DISCRETE SEMICONDUCTORS

Optocouplers

BOOK SC12 1989

Philips Components

PHILIPS

OPTOCOUPLERS

page

SELECTION GUIDE

Optocouplers

OPTOCOUPLERS

Standard types, UL recognized and VDE approved

Transistor output

type	case	CTR		V_{CEsat}	V_{IORM}	t_{on}/t_{off} (typ.)		$V_{(BR)CEO}$	page
		I_F = 10 mA; V_{CE} = 0,4 V		I_F = 10 mA; I_C = 2 mA	kV (AC)	I_C = 2 mA; V_{CC} = 5 V; R_L = 100 Ω			
		min.	max.	max. (V)	peak value	t_{on} (μs)	t_{off} (μs)	min. (V)	
CNX35U	SOT90B	0,4	1,6	0,4	4,4	3	3	30	161
CNX39U	SOT90B	0,6	1,0	0,4	4,4	5,5	4	30	161
CNX36U	SOT90B	0,8	2,0	0,4*	4,4	8	6	30	161
●CNY57U	SOT90B	0,2	0,8	0,4	4,4	3	3	30	—
●CNY57AU	SOT90B	0,4		0,4*	4,4	5*	5*	30	—

* I_C = 4 mA. ● Withdrawn types not included in this handbook, superseded by CNX35U.

High-voltage transistor output

type	case	CTR		V_{CEsat}	V_{IORM}	t_{on}/t_{off} (typ.)		$V_{(BR)CEO}$	page
		I_F = 10 mA; V_{CE} = 10 V		I_F = 16 mA; I_C = 2 mA	kV (AC)	I_C = 4 mA; V_{CC} = 5 V; R_L = 100 Ω			
		min.	max.	max. (V)	peak value	t_{on} (μs)	t_{off} (μs)	min. (V)	
CNX38U	SOT90B	0,7	2,1	0,4	4,4	5	5	80	195

Darlington transistor output

type	case	CTR		V_{CEsat}	V_{IORM}	t_{on}/t_{off} (typ.)		$V_{(BR)CEO}$	page
		I_F = 1 mA; V_{CE} = 1 V		I_F = 5 mA; I_C = 10 mA	kV (AC)	I_F = 10 mA; V_{CC} = 5 V; R_L = 100 Ω; R_{BE} = 1 MΩ			
		min.	max.	max. (V)	peak value	t_{on} (μs)	t_{off} (μs)	min. (V)	
CNX48U	SOT90B	5,0		1,0	4,4	5	30	30	223

Standard types

Transistor output

type	case	CTR		V_{CEsat}	V_{IORM}	t_{on}/t_{off} (typ.)		$V_{(BR)CEO}$	page
		I_F = 10 mA V_{CE} = 0,4 V		I_F = 10 mA I_C = 2 mA		I_C = 2 mA; V_{CC} = 5 V; R_L = 100 Ω			
		min.	max.	max. (V)	kV (AC) peak value	t_{on} (μs)	t_{off} (μs)	min. (V)	
CNX35	SOT90B	0,4	1,6	0,4	4,4	3	3	30	143
CNX39	SOT90B	0,6	1,0	0,4	4,4	5,5	4	30	143
CNX36	SOT90B	0,8	2,0	0,4*	4,4	8	6	30	143
●CNY57	SOT90B	0,2	0,8	0,4	4,4	3	3	30	–
●CNY57A	SOT90B	0,4		0,4*	4,4	5*	5*	30	–

* I_C = 4 mA ● withdrawn types not included in this handbook, superseded by CNX35.

High-voltage transistor output

type	case	CTR		V_{CEsat}	V_{IORM}	t_{on}/t_{off} (typ.)		$V_{(BR)CEO}$	page
		I_F = 10 mA V_{CE} = 10 V		I_F = 16 mA I_C = 2 mA		I_C = 4 mA; V_{CC} = 5 V; R_L = 100 Ω			
		min.	max.	max. (V)	kV (AC) peak value	t_{on} (μs)	t_{off} (μs)	min. (V)	
CNX38	SOT90B	0,7	2,1	0,4	4,4	5	5	80	179

Darlington transistor output

type	case	CTR		V_{CEsat}	V_{IORM}	t_{on}/t_{off} (typ.)		$V_{(BR)CEO}$	page
		I_F = 1 V V_{CE} = 1 V		I_F = 5 mA; I_C = 10 mA		I_F = 10 mA; V_{CC} = 5 V; R_L = 100 Ω; R_{BE} = 1 MΩ			
		min.	max.	max. (V)	kV (AC) peak value	t_{on} (μs)	t_{off} (μs)	min. (V)	
CNX48	SOT90B	5,0		1,0	4,4	5	30	30	211

Other standard types, UL recognized, VDE approved.

Transistor output

type	case	CTR		V_{CEsat}	V_{IORM}	t_{on}/t_{off} (typ.)		$V_{(BR)CEO}$	page
		I_F = 10 mA; V_{CE} = 10 V		I_F = 50 mA; I_C = 2 mA		I_C = 2 mA; V_{CC} = 10 V; R_L = 100 Ω			
		min.	max.	max. (V)	kV (AC) peak value	t_{on} (μs)	t_{off} (μs)	min. (V)	
4N25	SOT90B	0,2		0,5	2,820	3 *	3 *	30	397
4N25A	SOT90B	0,2		0,5	2,820	3 *	3 *	30	397
4N26	SOT90B	0,2		0,5	2,820	3 *	3 *	30	397
4N27	SOT90B	0,1		0,5	2,820	3 *	3 *	30	397
4N28	SOT90B	0,1		0,5	2,820	3 *	3 *	30	397

type	case	CTR		V_{CEsat}	V_{IORM}	t_{on}/t_{off} (typ.)		$V_{(BR)CEO}$	page
		I_F = 10 mA; V_{CE} = 10 V		I_F = 10 mA; I_C = 0,5 mA		I_C = 2 mA; V_{CC} = 10 V; R_L = 100 Ω			
		min.	max.	max. (V)	kV (AC) peak value	t_{on} (μs)	t_{off} (μs)	min. (V)	
4N35	SOT90B	1,0		0,3	4,4	7 (< 10)	5 (< 10)	30	411
4N36	SOT90B	1,0		0,3	2,820	7 (< 10)	5 (< 10)	30	411
4N37	SOT90B	1,0		0,3	2,820	7 (< 10)	5 (< 10)	30	411
H11A1	SOT90B	0,5		0,4	2,820	3*	3*	30	303
H11A2	SOT90B	0,2		0,4	2,820	3*	3*	30	303
H11A3	SOT90B	0,2		0,4	2,820	3*	3*	30	303
H11A4	SOT90B	0,1		0,4	2,820	3*	3*	30	303
H11A5	SOT90B	0,3		0,4	2,820	3*	3*	30	303

* t_r/t_f.

Other standard types, UL recognized, VDE approved.

Transistor output (cont.)

type	case	CTR		V_{CEsat}	V_{IORM}	t_{on}/t_{off} (typ.)		$V_{(BR)CEO}$	page
		I_F = 10 mA; V_{CE} = 10 V		I_F = 60 mA; I_C = 1,6 mA		I_C = 2 mA; V_{CC} = 10 V; R_L = 100 Ω			
		min.	max.	max. (V)	kV (AC) peak value	t_{on} (μs)	t_{off} (μs)	min. (V)	
MCT26	SOT90B	0,06		0,5	4,4	3*	3*	30	333

* t_r/t_f.

type	case	CTR		V_{CEsat}	V_{IORM}	t_{on}/t_{off} (typ.)		$V_{(BR)CEO}$	page
		I_F = 10 mA; V_{CE} = 10 V		I_F = 16 mA; I_C = 2 mA		I_F = 20 mA; V_{CC} = 5 V; R_L = 2 kΩ; R_{BE} = 100 kΩ			
		min.	max.	max. (V)	kV (AC) peak value	t_{on} (μs)	t_{off} (μs)	min. (V)	
MCT2	SOT90B	0,2		0,4	4,4	5	10	30	327

High-voltage transistor output

type	case	CTR		V_{CEsat}	V_{IORM}	t_{on}/t_{off} (typ.)		$V_{(BR)CEO}$	page
		I_F = 10 mA; V_{CE} = 10 V		I_F = 20 mA; I_C = 4 mA		I_C = 2 mA; V_{CC} = 10 V; R_L = 100 Ω			
		min.	max.	max. (V)	kV (AC) peak value	t_{on} (μs)	t_{off} (μs)	min. (V)	
4N38	SOT90B	0,2		1,0	2,820	5	5	80	417
4N38A	SOT90B	0,2		1,0	2,820	5	5	80	417

Other standard types, UL recognized, VDE approved.

High-voltage transistor output (cont.)

type	case	CTR		V_{CEsat}	V_{IORM}	t_{on}/t_{off} (typ.)		$V_{(BR)CEO}$	page
		I_F = 10 mA V_{CE} = 5 V		I_F = 10 mA I_C = 2,5 mA		I_C = 2 mA; V_{CC} = 10 V; R_L = 100 Ω			
		min.	max.	max. (V)	kV (AC) peak value	t_{on} (μs)	t_{off} (μs)	min. (V)	
CNY17-1	SOT90B	0,4	0,8	0,3	4,4	5 (< 10)	5 (< 10)	70	297
CNY17-2	SOT90B	0,63	1,25	0,3	4,4	5 (< 10)	5 (< 10)	70	297
CNY17-3	SOT90B	1,0	2,0	0,3	4,4	5 (< 10)	5 (< 10)	70	297
CNY17-4	SOT90B	1,6	3,2	0,3	4,4	5 (< 10)	5 (< 10)	70	297

Darlington transistor output

type	case	CTR		V_{CEsat}	V_{IORM}	t_{on}/t_{off} (typ.)		$V_{(BR)CEO}$	page
		I_F = 1 mA V_{CE} = 5 V		I_F = 1 mA I_C = 1 mA		I_C = 10 mA; V_{CC} = 10 V; R_L = 100 Ω			
		min.	max.	max. (V)	kV (AC) peak value	t_{on} (μs)	t_{off} (μs)	min. (V)	
H11B1	SOT90B	5,0		1,0	2,820	125	100	25	309
H11B2	SOT90B	2,0		1,0	2,820	125	100	25	309
H11B3	SOT90B	1,0		1,0	2,820	125	100	25	309

type	case	CTR		V_{CEsat}	V_{IORM}	t_{on}/t_{off} (typ.)		$V_{(BR)CEO}$	page
		I_F = 10 mA V_{CE} = 5 V		I_F = 50 mA I_C = 50 mA		I_C = 10 mA; V_{CC} = 10 V; R_L = 100 Ω			
		min.	max.	max. (V)	kV (AC) peak value	t_{on} (μs)	t_{off} (μs)	min. (V)	
H11B255	SOT90B	1,0		1,0	2,820	125	100	55	315

Other standard types, UL recognized, VDE approved.

Darlington transistor output (cont.)

type	case	CTR		V_{CEsat}	V_{IORM}	t_{on}/t_{off} (typ.)		$V_{(BR)CEO}$	page
		I_F = 10 mA V_{CE} = 5 V		I_F = 50 mA; I_C = 50 mA		I_F = 10 mA; V_{CC} = 5 V; R_L = 100 Ω			
		min.	max.	max. (V)	kV (AC) peak value	t_{on} (μs)	t_{off} (μs)	min. (V)	
MCA230	SOT90B	1,0		1,0	4,4	5	100	30	321
MCA231	SOT90B	2,0		1,2*	4,4	5	100	30	321
MCA255	SOT90B	1,0		1,0	4,4	5	100	55	321

type	case	CTR		V_{CEsat}	V_{IORM}	t_{on}/t_{off} (max.)		$V_{(BR)CEO}$	page
		I_F = 10 mA V_{CE} = 10 V		I_F = 8 mA I_C = 2 mA		I_F = 200 mA; V_{CC} = 10 V R_L = 180 Ω			
		min.	max.	max. (V)	kV (AC) peak value	t_{on} (μs)	t_{off} (μs)	min. (V)	
4N29	SOT90B	1,0		1,0	4,4	5	40	30	403
4N30	SOT90B	1,0		1,0	4,4	5	40	30	403
4N31	SOT90B	0,5		1,2	4,4	5	40	30	403
4N32	SOT90B	5,0		1,0	4,4	5	100	30	403
4N33	SOT90B	5,0		1,0	4,4	5	100	30	403

* I_F = 10 mA.

Types for mains applications, UL recognized, VDE approved

type	case	CTR		V_{CEsat}	V_{IORM}	t_{on}/t_{off} (typ.)		$V_{(BR)CEO}$	page
		I_F = 10 mA; V_{CE} = 0,4 V		I_F = 10 mA; I_C = 4 mA	kV (AC)	I_C = 2 mA; V_{CC} = 5 V; R_L = 100 Ω			
		min.	max.	max. (V)	peak value	t_{on} (μs)	t_{off} (μs)	min. (V)	
+CNX62	SOT174	0,4		0,4	5,3	3	3	50	235
CNX71	SOT90B	0,4	1,6	0,4	5,3*	20***	20***	30	253
●CNX72	SOT90B	0,4	1,6	0,4	5,3*	26**	2,5**	30	–
●CNX82	SOT212	0,4		0,4	5,3	3	3	50	–
●CNX83	SOT212	0,4		0,4	5,3	3	3	50	–
CNX62A	SOT230	0,4		0,4	5,3	3	3	50	243
CNX72A	SOT229	0,4	1,6	0,4	5,3*	26**	2,5**	30	263
CNX82A	SOT231	0,4		0,4	5,3	3	3	50	275
CNX83A	SOT231	0,4		0,4	5,3	3	3	50	285
CNW82	SOT228	0,4		0,4	8,34	3	3	50	113
CNW83	SOT228	0,4		0,4	8,34	3	3	50	123

* VDE approved for 4,4 kV.
** Max. values, R_{BE} = 56 kΩ, R_L = 1 kΩ.
*** Max. values, V_{CC} = 10 V.

● Withdrawn types not included in this handbook - successors CNX72A, CNX82A and CNX83A.
+ Types which will be withdrawn soon-successor CNX62A.

Notes: CNX82, CNX83, CNX82A, CNX83A, CNW82 and CNW83—pin distance 10,16 mm.
CNX62, CNX82, CNX71, CNX62A, CNX82A, CNW82 have no base connection.

Types with input/output pin distance 15,24 mm

type	case	CTR		V_{CEsat}	V_{IORM}	t_{on}/t_{off} (typ.)		$V_{(BR)CEO}$	page
		I_F = 10 mA V_{CE} = 0,4 V		I_F = 10 mA I_C = 2 mA		I_C = 2 mA; V_{CC} = 5 V; R_L = 100 Ω			
		min.	max.	max. (V)	kV (AC) peak value	t_{on} (μs)	t_{off} (μs)	min. (V)	
CNX21	SOT211	0,2		0,15*	10	3	3	30	135

* Typ. value.

Types for telephony applications, recognized by French CNET, CECC approved

type	case	CTR		V_{CEsat}	V_{IORM}	t_{on}/t_{off} (max.)		$V_{(BR)CEO}$	page
		I_F = 2 mA V_{CE} = 5 V		I_F = 50 mA I_C = 10 mA		I_C = 16 mA; V_{CC} = 5 V; R_L = 1 kΩ			
		min.	max.	max. (V)	kV (AC) peak value	t_{on} (μs)	t_{off} (μs)	min. (V)	
SL5500	SOT90B	0,4		0,4	3,5	20	50	30	357

type	case	CTR		V_{CEsat}	V_{IORM}	t_{on}/t_{off} (max.)		$V_{(BR)CEO}$	page
		I_F = 2 mA V_{CE} = 5 V		I_F = 2,0 mA; I_C = 2 mA		I_C = 16 mA; V_{CC} = 5 V; R_L = 1 kΩ			
		min.	max.	max. (V)	kV (AC) peak value	t_{on} (μs)	t_{off} (μs)	min. (V)	
SL5501	SOT90B	0,15		0,4	3,5	20	50	30	357

Types for telephony applications, recognized by CNET, CECC approved (cont.)

type	case	CTR		V_{CEsat}	V_{IORM}	t_{on}/t_{off} (max.)		$V_{(BR)CEO}$	page
		I_F = 2 mA; V_{CE} = 5 V		I_F = 20 mA; I_C = 2 mA		I_C = 16 mA; V_{CC} = 5 V; R_L = 1 kΩ			
		min.	max.	max. (V)	kV (AC) peak value	t_{on} (μs)	t_{off} (μs)	min. (V)	
SL5504	SOT90B	0,15		0,4	3,5	50	150	80	375
SL5511	SOT90B	0,25		0,4	3,5	20	50	30	357

New generation of optocouplers with GaAlAs emitter diode

Low current types, transistor output, UL recognized, VDE approved.

type	case	CTR		V_{CEsat}	V_{IORM}	t_{on}/t_{off} (typ.)		$V_{(BR)CEO}$	page
		I_F = 10 mA; V_{CE} = 0,4 V		I_F = 10 mA; I_C = 2 mA		I_C = 2 mA; V_{CC} = 5 V; R_L = 100 Ω			
		min.	max.	max. (V)	kV (AC) peak value	t_{on} (μs)	t_{off} (μs)	min. (V)	
CNG35	SOT90B	0,4	1,6	0,4	4,4	3	3	30	55
CNG36	SOT90B	0,8	2,0 1,4* 0,8**	0,4***	4,4	8	6	30	55

* Typ. value at I_F = 2 mA.
** Typ. value at I_F = 0,5 mA.
*** I_C = 4 mA

Types for mains applications, UC recognized, VDE approved.

type	case	CTR		V_{CEsat}	V_{IORM}	t_{on}/t_{off} (typ.)		$V_{(BR)CEO}$	page
		I_F = 10 mA; V_{CE} = 0,4 V		I_F = 10 mA; I_C = 4 mA		I_C = 2 mA; V_{CC} = 5 V; R_L = 100 Ω			
		min.	max.	max. (V)	kV (AC) peak value	t_{on} (μs)	t_{off} (μs)	min. (V)	
CNG82	SOT212	0,4	1,6	0,4	5,3	3	3	50	77
CNG83	SOT212	0,4	1,6	0,4	5,3	3	3	50	87

CNG82 has no base connection

New generation of optocouplers with GaAlAs emitter diode (cont.)

Telephony applications, approved by British Telecom (output transistor), UL recognized.

type	case	CTR		V_{CEsat}	V_{IORM}	t_{on}/t_{off} (max.)		$V_{(BR)CEO}$	page
		I_F = 10 mA V_{CE} = 0,5 V		I_F = 10 mA I_C = 1 mA		I_C = 2 mA; V_{CC} = 10 V; R_L = 100 Ω			
		min.	max.	max. (V)	kV (AC) peak value	t_{on} (μs)	t_{off} (μs)	min. (V)	
PO40/44A	SOT90B	0,6 0,25*	1,5	0,5	3,5	7	7	30	341

* Min. value at I_F = 1 mA; V_{CE} = 0,4 V.

Note : The PO40/44A can replace each individual type PO40A, PO41A, PO42A, PO43A and PO44A.

High-speed type, diode/transistor output

type	case	CTR		V_{CEsat}	V_{IORM}	t_{PHL}/t_{PLH} (max.)		$V_{(BR)CEO}$	page
		I_F = 10 mA V_{CC} = 4,5 V V_O = 0,4 V		I_F = 10 mA I_C = 2 mA V_{CC} = 4,5 V		I_F = 10 mA; V_{CC} = 5 V; R_L = 2,5 kΩ			
		min.	max.	max. (V)	kV (AC) peak value	t_{PHL} (μs)	t_{PLH} (μs)	min. (V)	
CNR36	SOT97F	0,2		0,4	3,5	0,8	0,8	18	99
SL5505S	SOT97F	0,2	4,0	0,4	3,5	0,8	0,8	18	389
6N135	SOT97F	0,07(1)		0,4 (2)	3,5	1,5 (4)	1,5 (4)	15	429
6N136	SOT47F	0,14 (1)		0,4 (3)	4,4	0,8 (5)	0,8 (5)	15	429

(1) I_F = 16 mA
(2) I_F = 16 mA; I_C = 1,1 mA
(3) I_F = 16 mA; I_C = 2,4 mA
(4) I_F = 16 mA; R_L = 4,1 kΩ
(5) I_F = 16 mA; R_L = 1,9 kΩ

Resistance - darlington output

type	case	CTR		V_{CEsat}	V_{IORM}	t_{on}/t_{off} (max.)		$V_{(BR)CEO}$	page
		$I_F = 1$ mA $V_{CE} = 5$ V		$I_F = 1$ mA $I_C = 1$ mA		$I_F = 0,5$ mA; $V_{CC} = 5$ V $R_L = 2,2$ kΩ			
		min.	max.	max. (V)	kV (AC) peak value	t_{on} (μs)	t_{off} (μs)	min. (V)	
CNG40	SOT231	5		1,0	5,3	150	600	80	71
4N46	SOT229	5		1,0*	4,4	50**	500**	30	423

* $I_C = 5$ mA
** $I_F = 10$ mA; $R_L = 220$ Ω; t_{PHL}/t_{PLH}

DUAL OPTOCOUPLER

type	case	CTR		V_{CEsat}	V_{IORM}	t_{on}/t_{off} (typ.)		$V_{(BR)CEO}$	page
		$I_F = 5$ mA $V_{CE} = 5$ V		$I_F = 10$ mA $I_C = 2$ mA		$I_C = 2$ mA; $V_{CC} = 5$ V $R_L = 100$ Ω			
		min.	max.	max. (V)	kV (AC) peak value	t_{on} (μs)	t_{off} (μs)	min. (V)	
CNS35	SOT97F	0,5	6	0,4	4,4	3	3	35	107

TYPE NUMBER SURVEY

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

GENERAL

Safety recommendations
Rating system
Letter symbols
Type designation
Definitions
Current transfer ratio
Switching times
Approvals/recognitions

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

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

Subscripts for multiple devices

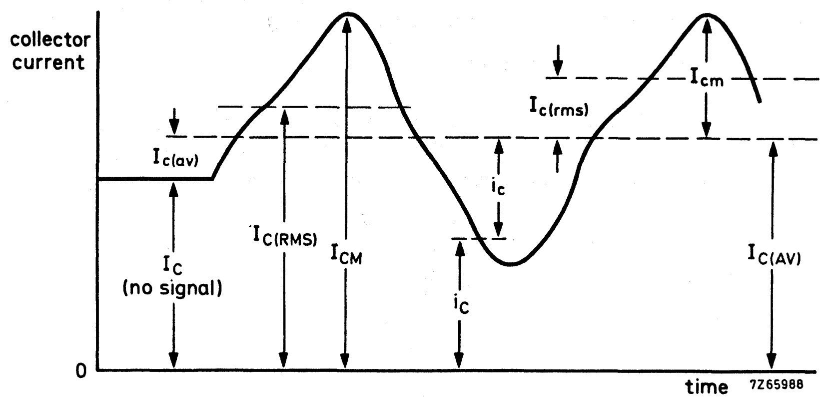
For multiple unit devices, the subscripts are modified by a number preceding the letter subscript; in the case of multiple subscripts, hyphens may be necessary to avoid misunderstanding.

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

$V_{1C\text{-}2C}$ = 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 ($R_{th\ j\text{-}mb} \leqslant 15$ 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 ($R_{th\ j\text{-}mb} \leqslant 15$ 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 ($R_{th\ j\text{-}mb} \leqslant 15$ K/W)
U. TRANSISTOR; power, switching ($R_{th\ j\text{-}mb} \leqslant 15$ 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).

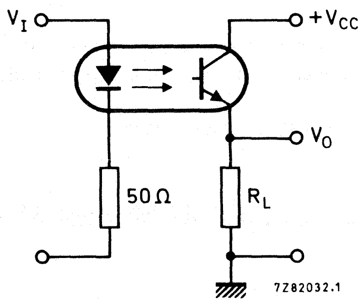


Fig. 1 Switching circuit.

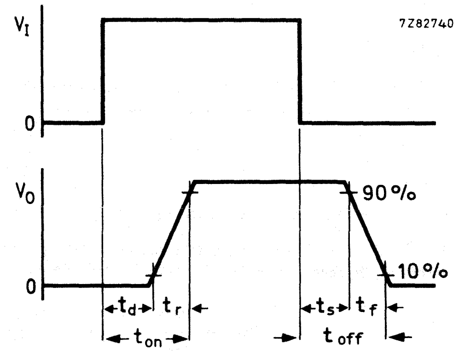


Fig. 2 Waveforms.

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.

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

Luminous exitance (luminous emittance) M_v

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

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

Luminance L_v

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

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

Steradian sr (see Fig. 3)

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

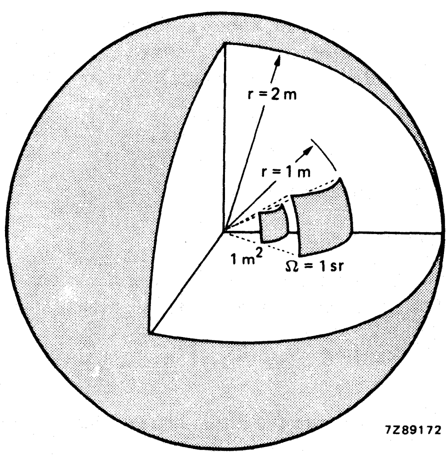


Fig. 3.

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.

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

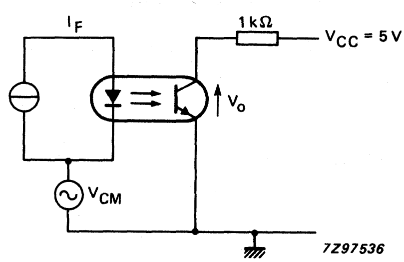


Fig. 1.

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.

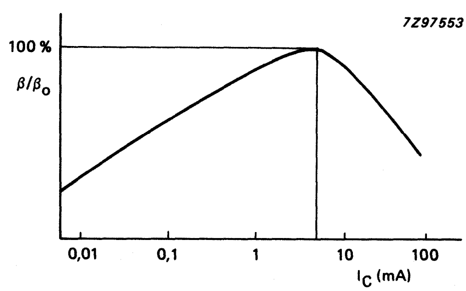


Fig. 2.

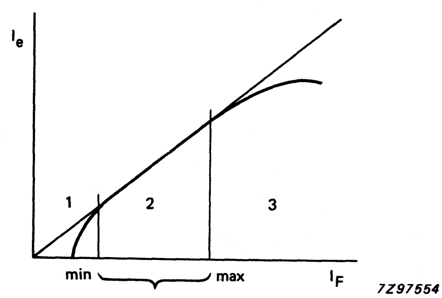


Fig. 3.

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.

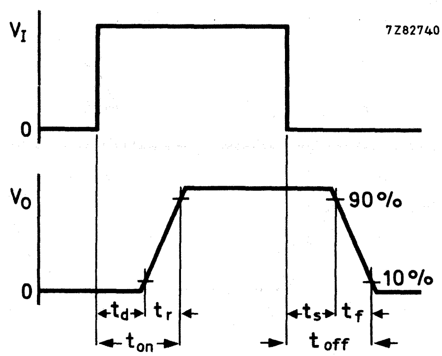


Fig. 4 Waveforms.

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.

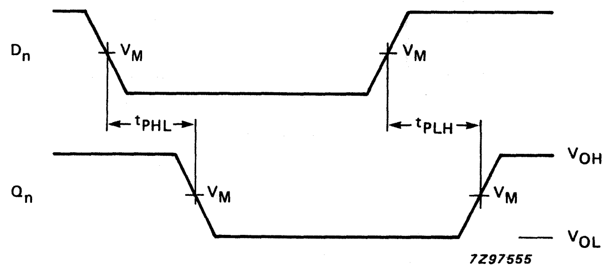


Fig. 5 TTL.

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.

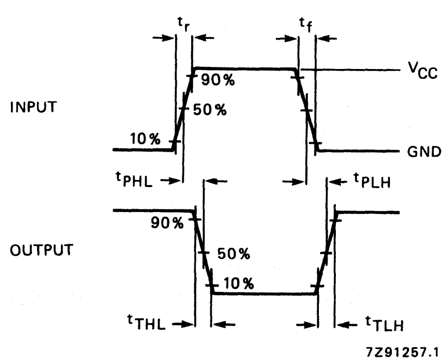


Fig. 6 CMOS.

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}.

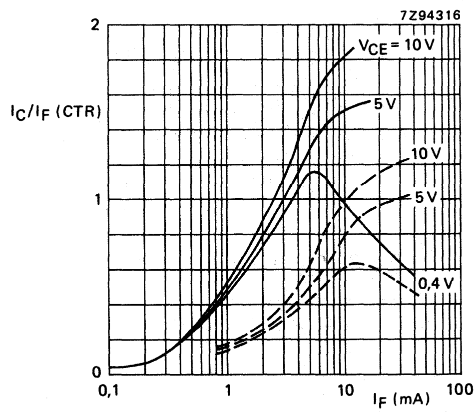


Fig. 1.

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

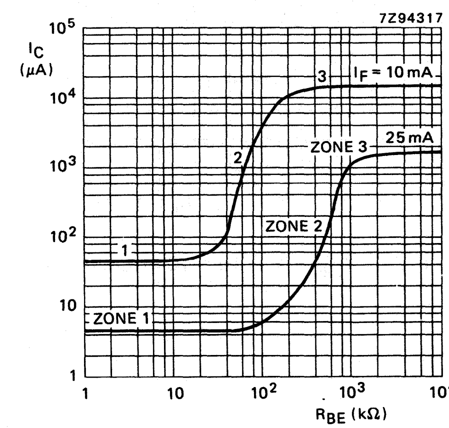


Fig. 2 V_{CC} = 5 V; T_{amb} = 25 °C; typical values.

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 photo-transistor. 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.

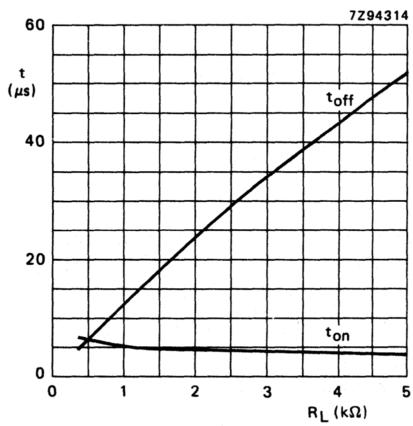


Fig. 1 V_{CC} = 5 V; I_F = 10 mA.

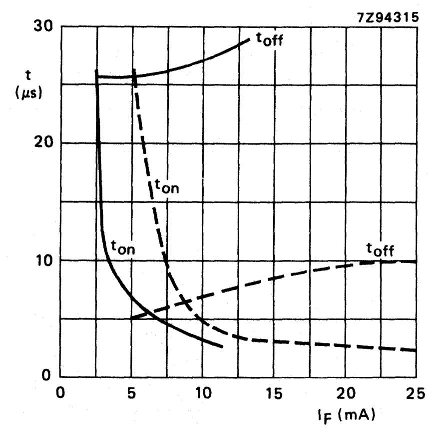


Fig. 2 V_{CC} = 5 V; R_L = 2,5 kΩ.

——— $R_{BE} = \infty$

– – – – R_{BE} = 100 kΩ

APPROVALS/RECOGNITIONS

	UL 1577	VDE 0883	VDE 0804 0860	VDE 0805 0806	others
CNG35	x	x	x		British Telecom
CNG36	x	x	x		British Telecom
CNG40					Note 2
CNG82	x	x	x		British Telecom; BS415
CNG83	x	x	x		British Telecom; BS415
CNR36	x	pending			
CNS35					Note 3
CNW82	x	x	x	x	BS415; VDE 0750-1; NORDIC Note 4
CNW83	x	x	x	x	BS415; VDE 0750-1; NORDIC Note 4
CNX21 CNX35					CECC 20004.003
CNX35U	x	x	x		CECC 20004.003
CNX36					CECC 20004.003
CNX36U	x	x	x		CECC 20004.003
CNX38					CECC 20004.003
CNX38U	x	x	x		CECC 20004.003
CNX39					CECC 20004.003
CNX39U	x	x	x		CECC 20004.003
CNX48					
CNX48U	x	x	x		
CNX62	x	x	x		
CNX62A	x	x	x	x	BS 415; NORDIC Note 4
CNX71	x	x	x		
CNX72A	x	x	x		
CNX82A	x	x	x	x	BS 415; NORDIC Note 4
CNX83A	x	x	x	x	BS 415; NORDIC Note 4

	UL 1577	VDE 0883	VDE 0804 0860	VDE 0805 0806	others
CNY17-1	x	x	x		
CNY17-2	x	x	x		
CNY17-3	x	x	x		
CNY17-4	x	x	x		
H11A1	x	x			
H11A2	x	x			
H11A3	x	x			
H11A4	x	x			
H11A5	x	x			
H11B1	x	x			
H11B2	x	x			
H11B3	x	x			
H11B255	x	x			
MCA230	x	x	x		
MCA231	x	x	x		
MCA255	x	x	x		
MCT2	x	x	x		
MCT26	x	x	x		
P040/44A	x				British Telecom
SL5500					French CNET; CECC 20004.001
SL5501					French CNET; CECC 20004.001
SL5504					French CNET; CECC 20004.001
SL5511					French CNET; CECC 20004.001
SL5505S	x	pending			French CNET
4N25	x	x			
4N25A	x	x			
4N26	x	x			
4N27	x	x			
4N28	x	x			
4N29	x	x	x		
4N30	x	x	x		
4N31	x	x	x		
4N32	x	x	x		
4N33	x	x	x		
4N35	x	x	x		
4N36	x	x			
4N37	x	x			

	UL 1577	VDE 0883	VDE 0804 0860	VDE 0805 0806	others
4N38	x	x			
4N38A	x	x			
6N135	x	pending			
6N136	x	pending	pending		
4N46					Note 3
CNG41					Notes 1 and 2
CNY17G-1					Notes 1 and 2
CNY17G-2					Notes 1 and 2
CNY17G-3					Notes 1 and 2
CNY17G-4					Notes 1 and 2
CNY17GF-1					Notes 1 and 2
CNY17GF-2					Notes 1 and 2
CNY17GF-3					Notes 1 and 2
CNY17GF-4					Notes 1 and 2
H11G1					Notes 1 and 3
H11G2					Notes 1 and 3
H11G3					Notes 1 and 3
SL5522					Notes 1 and 3; French CNET pending
SL5582					Notes 1 and 2; French CNET
SL5583					Notes 1 and 2; French CNET
SL5582W					Notes 1 and 2; French CNET
SL5583W					Notes 1 and 2; French CNET

Note 1: Data sheet not yet included in handbook.

Note 2: UL1577, VDE 0883/0804/0860/0805/0806, BSI 415 and NORDIC IEC 65/380/950/335 will be applied for. (VDE 0750-1 for SL5582W/5583W)

Note 3: UL1577, VDE 0883/0804/0860 will be applied for.

Note 4: NORDIC – Tested for applications (reinforced isolation).
– Class II application for pluggable apparatus in normal tight execution.

SETI, SEMKO, NEMKO – According to IEC65 (IEC380/950/335 pending).
DEMKO – According to IEC65/380/950/335.

SECTION A1

Optocouplers in a plastic encapsulation

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

BRITISH TELECOM APPROVAL

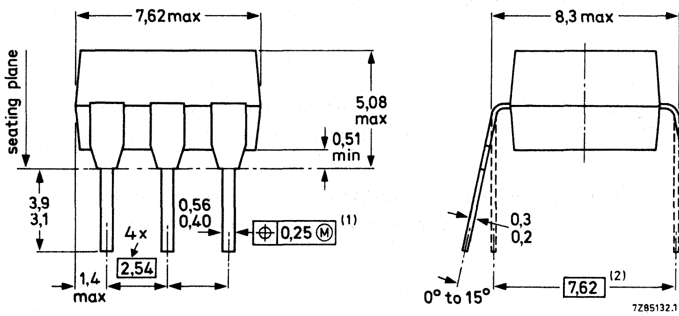
QUICK REFERENCE DATA

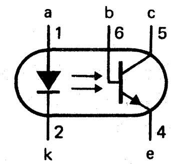
Diode				
Continuous reverse voltage		V_R	max.	5 V
DC forward current		I_F	max.	100 mA
Transistor				
Collector-emitter voltage (open base)		V_{CEO}	max.	30 V
Optocoupler				
Output/input DC current transfer ratio (CTR)				
I_F = 10 mA; V_{CE} = 0.4 V	CNG35	I_C/I_F	min.	0.4 - 1.6
	CNG36	I_C/I_F	min.	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_{IORM}	min.	4.4 kV
Isolation voltage AC (RMS value)				3.12 kV

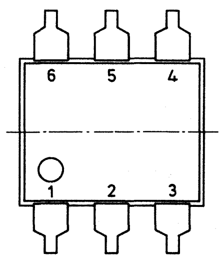
MECHANICAL DATA

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
DC current gain $I_C = 1$ mA; $V_{CE} = 5$ V	h_{FE}		150 to 1500

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.	100	μA
Isolation voltage DC		V_{IORM}	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} = 1 kV		R_{IO}	min.	10	GΩ
			typ.	1	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 tim	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.

			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

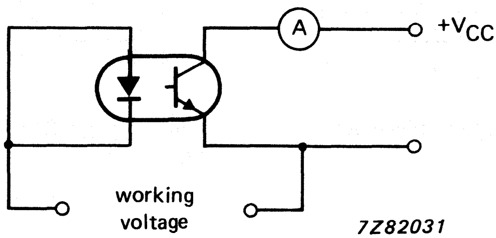


Fig.2.

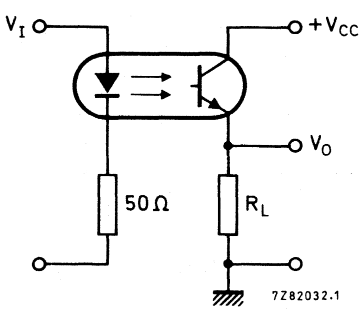


Fig.3 Switching circuit.

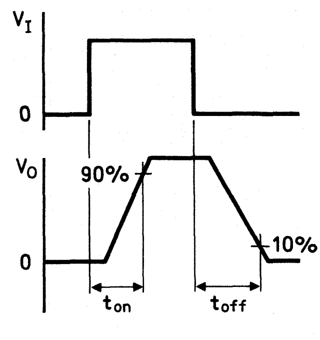


Fig.4 Waveforms.

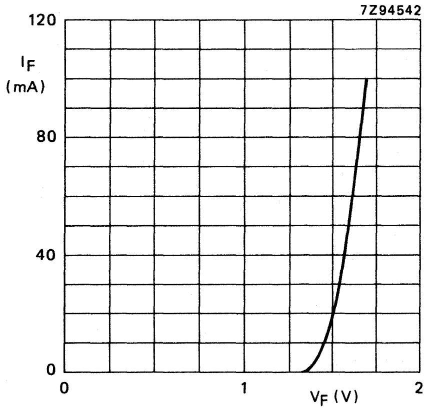


Fig. 5 T_{amb} = 25 °C; typical values.

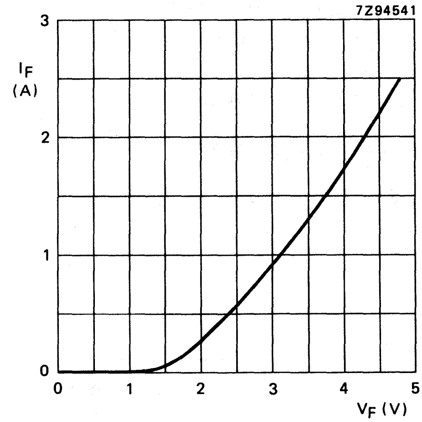


Fig. 6 T_{amb} = 25 °C; t_p = 10 μs; T = 1 ms; typical values.

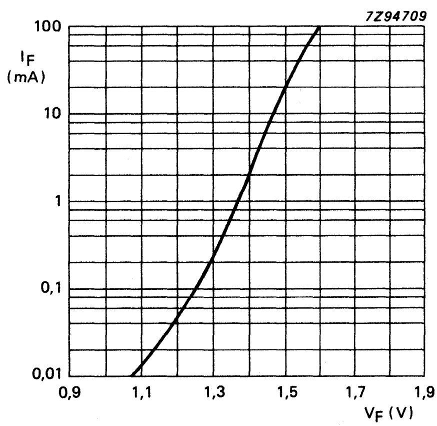


Fig. 7 T_{amb} = 25 °C; typical values.

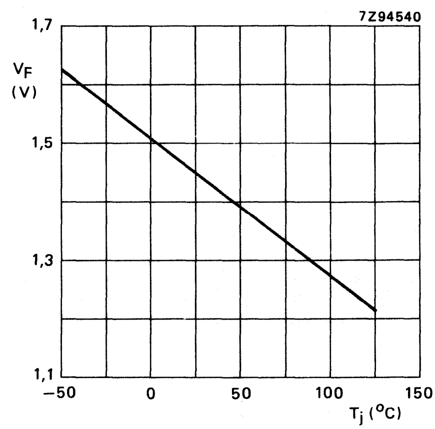


Fig. 8 I_F = 10 mA; typical values.

