DISCRETE SEMICONDUCTORS

Optocouplers

BOOK SC12 1991

Philips Semiconductors

PHILIPS

Optocouplers

Contents

'GULL-WING' SURFACE MOUNT OPTION

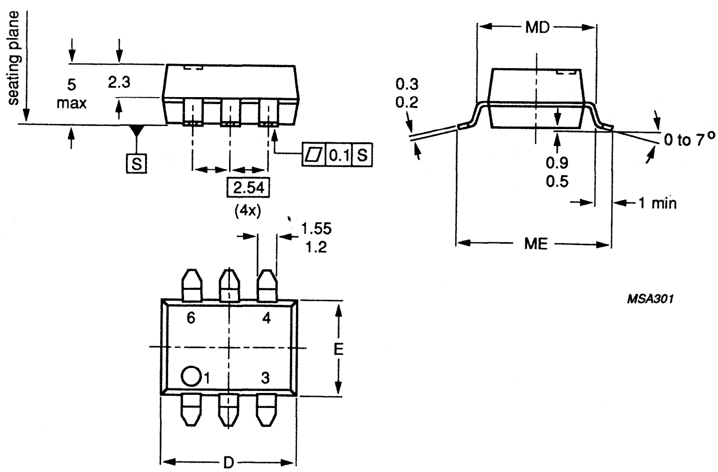
All Philips dual-in-line (DIL) optocouplers except CNX62A are available with 'Gull-wing' bent leads for surface mount circuit assembly.

Safety approvals, relevant for the standard DIL part, remain valid. The devices are suitable for wave and vapour-phase reflow soldering. Lead plating is tin-lead. Packing is in tubes.

For ordering purposes, the type number suffix is '-S', e.g. CNW11AV-1 becomes CNW11AV-1-S; CNX83A becomes CNX83A-S, etc.

Outline survey

NUMBER OF PINS	STANDARD DIL REFERENCE	'GULL-WING' OPTION	MEASUREMENTS (mm)				
			ME		MD	E	D
			min.	max.	typ.	typ.	max.
6	SOT90B	SOT295	9.4	10.0	7.9	6.3	7.62
6	SOT229B	SOT296	9.4	10.0	7.9	6.3	8.90
6	SOT231	SOT297	12.0	12.6	10.5	6.3	8.90
6	SOT228	SOT298	12.0	12.6	10.5	9.0	8.90
8	SOT97F	SOT299	9.4	10	7.9	6.3	10.16
8	SOT271	SOT300	12.0	12.6	10.5	9.0	11.3



Dimensions in mm.

Fig.1 'Gull-wing' outline option.

SELECTION GUIDE

INTRODUCTION

The following tables represent our complete range of optocouplers. For each device, the base is connected, unless otherwise specified in the 'remarks' column.

Optocouplers with GaAs emitter diode (DIL 6)

STANDARD TYPES

TYPE	PIN SPACING (note 1)	APPROVAL (note 2)	V_{IO} min. (kV DC)	$V_{(BR)CEO}$ min. (V)	CTR		MEASURED AT		REMARKS	PAGE
					min.	max.	I_F (mA)	V_{CE} (V)		
Phototransistor output										
CNX35U	3e	E,Z	4.4	30	0.4 0.15	1.6 –	10 2	0.4 5		177
CNX36U	3e	E,Z	4.4	30	0.8 0.15	2 –	10 2	0.4 5		177
CNX39U	3e	E,Z	4.4	30	0.6 0.15	1 –	10 2	0.4 5		177
4N25	3e	C,Z	2.82	30	0.2	–	10	10		403
4N25A	3e	C,Z	2.82	30	0.2	–	10	10		403
4N26	3e	C,Z	2.82	30	0.2	–	10	10		403
4N27	3e	C,Z	2.82	30	0.1	–	10	10		403
4N28	3e	C,Z	2.82	30	0.1	–	10	10		403
4N35	3e	E,Z	4.4	30	1	–	10	10		417
4N36	3e	C,Z	2.82	30	1	–	10	10		417
4N37	3e	C,Z	2.82	30	1	–	10	10		417
H11A1	3e	C,Z	2.82	30	0.5	–	10	10		275
H11A2	3e	C,Z	2.82	30	0.5	–	10	10		275
H11A3	3e	C,Z	2.82	30	0.2	–	10	10		275
H11A4	3e	C,Z	2.82	30	0.1	–	10	10		275
H11A5	3e	C,Z	2.82	30	0.3	–	10	10		275
MCT2	3e	E,Z	4.4	30	0.2	–	10	10		299
MCT26	3e	E,Z	4.4	30	0.06	–	10	10		305
High voltage phototransistor output										
CNX38U	3e	E,Z	4.4	80	0.7 0.5 0.15	2.1 – –	10 16 2	10 0.4 5		195

TYPE	PIN SPACING (note 1)	APPROVAL (note 2)	V_{IO} min. (kV DC)	$V_{(BR)CEO}$ min. (V)	CTR		MEASURED AT		REMARKS	PAGE
					min.	max.	I_F (mA)	V_{CE} (V)		
4N38	3e	C,Z	2.82	80	0.2	–	10	10		423
4N38A	3e	C,Z	2.82	80	0.2	–	10	10		423
CNY17-1	3e	E,Z	4.4	70	0.4 0.13	0.8 –	10 1	5 5		259
CNY17-2	3e	E,Z	4.4	70	0.63 0.22	1.25 –	10 1	5 5		259
CNY17-3	3e	E,Z	4.4	70	1 0.34	2 –	10 1	5 5		259
CNY17-4	3e	E,Z	4.4	70	1.6 0.56	3.2 –	10 1	5 5		259
CNY17F-1	3e	B,Z	4.4	70	0.4 0.13	0.8 –	10 1	5 5	base not connected	259
CNY17F-2	3e	B,Z	4.4	70	0.63 0.22	1.25 –	10 1	5 5	base not connected	259
CNY17F-3	3e	B,Z	4.4	70	1 0.34	2 –	10 1	5 5	base not connected	259
CNY17F-4	3e	B,Z	4.4	70	1.6 0.56	3.2 –	10 1	5 5	base not connected	259
Photo-Darlington output										
CNX48U	3e	E	4.4	30	5 0.5	– –	1 0.5	1 1		211
H11B1	3e	C	2.82	25	5	–	1	5		281
H11B2	3e	C	2.82	25	2	–	1	5		281
H11B3	3e	C	2.82	25	1	–	1	5		281
H11B255	3e	C	2.82	55	1	–	10	5		287
MCA230	3e	E	4.4	30	1	–	10	5		293
MCA231	3e	E	4.4	30	2	–	10	5		293
MCA255	3e	E	4.4	55	1	–	10	5		293
4N29	3e	E	4.4	30	1	–	10	10		409
4N30	3e	E	4.4	30	1	–	10	10		409
4N31	3e	E	4.4	30	0.5	–	10	10		409
4N32	3e	E	4.4	30	5	–	10	10		409
4N33	3e	E	4.4	30	5	–	10	10		409

TYPES FOR MAINS ISOLATION

TYPE	PIN SPACING (note 1)	APPROVAL (note 2)	V_{IO} min. (kV DC)	$V_{(BR)CEO}$ min. (V)	CTR		MEASURED AT		REMARKS	PAGE
					min.	max.	I_F (mA)	V_{CE} (V)		
Phototransistor output										
CNX62A	3.5e	H,Z	5.3	50	0.4	–	10	0.4	base not connected	223
CNX71A	3e	E,Z	5.3	30	0.4	1.6	10	0.4	base not connected	235
CNX72A	3e	E,Z	5.3	30	0.4	1.6	10	0.4		235
CNX82A	4e	H,Z	5.3	50	0.4 0.4 0.1	2.5 – 1	10 10 1	5 0.4 5	base not connected	247
CNX83A	4e	H,Z	5.3	50	0.4 0.4 0.1	2.5 – 1	10 10 1	5 0.4 5		247
CNY17G-1	4e	H,Z	5.3	70	0.4 0.13	0.8 –	10 1	5 5		267
CNY17G-2	4e	H,Z	5.3	70	0.63 0.22	1.25 –	10 1	5 5		267
CNY17G-3	4e	H,Z	5.3	70	1 0.34	2 –	10 1	5 5		267
CNY17G-4	4e	H,Z	5.3	70	1.6 0.56	3.2 –	10 1	5 5		267
CNY17GF-1	4e	H,Z	5.3	70	0.4 0.13	0.8 –	10 1	5 5	base not connected	267
CNY17GF-2	4e	H,Z	5.3	70	0.63 0.22	1.25 –	10 1	5 5	base not connected	267
CNY17GF-3	4e	H,Z	5.3	70	1 0.34	2 –	10 1	5 5	base not connected	267
CNY17GF-4	4e	H,Z	5.3	70	1.6 0.56	3.2 –	10 1	5 5	base not connected	267
CNW82	4e	I,Z	8.3	50	0.4	–	10	0.4	wide body DIP; base not connected	113
CNW83	4e	I,Z	8.3	50	0.4	–	10	0.4	wide body DIP	113

TYPE	PIN SPACING (note 1)	APPROVAL (note 2)	V_{IO} min. (kV DC)	$V_{(BR)CEO}$ min. (V)	CTR		MEASURED AT		REMARKS	PAGE
					min.	max.	I_F (mA)	V_{CE} (V)		
Phototransistor output										
CNW84	4e	J	8.34	80	0.63	3.2	10	5	wide body DIP; 2 mm separation; base not connected	127
CNW85	4e	J	8.34	80	0.63	3.2	10	5	wide body DIP; 2 mm separation	127
CNW11AV-1	4e	J	5.65	40	1	3	10	10	wide body DIP; 2 mm separation	103
CNW11AV-2	4e	J	5.65	40	0.5	–	10	10	wide body DIP; 2 mm separation	103
CNW11AV-3	4e	J	5.65	40	0.2	–	10	10	wide body DIP; 2 mm separation	103
CNX21	6e	None	10	30	0.2	–	10	0.4	4 pins; base not connected	169

TELEPHONY SELECTIONS

TYPE	PIN SPACING (note 1)	APPROVAL (note 2)	V_{IO} min. (kV DC)	$V_{(BR)CEO}$ min. (V)	CTR		MEASURED AT		REMARKS	PAGE
					min.	max.	I_F (mA)	V_{CE} (V)		
Standard transistor output										
SL5500	3e	A,Z	3.5	30	0.5 0.4	3 –	10 2	0.4 5		337
SL5501	3e	A,Z	3.5	30	0.25 0.15	4 –	10 2	0.4 5		337
SL5511	3e	A,Z	3.5	30	0.2 0.25	– –	0.5 2	0.4 5		337
Standard high voltage transistor output										
SL5504	3e	A,Z	3.5	80	0.25 0.15	4 –	10 2	0.4 5		355
OF4114	3e	E,Z	4.4	70	1 0.34	2 –	10 1	5 5	14CNP spec.	313
Types for mains isolation										
SL5582	4e	H,Z	5.3	50	0.4 0.2	3.2 –	10 2	5 5	base not connected	379
SL5583	4e	H,Z	5.3	50	0.4 0.2	3.2 –	10 2	5 5		379
SL5582W	4e	I,Z	8.3	50	0.4 0.2	3.2 –	10 2	5 5	wide body; base not connected	391
SL5583W	4e	I,Z	8.3	50	0.4 0.2	3.2 –	10 2	5 5	wide body	391

Optocouplers with GaAlAs emitter diode (DIL 6)

LOW INPUT CURRENT, HIGH STABILITY

TYPE	PIN SPACING (note 1)	APPROVAL (note 2)	V_{IO} min. (kV DC)	$V_{(BR)CEO}$ min. (V)	CTR		MEASURED AT		REMARKS	PAGE
					min.	max.	I_F (mA)	V_{CE} (V)		
Standard types										
CNG35	3e	E	4.4	30	0.4	1.6	10	0.4		55
					0.3	–	2	5		
					0.1	–	0.5	0.4		
CNG36	3e	E	4.4	30	0.8	2	10	0.4		55
					0.3	–	2	5		
					0.2	–	0.5	0.4		
Types for mains isolation										
CNG82	4e	E	5.3	50	0.4	1.6	10	0.4	base not connected	71
					0.1	–	0.5	0.4		
CNG83	4e	E	5.3	50	0.4	1.6	10	0.4		71
					0.1	–	0.5	0.4		
Telephony selection										
PO40/44A	3e	E	3.5	30	0.6	1.5	10	0.5		321
					0.1	–	0.5	5		

Optocouplers with GaAlAs emitter diode (DIL 8)

STANDARD HIGH SPEED TYPES

TYPE	PIN SPACING (note 1)	APPROVAL (note 2)	V_{IO} min. (kV DC)	$V_{(BR)CEO}$ min. (V)	CTR		MEASURED AT		REMARKS	PAGE
					min.	max.	I_F (mA)	V_{CE} (V)		
Transistor output										
6N135	3e	D	3.5	15	0.07	–	16	0.4		429
6N136	3e	E	4.4	15	0.19	–	16	0.4		429
Darlington output										
6N138	3e	D	3.5	7	3	–	1.6	0.4		441
6N139	3e	D	3.5	18	5	–	1.6	0.4		441
					4	–	0.5	0.4		

TYPES FOR MAINS ISOLATION

TYPE	PIN SPACING (note 1)	APPROVAL (note 2)	V_{IO} min. (kV DC)	$V_{(BR)CEO}$ min. (V)	CTR		MEASURED AT		REMARKS	PAGE
					min.	max.	I_F (mA)	V_{CE} (V)		
Transistor output										
CNW135	4e	I,V	7.07	20	0.07	–	16	0.4	wide body	137
CNW136	4e	I,V	7.07	20	0.19	–	16	0.4	wide body	137
CNW4502	4e	I,V	7.07	20	0.19	–	16	0.4	wide body; base not connected	137
Darlington output										
CNW138	4e	I,V	7.07	7	3	–	1.6	0.4	wide body	153
CNW139	4e	I,V	7.07	18	5	–	1.6	0.4	wide body	153
					4	–	0.5	0.4		

TELEPHONY SELECTION

TYPE	PIN SPACING (note 1)	APPROVAL (note 2)	V_{IO} min. (kV DC)	$V_{(BR)CEO}$ min. (V)	CTR		MEASURED AT		REMARKS	PAGE
					min.	max.	I_F (mA)	V_{CE} (V)		
Transistor output										
SL5505S	3e	D	3.5	18	0.2	4	10	0.4		369
					0.1	–	2	5		

Dedicated IC optocoupler (DIL 8)

SELF OSCILLATING POWER SUPPLY (SOPS)

TYPE	PIN SPACING (note 1)	APPROVAL (note 2)	V_{IO} min. (kV DC)	V_{CC} (V)	REMARKS	PAGE
CNR50	4e	I,V	7.07	18	wide body; see data sheet for functions	85

Notes

1. e = 2.54 mm.
2. These codes are explained in the section entitled 'Approvals'.

TYPE NUMBER SURVEY

INTRODUCTION

In this alphanumeric list we present all optoelectronic devices mentioned in this handbook.

TYPE NUMBER	DIODE TECHNOLOGY	MINIMUM ISOLATION VOLTAGE (kV DC)	PACKAGE	PAGE
CNG35	GaAlAs	4.4	SOT90B	55
CNG36	GaAlAs	4.4	SOT90B	55
CNG82	GaAlAs	5.3	SOT212	71
CNG83	GaAlAs	5.3	SOT212	71
CNR50	GaAlAs	7.07	SOT271	85
CNW11AV-1	GaAs	5.656	SOT228	103
CNW11AV-2	GaAs	5.656	SOT228	103
CNW11AV-3	GaAs	5.656	SOT228	103
CNW82	GaAs	8.34	SOT228	113
CNW83	GaAs	8.34	SOT228	113
CNW84	GaAs	8.34	SOT228	127
CNW85	GaAs	8.34	SOT228	127
CNW135	GaAlAs	7.07	SOT271	137
CNW136	GaAlAs	7.07	SOT271	137
CNW138	GaAlAs	7.07	SOT271	153
CNW139	GaAlAs	7.07	SOT271	153
CNW4502	GaAlAs	7.07	SOT271	137
CNX21	GaAs	10	SOT211	169
CNX35U	GaAs	4.4	SOT90B	177
CNX36U	GaAs	4.4	SOT90B	177
CNX38U	GaAs	4.4	SOT90B	195
CNX39U	GaAs	4.4	SOT90B	177
CNX48U	GaAs	4.4	SOT90B	211
CNX62A	GaAs	5.3	SOT230	223
CNX71A	GaAs	5.3	SOT229B	235
CNX72A	GaAs	5.3	SOT229B	235
CNX82A	GaAs	5.3	SOT231	247
CNX83A	GaAs	5.3	SOT231	247
CNY17-1	GaAs	4.4	SOT90B	259
CNY17-2	GaAs	4.4	SOT90B	259
CNY17-3	GaAs	4.4	SOT90B	259
CNY17-4	GaAs	4.4	SOT90B	259
CNY17F-1	GaAs	4.4	SOT90B	259
CNY17F-2	GaAs	4.4	SOT90B	259
CNY17F-3	GaAs	4.4	SOT90B	259

TYPE NUMBER	DIODE TECHNOLOGY	MINIMUM ISOLATION VOLTAGE (kV DC)	PACKAGE	PAGE
CNY17F-4	GaAs	4.4	SOT90B	259
CNY17G-1	GaAs	5.3	SOT231	267
CNY17G-2	GaAs	5.3	SOT231	267
CNY17G-3	GaAs	5.3	SOT231	267
CNY17G-4	GaAs	5.3	SOT231	267
CNY17GF-1	GaAs	5.3	SOT231	267
CNY17GF-2	GaAs	5.3	SOT231	267
CNY17GF-3	GaAs	5.3	SOT231	267
CNY17GF-4	GaAs	5.3	SOT231	267
H11A1	GaAs	2.82	SOT90B	275
H11A2	GaAs	2.82	SOT90B	275
H11A3	GaAs	2.82	SOT90B	275
H11A4	GaAs	2.82	SOT90B	275
H11A5	GaAs	2.82	SOT90B	275
H11B1	GaAs	2.82	SOT90B	281
H11B2	GaAs	2.82	SOT90B	281
H11B3	GaAs	2.82	SOT90B	281
H11B255	GaAs	2.82	SOT90B	287
MCA230	GaAs	4.4	SOT90B	293
MCA231	GaAs	4.4	SOT90B	293
MCA255	GaAs	4.4	SOT90B	293
MCT2	GaAs	4.4	SOT90B	299
MCT26	GaAs	4.4	SOT90B	305
OF4114	GaAs	4.4	SOT90B	313
PO40/44A	GaAlAs	3.5	SOT90B	321
SL5500	GaAs	3.5	SOT90B	337
SL5501	GaAs	3.5	SOT90B	337
SL5504	GaAs	3.5	SOT90B	355
SL5505S	GaAlAs	3.5	SOT97F	369
SL5511	GaAs	3.5	SOT90B	337
SL5582	GaAs	5.3	SOT231	379
SL5583	GaAs	5.3	SOT231	379
SL5582W	GaAs	8.34	SOT228	391
SL5583W	GaAs	8.34	SOT228	391
4N25	GaAs	2.82	SOT90B	403
4N25A	GaAs	2.82	SOT90B	403
4N26	GaAs	2.82	SOT90B	403

TYPE NUMBER	DIODE TECHNOLOGY	MINIMUM ISOLATION VOLTAGE (kV DC)	PACKAGE	PAGE
4N27	GaAs	2.82	SOT90B	403
4N28	GaAs	2.82	SOT90B	403
4N29	GaAs	4.4	SOT90B	409
4N30	GaAs	4.4	SOT90B	409
4N31	GaAs	4.4	SOT90B	409
4N32	GaAs	4.4	SOT90B	409
4N33	GaAs	4.4	SOT90B	409
4N35	GaAs	4.4	SOT90B	417
4N36	GaAs	2.82	SOT90B	417
4N37	GaAs	2.82	SOT90B	417
4N38	GaAs	2.82	SOT90B	423
4N38A	GaAs	2.82	SOT90B	423
6N135	GaAlAs	3.5	SOT97F	429
6N136	GaAlAs	4.4	SOT97F	429
6N138	GaAlAs	3.5	SOT97F	441
6N139	GaAlAs	3.5	SOT97F	441

CROSS-REFERENCE GUIDE

OPTOCOUPLER	PHILIPS' OPTOCOUPLER	REPLACEMENT CODE (note 1)
CNX35	CNX35U	direct
CNX36	CNX36U	direct
CNY17-1	CNY17-1	direct
CNY17-2	CNY17-2	direct
CNY17-3	CNY17-3	direct
CNY17-4	CNY17-4	direct
CNY17F-1	CNY17F-1	direct
CNY17F-2	CNY17F-2	direct
CNY17F-3	CNY17F-3	direct
CNY17F-4	CNY17F-4	direct
CNY17GF-1	CNY17GF-1	direct
CNY17GF-2	CNY17GF-2	direct
CNY17GF-3	CNY17GF-3	direct
CNY17GF-4	CNY17GF-4	direct
CNY47	4N25	minor
CNY48	CNX48U	direct
CNY51	CNY17-3	direct
CNY64	CNW84	major
CNY65	CNW84	major
CNY75A	CNY17-2	minor
CNY75B	CNY17-3	minor
CNY75C	CNY17-4	minor
CNY75GA	CNY17G-2	minor
CNY75GB	CNY17G-3	minor
CNY75GCB	CNY17G-4	minor
CQY80	CNX35U	direct
CQY80N	CNX72A	direct
CQY80NG	CNX83A	direct
GFH600-1	CNY17-2	direct
GFH600-2	CNY17-3	direct
GFH600-3	CNY17-4	direct
GFH601-1	CNY17-2	minor
GFH601-2	CNY17-3	minor
GFH601-3	CNY17-4	minor
H11A1	H11A1	direct
H11A1Z	CNX72A	direct
H11A1ZW	CNX83A	direct
H11A2	H11A2	direct

OPTOCOUPLER	PHILIPS' OPTOCOUPLER	REPLACEMENT CODE (note 1)
H11A3	H11A3	direct
H11A4	H11A4	direct
H11A5	H11A5	direct
H11A10	CNY17	direct
H11A5100	CNY17-3	direct
H11A520	CNX35U	direct
H11A550	CNX36U	direct
H11AG1	CNG36	minor
H11AG2	CNG35	minor
H11AG3	CNG35	minor
H11AV1A	CNW11AV-1	direct
H11AV2A	CNW11AV-2	direct
H11AV3A	CNW11AV-3	direct
H11B1	H11B1	direct
H11B2	H11B2	direct
H11B3	H11B3	direct
H11B255	H11B255	direct
IL1	H11A2	direct
IL5	H11A1	direct
IL10	CNW84	major
IL30	MCA230	minor
IL55	MCA255	minor
IL74	H11A2	direct
K1049P	SL5511	direct
K104P	SL5504	direct
K119P	CNY17-3	minor
K258P	SL5500	direct
K259P	SL5501	direct
MCA230	MCA230	direct
MCA231	MCA231	direct
MCA255	MCA255	direct
MCA2230Z	MCA230	minor
MCA2231Z	MCA231	minor
MCA225Z	MCA255	minor
MCT2	MCT2	direct
MCT2E	MCT2	direct
MCT26	MCT26	direct
MCT210	CNY17-4	direct

OPTOCOUPLER	PHILIPS' OPTOCOUPLER	REPLACEMENT CODE (note 1)
MCT270	CNX35U	direct
MCT271	CNY17-1	minor
MCT272	CNY17-2	minor
MCT273	CNY17-3	minor
MCT274	CNY17-4	minor
MCT275	CNX38U	direct
MCT277	CNX35U	minor
MCT2200XWC	CNX83A	direct
MCT2200Z	CNX71A	direct
MCT2201WZ	CNY17G-3	direct
MCT2202WZ	CNY17G-2	direct
MCT5200	CNY17-4	direct
MCT5210	CNX36U	minor
MOC8080	CNX48U	minor
MOC8100	CNX36U	minor
MOC8111	CNX72A	minor
MOC8112	CNX72A	minor
MOC8113	CNX72A	minor
PC100	CNW85	major
PC101	CNW84	major
PC110	CNX83A	minor
PC111	CNX82A	minor
PC112	CNY17G	minor
PC113	CNY17GF	minor
PC702V	CNY17-1	minor
PC703V	CNY17-4	minor
PC713V	CNX71A	minor
PC714V	CNX72A	minor
PC723V	CNX38U	minor
SFH600-0	CNY17-1	minor
SFH600-1	CNY17-2	minor
SFH600-2	CNY17-3	minor
SFH600-3	CNY17-4	minor
SFH601-1	CNY17-1	minor
SFH601-2	CNY17-2	minor
SFH601-3	CNY17-3	minor
SFH601-4	CNY17-4	minor
SFH601G-1	CNY17G-1	direct

OPTOCOUPLER	PHILIPS' OPTOCOUPLER	REPLACEMENT CODE (note 1)
SFH601G-2	CNY17G-2	direct
SFH601G-3	CNY17G-3	direct
SFH601G-4	CNY17G-4	direct
SFH606-1	CNY17-2	minor
SFH6011G	CNY17G	minor
SL5500	SL5500	direct
SL5501	SL5501	direct
SL5504	SL5504	direct
SL5505S	SL5505S	direct
SL5511	SL5511	direct
TCDT1101	CNX71A	minor
TCDT1101G	CNX82A	direct
TIL111	CNX35U	direct
TIL112	CNX35U	direct
TIL113	4N32	direct
TIL114	CNX35U	direct
TIL116	4N25	direct
TIL117	H11A1	direct
TIL126	CNX72A	direct
TIL127	CNX48U	minor
TLP331	CNG36	minor
TLP535	CNY17	direct
TLP536	CNY17F	direct
TLP571	CNX48U	direct
TLP575	H11B1	direct
TLP580	CNW84	major
TLP581	CNW85	major
TLP631	CNY17-3	direct
TLP632	CNX71A	minor
TLP634	CNX71A	minor
TLP731	CNX72A	direct
TLP731LF2	CNX82A	direct
TLP735F	CNW85	direct
TLP736F	CNW84	direct
4N25	4N25	direct
4N25A	4N25A	direct
4N26	4N26	direct
4N27	4N27	direct

OPTOCOUPLER	PHILIPS' OPTOCOUPLER	REPLACEMENT CODE (note 1)
4N28	4N28	direct
4N29	4N29	direct
4N30	4N30	direct
4N31	4N31	direct
4N32	4N32	direct
4N32A	4N32A	direct
4N33	4N33	direct
4N35	4N35	direct
4N36	4N36	direct
4N37	4N37	direct
4N38	4N38	direct
4N38A	4N38A	direct
6N135	6N135	direct
6N136	6N136	direct
6N138	6N138	direct
6N139	6N139	direct

Note

1. Direct: direct replacement.
   Minor: minor differences.
   Major: major electrical and/or mechanical differences.

APPROVALS

INTRODUCTION

Virtually all Philips' optocouplers are UL 1577 recognized and VDE 0883 (0884 in preparation) approved. To obtain these approvals, Philips optocouplers have been fully screened and tested for rugged construction, reliability, safety and conformance to specified ratings. Furthermore, Philips is obliged to maintain a consistently high standard of assembly and testing.

In addition to the above approvals, most types have VDE, BSI or NORDIC (SETI, SEMKO, NEMKO, DEMKO) certifications for such characteristics as isolation voltage rating, package creepage and clearance distances, and isolation thickness according to the requirements laid down in the national and international equipment standards listed in the following table.

The majority of Philips optocouplers are CECC approved by a capability of approval for GaAs optocouplers.

In the following table, the letters B to J and V refer to codes in the Selection Guide of this handbook.

Optocoupler approval references

STANDARD	DESCRIPTION	B	C	D	E	F	G	H	I	J	V
Component approval											
UL 1577	safety of optical isolators	X	X	X	X	X	X	X	X	X	
VDE 0883	optocouplers		X	X	X	X	X	X	X	X	
VDE 0884	optocouplers for safe electrical isolation										X
Equipment approval											
VDE 0804	telecommunications equipment			X	X	X	X	X	X	X	
VDE 0860	electronic household equipment				X	X	X	X	X	X	
VDE 0805	data processing equipment					X	X	X	X	X	
VDE 0806	office machines					X	X	X	X	X	
VDE IEC 950	information technology and business equipment										
VDE 0750-1	medical equipment								X	X	
VDE 0700-1	electrical household equipment									X	
BS415	electronic household appliances					X	X	X	X	X	
BS7002 (note 1)	information technology and business equipment						X	X	X	X	
NORDIC IEC 65	electronic household equipment							X	X	X	
NORDIC IEC 950	information technology and business equipment							X	X	X	
NORDIC IEC 380	office machines							X	X	X	
NORDIC IEC 335	electrical household equipment							X	X	X	

Notes

Special approvals are indicated in the Selection Guide by the letter 'A'.

Types with CECC approval are indicated in the Selection Guide by the letter 'Z'.

1. BS7002 replaces BS5850 (office machines) and BS6204 (data processing).

Special approvals

STANDARD	TYPES
CNET	SL5500, SL5501, SL5504, SL5511, SL5582, SL5583, SL5582W, SL5583W, SL5505S, H11G2
BS415/7002/6301	SL5500, SL5501, SL5504, SL5511
BS6301	CNW135, CNW136, CNW4502, CNW138, CNW139, CNR50

APPLICATIONS

APPLICATION	APPARATUS/ TYPE	EQUIPMENT	RECOMMENDED OPTOCOUPLER TYPE (note 1)
Switched mode power supply	consumer	TV, VCR	CNX82A/83A, CNW136/4502, CNR50
	domestic appliances	microwave ovens	CNW84/85
	medical	monitors, hospital TV	CNW82/83, CNW84/85
	EDP/office machines	PCs, monitors, printers	CNX82A/83A, CNW136/4502, CNW82/83, CNR50
	telecom	exchanges, sub-stations	CNX35U/38U/72A, SL5582/82W
	industrial	various	CNX82A, CNW82/84, CNW136
Line/system protection; line control without interference; system separation/matching	telecom	exchanges, answering and FAX machines	CNX36U/38U/48U, SL5500/01/04, PO40/44A, OF4114, CNG36, CNX38U
	public service	electronic wattmeters	CNG82/83, CNW82/83/84/85
	industrial	process control	CNG36/82/83, CNX38U/48U/71A, 6N136/139, CNW4502, CNW84/85

Note

1. For second sourcing, see the Cross-reference Guide in this handbook.

GENERAL

Safety recommendations
Rating systems
Letter symbols
Type designation
Definitions
Current transfer ratio
Switching times

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, 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. OTHER COMPOUNDS

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

The above information and recommendations are given in good faith and are in accordance with the best knowledge and opinion available at the date of the compilation of the data sheets.

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

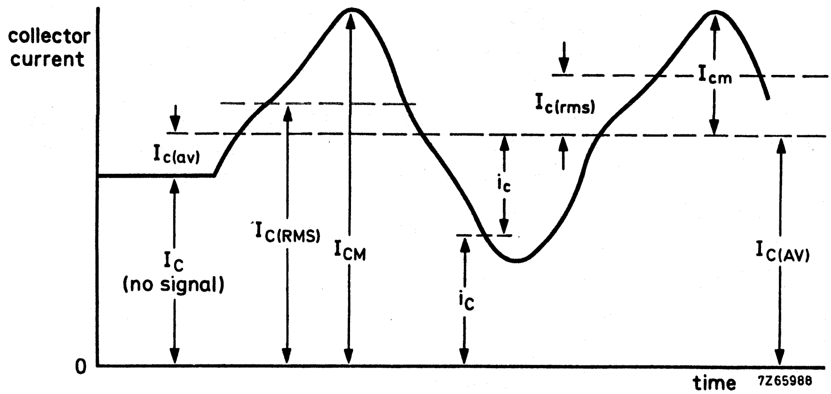
For multiple unit devices, the subscripts are modified by a number preceding the letter subscript; in the case of multiple subscripts, hyphens may be necessary to avoid misunderstanding.

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 PARAMETERE METERS

Defenition

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, l	=	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}

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.

"Although not all type numbers accord with the Pro Electron system, the following explanation is given for the ones that do."

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 ($R_{th\ j\text{-}mb} > 15$ K/W)
D. TRANSISTOR; power, audio frequency ($R_{th\ j\text{-}mb} \leq 15$ K/W)
E. DIODE; tunnel
F. TRANSISTOR; low power, high frequency ($R_{th\ j\text{-}mb} > 15$ K/W)
G. MULTIPLE OF DISSIMILAR DEVICES – MISCELLANEOUS; e.g. oscillator
H. DIODE; magnetic sensitive
L. TRANSISTOR; power, high frequency ($R_{th\ j\text{-}mb} \leq 15$ K/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 ($R_{th\ j\text{-}mb} > 15$ K/W)
S. TRANSISTOR; low power, switching ($R_{th\ j\text{-}mb} > 15$ K/W)
T. CONTROL AND SWITCHING DEVICE; e.g. thyristor, power ($R_{th\ j\text{-}mb} \leq 15$ K/W)
U. TRANSISTOR; power, switching ($R_{th\ j\text{-}mb} \leq 15$ K/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.

* When these serial numbers are exhausted the serial number for consumer types may be extended to four figures, and that for industrial types to three figures.

DEFINITIONS FOR OPTOELECTRONIC DEVICES ACCORDING TO IEC 306

DEFINITIONS AND UNITS VALID FOR INFRARED RADIATION

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.

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

DEFINITIONS AND UNITS VALID FOR VISIBLE 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 a given direction, of a source emitting monochromatic radiation at a frequency of 540×10^{12} Hz*, the radiant intensity of which, in that direction, being 1/683 W/sr.

* Approximately 555 nm.

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:

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

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

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

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).

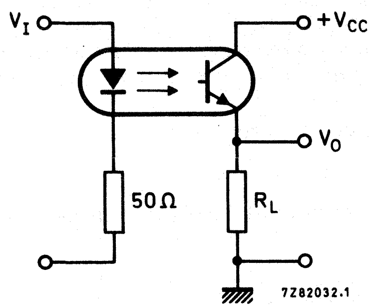


Fig. 1 Switching circuit.

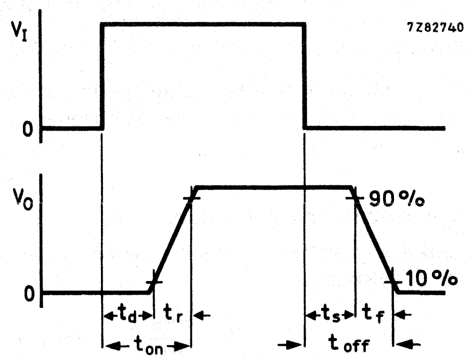


Fig. 2 Waveforms.

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 (2 π 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.

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

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.

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

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.

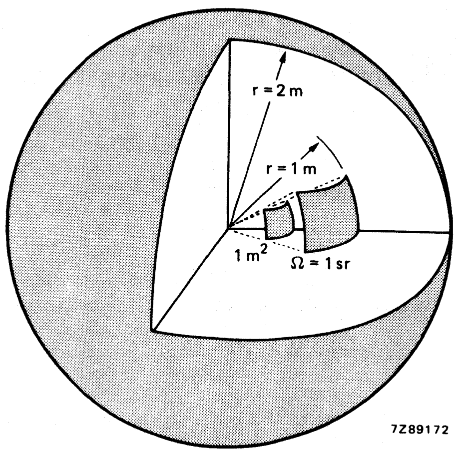


Fig. 3.

ADDITIONAL DEFINITIONS FOR OPTOCOUPLERS

Input current I_i

Current flowing in the input terminals corresponding, in most cases, to the forward current of the LED (I_F).

Output current I_o

Current flowing in the output terminals corresponding, in most cases, to the collector current of the transistor.

Transfer matrix

The output expressed as a function of the input is

$$V_o = AV_i + Bi_i$$
$$i_o = CV_i + Di_i$$

which can be expressed as the matrix

$$M = \begin{pmatrix} V_o \\ i_o \end{pmatrix} = \begin{pmatrix} A & B \\ C & D \end{pmatrix} \begin{pmatrix} v_i \\ i_i \end{pmatrix}$$

the general transfer matrix.

Transfer ratio τ

The transfer ratio is derived from

$$V_o/V_i = A$$
$$i_o/V_i = C$$
$$V_o \approx Bi_i$$
$$i_o \approx Di_i$$

and $\tau = i_i/i_e$ for a given V_o

The ratio is usually expressed as a factor.

Isolation voltage V_{IORM}

The maximum voltage that can be applied between the short-circuited input terminals and the short-circuited output terminals. The type of voltage must be specified, i.e. direct, alternating or repetitive peak.

Repetitive peak voltage rating indicates the resistance to transients. If exceeded, this can result in irreversible damage to the device.

Working voltage V_z

The maximum voltage that may be applied continuously between the input and the output of the device under normal operating conditions without altering its characteristics.

Collector cut-off current (dark) I_{CEW}

The collector cut-off (dark) current at a defined V_{CC} and a defined working voltage V_z applied between the short-circuited leads of the IR diode and the emitter of the transistor.

Input and output capacitance C_{io}

The capacitance between the input terminals and the output terminals.

Insulation resistance R_{io}

The resistance between the input terminals and the output terminals.

Common-mode rejection ratio CMRR

The ratio between a common-mode voltage and the output voltage expressed in dB. The coupling, mainly capacitive, reduces the value.

$$CMRR = 20 \log \frac{V_o}{V_{cm}}$$

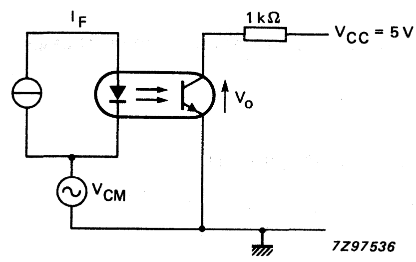


Fig. 1.

Linearity

Linearity depends on both the emitter and receiver characteristics. The characteristics of the transistor are shown in Fig. 2, those of the diode are shown in Fig. 3.

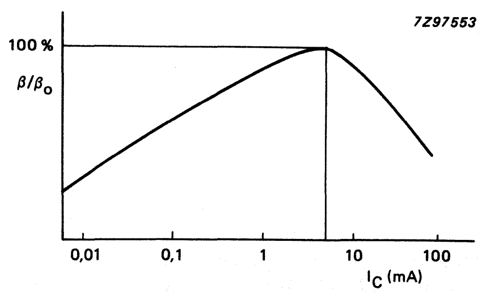


Fig. 2.

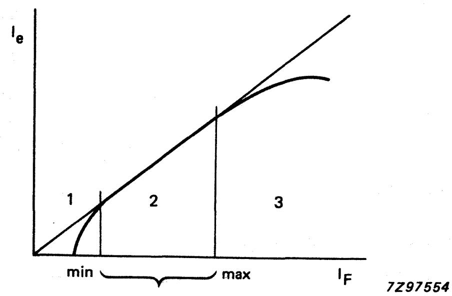


Fig. 3.

Zone 1 shows the non-linearity caused by the non-radiative current of the LED being greater than the radiative current. Non-linearity in zone 3 is caused by saturation.

DEFINITIONS OF TIME QUANTITIES

Switching times

Switching times are defined for a square input pulse, V_i.

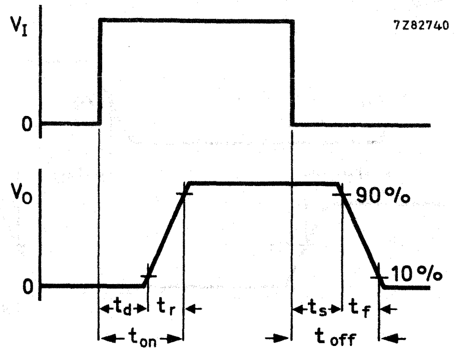


Fig. 4 Waveforms.

Delay time t_d

The time elapsing between the start of the pulse and the moment when the output signal reaches 10% of its maximum value.

Rise time t_r

The time elapsing between the moment when the output signal is 10% of its maximum value and the moment when it reaches 90% of this value.

Turn-on time t_{on}

The time elapsing between the start of the pulse and the moment when the corresponding output signal is 90% of its maximum value.

$$t_{on} = t_d + t_r$$

Storage time t_s

The time elapsing between the end of the input pulse and the moment when the corresponding output signal drops by 10% of its maximum value (or the time when it is still 90%).

Fall time t_f

The time elapsing between the moment when the output signal is still 90% of its maximum value and the moment when it is no more than 10%.

Turn-off time t_{off}

The time elapsing between the end of the input pulse and the moment when the corresponding output signal falls to 10% of its maximum value.

$$t_{off} = t_s + t_f$$

Propagation delay times

High-Low propagation delay time t_{PHL}

for TTL: The time between the specified reference points on the input and output waveforms with the output changing from the defined HIGH level to the defined LOW level.

for CMOS: The time between the specified reference points, normally the 50% points on the input and output waveforms, with the output changing from the defined HIGH level to the defined LOW level.

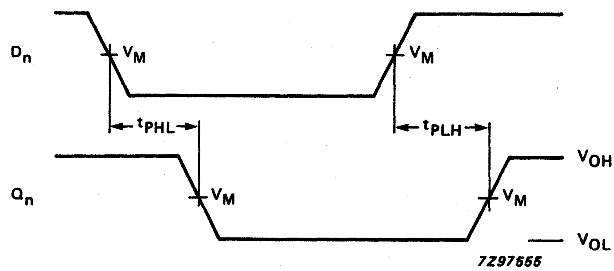


Fig. 5 TTL.

Low-High propagation delay time t_{PLH}

for TTL: The time between the specified reference points on the input and output waveforms with the output changing from the defined LOW level to the defined HIGH level.

for CMOS: The time between the specified reference points, normally the 50% points on the input and output waveforms, with the output changing from the defined LOW level to the defined HIGH level.

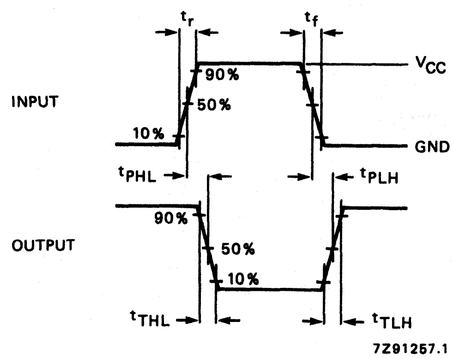


Fig. 6 CMOS.

PARAMETERS INFLUENCING THE CURRENT TRANSFER RATIO OF AN OPTOCOUPLER

Our optocouplers are frequently specified at V_{CE} = 0,4 V, I_F = 10 mA. Many other suppliers specify the transfer ratio at V_{CE} = 5 V or even 10 V when, in fact, the C.T.R. can be much higher. In comparing Philips optocouplers with alternative types a correction factor should be applied.

The current transfer ratio I_C/I_F (CTR) of an optocoupler depends mainly on the biasing conditions of the LED and phototransistor.

The curve of Fig. 1 shows a typical example of the I_C/I_F (CTR) at different I_F and V_{CE} values. The I_C/I_F (CTR) is normailized at 1 for I_F = 10 mA, V_{CE} = 0,4 V and for a high I_C/I_F (CTR).

If the base of the device is accessible, it is possible to limit the I_C/I_F (CTR) by wiring a resistance R_{BE} between the base and emitter. This resistance provides a threshold and thus limits the noise at the optocoupler output.

The curve of Fig. 2 shows three zones:

1. The phototransistor is OFF and only the current of the collector-base photodiode is available.
2. The phototransistor is just at the limit of conduction.
3. The phototransistor is ON and the collector current is no longer dependent on R_{BE}.

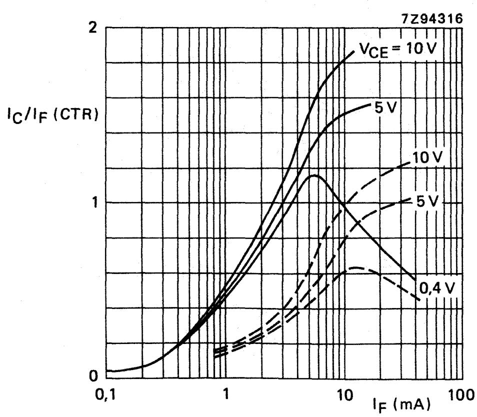


Fig. 1.

—— Piece with a high I_C/I_F (CTR)
– – – Piece with a low I_C/I_F (CTR)

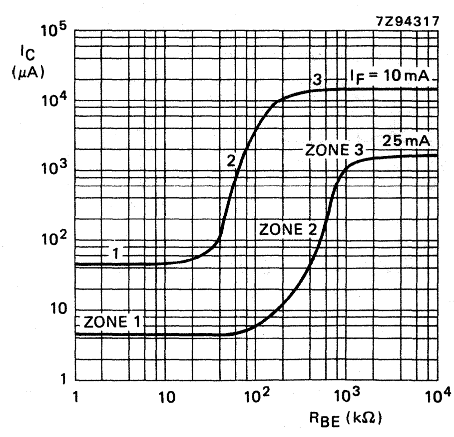


Fig. 2 V_{CC} = 5 V; T_{amb} = 25 °C; typical values.

OPTOCOUPLER SWITCHING TIMES

The curves published for each optocoupler type refer to the non-saturating mode. It is possible to choose the collector current and the load resistance R_L corresponding to the desired switching times.

In the saturation mode, the switching times depend on the forward current I_F, the load resistance R_L and an extra resistance R_{BE} which may be connected between the base and emitter of the phototransistor. This greatly improves the speed of the circuit.

Fig. 1 shows the typical switching times as a function of R_L without R_{BE}.

Fig. 2 shows these times as a function of I_F without R_{BE} and with R_{BE} = 100 kΩ.

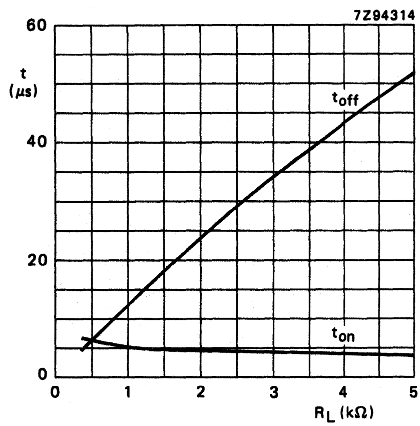


Fig. 1 V_{CC} = 5 V; I_F = 10 mA.

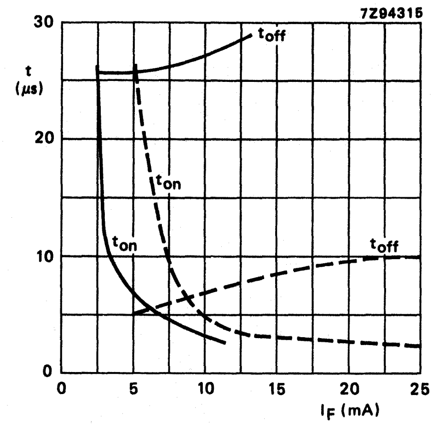


Fig. 2 V_{CC} = 5 V; R_L = 2,5 kΩ.

——— $R_{BE} = \infty$

– – – – R_{BE} = 100 kΩ

DEVICE DATA

GaAlAs OPTOCOUPLERS

Optically coupled isolators consisting of an infrared emitting GaAlAs diode and a silicon npn phototransistor with accessible base in a SOT90B envelope, designed for low input current and long life operation.

The application of an IR emitting diode, based on a special GaAlAs (intrinsic) process results in a perfect linearity at low input currents and a very low degradation during the devices operating life.

Features

- High output/input DC current transfer ratio
- Low saturation voltage
- High isolation voltage of 3.12 kV RMS and 4.4 kV DC
- Working voltage of 2.5 kV DC

UL — Covered under UL component recognition FILE E90700

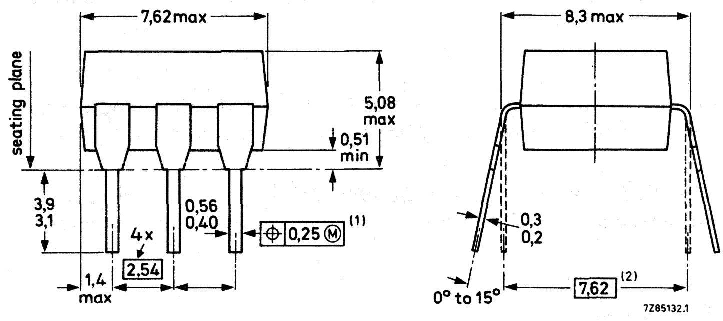
VDE — Approved according to VDE 0883/6.80
Reference voltage (VDE 0110b tab 4); AC 380 V/DC 450 V
Isolation group C
Complied for reinforced isolation at 250 V AC with:
DIN 57804/VDE 0804/1.83 (isolation group C)
DIN VDE 0860/8.86/HD 195 S4

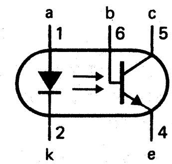
QUICK REFERENCE DATA

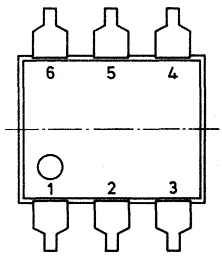
Diode				
Continuous reverse voltage		V_R	max.	5 V
DC forward current		I_F	max.	100 mA
Transistor				
Collector-emitter voltage (open base)		V_{CEO}	max.	30 V
Optocoupler				
Output/input DC current transfer ratio (CTR)				
I_F = 10 mA; V_{CE} = 0.4 V	CNG35	I_C/I_F	min.	0.4 - 1.6
	CNG36	I_C/I_F	min.	0.8 - 2.0
I_F = 500 μA; V_{CE} = 0.4 V	CNG35	I_C/I_F	min.	0.1
	CNG36	I_C/I_F	min.	0.2
Leakage current under working voltage 2.5 kV DC value; V_{CC} = 10 V		I_{CEW}	max.	200 nA
Isolation voltage DC		V_{IO}	min.	4.4 kV
Isolation voltage AC (RMS value)		V_{IO}	min.	3.12 kV

MECHANICAL DATA Dimensions in mm

Fig.1 SOT90B.







⊕ Positional accuracy.

Ⓜ Maximum Material Condition.

(1) 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.

(2) When the leads are parallel, the tips are in position for automatic insertion.

RATINGS

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

Diode

Continuous reverse voltage	V_R	max.	5	V
DC forward current	I_F	max.	100	mA
(peak value); T_p = 10 μs; δ = 0.01%	I_{FRM}	max.	2.5	A
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	I_C	max.	100	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	200	mW

Optocoupler

Storage temperature range	T_{stg}		−55 to +150 °C
Junction temperature	T_j	max.	125 °C
Operating ambient temperature range	T_{amb}		−40 to +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	$R_{th\ j\text{-}a}$	=	500 K/W
transistor	$R_{th\ j\text{-}a}$	=	500 K/W
From junction to ambient, device mounted on a printed circuit board			
diode	$R_{th\ j\text{-}a}$	=	400 K/W
transistor	$R_{th\ j\text{-}a}$	=	400 K/W

ISOLATION RELATED VALUES

External air gap (clearance) input terminals to output terminals	L(I01)	min.	7.2 mm
External tracking path (creepage distance) input terminals to output terminals	L(I02)	min.	7.0 mm
Tracking resistance (KB-value)			KB-100/A
Internal plastic gap (clearance) isolation thickness between emitter and receiver		min.	1.0 mm

CHARACTERISTICS

$T_j = 25$ °C unless otherwise specified

Diode

Forward voltage $I_F = 10$ mA	V_F	typ.	1.45 V
		max.	1.75 V
Reverse current $V_R = 5$ V	I_R	max.	10 μA

Transistor

Collector-emitter breakdown voltage open base; $I_C = 1$ mA	$V_{(BR)CEO}$	min.	30 V
Collector-base breakdown voltage open emitter; $I_C = 0.1$ mA	$V_{(BR)CBO}$	min.	70 V
Emitter-collector breakdown voltage open base; $I_E = 0.1$ mA	$V_{(BR)ECO}$	min.	7 V
Collector cut-off current (dark) $V_{CE} = 10$ V	I_{CEO}	typ.	2 nA
		max.	50 nA
$V_{CE} = 10$ V; $T_{amb} = 70$ °C	I_{CEO}	max.	10 μA
$V_{CB} = 10$V	I_{CBO}	max.	20 nA

Optocoupler

Collector current at T_{amb} = 0 °C to 70 °C				
V_F = 0.8 V; V_{CE} = 15 V		$I_{CE(1)}$	max.	15 μA
I_F = 2 mA; V_{CE} = 0.4 V		$I_{CE(2)}$	max.	250 μA
Collector-emitter saturation voltage				
I_F = 10 mA; I_C = 2 mA	CNG35	V_{CEsat}	typ.	0.15 V
			max.	0.4 V
I_F = 10 mA; I_C = 4 mA	CNG36	V_{CEsat}	typ.	0.19 V
			max.	0.4 V
Output capacitance				
V_{CB} = 10 V; f = 1 MHz		$C_{b'c}$	typ.	4.5 pF
Collector current at working voltage V_W = 2.5 kV DC (notes 1 and 2)				
V_{CC} = 10 V; T_j = 25 °C		I_{CEW}	max.	200 nA
V_{CC} = 10 V; T_j = 70 °C		I_{CEW}	max.	5 μA
Isolation voltage DC		V_{IO}	min.	4.4 kV
(note 3) t = 1 min; AC (RMS value)			min.	3.12 kV
Capacitance between input and output				
V = 0; f = 1 MHz		C_{io}	typ.	0.6 pF
			max.	1.3 pF
Insulation resistance between input and output				
± V_{IO} = 500 V		R_{IO}	min.	1 TΩ
			typ.	10 TΩ
Switching times (see Figs 3 and 4)				
I_C = 2 mA; V_{CC} = 5 V; R_L = 100 Ω				
Turn-on time	CNG35	t_{on}	typ.	3 μs
			max.	20 μs
Turn-off time		t_{off}	typ.	3 μs
			max.	20 μs
I_C = 2 mA; V_{CC} = 5 V; R_L = 1 kΩ				
Turn-on time	CNG35	t_{on}	typ.	12 μs
			max.	50 μs
Turn-off time		t_{off}	typ.	12 μs
			max.	50 μs
I_C = 2 mA; V_{CC} = 5 V; R_L = 100 Ω				
Turn-on time	CNG36	t_{on}	typ.	8 μs
			max.	20 μ
Turn-off time		t_{off}	typ.	6 μs
			max.	20 μs
I_C = 2 mA; V_{CC} = 5 V; R_L = 1 kΩ				
Turn-on time	CNG36	t_{on}	typ.	20 μs
			max.	50 μs
Turn-off time		t_{off}	typ.	18 μs
			max.	50 μs

Notes

1. This parameter is the maximum collector-emitter leakage current measured when a high voltage is applied between the emitter and the two shorted diode leads.
2. As quality assurance (on a sample basis), these parameters are covered by a 1000 hour reliability test.
3. Every single product is tested by applying an isolation test voltage of 3750 V (RMS) for 2 seconds between the shorted input (diode) leads and the shorted output (phototransistor) leads, with a detection current of about 1 μA.

			CNG35	CNG36
DC current transfer ratio (CTR)		min.	0.4	0.8
I_F = 10 mA; V_{CE} = 0.4 V	I_C/I_F	typ.	0.7	1.0
		max.	1.6	2.0
I_F = 2 mA; V_{CE} = 0.4 V	I_C/I_F	typ.	0.9	1.4
I_F = 0.5 mA; V_{CE} = 0.4 V	I_C/I_F	min.	0.1	0.2
		typ.	0.5	0.8
I_F = 2 mA; V_{CE} = 5 V	I_C/I_F	min.	0.3	0.3

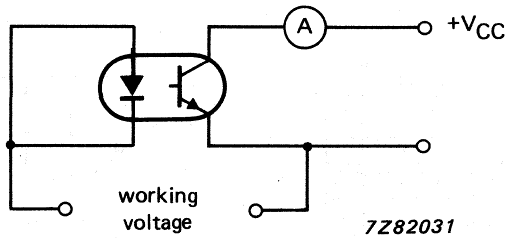


Fig.2.

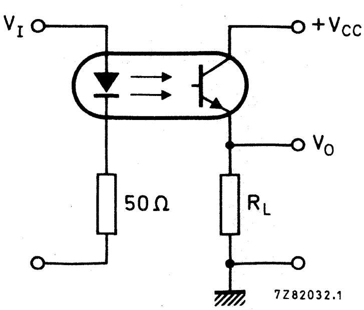


Fig.3 Switching circuit.

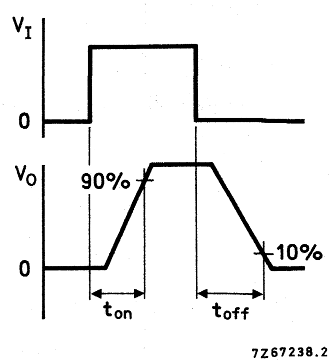


Fig.4 Waveforms.

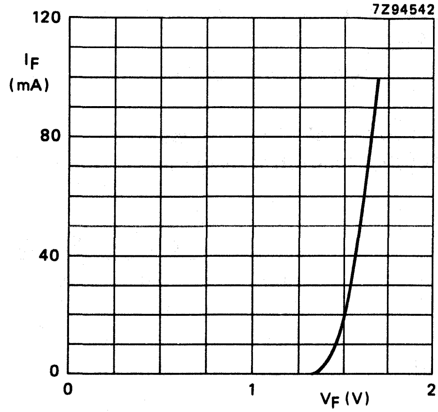


Fig. 5 T_{amb} = 25 °C; typical values.

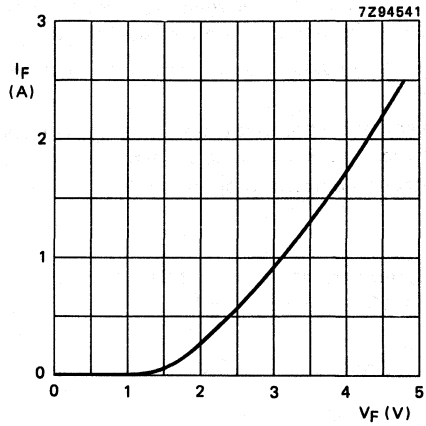


Fig. 6 T_{amb} = 25 °C; t_p = 10 μs; T = 1 ms; typical values.

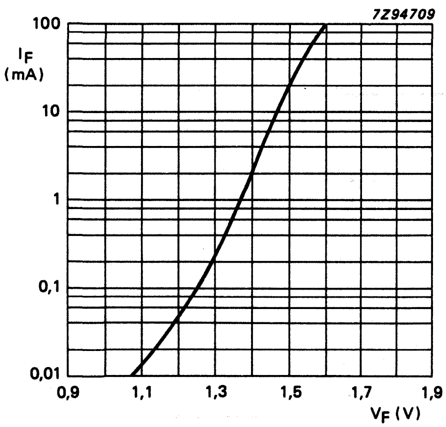


Fig. 7 T_{amb} = 25 °C; typical values.

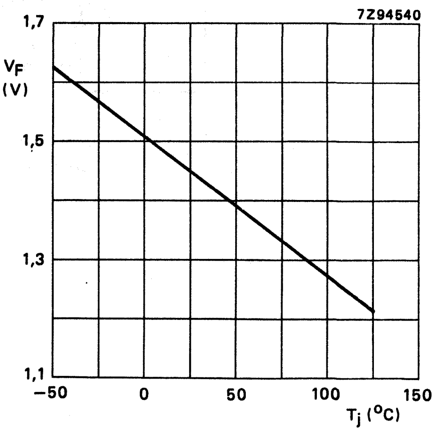


Fig. 8 I_F = 10 mA; typical values.

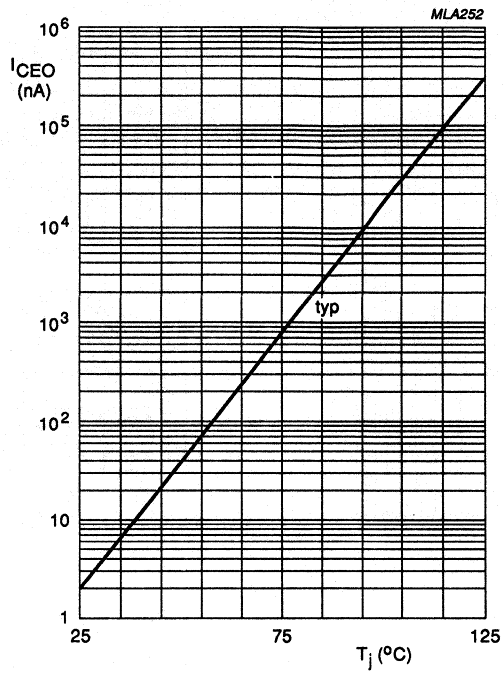


Fig. 9 $I_F = 0$; $V_{CE} = 10$ V, typical values.

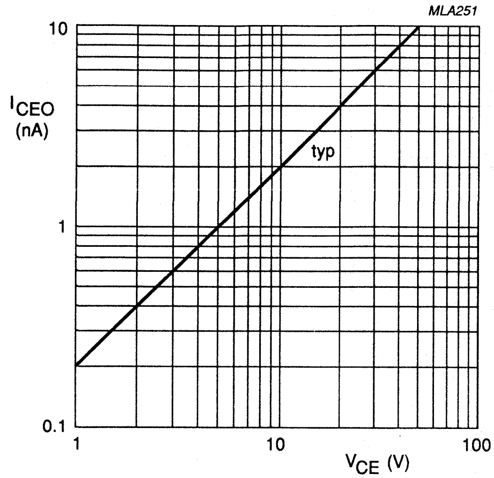


Fig. 10 $I_F = 0$; $T_j = 25\ ^oC$; typical values.

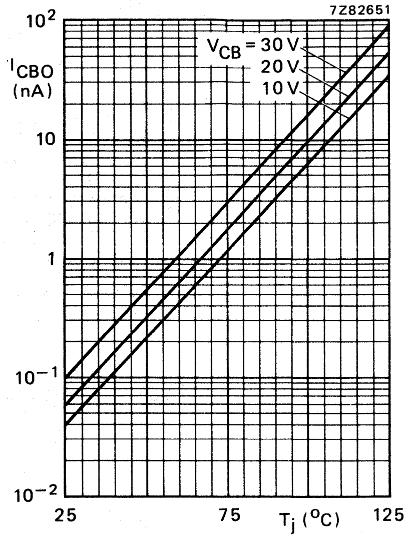


Fig. 11 Typical values.

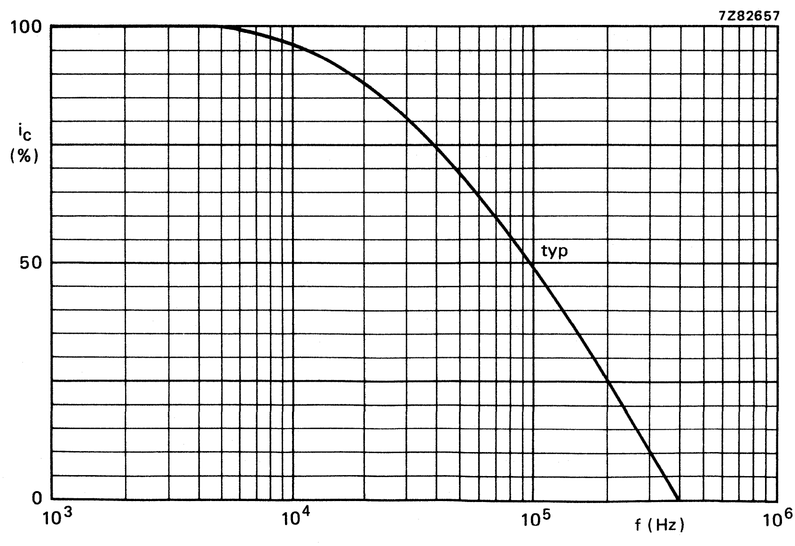


Fig. 12 $I_B = 0$; $I_C = 2\ mA$; $V_{CC} = 5\ V$; $R_L = 1\ k\Omega$; $T_{amb} = 25\ ^oC$.

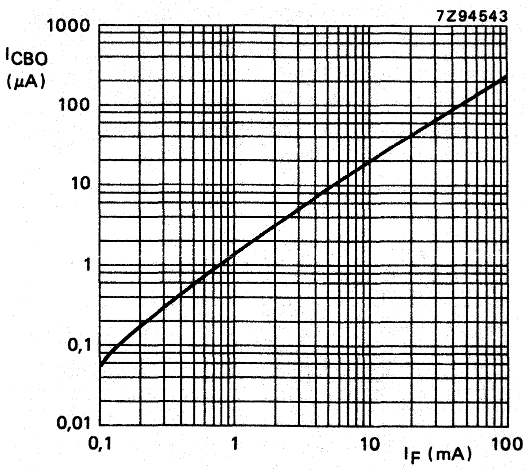


Fig. 13 V_{CB} = 5 V; T_{amb} = 25 °C; typical values.

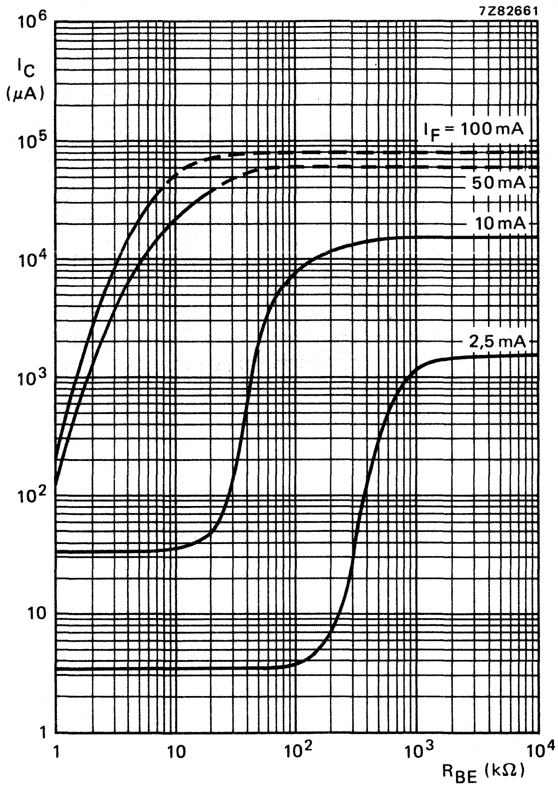


Fig. 14 $I_B = 0$; $V_{CE} = 5$ V; $T_{amb} = 25$ °C; typical values.

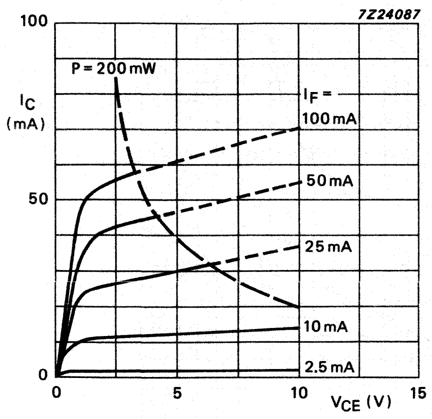


Fig.15 Collector current as a function of collector-emitter voltage; T_{amb} = 25 °C; typical values; **CNG35**.

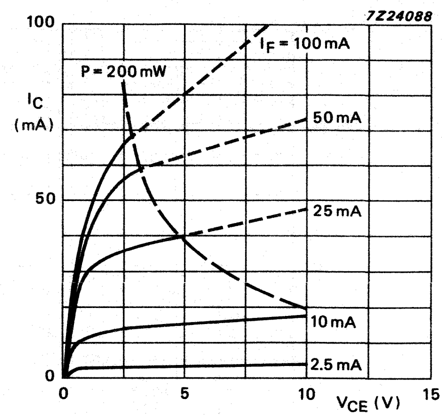


Fig.16 Collector current as a function of collector-emitter voltage; T_{amb} = 25 °C; typical values; **CNG36**.

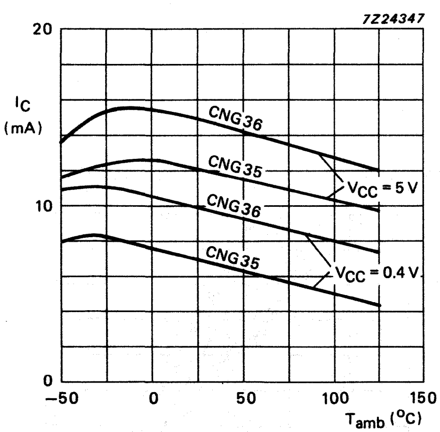


Fig.17 Collector current as a function of ambient temperature; I_F = 10 mA; typical values.

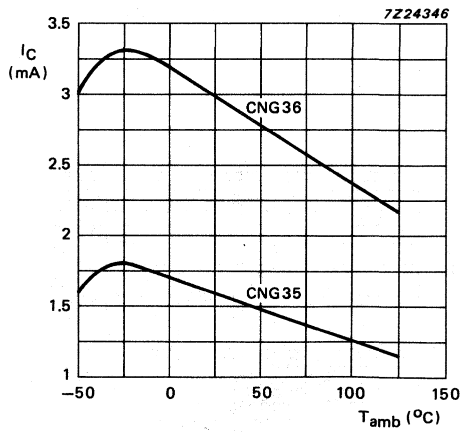


Fig.18 Collector current as a function of ambient temperature; I_F = 2 mA; V_{CE} = 0.4 V; typical values.

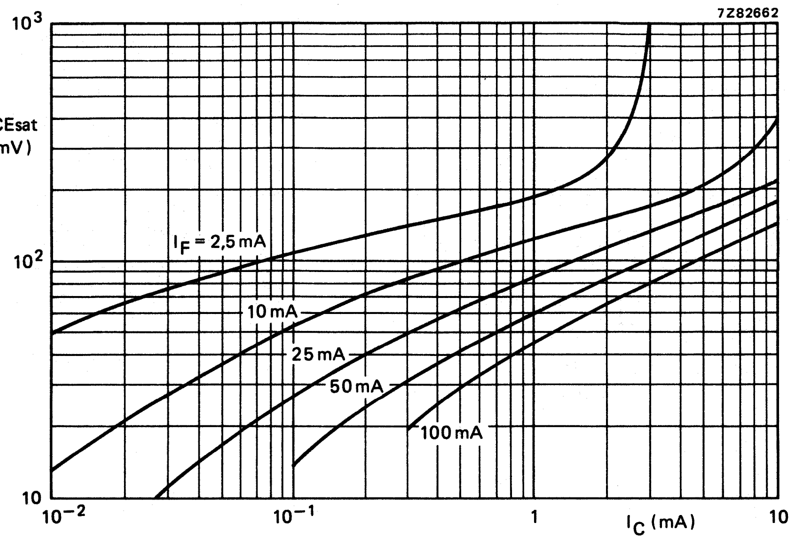


Fig.19 Collector-emitter saturation voltage as a function of collector current; $I_B = 0$; $T_{amb} = 25\ ^oC$; typical values.

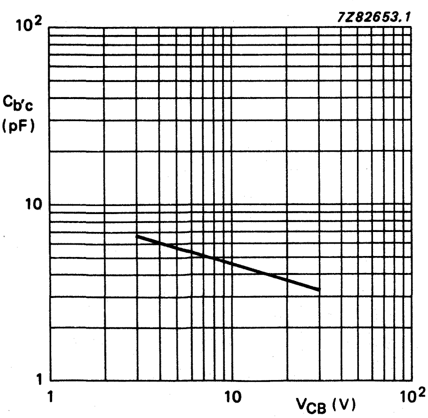


Fig.20 Output capacitance as a function of base-collector voltage; f = 1 MHz; $T_{amb} = 25\ ^oC$.

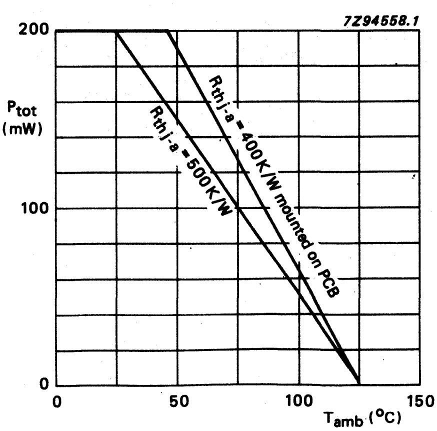


Fig.21 Total power dissipation as a function of ambient temperature.

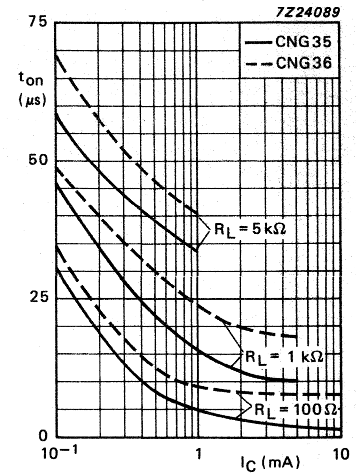


Fig.22 Turn-on time as a function of collector current; $I_B = 0$; $V_{CC} = 5$ V; $T_{amb} = 25$ °C; typical values.

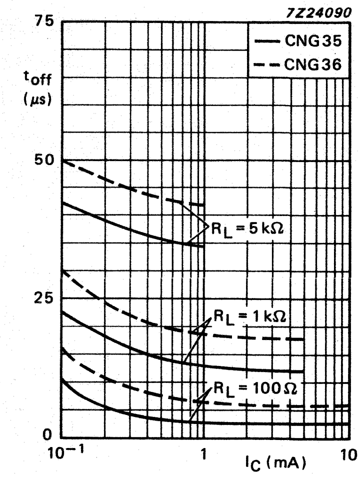


Fig.23 Turn-off time as a function of collector current; $I_B = 0$; $V_{CC} = 5$ V; $T_{amb} = 25$ °C; typical values.

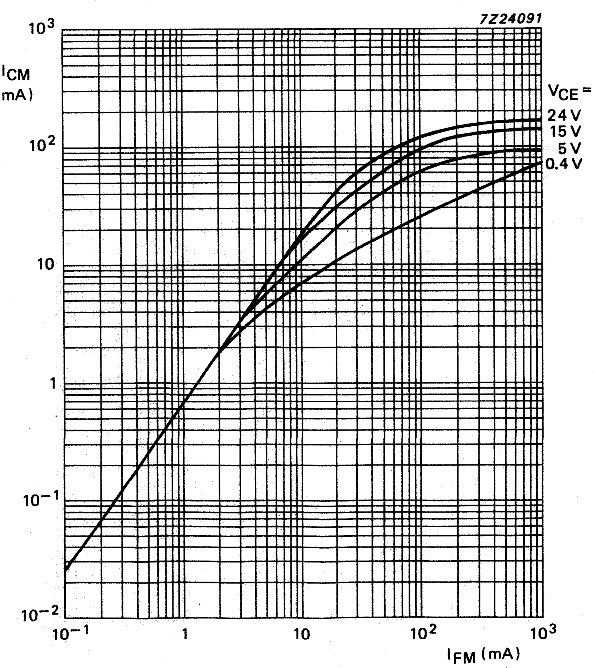


Fig.24 Maximum collector current as a function of maximum forward current; $T_{amb} = 25$ °C; $t_p = 10$ μs; T = 1 ms; typical values; **CNG35**.

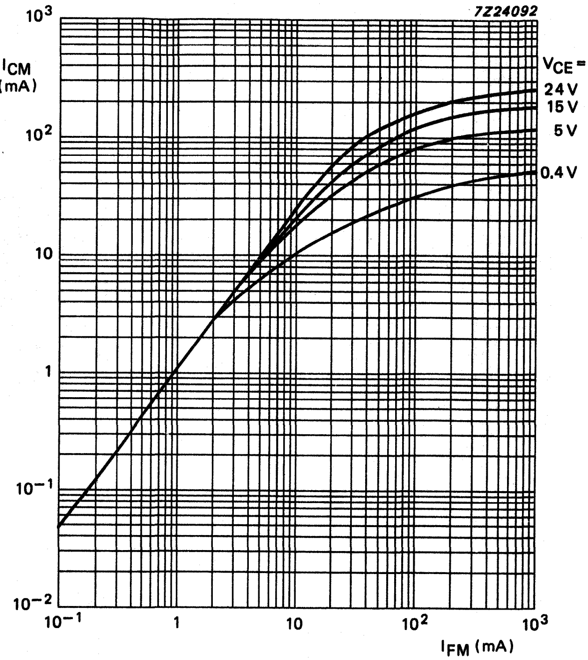


Fig.25 Maximum collector current as a function of maximum forward current; T_{amb} = 25 °C; t_p = 10 μs; T = 1 ms; typical values; **CNG36**.

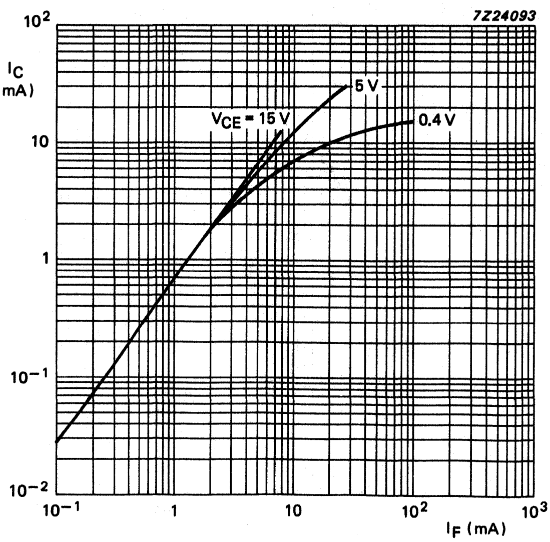


Fig.26 Collector current as a function of forward current; T_{amb} = 25 °C; typical values; **CNG35**.

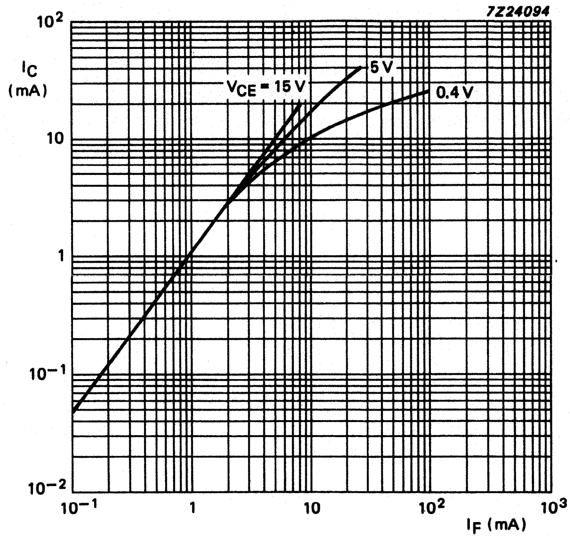


Fig.27 Collector current as a function of forward current; T_{amb} = 25 °C; typical values; **CNG36.**

GaAlAs high-voltage optocouplers

CNG82/CNG83

FEATURES

- High output/input current transfer ratio at low input current
- High degree of AC and DC insulation (3750 V (RMS) and 5300 V (DC))
- Input/output pin distance 10.16 mm
- Low saturation voltage.

DESCRIPTION

The CNG82 and CNG83 are optically coupled isolators consisting of an infrared emitting GaAlAs diode and a silicon npn phototransistor with accessible base, in a dual-in-line (DIL) SOT212 envelope and designed for low input current and long life operation. The base of the phototransistor is unconnected for the CNG82 and connected for the CNG83.

The application of an IR emitting diode, manufactured in a special GaAlAs process results in a good linearity at low input currents and a low degradation during the device's operating life.

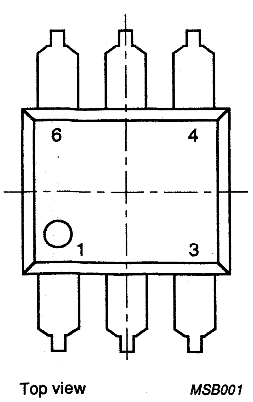


Fig.1 Simplified outline.

APPROVALS

STANDARD	REFERENCE
UL	Covered under UL component recognition FILE E90700
BSI	Certification in accordance with BS415:1990; Class II applications
VDE	Approved in accordance with VDE 0883/6.80 Reference voltage (VDE 0110b Tab 4): 500 V (AC)/600 V (DC) (isolation group C) Complied for reinforced isolation at 250 V (AC) with: DIN 57804/VDE 0804/1.83 (isolation group C) DIN VDE 0860/8.86/HD 195 S4

PINNING - CNG82

PIN	DESCRIPTION
1	anode
2	cathode
3	not connected
4	emitter
5	collector
6	not connected

PINNING - CNG83

PIN	DESCRIPTION
1	anode
2	cathode
3	not connected
4	emitter
5	collector
6	base

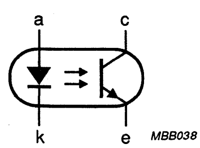


Fig.2 Symbol, CNG82.

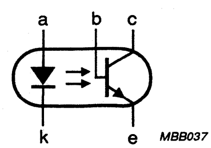


Fig.3 Symbol, CNG83.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Diode					
V_R	continuous reverse voltage		–	5	V
I_F	forward current	DC value	–	100	mA
I_{FRM}	forward current	peak value; t_{on} = 10 μs; δ = 0.01	–	3	A
P_{tot}	total power dissipation when mounted on PCB	up to T_{amb} = 25 °C	–	200	mW
Transistor					
V_{CEO}	collector-emitter voltage	open base	–	50	V
P_{tot}	total power dissipation when mounted on PCB	up to T_{amb} = 25 °C	–	200	mW
Optocoupler					
I_C/I_F	DC current transfer ratio (CTR)	I_F = 10 mA; V_{CE} = 0.4 V	0.4	1.6	
		I_F = 0.5 mA; V_{CE} = 0.4 V	0.1	–	
I_{CEW}	collector cut-off current (dark)	V_W = 2.5 kV (DC); V_{CC} = 10 V; I_F (diode) = 0; see Fig.4	–	200	nA
$V_{CE\ sat}$	collector-emitter saturation voltage	I_F = 10 mA; I_C = 4 mA	–	0.4	V

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Diode					
V_R	continuous reverse voltage		–	5	V
I_F	forward current	DC value	–	100	mA
I_{FRM}	forward current	peak value; t_{on} = 10 µs; δ = 0.01	–	3	A
P_{tot}	total power dissipation when mounted on PCB	up to T_{amb} = 25 °C	–	200	mW
Transistor					
V_{CBO}	collector-base voltage (CNG83 only)		–	70	V
V_{CEO}	collector-emitter voltage	open base	–	50	V
V_{ECO}	emitter-collector voltage		–	7	V
I_C	collector current	DC value	–	100	mA
P_{tot}	total power dissipation when mounted on PCB	up to T_{amb} = 25 °C	–	200	mW
Optocoupler					
T_{stg}	storage temperature range		–55	150	°C
T_{amb}	ambient operating temperature range		–40	100	°C
T_j	junction temperature		–	125	°C
T_{sld}	soldering temperature up to the seating plane	T_{sld} < 10 s	–	260	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	MAX.	UNIT
Diode			
$R_{th\ j\text{-}a}$	from junction to ambient in free air	500	K/W
$R_{th\ j\text{-}a}$	from junction to ambient when mounted on PCB	400	K/W
Transistor			
$R_{th\ j\text{-}a}$	from junction to ambient in free air	500	K/W
$R_{th\ j\text{-}a}$	from junction to ambient when mounted on PCB	400	K/W

ISOLATION RELATED VALUES

SYMBOL	PARAMETER	CONDITIONS	MIN.	UNIT
L(IO1)	external air gap (clearance)	between input and output terminals	9.6	mm
L(IO2)	external tracking path (creepage distance)	between input and output terminals	7	mm
	internal plastic gap (clearance)	isolation thickness between emitter and receiver	1	mm

CLASSIFICATION CATEGORIES

Tracking resistance	KB-100/A

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETERS	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Diode						
V_F	forward voltage	I_F = 10 mA	–	1.45	1.75	V
I_R	reverse current	V_R = 5 V	–	–	10	μA
Transistor						
$V_{(BR)CEO}$	collector-emitter breakdown voltage	I_C = 1 mA	50	–		V
$V_{(BR)CBO}$	collector-base breakdown voltage (CNG83 only)	I_C = 0.1 mA	70	–	–	V
$V_{(BR)ECO}$	emitter-collector breakdown voltage	I_E = 0.1 mA	7	–	–	V
I_{CEO}	collector cut-off current (dark)	I_F = 0; V_{CE} = 10 V	–	2	50	nA
		V_{CE} = 10 V; T_{amb} = 70 °C	–	–	10	μA
I_{CBO}	collector cut-off current (dark) (CNG83 only)	V_{CB} = 10 V	–	–	20	nA
Optocoupler						
I_C/I_F	DC current transfer ratio (CTR)	I_F = 10 mA; V_{CE} = 0.4 V	0.4	–	1.6	
		I_F = 0.5 mA; V_{CE} = 0.4 V	0.1	–	–	
$I_{CE(L)}$	collector cut-off current (light)	T_{amb} ≤ 70 °C; V_F = 0.8 V; V_{CE} = 15 V	–	–	15	μA
		T_{amb} ≤ 70 °C; I_F = 2 mA; V_{CE} = 0.4 V	250	–	–	μA
$V_{CE\ sat}$	collector-emitter saturation voltage	I_F = 10 mA; I_C = 4 mA	–	0.19	0.4	V
C_{bc}	collector capacitance (CNG83 only)	V_{CB} = 10 V; f = 1 MHz	–	4.5	–	pF
I_{CEW}	collector cut-off current (dark)	V_W = 2.5 kV (DC); V_{CC} = 10 V; T_j = 25 °C; notes 1 and 2 and Fig.4	–	–	200	nA
		V_W = 2.5 kV (DC); V_{CC} = 10 V; T_j = 70 °C; notes 1 and 2 and Fig. 4	–	–	2	μA

SYMBOL	PARAMETERS	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Optocoupler						
C_{IO}	capacitance between input and output	V = 0; f = 1 MHz	–	0.6	1.3	pF
R_{IO}	insulation resistance between input and output	V_{IO} = ±500 V	1	10	–	TΩ
Switching times (see Figs 5 and 6)						
t_{on}	turn-on time	I_C = 2 mA; V_{CC} = 5 V; R_L = 100 Ω	–	3	–	µs
		I_C = 2 mA; V_{CC} = 5 V; R_L = 1 kΩ	–	12	–	µs
t_{off}	turn-off time	I_C = 2 mA; V_{CC} = 5 V; R_L = 100 Ω	–	3	–	µs
		I_C = 2 mA; V_{CC} = 5 V; R_L = 1 kΩ	–	12	–	µs

Notes

1. This parameter is the maximum collector-emitter leakage current measured when a high voltage is applied between the shorted diode leads and the transistor emitter.
2. For quality assurance, the two parameters are tested on a sample basis for 1000 hours.
3. Every product is tested by applying an isolation test voltage of 4500 V (RMS) for 2 s between all shorted input side leads and all shorted output side leads, with a detection current of approximately 1 µA.

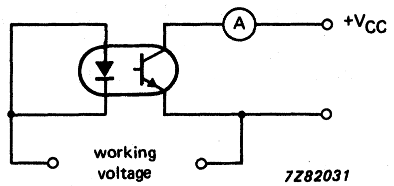


Fig.4 Test circuit.

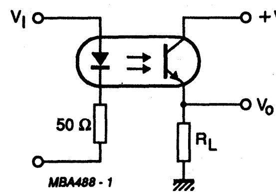


Fig.5 Switching circuit.

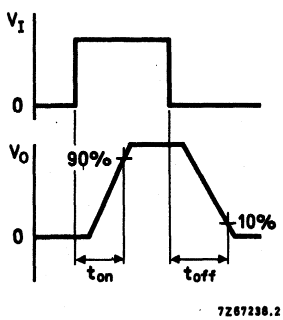
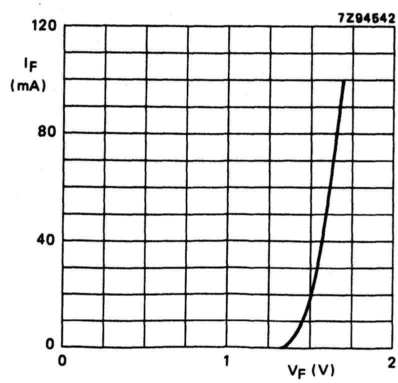
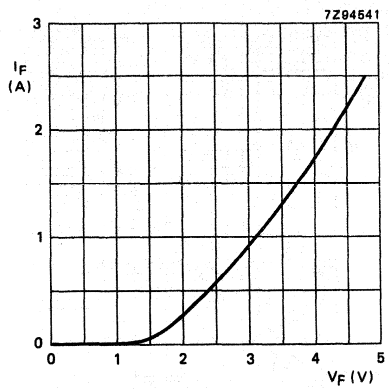


Fig.6 Waveforms.



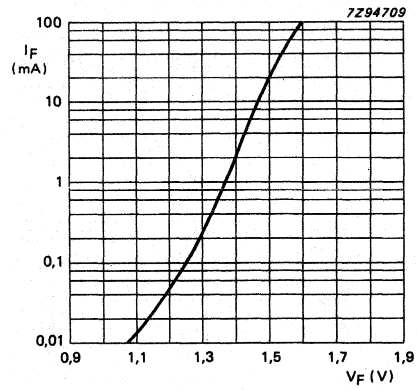
T_{amb} = 25 °C.

Fig.7 Forward current as a function of forward voltage, typical values.



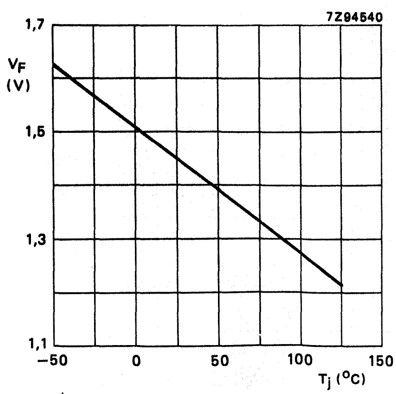
T_{amb} = 25 °C; t_p = 1 ms.

Fig.8 Forward current as a function of forward voltage, typical values.



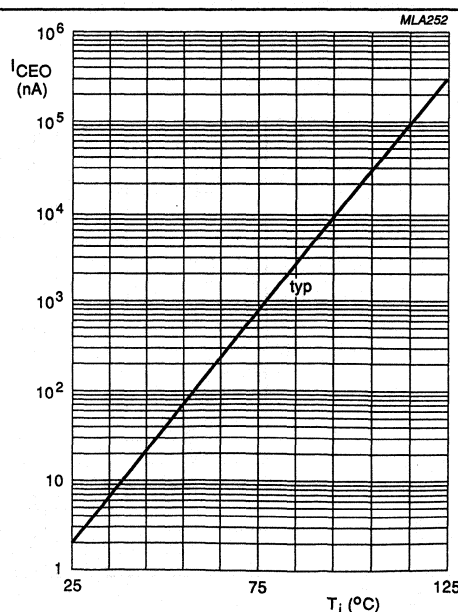
T_{amb} = 25 °C.

Fig.9 Forward current as a function of forward voltage, typical values.



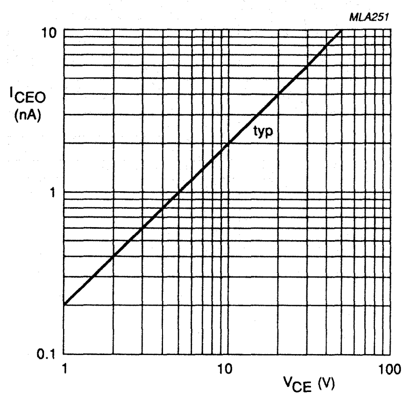
I_F = 10 mA.

Fig.10 Forward voltage as a function of temperature, typical values.



I_F = 0; V_{CE} = 10 V.

Fig.11 Collector cut-off current as a function of temperature.



$I_F = 0$; $T_{amb} = 25$ °C.

Fig.12 Collector cut-off current as a function of collector-emitter voltage, typical values.

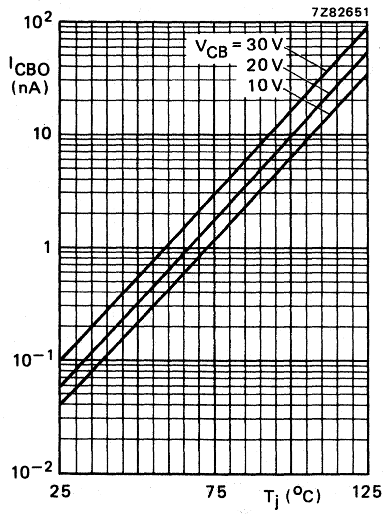
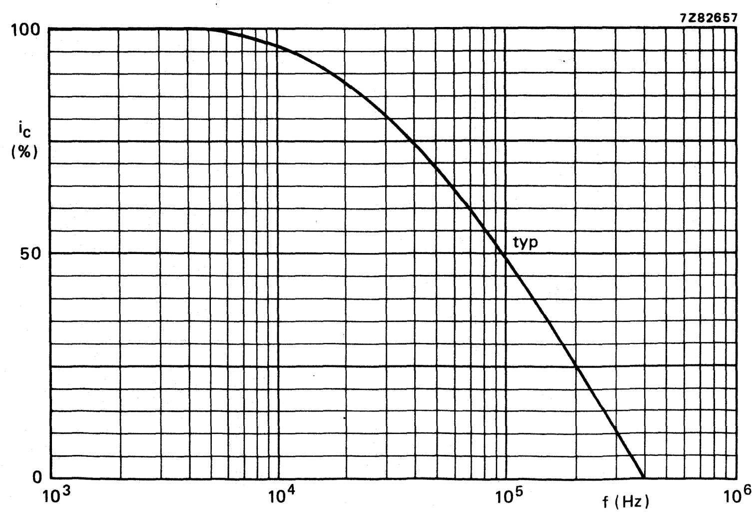
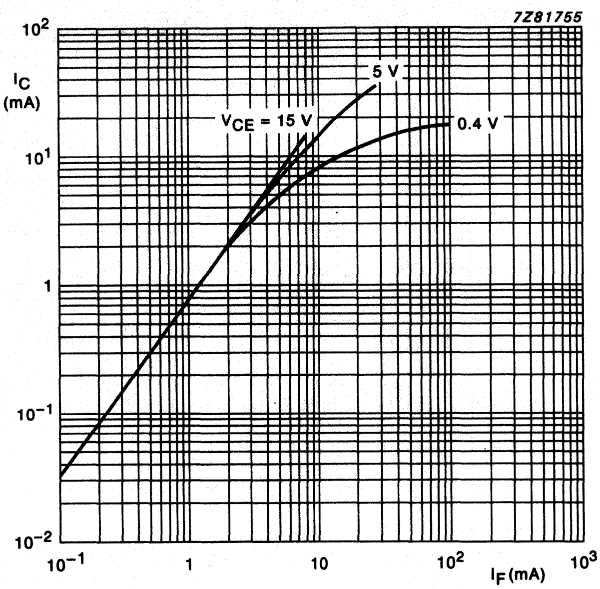


Fig.13 Collector-base cut-off current as a function of junction temperature, CNG83.



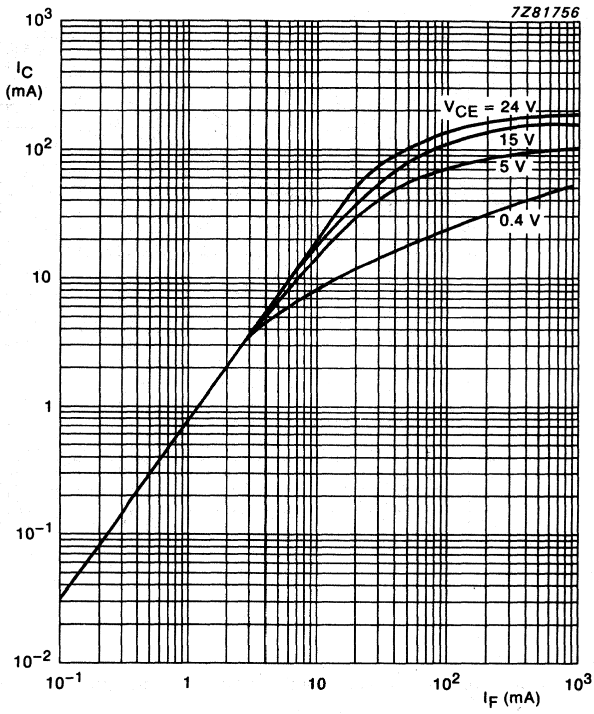
$I_B = 0$; $I_C = 2$ mA; $V_{CC} = 5$ V; $R_L = 1$ kΩ; $T_{amb} = 25$ °C.

Fig.14 Frequency response curve.



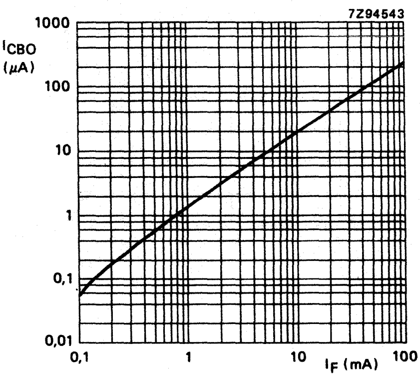
T_{amb} = 25 °C.

Fig.15 Collector current as a function of forward current, typical values.



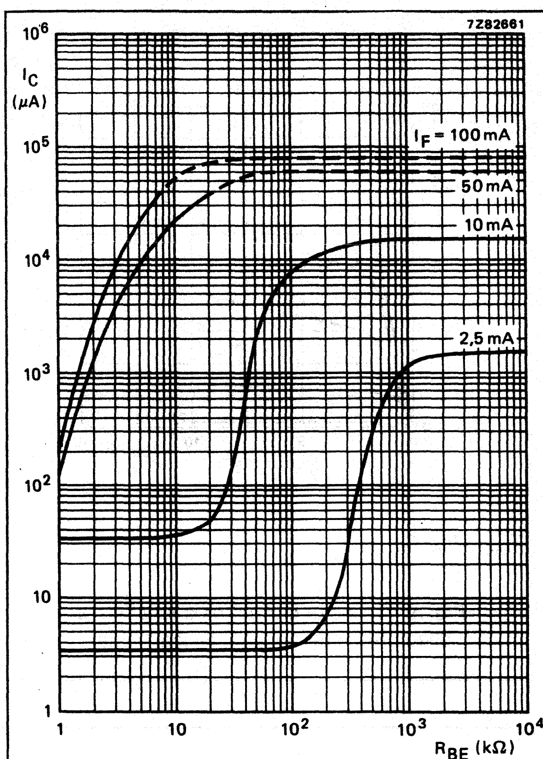
T_{amb} = 25 °C; t_p = 10 μs; t = 1 ms.

Fig.16 Maximum collector current as a function of maximum forward current, typical values.



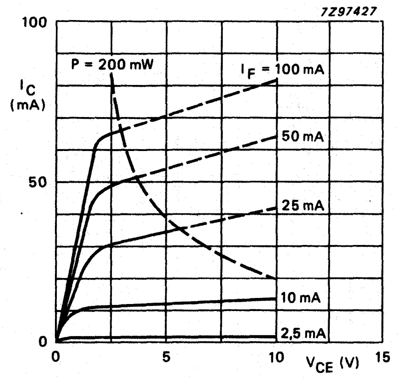
V_{CB} = 5 V; T_{amb} = 25 °C.

Fig.17 Collector-base current as a function of forward current, CNG83; typical values.



I_B = 0; V_{CE} = 5 V; T_{amb} = 25 °C.

Fig.18 Collector current as a function of base-emitter resistance, CNG83; typical values.



T_{amb} = 25 °C.

Fig.19 Collector current as a function of collector-emitter voltage, typical values.

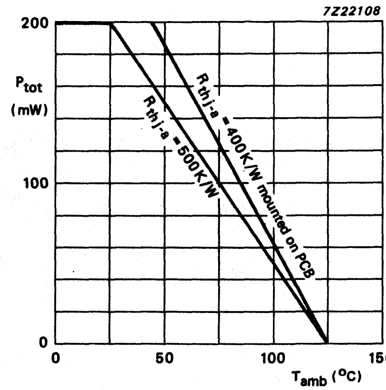
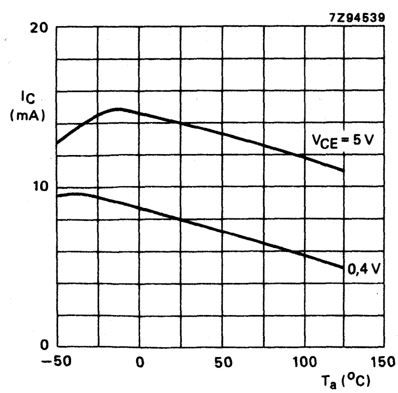
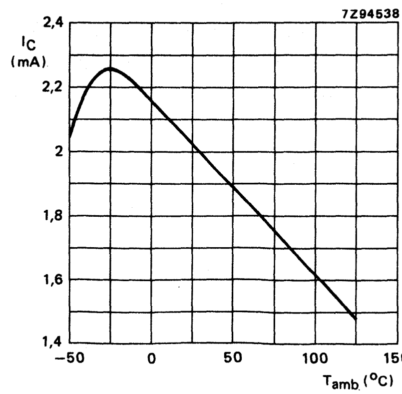


Fig.20 Total power dissipation as a function of ambient temperature.



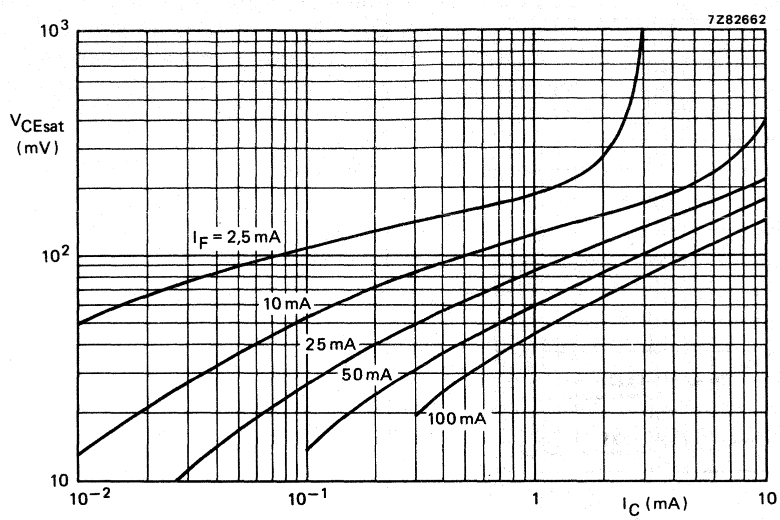
I_F = 10 mA.

Fig.21 Collector current as a function of ambient temperature, typical values.



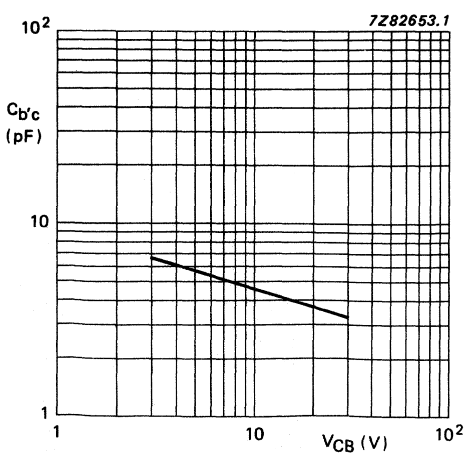
I_F = 2 mA; V_{CE} = 0.4 V.

Fig.22 Collector current as a function of ambient temperature, typical values.



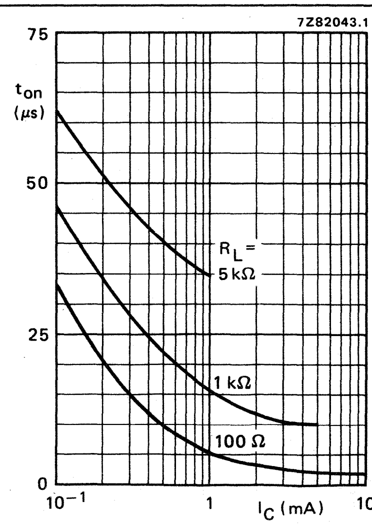
I_B = 0; T_{amb} = 25 °C.

Fig.23 Collector-emitter saturation voltage as a function of collector current, typical values.



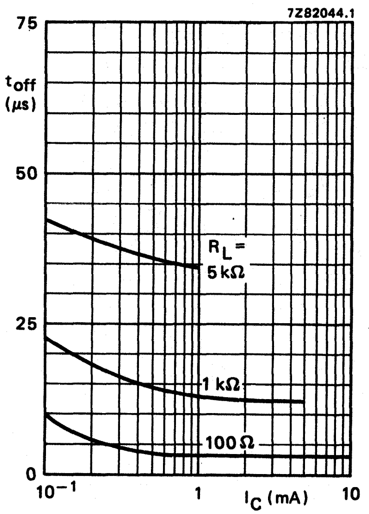
f = 1 MHz; T_{amb} = 25 °C.

Fig.24 Collector capacitance as a function of collector-base voltage, CNG83.



I_B = 0; V_{CC} = 5 V; T_{amb} = 25 °C.

Fig.25 Turn-on time as a function of collector current.



