lo}	typ.	1150	Ω
Spectral response, current rise and decay curves		type D		
Outline dimensions		max.	29,5 x 12,6 x 1,5	mm

MECHANICAL DATA Dimensions in mm



Soldering

The cell may be soldered directly into the circuit but heat conducted to the tablet should be kept to a minimum by the use of a thermal shunt. The cell may be dipsoldered at a solder temperature of 240 °C for maximum 10 s up to a point 5 mm from the stress relief band.

Mounting

The cell is not insulated electrically and should be mounted accordingly.

Notice

If the cell is to be encapsulated, request manufacturer's instructions.

1) Stress relief band.

ELECTRICAL DATA

General

The electrical properties of CdS cells are dependent on many factors such as illumination, colour temperature of the light source, voltage, current, temperature, total time of operation in the circuit and time of operation during the last 24 hours prior to the measurement. The following basic characteristics are therefore only check points of the electrical properties of these devices measured with defined values of the various conditions and at delivery.

Basic characteristics at T_{amb} = 25 °C, illumination with colour temperature of 2700 K and at delivery

Initial dark resistance measured with 400 V d.c. applied via 1 MΩ, 20 s after switching off the illumination	r_{do}	>	9	MΩ 1)
Equilibrium dark resistance measured with 400 V d.c. applied via 1 MΩ, 30 minutes after switching off the illumination	r_{de}	>	200	MΩ 1)
Initial illlumination resistance measured at 10 V d.c., illumination = 50 lx, after 16 hrs in darkness 2)	r_{lo}		700 to 3300	Ω
		typ.	1150	Ω
Equilibrium illumination resistance measured at 10 V d.c., illumination = 50 lx, after 15 min under the measuring conditions	r_{le}		700 to 4100	Ω
		typ.	1450	Ω
Negative temperature response of illumination resistance		typ.	0,2	%/°C
		<	0,5	%/°C
Voltage response $\frac{\text{r at 0,5 V d.c.}}{\text{r at 10 V d.c.}}$	α	typ.	1,05	

1) The spread of the dark resistance is large and values higher than 100 MΩ and 1000 MΩ are possible for the initial dark resistance and the equilibrium dark resistance respecitively.

2) After 16 hours in darkness changes in the CdS material are still occurring but have only insignificant effect on the illumination resistance.

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

Cell voltage, d.c. and repetitive peak	V	max.	400	V
Cell voltage, pulse, $t_p \leq 5$ ms, $p_{rr} \leq$ once per minute	V_M	max.	1000	V
Power dissipation (t_{av} = 2 s) see graph P_{max}				
Power dissipation, pulse	P_M	max.	$5 \times P_{max}$	
Cell current, d.c. and repetitive peak	I	max.	500	mA
Illumination	E	max.	50 000	lx
Temperature CdS tablet, operating	T_{tablet}	max.	+85	°C
Ambient temperature, storage and operating	T_{amb}	min.	−40	°C
storage	T_{stg}	max.	+50	°C 1)
operating	T_{amb}	max.	+70	°C

DESIGN CONSIDERATIONS

Apparatus with CdS cells should be designed so that changes in illumination resistance of the cells during life under rated load from −30 % to +70 % (typ. +40 %) do not impair the circuit performance. Direct sunlight irradiation should be avoided.

CLIMATIC DATA

The device withstands the damp heat test Ca (steady state) of IEC Publication 68-2-3: severity 56 days, under no-load conditions or under continuous load conditions such that the tablet temperature is ≥ 5 °C above ambient temperature.