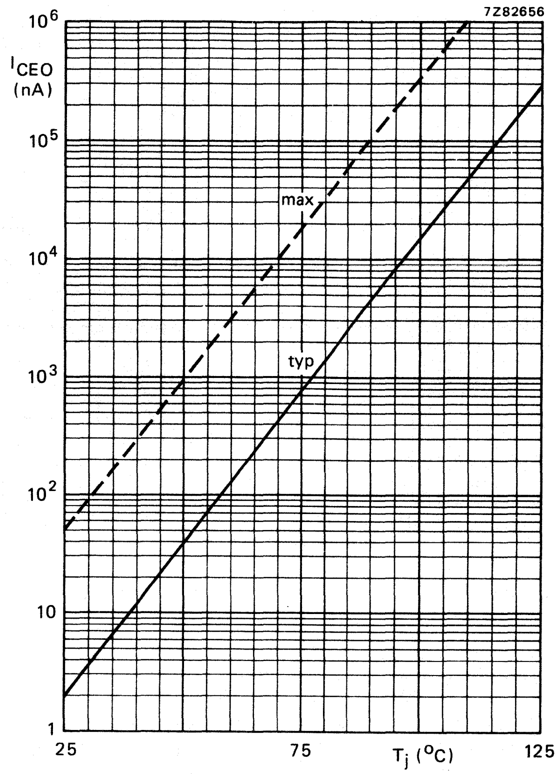


Fig. 9 $I_F = 0$; $V_{CE} = 10$ V.

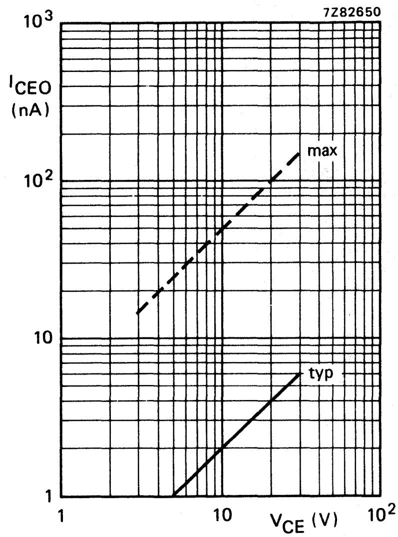


Fig. 10 $I_F = 0$; $T_j = 25\ ^oC$.

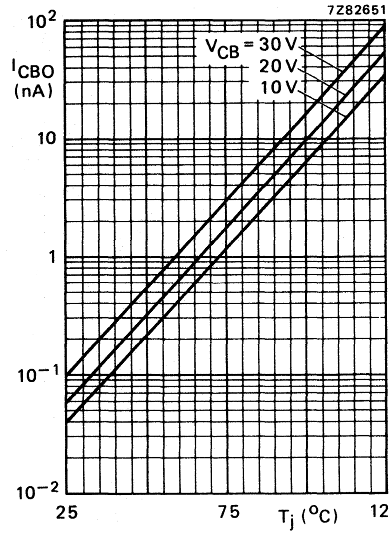


Fig. 11 Typical values.

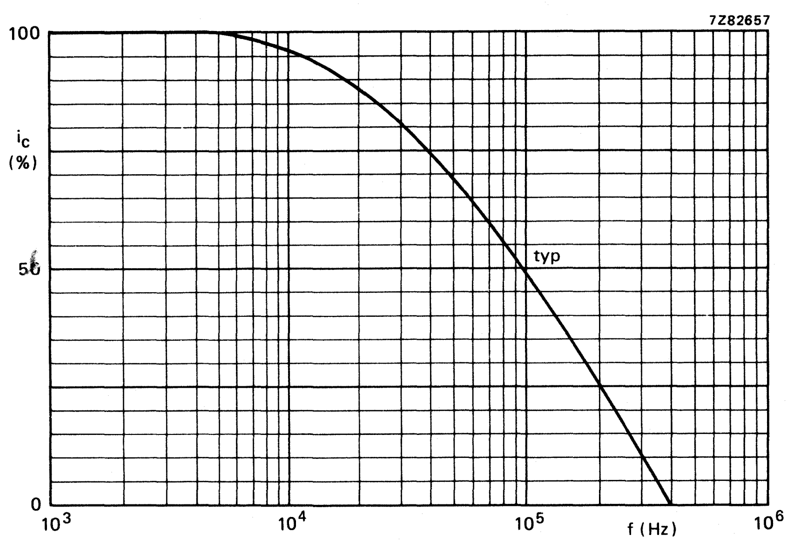


Fig. 12 $I_B = 0$; $I_C = 2$ mA; $V_{CC} = 5$ V; $R_L = 1$ kΩ; $T_{amb} = 25\ ^oC$.

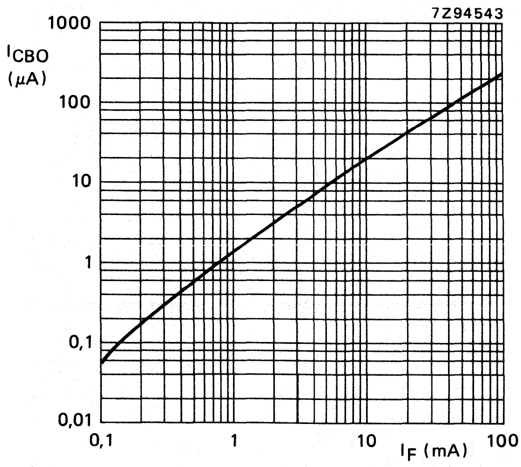


Fig. 13 V_{CB} = 5 V; T_{amb} = 25 °C; typical values.

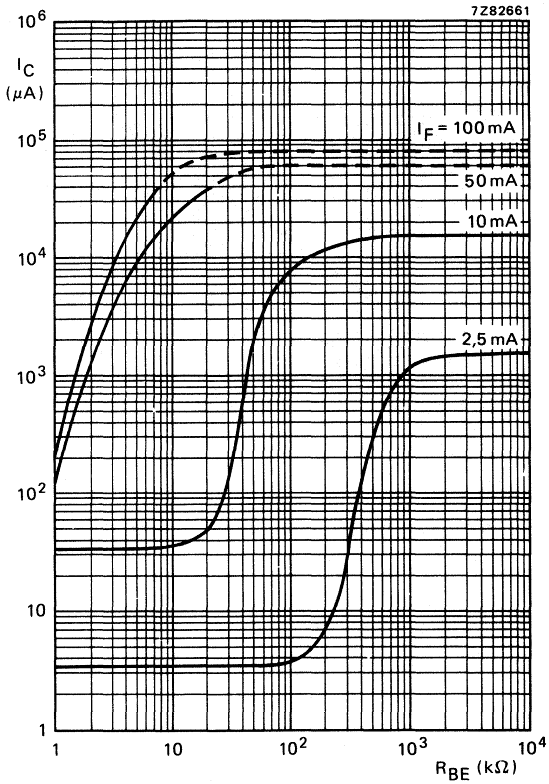


Fig. 14 $I_B = 0$; $V_{CE} = 5$ V; $T_{amb} = 25$ °C; typical values.

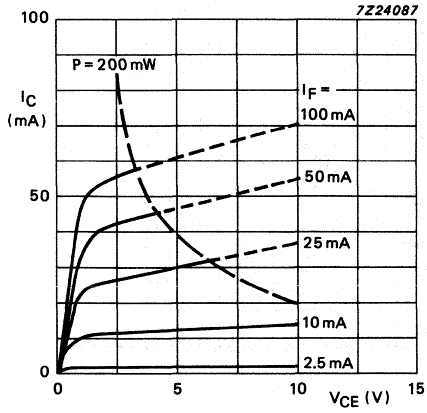


Fig.15 Collector current as a function of collector-emitter voltage; T_{amb} = 25 °C; typical values; **CNG35**.

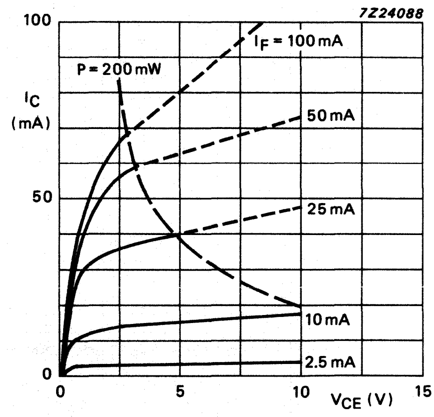


Fig.16 Collector current as a function of collector-emitter voltage; T_{amb} = 25 °C; typical values; **CNG36**.

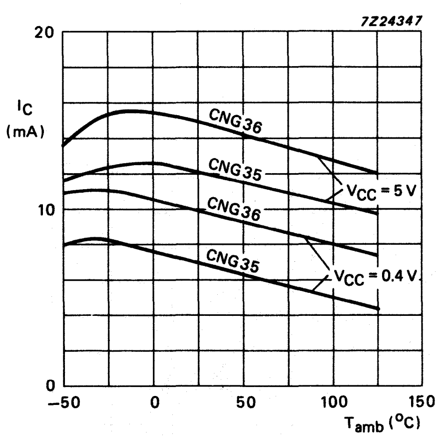


Fig.17 Collector current as a function of ambient temperature; I_F = 10 mA; typical values.

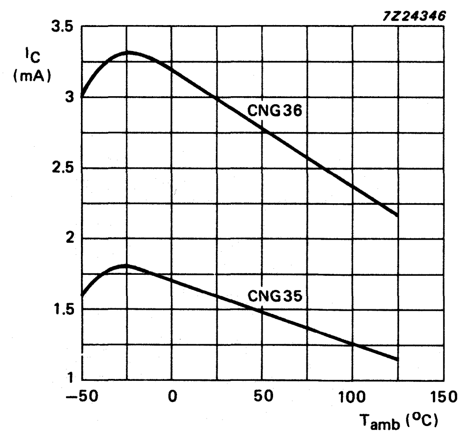


Fig.18 Collector current as a function of ambient temperature; I_F = 2 mA; V_{CE} = 0.4 V; typical values.

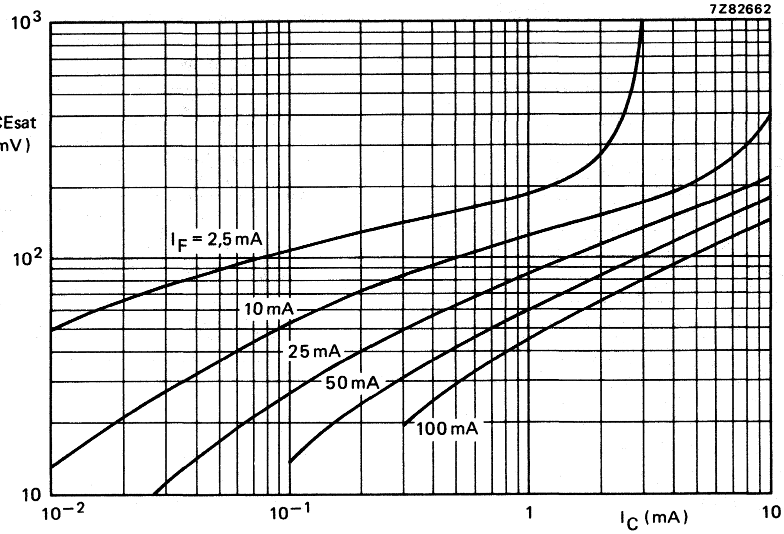


Fig.19 Collector-emitter saturation voltage as a function of collector current; $I_B = 0$; $T_{amb} = 25\ ^oC$; typical values.

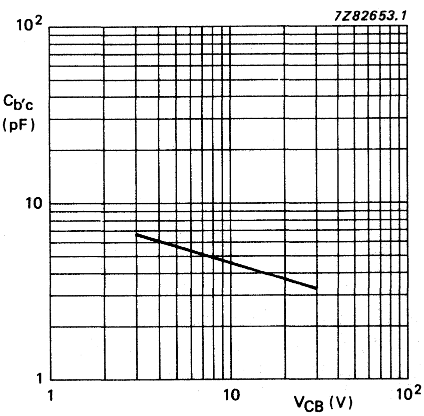


Fig.20 Output capacitance as a function of base-collector voltage; f = 1 MHz; $T_{amb} = 25\ ^oC$.

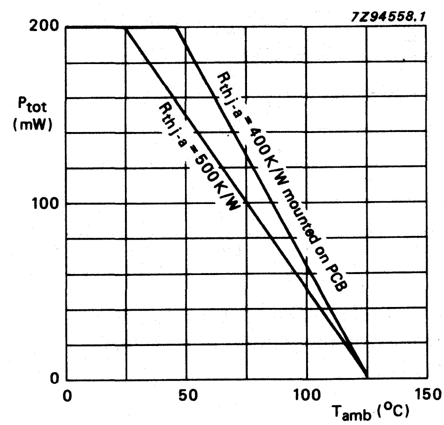


Fig.21 Total power dissipation as a function of ambient temperature.

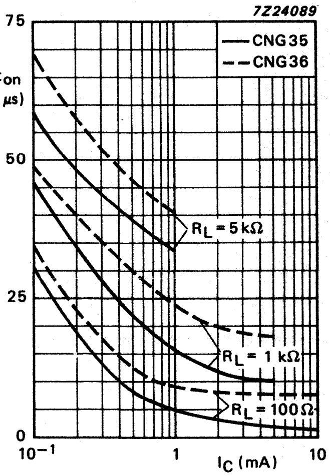


Fig.22 Turn-on time as a function of collector current; $I_B = 0$; $V_{CC} = 5$ V; $T_{amb} = 25$ °C; typical values.

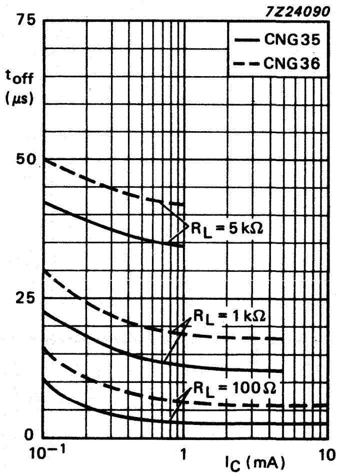


Fig.23 Turn-off time as a function of collector current; $I_B = 0$; $V_{CC} = 5$ V; $T_{amb} = 25$ °C; typical values.

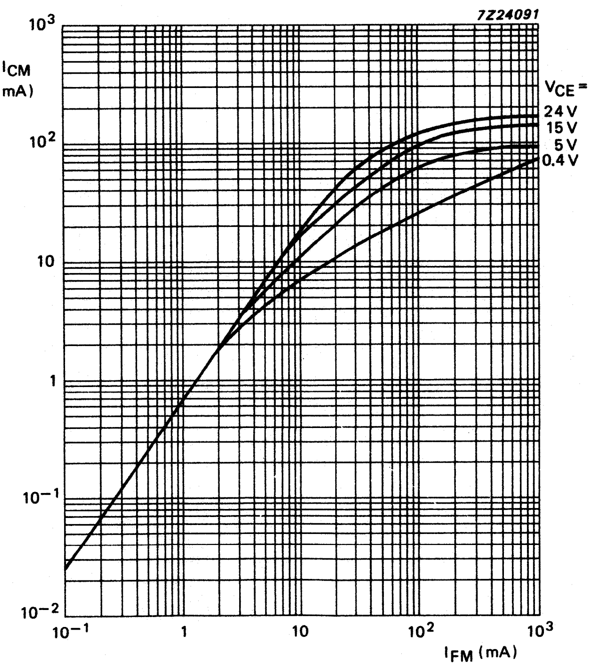


Fig.24 Maximum collector current as a function of maximum forward current; $T_{amb} = 25$ °C; $t_p = 10$ μs; T = 1 ms; typical values; **CNG35**.

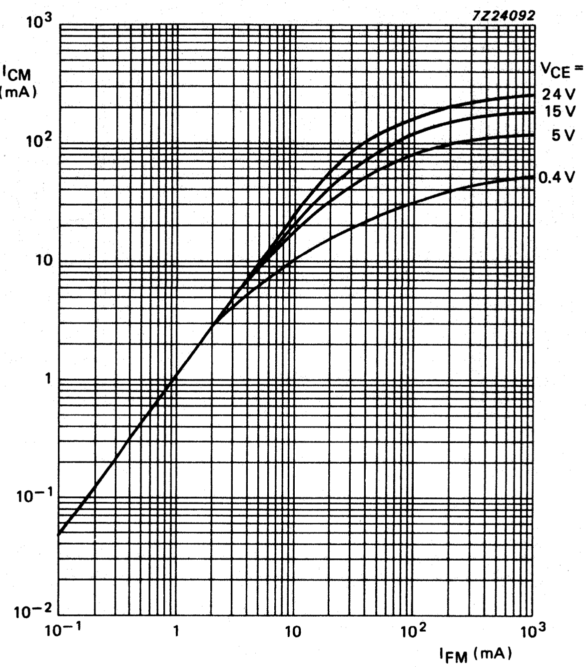


Fig.25 Maximum collector current as a function of maximum forward current; T_{amb} = 25 °C; t_p = 10 μs; T = 1 ms; typical values; **CNG36**.

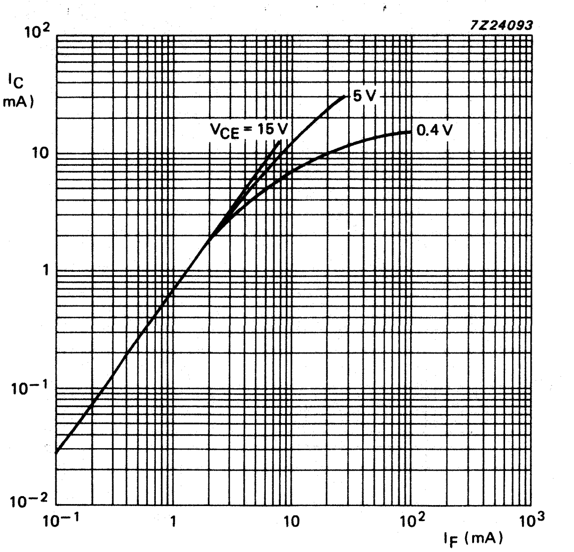


Fig.26 Collector current as a function of forward current; T_{amb} = 25 °C; typical values; **CNG35**.

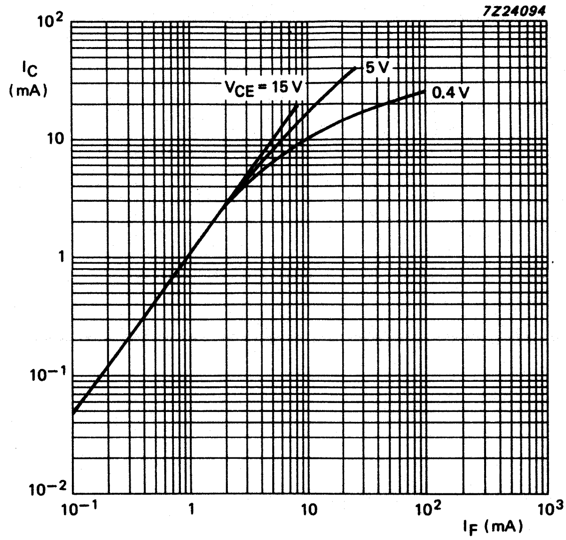


Fig.27 Collector current as a function of forward current; T_{amb} = 25 °C; typical values; **CNG36**.

GaAlAs, RESISTOR-DARLINGTON, HIGH VOLTAGE OPTOCOUPLER

The CNG40 is an optocoupler in a dual-in-line (DIL) 6-pin plastic SOT231 envelope. It consists of a GaAlAs infra-red emitter optically coupled to a silicon npn photodarlington. The output transistor has an integral base-emitter resistor to optimize switching speeds and elevate temperature characteristics.

Features

- High current transfer ratio/high sensitivity at low imput current
- High degree of AC and DC insulation (3750 V RMS and 5300 V DC)
- Working voltage of 2.5 kV DC
- Collector-emitter breakdown voltage of 80 V
- Long operational life
- A pin distance of 10.16 mm

Applications

- Telephone, telegraph and general telecommunication
- CMOS compatible
- Low input current TTL interface
- General purpose switching
- Power supply isolation

QUICK REFERENCE DATA

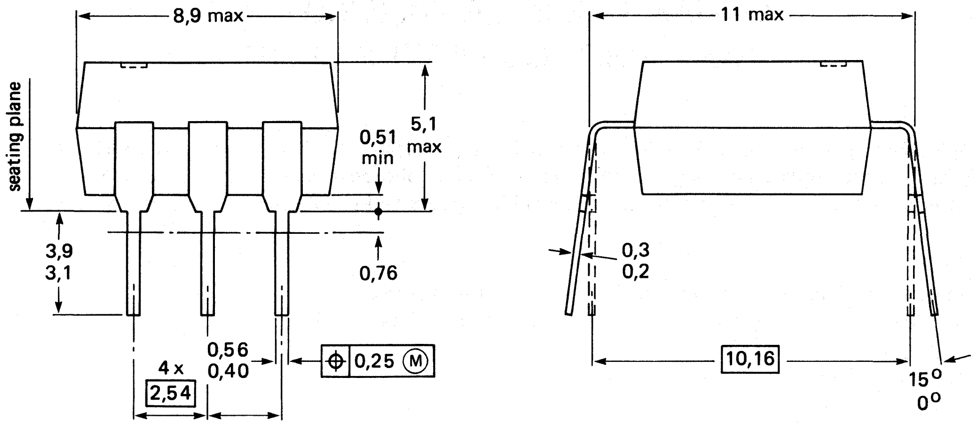
Diode			
DC Forward current	I_F	max.	100 mA
DC Reverse voltage	V_R	max.	5 V
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	200 mW
Transistor			
DC Collector current	I_C	max.	100 mA
Collector-emitter voltage (open base)	V_{CEO}	max.	80 V
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	200 mW
Optocoupler			
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} = 5 V	I_C/I_F	min.	5.0
I_F = 10 mA; V_{CE} = 1 V	I_C/I_F	min. max.	5.0 *
Isolation voltage DC AC (RMS value)	V_{IORM}	max.	5300 V 3750 V

MECHANICAL DATA: SOT231 (see Fig. 1).

* Value to be fixed.

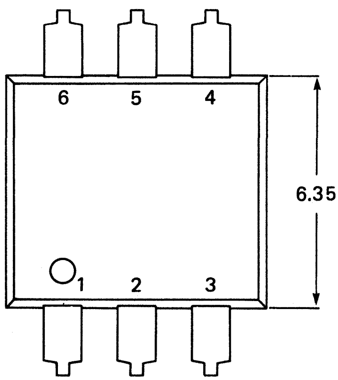
MECHANICAL DATA

Dimensions in mm



Pinning

1 = Anode
2 = Cathode
3 = Not Connected
4 = Emitter
5 = Collector
6 = Base



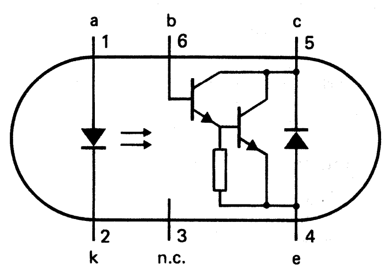


Fig. 1 SOT231.

RATINGS

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

Diode

DC Forward current	I_F	max.	100 mA
Forward current (peak: t_{on} = 10 μs; δ = 0.01)	I_{FRM}	max.	2.5 A
DC Reverse voltage	V_R	max.	5 V
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	200 mW

DEVELOPMENT DATA

Transistor

DC Collector current	I_C	max.	100 mA
Collector-emitter voltage (open base)	V_{CEO}	max.	80 V
Collector-base voltage (open base)	V_{CBO}	max.	80 V
Base-emitter voltage (open collector)	V_{EBO}	max.	7 V
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	200 mW

Optocoupler

Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	250 mW
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
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 when mounted on a PCB			
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.	9.6 mm
External tracking path (creepage distance)	L(IO2)	min.	8.0 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	V_F	typ.	1.45 V
I_F = 10 mA	V_F	max.	1.7 V
Reverse current V_R = 5 V	I_R	max.	10 A

Transistor

Collector-emitter breakdown voltage I_C = 1 mA	$V_{(BR)CEO}$	min.	80 V
Collector-base breakdown voltage I_C = 0.1 mA	$V_{(BR)CBO}$	min.	80 V

CHARACTERISTICS (continued)

Emitter-base breakdown voltage			
$I_E = 0.1$ mA	$V_{(BR)EBO}$	min.	7 V
Collector-emitter cut-off current (dark)			
$I_F = 0$; $V_{CE} = 10$ V	I_{CEO}	typ.	* nA
		max.	100 nA
Collector-base cut-off current			
$I_F = 0$; $V_{CB} = 10$ V	I_{CBO}	max.	20 nA
Optocoupler			
DC current transfer ratio (CTR)			
$I_F = 0.5$ mA; $V_{CE} = 1$ V	I_C/I_F	min.	3.5
$I_F = 1$ mA; $V_{CE} = 5$ V	I_C/I_F	min.	5.0
$I_F = 10$ mA; $V_{CE} = 1$ V	I_C/I_F	min.	5.0
		max.	*
Collector-emitter saturation voltage			
$I_F = 1$ mA; $I_C = 1$ mA	V_{CEsat}	max.	1.0 V
		typ.	* V
$I_F = 16$ mA; $I_C = 50$ mA	V_{CEsat}	max.	1.0 V
		typ.	* V
Isolation voltage (see note 1) DC			5300 V
t = 1 min AC (RMS value)	V_{IORM}	min.	3750 V
Capacitance between input and output			
$V_{IO} = 0$; f = 1 MHz	C_{IO}	typ.	0.4 pF
		max.	1.0 pF
Insulation resistance between input and output			
$V_{IO} = \pm 1000$ V	R_{IO}	min.	10 GΩ
		typ.	1 TΩ
Switching times (see Figs 3 and 4)			
$I_F = 0.5$ mA; $V_{CC} = 5$ V; $R_L = 2200\ \Omega$			
Turn-on time	T_{on}	max.	150 µs
		typ.	* µs
Turn-off time	T_{off}	max.	600 µs
		typ.	* µs
Leakage current under working voltage (see notes 2 and 3 and Fig. 2)			
$V_{IO} = 2500$ V DC; $V_{CC} = 10$ V	I_{CEW}	max.	* nA
$V_{IO} = 2500$ V DC; $V_{CC} = 10$ V; $T_{amb} = 70$ °C	I_{CEW}	max.	* µA
Output capacitance			
$V_{CB} = 10$ V; f = 1 MHz	C_{bc}	typ.	5 pF

* Value to be fixed.

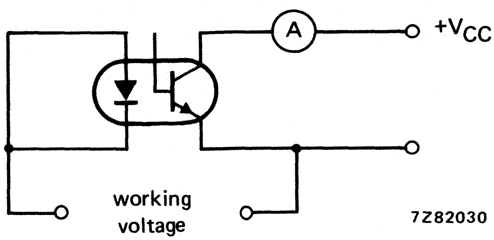


Fig. 2 Test circuit.

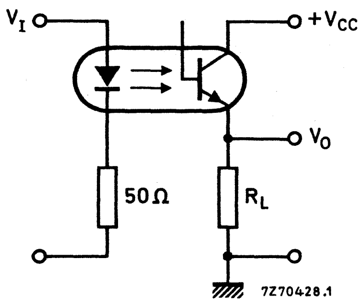


Fig. 3 Switching circuit.

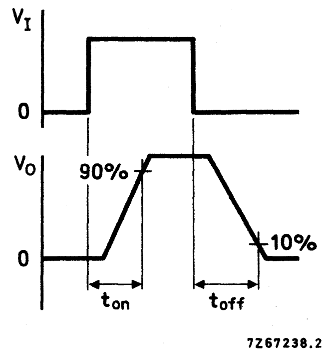


Fig. 4 Waveforms.

Notes

1. Every single product is tested by applying an isolation test voltage of 4500 V RMS for 2 seconds between the shorted input (diode) leads and the shorted output (phototransistor) leads.
2. This parameter is the maximum collector-emitter leakage current measured when a high voltage is applied between both diode leads shorted together, and the emitter.
3. As a quality assurance, on a sample basis, these parameters are covered by a reliability test of 1000 hours duration.

GaAlAs HIGH-VOLTAGE OPTOCOUPLER

Optically coupled isolator consisting of an infrared emitting GaAlAs diode and a silicon npn phototransistor with unconnected base in a SOT212 envelope, designed for low input current and long life operation.

The application of an infrared 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 device's operating life.

Features

- High degree of AC and DC insulation (3.75 kV RMS and 5.3 kV DC)
- Working voltage of 2.5 kV DC
- High output/input DC current transfer ratio
- Low saturation voltage

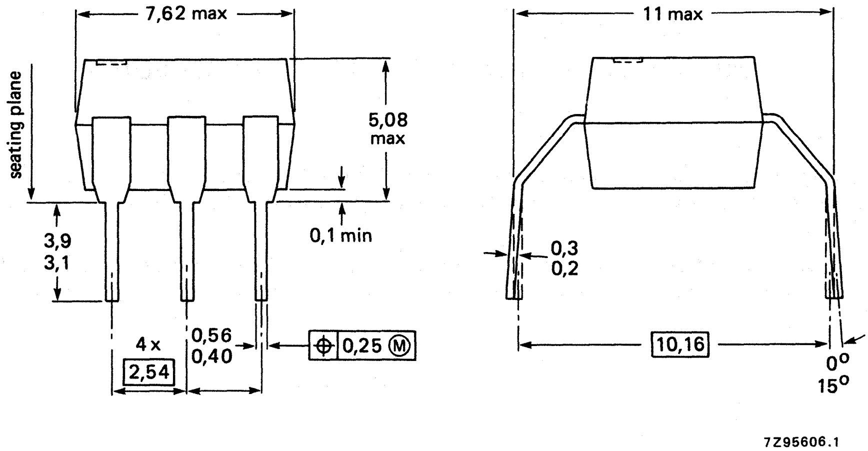
UL — Covered under UL component recognition FILE E90700
BSI — Certification according to BS415: 1979 (Home appliance)
VDE — Approved according to VDE 0833/6-80
Reference voltage (VDE 0110b Tab 4): AC 500 V/DC 600 V — isolation group C
Complied for reinforced isolation at 250 V AC with:
DIN 57804/VDE 0804/1.83 (isolation group C)
DIN VDE 0860/8.86/HD 195 S4
BRITISH TELECOM APPROVAL

QUICK REFERENCE DATA

Diode			
Continuous reverse voltage	V_R	max.	5.0 V
DC forward current	I_F	max.	100 mA
peak value; t_{on} = 10 μs; δ = 0.01	I_{FRM}	max.	3.0 A
Total power dissipation up to T_{amb} = 25 °C when mounted on a printed circuit board (PCB)	P_{tot}	max.	200 mW
Transistor			
Collector-emitter voltage (open base)	V_{CEO}	max.	50 V
Total power dissipation up to T_{amb} = 25 °C when mounted on a PCB	P_{tot}	max.	200 mW
Optocoupler			
Output/input DC current transfer ratio (CTR) I_F = 10 mA; V_{CE} = 0.4 V	I_C/I_F	min.	0.4
Collector cut-off current (dark) V_{CC} = 10 V; working voltage = 2.5 kV DC I_F (diode) = 0 (see Fig. 4)	I_{CEW}	max.	200 nA
Collector-emitter saturation voltage I_F = 10 mA; I_C = 4 mA	V_{CEsat}	max.	0.4 V
Isolation voltage DC	V_{IORM}	min.	5.3 kV
Isolation voltage AC (RMS value)	V_{IORM}	min.	3.75 kV

MECHANICAL DATA

Dimensions in mm



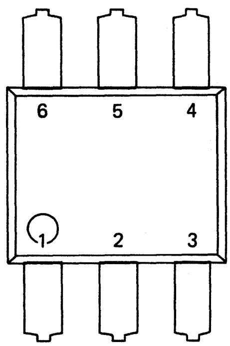
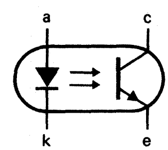


Fig. 1 SOT212.



The base is not connected.

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_{on} = 10 μs; δ = 0.01	I_{FRM}	max.	3.0 A
Total power dissipation up to T_{amb} = 25 °C when mounted on a PCB	P_{tot}	max.	200 mW

Transistor

Collector-emitter voltage (open base)	V_{CEO}	max.	50 V
Emitter-collector voltage (open base)	V_{ECO}	max.	7.0 V
DC collector current	I_C	max.	100 mA
Total power dissipation up to T_{amb} = 25 °C when mounted on a PCB	P_{tot}	max.	200 mW

DEVELOPMENT DATA

Optocoupler

Storage temperature range	T_{stg}		−55 to +150 °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 PCB			
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.	9.6 mm
External tracking path (creepage distance) input terminals to output terminals	L(IO2)	min.	7.0 mm
Tracking resistance (KB-value)	V_{TR}		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. max.	1.45 V 1.75 V
Reverse current V_R = 5 V	I_R	max.	10 μA

Transistor

Collector-emitter breakdown voltage I_C = 1 mA	$V_{(BR)CEO}$	min.	50 V
Emitter-collector breakdown voltage I_E = 0.1 mA	$V_{(BR)ECO}$	min.	7.0 V
Collector-cut-off current (dark) I_F = 0; V_{CE} = 10 V	I_{CEO}	typ. max.	2.0 nA 50 nA
V_{CE} = 10 V; T_{amb} = 70 °C	I_{CEO}	max.	10 μA

Optocoupler

Output/input DC current transfer ratio (CTR)			
I_F = 10 mA; V_{CE} = 0.4 V	I_C/I_F	min. max.	0.4 1.6
I_F = 0.5 mA; V_{CE} = 0.4 V	I_C/I_F	min.	0.1
Collector cut-off current (light)			
$T_{amb} \leqslant 70\ ^{o}C$; V_F = 0.8 V; V_{CE} = 15 V	$I_{CE(L)}$	max.	15 μA
$T_{amb} \leqslant 70\ ^{o}C$; I_F = 2 mA; V_{CE} = 0.4 V	$I_{CE(L)}$	min.	250 μA
Collector-emitter saturation voltage			
I_F = 10 mA; I_C = 4 mA	V_{CEsat}	typ. max.	0.19 V 0.40 V
Collector cut-off current (dark) at working voltage V_W = 2.5 kV (DC value);			
V_{CC} = 10 V; T_j = 25 ^{o}C (see notes 1 and 2 and Fig. 4)	I_{CEW}	max.	200 nA
V_{CC} = 10 V; T_j = 70 ^{o}C (see notes 1 and 2 and Fig. 4)	I_{CEW}	max.	100 μA
Isolation voltage; t = 1 min. (note 3) DC AC (RMS value)	V_{IORM}	max.	5.3 kV 3.75 kV
Capacitance between input and output V = 0; f = 1 MHz	C_{io}	typ.	0.6 pF
Insulation resistance between input and output V_{IO} = ± 1 kV	R_{IO}	min. typ.	10 GΩ 1 TΩ
Switching times (see Figs 2 and 3)			
Turn-on time			
I_C = 2 mA; V_{CC} = 5 V; R_L = 100 Ω I_C = 2 mA; V_{CC} = 5 V; R_L = 1 kΩ	t_{on}	typ. typ.	3.0 μs 12 μs
Turn-off time			
I_C = 2 mA; V_{CC} = 5 V; R_L = 100 Ω I_C = 2 mA; V_{CC} = 5 V; R_L = 1 kΩ	t_{off}	typ. typ.	3.0 μs 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 single product is tested by applying an isolation test voltage of 4500 V (RMS) for 2 seconds between the shorted input (diode) leads and the shorted output (phototransistor) leads.

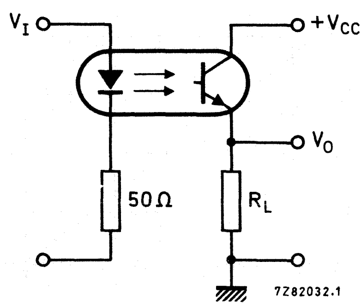


Fig. 2 Switching circuit.

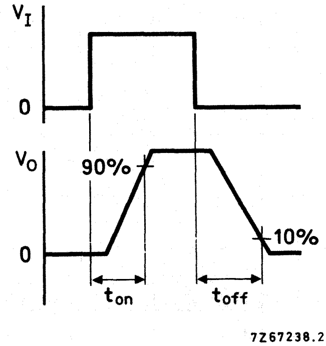


Fig. 3 Waveforms.

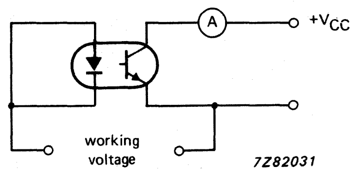


Fig. 4 Test circuit.

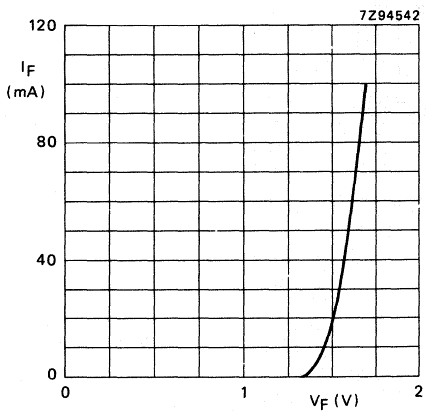


Fig. 5 Forward current as a function of forward voltage; T_{amb} = 25 ^{o}C; typical values.

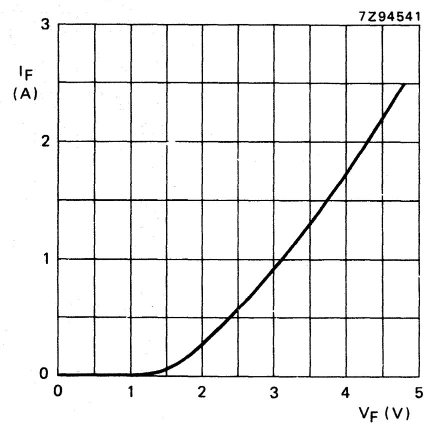


Fig. 6 Forward current as a function of forward voltage; T_{amb} = 25 ^{o}C; t_p = 1 ms; typical values.

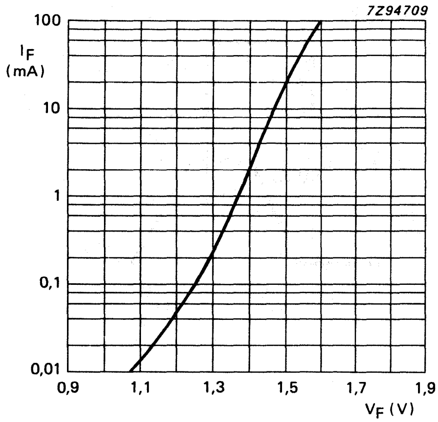


Fig. 7 Forward current as a function of forward voltage; T_{amb} = 25 °C; typical values.

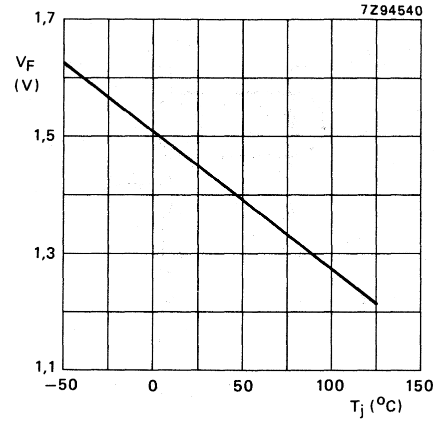


Fig. 8 Forward voltage as a function of temperature; I_F = 10 mA; typical values.

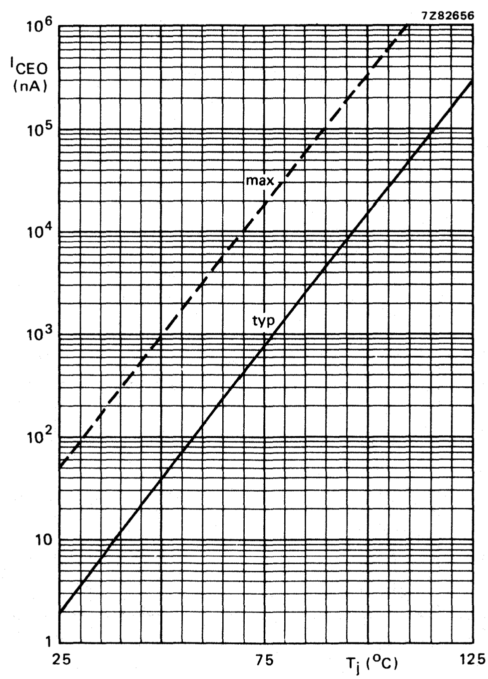


Fig. 9 Collector cut-off current as a function of temperature; I_F = 0; V_{CE} = 10 V.

DEVELOPMENT DATA

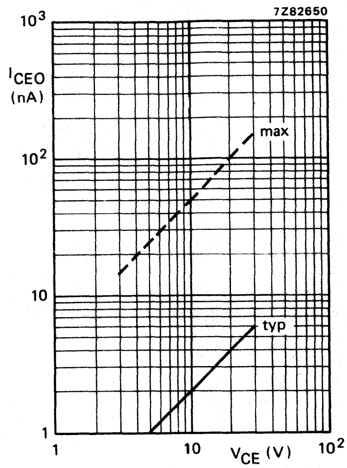


Fig. 10 Collector cut-off current as a function of collector-emitter voltage; $I_F = 0$; $T_j = 25\ ^oC$.