$I_B = 0$; $V_{CC} = 5$ V; $T_{amb} = 25$ °C.

Fig.26 Turn-off time as a function of collector current.

Dedicated IC-optocoupler CNR50

FEATURES

- A cost effective optocoupler with integrated additional functions
- A wide body DIL 8 encapsulation with a pin distance of 10.16 mm
- A clearance of 9.6 mm minimum and a creepage of 10 mm minimum
- High degree of AC and DC insulation (5000 V (RMS) and 7070 V (DC))
- Maximum permissible voltage of 8000 V (peak) and maximum operating isolation voltage of 1000 V (RMS) in accordance with VDE 0884.

DESCRIPTION

The CNR50 is an optocoupler specifically designed for use as a cost-effective integrated feed-back loop element in Self Oscillation Power Supplies (SOPS).

It consists of an infra-red emitting GaAlAs diode and an integrated photodetector circuit in an 8-pin dual-in-line (DIL) SOT271 wide body envelope, providing high isolation voltage, creepage and clearance distances.

The photodetector circuit incorporates a low-current initialization circuit, an under-voltage detection comparator and a starting current generator.

The CNR50 can operate in SOPS circuits either using discrete components, or with a dedicated control IC : TDA8385.

APPROVALS

STANDARD	REFERENCE
UL	Covered under UL component recognition FILE E90700
BSI	Certification in accordance with BS415:1990; BS7002:1989; BS5301:1982 for class II applications
NORDIC	Tested for applications (reinforced isolation); Class II applications for pluggable apparatus in normal tight execution
SETI	In accordance with IEC 65, 380, 950 & 335
SEMKO	In accordance with IEC 65, 380, 950 & 335
NEMKO	In accordance with IEC 65, 380, 950 & 335
DEMKO	In accordance with IEC 65, 380, 950 & 335
VDE	VDE 0884/0804/0860/0805/0806/750-1/IEC 950

Dedicated IC-optocoupler CNR50

PINNING - SOT271

PIN	DESCRIPTION
1	not connected
2	anode
3	cathode
4	not connected
5	ground
6	V_{OUT}
7	V_{IN}
8	V_{CC}

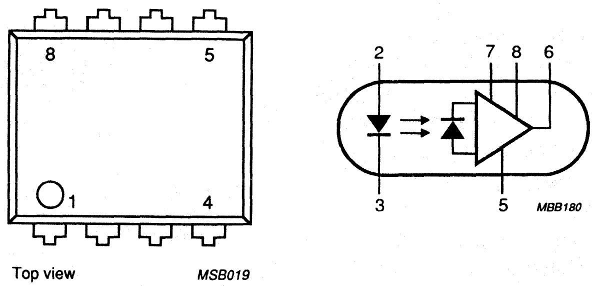


Fig.1 Simplified outline and symbol.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Diode					
I_F	forward current	DC value	–	60	mA
V_R	reverse voltage	DC value	–	5	V
Photodetector					
I_{OUT}	output current	t_p = 3 μs; δ = 0.1	–	2	A
V_{CC}	supply voltage		–	18	V
Optocoupler					
V_{IO}	isolation voltage	(UL/IEC/BSI)			
		DC value	–	7.07	kV
		RMS value	–	5	kV
V_{Tr}	maximum permissible overvoltage	peak value (VDE 0884)	8000	–	V
V_{IORM}	maximum operating isolation voltage	RMS value (VDE 0884)	–	1000	V
SWITCHING TIMES					
t_{PHL}	propagation switching time from high to low level output		–	0.5	μs
t_{PLH}	propagation switching time from low to high level output		–	1	μs

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Diode					
I_F	forward current	DC value	–	60	mA
V_R	reverse voltage	DC value	–	5	V
P_{tot}	total power dissipation	T_{amb} = 25 °C	–	200	mW
Photodetector					
I_{OUT}	output current range (output transistor on)	DC value	0	100	mA
		peak value; t_p = 3 µs; δ = 0.1	0	2	A
V_{CC}	supply voltage range	V_{source}	–0.5	18	V
V_{OUT}	output voltage range		–0.5	18	V
V_{IN}	input voltage range (input undervoltage)	V_{IN} - V_{CC} < = 0.5 V	–0.5	18	V
Optocoupler					
T_{stg}	storage temperature range		–55	150	°C
T_{amb}	ambient operating temperature range		0	70	°C
T_{sld}	soldering temperature up to the seating plane	T_{sld} < 10 s	–	260	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	MAX.	UNIT
Diode			
$R_{th\ j\text{-}a}$	from junction to ambient in free air	500	K/W
$R_{th\ j\text{-}a}$	from junction to ambient when mounted on PCB	400	K/W
Transistor			
$R_{th\ j\text{-}a}$	from junction to ambient in free air	500	K/W

ISOLATION RELATED VALUES

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
L(IO1)	external air gap (clearance)	between input and output terminals	9.6	–	–	mm
L(IO2)	external tracking path(creepage distance)	between input and output terminals	10	–	–	mm
	internal plastic gap (clearance)	isolation thickness between emitter and receiver	1	–	–	mm
C_{io}	capacitance input to output	V_{IO} = 0; f = 1 MHz	–	0.4	0.6	pF

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
R_{IO}	insulation resistance input to output	V_{IO} = ±500 V at 25 °C	10^{12}	10^{13}	–	Ω
		V_{IO} = ±500 V at 100 °C	10^{11}	–	–	Ω
		V_{IO} = ±500 V at 150 °C (T_{si} max.)	10^{9}	–	–	Ω
V_{IO}	isolation voltage (for UL 1577, IEC, BSI)	DC value; t = 1 min (note 1)	7.07	–	–	kV
		RMS value; t = 1 min (note 1)	5	–	–	kV
V_{IORM}	maximum operating isolation voltage	RMS value; VDE 0884	1000	–	–	V
V_{Pr}	partial discharge test voltage	RMS value; VDE 0884; V_{Pr} = 1.6 x V_{IORM} for t_p = 1 s; P_d < 5 pC (note 2, Fig.10, procedure 'b')	1600	–	–	V
		RMS value VDE 0884; V_{Pr} = 1.2 x V_{IORM} for t_p = 60 s; P_d < 5 pC (note 3, Fig.11, procedure 'a')	1200	–	–	V
V_{Tr}	maximum permissible overvoltage	peak value; VDE 0884; t_{Tr} = 10 s (note 3, Fig.11, procedure 'a')	8000	–	–	V
Maximum safety ratings (maximum permissible in case of fault) (Note 4 and Fig.9)						
T_{si}	package temperature		–	–	150	°C
I_{si}	input current I_F	P_{si} = 0	–	–	400	mA
P_{si}	total power dissipation		–	–	700	mW

Notes

1. Every product is tested by applying an isolation test voltage of 6000 V (RMS) for 2 seconds, between all shorted input side leads and all shorted output side leads, with a detection current of approximately 1 µA. Test at 5000 V (RMS) for 1 min is performed by sampling.
2. Every product is tested by applying a partial discharge test voltage of 1600 V (RMS) for 1 second, between all shorted input side leads and all shorted output side leads, with a maximum partial discharge of 5 pC (see test procedure 'b', Fig.10)
3. Test procedure 'a' is performed by sampling (see Fig.11)
4. Isolation characteristics are guaranteed only within the maximum ratings that must be ensured by protective circuits in application.

CLASSIFICATION CATEGORIES

Installation category for rated line voltages ≤600 V (RMS)	DIN VDE 0109, Dec. 83, tab 1: I-IV
Installation category for rated line voltages ≤1000 V (RMS)	DIN VDE 0109, Dec. 83, tab 1: I-III
IEC climatic category	DIN IEC 68, part 1/0980: 55/100/21
Pollution degree	DIN VDE 0109, Dec. 83: 2
Comparative tracking index (CTI)	DIN IEC 112/VDE 0303, part 1: 175
Material group	DIN VDE 0109: IIIa

FUNCTIONAL DESCRIPTION (Fig.2)

The CNR50 provides the turn-off pulses to the power switching transistor of the SOPS. Under normal operation conditions, these turn-off pulses are controlled by the diode forward current.

The IC-photodetector comprises:

1. An internal supplies block:

   This block provides internally stabilized voltage/current supplies to the other blocks.

2. An initialization block:

   As the circuit is intended to be used on the primary side of the power supply, it should be supplied by a take-over winding on the transformer.

   To initialize the operation, a high ohmic resistor between the rectified mains voltage and the supply (V_{CC}) connection of the IC will slowly charge the capacitor connected to this pin. When the voltage exceeds the initialization level of typically 15.3 V, the circuit starts up.

   When the voltage on the V_{CC} pin drops below typically 3.9 V, the circuit abruptly shuts down.

   During the initialization phase (1.5 V < V_{CC} < 15.3 V), the optocoupler is in "output on" state.

3. A photodetector block:

   When current (5 mA minimum) is fed into the infra-red emitter; the light produced is transformed into a current through the photodiode. This current is then fed into a transimpedance amplifier.

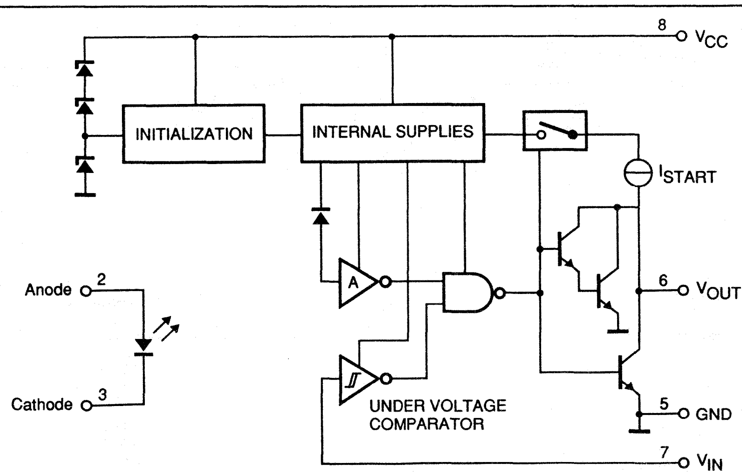


Fig.2 Functional diagram.

The collector output of the IC is turned on when the infra-red emitter is conducting.

4. An under voltage comparator:

The V_{IN} voltage is fed into a Schmitt trigger. When V_{IN} becomes lower than typically 2.35 V, the output of the IC is turned on. The output is switched off again when V_{IN} exceeds typically 2.9 V.

If V_{IN} is below 2.9 V during the initializing phase, the output will remain "on" after initialization, unless V_{IN} rises above 2.9 V.

5. An ISTART block:

A starting current of min. 1 mA is fed to the output, to enable the start up of the SOPS after the initializing phase.

If the output is active (on), the starting current will be blocked.

6. An output stage:

The output stage comprises a Darlington in parallel with a transistor. This configuration enables a high current capability together with a low saturation voltage for low output currents.

During the initialization phase $V_{CC} \geq 1.5$ V, the output stage will be active (on).

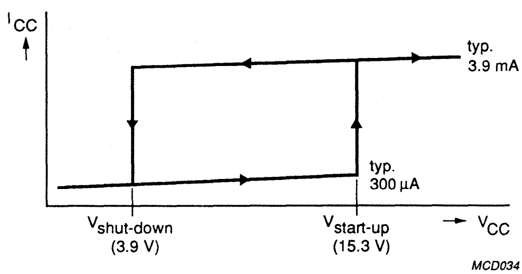


Fig.3 Initialization waveform.

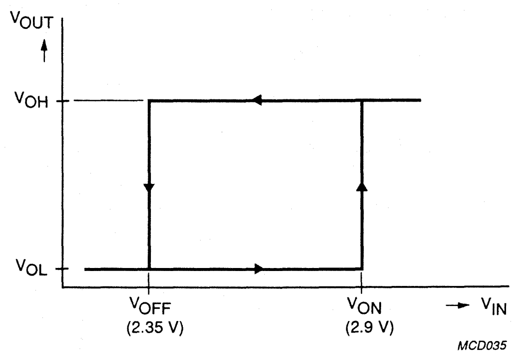


Fig.4 Comparator waveform.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Diode						
V_F	forward voltage	I_F = 10 mA	1.2	1.5	1.9	V
		I_F = 5 mA	–	1.45	–	V
I_R	reverse current	V_R = 5 V	–	–	10	µA
C_d	diode capacitance	V_D = 0; f = 1 MHz	–	200	–	pF
Initialization/supply						
V_{START}	start-up voltage		13.5	15.3	15.5	V
V_{STOP}	shut-down voltage		3.4	3.9	4	V
V_{START}/V_{STOP}	start/stop ratio		3.6	3.95	4.4	V
$I_{CC\ off}$	supply current (shut off)	V_{CC} = 10 V	–	170	220	µA
$I_{CC\ start}$	supply current at start-up	$V_{CC} = V_{START} - \delta V$ note 1	–	300	350	µA
$I_{CC\ on}$	supply current (started)	V_{CC} = 10 V; $V_{IN} \leq 2$ V	–	3.9	5	mA
$I_{START\ on}$	starting current (started)	V_{CC} = 10 V; $V_{IN} \geq 3.2$ V	1	1.5	–	mA
Undervoltage Schmitt trigger						
V_{ON}	turn-on voltage	I_F = 0; V_{CC} = 10 V; V_{OUT} = 0.2 V	2.85	2.9	3	V
V_{OFF}	turn-off voltage	I_F = 0; V_{CC} = 10 V; V_{OUT} = 0.2 V	2.27	2.35	2.42	V
I_{IN}	input current	V_{CC} = 10 V; V_{IN} = 3.2 V	–	12	30	µA

Note

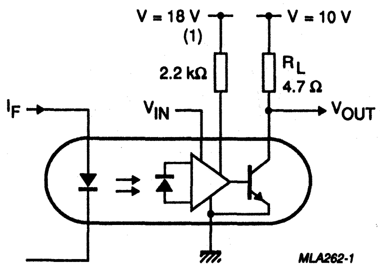
1. $V_{CC\ start}$ is an unstable point for the current variation, so the measurement is made at a very close and stable point, (e.g. δV = 10 mV).

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Optocoupler						
I_{OUT}	output current	I_F = 5 mA; V_{CC} = 10 V; V_{IN} = 3.2 V; V_{OUT} = 0.2 V	10	10.5	–	mA
		I_F = 5 mA; V_{CC} = 10 V; V_{IN} = 3.2 V; V_{OUT} = 1 V; t_p = 3 µs; δ = 0.1	0.75	0.80	–	A
		I_F = 0; V_{CC} = 3 V; V_{OUT} = 0.3 V	1	2.5	–	mA
		I_F = 0; V_{CC} = 3 V; V_{OUT} = 1.5 V; t_{on} = 10 µs	0.9	1.05	–	A
V_{OUT}	output voltage	I_F = 5 mA; V_{CC} = 10 V; V_{IN} = 3.2 V; I_{OUT} = 2 A; t_p = 3 µs; δ = 0.1	–	1.39	1.45	V
Switching times (see Figs 5 and 6)						
t_{PHL}	propagation switching time from high to low level output	I_F = 5 mA; V_{IN} = 3.2 V; R_L = 4.7 Ω; V_{CC} = 10 V started	–	0.3	0.5	µs
t_{PLH}	propagation switching time from low to high level output	I_F = 5 mA; V_{IN} = 3.2 V; R_L = 4.7 Ω; V_{CC} = 10 V started	–	0.4	1	µs
Switching times on the initialization curve (see Figs 7 and 8)						
t_{HL}	switching time from high to low level output	I_F = 0; V_{IN} = 3.2 V; R_L = 50 Ω; start-up V_{CC} = 16 V; shut-down V_{CC} = 3.4 V;	–	1.8	–	µs
t_{LH}	switching time from low to high level output	I_F = 0; V_{IN} = 3.2 V; R_L = 50 Ω; start-up V_{CC} = 16 V; shut-down V_{CC} = 3.4 V;	–	0.9	–	µs

CAUTION

It is advised that normal static precautions have to be taken in the handling and assembling of these components, to prevent damage and/or degradation which may be induced by ESD (Electrostatic Discharge).

The partial discharge test according to VDE 0884 is performed after all the other high voltage tests.



(1) V_{CC} = 10 V after start.

Fig.5 Switching times test circuit.

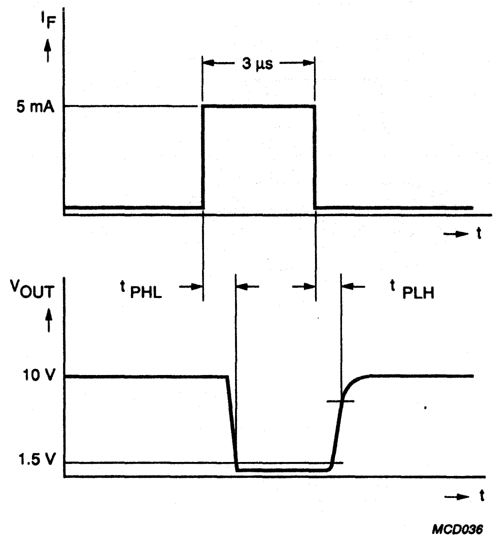


Fig.6 Switching times waveform.

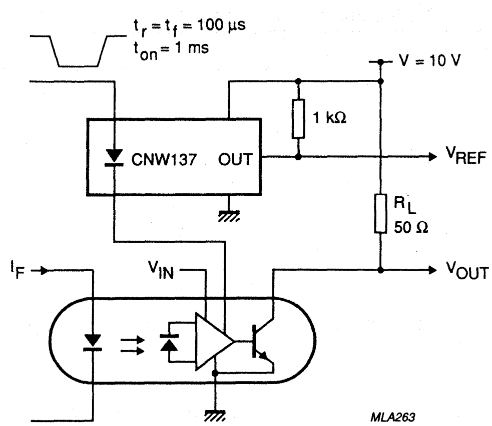


Fig.7 Switching times (on the initialization curve) test circuit.

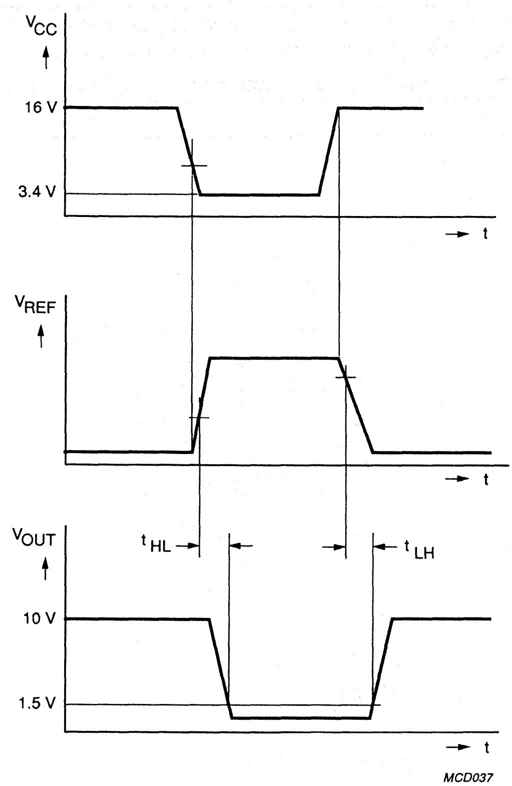


Fig.8 Switching times (on the initialization curve) waveforms.

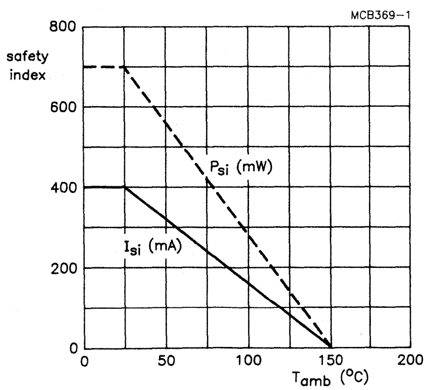
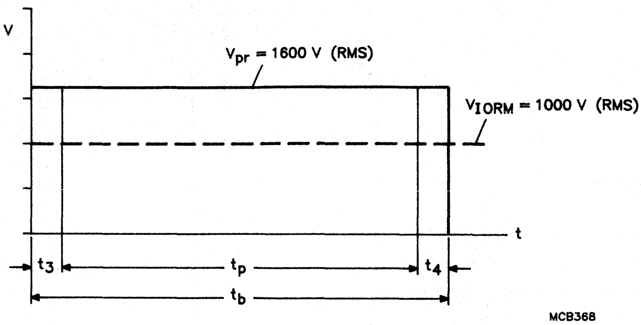
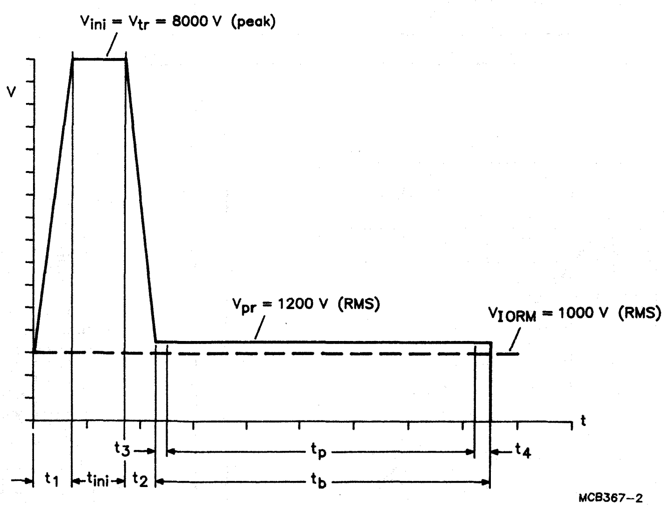


Fig.9 Dependence of safety maximum ratings with ambient temperature.



t_p = 1 s.
t_b = 1.2 s.
$t_3 = t_4$ = 0.1 s.
T_{amb} = 15 to 35 °C/(23±1) °C in case of dispute.
RH = 45 to 75/(50±2)% in case of dispute.
Partial discharge test limit q_c = 5 pC (during t_p).

Fig.10 Partial discharge measurement procedure 'b', according to VDE 0884 non destructive test for 100% inspection.



t_{ini} = 10 s.
$t_1 = t_2$ = 100 V/s to 1000 V/s.
t_p = 60 s.
$t_3 = t_4$ = 1 s.
T_{amb} = 15 to 35 °C/(23±1) °C in case of dispute.
RH = 45 to 75/(50±2)% in case of dispute.
Partial discharge test limit q_c = 5 pC (during t_p).

Fig.11 Partial discharge measurement procedure 'a', according to VDE 0884 destructive test for qualification and sampling tests.

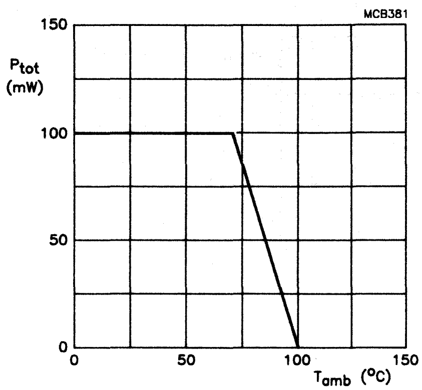
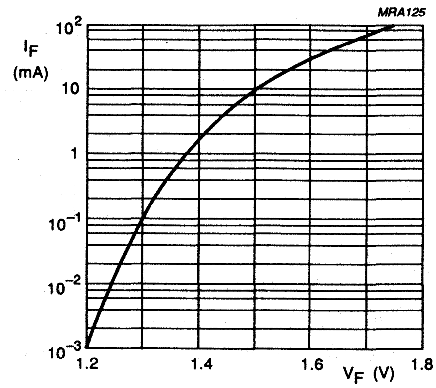
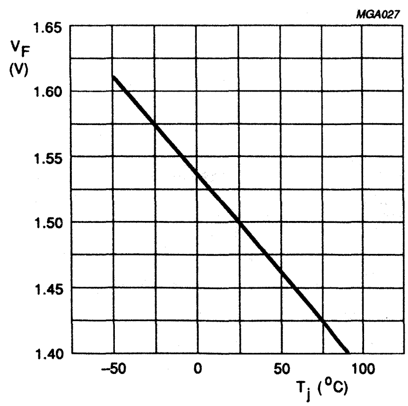


Fig.12 Total power dissipation as a function of ambient temperature.



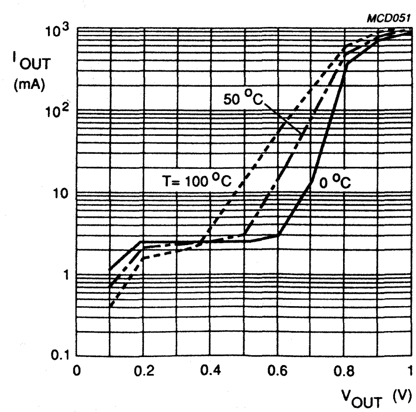
T_{amb} = 25 °C.

Fig.13 Forward current as a function of forward voltage; typical values.



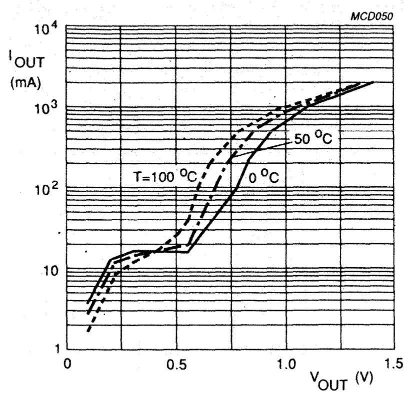
I_F = 10 mA.

Fig.14 Forward voltage as a function of junction temperature, typical values.



$V_{CC\ off}$.

Fig.15 Output stage as a function of temperature, measured at V_{CC} = 10 V.



$V_{CC\ on}$.

Fig.16 Output stage as a function of temperature, measured at V_{CC} = 10 V.

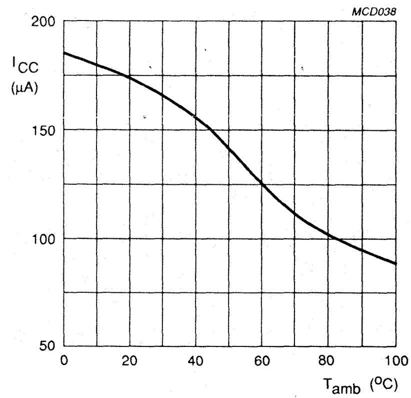


Fig.17 $I_{CC\ off}$ as a function of temperature.

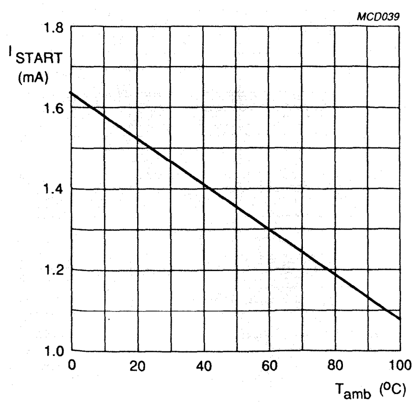


Fig.18 I_{START} as a function of temperature.

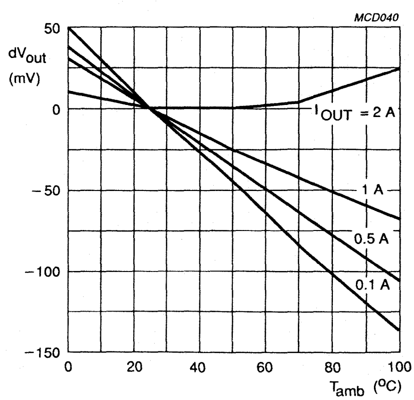


Fig.19 Output voltage variation (dV_{OUT}) as a function of temperature.

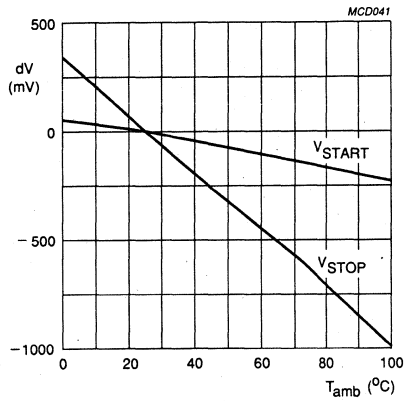


Fig.20 Voltage variations (dV_{START} and dV_{STOP}) as functions of temperature.

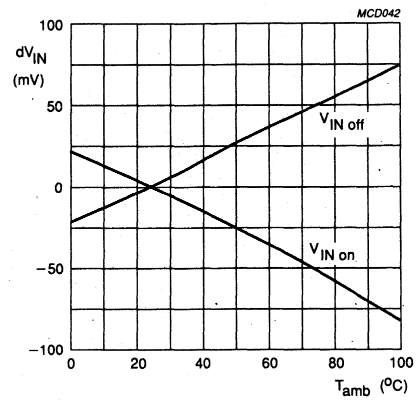


Fig.21 Input voltage variation (dV_{IN}) as a function of temperature.

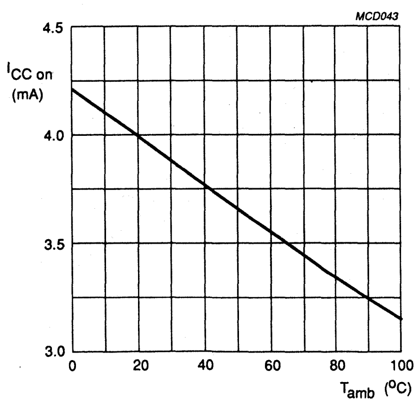


Fig.22 Supply 'on' current ($I_{CC\ on}$) as a function of temperature.

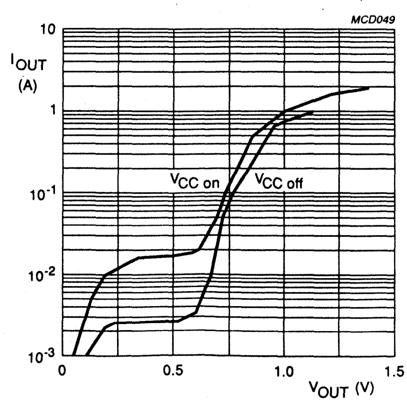


Fig.23 Output stage: output current as a function of output voltage, measured at V_{CC} = 10 V.

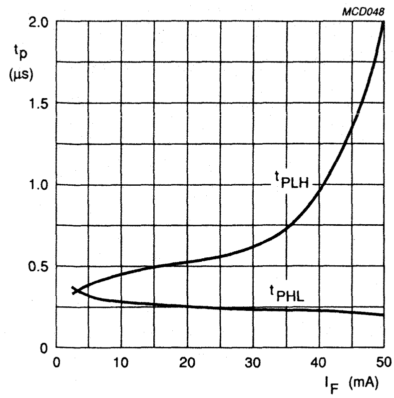


Fig.24 Propagation delay times as functions of forward current.

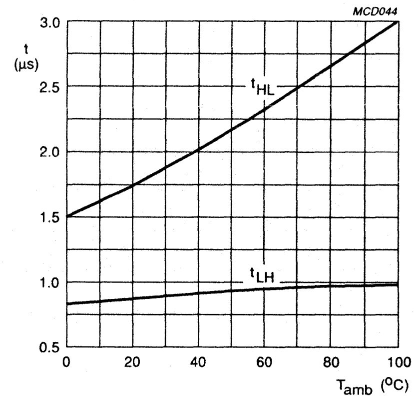


Fig.25 Switching times as functions of temperature.

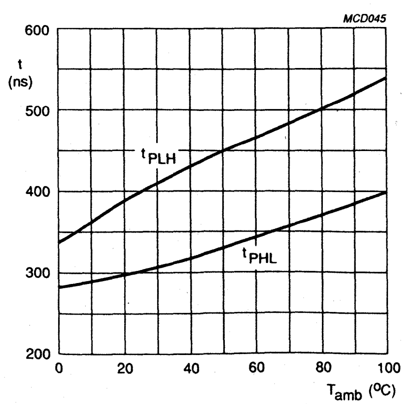


Fig.26 Propagation delay times as functions of temperature.

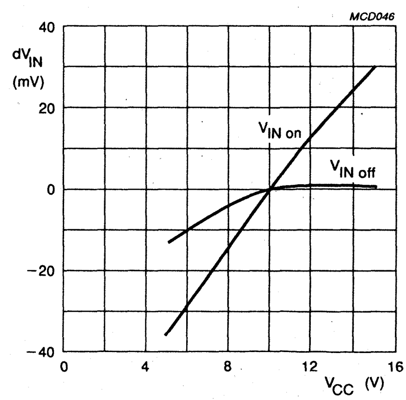


Fig.27 Input voltage variation (dV_{IN}) as a function of supply voltage.

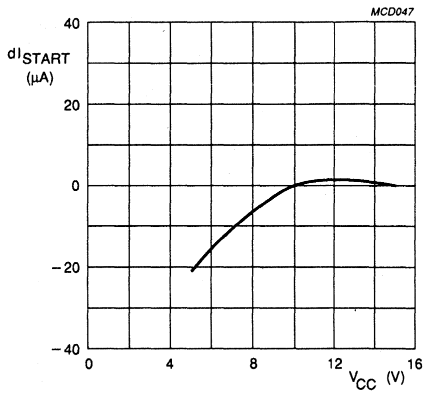


Fig.28 Starting current variation (dI_{START}) as a function of supply voltage.

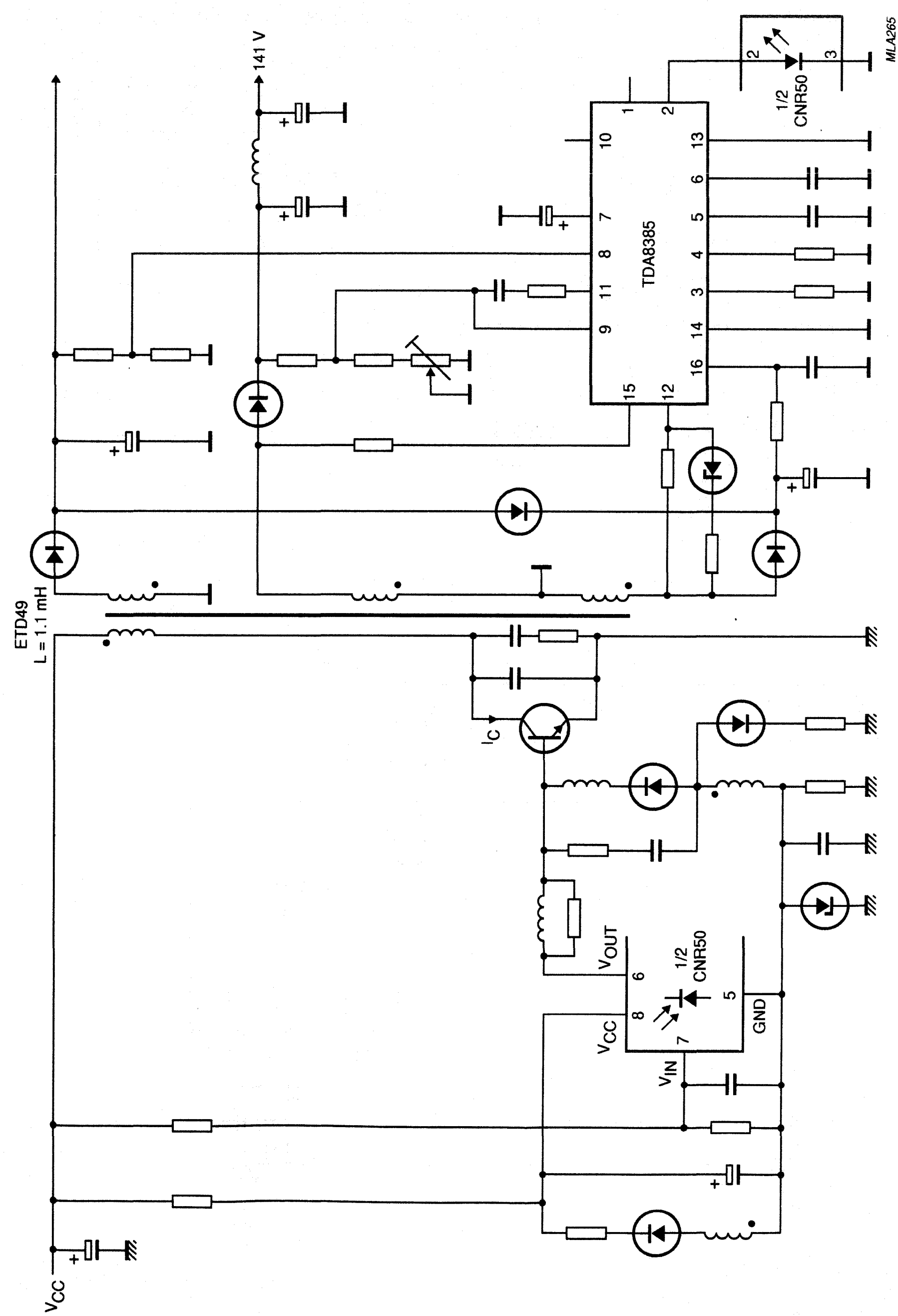


Fig.29 Typical application circuit with bipolar switch.

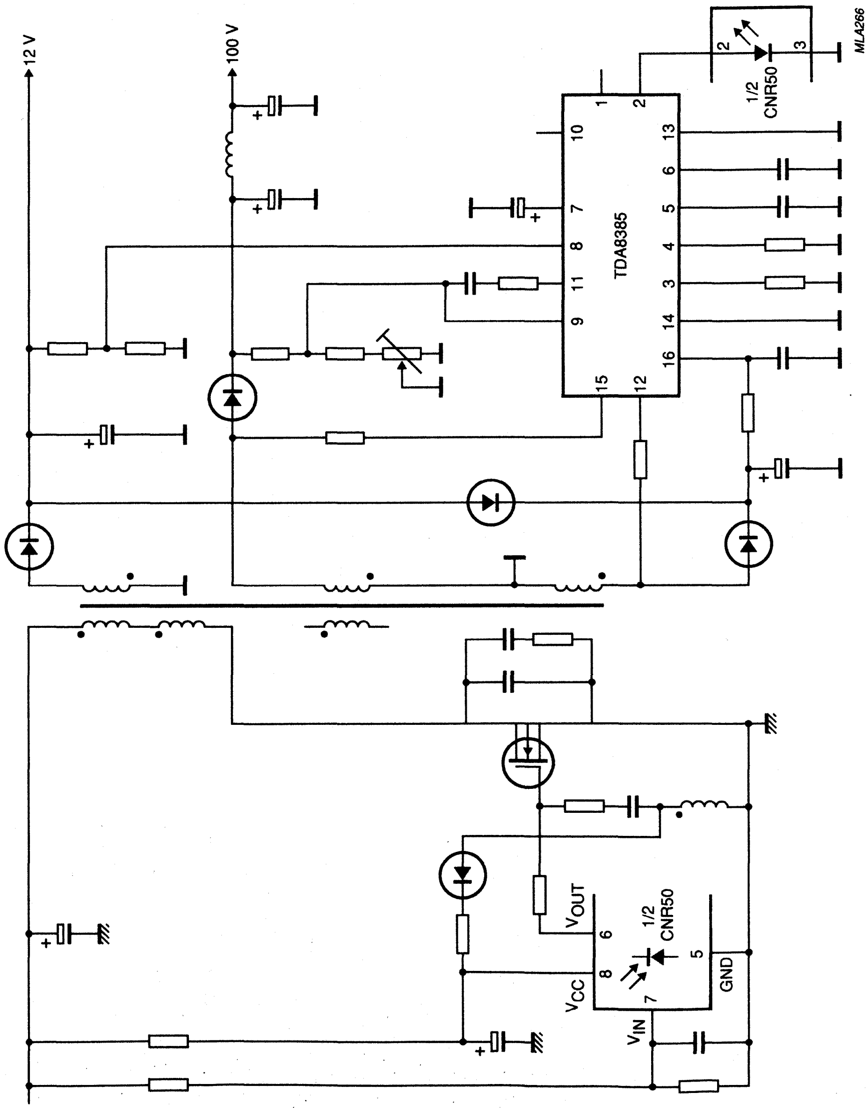


Fig.30 Typical application circuit with MOS switch.

Heavy duty optocouplers — CNW11AV-1/2/3

FEATURES

- Minimum 2 mm isolation thickness between emitter and receiver
- A wide body encapsulation with a pin distance of 10.16 mm
- An external clearance of 9.6 mm minimum and an external creepage of 10 mm minimum
- High current transfer ratio and low saturation voltage, making the devices suitable for use with TTL integrated circuits
- High degree of AC and DC insulation (4000 V (RMS) and 5656 V (DC))
- Collector-emitter breakdown voltage of 70 V
- Low isolation capacitance of 0.5 pF maximum.

DESCRIPTION

The CNW11AV series are high voltage optocouplers in a dual-in-line (DIL) SOT228 plastic envelope.

Each optocoupler consists of a GaAs infrared emitter optically coupled to a silicon npn phototransistor with the base connected.

PINNING

PIN	DESCRIPTION
1	anode
2	cathode
3	not connected
4	emitter
5	collector
6	base

APPROVALS

STANDARD	REFERENCE
UL	covered under UL component recognition FILE E90700
BSI	certification in accordance with BS415:1990; BS7002:1989; Class II applications
NORDIC	tested for applications (reinforced isolation); Class II applications for pluggable apparatus in normal tight execution
SETI	in accordance with IEC 65, 380, 950 & 335
SEMKO	in accordance with IEC 65, 380, 950 & 335
NEMKO	in accordance with IEC 65, 380, 950 & 335
DEMKO	in accordance with IEC 65, 380, 950 & 335
VDE	approved in accordance with VDE 0883/6.80 reference voltage (VDE 0110b Tab 4): 500 V (AC)/600 V (DC) complied for reinforced isolation at 250 V (AC) with: DIN IEC 380/VDE 0806/8.81 DIN IEC 435/VDE0805 "ENTWURF", Nov. 84 DIN 57804/VDE 0804/1.83 (isolation group C) DIN VDE 0860/8.86/HD 195 S4 DIN IEC 601 Teil 1/VDE 0750 Teil 1/5.82 DIN VDE 0700 Teil 1/2.81

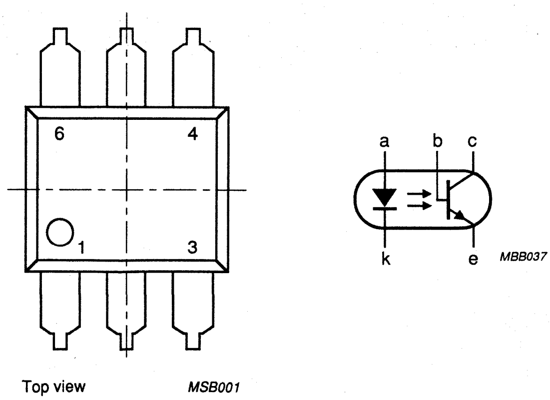


Fig.1 Simplified outline and symbol.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Diode					
I_F	forward current	DC value	–	100	mA
V_R	reverse voltage	DC value	–	6	V
P_{tot}	total power dissipation	up to T_{amb} = 25 °C	–	200	mW
Transistor					
I_C	collector current	DC value	–	100	mA
V_{CEO}	collector-emitter voltage	open base	–	70	V
P_{tot}	total power dissipation	up to T_{amb} = 25 °C	–	200	mW
Optocoupler					
I_C/I_F	current transfer ratio (CTR)	DC value; I_F = 10 mA; V_{CE} = 10 V			
	CNW11AV-1		1	3	
	CNW11AV-2		0.5	–	
	CNW11AV-3		0.2	–	
V_{IO}	isolation voltage				
		DC value	5.656	–	kV
		RMS value	4	–	kV

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX	UNIT
Diode					
V_R	reverse voltage	DC value	–	6	V
I_F	forward current	DC value	–	100	mA
i_{FRM}	forward current	peak value; t_{on} = 10 μs; δ = 0.01	–	3	A
P_{tot}	total power dissipation	up to T_{amb} = 25 °C	–	200	mW
Transistor					
V_{CEO}	collector-emitter voltage	open base	–	70	V
V_{CBO}	collector-base voltage	open base	–	70	V
V_{ECO}	emitter-collector voltage	open base	–	7	V
V_{EBO}	emitter-base voltage	open collector	–	7	V
I_C	collector current	DC value	–	100	mA
P_{tot}	total power dissipation	up to T_{amb} = 25 °C	–	200	mW
Optocoupler					
T_{stg}	storage temperature range		–55	150	°C
T_{amb}	ambient operating temperature range		–40	100	°C
T_j	junction temperature		–	125	°C
T_{sld}	soldering temperature up to the seating plane	T_{sld} < 10 s	–	260	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	MAX.	UNIT
Diode			
$R_{th\ j\text{-}a}$	from junction to ambient in free air	500	K/W
$R_{th\ j\text{-}a}$	from junction to ambient when mounted on PCB	400	K/W
Transistor			
$R_{th\ j\text{-}a}$	from junction to ambient in free air	500	K/W
$R_{th\ j\text{-}a}$	from junction to ambient when mounted on PCB	400	K/W

ISOLATION RELATED VALUES

SYMBOL	PARAMETER	CONDITIONS	MIN.	UNIT
L(IO1)	external air gap (clearance)	between input and output terminals	9.6	mm
L(IO2)	external tracking path (creepage distance)	between input and output terminals	10	mm
	internal plastic gap (clearance)	isolation thickness between emitter and receiver	2	mm

CLASSIFICATION CATEGORIES

Tracking resistance	KB-100/A

CHARACTERISTICS

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Diode						
V_F	forward voltage	I_F = 10 mA	0.8	1.15	1.5	V
		I_F = 10 mA; T_{amb} = −55 °C	0.9	–	1.7	V
		I_F = 10 mA; T_{amb} = 100 °C	0.7	–	1.4	V
I_R	reverse current	V_R = 6 V	–	–	10	μA
C_d	diode capacitance	V_d = 0; f = 1 MHz	–	25	100	pF
Transistor						
$V_{(BR)CEO}$	collector-emitter breakdown voltage	I_C = 1 mA	70	–	–	V
$V_{(BR)CBO}$	collector-base breakdown voltage	I_C = 0.1 mA	70	–	–	V
$V_{(BR)ECO}$	emitter-collector breakdown voltage	I_E = 0.1 mA	7	–	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	I_E = 0.1 mA	7	–	–	V
I_{CEO}	collector-emitter cut-off current (dark)	I_F = 0; V_{CE} = 10 V	–	0.5	50	nA
		I_F = 0; V_{CE} = 10 V; T_{amb} = 70 °C	–	–	10	μA
I_{CBO}	collector-base cut-off current	I_F = 0; V_{CB} = 10 V	–	–	20	nA
Optocoupler						
I_C/I_F	DC current transfer ratio (CTR)	I_F = 10 mA; V_{CE} = 10 V				
	CNW11AV-1		1	1.3	3	
	CNW11AV-2		0.5	–	–	
	CNW11AV-3		0.2	–	–	
$V_{CE\,sat}$	collector-emitter saturation voltage	I_F = 20 mA; I_C = 2 mA	–	0.1	0.4	V
V_{IO}	isolation voltage (note 1)	DC value t = 1 min	5.656	–	–	kV
		RMS value t = 1 min	4	–	–	kV
C_{io}	capacitance between input and output	V_{IO} = 0; f = 1 MHz	–	0.3	0.5	pF
R_{IO}	insulation resistance between input and output	V_{IO} = ±500 V	1	10	–	TΩ

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Optocoupler						
I_{CEW}	leakage current at working voltage	V_{IO} = 2.5 kV (DC); V_{CC} = 10 V; notes 2 and 3 and Fig.2	–	–	200	nA
		V_{IO} = 2.5 kV (DC); V_{CC} = 10 V; T_{amb} = 70 °C; notes 2 and 3 and Fig.2	–	–	2	µA
C_{bc}	output capacitance	V_{CB} = 10 V; f = 1 MHz	–	4.5	–	pF
CMRR	common mode rejection ratio	I_C = 2 mA; V_{CC} = 5 V; f = 10 kHz; R = 1 kΩ	–	–60	–	dB
Switching times (see Figs 3 and 4)						
t_{on}	turn-on time	I_C = 2 mA; V_{CC} = 10 V; R_L = 100 Ω	–	3	15	µs
t_{off}	turn-off time	I_C = 2 mA; V_{CC} = 10 V; R_L = 100 Ω	–	2.5	15	µs

Notes

1. Every product is tested by applying an isolation test voltage of 4.8 kV (RMS) for 2 s between all shorted input side leads and all shorted output side leads, with a detection current of approximately 1 µA.
2. This parameter is the maximum collector-emitter leakage current measured when a high voltage is applied between the shorted diode leads and the transistor emitter.
3. For quality assurance, the two parameters are tested for reliability on a sample basis for 1000 hrs.

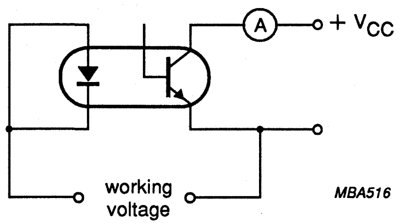


Fig.2 Test circuit.

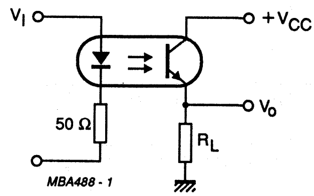


Fig.3 Switching circuit.

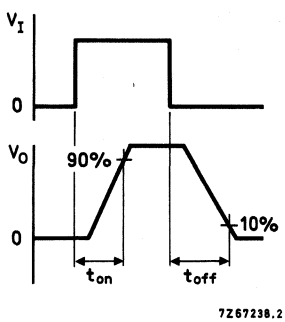
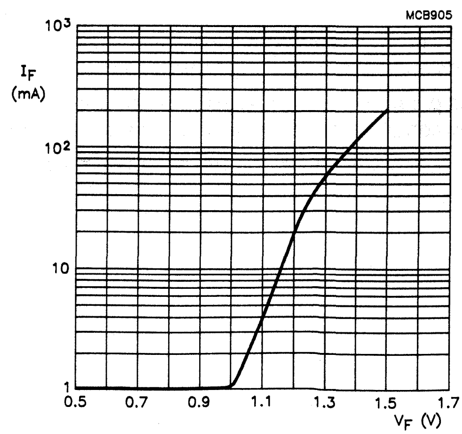


Fig.4 Waveforms.



T_{amb} = 25 °C.

Fig.5 Forward current as a function of forward voltage, typical values.

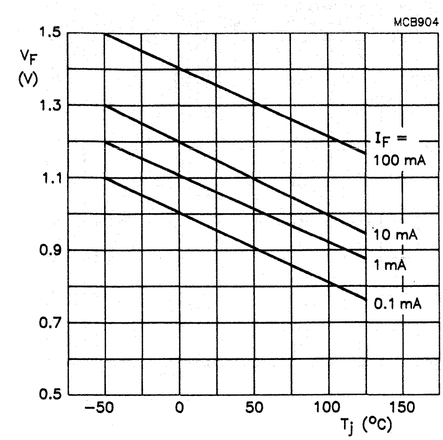
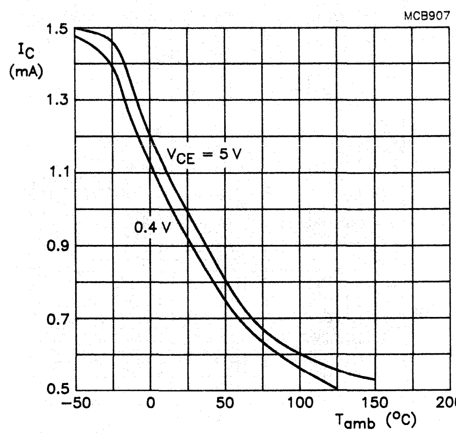
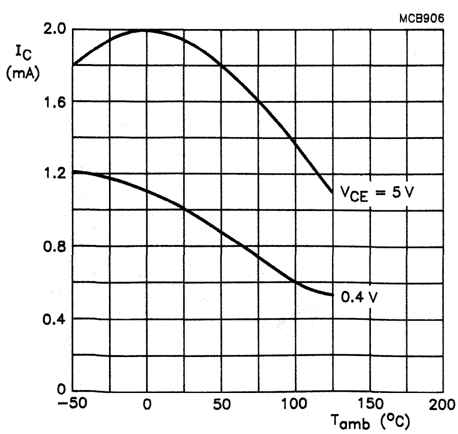


Fig.6 Forward voltage as a function of junction temperature, typical values.



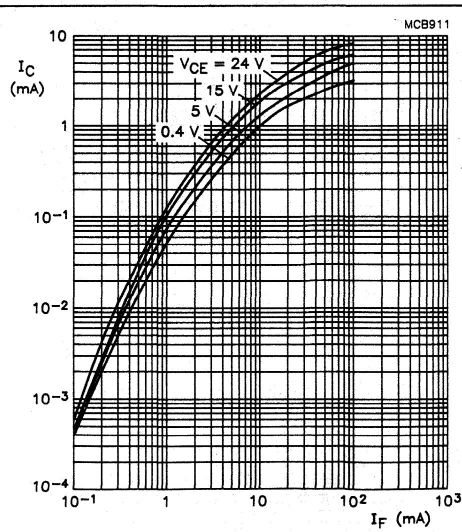
I_F = 1 mA; normalized to V_{CE} = 5 V; T_{amb} = 25 °C.

Fig.7 Collector current as a function of ambient temperature.



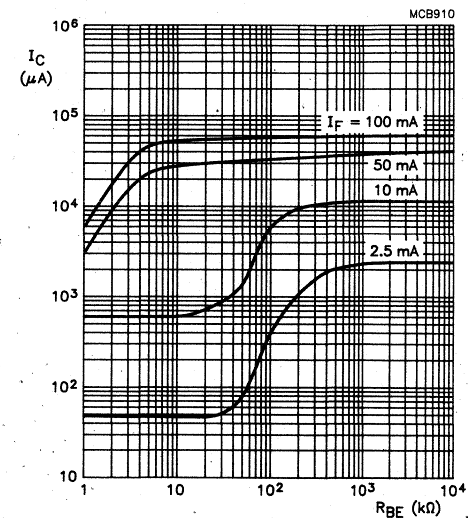
I_F = 10 mA; normalized to V_{CE} = 0.4 V; T_{amb} = 25 °C.

Fig.8 Collector current as a function of ambient temperature.



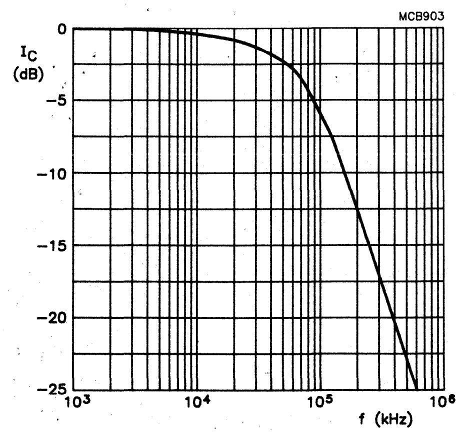
I_F = 10 mA; normalized to V_{CE} = 0.4 V; T_{amb} = 25 °C.

Fig.9 Collector current as a function of forward current.



V_{CE} = 5 V; I_B = 0; T_{amb} = 25 °C.

Fig.10 Collector current as a function of base-emitter resistance.



I_B = 0; R_L = 1 kΩ; I_C = 2 mA; V_{CE} = 5 V; T_{amb} = 25 °C.

Fig.11 Relative collector current as a function of frequency.

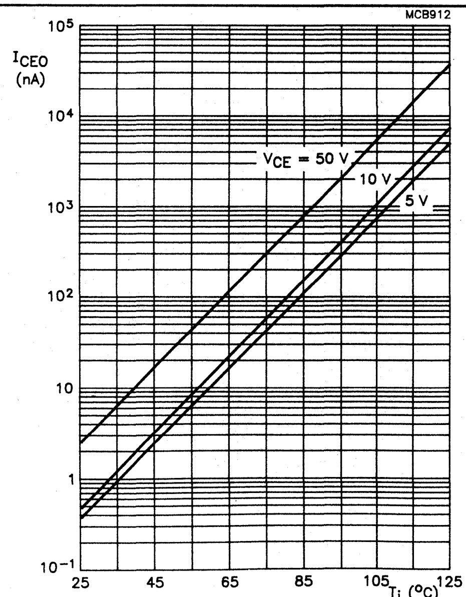
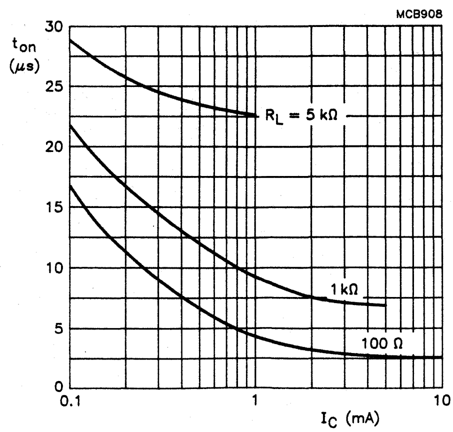
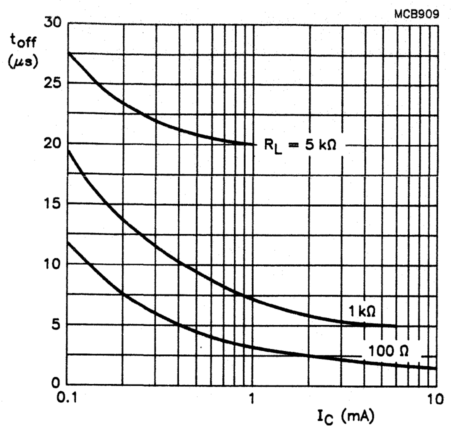


Fig.12 Collector-emitter dark current as a function of junction temperature.



V_{CC} = 5 V; T_{amb} = 25 °C.

Fig.13 Turn-on time as a function of collector current, typical values.



V_{CC} = 5 V; T_{amb} = 25 °C.

Fig.14 Turn-off time as a function of collector current, typical values.

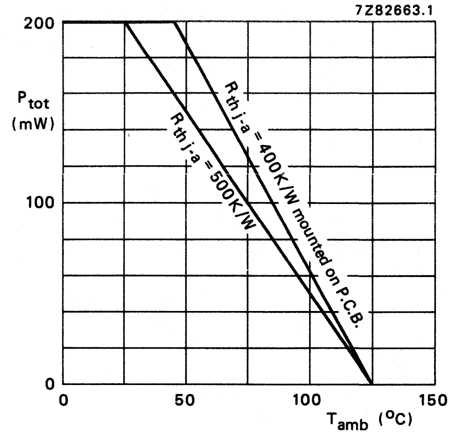
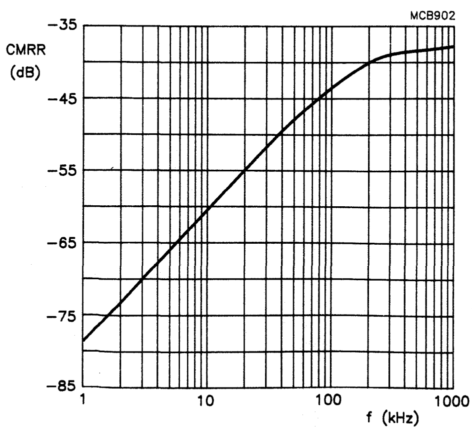


Fig.15 Total power dissipation as a function of ambient temperature.



V_{CC} = 5 V; I_C = 2 mA; T_{amb} = 25 °C; R_L = 1 kΩ.

Fig.16 Common mode rejection ratio as a function of frequency.

Wide body, high isolation optocouplers

CNW82/CNW83

FEATURES

- Wide body DIL encapsulation, with a pin distance of 10.16 mm
- Minimum creepage distance 10 mm
- High current transfer ratio and low saturation voltage, making the devices suitable for use with TTL integrated circuits
- High degree of AC and DC insulation (5900 V (RMS) and 8340 V (DC)).

DESCRIPTION

The CNW82 and CNW83 are photocouplers consisting of an infrared emitting GaAs diode and a silicon npn phototransistor, in a wide dual-in-line (DIL) SOT228 plastic envelope. The base of the phototransistor is unconnected for the CNW82 and connected for the CNW83.

PINNING - CNW82

PIN	DESCRIPTION
1	anode
2	cathode
3	not connected
4	emitter
5	collector
6	not connected

PINNING - CNW83

PIN	DESCRIPTION
1	anode
2	cathode
3	not connected
4	emitter
5	collector
6	base

APPROVALS

STANDARD	REFERENCE
UL	covered under UL component recognition FILE E90700
BSI	certification in accordance with BS415:1990; BS7002:1989; Class II applications
NORDIC	tested for applications (reinforced isolation); Class II applications for pluggable apparatus in normal tight execution
SETI	in accordance with IEC 65, 380, 950 & 335
SEMKO	in accordance with IEC 65, 380, 950 & 335
NEMKO	in accordance with IEC 65, 380, 950 & 335
DEMKO	in accordance with IEC 65, 380, 950 & 335
VDE	approved in accordance with VDE 0883/6.80 reference voltage (VDE 0110b Tab 4): 500 V (AC)/600 V (DC) (isolation group C) complied for reinforced isolation at 250 V (AC) with: DIN IEC 380/VDE 0806/8.81 DIN IEC 435/VDE0805 "ENTWURF", Nov. 84 DIN 57804/VDE 0804/1.83 (isolation group C) DIN VDE 0860/8.86/HD 195 S4 DIN VDE 0750 Teil 1/5.82 IEC 601 Teil 1

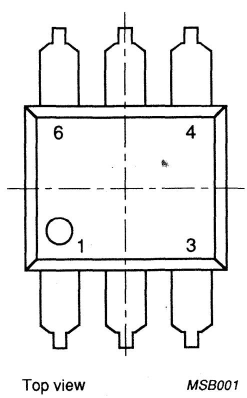


Fig.1 Simplified outline.

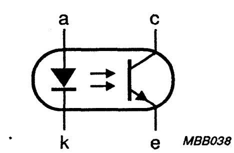


Fig.2 Symbol, CNW82.

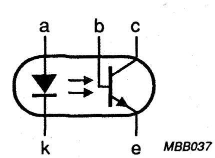


Fig.3 Symbol, CNW83.

Wide body, high isolation optocouplers

CNW82/CNW83

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Diode					
I_F	forward current	DC value	–	100	mA
Transistor					
V_{CEO}	collector-emitter voltage	open base	–	50	V
Photocoupler					
I_C/I_F	DC current transfer ratio (CTR)	$I_F = 10$ mA; $V_{CE} = 0.4$ V	0.4	–	
I_{CEW}	collector cut-off current (dark)	$V_W = 2.5$ kV (DC); $V_{CC} = 10$ V	–	200	nA
V_{IO}	isolation voltage				
		DC value	8.34	–	kV
		RMS value	5.9	–	kV

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Diode					
V_R	continuous reverse voltage		–	5	V
I_F	forward current	DC value	–	100	mA
I_{FRM}	forward current	peak value; t_{on} = 10 µs; δ = 0.01	–	3	A
P_{tot}	total power dissipation	up to T_{amb} = 25 °C	–	200	mW
Transistor					
V_{CEO}	collector-emitter voltage	open base	–	50	V
V_{ECO}	emitter-collector voltage		–	7	V
I_C	collector current	DC value	–	100	mA
P_{tot}	total power dissipation	up to T_{amb} = 25 °C	–	200	mW
Photocoupler					
T_{stg}	storage temperature range		–55	150	°C
T_{amb}	ambient operating temperature range		–40	100	°C
T_j	junction temperature		–	125	°C
T_{sld}	soldering temperature up to the seating plane	T_{sld} < 10 s	–	260	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	MAX.	UNIT
Diode			
$R_{th\ j\text{-}a}$	from junction to ambient in free air	500	K/W
$R_{th\ j\text{-}a}$	from junction to ambient when mounted on PCB	400	K/W
Transistor			
$R_{th\ j\text{-}a}$	from junction to ambient in free air	500	K/W
$R_{th\ j\text{-}a}$	from junction to ambient when mounted on PCB	400	K/W

ISOLATION RELATED VALUES

SYMBOL	PARAMETER	CONDITIONS	MIN.	UNIT
L(IO1)	external air gap (clearance)	between input and output terminals	9.6	mm
L(IO2)	external tracking path (creepage distance)	between input and output terminals	10	mm
	internal plastic gap (clearance)	isolation thickness between emitter and receiver	1	mm

CLASSIFICATION CATEGORIES

Tracking resistance	KB-100/A

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETERS	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Diode						
V_F	forward voltage	I_F = 10 mA	–	1.15	1.5	V
I_R	reverse current	V_R = 5 V	–	–	10	μA
Transistor						
$V_{(BR)CEO}$	collector-emitter breakdown voltage	I_C = 1 mA	50	–		V
$V_{(BR)CBO}$	collector-base breakdown voltage (CNW83 only)	I_C = 0.1 mA	70	–	–	V
$V_{(BR)ECO}$	emitter-collector breakdown voltage	I_E = 0.1 mA	7	–	–	V
I_{CEO}	collector cut-off current (dark)	I_F = 0; V_{CE} = 10 V	–	2	50	nA
		V_{CE} = 10 V; T_{amb} = 70 °C	–	–	10	μA
I_{CBO}	collector cut-off current (dark) (CNW83 only)	V_{CB} = 10 V	–	–	20	nA
Photocoupler						
I_C/I_F	DC current transfer ratio (CTR)	I_F = 10 mA; V_{CE} = 0.4 V	0.4	0.8	–	
		I_F = 10 mA; V_{CE} = 5 V	–	1.5	–	
$I_{CE(L)}$	collector cut-off current (light)	T_{amb} ≤ 70 °C; V_F = 0.8 V; V_{CE} = 15 V	–	–	15	μA
		T_{amb} ≤ 70 °C; I_F = 2 mA; V_{CE} = 0.4 V	150	–	–	μA
$V_{CE\ sat}$	collector-emitter saturation voltage	I_F = 10 mA; I_C = 4 mA	–	0.19	0.4	V
C_{bc}	collector capacitance (CNW83 only)	V_{CB} = 10 V; f = 1 MHz	–	4.5	–	pF
I_{CEW}	collector cut-off current (dark) (see Fig.4)	V_W = 2.5 kV (DC); V_{CC} = 10 V; T_j = 25 °C; notes 1 and 2	–	–	200	nA
		V_W = 2.5 kV (DC); V_{CC} = 10 V; T_j = 70 °C; notes 1 and 2	–	–	2	μA

SYMBOL	PARAMETERS	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Photocoupler						
V_{IO}	isolation voltage	DC value; t = 1 min; note 3	8.34	–	–	kV
		RMS value; t = 1 min; note 3	5.9	–	–	kV
C_{io}	capacitance between input and output	V = 0; f = 1 MHz	–	0.4	1	pF
R_{IO}	insulation resistance between input and output	V_{IO} = ±500 V	1	10	–	TΩ
Switching times (see Figs 5 and 6)						
t_{on}	turn-on time	I_C = 2 mA; V_{CC} = 5 V; R_L = 100 Ω	–	3	–	µs
		I_C = 2 mA; V_{CC} = 5 V; R_L = 1 kΩ	–	12	–	µs
t_{off}	turn-off time	I_C = 2 mA; V_{CC} = 5 V; R_L = 100 Ω	–	3	–	µs
		I_C = 2 mA; V_{CC} = 5 V; R_L = 1 kΩ	–	12	–	µs

Notes

1. This parameter is the maximum collector-emitter leakage current measured when a high voltage is applied between the shorted diode leads and the transistor emitter.
2. For quality assurance, the two parameters are tested on a sample basis for 1000 hours.
3. Every product is tested by applying an isolation test voltage of 7080 V (RMS) for 2 s between all shorted input side leads and all shorted output side leads, with a detection current of approximately 1 µA.

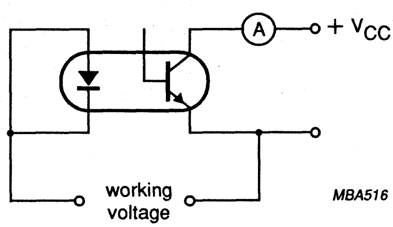


Fig.4 Test circuit.

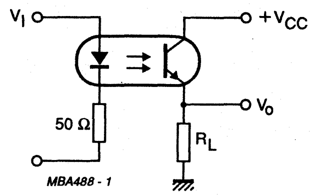


Fig.5 Switching circuit.

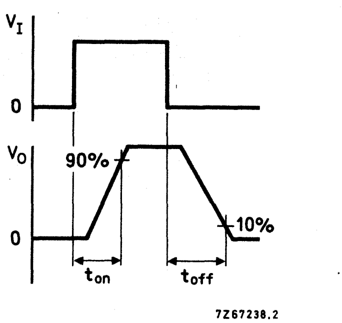
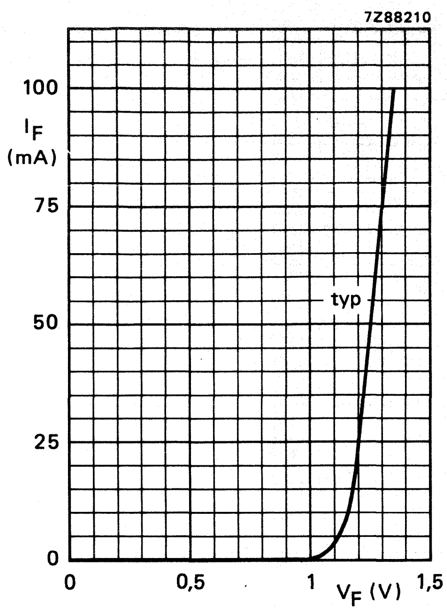
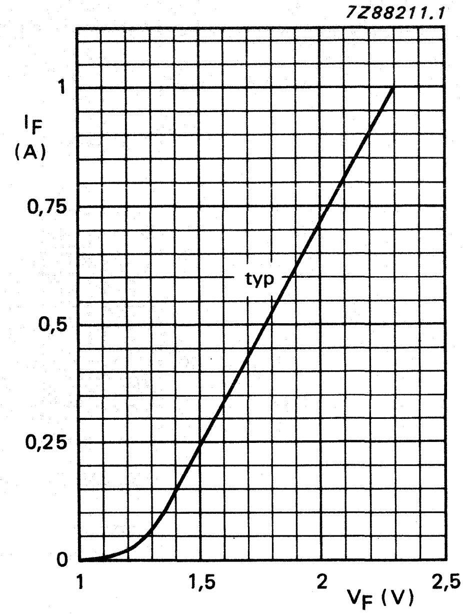


Fig.6 Waveforms.



T_{amb} = 25 °C.

Fig.7 Forward current as a function of forward voltage, typical values.



T_{amb} = 25 °C; t_p = 20 μs; δ = 0.01.

Fig.8 Forward current as a function of forward voltage, typical values.

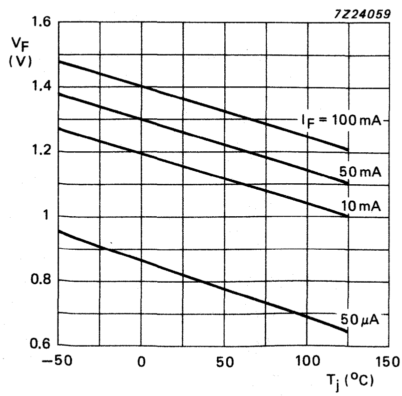
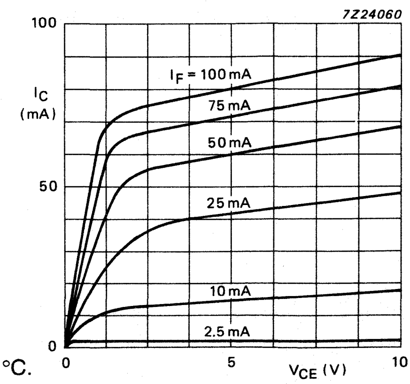
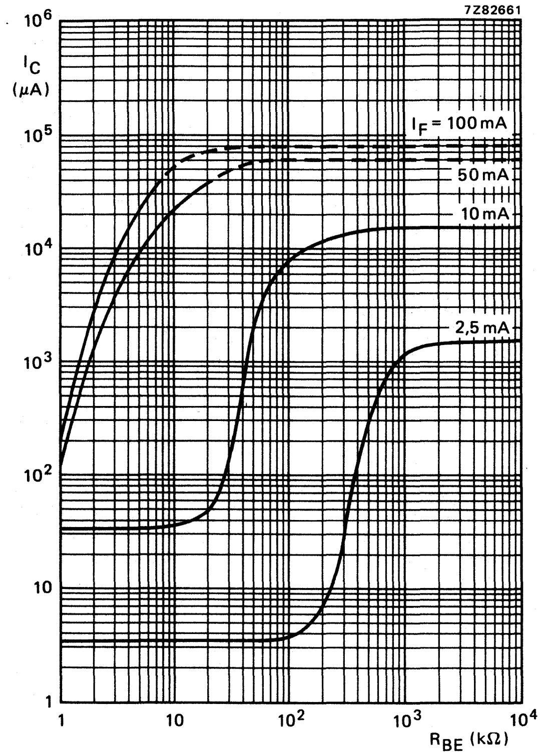


Fig.9 Forward voltage as a function of junction temperature, typical values.



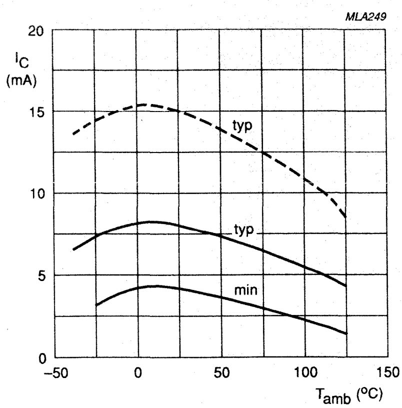
T_{amb} = 25 °C.

Fig.10 Collector current as a function of collector-emitter voltage, typical values.



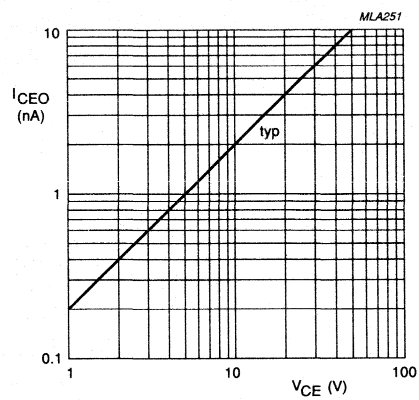
$I_B = 0$; $V_{CE} = 5$ V; $T_{amb} = 25$ °C.

Fig.11 Collector current as a function of base-emitter resistance, typical values; CNW83 only.



Solid line: I_F = 10 mA; V_{CE} = 0.4 V.
Dotted line: I_F = 10 mA; V_{CE} = 5 V.

Fig.12 Collector current as a function of ambient temperature.



T_{amb} = 25 °C.

Fig.13 Collector-emitter dark current as a function of collector-emitter voltage, typical values.

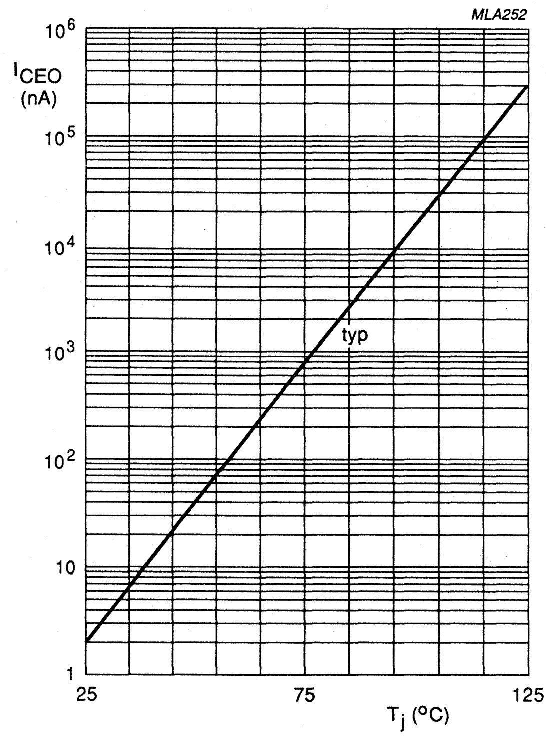
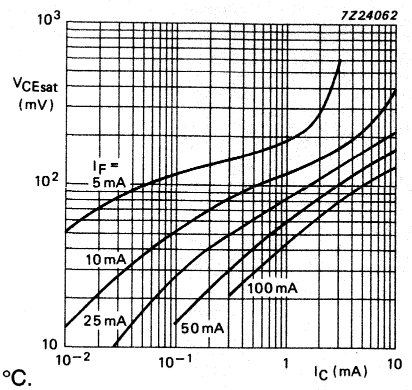
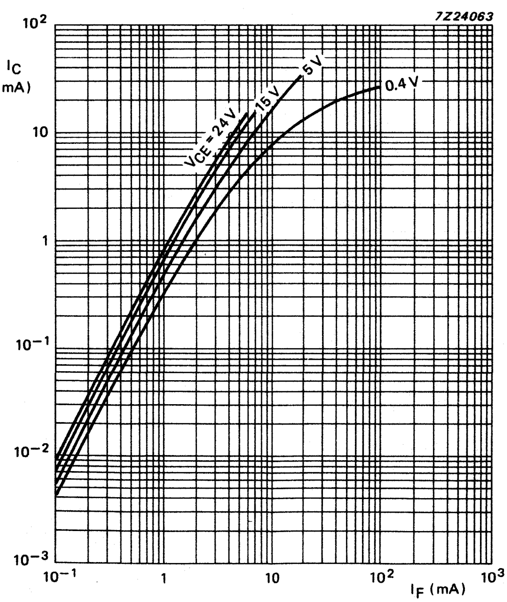


Fig.14 Collector-emitter dark current as a function of junction temperature.



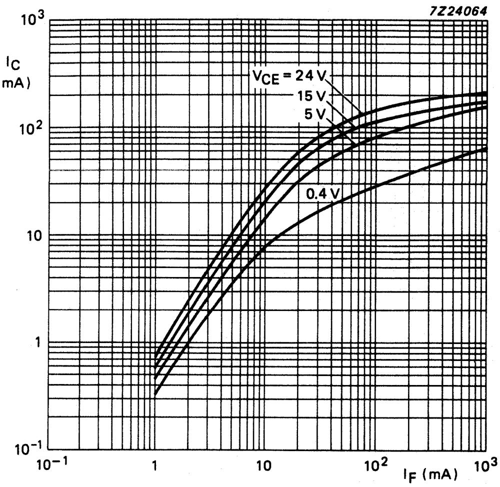
T_{amb} = 25 °C.

Fig.15 Collector-emitter saturation voltage as a function of collector current, typical values.



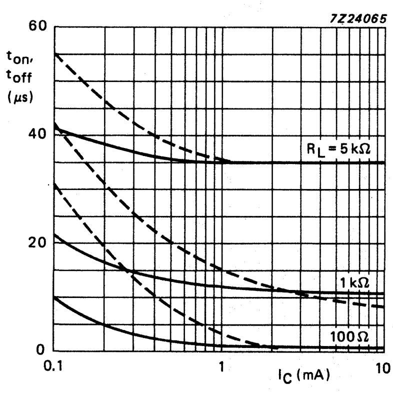
T_{amb} = 25 °C.

Fig.16 Collector current as a function of forward current, typical values.



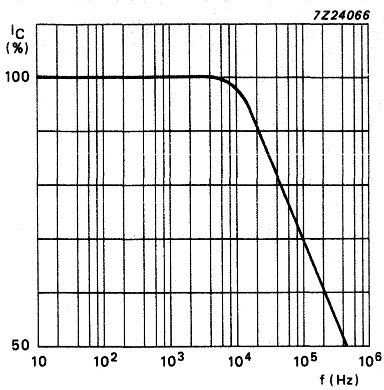
T_{amb} = 25 °C; t_p = 10 μs; δ = 0.01.

Fig.17 Collector current as a function of forward current, typical values.



T_{amb} = 25 °C.
Solid line: t_{off}.
Dotted line: t_{on}.

Fig.18 Switching times as a function of collector current.



T_{amb} = 25 °C; I_C = 2 mA; V_{CC} = 5 V; R_L = 1 kΩ.

Fig.19 Relative collector current as a function of frequency.

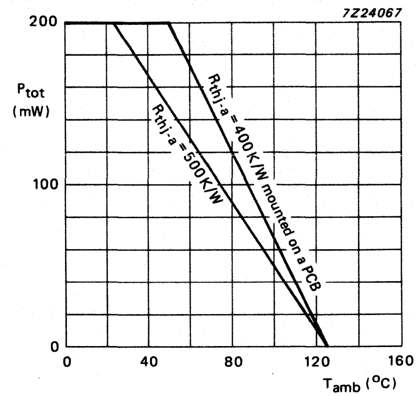


Fig.20 Total power dissipation as a function of ambient temperature.

Heavy duty optocouplers — CNW84/CNW85

FEATURES

- Minimum 2 mm isolation thickness between emitter and receiver
- A wide body DIL encapsulation with a pin distance of 10.16 mm
- An external clearance of 9.6 mm minimum and an external creepage distance of 10 mm minimum
- High current transfer ratio and a low saturation voltage suitable for use with TTL integrated circuits
- High degree of AC and DC insulation (5.9 kV (RMS) and 8.34 kV (DC))
- Collector-emitter breakdown voltage of 80 V
- Low isolation capacitance of 0.5 pF maximum.

DESCRIPTION

The CNW84 and CNW85 are high voltage optocouplers in a dual-in-line (DIL) SOT228 plastic envelope.

Each optocoupler consists of a GaAs infrared emitter optically coupled to a silicon npn phototransistor. The base is unconnected for the CNW84 and connected for the CNW85.

These heavy duty optocouplers satisfy the world's most severe safety standards.

APPROVALS

STANDARD	REFERENCE
UL	covered under UL component recognition FILE E90700
BSI	certification in accordance with BS415:1990; BS7002:1989; Class II applications
NORDIC	tested for applications (reinforced isolation); Class II applications for pluggable apparatus in normal tight execution
SETI	in accordance with IEC 65, 380, 950 & 335
SEMKO	in accordance with IEC 65, 380, 950 & 335
NEMKO	in accordance with IEC 65, 380, 950 & 335
DEMKO	in accordance with IEC 65, 380, 950 & 335
VDE (note 1)	approved in accordance with VDE 0883/6.80 reference voltage (VDE 0110b Tab 4): 500 V (AC)/600 V (DC) complied for reinforced isolation at 250 V (AC) with: DIN IEC 380/VDE 0806/8.81 DIN IEC 435/VDE 0805 "ENTWURF", Nov. 84 DIN 57804/VDE 0804/1.83 (isolation group C) DIN VDE 0860/8.86/HD 195 S4 DIN IEC 601 Teil 1/VDE 0750 Teil 1/5.82 DIN VDE 0700 Teil 1/2.81

Note

1. VDE0884 approval pending.

Heavy duty optocouplers — CNW84/CNW85

PINNING - CNW84

PIN	DESCRIPTION
1	anode
2	cathode
3	not connected
4	emitter
5	collector
6	not connected

PINNING - CNW85

PIN	DESCRIPTION
1	anode
2	cathode
3	not connected
4	emitter
5	collector
6	base

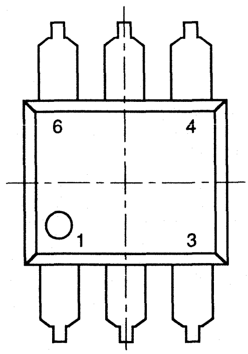


Fig.1 Simplified outline.

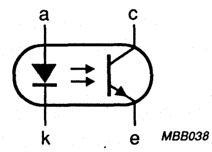


Fig.2 Symbol, CNW84.

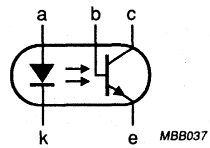


Fig.3 Symbol, CNW85.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Diode					
I_F	forward current	DC value	–	100	mA
V_R	reverse voltage	DC value	–	5	V
P_{tot}	total power dissipation	up to T_{amb} = 25 °C	–	200	mW
Transistor					
I_C	collector current	DC value	–	100	mA
V_{CEO}	collector-emitter voltage	open base	–	80	V
P_{tot}	total power dissipation	up to T_{amb} = 25 °C	–	200	mW
Optocoupler					
I_C/I_F	DC current transfer ratio (CTR)	I_F = 10 mA; V_{CE} = 5 V	0.63	3.2	
V_{IO}	isolation voltage	DC value	8.34	–	kV
		RMS value	5.9	–	kV

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX	UNIT
Diode					
I_F	forward current	DC value	–	100	mA
I_{FRM}	forward current	peak value t_{on} = 10 µs; δ = 0.01	–	3	A
V_R	reverse voltage	DC value	–	5	V
P_{tot}	total power dissipation	up to T_{amb} = 25 °C	–	200	mW
Transistor					
I_C	collector current	DC value	–	100	mA
V_{CEO}	collector-emitter voltage	open base	–	80	V
V_{CBO}	collector-base voltage (CNW85 only)	open base	–	120	V
V_{ECO}	emitter-collector voltage	open base	–	7	V
P_{tot}	total power dissipation	up to T_{amb} = 25 °C	–	200	mW
Optocoupler					
T_{stg}	storage temperature range		–55	150	°C
T_{amb}	ambient operating temperature range		–40	100	°C
T_j	junction temperature		–	125	°C
T_{sld}	soldering temperature up to the seating plane	T_{sld} < 10 s	–	260	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	MAX.	UNIT
Diode			
$R_{th\ j\text{-}a}$	from junction to ambient in free air	500	K/W
$R_{th\ j\text{-}a}$	from junction to ambient when mounted on PCB	400	K/W
Transistor			
$R_{th\ j\text{-}a}$	from junction to ambient in free air	500	K/W
$R_{th\ j\text{-}a}$	from junction to ambient when mounted on PCB	400	K/W

ISOLATION RELATED VALUES

SYMBOL	PARAMETER	CONDITIONS	MIN.	UNIT
L(IO1)	external air gap (clearance)	between input and output terminals	9.6	mm
L(IO2)	external tracking path (creepage distance)	between input and output terminals	10	mm
	internal plastic gap (clearance)	isolation thickness between emitter and receiver	2	mm

CLASSIFICATION CATEGORIES

Tracking resistance	KB-100/A

CHARACTERISTICS

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Diode						
V_F	forward voltage	I_F = 10 mA	–	1.15	1.5	V
I_R	reverse current	V_R = 5 V	–	–	10	μA
C_d	diode capacitance	V_d = 0; f = 1 MHz	–	25	100	pF
Transistor						
$V_{(BR)CEO}$	collector-emitter breakdown voltage	I_C = 1 mA	80	–	–	V
$V_{(BR)CBO}$	collector-base breakdown voltage (CNW85 only)	I_C = 0.1 mA	120	–	–	V
$V_{(BR)ECO}$	emitter-collector breakdown voltage	I_E = 0.1 mA	7	–	–	V
I_{CEO}	collector-emitter cut-off current (dark)	I_F = 0; V_{CE} = 10 V	–	0.5	50	nA
		I_F = 0; V_{CE} = 10 V; T_{amb} = 70 °C	–	–	10	μA
I_{CBO}	collector-base cut-off current (CNW85 only)	I_F = 0; V_{CB} = 10 V	–	–	20	nA
Optocoupler						
I_C/I_F	DC current transfer ratio (CTR)	I_F = 10 mA; V_{CE} = 5 V	0.63	1.2	3.2	
		I_F = 10 mA; V_{CE} =0.4 V	–	0.8	–	
		I_F = 2 mA; V_{CE} = 5 V	–	0.6	–	
$I_{CE(1)}$	collector current	V_F = 0.8 V; V_{CE} = 15 V; T_{amb} = 70 °C	–	–	15	μA
$I_{CE(2)}$	collector current	I_F = 2 mA; V_{CE} = 0.4 V; T_{amb} = 70 °C	150	–	–	μA
$V_{CE\,sat}$	collector-emitter saturation voltage	I_F = 10 mA; I_C = 4 mA	–	0.19	0.4	V
V_{IO}	isolation voltage (note 1)	DC value; t = 1 min	8.34	–	–	kV
		RMS value; t = 1 min	5.9	–	–	kV

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Optocoupler						
C_{io}	capacitance between input and output	$V_{IO} = 0$; f = 1 MHz	–	0.3	0.5	pF
R_{IO}	insulation resistance between input and output	$V_{IO} = \pm 500$ V	1	10	–	TΩ
I_{CEW}	leakage current at working voltage	$V_{CC} = 10$ V; $V_{IO} = 2.5$ kV (DC); notes 2 and 3 and Fig.4	–	–	200	nA
		$V_{CC} = 10$ V; $V_{IO} = 2.5$ kV (DC); $T_{amb} = 70$ °C; notes 2 and 3 and Fig.4	–	–	2	µA
C_{bc}	output capacitance (CNW85 only)	$V_{CB} = 10$ V; f = 1 MHz	–	4.5	–	pF
CMRR	common mode rejection ratio	$I_C = 2$ mA; f = 10 kHz; VCC = 5 V; R = 1 kΩ; see Fig.7				
	CNW84		–	–75	–	dB
	CNW85		–	–60	–	dB
Switching times (see Figs 5 and 6)						
t_{on}	turn-on time	$I_C = 2$ mA; $V_{CC} = 5$ V; $R_L = 100$ Ω	–	3	–	µs
		$I_C = 2$ mA; $V_{CC} = 5$ V; $R_L = 1$ kΩ	–	7.5	–	µs
t_{off}	turn-off time	$I_C = 2$ mA; $V_{CC} = 5$ V; $R_L = 100$ Ω	–	2.5	–	µs
		$I_C = 2$ mA; $V_{CC} = 5$ V; $R_L = 1$ kΩ	–	6	–	µs

Notes

1. Every product is tested by applying an isolation test voltage of 7.08 kV (RMS) for 2 s between all shorted input side leads and all shorted output side leads, with a detection current of approximately 1 µA.
2. This parameter is the maximum collector-emitter leakage current measured when a high voltage is applied between the shorted diode leads and the transistor emitter.
3. For quality assurance, the two parameters are tested for reliability on a sample basis for 1000 hrs.

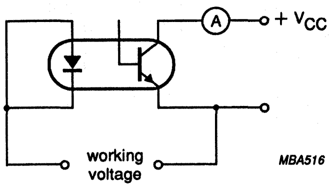


Fig.4 Test circuit.

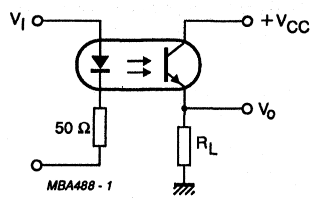


Fig.5 Switching circuit.

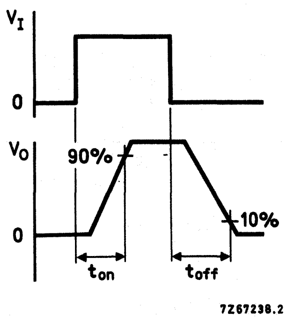


Fig.6 Waveforms.

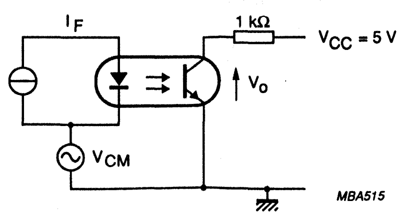
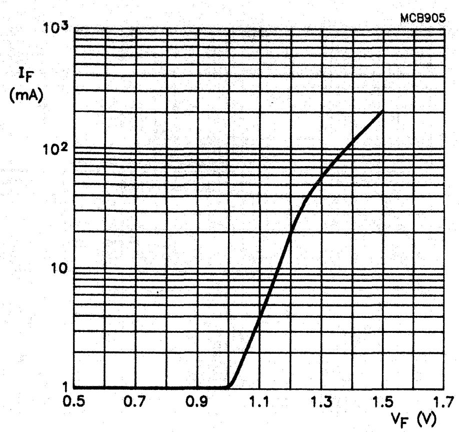


Fig.7 Common mode rejection.



T_{amb} = 25 °C.

Fig.8 Forward current as a function of forward voltage, typical values.

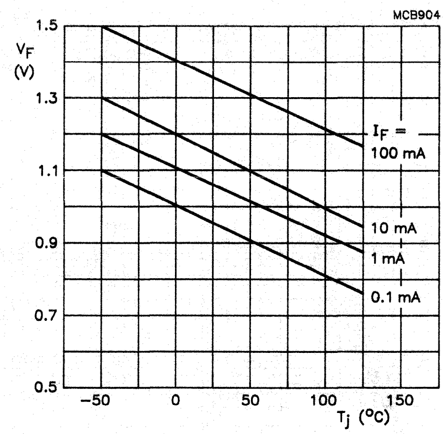
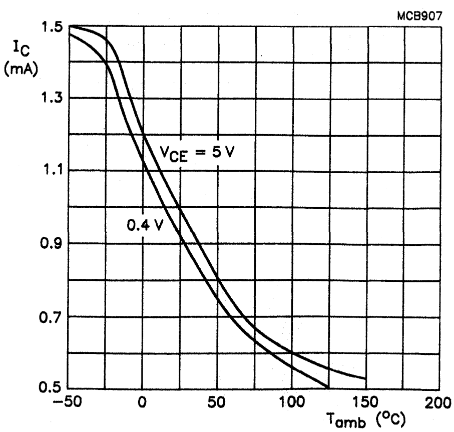
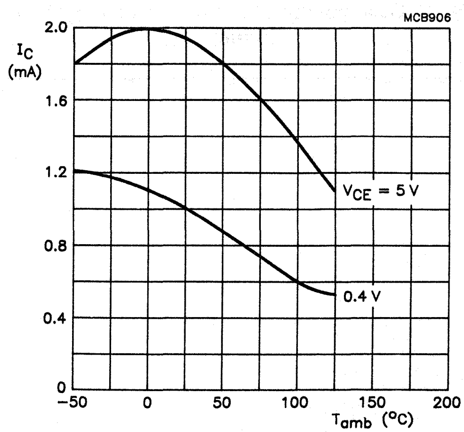


Fig.9 Forward voltage as a function of junction temperature.



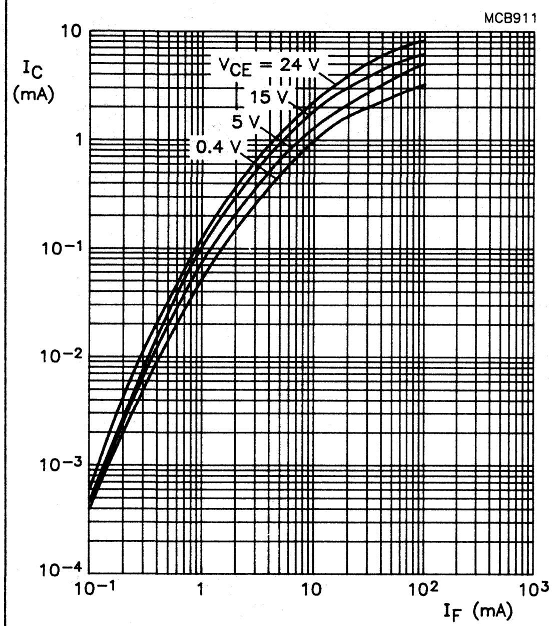
I_F = 1 mA; normalized to V_{CE} = 5 V; T_{amb} = 25 °C.

Fig.10 Collector current as a function of ambient temperature.



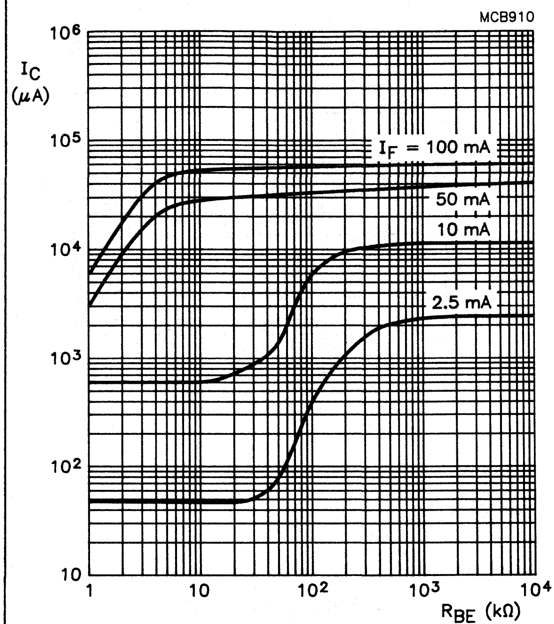
I_F = 10 mA; normalized to V_{CE} = 0.4 V; T_{amb} = 25 °C.

Fig.11 Collector current as a function of ambient temperature.



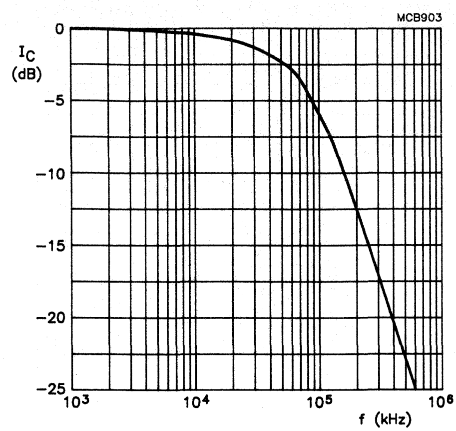
I_F = 10 mA; normalized to V_{CE} = 0.4 ; T_{amb} = 25 °C.

Fig.12 Collector current as a function of forward current.



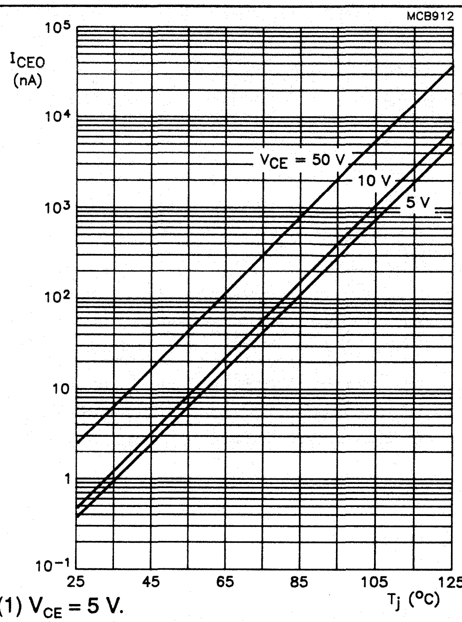
I_B = 0; V_{CE} = 5 V; T_{amb} = 25 °C.

Fig.13 Collector current as a function of base-emitter resistance.



$I_B = 0$; $V_{CE} = 5$ V; $I_C = 2$ mA; $R_L = 1$ kΩ; $T_{amb} = 25$ °C.

Fig.14 Relative collector current as a function of frequency.

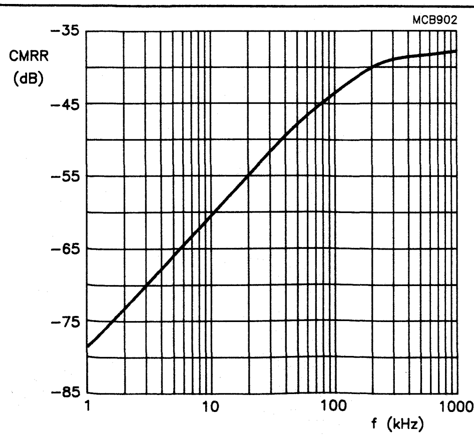


(1) $V_{CE} = 5$ V.

(2) $V_{CE} = 10$ V.

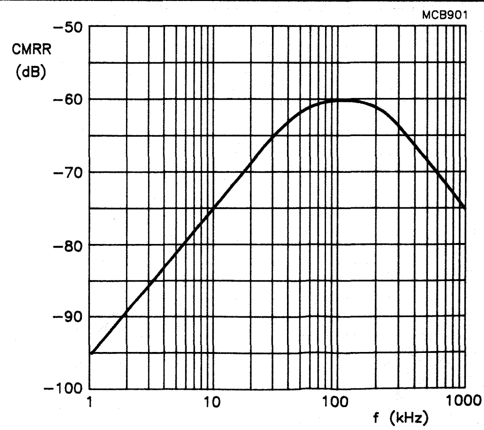
(3) $V_{CE} = 50$ V.

Fig.15 Collector-emitter dark current as a function of junction temperature.



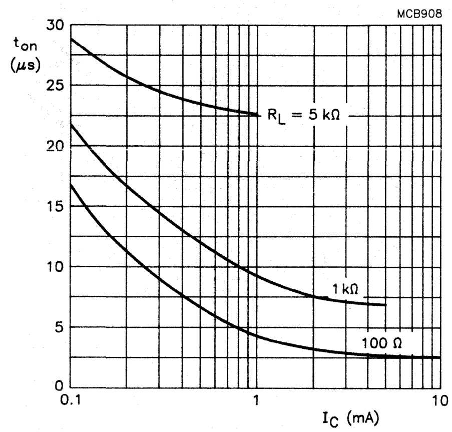
$V_{CC} = 5$ V; $I_C = 2$ mA; $T_{amb} = 25$ °C; R = 1 kΩ.

Fig.16 Common mode rejection ratio as a function of frequency, CNW85.



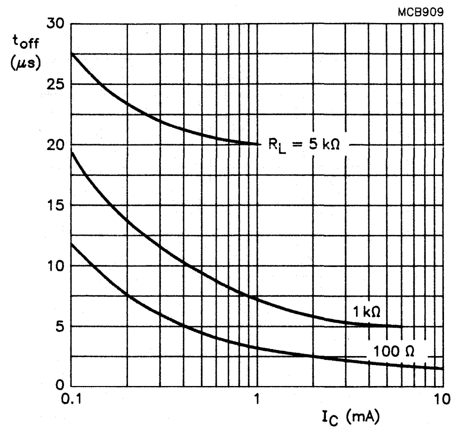
$V_{CC} = 5$ V; $I_C = 2$ mA; $T_{amb} = 25$ °C; R = 1 kΩ.

Fig.17 Common mode rejection ratio as a function of frequency, CNW84.



T_{amb} = 25 °C.

Fig.18 Turn-on time as a function of collector current.



T_{amb} = 25 °C.

Fig.19 Turn-off time as a function of collector current.

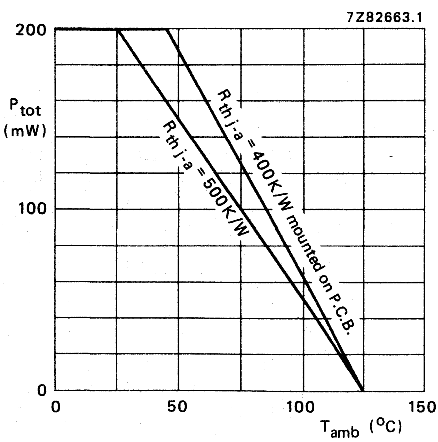


Fig.20 Total power dissipation as a function of ambient temperature.

Wide body, high isolation, high-speed optocouplers

CNW135/CNW136/CNW4502

FEATURES

- Wide body DIL encapsulation, with a pin distance of 10.16 mm
- Minimum clearance of 9.6 mm and minimum creepage of 10 mm
- 11 MHz bandwidth
- Short propagation delay times
- TTL compatible
- Low saturation voltage
- High transient immunity
- High degree of AC and DC insulation (5000 V (RMS) and 7070 V (DC)) in accordance with UL 1577 and IEC/BSI specifications
- Maximum permissible voltage of 8000 V (peak) and maximum operating isolation voltage of 1000 V (RMS) in accordance with VDE 0884.

APPLICATIONS

- High voltage isolation
- Video signal isolation
- Feedback element in SMPS
- Line receivers
- High-speed logic ground isolation
- Analog signal ground isolation
- Replaces pulse transformers.

DESCRIPTION

The CNW135, 136 and 4502 are high isolation voltage, fast-switching optocouplers, comprising an infrared emitting GaAlAs diode, optically coupled to a silicon photodetector in a wide 8-pin dual-in-line (DIL) SOT271 plastic envelope, and intended for use in "mains" applications.

The CNW4502 provides the same electrical switching and isolation performances as the CNW136, and increased ESD protection due to a non-connected base.

APPROVALS

STANDARD	REFERENCE
UL	covered under UL component recognition FILE E90700
BSI	certification in accordance with BS415:1990; BS7002:1989; BS6301 - class II applications
NORDIC	tested for applications (reinforced isolation); Class II applications for pluggable apparatus in normal tight execution
SETI	in accordance with IEC 65, 380, 950 & 335
SEMKO	in accordance with IEC 65, 380, 950 & 335
NEMKO	in accordance with IEC 65, 380, 950 & 335
DEMKO	in accordance with IEC 65, 380, 950 & 335
VDE (note 1)	approved in accordance with VDE 0883/6.80 reference voltage (VDE 0110b Tab 4): 500 V (AC)/600 V (DC) complied for reinforced isolation at 250 V (AC) with: DIN IEC 380/VDE 0806/8.81 DIN IEC 435/VDE 0805 "ENTWURF", Nov. 84 DIN 57804/VDE 0804/1.83 (isolation group C) DIN VDE 0860/8.86/HD 195 S4 DIN VDE 0750 Teil 1/5.82 IEC 601 Teil 1 IEC 950

Note

1. Approval in accordance with VDE 0884 pending.

CAUTION

It is advised that normal static precautions have to be taken in the handling and assembling of these components, to prevent damage and/or degradation which may be induced by ESD (Electrostatic Discharge).