MECHANICAL ROBUSTNESS

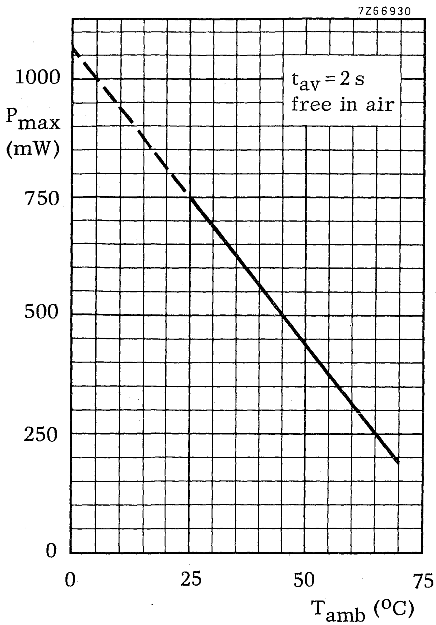
Tensile test

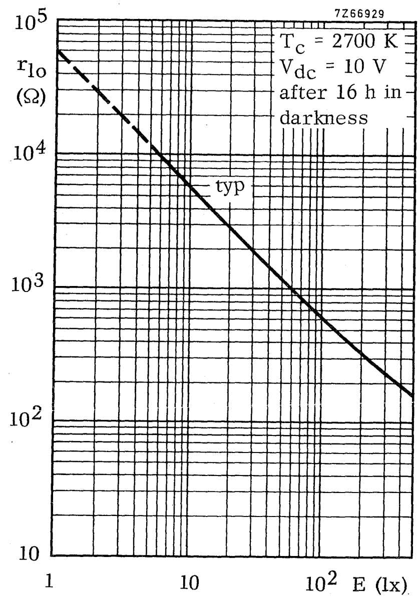
The device withstands the tensile test of IEC Publication 68-2-21, Test Ua: loading weight 500 g.

Pull test

The device withstands the following test: The leads are bent outwards over an angle of 90° at 2 mm from the stress relief band; a pulling force of 500 g is then applied at the end of the leads.

1) Operation of the cell counteracts the deteriorating effect of long periods at high temperature. The maximum operating temperature is therefore higher than the maximum storage temperature.


7Z66930
1000
750
500
250
0
P_{max}
(mW)
t_{av} = 2 s
free in air
0
25
50
75
T_{amb} (°C)


7Z66929
10^5
10^4
10^3
10^2
10
r_{lo}
(Ω)
T_c = 2700 K
V_{dc} = 10 V
after 16 h in
darkness
typ
1
10
10^2
E (lx)

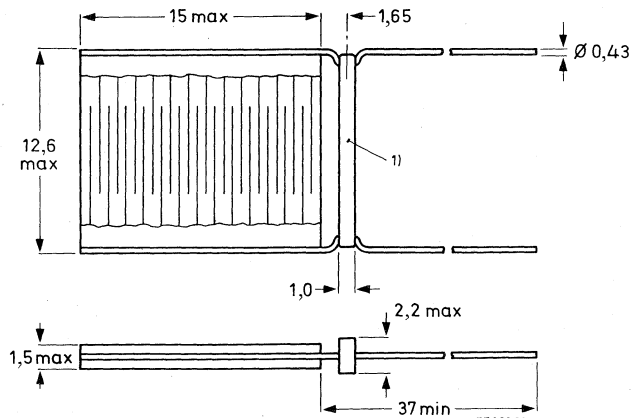
CADMIUM SULPHIDE PHOTOCONDUCTIVE CELL

Side sensitive cadmium sulphide photoconductive cell protected by a lacquer coating. The device withstands the steady state damp heat test of IEC publication 68-2-3 (test Ca: severity 56 days).

QUICK REFERENCE DATA				
Power dissipation at T_{amb} = 25 °C	P	max.	0,500	W
Cell voltage, d.c. and repetitive peak	V	max.	200	V
Cell resistance at 50 lx, 2700 K colour temperature	r_{lo}	typ.	1150	Ω
Spectral response, current rise and decay curves		type D		
Outline dimensions		max.	15 x 12,6 x 1,5	mm

MECHANICAL DATA

Dimensions in mm



Soldering

The cell may be soldered directly into the circuit but heat conducted to the tablet should be kept to a minimum by the use of a thermal shunt. The cell may be dipsoldered at a solder temperature of 240 °C for maximum 10 s up to a point 5 mm from the stress relief band.

Mounting

The cell is not insulated electrically and should be mounted accordingly.

Notice

If the cell is to be encapsulated, request manufacturer's instructions.

1) Stress relief band.

ELECTRICAL DATA

General

The electrical properties of CdS cells are dependent on many factors such as illumination, colour temperature of the light source, voltage, current, temperature, total time of operation in the circuit and time of operation during the last 24 hours prior to the measurement. The following basic characteristics are therefore only check points of the electrical properties of these devices measured with defined values of the various conditions and at delivery.

Basic characteristics at T_{amb} = 25 °C, illumination with colour temperature of 2700 K and at delivery

Initial dark resistance measured with 200 V d.c. applied via 1 MΩ, 20 s after switching off the illumination	r_{do}	>	9	MΩ [1]
Equilibrium dark resistance measured with 200 V d.c. applied via 1 MΩ, 30 minutes after switching off the illumination	r_{de}	>	100	MΩ [1]
Initial illumination resistance measured at 10 V d.c., illumination = 50 lx, after 16 hrs in darkness [2]	r_{lo}	700 to	3300	Ω
		typ.	1150	Ω
Equilibrium illumination resistance measured at 10 V d.c., illumination = 50 lx, after 15 min under the measuring conditions	r_{le}	700 to	4100	Ω
		typ.	1450	Ω
Negative temperature response of illumination resistance		<	0,5	%/°C
		typ.	0,2	%/°C
Voltage response $\frac{\text{r at } 0,5 \text{ V d.c.}}{\text{r at } 10 \text{ V d.c.}}$	α	typ.	1,05	

1) The spread of the dark resistance is large and values higher than 100 MΩ and 1000 MΩ are possible for the initial dark resistance and the equilibrium dark resistance respecitively.