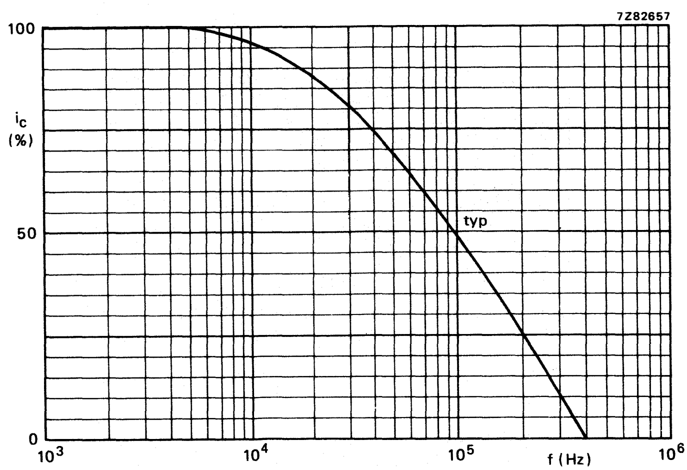


Fig. 11 Frequency response curve; $I_B = 0$; $I_C = 2$ mA; $V_{CC} = 5$ V; $R_L = 1\ k\Omega$; $T_{amb} = 25\ ^oC$.

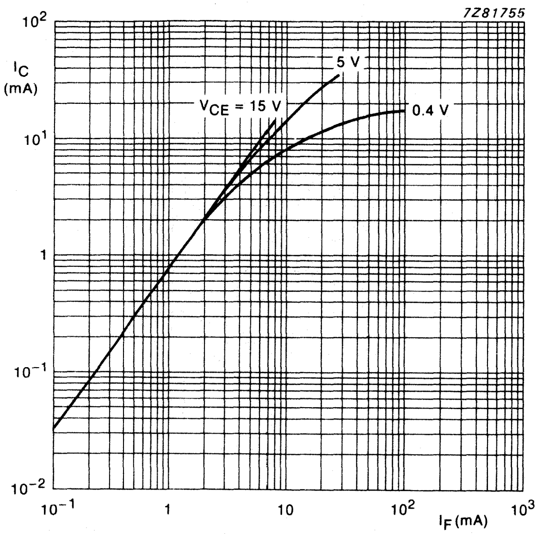


Fig. 12 Collector current as a function of forward current; T_{amb} = 25 °C; typical values.

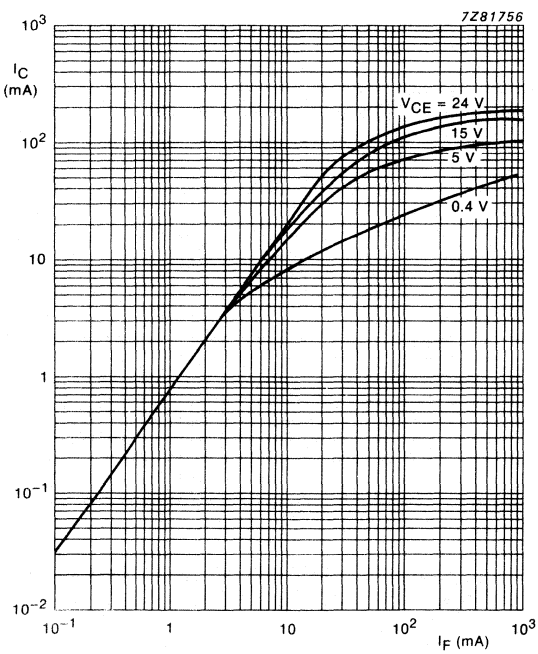


Fig. 13 Collector current (max.) as a function of forward current (max.); T_{amb} = 25 °C; t_p = 10 μs; T = 1 ms; typical values.

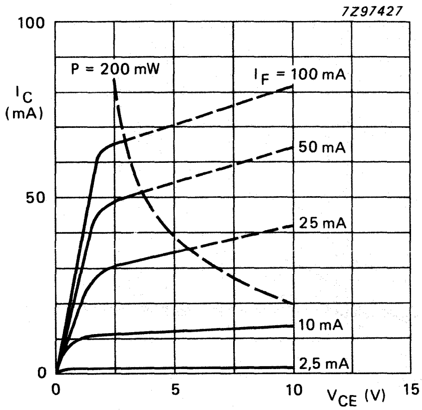


Fig. 14 Collector current as a function of collector-emitter voltage; T_{amb} = 25 °C; typical values.

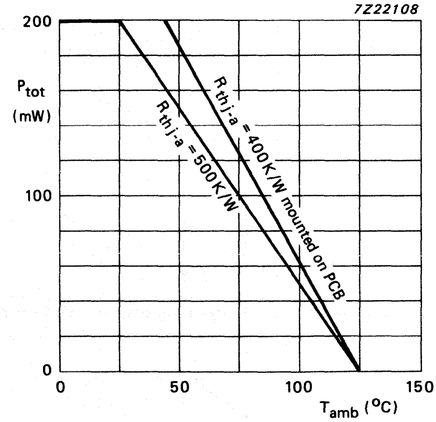


Fig. 15 Total power dissipation as a function of ambient temperature.

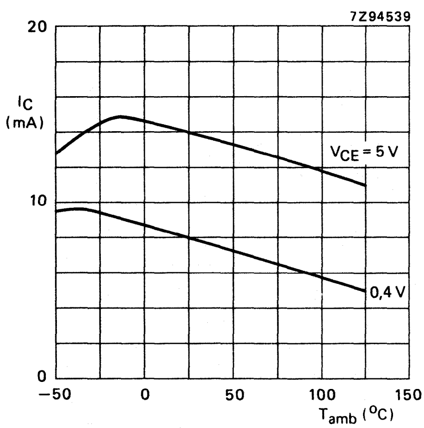


Fig. 16 Collector current as a function of ambient temperature; I_F = 10 mA; typical values.

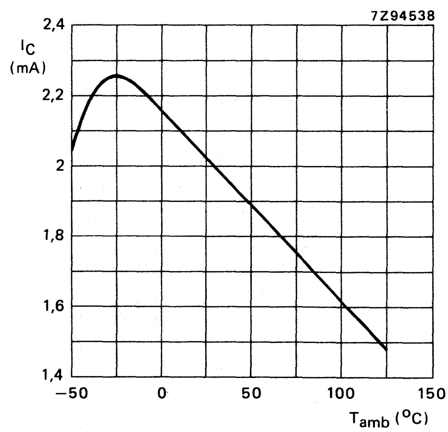


Fig. 17 Collector current as a function of ambient temperature; I_F = 2 mA; V_{CE} = 0.4 V; typical values.

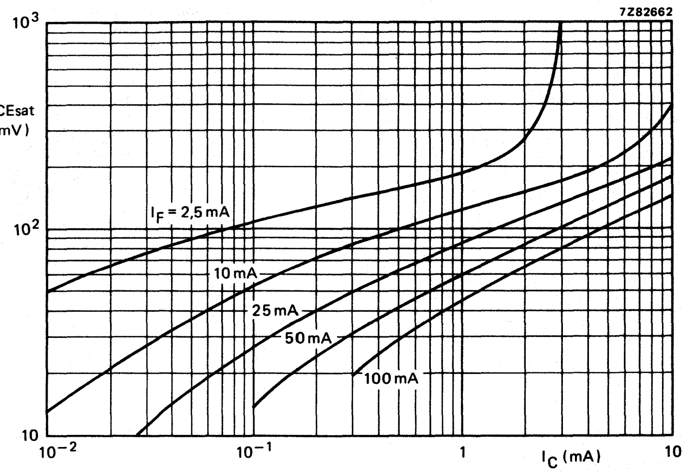


Fig. 18 Collector-emitter saturation voltage as a function of collector current; $I_B = 0$; $T_{amb} = 25\ ^oC$; typical values.

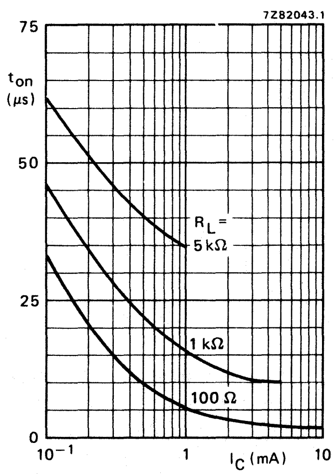


Fig. 19 Turn-on time as a function of collector current; $I_B = 0$; $V_{CC} = 5$ V; $T_{amb} = 25\ ^oC$; typical values.

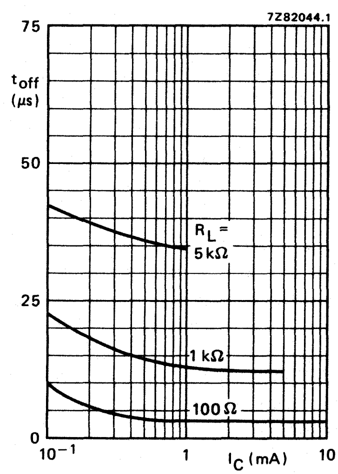


Fig. 20 Turn-off time as a function of collector current; $I_B = 0$; $V_{CC} = 5$ V; $T_{amb} = 25\ ^oC$; typical values.

GaAlAs HIGH-VOLTAGE OPTOCOUPLER

Optically coupled isolator consisting of an infrared emitting GaAlAs diode and a silicon npn phototransistor with accessible base in a SOT212 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 device's operating life.

Features

- High degree of AC and DC insulation (3.75 kV RMS and 5.3 kV DC)
- Working voltage of 2.5 kV (DC)
- High output/input DC current transfer ratio
- Low saturation voltage

UL — Covered under UL component recognition FILE E90700
BSI — Certification according to BS415:1979 (Home appliance)
VDE — Approved according to VDE 0833/6-80
Reference voltage (VDE 0110b Tab 4): AC 500 V/DC 600 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
BRITISH TELECOM APPROVAL

QUICK REFERENCE DATA

Diode				
Continuous reverse voltage	V_R	max.	5.0	V
DC forward current	I_F	max.	100	mA
peak value; t_{on} = 10 μs; δ = 0.01	I_{FRM}	max.	3.0	A
Total power dissipation up to T_{amb} = 25 °C when mounted on a printed circuit board (PCB)	P_{tot}	max.	200	mW
Transistor				
Collector-emitter voltage (open base)	V_{CEO}	max.	50	V
Total power dissipation up to T_{amb} = 25 °C when mounted on a PCB	P_{tot}	max.	200	mW
Optocoupler				
Output/input DC current transfer ratio (CTR) I_F = 10 mA; V_{CE} = 0.4 V	I_C/I_F	min.	0.4	
Collector cut-off current (dark) V_{CC} = 10 V; working voltage = 2.5 kV DC I_F (diode) = 0 (see Fig. 4)	I_{CEW}	max.	200	nA
Collector-emitter saturation voltage I_F = 10 mA; I_C = 4 mA	V_{CEsat}	max.	0.4	V
Isolation voltage DC	V_{IORM}	min.	5.3	kV
Isolation voltage AC (RMS value)	V_{IORM}	min.	3.75	kV

MECHANICAL DATA

Dimensions in mm

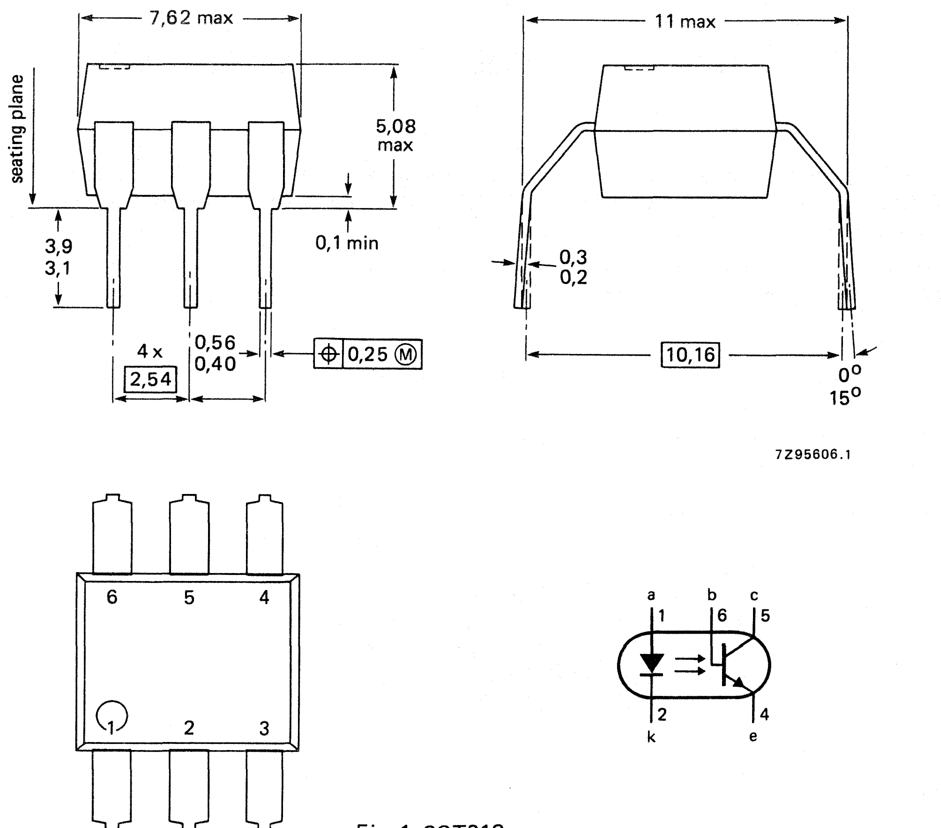


Fig. 1 SOT212.

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_{on} = 10 μs; δ = 0.01	I_{FRM}	max.	3.0 A
Total power dissipation up to T_{amb} = 25 °C when mounted on a PCB	P_{tot}	max.	200 mW

Transistor

Collector-base voltage	V_{CBO}	max.	70 V
Collector-emitter voltage (open base)	V_{CEO}	max.	50 V
Emitter-collector voltage	V_{ECO}	max.	7.0 V
DC collector current	I_C	max.	100 mA
Total power dissipation up to T_{amb} = 25 °C when mounted on a PCB	P_{tot}	max.	200 mW

Optocoupler

Storage temperature range	T_{stg}		−55 to +150 °C
Junction temperature	T_j	max.	125 °C
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 when mounted on a PCB			
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.	9.6 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. max.	1.45 V 1.75 V
Reverse current V_R = 5 V	I_R	max.	10 μA

Transistor

Collector-base breakdown voltage I_C = 0.1 mA	$V_{(BR)CBO}$	min.	70 V
Collector-emitter breakdown voltage I_C = 1 mA	$V_{(BR)CEO}$	min.	50 V
Emitter-collector breakdown voltage I_E = 0.1 mA	$V_{(BR)ECO}$	min.	7.0 V
Collector-cut-off current (dark) $I_F = 0$; V_{CE} = 10 V	I_{CEO}	typ. max.	2.0 nA 50 nA
V_{CE} = 10 V; T_{amb} = 70 °C	I_{CEO}	max.	10 μA
V_{CB} = 10 V	I_{CBO}	max.	20 nA

DEVELOPMENT DATA

Optocoupler

Output/input DC current transfer ratio (CTR)				
I_F = 10 mA; V_{CE} = 0.4 V	I_C/I_F	min. max.	0.4 1.6	
I_F = 0.5 mA; V_{CE} = 0.4 V	I_C/I_F	min.	0.1	
Collector cut-off current (light)				
$T_{amb} \leqslant 70\ ^oC$; V_{CE} = 15 V; V_F = 0.8 V	$I_{CE(L)}$	max.	15	μA
$T_{amb} \leqslant 70\ ^oC$; I_F = 2 mA; V_{CE} = 0.4 V	$I_{CE(L)}$	min.	250	μA
Collector-emitter saturation voltage				
I_F = 10 mA; I_C = 4 mA	V_{CEsat}	typ. max.	0.19 0.40	V V
Collector cut-off current (dark) at working voltage				
V_W = 2.5 kV (DC value);				
V_{CC} = 10 V; T_j = 25 ^oC (notes 1 and 2, see Fig.4)	I_{CEW}	max.	200	nA
V_{CC} = 10 V; T_j = 70 ^oC (notes 1 and 2, see Fig.4)	I_{CEW}	max.	100	μA
Isolation voltage; t = 1 min. (see note 3) DC AC (RMS value)	V_{IORM}	max.	5.3 3.75	kV kV
Output capacitance				
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.	0.6	pF
Insulation resistance between input and output				
V_{IO} = ± 1 kV	R_{IO}	min. typ.	10 1	GΩ TΩ
Switching times (see Figs 2 and 3)				
Turn-on time				
I_C = 2 mA; V_{CC} = 5 V; R_L = 100 Ω I_C = 2 mA; V_{CC} = 5 V; R_L = 1 kΩ	t_{on}	typ. typ.	3.0 12	μs μs
Turn-off time				
I_C = 2 mA; V_{CC} = 5 V; R_L = 100 Ω I_C = 2 mA; V_{CC} = 5 V; R_L = 1 kΩ	t_{off}	typ. typ.	3.0 12	μs 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 single product is tested by applying an isolation test voltage of 4500 V (RMS) for 2 seconds between the shorted input (diode) leads and the shorted output (phototransistor) leads.

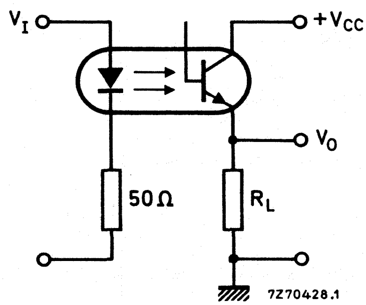


Fig. 2 Switching circuit.

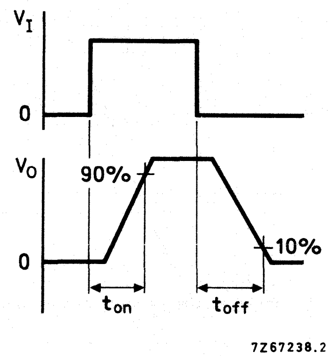


Fig. 3 Waveforms.

DEVELOPMENT DATA

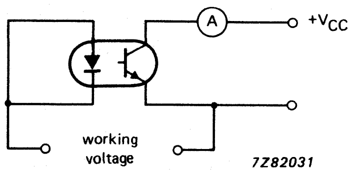


Fig. 4 Test circuit.

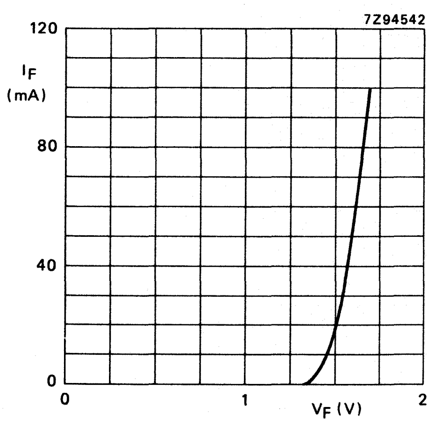


Fig. 5 Forward current as a function of forward voltage; T_{amb} = 25 ^{o}C; typical values.

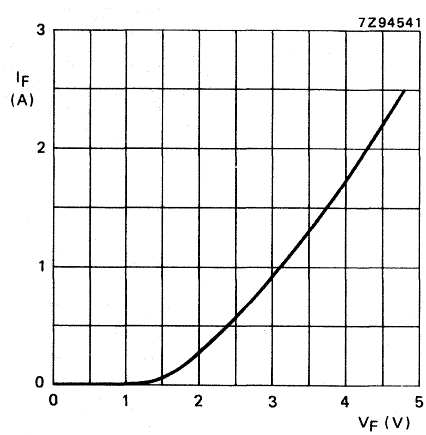


Fig. 6 Forward current as a function of forward voltage; T_{amb} = 25 ^{o}C; t_p = 1 ms; typical values.

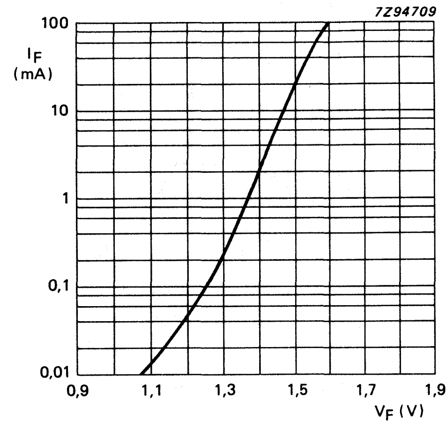


Fig. 7 Forward current as a function of forward voltage; T_{amb} = 25 °C; typical values.

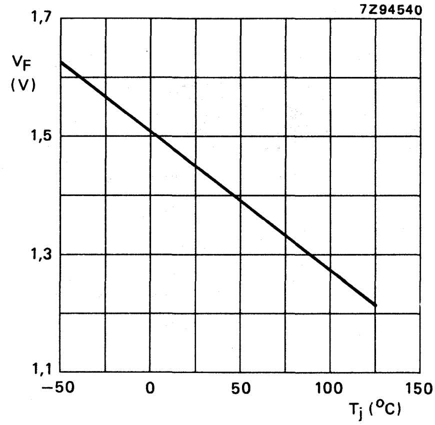


Fig. 8 Forward voltage as a function of temperature; I_F = 10 mA; typical values.

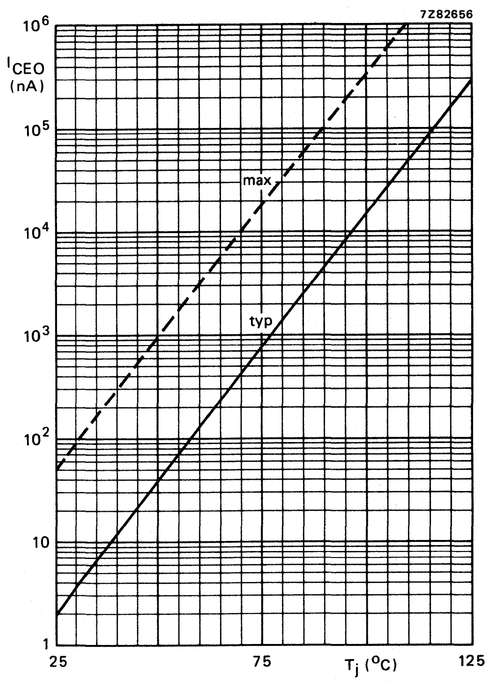


Fig. 9 Collector cut-off current as a function of temperature; I_F = 0; V_{CE} = 10 V.

DEVELOPMENT DATA

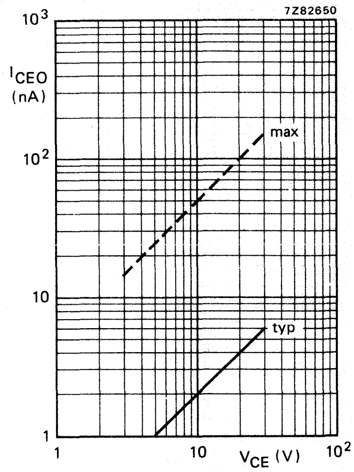


Fig. 10 Collector cut-off current as a function of collector-emitter voltage; $I_F = 0$; $T_j = 25\ ^oC$.

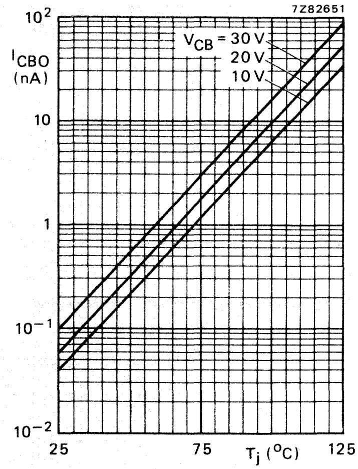


Fig. 11 Collector cut-off current as a function of temperature; typical values.

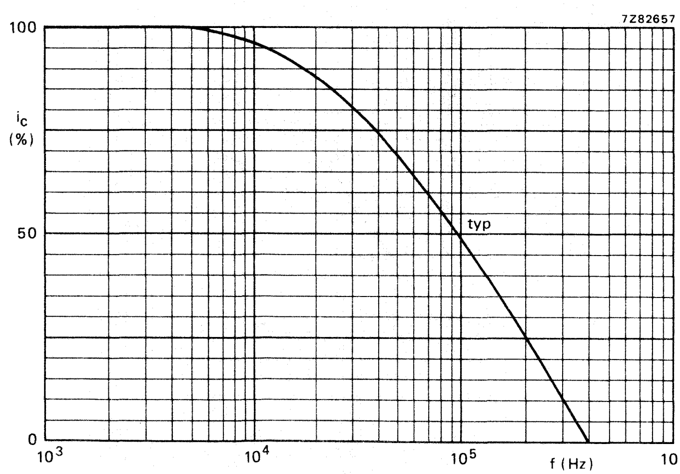


Fig. 12 Frequency response curve; $I_B = 0$; $I_C = 2$ mA; $V_{CC} = 5$ V; $R_L = 1\ k\Omega$; $T_{amb} = 25\ ^oC$.

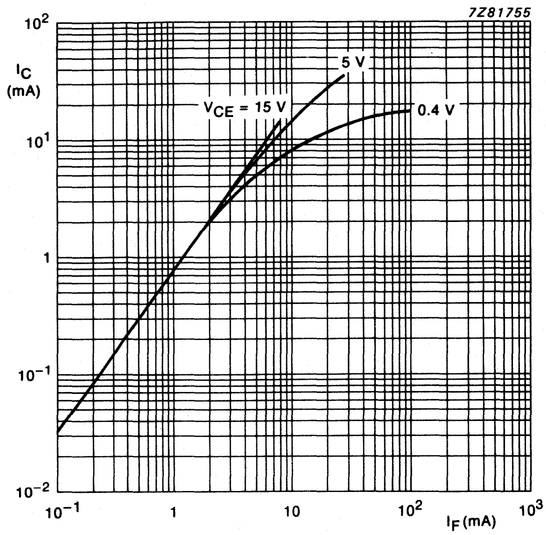


Fig. 13 Collector current as a function of forward current;
T_{amb} = 25 °C; typical values.

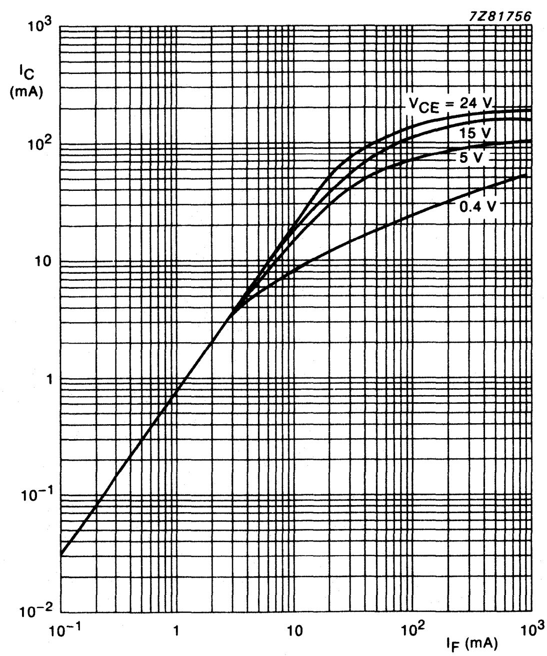


Fig. 14 Collector current (max.) as a function of forward current (max.);
T_{amb} = 25 °C; t_p = 10 μs; T = 1 ms; typical values.

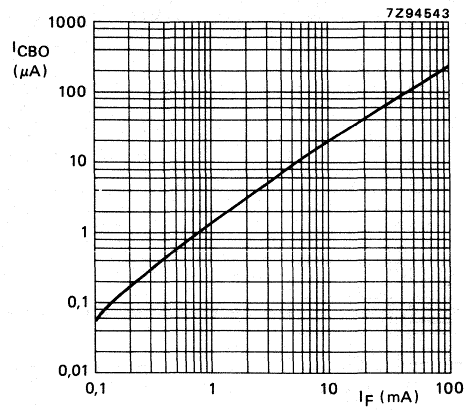


Fig. 15 Collector-base current as a function of forward current; V_{CB} = 5 V; T_{amb} = 25 °C; typical values.

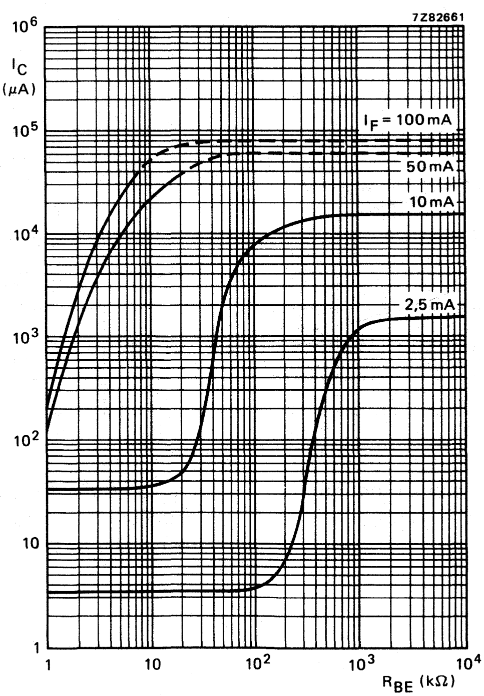


Fig. 16 Collector current as a function of base-emitter resistance; I_B = 0; V_{CE} = 5 V; T_{amb} = 25 °C; typical values.

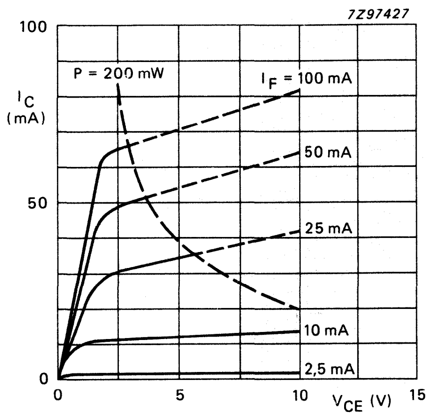


Fig. 17 Collector current as a function of collector-emitter voltage; T_{amb} = 25 °C; typical values.

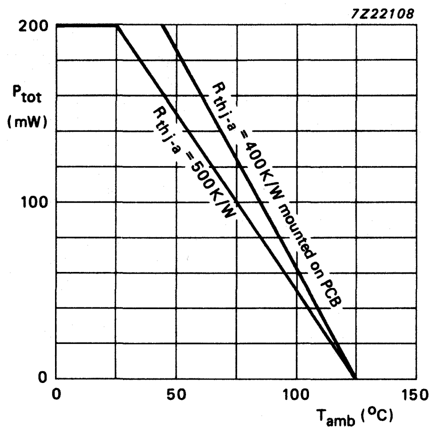


Fig. 18 Total power dissipation as a function of ambient temperature.

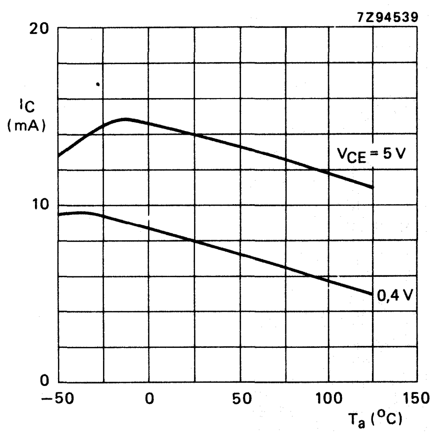


Fig. 19 Collector current as a function of ambient temperature; I_F = 10 mA; typical values.

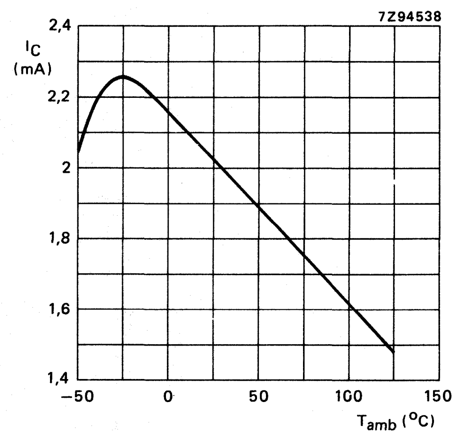


Fig. 20 Collector current as a function of ambient temperature; I_F = 2 mA; V_{CE} = 0.4 V; typical values.

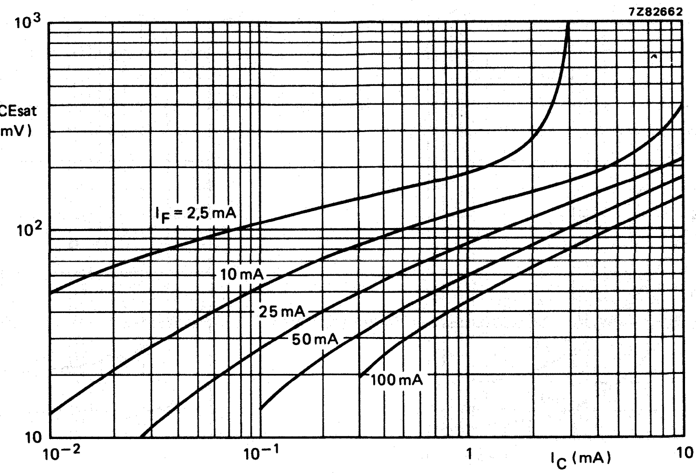


Fig. 21 Collector-emitter saturation voltage as a function of collector current; $I_B = 0$; $T_{amb} = 25\ ^oC$; typical values.

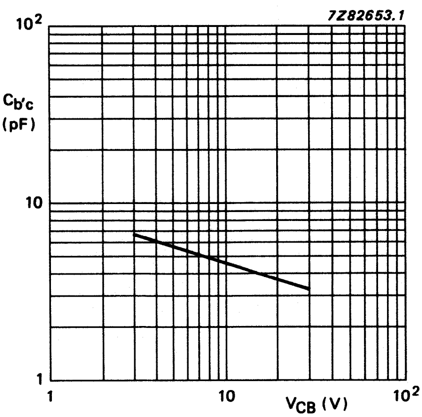


Fig. 22 Collector capacitance as a function of collector-base voltage; f = 1 MHz; $T_{amb} = 25\ ^oC$.

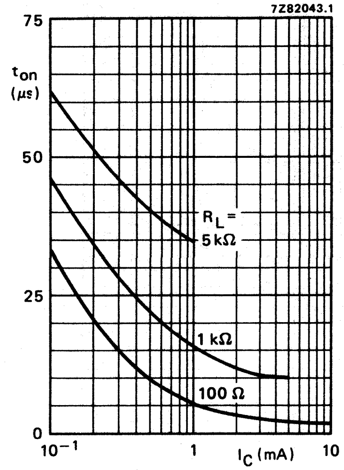


Fig. 23 Turn-on time as a function of collector current; $I_B = 0$; $V_{CC} = 5$ V; $T_{amb} = 25\ ^oC$; typical values.

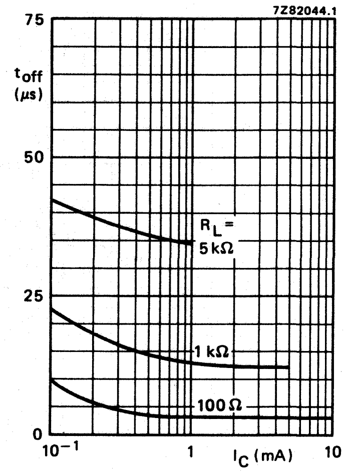


Fig. 24 Turn-off time as a function of collector current; $I_B = 0$; $V_{CC} = 5$ V; $T_{amb} = 25\ ^oC$; typical values.

HIGH-SPEED OPTOCOUPLER

The CNR36 is a fast switching optocoupler consisting of a GaAlAs light emitting diode which is optically coupled to an integrated silicon photodetector in an 8-pin dual-in-line (DIL) envelope SOT97F. It is suitable for use with TTL integrated circuits.

Features

- Short propagation delay times
- Low saturation voltage
- High isolation voltage of 2.5 kV RMS and 3.5 kV DC
- Working voltage of 2.5 kV DC
- High transient immunity

Requests for UL recognition and VDE approval are pending.

QUICK REFERENCE DATA

Diode			
Continuous reverse voltage	V_R	max.	5 V
DC forward current	I_F	max.	100 mA
peak value; t_{on} = 1 μs	I_{FRM}	max.	1 A
Transistor			
Collector-emitter breakdown voltage I_C = 10 mA	$V_{(BR)CEO}$	min.	18 V
Optocoupler			
Output current I_F = 10 mA; V_{CC} = 4.5 V; V_o = 0.4 V	I_{OL}	min.	2 mA
		typ.	4 mA
Logic low output voltage I_F = 10 mA; V_{CC} = 4.5 V; I_o = 2 mA	V_{OL}	typ.	0.2 V
		max.	0.4 V
Propagation delay time	t_{PHL}	max.	0.8 μs
	t_{PLH}	max.	0.8 μs
Common mode transient immunity	±CM	min.	1 kV/μs
Isolation voltage DC	V_{IORM}	min.	3.5 kV
Isolation voltage AC (RMS value)			2.5 kV

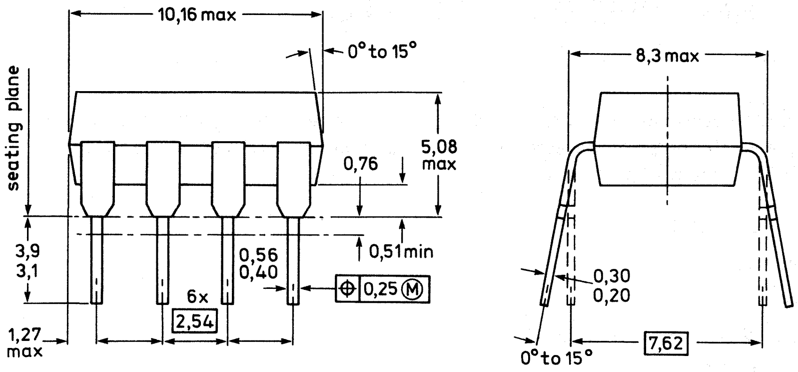
MECHANICAL DATA

SOT97F (see Fig.1).

MECHANICAL DATA

Dimensions in mm

Fig.1 SOT97F.



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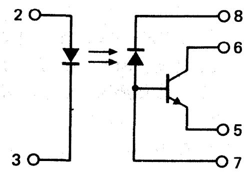

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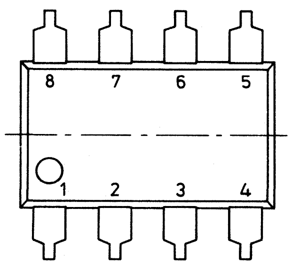


⊕ Positional accuracy.

Ⓜ 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 the nominal by 0,25 mm.

(2) When the leads are parallel, the tips remain 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 = 1 μs	I_{FRM}	max.	1 A
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	250 mW

Transistor

Collector-emitter breakdown voltage I_C = 10 mA	$V_{(BR)CEO}$	min.	18 V
Emitter-base breakdown voltage I_E = 0.1 mA	$V_{(BR)EBO}$	min.	5 V
DC collector current	I_C	max.	10 mA
Total power dissipation up to T_{amb} = 85 °C	P_{tot}	max.	100 mW

Optocoupler

Storage temperature range	T_{stg}		–55 to +150 °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, with the 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

CHARACTERISTICS

$T_j = 25$ °C unless otherwise specified

Diode

Forward voltage $I_F = 10$ mA	V_F	typ. max.	1.65 V 1.9 V
Reverse current $V_R = 5$ V	I_R	max.	10 μA

Transistor (diode: $I_F = 0$)

Collector-emitter breakdown voltage at $I_C = 10$ mA	$V_{(BR)CEO}$	min.	18 V
Collector-base breakdown voltage* at $I_C = 100$ μA	$V_{(BR)CBh}$	min.	30 V
Emitter-base breakdown voltage at $I_E = 0.1$ mA	$V_{(BR)EBO}$	min.	5 V
Logic high output current $I_F = 0$; $V_o = V_{CC} = 5.5$ V	I_{OH}	typ. max.	5 nA 500 nA
Logic high output current $I_F = 0$; $V_o = V_{CC} = 15$ V	I_{OH}	max.	100 μA
Logic high supply current $I_F = 0$; $I_o = 0$; $V_{CC} = 15$ V	I_{CCH}	max.	1 μA
Logic low supply current $I_F = 10$ mA; $V_{CC} = 15$ V; $I_o = 0$	I_{CCL}	typ.	20 μA ←

Optocoupler

Output current $I_F = 10$ mA; $V_{CC} = 4.5$ V; $V_o = 0.4$ V	I_{OL}	min. typ.	2 mA 4 mA

DEVELOPMENT DATA

* Cathode connected to collector

Logic low output voltage I_F = 10 mA; V_{CC} = 4.5 V; I_O = 2 mA	V_{OL}	typ. max.	0.2 V 0.4 V
Isolation voltage (note 1) DC t = 1 min AC (RMS value)	V_{IORM}	min.	3.5 kV 2.5 kV
Capacitance between input and output f = 1 MHz	C_{io}	typ.	0.6 pF
Insulation resistance between input and output $\pm V_{IO}$ = 1 kV	r_{IO}	min. typ.	10 GΩ 1 TΩ
Switching times (see Figs 2 and 3) I_F = 10 mA; V_{CC} = 5 V; R_L = 2.5 kΩ			
Propagation delay time to logic low at output	t_{PHL}	typ. max.	0.5 μs 0.8 μs
Propagation delay time to logic high at output	t_{PLH}	typ. max.	0.4 μs 0.8 μs

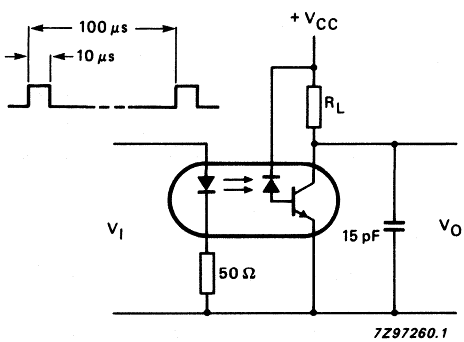


Fig. 2 Switching circuit.