The partial discharge test according to VDE 0884 is performed after all the other high voltage tests.

Wide body, high isolation, high-speed optocouplers

CNW135/CNW136/CNW4502

PINNING

PIN	DESCRIPTION
1	not connected
2	anode
3	cathode
4	not connected
5	ground
6	V_O
7	V_B
8	V_{CC}

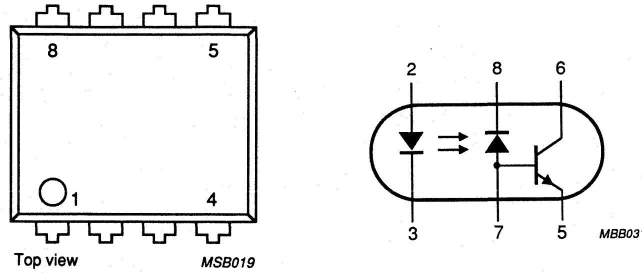


Fig.1 Simplified outline and symbol.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Diode					
I_F	forward current	DC value	–	100	mA
V_R	reverse voltage	DC value	–	5	V
Detector					
I_C	collector current		–	10	mA
V_{CEO}	collector-emitter voltage	open base	–	20	V
Optocoupler					
V_{IO}	isolation voltage	(VDE 0883/UL/IEC/BSI)			
		DC value	7.07	–	kV
		RMS value	5	–	kV
V_{Tr}	maximum permissible overvoltage (VDE 0884)	peak value	–	8000	V
V_{IORM}	maximum operating isolation voltage (VDE 0884)	RMS value	–	1000	V
I_C/I_F	current transfer ratio (CTR)	DC value; I_F = 16 mA; V_O = 0.4 V; V_{CC} = 4.5 V			
	CNW135		0.07	–	
	CNW136/4502		0.19	–	
t_{PHL}/t_{PLH}	propagation delay time	I_F = 16 mA; V_{CC} = 5 V; R_L = 4.1 kΩ for CNW135 and 1.9 kΩ for CNW136/4502			
	CNW135		–	1.5	µs
	CNW136/4502		–	0.8	µs
CMH	common mode transient immunity (logic HIGH)	V_{CM} = 10 $V_{(p-p)}$	1	–	kV/µs
CML	common mode transient immunity (logic LOW)	V_{CM} = 10 $V_{(p-p)}$	–1	–	kV/µs

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Diode					
I_F	forward current	DC value	–	100	mA
I_{FRM}	forward current	peak value; t_p = 1 µs; f = 300 Hz	–	1	A
V_R	reverse voltage	DC value	–	5	V
P_{tot}	total power dissipation	up to T_{amb} = 70 °C	–	250	mW
Detector					
I_C	collector current	DC value	–	10	mA
V_{CC}	supply voltage (pins 8 & 5)		–0.5	30	V
V_{CEO}	collector-emitter voltage (pins 6 & 5)		–0.5	20	V
V_{EBO}	emitter-base voltage (pins 7 & 5) (not for CNW4502)		–	5	V
P_{tot}	total power dissipation	up to T_{amb} = 70 °C	–	100	mW
Optocoupler					
T_{stg}	storage temperature range		–55	150	°C
T_{amb}	ambient operating temperature range		–55	85	°C
T_{sld}	soldering temperature up to the seating plane	T_{sld} < 10 s	–	260	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	MAX.	UNIT
Diode			
$R_{th\ j\text{-}a}$	from junction to ambient in free air	500	K/W
$R_{th\ j\text{-}a}$	from junction to ambient when mounted on PCB	400	K/W
Transistor			
$R_{th\ j\text{-}a}$	from junction to ambient in free air	500	K/W
$R_{th\ j\text{-}a}$	from junction to ambient when mounted on PCB	400	K/W

ISOLATION RELATED VALUES

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
L(IO1)	external air gap (clearance)	between input and output terminals	9.6	–	–	mm
L(IO2)	external tracking path (creepage distance)	between input and output terminals	10	–	–	mm
	internal plastic gap (clearance)	isolation thickness between emitter and receiver	1	–	–	mm
C_{io}	capacitance input to output	V_{IO} = 0; f = 1 MHz	–	0.4	0.6	pF
R_{IO}	insulation resistance between input and output	V_{IO} = ±500 V (DC); at 25 °C	10^{12}	10^{13}	–	Ω
		V_{IO} = ±500 V (DC); at 100 °C	10^{11}	–	–	Ω
		V_{IO} = ±500 V (DC); at 175 °C	10^{9}	–	–	Ω
V_{IO}	isolation voltage (note 1)	(VDE 0883/UL/IEC/BSI); t = 1 min				
		DC value	7.07	–	–	kV
		RMS value	5	–	–	kV
V_{IORM}	maximum operating isolation voltage	VDE 0884				
		RMS value	–	–	1000	V
		peak value	–	–	1414	V
V_{Pr}	partial discharge test voltage (note 2)	VDE 0884; V_{Pr} = 1.6 x V_{IORM} for t_p = 1 s, q_c < 5 pC				
		RMS value	–	–	1600	V
		peak value	–	–	2263	V
	partial discharge test voltage (note 3)	VDE 0884; V_{Pr} = 1.2 x V_{IORM} for t_p = 60 s, q_c < 5 pC				
		RMS value	–	–	1200	V
		peak value	–	–	1647	V
V_{Tr}	maximum permissible overvoltage (note 3)	VDE 0884; peak value; t_{Tr} = 10 s	–	–	8000	V

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Maximum safety ratings (maximum permissible in case of fault) (note 4 and Fig.7)						
T_{si}	package temperature		–	–	150	°C
I_{si}	input current I_F	$P_{si} = 0$	–	–	400	mA
P_{si}	power (output or total power dissipation)		–	–	700	mW

Notes

1. Every product is tested by applying an isolation test voltage of 6000 V (RMS) for 2 s between all shorted input side leads and all shorted output side leads, with a detection current of approximately 1 µA. A test at 5000 V (RMS) for 1 min is performed by sampling.
2. Every product is tested by applying a partial discharge test voltage of 1600 V (RMS) for 1 s between all shorted input side leads and all shorted output side leads, with a maximum partial discharge of 5 pC (see test procedure 'b', Fig.8)
3. Test procedure 'a' is performed by sampling (see Fig.9)
4. Isolation characteristics are guaranteed only within the maximum ratings that must be ensured by protective circuits in application.

CLASSIFICATION CATEGORIES

Installation category for rated line voltages ≤600 V (RMS)	DIN VDE 0109, Dec. 83, tab 1: I-IV
Installation category for rated line voltages ≤1000 V (RMS)	DIN VDE 0109, Dec. 83, tab 1: I-III
IEC climatic category	DIN IEC 68, part 1/0980: 55/100/21
Pollution degree	DIN VDE 0109, Dec. 83: 2
Comparative tracking index (CTI)	DIN IEC 112/VDE 0303, part 1: 175
Material group	DIN VDE 0109: IIIa

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Diode						
V_F	forward voltage	I_F = 16 mA	1.25	1.52	1.7	V
		I_F = 16 mA; T_{amb} = 0 to 70 °C	1.2	–	1.8	V
I_R	reverse current	V_R = 5 V	–	–	10	µA
		V_R = 5 V; T_{amb} = 0 to 70 °C	–	–	100	µA
C_d	diode capacitance	V_D = 0; f = 1 MHz	–	200	–	pF
Transistor						
$V_{(BR)CEO}$	collector-emitter breakdown voltage	I_C = 1 mA	20	–	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage (not for CNW4502)	I_C = 0.1 mA	5	–	–	V
I_{OH}	logic high output current	I_F = 0; $V_O = V_{CC}$ = 5.5 V	–	1.5	500	nA
		I_F = 0; $V_O = V_{CC}$ = 15 V	–	–	1	µA
		I_F = 0; $V_O = V_{CC}$ = 5.5 V; T_{amb} = 0 to 70 °C	–	–	50	µA
I_{CCH}	logic high supply current	I_F = 0; I_O = 0; V_{CC} = 15 V	–	–	1	µA
		I_F = 0; I_O = 0; V_{CC} = 15 V; T_{amb} = 0 to 70 °C	–	–	2	µA
I_{CCL}	logic low supply current	I_F = 16 mA; I_O = 0; V_{CC} = 15 V	–	50	200	µA
h_{FE}	DC current gain	I_O = 3 mA; V_O = 5 V	–	180	–	

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Optocoupler						
I_C/I_F	current transfer ratio (CTR)	DC value; I_F = 16 mA; V_O = 0.4 V; V_{CC} = 4.5 V; T_{amb} = 0 to 25 °C				
	CNW135		0.07	0.18	–	
	CNW136/4502		0.19	0.4	–	
		DC value; I_F = 16 mA; V_O = 0.4 V; V_{CC} = 4.5 V; T_{amb} = 0 to 70 °C				
	CNW135		0.05	–	0.75	
	CNW136/4502		0.15	–	0.75	
V_{OL}	logic low output voltage					
	CNW135	I_F = 16 mA; I_C = 1.1 mA; V_{CC} = 4.5 V	–	0.1	0.4	V
	CNW136/4502	I_F = 16 mA; I_C = 3 mA; V_{CC} = 4.5 V	–	0.1	0.4	V
	CNW135	I_F = 16 mA; I_C = 0.8 mA; V_{CC} = 4.5 V; T_{amb} = 0 to 70 °C	–	–	0.5	V
	CNW136/4502	I_F = 16 mA; I_C = 2.4 mA; V_{CC} = 4.5 V; T_{amb} = 0 to 70 °C	–	–	0.5	V
I_{OHW}	logic high output current (note 2)	V_{CC} = 10 V; V_W = 2.5 kV (DC); T_{amb} = 70 °C	–	–	2	µA
B	bandwidth (note 3)		–	11	–	MHz

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Switching times, CNW135 (see Figs 2 and 3)						
t_{PHL}	propagation delay time to logic low at output	I_F = 16 mA; V_{CC} = 5 V; R_L = 4.1 kΩ	–	0.3	1.5	μs
		I_F = 16 mA; V_{CC} = 5 V; R_L = 4.1 kΩ; 0 to 70 °C	–	–	2	μs
t_{PLH}	propagation delay time to logic high at output	I_F = 16 mA; V_{CC} = 5 V; R_L = 4.1 kΩ	–	0.6	1.5	μs
		I_F = 16 mA; V_{CC} = 5 V; R_L = 4.1 kΩ; 0 to 70 °C	–	–	2	μs
Switching times, CNW136/4502 (see Figs 2 and 3)						
t_{PHL}	propagation delay time to logic low at output	I_F = 16 mA; V_{CC} = 5 V; R_L = 1.9 kΩ	–	0.4	0.8	μs
		I_F = 16 mA; V_{CC} = 5 V; R_L = 1.9 kΩ; 0 to 70 °C	–	–	1	μs
t_{PLH}	propagation delay time to logic high at output	I_F = 16 mA; V_{CC} = 5 V; R_L = 1.9 kΩ	–	0.35	0.8	μs
		I_F = 16 mA; V_{CC} = 5 V; R_L = 1.9 kΩ; 0 to 70 °C	–	–	1	μs

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Transient immunity (see Fig.4)						
CMH	common mode transient immunity at logic high	$I_F = 0$; $V_{CC} = 5$ V; $V_{CM} = 10\ V_{(p-p)}$; $R_L = 4.1$ kΩ for CNW135 & 1.9 kΩ for CNW136/4502	1	–	–	kV/μs
CML	common mode transient immunity at logic low	$I_F = 16$ mA; $V_{CC} = 5$ V; $V_{CM} = 10\ V_{(p-p)}$; $R_L = 4.1$ kΩ for CNW135 & 1.9 kΩ for CNW136/4502	−1	–	–	kV/μs
CMRR	common mode rejection ratio	$I_C = 6$ mA; f = 10 kHz; $V_{CC} = 10$ V; $R_L = 1$ kΩ	–	−80	–	dB

Notes

1. Not for CNW4502.
2. This parameter is the maximum collector-emitter leakage current measured when a high DC voltage is applied between the emitter and the two shorted diode leads (see Fig.5).
3. The frequency at which the AC output voltage is 3 dB below its maximum value (see Fig.6).

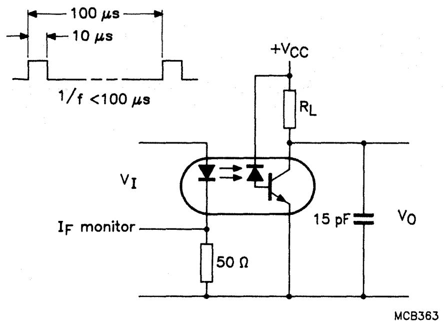


Fig.2 Switching times test circuit.

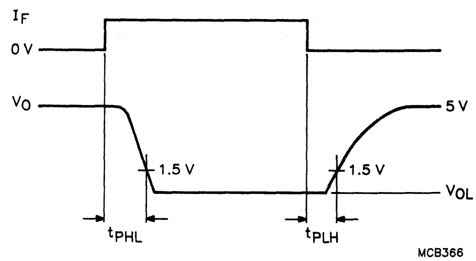


Fig.3 Switching times waveforms.

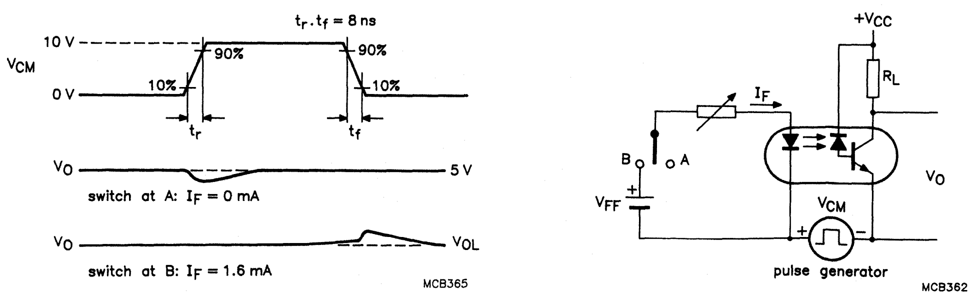


Fig.4 Transient immunity test circuit and waveforms.

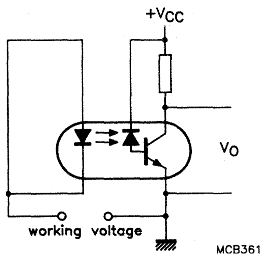
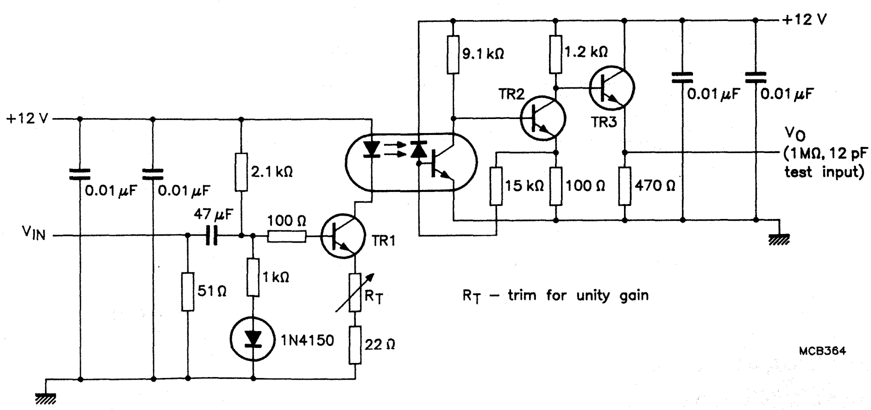


Fig.5 Logic output current test circuit.



Linearity ±3% at $V_{IN(p-p)}$ = 1 V; SNR = 50 dB; R_t = 375 Ω; V_O = 3.8 V (DC); I_F = 9 mA;

Fig.6 Frequency response test circuit, typical values.

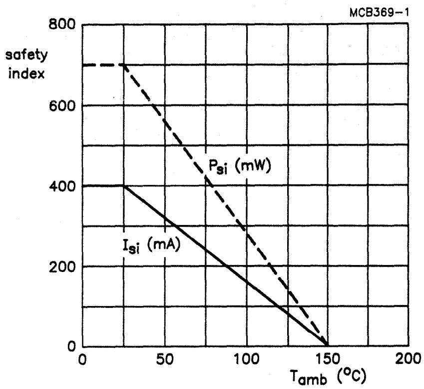
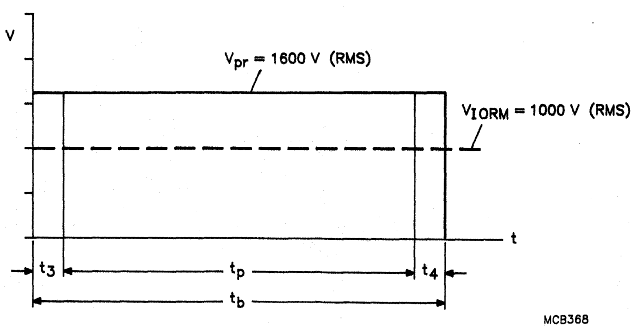


Fig.7 Dependence of maximum safety ratings with ambient temperature.



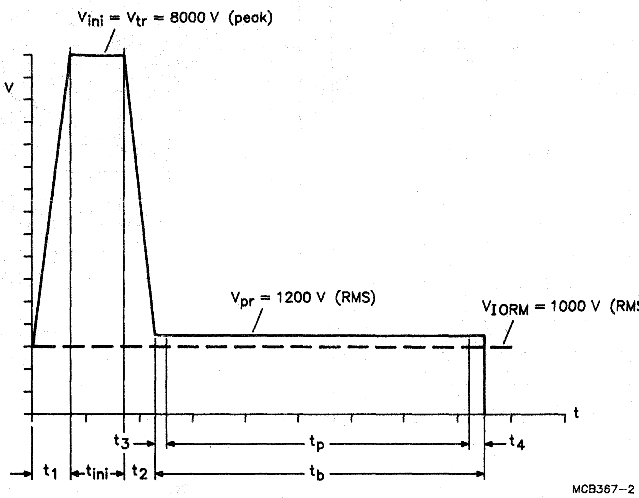
t_p = 1 s; t_b = 1.2 s; t_3 = t_4 = 0.1 s.

T_{amb} = 15 to 35 °C/(23±1) °C in case of dispute.

R_H = 45 to 75/(50±2)% in case of dispute.

Partial discharge test limit q_c = 5 pC (during t_p).

Fig.8 Partial discharge measurement procedure 'b', in accordance with VDE 0884 non destructive test for 100% inspection.



t_{ini} = 10 s; t_4 = t_2 = 100 V/s to 1000 V/s; t_p = 60 s; t_3 = t_4 = 1 s.

T_{amb} = 15 to 35 °C/(23±1) °C in case of dispute.

R_H = 45 to 75/(50±2)% in case of dispute.

Partial discharge test limit q_c = 5 pC (during t_p).

Fig.9 Partial discharge measurement procedure 'a', in accordance with VDE 0884 destructive test for qualification and sampling tests.

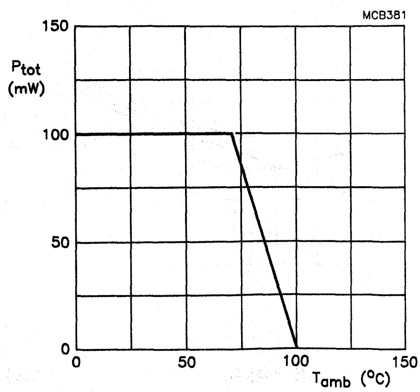
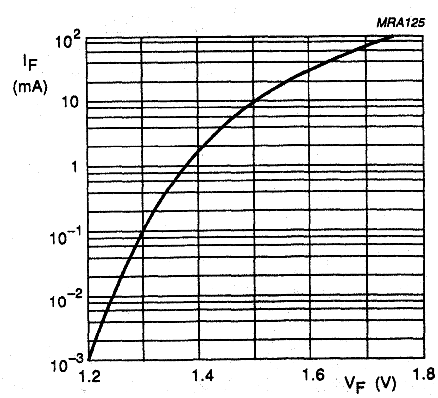
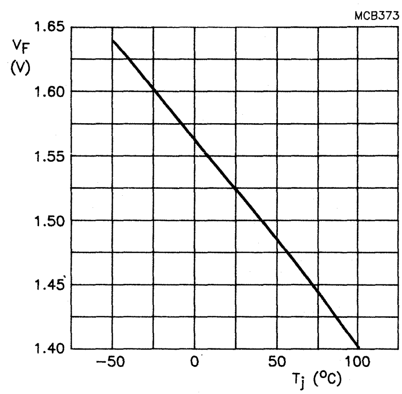


Fig.10 Total power dissipation as a function of ambient temperature.



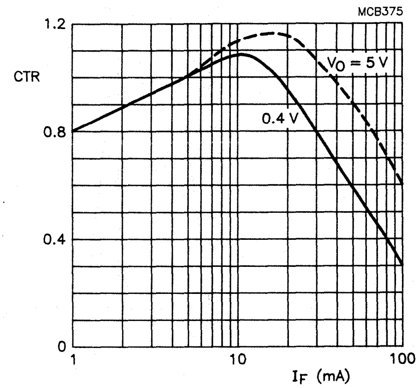
T_{amb} = 25 °C.

Fig.11 Forward current as a function of forward voltage; typical values.



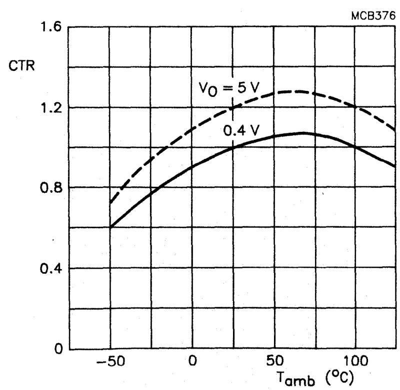
I_F = 16 mA.

Fig.12 Forward voltage as a function of junction temperature, typical values.



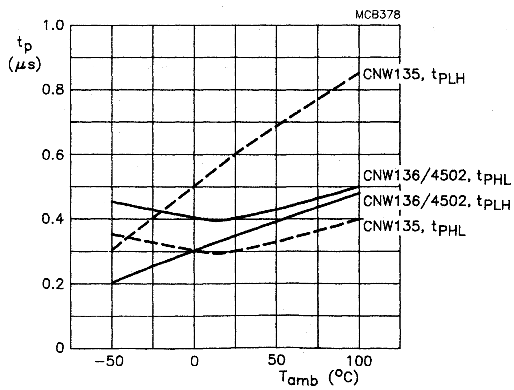
Normalized at I_F = 16 mA; V_{CC} = 4.5 V; V_O = 0.4 V; T_{amb} = 25 °C.

Fig.13 Current transfer ratio as a function of forward current.



Normalized at I_F = 16 mA; V_{CC} = 4.5 V; V_O = 0.4 V; T_{amb} = 25 °C.

Fig.14 Current transfer ratio as a function of ambient temperature.



V_{CC} = 5 V; I_F = 16 mA; R_L = 4.1 kΩ for CNW135 and 1.9 kΩ for CNW136/4502.

Fig.15 Propagation delay times as functions of ambient temperature, typical values.

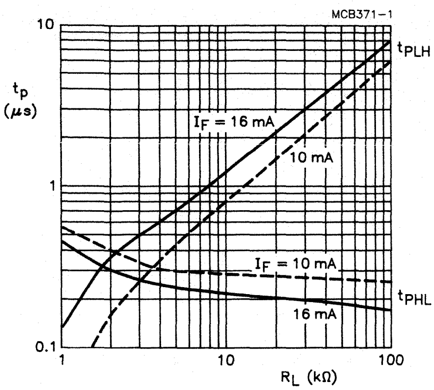
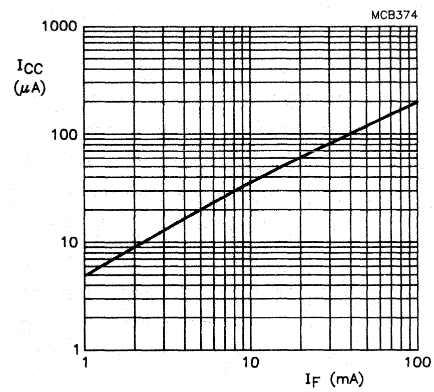


Fig.16 Propagation delay times as functions of loading resistance.



V_{CC} = 15 V; I_O = 0; T_{amb} = 25 °C.

Fig.17 Logic low supply current as a function of forward current, typical values.

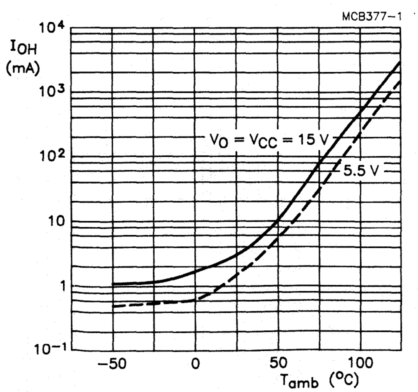
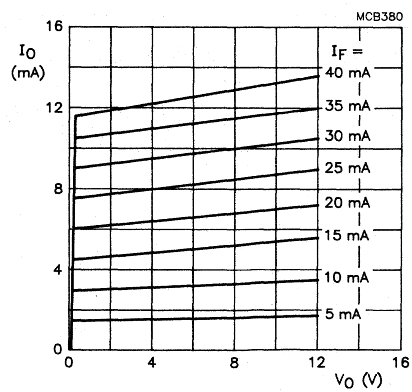
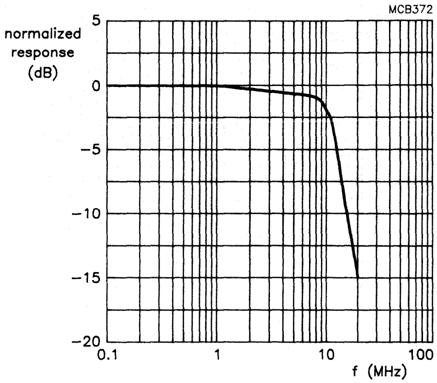


Fig.18 Logic HIGH output current as a function of ambient temperature, typical values.



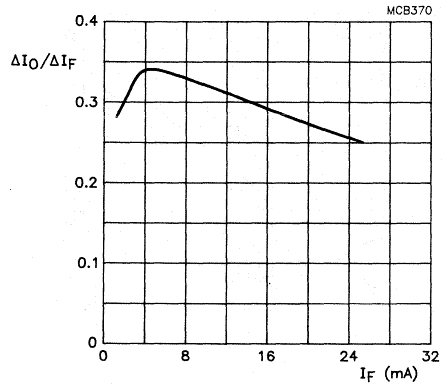
V_{CC} = 15 V; T_{amb} = 25 °C.

Fig.19 DC and pulsed transfer characteristics, typical values.



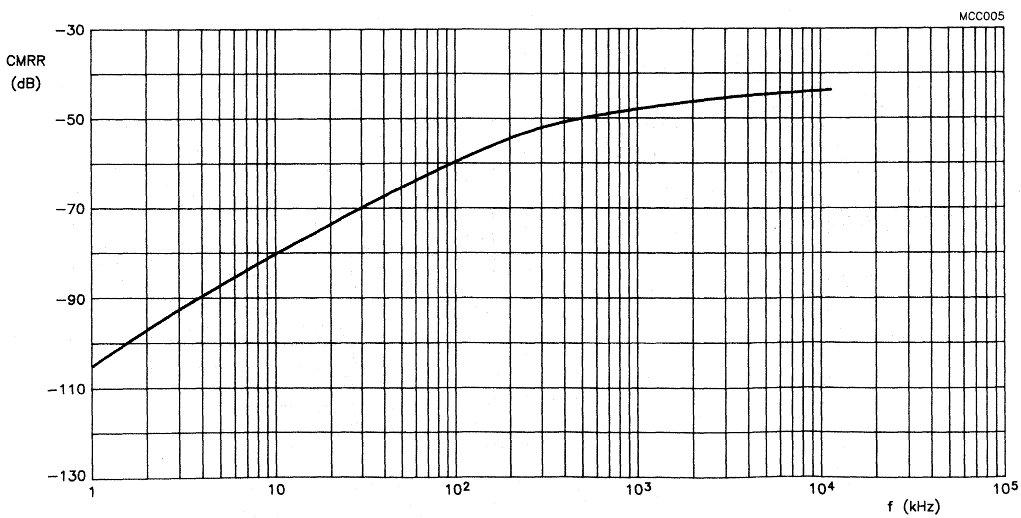
T_{amb} = 25 °C.

Fig.20 Frequency response.



R_l = 100 Ω; V_{CC} = 5 V; T_{amb} = 25 °C.

Fig.21 Small signal current transfer ratio ($\Delta I_O/\Delta I_F$) as a function of quiescent input current.



V_{CC} = 10 V; R_L = 1 kΩ; I_C = 6 mA; T_{amb} = 25 °C.

Fig.22 Common mode rejection ratio as a function of frequency.

Wide body, high isolation/high-gain optocouplers

CNW138/CNW139

FEATURES

- Wide body DIL encapsulation, with a pin distance of 10.16 mm
- Minimum clearance of 9.6 mm and minimum creepage of 10 mm
- High current transfer ratio
- Short propagation delay times
- TTL compatible
- Low saturation voltage
- High transient immunity
- High degree of AC and DC insulation (5000 V (RMS) and 7070 V (DC)) in accordance with UL 1577 and IEC/BSI specifications
- Maximum permissible voltage of 8000 V (peak) and maximum operating isolation voltage of 1000 V (RMS) in accordance with VDE 0884.

APPLICATIONS

- High voltage isolation
- Line receivers
- Logic families ground isolation
- Low power systems
- Line voltage status indicator.

DESCRIPTION

The CNW138 and 139 are high isolation voltage optocouplers, comprising an infrared emitting GaAlAs diode, optically coupled to a high gain Darlington photodetector in an 8-pin dual-in-line (DIL) SOT271 plastic envelope, and intended for use in "mains" applications.

APPROVALS

STANDARD	REFERENCE
UL	covered under UL component recognition FILE E90700
BSI	certification in accordance with BS415:1990; BS7002:1989; BS6301 - class II applications
NORDIC	tested for applications (reinforced isolation); Class II applications for pluggable apparatus in normal tight execution
SETI	in accordance with IEC 65, 380, 950 & 335
SEMKO	in accordance with IEC 65, 380, 950 & 335
NEMKO	in accordance with IEC 65, 380, 950 & 335
DEMKO	in accordance with IEC 65, 380, 950 & 335
VDE (note 1)	approved in accordance with VDE 0883/6.80 reference voltage (VDE 0110b Tab 4): 500 V (AC)/600 V (DC) complied for reinforced isolation at 250 V (AC) with: DIN IEC 380/VDE 0806/8.81 DIN IEC 435/VDE 0805 "ENTWURF", Nov. 84 DIN 57804/VDE 0804/1.83 (isolation group C) DIN VDE 0860/8.86/HD 195 S4 DIN VDE 0750 Teil 1/5.82 IEC 601 Teil 1 IEC 950

Note

1. Approval in accordance with VDE 0884 pending.

PINNING

PIN	DESCRIPTION
1	not connected
2	anode
3	cathode
4	not connected
5	ground
6	V_O
7	V_B
8	V_{CC}

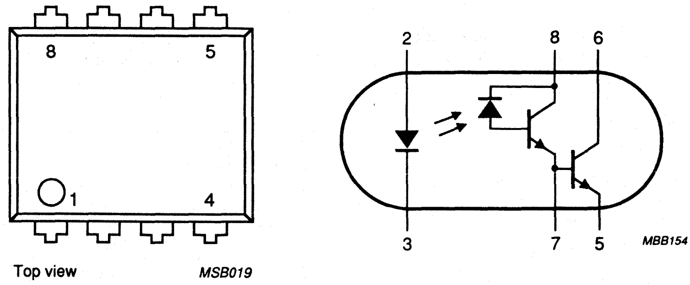


Fig.1 Simplified outline and symbol.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Diode					
I_F	forward current	DC value	–	100	mA
V_R	reverse voltage	DC value	–	5	V
Detector					
I_C	collector current		–	60	mA
V_{CEO}	collector-emitter voltage				
	CNW138		–	7	V
	CNW139		–	18	V
Optocoupler					
V_{IO}	isolation voltage	(VDE 0883/UL/IEC/BSI)			
		DC value	7.07	–	kV
		RMS value	5	–	kV
V_{Tr}	maximum permissible overvoltage (VDE 0884)	peak value	–	8000	V
V_{IORM}	maximum operating isolation voltage (VDE 0884)	RMS value	–	1000	V
I_C/I_F	DC current transfer ratio (CTR)	I_F = 1.6 mA; V_O = 0.4 V; V_{CC} = 4.5 V			
	CNW138		3	–	
	CNW139		5	–	
t_{PHL}	propagation delay time to logic low at output, CNW138	I_F = 1.6 mA; V_{CC} = 5 V; R_L = 2.2 kΩ	–	10	µs
	propagation delay time to logic low at output, CNW139	I_F = 0.5 mA; V_{CC} = 5 V; R_L = 4.7 kΩ	–	25	µs
t_{PLH}	propagation delay time to logic high at output, CNW138	I_F = 1.6 mA; V_{CC} = 5 V; R_L = 2.2 kΩ	–	35	µs
	propagation delay time to logic high at output, CNW139	I_F = 0.5 mA; V_{CC} = 5 V; R_L = 4.7 kΩ	–	60	µs
CMH	common mode transient immunity (logic high)	V_{CM} = 10 $V_{(p-p)}$	0.5	–	kV/µs
CML	common mode transient immunity (logic low)	V_{CM} = 10 $V_{(p-p)}$	–0.5	–	kV/µs

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Diode					
I_F	forward current	DC value	–	100	mA
I_{FRM}	forward current	peak value; t_p = 1 μs; f = 300 Hz	–	1	A
V_R	reverse voltage	DC value	–	5	V
P_{tot}	total power dissipation	up to T_{amb} = 70 °C	–	250	mW
Detector					
I_C	collector current	DC value	–	60	mA
V_O	output voltage (pins 6 & 5)				
	CNW138		−0.5	7	V
	CNW139		−0.5	18	V
V_{CC}	supply voltage (pins 8 & 5)				
	CNW138		−0.5	7	V
	CNW139		−0.5	18	V
V_{EBO}	emitter-base voltage (pins 7 & 5)		–	5	V
P_{tot}	total power dissipation	up to T_{amb} = 70 °C	–	100	mW
Optocoupler					
T_{stg}	storage temperature range		−55	150	°C
T_{amb}	ambient operating temperature range		−55	85	°C
T_{sld}	soldering temperature up to the seating plane	T_{sld} < 10 s	–	260	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	MAX.	UNIT
Diode			
$R_{th\ j\text{-}a}$	from junction to ambient in free air	500	K/W
$R_{th\ j\text{-}a}$	from junction to ambient when mounted on PCB	400	K/W
Transistor			
$R_{th\ j\text{-}a}$	from junction to ambient in free air	500	K/W
$R_{th\ j\text{-}a}$	from junction to ambient when mounted on PCB	400	K/W

ISOLATION RELATED VALUES

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
L(IO1)	external air gap (clearance)	between input and output terminals	9.6	–	–	mm
L(IO2)	external tracking path (creepage distance)	between input and output terminals	10	–	–	mm

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
	internal plastic gap (clearance)	isolation thickness between emitter and receiver	1	–	–	mm
C_{io}	capacitance input to output	$V_{IO} = 0$; f = 1 MHz	–	0.4	0.6	pF
R_{IO}	insulation resistance between input and output	$V_{IO} = \pm 500$ V (DC); at 25 °C	10^{12}	10^{13}	–	Ω
		$V_{IO} = \pm 500$ V (DC); at 100 °C	10^{11}	–	–	Ω
		$V_{IO} = \pm 500$ V (DC); at 175 °C (T_{si} max.)	10^{9}	–	–	Ω
V_{IO}	isolation voltage (note 1)	(VDE 0883/UL/IEC/BSI); t = 1 min				
		DC value	7.07	–	–	kV
		RMS value	5	–	–	kV
V_{IORM}	maximum operating isolation voltage	VDE 0884; RMS value	1000	–	–	V
V_{Pr}	partial discharge test voltage (note 2)	VDE 0884; RMS value; $V_{Pr} = 1.6 \times V_{IORM}$ for $t_p = 1$ s, $q_c < 5$ pC	1600	–	–	V
	partial discharge test voltage (note 3)	VDE 0884; RMS value; $V_{Pr} = 1.2 \times V_{IORM}$ for $t_p = 60$ s, $q_c < 5$ pC	1200	–	–	V
V_{Tr}	maximum permissible overvoltage (note 3)	VDE 0884; peak value; $t_{Tr} = 10$ s	8000	–	–	V
Maximum safety ratings (maximum permissible in case of fault) (note 4 and Fig.6)						
T_{si}	package temperature		–	–	150	°C
I_{si}	input current I_F	$P_{si} = 0$	–	–	400	mA
P_{si}	power (output or total power dissipation)		–	–	700	mW

Notes

1. Every product is tested by applying an isolation test voltage of 6000 V (RMS) for 2 s between all shorted input side leads and all shorted output side leads, with a detection current of approximately 1 µA. A test at 5000 V (RMS) for 1 min is performed by sampling.
2. Every product is tested by applying a partial discharge test voltage of 1600 V (RMS) for 1 s between all shorted input side leads and all shorted output side leads, with a maximum partial discharge of 5 pC (see test procedure 'b', Fig.7)
3. Test procedure 'a' is performed by sampling (see Fig.8)
4. Isolation characteristics are guaranteed only within the maximum ratings that must be ensured by protective circuits in application.

CLASSIFICATION CATEGORIES

Installation category for rated line voltages ≤600 V (RMS)	DIN VDE 0109, Dec. 83, tab 1: I-IV
Installation category for rated line voltages ≤1000 V (RMS)	DIN VDE 0109, Dec. 83, tab 1: I-III
IEC climatic category	DIN IEC 68, part 1/0980: 55/100/21
Pollution degree	DIN VDE 0109, Dec. 83: 2
Comparative tracking index (CTI)	DIN IEC 112/VDE 0303, part 1: 175
Material group	DIN VDE 0109: IIIa

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Diode						
V_F	forward voltage	I_F = 1.6 mA	1.25	1.4	1.7	V
		I_F = 1.6 mA; 0 to 70 °C	1.1	–	1.8	V
I_R	reverse current	V_R = 5 V	–	–	10	μA
		V_R = 5 V; 0 to 70 °C	–	–	100	μA
C_d	diode capacitance	V_D = 0; f = 1 MHz	–	200	–	pF
Transistor						
$V_{(BR)CEO}$	collector-emitter breakdown voltage	I_C = 1 mA				
	CNW138		7	–	–	V
	CNW139		18	–	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage (not for CNW4502)	I_C = 0.1 mA	0.5	–	–	V
I_{OH}	logic high output current, CNW138	I_F = 0; V_O = V_{CC} = 7 V; 0 to 70 °C	–	0.05	250	μA
	logic high output current, CNW139	I_F = 0; V_O = V_{CC} = 18 V; 0 to 70 °C	–	0.1	100	μA
I_{CCH}	logic high supply current	I_F = 0; I_O = 0; V_{CC} = 18 V; 0 to 70 °C	–	0.01	1	μA
I_{CCL}	logic low supply current	I_F = 1.6 mA; I_O = 0; V_{CC} = 18 V; 0 to 70 °C	–	0.5	2	mA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Optocoupler						
I_C/I_F	DC current transfer ratio (CTR)	I_F = 1.6 mA; V_O = 0.4 V; V_{CC} = 4.5 V; 0 to 70 °C				
	CNW138		3	15	–	
	CNW139		5	30	–	
	DC current transfer ratio, CNW139	I_F = 0.5 mA; V_O = 0.4 V; V_{CC} = 4.5 V; 0 to 70 °C	4	45	–	
V_{OL}	logic low output voltage, CNW138	I_F = 1.6 mA; I_C = 4.8 mA; V_{CC} = 4.5 V; 0 to 70 °C	–	0.1	0.4	V
	logic low output voltage, CNW139	I_F = 1.6 mA; I_C = 8 mA; V_{CC} = 4.5 V; 0 to 70 °C	–	0.1	0.4	V
		I_F = 5 mA; I_C = 15 mA; V_{CC} = 4.5 V; 0 to 70 °C	–	0.1	0.4	V
		I_F = 12 mA; I_C = 24 mA; V_{CC} = 4.5 V; 0 to 70 °C	–	0.1	0.4	V
I_{OHW}	logic high output current (note 1)	V_{CC} = 5.5 V; V_W = 2.5 kV (DC); T_{amb} = 70 °C	–	–	20	µA
Switching times, CNW138 (see Figs 2 and 3)						
t_{PHL}	propagation delay time to logic low at output	I_F = 1.6 mA; V_{CC} = 5 V; R_L = 2.2 kΩ	–	2	10	µs
		I_F = 1.6 mA; V_{CC} = 5 V; R_L = 2.2 kΩ; 0 to 70 °C	–	–	11	µs
t_{PLH}	propagation delay time to logic high at output	I_F = 1.6 mA; V_{CC} = 5 V; R_L = 2.2 kΩ	–	20	35	µs
		I_F = 1.6 mA; V_{CC} = 5 V; R_L = 2.2 kΩ; 0 to 70 °C	–	–	70	µs

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Switching times, CNW139 (see Figs 2 and 3)						
t_{PHL}	propagation delay time to logic low at output	I_F = 0.5 mA; V_{CC} = 5 V; R_L = 4.7 kΩ	–	7	25	μs
		I_F = 0.5 mA; V_{CC} = 5 V; R_L = 4.7 kΩ; 0 to 70 °C	–	–	30	μs
		I_F = 12 mA; V_{CC} = 5 V; R_L = 270 Ω	–	0.3	1	μs
		I_F = 12 mA; V_{CC} = 5 V; R_L = 270 Ω; 0 to 70 °C	–	–	1.1	μs
t_{PLH}	propagation delay time to logic high at output	I_F = 0.5 mA; V_{CC} = 5 V; R_L = 4.7 kΩ	–	40	60	μs
		I_F = 0.5 mA; V_{CC} = 5 V; R_L = 4.7 kΩ; 0 to 70 °C	–	–	115	μs
		I_F = 12 mA; V_{CC} = 5 V; R_L = 270 Ω	–	3.5	7	μs
		I_F = 12 mA; V_{CC} = 5 V; R_L = 270 Ω; 0 to 70 °C	–	–	11	μs
Transient immunity (see Fig.4 and note 2)						
CMH	common mode transient immunity at logic high	I_F = 0; V_{CC} = 5 V; V_{CM} = 10 $V_{(p-p)}$; R_L = 2.2 kΩ	0.5	–	–	kV/μs
CML	common mode transient immunity at logic low	I_F = 1.6 mA; V_{CC} = 5 V; V_{CM} = 10 $V_{(p-p)}$; R_L = 2.2 kΩ	–0.5	–	–	kV/μs

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Transient immunity (see Fig.4 and note 2)						
CMRR	common mode rejection ratio	I_C = 45 mA; f = 10 kHz; V_{CC} = 10 V; R_L = 100 Ω	–	–65	–	dB

Notes

1. This parameter is the maximum collector-emitter leakage current measured when a high DC voltage is applied between the emitter and the two shorted diode leads (see Fig.5).
2. R_{CC} (kΩ) = 1 V/0.15 I_F (mA), to protect the photodetector against high surge currents.

CAUTION

It is advised that normal static precautions have to be taken in the handling and assembling of these components, to prevent damage and/or degradation which may be induced by ESD (Electrostatic Discharge).
The partial discharge test according to VDE 0884 is performed after all the other high voltage tests.

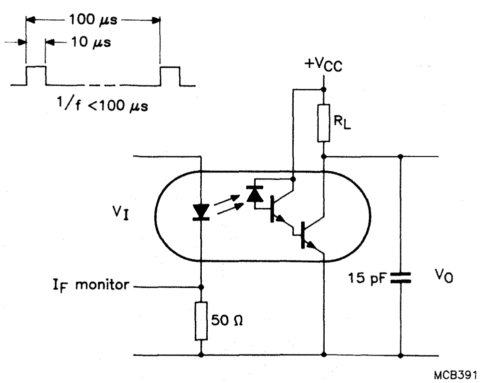


Fig.2 Switching times test circuit.

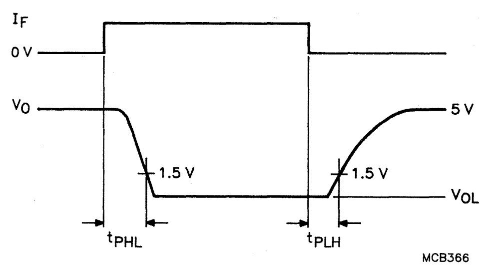


Fig.3 Switching times waveforms.

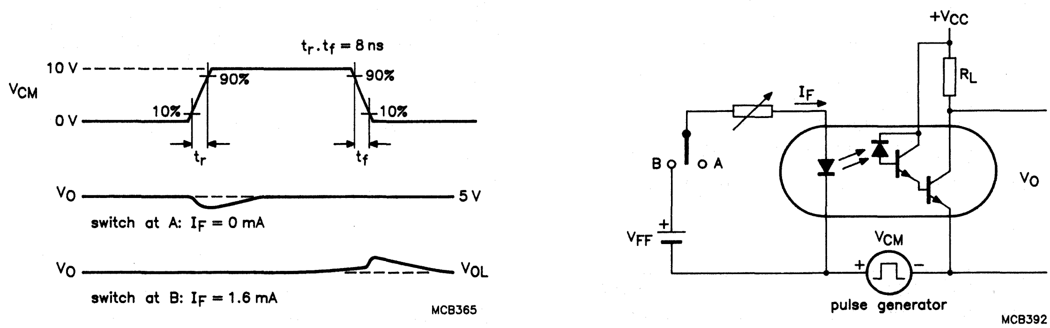


Fig.4 Transient immunity test circuit and waveforms.

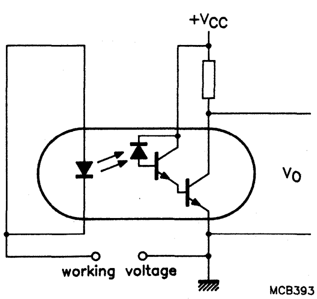


Fig.5 Logic output current test circuit.

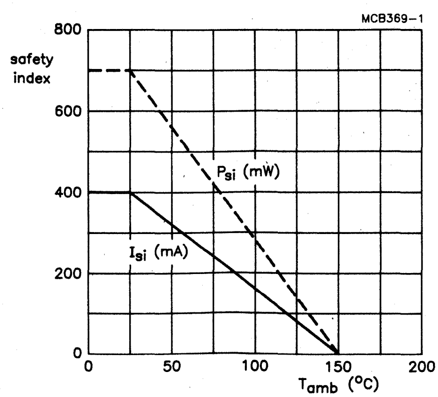
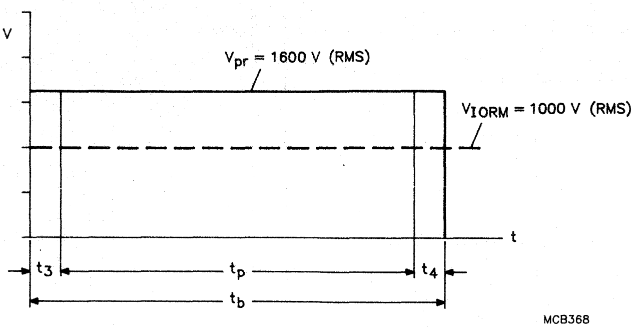


Fig.6 Dependence of maximum safety ratings with ambient temperature.



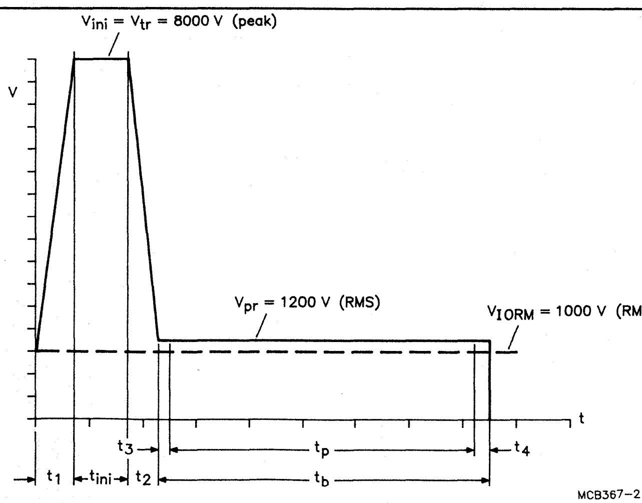
t_p = 1 s; t_b = 1.2 s; $t_3 = t_4$ = 0.1 s.

T_{amb} = 15 to 35 °C/(23±1) °C in case of dispute.

R_H = 45 to 75/(50±2)% in case of dispute.

Partial discharge test limit q_c = 5 pC (during t_p).

Fig.7 Partial discharge measurement procedure 'b', in accordance with VDE 0884 non destructive test for 100% inspection.



t_{ini} = 10 s; $t_4 = t_2$ = 100 V/s to 1000 V/s; t_p = 60 s; $t_3 = t_4$ = 1 s.

T_{amb} = 15 to 35 °C/(23±1) °C in case of dispute.

R_H = 45 to 75/(50±2)% in case of dispute.

Partial discharge test limit q_c = 5 pC (during t_p).

Fig.8 Partial discharge measurement procedure 'a', according to VDE 0884 destructive test for qualification and sampling tests.

Wide body, high isolation/high-gain optocouplers

CNW138/CNW139

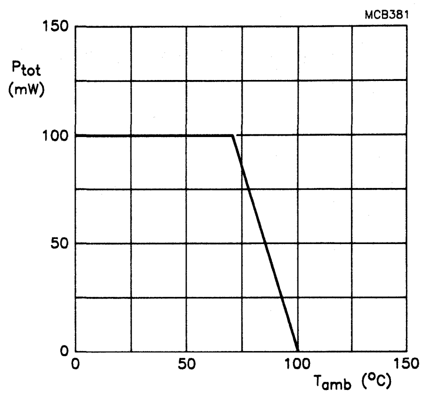
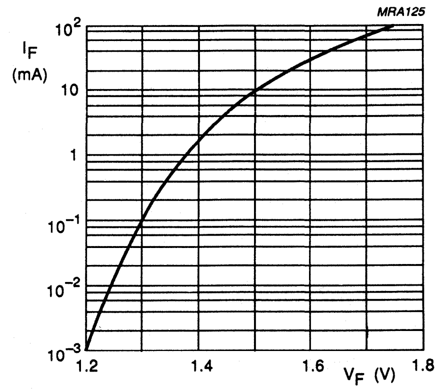
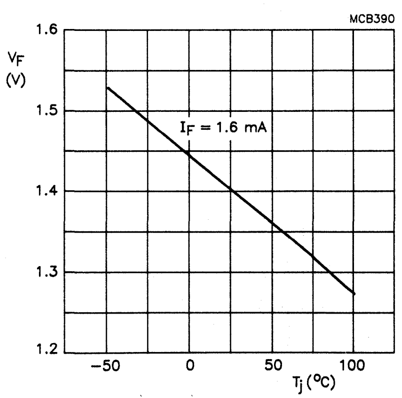


Fig.9 Total power dissipation as a function of ambient temperature.



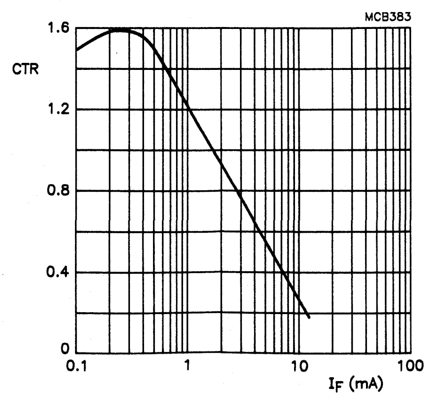
T_{amb} = 25 °C.

Fig.10 Forward current as a function of forward voltage; typical values.



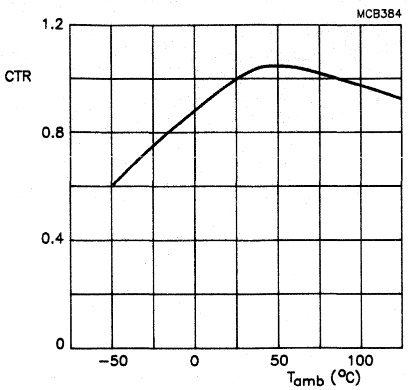
I_F = 1.6 mA.

Fig.11 Forward voltage as a function of junction temperature, typical values.



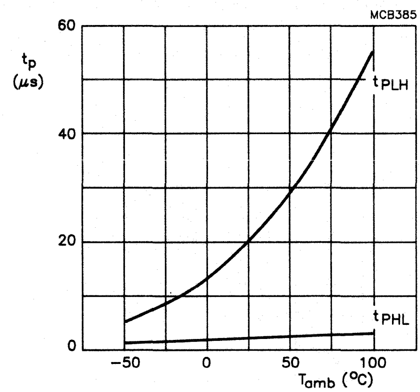
Noramlized at I_F = 1.6 mA; V_{CC} = 4.5 V; V_O = 0.4 V; T_{amb} = 25 °C.

Fig.12 Current transfer ratio as a function of forward current.



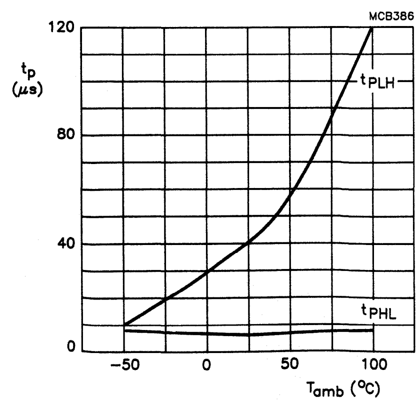
Noramlized at I_F = 1.6 mA; V_{CC} = 4.5 V; V_O = 0.4 V; T_{amb} = 25 °C.

Fig.13 Current transfer ratio as a function of ambient temperature.



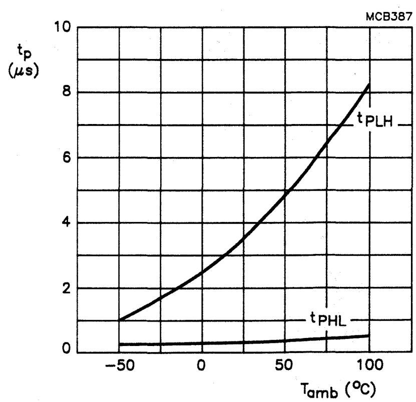
I_F = 1.6 mA; V_{CC} = 5 V; R_L = 2.2 kΩ; typical values.

Fig.14 Propagation delay times as functions of ambient temperature, CNW138.



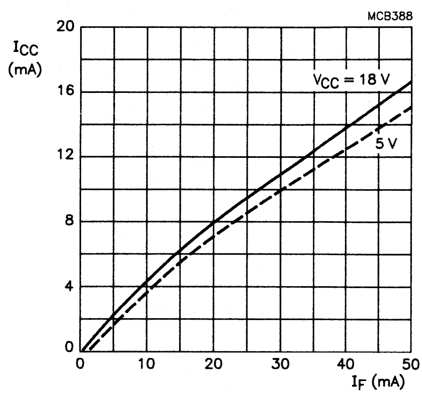
I_F = 0.5 mA; V_{CC} = 5 V; R_L = 4.7 kΩ; typical values.

Fig.15 Propagation delay times as functions of ambient temperature, CNW139.



I_F = 12 mA; V_{CC} = 5 V; R_L = 270 Ω; typical values.

Fig.16 Propagation delay times as functions of ambient temperature, CNW139.



$I_O = 0$; $T_{amb} = 25$ °C.

Fig.17 Logic low supply current as a function of forward current, typical values.

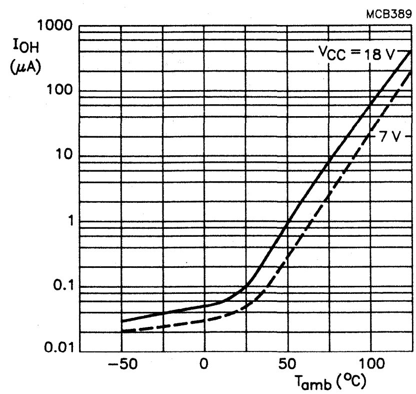
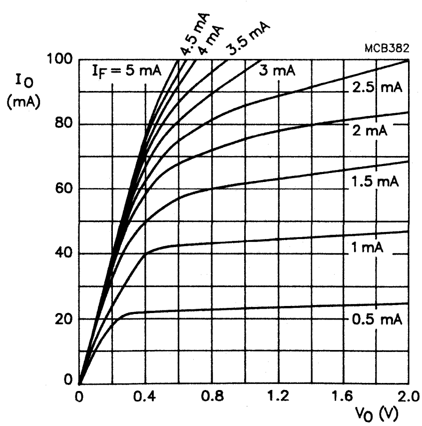
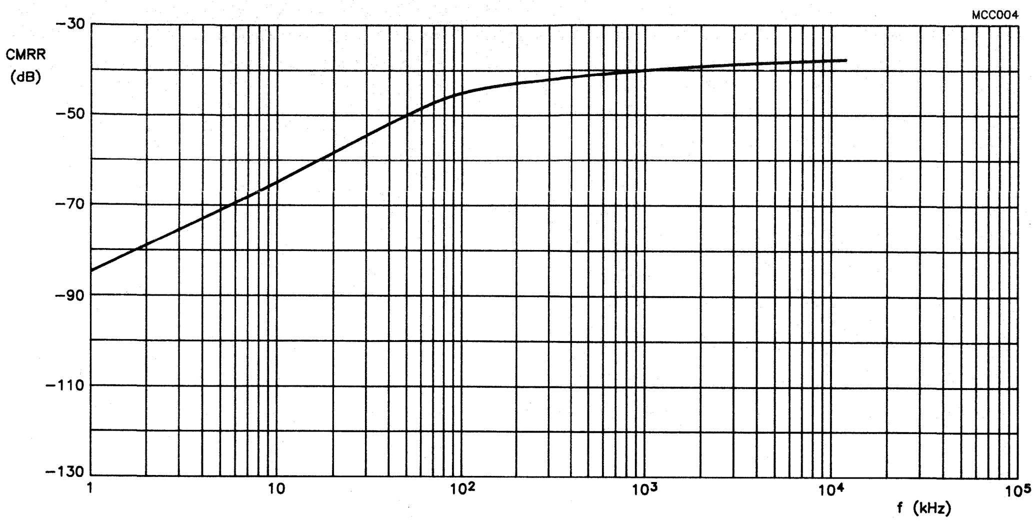


Fig.18 Logic high output current as a function of ambient temperature, typical values.



$V_{CC} = 5$ V; $T_{amb} = 25$ °C.

Fig.19 DC and pulsed transfer characteristics, typical values.



V_{CC} = 10 V; R_L = 100 Ω; I_C = 45 mA; T_{amb} = 25 °C.

Fig.20 Common mode rejection ratio as a function of frequency.

HIGH-VOLTAGE OPTOCOUPLER

Optically coupled isolator consisting of an infrared emitting GaAs diode and a silicon n-p-n photo-transistor. The base is not accessible.

Features of this product:

- very high isolation voltage of 10 kV (d.c.).
- working voltage of 10 kV (d.c.).
- high common mode rejection 85 dB

QUICK REFERENCE DATA

Diode				
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_{FRM}	max.	3	A
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
Optocoupler				
Output/input d.c. current transfer ratio (C.T.R.) 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_{IORM}	min.	10	kV

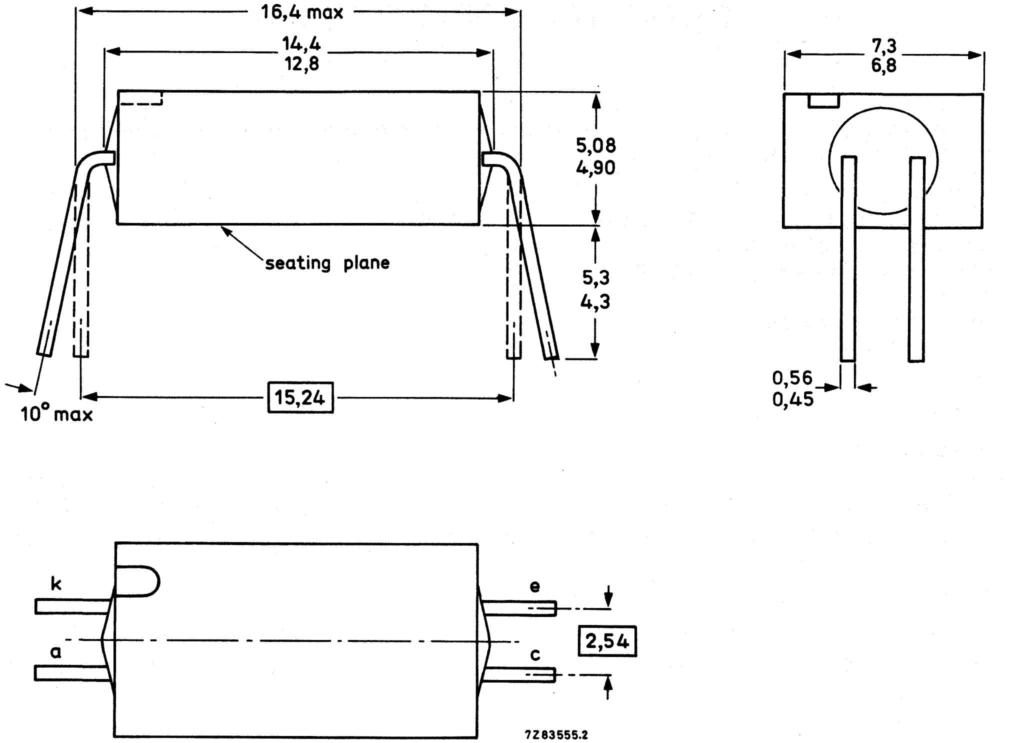
MECHANICAL DATA

SOT-211 (see Fig. 1)

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-211.



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.	50	mA
(peak value); t_p = 10 μs; δ = 0,01	I_{FRM}	max.	3	A
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

Optocoupler

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	$R_{th\ j\text{-}a}$	max.	750	K/W
transistor	$R_{th\ j\text{-}a}$	max.	750	K/W
From junction to ambient, device mounted on a printed circuit board				
diode	$R_{th\ j\text{-}a}$	max.	400	K/W
transistor	$R_{th\ j\text{-}a}$	max.	400	K/W

CHARACTERISTICS

$T_j = 25$ °C unless otherwise specified

Diode

Forward voltage $I_F = 10$ mA	V_F	typ.	1,15	V
		<	1,3	V
Reverse current $V_R = 5$ V	I_R	<	100	μA
Diode capacitance at f = 1 MHz $V_R = 0$	C_d	typ.	40	pF

Transistor

Collector cut-off current (dark) $V_{CE} = 10$ V	I_{CEO}	typ.	2	nA
		<	50	nA
Collector-emitter breakdown voltage open base; $I_C = 1$ mA	$V_{(BR)CEO}$	min.	30	V
Emitter-collector breakdown voltage open base; $I_E = 0,1$ mA	$V_{(BR)ECO}$	min.	7	V

Optocoupler ($I_B = 0$)*

Output/input d.c. current transfer ratio (C.T.R.) $I_F = 10$ mA; $V_{CE} = 0,4$ V	I_C/I_F	min.	0,2	
		typ.	0,5	
Collector-emitter saturation voltage $I_F = 10$ mA; $I_C = 2$ mA	V_{CEsat}	typ.	0,15	V
Isolation voltage, d.c. value (see note 1)	V_{IORM}	min.	10	kV

Note see next page.

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

Capacitance between input and output $I_F = 0$; $V = 0$; $f = 1$ MHz	C_{io}	typ.	0,15 pF
Insulation resistance between input and output $\pm V_{IO} = 1$ kV	r_{IO}	>	10^{11} Ω 12^{12} Ω
Common mode rejection (see Fig. 3) $I_C = 2$ mA; $f = 10$ kHz	CMRR	typ.	85 dB
Switching times (see Fig. 13) $I_{Con} = 2$ 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
Collector cut-off current (dark) see Fig. 2 $V_{CC} = 10$ V; working voltage (d.c.) = 10 kV	I_{CEW}	<	200 nA*

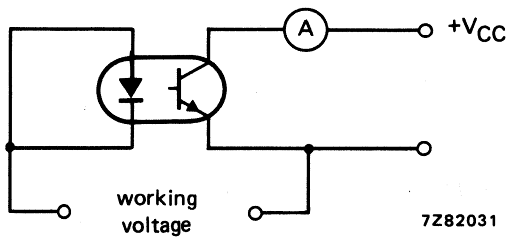


Fig. 2.

Notes

1. This parameter is tested with both input (diode) leads shorted together and both output (photo-transistor) leads shorted together at 10 kV (d.c.) for 1 min. Tested on sample basis.
2. $CMRR = \frac{V_o}{V_{CM}}$.

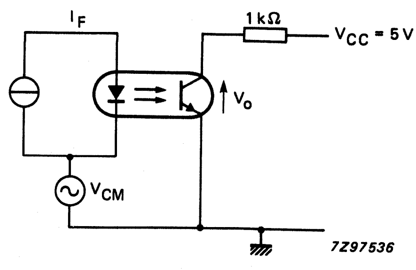


Fig. 3.

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

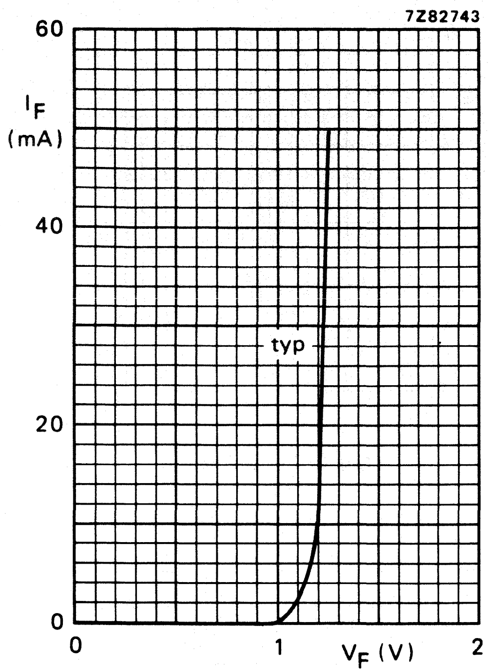


Fig. 4 T_j = 25 °C.

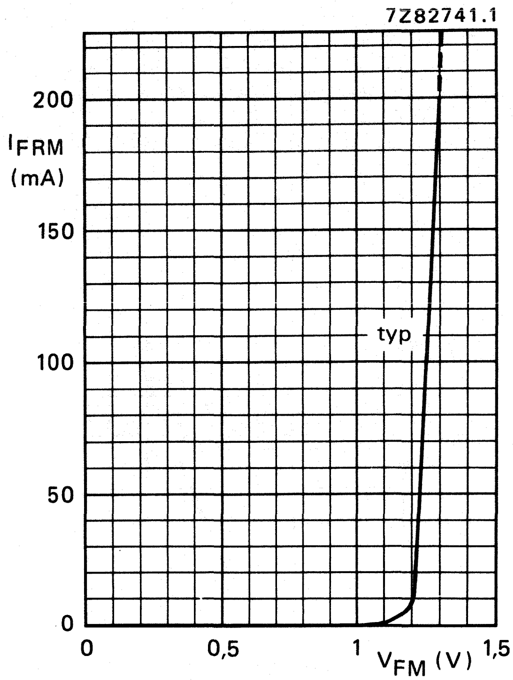


Fig. 5 T_{amb} = 25 °C; t_p = 10 μs; T = 1 ms.

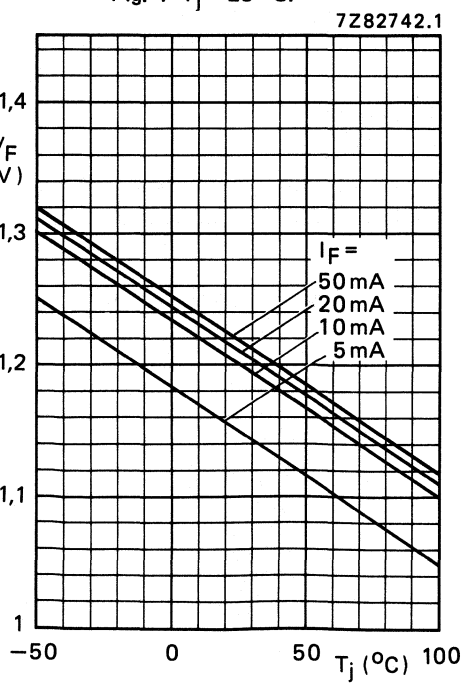


Fig. 6 Typical values.

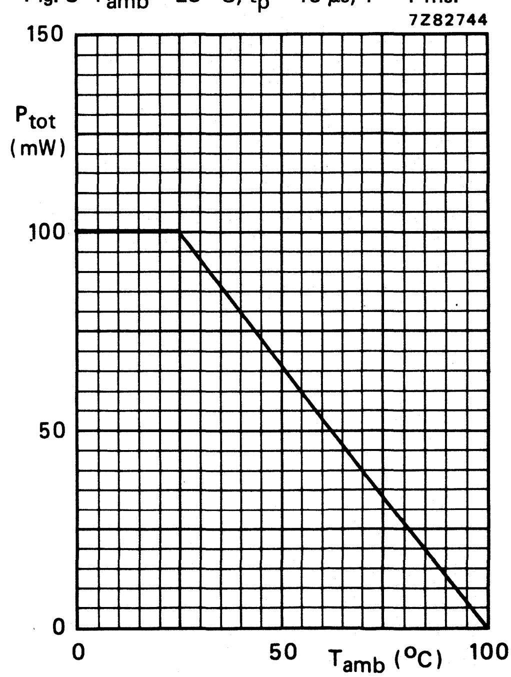


Fig. 7 Power derating curve for diode and transistor versus ambient temperature.

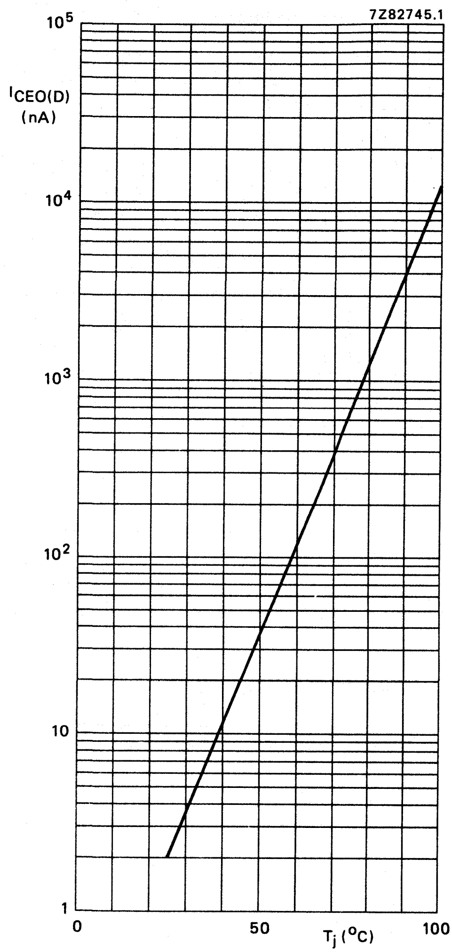


Fig. 8 Typical values.

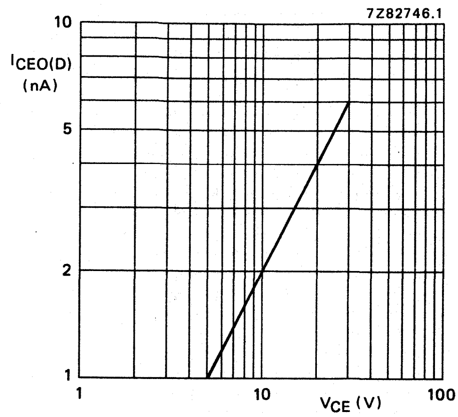


Fig. 9 Typical values.

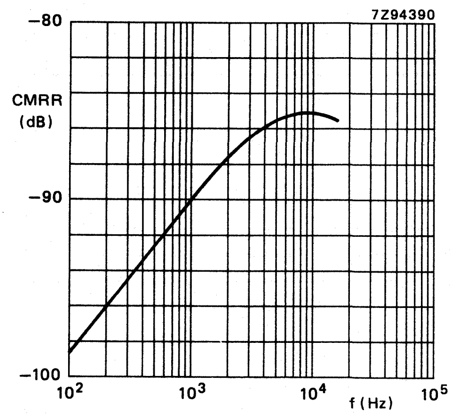


Fig. 10 Typical values.

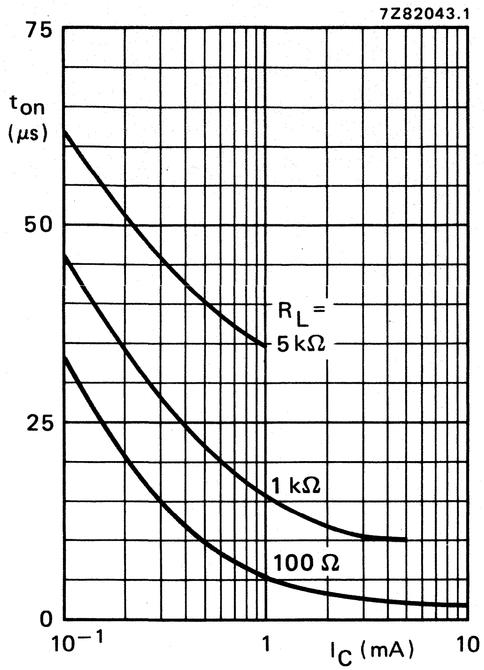


Fig. 11 $I_B = 0$; $V_{CC} = 5$ V; $T_{amb} = 25$ °C; typical values. See also Fig. 13.

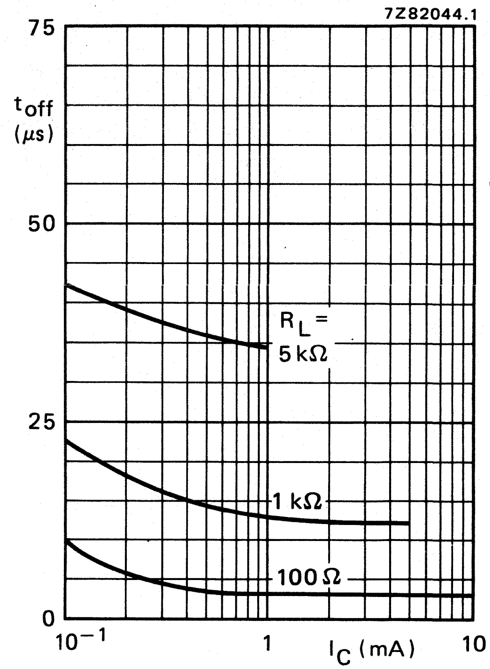


Fig. 12 $I_B = 0$; $V_{CC} = 5$ V; $T_{amb} = 25$ °C; typical values. See also Fig. 13.

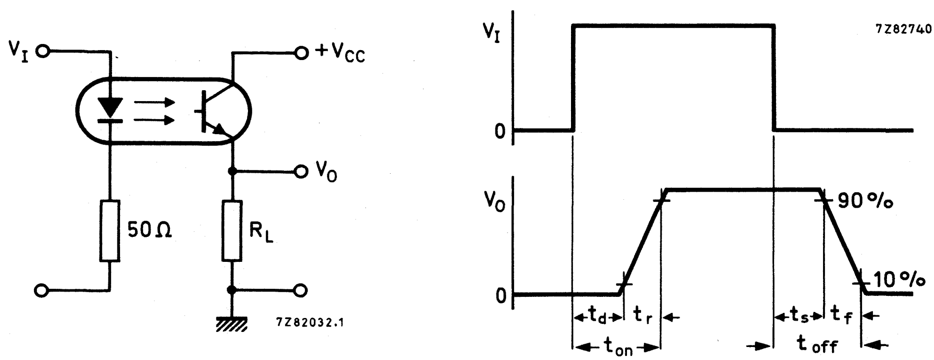


Fig. 13 Switching circuit and waveforms.

OPTOCOUPLERS

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

Features

- High output/input DC current transfer ratio
- Low saturation voltage
- High isolation voltage of 3.12 kV RMS and 4.4 kV DC
- Working voltage 2.5 kV DC

CECC — Capability of approval GaAs optocouplers
UL — Covered under UL component recognition FILE E90700
VDE — Approved according to VDE 0883/6.80

Reference voltage (VDE 0110b TAB 4): AC 380 V/DC 450 V (isolation group C)

Complied for reinforced isolation at 250 V AC with:

DIN 57 804/VDE 0804/1.83 (isolation group C)
DIN VDE 0860/8.86/HD 195 S4

QUICK REFERENCE DATA

Diode					
Continuous reverse voltage		V_R	max.	5	V
DC forward current		I_F	max.	100	mA
(peak value); t_p = 10 μs; δ = 0.01		I_{FRM}	max.	3	A
Total power dissipation up to T_{amb} = 25 ^oC		P_{tot}	max.	200	mW
Transistor					
Collector-emitter voltage (open base)		V_{CEO}	max.	30	V
Total power dissipation up to T_{amb} = 25 ^oC		P_{tot}	max.	200	mW
Optocoupler					
Output/input DC current transfer ratio (CTR)	**CNX35U**			0.4 to 1.6	
I_F = 10 mA; V_{CE} = 0.4 V; (I_B = 0)	**CNX39U**	I_C/I_F		0.6 to 1.0	
	CNX36U			0.8 to 2.0	
Collector cut-off current (dark) V_{CC} = 10 V; working voltage = 2.5 kV DC diode: I_F = 0 (see also Fig.2)		I_{CEW}	max.	200	nA
Isolation voltage DC		V_{IO}	min.	4.4	kV
AC (RMS value)				3.12	kV

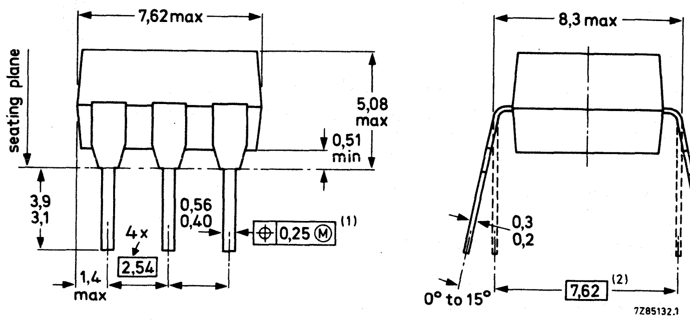
MECHANICAL DATA

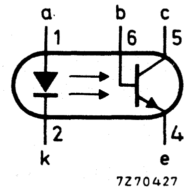
SOT90B (see Fig.1).

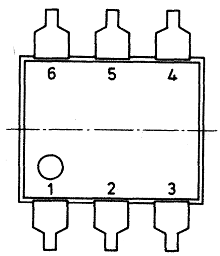
MECHANICAL DATA

Dimensions in mm

Fig.1 SOT90B.







⊕ Positional accuracy.

Ⓜ Maximum Material Condition.

(1) 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.

(2) When the leads are parallel, the tips are in position for automatic insertion.

RATINGS

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

Diode

Continuous reverse voltage	V_R	max.	5	V
DC forward current	I_F	max.	100	mA
(peak value); t_p = 10 μs; δ = 0.01	I_{FRM}	max.	3	A
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
DC collector current	I_C	max.	100	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	200	mW

Optocoupler

Storage temperature range	T_{stg}	−55 to + 150	°C
Operating junction temperature	T_j	max. 125	°C
Operating ambient temperature range	T_{amb}	−40 to + 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	$R_{th\,j\text{-}a}$	= 500	K/W
transistor	$R_{th\,j\text{-}a}$	= 500	K/W
From junction to ambient, device mounted on a printed-circuit board			
diode	$R_{th\,j\text{-}a}$	= 400	K/W
transistor	$R_{th\,j\text{-}a}$	= 400	K/W

ISOLATION RELATED VALUES

External air gap (clearance) input terminals to output terminals	L(IO1)	min. 7.2	mm
External tracking path (creepage distance) input terminals to output terminals	L(IO2)	min. 7.0	mm
Tracking resistance (KB-value)		KB-100/A	
Internal plastic gap (clearance) isolation thickness between emitter and receiver		min. 1	mm

CHARACTERISTICS

$T_j = 25$ °C unless otherwise specified

Diode

Forward voltage $I_F = 10$ mA	V_F	typ. 1.15	V
		max. 1.5	V
Reverse current $V_R = 5$ V	I_R	max. 10	μA

Transistor ($I_F = 0$)

Collector cut-off current (dark)			
$V_{CE} = 10$ V	I_{CEO}	typ. 2	nA
		max. 50	nA
$V_{CE} = 10$ V; $T_{amb} = 70$ °C	I_{CEO}	max. 10	μA
$V_{CB} = 10$ V	I_{CBO}	max. 20	nA
Collector-emitter breakdown voltage at $I_C = 1$ mA	$V_{(BR)CEO}$	min. 30	V
Collector-base breakdown voltage at $I_C = 0.1$ mA	$V_{(BR)CBO}$	min. 70	V
Emitter-collector breakdown voltage at $I_E = 0.1$ mA	$V_{(BR)ECO}$	min. 7	V

Optocoupler ($I_B = 0$) (note 1)

Output/input DC current transfer ratio (CTR)					
I_F = 10 mA; V_{CE} = 0.4 V	**CNX35U**	I_C/I_F		0.4 to 1.6	
	CNX39U	I_C/I_F		0.6 to 1.0	
	CNX36U	I_C/I_F		0.8 to 2.0	
Output/input DC current transfer ratio (CTR)					
I_F = 10 mA; V_{CE} = 5 V		I_C/I_F	typ.	1.5	
I_F = 2 mA; V_{CE} = 5 V		I_C/I_F	min.	0.15	
Collector-emitter saturation voltage					
I_F = 10 mA; I_C = 2 mA	**CNX35U** **CNX39U**	V_{CEsat}	max.	0.4	V
			typ.	0.15	V
I_F = 10 mA; I_C = 4 mA	**CNX36U**	V_{CEsat}	max.	0.4	V
			typ.	0.19	V
Isolation voltage; DC		V_{IO}	min.	4.4	kV
t = 1 min; AC (RMS value) (note 2)		V_{IO}	min.	3.12	kV
Collector cut-off current (light) at T_{amb} = 0 °C to 70 °C					
V_F = 0.8 V; V_{CE} = 15 V		$I_{CE(L)}$	max.	15	μA
I_F = 2 mA; V_{CE} = 0.4 V		$I_{CE(L)}$	min.	150	μA
Collector capacitance at f = 1 MHz					
$I_E = I_e = 0$; V_{CB} = 10 V		$C_{b'c}$	typ.	4.5	pF
Capacitance between input and output					
$I_F = 0$; V = 0; f = 1 MHz		C_{io}	typ.	0.6	pF
			max.	1.3	pF
Insulation resistance between input and output					
± V_{IO} = 500 V		R_{IO}	min.	1	TΩ
			typ.	10	TΩ

Switching times (see Figs 2 and 3)			CNX35U	CNX39U	CNX36U	
I_{Con} = 2 mA; V_{CC} = 5 V; R_L = 100 Ω						
Turn-on time	t_{on}	typ.	3	5.5	8	μs
		max.	20	20	20	μs
Turn-off time	t_{off}	typ.	3	4	6	μs
		max.	20	20	20	μs
I_{Con} = 2 mA; V_{CC} = 5 V; R_L = 1 kΩ						
Turn-on time	t_{on}	typ.	12	14	20	μs
		max.	50	50	50	μs
Turn-off time	t_{off}	typ.	12	12	18	μs
		max.	50	50	50	μs

Collector cut-off current (dark) see Fig.4				
V_{CC} = 10 V; working voltage (DC) = 2.5 kV	I_{CEW}	max.	200	nA (note 3)
V_{CC} = 10 V; working voltage (DC) = 2.5 kV; T_j = 70 °C	I_{CEW}	max.	5	μA (note 3)

Notes

1. Where the phototransistor receives light from the diode the O (for open base) has been omitted from the symbols.
2. Every single product is tested by applying an isolation test voltage of 3750 V AC (RMS) for 2 seconds between the shorted input (diode) leads and the shorted output (phototransistor) leads, with a detection current of about 1 μA.
3. As quality assurance (on a sample basis), these parameters are covered by a 1000 hour reliability test.

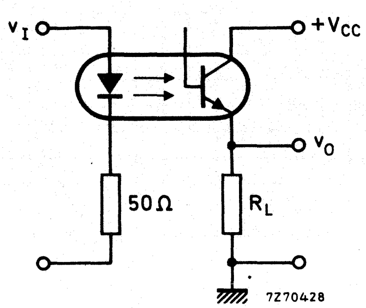


Fig. 2 Switching circuit.

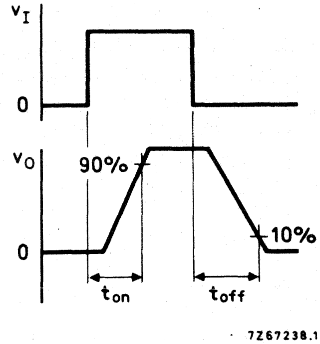


Fig. 3 Waveforms.

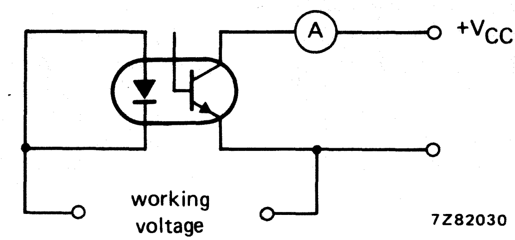


Fig. 4.

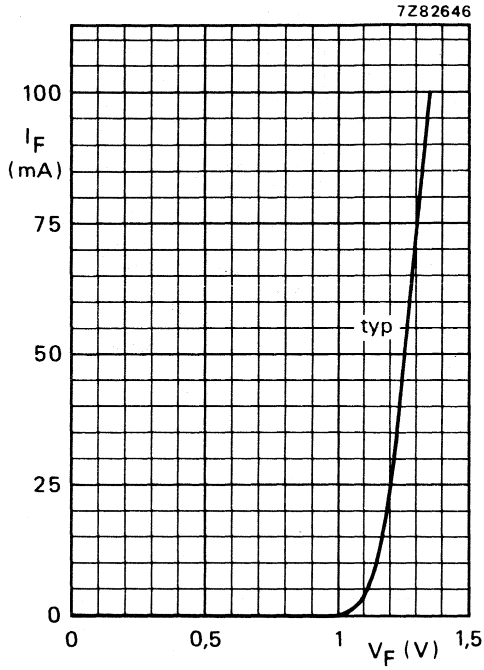


Fig. 5 T_{amb} = 25 °C.

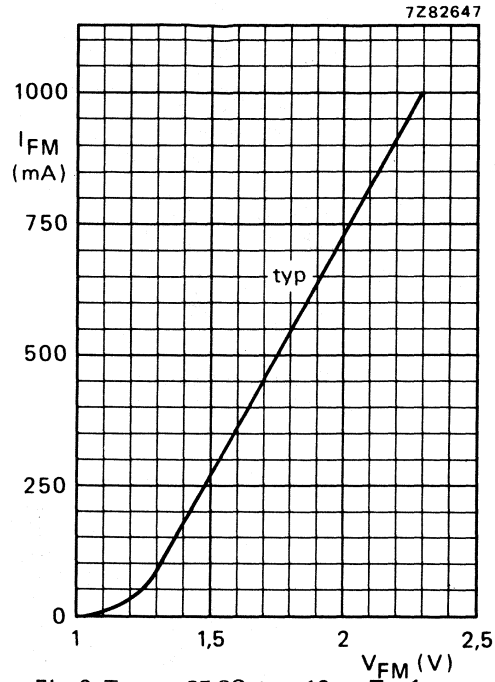


Fig. 6 T_{amb} = 25 °C; t_p = 10 μs; T = 1 ms.

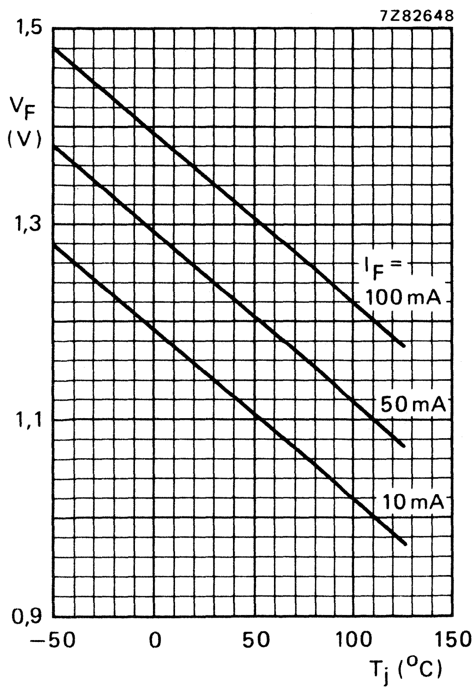


Fig. 7 Typical values.

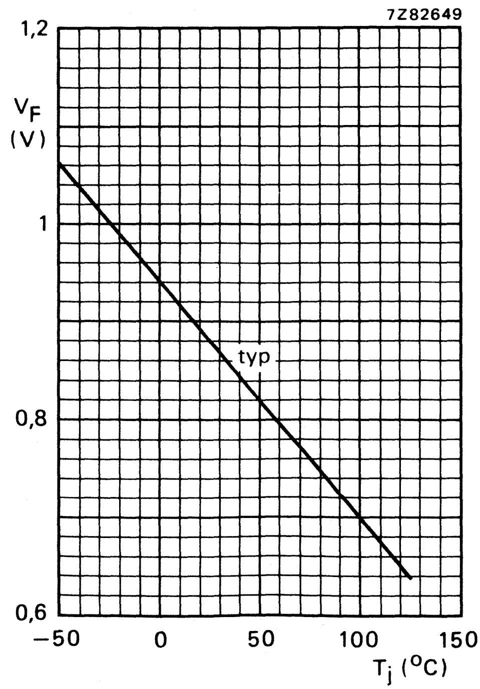


Fig. 8 I_F = 50 μA.

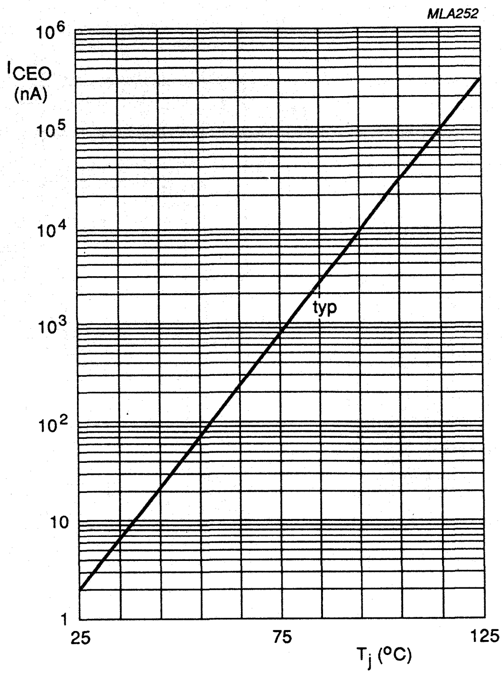


Fig. 9 $I_F = 0$; $V_{CE} = 10$ V; typical values.

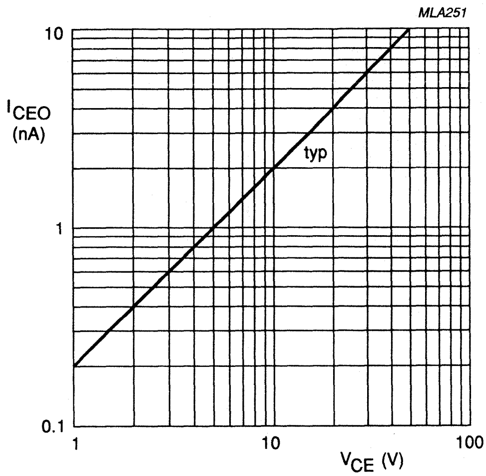


Fig. 10 $I_F = 0$; $T_j = 25\ ^oC$; typical values.

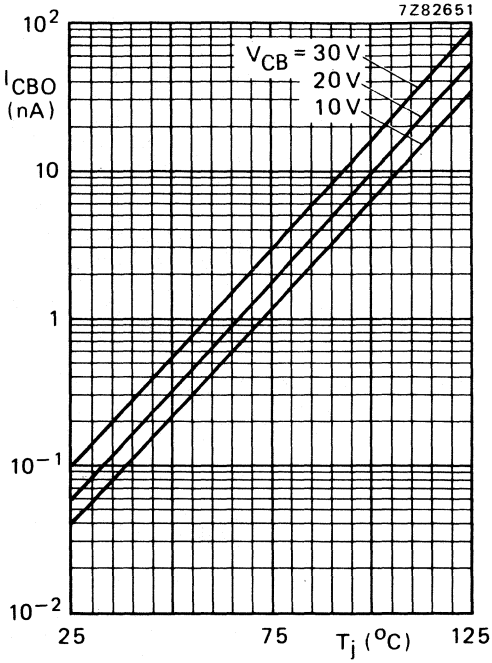


Fig. 11 Typical values.

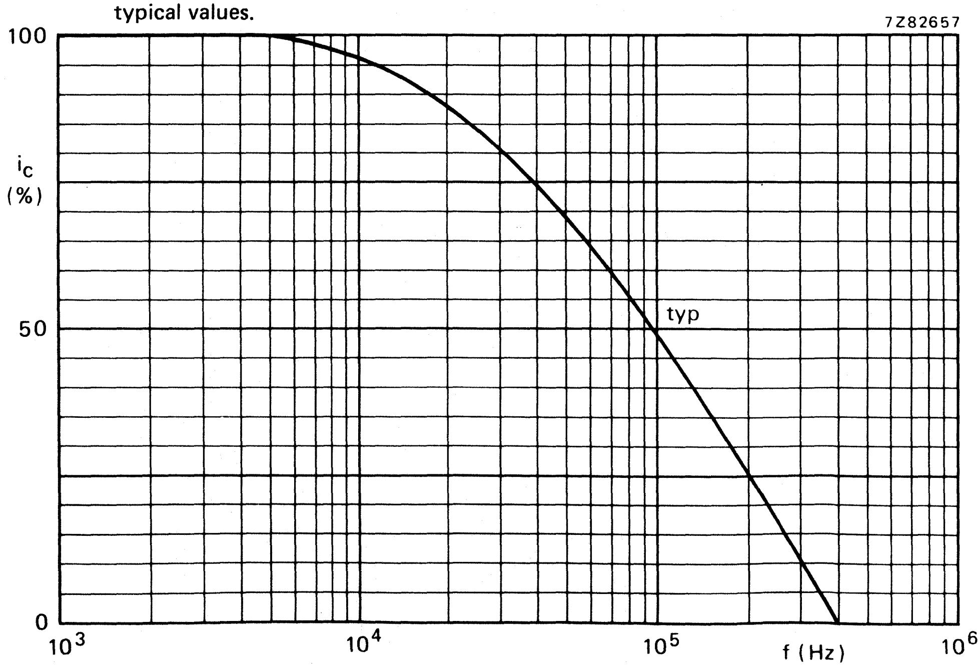


Fig. 12 $I_B = 0$; $I_C = 2$ mA; $V_{CC} = 5$ V; $R_L = 1$ kΩ; $T_{amb} = 25\ ^oC$.

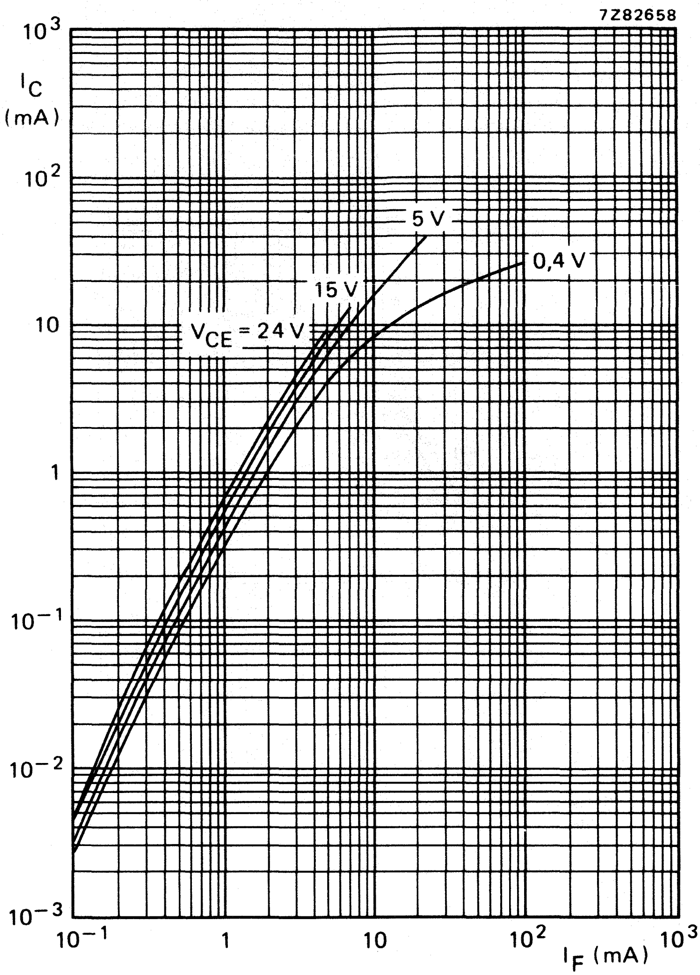


Fig. 13 T_{amb} = 25 °C, typical values.

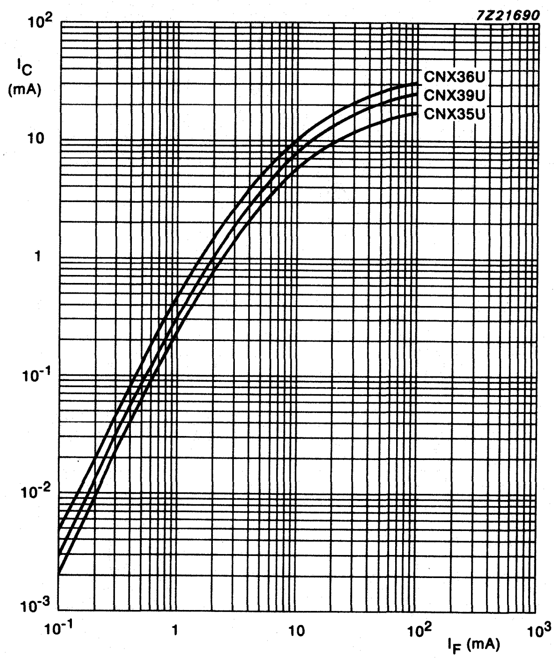


Fig. 14 Typical collector current as a component of forward current.

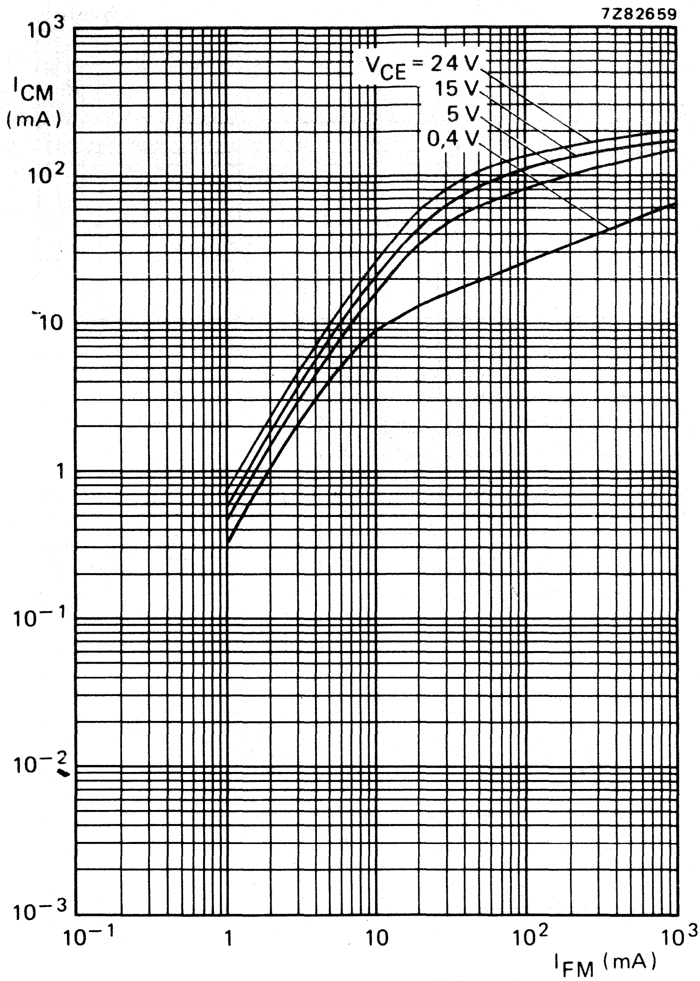


Fig. 15 T_{amb} = 25 °C; t_p = 10 μs; T = 1 ms; typical values.

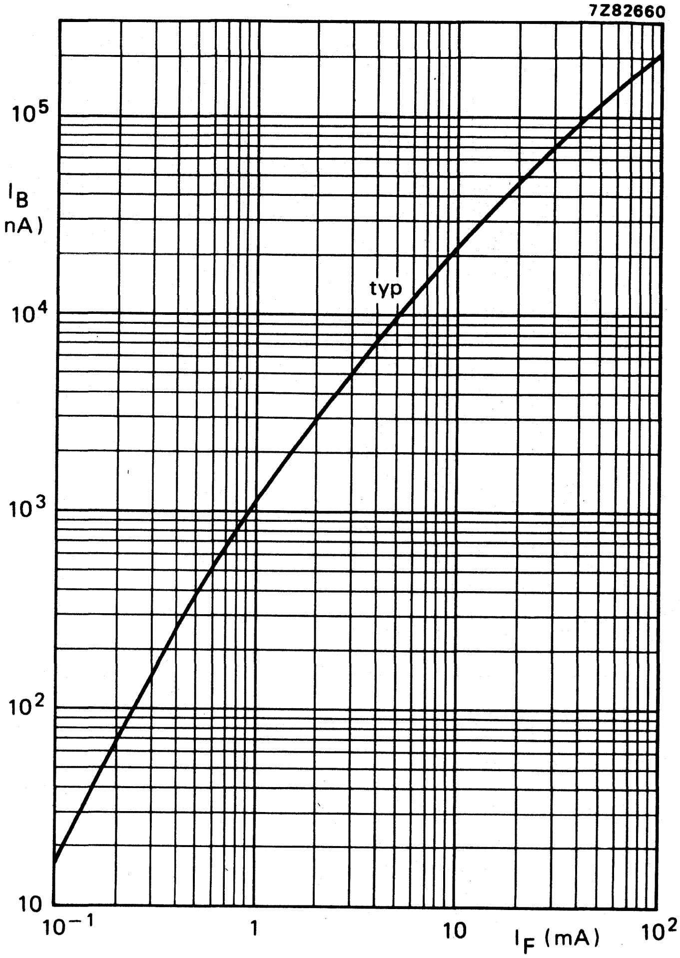


Fig. 16 V_{CB} = 5 V; T_{amb} = 25 °C.

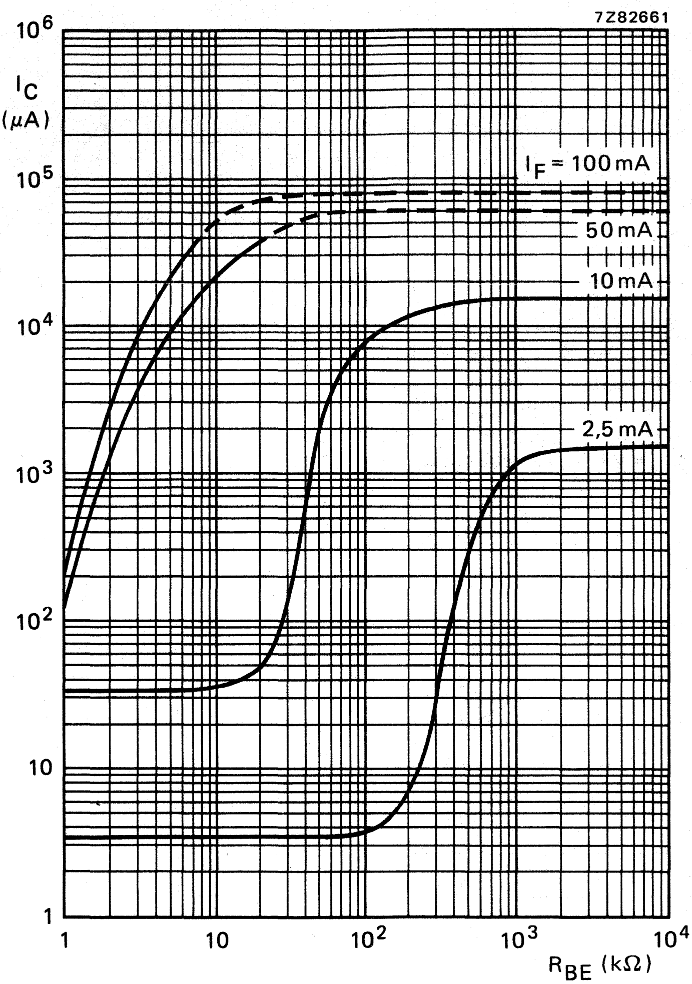


Fig. 17 $I_B = 0$; $V_{CE} = 5$ V; $T_{amb} = 25$ °C; typical values.