2) After 16 hours in darkness changes in the CdS material are still occurring but have only insignificant effect on the illumination resistance.

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

Cell voltage, d.c. and repetitive peak	V	max.	200	V
Cell voltage, pulse, $t_p \leq 5$ ms, $p_{rr} \leq$ once per minute	V_M	max.	500	V
Power dissipation (t_{av} = 2 s) see graph P_{max}				
Power dissipation, pulse	P_M	max.	$5 \times P_{max}$	
Cell current, d.c. and repetitive peak	I	max.	250	mA
Illumination	E	max.	50 000	lx
Temperature CdS tablet, operating	T_{tablet}	max.	+85	^oC
Ambient temperature, storage and operation	T_{amb}	max.	−40	^oC
storage	T_{stg}	max.	+50	^oC 1)
operating	T_{amb}	max.	+70	^oC

DESIGN CONSIDERATIONS

Apparatus with CdS cells should be designed so that changes in illumination resistance of the cells during life under rated load from −30 % to +70 % (typ. +40 %) do not impair the circuit performance. Direct sunlight irradiation should be avoided.

CLIMATIC DATA

The device withstands the damp heat test Ca (steady state) of IEC Publication 68-2-3: severity 56 days, under no-load conditions or under continuous load conditions such that the tablet temperature is ≥ 5 ^oC above ambient temperature.

MECHANICAL ROBUSTNESS

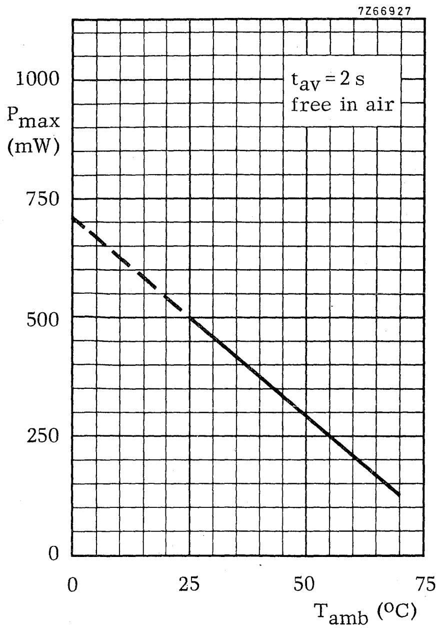
Tensile test

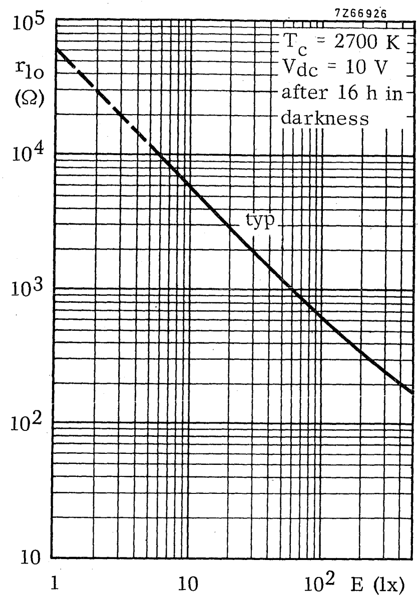
The device withstands the tensile test of IEC Publication 68-2-21, Test Ua: loading weight 500 g.

Pull test

The device withstands the following test: The leads are bent outwards over an angle of 90^o at 2 mm from the stress relief band; a pulling force of 500 g is then applied at the end of the leads.

1) Operation of the cell counteracts the deteriorating effect of long periods at high temperature. The maximum operating temperature is therefore higher than the maximum storage temperature.


7Z66927
t_{av} = 2 s
free in air
P_{max} (mW)
1000
750
500
250
0
0
25
50
75
T_{amb} (°C)


7Z66926
T_c = 2700 K
V_{dc} = 10 V
after 16 h in darkness
typ
r_{lo} (Ω)
10^5
10^4
10^3
10^2
10
1
10
10^2
E (lx)

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