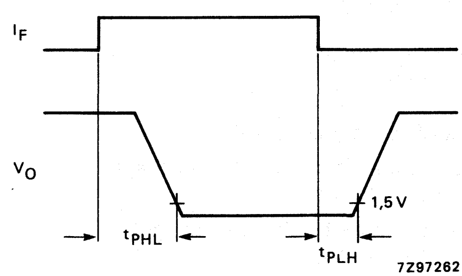


Fig. 3 Waveforms.

Switching times (see Figs 4 and 5) I_{Con} = 2 mA; V_{CC} = 5 V; R_L = 100 Ω			
Turn-on time	t_{on}	typ.	0.85 μs
Turn-off time	t_{off}	typ.	0.85 μs

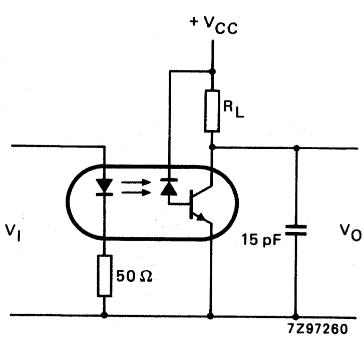


Fig. 4 Switching circuit.

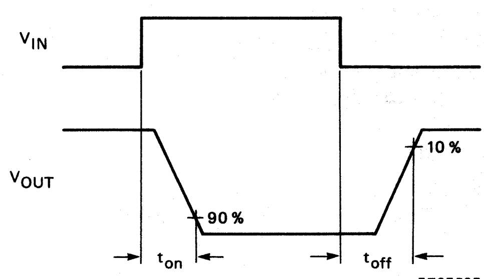


Fig. 5 Waveforms.

Transient immunity

V_{CC} = 5 V; V_{CM} = 10 V_{PP}; R_L = 2.5 kΩ

Common mode transient immunity at logic low I_F = 10 mA	C_{ML}	min.	−1 kV/μs
Common mode transient immunity at logic high I_F = 0	C_{MH}	min.	1 kV/μs
Logic high output current (note 2, see Fig. 6) V_{CC} = 5.5 V; working voltage = 2.5 kV DC; T_{amb} = 70 °C	I_{OHW}	max.	100 μA

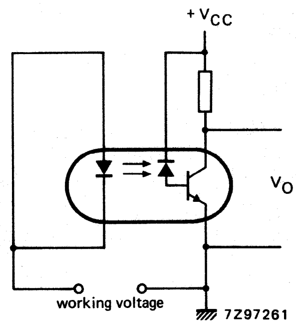


Fig.6.

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

Notes

1. Every single product is tested by applying an isolation test voltage of 3000 V (RMS) for 2 seconds between the shorted input (diode) leads and the shorted output (phototransistor) leads.
2. This parameter is the working collector-emitter leakage current measured when a high voltage is applied between the emitter and the short circuited diode leads.

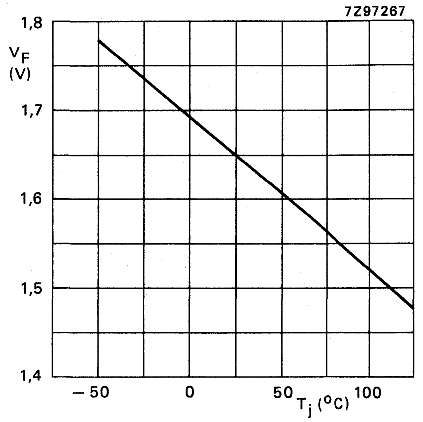


Fig. 7 I_F = 10 mA; typical values.

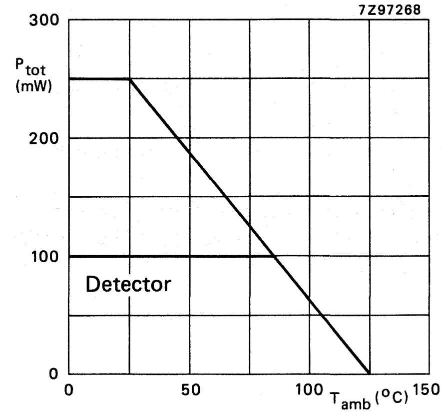


Fig. 8.

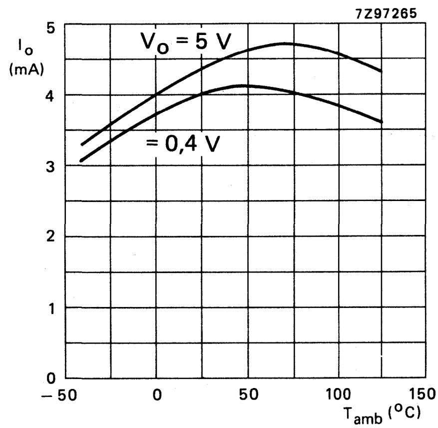


Fig. 9 V_{CC} = 5 V; I_F = 10 mA; typical values.

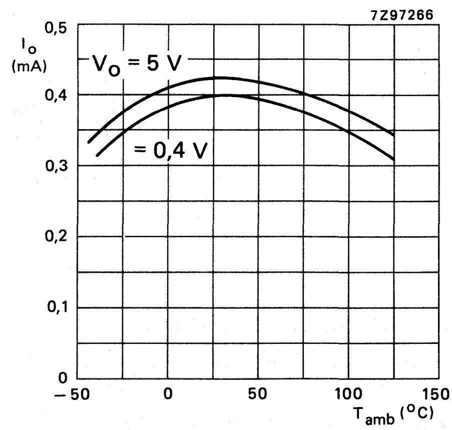


Fig. 10 V_{CC} = 5 V; I_F = 2 mA; typical values.

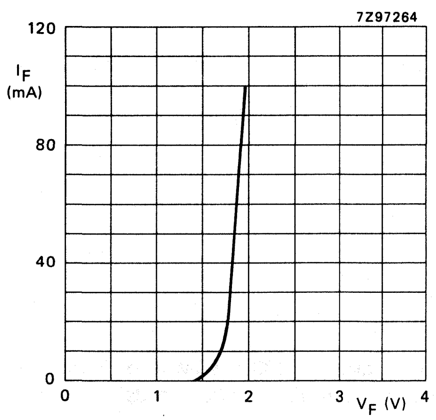


Fig. 11 T_{amb} = 25 °C; typical values.

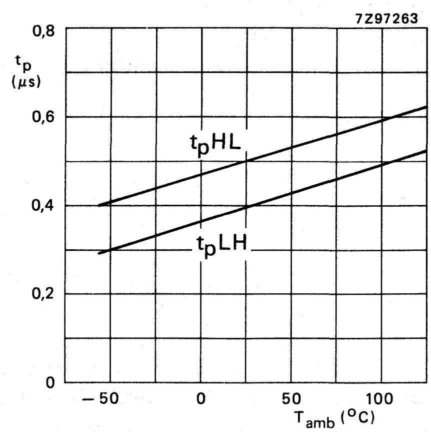


Fig. 12 I_F = 10 mA; V_{CC} = 5 V; R_L = 2.5 kΩ; typical values.

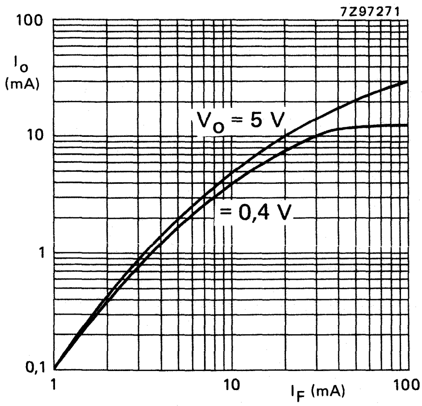


Fig. 13 V_{CC} = 5 V; typical values.

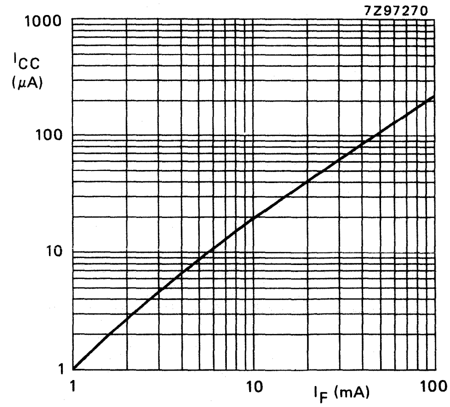


Fig. 14 V_{CC} = 15 V; I_o = 0; typical values.

DEVELOPMENT DATA

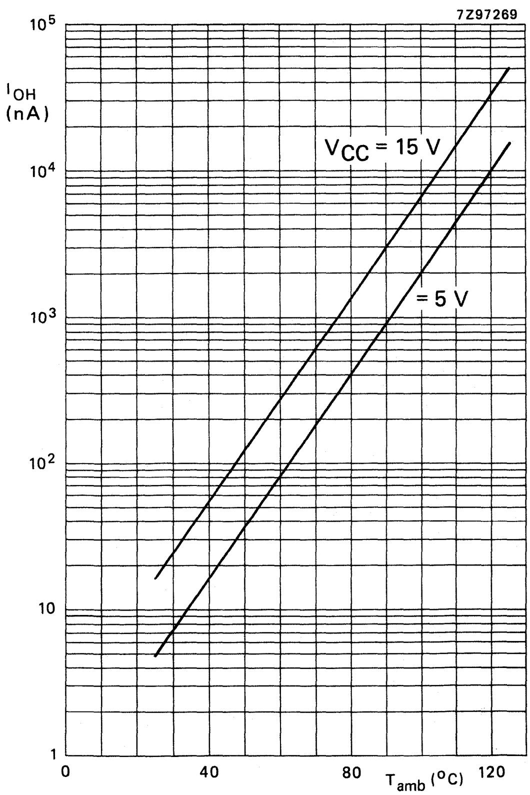


Fig. 15 Typical values.

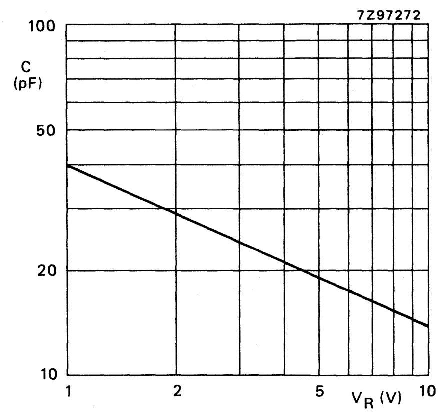


Fig. 16 T_{amb} = 25 °C; typical values.

Photodiode capacitance

DUAL OPTOCOUPLER

The CNS35 is a DUAL optocoupler in a SOT97F dual-in-line (DIL) 8 pin plastic envelope. It consists of two separate optocouplers in the same encapsulation. Each optocoupler is composed of a GaAs infra-red emitter optically coupled to a silicon npn phototransistor.

Features

- High current transfer ratio and low saturation voltage suitable for use with TTL integrated circuits
- High degree of AC and DC insulation (3120 V RMS and 4400 V DC)
- Working voltage of 2.5 kV DC
- Low crosstalk between the two channels

QUICK REFERENCE DATA

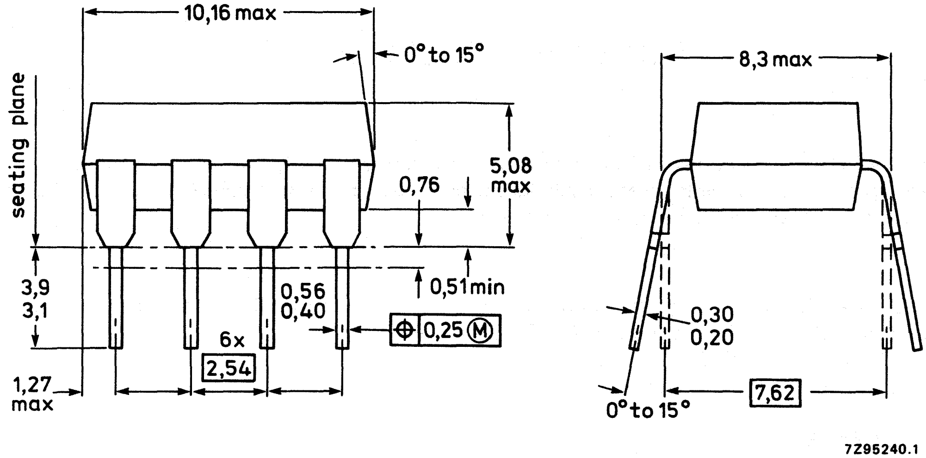
Diode				
DC forward current	I_F	max.	100	mA
DC reverse voltage	V_R	max.	5	V
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	200	mW
Transistor				
DC collector current	I_C	max.	50	mA
Collector-emitter voltage (open base)	V_{CEO}	max.	35	V
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	200	mW
Optocoupler				
DC current transfer ratio (CTR) I_F = 5.0 mA; V_{CE} = 5 V	I_C/I_F	min.	0.5	
		max.	6.0	
Crosstalk between channels				
$I_F^1 = 0$; I_F^2 = 5 mA; $V_{CE}^1 = V_{CE}^2$ = 5 V	I_C^1/I_C^2	max.	1	%
$I_F^2 = 0$; I_F^1 = 5 mA; $V_{CE}^1 = V_{CE}^2$ = 5 V	I_C^2/I_C^1	max.	1	%
Isolation voltage DC	V_{IORM}	max.	4400	V
Isolation voltage AC (RMS value)			3120	V

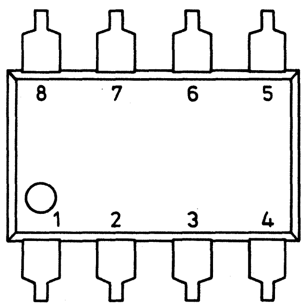
MECHANICAL DATA

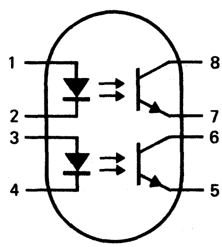
SOT97F (see Fig.1).

MECHANICAL DATA

Dimensions in mm







Pinning:

1 = anode
2 = cathode
3 = anode
4 = cathode
5 = emitter
6 = collector
7 = emitter
8 = collector

Fig.1 SOT97F.

RATINGS

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

Diode

DC forward current	I_F	max.	100	mA
Forward current (peak: t_{on} = 100 μs, f = 100 Hz)	I_{FRM}	max.	1.0	A
DC reverse voltage	V_R	max.	5	V
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	200	mW

Transistor

DC collector current	I_C	max.	50	mA
Collector-emitter voltage (open base)	V_{CEO}	max.	35	V
Emitter-collector voltage (open base)	V_{ECO}	max.	7	V
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	200	mW

Optocoupler

Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	250 mW
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
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 when mounted on a PCB			
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)	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.	1.15 V
		max.	1.5 V
Reverse current V_R = 5 V	I_R	max.	10 μA

Transistor

Collector-emitter breakdown voltage I_C = 1 mA	$V_{(BR)CEO}$	min.	35 V
Emitter-collector breakdown voltage I_E = 0.1 mA	$V_{(BR)ECO}$	min.	7 V
Collector-emitter cut-off current (dark) I_F = 0; V_{CE} = 10 V	I_{CEO}	typ.	2 nA
		max.	50 nA
I_F = 0; V_{CE} = 10 V; T_{amb} = 70 °C	I_{CEO}	max.	10 μA

DEVELOPMENT DATA

Optocoupler

DC current transfer ratio (CTR) $I_F = 5.0$ mA; $V_{CE} = 5$ V	I_C/I_F		0.5 to 6.0 typ. 1.6
Collector-emitter saturation voltage $I_F = 10$ mA; $I_C = 2$ mA	V_{CEsat}	max. typ.	0.4 V 0.15 V
Collector current $V_F = 0.8$ V; $V_{CE} = 15$ V; $T_{amb} = 0$ to 70 °C	I_{CE}^1	max.	15 µA
Collector current $I_F = 2$ mA; $V_{CE} = 0.4$ V; $T_{amb} = 0$ to 70 °C	I_{CE}^2	min.	300 µA
Crosstalk between channels (note 1) $I_F^1 = 0$; $I_F^2 = 5$ mA; $V_{CE}^1 = V_{CE}^2 = 5$ V	I_C^1/I_C^2	max.	1 %
$I_F^2 = 0$; $I_F^1 = 5$ mA; $V_{CE}^1 = V_{CE}^2 = 5$ V	I_C^2/I_C^1	max.	1 %
Channel matching $I_F^1 = 5$ mA; $V_{CE}^1 = 5$ V $I_F^2 = 5$ mA; $V_{CE}^2 = 5$ V	$CTR^1/$ CTR^2	min. max.	50 % 200 %
Isolation voltage t = 1 min (note 2) DC AC (RMS value)	V_{IORM}	min. min.	4400 V 3120 V
Capacitance between input and output $V_{IO} = 0$; f = 1 MHz The two channels in parallel	C_{IO}	typ.	0.6 pF
Insulation resistance between input and output $V_{IO} = \pm 1000$ V	R_{IO}	typ. min.	1 TΩ 10 GΩ
Switching times (Figs 3 and 4) $I_C = 2$ 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
$I_C = 2$ mA; $V_{CC} = 5$ V; $R_L = 1$ kΩ			
Turn-on time	t_{on}	typ.	10 µs
Turn-off time	t_{off}	typ.	10 µs
Leakage current under working voltage $V_{IO} = 2500$ V DC; $V_{CC} = 10$ V	I_{CEW}	max.	200 nA
$V_{IO} = 2500$ V DC; $V_{CC} = 10$ V; $T_{amb} = 70$ °C (notes 3 and 4 and Fig.2)	I_{CEW}	max.	100 µA

Notes

1. The cross talk channel is defined as the ratio of the two current transfer ratio (CTR) when only one infra-red emitter is driven.
2. 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.
3. This parameter is the maximum collector-emitter leakage current measured when a high voltage is applied between both diode leads shorted together, and the emitter.
4. As a quality assurance, on a sample basis, these parameters are covered by a reliability test of 1000 hours duration.

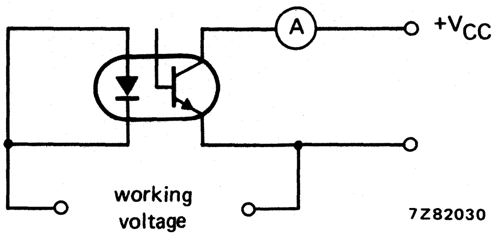


Fig.2 Test circuit.

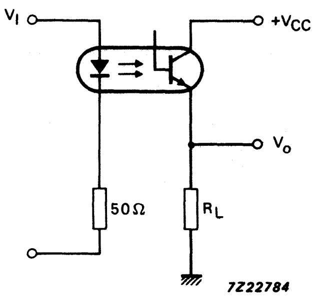


Fig.3 Switching circuit.

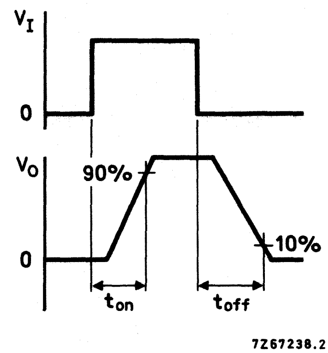


Fig.4 Waveforms.

DEVELOPMENT DATA

HIGH-VOLTAGE OPTOCOUPLER

The CNW82 is a photocoupler consisting of an infrared emitting GaAs diode and a silicon npn phototransistor, with base unconnected, in a dual-in-line (DIL) plastic envelope SOT228.

Features

- High current transfer ratio and a low saturation voltage suitable for use with TTL integrated circuits
- High degree of AC and DC insulation (5900 V RMS and 8340 V 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): 500 VAC/600 VDC
(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/HD 195 54
DIN IEC 380/VDE 0806/8.81
DIN IEC 435/VDE 0805 "ENTWURF" NOV. 84
DIN VDE 0750 Teil 1/5.82 IEC 601 Teil 1
BSI-Certification according to BS 415 : 1979 (Home appliance)
NORDIC-SETI, SEMKO, NEMKO Acceptance for applications tested according to IEC 65 (Electronic household equipments: TV, AUDIO, VIDEO excluding monitors).
DEMKO-General approval IEC 664 (IEC 65-335-380-950).

QUICK REFERENCE DATA

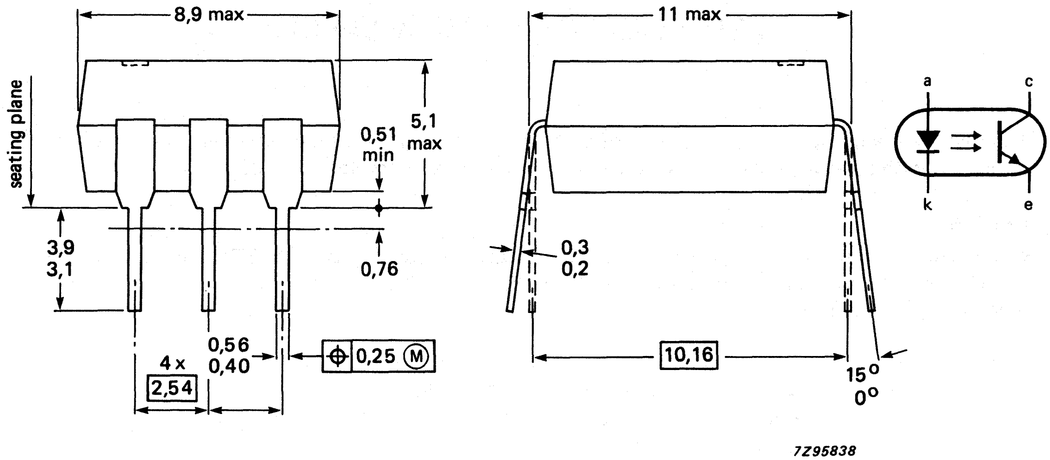
Diode				
DC forward current	I_F	max.	100	mA
Transistor				
Collector-emitter voltage (open base)	V_{CEO}	max.	50	V
Photocoupler				
Output/input DC current transfer ratio I_F = 10 mA; V_{CE} = 0.4 V	I_C/I_F	min.	0.4	
Collector cut-off current (dark) V_{CC} = 10 V; working voltage = 2.5 kV DC	I_{CEW}	max.	200	nA
Test isolation voltage DC	V_{IORM}	max.	8.34	kV
AC (RMS value)	V_{IORM}	max.	5.9	kV

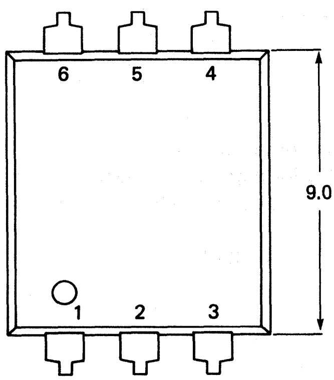
MECHANICAL DATA

SOT228 (see Fig. 1).

MECHANICAL DATA

Dimensions in mm





Pinning:
1 = Anode
2 = Cathode
3 = Not Connected
4 = Emitter
5 = Collector
6 = Not Connected

Fig. 1 SOT228.

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_{on} = 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

Transistor

Collector-emitter voltage (open base)	V_{CEO}	max.	50 V
Emitter-collector voltage	V_{ECO}	max.	7.0 V
DC collector current	I_C	max.	100 mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	200 mW

Photocoupler

Storage temperature range	T_{stg}		−55 to + 150 °C
Junction temperature	T_j	max.	125 °C
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 when mounted on a PCB			
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.	9.6 mm
External tracking path (creepage distance) input terminals to output terminals	L(IO2)	min.	10 mm
Tracking resistance (KB value)			KB-100A
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. max.	1.15 V 1.5 V
Reverse current $V_R = 5$ V	I_R	max.	10 μA

Transistor

Collector-emitter breakdown voltage $I_C = 1$ mA	$V_{(BR)CEO}$	min.	50 V
Emitter-collector breakdown voltage $I_E = 0.1$ mA	$V_{(BR)ECO}$	min.	7.0 V
Collector cut-off current (dark); diode $I_F = 0$ $V_{CE} = 10$ V	I_{CEO}	typ. max.	2.0 nA 50 nA
$V_{CE} = 10$ V; $T_{amb} = 70$ °C	I_{CEO}	max.	10 μA

CHARACTERISTICS (continued)

Photocoupler

Output/input DC current transfer ratio			
I_F = 10 mA; V_{CE} = 0.4 V	I_C/I_F	min. typ.	0.4 0.8
I_F = 10 mA; V_{CE} = 5 V	I_C/I_F	typ.	1.5
Collector cut-off current (light)			
$T_{amb} \leqslant 70$ °C; V_F = 0.8 V; V_{CE} = 15 V	$I_{CE(L)}$	max.	15 μA
$T_{amb} \leqslant 70$ °C; I_F = 2 mA; V_{CE} = 0.4 V	$I_{CE(L)}$	min.	150 μA
Collector-emitter saturation voltage			
I_F = 10 mA; I_C = 4 mA	V_{CEsat}	typ. max.	0.19 V 0.40 V
Collector cut-off current (dark) at working voltage V_W = 2.5 kV (DC value);			
V_{CC} = 10 V; T_j = 25 °C (see notes 1 and 2)	I_{CEW}	max.	200 nA
V_{CC} = 10 V; T_j = 70 °C (see notes 1 and 2)	I_{CEW}	max.	100 μA
Test isolation voltage t = 1 min (see note 3) DC AC (RMS value)	V_{IORM}	max. max.	8.34 kV 5.9 kV
Capacitance between input and output			
V = 0; f = 1 MHz	C_{io}	typ.	0.4 pF
Insulation resistance between input and output			
V_{IO} = ± 1000 V	R_{IO}	min. typ.	10 GΩ 1 TΩ
Switching times (see Figs 3 and 4)			
Turn-on time			
I_C = 2 mA; V_{CC} = 5 V; R_L = 100 Ω	t_{on}	typ.	3.0 μs
I_C = 2 mA; V_{CC} = 5 V; R_L = 1 kΩ	t_{on}	typ.	12 μs
Turn-off time			
I_C = 2 mA; V_{CC} = 5 V; R_L = 100 Ω	t_{off}	typ.	3.0 μs
I_C = 2 mA; V_{CC} = 5 V; R_L = 1 kΩ	t_{off}	typ.	12 μs

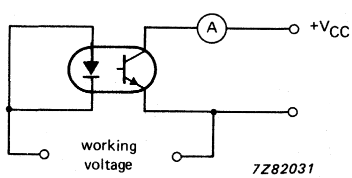


Fig. 2 Test circuit.

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 single product is tested by applying an isolation test voltage of 7080 V (RMS) for 2 seconds between the shorted input (diode) leads and the shorted output (phototransistor) leads.

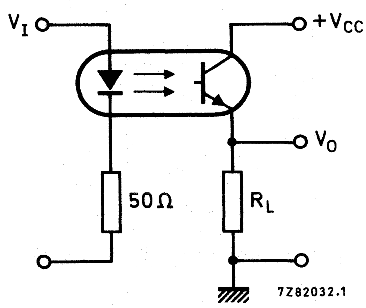


Fig. 3 Switching circuit.

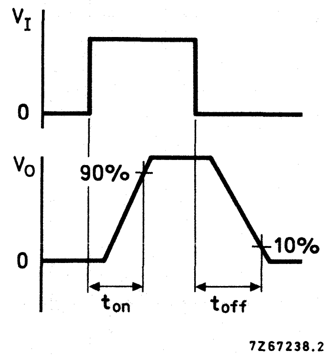


Fig. 4 Waveforms.

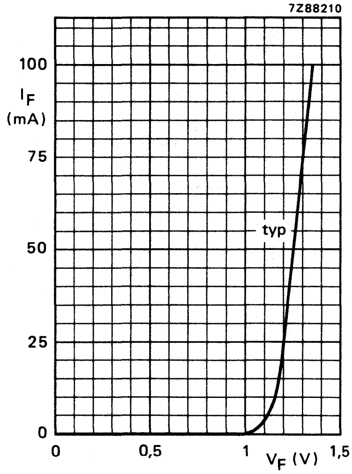


Fig. 5 Typical forward current as a function of forward voltage; T_{amb} = 25 °C.

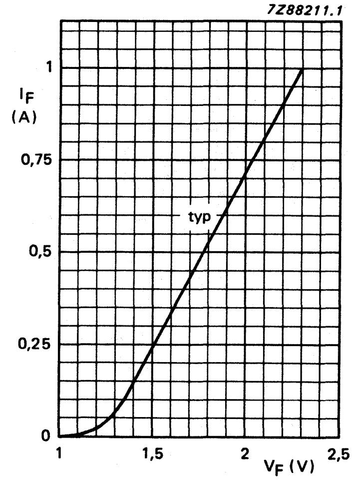


Fig. 6 Typical forward current as a function of forward voltage; T_{amb} = 25 °C; t_p = 20 μs; δ = 0.01.

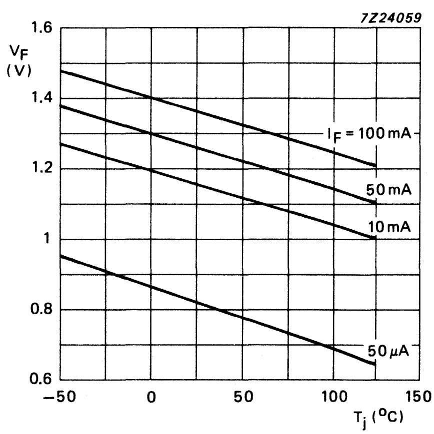


Fig. 7 Typical forward voltage as a function of junction temperature.

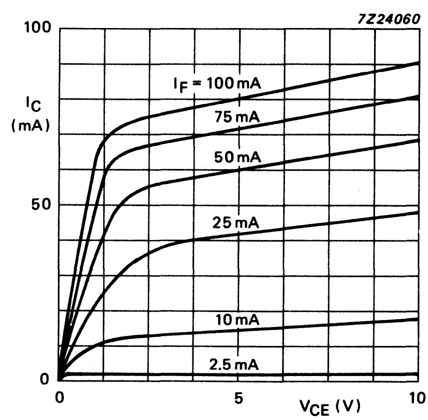
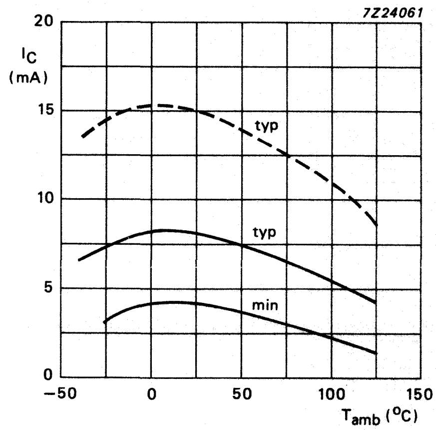


Fig. 8 Typical collector current as a function of collector-emitter voltage; T_{amb} = 25 °C.



——— I_F = 10 mA; V_{CE} = 0.4 V
– – – I_F = 10 mA; V_{CE} = 5 V

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

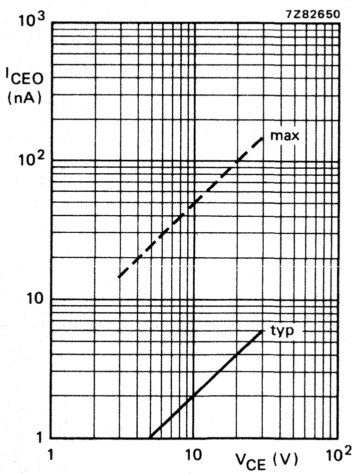


Fig. 10 Collector-emitter dark current as a function of collector-emitter voltage; T_{amb} = 25 °C.

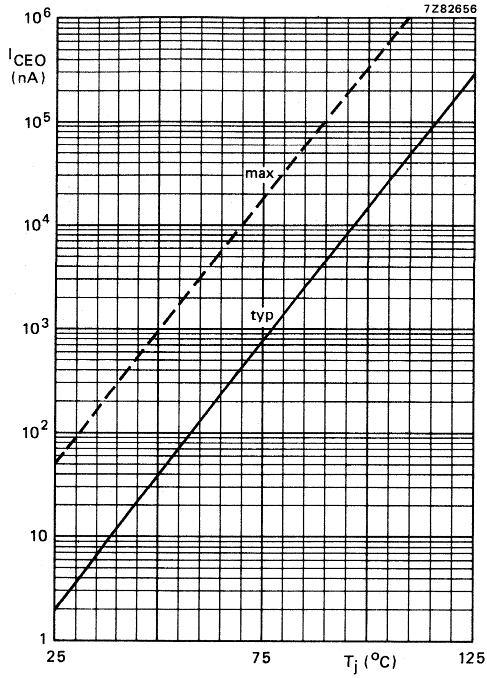


Fig. 11 Collector-emitter dark current as a function of junction temperature.

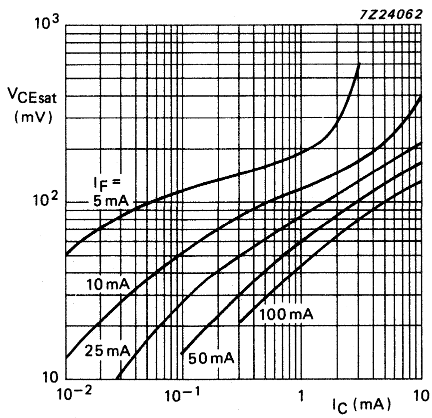


Fig. 12 Typical collector-emitter saturation voltage as a function of collector current; T_{amb} = 25 °C.

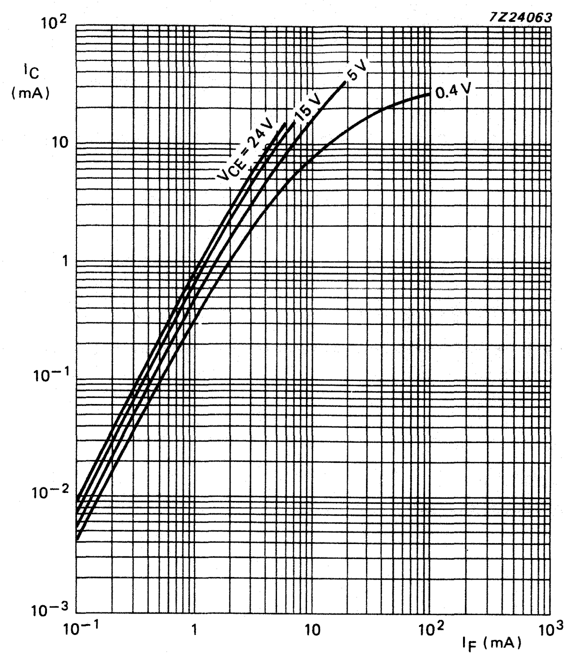


Fig. 13 Typical collector current as a function of forward current; T_{amb} = 25 °C.

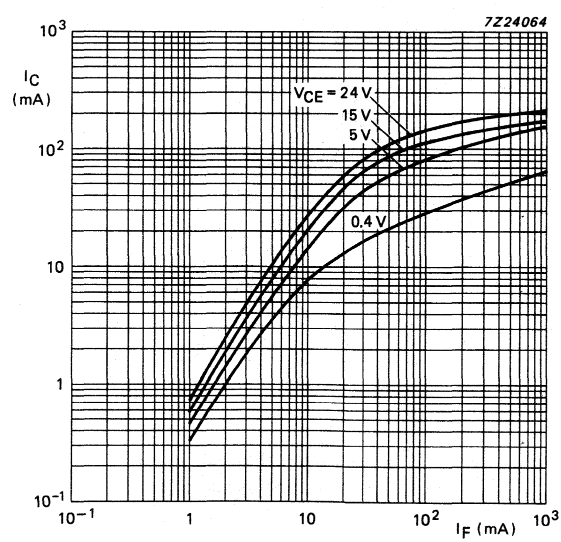
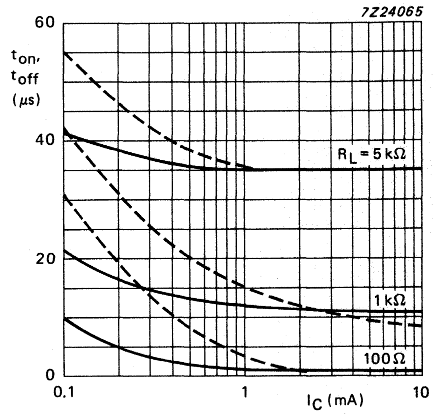


Fig. 14 Typical collector current as a function of forward current; T_{amb} = 25 °C; t_p = 10 μs; δ = 0.01.



—— = t_{off}; – – – – = t_{on}

Fig. 15 Typical turn-on and turn-off times as a function of collector current; T_{amb} = 25 °C.

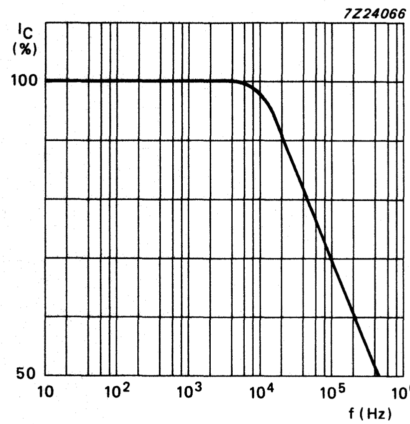


Fig. 16 Relative collector current as a function of frequency; T_{amb} = 25 °C; I_C = 2 mA; V_{CC} = 5 V.

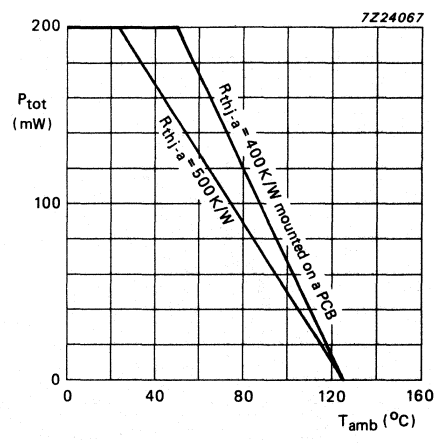


Fig. 17 Total power dissipation as a function of ambient temperature.

HIGH-VOLTAGE OPTOCOUPLER

The CNW83 is a photocoupler consisting of an infrared emitting GaAs diode and a silicon npn phototransistor, in a dual-in-line (DIL) plastic envelope SOT228.

Features

- High current transfer ratio and a low saturation voltage suitable for use with TTL integrated circuits
- High degree of AC and DC insulation (5900 V RMS and 8340 V DC)
- Working voltage of 2.5 kV (DC)

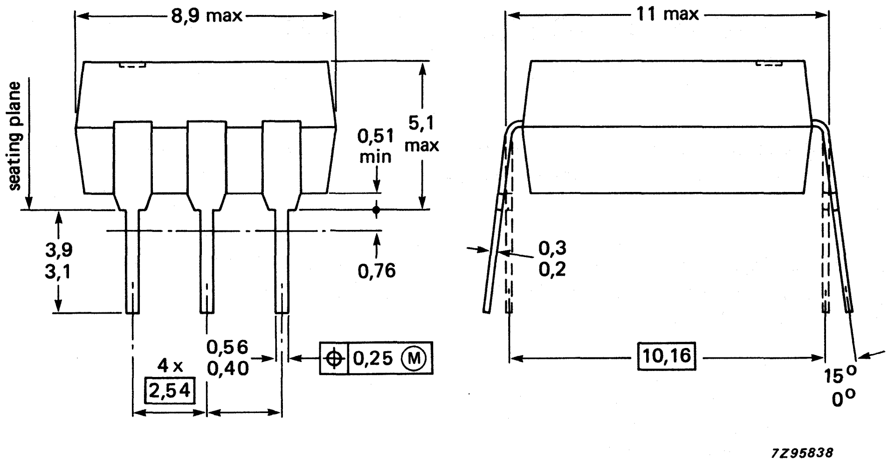
UL – Covered under UL component recognition FILE E90700
VDE – Approved according to VDE 0883/6.80
Reference voltage (VDE 0110b Tab 4): 500 VAC/600 VDC
(isolation group C)
Complied for reinforced isolation at 250 V AC with:
DIN 57 804/VDE 0804/1.83 (isolation group C)
DIN VDE 0860/8.86/HD 195 54
DIN IEC 380/VDE 0806/8.81
DIN IEC 435/VDE 0805 "ENTWURF" NOV. 84
DIN VDE 0750 Teil 1/5.82 IEC 601 Teil 1
BSI – Certification according to BS 415 : 1979 (Home appliance)
NORDIC – SETI, SEMKO, NEMKO acceptance for applications tested according to IEC 65 (Electronic household equipments, TV, AUDIO, VIDEO excluding monitors).
DEMKO – General approval IEC 664 (IEC 65- 335- 380- 950).