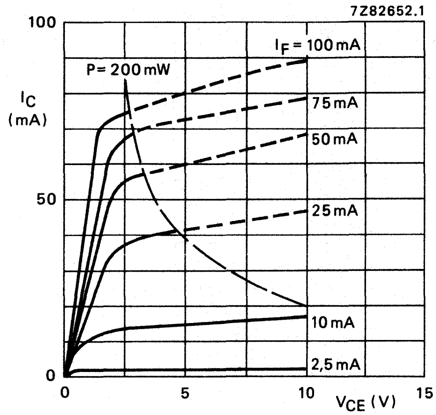


Fig. 18 T_{amb} = 25 °C; typical values.

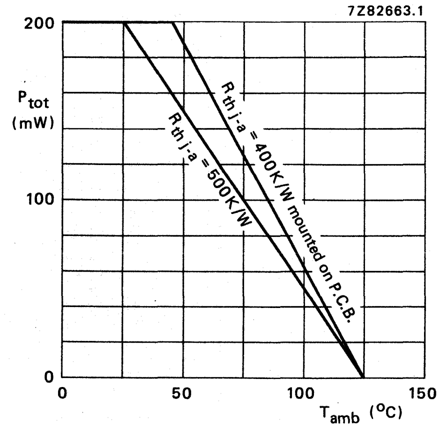


Fig. 19.

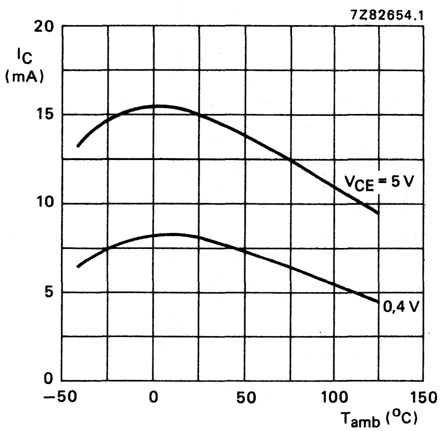


Fig. 20 I_F = 10 mA; typical values.

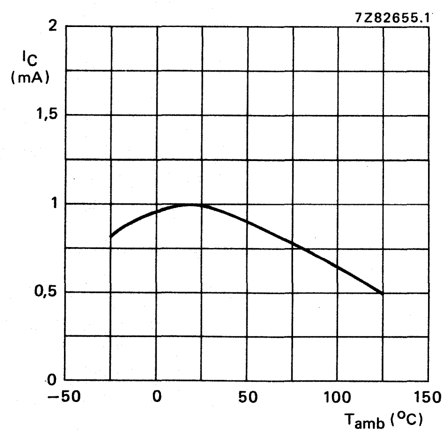


Fig. 21 I_F = 2 mA; V_{CE} = 0,4 V; typical values.

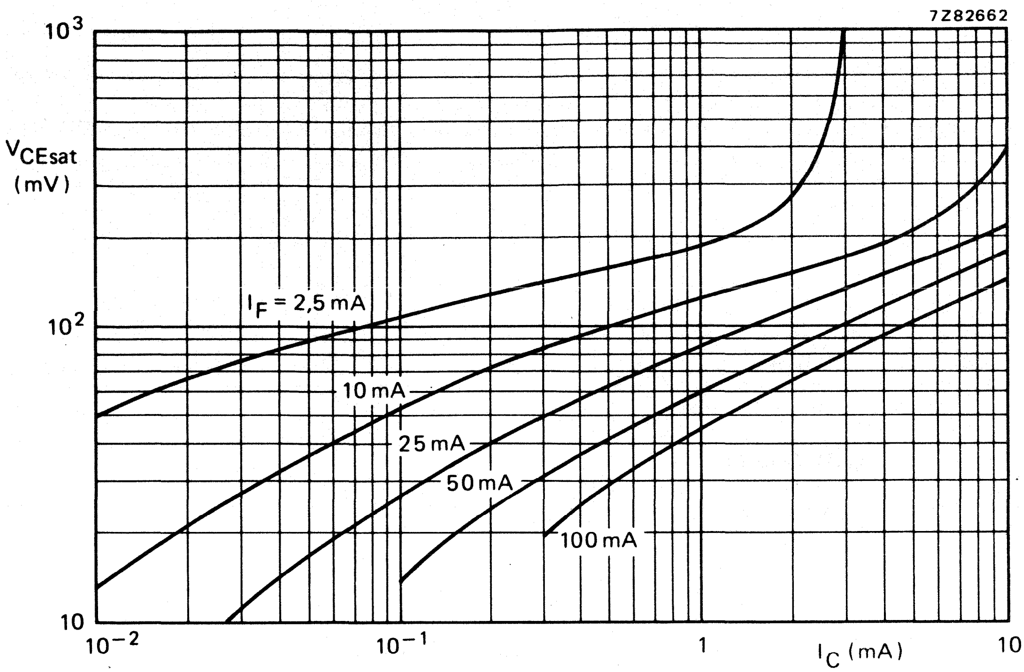


Fig. 22 $I_B = 0$; $T_{amb} = 25\ ^oC$; typical values.

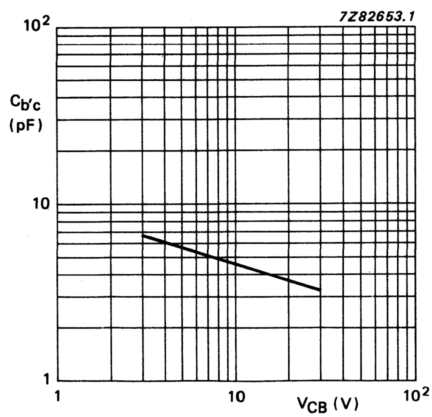


Fig. 23 f = 1 MHz; $T_{amb} = 25\ ^oC$.

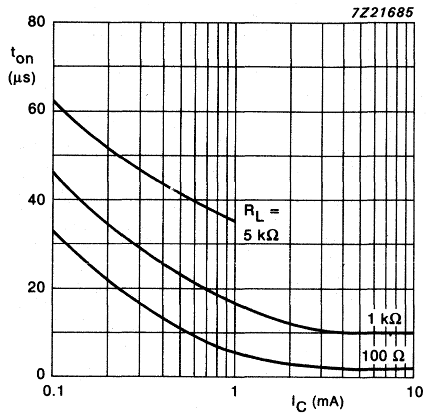


Fig. 24 CNX35U.

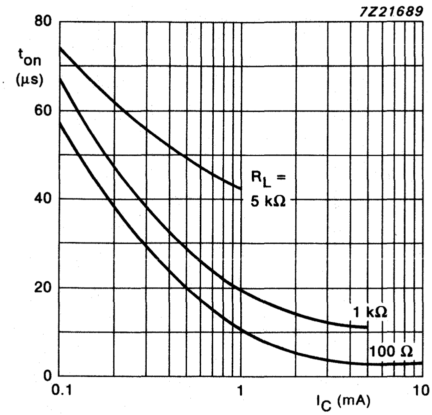


Fig. 25 CNX39U.

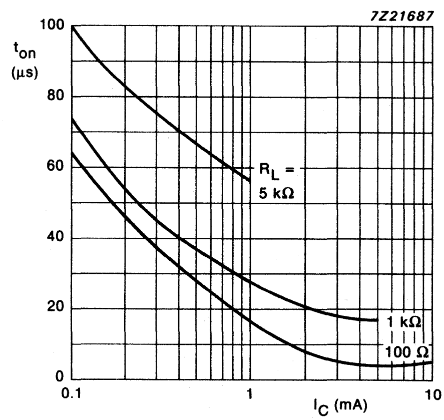


Fig. 26 CNX36U.

Typical turn-on time as a component of collector current.

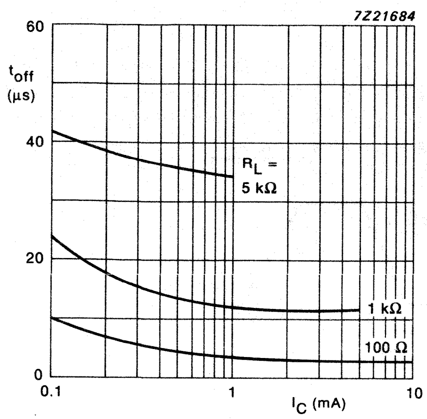


Fig. 27 CNX35U.

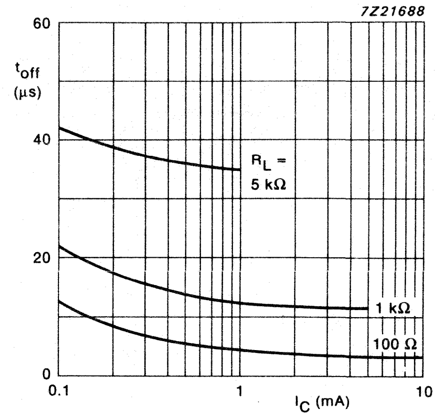


Fig. 28 CNX39U.

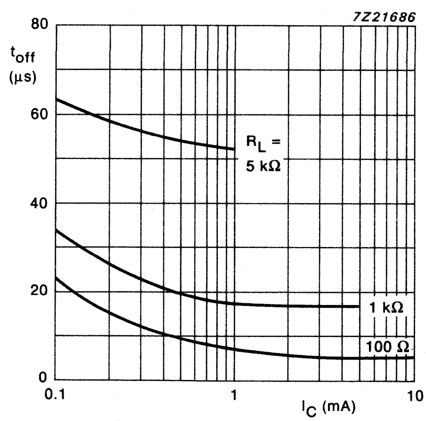


Fig. 29 CNX36U.

Typical turn-off time as a component of collector current.

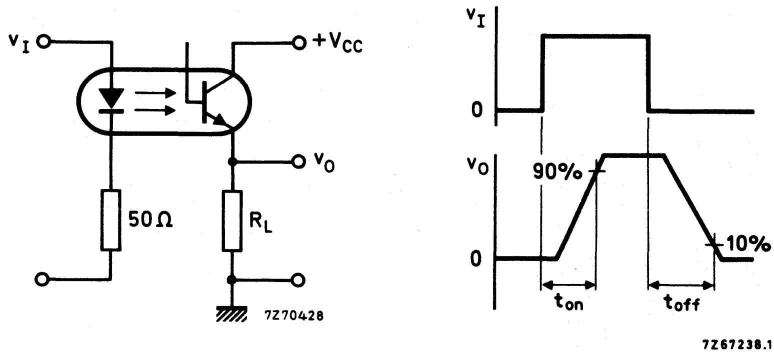


Fig. 30 Switching circuit and waveforms.

OPTOCOUPLER

Optically coupled isolator consisting of an infrared emitting GaAs diode and a high voltage silicon npn phototransistor with accessible base. Plastic envelope. Suitable for TTL integrated circuits.

Features

- High output/input DC current transfer ratio
- Low saturation voltage
- High isolation voltage of 3.12 kV (RMS) and 4.4 kV (DC)
- Working voltage 2.5 kV (DC)

CECC — Capability of approval GaAs optocouplers
UL — Covered under UL component recognition FILE E90700
VDE — Approved according to VDE 0883/6.80
Reference voltage (VDE 0110b Tab 4); AC 380 V/DC 450 V isolation group C
Complied for reinforced isolation at 250 V AC with:
DIN 57 804/VDE 0804/1.83 (isolation group C)
DIN VDE 0860/8.86/HE195 S4

QUICK REFERENCE DATA

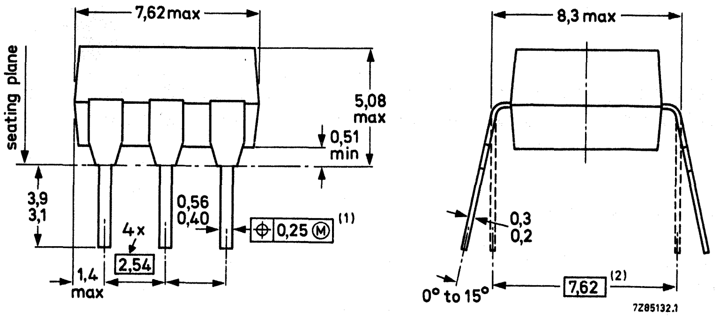
Diode				
Continuous reverse voltage	V_R	max.	5	V
DC forward current	I_F	max.	100	mA
(peak value); t_p = 10 μs; δ = 0.01	I_{FRM}	max.	3	A
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	200	mW
Transistor				
Collector-emitter voltage (open base)	V_{CEO}	max.	80	V
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	200	mW
Optocoupler				
Output/input DC current transfer ratio (CTR) 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 = 2.5 kV DC diode: I_F = 0 (see also Fig. 4)	I_{CEW}	max.	200	nA
Isolation voltage DC	V_{IO}	min.	4.4	kV
Isolation voltage AC (RMS value)	V_{IO}	min.	3.12	kV

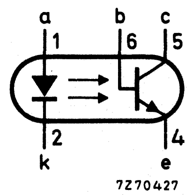
MECHANICAL DATA

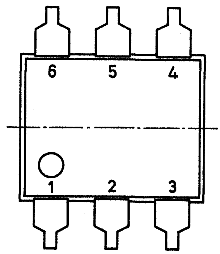
SOT90B (see Fig.1).

MECHANICAL DATA Dimensions in mm

Fig.1 SOT90B.







⊕ Positional accuracy.

(M) Maximum Material Condition.

(1) 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.

(2) When the leads are parallel, the tips are in position for automatic insertion.

RATINGS

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

Diode

Continuous reverse voltage	V_R	max.	5 V
DC forward current	I_F	max.	100 mA
(peak value); t_p = 10 μs; δ = 0,01	I_{FRM}	max.	3 A
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	200 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
DC collector current	I_C	max.	100 mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	200 mW

Optocoupler

Storage temperature range	T_{stg}	−55 to + 150	°C
Operating ambient temperature range	T_{amb}	−40 to + 100	°C
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	K/W
transistor	$R_{th\ j\text{-}a}$	=	500	K/W
From junction to ambient, device mounted on a printed-circuit board				
diode	$R_{th\ j\text{-}a}$	=	400	K/W
transistor	$R_{th\ j\text{-}a}$	=	400	K/W

ISOLATION RELATED VALUES

External air gap (clearance) input terminals to output terminals	L(IO1)	min.	7.2	mm
External tracking path (creepage distance) input terminals to output terminals	L(IO2)	min.	7.0	mm
Tracking resistance (KB-value)			KB-100/A	
Internal plastic gap (clearance) isolation thickness between emitter and receiver		min.	1	mm

CHARACTERISTICS

$T_j = 25$ °C unless otherwise specified

Diode

Forward voltage $I_F = 10$ mA	V_F	typ.	1.15	V
		max.	1.5	V
Reverse current $V_R = 5$ V	I_R	max.	10	μA

Transistor ($I_F = 0$)

Collector cut-off current (dark)				
$V_{CE} = 50$ V	I_{CEO}	typ.	2	nA
		max.	50	nA
$V_{CE} = 50$V; $T_{amb} = 70$ °C	I_{CEO}	max.	10	μA
$V_{CB} = 10$ V; $T_{amb} = 25$ °C	I_{CBO}	max.	20	nA
Collector-emitter breakdown voltage at $I_C = 1$ mA	$V_{(BR)CEO}$	min.	80	V
Collector-base breakdown voltage at $I_C = 0.1$ mA	$V_{(BR)CBO}$	min.	120	V
Emitter-collector breakdown voltage at $I_E = 0.1$ mA	$V_{(BR)ECO}$	min.	7	V

Optocoupler ($I_B = 0$) (note 1)

Output/input DC current transfer ratio (CTR)			
$I_F = 10$ 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	min.	0.5
$I_F = 2$ mA; $V_{CE} = 5$ V	I_C/I_F	min.	0.15
Collector-emitter saturation voltage $I_F = 16$ mA; $I_C = 2$ mA	V_{CEsat}	typ. max.	0.2 V 0.4 V
Isolation voltage; t = 1 min DC (see note 2) AC (RMS value)	V_{IO}	min.	4.4 kV 3.12 kV
Collector capacitance at f = 1 MHz $I_E = I_e = 0$; $V_{CB} = 10$ V	$C_{b'c}$	typ.	4.5 pF
Capacitance between input and output $I_F = 0$; V = 0; f = 1 MHz	C_{io}	typ. max.	0.6 pF 1.3 pF
Insulation resistance between input and output $\pm V_{IO} = 500$ V	R_{IO}	min. typ.	1 TΩ 10 TΩ
Switching times (see Figs 2 and 3)			
$I_{Con} = 4$ mA; $V_{CC} = 5$ V; $R_L = 100\ \Omega$ Turn-on time	t_{on}	typ. max.	5 μs 20 μs
Turn-off time	t_{off}	typ. max.	5 μs 20 μs
$I_{Con} = 4$ mA; $V_{CC} = 5$ V; $R_L = 1$ kΩ Turn-on time	t_{on}	typ. max.	15 μs 50 μs
Turn-off time	t_{off}	typ. max.	15 μs 50 μs
Collector cut-off current $V_F = 0.8$ V; $-V_{CE} = 15$ V $T_{amb} = 0\ ^oC$ to $+70\ ^oC$	I_{CE1}	max.	15 μA
Collector cut-off current at $I_F = 2$ mA; $-V_{CE} = 0.4$ V $T_{amb} = 0\ ^oC$ to $+70\ ^oC$	I_{CE2}	min.	150 μA
Collector cut-off current (dark) see Fig.4			
$V_{CC} = 10$ V; working voltage = 1.5 kV DC	I_{CEW}	max.	200 nA (note 3)
$V_{CC} = 10$ V; working voltage = 1.5 kV DC; $T_j = 70\ ^oC$	I_{CEW}	max.	100 μA (note 3)

Notes

1. Where the phototransistor receives light from the diode the O (for open base) has been omitted from the symbols.
2. Every single product is tested by applying an isolation test of 3750 V AC (RMS) for 2 seconds between the shorted input (diode) leads and the shorted output (phototransistor) leads, with a detection current of about 1 μA.
3. As quality assurance (on a sample basis), these parameters are covered by a 1000 h reliability test.

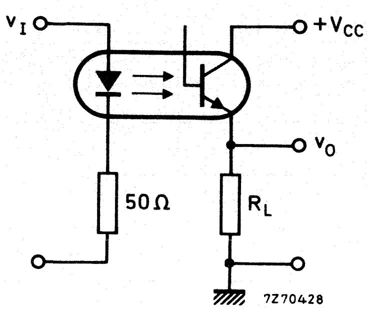


Fig. 2 Switching circuit.

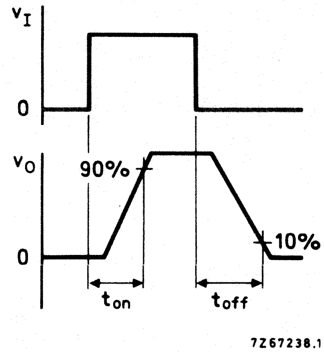


Fig. 3 Waveforms.

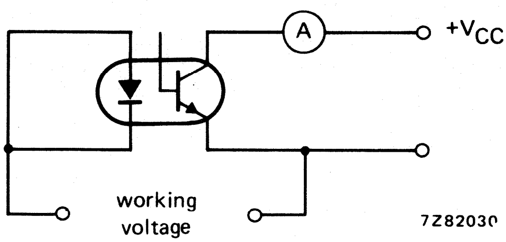


Fig. 4.

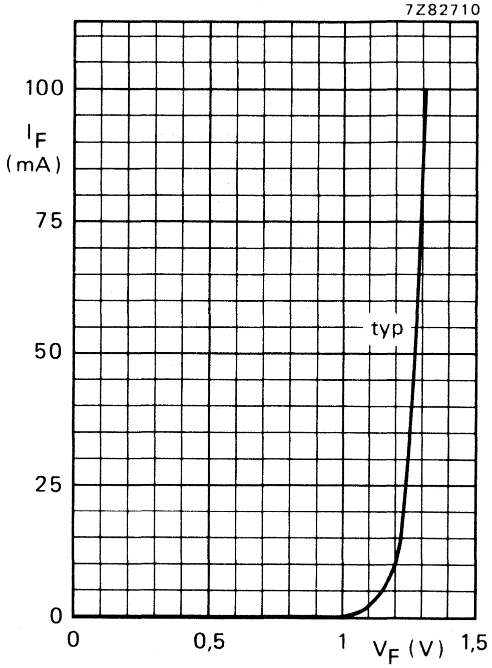


Fig. 5 T_{amb} = 25 °C.

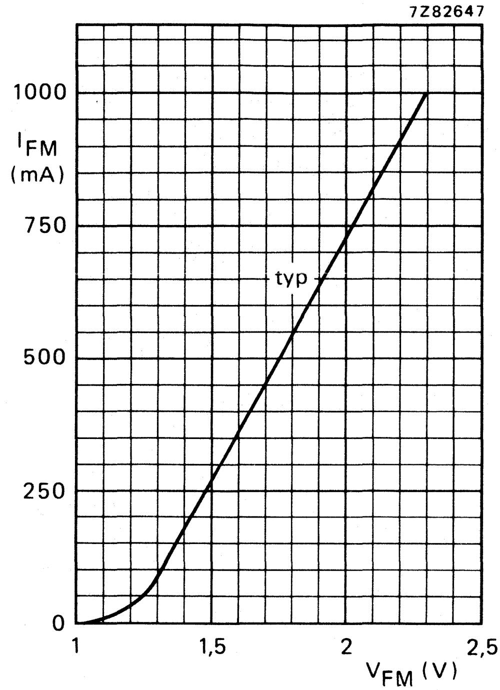


Fig. 6 T_{amb} = 25 °C; t_p = 10 μs; T = 1 ms.

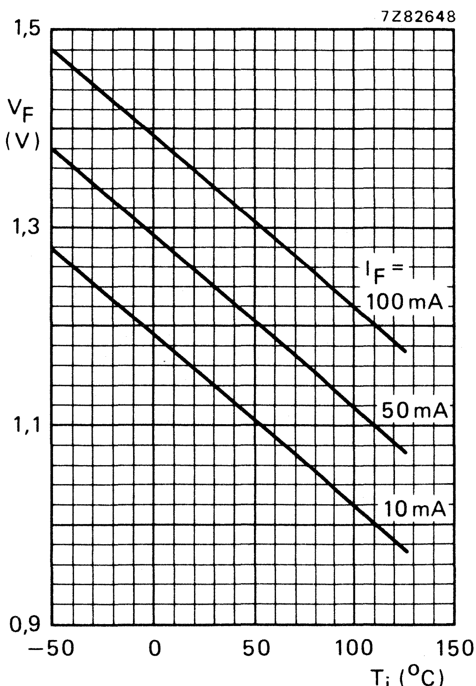


Fig. 7 Typical values.

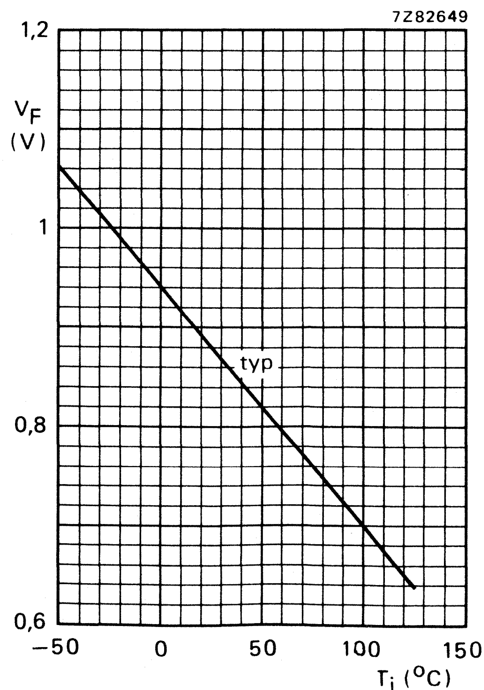


Fig. 8 I_F = 50 μA.

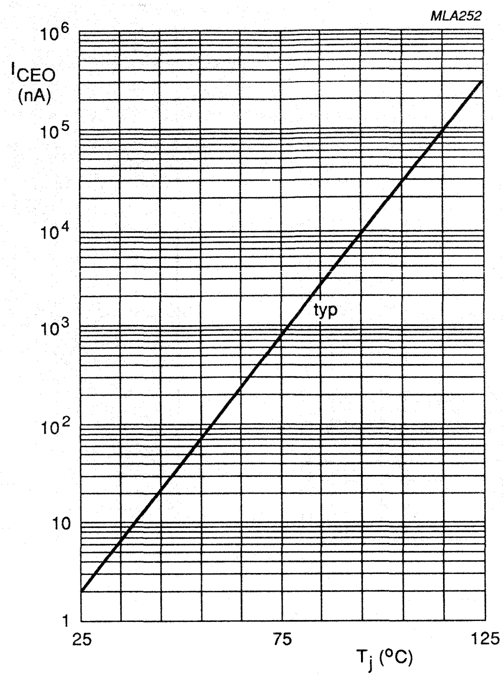


Fig. 9 $I_F = 0$; $V_{CE} = 50$ V; typical values.

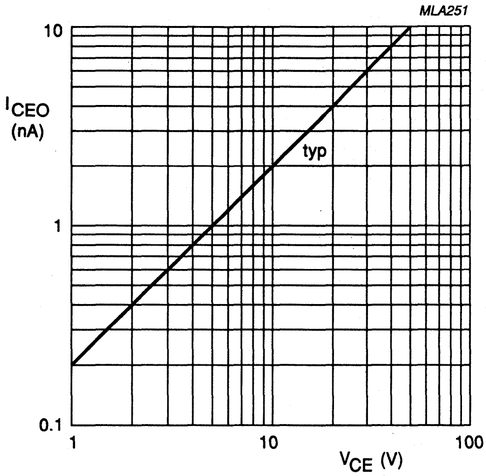


Fig. 10 $I_F = 0$; $T_j = 25\ ^oC$; typical values.

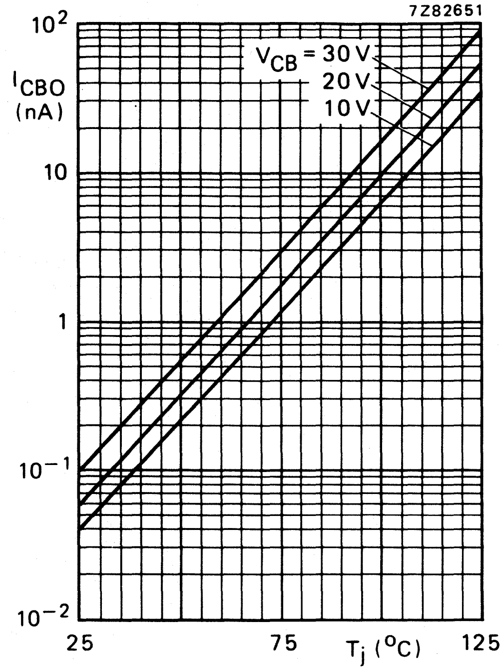


Fig. 11 Typical values.

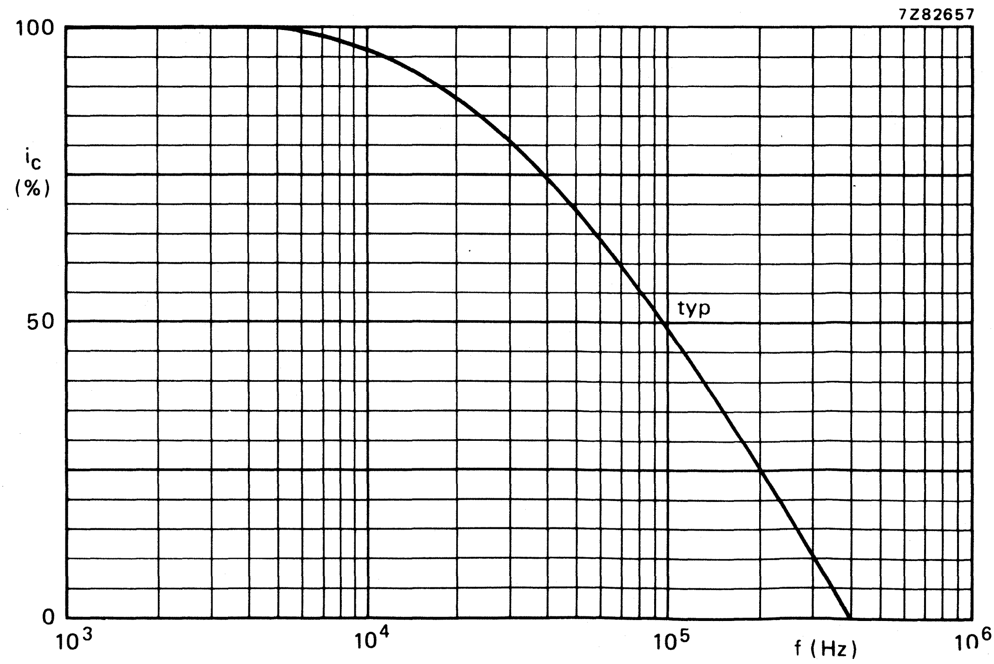


Fig. 12 $I_B = 0$; $I_C = 2$ mA; $V_{CC} = 5$ V, $R_L = 1$ kΩ; $T_{amb} = 25\ ^oC$.

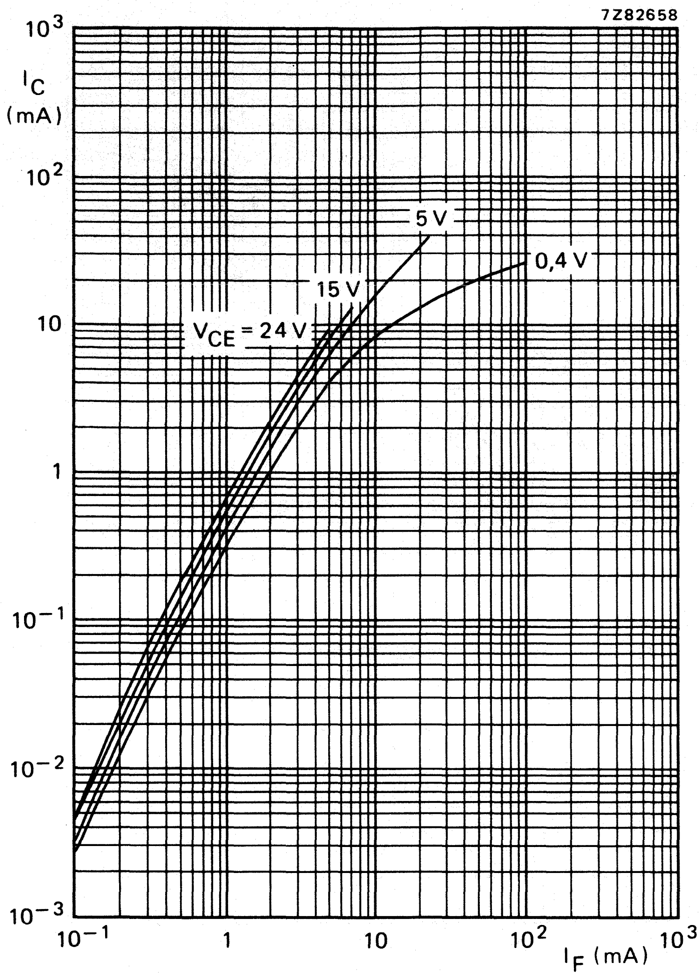


Fig. 13 T_{amb} = 25 °C, typical values.

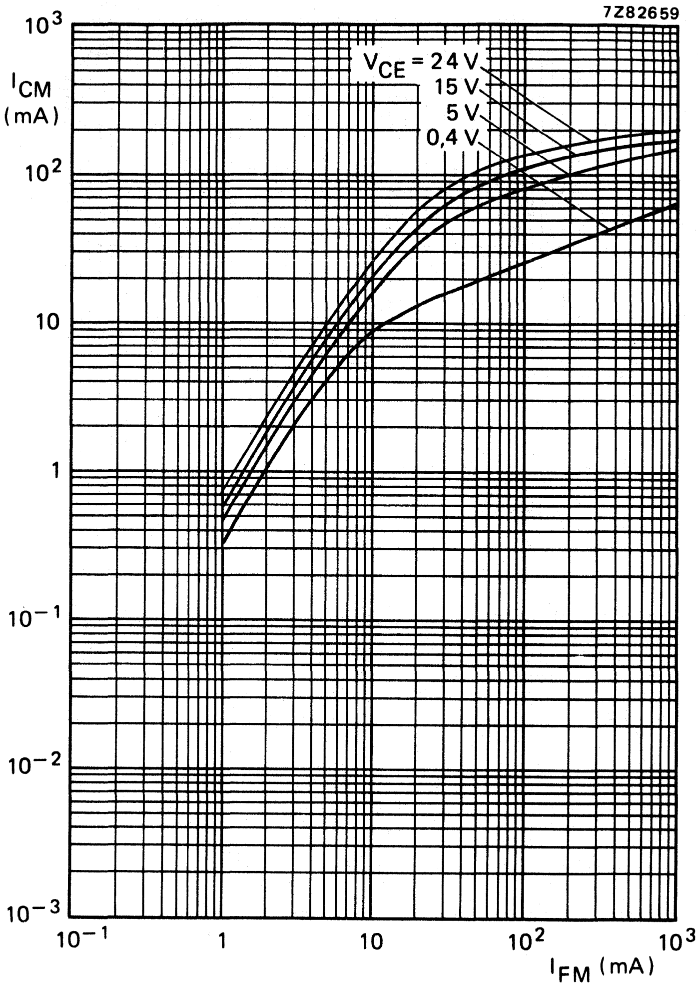


Fig. 14 T_{amb} = 25 °C; t_p = 20 μs; T = 2 ms; typical values.

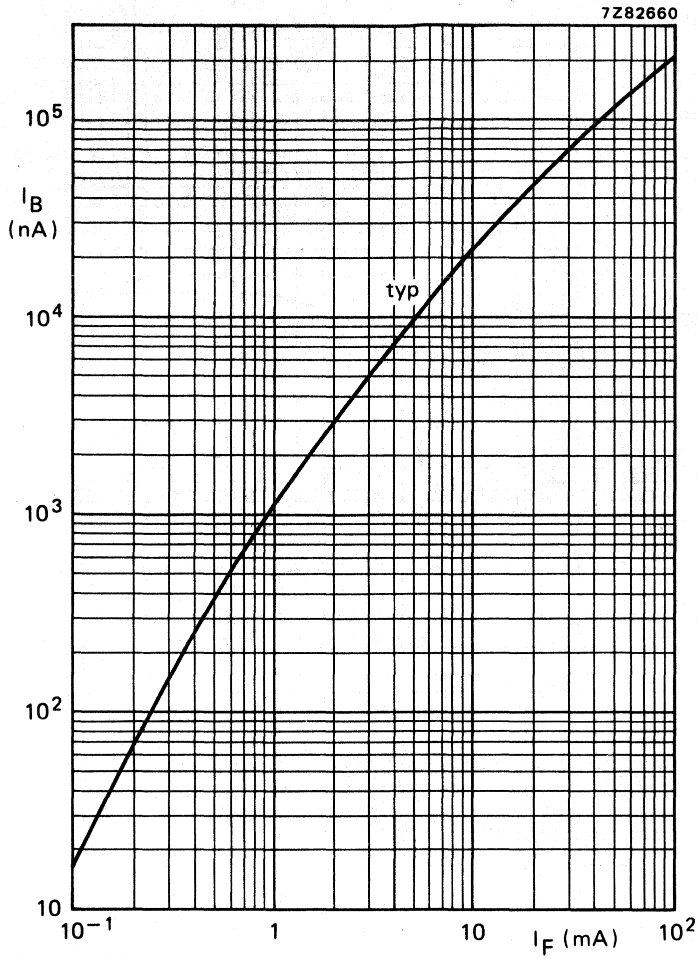


Fig. 15 V_{CB} = 5 V; T_{amb} = 25 °C.

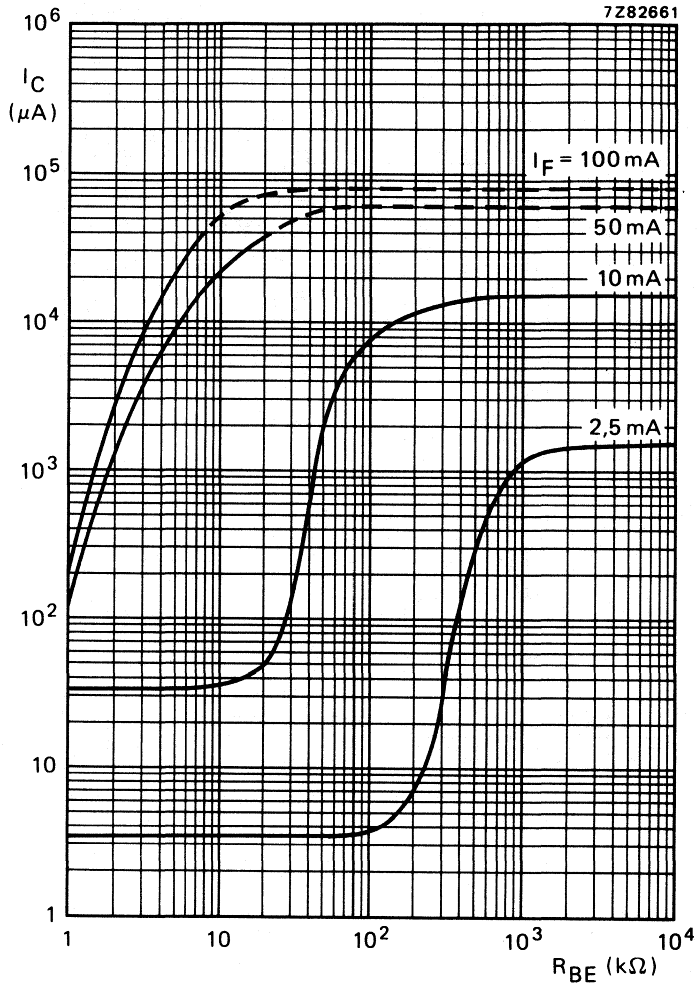


Fig. 16 $I_B = 0$; $V_{CE} = 5$ V; $T_{amb} = 25$ °C; typical values.

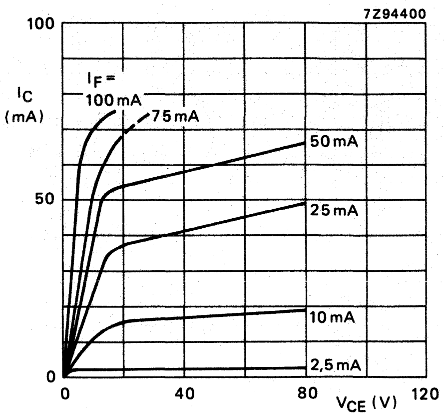


Fig. 17 T_{amb} = 25 °C; typical values.

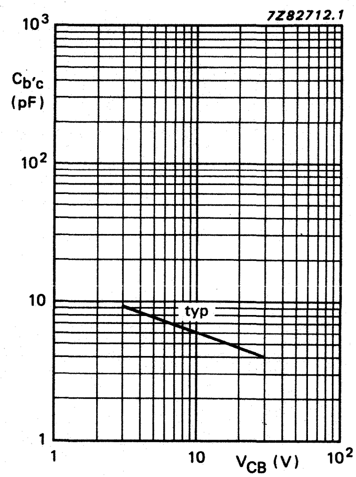


Fig. 18 f = 1 MHz; T_{amb} = 25 °C.

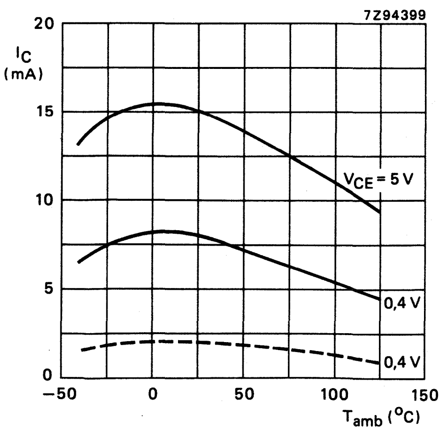


Fig. 19 I_F = 10 mA; typical values.
— — — min. values.

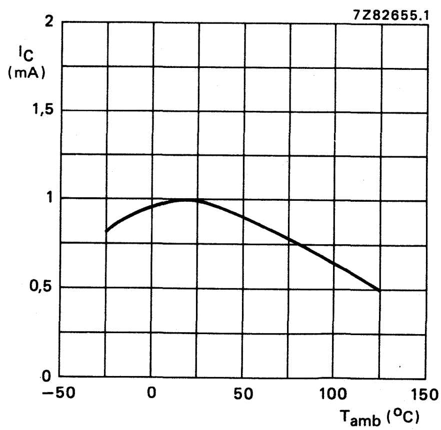


Fig. 20 I_F = 2 mA; typical values.
V_{CE} = 0.4 V.

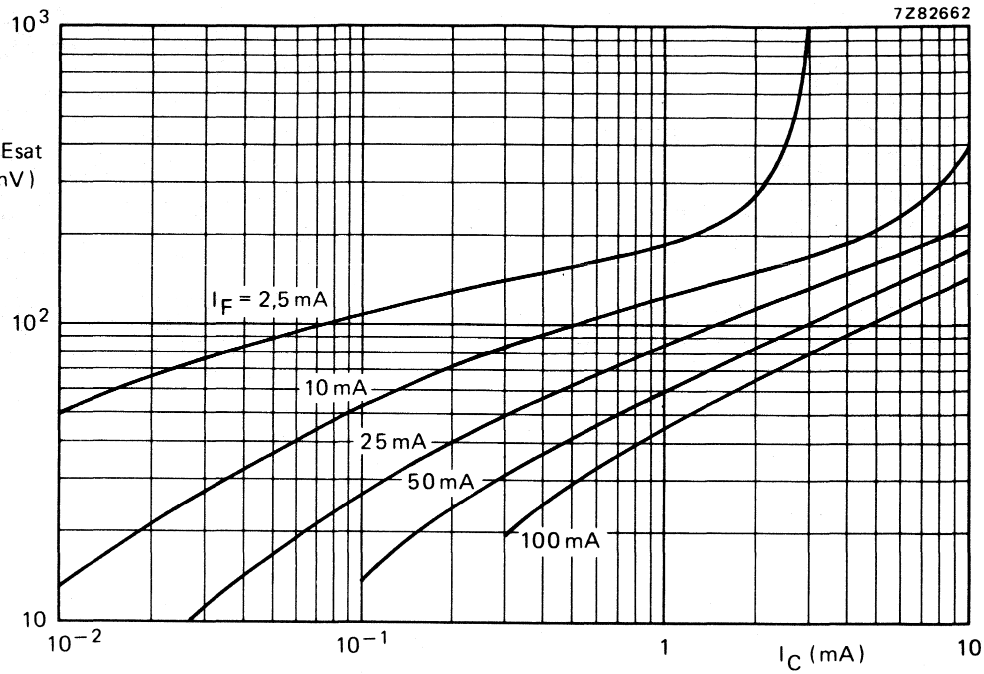


Fig. 21 $I_B = 0$; $T_{amb} = 25$ °C; typical values.

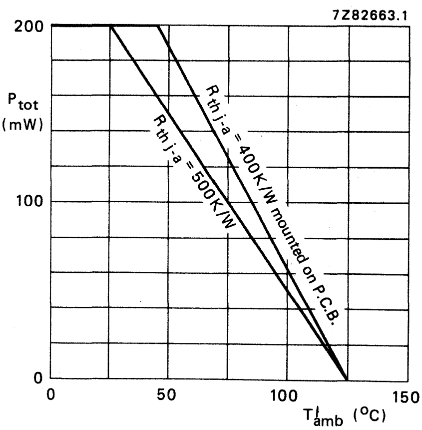


Fig. 22 Max. permissible power dissipation for total device versus ambient temperature.

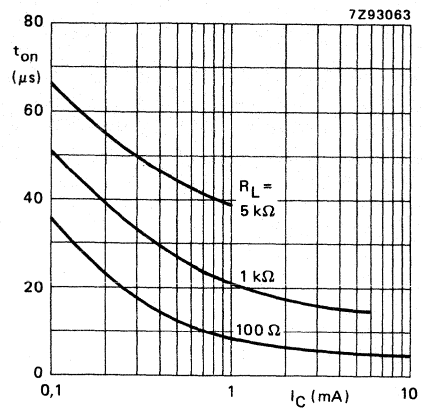


Fig. 23 $I_B = 0$; $V_{CC} = 5$ V; $T_{amb} = 25$ °C; typical values. (See also Fig. 25.)

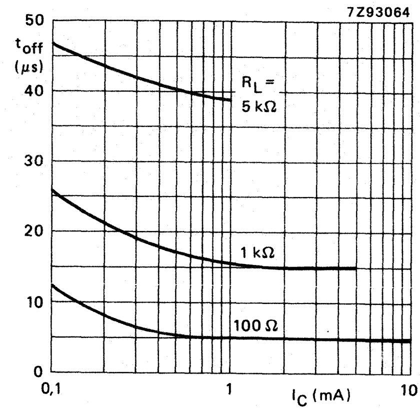


Fig. 24 $I_B = 0$; $V_{CC} = 5$ V; $T_{amb} = 25$ °C, typical values. (See also Fig. 25.)

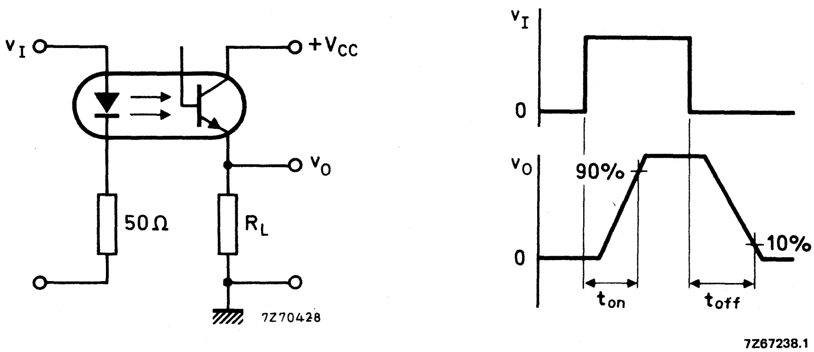


Fig. 25 Switching circuit and waveforms.

OPTOCOUPLER

Opto-isolator comprising an infrared emitting GaAs diode and a silicon npn Darlington phototransistor with accessible base. Plastic 6-lead dual-in line (DIL) envelope.

Features

- Very high output/input DC current transfer ratio
- High isolation voltage of 3,12 kV RMS and 4,4 kV DC
- Working voltage 2,5 kV DC

UL — Covered under UL component recognition FILE E90700

VDE — Approved according to VDE 0883/6.80
Reference voltage (VDE 0110b Tab 4): AC 380 V/DC 450 V
isolation group C

Complied for reinforced isolation at 250 V AC with:
DIN 57 804/VDE 0804/1.83 (isolation group C)
DIN VDE 0860/8.86/HD 195 S4

QUICK REFERENCE DATA

Diode			
Continuous reverse voltage	V_R	max.	5 V
DC forward current	I_F	max.	100 mA
(peak value); t_p = 10 μs; δ = 0,01	I_{FRM}	max.	3 A
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
Optocoupler			
Output/input DC current transfer ratio (CTR) I_F = 1 mA; V_{CE} = 1 V; (I_B = 0)	I_C/I_F	min.	5
Collector-cut-off current (dark) V_{CC} = 10 V; working voltage = 1,5 kV DC diode: I_F = 0 (see also Fig. 2)	I_{CEW}	max.	1 μA
Isolation voltage DC	V_{IO}	min.	4,4 kV
AC (RMS value)	V_{IO}	min.	3,12 kV

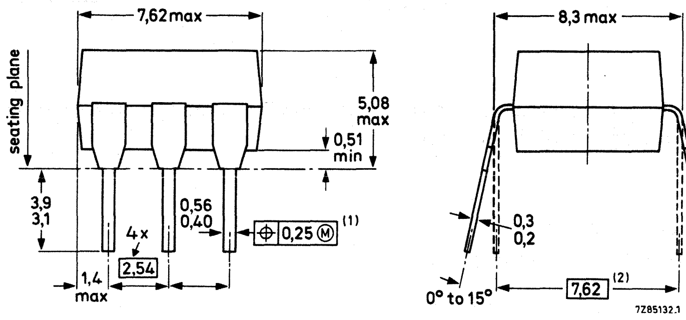
MECHANICAL DATA

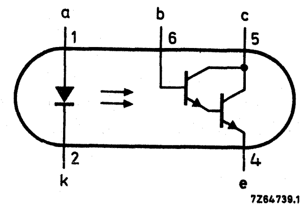
SOT90B (see Fig. 1).

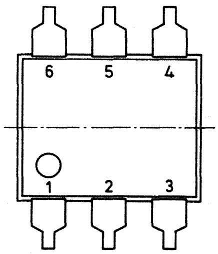
MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT90B.







⊕ Positional accuracy.

Ⓜ Maximum material condition.

(1) 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.

(2) When the leads are parallel, the tips are in position for automatic insertion.

RATINGS

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

Diode

Continuous reverse voltage	V_R	max.	5 V
DC forward current	I_F	max.	100 mA
(peak value); t_p = 10 μs; δ = 0,01	I_{FRM}	max.	3 A
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	200 mW
Junction temperature	T_j	max.	125 °C

Transistor

Collector-emitter breakdown voltage I_C = 1 mA	$V_{(BR)CEO}$	min.	30 V
Collector-base breakdown voltage I_C = 0,1 mA	$V_{(BR)CBO}$	min.	30 V
Emitter-collector breakdown voltage I_E = 0,1 mA	$V_{(BR)ECO}$	min.	6 V
DC collector current	I_C	max.	100 mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	200 mW
Junction temperature	T_j	max.	125 °C

Optocoupler

Storage temperature range	T_{stg}		−55 to + 150 °C
Operating ambient temperature range	T_{amb}		−40 to + 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 and transistor	$R_{th\ j\text{-}a}$	=	500 K/W
From junction to ambient, device mounted on a printed-circuit board diode and transistor	$R_{th\ j\text{-}a}$	=	400 K/W

ISOLATION RELATED VALUES

External air gap (clearance) input terminals to output terminals	L(IO1)	min.	7,2 mm
External tracking path (creepage distance) input terminals to output terminals	L(IO2)	min.	7,0 mm
Tracking resistance (KB value)			KB-100/A
Internal plastic gap (clearance) isolation thickness between emitter and receiver		min.	1 mm

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Diode

Forward voltage I_F = 10 mA	V_F	typ. max.	1,15 V 1,3 V
Reverse current V_R = 5 V	I_R	max.	10 μA

Transistor ($I_F = 0$)			
Collector cut-off current (dark)			
$V_{CE} = 10$ V	I_{CEO}	typ.	20 nA
		max.	100 nA
$V_{CB} = 10$ V	I_{CBO}	max.	20 nA
Collector-emitter breakdown voltage at $I_C = 1$ mA	$V_{(BR)CEO}$	min.	30 V
Collector-base breakdown voltage at $I_C = 0,1$ mA	$V_{(BR)CBO}$	min.	30 V
Emitter-base breakdown voltage at $I_E = 0,1$ mA	$V_{(BR)ECO}$	min.	6 V
Optocoupler ($I_B = 0$) (note 1)			
Output/input DC current transfer ratio (CTR)			
$I_F = 0,5$ mA; $V_{CE} = 1$ V	I_C/I_F	min.	3,5
$I_F = 1,0$ mA; $V_{CE} = 1$ V	I_C/I_F	min.	5
$I_F = 10$ mA; $V_{CE} = 1$ V	I_C/I_F	min.	6
Collector cut-off current (dark); see Fig. 2 (note 2)			
$V_{CC} = 10$ V; working voltage = 1,5 kV DC	I_{CEW}	max.	1 μA
$V_{CC} = 10$ V; working voltage = 1,5 kV DC; $T_j = 70$ °C	I_{CEW}	max.	5 μA
Collector-emitter saturation voltage $I_F = 5$ mA; $I_C = 10$ mA	V_{CEsat}	max.	1 V
Isolation voltage (note 3) t = 1 min			
DC	V_{IO}	min.	4,4 kV
AC (RMS value)			3,12 kV
Collector capacitance at f = 1 MHz $I_E = I_e = 0$; $V_{CB} = 10$ V	$C_{b'c}$	typ.	4,5 pF
Capacitance between input and output $I_F = 0$; V = 0; f = 1 MHz	C_{io}	typ.	0.6 pF
		max.	1.3 pF
Insulation resistance between input and output $\pm V_{IO} = 500$ V	R_{IO}	min.	1 TΩ
		typ.	10 TΩ
Switching times (see Figs 3 and 4)			
$I_{Fon} = 10$ mA; $V_{CC} = 5$ V; $R_E = 100$ Ω; $R_{BE} = 1$ MΩ	t_{on}	typ.	5 μs
	t_{off}	typ.	30 μs
$I_{Fon} = 1$ mA; $V_{CC} = 5$ V; $R_E = 1$ kΩ; $R_{BE} = 10$ MΩ	t_{on}	typ.	50 μs
	t_{off}	typ.	250 μs

Notes

1. Where the phototransistor receives light from the diode the O (for open base) has been omitted from the symbols.
2. As quality assurance (on a sample basis), these parameters are covered by a 1000 h reliability test.
3. Every single product is tested by applying an isolation test voltage of 3750 V AC (RMS) for 2 seconds between the shorted input (diode) leads and the shorted output (phototransistor) leads; with a detection current of about 1 μA.

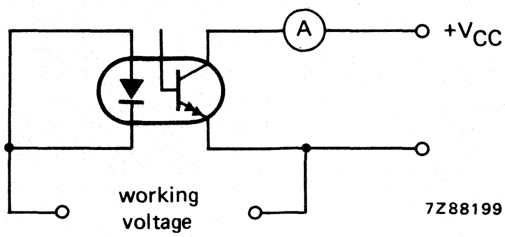


Fig. 2.

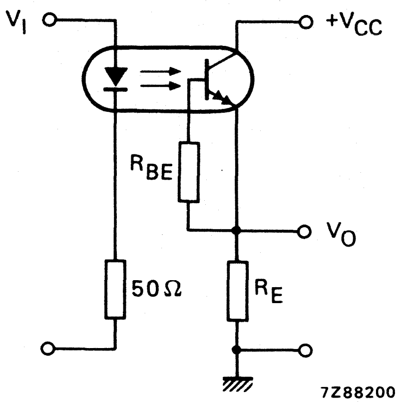


Fig. 3 Switching circuit.

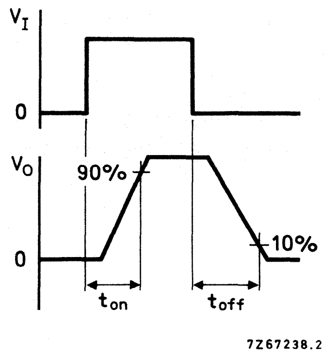


Fig. 4 Waveforms.

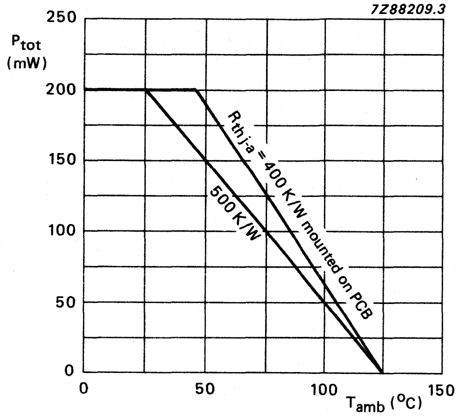


Fig. 5 Power derating curve for diode and transistor as a function of temperature.

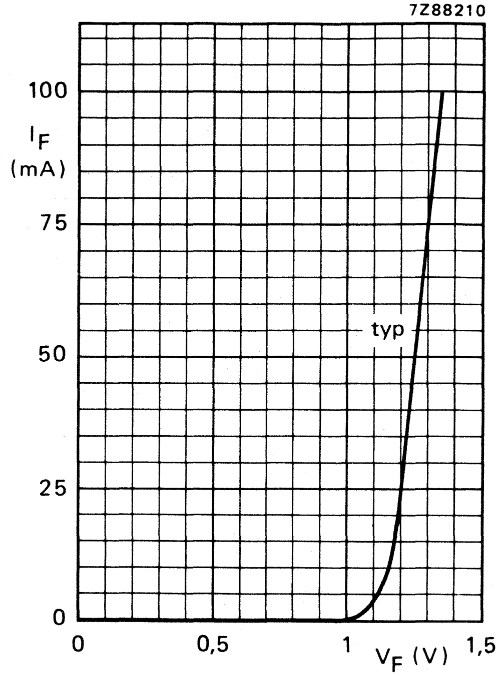


Fig. 6 T_{amb} = 25 °C.

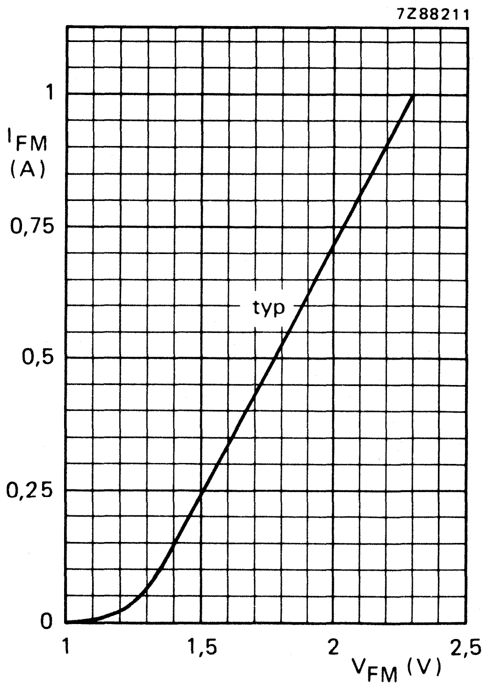


Fig. 7 T_{amb} = 25 °C; t_p = 10 μs; δ = 0,01.

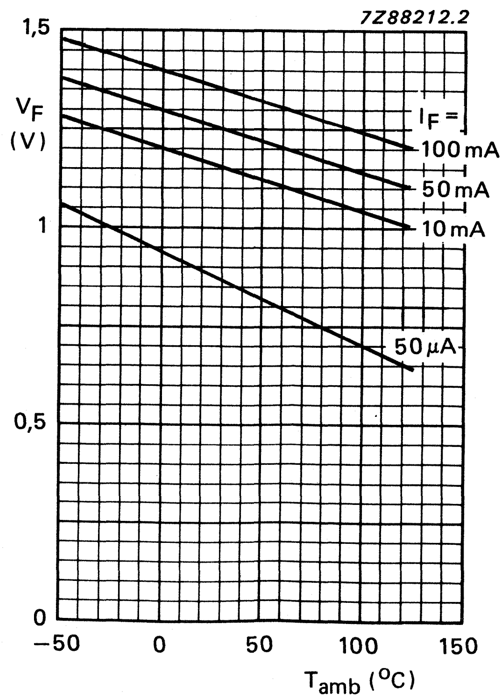


Fig. 8 Typical values.

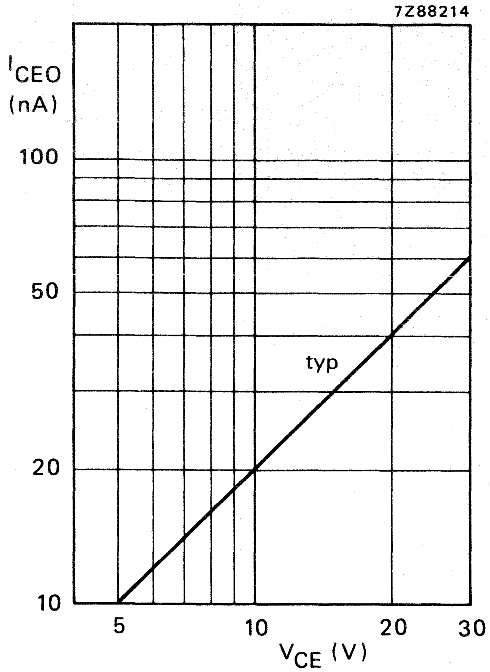


Fig. 9 $I_F = 0$; $T_j = 25\ ^oC$.

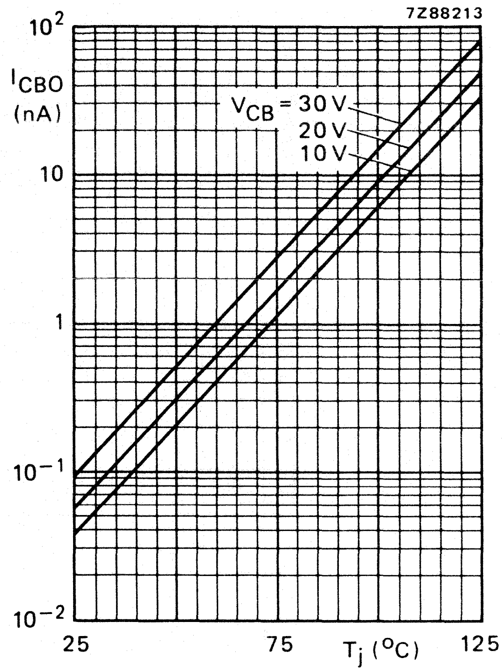


Fig. 10 Typical values.

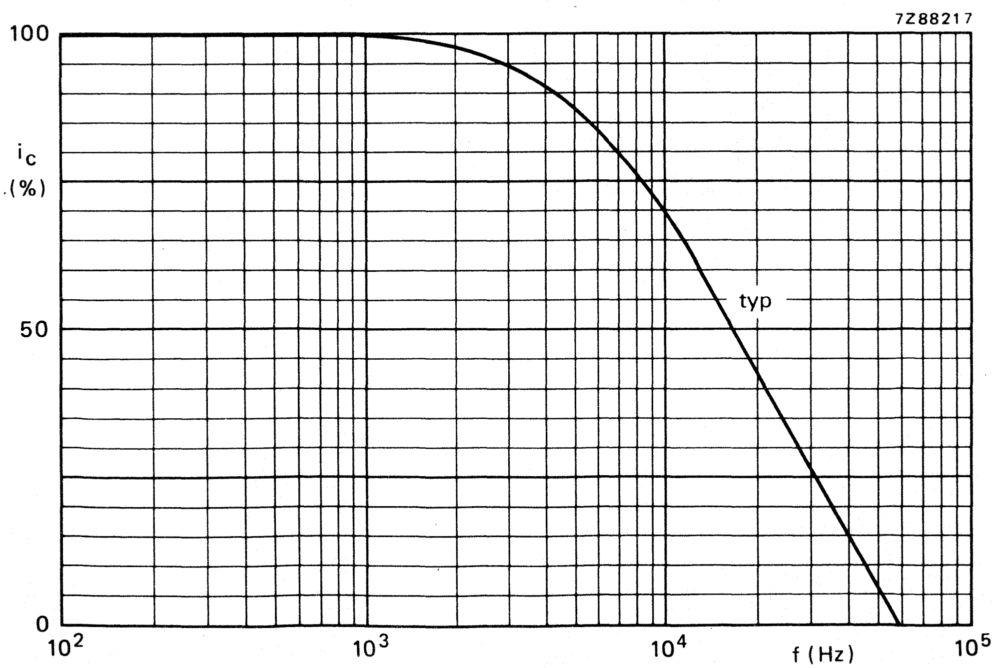


Fig. 11 $I_C = 10$ mA; $V_{CC} = 5$ V; $R_E = 100\ \Omega$; $R_{BE} = 1\ M\Omega$; see also Fig. 3.

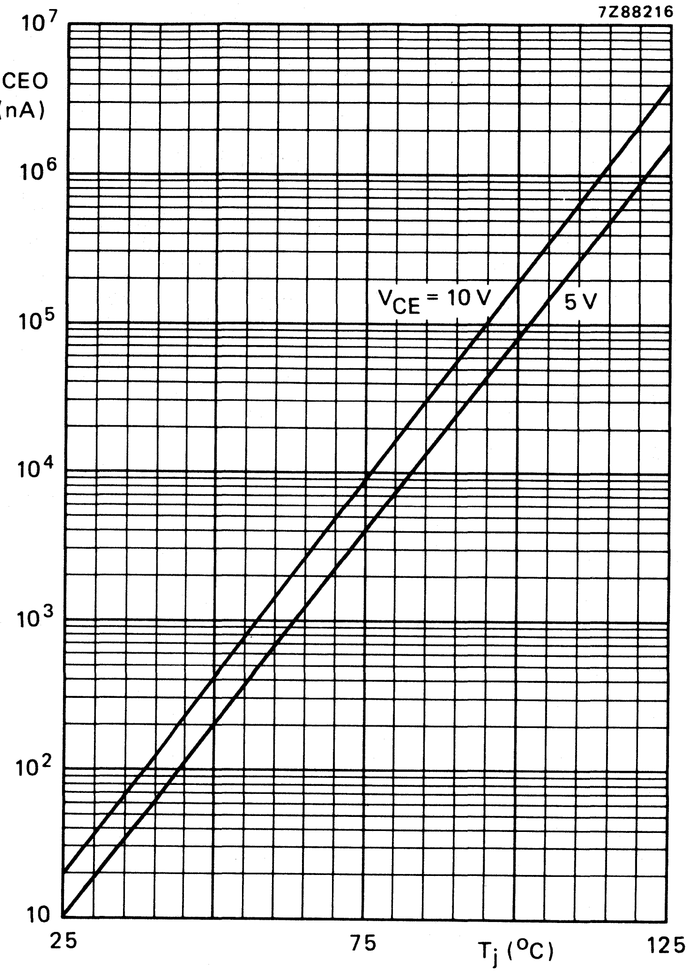


Fig. 12 $I_F = 0$; typical values.

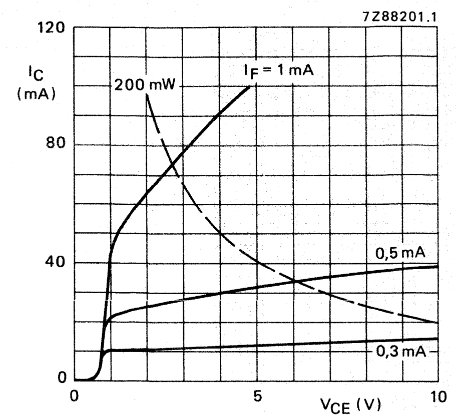


Fig. 13 Typical values; T_{amb} = 25 °C.

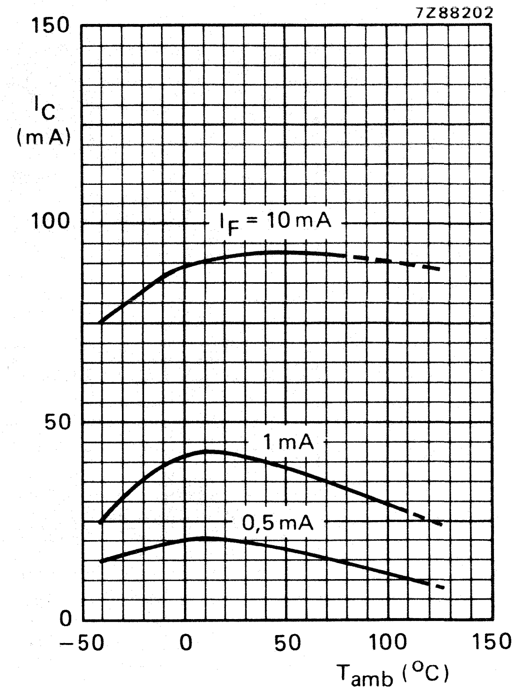


Fig. 14 Typical values; I_B = 0; V_{CE} = 1 V.

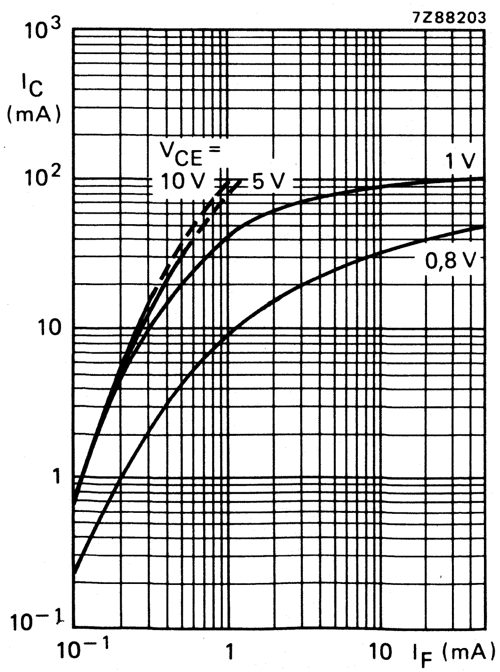


Fig. 15 Typical values; I_B = 0; T_{amb} = 25 °C.

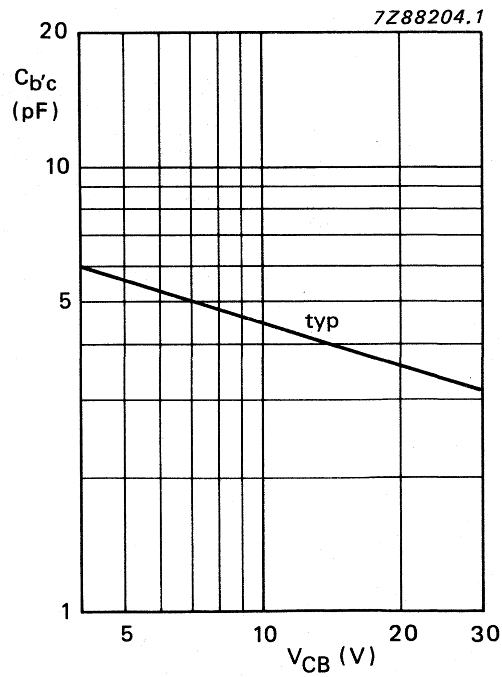


Fig. 16 $I_E = I_e = 0$; f = 1 MHz; T_{amb} = 25 °C.

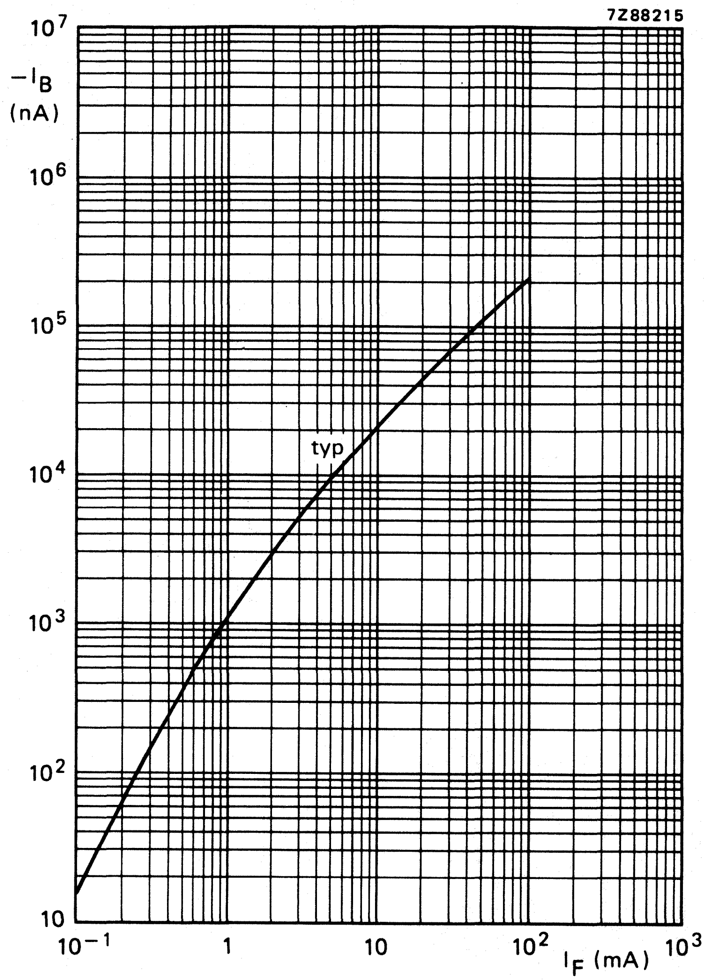


Fig. 17 $I_E = 0$; $V_{CB} = 5$ V; $T_{amb} = 25$ °C.

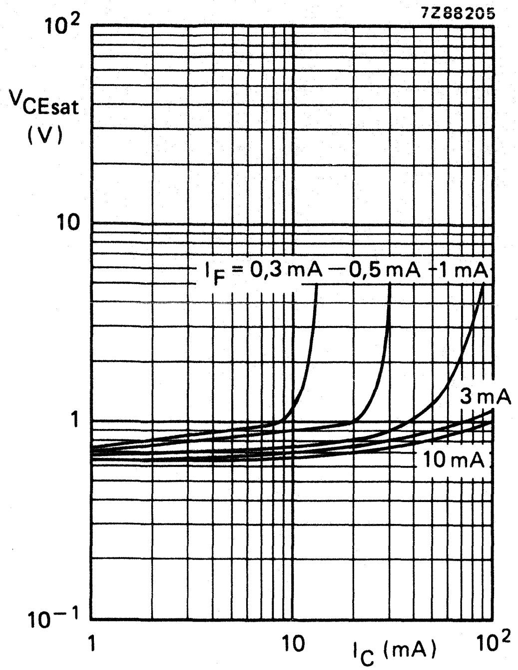


Fig. 18 Typical values; $I_B = 0$; $T_{amb} = 25\ ^oC$.

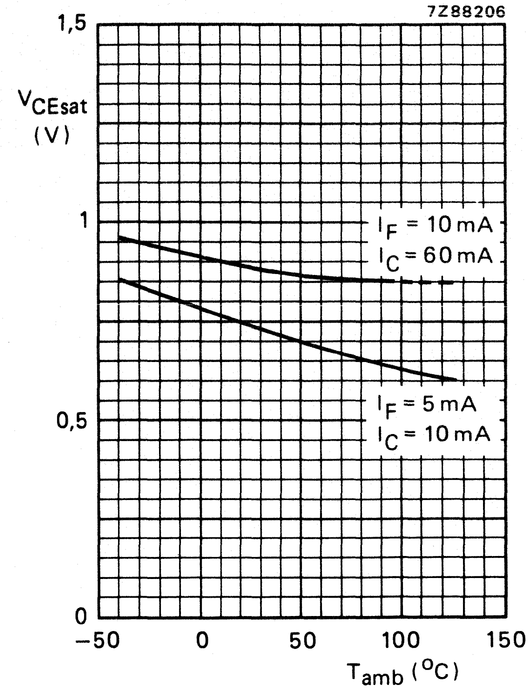


Fig. 19 Typical values; $I_B = 0$.

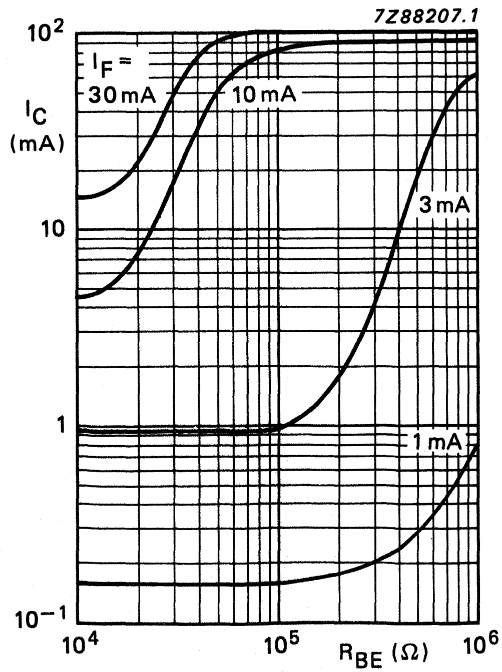


Fig. 20 Typ. values; $V_{CE} = 1$ V; $T_{amb} = 25\ ^oC$.

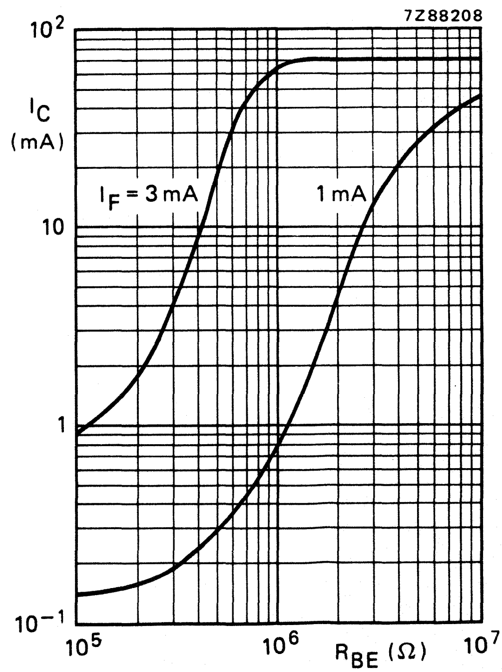


Fig. 21 Typ. values; $V_{CE} = 1$ V; $T_{amb} = 25\ ^oC$.

High-voltage optocoupler | CNX62A

FEATURES

- High current transfer ratio and a low saturation voltage, making the devices suitable for use with TTL integrated circuits
- High degree of AC and DC insulation (3750 V (RMS) and 5300 V (DC)).

DESCRIPTION

The CNX62A is a photocoupler consisting of an infrared emitting GaAs diode and a silicon npn phototransistor, in a dual-in-line (DIL) SOT230 plastic envelope. The base of the phototransistor is not connected.

PINNING - SOT230

PIN	DESCRIPTION
1	anode
2	cathode
3	not connected
4	emitter
5	collector
6	not connected

APPROVALS

STANDARD	REFERENCE
UL	covered under UL component recognition FILE E90700
BSI	certification in accordance with BS415:1990; BS7002:1989; Class II applications
NORDIC	tested for applications (reinforced isolation); Class II applications for pluggable apparatus in normal tight execution
SETI	in accordance with IEC 65, 380, 950 & 335
SEMKO	in accordance with IEC 65, 380, 950 & 335
NEMKO	in accordance with IEC 65, 380, 950 & 335
DEMKO	in accordance with IEC 65, 380, 950 & 335
VDE	approved in accordance with VDE 0883/6.80 reference voltage (VDE 0110b Tab 4): 500 V (AC)/600 V (DC) (isolation group C) complied for reinforced isolation at 250 V (AC) with: DIN IEC 380/VDE 0806/8.81 DIN IEC 435/VDE0805 "ENTWURF", Nov. 84 DIN 57804/VDE 0804/1.83 (isolation group C) DIN VDE 0860/8.86/HD 195 S4
CECC	Capability of approval: GaAs optocouplers

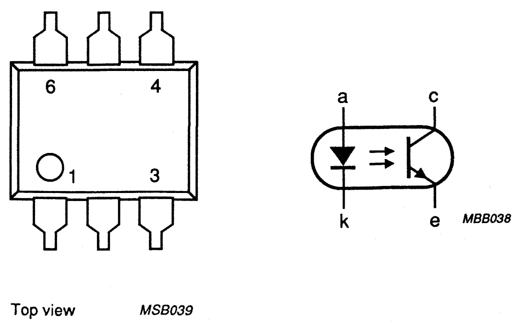


Fig.1 Simplified outline and symbol.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Diode					
V_R	continuous reverse voltage		–	5	V
I_F	forward current	DC value	–	100	mA
P_{tot}	total power dissipation	up to T_{amb} = 25 °C	–	200	mW
Transistor					
V_{CEO}	collector-emitter voltage	open base	–	50	V
P_{tot}	total power dissipation	up to T_{amb} = 25 °C	–	200	mW
Photocoupler					
I_C/I_F	output/input DC current transfer ratio	I_F = 10 mA; V_{CE} = 0.4 V	0.4	–	
I_{CEW}	collector cut-off current (dark)	V_{CC} = 10 V V_W = 2.5 kV (DC); I_F = 0 see Fig.2	–	200	nA
V_{IO}	isolation voltage				
		DC value	5.3	–	kV
		RMS value	3.75	–	kV

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX	UNIT
Diode					
V_R	continuous reverse voltage		–	5	V
I_F	forward current	DC value	–	100	mA
I_{FRM}	forward current	peak value; t_{on} = 10 μs; δ = 0.01	–	3	A
P_{tot}	total power dissipation	up to T_{amb} = 25 °C	–	200	mW
Transistor					
V_{CEO}	collector-emitter voltage	open base	–	50	V
V_{ECO}	emitter-collector voltage		–	7	V
I_C	collector current	DC value	–	100	mA
P_{tot}	total power dissipation	up to T_{amb} = 25 °C	–	200	mW
Photocoupler					
T_{stg}	storage temperature range		–55	150	°C
T_{amb}	ambient operating temperature range		–40	100	°C
T_j	junction temperature		–	125	°C
T_{sld}	soldering temperature up to the seating plane	T_{sld} < 10 s	–	260	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	MAX.	UNIT
Diode			
$R_{th\ j\text{-}a}$	from junction to ambient in free air	500	K/W
$R_{th\ j\text{-}a}$	from junction to ambient when mounted on PCB	400	K/W
Transistor			
$R_{th\ j\text{-}a}$	from junction to ambient in free air	500	K/W
$R_{th\ j\text{-}a}$	from junction to ambient when mounted on PCB	400	K/W

ISOLATION RELATED VALUES

SYMBOL	PARAMETER	CONDITIONS	MIN.	UNIT
L(IO1)	external air gap (clearance)	between input and output terminals	8.4	mm
L(IO2)	external tracking path (creepage distance)	between input and output terminals	8	mm
	internal plastic gap (clearance)	isolation thickness between emitter and receiver	1	mm

CLASSIFICATION CATEGORIES

Tracking resistance	KB-100/A

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETERS	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Diode						
V_F	forward voltage	I_F = 10 mA	–	1.15	1.5	V
I_R	reverse current	V_R = 5 V	–	–	10	µA
Transistor						
$V_{(BR)CEO}$	collector-emitter breakdown voltage	I_C = 1 mA	50	–	–	V
$V_{(BR)ECO}$	emitter-collector breakdown voltage	I_E = 0.1 mA	7	–	–	V
I_{CEO}	collector cut-off current (dark)	I_F = 0; V_{CE} = 10 V	–	2	50	nA
		I_F = 0; V_{CE} = 10 V; T_{amb} = 70 °C	–	–	10	µA
Photocoupler						
I_C/I_F	output/input DC current transfer ratio (CTR)	I_F = 10 mA; V_{CE} = 0.4 V	0.4	0.8	–	
		I_F = 10 mA; V_{CE} = 5 V	–	1.5	–	
$I_{CE(L)}$	collector cut-off current (light)	T_{amb} ≤ 70 °C; V_F = 0.8 V; V_{CE} = 15 V	–	–	15	µA
		T_{amb} ≤ 70 °C; I_F = 2 mA; V_{CE} = 0.4 V	150	–	–	µA
$V_{CE\ sat}$	collector-emitter saturation voltage	I_F = 10 mA; I_C = 4 mA	–	0.19	0.4	V
I_{CEW}	collector cut-off current (dark) (see notes 1 and 2 and Fig.2)	V_W = 2.5 kV (DC); V_{CC} =10 V; T_j = 25 °C	–	–	200	nA
		V_W = 2.5 kV (DC); V_{CC} = 10 V; T_j = 70 °C	–	–	100	µA
V_{IO}	isolation voltage	DC value; t = 1 min; (note 3)	5.3	–	–	kV
		RMS value; t = 1 min; (note 3)	3.75	–	–	kV
C_{io}	capacitance between input and output	V = 0; f = 1 MHz	–	0.4	1	pF
R_{IO}	insulation resistance between input and output	V_{IO} = ±500 V	1	10	–	TΩ

SYMBOL	PARAMETERS	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Switching times (see Figs 3 and 4)						
t_{on}	turn-on time	$I_C = 2$ mA; $V_{CC} = 5$ V; $R_L = 100\ \Omega$	–	3	–	μs
		$I_C = 2$ mA; $V_{CC} = 5$ V; $R_L = 1\ k\Omega$	–	12	–	μs
t_{off}	turn-off time	$I_C = 2$ mA; $V_{CC} = 5$ V; $R_L = 100\ \Omega$	–	3	–	μs
		$I_C = 2$ mA; $V_{CC} = 5$ V; $R_L = 1\ k\Omega$	–	12	–	μs

Notes

1. This parameter is the maximum collector-emitter leakage current measured when a high voltage is applied between the shorted diode leads and the transistor emitter, with a detection current of approximately 1 μA.
2. For quality assurance, the two parameters are tested on a sample basis for 1000 hrs.
3. Every product is tested by applying an isolation test voltage of 4500 V (RMS) for 2 s between all shorted input side leads and all shorted output side leads.

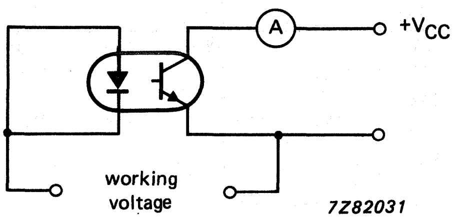


Fig.2 Test circuit.

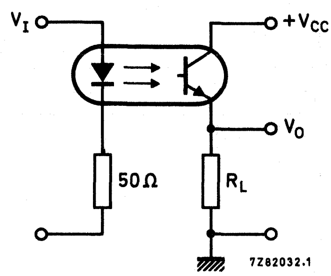


Fig.3 Switching circuit.

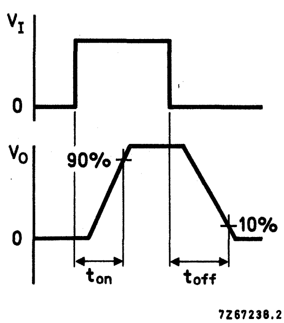
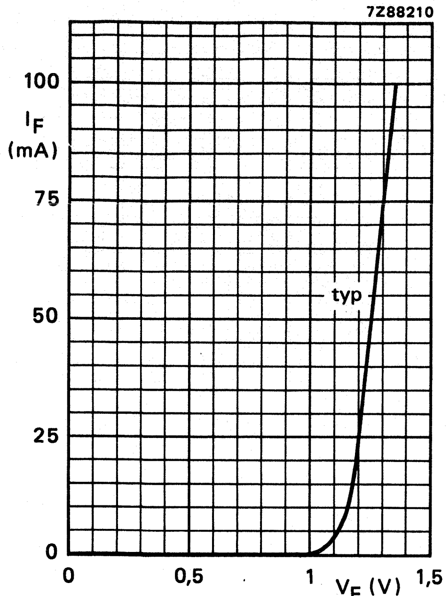
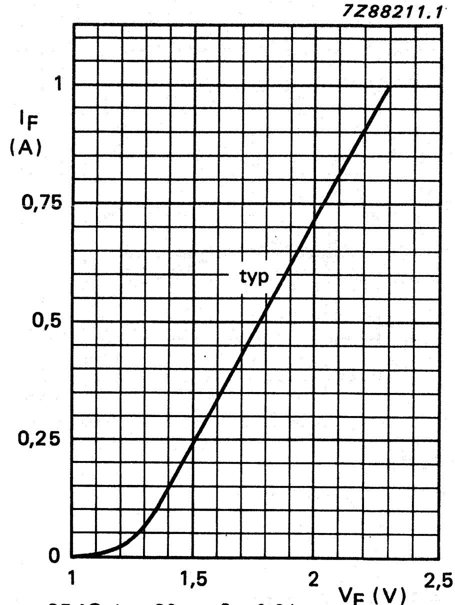


Fig.4 Waveforms.



T_{amb} = 25 °C.

Fig.5 Forward current as a function of forward voltage, typical values.



T_{amb} = 25 °C; t_p = 20 μs; δ = 0.01.

Fig.6 Forward current as a function of forward voltage, typical values.

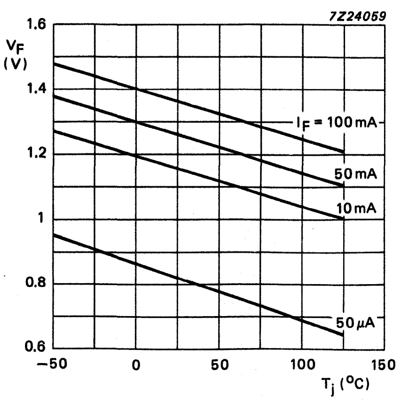
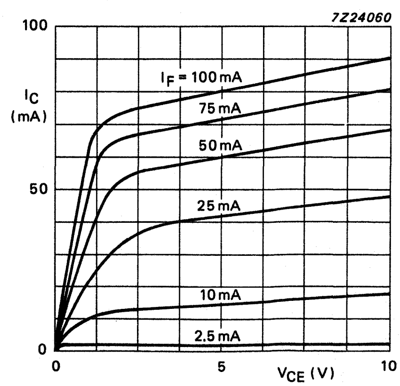
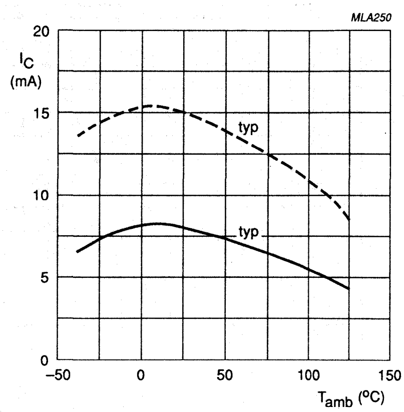


Fig.7 Forward voltage as a function of junction temperature, typical values.



T_{amb} = 25 °C.

Fig.8 Collector current as a function of collector-emitter voltage, typical values.

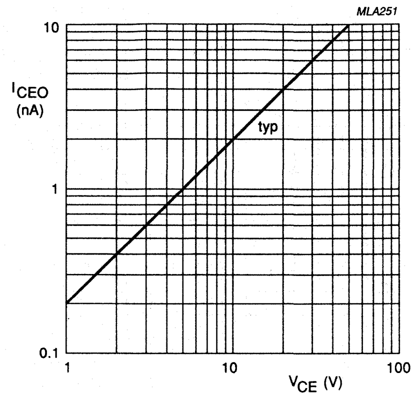


I_F = 10 mA;

Solid line: V_{CE} = 0.4 V;

Dotted line: V_{CE} = 5 V.

Fig.9 Collector current as a function of ambient temperature.



T_{amb} = 25 °C.

Fig.10 Collector-emitter dark current as a function of collector-emitter voltage.

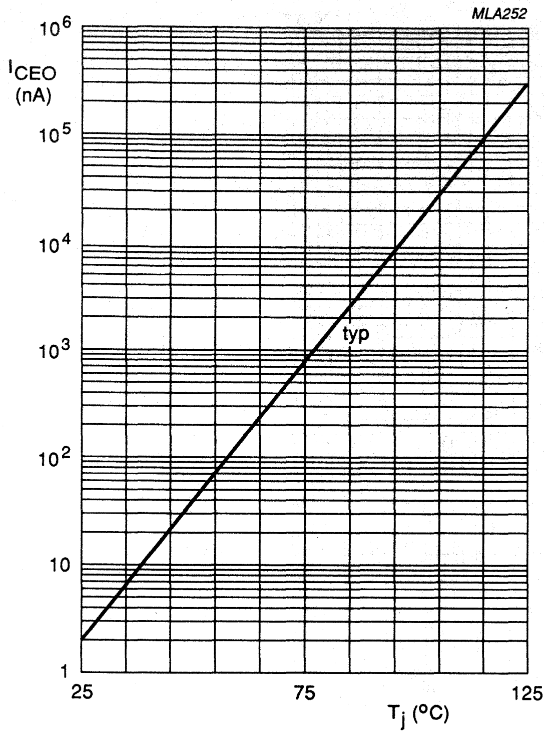
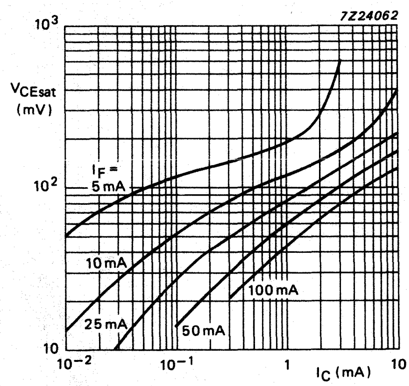
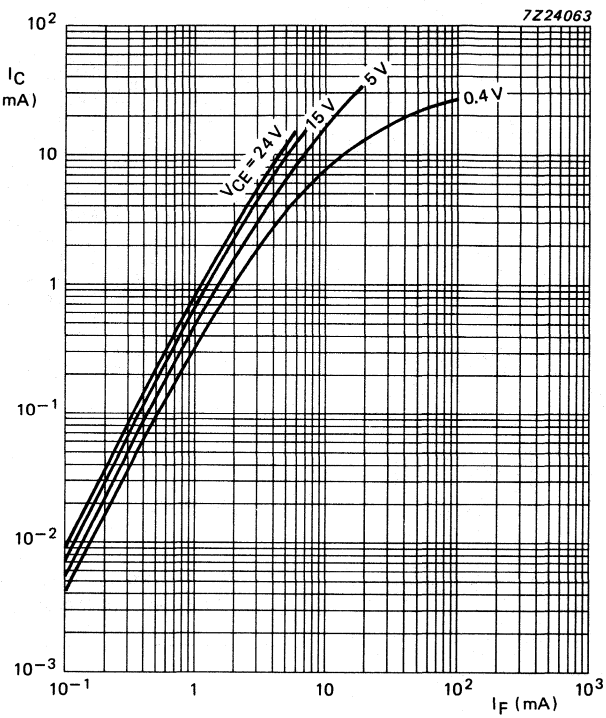


Fig.11 Collector-emitter dark current as a function of junction temperature.



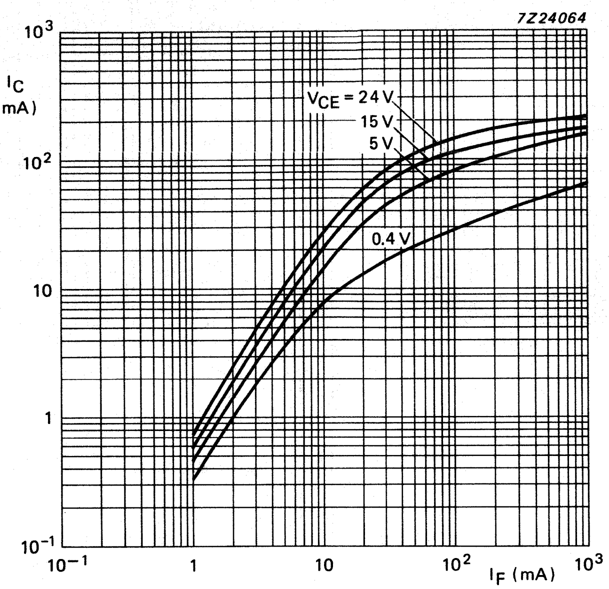
T_{amb} = 25 °C.

Fig.12 Collector-emitter saturation voltage as a function of collector current, typical values.



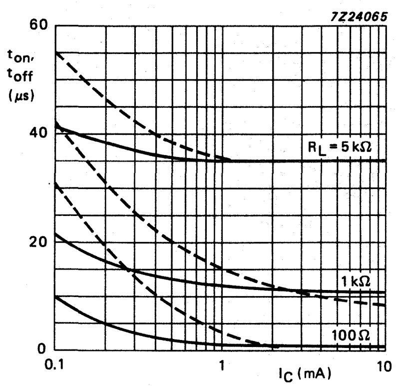
T_{amb} = 25 °C.

Fig.13 Collector current as a function of forward current, typical values.



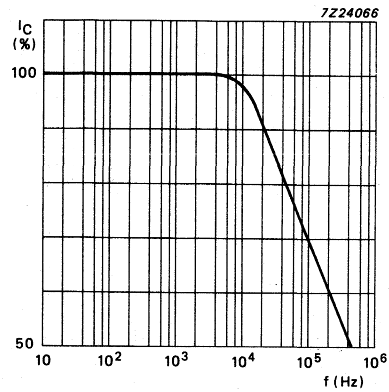
T_{amb} = 25 °C; t_p = 10 μs; δ = 0.01.

Fig.14 Collector current as a function of forward current, typical values.



T_{amb} = 25 °C;
Solid line = t_{on};
Dotted line = t_{off}.

Fig.15 Switching times as a function of collector current.



T_{amb} = 25 °C; I_C = 2 mA; V_{CC} = 5 V; R_L = 1 kΩ.

Fig.16 Relative collector current as a function of frequency.

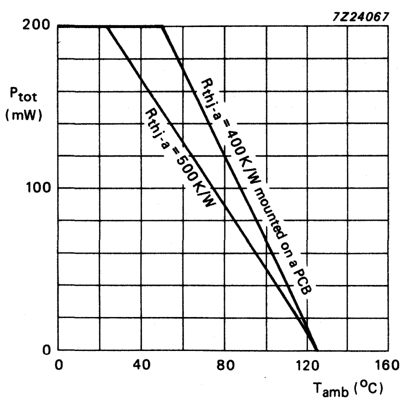


Fig.17 Total power dissipation as a function of ambient temperature.

High-voltage optocouplers CNX71A/CNX72A

FEATURES

- High current transfer ratio and a low saturation voltage, making the devices suitable for use with TTL integrated circuits
- High degree of AC and DC insulation (3750 V (RMS) and 5300 V (DC)).

DESCRIPTION

The CNX71A and CNX72A are optocouplers consisting of an infrared emitting GaAs diode and a silicon npn phototransistor, in dual-in-line (DIL) SOT229B plastic envelopes. The base of the phototransistor is connected for the CNX72A, but not connected for the CNX71A.

PINNING - CNX71A

PIN	DESCRIPTION
1	anode
2	cathode
3	not connected
4	emitter
5	collector
6	not connected

PINNING - CNX72A

PIN	DESCRIPTION
1	anode
2	cathode
3	not connected
4	emitter
5	collector
6	base

APPROVALS

STANDARD	REFERENCE
UL	covered under UL component recognition FILE E90700
VDE	approved in accordance with VDE 0883/6.80 reference voltage (VDE 0110b Tab 4): 380 V (AC)/450 V (DC) complied for reinforced isolation at 250 V (AC) with: DIN 57804/VDE 0804/1.83 (isolation group C) DIN VDE 0860/8.86/HD 195 S4
CECC	capability of approval: GaAs optocouplers with phototransistor output

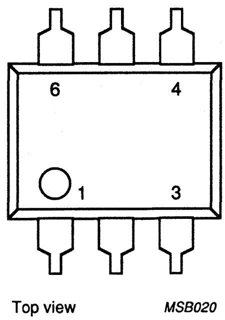


Fig.1 Simplified outline.

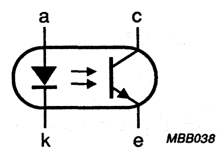


Fig.2 Symbol, CNX71A.

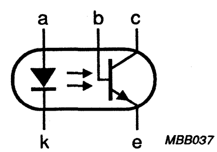


Fig.3 Symbol, CNX72A.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Diode					
V_R	reverse voltage	DC value	–	5	V
I_F	forward current	DC value	–	100	mA
P_{tot}	total power dissipation	up to T_{amb} = 25 °C	–	200	mW
Transistor					
I_C	collector current	DC value	–	100	mA
V_{CEO}	collector-emitter voltage	open base	–	30	V
P_{tot}	total power dissipation	up to T_{amb} = 25 °C	–	200	mW
Optocoupler					
I_C/I_F	DC current transfer ratio (CTR)	I_F = 10 mA; V_{CE} = 0.4 V	0.4	1.6	
		I_F = 10 mA; V_{CE} = 10 V; CNX71A only	0.5	–	
V_{IO}	isolation voltage (note 1)				
		DC value	5.3	–	kV
		RMS value	3.75	–	kV

Note

1. VDE approved for 3.12 kV (RMS)/4.4 kV (DC).

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX	UNIT
Diode					
V_R	reverse voltage	DC value	–	5	V
I_F	forward current	DC value	–	100	mA
I_{FRM}	forward current	peak value; t_{on} = 10 μs; δ = 0.01	–	3	A
P_{tot}	total power dissipation	up to T_{amb} = 25 °C	–	200	mW
Transistor					
V_{CEO}	collector-emitter voltage	open base	–	30	V
V_{ECO}	emitter-collector voltage	open base	–	7	V
V_{CBO}	collector-base voltage (CNX72A only)	open emitter	–	70	V
I_C	collector current	DC value	–	100	mA
P_{tot}	total power dissipation	up to T_{amb} = 25 °C	–	200	mW
Optocoupler					
T_{stg}	storage temperature range		–55	150	°C
T_{amb}	ambient operating temperature range		–40	100	°C
T_j	junction temperature		–	125	°C
T_{sld}	soldering temperature up to the seating plane	T_{sld} < 10 s	–	260	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	MAX.	UNIT
Diode			
$R_{th\ j\text{-}a}$	from junction to ambient in free air	500	K/W
$R_{th\ j\text{-}a}$	from junction to ambient when mounted on PCB	400	K/W
Transistor			
$R_{th\ j\text{-}a}$	from junction to ambient in free air	500	K/W
$R_{th\ j\text{-}a}$	from junction to ambient when mounted on PCB	400	K/W

ISOLATION RELATED VALUES

SYMBOL	PARAMETER	CONDITIONS	MIN.	UNIT
L(IO1)	external air gap (clearance)	between input and output terminals	7.2	mm
L(IO2)	external tracking path (creepage distance)	between input and output terminals	8	mm
	internal plastic gap (clearance)	isolation thickness between emitter and receiver	1	mm

CLASSIFICATION CATEGORIES

Tracking resistance	KB-100/A

CHARACTERISTICS

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Diode						
V_F	forward voltage	I_F = 10 mA	–	1.15	1.5	V
I_R	reverse current	V_R = 5 V	–	–	10	μA
Transistor						
$V_{(BR)CEO}$	collector-emitter breakdown voltage	I_C = 1 mA	30	–		V
$V_{(BR)ECO}$	emitter-collector breakdown voltage	I_E = 0.1 mA	7	–	–	V
$V_{(BR)CBO}$	collector-base breakdown voltage (CNX72A only)	I_C = 0.1 mA	70	–	–	V
I_{CEO}	collector-emitter cut-off current (dark)	I_F = 0; V_{CE} = 10 V	–	2	50	nA
		I_F = 0; V_{CE} = 10 V; T_{amb} = 70 °C	–	–	10	μA
I_{CBO}	collector-base cut-off current (CNX72A only)	I_F = 0; V_{CB} = 10 V	–	–	20	nA
Optocoupler						
I_C/I_F	DC current transfer ratio (CTR)	I_F = 10 mA; V_{CE} = 0.4 V	0.4	–	1.6	
		I_F = 10 mA; V_{CE} = 10 V; CNX71A only	0.5	–	–	
$I_{CE(L)}$	collector cut-off current (light)	T_{amb} = 0 to 70 °C; V_F = 0.8 V; V_{CE} = 15 V	–	–	15	μA
		T_{amb} = 0 to 70 °C; I_F = 2 mA; V_{CE} = 0.4 V	150	–	–	μA
$V_{CE\ sat}$	collector-emitter saturation voltage	I_F = 10 mA; I_C = 4 mA	–	0.19	0.4	V
I_{CEW}	leakage current at working voltage	V_{IO} = 2.5 kV (DC); V_{CC} = 10 V; notes 1 and 2 and Fig.4	–	–	200	nA
		V_{IO} = 2.5 kV (DC); V_{CC} = 10 V; T_a = 70 °C notes 1 and 2 and Fig.4	–	–	2	μA
V_{IO}	isolation voltage (note 3)	DC value; t = 1 min; note 4	5.3	–	–	kV
		RMS value; t = 1 min; note 4	3.75	–	–	kV

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Optocoupler						
C_{bc}	output capacitance (CNX72A only)	V_{CB} = 10 V; f = 1 MHz	–	4.5	–	pF
C_{io}	capacitance between input and output	V_{IO} = 0; f = 1 MHz	–	0.4	1	pF
R_{IO}	insulation resistance between input and output	V_{IO} = ± 500 V	1	10	–	TΩ
Switching times (see Figs 5 and 6)						
t_{on}	turn-on time	CNX71A; I_F = 10 mA; V_{CC} = 10 V; R_L = 4.7 kΩ	–	–	20	µs
		CNX71A; I_C = 2 mA; V_{CC} = 10 V; R_L = 100 Ω	–	20	–	µs
		CNX72A; I_C = 2 mA; V_{CC} = 5 V; R_L = 1 kΩ; R_{BE} = 56 kΩ	–	–	26	µs
t_{off}	turn-off time	CNX71A; I_F = 10 mA; V_{CC} = 10 V; R_L = 4.7 kΩ	–	–	120	µs
		CNX71A; I_C = 2 mA; V_{CC} = 10 V; R_L = 100 Ω	–	20	–	µs
		CNX72A; I_C = 2 mA; V_{CC} = 5 V; R_L = 1 kΩ; R_{BE} = 56 kΩ	–	–	2.5	µs

Notes

1. This parameter is the maximum collector-emitter leakage current measured when a high voltage is applied between the shorted diode leads and the transistor emitter.
2. For quality assurance, the two parameters are tested for reliability on a sample basis for 1000 hrs.
3. Every product is tested by applying an isolation test voltage of 4500 V (RMS) for 2 s between all shorted input side leads and all shorted output side leads with a detection current of approximately 1 µA.
4. VDE approved for 3.12 kV (RMS)/4.4 kV (DC).