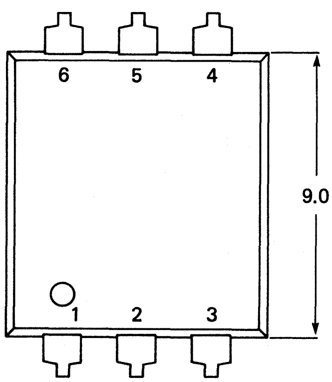
QUICK REFERENCE DATA

Diode				
DC forward current	I_F	max.	100	mA
Transistor				
Collector-emitter voltage (open base)	V_{CEO}	max.	50	V
Photocoupler				
Output/input DC current transfer ratio I_F = 10 mA; V_{CE} = 0.4 V	I_C/I_F	min.	0.4	
Collector cut-off current (dark) V_{CC} = 10 V; working voltage = 2.5 kV DC	I_{CEW}	max.	200	nA
Test isolation voltage DC	V_{IORM}	max.	8.34	kV
AC (RMS value)		max.	5.9	kV

MECHANICAL DATA

Dimensions in mm





Pinning:
1 = Anode
2 = Cathode
3 = Not Connected
4 = Emitter
5 = Collector
6 = Base

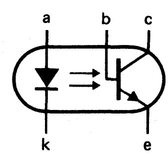


Fig. 1 SOT228.

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_{on} = 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

Transistor

Collector-emitter voltage (open base)	V_{CEO}	max.	50 V
Emitter-collector voltage	V_{ECO}	max.	7.0 V
DC collector current	I_C	max.	100 mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	200 mW

Photocoupler

Storage temperature range	T_{stg}		−55 to + 150 °C
Junction temperature	T_j	max.	125 °C
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 when mounted on a PCB			
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.	9.6 mm
External tracking path (creepage distance) input terminals to output terminals	L(IO2)	min.	10 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. max.	1.15 V 1.5 V
Reverse current $V_R = 5$ V	I_R	max.	10 μA

Transistor

Collector-emitter breakdown voltage $I_C = 1$ mA	$V_{(BR)CEO}$	min.	50 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.	7.0 V
Collector cut-off current (dark); diode $I_F = 0$ $V_{CE} = 10$ V	I_{CEO}	typ. max.	2.0 nA 50 nA
$V_{CE} = 10$ V; $T_{amb} = 70$ °C	I_{CEO}	max.	10 μA
$V_{CB} = 10$ V	I_{CBO}	max.	20 nA

CHARACTERISTICS (continued)

Photocoupler

Output/input DC current transfer ratio			
I_F = 10 mA; V_{CE} = 0.4 V	I_C/I_F	min.	0.4
		typ.	0.8
I_F = 10 mA; V_{CE} = 5 V	I_C/I_F	typ.	1.5
Collector cut-off current (light)			
$T_{amb} \leqslant 70$ °C; V_F = 0.8 V; V_{CE} = 15 V	$I_{CE(L)}$	max.	15 μA
$T_{amb} \leqslant 70$ °C; I_F = 2 mA; V_{CE} = 0.4 V	$I_{CE(L)}$	min.	150 μA
Collector-emitter saturation voltage			
I_F = 10 mA; I_C = 4 mA	V_{CEsat}	typ.	0.19 V
		max.	0.40 V
Collector capacitance			
V_{CB} = 10 V; f = 1 MHz	$C_{b'c}$	max.	5.5 pF
Collector cut-off current (dark) at working voltage V_W = 2.5 kV (DC value);			
V_{CC} = 10 V; T_j = 25 °C (see notes 1 and 2)	I_{CEW}	max.	200 nA
V_{CC} = 10 V; T_j = 70 °C (see notes 1 and 2)	I_{CEW}	max.	100 μA
Test isolation voltage DC	V_{IORM}	max.	8.34 kV
t = 1 min (see note 3) AC (RMS value)		max.	5.9 kV
Capacitance between input and output			
V = 0; f = 1 MHz	C_{io}	typ.	0.4 pF
Insulation resistance between input and output			
V_{IO} = ± 1000 V	R_{IO}	min.	10 GΩ
		typ.	1 TΩ
Switching times (see Figs 3 and 4)			
Turn-on time			
I_C = 2 mA; V_{CC} = 5 V; R_L = 100 Ω	t_{on}	typ.	3.0 μs
I_C = 2 mA; V_{CC} = 5 V; R_L = 1 kΩ		typ.	12 μs
Turn-off time			
I_C = 2 mA; V_{CC} = 5 V; R_L = 100 Ω	t_{off}	typ.	3.0 μs
I_C = 2 mA; V_{CC} = 5 V; R_L = 1 kΩ		typ.	12 μs

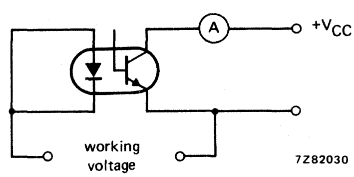


Fig. 2 Test circuit.

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 single product is tested by applying an isolation test voltage of 7080 V (RMS) for 2 seconds between the shorted input (diode) leads and the shorted output (phototransistor) leads.

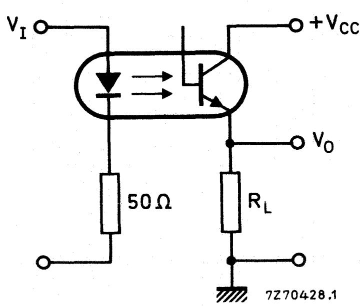


Fig. 3 Switching circuit.

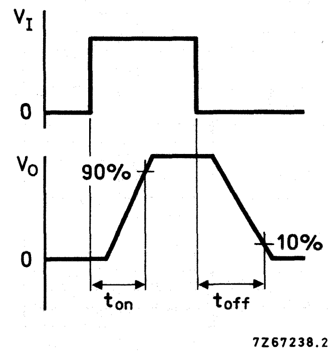


Fig. 4 Waveforms.

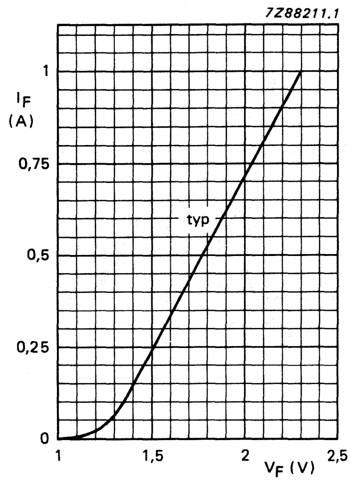


Fig. 5 Typical forward current as a function of forward voltage; $T_{amb} = 25\ ^oC$.

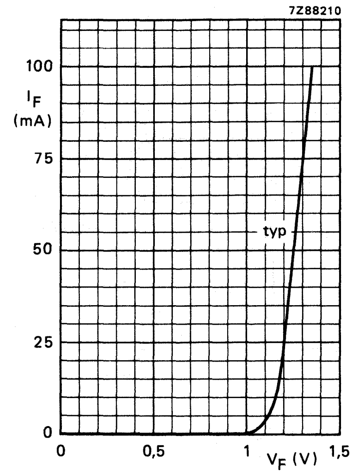


Fig. 6 Typical forward current as a function of forward voltage; $T_{amb} = 25\ ^oC$; $t_p = 20\ \mu s$; $\delta = 0.01$.

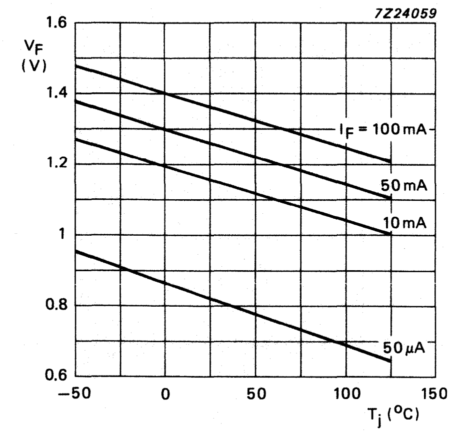


Fig. 7 Typical forward voltage as a function of junction temperature.

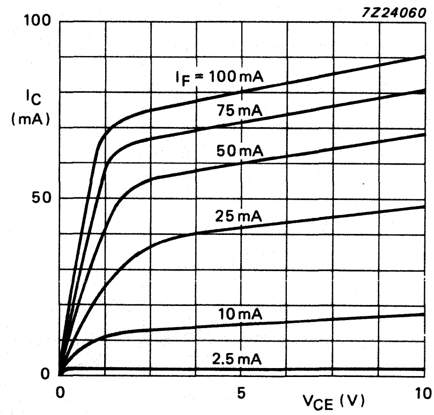


Fig. 8 Typical collector current as a function of collector-emitter voltage; T_{amb} = 25 °C.

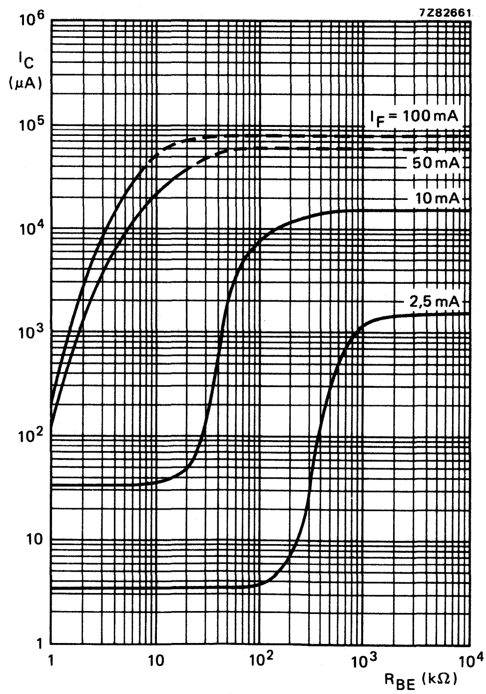
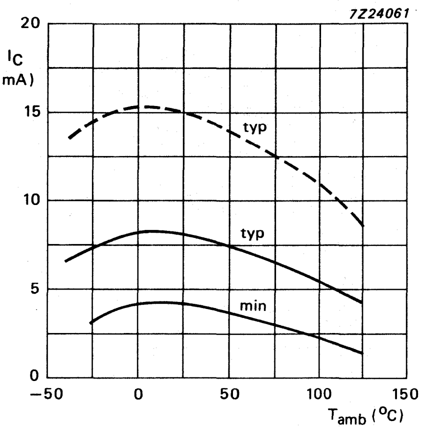


Fig. 9 Collector current as a function of base-emitter resistance; I_B = 0; V_{CE} = 5 V; T_{amb} = 25 °C; typical values.



——— I_F = 10 mA; V_{CE} = 0.4 V
– – – I_F = 10 mA; V_{CE} = 5 V

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

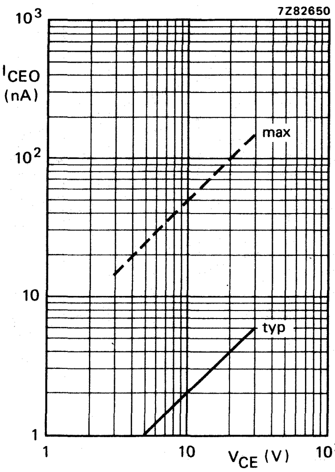


Fig. 11 Collector-emitter dark current as a function of collector-emitter voltage; T_{amb} = 25 °C.

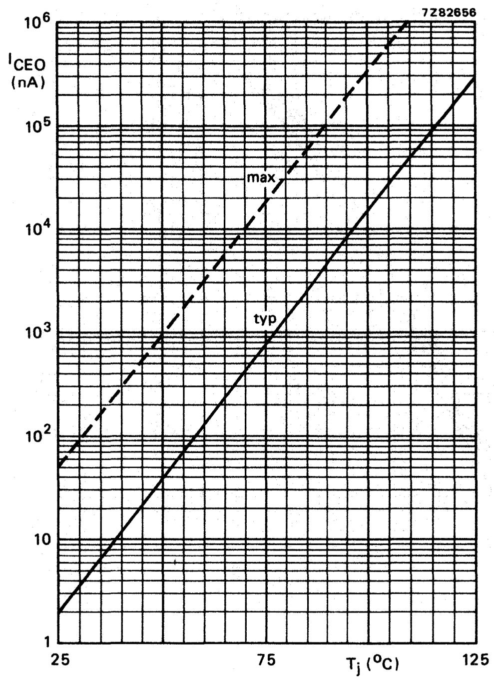


Fig. 12 Collector-emitter dark current as a function of junction temperature.

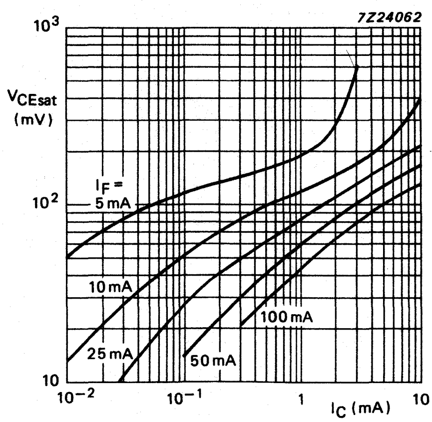


Fig. 13 Typical collector-emitter saturation voltage as a function of collector current; T_{amb} = 25 °C.

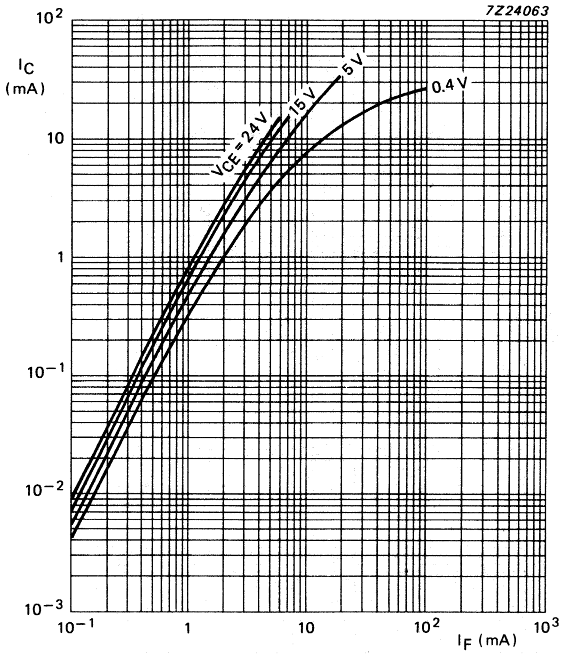


Fig. 14 Typical collector current as a function of forward current; T_{amb} = 25 °C.

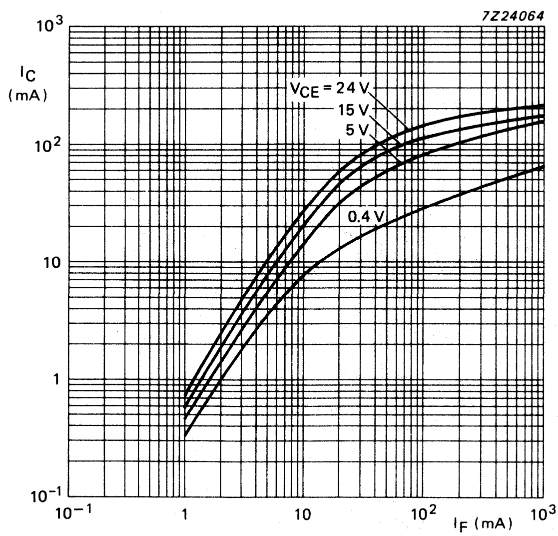
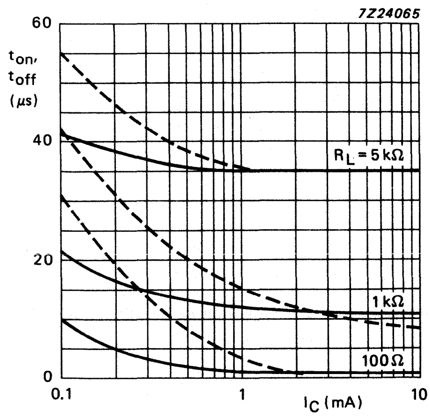


Fig. 15 Typical collector current as a function of forward current; T_{amb} = 25 °C; t_p = 10 μs; δ = 0.01.



—— = t_{off}; – – – = t_{on}

Fig. 16 Typical turn-on and turn-off times as a function of collector current; T_{amb} = 25 °C.

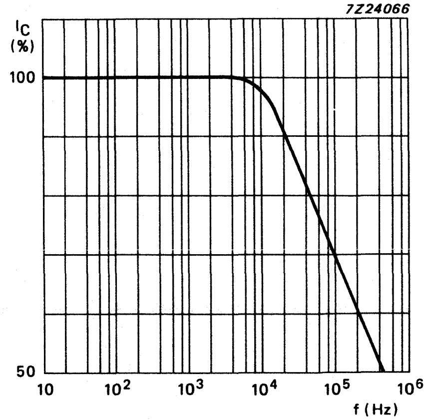


Fig. 17 Relative collector current as a function of frequency; T_{amb} = 25 °C; I_C = 2 mA; V_{CC} = 5 V.

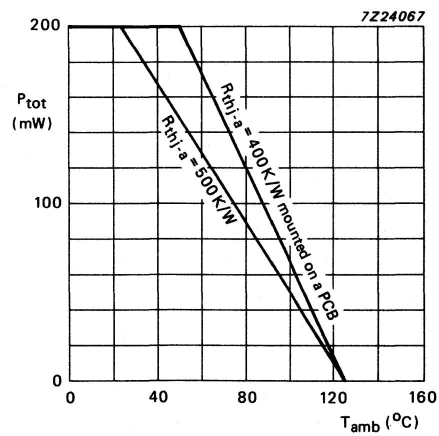


Fig. 18 Total power dissipation as a function of ambient temperature.

HIGH-VOLTAGE OPTOCOUPLER

Optically coupled isolator consisting of an infrared emitting GaAs diode and a silicon n-p-n phototransistor. 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

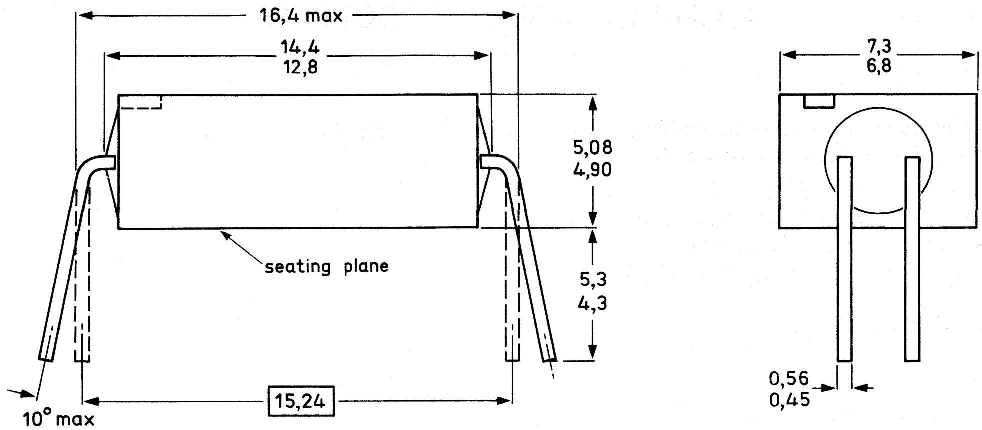
MECHANICAL DATA

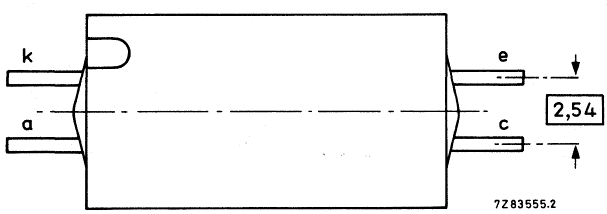
SOT-211 (see Fig. 1)

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*

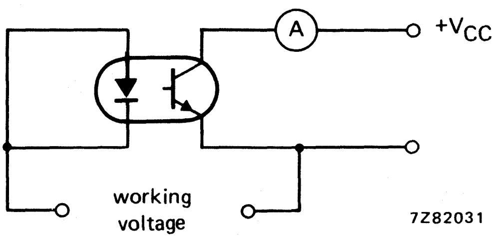


Fig. 2.

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. $CMRR = \frac{V_o}{V_{CM}}$.

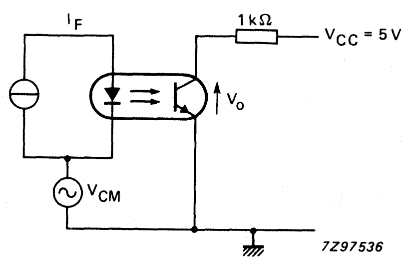


Fig. 3.

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

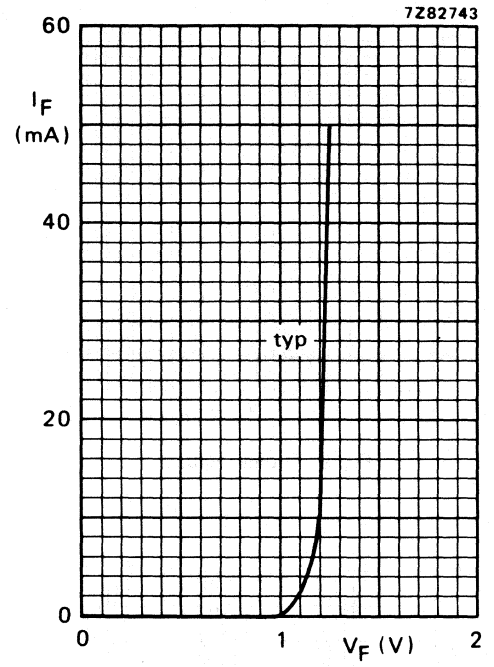


Fig. 4 T_j = 25 °C.

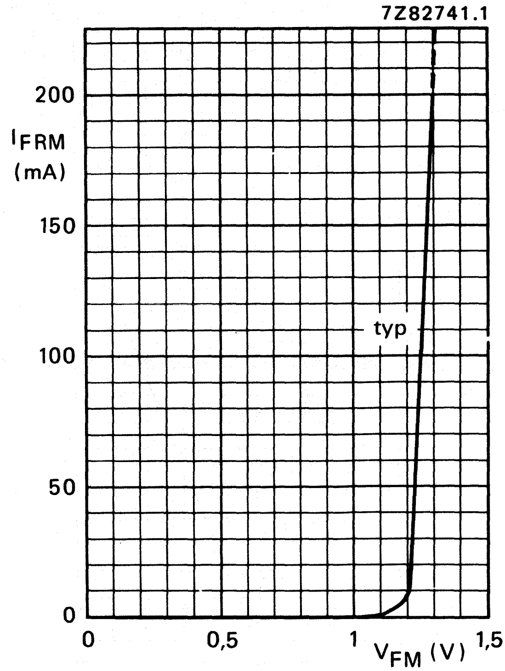


Fig. 5 T_{amb} = 25 °C; t_p = 10 μs; T = 1 ms.

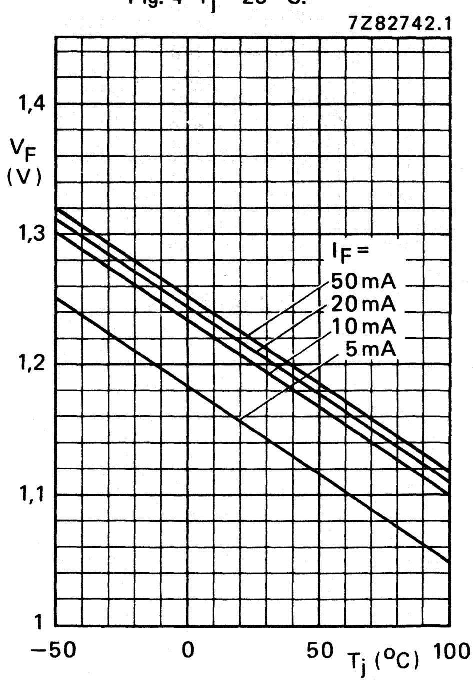


Fig. 6 Typical values.

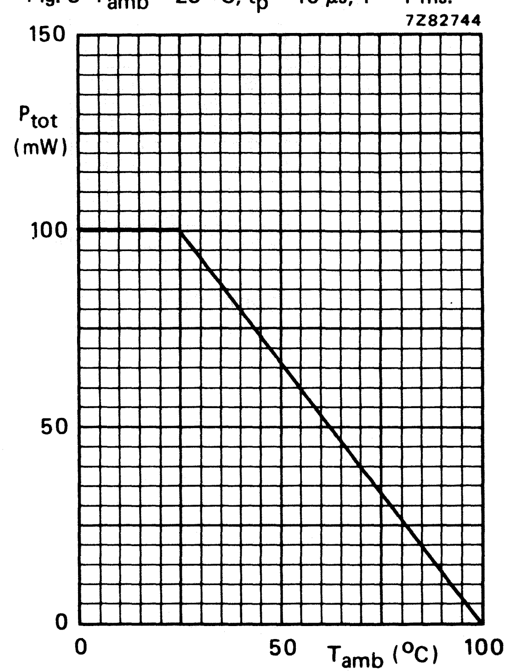


Fig. 7 Power derating curve for diode and transistor versus ambient temperature.

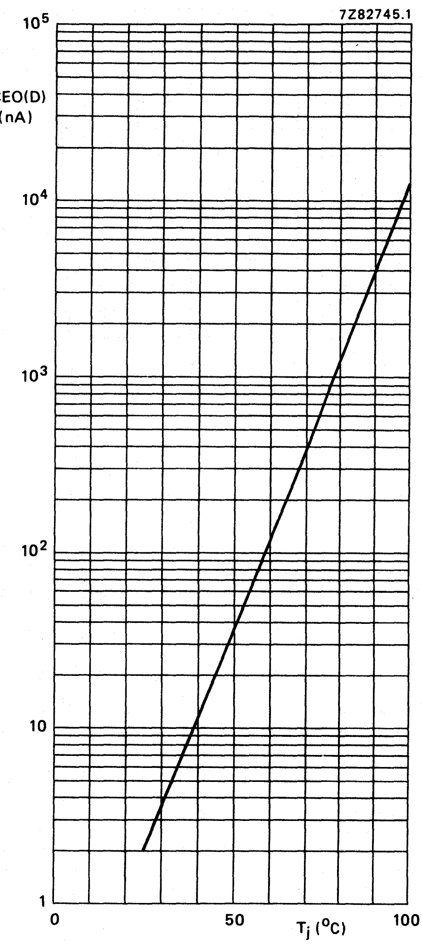


Fig. 8 Typical values.

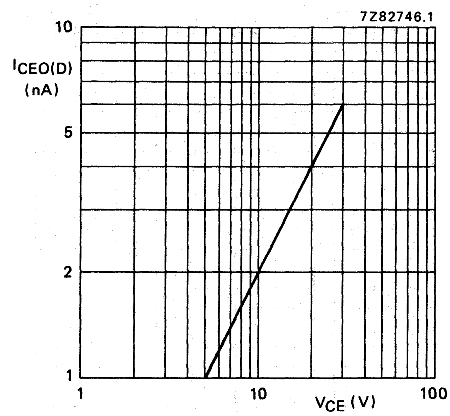


Fig. 9 Typical values.

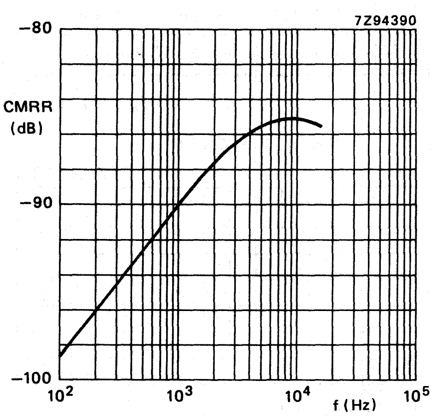


Fig. 10 Typical values.

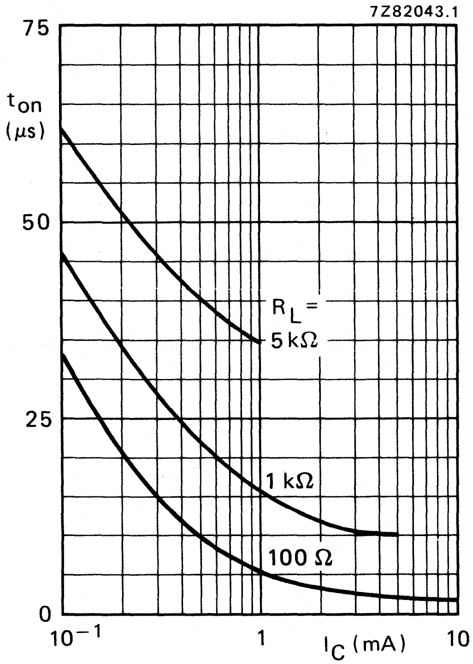


Fig. 11 $I_B = 0$; $V_{CC} = 5$ V; $T_{amb} = 25$ °C; typical values. See also Fig. 13.

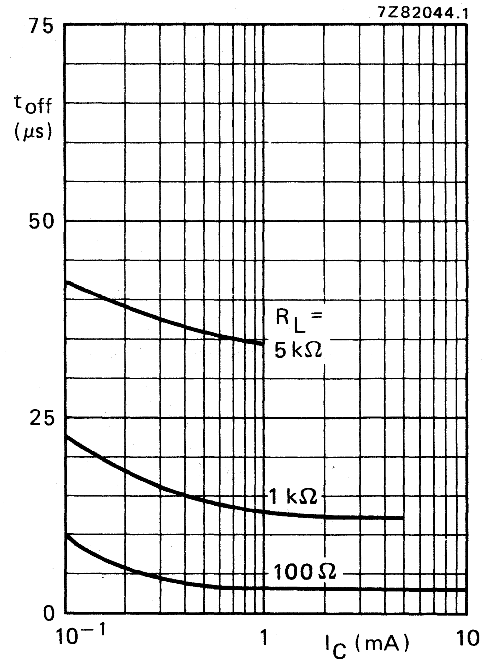


Fig. 12 $I_B = 0$; $V_{CC} = 5$ V; $T_{amb} = 25$ °C; typical values. See also Fig. 13.

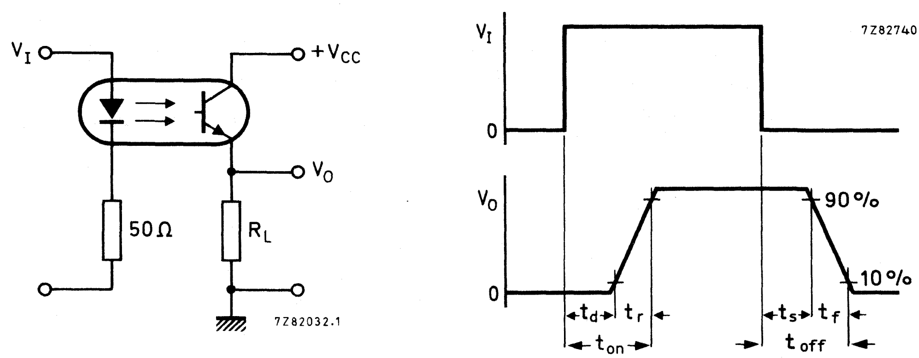


Fig. 13 Switching circuit and waveforms.

OPTOCOUPLERS

Optically coupled isolators consisting of an infrared emitting GaAs diode and a silicon npn photo transistor 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

a VDE and UL version is available, see CNX35U, CNX36U and CNX39U. ←

QUICK REFERENCE DATA

Diode					
Continuous reverse voltage		V_R	max.	5	V
DC forward current		I_F	max.	100	mA
(peak value); $t_p = 10\ \mu s$; $\delta = 0.01$		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)	**CNX35**			0.4 to 1.6	
$I_F = 10$ mA; $V_{CE} = 0.4$ V; ($I_B = 0$)	**CNX39**	I_C/I_F		0.6 to 1.0	
	CNX36			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_{IORM}	min.	4.4	kV ←
Isolation voltage AC (RMS value)		V_{IORM}	min.	3.12	kV ←

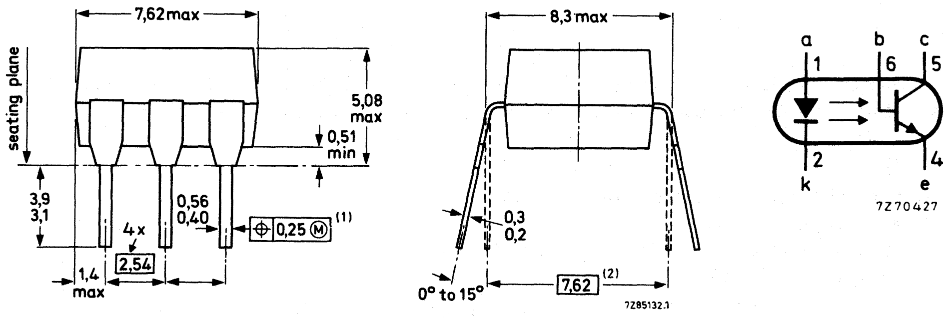
MECHANICAL DATA

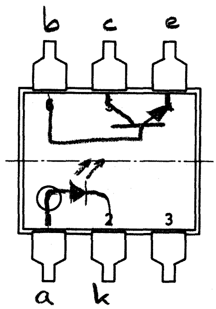
SOT90B (see Fig.1).

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

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)

Parameter / conditions	Type	Symbol		Value
Output/input DC current transfer ratio (CTR)				
→ I_F = 10 mA; V_{CE} = 0.4 V	**CNX35**	I_C/I_F		0.4 to 1.6
	CNX39	I_C/I_F		0.6 to 1.0
	CNX36	I_C/I_F		0.8 to 2.0
Output/input DC current transfer ratio (CTR)				
I_F = 2 mA; V_{CE} = 5 V		I_C/I_F	min.	0.15
I_F = 10 mA; V_{CE} = 5 V		I_C/I_F	typ.	1.5
Collector-emitter saturation voltage				
I_F = 10 mA; I_C = 2 mA	**CNX35**	V_{CEsat}	max.	0.4
	CNX39		typ.	0.15
I_F = 10 mA; I_C = 4 mA	**CNX36**	V_{CEsat}	max.	0.4
			typ.	0.19
Isolation voltage (note 3) t = 1 min DC		V_{IORM}	min.	4.4 kV
AC (RMS value)				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} = 1 kV		R_{IO}	min.	10 GΩ
			typ.	1 TΩ

Switching times (see Figs 2 and 3)

Conditions	Symbol		CNX35	CNX39	CNX36
$I_{C\,on}$ = 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
$I_{C\,on}$ = 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

Parameter / conditions	Symbol		Value
Collector cut-off current (dark) see Fig.4			
V_{CC} = 10 V; working voltage = 2.5 kV DC	I_{CEW}	max.	200 nA (note 2)
V_{CC} = 10 V; working voltage = 2.5 kV DC; T_j = 70 °C	I_{CEW}	max.	100 μA (note 2)
DC current gain			
→ I_C = 1 mA; V_{CE} = 5 V	h_{FE}		150 to 1500

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) and the shorted output (phototransistor) leads.

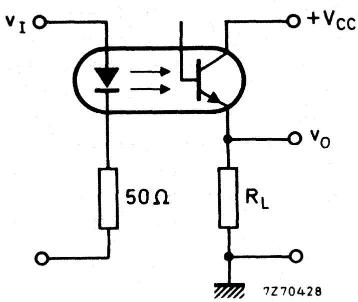


Fig. 2 Switching circuit.

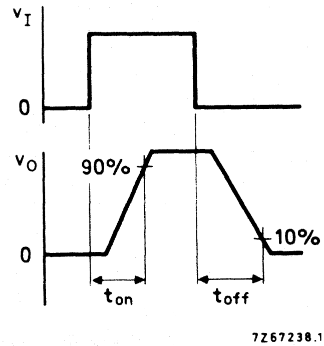


Fig. 3 Waveforms.

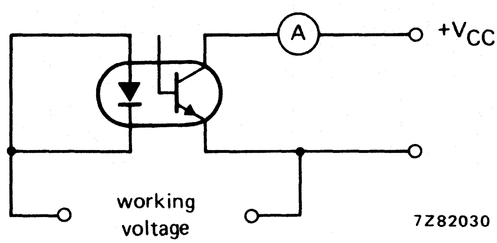


Fig. 4.

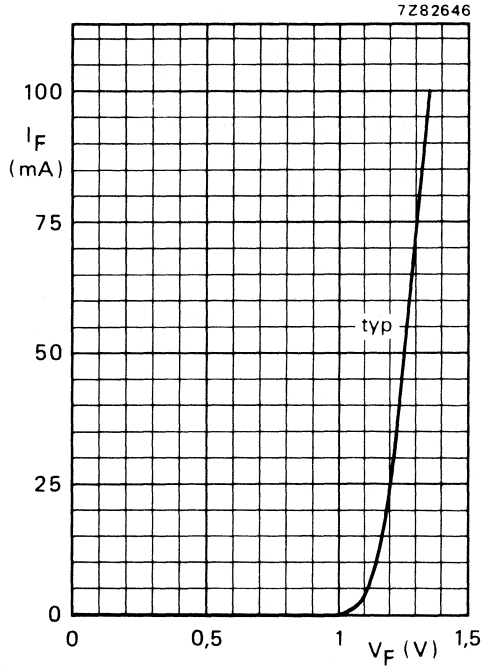


Fig. 5 T_{amb} = 25 °C.

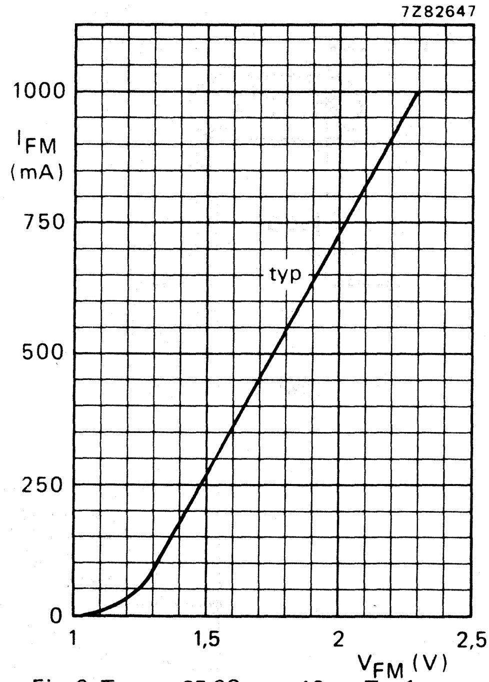


Fig. 6 T_{amb} = 25 °C; t_p = 10 μs; T = 1 ms.

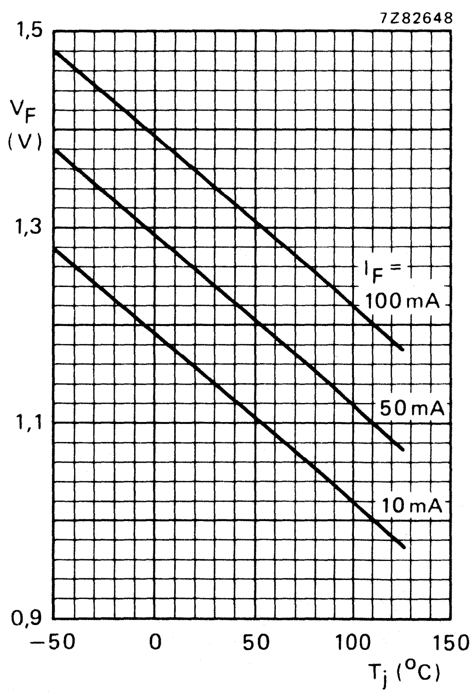


Fig. 7 Typical values.

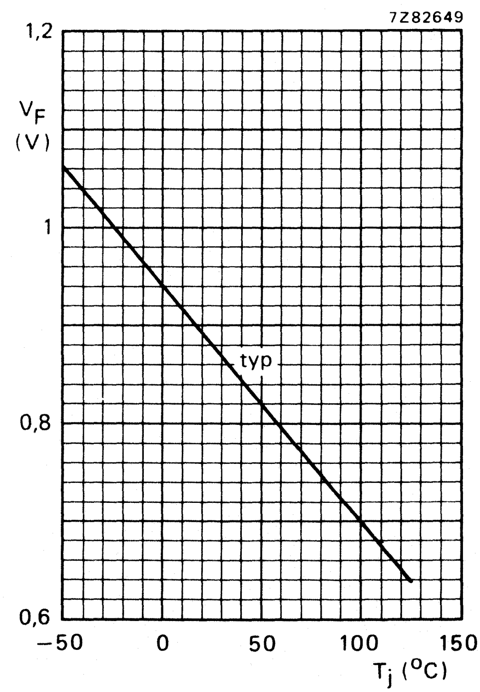


Fig. 8 I_F = 50 μA.

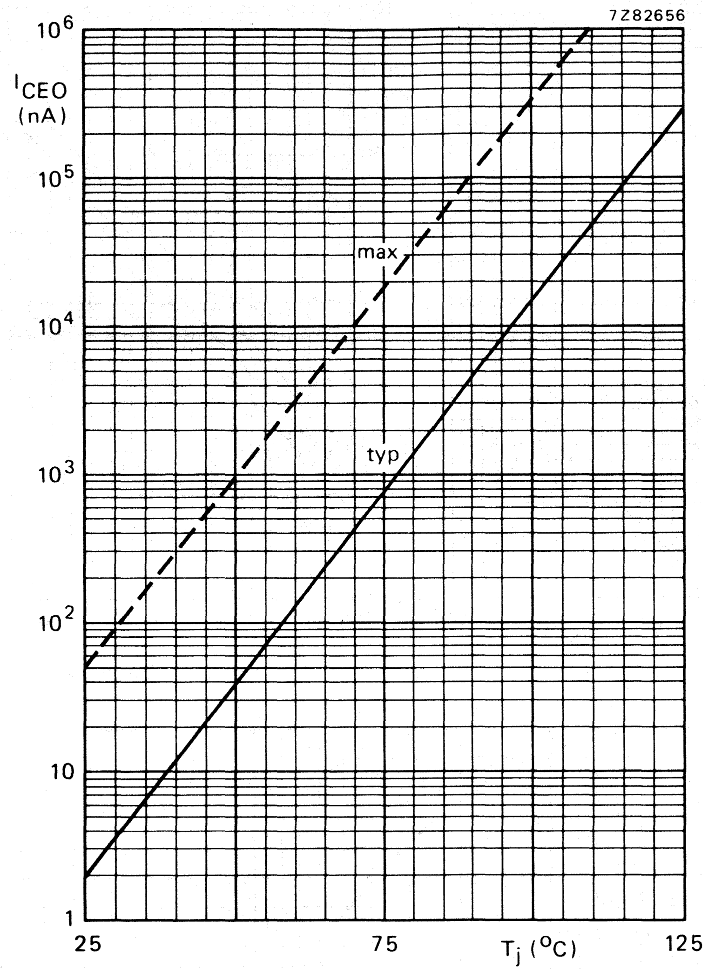


Fig. 9 $I_F = 0$; $V_{CE} = 10$ V.

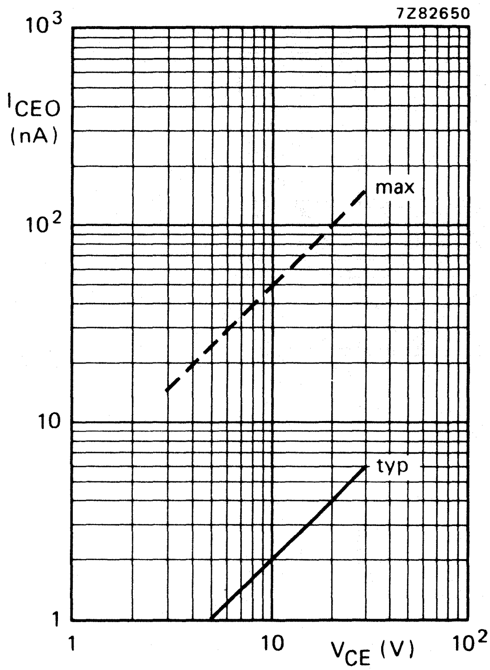


Fig. 10 $I_F = 0$; $T_j = 25$ °C.

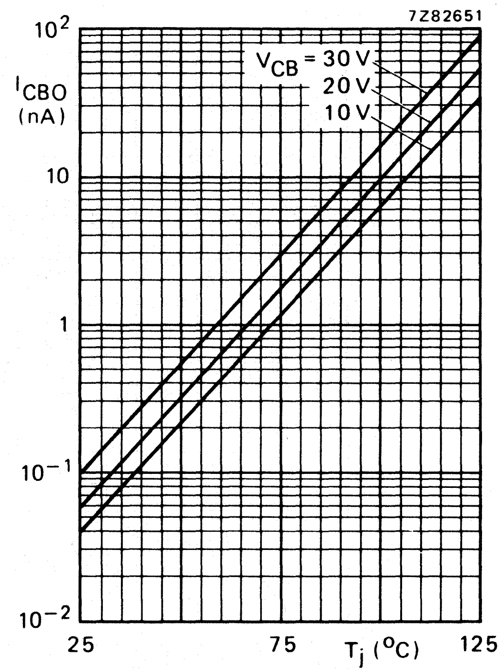


Fig. 11 Typical values.

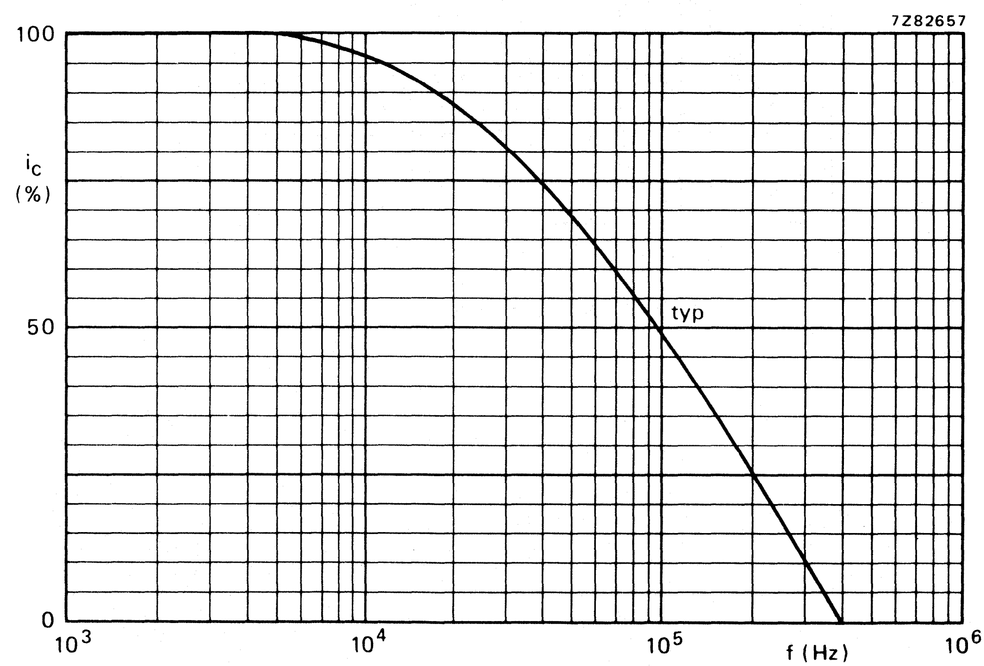


Fig. 12 $I_B = 0$; $I_C = 2$ mA; $V_{CC} = 5$ V; $R_L = 1$ kΩ; $T_{amb} = 25$ °C.

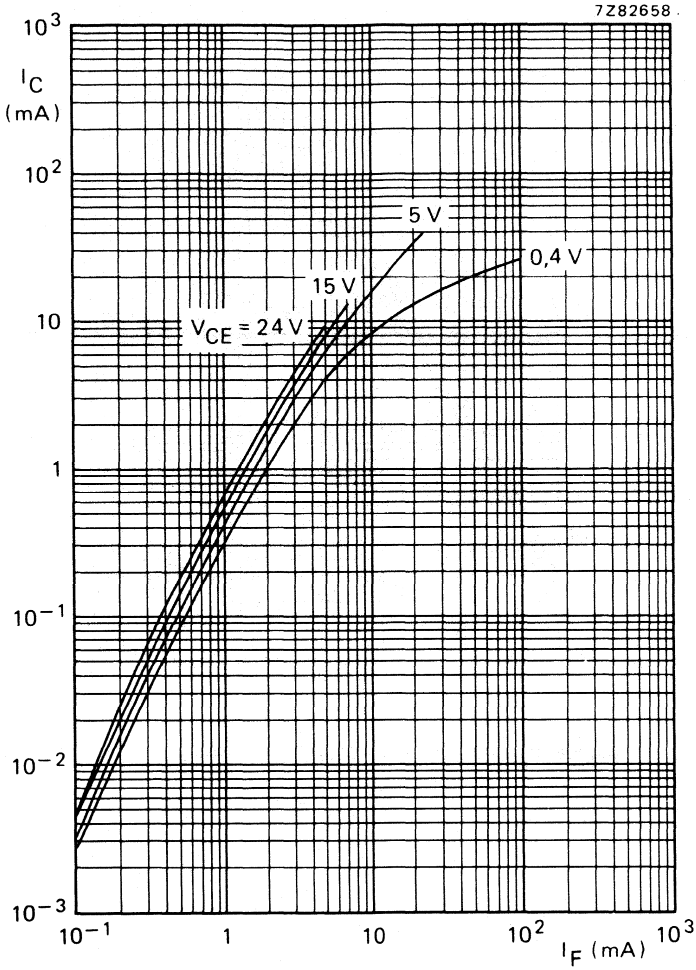


Fig. 13 T_{amb} = 25 °C, typical values.

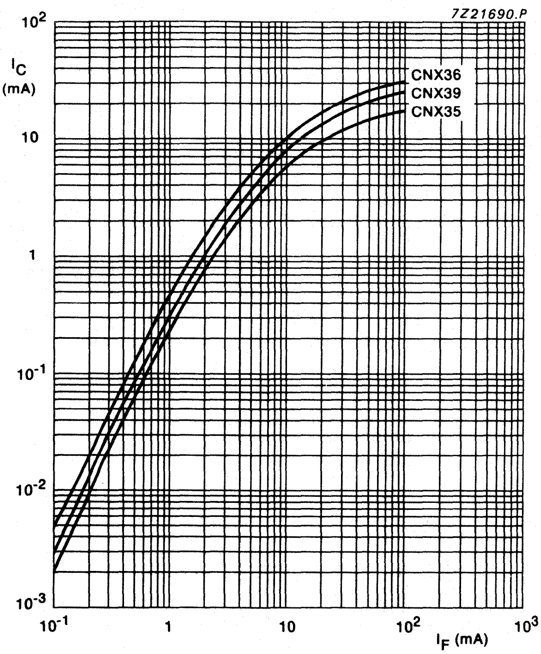


Fig.14 Typical collector current versus forward current.

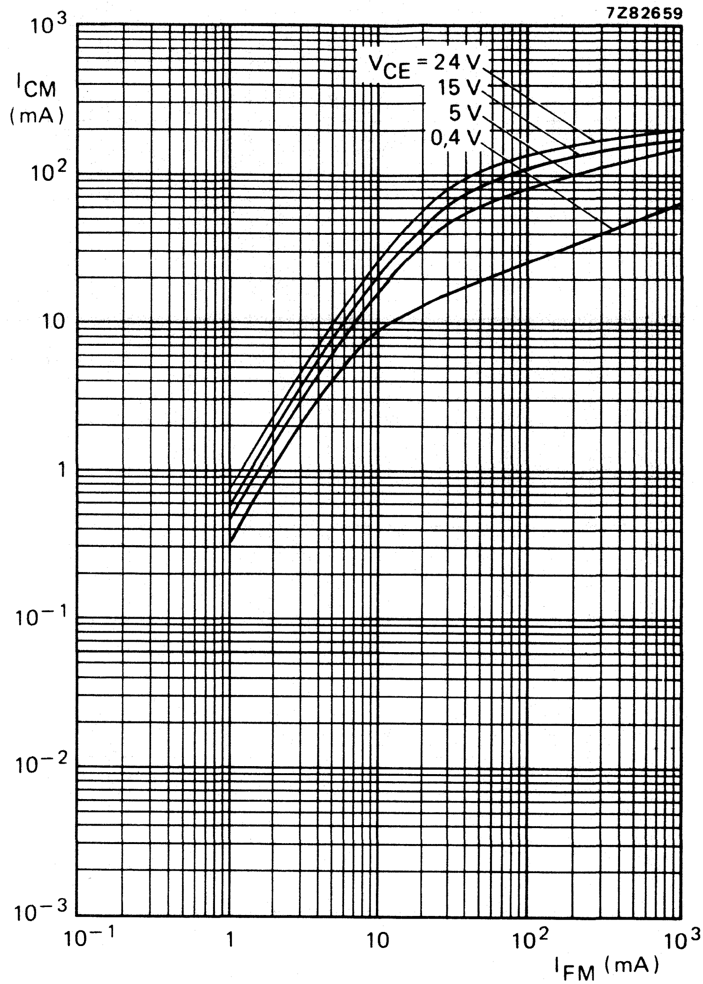


Fig. 15 T_{amb} = 25 °C; t_p = 10 μs; T = 1 ms; typical values.

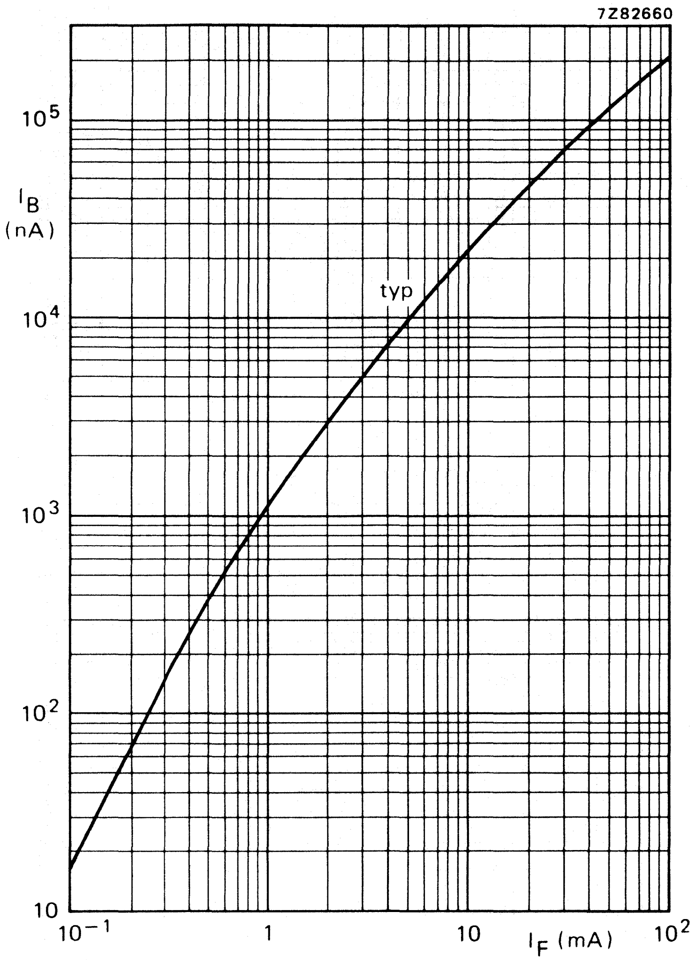


Fig. 16 V_{CB} = 5 V; T_{amb} = 25 °C.

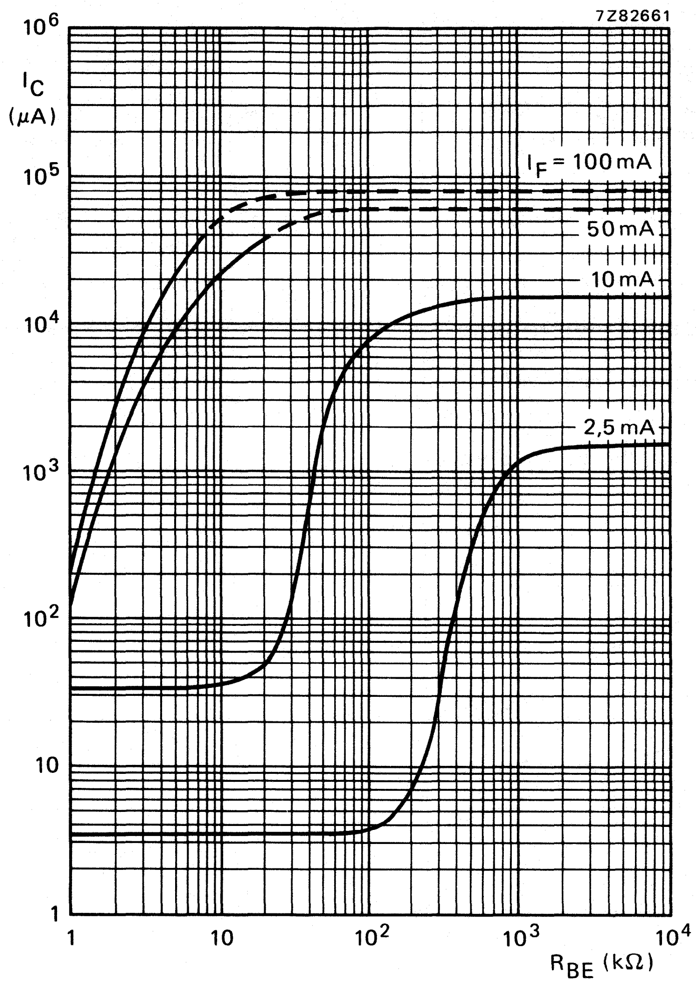


Fig. 17 $I_B = 0$; $V_{CE} = 5$ V; $T_{amb} = 25$ °C; typical values.

→

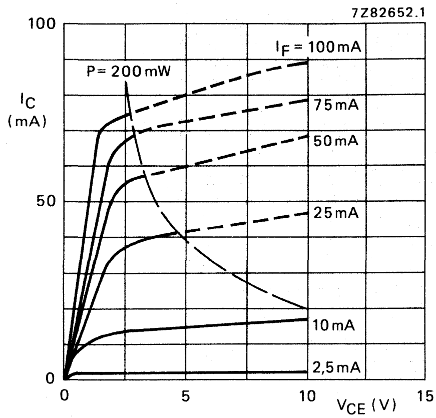


Fig. 18 T_{amb} = 25 °C; typical values.

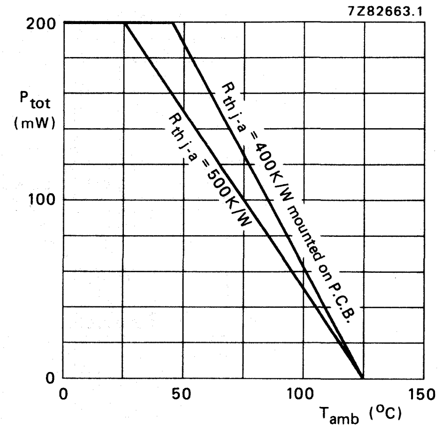


Fig. 19.

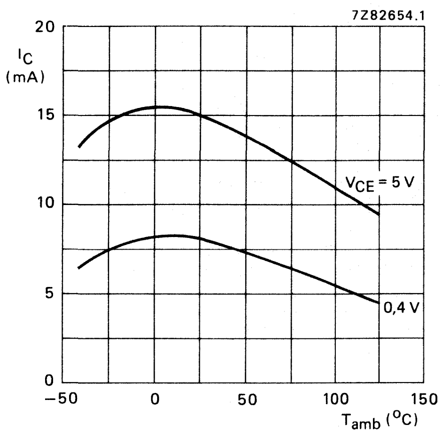


Fig. 20 I_F = 10 mA; typical values.

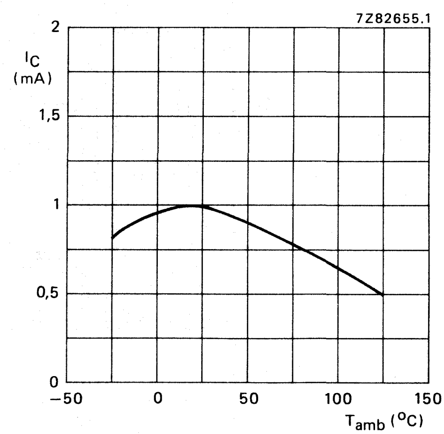


Fig. 21 I_F = 2 mA; V_{CE} = 0.4 V; typical values.

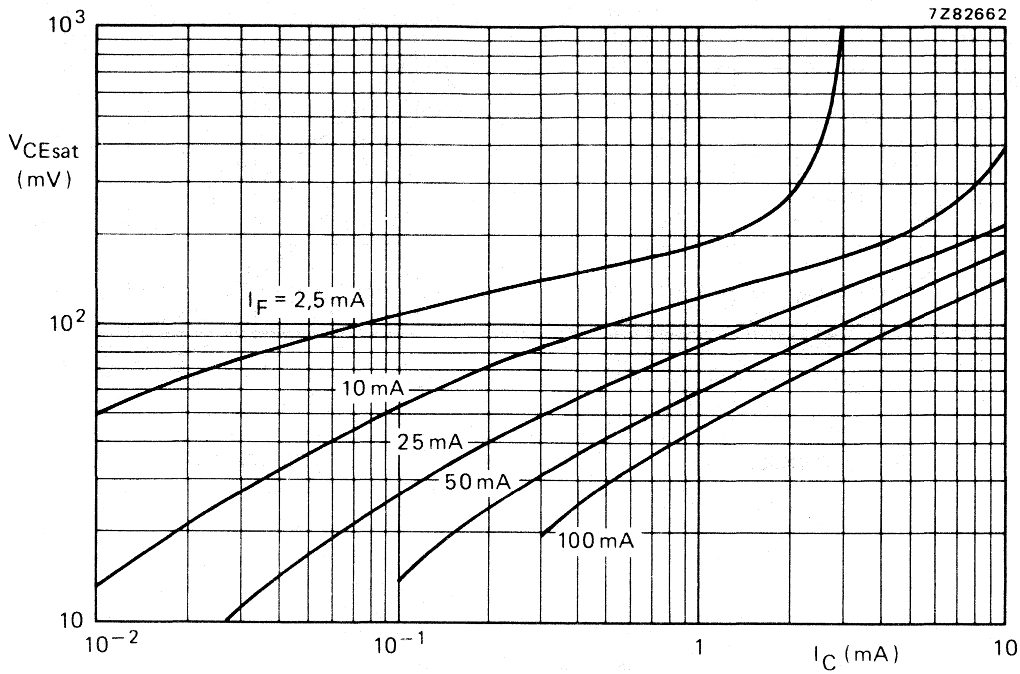


Fig. 22 $I_B = 0$; $T_{amb} = 25\ ^oC$; typical values.

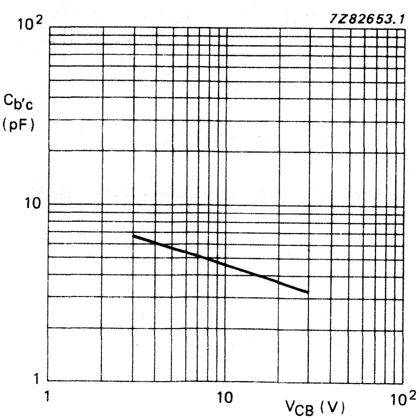


Fig. 23 f = 1 MHz; $T_{amb} = 25\ ^oC$.

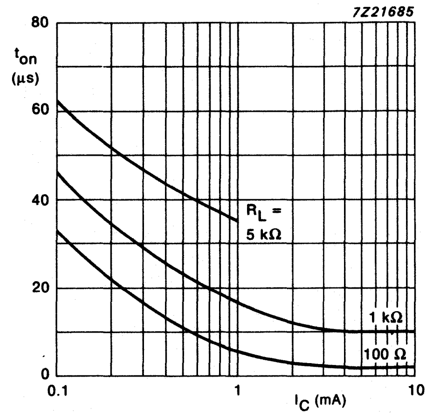


Fig.24 **CNX35.**

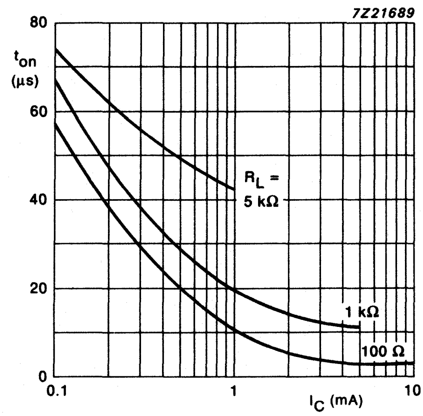


Fig.25 **CNX39.**

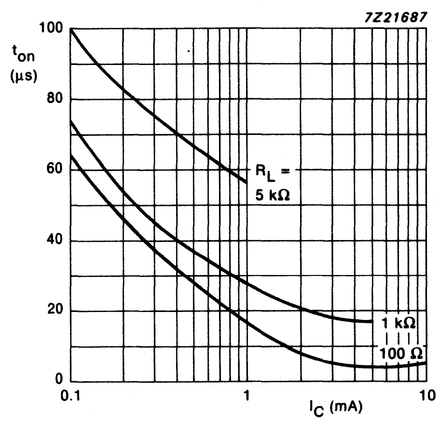


Fig.26 **CNX36.**

Typical turn-on time versus collector current.

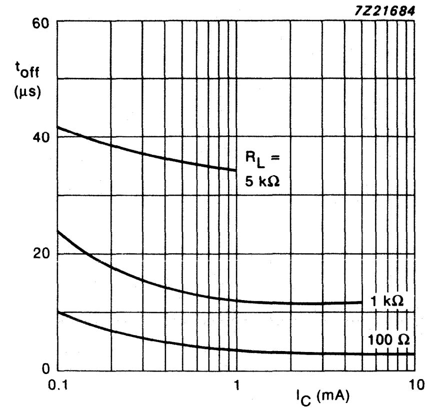


Fig.27 **CNX35.**

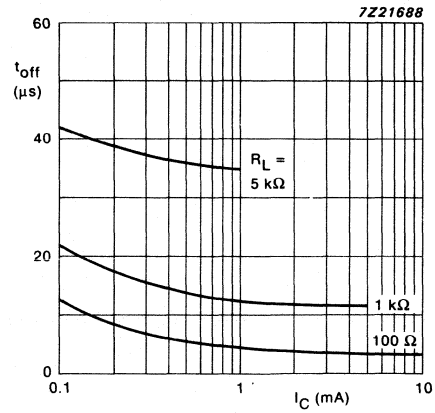


Fig.28 **CNX39.**

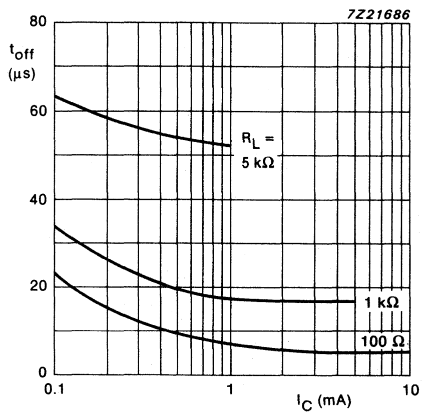


Fig.29 **CNX36.**

Typical turn-off time versus collector current.

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

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_{IORM}	min.	4.4 kV
AC (RMS value)				3.12 kV

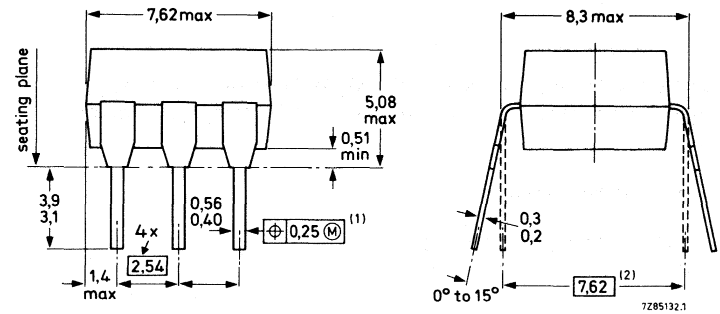
MECHANICAL DATA

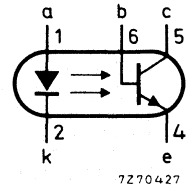
SOT90B (see Fig.1).

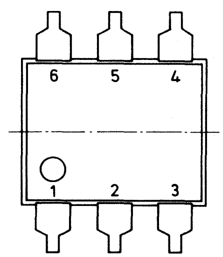
MECHANICAL DATA

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

$T_j = 25\ ^{o}C$ 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; $T_{amb} = 70\ ^{o}C$	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_{IORM}	min.	4.4 kV
t = 1 min; AC (RMS value) (note 2)		V_{IORM}	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				
$\pm V_{IO} = 1$ kV		R_{IO}	min.	10 GΩ
			typ.	1 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.	100 μA (note 3)
DC current gain			
$I_C = 1$ mA; $V_{CE} = 5$ V	h_{FE}		150 to 1500

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

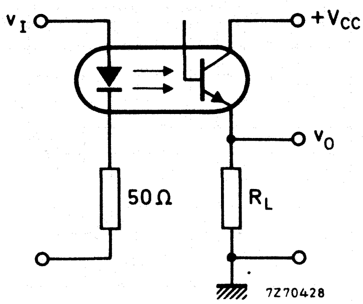


Fig. 2 Switching circuit.

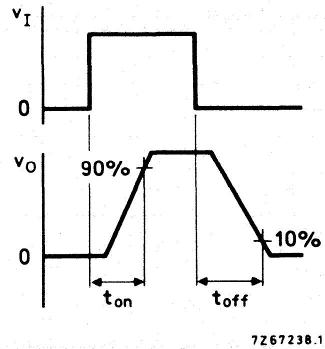


Fig. 3 Waveforms.

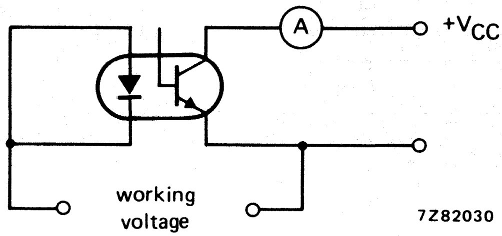


Fig. 4.

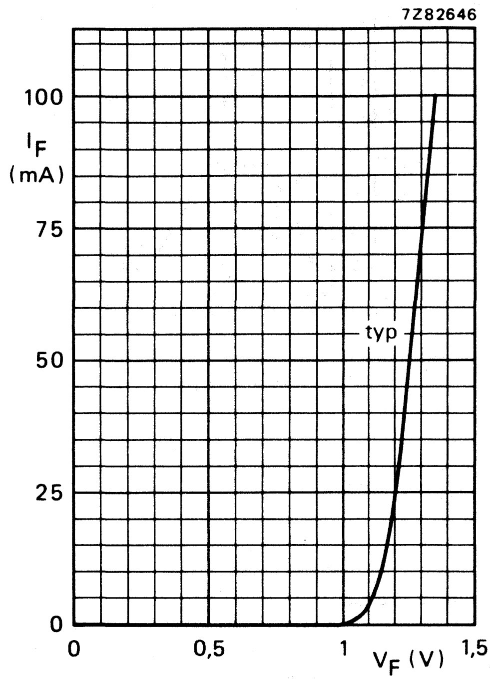


Fig. 5 T_{amb} = 25 °C.

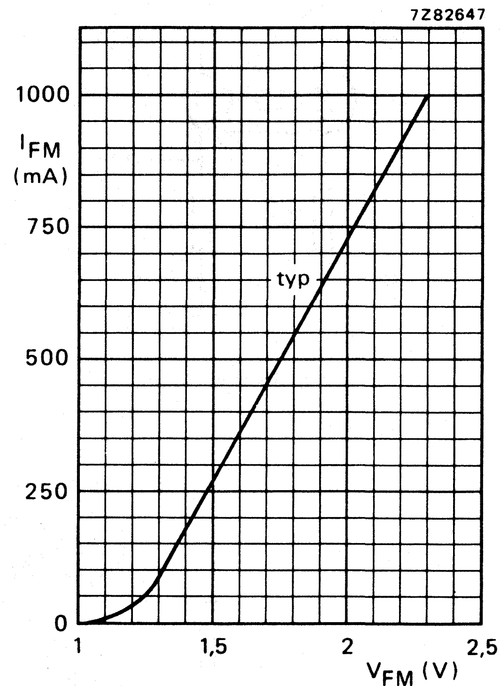


Fig. 6 T_{amb} = 25 °C; t_p = 10 μs; T = 1 ms.

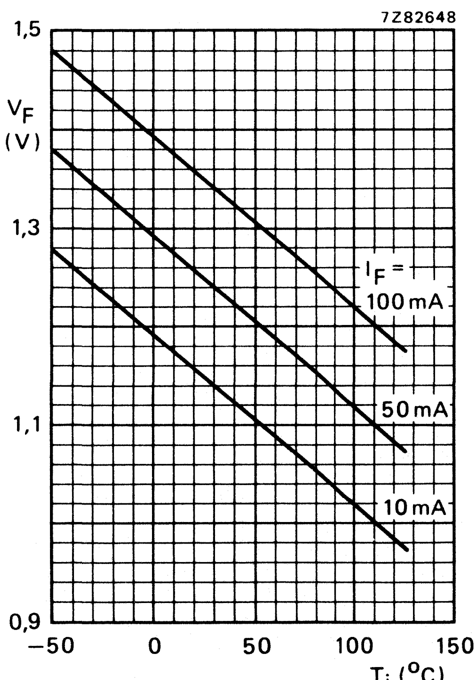


Fig. 7 Typical values.

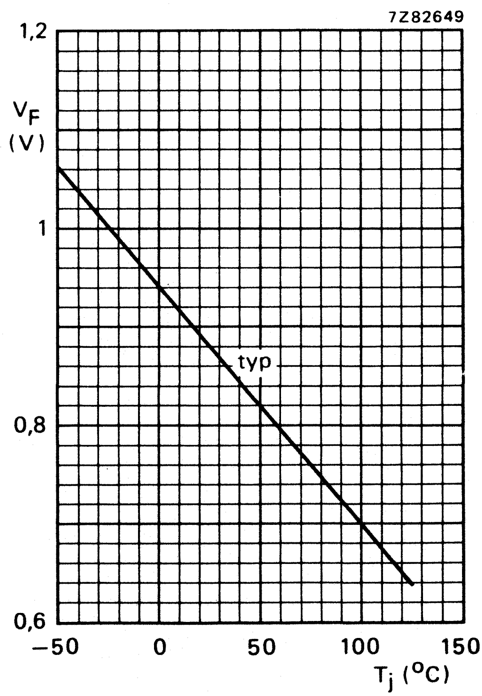


Fig. 8 I_F = 50 μA.

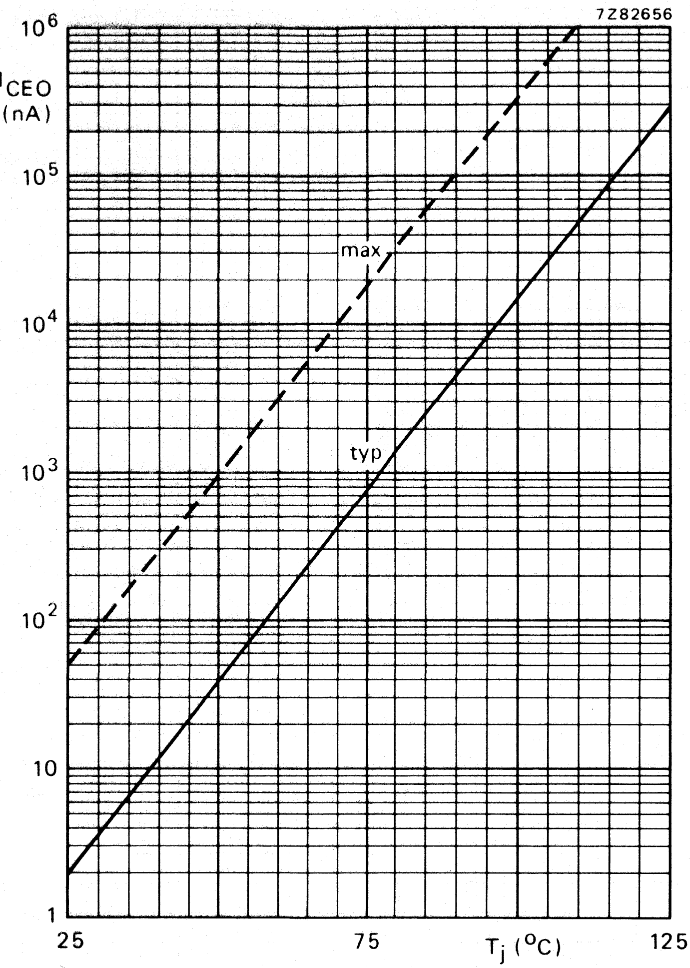


Fig. 9 $I_F = 0$; $V_{CE} = 10$ V.

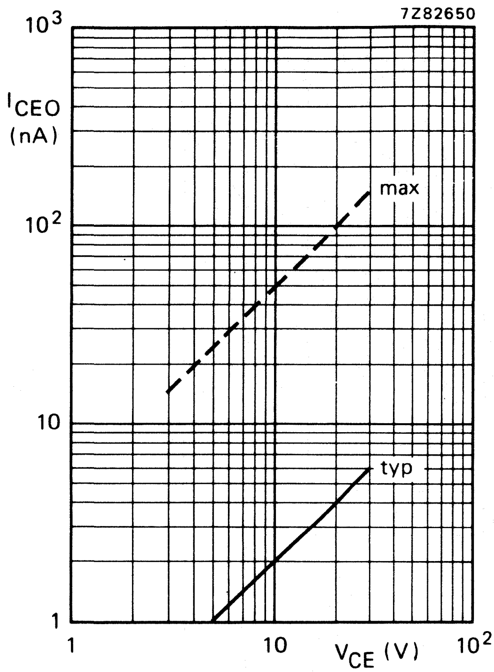


Fig. 10 $I_F = 0$; $T_j = 25$ °C.

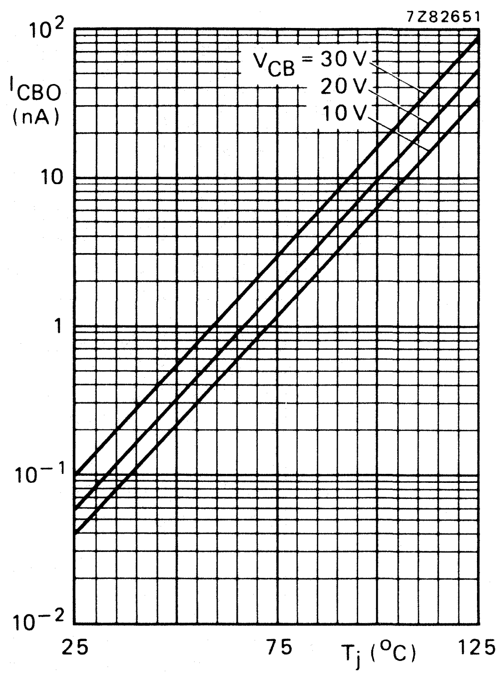


Fig. 11 Typical values.

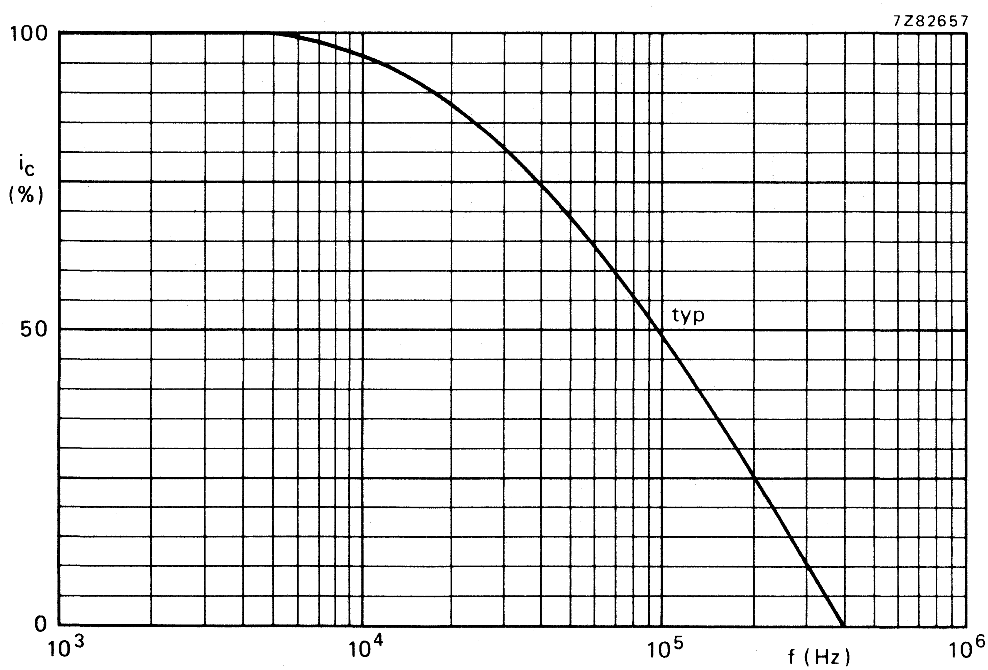


Fig. 12 $I_B = 0$; $I_C = 2$ mA; $V_{CC} = 5$ V; $R_L = 1$ kΩ; $T_{amb} = 25$ °C.