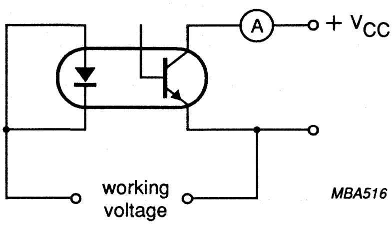
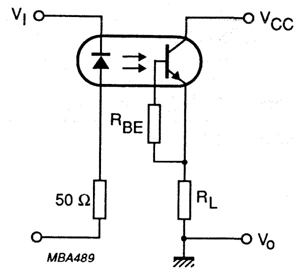


Fig.4 Test circuit.



R_{BE} connected for CNX72A only.

Fig.5 Switching circuit.

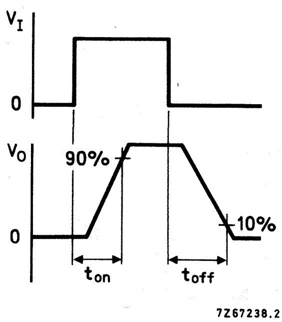
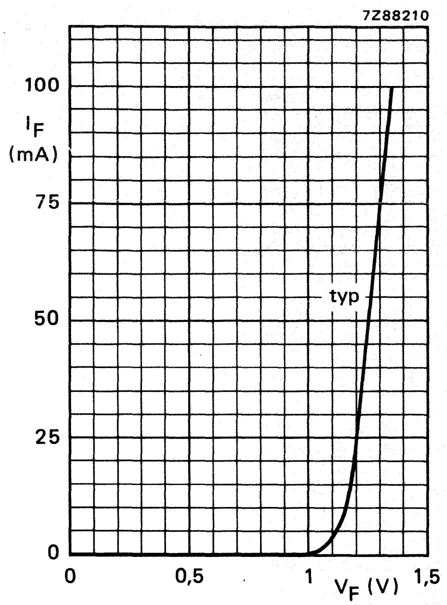
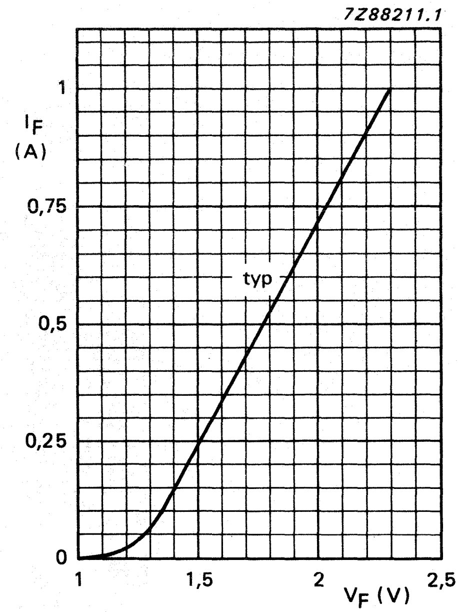


Fig.6 Waveforms.



T_{amb} = 25 °C.

Fig.7 Forward current as a function of forward voltage, typical values.



T_{amb} = 25 °C; δ = 0.01.

Fig.8 Forward current as a function of forward voltage, typical values.

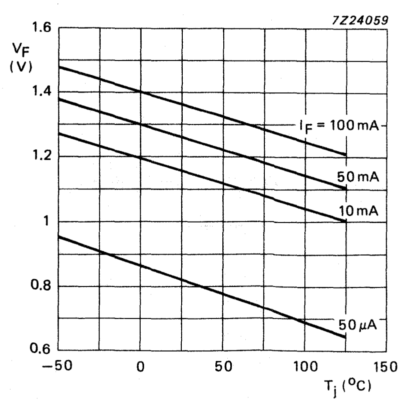
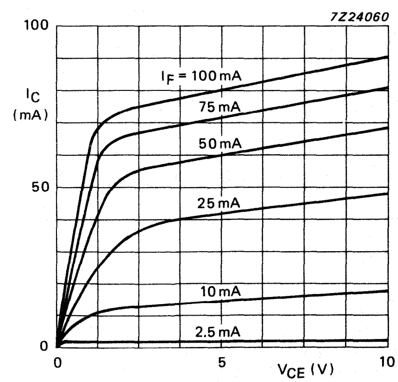
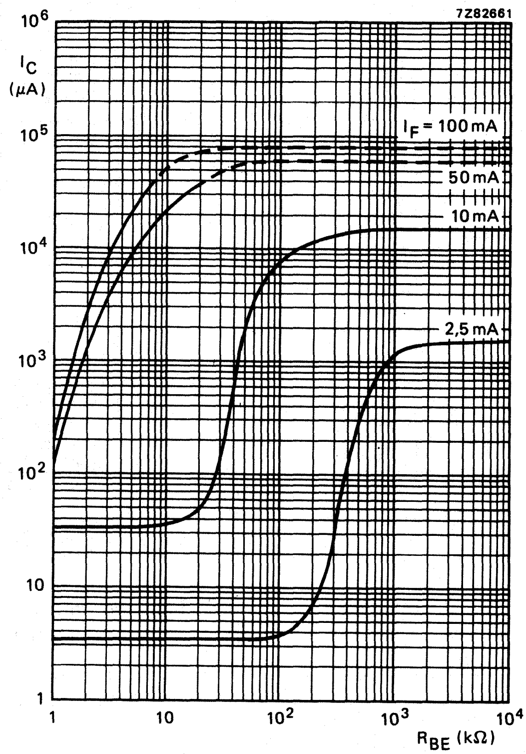


Fig.9 Forward voltage as a function of junction temperature, typical values.



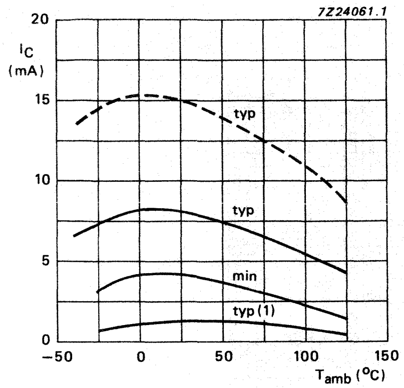
T_{amb} = 25 °C.

Fig.10 Collector current as a function of collector-emitter voltage, typical values.



$I_B = 0$; $V_{CE} = 5$ V; $T_{amb} = 25$ °C.

Fig.11 Collector current as a function of base-emitter resistance, CNX72A; typical values.

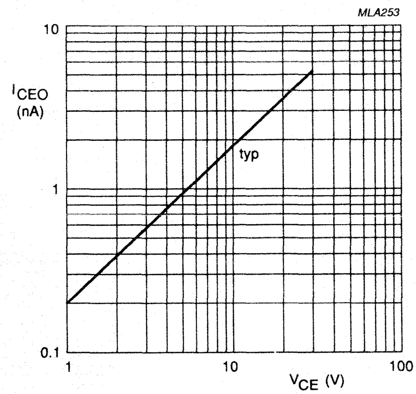


Solid line: I_F = 10 mA; V_{CE} = 0.4 V.

Dotted line: I_F = 10 mA; V_{CE} = 5 V.

(1) I_F = 2 mA; V_{CE} = 0.4 V.

Fig.12 Collector current as a function of ambient temperature, typical values.



T_{amb} = 25 °C.

Fig.13 Collector-emitter dark current as a function of collector-emitter voltage.

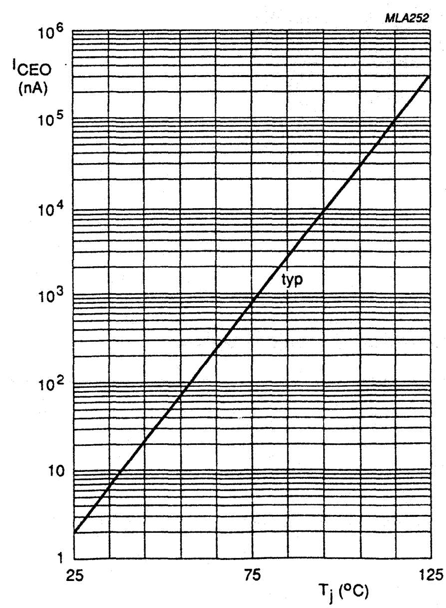
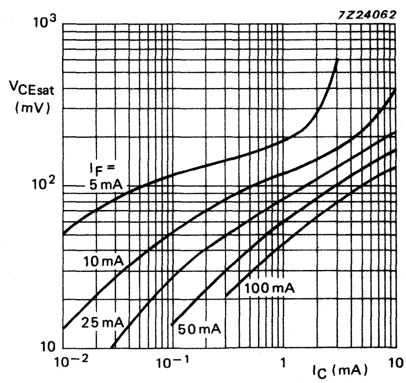


Fig.14 Collector-emitter dark current as a function of junction temperature.

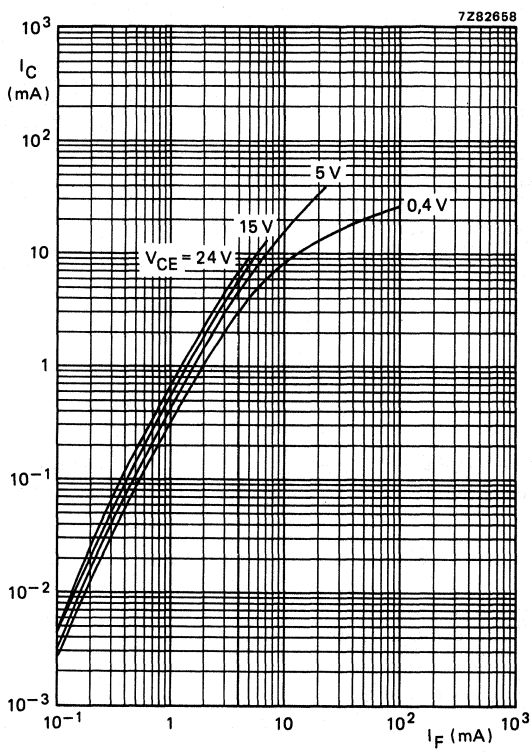


T_{amb} = 25 °C.

Fig.15 Collector-emitter saturation voltage as a function of collector current, typical values.

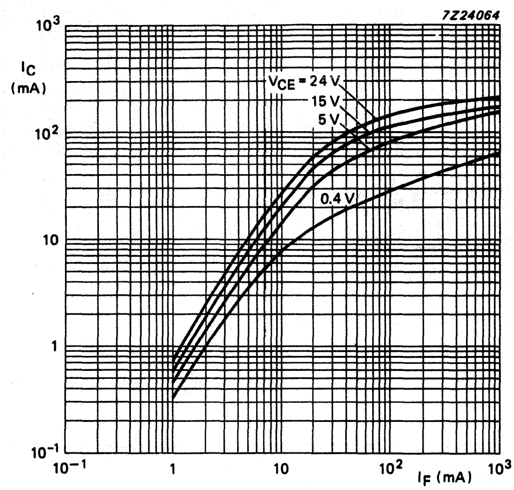
High-voltage optocouplers

CNX71A/CNX72A



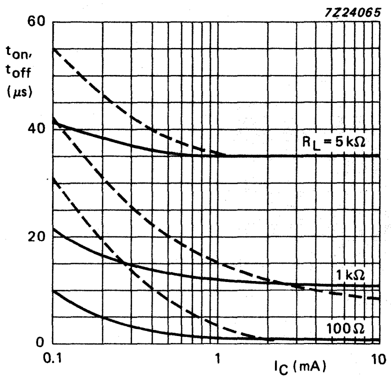
T_{amb} = 25 °C.

Fig.16 Collector current as a function of forward current, typical values.



T_{amb} = 25 °C; t_p = 10 µs; δ = 0.01.

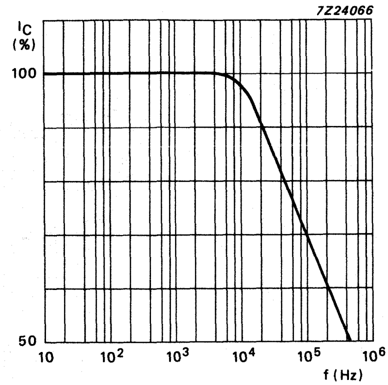
Fig.17 Collector current as a function of forward current, typical values.



Solid line: t_{off}.

Dotted line: t_{on}.

Fig.18 Switching times as a function of collector current, typical values.



$T_{amb} = 25\ °C$; $I_C = 2\ mA$; $V_{CC} = 5\ V$; $R_L = 1\ k\Omega$.

Fig.19 Relative collector current as a function of frequency.

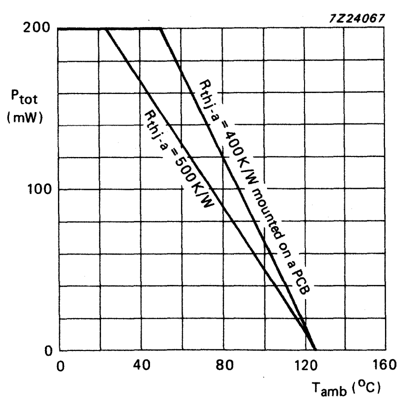


Fig.20 Total power dissipation as a function of ambient temperature.

High-voltage optocouplers — CNX82A/CNX83A

FEATURES

- High current transfer ratio and low saturation voltage, making the devices suitable for use with TTL integrated circuits
- High degree of AC and DC insulation (3750 V (RMS) and 5300 V (DC))
- Input/output pin distance 10.16 mm.

DESCRIPTION

The CNX82A and CNX83A are photocouplers consisting of an infrared emitting GaAs diode and a silicon npn phototransistor, in a dual-in-line (DIL) SOT231 plastic envelope. The base of the phototransistor is unconnected for the CNX82A and connected for the CNX83A.

PINNING - CNX82A

PIN	DESCRIPTION
1	anode
2	cathode
3	not connected
4	emitter
5	collector
6	not connected

PINNING - CNX83A

PIN	DESCRIPTION
1	anode
2	cathode
3	not connected
4	emitter
5	collector
6	base

APPROVALS

STANDARD	REFERENCE
UL	covered under UL component recognition FILE E90700
BSI	certification in accordance with BS415:1990; BS7002:1989; Class II applications
NORDIC	tested for applications (reinforced isolation); Class II applications for pluggable apparatus in normal tight execution
SETI	in accordance with IEC 65, 380, 950 & 335
SEMKO	in accordance with IEC 65, 380, 950 & 335
NEMKO	in accordance with IEC 65, 380, 950 & 335
DEMKO	in accordance with IEC 65, 380, 950 & 335
VDE	approved in accordance with VDE 0883/6.80 reference voltage (VDE 0110b Tab 4): 500 V (AC)/600 V (DC) (isolation group C) complied for reinforced isolation at 250 V (AC) with: DIN IEC 380/VDE 0806/8.81 DIN IEC 435/VDE0805 "ENTWURF", Nov. 84 DIN 57804/VDE 0804/1.83 (isolation group C) DIN VDE 0860/8.86/HD 195 S4
CECC	Capability of approval: GaAs optocouplers

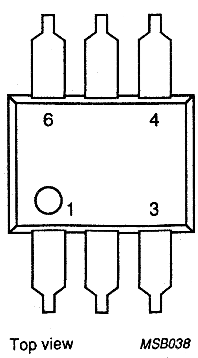


Fig.1 Simplified outline.

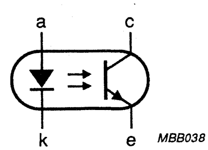


Fig.2 Symbol, CNX82A.

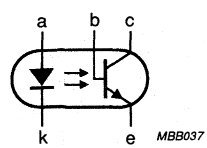


Fig.3 Symbol, CNX83A.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Diode					
I_F	forward current	DC value	–	100	mA
Transistor					
V_{CEO}	collector-emitter voltage	open base	–	50	V
Photocoupler					
I_C/I_F	DC current transfer ratio (CTR)	I_F = 10 mA; V_{CE} = 0.4 V	0.4	–	
I_{CEW}	collector cut-off current (dark)	V_W = 2.5 kV (DC); V_{CC} = 10 V	–	200	nA
V_{IO}	isolation voltage				
		DC value	5.3	–	kV
		RMS value	3.75	–	kV

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Diode					
V_R	continuous reverse voltage		–	5	V
I_F	forward current	DC value	–	100	mA
I_{FRM}	forward current	peak value; t_{on} = 10 µs; δ = 0.01	–	3	A
P_{tot}	total power dissipation	up to T_{amb} = 25 °C	–	200	mW
Transistor					
V_{CEO}	collector-emitter voltage	open base	–	50	V
V_{ECO}	emitter-collector voltage		–	7	V
V_{CBO}	collector-base voltage (CNX83A only)		–	70	V
I_C	collector current	DC value	–	100	mA
P_{tot}	total power dissipation	up to T_{amb} = 25 °C	–	200	mW
Photocoupler					
T_{stg}	storage temperature range		–55	150	°C
T_{amb}	ambient operating temperature range		–40	100	°C
T_j	junction temperature		–	125	°C
T_{sld}	soldering temperature up to the seating plane	T_{sld} < 10 s	–	260	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	MAX.	UNIT
Diode			
$R_{th\ j\text{-}a}$	from junction to ambient in free air	500	K/W
$R_{th\ j\text{-}a}$	from junction to ambient when mounted on PCB	400	K/W
Transistor			
$R_{th\ j\text{-}a}$	from junction to ambient in free air	500	K/W
$R_{th\ j\text{-}a}$	from junction to ambient when mounted on PCB	400	K/W

ISOLATION RELATED VALUES

SYMBOL	PARAMETER	CONDITIONS	MIN.	UNIT
L(IO1)	external air gap (clearance)	between input and output terminals	9.6	mm
L(IO2)	external tracking path (creepage distance)	between input and output terminals	8	mm
	internal plastic gap (clearance)	isolation thickness between emitter and receiver	1	mm

CLASSIFICATION CATEGORIES

Tracking resistance	KB-100/A

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETERS	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Diode						
V_F	forward voltage	I_F = 10 mA	–	1.15	1.5	V
I_R	reverse current	V_R = 5 V	–	–	10	μA
Transistor						
$V_{(BR)CEO}$	collector-emitter breakdown voltage	I_C = 1 mA	50	–		V
$V_{(BR)CBO}$	collector-base breakdown voltage (CNX83A only)	I_C = 0.1 mA	70	–	–	V
$V_{(BR)ECO}$	emitter-collector breakdown voltage	I_E = 0.1 mA	7	–	–	V
I_{CEO}	collector cut-off current (dark)	I_F = 0; V_{CE} = 10 V	–	2	50	nA
		V_{CE} = 10 V; T_{amb} = 70 °C	–	–	10	μA
I_{CBO}	collector cut-off current (dark) (CNX83A only)	V_{CB} = 10 V	–	–	20	nA
Photocoupler						
I_C/I_F	DC current transfer ratio (CTR)	I_F = 10 mA; V_{CE} = 0.4 V	0.4	0.8	–	
		I_F = 10 mA; V_{CE} = 5 V	0.4	–	2.5	
		I_F = 1 mA; V_{CE} = 5 V	0.1	–	1	
$I_{CE(L)}$	collector cut-off current (light)	T_{amb} ≤ 70 °C; V_F = 0.8 V; V_{CE} = 15 V	–	–	15	μA
		T_{amb} ≤ 70 °C; I_F = 2 mA; V_{CE} = 0.4 V	150	–	–	μA
$V_{CE\,sat}$	collector-emitter saturation voltage	I_F = 10 mA; I_C = 4 mA	–	0.19	0.4	V
C_{bc}	output capacitance (CNX83A only)	V_{CB} = 10 V; f = 1 MHz	–	4.5	–	pF
I_{CEW}	collector cut-off current (dark) (see Fig.4)	V_W = 2.5 kV (DC); V_{CC} = 10 V; T_j = 25 °C; notes 1 and 2	–	–	200	nA
		V_W = 2.5 kV (DC); V_{CC} = 10 V; T_j = 70 °C; notes 1 and 2	–	–	2	μA

SYMBOL	PARAMETERS	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Photocoupler						
V_{IO}	isolation voltage	DC value; t = 1 min; note 3	5.3	–	–	kV
		RMS value; t = 1 min; note 3	3.75	–	–	kV
C_{io}	capacitance between input and output	V = 0; f = 1 MHz	–	0.4	1	pF
R_{IO}	insulation resistance between input and output	V_{IO} = ±500 V	1	10	–	TΩ
Switching times (see Figs 5 and 6)						
t_{on}	turn-on time	I_C = 2 mA; V_{CC} = 5 V; R_L = 100 Ω	–	3	–	µs
		I_C = 2 mA; V_{CC} = 5 V; R_L = 1 kΩ	–	12	–	µs
t_{off}	turn-off time	I_C = 2 mA; V_{CC} = 5 V; R_L = 100 Ω	–	3	–	µs
		I_C = 2 mA; V_{CC} = 5 V; R_L = 1 kΩ	–	12	–	µs

Notes

1. This parameter is the maximum collector-emitter leakage current measured when a high voltage is applied between the shorted diode leads and the transistor emitter.
2. For quality assurance, the two parameters are tested on a sample basis for 1000 hours.
3. Every product is tested by applying an isolation test voltage of 4500 V (RMS) for 2 s between all shorted input side leads and all shorted output side leads, with a detection current of approximately 1 µA.

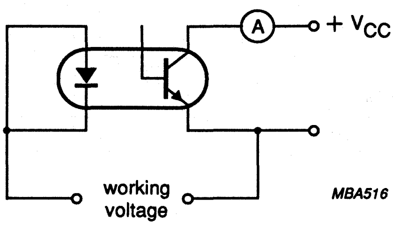


Fig.4 Test circuit.

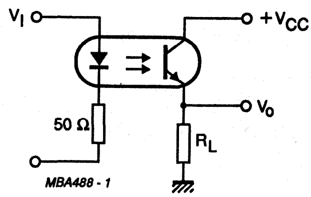


Fig.5 Switching circuit.

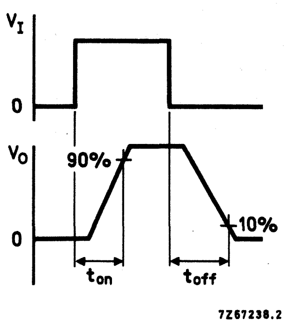
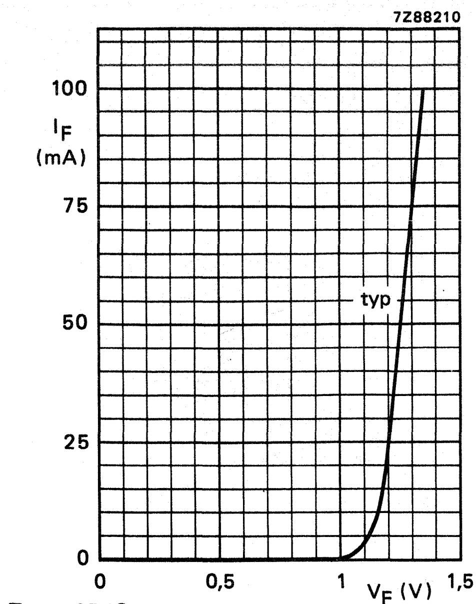
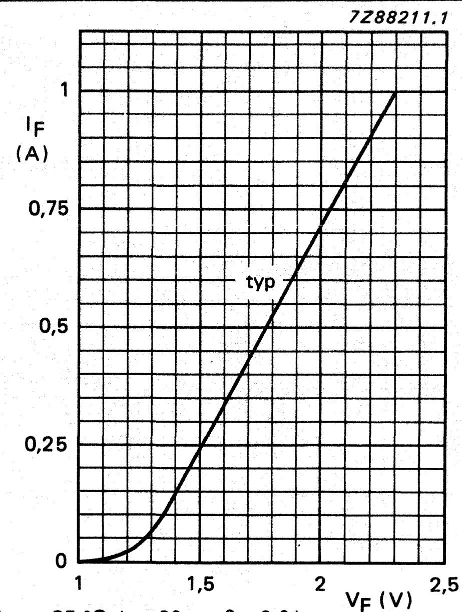


Fig.6 Waveforms.



T_{amb} = 25 °C.

Fig.7 Forward current as a function of forward voltage, typical values.



T_{amb} = 25 °C; t_p = 20 μs; δ = 0.01.

Fig.8 Forward current as a function of forward voltage, typical values.

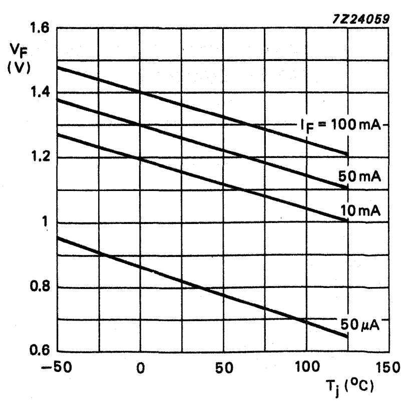
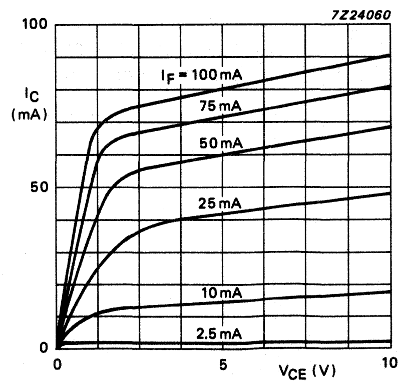
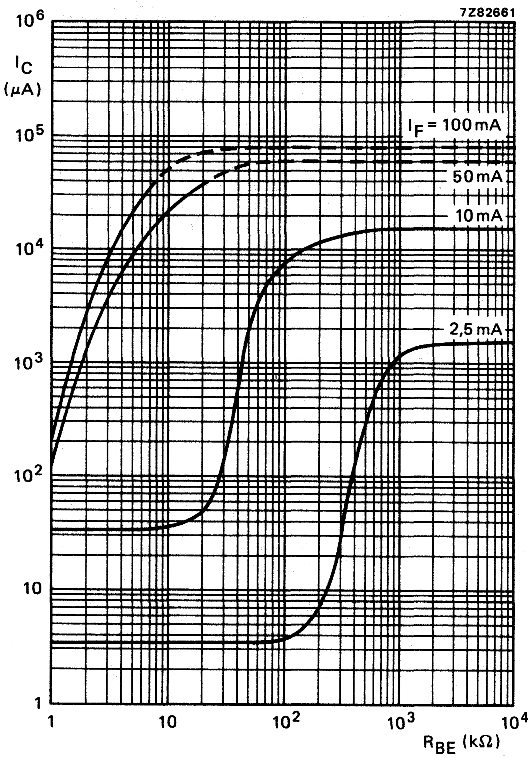


Fig.9 Forward voltage as a function of junction temperature, typical values.



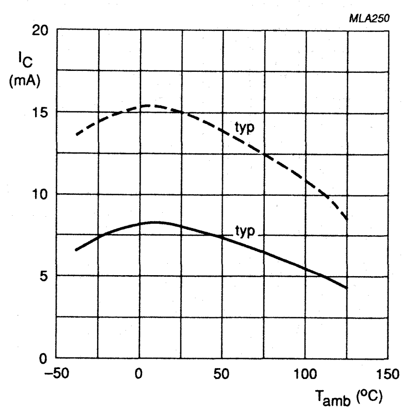
T_{amb} = 25 °C.

Fig.10 Collector current as a function of collector-emitter voltage, typical values.



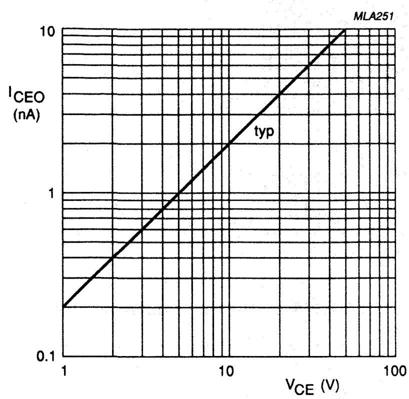
CNX83A; $I_B = 0$; $V_{CE} = 5$ V; $T_{amb} = 25$ °C.

Fig.11 Collector current as a function of base-emitter resistance, typical values.



Solid line: $I_F = 10$ mA; $V_{CE} = 0.4$ V.
Dotted line: $I_F = 10$ mA; $V_{CE} = 5$ V.

Fig.12 Collector current as a function of ambient temperature.



T_{amb} = 25 °C.

Fig.13 Collector-emitter dark current as a function of collector-emitter voltage, typical values.

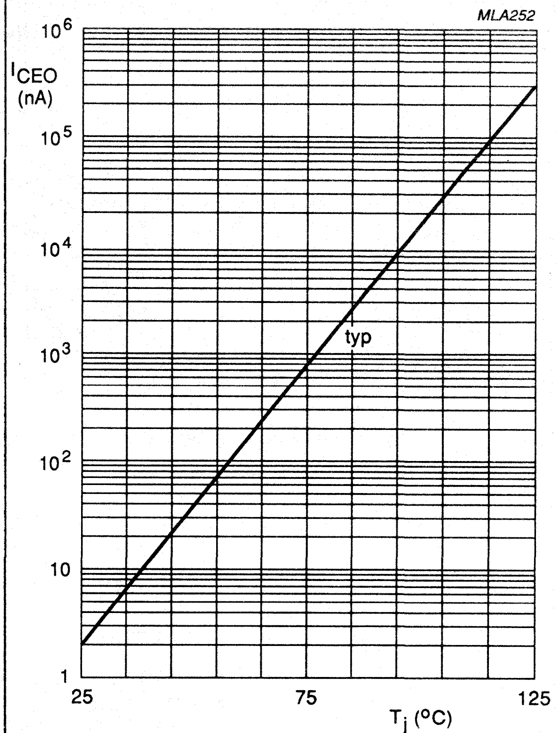
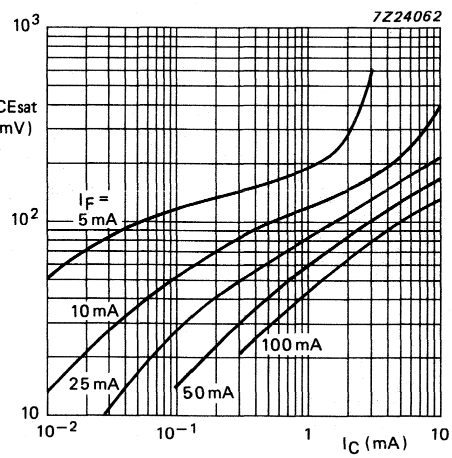
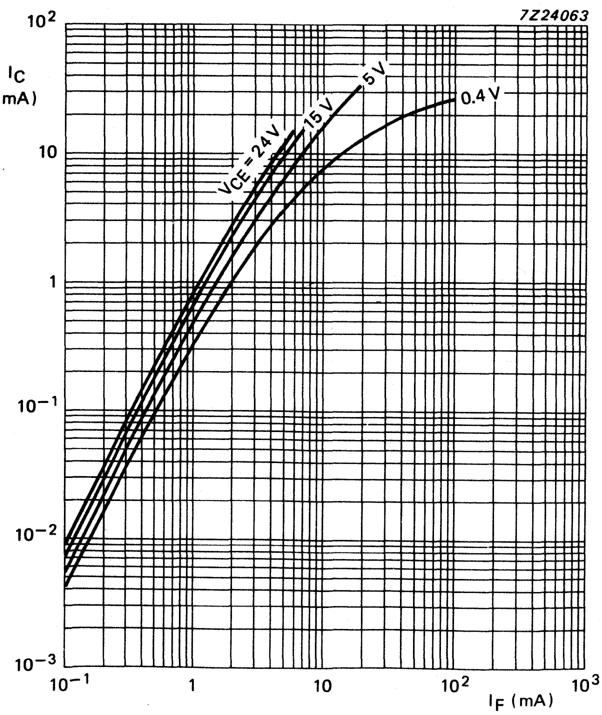


Fig.14 Collector-emitter dark current as a function of junction temperature.



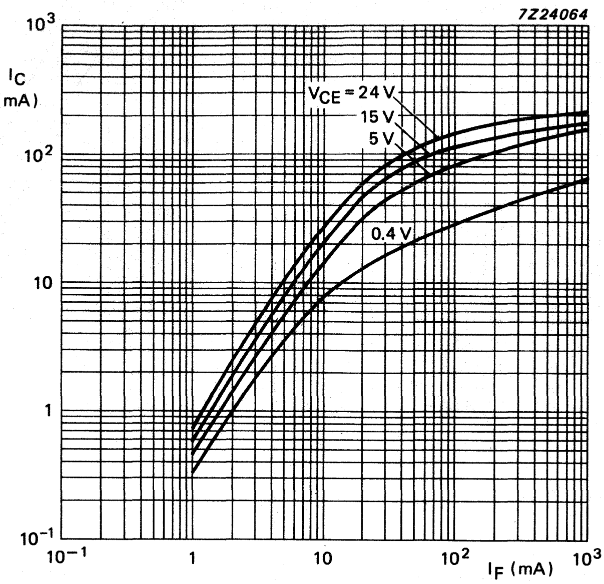
T_{amb} = 25 °C.

Fig.15 Collector-emitter saturation voltage as a function of collector current, typical values.



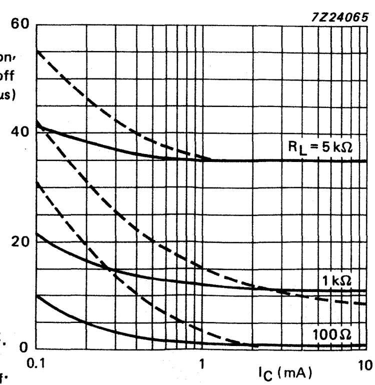
T_{amb} = 25 °C.

Fig.16 Collector current as a function of forward current, typical values.



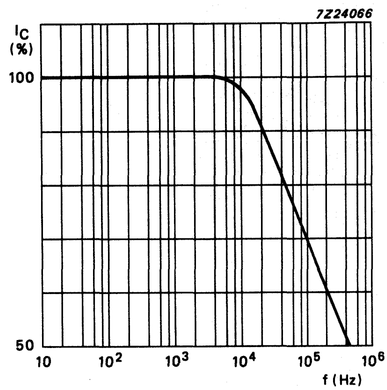
T_{amb} = 25 °C; t_p = 10 μs; δ = 0.01.

Fig.17 Collector current as a function of forward current, typical values.



T_{amb} = 25 °C.
Solid line: t_{off}.
Dotted line: t_{on}.

Fig.18 Switching times as a function of collector current.



T_{amb} = 25 °C; I_C = 2 mA; V_{CC} = 5 V; R_L = 1 kΩ.

Fig.19 Relative collector current as a function of frequency.

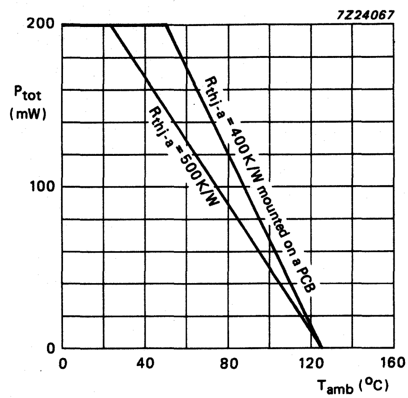


Fig.20 Total power dissipation as a function of ambient temperature.

FEATURES

- Fast switching
- Low saturation voltage
- High maximum output voltage
- Output/input DC current transfer ratio offered in four classes
- High isolation voltage (3.12 kV (RMS) and 4.4 kV (DC)).

DESCRIPTION

The CNY17 and CNY17F series are optically coupled isolators in a 6-pin, dual-in-line (DIL) SOT90B plastic envelope. Each one comprises an infrared emitting GaAs diode and an npn silicon phototransistor. They are suitable for use with TTL integrated circuits.

The base is connected for the CNY17-1 to 4 and unconnected for the CNY17F-1 to 4.

PINNING - CNY17 types

PIN	DESCRIPTION
1	anode
2	cathode
3	not connected
4	emitter
5	collector
6	base

PINNING - CNY17F types

PIN	DESCRIPTION
1	anode
2	cathode
3	not connected
4	emitter
5	collector
6	not connected

APPROVALS

STANDARD	REFERENCE
UL (note 1)	covered under UL component recognition FILE E90700
VDE (note 1)	approved in accordance with VDE 0883/6.80 reference voltage (VDE 0110b Tab 4): 380 V (AC)/450 V (DC) complied for reinforced isolation at 250 V (AC) with: DIN 57804/VDE 0804/1.83 DIN VDE 0860/8.86/HD 195 S4
CECC	Capability of approval: GaAs optocouplers

Note

1. UL & VDE recognition pending for CNY17F types.

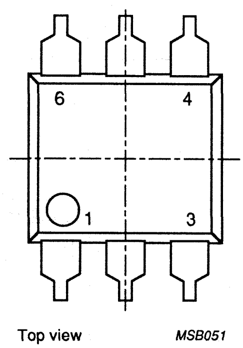


Fig.1 Simplified outline.

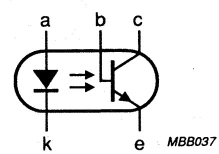


Fig.2 Symbol, CNY17 types.

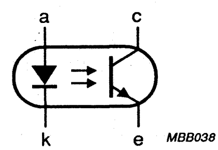


Fig.3 Symbol, CNY17F types.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Diode					
I_F	forward current	DC value	–	100	mA
V_R	continuous reverse voltage	DC value	–	6	V
P_{tot}	total power dissipation	up to T_{amb} = 25 °C	–	200	mW
Transistor					
V_{CEO}	collector-emitter voltage	open base	–	70	V
P_{tot}	total power dissipation	up to T_{amb} = 25 °C	–	200	mW
Optocoupler					
I_C/I_F	current transfer ratio (CTR)	DC value; I_F = 10 mA; V_{CE} = 5 V			
	CNY17-1/17F-1		0.4	0.8	
	CNY17-2/17F-2		0.63	1.25	
	CNY17-3/17F-3		1	2	
	CNY17-4/17F-4		1.6	3.2	
V_{IO}	isolation voltage				
		DC value	4.4	–	kV
		RMS value	3.12	–	kV
Switching times					
t_{on}	turn-on time	I_C = 2 mA; V_{CC} = 10 V; R_L = 100 Ω	–	10	µs
t_{off}	turn-off time	I_C = 2 mA; V_{CC} = 10 V; R_L = 100 Ω	–	10	µs

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX	UNIT
Diode					
I_F	forward current	DC value	–	100	mA
I_{FRM}	forward current	peak value; t_p = 1 μs; f = 300 Hz	–	3	A
V_R	continuous reverse voltage	DC value	–	6	V
P_{tot}	total power dissipation	up to T_{amb} = 25 °C (see note 1)	–	200	mW
Transistor					
I_C	collector current	DC value	–	100	mA
V_{CEO}	collector-emitter voltage	open base	–	70	V
V_{CBO}	collector-base voltage (CNY17 types only)	open emitter	–	70	V
V_{EBO}	emitter-base voltage (CNY17 types only)	open collector	–	7	V
P_{tot}	total power dissipation	up to T_{amb} = 25 °C (see note 1)	–	200	mW
Optocoupler					
T_{stg}	storage temperature range		–55	150	°C
T_{amb}	ambient operating temperature range		–40	100	°C
T_j	junction temperature		–	125	°C
T_{sld}	soldering temperature up to the seating plane	T_{sld} < 10 s	–	260	°C

Note

1. The linear derating factor above 25 °C is 2 mW/K.

ISOLATION RELATED VALUES

SYMBOL	PARAMETER	CONDITIONS	MIN.	UNIT
L(IO1)	external air gap (clearance)	between input and output terminals	7.2	mm
L(IO2)	external tracking path (creepage distance)	between input and output terminals	7	mm
	internal plastic gap (clearance)	isolation thickness between emitter and receiver	1	mm

CLASSIFICATION CATEGORIES

Tracking resistance	KB-100/A

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Diode						
V_F	forward voltage	I_F = 10 mA	–	1.1	1.5	V
I_R	reverse current	V_R = 6 V	–	–	10	μA
Transistor						
$V_{(BR)CEO}$	collector-emitter breakdown voltage	I_C = 1 mA	70	–	–	V
$V_{(BR)CBO}$	collector-base breakdown voltage (CNY17 types only)	I_C = 0.1 mA	70	–	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage (CNY17 types only)	I_E = 0.1 mA	7	–	–	V
I_{CEO}	collector-emitter cut-off current (dark)	V_{CE} = 10 V	–	2	50	nA
Optocoupler						
I_C/I_F	current transfer ratio (CTR)	DC value; I_F = 10 mA; V_{CE} = 5 V				
	CNY17-1/17F-1		0.4	–	0.8	
	CNY17-2/17F-2		0.63	–	1.25	
	CNY17-3/17F-3		1	–	2	
	CNY17-4/17F-4		1.6	–	3.2	
		DC value; I_F = 1 mA; V_{CE} = 5 V				
	CNY17-1/17F-1		0.13	–	–	
	CNY17-2/17F-2		0.22	–	–	
	CNY17-3/17F-3		0.34	–	–	
	CNY17-4/17F-4		0.56	–	–	
$V_{CE\ sat}$	collector-emitter saturation voltage	I_F = 10 mA; I_C = 2.5 mA	–	–	0.3	V
V_{IO}	isolation voltage (note 1)					
		DC value; t = 1 min	4.4	–	–	kV
		RMS value; t = 1 min	3.12	–	–	kV
C_{io}	capacitance between input and output	V_O = 0; f = 1 MHz	–	0.6	1.3	pF
R_{IO}	insulation resistance between input and output	V_{IO} = ±500 V	1	10	–	TΩ

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Switching times (see Figs 4 and 5)						
t_{on}	turn-on time	I_C = 2 mA; V_{CC} = 10 V; R_L = 100 Ω	–	5	10	μs
t_{off}	turn-off time	I_C = 2 mA; V_{CC} = 10 V; R_L = 100 Ω	–	5	10	μs

Note

1. Every product is tested by applying an isolation test voltage of 3.75 kV (RMS) for 2 s between all shorted input side leads and all shorted output side leads, with a detection current of approximately 1 μA.

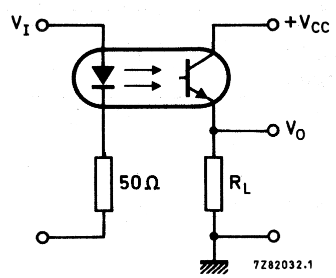


Fig.4 Switching circuit.

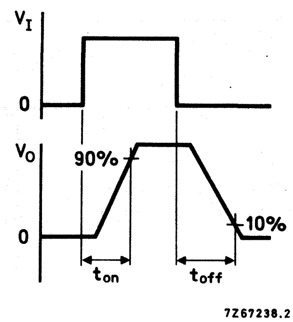
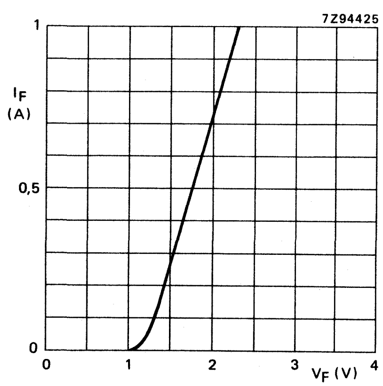
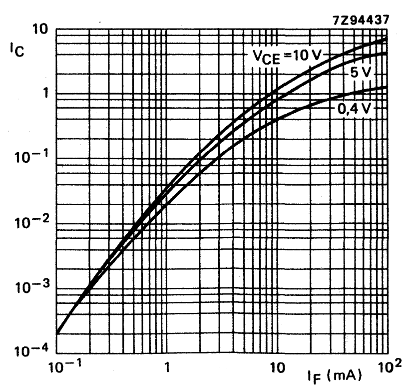


Fig.5 Waveforms.



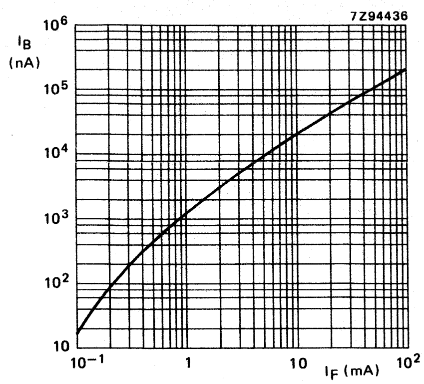
T_{amb} = 25 °C; t_{on} = 20 μs; δ = 0.01.

Fig.6 Forward current as a function of forward voltage, typical values.



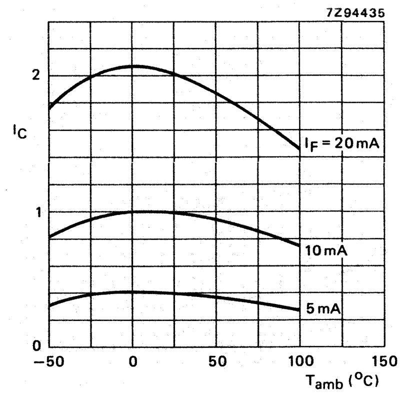
Normalized to I_F = 10 mA; V_{CE} = 10 V.

Fig.7 Collector current as a function of forward current, typical values.



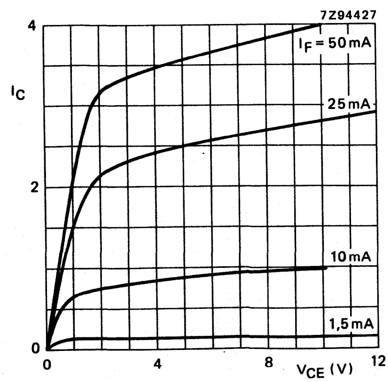
CNY17 types only; V_{CB} = 10 V; T_{amb} = 25 °C.

Fig.8 Base current as a function of forward current, typical values.



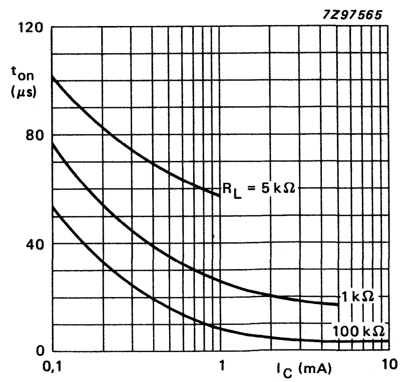
Normalized to I_F = 1 mA; V_{CE} = 10 V.

Fig.9 Collector current as a function of ambient temperature, typical values.



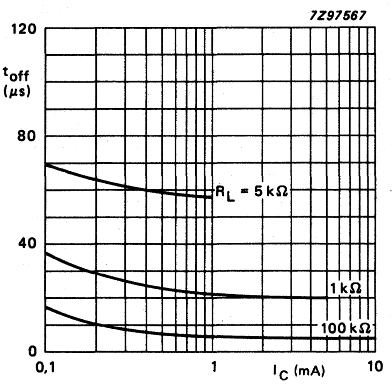
I_F = 10 mA; V_{CE} = 10 V.

Fig.10 Collector current as a function of collector-emitter voltage, typical values.



T_{amb} = 25 °C.

Fig.11 Turn-on time as a function of collector current, typical values.



T_{amb} = 25 °C.

Fig.12 Turn-off time as a function of collector current, typical values.

High-voltage optocouplers CNY17G/CNY17GF

FEATURES

- High current transfer ratio and a low saturation voltage, making the devices suitable for use with TTL integrated circuits
- High degree of AC and DC insulation (3750 V (RMS) and 5300 V (DC))
- Working voltage of 2.5 kV (DC)
- Fast switching
- A pin distance of 10.16 mm.

DESCRIPTION

The CNY17G and CNY17GF are optocouplers consisting of an infrared emitting GaAs diode and a silicon npn phototransistor, in a dual-in-line (DIL) SOT231 plastic envelope. The base of the phototransistor is connected for CNY17G and unconnected for CNY17GF.

PINNING - CNY17G

PIN	DESCRIPTION
1	anode
2	cathode
3	not connected
4	emitter
5	collector
6	base

PINNING - CNY17GF

PIN	DESCRIPTION
1	anode
2	cathode
3	not connected
4	emitter
5	collector
6	not connected

APPROVALS

STANDARD	REFERENCE
UL	covered under UL component recognition FILE E90700
BSI	certification in accordance with BS415:1990; BS7002:1989, class II applications
NORDIC	tested for applications (reinforced isolation); Class II applications for pluggable apparatus in normal tight execution
SETI	in accordance with IEC 65, 380, 950 & 335
SEMKO	in accordance with IEC 65, 380, 950 & 335
NEMKO	in accordance with IEC 65, 380, 950 & 335
DEMKO	in accordance with IEC 65, 380, 950 & 335
VDE	approved in accordance with VDE 0883/6.80 reference voltage (VDE 0110b Tab 4): 500 V (AC)/600 V (DC) complied for reinforced isolation at 250 V (AC) with: DIN IEC 380/VDE 0806/8.81 DIN IEC 435/VDE0805 "ENTWURF", Nov. 84 DIN 57804/VDE 0804/1.83 (isolation group C) DIN VDE 0860/8.86/HD 195 S4
CECC	capability of approval: GaAs optocouplers with phototransistor output

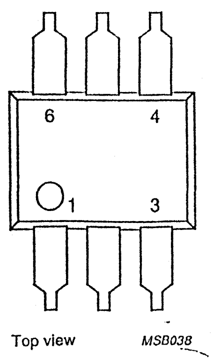


Fig.1 Simplified outline.

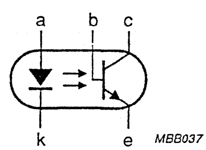


Fig.2 Symbol, CNY17G.

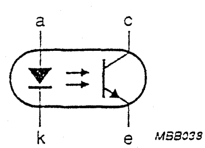


Fig.3 Symbol, CNY17GF.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Diode					
V_R	reverse voltage	DC value	–	6	V
I_F	forward current	DC value	–	100	mA
P_{tot}	total power dissipation	up to T_{amb} = 25 °C	–	200	mW
Transistor					
I_C	collector current	DC value	–	100	mA
V_{CEO}	collector-emitter voltage	open base	–	70	V
P_{tot}	total power dissipation	up to T_{amb} = 25 °C	–	200	mW
Optocoupler					
I_C/I_F	DC current transfer ratio (CTR)	V_{CE} = 5 V; I_F = 10 mA			
	CNY17G-1/GF-1		0.40	0.80	
	CNY17G-2/GF-2		0.63	1.25	
	CNY17G-3/GF-3		1.00	2.00	
	CNY17G-4/GF-4		1.60	3.20	
V_{IO}	isolation voltage				
		DC value	5.3	–	kV
		AC (RMS value)	3.75	–	kV
Switching times					
t_{on}	turn on time	I_C = 2 mA; V_{CE} = 10 V; R_L = 100 Ω	–	10	µs
t_{off}	turn off time	I_C = 2 mA; V_{CE} = 10 V; R_L = 100 Ω	–	10	µs

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX	UNIT
Diode					
V_R	reverse voltage		–	6	V
I_F	forward current	DC value	–	100	mA
I_{FRM}	forward current	peak value; t_{on} = 10 µs; δ = 0.01	–	3	A
P_{tot}	total power dissipation	up to T_{amb} = 25 °C	–	200	mW
Transistor					
V_{CEO}	collector-emitter voltage	open base	–	70	V
V_{CBO}	collector-base voltage (CNY17G only)	open emitter	–	70	V
V_{EBO}	emitter-base voltage (CNY17G only)	open collector	–	7	V
I_C	collector current	DC value	–	100	mA
P_{tot}	total power dissipation	up to T_{amb} = 25 °C	–	200	mW
Optocoupler					
T_{stg}	storage temperature range		–55	150	°C
T_{amb}	ambient operating temperature range		–40	100	°C
T_j	junction temperature		–	125	°C
T_{sld}	soldering temperature up to the seating plane	T_{sld} < 10 s	–	260	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	MAX.	UNIT
Diode			
$R_{th\ j\text{-}a}$	from junction to ambient in free air	500	K/W
$R_{th\ j\text{-}a}$	from junction to ambient when mounted on PCB	400	K/W
Transistor			
$R_{th\ j\text{-}a}$	from junction to ambient in free air	500	K/W
$R_{th\ j\text{-}a}$	from junction to ambient when mounted on PCB	400	K/W

ISOLATION RELATED VALUES

SYMBOL	PARAMETER	CONDITIONS	MIN.	UNIT
L(IO1)	external air gap (clearance)	between input and output terminals	9.6	mm
L(IO2)	external tracking path (creepage distance)	between input and output terminals	8	mm
	internal plastic gap (clearance)	isolation thickness between emitter and receiver	1	mm

CLASSIFICATION CATEGORIES

Tracking resistance	KB-100/A

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Diode						
V_F	forward voltage	I_F = 10 mA	–	1.1	1.5	V
I_R	reverse current	V_R = 6 V	–	–	10	μA
Transistor						
$V_{(BR)CEO}$	collector-emitter breakdown voltage	I_C = 10 mA	70	–	–	V
$V_{(BR)CBO}$	collector-base breakdown voltage (CNY17G only)	I_C = 0.1 mA	70	–	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage (CNY17G only)	I_E = 0.1 mA	7	–	–	V
I_{CEO}	collector-emitter cut-off current (dark)	I_F = 0; V_{CE} = 10 V	–	2	50	nA
Optocoupler						
I_C/I_F	DC current transfer ratio (CTR)	I_F = 10 mA; V_{CE} = 5 V				
	CNY17G-1/GF-1		0.4	–	0.8	
	CNY17G-2/GF-2		0.63	–	1.25	
	CNY17G-3/GF-3		1	–	2	
	CNY17G-4/GF-4		1.6	–	3.2	
		I_F = 1 mA; V_{CE} = 5 V				
	CNY17G-1/GF-1		0.13	–	–	
	CNY17G-2/GF-2		0.22	–	–	
	CNY17G-3/GF-3		0.34	–	–	
	CNY17G-4/GF-4		0.56	–	–	
$V_{CE\ sat}$	collector-emitter saturation voltage	I_F = 10 mA; I_C = 2.5 mA	–	–	0.3	V
I_{CEW}	collector cut-off current (dark) (see Fig.4)	V_W = 2.5 kV (DC); V_{CC} =10 V; T_{amb} = 25 °C; notes 1 and 2	–	–	200	nA
		V_W = 2.5 kV (DC); V_{CC} = 10 V; T_{amb} = 70 °C; notes 1 and 2	–	–	2	μA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Diode						
V_{IO}	isolation voltage (note 3)	DC value; t = 1 min	5.3	–	–	kV
		RMS value; t = 1 min	3.75	–	–	kV
C_{io}	capacitance between input and output	$V_{IO} = 0$; f = 1 MHz	–	0.4	1	pF
R_{IO}	insulation resistance between input and output	$V_{IO} = \pm 500$ V	10^{12}	10^{13}	–	Ω
Switching times (see Figs 5 and 6)						
t_{on}	turn-on time	$I_C = 2$ mA; $V_{CC} = 10$ V; $R_L = 100\ \Omega$	–	5	10	μs
t_{off}	turn-off time	$I_C = 2$ mA; $V_{CC} = 10$ V; $R_L = 100\ \Omega$	–	5	10	μs

Notes

1. This parameter is the maximum collector-emitter leakage current measured when a high voltage is applied between the shorted diode leads and the transistor emitter.
2. For quality assurance, the two parameters are tested on a sample basis for 1000 hrs.
3. Every product is tested by applying an isolation test voltage of 4500 V (RMS) for 2 s between the shorted input (diode) leads and the shorted output (phototransistor) leads with a detection current of approximately 1 μA.

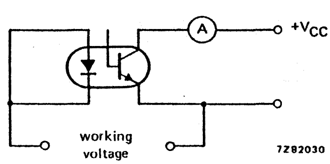


Fig.4 Test circuit.

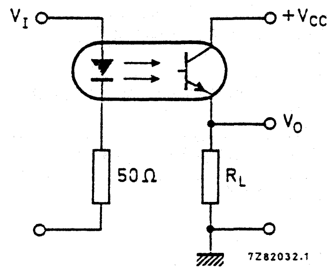


Fig.5 Switching circuit.

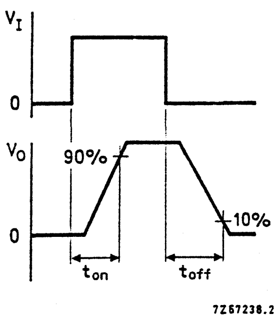
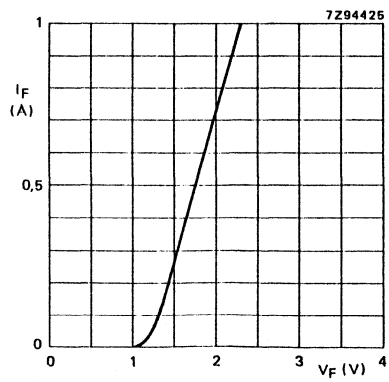
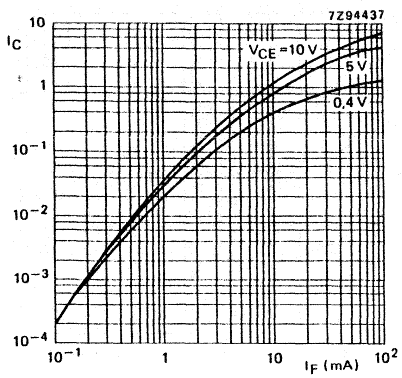


Fig.6 Waveforms.



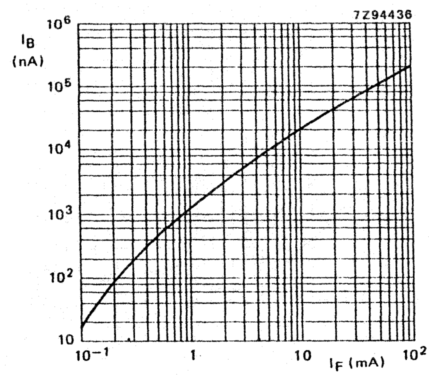
T_{amb} = 25 °C; t_{on} = 20 μs; δ = 0.01.

Fig.7 Forward current as a function of forward voltage, typical values.



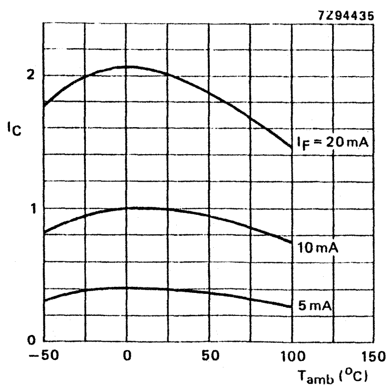
V_{CE} = 10 V; I_F = 10 mA.

Fig.8 Collector current as a function of forward current, typical values.



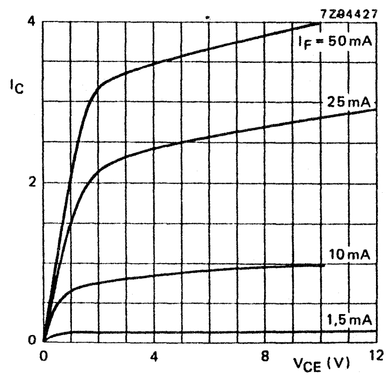
CNY17G; V_{CB} = 10 V; T_{amb} = 25 °C.

Fig.9 Base current as a function of forward current, typical values.



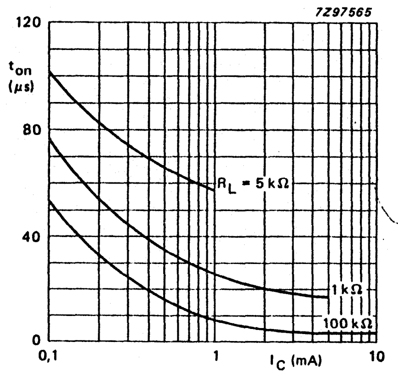
I_F = 10 mA; V_{CE} = 10 V.

Fig.10 Collector current as a function of ambient temperature, typical values.



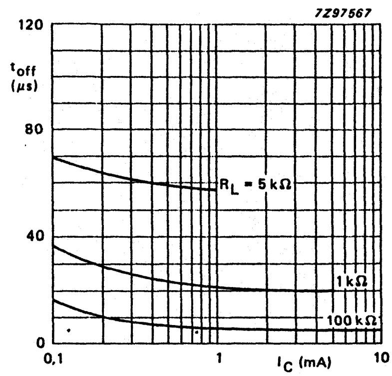
I_F = 10 mA; V_{CE} = 10 V.

Fig.11 Collector current as a function of collector-emitter voltage, typical values.



V_{CC} = 10 V; T_{amb} = 25 °C.

Fig.12 Turn-on time as a function of collector current, typical values.



V_{CC} = 10 V; T_{amb} = 25 °C.

Fig.13 Turn-off time as a function of collector current, typical values.

OPTOCOUPLERS

This product range is one of the industrial standards applied in the market. The current transfer ratio, isolation voltage and low saturation voltage comply with the specifications of the main part of the optocoupler market.

This range can be used with TTL circuits and is comprised of an infrared emitting GaAs diode and a npn silicon phototransistor.

Features

- Fast switching speeds
- Low saturation voltage
- High output/input DC current transfer ratio
- Isolation voltage of 2 kV (RMS) and 2.82 kV (DC)

UL — Covered under UL component recognition FILE E90700

VDE — Approved according to VDE 0883/6.80
Reference voltage (VDE 0110b Tab 4); AC 250 V/DC 300 V isolation group C.

CECC — Capability of approval GaAs optocouplers

QUICK REFERENCE DATA

Collector-emitter voltage of phototransistor		V_{CEO}	max.	30	V
DC forward current of infrared emitting diode		I_F	max.	60	mA
DC current transfer ratio at I_F = 10 mA; V_{CE} = 10 V	H11A1	I_C/I_F	min.	0.5	
	H11A2	I_C/I_F	min.	0.2	
	H11A3	I_C/I_F	min.	0.2	
	H11A4	I_C/I_F	min.	0.1	
	H11A5	I_C/I_F	min.	0.3	
Total power dissipation up to T_{amb} = 25 °C		P_{tot}	max.	250	mW
Isolation voltage DC		V_{IO}	min.	2	kV
AC (RMS value)			min.	2.82	kV

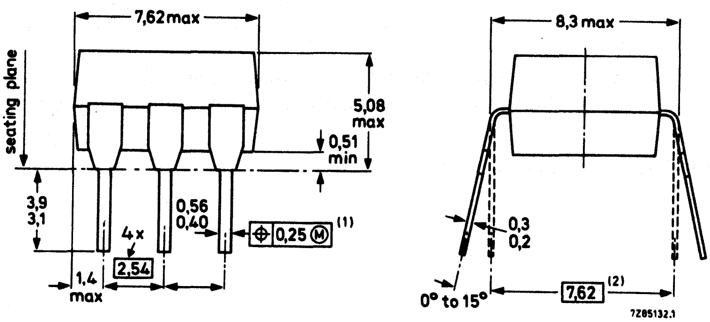
MECHANICAL DATA

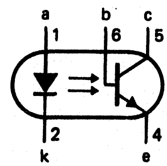
SOT90B (see Fig.1).

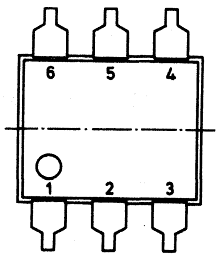
MECHANICAL DATA

Dimensions in mm

Fig.1 SOT90B.







⊕ Positional accuracy.

Ⓜ Maximum Material Condition.

(1) 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.

(2) When the leads are parallel, the tips remain in position for automatic insertion.

RATINGS

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

Diode			
Continuous reverse voltage	V_R	max.	5 V
DC forward current	I_F	max.	60 mA
peak value; t_{on} = 10 μs; δ = 0.01	I_{FRM}	max.	3 A
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-base voltage (open emitter)	V_{CBO}	max.	70 V
Emitter-collector voltage (open base)	V_{ECO}	max.	7 V
DC collector current	I_C	max.	100 mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	150 mW

Optocoupler

Storage temperature range	T_{stg}		−55 to + 150	°C
Operating ambient temperature range	T_{amb}		−40 to + 100	°C
Operating temperature up to the seating plane; t_{sld} < 10 s	T_{sld}	max.	260	°C
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	250	mW

THERMAL RESISTANCE

From junction to ambient in free air

diode	$R_{th\,j\text{-}a}$	=	500	K/W
transistor	$R_{th\,j\text{-}a}$	=	500	K/W

LINEAR DERATING FACTORS

Above 25 °C

diode	1.33	mW/K
transistor	2	mW/K

ISOLATION RELATED VALUES

External air gap (clearance)				
input terminals to output terminals	L(IO1)	min.	7.2	mm
External tracking path (creepage distance)				
input terminals to output terminals	L(IO2)	min.	7.0	mm
Tracking resistance (KB-value)			KB-100/A	
Internal plastic gap (clearance)				
isolation thickness between emitter and receiver		min.	1	mm

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Diode

Forward voltage					
I_F = 10 mA		V_F	typ.	1.15	V
	H11A1-A2-A3-A4	V_F	max.	1.5	V
	H11A5	V_F	max.	1.7	V
Reverse current					
V_R = 5 V		I_R	max.	10	μA
Capacitance at f = 1 MHz					
V = 0		C_d	typ.	50	pF

Transistor

Collector-emitter breakdown voltage				
I_C = 10 mA	$V_{(BR)CEO}$	min.	30	V
Collector-base breakdown voltage				
I_C = 0.1 mA	$V_{(BR)CBO}$	min.	70	V
Emitter-collector breakdown voltage				
I_E = 0.1 mA	$V_{(BR)ECO}$	min.	7	V
Dark current				
V_{CE} = 10 V	I_{CEO}	typ.	2	nA
		max.	50	nA

Optocoupler

Output/input DC current transfer ratio I_F = 10 mA; V_{CE} = 10 V	H11A1	I_C/I_F	min.	0.5
	H11A2, H11A3	I_C/I_F	min.	0.2
	H11A4	I_C/I_F	min.	0.1
	H11A5	I_C/I_F	min.	0.3
Collector-emitter saturation voltage I_F = 10 mA; I_C = 0.5 mA		V_{CEsat}	max.	0.4 V
			typ.	0.1 V
Output capacitance at f = 1 MHz V_{CE} = 10 V		C_{CE}	typ.	2 pF
Isolation voltage (note 1) DC		V_{IO}	min.	2 kV
Isolation voltage (note 1) AC (RMS value)			min.	2.82 kV
Capacitance between input and output V = 0; f = 1 MHz		C_{io}	max.	1.3 pF
			typ.	0.6 pF
Insulation resistance between input and output V_{IO} = 500 V		R_{IO}	min.	1 TΩ
			typ.	10 TΩ
Rise time I_C = 2 mA; V_{CC} = 10 V; R_L = 100 Ω		t_r	typ.	3 μs
Fall time I_C = 2 mA; V_{CC} = 10 V; R_L = 100 Ω		t_f	typ.	3 μs

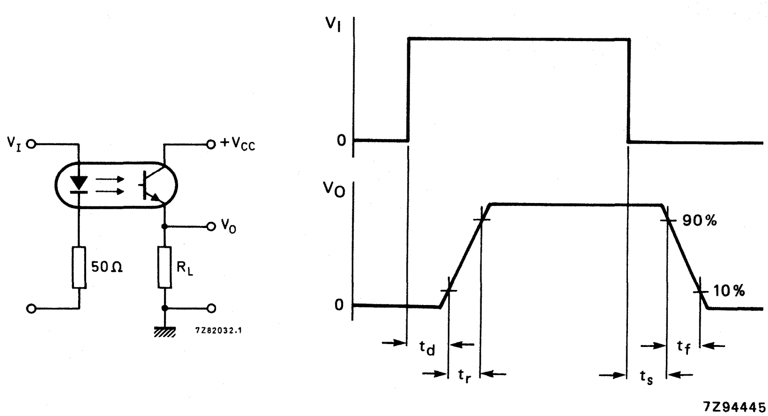


Fig.2 Measuring circuit and waveforms.

Note

1. Every single product is tested by applying an isolation test voltage of 2500 V (RMS) for 2 seconds between the shorted input (diode) leads and the shorted output (phototransistor) leads; with a detection current of about 1 μA.

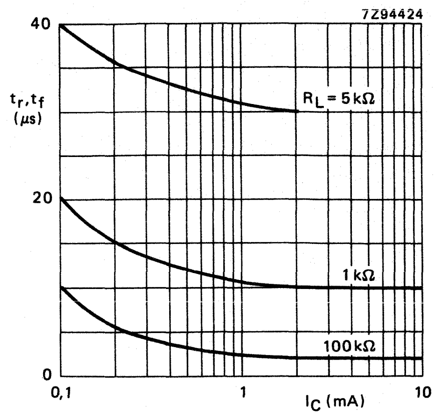


Fig. 3 V_{CC} = 10 V; T_{amb} = 25 °C; typical values.

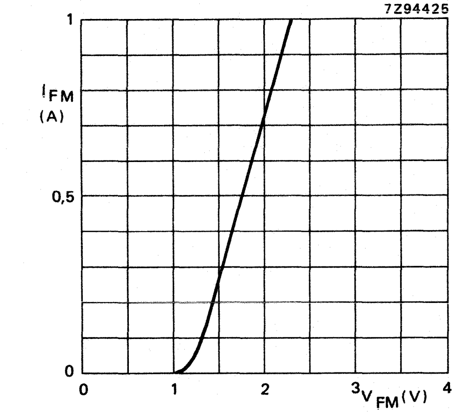


Fig. 4 T_{amb} = 25 °C; t_{on} = 20 μs; δ = 0,01; typical values.

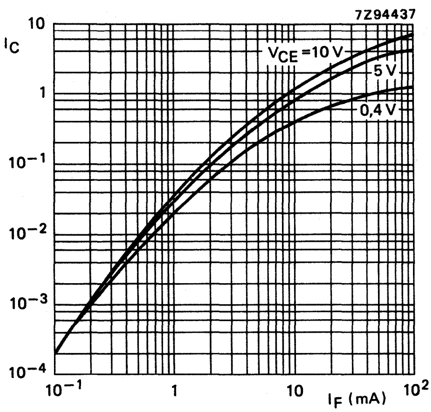


Fig. 5 Normalized to I_F = 10 mA; V_{CE} = 10 V; typical values.

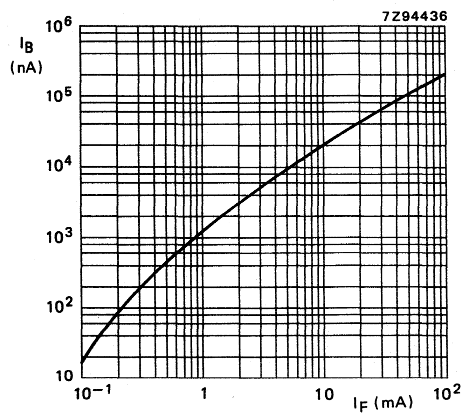


Fig. 6 V_{CB} = 10 V; T_{amb} = 25 °C; typical values.

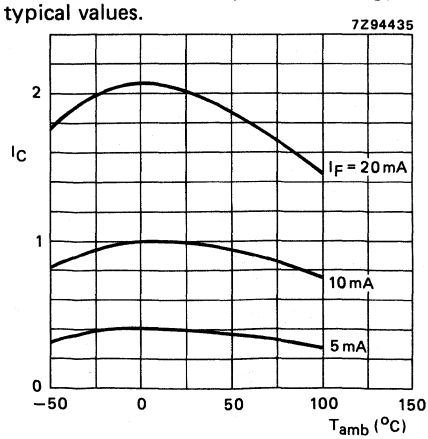


Fig. 7 Normalized at I_F = 10 mA; V_{CE} = 10V; typical values.

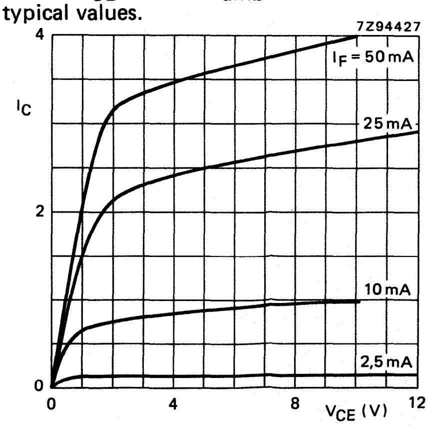


Fig. 8 Normalized at 10 mA; V_{CE} = 10 V; T_{amb} = 25 °C; typical values.

OPTOCOUPLERS

Optically coupled isolators consisting of an infrared emitting GaAs diode and an npn silicon photo-Darlington transistor.

Features

- Very high output/input DC current transfer ratio
- Isolation voltage of 2 kV RMS and 2.82 kV DC

UL — Covered under UL component recognition FILE E 90700

VDE — Approved according to VDE 0883/6.80
Reference voltage (VDE 0110b Tab 4): AC 250 V/DC 300 V— isolation group C

QUICK REFERENCE DATA

Diode					
Continuous reverse voltage		V_R	max.	6	V
DC forward current		I_F	max.	60	mA
(peak value); t_p = 1 μs; f = 300 Hz		I_{FRM}	max.	3	A
Total power dissipation up to T_{amb} = 25 °C		P_{tot}	max.	100	mW
Transistor					
Collector-emitter voltage (open base)		V_{CEO}	max.	25	V
Total power dissipation up to T_{amb} = 25 °C		P_{tot}	max.	150	mW
Optocoupler					
DC current transfer ratio (CTR) I_F = 1 mA; V_{CE} = 5 V	H11B1	I_C/I_F	min.	5.0	
	H11B2	I_C/I_F	min.	2.0	
	H11B3	I_C/I_F	min.	1.0	
Switching times I_C = 10 mA; V_{CC} = 10 V; R_L = 100 Ω		t_{on}	typ.	125	μs
		t_{off}	typ.	100	μs
Isolation voltage DC		V_{IO}	min.	2.82	kV
Isolation voltage AC (RMS value)		V_{IO}	min.	2.0	kV

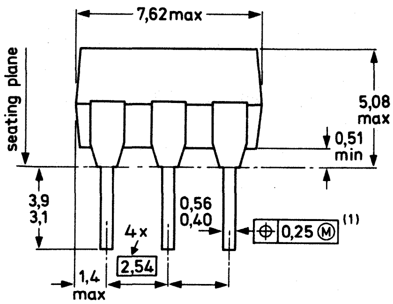
MECHANICAL DATA

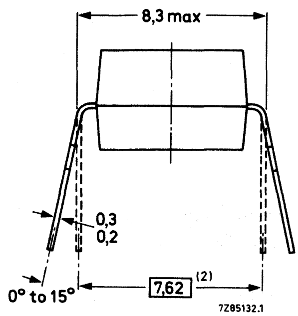
SOT90B (see Fig.1).

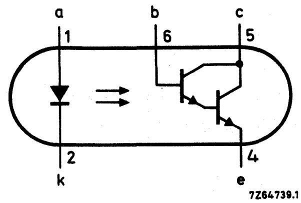
MECHANICAL DATA

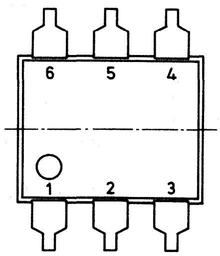
Dimensions in mm

Fig.1 SOT90B.









⊕ Positional accuracy.

Ⓜ Maximum Material Condition.

(1) 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.

(2) When the leads are parallel, the tips are in position for automatic insertion.

RATINGS

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

Diode

Continuous reverse voltage	V_R	max.	6 V
DC forward current	I_F	max.	60 mA
peak value; t_p = 1 μs; f = 300 Hz	I_{FRM}	max.	3 A
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	100 mW

Transistor

Collector-emitter voltage (open base)	V_{CEO}	max.	25 V
Collector-base voltage (open emitter)	V_{CBO}	max.	30 V
Emitter-base voltage (open collector)	V_{EBO}	max.	7 V
DC collector current	I_C	max.	100 mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	150 mW

Optocoupler

Storage temperature	T_{stg}		−55 to + 150 °C
Operating ambient temperature	T_{amb}		−40 to + 100 °C
Soldering temperature up to the seating plane; t_{sld} < 10 s	T_{sld}	max.	260 °C

LINEAR DERATING FACTOR

Above 25 °C			
diode			1,33 mW/K
transistor			2 mW/K

ISOLATION RELATED VALUES

External air gap (clearance) input terminals to output terminals	L(IO1)	min.	7,2 mm
External tracking path (creepage dist) input terminals to output terminals	L(IO2)	min.	7,0 mm
Tracking resistance (KB-value)			KB-100/A
Internal plastic gap (clearance) isolation thickness between emitter and receiver		min.	1 mm

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Diode

Forward voltage				
I_F = 10 mA	H11B1-H11B2	V_F	typ.	1,1 V
I_F = 50 mA	H11B3	V_F	max.	1,5 V
Reverse current V_R = 6 V		I_R	max.	10 μA

Transistor

Collector-emitter breakdown voltage I_C = 10 mA	$V_{(BR)CEO}$	min.	25 V
Collector-base breakdown voltage I_C = 0,1 mA	$V_{(BR)CBO}$	min.	30 V
Emitter-base breakdown voltage I_E = 0,1 mA	$V_{(BR)EBO}$	min.	7 V
Dark current V_{CE} = 10 V	I_{CEO}	typ.	20 nA
		max.	100 nA

Optocoupler

DC current transfer ratio (CTR)				
I_F = 1 mA; V_{CE} = 5 V — H11B1	I_C/I_F	min.	5,0	
H11B2	I_C/I_F	min.	2,0	
H11B3	I_C/I_F	min.	1,0	
Collector-emitter saturation voltage				
I_F = 1 mA; I_C = 1 mA	V_{CEsat}	max.	1,0	V
Output capacitance at f = 1 MHz				
V_{CE} = 10 V	C_{ce}	typ.	2,0	pF
Isolation voltage t = 1 min DC (see note)	V_{IO}	min.	2,82	kV
AC (RMS value)	V_{IO}	min.	2,0	kV
Capacitance between input and output				
V_O = 0; f = 1 MHz	C_{io}	max.	1.3	pF
	C_{io}	typ.	0,6	pF
Insulation resistance between input and output				
± V_{IO} = 500 V	r_{IO}	min.	1	TΩ
	r_{IO}	typ.	10	TΩ
Switching times (see Figs 2 and 3)				
I_C = 10 mA; V_{CC} = 10 V; R_L = 100 Ω				
Turn-on time	t_{on}	typ.	125	μs
Turn-off time	t_{off}	typ.	100	μs

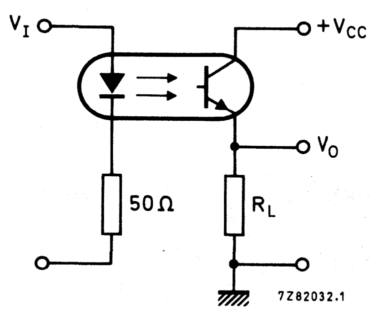


Fig. 2 Switching circuit.

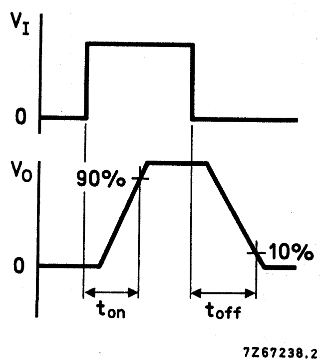


Fig. 3 Waveforms.

Note:
Every single product is tested by applying an isolation test voltage of 2,5 kV (RMS) for 2 seconds between the shorted input (diode) leads and the shorted output (phototransistor) leads; with a detection current of about 1 μA.

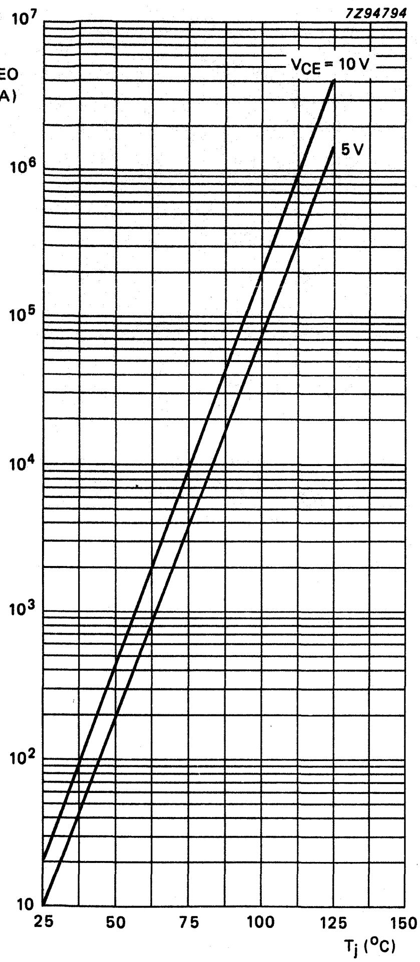


Fig. 4 Typical values.

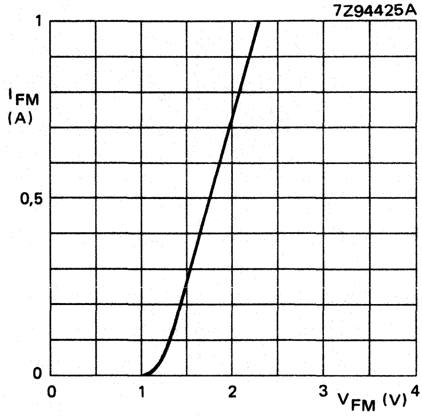


Fig. 5 T_{amb} = 25 °C; t_{on} = 20 μs; δ = 0,01; typical values.

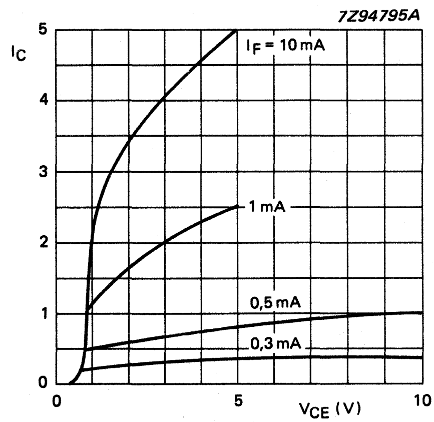


Fig. 6 Normalized to I_F = 0,5 mA; V_{CE} = 10 V; typical values.

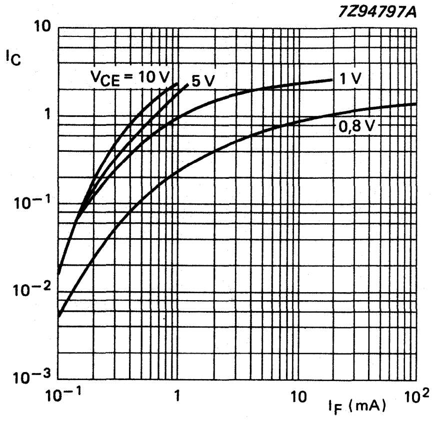


Fig. 7 Normalized to I_F = 0,5 mA; V_{CE} = 10 V; T_{amb} = 25 °C; typical values.

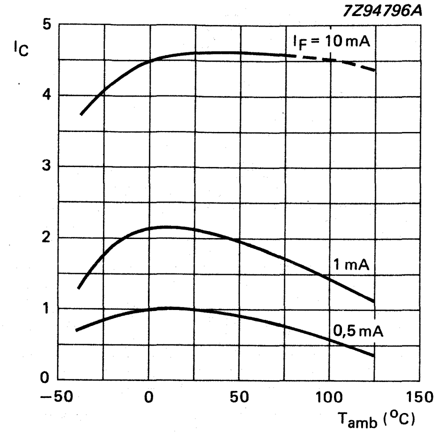


Fig. 8 Normalized to I_F = 0,5 mA; V_{CE} = 10 V; T_{amb} = 25 °C; typical values.

OPTOCOUPLER

Optically coupled isolator consisting of an infrared emitting GaAs diode and an npn silicon photo-Darlington transistor.

Features

- High maximum output voltage
- Very high output/input DC current transfer ratio
- Isolation voltage of 2 kV RMS and 2,82 kV DC

UL — Covered under UL component recognition FILE E 90700

VDE — Approved according to VDE 0883/6.80
Reference voltage (VDE 0110b Tab 4): AC 250 V/ DC 300 V — isolation group C

QUICK REFERENCE DATA

Diode				
Continuous reverse voltage	V_R	max.	6	V
DC forward current	I_F	max.	60	mA
(peak value) t_p = 1 μs; f = 300 Hz	I_{FRM}	max.	3	A
Total power dissipation up to T_{amb} = 25 ^oC	P_{tot}	max.	90	mW
Transistor				
Collector-emitter voltage (open base)	V_{CEO}	max.	55	V
Total power dissipation up to T_{amb} = 25 ^oC	P_{tot}	max.	210	mW
Optocoupler				
DC current transfer ratio (CTR) I_F = 10 mA; V_{CE} = 5 V	I_C/I_F	min.	1,0	
Switching times I_C = 10 mA; V_{CC} = 10 V; R_L = 100 Ω	t_{on}	typ.	125	μs
	t_{off}	typ.	100	μs
Isolation voltage DC	V_{IO}	min.	2,82	kV
AC (RMS value)		min.	2,0	kV

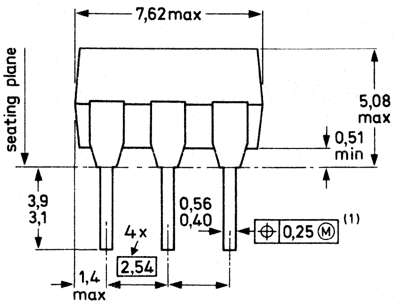
MECHANICAL DATA

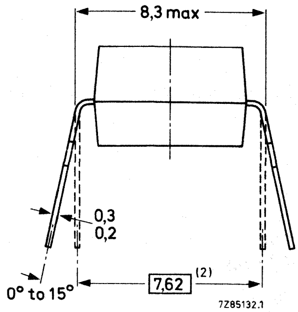
SOT 90B (see Fig. 1).

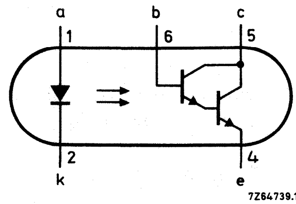
MECHANICAL DATA

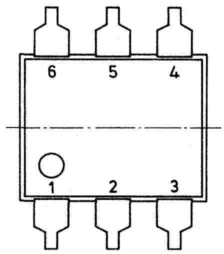
Dimensions in mm

Fig. 1 SOT 90B.









⊕ Positional accuracy.

Ⓜ Maximum Material Condition.

(1) 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.

(2) When the leads are parallel, the tips are in position for automatic insertion.

RATINGS

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

Diode

Continuous reverge voltage	V_R	max.	6	V
DC forward current	I_F	max.	60	mA
peak value; t_p = 1 μs; f = 300 Hz	I_{FRM}	max.	3	A
Total power dissipation up to T_{amb} = 25 ^oC	P_{tot}	max.	90	mW

Transistor

Collector-emitter voltage (open base)	V_{CEO}	max.	55	V
Collector-base voltage (open emitter)	V_{CBO}	max.	55	V
Emitter-base voltage (open collector)	V_{EBO}	max.	8	V
DC collector current	I_C	max.	100	mA
Total power dissipation up to T_{amb} = 25 ^oC	P_{tot}	max.	210	mW

Optocoupler

Storage temperature	T_{stg}		–55 to + 150 °C
Operating ambient temperature	T_{amb}		–40 to + 100 °C
Soldering temperature up to the seating plane; t_{sld} < 10 s	T_{sld}	max.	260 °C

LINEAR DERATING FACTOR

Above 25 °C			
diode			1,2 mW/K
transistor			2,8 mW/K

ISOLATION RELATED VALUES

External air gap (clearance) input terminals to output terminals	L(IO1)	min.	7,2 mm
External tracking path (creepage distance) input terminals to output terminals	L(IO2)	min.	7,0 mm
Tracking resistance (KB-value)			KB-100/A
Internal plastic gap (clearance) isolation thickness between emitter and receiver		min.	1 mm

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Diode

Forward voltage I_F = 20 mA	V_F	typ.	1,1 V
		max.	1,5 V
Reverse current V_R = 6 V	I_R	max.	10 μA

Transistor

Collector-emitter breakdown voltage I_C = 0,1 mA	$V_{(BR)CEO}$	min.	55 V
Collector-base breakdown voltage I_C = 0,1 mA	$V_{(BR)CBO}$	min.	55 V
Emitter-base breakdown voltage I_E = 0,1 mA	$V_{(BR)EBO}$	min.	8 V
Dark current V_{CE} = 10 V	I_{CEO}	typ.	20 nA
		max.	100 nA

Optocoupler

DC current transfer ratio (CTR) I_F = 10 mA; V_{CE} = 5 V	I_C/I_F	min.	1,0
Collector-emitter saturation voltage I_F = 50 mA; I_C = 50 mA	V_{CEsat}	max.	1,0 V
Output capacitance at f = 1 MHz V_{CE} = 10 V	C_{ce}	typ.	2,0 pF
Isolation voltage t = 1 min. (see note) DC	V_{IO}	min.	2,82 kV
AC (RMS value)		min.	2,0 kV
Capacitance between input and output V_O = 0; f = 1 MHz	C_{io}	max.	1.3 pF
		typ.	0,6 pF
Insulation resistance between input and output ± V_{IO} = 500 V	r_{IO}	min.	1 TΩ
		typ.	10 TΩ
Switching times (see Figs 2 and 3) I_C = 10 mA; V_{CC} = 10 V; R_L = 100 Ω			
Turn-on time	t_{on}	typ.	125 μs
Turn-off time	t_{off}	typ.	100 μs

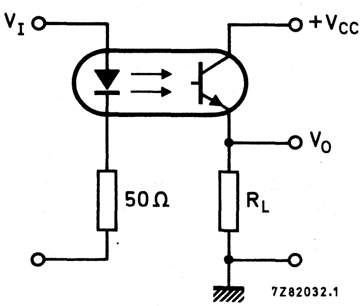


Fig. 2 Switching circuit.

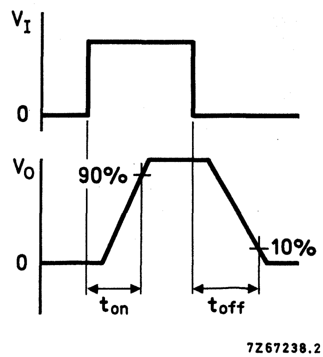


Fig. 3 Waveforms.

Note

Every single product is tested by applying an isolation test voltage of 2,5 kV (RMS) for 2 seconds between the shorted input (diode) leads and the shorted output (phototransistor) leads with a detection current of about 1 μA.

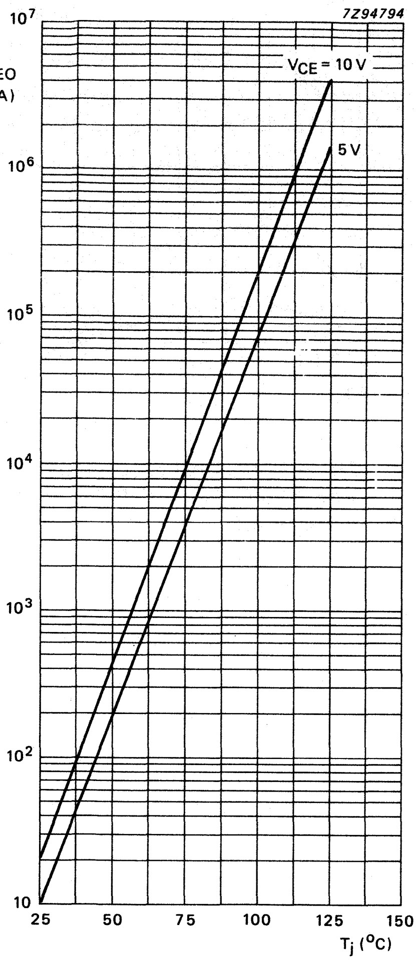


Fig. 4 Typical values.

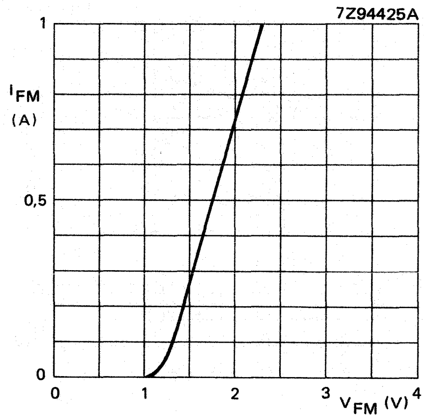


Fig. 5 T_{amb} = 25 °C; t_{on} = 20 μs; δ = 0,01; typical values.

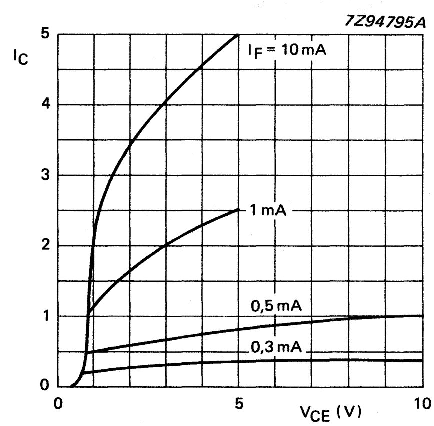


Fig. 6 Normalized to I_F = 0,5 mA; V_{CE} = 10 V; typical values.

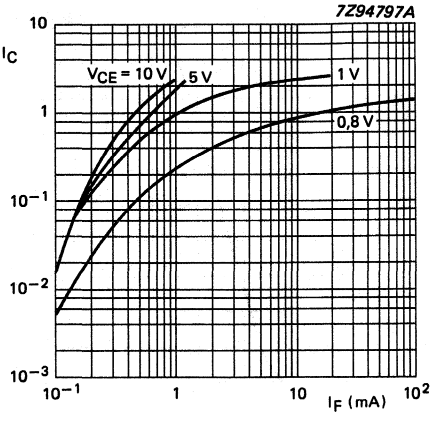


Fig. 7 Normalized to I_F = 0,5 mA; V_{CE} = 10 V; T_{amb} = 25 °C; typical values.

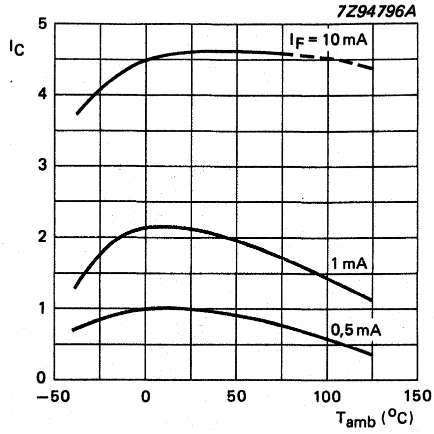


Fig. 8 Normalized to I_F = 0,5 mA; V_{CE} = 10 V; T_{amb} = 25 °C; typical values.

OPTOCOUPLERS

Optically coupled isolators consisting of an infrared emitting GaAs diode and an npn silicon photo-Darlington transistor.

Features of these products:

- High output/input DC current transfer ratio
- Fast turn on
- High isolation voltage of 3.12 kV (RMS) and 4.4 kV (DC)
- High maximum output voltage (MCA255)

UL — Covered under UL component recognition FILE E90700

VDE — Approved according to VDE 0883/6.80
Reference voltage (VDE 0110b Tab 4): AC 380 V/DC 450 V — isolation group C
Complied for reinforced isolation at 250 V AC with:
DIN 57 804/VDE 0804/1.83
DIN VDE 0860/8.86/HD 195 S4

QUICK REFERENCE DATA

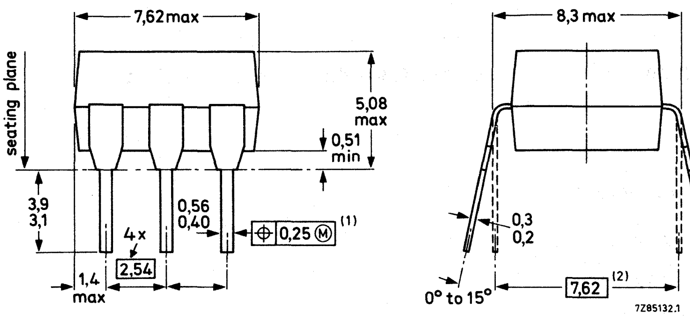
Diode					
Continuous reverse voltage		V_R	max.	6	V
DC forward current		I_F	max.	60	mA
(peak value); t_{on} = 300 μs; δ = 0.02		I_{FRM}	max.	0.5	A
Total power dissipation up to T_{amb} = 25 °C		P_{tot}	max.	100	mW
Transistor					
Collector-emitter voltage (open base)	MCA230/231	V_{CEO}	max.	30	V
	MCA255	V_{CEO}	max.	55	V
Total power dissipation up to T_{amb} = 25 °C		P_{tot}	max.	210	mW
Optocoupler					
DC current transfer ratio (CTR)					
I_F = 10 mA; V_{CE} = 5 V	MCA230/255	I_C/I_F	min.	1.0	
	MCA231	I_C/I_F	min.	2.0	
Switching times					
I_C = 10 mA; V_{CC} = 5 V; R_L = 100		t_{on}	typ.	5	μs
		t_{off}	typ.	100	μs
Isolation voltage DC		V_{IO}	min.	4.4	kV
AC (RMS value)		V_{IO}	min.	3.12	kV

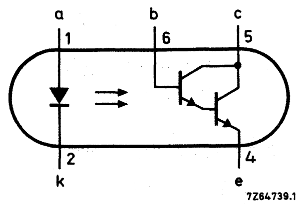
MECHANICAL DATA

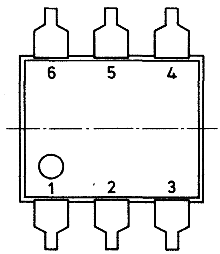
SOT90B (see Fig.1)

MECHANICAL DATA Dimensions in mm

Fig. 1 SOT90B.







⊕ Positional accuracy.

Ⓜ Maximum Material Condition.

(1) 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.

(2) When the leads are parallel, the tips are in position for automatic insertion.

RATINGS

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

Diode

Continuous reverse voltage		V_R	max.	6	V
DC forward current		I_F	max.	60	mA
peak value; t_p = 300 μs; δ = 0.02		I_{FRM}	max.	0.5	A
peak value; t_p = 1 μs; f = 300 Hz		I_{FRM}	max.	3	A
Total power dissipation up to T_{amb} = 25 °C		P_{tot}	max.	100	mW

Transistor

Collector-emitter voltage (open base)	MCA230/231	V_{CEO}	max.	30	V
	MCA255	V_{CEO}	max.	55	V
Collector-base voltage (open emitter)	MCA230/231	V_{CBO}	max.	30	V
	MCA255	V_{CBO}	max.	55	V
Emitter-base voltage (open collector)		V_{EBO}	max.	8	V
DC collector current		I_C	max.	150	mA
Total power dissipation up to T_{amb} = 25 °C		P_{tot}	max.	210	mW

Optocoupler

Storage temperature range	T_{stg}		−55 to +150 °C
Operating ambient temperature range	T_{amb}		−40 to +100 °C
Soldering temperature up to the seating plane; $t_{sld} < 10$ s	T_{sld}	max.	260 °C

LINEAR DERATING FACTOR

Above 25 °C	
diode	1.33 mW/K
transistor	2.8 mW/K

ISOLATION RELATED VALUES

External air gap (clearance) input terminals to output terminals	L(IO1)	min.	7.2 mm
External tracking path (creepage distance) input terminals to output terminals	L(IO2)	min.	7.0 mm
Tracking resistance (KB-value)			KB-100/A
Internal plastic gap (clearance) isolation thickness between emitter and receiver		min.	1 mm

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Diode

Forward voltage I_F = 20 mA		V_F	typ.	1.1 V
			max.	1.5 V
Reverse current V_R = 6 V		I_R	max.	10 μA

Transistor

Collector-emitter breakdown voltage I_C = 1 mA	MCA230/231	$V_{(BR)CEO}$	min.	30 V
	MCA255	$V_{(BR)CEO}$	min.	55 V
Collector-base breakdown voltage I_C = 10 μA	MCA230/231	$V_{(BR)CBO}$	min.	30 V
	MCA255	$V_{(BR)CBO}$	min.	55 V
Emitter-base breakdown voltage I_E = 10 μA		$V_{(BR)EBO}$	min.	8 V
Dark current V_{CE} = 10 V		I_{CEO}	typ.	20 nA
			max.	100 nA

Optocoupler

DC current transfer ratio (CTR)				
I_F = 10 mA; V_{CE} = 5 V	MCA230/255	I_C/I_F	min.	1.0
	MCA231	I_C/I_F	min.	2.0
Collector-emitter saturation voltage				
I_F = 1 mA; I_C = 2 mA	MCA231	V_{CEsat}	max.	1.0 V
I_F = 5 mA; I_C = 10 mA	MCA231	V_{CEsat}	max.	1.0 V
I_F = 10 mA; I_C = 50 mA	MCA231	V_{CEsat}	max.	1.2 V
I_F = 50 mA; I_C = 50 mA	MCA230/255	V_{CEsat}	max.	1.0 V
Isolation voltage t = 1 min (see note)	DC	V_{IO}	min.	4.4 kV
	AC (RMS value)			3.12 kV
Capacitance between input and output				
V_O = 0; f = 1 MHz		C_{io}	max.	1.3 pF
			typ.	0.6 pF
Insulation resistance between input and output				
$\pm V_{IO}$ = 500 V		R_{IO}	min.	1 TΩ
			typ.	10 TΩ
Switching times (see Figs 2 and 3)				
I_F = 10 mA; V_{CC} = 5 V; R_L = 100 Ω				
Turn-on time		t_{on}	typ.	5 μs
Turn-off time		t_{off}	typ.	100 μs

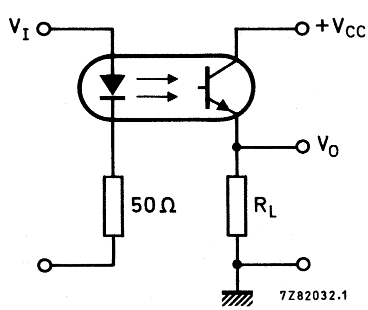


Fig. 2 Switching circuit.

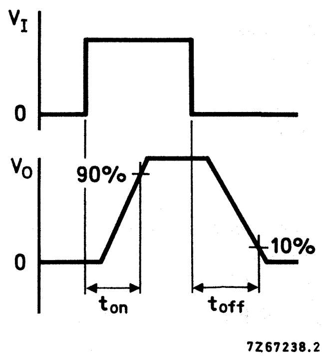


Fig. 3 Waveforms.

Note

Every single product is tested by applying an isolation test voltage of 3.75 kV (RMS) for 2 seconds between the shorted input (diode) leads and the shorted output (phototransistor leads); with a detection current of about 1 μA.

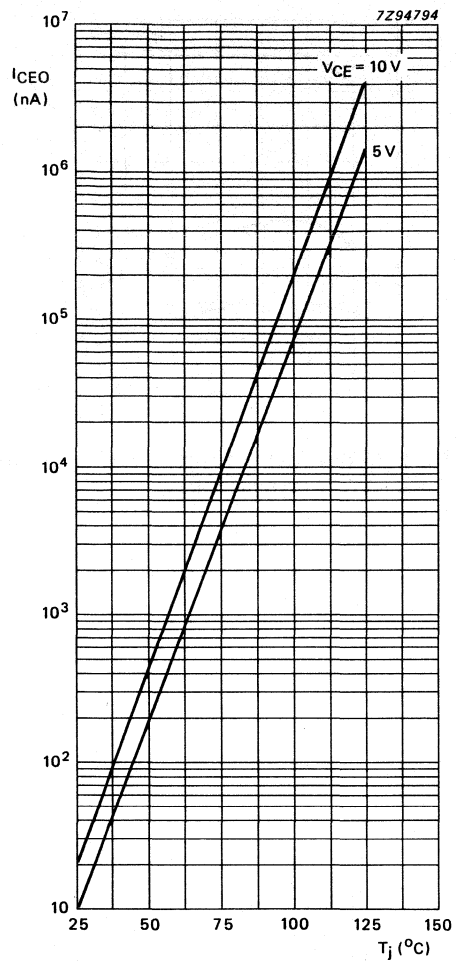


Fig. 4 Typical values.