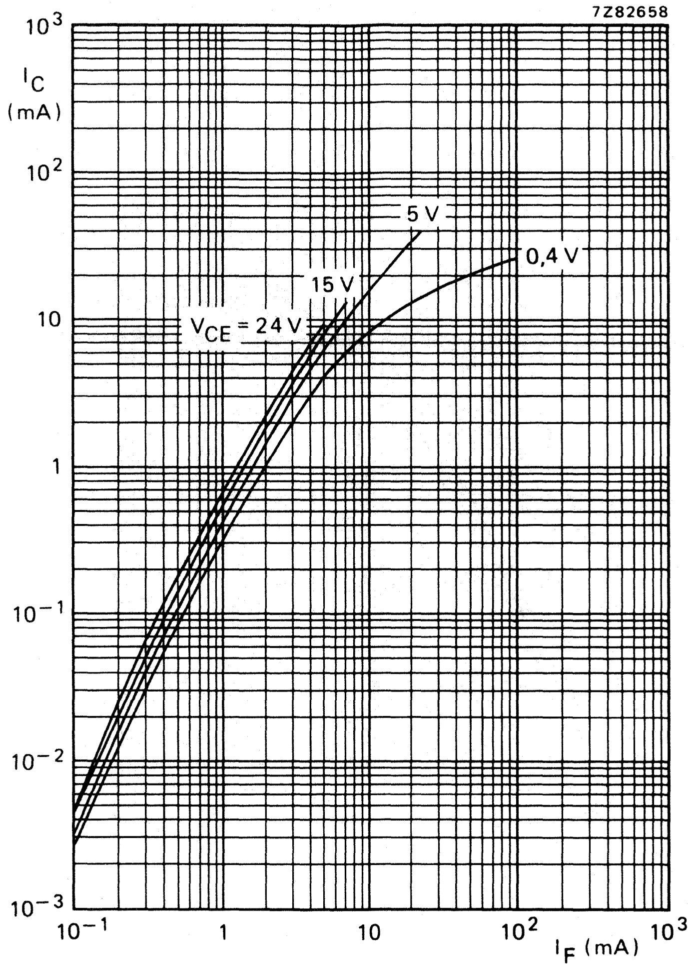


Fig. 13 T_{amb} = 25 °C, typical values.

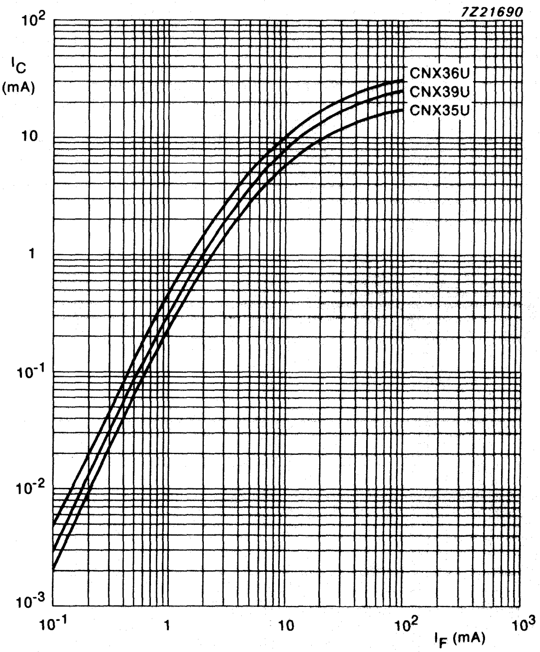


Fig. 14 Typical collector current as a component of forward current.

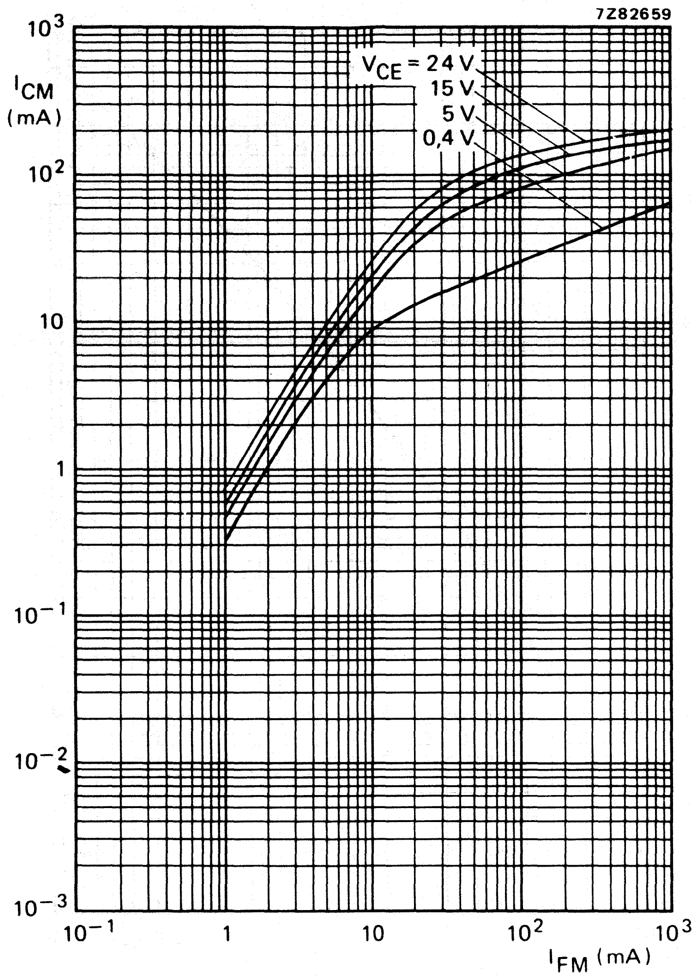


Fig. 15 T_{amb} = 25 °C; t_p = 10 μs; T = 1 ms; typical values.

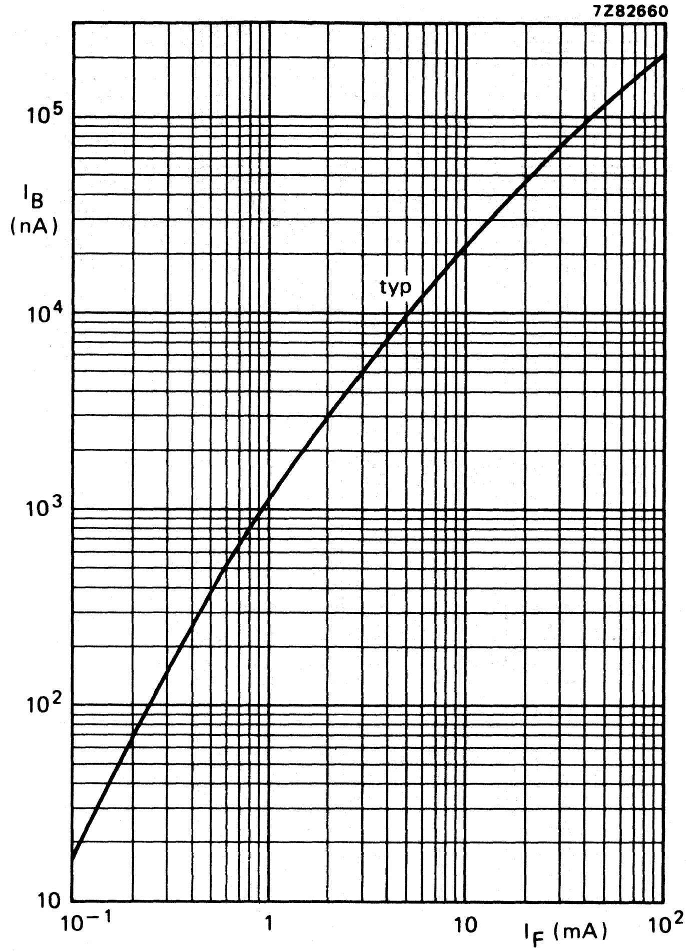


Fig. 16 V_{CB} = 5 V; T_{amb} = 25 °C.

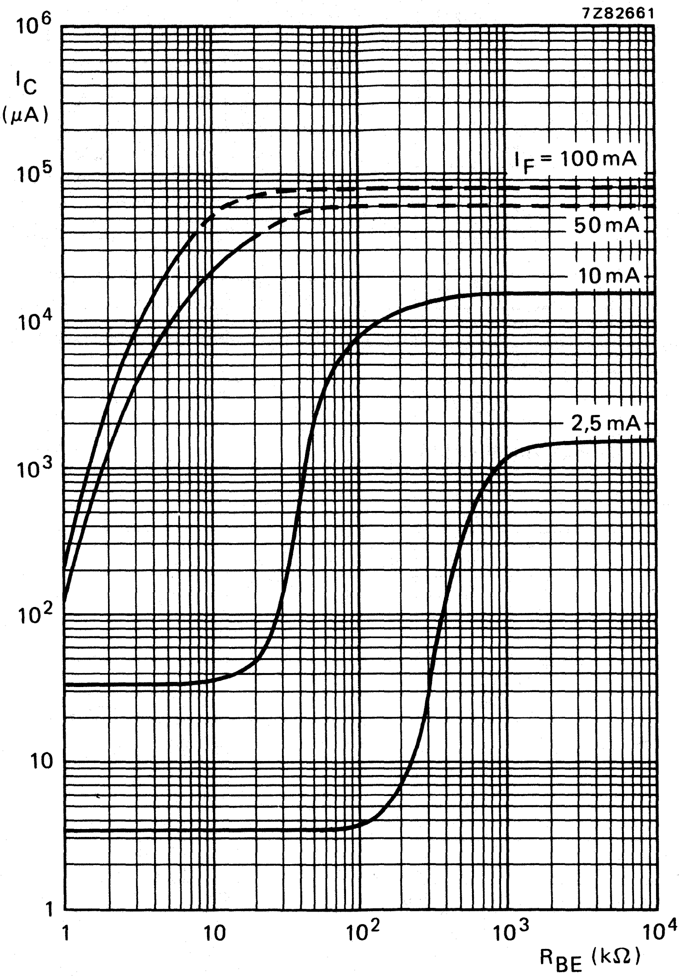


Fig. 17 $I_B = 0$; $V_{CE} = 5$ V; $T_{amb} = 25$ °C; typical values.

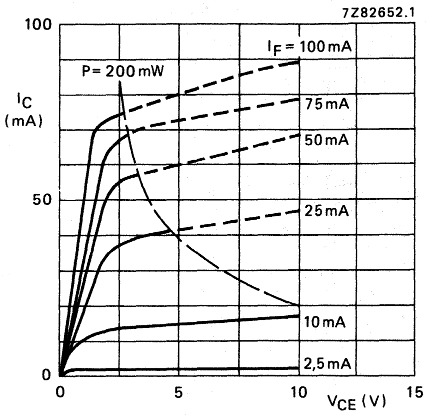


Fig. 18 T_{amb} = 25 °C; typical values.

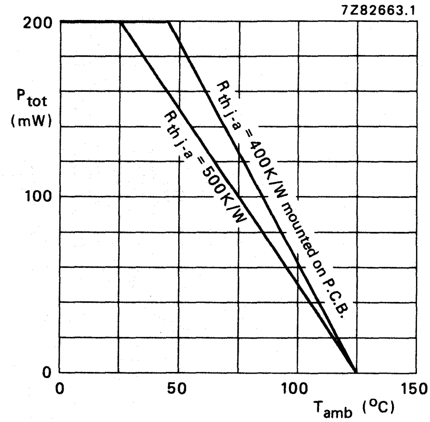


Fig. 19.

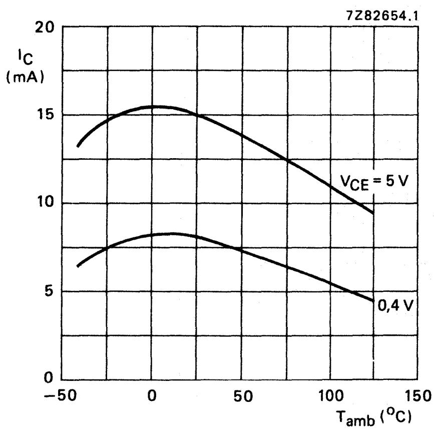


Fig. 20 I_F = 10 mA; typical values.

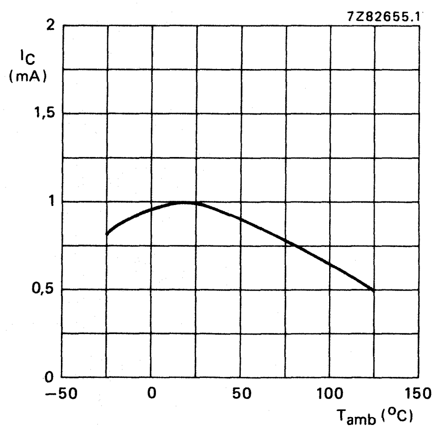


Fig. 21 I_F = 2 mA; V_{CE} = 0,4 V; typical values.

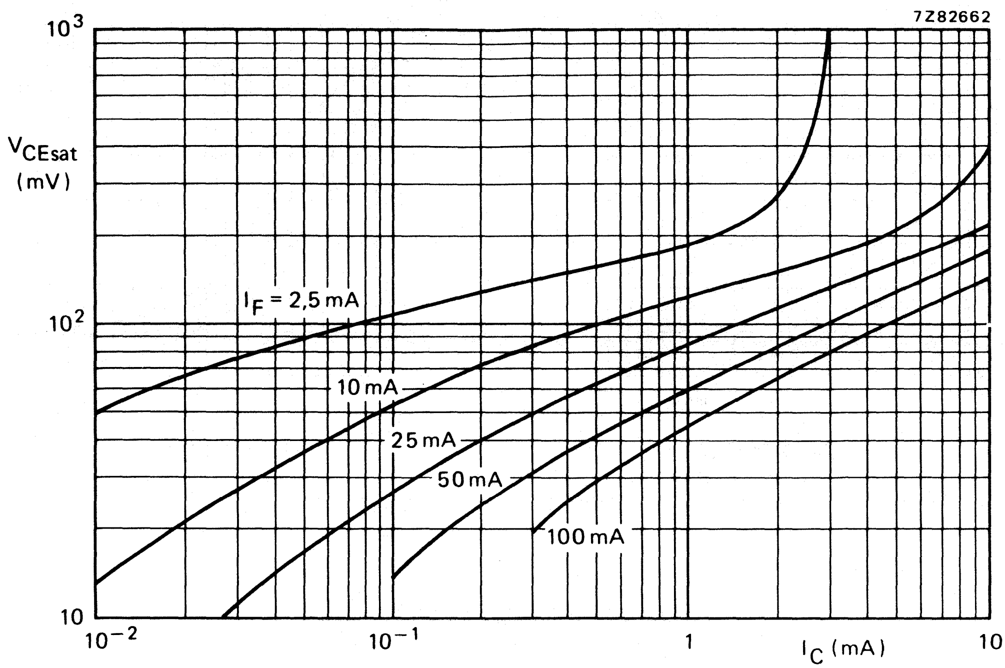


Fig. 22 $I_B = 0$; $T_{amb} = 25\ ^oC$; typical values.

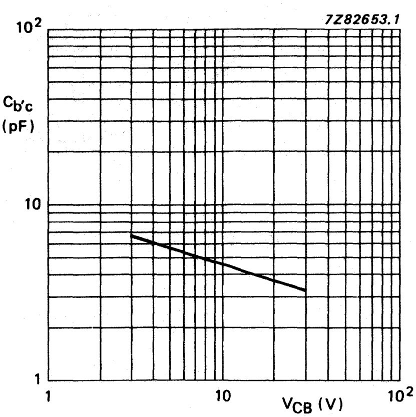


Fig. 23 f = 1 MHz; $T_{amb} = 25\ ^oC$.

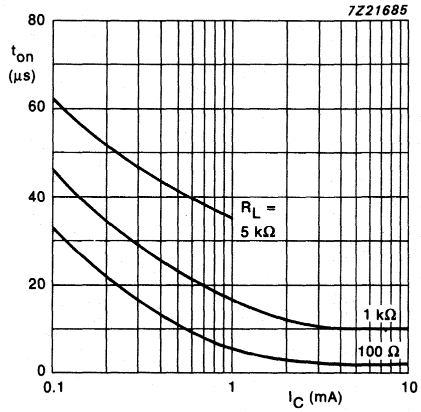


Fig. 24 CNX35U.

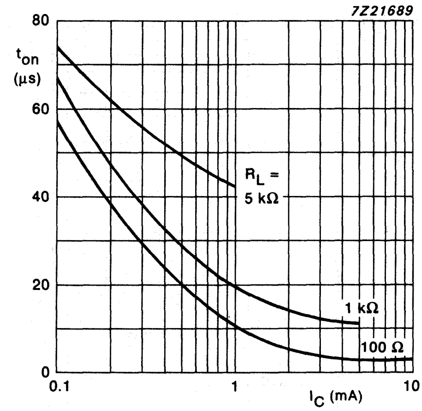


Fig. 25 CNX39U.

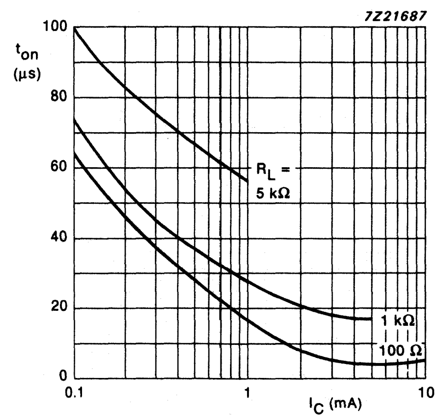


Fig. 26 CNX36U.

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

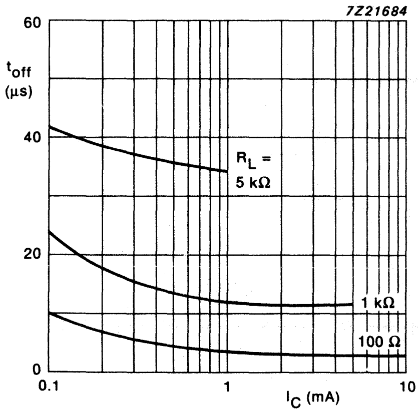


Fig. 27 CNX35U.

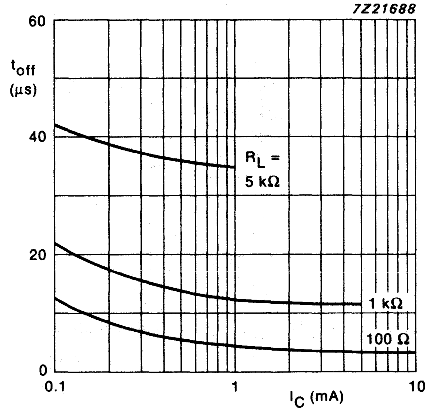


Fig. 28 CNX39U.

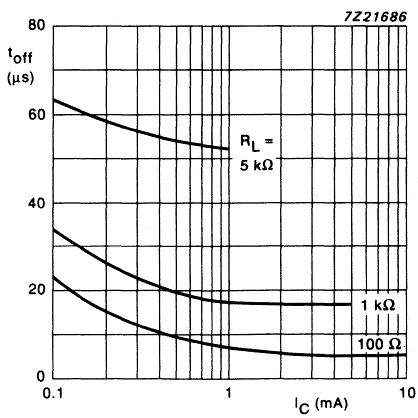


Fig. 29 CNX36U.

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

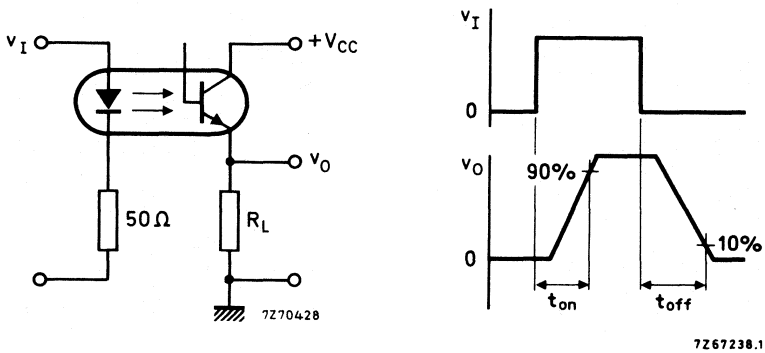


Fig. 30 Switching circuit and waveforms.

OPTOCOUPLER

Optically coupled isolator consisting of an infrared emitting GaAs diode and a 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)
- A VDE and UL version is available: see CNX38U

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
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_{IORM}	min.	4.4	kV
Isolation voltage AC (RMS value)	V_{IORM}	min.	3.12	kV

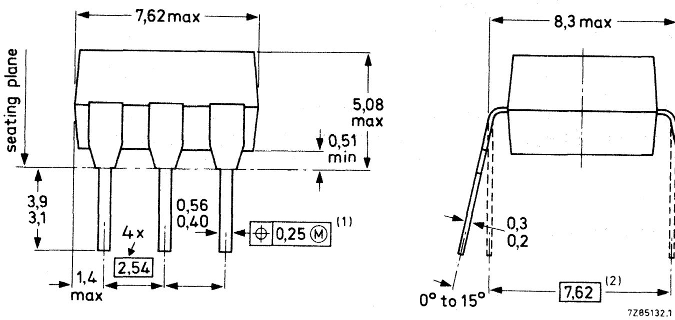
MECHANICAL DATA

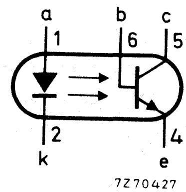
SOT90B (see Fig.1).

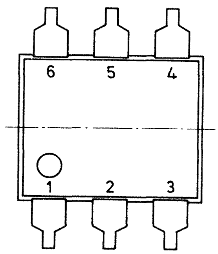
MECHANICAL DATA

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

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 ($I_B = 0$) (see 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.	0.2	V
		max.	0.4	V
Isolation voltage; t = 1 min (see note 2) DC	V_{IORM}	min.	4.4	kV
AC (RMS value)		min.	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 $V_{IO} = 1$ kV	R_{IO}	min.	10	GΩ
		typ.	1	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.	5	µs
		max.	20	µs
Turn-off time	t_{off}	typ.	5	µs
		max.	20	µs
$I_{Con} = 4$ mA; $V_{CC} = 5$ V; $R_L = 1$ kΩ				
Turn-on time	t_{on}	typ.	15	µs
		max.	50	µs
Turn-off time	t_{off}	typ.	15	µs
		max.	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)
DC current gain $I_C = 1$ mA; $V_{CE} = 5$ V	h_{FE}		150 to 1500	

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) and the shorted output (phototransistor) leads.
3. As quality assurance (on a sample basis), these parameters are covered by a 1000 h reliability test.

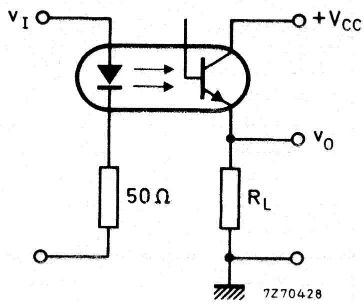


Fig. 2 Switching circuit.

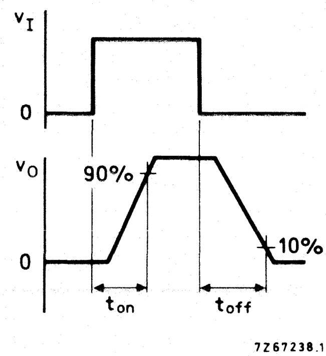


Fig. 3 Waveforms.

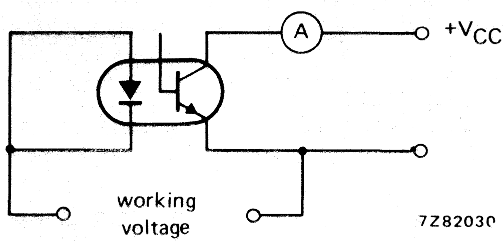


Fig. 4.

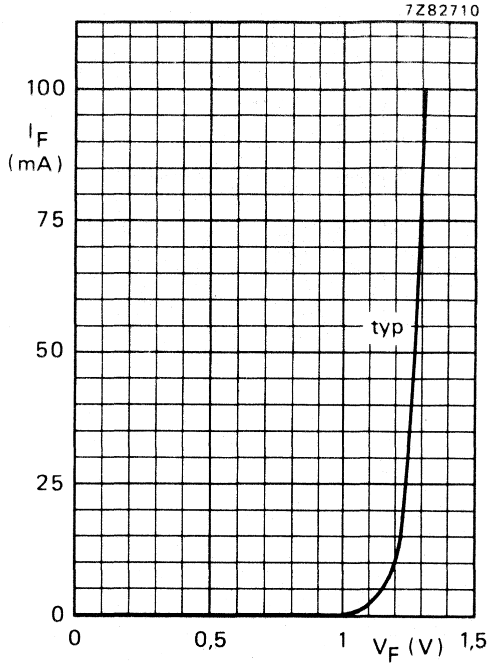


Fig. 5 $T_{amb} = 25\ ^{o}C$.

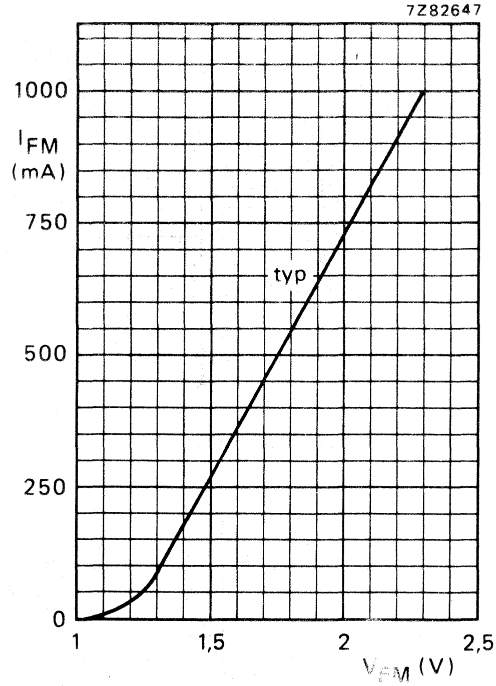


Fig. 6 $T_{amb} = 25\ ^{o}C$; $t_p = 10\ \mu s$; $T = 1$ ms.

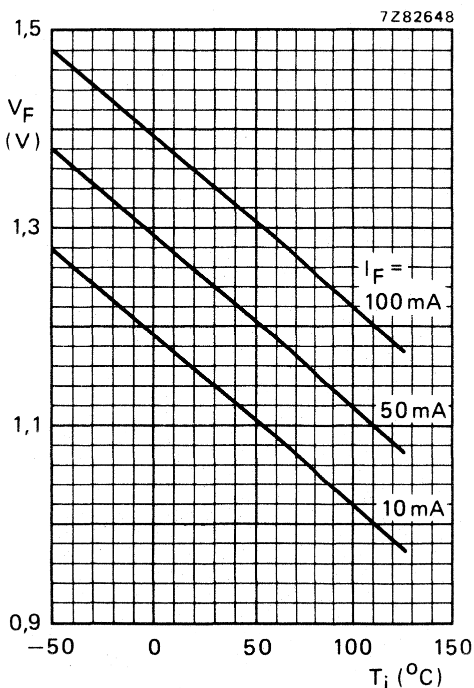


Fig. 7 Typical values.

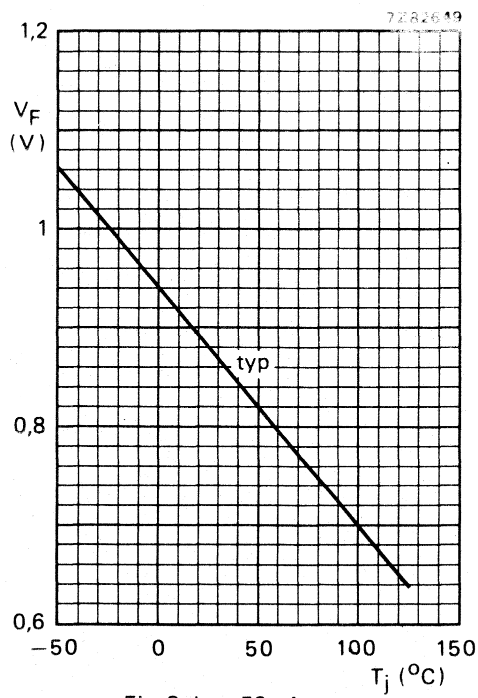


Fig. 8 $I_F = 50\ \mu A$.

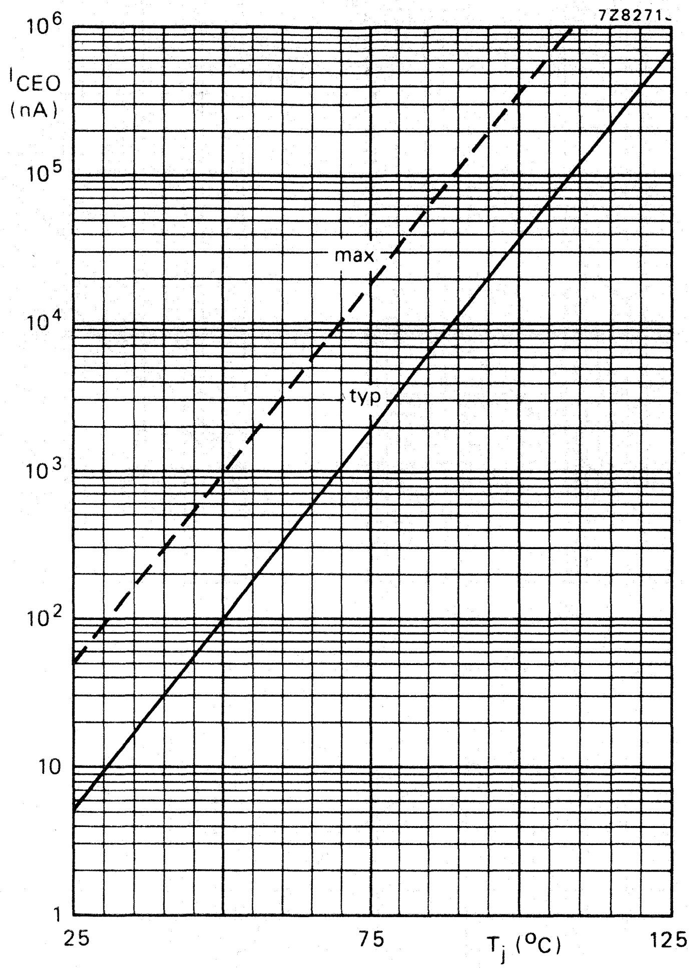


Fig. 9 $I_F = 0$; $V_{CE} = 10$ V.

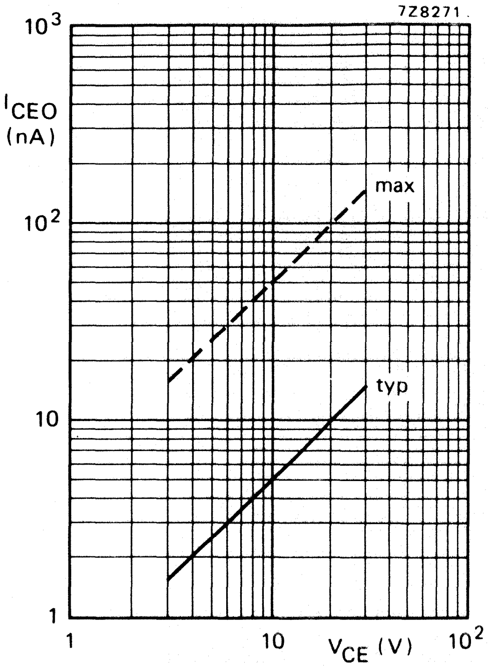


Fig. 10 $I_F = 0$; $T_j = 25\ ^oC$.

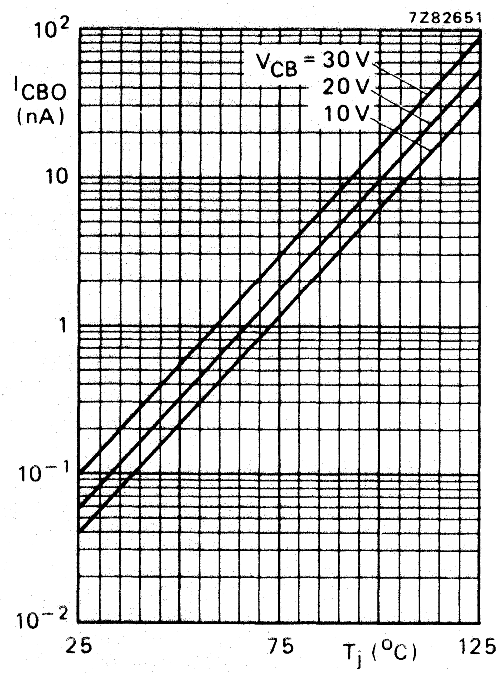


Fig. 11 Typical values.

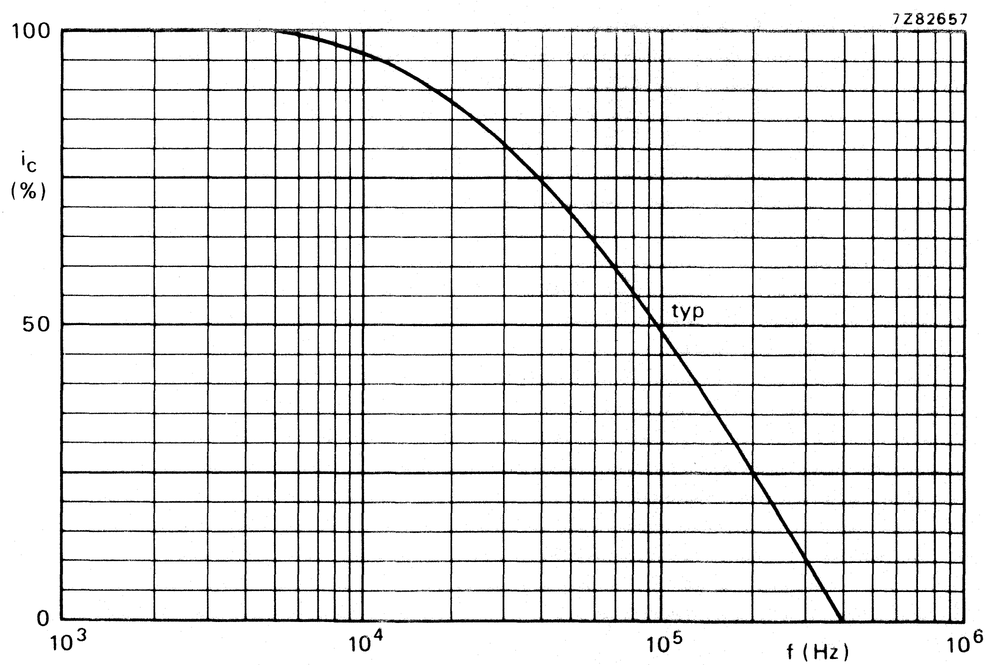


Fig. 12 $I_B = 0$; $I_C = 2$ mA; $V_{CC} = 5$ V, $R_L = 1\ k\Omega$; $T_{amb} = 25\ ^oC$.

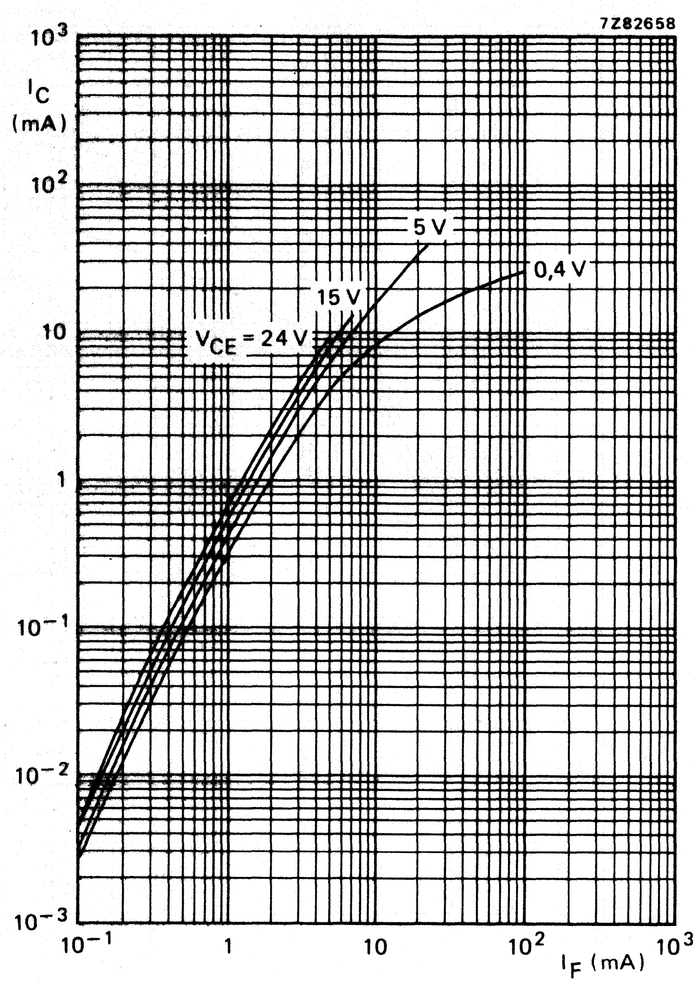


Fig. 13 T_{amb} = 25 °C, typical values.

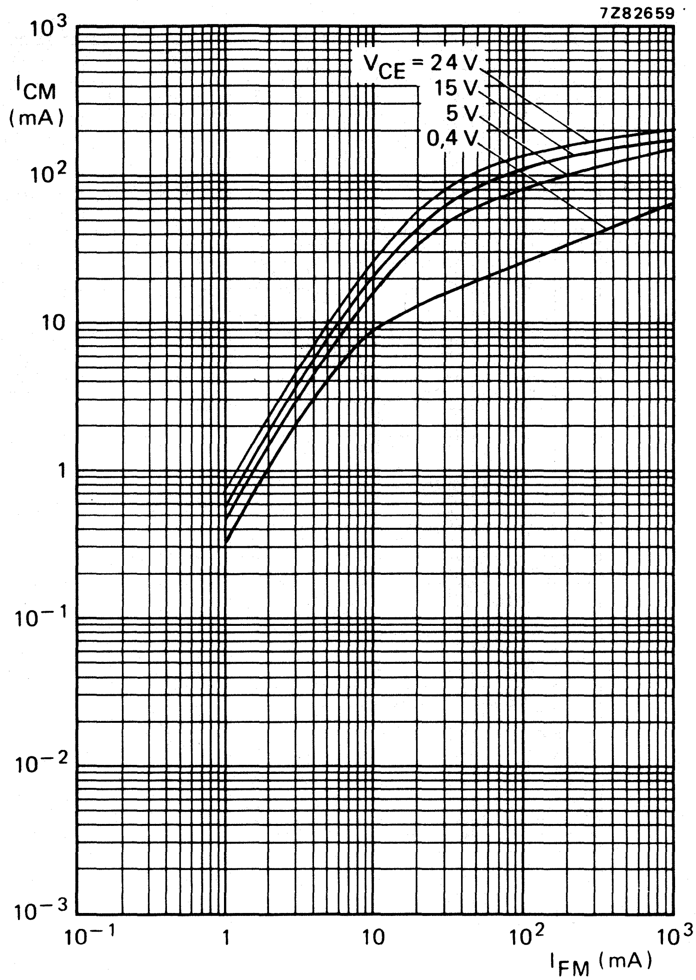


Fig. 14 T_{amb} = 25 °C; t_p = 20 μs; T = 2 ms; typical values.

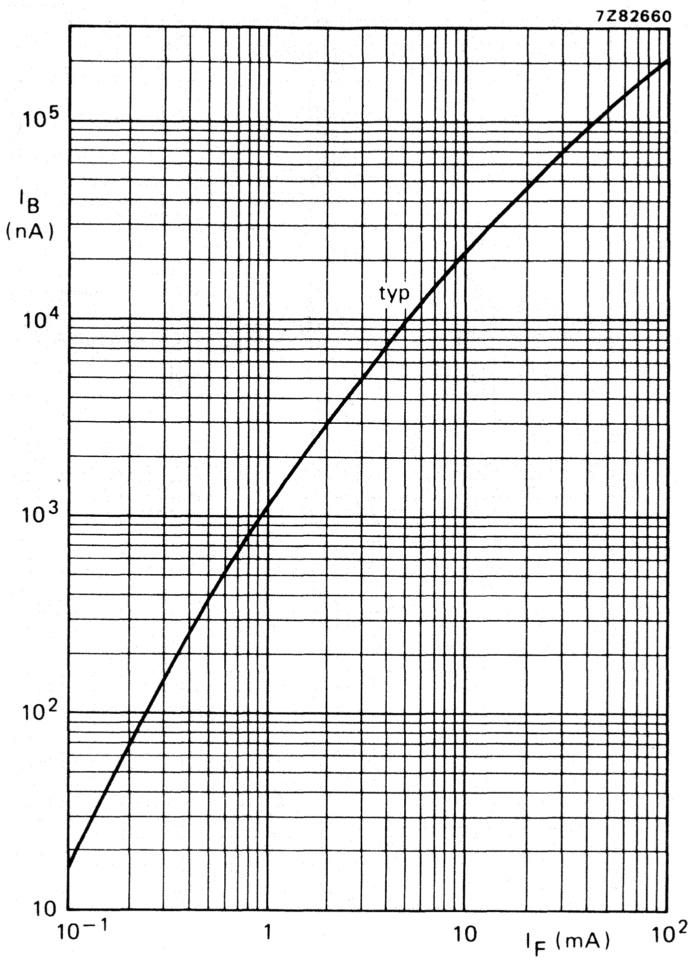


Fig. 15 V_{CB} = 5 V; T_{amb} = 25 °C.