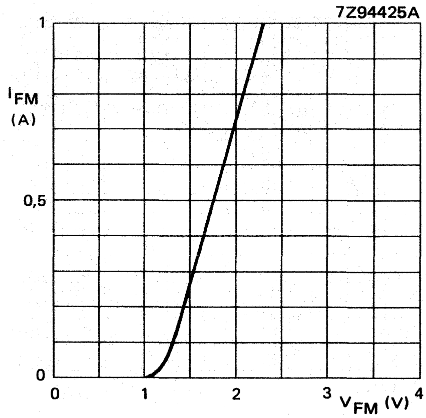


Fig. 5 T_{amb} = 25 °C; t_{on} = 20 μs; δ = 0.01; typical values.

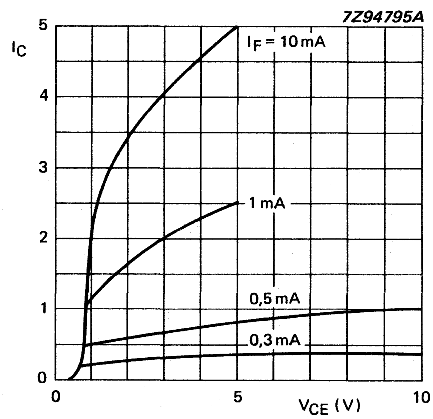


Fig. 6 Normalized to I_F = 0.5 mA; V_{CE} = 10 V; typical values.

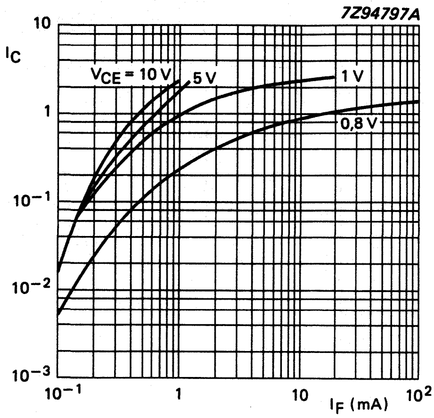


Fig. 7 Normalized to I_F = 0.5 mA; V_{CE} = 10 V; T_{amb} = 25 °C; typical values.

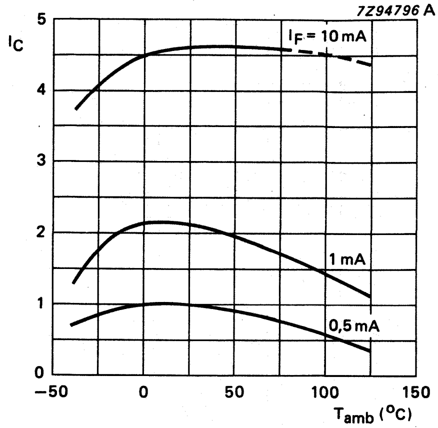


Fig. 8 Normalized to I_F = 0.5 mA; V_{CE} = 10 V; T_{amb} = 25 °C; typical values.

OPTOCOUPLER

This product range is one of the industrial standards applied in the market. The current transfer ratio, isolation voltage and low saturation voltage comply to the specifications of the main part of the optocoupler market.

It can be used with TTL circuits and is comprised of an infrared emitting GaAs diode and a npn silicon phototransistor.

UL — Covered under UL component recognition FILE E90700

VDE — Approved according to VDE 0883/6.80
Reference voltage (VDE 0110b Tab 4); AC 380 V/DC 450 V
isolation group C
Complied for reinforced isolation at 250 VAC with:
DIN 57 804/VDE 0804/1.83 (isolation group C)
DIN VDE 0860/8.86/HD195 S4.

CECC — Capability of approval GaAs optocouplers

QUICK REFERENCE DATA

Collector-emitter voltage of phototransistor	V_{CEO}	max.	30	V
DC forward current of infrared emitting diode	I_F	max.	60	mA
DC current transfer ratio at I_F = 10 mA; V_{CE} = 10 V	I_C/I_F	min.	0,2	
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	250	mW
Isolation voltage DC	V_{IO}	min.	4,4	kV
AC (RMS value)	V_{IO}	min.	3,12	kV

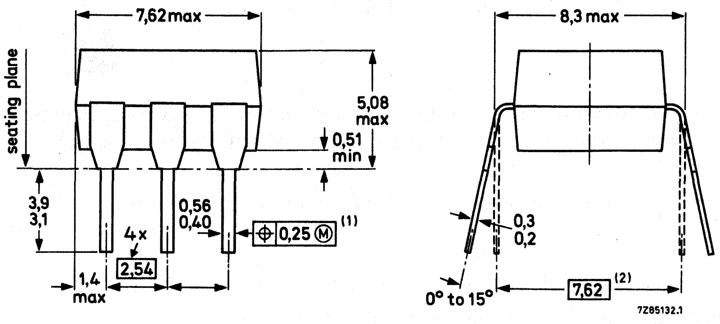
MECHANICAL DATA

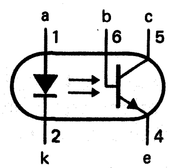
SOT90B (see Fig. 1).

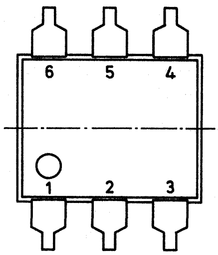
MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT90B.







⌖ Positional accuracy.

Ⓜ Maximum Material Condition.

(1) 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.

(2) When the leads are parallel, the tips remain in position for automatic insertion.

RATINGS

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

Diode				
Continuous reverse voltage	V_R	max.	5	V
DC forward current	I_F	max.	60	mA
peak value; t_{on} = 10 μs; δ = 0,01	I_{FRM}	max.	3	A
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
DC collector current	I_C	max.	100	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	200	mW

Optocoupler

Storage temperature range	T_{stg}		–55 to + 150 °C
Operating ambient temperature range	T_{amb}		–40 to + 100 °C
Soldering temperature up to the seating plane; $t_{sld} < 10$ s	T_{sld}	max.	260 °C
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	250 mW

THERMAL RESISTANCE

From junction to ambient in free air			
diode	$R_{th\ j-a}$	=	500 K/W
transistor	$R_{th\ j-a}$	=	500 K/W

LINEAR DERATING FACTORS

Above 25 °C	
diode	2,6 mW/K
transistor	2,6 mW/K
optocoupler	3,3 mW/K

ISOLATION RELATED VALUES

External air gap (clearance) input terminals to output terminals	L(IO1)	min.	7,2 mm
External tracking path (creepage distance) input terminals to output terminals	L(IO2)	min.	7,0 mm
Tracking resistance (KB value)			KB-100/A
Internal plastic gap (clearance) isolation thickness between emitter and receiver		min.	1 mm

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Diode

Forward voltage I_F = 20 mA	V_F	typ. max.	1,2 V 1,5 V
Reverse current V_R = 5 V	I_R	max.	10 μA
Capacitance at f = 1 MHz V = 0	C_d	typ.	50 pF

Transistor

Collector-emitter breakdown voltage I_C = 1 mA	$V_{(BR)CEO}$	min.	30 V
Collector-base breakdown voltage I_C = 0,01 mA	$V_{(BR)CBO}$	min.	70 V
Emitter-collector breakdown voltage I_E = 0,1 mA	$V_{(BR)ECO}$	min.	7 V
Dark current V_{CE} = 10 V	I_{CEO}	typ. max.	2 nA 50 nA
V_{CB} = 10 V	I_{CBO}	max.	20 nA

Optocoupler

Output/input DC current transfer ratio I_F = 10 mA; V_{CE} = 10 V	I_C/I_F	typ. min.	0,6 0,2
Collector-emitter saturation voltage I_F = 16 mA; I_C = 2 mA	V_{CEsat}	max. typ.	0,4 V 0,15 V
Emitter-base capacitance V_{BE} = 0	C_{be}	typ.	8 pF
Collector-base capacitance at f = 1 MHz V_{CB} = 10 V	$C_{b'c}$	typ.	4,5 pF
Collector-emitter capacitance V_{CE} = 0	C_{ce}	typ.	8 pF
Isolation voltage (see note) t = 1 min DC AC (RMS value)	V_{IO}	min.	 4,4 kV 3,12 kV
Capacitance between input and output V = 0; f = 1 MHz	C_{io}	typ. max.	0,6 pF 1.3 pF
Insulation resistance between input and output V_{IO} = ± 500 V	R_{IO}	min. typ.	1 TΩ 10 TΩ
Turn-on time (saturated) see Fig. 2 (TTL def.) I_F = 15 mA; V_{CC} = 5 V; R_L = 2 kΩ R_{BE} = ∞	t_{on}	typ.	5 μs
I_F = 20 mA; V_{CC} = 5 V; R_L = 2 kΩ R_{BE} = 100 kΩ	t_{on}	typ.	5 μs
Turn-off time (saturated) see Fig. 2 (TTL def.) I_F = 15 mA; V_{CC} = 5 V; R_L = 2 kΩ R_{BE} = ∞	t_{off}	typ.	30 μs
I_F = 20 mA; V_{CC} = 5 V; R_L = 2 k Ω R_{BE} = 100 kΩ	t_{off}	typ.	10 μs
Bandwidth I_C = 2 mA; V_{CE} = 10 V; R_L = 100 kΩ	B_W	typ.	300 kHz

Note

Every single product is tested by applying an isolation test voltage of 3750 V (RMS) for 2 seconds between the shorted input (diode) leads and the shorted output (phototransistor) leads; with a detection current of about 1 μA.

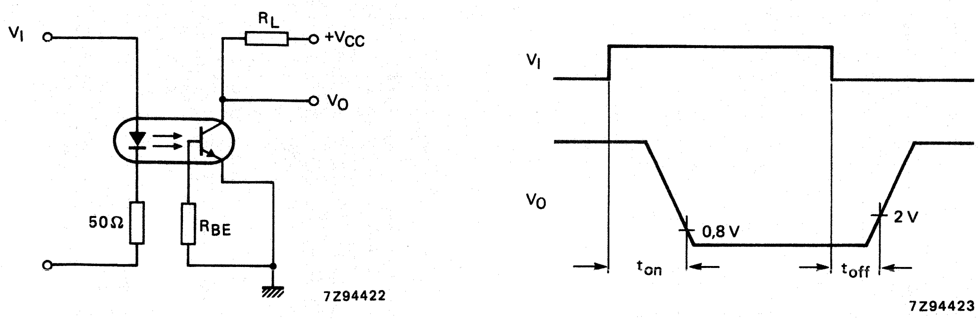


Fig. 2 Measuring circuit and waveforms.

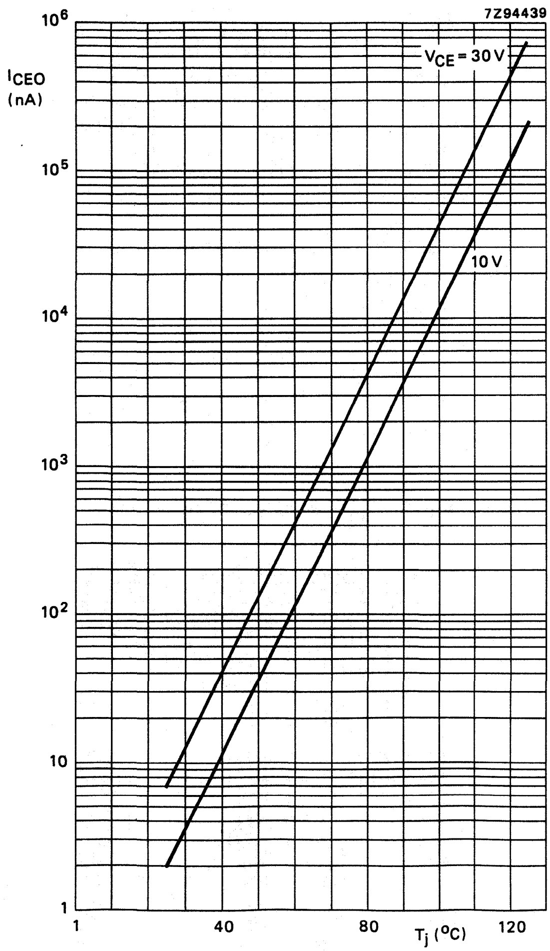


Fig. 3 Typical values.

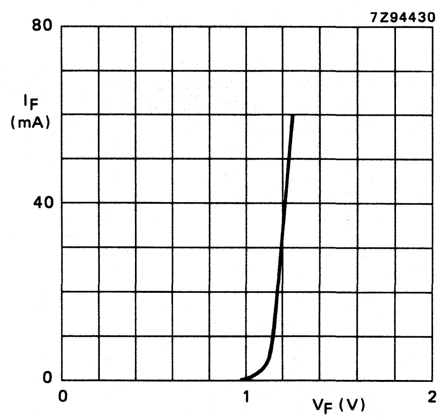


Fig. 4 T_{amb} = 25 °C; typical values.

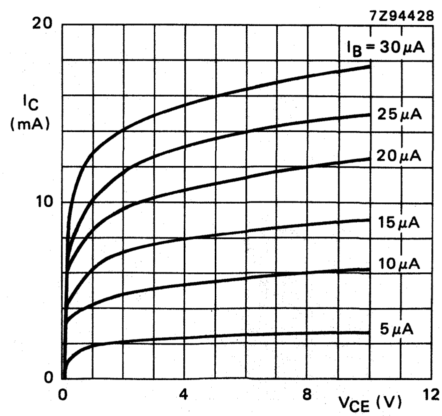


Fig. 5 T_{amb} = 25 °C; typical values.

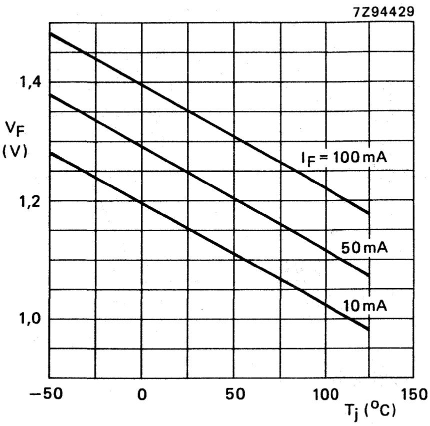


Fig. 6 Typical values.

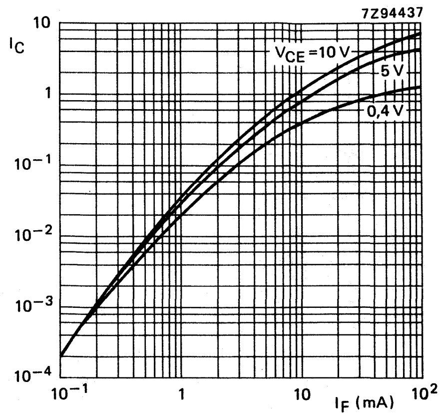


Fig. 7 Normalized to I_F = 10 mA; V_{CE} = 10 V; T_{amb} = 25 °C; typical values.

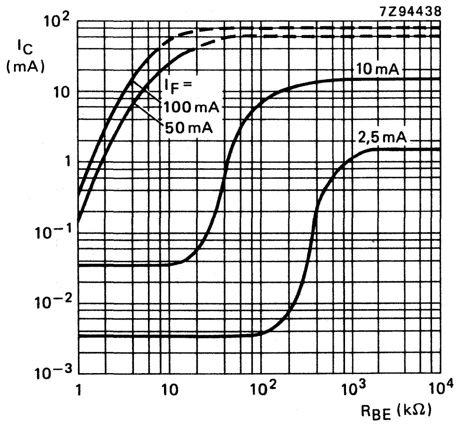


Fig. 8 V_{CE} = 5 V; T_{amb} = 25 °C; typical values.

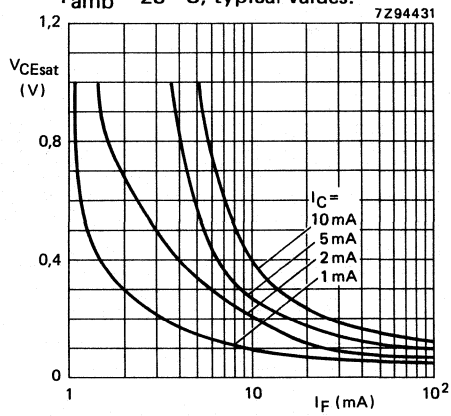


Fig. 9 T_{amb} = 25 °C; typical values.

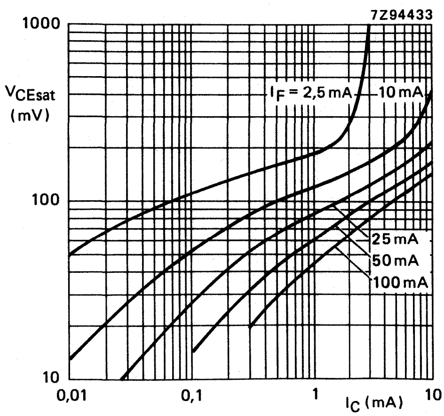


Fig. 10 T_{amb} = 25 °C; typical values.

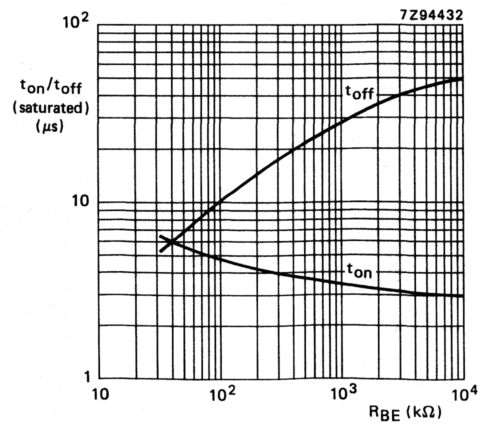


Fig. 11 I_F = 20 mA; R_L = 2 kΩ; T_{amb} = 25 °C; typical values.

OPTOCOUPLER

Optocoupler in a DIL plastic envelope. The MCT26 comprises an infrared GaAs diode and a npn silicon phototransistor.

UL — Covered under UL component recognition FILE E 90700

VDE — Approved according to VDE 0883/6.80
Reference voltage (VDE 0110b Tab 4): AC 380 V/DC 450 V — isolation group C
Complied for reinforced isolation at 250 V AC with
DIN 57 804/VDE 0804/1.83 (isolation group C)
DIN VDE 0860/8.86/HD195 S4

CECC — Capability of approval GaAs optocouplers

QUICK REFERENCE DATA

Collector-emitter voltage of phototransistor	V_{CEO}	max.	30	V
DC forward current of infrared emitting diode	I_F	max.	60	mA
Output/input DC current transfer ratio (CTR) I_F = 10 mA; V_{CE} = 10 V	I_C/I_F	min.	0.06	
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	250	mW
Isolation voltage DC	V_{IO}	min.	4.4	kV
AC (RMS value)			3.12	kV

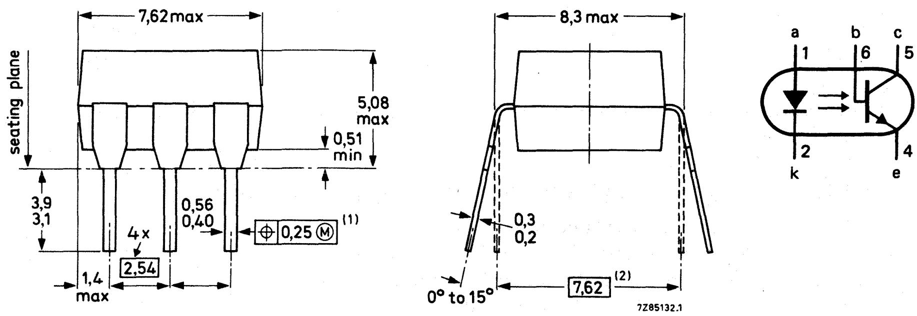
MECHANICAL DATA

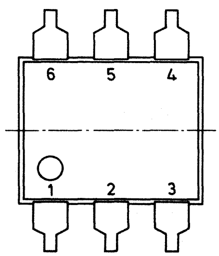
SOT90B (see Fig. 1).

MECHANICAL DATA

Dimensions in mm

Fig.1 SOT90B.





⊕ Positional accuracy.

Ⓜ Maximum Material Condition.

(1) 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.

(2) When the leads are parallel, the tips remain in position for automatic insertion.

RATINGS

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

Diode

Continuous reverse voltage	V_R	max.	5 V
DC forward current	I_F	max.	60 mA
peak value; t_{on} = 10 μs; δ = 0.01	I_{FRM}	max.	3 A
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.	30 V
Emitter-collector voltage (open base)	V_{ECO}	max.	7 V
DC collector current	I_C	max.	100 mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	200 mW

Optocoupler

Storage temperature range	T_{stg}		−55 to +150 °C
Operating ambient temperature range	T_{amb}		−40 to + 100 °C
Soldering temperature up to the seating plane; $t_{sld} < 10$ s	T_{sld}	max.	260 °C
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	250 mW

THERMAL RESISTANCE

From junction to ambient in free air			
diode	$R_{th\ j\text{-}a}$	=	500 K/W
transistor	$R_{th\ j\text{-}a}$	=	500 K/W

LINEAR DERATING FACTORS

Above 25 °C	
diode	2.6 mW/K
transistor	2.6 mW/K
optocoupler	3.3 mW/K

ISOLATION RELATED VALUES

External air gap (clearance) input terminals to output terminals	L(IO1)	min.	7.2 mm
External tracking path (creepage distance) input terminals to output terminals	L(IO2)	min.	7.0 mm
Tracking resistance (KB-value)			KB-100/A
Internal plastic gap (clearance) isolation thickness between emitter and receiver.		min.	1 mm

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Diode

Forward voltage I_F = 20 mA	V_F	typ. max.	1.2 V 1.5 V
Reverse current V_R = 5 V	I_R	max.	10 μA
Capacitance at f = 1 MHz V = 0	C_d	typ.	50 pF

Transistor

Collector-emitter breakdown voltage I_C = 1 mA	$V_{(BR)CEO}$	min.	30 V
Collector-base breakdown voltage I_C = 0,01 mA	$V_{(BR)CBO}$	min.	30 V
Emitter-collector breakdown voltage I_E = 0,1 mA	$V_{(BR)ECO}$	min.	7 V
Dark current V_{CE} = 5 V	I_{CEO}	typ. max.	2 nA 100 nA
V_{CB} = 5 V	I_{CBO}	max.	100 nA

Optocoupler

Output/input DC current transfer ratio I_F = 10 mA; V_{CE} = 10 V	I_C/I_F	min.	0.06
Collector-emitter saturation voltage I_F = 20 mA; I_C = 0.25 mA	V_{CEsat}	max. typ.	0.3 V 0.1 V
I_F = 60 mA; I_C = 1.6 mA	V_{CEsat}	max. typ.	0.5 V 0.2 V
Collector-emitter capacitance V_{CE} = 0	C_{ce}	typ.	8 pF
Isolation voltage DC (see note) AC (RMS value)	V_{IO}	min.	4.4 kV 3.12 kV
Capacitance between input and output V = 0; f = 1 MHz	C_{io}	typ. max.	0.6 pF 1.3 pF
Insulation resistance between input and output V_{IO} = 500 V	R_{IO}	min. typ.	1 TΩ 10 TΩ
Rise time (see Fig. 2) I_C = 2 mA; V_{CC} = 10 V; R_L = 100 Ω	t_r	typ.	3 μs
Fall time (see Fig. 2) I_C = 2 mA; V_{CC} = 10 V; R_L = 100 Ω	t_f	typ.	3 μs
Bandwidth I_C = 2 mA; V_{CE} = 10 V; R_L = 100 Ω	B_W	typ.	300 kHz

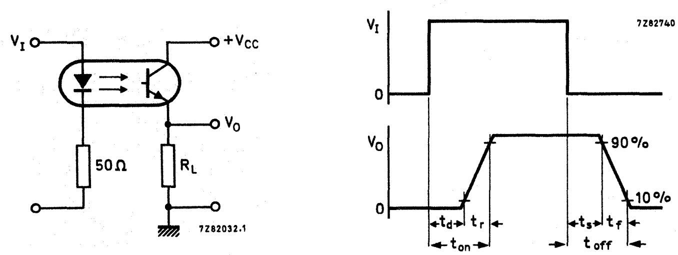


Fig. 2 Measuring circuit and waveforms.

Note

Every single product is tested by applying an isolation test voltage of 3750 V (RMS) for 2 seconds between the shorted input (diode) leads and the shorted output (phototransistor) leads, with a detection current of about 1 μA.

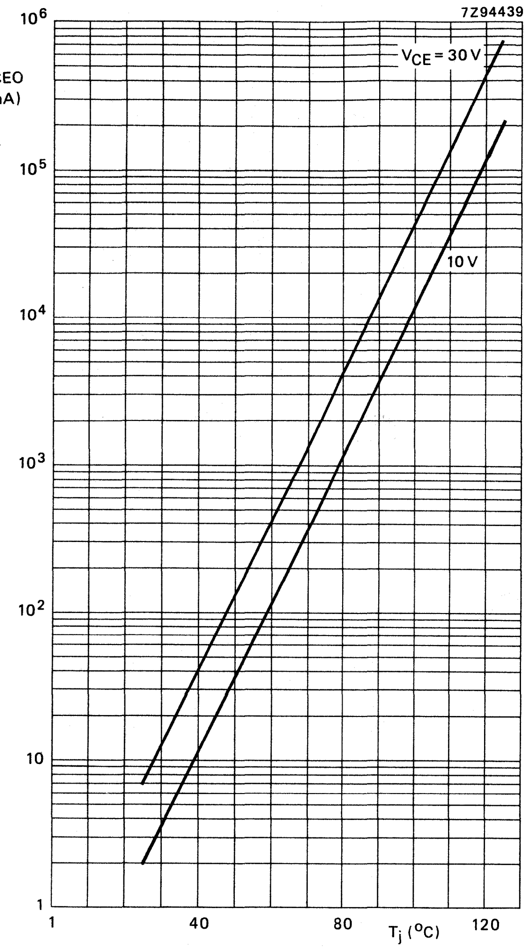


Fig. 3 Typical values.

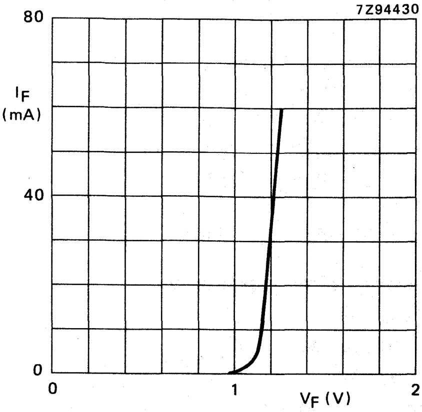


Fig. 4 T_{amb} = 25 °C; typical values.

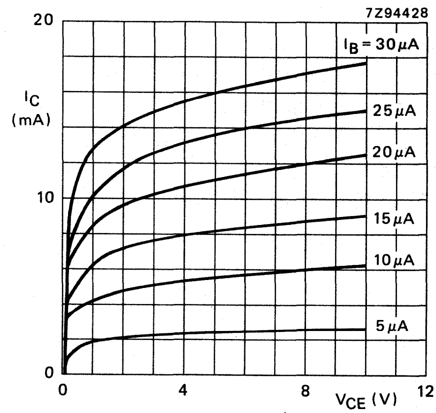


Fig. 5 T_{amb} = 25 °C; typical values.

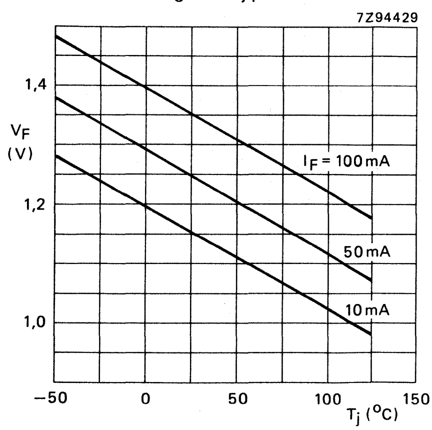


Fig. 6 Typical values.

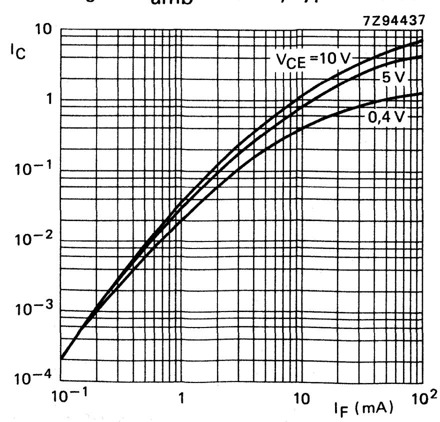


Fig. 7 Normalized to I_F = 10 mA; V_{CE} = 10 V; T_{amb} = 25 °C; typical values.

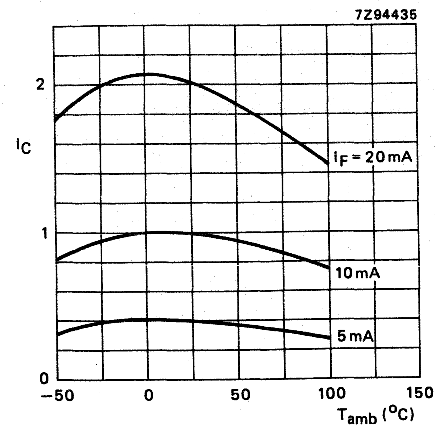


Fig. 8 Normalized to I_F = 10 mA; V_{CE} = 10 V; T_{amb} = 25 °C; typical values.

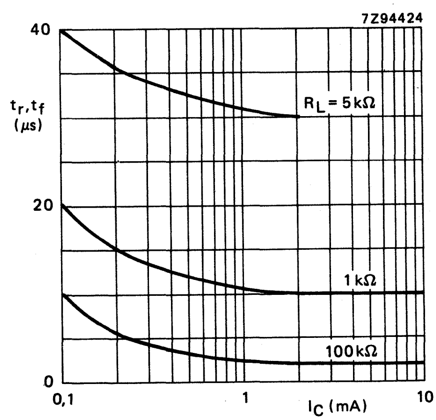


Fig. 9 T_{amb} = 25 °C; typical values.

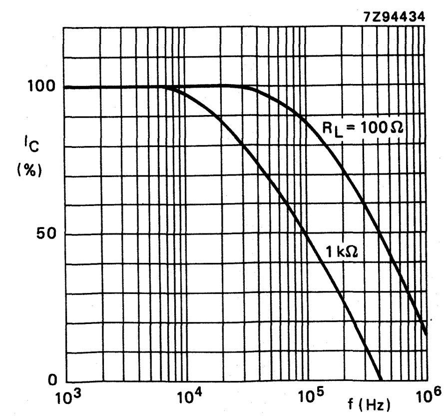


Fig. 10 I_C = 2 mA; V_{CC} = 10 V; T_{amb} = 25 °C; typical values.

FEATURES

- High current transfer ratio and low saturation voltage, making the device suitable for use with TTL integrated circuits
- Fast switching
- High degree of AC and DC insulation (3120 V (RMS) and 4400 V (DC)).

DESCRIPTION

The OF4114 is an optocoupler, comprising an infrared emitting GaAs diode, and a silicon npn phototransistor in a 6-pin dual-in-line (DIL) SOT90B plastic envelope.

This type is an electrical selection of the CNY17-3, in accordance with the German Telecom specification 14CNP.

PINNING - SOT90B

PIN	DESCRIPTION
1	anode
2	cathode
3	not connected
4	emitter
5	collector
6	base

APPROVALS

STANDARD	REFERENCE
UL	covered under UL component recognition FILE E90700
VDE	approved in accordance with VDE 0883/6.80 reference voltage (VDE 0110b Tab 4): 380 V (AC)/450 V (DC) (isolation group C) complied for reinforced isolation at 250 V (AC) with: DIN 57804/VDE 0804/1.83 (isolation group C) DIN VDE 0860/8.86/HD 195 S4
CECC	Capability of approval: GaAs optocouplers

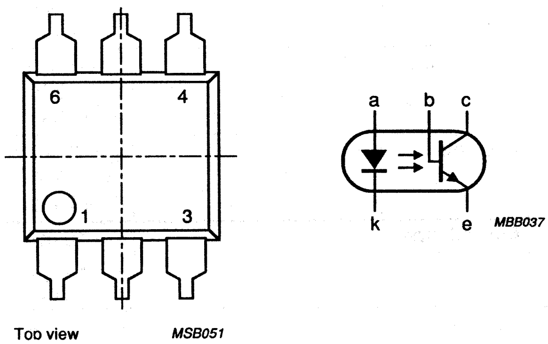


Fig.1 Simplified outline and symbol.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Diode					
I_F	forward current	DC value	–	90	mA
V_R	reverse voltage	DC value	–	6	V
P_{tot}	total power dissipation	up to T_{amb} = 25 °C	–	150	mW
Transistor					
I_C	collector current		–	150	mA
V_{CEO}	collector-emitter voltage	open base	–	70	V
P_{tot}	total power dissipation	up to T_{amb} = 25 °C	–	150	mW
Optocoupler					
V_{IO}	isolation voltage				
		DC value	4.4	–	kV
		RMS value	3.12	–	kV
I_C/I_F	DC current transfer ratio (CTR)	I_F = 10 mA; V_{CE} = 5 V	1	2	
		I_F = 1 mA; V_{CE} = 5 V	0.34	–	
Switching times					
t_{on}	turn-on time	I_F = 10 mA; V_{CC} = 5 V; R_L = 75 Ω	–	10	µs
t_r	rise time	I_F = 10 mA; V_{CC} = 5 V; R_L = 75 Ω	–	4	µs
t_{off}	turn-off time	I_F = 10 mA; V_{CC} = 5 V; R_L = 75 Ω	–	10	µs
t_f	fall time	I_F = 10 mA; V_{CC} = 5 V; R_L = 75 Ω	–	4	µs

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Diode					
I_F	forward current	DC value	–	90	mA
I_{FRM}	forward current	peak value; t_{on} = 10 µs; δ = 0.01	–	3	A
V_R	reverse voltage	DC value	–	6	V
P_{tot}	total power dissipation	up to T_{amb} = 25 °C	–	150	mW
Transistor					
I_C	collector current	DC value	–	150	mA
V_{CEO}	collector-emitter voltage	open base	–	70	V
V_{EBO}	emitter-base voltage	open collector	–	7	V
V_{CBO}	collector-base voltage	open emitter	–	70	V
P_{tot}	total power dissipation	up to T_{amb} = 25 °C	–	150	mW
Optocoupler					
T_{stg}	storage temperature range		–55	150	°C
T_{amb}	ambient operating temperature range		–40	100	°C
T_j	junction temperature		–	125	°C
T_{sld}	soldering temperature up to the seating plane	T_{sld} < 10 s	–	260	°C

ISOLATION RELATED VALUES

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
L(IO1)	external air gap (clearance)	between input and output terminals	7.2	–	–	mm
L(IO2)	external tracking path (creepage distance)	between input and output terminals	7	–	–	mm
	internal plastic gap (clearance)	isolation thickness between emitter and receiver	1	–	–	mm

CLASSIFICATION CATEGORIES

Tracking resistance	KB-100/A

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Diode						
V_F	forward voltage	I_F = 10 mA	–	1.1	1.5	V
		I_F = 60 mA	–	–	1.65	V
I_R	reverse current	V_R = 6 V	–	–	10	μA
C_d	diode capacitance	V_D = 0; f = 1 MHz	–	50	–	pF
Transistor						
$V_{(BR)CEO}$	collector-emitter breakdown voltage	I_C = 1 mA	70	–	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	I_E = 0.1 mA	7	–	–	V
$V_{(BR)CBO}$	collector-base breakdown voltage	I_C = 0.1 mA	70	–	–	V
I_{CEO}	collector-emitter cut-off current (dark)	I_F = 0; V_{CE} = 10 V	–	–	100	nA
		I_F = 0; V_{CE} = 10 V; T_{amb} = 70 °C	–	–	10	μA
		I_F = 0; V_{CE} = 30 V	–	–	150	nA
I_{CEX}	collector-emitter cut-off current (dark)	V_F = 0.6 V; V_{CE} = 10 V	–	–	150	nA
		V_F = 0.6 V; V_{CE} = 10 V; T_{amb} = 100 °C	–	–	25	μA
		V_F = 0.6 V; V_{CE} = 30 V	–	–	200	nA
		V_F = 0.6 V; V_{CE} = 30 V; T_{amb} = 100 °C	–	–	75	μA
Optocoupler						
h_{FE}	DC current gain	I_C = 10 mA; V_{CE} = 5 V	–	–	650	
$V_{CE\,sat}$	collector-emitter saturation voltage	I_F = 10 mA; I_C = 2.5 mA	–	–	0.3	V

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Optocoupler						
I_C/I_F	current transfer ratio (CTR)	DC value; $I_F = 1$ mA; $V_{CE} = 5$ V	0.34	–	–	
		DC value; $I_F = 3$ mA; $V_{CE} = 0.3$ V	0.3	–	–	
		DC value; $I_F = 5$ mA; $V_{CE} = 0.3$ V; $T_{amb} = 75$ °C	0.2	–	–	
		DC value; $I_F = 10$ mA; $V_{CE} = 5$ V	1	–	2	
		DC value; $I_F = 13$ mA; $V_{CE} = 2$ V	0.75	–	–	
		DC value; $I_F = 17$ mA; $V_{CE} = 2$ V; $T_{amb} = 75$ °C	0.6	–	–	
V_{IO}	isolation voltage (note 1)	t = 1 min				
		DC value	4.4	–	–	kV
		RMS value	3.12	–	–	kV
C_{io}	capacitance between input and output	$V_{IO} = 0$; f = 1 MHz	–	0.6	1.3	pF
R_{IO}	insulation resistance between input and output	$V_{IO} = \pm 500$ V	1	10	–	TΩ
Switching times (see Figs 2 and 3)						
t_{on}	turn-on time	$I_F = 10$ mA; $V_{CC} = 5$ V; $R_L = 75$ Ω	–	–	10	µs
t_r	rise time	$I_F = 10$ mA; $V_{CC} = 5$ V; $R_L = 75$ Ω	–	–	4	µs
t_{off}	turn-off time	$I_F = 10$ mA; $V_{CC} = 5$ V; $R_L = 75$ Ω	–	–	10	µs
t_f	fall time	$I_F = 10$ mA; $V_{CC} = 5$ V; $R_L = 75$ Ω	–	–	4	µs

Note

1. Every product is tested by applying an isolation test voltage of 3750 V (RMS) for 2 s between alll shorted input side leads and all shorted output side leads, with a detection current of approximately 1 µA.

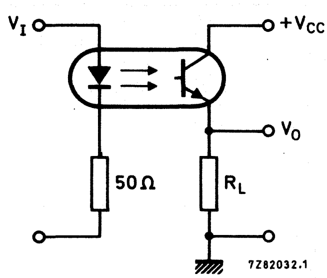


Fig.2 Switching times test circuit.

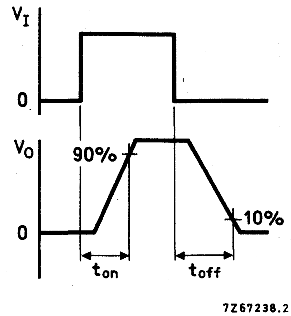
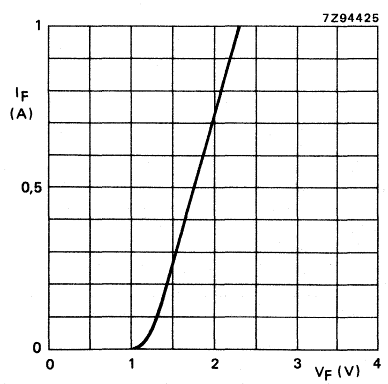
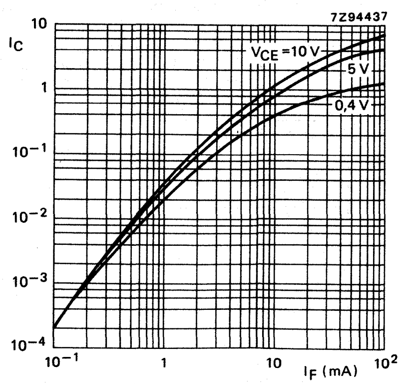


Fig.3 Switching times waveforms.



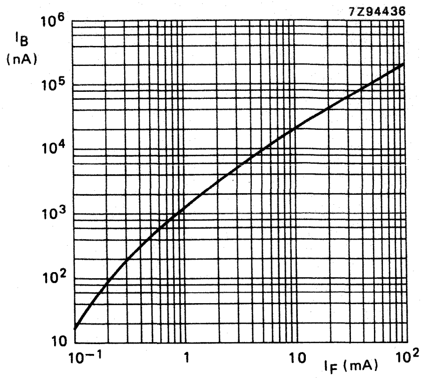
T_{amb} = 25 °C; t_{on} = 20 μs; δ = 0.01.

Fig.4 Forward current as a function of forward voltage, typical values.



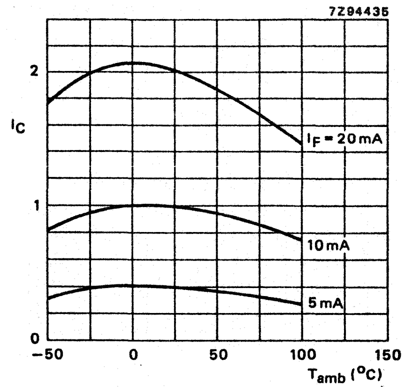
Normalized to I_F = 10 mA; V_{CE} = 10 V.

Fig.5 Collector current as a function of forward current, typical values.



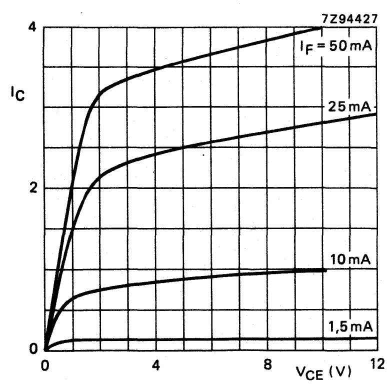
V_{CB} = 10 V; T_{amb} = 25 °C.

Fig.6 Base current as a function of forward current, typical values.



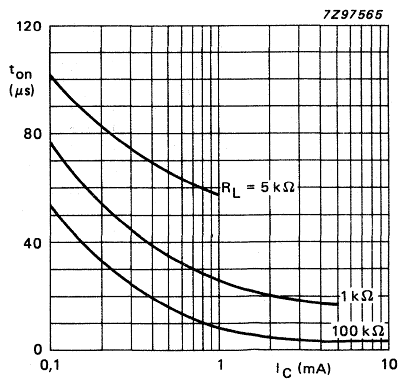
I_F = 10 mA; V_{CE} = 10 V.

Fig.7 Collector current as a function of ambient temperature, typical values.



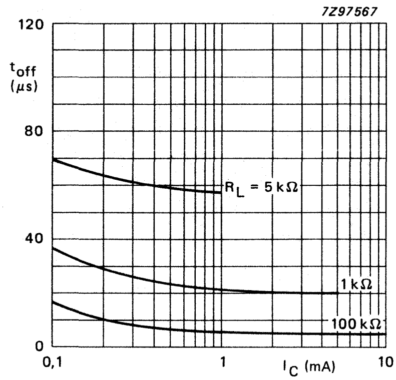
Normalized to I_F = 10 mA; V_{CE} = 10 V.

Fig.8 Collector current as a function of collector-emitter voltage, typical values.



V_{CC} = 10 V; T_{amb} = 25 °C.

Fig.9 Turn-on time as a function of collector current, typical values.



V_{CC} = 10 V; T_{amb} = 25 °C.

Fig.10 Turn-off time as a function of collector current, typical values.

OPTOCOUPLER

Optically coupled isolator consisting of an infrared emitting GaAlAs diode and a silicon npn phototransistor with accessible base in a SOT90B envelope. Designed for low input current and long life operation.

The application of an IR emitting device, based on a special GaAlAs (intrinsic) process, results in perfect linearity at low input currents and a very low degradation during the device's operating life.

The PO40/44A is selected according to British Telecom specifications for telephony and can serve for each individual specification PO40A, PO41A, PO42A, PO43A, PO44A and is BT approved.

Features

- High output/input DC current transfer ratio
- Low saturation voltage
- High insulation (3.5 kV DC and 2.5 kV RMS)
- High working voltage (2.5 kV DC)

UL — Covered under UL component recognition FILE E90700

VDE — Approved according to VDE 0883/6.80
Reference voltage (VDE 0110b Tab 4): AC 380 V/DC 450 V, isolation group C
Complied for reinforced isolation at 250 VAC with:
DIN 57 804/VDE 0804/1.83 (isolation group C)
DIN VDE 0860/8.86/HD195 S4.

QUICK REFERENCE DATA

Diode			
DC forward current	I_F	max.	100 mA
Transistor			
Collector-emitter voltage (open base)	V_{CEO}	max.	30 V
Optocoupler			
Output/input DC current transfer ratio (CTR)			
I_F = 0.5 mA; V_{CE} = 5 V	I_C/I_F	min.	0.1
I_F = 1.0 mA; V_{CE} = 0.4 V	I_C/I_F	min.	0.25
I_F = 10 mA; V_{CE} = 0.5 V	I_C/I_F	min.	0.6
Leakage current under working voltage 2.5 kV (DC value) V_{CC} = 10 V	I_{CEW}	max.	200 nA
Isolation voltage DC	V_{IO}	min.	3.5 kV
Isolation voltage AC (RMS value)	V_{IO}	min.	2.5 kV

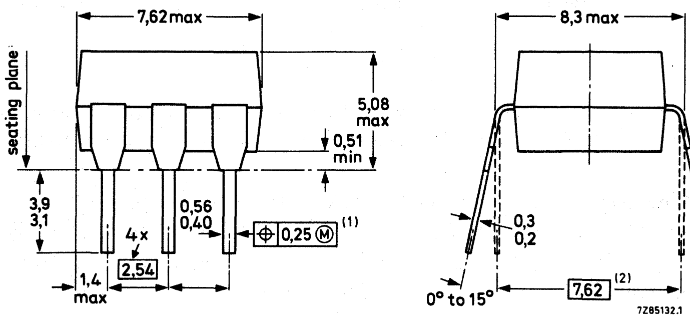
MECHANICAL DATA

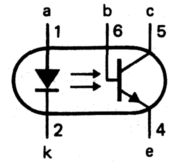
SOT90B (see Fig.1).

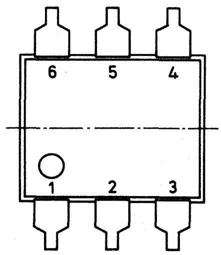
MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT90B.







⊕ Positional accuracy.

Ⓜ Maximum Material Condition.

(1) 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.

(2) When the leads are parallel, the tips are in position for automatic insertion.

RATINGS

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

Diode			
Continuous reverse voltage	V_R	max.	5 V
DC forward current	I_F	max.	100 mA
(peak value); t_p = 10 μs; δ = 0.01	I_{FRM}	max.	2,5 A
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.	5 V
DC collector current	I_C	max.	100 mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	200 mW

Optocoupler

Storage temperature range	T_{stg}		−55 to +150 °C
Operating ambient temperature range	T_{amb}		−40 to +100 °C
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	250 mW
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 K/W
transistor	$R_{th\ j\text{-}a}$	=	500 K/W
From junction to ambient, device mounted on a printed circuit board			
diode	$R_{th\ j\text{-}a}$	=	400 K/W
transistor	$R_{th\ j\text{-}a}$	=	400 K/W

ISOLATION RELATED VALUES

External air gap (clearance) input terminals to output terminals	L(IO1)	min.	7,2 mm
External tracking path (creepage distance) input terminals to output terminals	L(IO2)	min.	7,0 mm
Tracking resistance (KB-value)			KB-100/A
Internal plastic gap (clearance) isolation thickness between emitter and receiver		min.	1,0 mm

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Diode

Forward voltage			
I_F = 10 mA	V_F	typ.	1,45 V
		max.	1,6 V *
I_F = 0,1 mA; T_{amb} = 70 °C	V_F	min.	0,45 V
Reverse current V_R = 5 V	I_R	max.	10 μA

Transistor

Collector-emitter breakdown voltage open base; I_C = 1 mA	$V_{(BR)CEO}$	min.	30 V
Collector-base breakdown voltage open emitter; I_C = 0,1 mA	$V_{(BR)CBO}$	min.	70 V
Emitter-collector breakdown voltage open base; I_E = 0,1 mA	$V_{(BR)ECO}$	min.	5 V
Collector cut-off current (dark) V_{CE} = 28 V	I_{CEO}	typ.	2 nA
		max.	200 nA

* Internal specification.

Optocoupler

Output/input DC current transfer ratio (CTR)			
I_F = 10 mA; V_{CE} = 0,5 V	I_C/I_F	min. max.	0,6 1,5
I_F = 1 mA; V_{CE} = 0,4 V	I_C/I_F	min.	0,25
I_F = 0,5 mA; V_{CE} = 5 V	I_C/I_F	min.	0,1
I_F = 3 mA; V_{CE} = 1 V	I_C/I_F	min.	0,3
I_F = 5 mA; V_{CE} = 5 V	I_C/I_F	min.	0,3
I_F = 10 mA; V_{CE} = 10 V	I_C/I_F	min.	0,25
I_F = 20 mA; V_{CE} = 0,5 V	I_C/I_F	min.	0,25
Collector current			
I_F = 0,1 mA; V_{CE} = 5 V	I_{CE}	max.	150 μA*
DC current gain			
I_C = 0,4 mA; V_{CE} = 1 V	h_{FE}	min.	200
Collector-emitter saturation voltage			
I_F = 10 mA; I_C = 1 mA	V_{CEsat}	max.	0,5 V
Output capacitance			
V_{CB} = 10 V; f = 1 MHz	$C_{b'c}$	typ.	4,5 pF
Collector cut-off current (dark) at working voltage V_W = 2,5 kV; (DC value) (notes 1 and 2)			
V_{CC} = 10 V;	I_{CEW}	max.	200 nA
V_{CC} = 10 V; T_j = 70 °C	I_{CEW}	max.	5 μA
Isolation voltage; t = 1 min (note 3) DC AC (RMS value)	V_{IO}	min.	3,5 kV 2,5 kV
Capacitance between input and output			
V = 0; f = 1 MHz	C_{io}	typ. max.	0.6 pF 1.3 pF
Insulation resistance between input and output			
$\pm V_{IO}$ = 500 V	R_{IO}	min. typ.	1 TΩ 10 TΩ
Switching times (see Figs 3 and 4)			
I_C = 2 mA; V_{CC} = 10 V; R_L = 100 Ω			
Turn-on time	t_{on}	max.	7 μs
Turn-off time	t_{off}	max.	7 μs

Notes.

1. This parameter is the maximum collector-emitter leakage current measured when a high voltage is applied between the emitter and the two shorted diode leads (see Fig. 2).
2. As quality assurance (on a sample basis), these parameters are covered by a 1000 hour reliability test.
3. Every single product is tested by applying an isolation test voltage of 3750 V AC (RMS) for 2 seconds, between the shorted input (diode) leads and the shorted output (phototransistor) leads; with a detection current of about 1 μA.

* Internal specification.

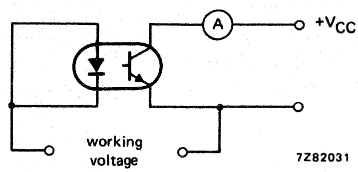


Fig. 2.

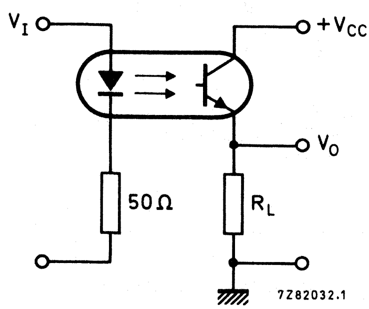


Fig. 3 Switching circuit.

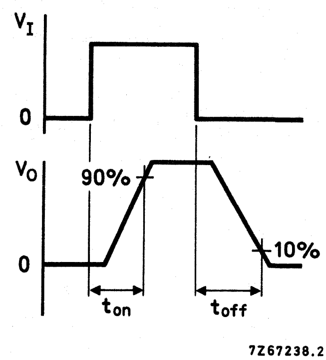


Fig. 4 Waveforms.

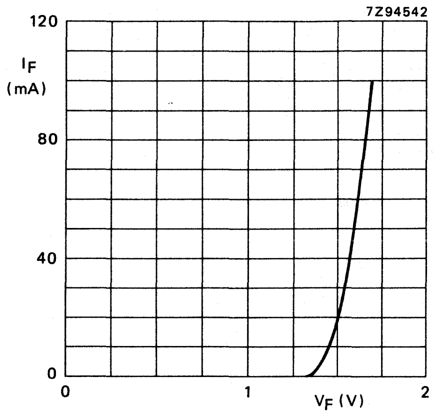


Fig. 5 T_{amb} = 25 °C; typical values.

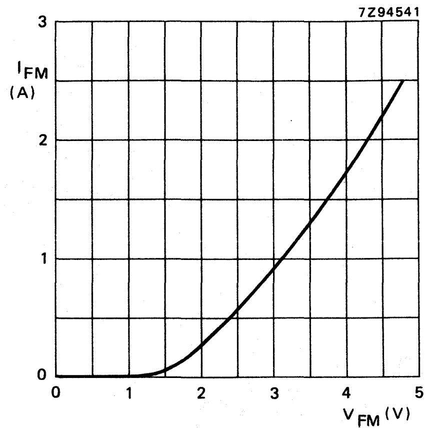


Fig. 6 T_{amb} = 25 °C; t_p = 10 μs; T = 1 ms; typical values.

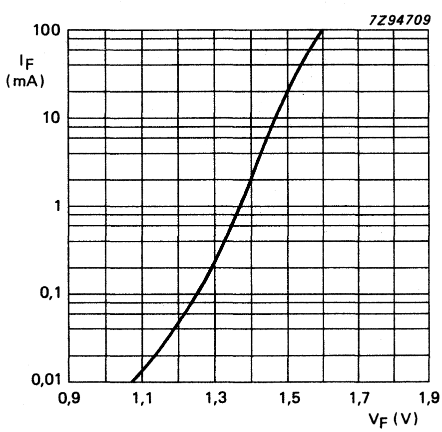


Fig. 7 T_{amb} = 25 °C; typical values.

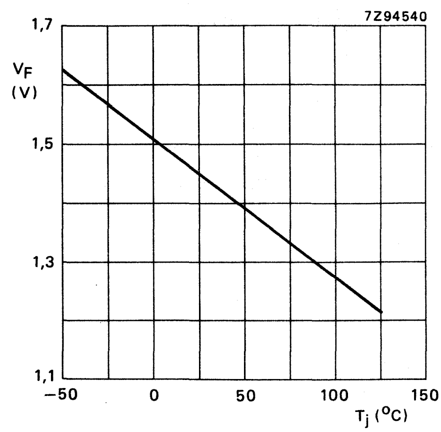


Fig. 8 I_F = 10 mA; typical values.

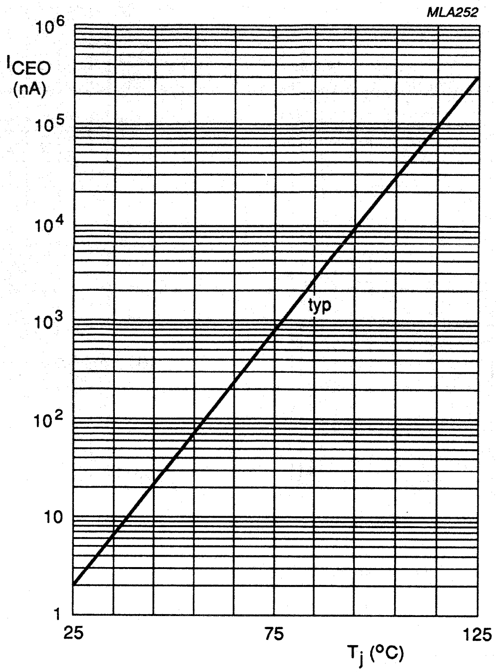


Fig. 9 $I_F = 0$; $V_{CE} = 10$ V; typical values.

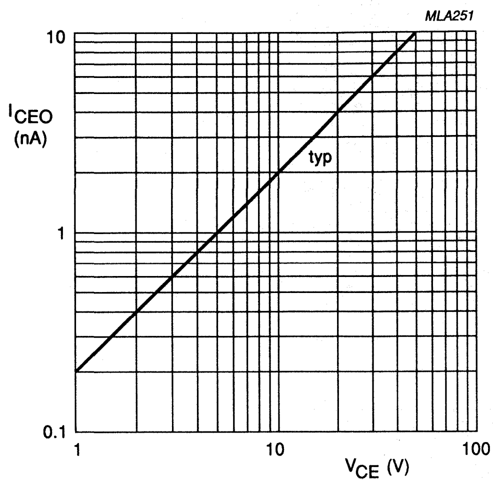


Fig. 10 $I_F = 0$; $T_j = 25\ ^oC$; typical values .

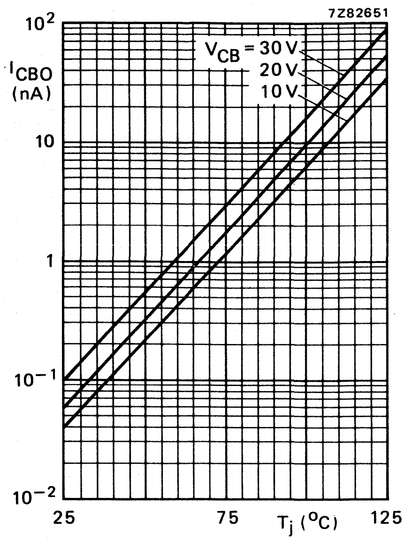


Fig. 11 Typical values.

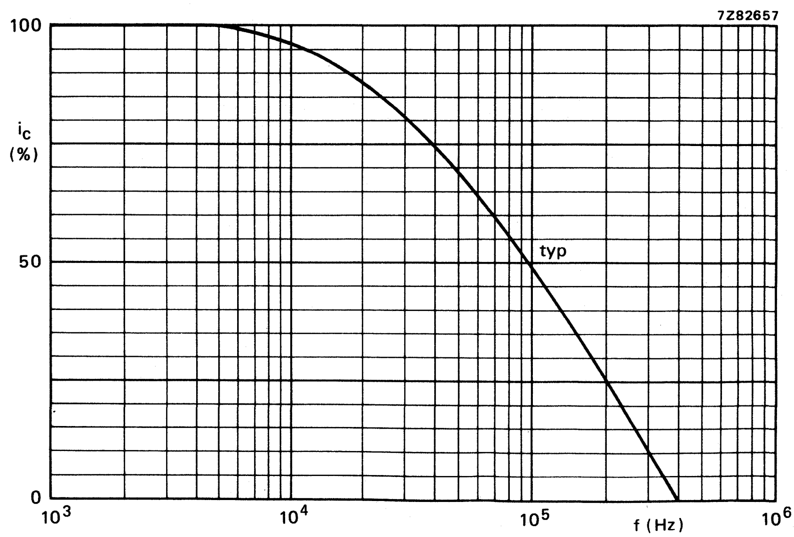


Fig. 12 $I_B = 0$; $I_C = 2$ mA; $V_{CC} = 5$ V; $R_L = 1\ k\Omega$; $T_{amb} = 25\ ^oC$.

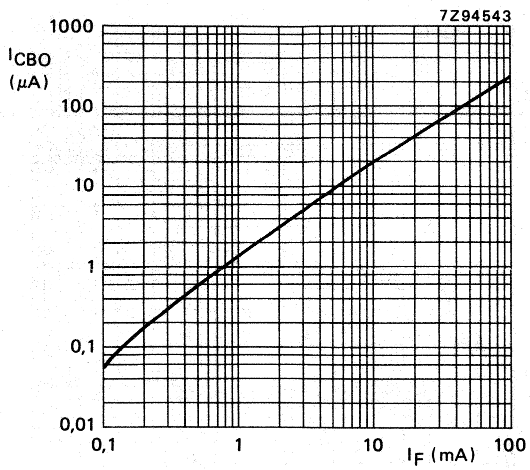


Fig. 13 V_{CB} = 5 V; T_{amb} = 25 °C; typical values.

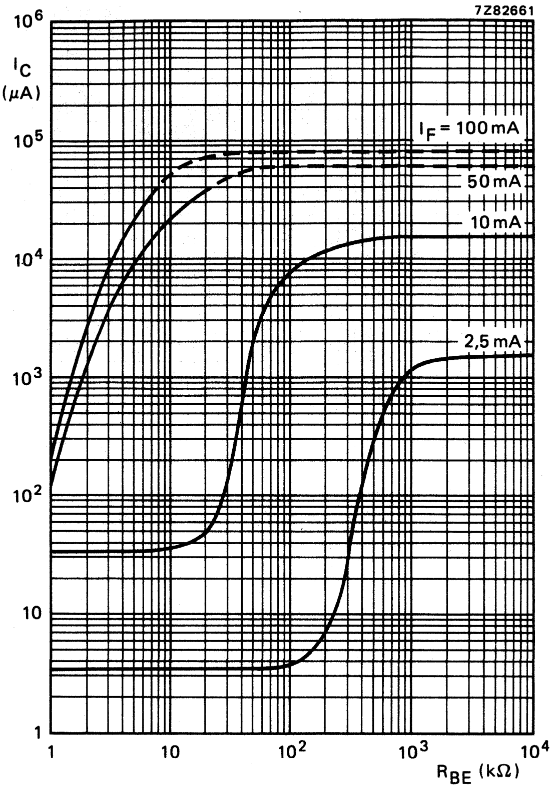


Fig. 14 $I_B = 0$; $V_{CE} = 5$ V; $T_{amb} = 25$ °C; typical values.

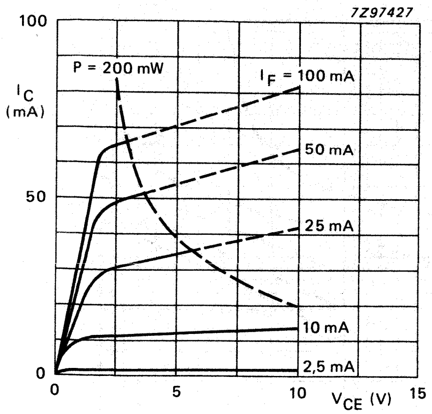


Fig. 15 T_{amb} = 25 °C; typical values.

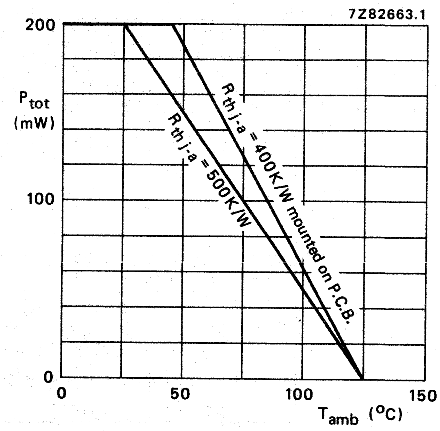


Fig. 16.

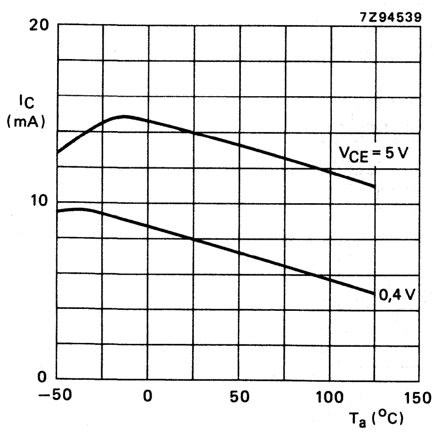


Fig. 17 I_F = 10 mA; typical values.

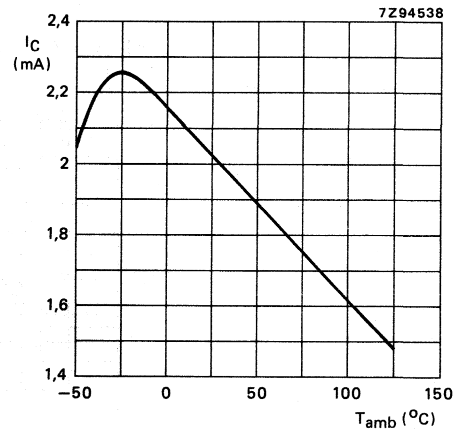


Fig. 18 I_F = 2 mA; V_{CE} = 0,4 V; typical values.

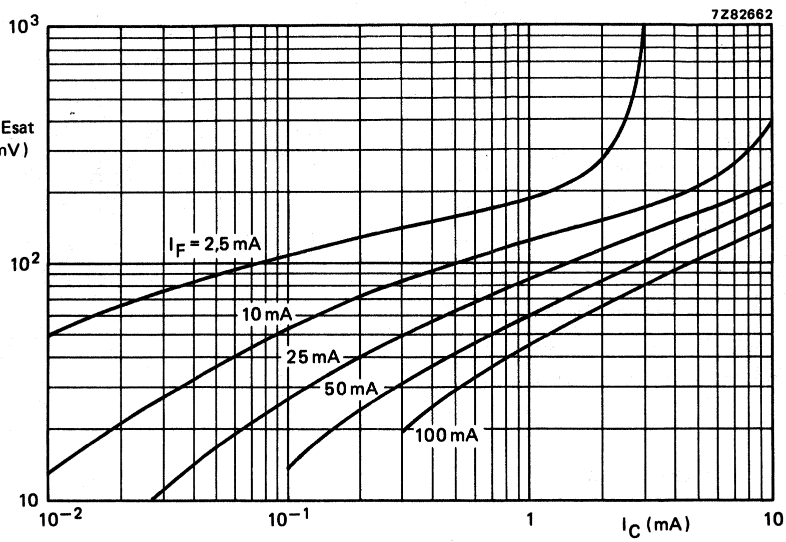


Fig. 19 $I_B = 0$; $T_{amb} = 25\ ^oC$; typical values.

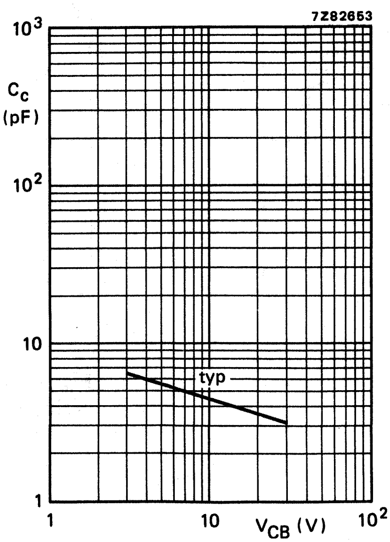


Fig.20 f = 1 MHz; $T_{amb} = 25\ ^oC$.

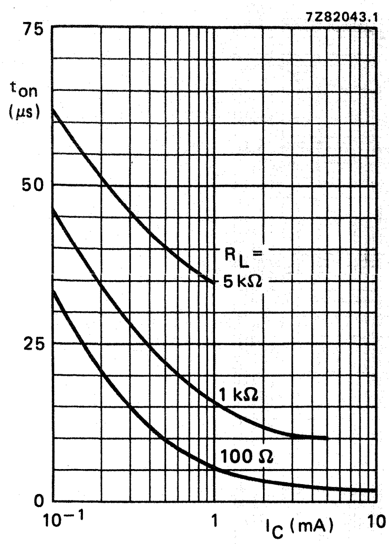


Fig. 21 $I_B = 0$; $V_{CC} = 5$ V; $T_{amb} = 25$ °C; typical values (see also Fig.23).

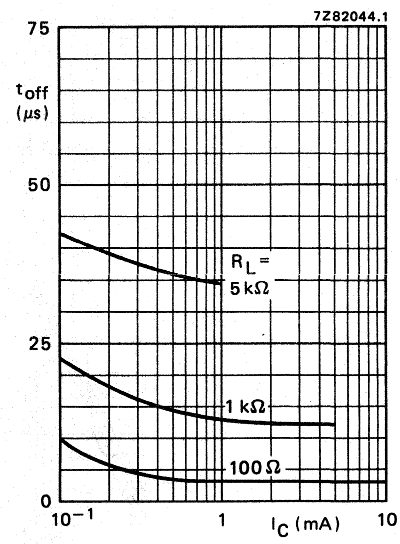


Fig. 22 $I_B = 0$; $V_{CC} = 5$ V; $T_{amb} = 25$ °C; typical values (see also Fig.23).

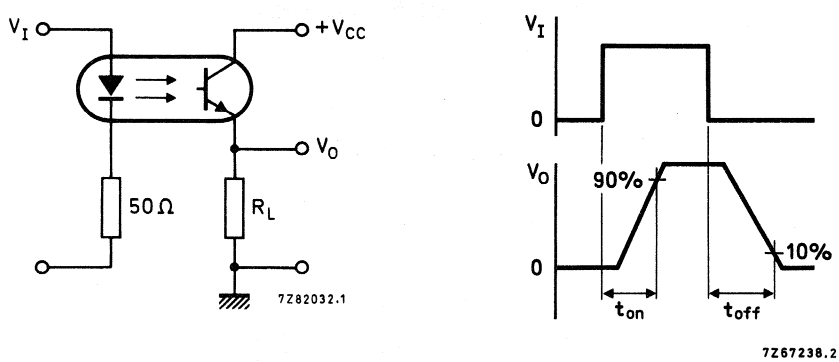


Fig. 23 Switching circuit and waveforms.

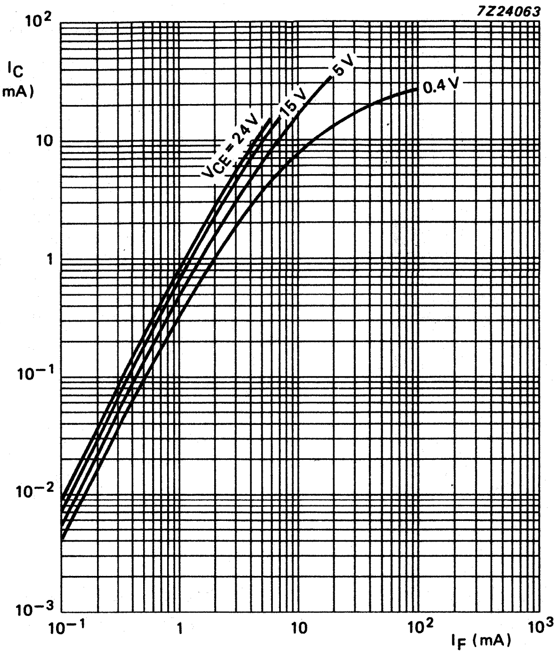


Fig. 24 T_{amb} = 25 °C, typical values.

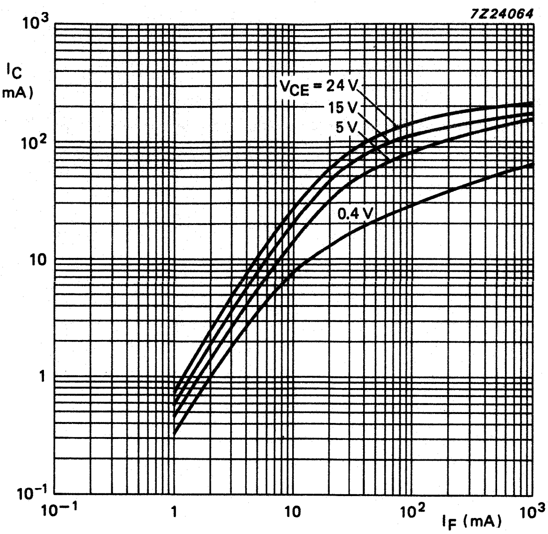


Fig. 25 T_{amb} = 25 °C; t_p = 10 μs; T = 1 ms; Typical values.

OPTOCOUPLERS

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

Features

- High output/input DC current transfer ratio
- Low saturation voltage
- High isolation voltage of 2.5 kV RMS and 3.5 kV DC

These types are selected according to CNET specification and are intended for use on telephone and telegraphic applications.

CNET approved
CECC — Capability of approval GaAs optocouplers.

QUICK REFERENCE DATA

class V: climatical class (5 °C – 70 °C – 56 days) 864

Diode					
Continuous reverse voltage		V_R	max.	3	V
DC forward current		I_F	max.	60	mA
peak value; t_p = 10 µs; δ = 0.01		I_{FRM}	max.	3	A
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.	150	mW
Optocoupler					
Output/input DC current transfer ratio (CTR);	SL5500		min.	0.4	
I_F = 2 mA; V_{CE} = 5 V; (I_B = 0)	SL5501	I_C/I_F	min.	0.15	
	SL5511		min.	0.25	
Continuous DC voltage between input and output		V_{IOWM}	max.	800	V
Isolation voltage DC		V_{IO}	min.	3.5	kV
Isolation voltage AC (RMS value)		V_{IO}	min.	2.5	kV

MECHANICAL DATA

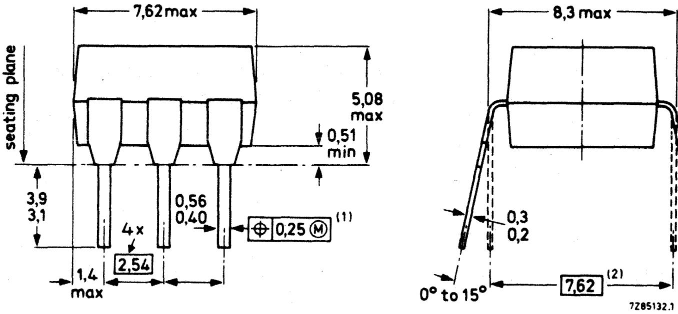
SOT90B (see Fig.1).

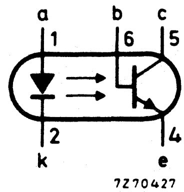
Products approved to CECC 20 004-001

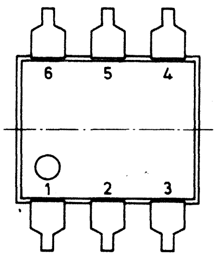
MECHANICAL DATA

Dimensions in mm

Fig.1 SOT90B.







⊕ Positional accuracy.

Ⓜ Maximum Material Condition.

(1) 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.

(2) When the leads are parallel, the tips are in position for automatic insertion.

RATINGS

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

Diode				
Continuous reverse voltage	V_R	max.	3	V
DC forward current	I_F	max.	60	mA
peak value; t_p = 10 μs; δ = 0.01	I_{FRM}	max.	3	A
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-base voltage (open emitter)	V_{CBO}	max.	70	V
Emitter-collector voltage (open base)	V_{ECO}	max.	7	V
Emitter-base voltage (open collector)	V_{EBO}	max.	7	V
DC collector current	I_C	max.	100	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	150	mW

Optocoupler

Storage temperature range	T_{stg}		−55 to + 150 °C
Operating ambient temperature range	T_{amb}		−40 to +100 °C
Lead soldering temperature up to the seating plane; $t_{sld} < 10$ s	T_{sld}	max.	260 °C
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	250 mW

Thermal resistance

From junction to ambient in free air			
diode	$R_{th\ j\text{-}a}$	=	750 K/W
transistor	$R_{th\ j\text{-}a}$	=	650 K/W
optocoupler	$R_{th\ j\text{-}a}$	=	500 K/W

Isolation related values

External air gap (clearance) input terminals to output terminals	L(IO1)	min.	7.2 mm
External tracking path (creepage distance) input terminals to output terminals	L(IO2)	min.	7.0 mm
Tracking resistance (KB value)			KB-100/A
Internal plastic gap (clearance) isolation thickness between emitter and receiver		min.	1 mm

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Diode

Forward voltage			
I_F = 20 mA; T_{amb} = 25 to 70 °C	V_F	max.	1.3 V
I_F = 2 mA	V_F	max.	1.2 V
Reverse current			
V_R = 3 V; T_{amb} = 25 to 70 °C	I_R	max.	10 μA

Transistor

Collector cut-off current (dark);			
V_{CE} = 10 V	I_{CEO}	max.	50 nA
V_{CE} = 30 V	I_{CEO}	max.	10 μA
V_{CE} = 10 V; T_{amb} = 70 °C	I_{CEO}	max.	500 nA
V_{CB} = 30 V	I_{CBO}	max.	50 μA
Collector-emitter breakdown voltage I_C = 10 μA	$V_{(BR)CEO}$	min.	30 V
Collector-base breakdown voltage I_C = 10 μA	$V_{(BR)CBO}$	min.	30 V
Emitter-collector breakdown voltage I_E = 10 μA	$V_{(BR)ECO}$	min.	7 V
Emitter-base breakdown voltage I_E = 10 μA	$V_{(BR)EBO}$	min.	7 V

Optocoupler ($I_B = 0$) (see note 1)

Output/input DC current transfer ratio (CTR)				
I_F = 10 mA; V_{CE} = 0.4 V; T_{amb} = 25 °C	SL5500	I_C/I_F		0.5 to 3
T_{amb} = 70 °C	SL5500	I_C/I_F		0.4 to 3
T_{amb} = 25 to 70 °C	SL5501	I_C/I_F		0.25 to 4
I_F = 2 mA; V_{CE} = 5 V; T_{amb} = 25 °C	SL5500	I_C/I_F	min.	0.4
T_{amb} = 70 °C	SL5500	I_C/I_F	min.	0.3
T_{amb} = 25 to 70 °C	SL5501	I_C/I_F	min.	0.15
T_{amb} = 25 to 70 °C	SL5511	I_C/I_F	min.	0.25
I_F = 0.5 mA; V_{CE} = 0.4 V; T_{amb} = 25 to 70 °C	SL5511	I_C/I_F	min.	0.2
Collector-emitter saturation voltage				
I_F = 50 mA; I_C = 10 mA	SL5500	V_{CEsat}	max.	0.4 V
I_F = 20 mA; I_C = 2 mA	SL5501	V_{CEsat}	max.	0.4 V
	SL5511		max.	0.4 V
Isolation voltage; DC value				
t = 1 min. (see note 2) AC (RMS value)		V_{IO}	min.	3.5 kV
				2.5 kV
Collector capacitance; $I_E = I_e = 0$; V_{CB} = 10 V; f = 1 MHz		$C_{b'c}$	typ.	4.5 pF
Capacitance between input and output V = 0; f = 1 MHz		C_{io}	typ.	0.6 pF
			max.	1.3 pF
Insulation resistance between input and output V_{IO} = ± 500 V		R_{IO}	min.	1 TΩ
			typ.	10 TΩ
Switching times (see Figs 2 and 3)				
I_F = 16 mA; V_{CC} = 5 V; R_L = 1 kΩ				
Turn-on time		t_{on}	max.	20 μs
Turn-off time		t_{off}	max.	50 μs

Notes

1. Where the phototransistor receives light from the diode the O (for open base) has been omitted from the symbols.
2. Every single product is tested by applying an isolation test voltage of 3750 V AC (RMS) for 2 seconds between the shorted input (diode) leads and the shorted output (phototransistor) leads; with a detection current of about 1 μA.

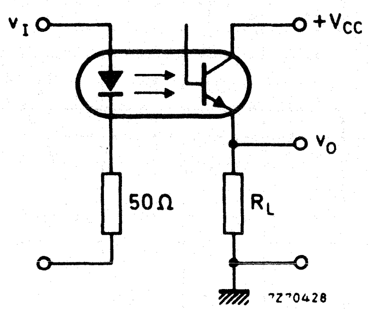


Fig. 2 Switching circuit.

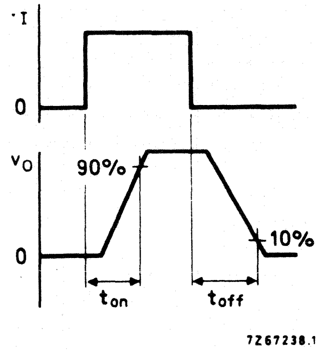


Fig. 3 Waveforms.

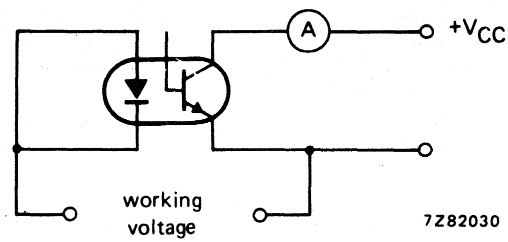


Fig. 4.

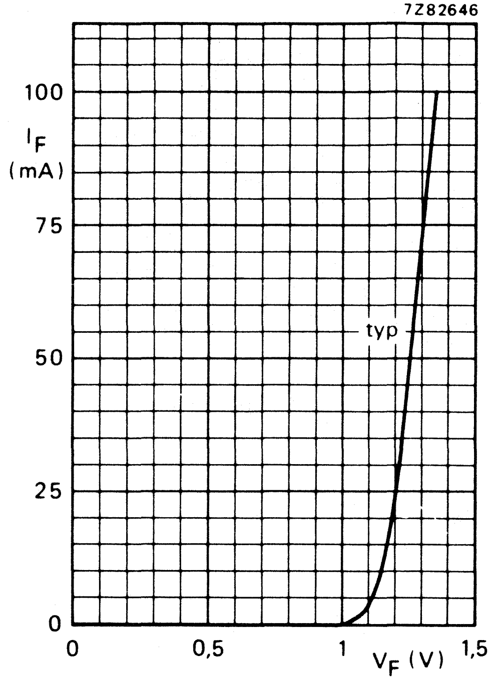


Fig. 5 T_{amb} = 25 °C.

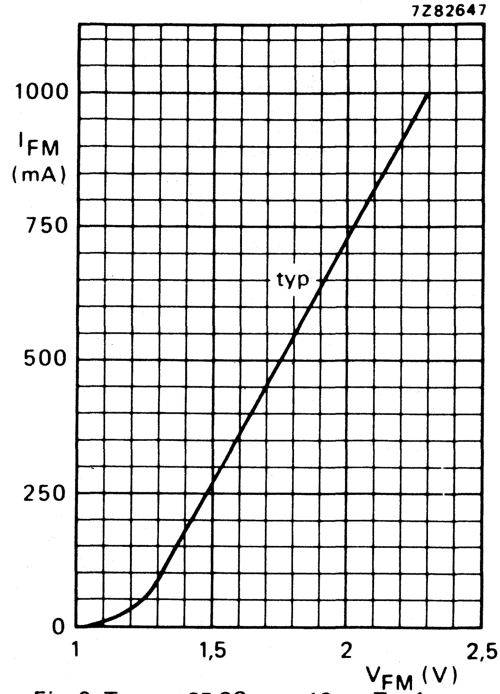


Fig. 6 T_{amb} = 25 °C; t_p = 10 μs; T = 1 ms.

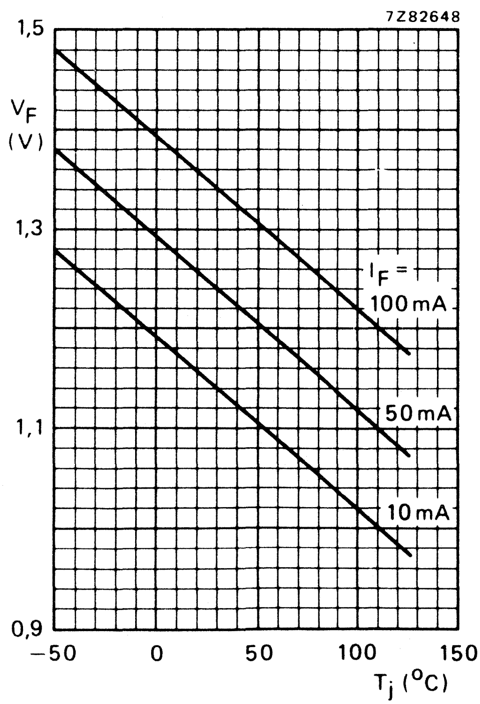


Fig. 7 Typical values.

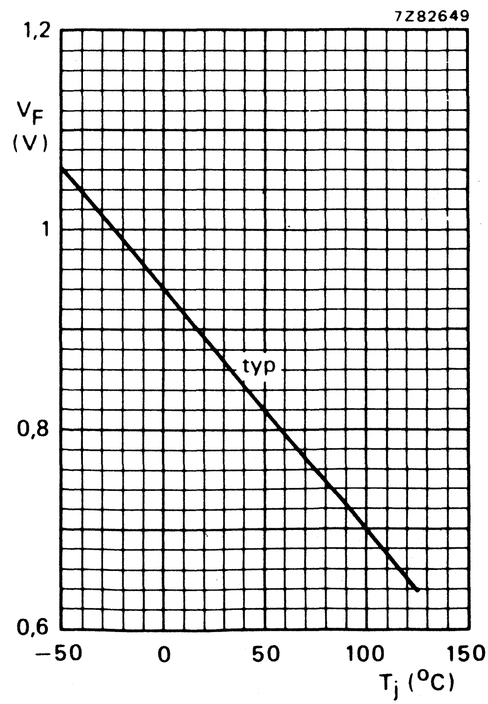


Fig. 8 I_F = 50 μA.

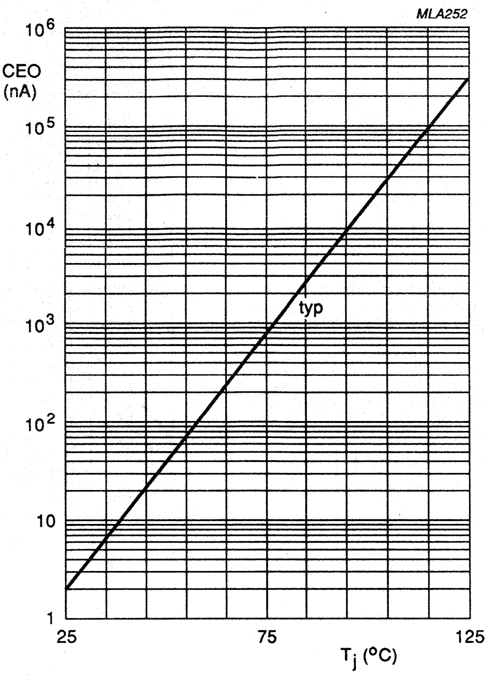


Fig. 9 $I_F = 0$; $V_{CE} = 10$ V; typical values.

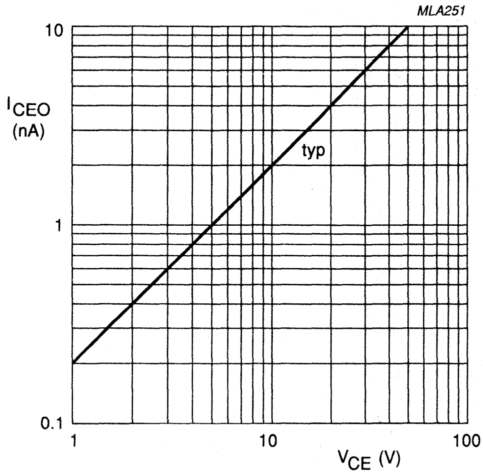


Fig. 10 $I_F = 0$; $T_j = 25\ ^oC$; typical values.

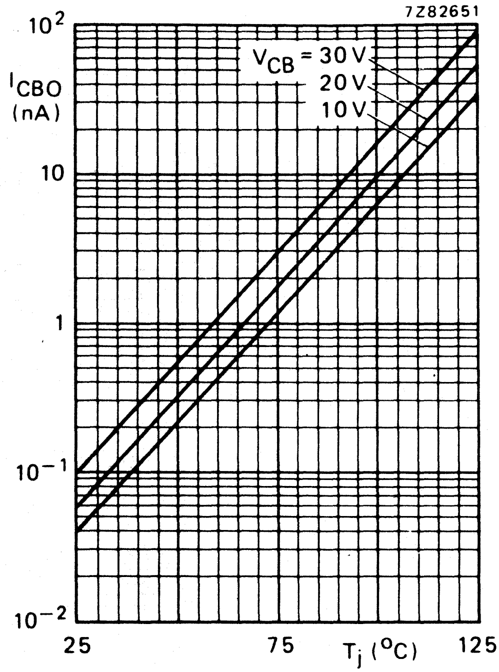


Fig. 11 Typical values.

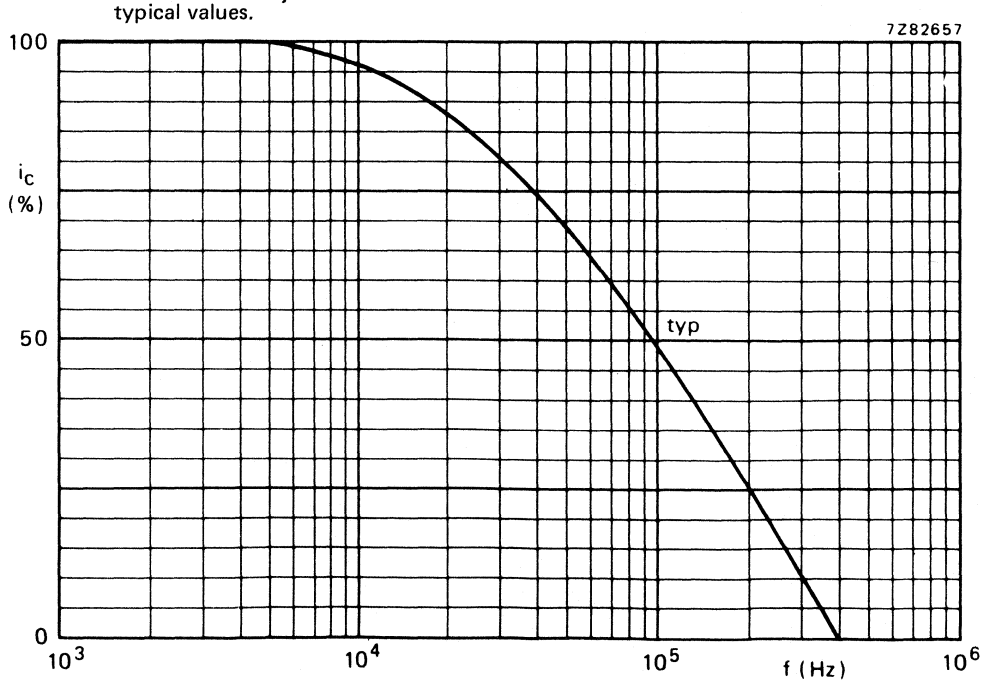


Fig. 12 $I_B = 0$; $I_C = 2$ mA; $V_{CC} = 5$ V; $R_L = 1\ k\Omega$; $T_{amb} = 25\ ^oC$.

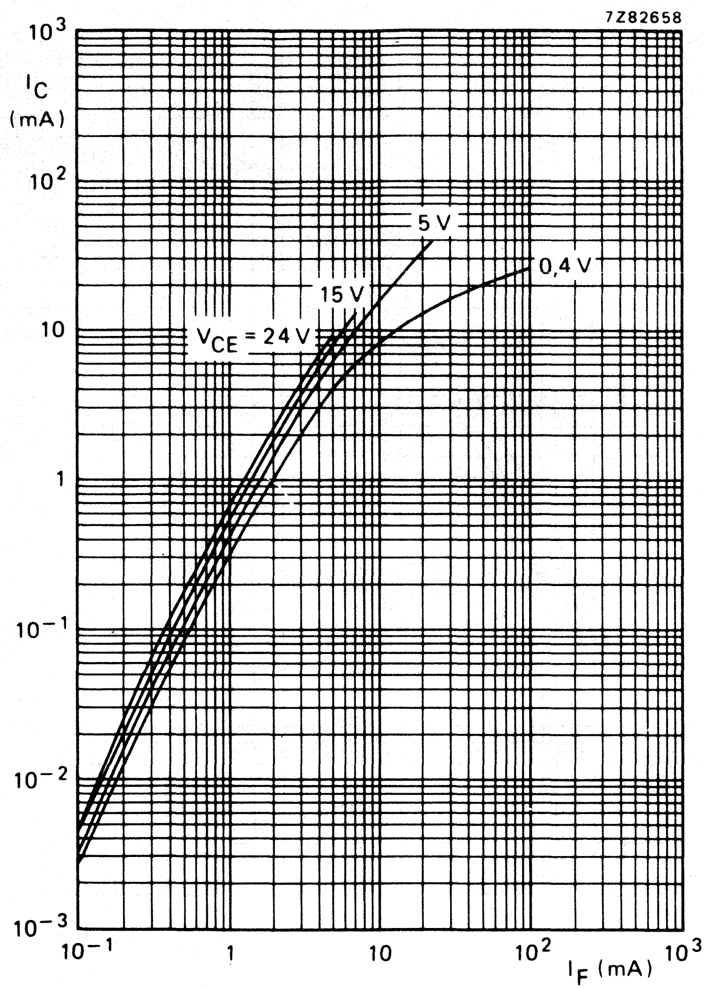


Fig. 13 T_{amb} = 25 °C, typical values.

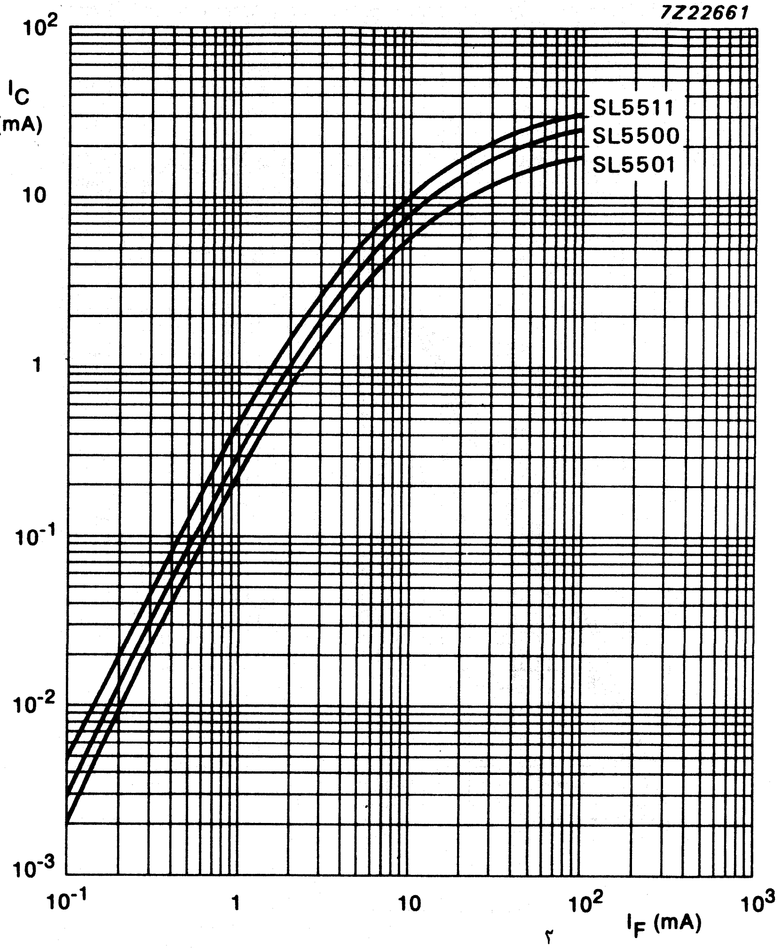


Fig. 14 Typical collector current versus forward current.

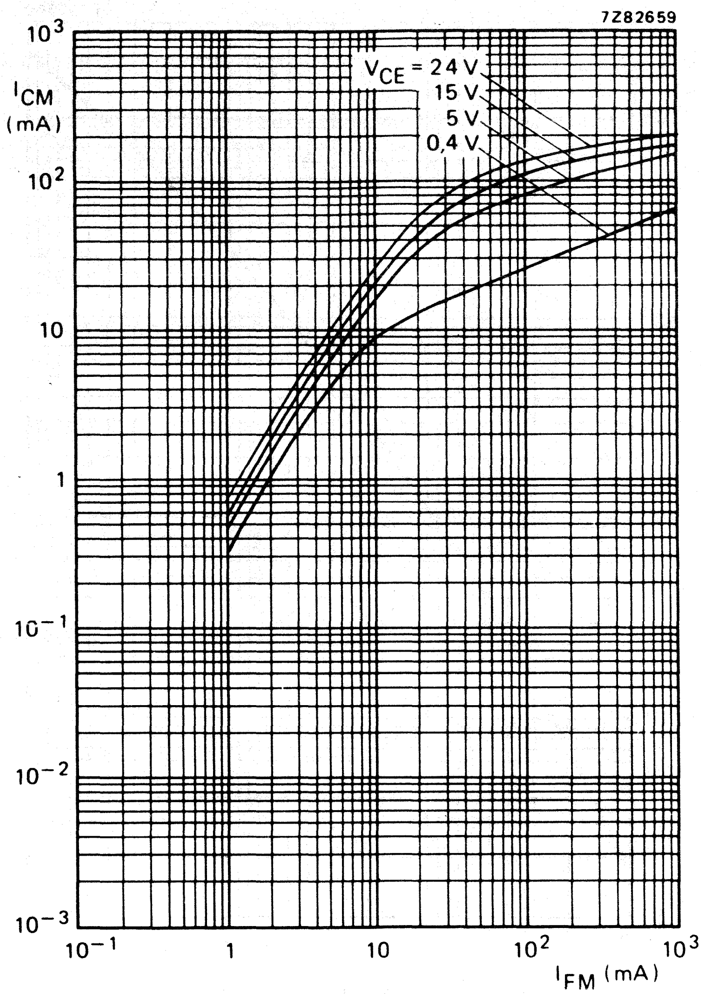


Fig. 15 T_{amb} = 25 °C; t_p = 10 µs; T = 1 ms; typical values.

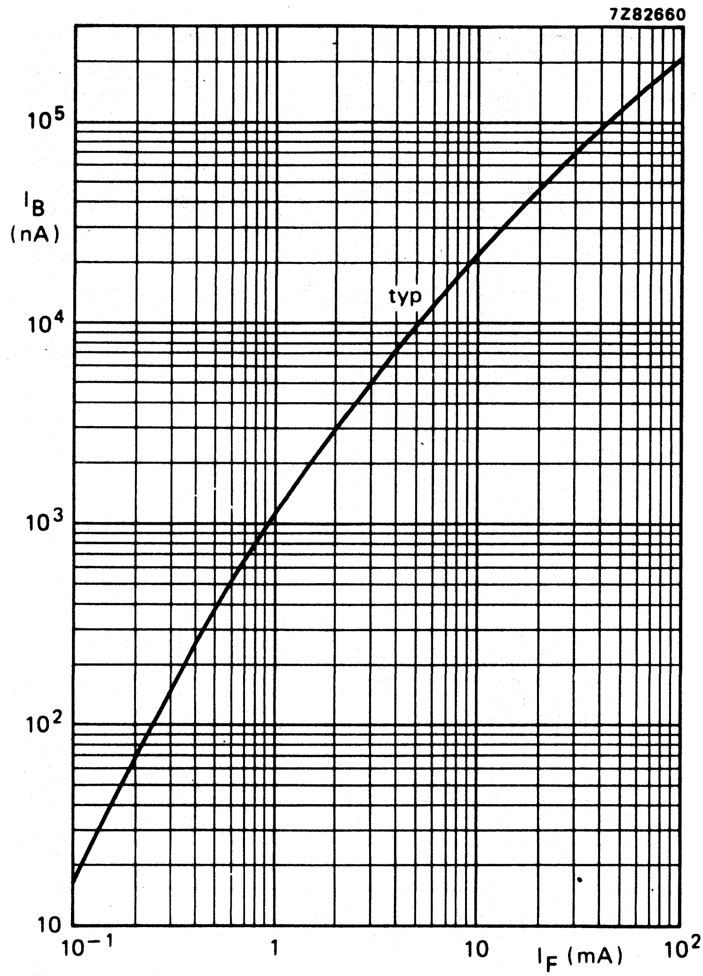


Fig. 16 V_{CB} = 5 V; T_{amb} = 25 °C.

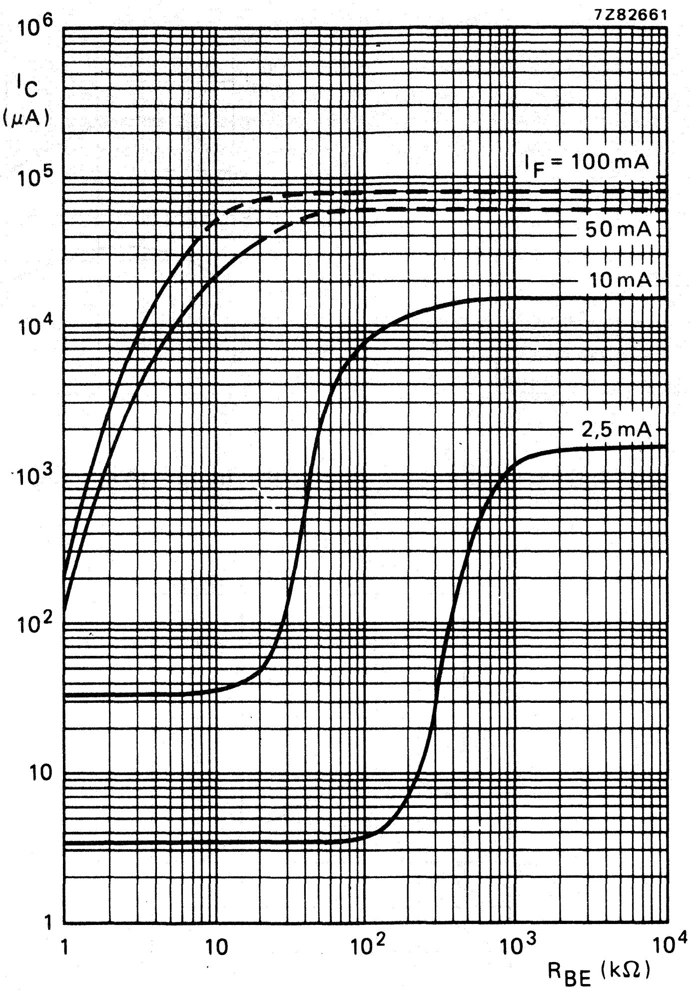


Fig. 17 $I_B = 0$; $V_{CE} = 5$ V; $T_{amb} = 25$ °C; typical values.

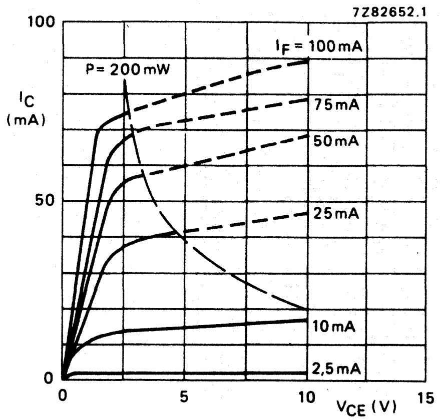


Fig. 18 T_{amb} = 25 °C; typical values.

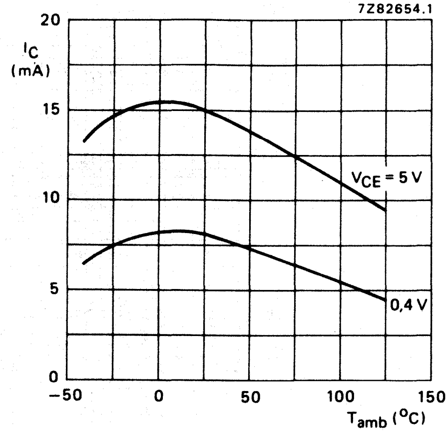


Fig. 19 I_F = 10 mA; typical values.

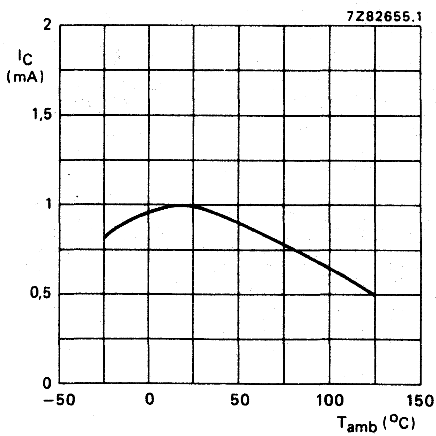


Fig. 20 I_F = 2 mA; V_{CE} = 0.4 V; typical values.

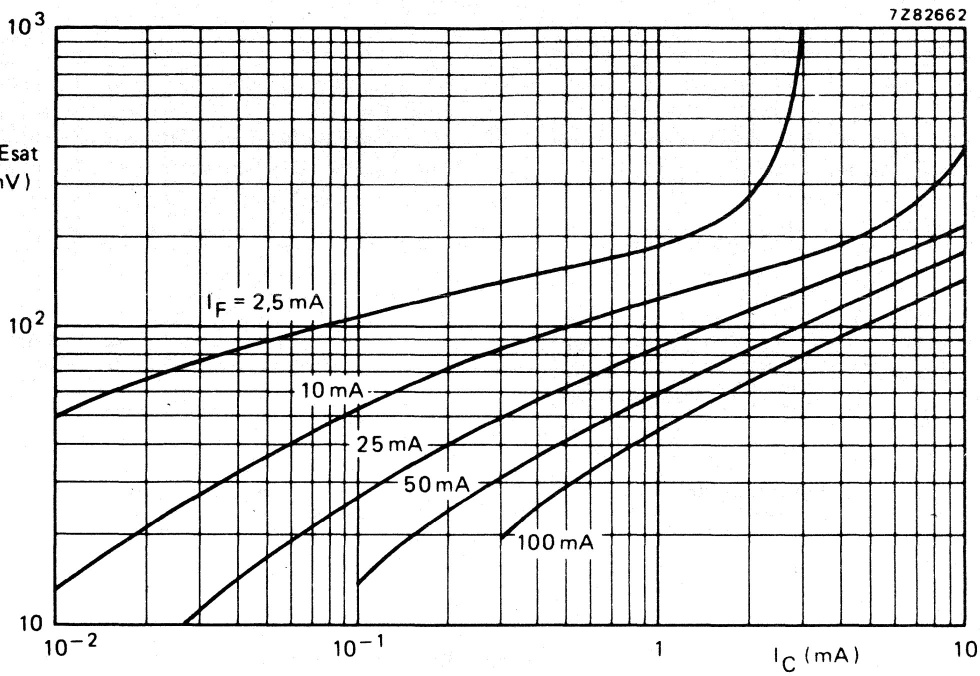


Fig. 21 $I_B = 0$; $T_{amb} = 25\ ^oC$; typical values.

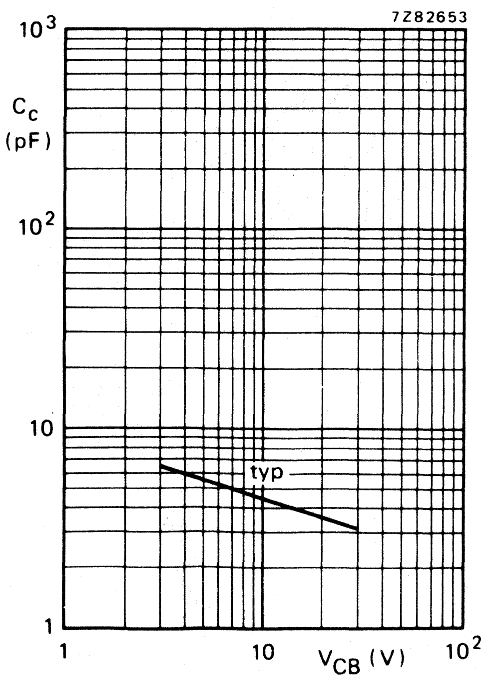


Fig. 22 f = 1 MHz; $T_{amb} = 25\ ^oC$.

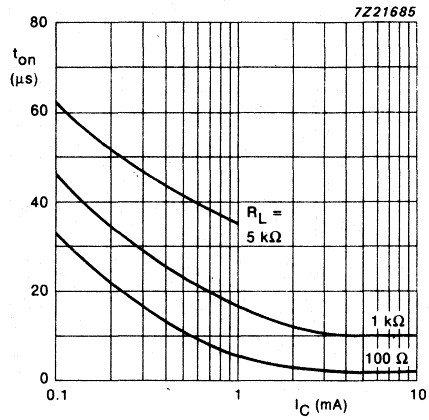


Fig. 23 SL5501.

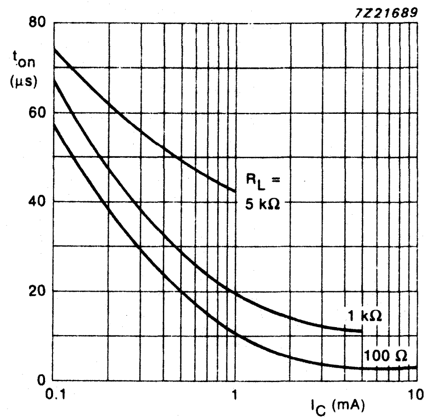


Fig. 24 SL5500.

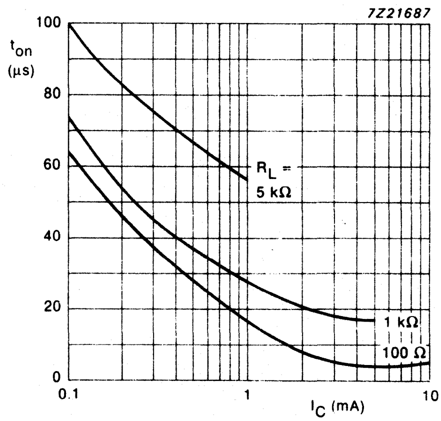


Fig. 25 SL5511.

Typical turn-on time versus collector current.

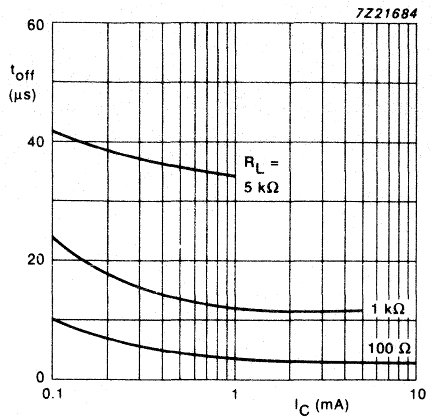


Fig. 26 SL5501.

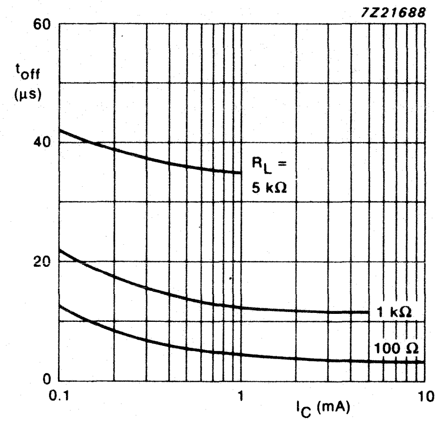


Fig. 27 SL5500.

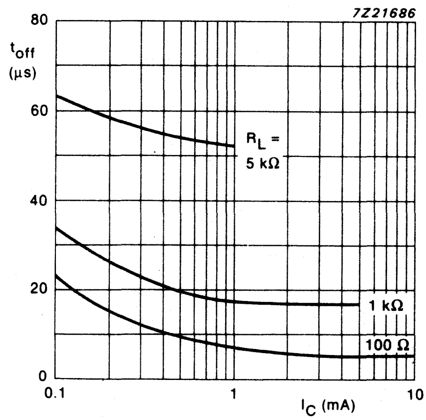


Fig. 28 SL5511.

Typical turn-off time versus collector current.

OPTOCOUPLER

Optically coupled isolator consisting of an infrared emitting GaAs diode and a high voltage silicon npn phototransistor with accessible base. Plastic envelope. Suitable for TTL integrated circuits.

Features

- High output/input DC current transfer ratio
- Low saturation voltage
- High isolation voltage of 2.5 kV RMS and 3.5 kV DC

This type is selected according to CNET specification and is intended for use on telephone and telegraphic applications.

CNET approved
CECC — Capability of approval GaAs optocouplers

QUICK REFERENCE DATA

Class V: climatical class (5 °C - 30 °C - 56 days) 864

Continuous reverse voltage	V_R	max.	3	V
DC forward current	I_F	max.	60	mA
(peak value); t_p = 10 μs; δ = 0.01	I_{FRM}	max.	3	A
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	100	mW
Transistor				
Collector-emitter voltage (open base)	V_{CEO}	max.	80	V
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	150	mW
Optocoupler				
Output/input DC current transfer ratio (CTR); I_F = 2 mA; V_{CE} = 5 V; (I_B = 0)	I_C/I_F	min.	0.15	
DC continuous voltage between input and output	V_{IOWM}	max.	800	V
Isolation voltage ;	V_{IO}	min.	3.5	kV
; (RMS value)			2.5	kV

MECHANICAL DATA

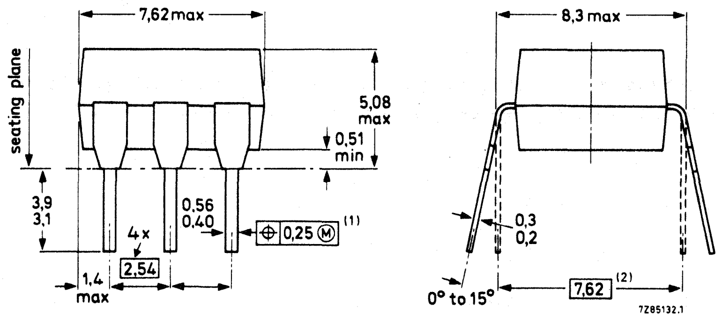
SOT90B (see Fig. 1).

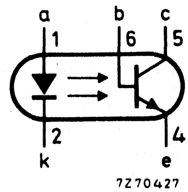
Products approved to CECC 20 004-001

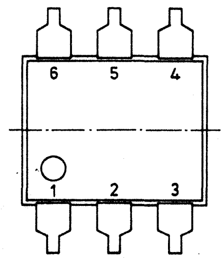
MECHANICAL DATA

Dimensions in mm

Fig.1 SOT90B.







⊕ Positional accuracy.

Ⓜ Maximum Material Condition.

(1) 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.

(2) When the leads are parallel, the tips are in position for automatic insertion.

RATINGS

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

Diode			
Continuous reverse voltage	V_R	max.	3 V
DC forward current	I_F	max.	60 mA
(peak value); t_p = 10 μs; δ = 0.01	I_{FRM}	max.	3 A
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	100 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
Emitter-base voltage (open collector)	V_{EBO}	max.	7 V
DC collector current	I_C	max.	100 mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	150 mW

Optocoupler

Storage temperature range	T_{stg}		−40 to + 100 °C
Operating ambient temperature	T_{amb}		−40 to +100 °C
Lead soldering temperature up to the seating plane; $t_{sld} < 10$ s	T_{sld}	max.	260 °C
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	250 mW

Thermal resistance

From junction to ambient in free air			
diode	$R_{th\ j\text{-}a}$	=	750 K/W
transistor	$R_{th\ j\text{-}a}$	=	650 K/W
optocoupler	$R_{th\ j\text{-}a}$	=	500 K/W

Isolation related values

External air gap (clearance) input terminals to output terminals	L(IO1)	min.	7.2 mm
External tracking path (creepage dist) input terminals to output terminals	L(IO2)	min.	7.0 mm
Tracking resistance (KB value)			KB-100/A
Internal plastic gap (clearance) isolation thickness between emitter and receiver		min.	1 mm

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Diode

Forward voltage			
I_F = 20 mA; T_{amb} = 25 to 70 °C	V_F	max.	1.3 V
I_F = 2 mA	V_F	max.	1.2 V
Reverse current			
V_R = 3 V; T_{amb} = 25 to 70 °C	I_R	max.	10 μA

Transistor

Collector cut-off current (dark);			
V_{CE} = 50 V	I_{CEO}	max.	50 nA
V_{CE} = 80 V	I_{CEO}	max.	10 μA
V_{CE} = 50 V; T_{amb} = 70 °C	I_{CEO}	max.	500 nA
V_{CE} = 30 V	I_{CBO}	max.	50 nA
Collector-emitter breakdown voltage I_C = 10 μA	$V_{(BR)CEO}$	min.	80 V
Collector-base breakdown voltage I_C = 10 μA	$V_{(BR)CBO}$	min.	120 V
Emitter-collector breakdown voltage I_E = 10 μA	$V_{(BR)ECO}$	min.	7 V
Emitter-base breakdown voltage I_E = 10 μA	$V_{(BR)EBO}$	min.	7 V

Optocoupler ($I_B = 0$) (see note 1)

Output/input DC current transfer ratio (CTR)			
$I_F = 2$ mA; $V_{CE} = 5$ V; $T_{amb} = 25$ to 70 °C	I_C/I_F	min.	0.15
$I_F = 10$ mA; $V_{CE} = 0.4$ V; $T_{amb} = 25$ to 70 °C	I_C/I_F	min.	0.25 to 4
Collector-emitter saturation voltage $I_F = 20$ mA; $I_C = 2$ mA	V_{CEsat}	max.	0.4 V
Isolation voltage, DC value t = 1 min. (see note 2)	V_{IO}	min.	3.5 kV
Isolation voltage, RMS value t = 1 min. (see note 2)	V_{IO}	min.	2.5 kV
Collector capacitance; $I_E = I_e = 0$; $V_{CB} = 10$ V; f = 1 MHz	C_{bc}	typ.	4.5 pF
Capacitance between input and output V = 0; f = 1 MHz	C_{io}	typ. max.	0.6 pF 1.3 pF
Insulation resistance between input and output $V_{IO} = \pm$ 500 V	R_{IO}	min. typ.	1 TΩ 10 TΩ
Switching times (see Figs 2 and 3) $I_F = 16$ mA; $V_{CC} = 5$ V; $R_L = 1$ kΩ			
Turn-on time	t_{on}	max.	50 μs
Turn-off time	t_{off}	max.	150 μs

Notes

1. Where the phototransistor receives light from the diode the O (for open base) has been omitted from the symbols.
2. Every single product is tested by applying an isolation test voltage of 3750 V AC (RMS) for 2 seconds between the shorted input (diode) leads and the shorted output (phototransistor) leads with a detection current of about 1 μA.

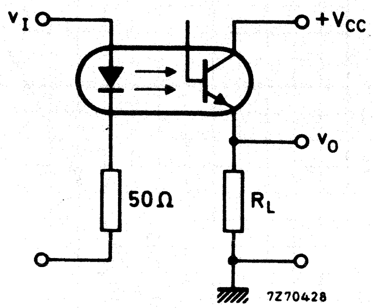


Fig. 2 Switching circuit.

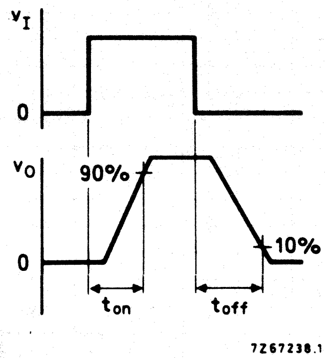


Fig. 3 Waveforms.

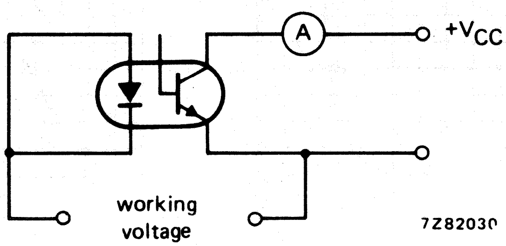


Fig. 4.

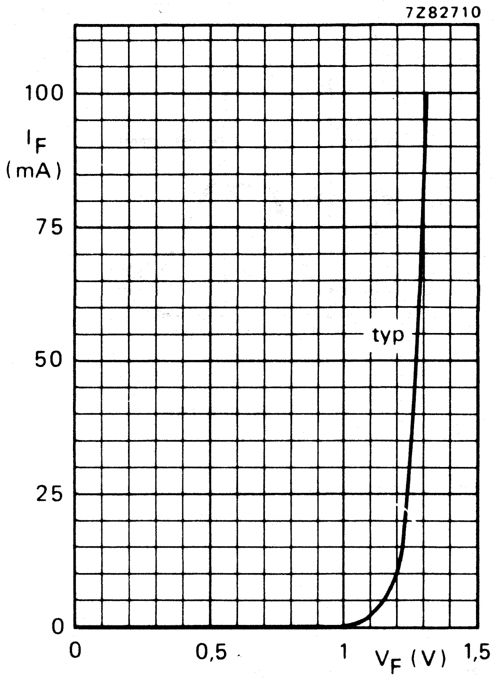


Fig. 5 T_{amb} = 25 °C.

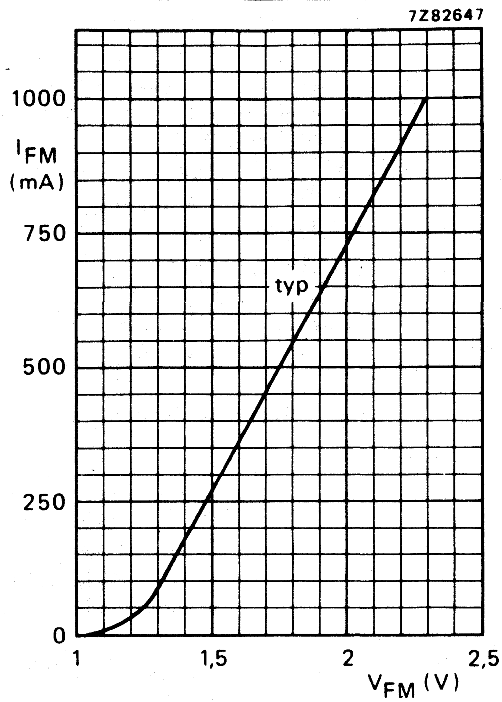


Fig. 6 T_{amb} = 25 °C; t_p = 10 μs; T = 1 ms.

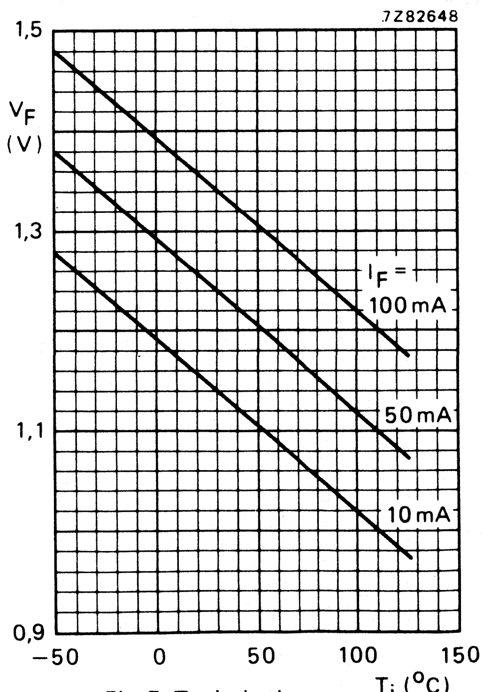


Fig. 7 Typical values.

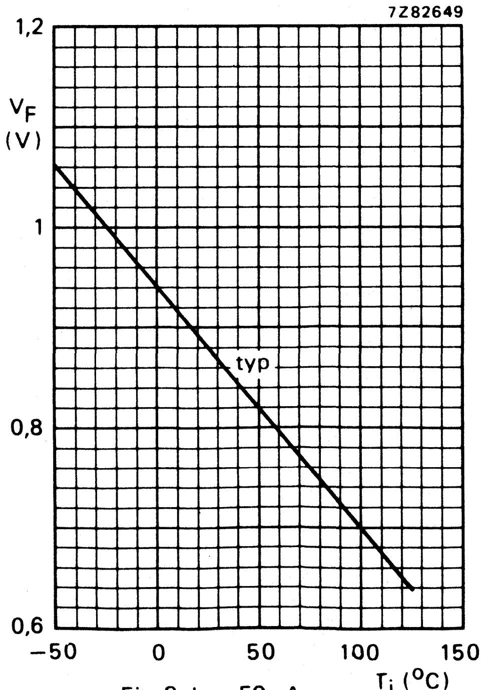


Fig. 8 I_F = 50 μA.

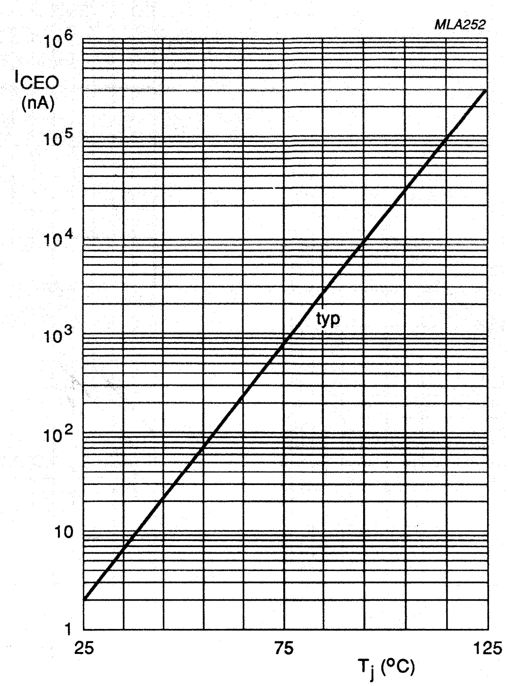


Fig. 9 $I_F = 0$; $V_{CE} = 50$ V; typical values.

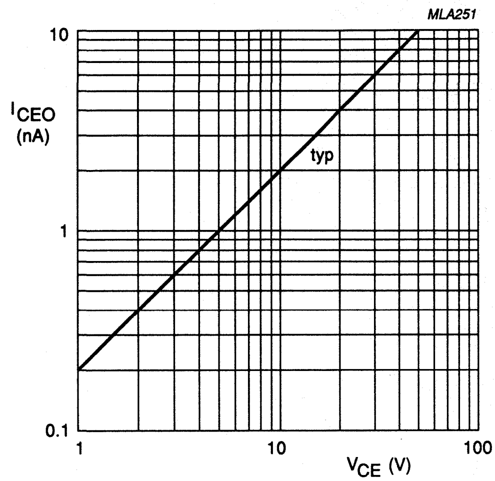


Fig. 10 $I_F = 0$; $T_j = 25\ ^oC$; typical values.

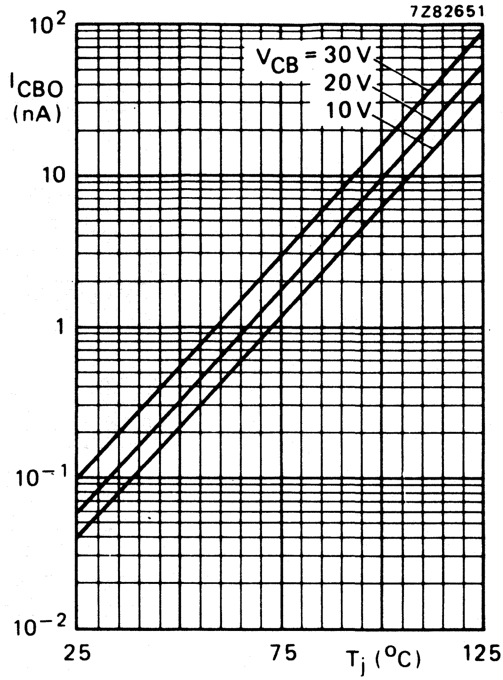


Fig. 11 Typical values.

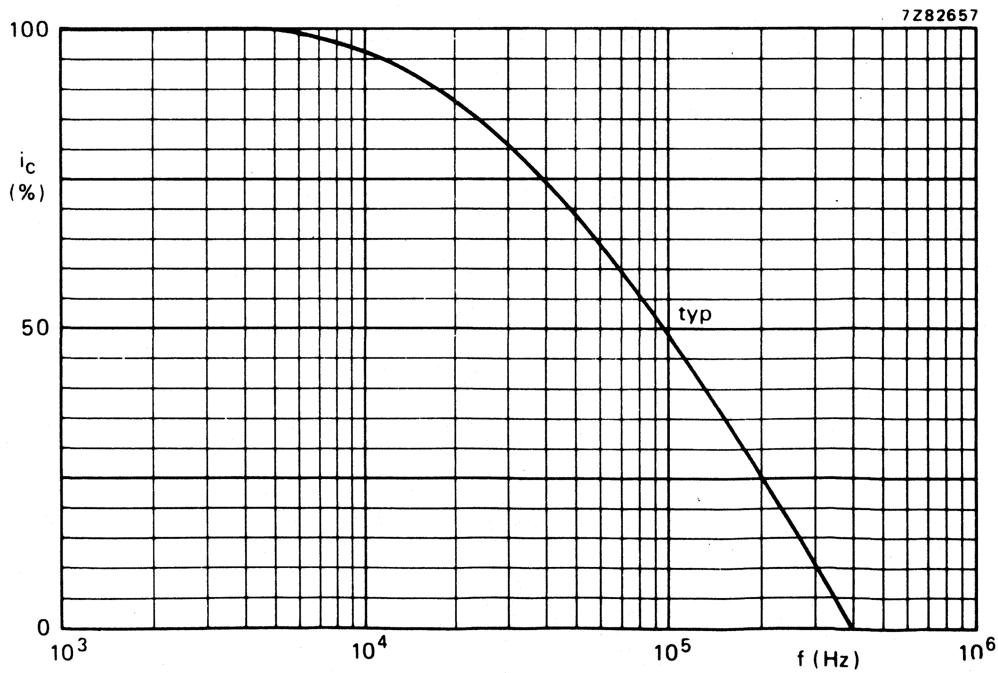


Fig. 12 $I_B = 0$; $I_C = 2$ mA; $V_{CC} = 5$ V, $R_L = 1\ k\Omega$; $T_{amb} = 25\ ^oC$.

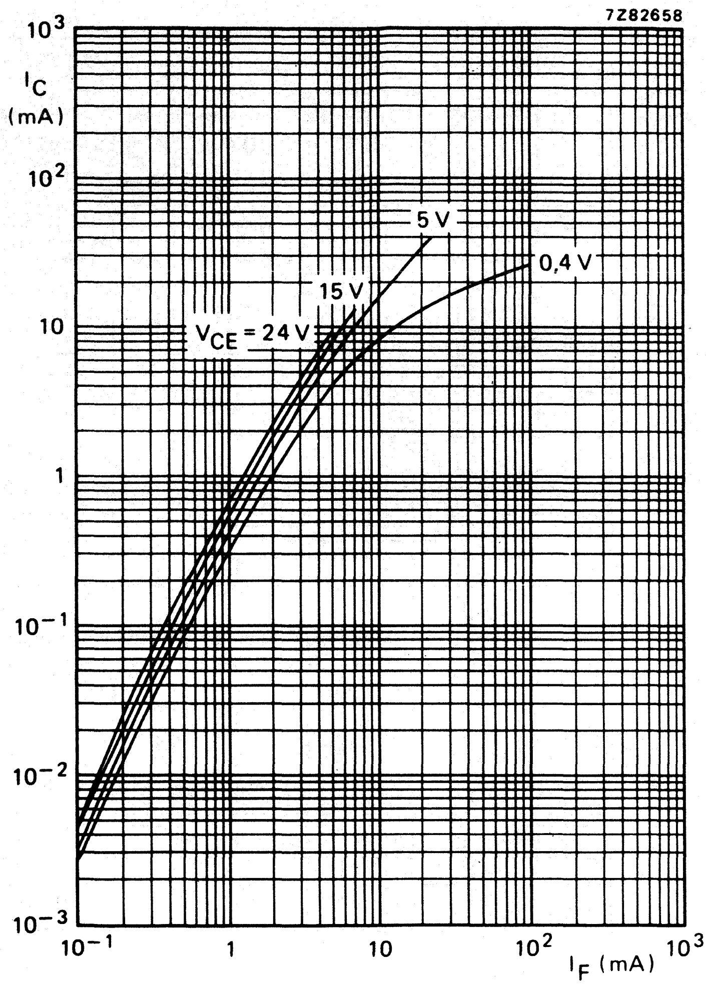


Fig. 13 T_{amb} = 25 °C, typical values.

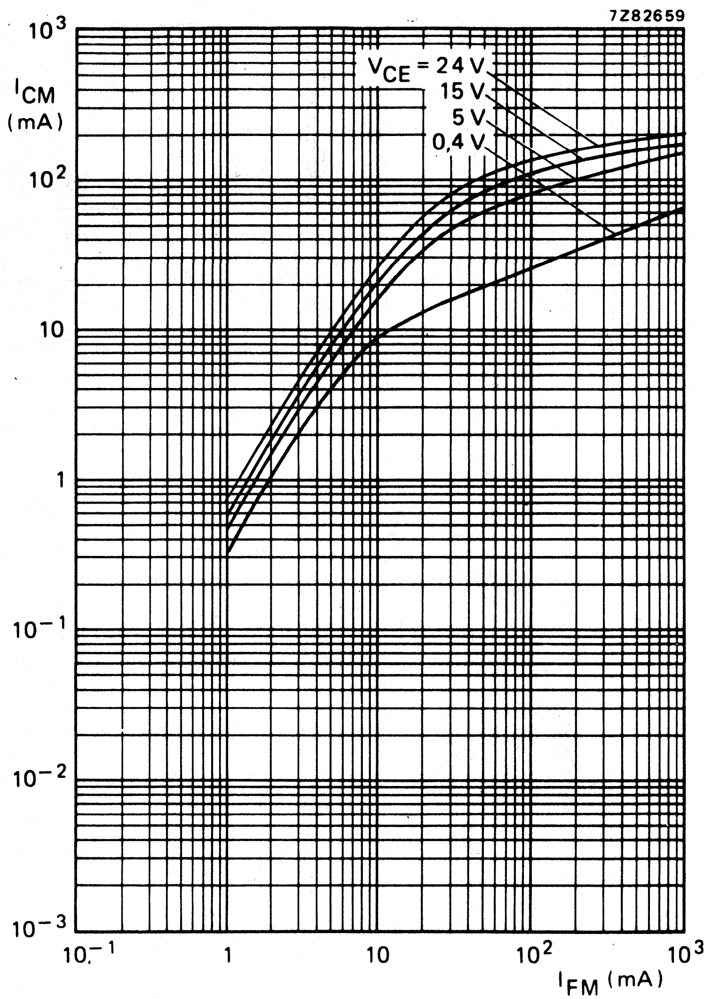


Fig. 14 T_{amb} = 25 °C; t_p = 20 μs; T = 2 ms; typical values.

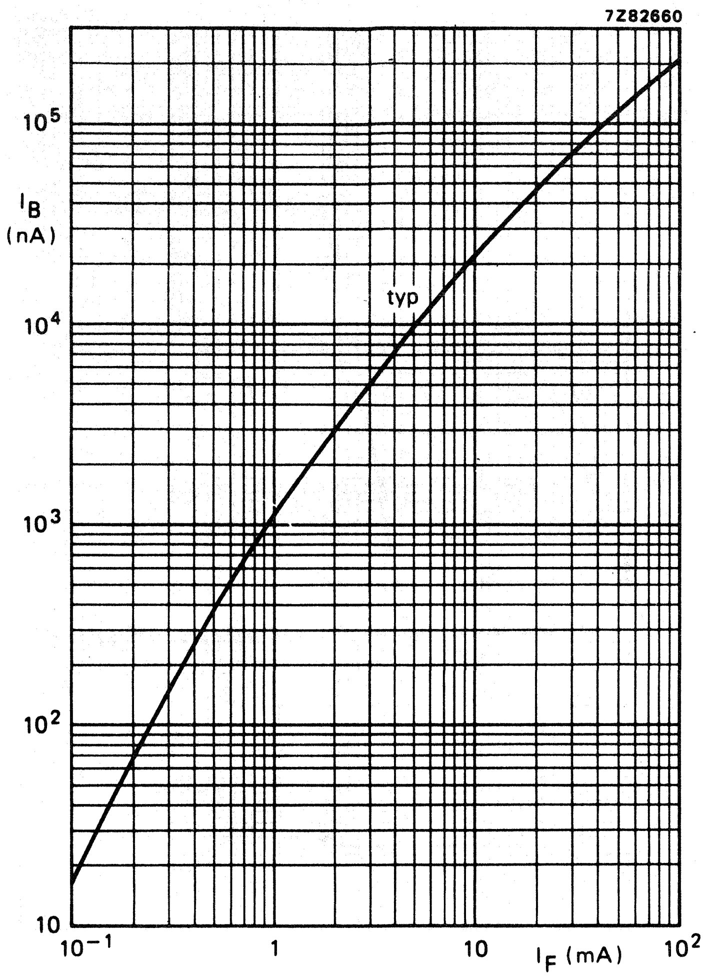


Fig. 15 V_{CB} = 5 V; T_{amb} = 25 °C.

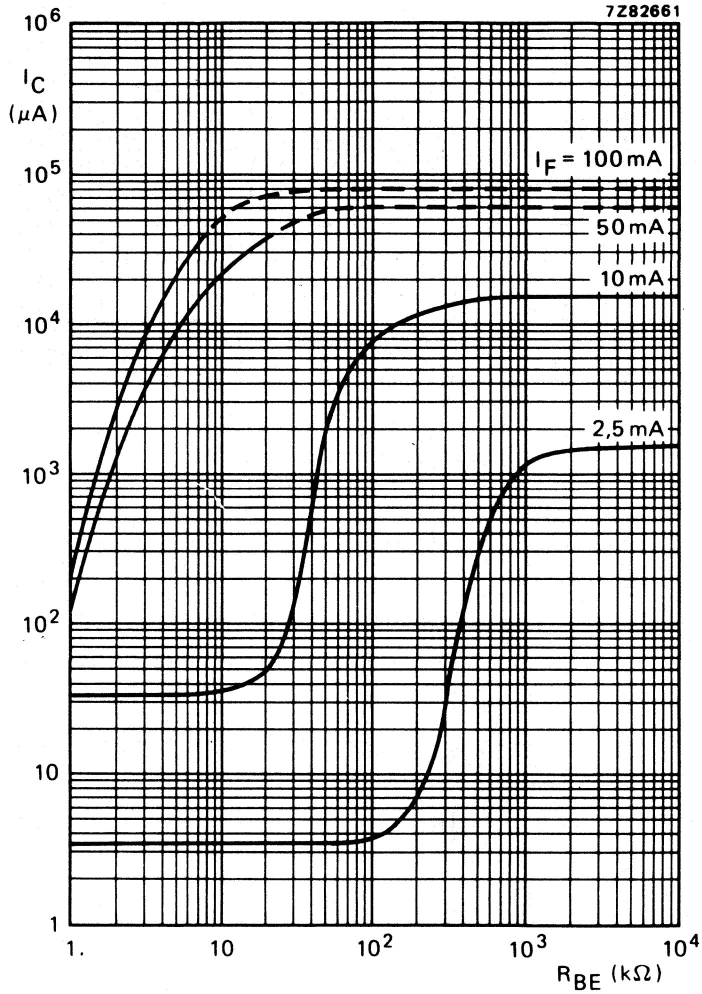


Fig. 16 $I_B = 0$; $V_{CE} = 5$ V; $T_{amb} = 25$ °C; typical values.

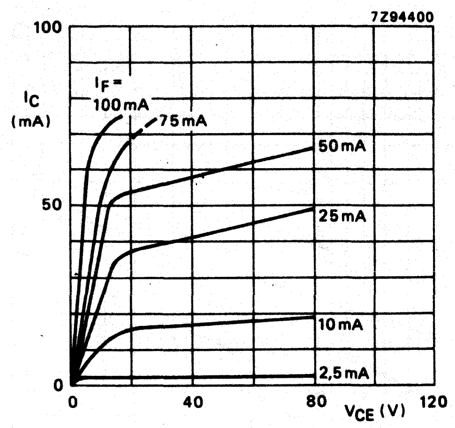


Fig. 17 T_{amb} = 25 °C; typical values.

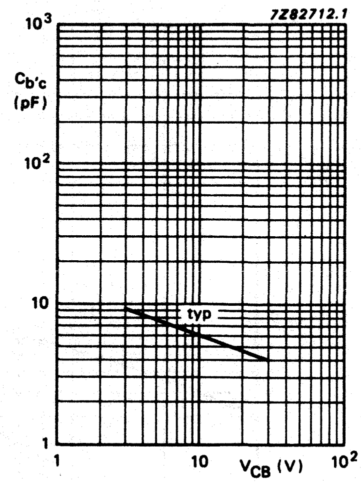


Fig. 18 f = 1 MHz; T_{amb} = 25 °C.

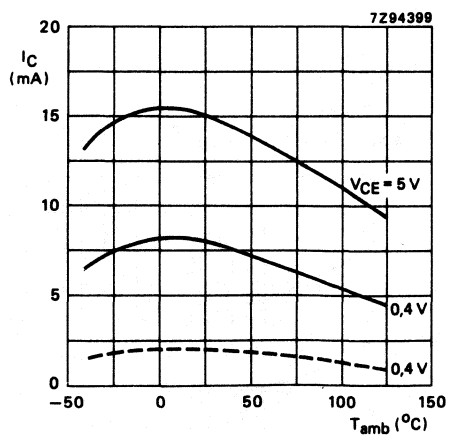


Fig. 19 I_F = 10 mA; typical values.
— — — min. values.

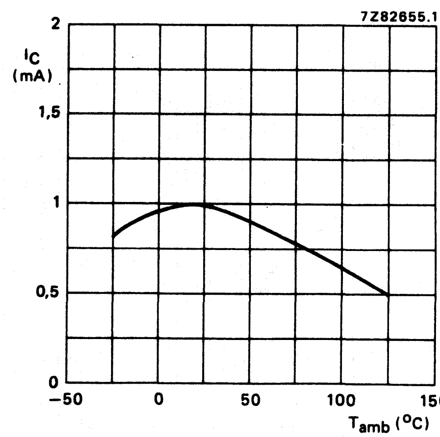


Fig. 20 I_F = 2 mA; typical values.
V_{CE} = 0.4 V.

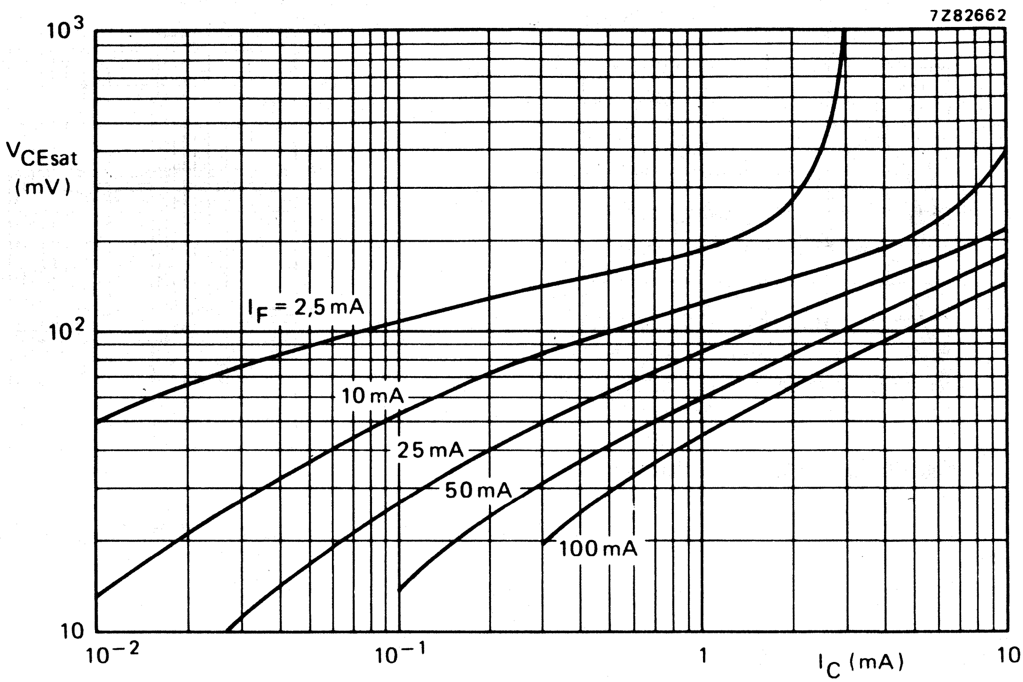


Fig. 21 $I_B = 0$; $T_{amb} = 25$ °C; typical values.

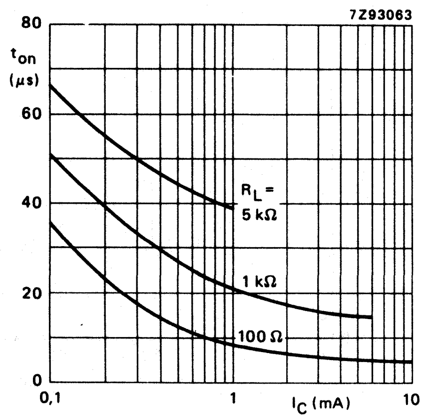


Fig. 22 $I_B = 0$; $V_{CC} = 5$ V; $T_{amb} = 25$ °C; typical values. (See also Fig. 25.)

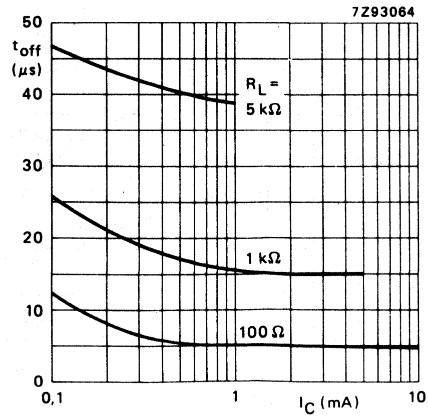


Fig. 23 $I_B = 0$; $V_{CC} = 5$ V; $T_{amb} = 25$ °C, typical values. (See also Fig. 25.)

High-speed optocoupler SL5505S

FEATURES

- Short propagation delay times
- Low saturation voltage
- High transient immunity
- High degree of AC and DC insulation (2500 V (RMS) and 3500 V (DC)).

DESCRIPTION

The SL5505S is a fast switching optocoupler, comprising an infrared emitting GaAlAs diode, optically coupled to a silicon photodetector in an 8-pin dual-in-line (DIL) SOT97F plastic envelope.

This type is selected in accordance with a specification from the French CNET, and is intended for use in telephone, telegraph and general telecommunications applications.

PINNING

PIN	DESCRIPTION
1	not connected
2	anode
3	cathode
4	not connected
5	ground
6	V_O
7	V_B
8	V_{CC}

APPROVALS

STANDARD	REFERENCE
UL	covered under UL component recognition FILE E90700
VDE	approved in accordance with VDE 0883/6.80 reference voltage (VDE 0110b Tab 4): 380 V (AC)/450 V (DC) (isolation group C) complied for reinforced isolation at 250 V (AC) with: DIN 57804/VDE 0804/1.83 (isolation group C)
CNET	listed on LNZ: class T climatic class 5/70/56 °C, 864 days

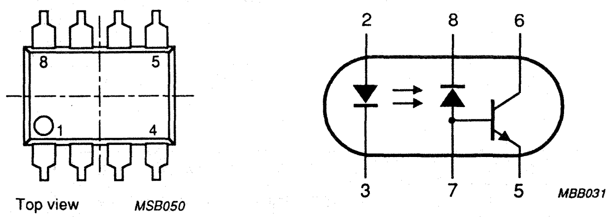


Fig.1 Simplified outline and symbol.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Diode					
I_F	forward current	DC value	–	100	mA
V_R	reverse voltage	DC value	–	5	V
Detector					
I_C	collector current		–	10	mA
V_{CEO}	collector-emitter voltage	open base		18	V
Optocoupler					
V_{IO}	isolation voltage				
		DC value	3.5	–	kV
		RMS value	2.5	–	kV
I_C/I_F	DC current transfer ratio (CTR)	I_F = 10 mA; V_O = 0.4 V; V_{CC} = 4.5 V	0.2	4	
t_{PHL}	propagation delay time to logic low at output	I_F = 10 mA; V_{CC} = 5 V; R_L = 2.5 kΩ	–	0.8	µs
t_{PLH}	propagation delay time to logic high at output	I_F = 10 mA; V_{CC} = 5 V; R_L = 2.5 kΩ	–	0.8	µs
CMH	common mode transient immunity (logic HIGH)	V_{CM} = 10 $V_{(p\text{-}p)}$	1	–	kV/µs
CML	common mode transient immunity (logic LOW)	V_{CM} = 10 $V_{(p\text{-}p)}$	–1	–	kV/µs

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Diode					
I_F	forward current	DC value	–	100	mA
I_{FRM}	forward current	peak value; t_p = 1 μs; f = 300 Hz	–	1	A
V_R	reverse voltage	DC value	–	5	V
P_{tot}	total power dissipation	up to T_{amb} = 70 °C	–	250	mW
Detector					
I_C	collector current	DC value	–	10	mA
V_{CEO}	collector-emitter voltage (pins 6 & 5)		–	18	V
V_O	output voltage (pins 6 & 5)		–0.5	18	V
V_{CC}	supply voltage (pins 8 & 5)		–0.5	18	V
V_{EBO}	emitter-base voltage (pins 7 & 5)		–	5	V
P_{tot}	total power dissipation	up to T_{amb} = 70 °C	–	100	mW
Optocoupler					
T_{stg}	storage temperature range		–55	150	°C
T_{amb}	ambient operating temperature range		–40	100	°C
T_{sld}	soldering temperature up to the seating plane	T_{sld} < 10 s	–	260	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	MAX.	UNIT
Diode			
$R_{th\ j\text{-}a}$	from junction to ambient in free air	500	K/W
$R_{th\ j\text{-}a}$	from junction to ambient when mounted on PCB	400	K/W
Transistor			
$R_{th\ j\text{-}a}$	from junction to ambient in free air	500	K/W
$R_{th\ j\text{-}a}$	from junction to ambient when mounted on PCB	400	K/W

ISOLATION RELATED VALUES

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
L(IO1)	external air gap (clearance)	between input and output terminals	7.2	–	–	mm
L(IO2)	external tracking path (creepage distance)	between input and output terminals	7	–	–	mm
	internal plastic gap (clearance)	isolation thickness between emitter and receiver	1	–	–	mm

CLASSIFICATION CATEGORIES

Tracking resistance	KB-100/A

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Diode						
V_F	forward voltage	I_F = 10 mA	1.2	1.5	1.9	V
I_R	reverse current	V_R = 5 V	–	–	10	μA
C_d	diode capacitance	V_D = 0; f = 1 MHz	–	200	–	pF
Detector						
$V_{(BR)CEO}$	collector-emitter breakdown voltage	I_C = 10 mA	18	–	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	I_E = 0.1 mA	5	–	–	V
$V_{(BR)CBH}$	collector-base breakdown voltage (note 3)	I_C = 0.1 mA	30	–	–	V
I_{OH}	logic high output current	I_F = 0; $V_O = V_{CC}$ = 5.5 V	–	5	500	nA
		I_F = 0; $V_O = V_{CC}$ = 15 V	–	–	10	μA
I_{CCH}	logic high supply current	I_F = 0; I_O = 0; V_{CC} = 15 V	–	–	1	μA
I_{CCL}	logic low supply current	I_F = 10 mA; I_O = 0; V_{CC} = 15 V	–	20	–	μA
Optocoupler						
I_C/I_F	DC current transfer ratio (CTR)	I_F = 10 mA; V_O = 0.4 V; V_{CC} = 4.5 V	0.2	0.4	4	
		I_F = 2 mA; V_O = 5 V; V_{CC} = 4.5 V	0.1	–	–	
V_{OL}	logic low output voltage	I_F = 10 mA; I_C = 2 mA; V_{CC} = 4.5 V	–	0.1	0.4	V
I_{OHW}	logic high output current (note 1)	V_{CC} = 5.5 V; V_W = 2.5 kV (DC); T_{amb} = 70 °C see Fig.7	–	–	5	μA
I_{CEO}	collector-emitter cut-off current	V_{CE} = 10 V	–	–	50	nA
I_{CBO}	collector-base cut-off current	V_{CB} = 22 V	–	–	50	nA
V_{IO}	isolation voltage (note 2)	t = 1 min				
		DC value	2.5	–	–	kV
		RMS value	3.5	–	–	kV

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Optocoupler						
C_{io}	capacitance between input and output	$V_{IO} = 0$; f = 1 MHz	–	0.6	1.3	pF
R_{IO}	insulation resistance between input and output	$V_{IO} = \pm 500$ V; $T_{amb} = 25$ °C	10^{12}	10^{13}	–	Ω
		$V_{IO} = \pm 500$ V; $T_{amb} = 100$ °C	10^{11}	–	–	Ω
Switching times (see Figs 2 and 3)						
t_{PHL}	propagation delay time to logic low at output	$I_F = 10$ mA; $V_{CC} = 5$ V; $R_L = 2.5$ kΩ	–	0.5	0.8	µs
t_{PLH}	propagation delay time to logic high at output	$I_F = 10$ mA; $V_{CC} = 5$ V; $R_L = 2.5$ kΩ	–	0.45	0.8	µs
Transient immunity (see Fig.4)						
CMH	common mode transient immunity (logic HIGH)	$I_F = 0$; $V_{CC} = 5$ V; $V_{CM} = 10\ V_{(p-p)}$; $R_L = 2.5$ kΩ	1	–	–	kV/µs
CML	common mode transient immunity (logic LOW)	$I_F = 10$ mA; $V_{CC} = 5$ V; $V_{CM} = 10\ V_{(p-p)}$; $R_L = 2.5$ kΩ	−1	–	–	kV/µs

Notes

1. This parameter is the maximum collector-emitter leakage current measured when a high DC voltage is applied between the emitter and the two shorted diode leads.
2. Every product is tested by applying an isolation test voltage of 3000 V (RMS) for 2 s between all shorted input side leads and all shorted output side leads, with a detection current of approximately 1 µA.
3. Cathode connected to collector.

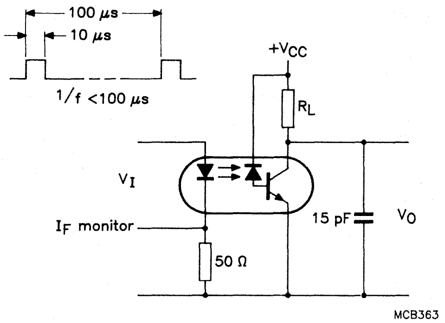


Fig.2 Switching times test circuit.

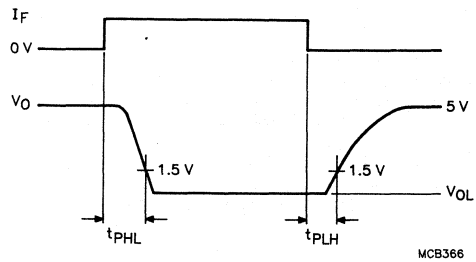


Fig.3 Switching times waveforms.

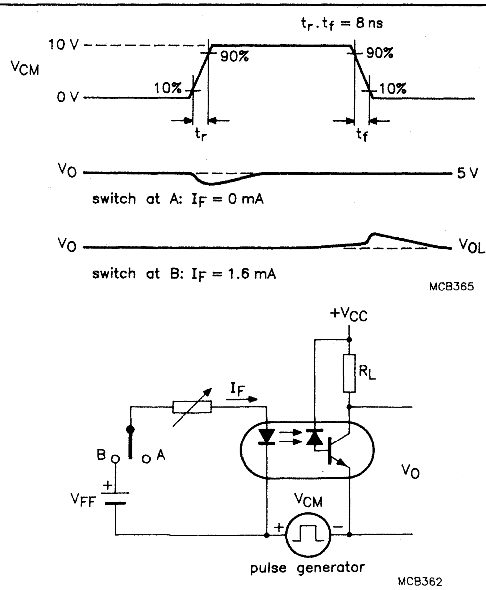


Fig.4 Transient immunity test circuit and waveforms.

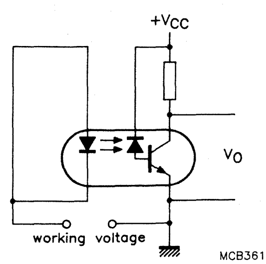
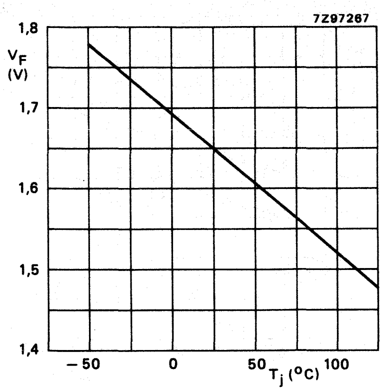


Fig.5 Logic output current test circuit.



I_F = 10 mA.

Fig.6 Forward voltage as a function of junction temperature, typical values.

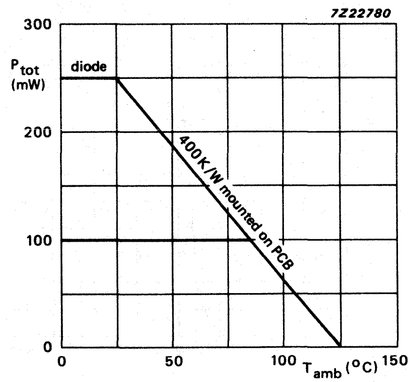
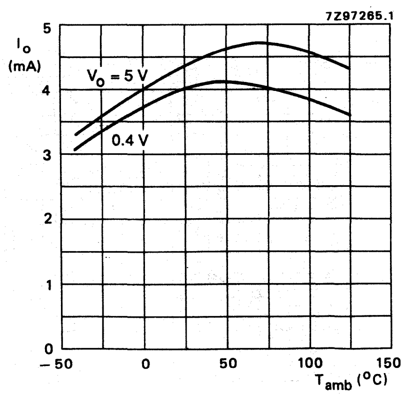
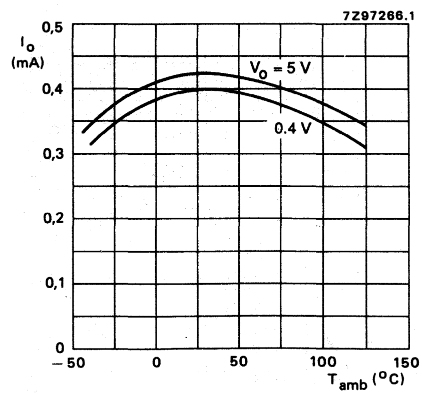


Fig.7 Total power dissipation as a function of ambient temperature.



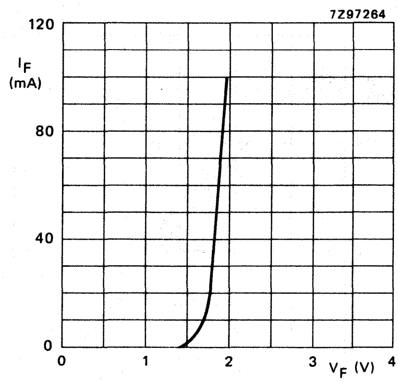
V_{CC} = 5 V; I_F = 10 mA.

Fig.8 Output current as a function of ambient temperature, typical values.



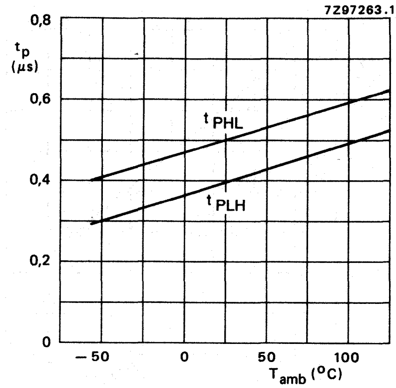
V_{CC} = 5 V; I_F = 2 mA.

Fig.9 Output current as a function of ambient temperature, typical values.



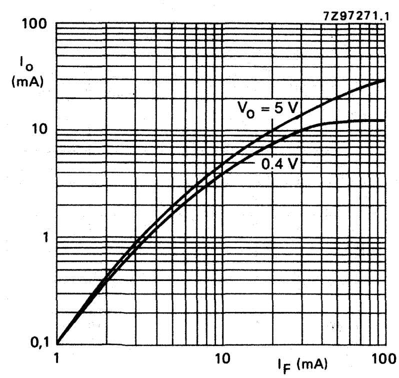
T_{amb} = 25 °C.

Fig.10 Forward current as a function of forward voltage; typical values.



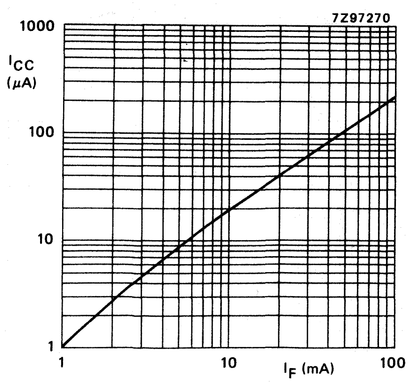
I_F = 10 mA; V_{CC} = 5 V; R_L = 2.5 kΩ; typical values.

Fig.11 Propagation delay time as a function of ambient temperature.



V_{CC} = 5 V.

Fig.12 Output current as a function of forward current, typical values.



V_{CC} = 15 V; I_O = 0.

Fig.13 Supply current as a function of forward current, typical values.

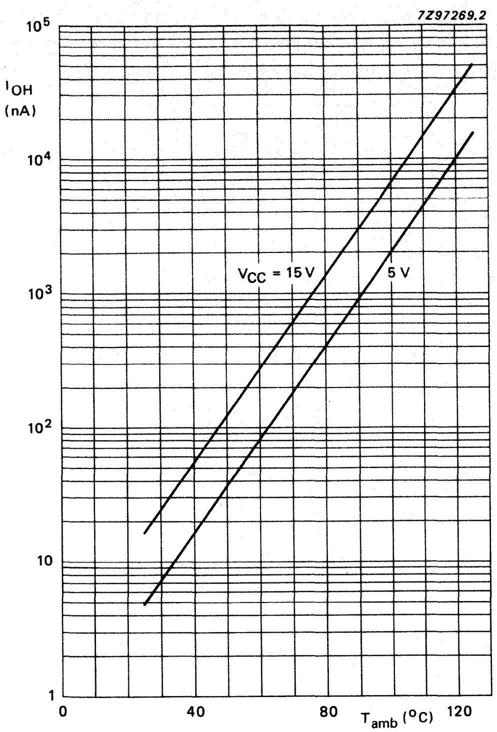
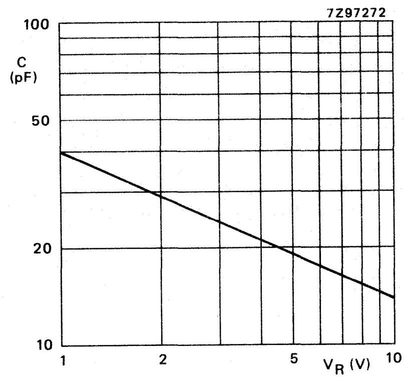


Fig.14 Logic high output current as a function of ambient temperature, typical values.



T_{amb} = 25 °C.

Fig.15 Photodiode capacitance.

FEATURES

- A pin distance of 10.16 mm
- An external clearance of 9.6 mm mimimum and an external creepage distance of 8 mm minimum
- High current transfer ratio and low saturation voltage, making the devices suitable for use with TTL integrated circuits
- High degree of AC and DC insulation (3750 V (RMS) and 5300 V (DC))
- Collector-emitter breakdown voltage of 50 V
- Low isolation capacitance of 1 pF maximum.

DESCRIPTION

The SL5582 and SL5583 are high voltage optocouplers consisting of a GaAs infrared emitter, coupled to a silicon npn phototransistor, in a dual-in-line (DIL) SOT231 plastic envelope. The base of the phototransistor is unconnected for the SL5582 and connected for the SL5583. These high voltage optocouplers are intended for use in "mains" applications.

APPROVALS

These types are on the CNET preferential list (S position).

STANDARD	REFERENCE
UL	covered under UL component recognition FILE E90700
BSI	certification in accordance with BS415:1990; BS7002:1989; Class II applications
NORDIC	tested for applications (reinforced isolation); Class II applications for pluggable apparatus in normal tight execution
SETI	in accordance with IEC 65, 380, 950 & 335
SEMKO	in accordance with IEC 65, 380, 950 & 335
NEMKO	in accordance with IEC 65, 380, 950 & 335
DEMKO	in accordance with IEC 65, 380, 950 & 335
VDE	approved in accordance with VDE 0883/6.80 reference voltage (VDE 0110b Tab 4): 500 V (AC)/600 V (DC) complied for reinforced isolation at 250 V (AC) with: DIN IEC 380/VDE 0806/8.81 DIN IEC 435/VDE0805 "ENTWURF", Nov. 84 DIN 57804/VDE 0804/1.83 (isolation group C) DIN VDE 0860/8.86/HD 195 S4

High-voltage optocouplers SL5582/SL5583

PINNING - SL5582

PIN	DESCRIPTION
1	anode
2	cathode
3	not connected
4	emitter
5	collector
6	not connected

PINNING - SL5583

PIN	DESCRIPTION
1	anode
2	cathode
3	not connected
4	emitter
5	collector
6	base

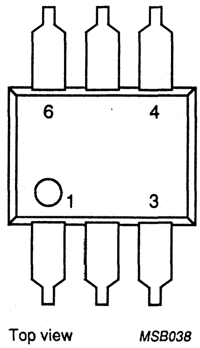


Fig.1 Simplified outline.

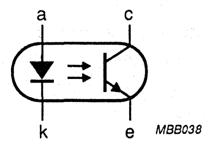


Fig.2 Symbol, SL5582.

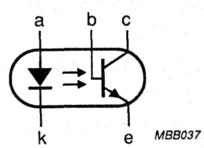


Fig.3 Symbol, SL5583.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Diode					
I_F	forward current	DC value	–	100	mA
V_R	reverse voltage	DC value	–	5	V
P_{tot}	total power dissipation	up to T_{amb} = 25 °C	–	200	mW
Transistor					
I_C	collector current	DC value	–	100	mA
V_{CEO}	collector-emitter voltage	open base	–	50	V
P_{tot}	total power dissipation	up to T_{amb} = 25 °C	–	200	mW
Optocoupler					
I_C/I_F	DC current transfer ratio (CTR)	I_F = 10 mA; V_{CE} = 5 V	0.4	3.2	
V_{IO}	isolation voltage				
		DC value	5.3	–	kV
		RMS value	3.75	–	kV

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Diode					
V_R	continuous reverse voltage		–	5	V
I_F	forward current	DC value	–	100	mA
I_{FRM}	forward current	peak value; t_{on} = 10 μs; δ = 0.01	–	3	A
P_{tot}	total power dissipation	up to T_{amb} = 25 °C	–	200	mW
Transistor					
V_{CEO}	collector-emitter voltage	open base	–	50	V
V_{ECO}	emitter-collector voltage	open base	–	7	V
V_{CBO}	collector-base voltage (SL5583 only)	open emitter	–	70	V
V_{EBO}	emitter-base voltage (SL5583 only)	open collector	–	7	V
I_C	collector current	DC value	–	100	mA
P_{tot}	total power dissipation	up to T_{amb} = 25 °C	–	200	mW
Optocoupler					
T_{stg}	storage temperature range		–55	150	°C
T_{amb}	ambient operating temperature range		–40	100	°C
T_j	junction temperature		–	125	°C
T_{sld}	soldering temperature up to the seating plane	T_{sld} < 10 s	–	260	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	MAX.	UNIT
Diode			
$R_{th\ j\text{-}a}$	from junction to ambient in free air	500	K/W
$R_{th\ j\text{-}a}$	from junction to ambient when mounted on PCB	400	K/W
Transistor			
$R_{th\ j\text{-}a}$	from junction to ambient in free air	500	K/W
$R_{th\ j\text{-}a}$	from junction to ambient when mounted on PCB	400	K/W

ISOLATION RELATED VALUES

SYMBOL	PARAMETER	CONDITIONS	MIN.	UNIT
L(IO1)	external air gap (clearance)	between input and output terminals	9.6	mm
L(IO2)	external tracking path (creepage distance)	between input and output terminals	8	mm
	internal plastic gap (clearance)	isolation thickness between emitter and receiver	1	mm

CLASSIFICATION CATEGORIES

Tracking resistance	KB-100/A

CHARACTERISTICS

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Diode						
V_F	forward voltage	I_F = 10 mA; T_{amb} = 25 to 100 °C	–	1.15	1.3	V
		I_F = 2 mA; T_{amb} = 25 °C	–	–	1.2	V
I_R	reverse current	V_R = 5 V	–	–	10	μA
Transistor						
$V_{(BR)CEO}$	collector-emitter breakdown voltage	I_C = 1 mA	50	–	–	V
$V_{(BR)CBO}$	collector-base breakdown voltage (SL5583 only)	I_C = 0.1 mA	70	–	–	V
$V_{(BR)ECO}$	emitter-collector breakdown voltage	I_E = 0.1 mA	7	–	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage (SL5583 only)	I_E = 0.1 mA	7	–	–	V
I_{CEO}	collector-emitter cut-off current (dark)	I_F = 0; V_{CE} = 10 V	–	2	50	nA
		I_F = 0; V_{CE} = 10 V; T_{amb} = 70 °C	–	–	500	nA
		I_F = 0; V_{CE} = 10 V; T_{amb} = 100 °C	–	–	50	μA
I_{CBO}	collector-base cut-off current (dark) (SL5583 only)	I_F = 0; V_{CB} = 10 V	–	–	20	nA
Optocoupler						
I_C/I_F	DC current transfer ratio (CTR)	I_F = 10 mA; V_{CE} = 5 V; T_{amb} = 25 °C	0.4	–	3.2	
		I_F = 10 mA; V_{CE} = 5 V; T_{amb} = 100 °C	0.25	–	3.2	
		I_F = 10 mA; V_{CE} = 0.4 V	0.4	–	–	
		I_F = 2 mA; V_{CE} = 5 V	0.2	–	–	
		I_F = 2 mA; V_{CE} = 5 V; T_{amb} = 100 °C	0.15	–	–	
$V_{CE\ sat}$	collector-emitter saturation voltage	I_F = 10 mA; I_C = 4 mA	–	0.19	0.4	V

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{IO}	isolation voltage	DC value; t = 1 min; note 3	5.3	–	–	kV
		RMS value; t = 1 min; note 3	3.75	–	–	kV
C_{io}	capacitance between input and output	V = 0; f = 1 MHz	–	0.4	1	pF
R_{IO}	insulation resistance between input and output	V_{IO} = ±500 V	1	10	–	TΩ
I_{CEW}	leakage current at working voltage	V_{IO} = 2.5 kV (DC); V_{CC} = 10 V; notes 1 and 2 and Fig.4	–	–	200	nA
		V_{IO} = 2.5 kV (DC); V_{CC} = 10 V; T_{amb} = 70 °C; notes 1 and 2 and Fig.4	–	–	2	μA
Switching times (see Figs 5 and 6)						
t_{on}	turn-on time	I_F = 16 mA; V_{CC} = 5 V; R_L = 1 kΩ	–	–	20	μs
		I_C = 2 mA; V_{CC} = 5 V; R_L = 1 kΩ	–	12	–	μs
		I_C = 2 mA; V_{CC} = 5 V; R_L = 100 Ω	–	3	–	μs
t_{off}	turn-off time	I_F = 16 mA; V_{CC} = 5 V; R_L = 1 kΩ	–	–	50	μs
		I_C = 2 mA; V_{CC} = 5 V; R_L = 1 kΩ	–	12	–	μs
		I_C = 2 mA; V_{CC} = 5 V; R_L = 100 Ω	–	3	–	μs

Notes

1. This parameter is the maximum collector-emitter leakage current measured when a high voltage is applied between the shorted diode leads and the transistor emitter.
2. For quality assurance, the two parameters are tested on a sample basis for 1000 hours.
3. Every product is tested by applying an isolation test voltage of 4500 V (RMS) for 2 s between the shorted input (diode) leads and the shorted output (phototransistor) leads, with a detection current of approximately 1 μA.

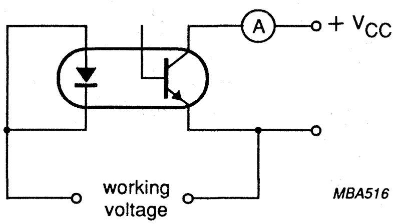


Fig.4 Test circuit.

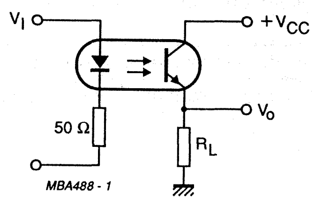


Fig.5 Switching circuit.

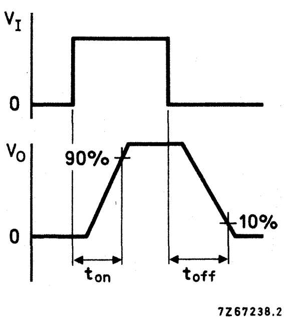
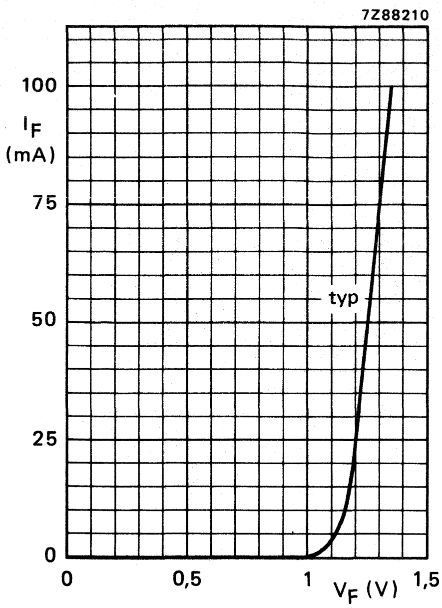
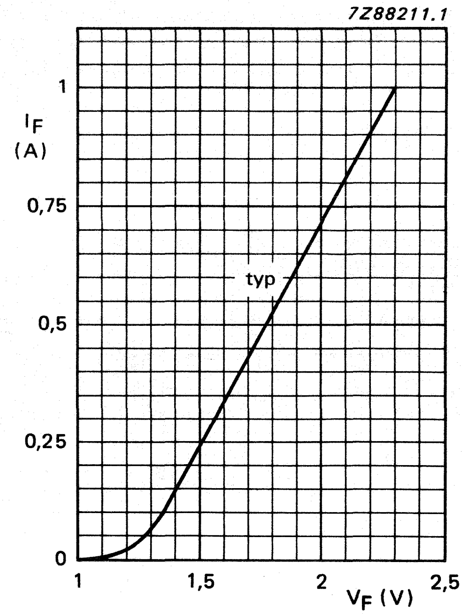


Fig.6 Waveforms.



T_{amb} = 25 °C.

Fig.7 Forward current as a function of forward voltage, typical values.



T_{amb} = 25 °C; t_p = 20 µs; δ = 0.01.

Fig.8 Forward current as a function of forward voltage, typical values.

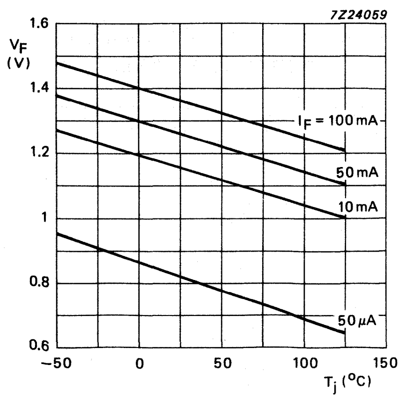
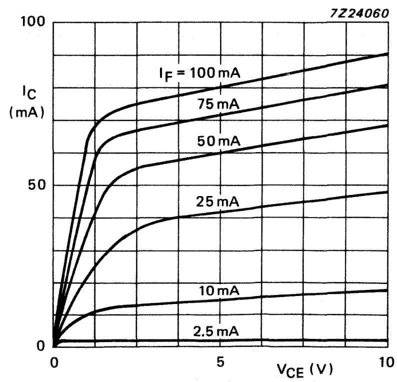
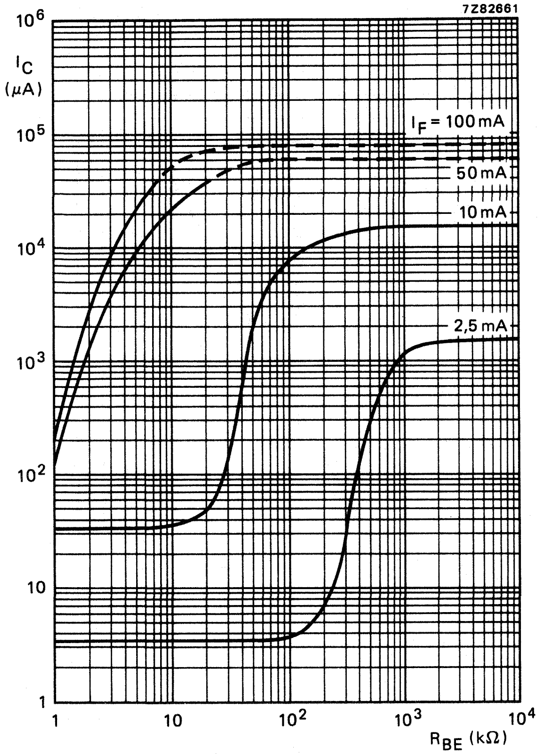


Fig.9 Forward voltage as a function of junction temperature, typical values.



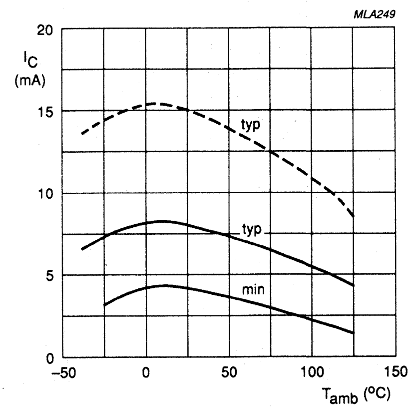
T_{amb} = 25 °C.

Fig.10 Collector current as a function of collector-emitter voltage, typical values.



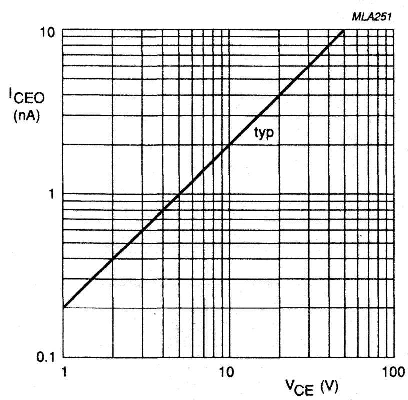
SL5583; I_B = 0; V_{CE} = 5 V; T_{amb} = 25 °C.

Fig.11 Collector current as a function of base-emitter resistance, typical values.



Solid line: I_F = 10 mA; V_{CE} = 0.4 V.
Dotted line: I_F = 10 mA; V_{CE} = 5 V.

Fig.12 Collector current as a function of ambient temperature.



T_{amb} = 25 °C.

Fig.13 Collector-emitter dark current as a function of collector-emitter voltage, typical values.

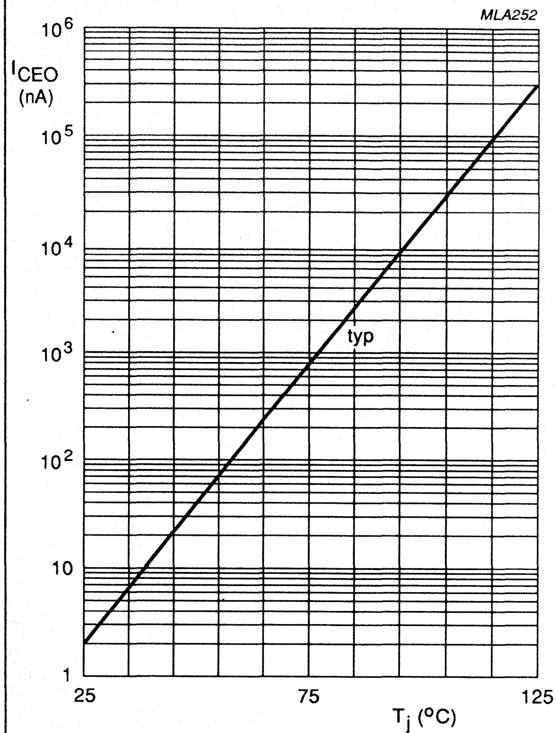
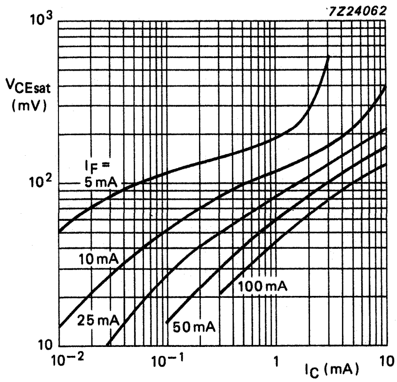
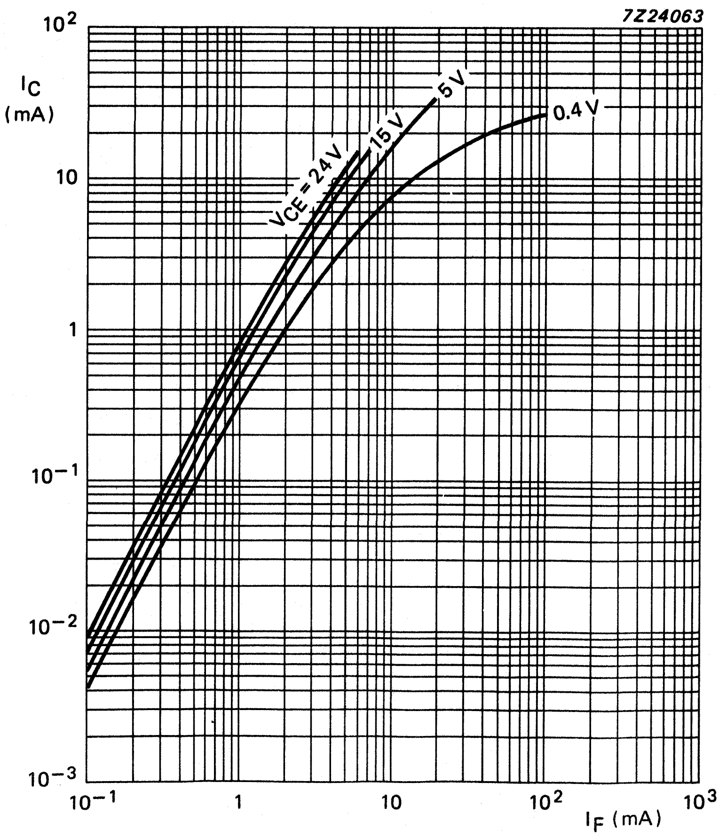


Fig.14 Collector-emitter dark current as a function of junction temperature.



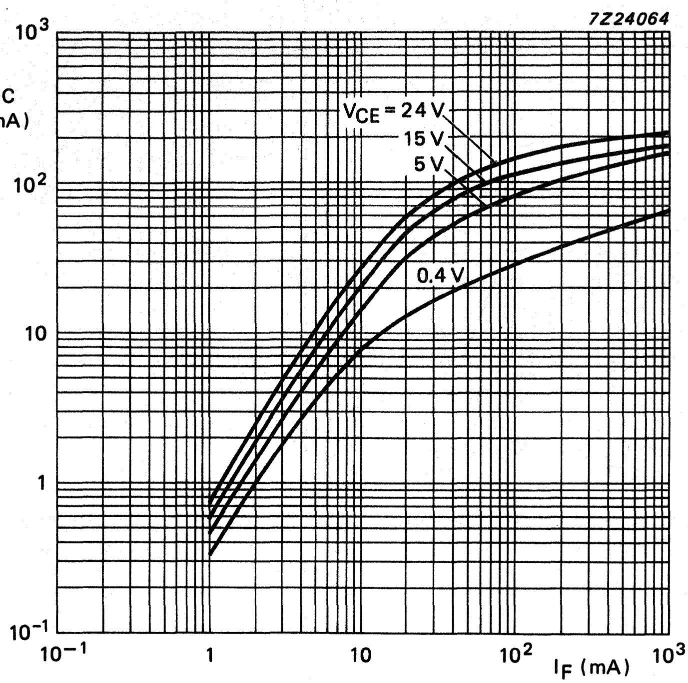
T_{amb} = 25 °C.

Fig.15 Collector-emitter saturation voltage as a function of collector current, typical values.



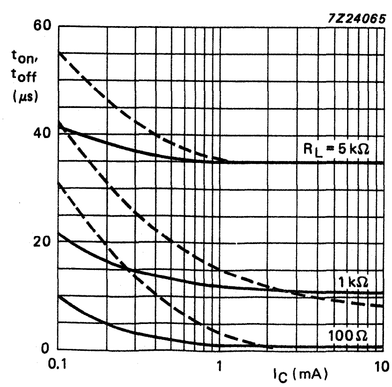
T_{amb} = 25 °C.

Fig.16 Collector current as a function of forward current, typical values.



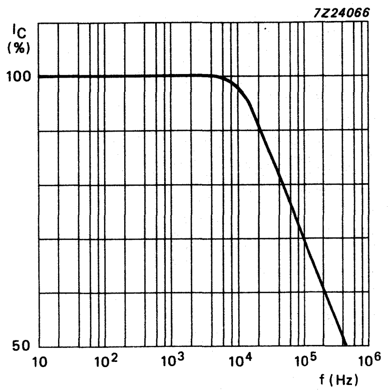
T_{amb} = 25 °C; t_p = 10 μs; δ = 0.01.

Fig.17 Collector current as a function of forward current, typical values.



T_{amb} = 25 °C.
Solid line: t_{off}.
Dotted line: t_{on}.

Fig.18 Switching times as a function of collector current.



T_{amb} = 25 °C; I_C = 2 mA; V_{CC} = 5 V; R_L = 1 kΩ.

Fig.19 Relative collector current as a function of frequency.

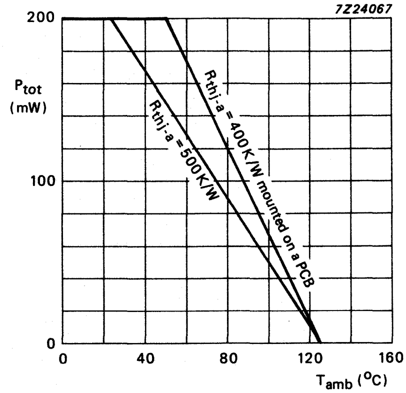


Fig.20 Total power dissipation as a function of ambient temperature.

FEATURES

- A wide body encapsulation with a pin distance of 10.16 mm
- An external clearance of 9.6 mm minimum and an external creepage of 10 mm minimum
- High current transfer ratio and a low saturation voltage, making the devices suitable for use with TTL integrated circuits
- High degree of AC and DC insulation (5.9 kV (RMS) and 8.34 kV (DC))
- Collector-emitter breakdown voltage of 50 V
- Low isolation capacitance of 1 pF maximum.

DESCRIPTION

The SL5582W and SL5583W are high voltage optocouplers in a dual-in-line (DIL) SOT228 plastic envelope.

Each optocoupler consists of a GaAs infrared emitter optically coupled to a silicon npn phototransistor. The base is unconnected for the SL5582W and connected for the SL5583W.

These high voltage optocouplers are intended for use in "mains" applications.

APPROVALS

These types are on the CNET preferential list (S position).

STANDARD	REFERENCE
UL	covered under UL component recognition FILE E90700
BSI	certification in accordance with BS415:1990; BS7002:1989; Class II applications
NORDIC	tested for applications (reinforced isolation); Class II applications for pluggable apparatus in normal tight execution
SETI	in accordance with IEC 65, 380, 950 & 335
SEMKO	in accordance with IEC 65, 380, 950 & 335
NEMKO	in accordance with IEC 65, 380, 950 & 335
DEMKO	in accordance with IEC 65, 380, 950 & 335
VDE	approved in accordance with VDE 0883/6.80 reference voltage (VDE 0110b Tab 4): 500 V (AC)/600 V (DC) complied for reinforced isolation at 250 V (AC) with: DIN IEC 380/VDE 0806/8.81 DIN IEC 435/VDE0805 "ENTWURF", Nov. 84 DIN 57804/VDE 0804/1.83 (isolation group C) DIN VDE 0860/8.86/HD 195 S4 DIN IEC 601 Teil 1/VDE 0750 Teil 1/5.82

High voltage optocouplers SL5582W/SL5583W

PINNING - SL5582W

PIN	DESCRIPTION
1	anode
2	cathode
3	not connected
4	emitter
5	collector
6	not connected

PINNING - SL5583W

PIN	DESCRIPTION
1	anode
2	cathode
3	not connected
4	emitter
5	collector
6	base

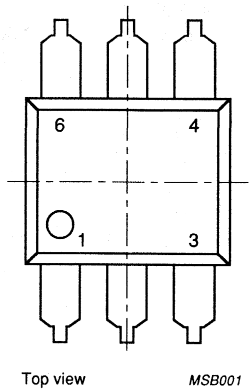


Fig.1 Simplified outline.

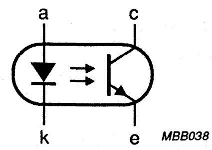


Fig.2 Symbol, SL5582W.

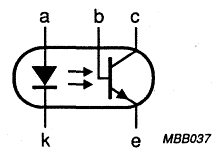


Fig.3 Symbol, SL5583W.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Diode					
I_F	forward current	DC value	–	100	mA
V_R	reverse voltage	DC value	–	5	V
P_{tot}	total power dissipation	up to T_{amb} = 25 °C	–	200	mW
Transistor					
I_C	collector current	DC value	–	100	mA
V_{CEO}	collector-emitter voltage	open base	–	50	V
P_{tot}	total power dissipation	up to T_{amb} = 25 °C	–	200	mW
Optocoupler					
I_C/I_F	current transfer ratio (CTR)	DC value; I_F = 10 mA; V_{CE} = 5 V	0.4	3.2	
V_{IO}	isolation voltage				
		DC value	8.34	–	kV
		RMS value	5.9	–	kV

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX	UNIT
Diode					
I_F	forward current	DC value	–	100	mA
I_{FRM}	forward current	peak value; t_{on} = 10 μs; δ = 0.01	–	3	A
V_R	reverse voltage	DC value	–	5	V
P_{tot}	total power dissipation	up to T_{amb} = 25 °C	–	200	mW
Transistor					
I_C	collector current	DC value	–	100	mA
V_{CEO}	collector-emitter voltage	open base	–	50	V
V_{CBO}	collector-base voltage (SL5583W only)	open emitter	–	70	V
V_{ECO}	emitter-collector voltage	open base	–	7	V
V_{EBO}	emitter-base voltage	open collector	–	7	V
P_{tot}	total power dissipation	up to T_{amb} = 25 °C	–	200	mW
Optocoupler					
T_{stg}	storage temperature range		–55	150	°C
T_{amb}	ambient operating temperature range		–40	100	°C
T_j	junction temperature		–	125	°C
T_{sld}	soldering temperature up to the seating plane	T_{sld} < 10 s	–	260	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	MAX.	UNIT
Diode			
$R_{th\ j-a}$	from junction to ambient in free air	500	K/W
$R_{th\ j-a}$	from junction to ambient when mounted on PCB	400	K/W
Transistor			
$R_{th\ j-a}$	from junction to ambient in free air	500	K/W
$R_{th\ j-a}$	from junction to ambient when mounted on PCB	400	K/W

ISOLATION RELATED VALUES

SYMBOL	PARAMETER	CONDITIONS	MIN.	UNIT
L(IO1)	external air gap (clearance)	between input and output terminals	9.6	mm
L(IO2)	external tracking path (creepage distance)	between input and output terminals	10	mm
	internal plastic gap (clearance)	isolation thickness between emitter and receiver	1	mm

CLASSIFICATION CATEGORIES

Tracking resistance	KB-100/A

CHARACTERISTICS

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

SYMBOL	PARAMETERS	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Diode						
V_F	forward voltage	I_F = 10 mA; T_{amb} = 25 to 100 °C	–	1.15	1.3	V
		I_F = 2 mA	–	–	1.2	V
I_R	reverse current	V_R = 5 V	–	–	10	μA
Transistor						
$V_{(BR)CEO}$	collector-emitter breakdown voltage	I_C = 1 mA	50	–	–	V
$V_{(BR)CBO}$	collector-base breakdown voltage (SL5583W only)	I_C = 0.1 mA	70	–	–	V
$V_{(BR)ECO}$	emitter-collector breakdown voltage	I_E = 0.1 mA	7	–	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage (SL5583W only)	I_E = 0.1 mA	7	–	–	V
I_{CEO}	collector-emitter cut-off current (dark)	I_F = 0; V_{CE} = 10 V	–	2	50	nA
		I_F = 0; V_{CE} = 10 V; T_{amb} = 70 °C	–	–	500	μA
		I_F = 0; V_{CE} = 10 V; T_{amb} = 100 °C	–	–	50	μA
I_{CBO}	collector-base cut-off current (SL5583W only)	I_F = 0; V_{CB} = 10 V	–	–	20	nA
Optocoupler						
I_C/I_F	current transfer ratio (CTR)	DC value; I_F = 10 mA; V_{CE} = 5 V	0.4	–	3.2	
		I_F = 10 mA; V_{CE} = 5 V; T_{amb} = 100 °C	0.25	–	3.2	
		I_F = 10 mA; V_{CE} = 0.4 V	0.4	–	–	
		I_F = 2 mA; V_{CE} = 5 V	0.2	–	–	
		I_F = 2 mA; V_{CE} = 5 V; T_{amb} = 100 °C	0.15	–	–	
$V_{CE\ sat}$	collector-emitter saturation voltage	I_F = 10 mA; I_C = 4 mA	–	0.19	0.4	V

SYMBOL	PARAMETERS	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Optocoupler						
V_{IO}	isolation voltage (note 1)	DC value; t = 1 min	8.34	–	–	kV
		RMS value; t = 1 min	5.9	–	–	kV
C_{io}	capacitance between input and output	V_{IO} = 0; f = 1 MHz	–	0.4	1	pF
R_{IO}	insulation resistance between input and output	V_{IO} = ±500 V	1	10	–	TΩ
I_{CEW}	leakage current at working voltage	V_{CC} = 10 V; V_{IO} = 2.5 kV (DC); notes 2 and 3 and Fig.4	–	–	200	nA
		V_{CC} = 10 V; V_{IO} = 2.5 kV (DC); T_{amb} = 70 °C; notes 2 and 3 and Fig.4	–	–	2	μA
Switching times (see Figs 5 and 6)						
t_{on}	turn-on time	I_F = 16 mA; V_{CC} = 5 V; R_L = 1 kΩ	–	–	20	μs
		I_C = 2 mA; V_{CC} = 5 V; R_L = 1 kΩ	–	12	–	μs
		I_C = 2 mA; V_{CC} = 5 V; R_L = 100 Ω	–	3	–	μs
t_{off}	turn-off time	I_F = 16 mA; V_{CC} = 5 V; R_L = 1 kΩ	–	–	50	μs
		I_C = 2 mA; V_{CC} = 5 V; R_L = 1 kΩ	–	12	–	μs
		I_C = 2 mA; V_{CC} = 5 V; R_L = 100 Ω	–	3	–	μs

Notes

1. Every product is tested by applying an isolation test voltage of 7.08 kV (RMS) for 2 s between the shorted output (phototransistor) leads, with a detection current of approximately 1 μA.
2. This parameter is the maximum collector-emitter leakage current measured when a high voltage is applied between the shorted diode leads and the transistor emitter.
3. For quality assurance, the two parameters are tested for reliability on a sample basis for 1000 hrs.

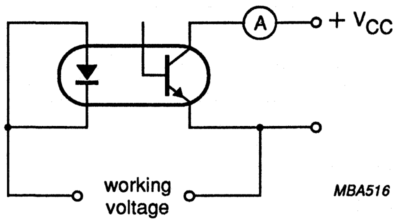


Fig.4 Test circuit.

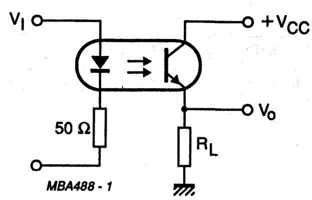


Fig.5 Switching circuit.

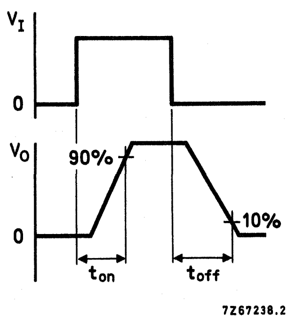
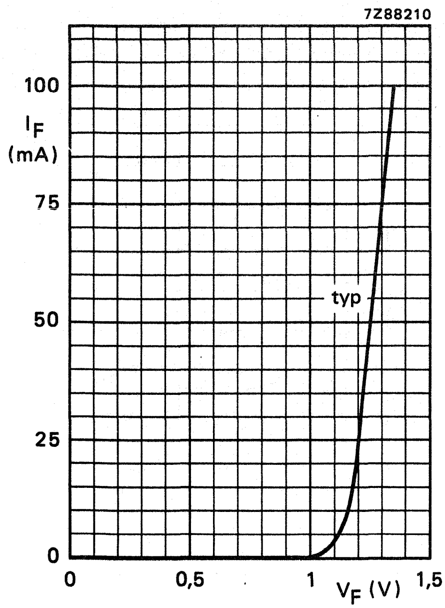
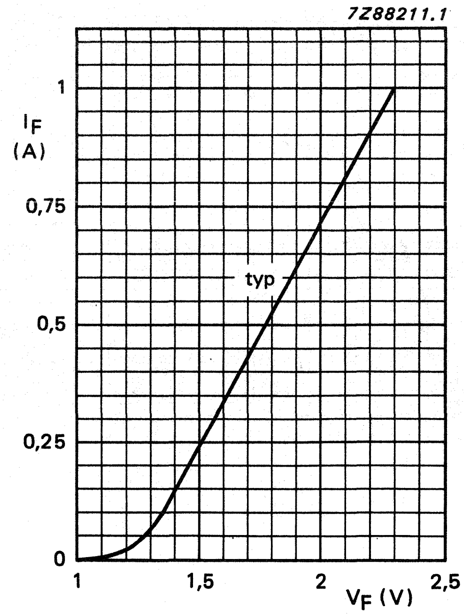


Fig.6 Waveforms.



T_{amb} = 25 °C.

Fig.7 Forward current as a function of forward voltage, typical values.



T_{amb} = 25 °C; t_p = 20 µs; δ = 0.01.

Fig.8 Forward current as a function of forward voltage.

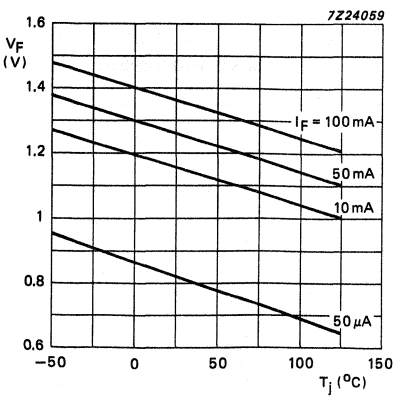
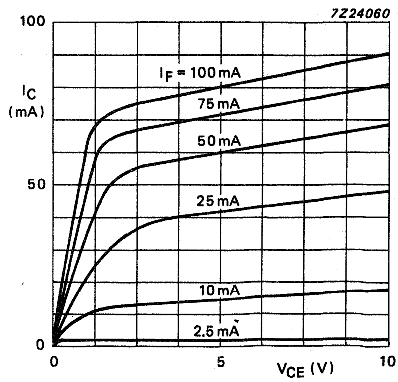
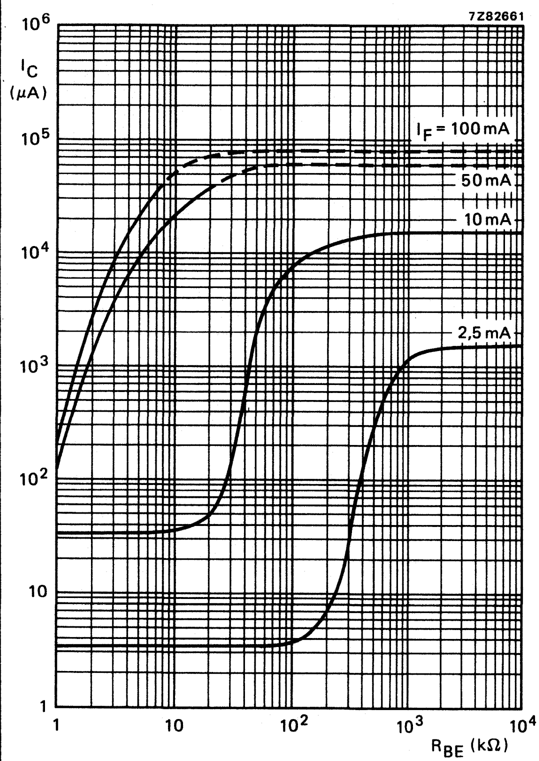


Fig.9 Forward voltage as a function of junction temperature.



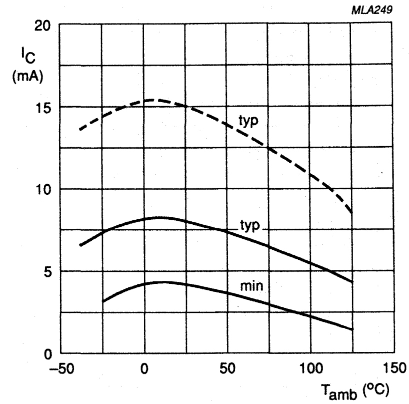
T_{amb} = 25 °C.

Fig.10 Collector current as a function of collector-emitter voltage.



$I_B = 0$; $V_{CE} = 5$ V; $T_{amb} = 25$ °C.

Fig.11 Collector current as a function of base-emitter resistance, typical values.



Solid line: $I_F = 10$ mA; $V_{CE} = 0.4$ V.

Dotted line: $I_F = 10$ mA; $V_{CE} = 5$ V.

Fig.12 Collector current as a function of ambient temperature.

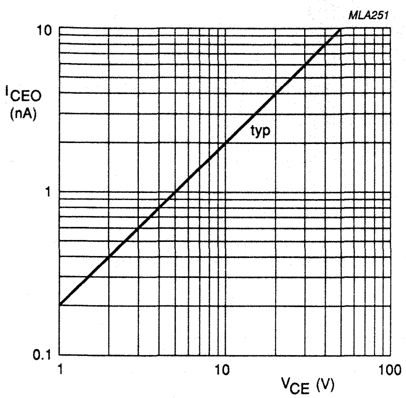


Fig.13 Collector-emitter dark current as a function of collector-emitter voltage.

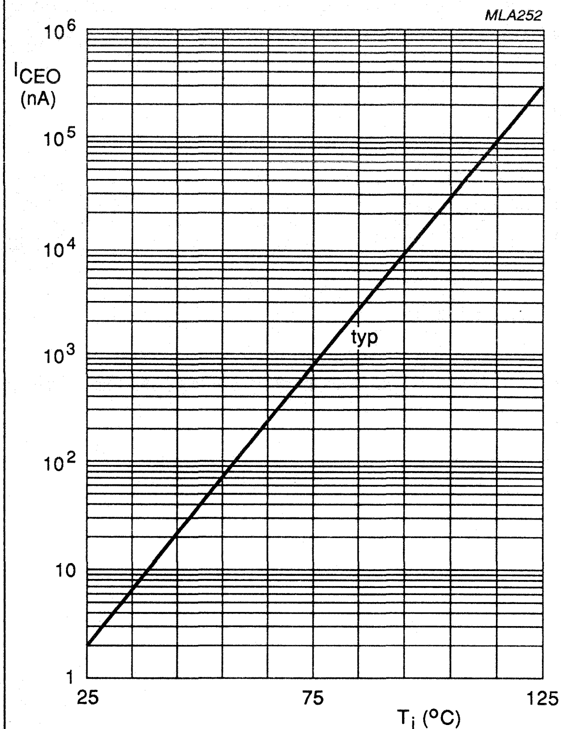
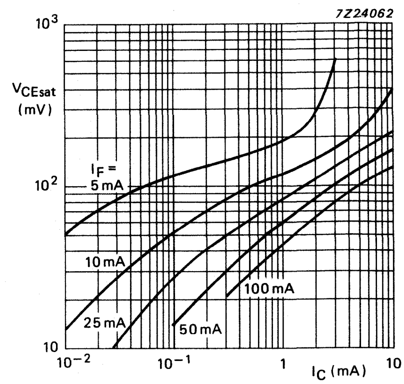
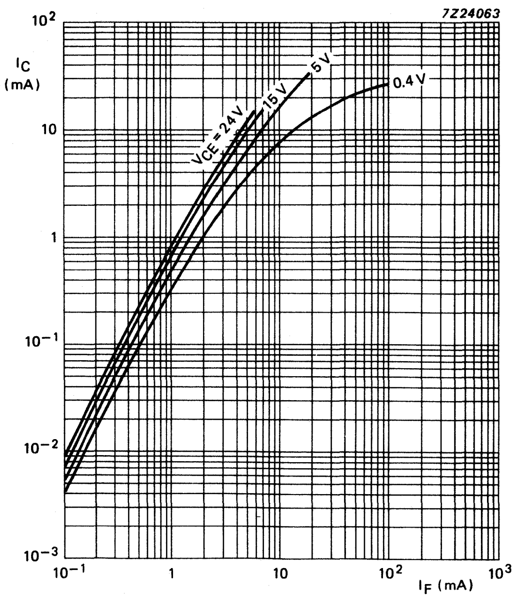


Fig.14 Collector-emitter dark current as a function of junction temperature.



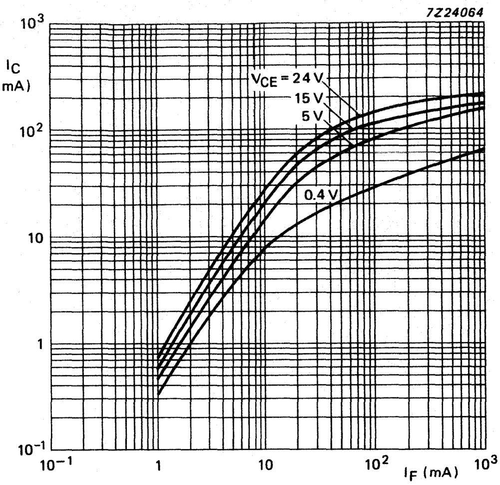
T_{amb} = 25 °C.

Fig.15 Collector-emitter saturation voltage as a function of collector current, typical values.



T_{amb} = 25 °C.

Fig.16 Collector current as a function of forward current, typical values.



T_{amb} = 25 °C; t_p = 10 µs; δ = 0.01.

Fig.17 Collector current as a function of forward current, typical values.

Solid line: t_{off}.
Dotted line: t_{on}.

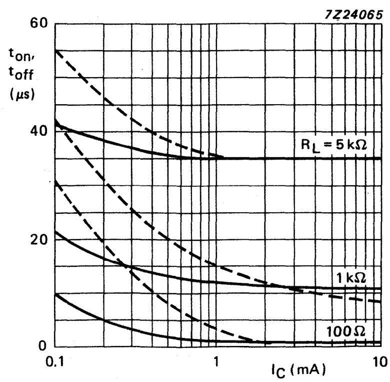
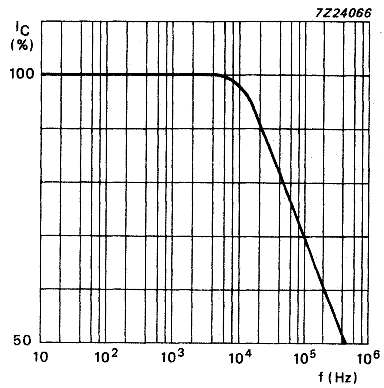


Fig.18 Switching times as a function of collector current, typical values.



I_C = 2 mA; V_{CC} = 5 V; R_L = 1 kΩ; T_{amb} = 25 °C.

Fig.19 Relative collector current as a function of frequency.

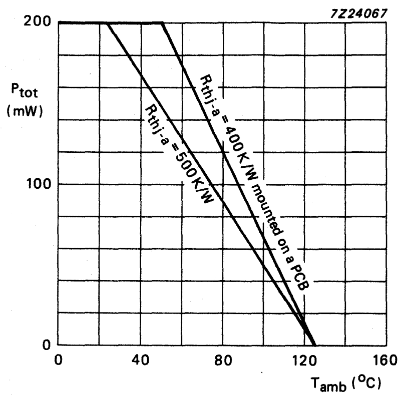


Fig.20 Total power dissipation as a function of ambient temperature.

OPTOCOUPLERS

This product range is one of the industrial standards applied in the market. The current transfer ratio, isolation voltage and low saturation voltage comply with the specifications of the main part of the optocoupler market.

This range can be used with TTL circuits and is comprised of an infrared emitting GaAs diode and an npn silicon phototransistor.

Features

- Fast switching speeds
- Low saturation voltage
- High output/input DC current transfer ratio
- Isolation voltage of 2 kV (RMS) and 2,82 kV (DC)

UL — Covered under UL component recognition FILE E90700

VDE — Approved according to VDE 0883/6.80
Reference voltage (VDE 0110b Tab. 4): AC 250 V/DC 300 V isolation group C

CECC — Capability of approval GaAs optocouplers

QUICK REFERENCE DATA

Collector-emitter voltage of phototransistor (see note)		V_{CEO}	max.	30 V
DC forward current of infrared emitting diode (see note)		I_F	max.	80 mA
DC current transfer ratio I_F = 10 mA; V_{CE} = 10 V (see note)	4N25 to 4N26	I_C/I_F	min.	0.2
	4N27 4N28	I_C/I_F	min.	0.1
Total power dissipation up to T_{amb} = 25 °C		P_{tot}	max.	250 mW
Isolation voltage DC		V_{IO}	min.	2.82 kV
AC (RMS value)				2.0 kV

MECHANICAL DATA

SOT90B (see Fig.1).

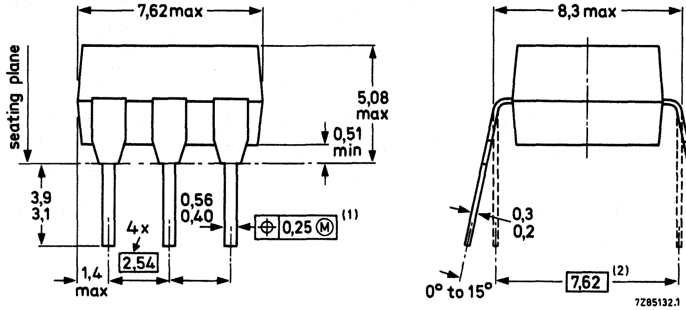
Note

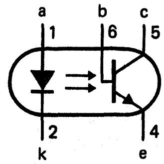
JEDEC registered data.

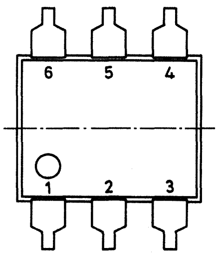
MECHANICAL DATA

Dimensions in mm

Fig.1 SOT90B.







⌖ Positional accuracy.

Ⓜ Maximum Material Condition.

(1) 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.

(2) When the leads are parallel, the tips remain in position for automatic insertion.

RATINGS

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

Diode

Continuous reverse voltage (note 2)	V_R	max.	5 V
DC forward current (note 1)	I_F	max.	80 mA
peak value; t_{on} = 300 μs; δ = 0.02	I_{FRM}	max.	3 A
Total power dissipation up to T_{amb} = 25 °C (note 1)	P_{tot}	max.	150 mW

Transistor

Collector-emitter voltage (open base) (note 1)	V_{CEO}	max.	30 V
Collector-base voltage (open emitter) (note 1)	V_{CBO}	max.	70 V
Emitter-collector voltage (open base) (note 1)	V_{ECO}	max.	7 V
DC collector current	I_C	max.	100 mA
Total power dissipation up to T_{amb} = 25 °C (note 1)	P_{tot}	max.	150 mW

Notes

1. JEDEC registered data.
2. JEDEC registered data is 3 V.

Optocoupler

Storage temperature range (note 1)	T_{stg}		−55 to +150	°C
Operating ambient temperature range (note 1)	T_{amb}		−40 to +100	°C
Soldering temperature up to the seating plane; $t_{sld} < 10$ s	T_{sld}	max.	260	°C
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	250	mW

THERMAL RESISTANCE

From junction to ambient in free air				
diode	$R_{th\ j\text{-}a}$	=	500	K/W
transistor	$R_{th\ j\text{-}a}$	=	500	K/W

LINEAR DERATING FACTORS

Above 25 °C		
diode (note 1)	2	mW/K
transistor (note 1)	2	mW/K
optocoupler (note 1)	3.3	mW/K

ISOLATION RELATED VALUES

External air gap (clearance) input terminals to output terminals	L(IO1)	min.	7.2	mm
External tracking path (creepage distance) input terminals to output terminals	L(IO2)	min.	7.0	mm
Tracking resistance (KB-value)			KB-100/A	
Internal plastic gap (clearance) isolation thickness between emitter and receiver		min.	1	mm

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Diode

Forward voltage (note 1) I_F = 10 mA	V_F	typ. max.	1.15 1.5	V V
Reverse current (note 2) V_R = 5 V	I_R	max.	100	μA
Capacitance at f = 1 MHz V = 0	C_d	typ.	50	pF

Transistor

Collector-emitter breakdown voltage (note 1) I_C = 1 mA	$V_{(BR)CEO}$	min.	30	V
Collector-base breakdown voltage (note 1) I_C = 0,1 mA	$V_{(BR)CBO}$	min.	70	V
Emitter-collector breakdown voltage (note 1) I_E = 0,1 mA	$V_{(BR)ECO}$	min.	7	V

Notes

1. JEDEC registered data.
2. JEDEC registered data is at V_R = 3 V.

Dark current (note 1)				
V_{CE} = 10 V	4N25 to 4N27	I_{CEO}	typ.	2 nA
			max.	50 nA
	4N28	I_{CEO}	max.	100 nA
V_{CB} = 10 V		I_{CBO}	max.	20 nA

Optocoupler

Output/input DC current transfer ratio (note 1)				
I_F = 10 mA; V_{CE} = 10 V	4N25 to 4N26	I_C/I_F	min.	0.2
	4N27 4N28	I_C/I_F	min.	0.1
Collector-emitter saturation voltage (note 1)				
I_F = 50 mA; I_C = 2 mA		V_{CEsat}	max.	0.5 V
			typ.	0.1 V
Isolation voltage; t = 1 min DC (see notes 2 and 3)		V_{IO}	min.	2.82 kV
AC (RMS value)				2.0 kV
Capacitance between input and output				
V_{IO} = 0; f = 1 MHz		C_{io}	typ.	0.6 pF
			max.	1.7 pF
Insulation resistance between input and output				
V_{IO} = 500 V		R_{IO}	typ.	10 TΩ
			min.	1 TΩ
Bandwidth				
$-I_C$ = 2 mA; V_{CE} = 10 V; R_L = 100 Ω		B_W	typ.	300 kHz
Switching times (unsaturated) see Fig. 2				
Rise time				
I_C = 2 mA; V_{CC} = 10 V; R_L = 100 Ω		t_r	typ.	3 μs
Fall time				
I_C = 2 mA; V_{CC} = 10 V; R_L = 100 Ω		t_f	typ.	3 μs
Switching times (saturated) see Fig. 3				
Turn-on time (TTL defined)				
I_F = 15 mA; V_{CC} = 5 V; R_L = 2 kΩ; R_{BE} = ∞		t_{on}	typ.	5 μs
I_F = 20 mA; V_{CC} = 5 V; R_L = 2 kΩ; R_{BE} = 100 kΩ		t_{on}	typ.	5 μs
Turn-off time (TTL defined)				
I_F = 15 mA; V_{CC} = 5 V; R_L = 2 kΩ; R_{BE} = ∞		t_{off}	typ.	30 μs
I_F = 20 mA; V_{CC} = 5 V; R_L = 2 kΩ; R_{BE} = 100 kΩ		t_{off}	typ.	10 μs

Notes

1. JEDEC registered data.
2. Satisfies JEDEC registered isolation voltage ratings (min. V_{IO}):

4N25	2.5 kV (peak)
4N25-A	1.775 kV (RMS)
4N26	1.5 kV (peak)
4N27	1.5 kV (peak)
4N28	0.5 kV (peak)

3. Every single product is tested by applying an isolation test voltage of 2500 V (RMS) for 2 seconds between the shorted input (diode) leads and the shorted output (phototransistor) leads, with a detection current of about 1 μA.

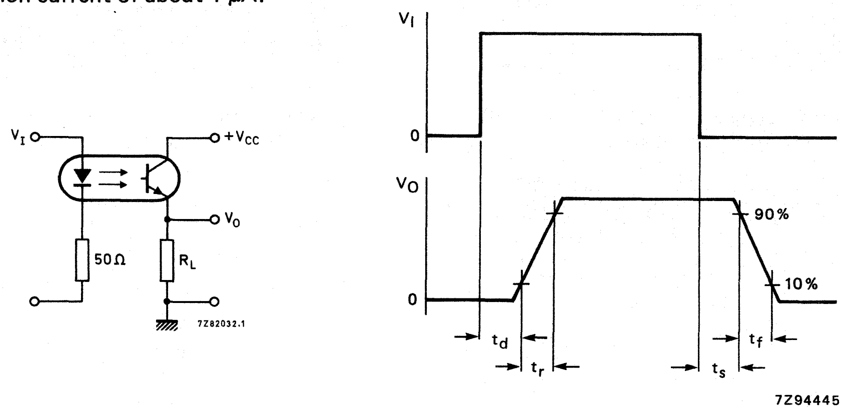


Fig. 2 Measuring circuit and waveforms.

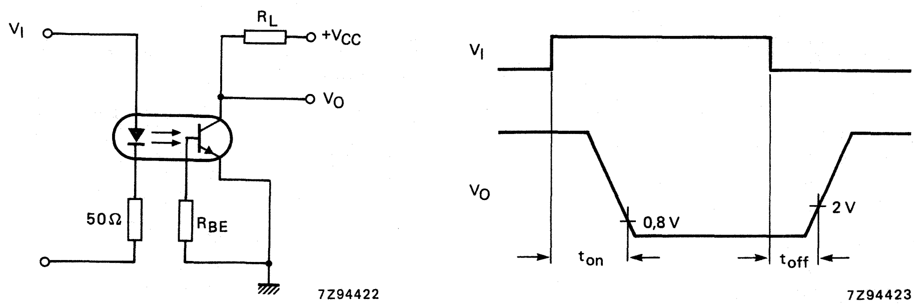


Fig. 3 Measuring circuit and waveforms.

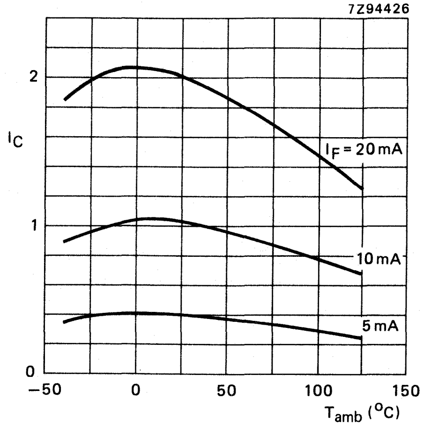


Fig. 4 Normalized at I_F = 10 mA; V_{CE} = 10 V; T_{amb} = 25 °C; typical values.

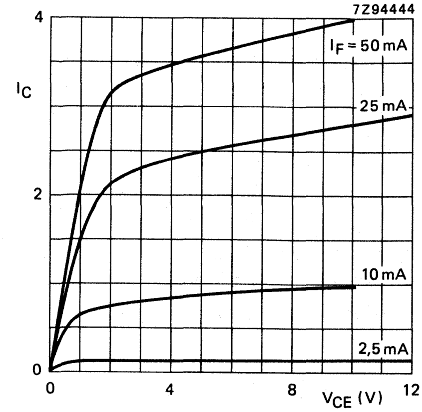


Fig. 5 Normalized at I_C = 1 mA; I_F = 10 mA; V_{CE} = 10 V; typical values.

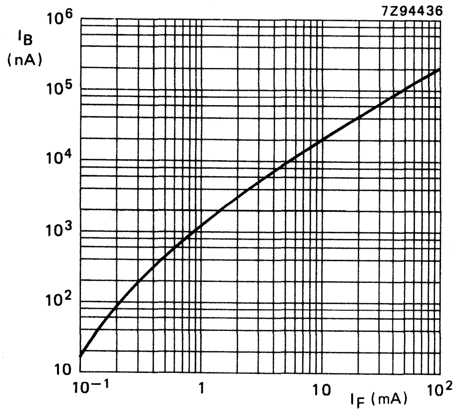


Fig. 6 V_{CB} = 10 V; T_{amb} = 25 °C; typical values.

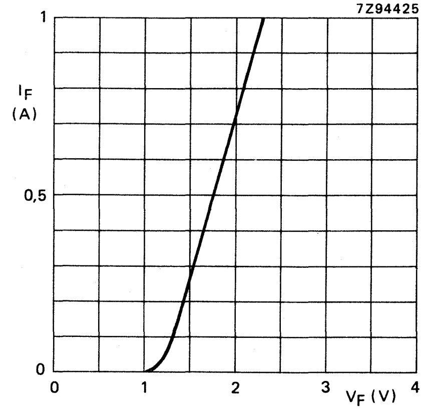


Fig. 7 T_{amb} = 25 °C; t_{on} = 20 μs; δ = 0,01; typical values.

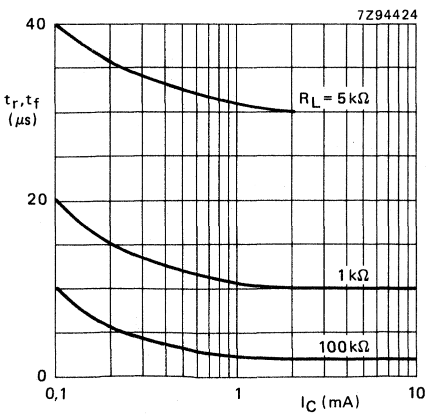


Fig. 8 Normalized at I_F = 10 mA; V_{CE} = 10 V; T_{amb} = 25 °C; typical values.

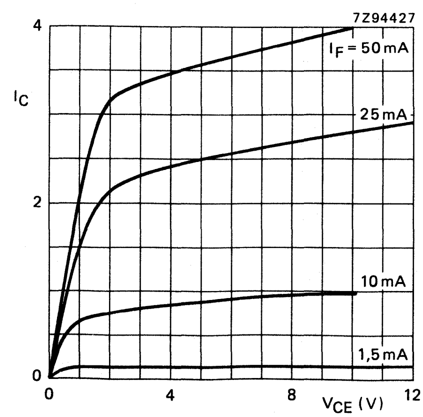


Fig. 9 T_{amb} = 25 °C; typical values.

OPTOCOUPLER

Opto-isolator comprising an infrared emitting GaAs diode and a silicon npn Darlington phototransistor with accessible base. Plastic 6-lead dual-in-line (DIL) envelope.

Features

- Very high output/input DC current transfer ratio
- High isolation voltage of 3.12 kV (RMS) and 4.4.kV (DC)
- Working voltage 2.5 kV

UL – Covered under UL component recognition FILE E90700

VDE – Approved according to VDE 0883/6.80
Reference voltage (VDE 0110B TAB 4): 380 V AC/450 V DC
(Isolation group C)
Complied for reinforced isolation at 250 V AC with:
DIN 57804/VDE 0804/1.83
DIN VDE 0860/8.86/HD 195 S4

QUICK REFERENCE DATA

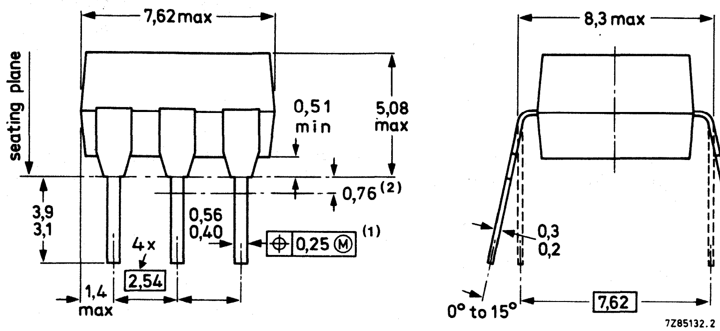
Diode				
Continuous reverse voltage		V_R	max.	5.0 V
DC forward current		I_F	max.	100 mA
peak value; t_p = 10 μs; δ = 0.01		I_{FRM}	max.	3.0 A
Total power dissipation up to T_{amb} = 25 ^oC		P_{tot}	max.	200 mW
Transistor				
Collector-emitter voltage (open base)		V_{CEO}	max.	30 V
Total power dissipation up to T_{amb} = 25 ^oC		P_{tot}	max.	200 mW
Optocoupler				
Output/input DC current transfer ratio (CTR) I_F = 10 mA; V_{CE} = 10 V; (I_B = 0)	4N31	I_C/I_F	min.	0.5
	4N29, 30	I_C/I_F	min.	1.0
	4N32, 33	I_C/I_F	min.	5.0
Collector cut-off current (dark) V_{CC} =10 V; working voltage = 2.5 kV DC diode: I_F = 0 (see Fig. 2)		I_{CEW}	max.	1.0 μA
Isolation voltage DC		V_{IO}	max.	4.4 KV
AC (RMS value)		V_{IO}	max.	3.12 kV

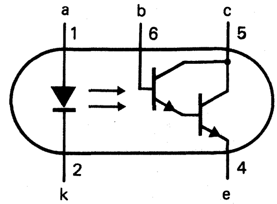
MECHANICAL DATA

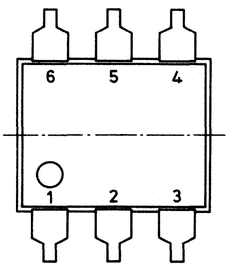
SOT90B (see Fig.1).

MECHANICAL DATA

Dimensions in mm







⊕ Positional accuracy.

Ⓜ Maximum Material Condition.

(1) Centre-lines of all leads are within ± 0,127 mm of the nominal position shown; in the worst case, the spacing between any two leads may deviate from nominal by ± 0,254 mm.

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

Fig.1 SOT90B.

RATINGS

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

Diode

Continuous reverse voltage	V_R	max.	5.0 V
DC forward current	I_F	max.	100 mA
peak value; t_p = 10 μs; δ = 0.01	I_{FRM}	max.	3.0 A
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	200 mW
Junction temperature	T_j	max.	125 °C

Transistor

Collector-emitter breakdown voltage I_C = 1 mA (see note 1)	$V_{(BR)CEO}$	min.	30 V
Collector-base breakdown voltage I_C = 0.1 mA (see note 1)	$V_{(BR)CBO}$	min.	30 V
Emitter-collector breakdown voltage I_E = 0.1 mA (see note 1)	$V_{(BR)ECO}$	min.	5.0 V

DC collector current	I_C	max.	100 mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	200 mW
Junction temperature	T_j	max.	125 °C

Optocoupler

Storage temperature range	T_{stg}		−55 to + 150 °C
Operating ambient temperature range	T_{amb}		−40 to + 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 and transistor	$R_{th\ j\text{-}a}$	=	500 K/W
From junction to ambient, device mounted on a PCB; diode and transistor	$R_{th\ j\text{-}a}$	=	400 K/W

ISOLATION RELATED VALUES

External air gap (clearance) input terminals to output terminals	L(IO1)	min.	7.2 mm
External tracking path (creepage distance) input terminals to output terminals	L(IO2)	min.	7.0 mm
Tracking resistance (KB-value)			KB-100/A
Internal plastic gap (clearance) isolation thickness between emitter and receiver		min.	1.0 mm

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Diode

Forward voltage (see note 1) I_F = 10 mA	V_F	typ.	1.15 V
		max.	1.5 V
Reverse current (see note 2) V_R = 5 V	I_R	max.	10 μA
Capacitance at f = 1 MHz V_R = 0	C_d	typ.	50 pF

Transistor (I_F = 0)

Collector cut-off current (dark) V_{CE} = 10 V (see note 1)	I_{CEO}	typ.	20 nA
		max.	100 nA
V_{CB} = 10 V	I_{CEO}	max.	20 nA

CHARACTERISTICS (continued)

Optocoupler

Output/input DC current transfer ratio (CTR) (see note 1)				
I_F = 10 mA; V_{CE} = 10 V	4N31	I_C/I_F	min.	0.5
	4N29, 30	I_C/I_F	min.	1.0
	4N32, 33	I_C/I_F	min.	5.0
Collector cut-off current (dark) (see Fig. 2 and notes 3 and 4)				
V_{CC} = 10 V; working voltage (DC) = 2.5 kV		I_{CEW}	max.	1.0 μA
V_{CC} = 10 V; working voltage (DC) = 2.5 kV; T_j = 70 °C		I_{CEW}	max.	5 μA
Collector-emitter saturation voltage (see note 1)				
I_F = 8 mA; I_C = 2 mA	4N29,30,32,33	V_{CEsat}	max.	1.0 V
	4N31	V_{CEsat}	max.	1.2 V
Isolation voltage; DC		V_{IO}	min.	4.4 kV
AC (RMS value)		V_{IO}	min.	3.12 kV
t = 1 min (see notes 3 and 5)				
Collector capacitance at f = 1 MHz				
$I_E = I_e$ = 0; V_{CB} = 10 V		C_{bc}	typ.	4.5 pF
Capacitance between input and output				
I_F = 0; V = 0; f = 1 MHz		C_{io}	typ.	0.6 pF
			max.	1.3 pF
Insulation resistance between input and output				
± V_{IO} = 500 V		R_{IO}	min.	1 TΩ
			typ.	10 TΩ
Switching times (see Figs 3 and 4 and note 1)				
I_{Fon} = 200 mA; V_{CC} = 10 V; R_L = 180 Ω; I_C = 50 mA		t_{on}	typ.	0.7 μs
			max.	5.0 μs
	4N29, 30, 31	t_{off}	typ.	25 μs
			max.	40 μs
	4N32, 33	t_{off}	typ.	35 μs
			max.	100 μs

Notes

1. JEDEC registered data.
2. JEDEC registered data is: I_R at V_R = 3 V max. 100 μA.
3. JEDEC registered data is: V_{IO} min. 2500 V (peak) for 4N29, 32.
   min. 1500 V (peak) for 4N30, 31, 33.
4. As quality assurance (on a sample basis), these parameters are covered by a 1000 h reliability test.
5. Every single product is tested by applying an isolation test voltage of 3750 V (RMS) for 2 seconds between the shorted input (diode) leads and the shorted output (phototransistor) leads with a detection current of about 1 μA.

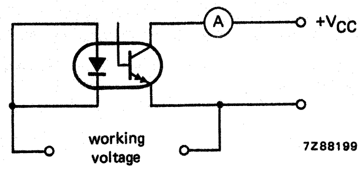


Fig. 2 Test circuit.

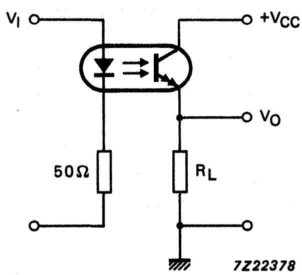


Fig. 3 Switching circuit.

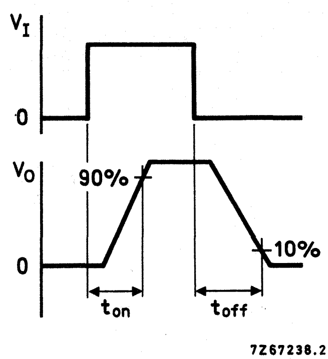


Fig. 4 Waveforms.

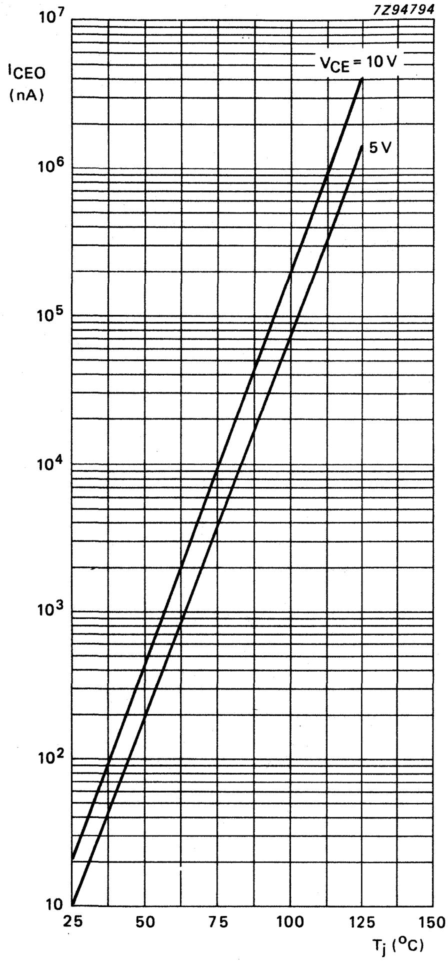


Fig. 5 Collector-emitter voltage as a function of junction temperature; typical values.

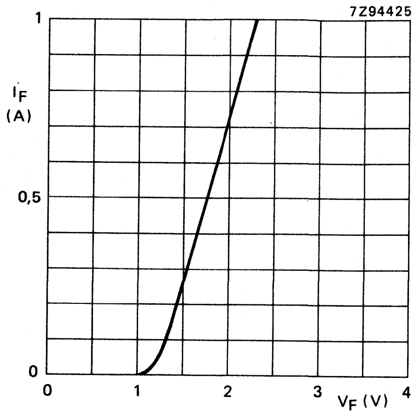


Fig. 6 Forward current as a function of forward voltage; T_{amb} = 25 °C; t_{on} = 20 μs; δ = 0.01; typical values.

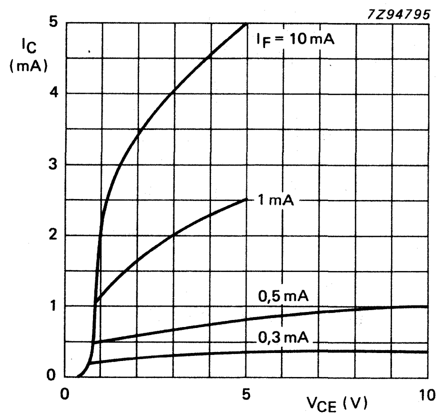


Fig. 7 Collector current as a function of collector-emitter voltage; normalized to I_F = 0.5 mA; V_{CE} = 10 V; typical values.

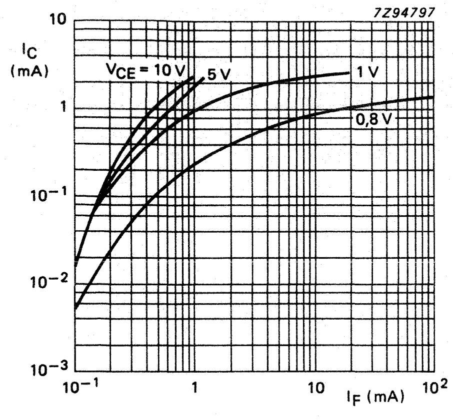


Fig. 8 Collector current as a function of forward current; normalized to I_F = 0.5 mA; V_{CE} = 10 V; T_{amb} = 25 °C; typical values.

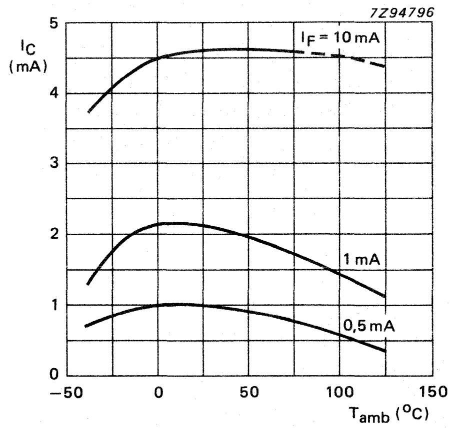


Fig. 9 Collector current as a function of ambient temperature; normalized to I_F = 0.5 mA; V_{CE} = 10 V; T_{amb} = 25 °C; typical values.

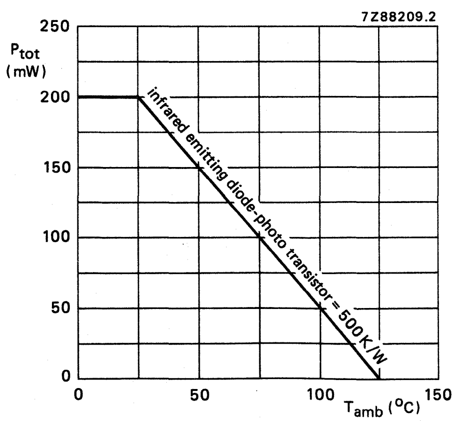


Fig. 10 Power derating curve for diode and transistor as a function of temperature.

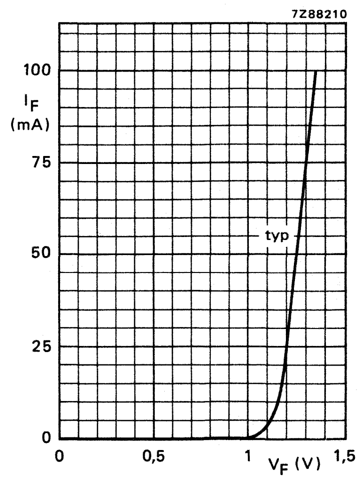


Fig. 11 Forward current as a function of forward voltage; T_{amb} = 25 °C.

OPTOCOUPLERS

Optically coupled isolators consisting of an infrared emitting GaAs diode and a npn silicon photo-transistor. They are suitable for use with TTL integrated circuits.

Features

- Fast switching speeds
- Low saturation voltage
- High output/input DC current transfer ratio
- High isolation voltage of 3.12 kV (RMS) and 4.4 kV (DC) for 4N35
- High isolation voltage of 2.0 kV (RMS) and 2.82 kV (DC) for 4N36 and 4N37

UL — Covered under UL component recognition FILE E90700

VDE — Approved according to VDE 0883/6.80
Reference voltage (VDE 0110b Tab 4) AC 250 V; DC 300 V
isolation group C

For 4N35 — Complied for reinforced isolation at 250 V AC with
DIN 57804/VDE 0804/1.83
DIN VDE 0860/8.86/HD 195 S4
Reference voltage (VDE 0110b Tab 4): AC 380 V; DC 450 V
isolation group C

CECC — Capability of approval GaAs optocouplers

QUICK REFERENCE DATA

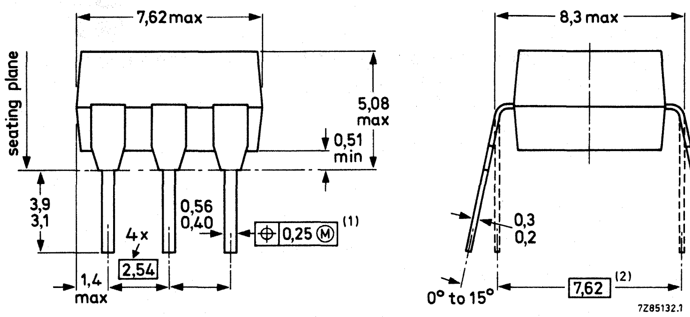
Diode				
Continuous reverse voltage (see note)		V_R	max.	6 V
DC forward current (see note)		I_F	max.	60 mA
(peak value) t_p = 1 μs; f = 300 Hz		I_{FRM}	max.	3 A
Total power dissipation up to T_{amb} = 25 °C (see note)		P_{tot}	max.	100 mW
Transistor				
Collector-emitter voltage (open base) (see note)		V_{CEO}	max.	30 V
Total power dissipation up to T_{amb} = 25 °C (see note)		P_{tot}	max.	300 mW
Optocoupler				
DC current transfer ratio (CTR) (see note)				
I_F = 10 mA; V_{CE} = 10 V		I_C/I_F	min.	1.0
Switching times (see note)				
I_C = 2 mA; V_{CC} = 10 V; R_L = 100 Ω		t_{on}	max.	10 μs
		t_{off}	max.	10 μs
Isolation voltage				
DC	4N35	V_{IO}	min.	4.4 kV
AC (RMS value)	4N35	V_{IO}	min.	3.12 kV
DC	4N36/37	V_{IO}	min.	2.82 kV
AC (RMS value)	4N36/37	V_{IO}	min.	2.0 kV

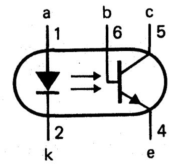
MECHANICAL DATA: SOT90B (see Fig. 1).

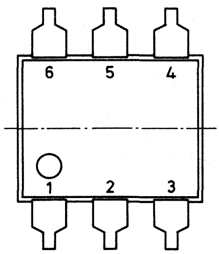
Note: JEDEC registered data.

MECHANICAL DATA Dimensions in mm

Fig. 1 SOT90B.







⊕ Positional accuracy.

Ⓜ Maximum Material Condition.

(1) 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.

(2) When the leads are parallel, the tips are in position for automatic insertion.

RATINGS

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

Diode			
Continuous reverse voltage (see note)	V_R	max.	6 V
DC forward current (see note)	I_F	max.	60 mA
peak value; t_p = 1 μs; f = 300 Hz	I_{FRM}	max.	3 A
Total power dissipation up to T_{amb} = 25 °C (see note)	P_{tot}	max.	100 mW
Transistor			
Collector-emitter voltage (open base) (see note)	V_{CEO}	max.	30 V
Collector-base voltage (open emitter) (see note)	V_{CBO}	max.	70 V
Emitter-base voltage (open collector) (see note)	V_{EBO}	max.	7 V
DC collector current (see note)	I_C	max.	100 mA
Total power dissipation up to T_{amb} = 25 °C (see note)	P_{tot}	max.	300 mW

Note: JEDEC registered data.

Optocoupler

Storage temperature range (see note 1)	T_{stg}		−55 to + 150 °C
Operating junction temperature range (see note 1)	T_j		−40 to + 100 °C (see note 2)
Soldering temperature (see note 1) up to the seating plane; $t_{sld} < 10$ s	T_{sld}	max.	260 °C

LINEAR DERATING FACTOR

Above 25 °C			
diode (see note 1)			1.33 mW/K
transistor (see note 1)			4.0 mW/K

ISOLATION RELATED VALUES

External air gap (clearance) input terminals to output terminals	L(IO1)	min.	7.2 mm
External tracking path (creepage distance) input terminals to output terminals	L(IO2)	min.	7.0 mm
Tracking resistance (KB value)			KB-100/A
Internal plastic gap (clearance) isolation thickness between emitter and receiver		min.	1 mm

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Diode

Forward voltage (see note 1) I_F = 10 mA	V_F	typ. max.	1.1 V 1.5 V
Reverse current (see note 1) V_R = 6 V	I_R	max.	10 μA
Capacitance at f = 1 MHz V = 0	C_d	typ.	50 pF

Transistor

Collector-emitter breakdown voltage (see note 1) I_C = 10 mA	$V_{(BR)CEO}$	min.	30 V
Collector-base breakdown voltage (see note 1) I_C = 0.1 mA	$V_{(BR)CBO}$	min.	70 V
Emitter-base breakdown voltage (see note 1) I_F = 0.1 mA	$V_{(BR)ECO}$	min.	7 V
Dark current (see note 1) V_{CE} = 10 V (see note 1)	I_{CEO}	typ. max.	2.0 nA 50 nA
V_{CE} = 30 V; T_{amb} = 100 °C (see note 1)	I_{CEO}	max.	500 μA
V_{CE} = 10 V; T_{amb} = 70 °C	I_{CEO}	max.	10 μA

Notes

1. JEDEC registered data.
2. T_{jmax} is 125 °C for the 4N35 (for VDE approval).

Optocoupler

DC current transfer ratio (CTR) (see note 1)				
I_F = 10 mA; V_{CE} = 10 V		I_C/I_F	min.	1.0
I_F = 10 mA; V_{CE} = 10 V; T_{amb} = −55 °C		I_C/I_C	min.	0.4
I_F = 10 mA; V_{CE} = 10 V; T_{amb} = 100 °C		I_F/I_C	min.	0.4
Collector-emitter saturation voltage (see note 1)				
I_F = 10 mA; I_C = 0.5 mA		V_{CEsat}	max.	0.3 V
Output capacitance at f = 1 MHz				
V_{CE} = 10 V		C_{ce}	typ.	2.0 pF
Isolation voltage (see notes 2 and 3)				
t = 1 min				
DC	4N35	V_{IO}	min.	4.4 kV
AC (RMS value)				3.12 kV
DC	4N36/37	V_{IO}	min.	2.82 kV
AC (RMS value)				2.0 kV
Capacitance between input and output (see note 1)				
V_O = 0; f = 1 MHz		C_{io}	max.	1.3 pF
			typ.	0.6 pF
Insulation resistance between input and output (see note 1)				
$\pm V_{IO}$ = 500 V		R_{IO}	min.	1 TΩ
			typ.	10 TΩ
Switching times (see Figs 2 and 3 and note 1)				
I_C = 2 mA; V_{CC} = 10 V; R_L = 100 Ω				
Turn-on time		t_{on}	typ.	7 μs
			max.	10 μs
Turn-off time		t_{off}	typ.	5 μs
			max.	10 μs

Notes

1. JEDEC registered data.
2. Every single product is tested by applying an isolation test voltage of 2.5 kV (RMS) for the 4N36/37 and 3.75 kV (RMS) for the 4N35 for 2 seconds between the shorted input (diode) leads and the shorted output (phototransistor) leads, with a detection current of about 1 μA.
3. JEDEC registered data is:

4N35	V_{IO}	min.	3.55 kV peak
4N36	V_{IO}	min.	2.5 kV peak
4N37	V_{IO}	min.	1.5 kV peak

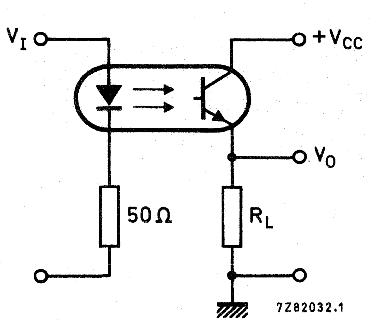


Fig. 2 Switching circuit.

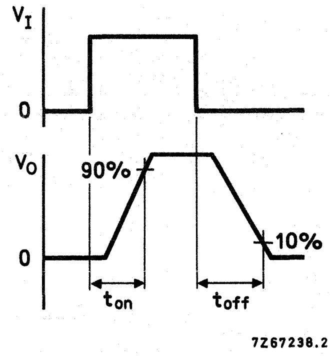


Fig. 3 Waveforms.

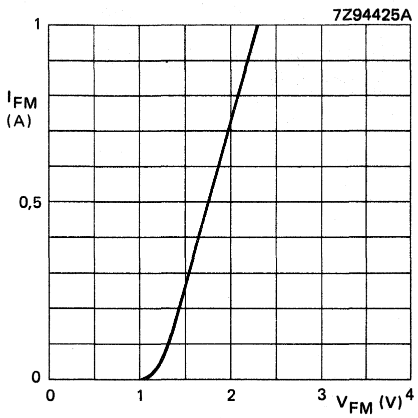


Fig. 4 T_{amb} = 25 °C; t_{on} = 20 μs; δ = 0,01; typical values.

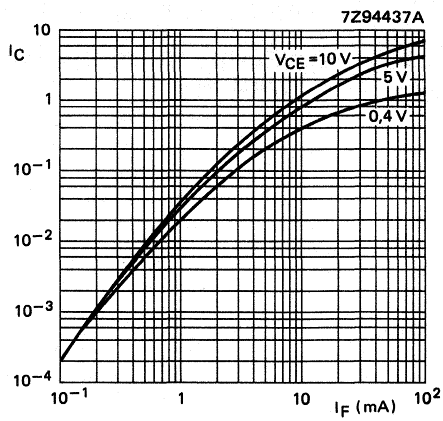


Fig. 5 Normalized to I_F = 10 mA; V_{CE} = 10 V; typical values.

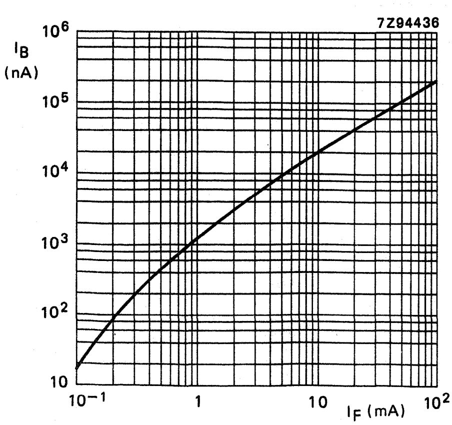


Fig. 6 V_{CB} = 10 V; T_{amb} = 25 °C; typical values.

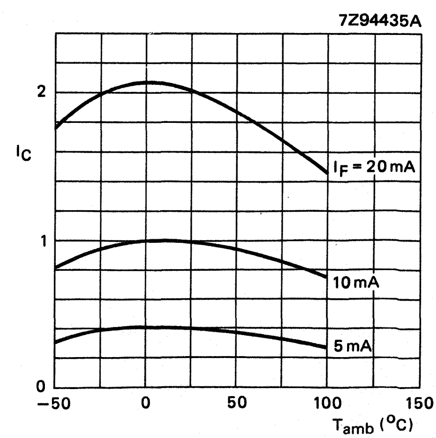


Fig.7 Normalized to I_F = 10 mA; V_{CE} = 10 V; T_{amb} = 25 °C; typical values.

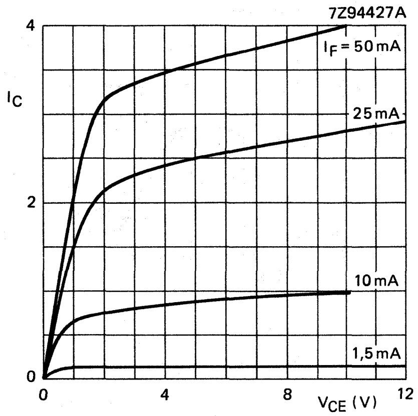


Fig. 8 Normalized to I_F = 10 mA; V_{CE} = 10 V; T_{amb} = 25 °C; typical values.

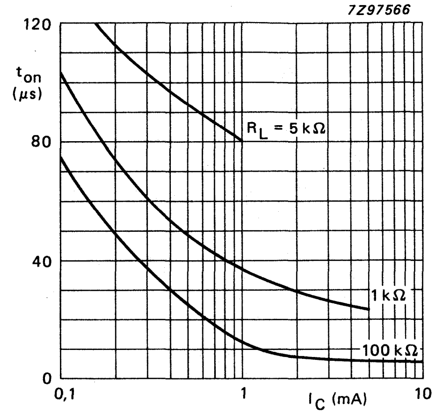


Fig. 9 V_{CC} = 10 V; T_{amb} = 25 °C; typical values.

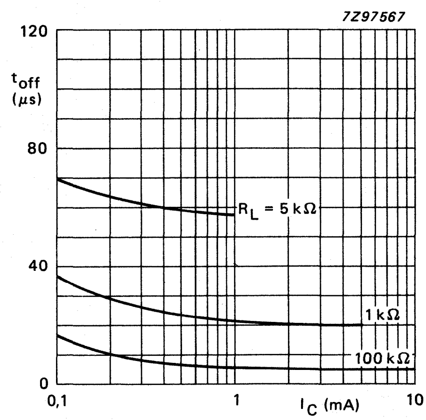


Fig. 10 V_{CC} = 10 V; T_{amb} = 25 °C; typical values.

OPTOCOUPLERS

Optically coupled isolators consisting of an infrared emitting GaAs diode and an npn silicon photo-transistor. They are suitable for use with TTL integrated circuits.

Features

- High maximum output voltage
- Fast switching and low saturation voltage
- Isolation voltage of 2 kV (RMS) and 2.82 kV (DC)

UL — Covered under UL component recognition FILE E90700

VDE — Approved according to VDE 0883/6.80
Reference voltage (VDE 0110b Tab 4); AC 250 V/DC 300 V isolation group C.

CECC — Capability of approval GaAs optocouplers

QUICK REFERENCE DATA

Diode				
Continuous reverse voltage (see note 2)	V_R	max.	5	V
DC forward current (see note 1)	I_F	max.	80	mA
(peak value) t_p = 300 μs; δ = 0.02	I_{FRM}	max.	3	A
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	150	mW
Transistor				
Collector-emitter voltage (open base) (see note 1)	V_{CEO}	max.	80	V
Total power dissipation up to T_{amb} = 25 °C (see note 1)	P_{tot}	max.	150	mW
Optocoupler				
DC current transfer ratio (CTR) (see note 1) I_F = 10 mA; V_{CE} = 10 V	I_C/I_F	min.	0.2	
Switching times (see note 1) I_C = 2 mA; V_{CC} = 10 V; R_L = 100 Ω	t_{on}, t_{off}	typ.	5	μs
Isolation voltage DC	V_{IO}	min.	2.82	kV
Isolation voltage AC (RMS value)	V_{IO}	min.	2.0	kV

MECHANICAL DATA

SOT90B (see Fig.1).

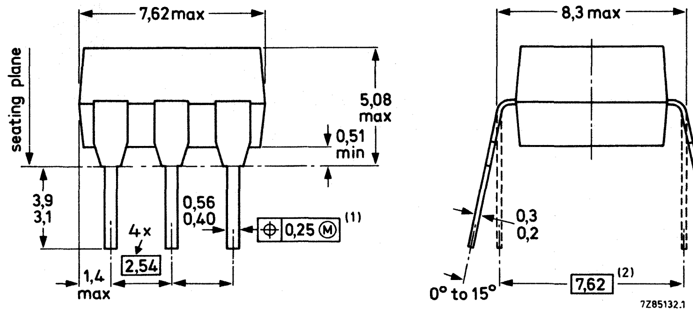
Notes

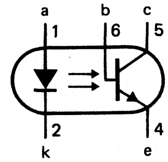
1. Indicates JEDEC registered data.
2. JEDEC registered data is 3 V.

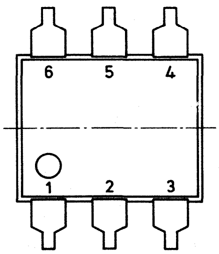
MECHANICAL DATA

Dimensions in mm

Fig.1 SOT90B.







⊕ Positional accuracy.

Ⓜ Maximum Material Condition.

(1) 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.

(2) When the leads are parallel, the tips are in position for automatic insertion.

RATINGS

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

Diode

Continuous reverse voltage (see note 2)	V_R	max.	5 V
DC forward current (see note 1)	I_F	max.	80 mA
peak value; t_p = 300 μs; δ = 0.02	I_{FRM}	max.	3 A
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	150 mW

Transistor

Collector-emitter voltage (open base) (see note 1)	V_{CEO}	max.	80 V
Collector-base voltage (open emitter) (see note 1)	V_{CBO}	max.	80 V
Emitter-base voltage (open collector) (see note 1)	V_{EBO}	max.	7 V
DC collector current (see note 1)	I_C	max.	100 mA
Total power dissipation up to T_{amb} = 25 °C (see note 1)	P_{tot}	max.	150 mW

Notes

1. Indicates JEDEC registered data.
2. JEDEC registered data is 3 V.

Optocoupler

Storage temperature range (see note 1)	T_{stg}		–55 to +150 °C
Operating junction temperature range (see note 1)	T_j		–40 to +100 °C
Soldering temperature (see note 1) up to the seating plane; $t_{sld} < 10$ s	T_{sld}	max.	260 °C

LINEAR DERATING FACTOR

Above 25 °C			
diode (see note 1)			2.0 mW/K
transistor (see note 1)			2.0 mW/K

ISOLATION RELATED VALUES

External air gap (clearance) input terminals to output terminals	L(IO1)	min.	7.2 mm
External tracking path (creepage distance) input terminals to output terminals	L(IO2)	min.	7.0 mm
Tracking resistance (KB-value)			KB-100/A
Internal plastic gap (clearance) isolation thickness between emitter and receiver		min.	1 mm

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Diode

Forward voltage (see note 1) I_F = 10 mA	V_F	typ. max.	1.1 V 1.5 V
Reverse current (see note 2) V_R = 5 V	I_R	max.	10 μA

Transistor

Collector-emitter breakdown voltage (see note 1) I_C = 1 mA	$V_{(BR)CEO}$	min.	80 V
Collector-base breakdown voltage (see note 1) I_C = 1 μA	$V_{(BR)CBO}$	min.	80 V
Emitter-base breakdown voltage (see note 1) I_E = 0.1 mA	$V_{(BR)EBO}$	min.	7 V
Dark current (see note 1) V_{CE} = 60 V	I_{CEO}	typ. max.	2.0 nA 50 nA

Notes

1. Indicates JEDEC registered data.
2. JEDEC registered data at V_R = 3 V.

Optocoupler

DC current transfer ratio (CTR) (see note 3)			
I_F = 10 mA; V_{CE} = 10 V	I_C/I_F	min.	0.2
Collector-emitter saturation voltage (see note 3)			
I_F = 20 mA; I_C = 4 mA	V_{CEsat}	max.	1.0 V
Output capacitance at f = 1 MHz			
V_{CE} = 10 V	C_{ce}	typ.	2.0 pF
Isolation voltage; t = 1 min (see notes 1 and 2) DC	V_{IO}	min.	2.82 kV
AC (RMS value)			2.0 kV
Capacitance between input and output (see note 3)			
V_O = 0; f = 1 MHz	C_{io}	typ.	0.6 pF
		max.	1.3 pF
Insulation resistance between input and output (see note 3)			
$\pm V_{IO}$ = 500 V	R_{IO}	min.	1 TΩ
		typ.	10 TΩ
Switching times (see Figs 2 and 3 and note 3)			
I_C = 2 mA; V_{CC} = 10 V; R_L = 100 Ω			
Turn-on time	t_{on}	typ.	5 μs
Turn-off time	t_{off}	typ.	5 μs

Notes

1. Every single product is tested by applying an isolation test voltage of 2.5 kV (RMS) for 2 seconds between the shorted input (diode) leads and the shorted output (phototransistor) leads, with a detection current of about 1 μA.
2. JEDEC registered data is:

4N38	V_{IO}	min.	1.5 kV peak
4N38A	V_{IO}	min.	2.5 kV peak

3. Indicates JEDEC registered data.

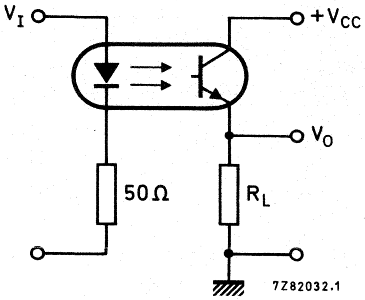


Fig. 2 Switching circuit.

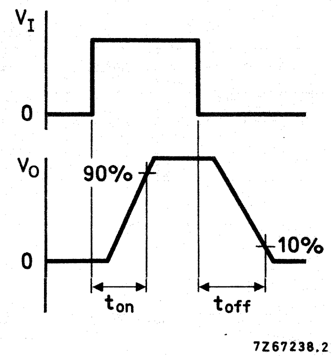


Fig. 3 Waveforms.

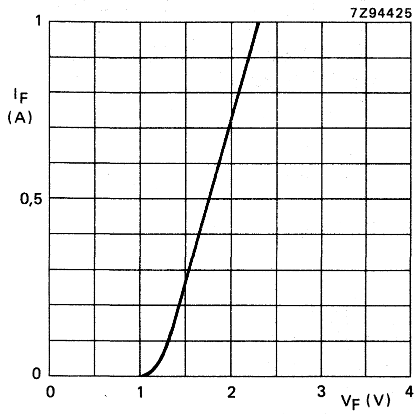


Fig. 4 T_{amb} = 25 °C; t_{on} = 20 μs; δ = 0.01; typical values.

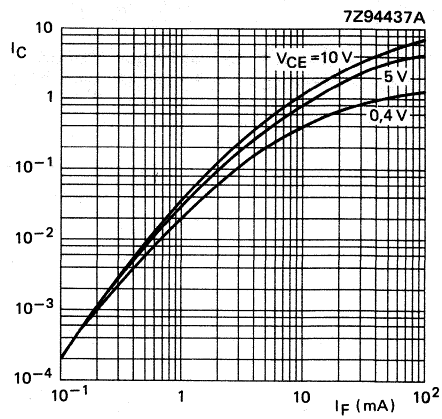


Fig. 5 Normalized to I_F = 10 mA; V_{CE} = 10 V; typical values.

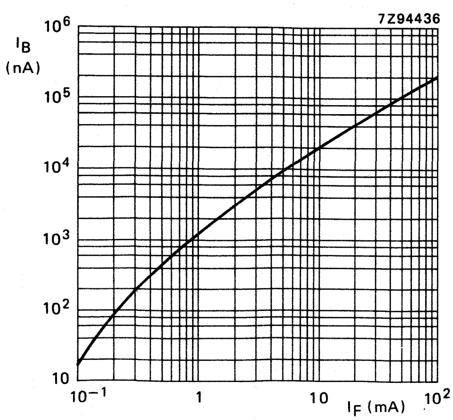


Fig. 6 V_{CB} = 10 V; T_{amb} = 25 °C; typical values.

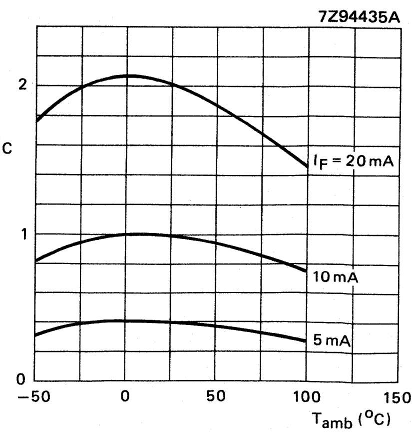


Fig. 7 Normalized to I_F = 10 mA; V_{CE} = 10 V; T_{amb} = 25 °C; typical values.

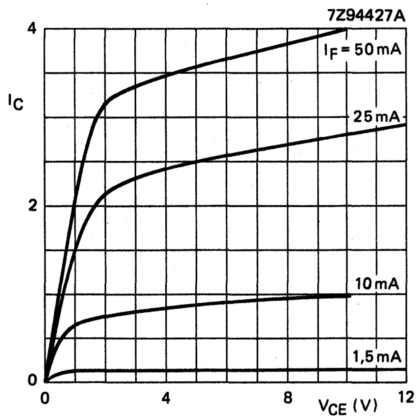


Fig. 8 T_{amb} = 25 °C; typical values.
Normalized to I_F = 10 mA; V_{CE} = 10 V.

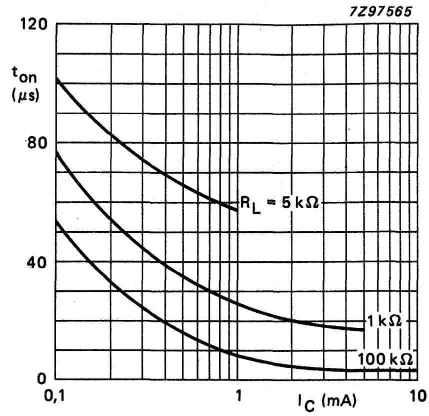


Fig. 9 V_{CC} = 10 V; T_{amb} = 25 °C; typical values.

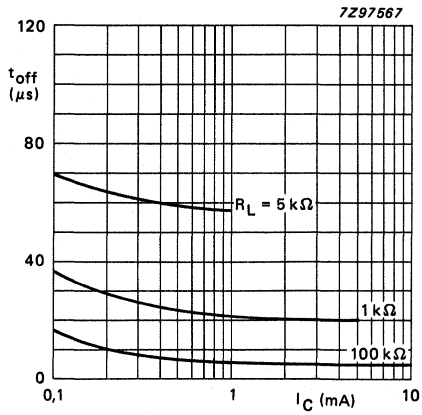


Fig. 10 V_{CC} = 10 V; T_{amb} = 25 °C; typical values.

High-speed optocouplers 6N135/6N136

FEATURES

- Short propagation delay times
- Low saturation voltage
- High transient immunity
- High degree of AC and DC insulation (2500 V (RMS)/3500 V (DC) for the 6N135 and 3120 V (RMS)/4400 V (DC) for the 6N136).

DESCRIPTION

The 6N135 and 6N136 are fast switching optocouplers, comprising an infrared emitting GaAlAs diode, optically coupled to a silicon photodetector in an 8-pin dual-in-line (DIL) SOT97F plastic envelope.

PINNING

PIN	DESCRIPTION
1	not connected
2	anode
3	cathode
4	not connected
5	ground
6	V_O
7	V_B
8	V_{CC}

APPROVALS

STANDARD	REFERENCE
UL	covered under UL component recognition FILE E90700
VDE	approved in accordance with VDE 0883/6.80 reference voltage (VDE 0110b Tab 4): 380 V (AC)/450 V (DC) (isolation group C) complied for reinforced isolation at 250 V (AC) with: DIN 57804/VDE 0804/1.83 (isolation group C) DIN VDE 0860/8.86/HD 195 S4 (6N136 only)

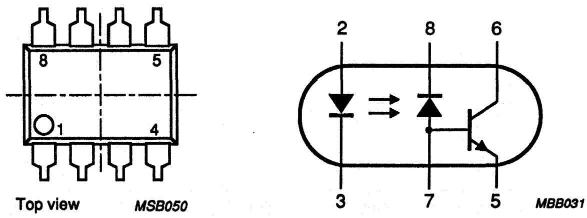


Fig.1 Simplified outline and symbol.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Diode					
I_F	forward current	DC value	–	100	mA
V_R	reverse voltage	DC value	–	5	V
Detector					
I_C	collector current		–	10	mA
V_{CEO}	collector-emitter voltage	open base	–	15	V
Optocoupler					
V_{IO}	isolation voltage				
	6N135	DC value	3.5	–	kV
		RMS value	2.5	–	kV
	6N136	DC value	4.4	–	kV
		RMS value	3.12	–	kV
I_C/I_F	DC current transfer ratio (CTR)	I_F = 16 mA; V_O = 0.4 V; V_{CC} = 4.5 V			
	6N135		0.07	–	
	6N136		0.19	–	
t_{PHL}/t_{PLH}	propagation delay time, 6N135	I_F = 16 mA; V_{CC} = 5 V; R_L = 4.1 kΩ	–	1.5	μs
	propagation delay time, 6N136	I_F = 16 mA; V_{CC} = 5 V; R_L = 1.9 kΩ	–	0.8	μs
CMH	common mode transient immunity (logic HIGH)		1	–	kV/μs
CML	common mode transient immunity (logic LOW)		–1	–	kV/μs

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Diode					
I_F	forward current	DC value	–	100	mA
I_{FRM}	forward current	peak value; t_p = 1 μs; f = 300 Hz	–	1	A
V_R	reverse voltage	DC value	–	5	V
P_{tot}	total power dissipation	up to T_{amb} = 70 °C	–	250	mW
Detector					
I_C	collector current	DC value	–	10	mA
V_{CEO}	collector-emitter voltage (pins 6 & 5)		–	15	V
V_O	output voltage (pins 6 & 5)		–0.5	15	V
V_{CC}	supply voltage (pins 8 & 5)		–0.5	15	V
V_{EBO}	emitter-base voltage (pins 7 & 5)		–	5	V
P_{tot}	total power dissipation	up to T_{amb} = 70 °C	–	100	mW
Optocoupler					
T_{stg}	storage temperature range		–55	150	°C
T_{amb}	ambient operating temperature range		–40	100	°C
T_{sld}	soldering temperature up to the seating plane	T_{sld} < 10 s	–	260	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	MAX.	UNIT
Diode			
$R_{th\ j\text{-}a}$	from junction to ambient in free air	500	K/W
$R_{th\ j\text{-}a}$	from junction to ambient when mounted on PCB	400	K/W
Transistor			
$R_{th\ j\text{-}a}$	from junction to ambient in free air	500	K/W
$R_{th\ j\text{-}a}$	from junction to ambient when mounted on PCB	400	K/W

ISOLATION RELATED VALUES

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
L(IO1)	external air gap (clearance)	between input and output terminals	7.2	–	–	mm
L(IO2)	external tracking path (creepage distance)	between input and output terminals	7	–	–	mm
	internal plastic gap (clearance)	isolation thickness between emitter and receiver	1	–	–	mm

CLASSIFICATION CATEGORIES

Tracking resistance	KB-100/A

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Diode						
V_F	forward voltage	I_F = 16 mA; T_{amb} = 25 °C	1.25	1.52	1.7	V
		I_F = 16 mA; T_{amb} = 0 to 70 °C	1.2	–	1.8	V
I_R	reverse current	V_R = 5 V; T_{amb} = 25 °C	–	–	10	μA
		V_R = 5 V; T_{amb} = 0 to 70 °C	–	–	100	μA
C_d	diode capacitance	V_D = 0; f = 1 MHz	–	200	–	pF
Detector						
$V_{(BR)CEO}$	collector-emitter breakdown voltage	I_C = 10 mA	15	–	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	I_E = 0.1 mA	5	–	–	V
I_{OH}	logic high output current	I_F = 0; V_O = V_{CC} = 5.5 V;	–	5	500	nA
		I_F = 0; V_O = V_{CC} = 15 V; 25 °C	–	–	1	μA
		I_F = 0; V_O = V_{CC} = 15 V; 0 to 70 °C	–	–	50	μA
I_{CCH}	logic high supply current	I_F = 0; I_O = 0; V_{CC} = 15 V; 25 °C	–	–	1	μA
		I_F = 0; I_O = 0; V_{CC} = 15 V; 0 to 70 °C	–	–	2	μA
I_{CCL}	logic low supply current	I_F = 16 mA; I_O = 0; V_{CC} = 15 V;	–	50	200	μA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Optocoupler						
I_C/I_F	current transfer ratio (CTR), 6N135	DC value; I_F = 16 mA; V_O = 0.4 V; V_{CC} = 4.5 V; 25 °C	0.07	–	–	
		DC value; I_F = 16 mA; V_O = 0.4 V; V_{CC} = 4.5 V; 0 to 70 °C	0.05	–	–	
I_C/I_F	current transfer ratio (CTR), 6N136	DC value; I_F = 16 mA; V_O = 0.4 V; V_{CC} = 4.5 V; 25 °C	0.19	–	–	
		DC value; I_F = 16 mA; V_O = 0.4 V; V_{CC} = 4.5 V; 0 to 70 °C	0.15	–	–	
V_{OL}	logic low output voltage, 6N135	I_F = 16 mA; I_C = 1.1 mA; V_{CC} = 4.5 V	–	0.1	0.4	V
	logic low output voltage, 6N136	I_F = 16 mA; I_C = 3 mA; V_{CC} = 4.5 V	–	0.1	0.4	V
I_{OHW}	logic high output current (note 1)	V_{CC} = 5.5 V; V_W = 2.5 kV (DC); T_{amb} = 70 °C (see Fig.5)	–	–	5	µA
V_{IO}	isolation voltage (note 2)	t = 1 min				
	6N135	DC value	3.5	–	–	kV
		RMS value	2.5	–	–	kV
	6N136	DC value	4.4	–	–	kV
		RMS value	3.12	–	–	kV
C_{io}	capacitance between input and output	V_{IO} = 0; f = 1 MHz	–	0.6	1.3	pF
R_{IO}	insulation resistance between input and output	V_{IO} = ±500 V; T_{amb} = 25 °C	10^{12}	10^{13}	–	Ω
		V_{IO} = ±500 V; T_{amb} = 100 °C	10^{11}	–	–	Ω

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Switching times, 6N135 (see Figs 2 and 3)						
t_{PHL}	propagation delay time to logic low at output	I_F = 16 mA; V_{CC} = 5 V; R_L = 4.1 kΩ	–	0.3	1.5	µs
t_{PLH}	propagation delay time to logic high at output	I_F = 16 mA; V_{CC} = 5 V; R_L = 4.1 kΩ	–	0.6	1.5	µs
Switching times, 6N136 (see Figs 2 and 3)						
t_{PHL}	propagation delay time to logic low at output	I_F = 16 mA; V_{CC} = 5 V; R_L = 1.9 kΩ	–	0.4	0.8	µs
t_{PLH}	propagation delay time to logic high at output	I_F = 16 mA; V_{CC} = 5 V; R_L = 1.9 Ω	–	0.35	0.8	µs
Transient immunity (see Fig.4)						
CMH	common mode transient immunity (logic HIGH)	I_F = 0; V_{CC} = 5 V; V_{CM} = 10 $V_{(p-p)}$; R_L = 4.1 kΩ for 6N135 and 1.9 kΩ for 6N136	1	–	–	kV/µs
CML	common mode transient immunity (logic LOW)	I_F = 16 mA; V_{CC} = 5 V; V_{CM} = 10 $V_{(p-p)}$; R_L = 4.1 kΩ for 6N135 and 1.9 kΩ for 6N136	−1	–	–	kV/µs
B	bandwidth (note 3 and Fig.6)		–	11	–	MHz

Notes

1. This parameter is the maximum collector-emitter leakage current measured when a high DC voltage is applied between the emitter and the two shorted diode leads.
2. Every product is tested by applying an isolation test voltage of 3000 V (RMS) for the 6N135 and 3750 V (RMS) for the 6N136 for 2 s between all shorted input side leads and all shorted output side leads, with a detection current of approximately 1 µA.
3. The frequency at which the AC output voltage is 3 dB below the low frequency asymptote.

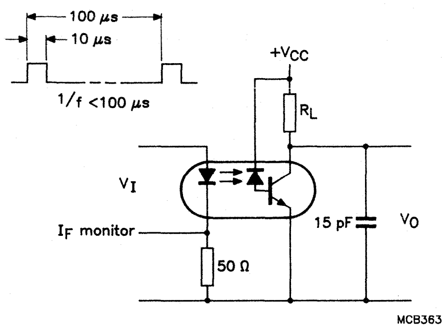


Fig.2 Switching times test circuit.

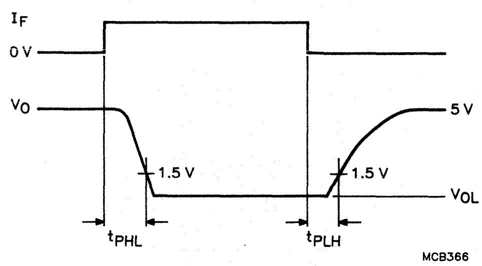


Fig.3 Switching times waveforms.

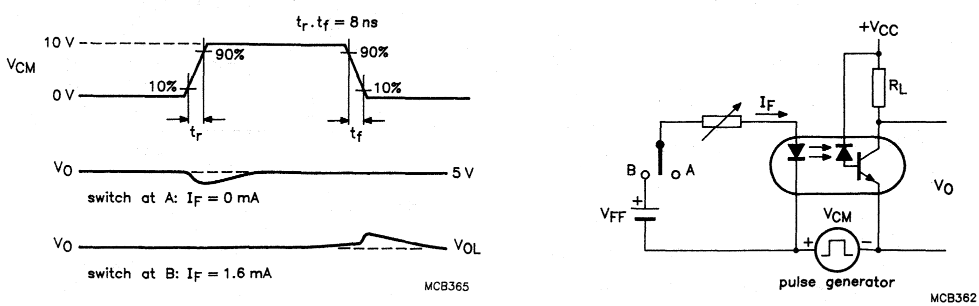


Fig.4 Transient immunity test circuit and waveforms.

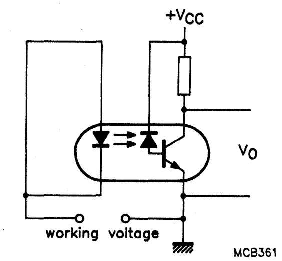
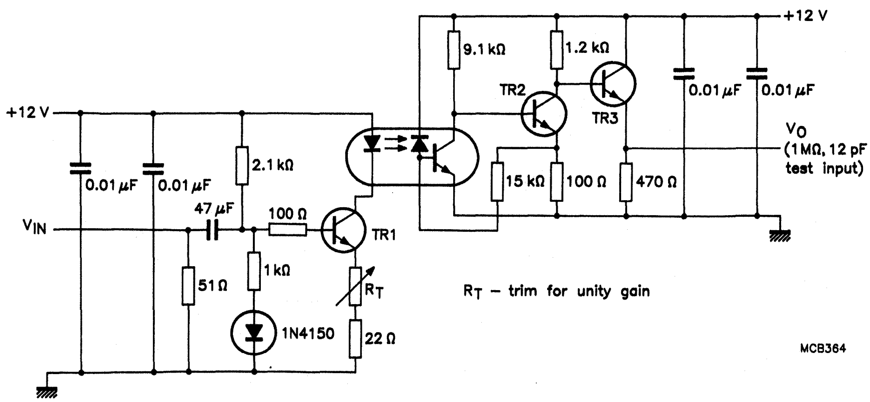


Fig.5 Logic output current test circuit.



Linearity = ±3% at $V_{IN(p\text{-}p)}$ = 1 V; SNR = 50 dB; R_T = 375 Ω; V_O (DC) = 3.8 V; I_F = 9 mA; typical values.

Fig.6 Frequency response test circuit.

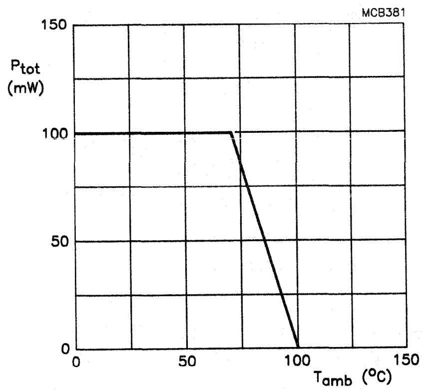
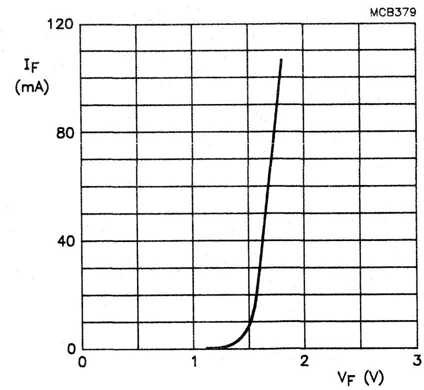
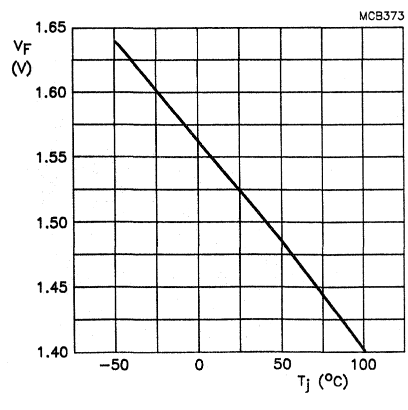


Fig.7 Total power dissipation as a function of ambient temperature.



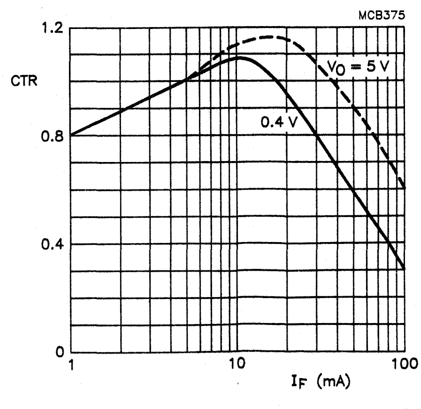
T_{amb} = 25 °C.

Fig.8 Forward current as a function of forward voltage; typical values.



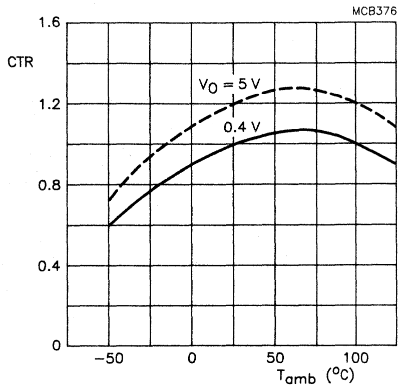
I_F = 16 mA.

Fig.9 Forward voltage as a function of junction temperature, typical values.



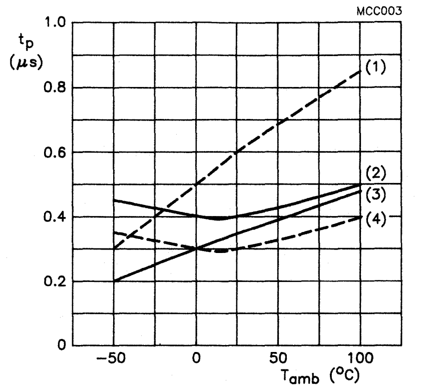
Normalized at I_F = 16 mA; V_{CC} = 4.5 V; V_O = 0.4 V; T_{amb} = 25 °C.

Fig.10 Current transfer ratio as a function of forward current.



Normalized at I_F = 16 mA; V_{CC} = 4.5 V; V_O = 0.4 V; T_{amb} = 25 °C.

Fig.11 Current transfer ratio as a function of ambient temperature.



(1) 6N135, t_{PLH}; (2) 6N136, t_{PHL}; (3) 6N136, t_{PHL}; (4) 6N135, t_{PHL}.

I_F = 16 mA; V_{CC} = 5 V;
R_L = 4.1 kΩ for 6N135 and 1.9 kΩ for 6N136; typical values.

Fig.12 Propagation delay times as a function of ambient temperature.

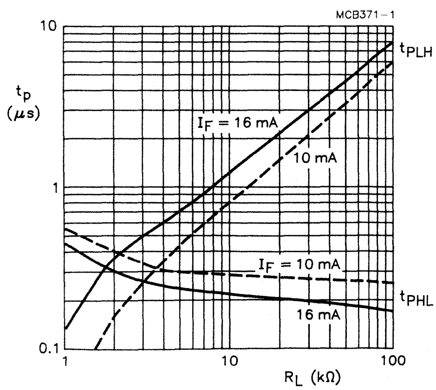
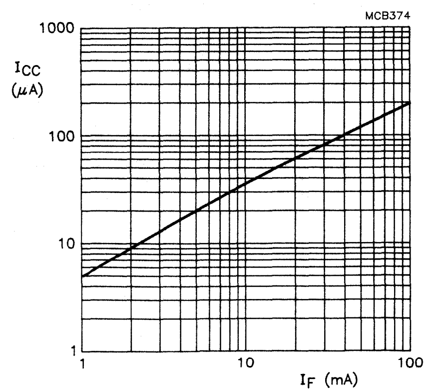


Fig.13 Propagation delay times as a function of loading resistance, typical values.



V_{CC} = 15 V; I_O = 0; T_{amb} = 25 °C.

Fig.14 Logic low supply current as a function of forward current, typical values.

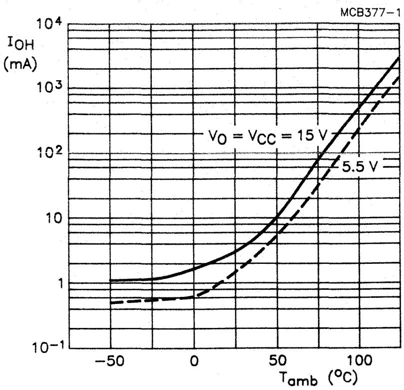
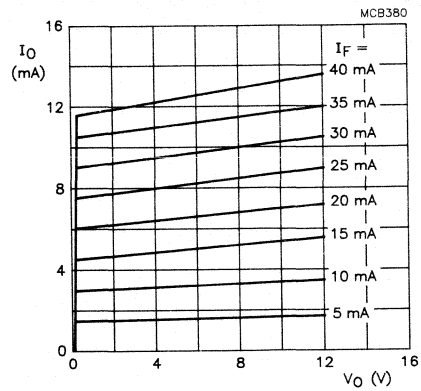
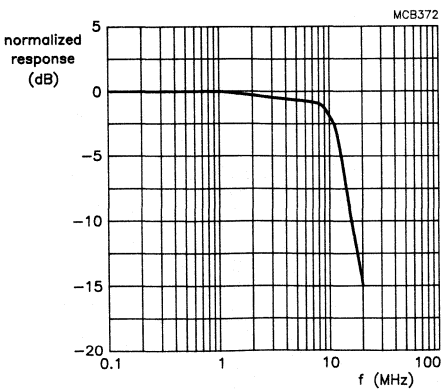


Fig.15 Logic HIGH output current as a function of ambient temperature, typical values.



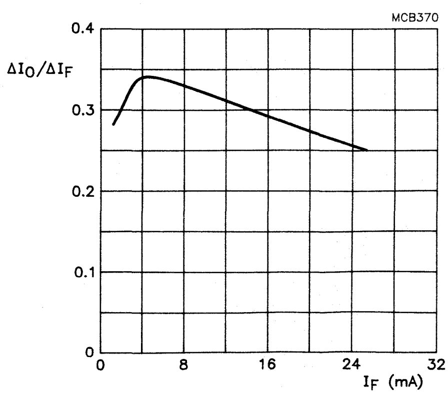
$V_{CC} = 5$ V; $T_{amb} = 25$ °C.

Fig.16 DC and pulsed transfer characteristics, typical values.



$T_{amb} = 25$ °C.

Fig.17 Frequency response.



$R_l = 100\ \Omega$; $V_{CC} = 5$ V; $T_{amb} = 25$ °C.

Fig.18 Small signal current transfer ratio ($\Delta I_O/\Delta I_F$) as a function of quiescent input current.

Low input current, high-gain optocouplers

6N138/6N139

FEATURES

- High current transfer ratio
- Short propagation delay times
- TTL compatible
- Low saturation voltage/low input current
- High transient immunity
- High degree of AC and DC insulation (2500 V (RMS) and 3000 V (DC)).

DESCRIPTION

The 6N138 and 6N139 are low input current, high-gain optocouplers, comprising an infrared emitting GaAlAs diode, optically coupled to a silicon photodetector in an 8-pin dual-in-line (DIL) SOT97F plastic envelope.

PINNING

PIN	DESCRIPTION
1	not connected
2	anode
3	cathode
4	not connected
5	ground
6	V_O
7	V_B
8	V_{CC}

APPROVALS

STANDARD	REFERENCE
UL	covered under UL component recognition FILE E90700

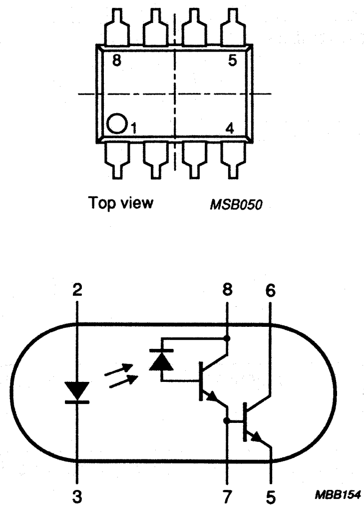


Fig.1 Simplified outline and symbol.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Diode					
I_F	forward current	DC value	–	100	mA
V_R	reverse voltage	DC value	–	5	V
Detector					
I_C	collector current		–	60	mA
V_{CEO}	collector-emitter voltage	open base			
	6N138		–	7	V
	6N139		–	18	V
Optocoupler					
V_{IO}	isolation voltage				
		DC value	3.5	–	kV
		RMS value	2.5	–	kV
I_C/I_F	DC current transfer ratio (CTR)	I_F = 1.6 mA; V_O = 0.4 V; V_{CC} = 4.5 V			
	6N138		3	–	
	6N139		5	–	
	DC current transfer ratio (CTR) (6N139 only)	I_F = 0.5 mA; V_O = 0.4 V; V_{CC} = 4.5 V	4		
t_{PHL}	propagation delay time to logic low at output, 6N138	I_F = 1.6 mA; V_{CC} = 5 V; R_L = 2.2 kΩ	–	10	μs
	propagation delay time to logic low at output, 6N139	I_F = 0.5 mA; V_{CC} = 5 V; R_L = 4.7 kΩ	–	25	μs
t_{PLH}	propagation delay time to logic high at output, 6N138	I_F = 1.6 mA; V_{CC} = 5 V; R_L = 2.2 kΩ	–	35	μs
	propagation delay time to logic high at output, 6N139	I_F = 0.5 mA; V_{CC} = 5 V; R_L = 4.7 kΩ	–	60	μs
CMH	common mode transient immunity (logic HIGH)	V_{CM} = 10 $V_{(p-p)}$	0.5	–	kV/μs
CML	common mode transient immunity (logic LOW)	V_{CM} = 10 $V_{(p-p)}$	–0.5	–	kV/μs

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Diode					
I_F	forward current	DC value	–	100	mA
I_{FRM}	forward current	peak value; t_p = 1 μs; f = 300 Hz	–	1	A
V_R	reverse voltage	DC value	–	5	V
P_{tot}	total power dissipation	up to T_{amb} = 70 °C	–	250	mW
Detector					
I_C	collector current	DC value	–	60	mA
V_{CEO}	collector-emitter voltage (pins 6 & 5)				
	6N138		–	7	V
	6N139		–	18	V
V_O	output voltage (pins 6 & 5)				
	6N138		–0.5	7	V
	6N139		–0.5	18	V
V_{CC}	supply voltage (pins 8 & 5)				
	6N138		–0.5	7	V
	6N139		–0.5	18	V
V_{EBO}	emitter-base voltage (pins 7 & 5)		–	0.5	V
P_{tot}	total power dissipation	up to T_{amb} = 70 °C	–	100	mW
Optocoupler					
T_{stg}	storage temperature range		–55	150	°C
T_{amb}	ambient operating temperature range		–40	100	°C
T_{sld}	soldering temperature up to the seating plane	t_{sld} < 10 s	–	260	°C

THERMAL RESISTANCE

SYMBOL	PARAMETER	MAX.	UNIT
Diode			
$R_{th\ j\text{-}a}$	from junction to ambient in free air	500	K/W
$R_{th\ j\text{-}a}$	from junction to ambient when mounted on PCB	400	K/W
Transistor			
$R_{th\ j\text{-}a}$	from junction to ambient in free air	500	K/W
$R_{th\ j\text{-}a}$	from junction to ambient when mounted on PCB	400	K/W

Low input current, high-gain optocouplers

6N138/6N139

ISOLATION RELATED VALUES

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
L(IO1)	external air gap (clearance)	between input and output terminals	7.2	–	–	mm
L(IO2)	external tracking path (creepage distance)	between input and output terminals	7	–	–	mm
	internal plastic gap (clearance)	isolation thickness between emitter and receiver	1	–	–	mm

CLASSIFICATION CATEGORIES

Tracking resistance	KB-100/A

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Diode						
V_F	forward voltage	I_F = 1.6 mA	1.25	1.4	1.7	V
		I_F = 1.6 mA; 0 to 70 °C	1.1	–	1.8	V
I_R	reverse current	V_R = 5 V; T_{amb} = 25 °C	–	–	10	µA
		V_R = 5 V; T_{amb} = 0 to 70 °C	–	–	100	µA
C_d	diode capacitance	V_D = 0; f = 1 MHz	–	200	–	pF
Detector						
$V_{(BR)CEO}$	collector-emitter breakdown voltage	I_C = 1 mA				
	6N138		7	–	–	V
	6N139		18	–	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	I_E = 0.1 mA	0.5	–	–	V
I_{OH}	logic high output current, 6N138	I_F = 0; $V_O = V_{CC}$ = 7 V; 0 to 70 °C	–	0.05	250	µA
	logic high output current, 6N139	I_F = 0; $V_O = V_{CC}$ = 18 V; 0 to 70 °C	–	0.1	100	µA
I_{CCH}	logic high supply current	I_F = 0; I_O = 0; V_{CC} = 18 V; 0 to 70 °C	–	0.01	1	µA
I_{CCL}	logic low supply current	I_F = 1.6 mA; I_O = 0; V_{CC} = 18 V; 0 to 70 °V	–	0.5	2	mA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{OL}	logic low output voltage, 6N138	I_F = 1.6 mA; I_C = 4.8 mA; V_{CC} = 4.5 V; 0 to 70 °C	–	0.1	0.4	V
	logic low output voltage, 6N139	I_F = 1.6 mA; I_C = 8 mA; V_{CC} = 4.5 V; 0 to 70 °C	–	0.1	0.4	V
		I_F = 5 mA; I_C = 15 mA; V_{CC} = 4.5 V; 0 to 70 °C	–	0.1	0.4	V
		I_F = 12 mA; I_C = 24 mA; V_{CC} = 4.5 V; 0 to 70 °C	–	0.1	0.4	V
I_{OHW}	logic high output current (note 1 and Fig.5)	V_{CC} = 5.5 V; V_W = 2.5 kV (DC); T_{amb} = 70 °C	–	–	20	µA
V_{IO}	isolation voltage (note 2)	t = 1 min				
		DC value	3.5	–	–	kV
		RMS value	2.5	–	–	kV
C_{io}	capacitance between input and output	V_{IO} = 0; f = 1 MHz	–	0.6	1.3	pF
R_{IO}	insulation resistance between input and output	V_{IO} = ±500 V; T_{amb} = 25 °C	10^{12}	10^{13}	–	Ω
		V_{IO} = ±500 V; T_{amb} = 100 °C	10^{11}	–	–	Ω
Switching times, 6N138 (see Figs 2 and 3)						
t_{PHL}	propagation delay time to logic low at output	I_F = 1.6 mA; V_{CC} = 5 V; R_L = 2.2 kΩ	–	2	10	µs
t_{PLH}	propagation delay time to logic high at output	I_F = 1.6 mA; V_{CC} = 5 V; R_L = 2.2 kΩ	–	20	35	µs
Switching times, 6N139 (see Figs 2 and 3)						
t_{PHL}	propagation delay time to logic low at output	I_F = 0.5 mA; V_{CC} = 5 V; R_L = 4.7 kΩ	–	7	25	µs
		I_F = 12 mA; V_{CC} = 5 V; R_L = 270 Ω	–	0.3	1	µs

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
t_{PLH}	propagation delay time to logic high at output	I_F = 0.5 mA; V_{CC} = 5 V; R_L = 4.7 kΩ	–	40	60	μs
		I_F = 12 mA; V_{CC} = 5 V; R_L = 270 Ω	–	3.5	7	μs
Transient immunity (see Fig.4)						
CMH	common mode transient immunity (logic HIGH)	I_F = 0; V_{CC} = 5 V; V_{CM} = 10 $V_{(p-p)}$; R_L = 2.2 kΩ	0.5	–	–	kV/μs
CML	common mode transient immunity (logic LOW)	I_F = 1.6 mA; V_{CC} = 5 V; V_{CM} = 10 $V_{(p-p)}$; R_L = 2.2 kΩ	–0.5	–	–	kV/μs

Notes

1. This parameter is the maximum collector-emitter leakage current measured when a high DC voltage is applied between the emitter and the two shorted diode leads.
2. Every product is tested by applying an isolation test voltage of 3000 V (RMS) for 2 s between all shorted input side leads and all shorted output side leads, with a detection current of approximately 1 μA.

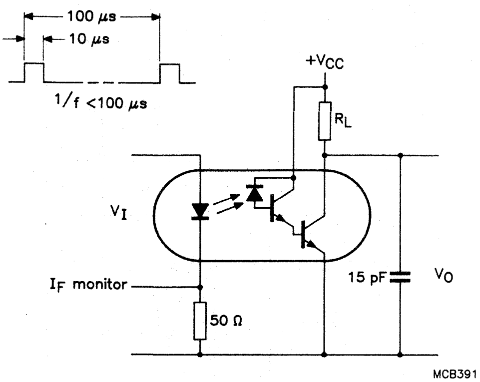


Fig.2 Switching times test circuit.

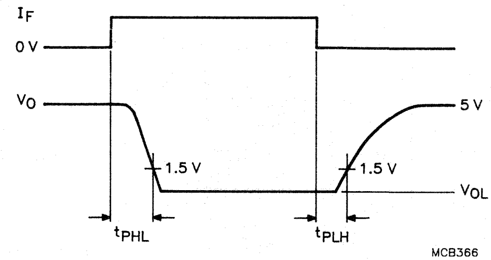


Fig.3 Switching times waveforms.

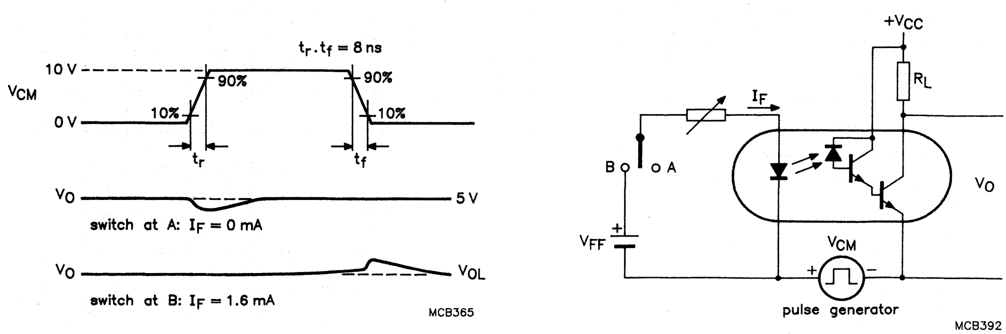


Fig.4 Transient immunity test circuit and waveforms.

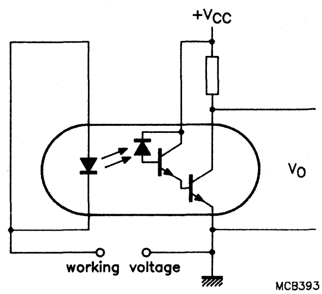


Fig.5 Logic output current test circuit.

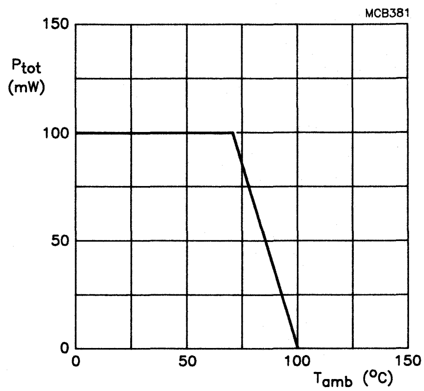
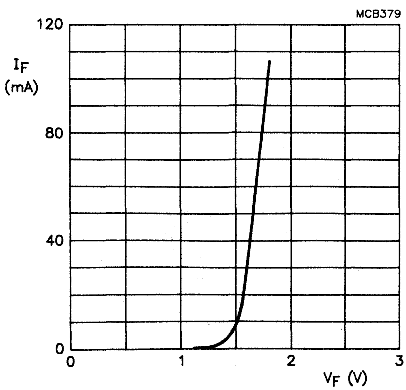
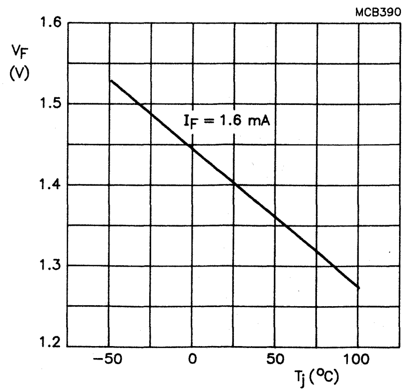


Fig.6 Total power dissipation as a function of ambient temperature.



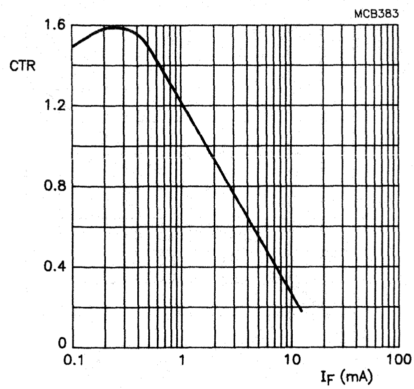
T_{amb} = 25 °C.

Fig.7 Forward current as a function of forward voltage; typical values.



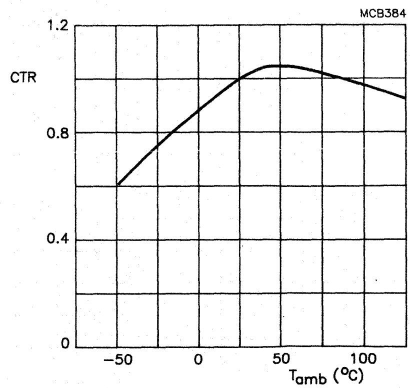
I_F = 1.6 mA.

Fig.8 Forward voltage as a function of junction temperature, typical values.



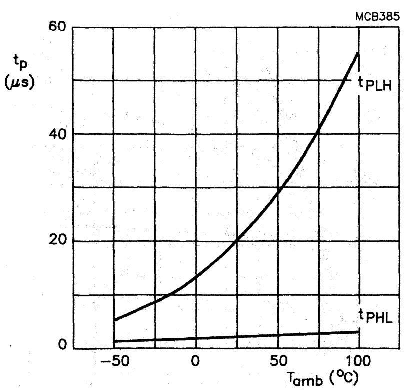
Normalized at I_F = 1.6 mA; V_{CC} = 4.5 V; V_D = 0.4 V; T_{amb} = 25 °C.

Fig.9 Current transfer ratio as a function of forward current.



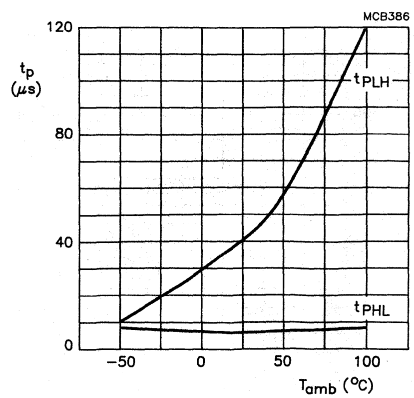
Normalized at I_F = 1.6 mA; V_{CC} = 4.5 V; V_O = 0.4 V; T_{amb} = 25 °C.

Fig.10 Current transfer ratio as a function of ambient temperature.



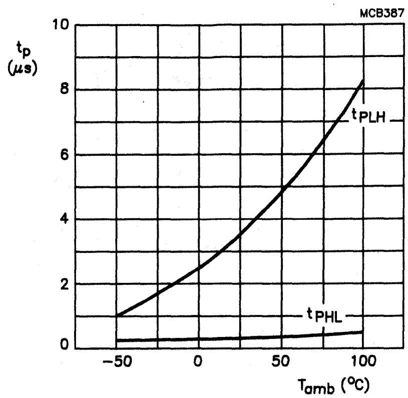
I_F = 1.6 mA; V_{CC} = 5 V; R_L = 2.2 kΩ; typical values.

Fig.11 Propagation delay times as a function of ambient temperature, 6N138.



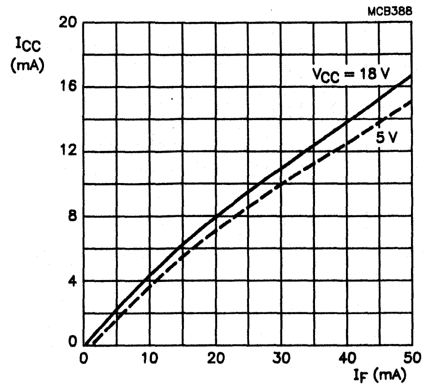
I_F = 0.5 mA; V_{CC} = 5 V; R_L = 4.7 kΩ; typical values.

Fig.12 Propagation delay times as a function of ambient temperature, 6N139.



I_F = 12 mA; V_{CC} = 5 V; R_L = 270 Ω; typical values.

Fig.13 Propagation delay times as a function of ambient temperature, 6N139.



I_O = 0; T_{amb} = 25 °C.

Fig.14 Logic LOW supply current as a function of forward current, typical values.

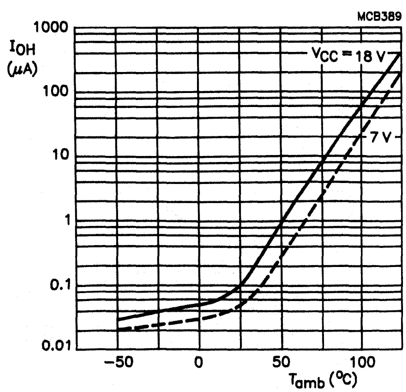
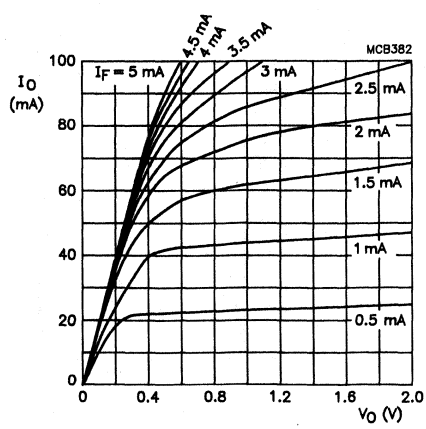


Fig.15 Logic HIGH output current as a function of ambient temperature, typical values.



V_{CC} = 5 V; T_{amb} = 25 °C.

Fig.16 DC and pulsed transfer characteristics, typical values.

PACKAGE OUTLINES

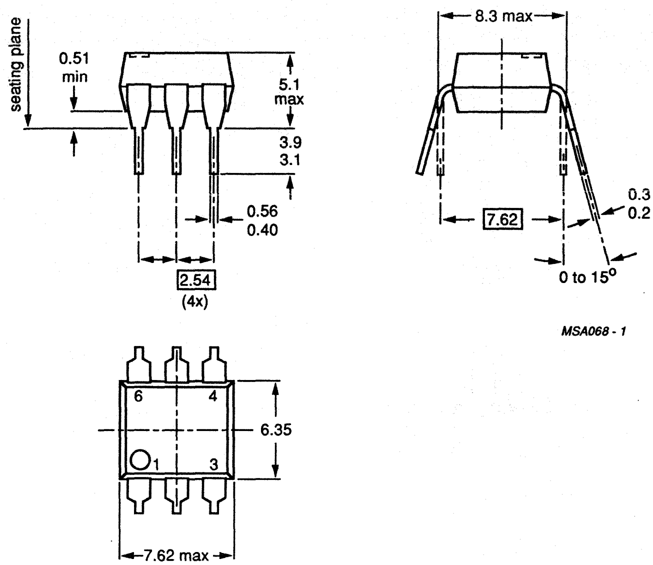


Fig.1 SOT90B.

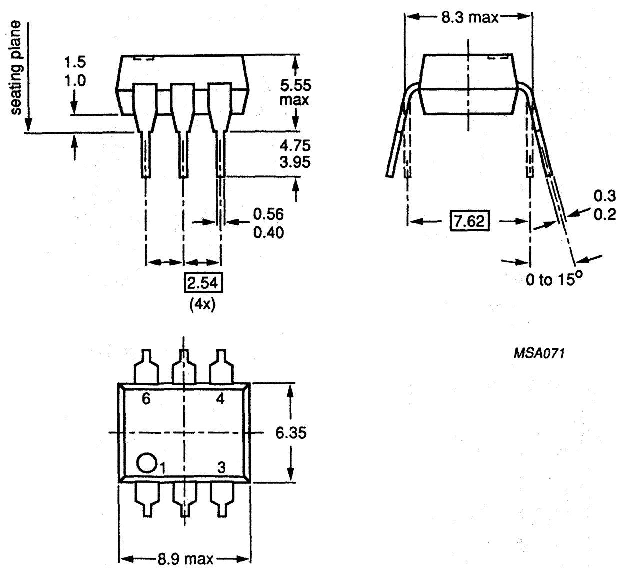


Fig.2 SOT229B.

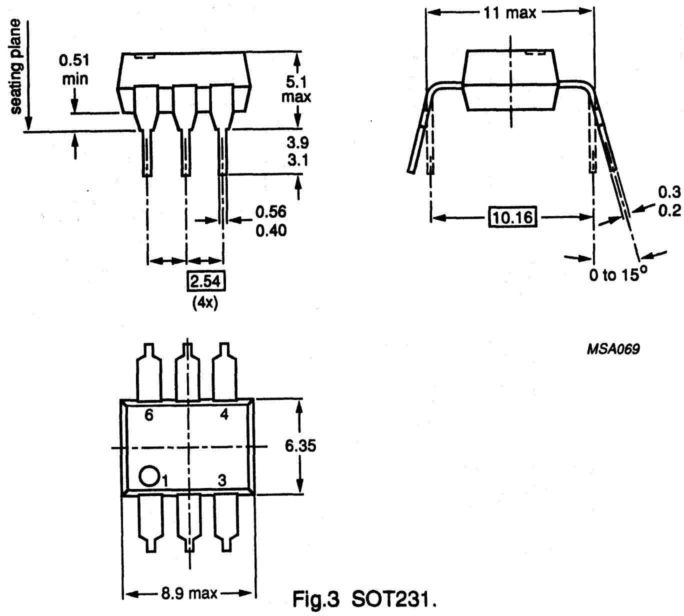


Fig.3 SOT231.

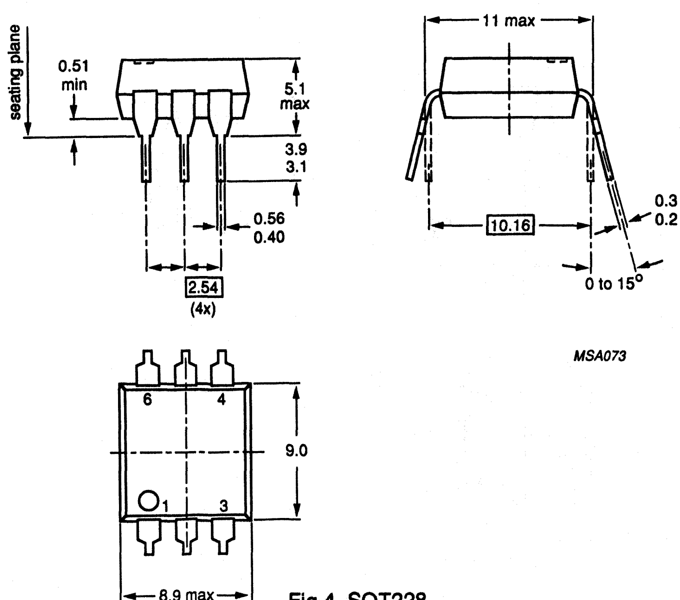


Fig.4 SOT228.

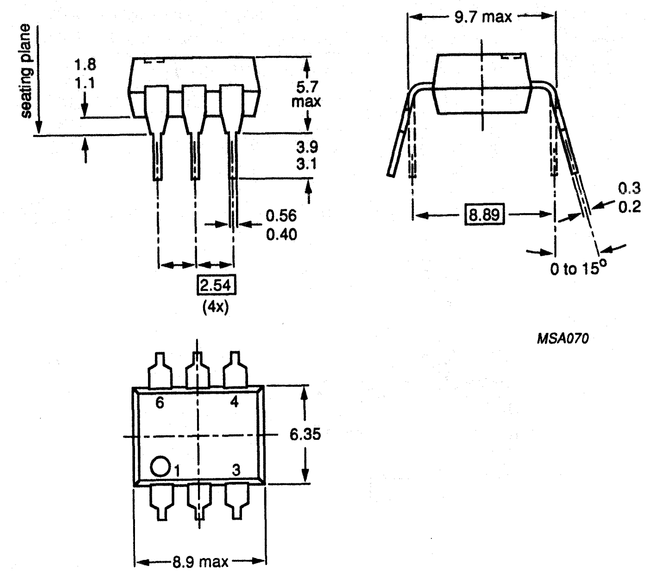


Fig.5 SOT230.

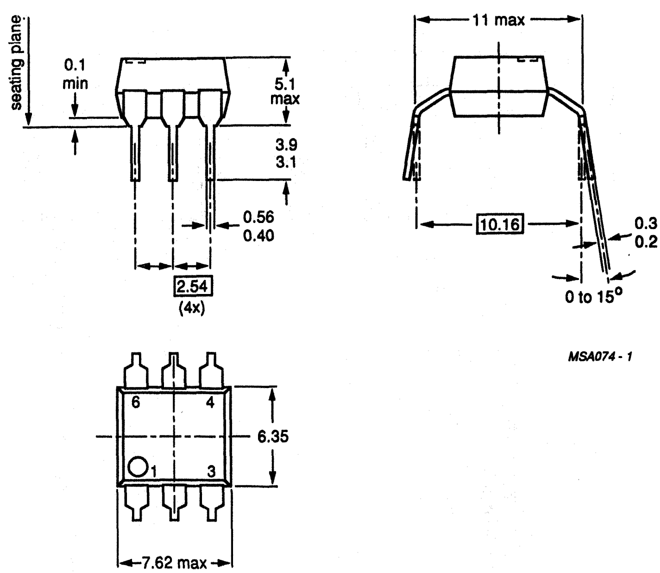


Fig.6 SOT212.

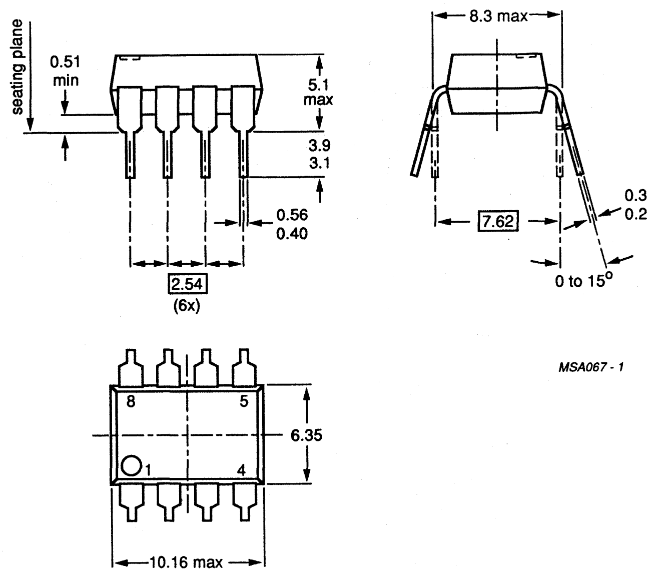


Fig.7 SOT97F.

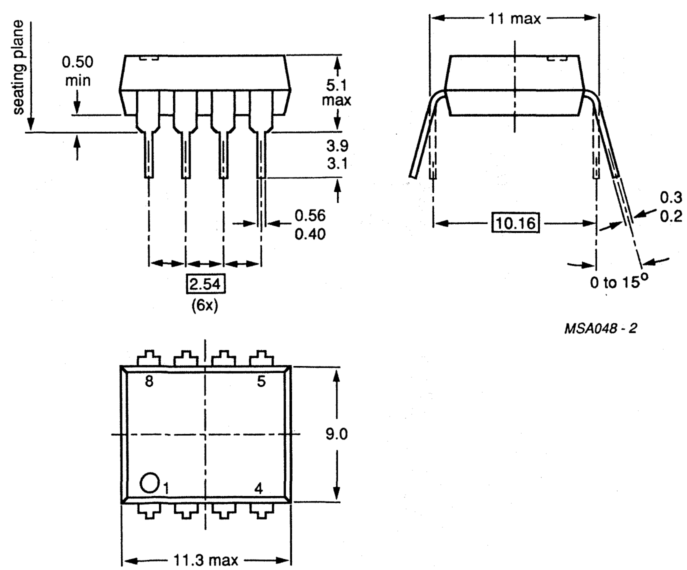
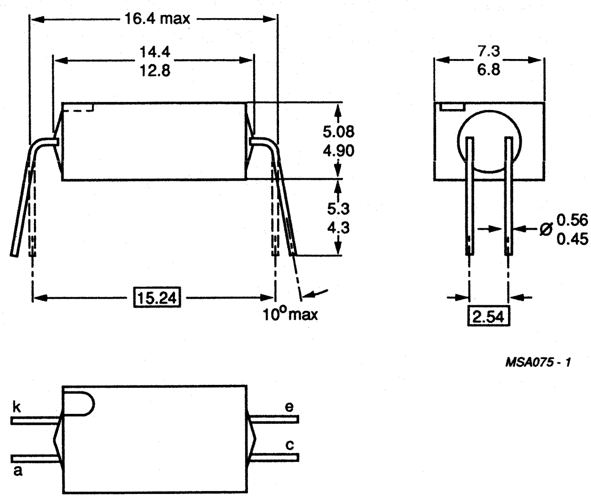


Fig.8 SOT271.


16.4 max
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4.3
15.24
10° max
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Ø 0.56
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Fig.9 SOT211.

NOTES

NOTES

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Data handbook system

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