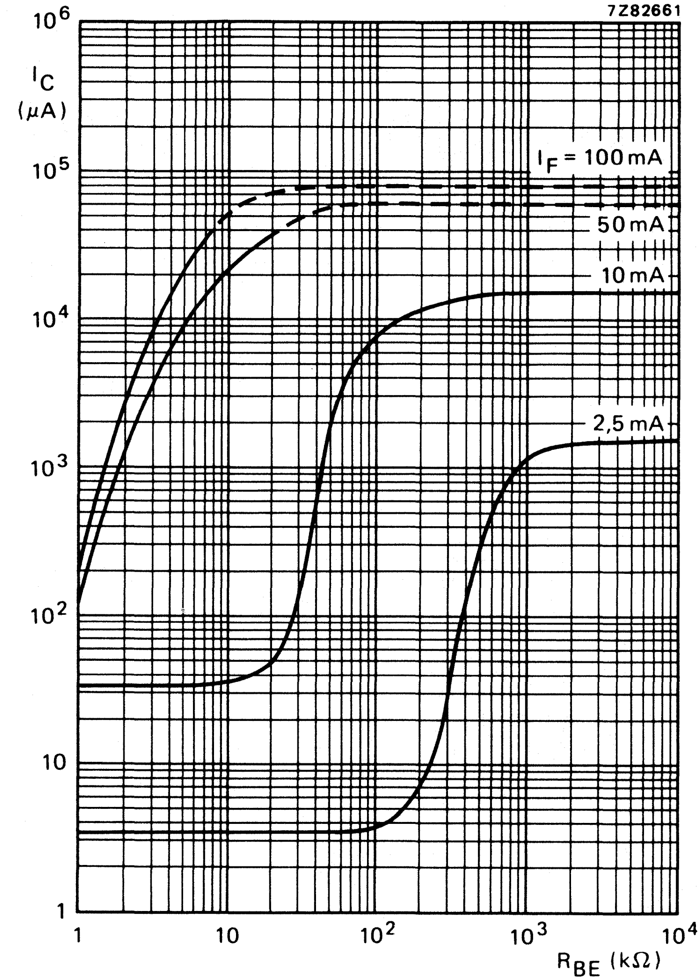


Fig. 16 $I_B = 0$; $V_{CE} = 5$ V; $T_{amb} = 25$ °C; typical values.

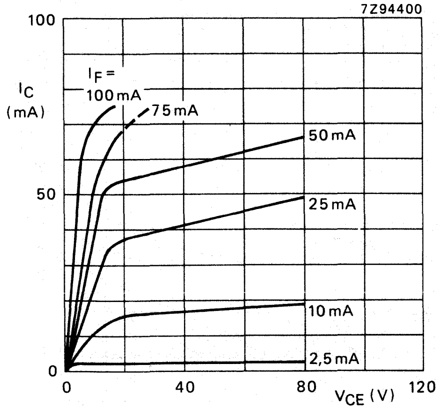


Fig. 17 T_{amb} = 25 °C; typical values.

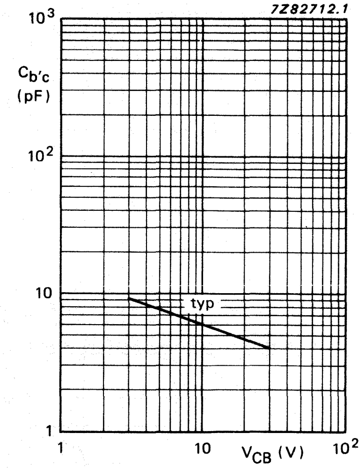


Fig. 18 f = 1 MHz; T_{amb} = 25 °C.

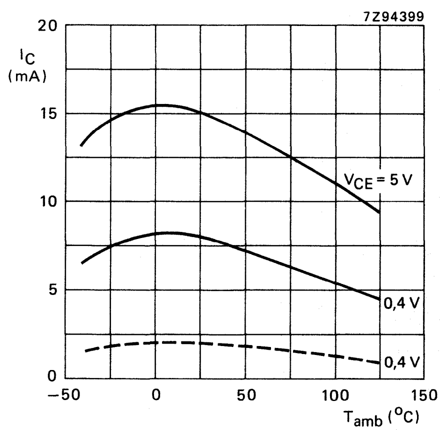


Fig. 19 I_F = 10 mA; typical values.
– – – min. values.

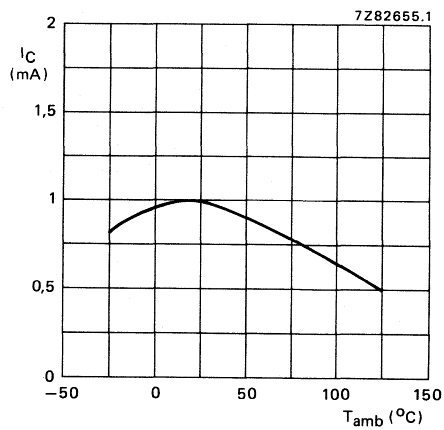


Fig. 20 I_F = 2 mA; typical values.
V_{CE} = 0.4 V.

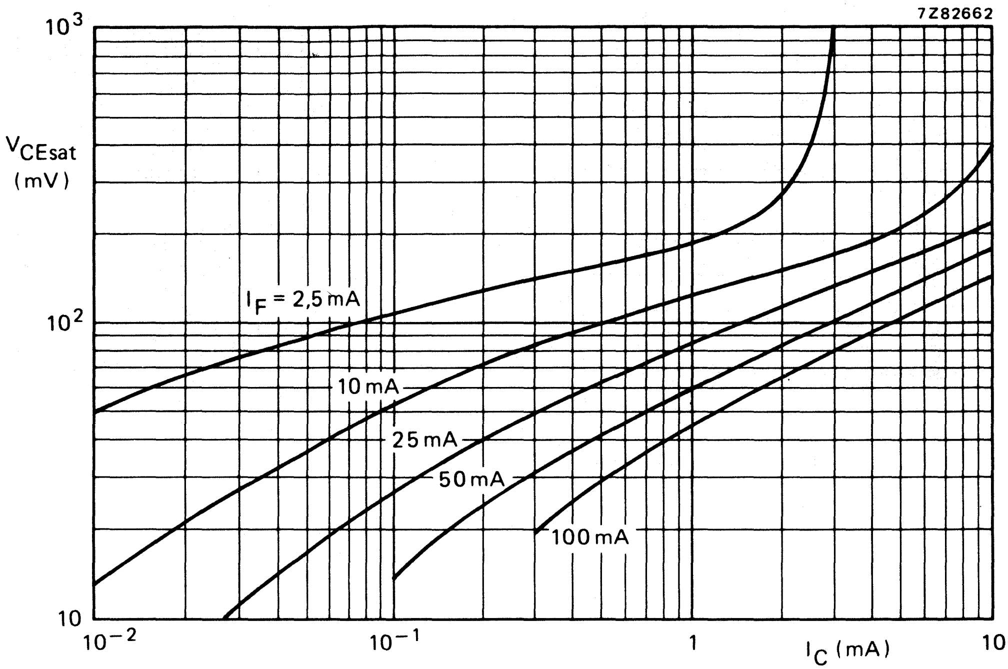


Fig. 21 $I_B = 0$; $T_{amb} = 25\ ^oC$; typical values.

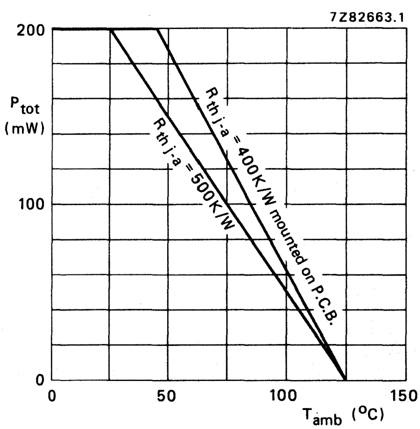


Fig. 22 Max. permissible power dissipation for total device versus ambient temperature.

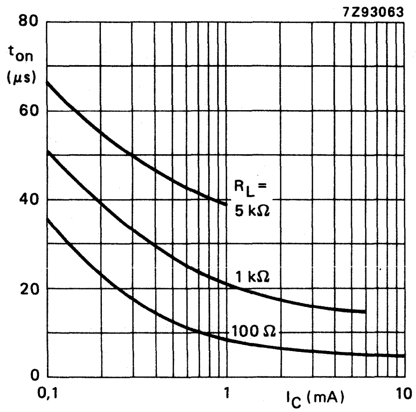


Fig. 23 $I_B = 0$; $V_{CC} = 5$ V; $T_{amb} = 25$ °C; typical values. (See also Fig. 25.)

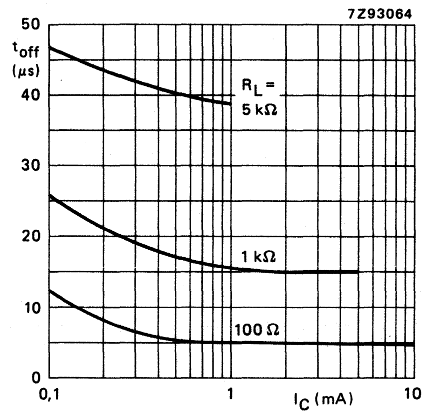


Fig. 24 $I_B = 0$; $V_{CC} = 5$ V; $T_{amb} = 25$ °C, typical values. (See also Fig. 25.)

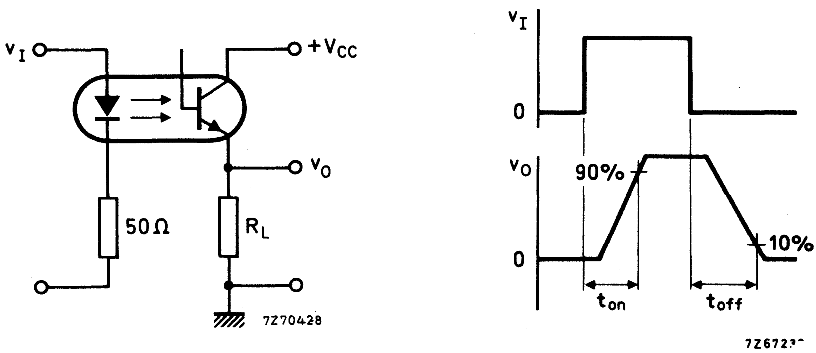


Fig. 25 Switching circuit and waveforms.

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)

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 ^oC	P_{tot}	max.	200	mW
Transistor				
Collector-emitter voltage (open base)	V_{CEO}	max.	80	V
Total power dissipation up to T_{amb} = 25 ^oC	P_{tot}	max.	200	mW
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_{IORM}	min.	4.4	kV
Isolation voltage AC (RMS value)	V_{IORM}	min.	3.12	kV

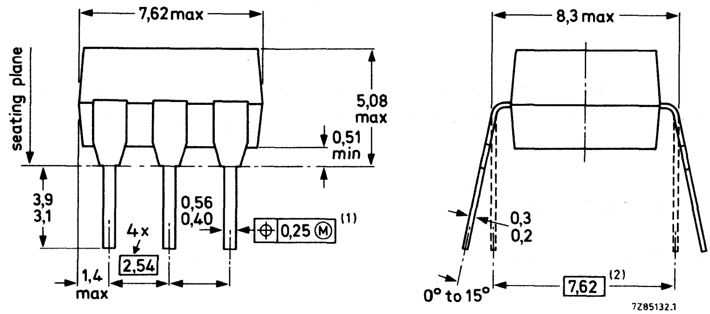
MECHANICAL DATA

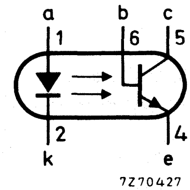
SOT90B (see Fig.1).

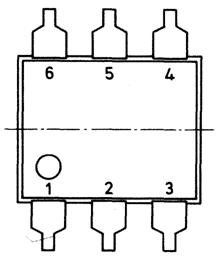
MECHANICAL DATA

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

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)

Parameter	Symbol		Value
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.	0.2 V
		max.	0.4 V
→ Isolation voltage; t = 1 min (see note 2) DC	V_{IORM}	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			
$\pm V_{IO}$ = 1 kV	R_{IO}	min.	100 GΩ
		typ.	1 TΩ
Switching times (see Figs 2 and 3)			
I_{Con} = 4 mA; V_{CC} = 5 V; R_L = 100 Ω			
Turn-on time	t_{on}	typ.	5 μs
		max.	20 μs
Turn-off time	t_{off}	typ.	5 μs
		max.	20 μs
→ I_{Con} = 4 mA; V_{CC} = 5 V; R_L = 1 kΩ			
Turn-on time	t_{on}	typ.	15 μs
		max.	50 μs
Turn-off time	t_{off}	typ.	15 μs
		max.	50 μs
Collector cut-off current			
V_F = 0.8 V; $-V_{CE}$ = 15 V; T_{amb} = 0 °C to + 70 °C	I_{CE1}	max.	15 μA
Collector cut-off current			
at I_F = 2 mA; $-V_{CE}$ = 0.4 V; T_{amb} = 0 °C to + 70 °C	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 °C	I_{CEW}	max.	100 μA (note 3)
DC current gain			
I_C = 1 mA; V_{CE} = 5 V	h_{FE}		150 to 1500

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

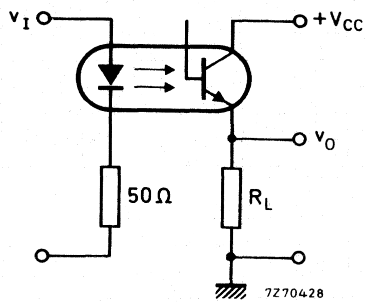


Fig. 2 Switching circuit.

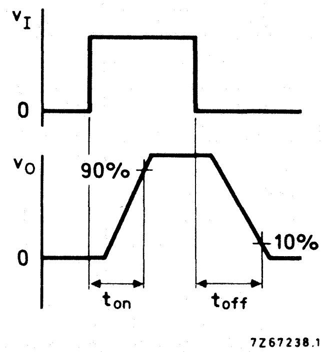


Fig. 3 Waveforms.

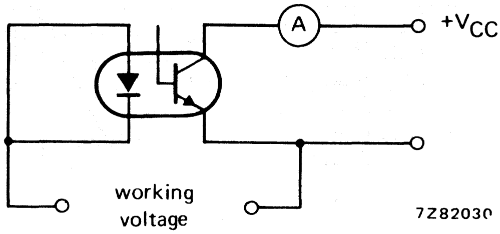


Fig. 4.

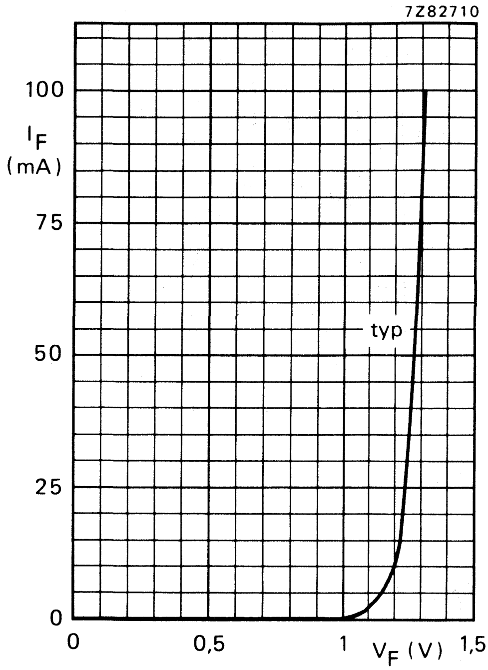


Fig. 5 T_{amb} = 25 °C.

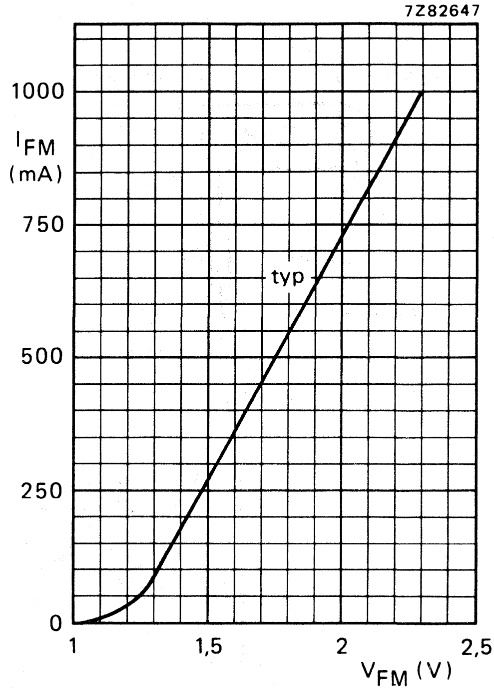


Fig. 6 T_{amb} = 25 °C; t_p = 10 μs; T = 1 ms.

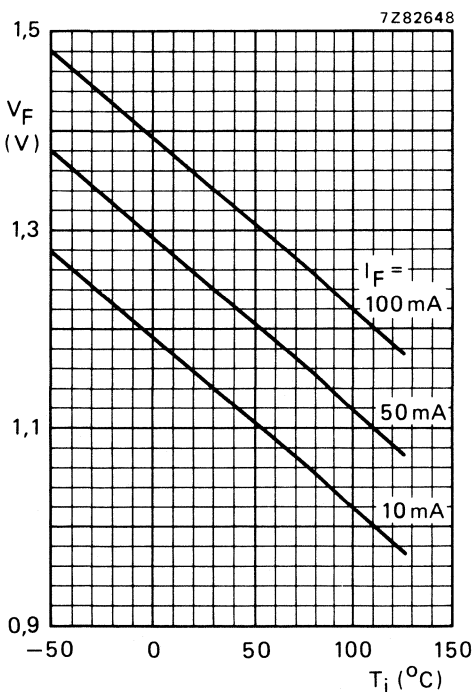


Fig. 7 Typical values.

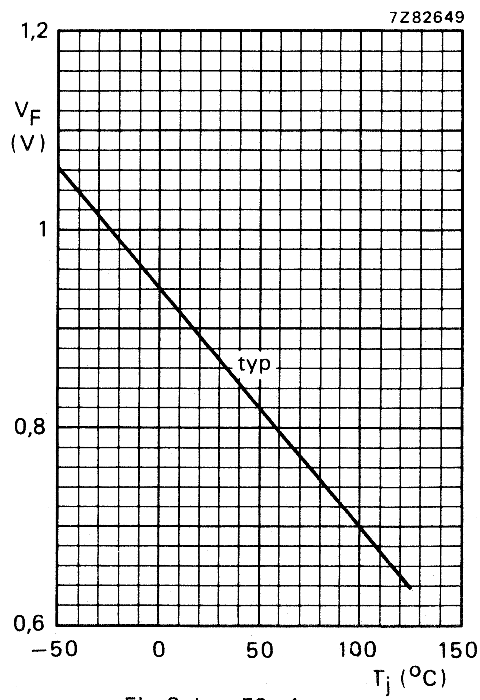


Fig. 8 I_F = 50 μA.

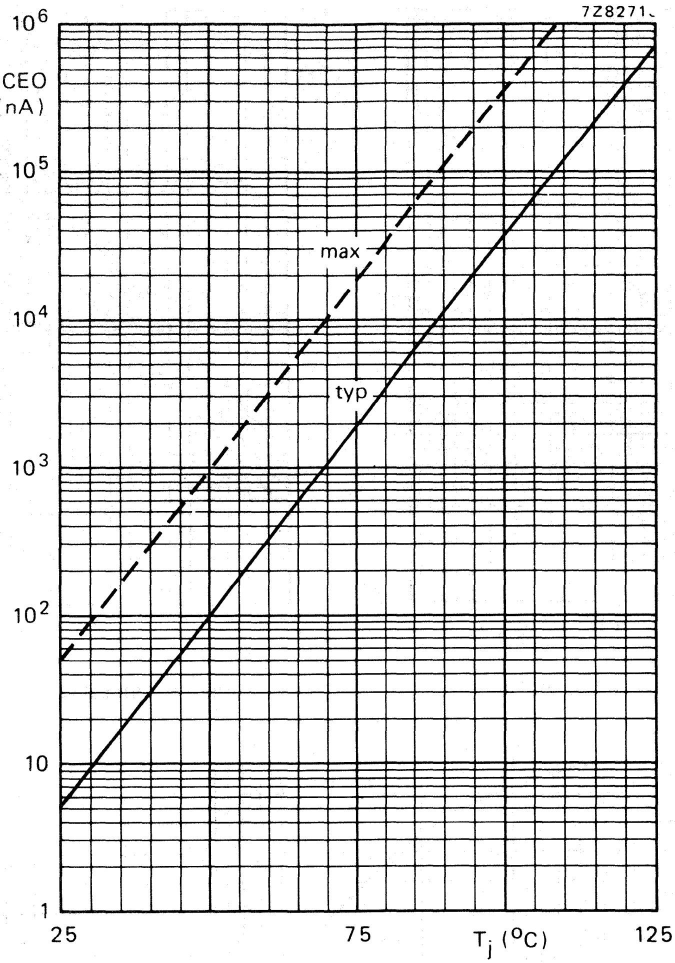


Fig. 9 $I_F = 0$; $V_{CE} = 10$ V.

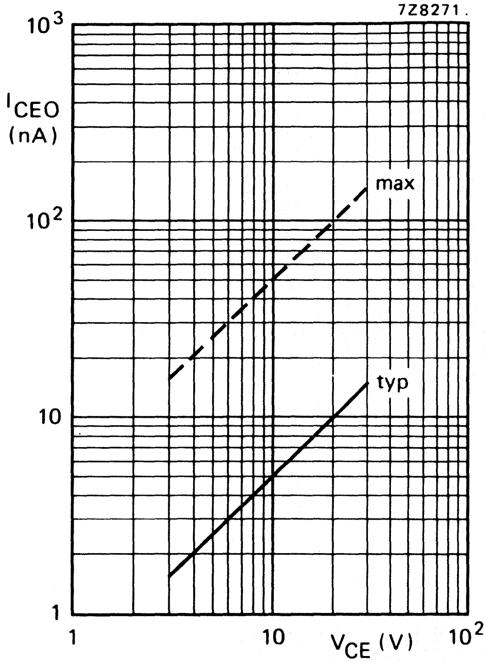


Fig. 10 $I_F = 0$; $T_j = 25$ °C.

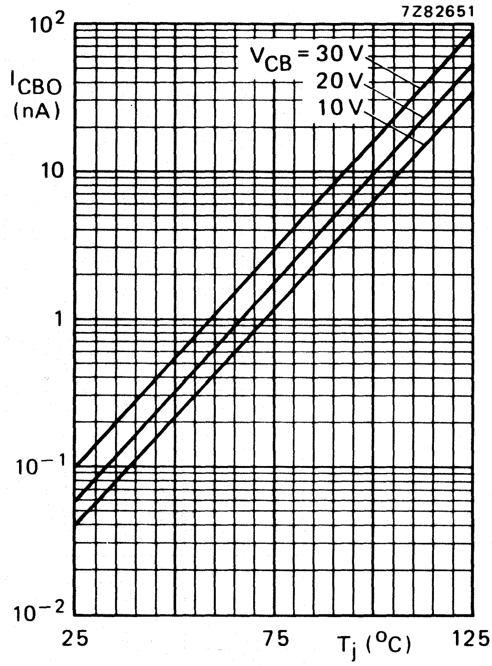


Fig. 11 Typical values.

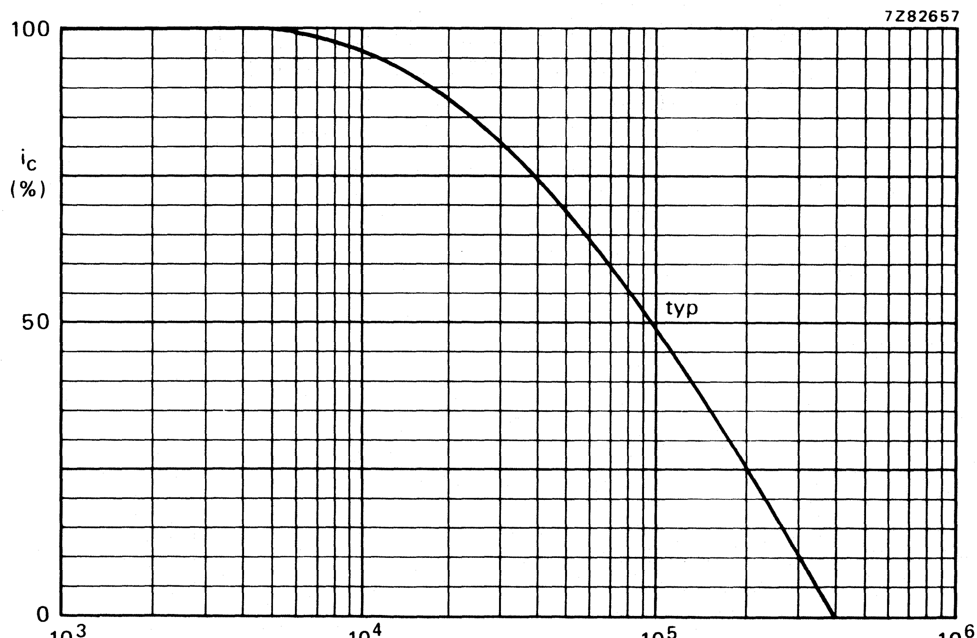


Fig. 12 $I_B = 0$; $I_C = 2$ mA; $V_{CC} = 5$ V, $R_L = 1$ kΩ; $T_{amb} = 25$ °C.

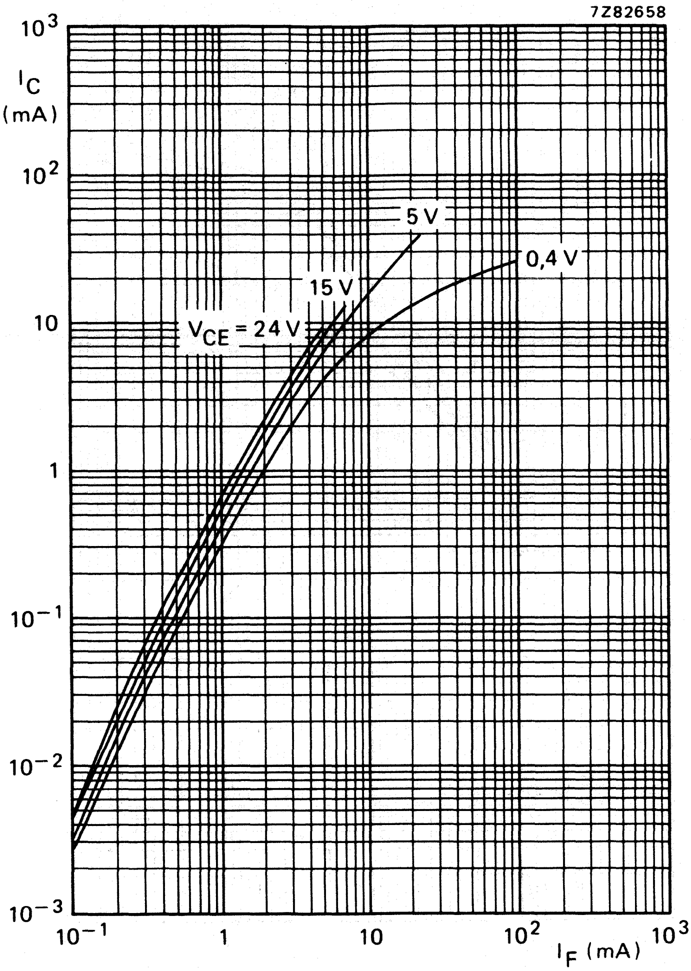


Fig. 13 T_{amb} = 25 °C, typical values.

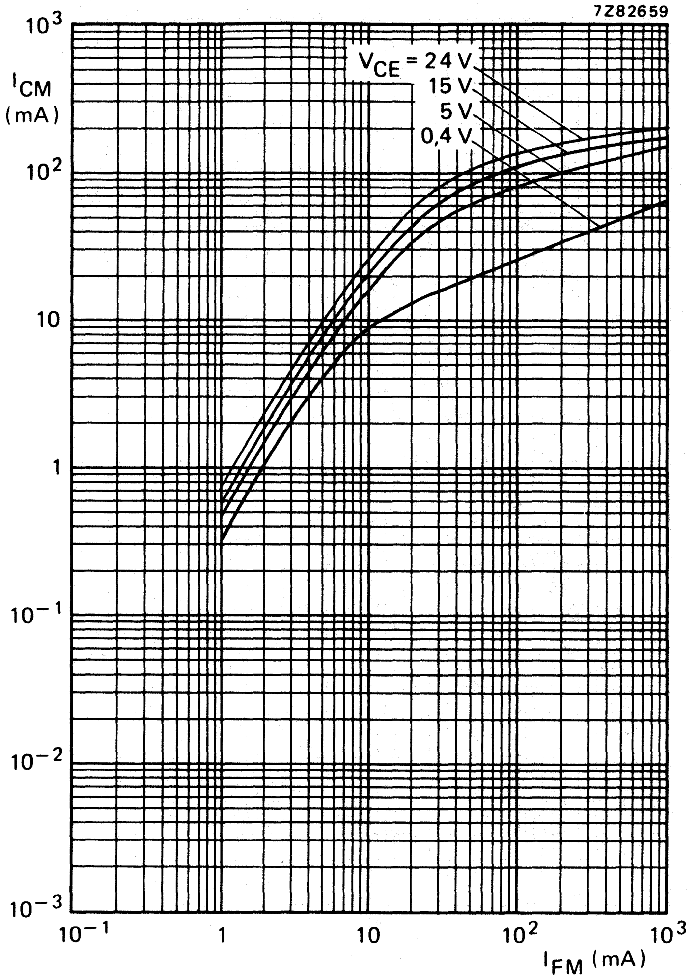


Fig. 14 T_{amb} = 25 °C; t_p = 20 μs; T = 2 ms; typical values.

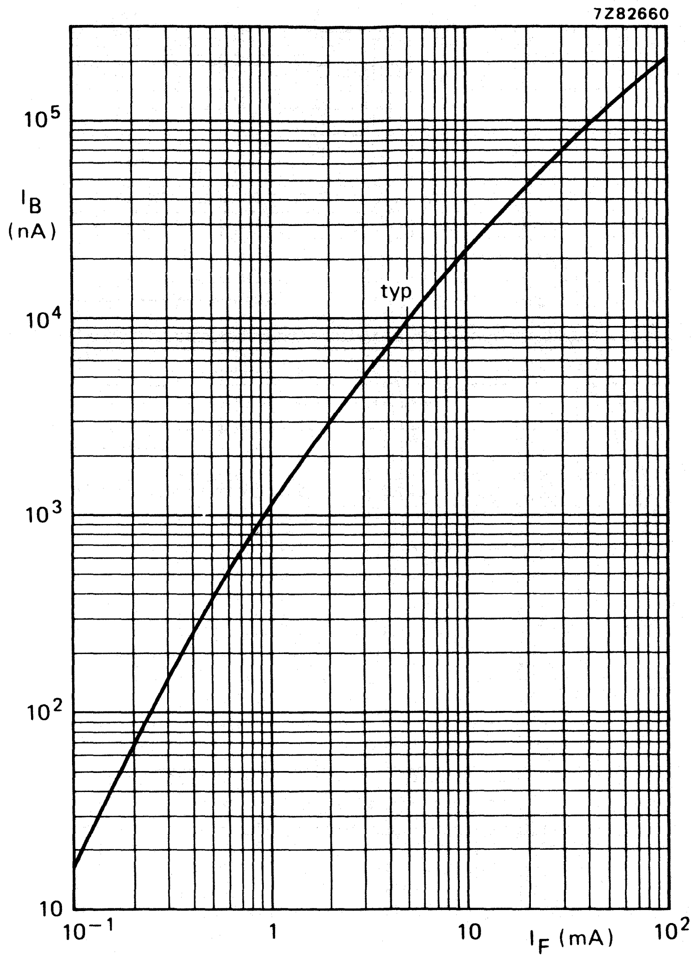


Fig. 15 V_{CB} = 5 V; T_{amb} = 25 °C.

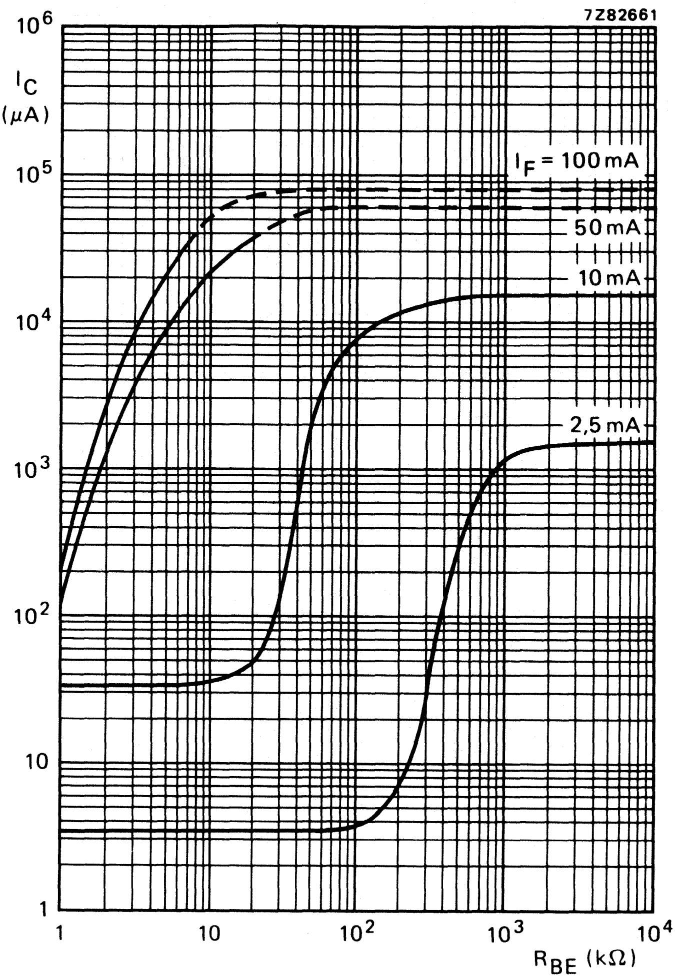


Fig. 16 $I_B = 0$; $V_{CE} = 5$ V; $T_{amb} = 25$ °C; typical values.

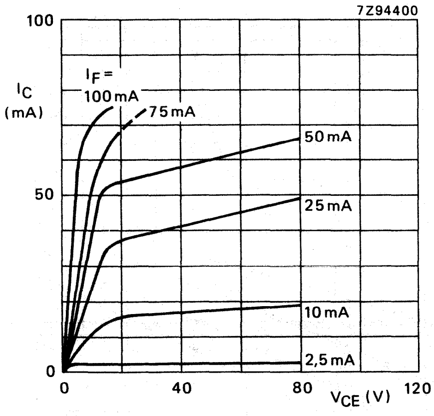


Fig. 17 T_{amb} = 25 °C; typical values.

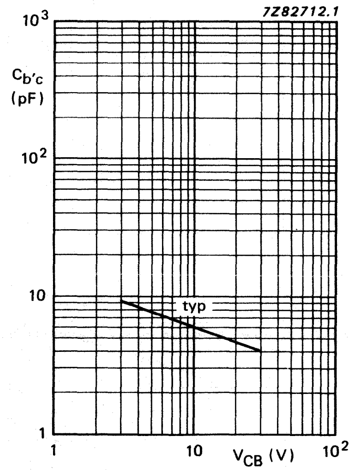


Fig. 18 f = 1 MHz; T_{amb} = 25 °C.

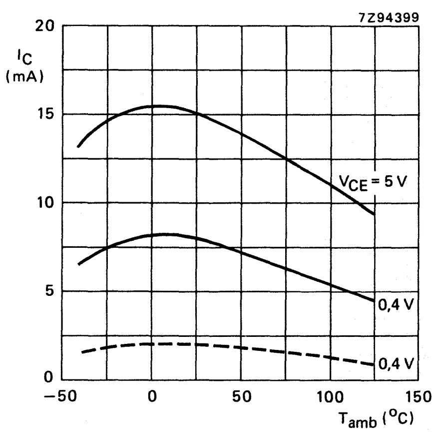


Fig. 19 I_F = 10 mA; typical values.
— — — min. values.

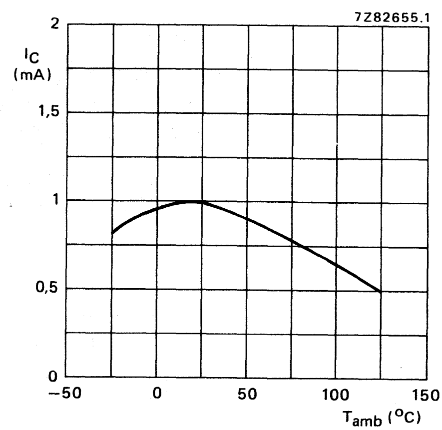


Fig. 20 I_F = 2 mA; typical values.
V_{CE} = 0.4 V.

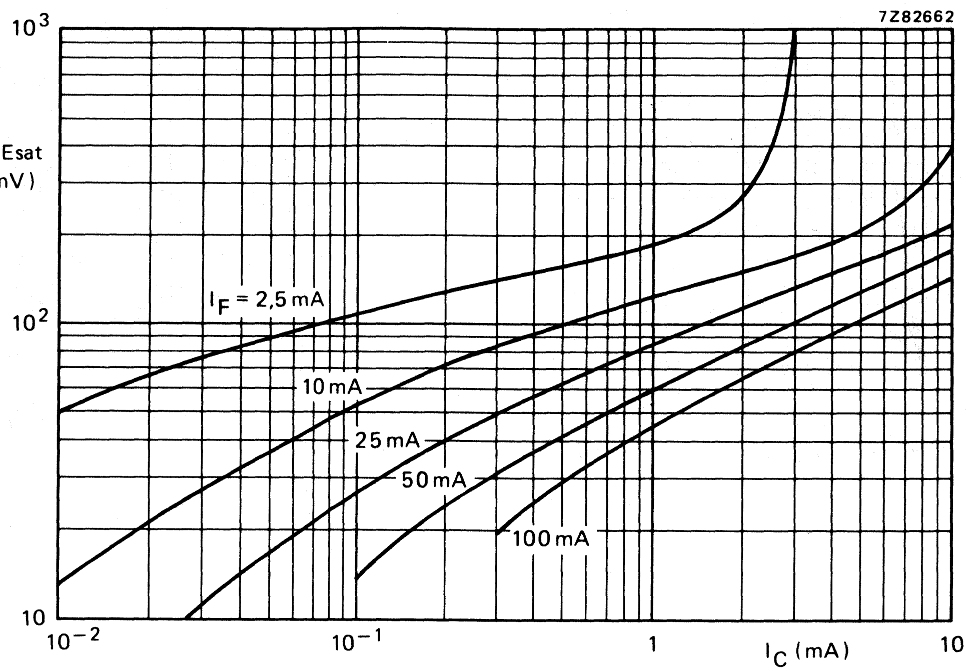


Fig. 21 $I_B = 0$; $T_{amb} = 25\ ^oC$; typical values.

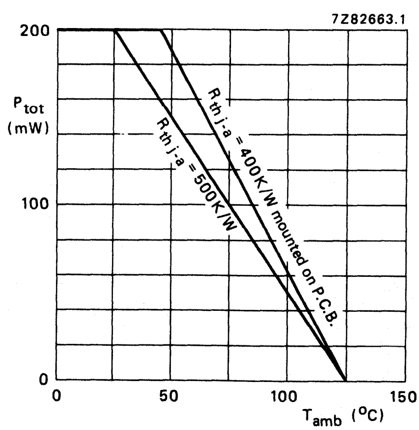


Fig. 22 Max. permissible power dissipation for total device versus ambient temperature.

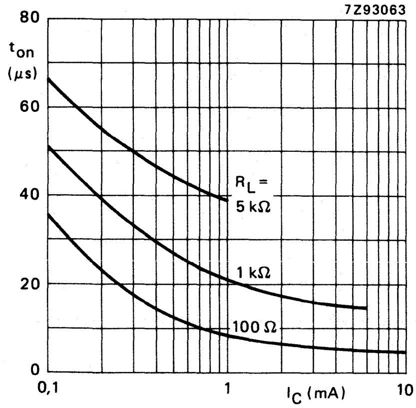


Fig. 23 $I_B = 0$; $V_{CC} = 5$ V; $T_{amb} = 25$ °C; typical values. (See also Fig. 25.)

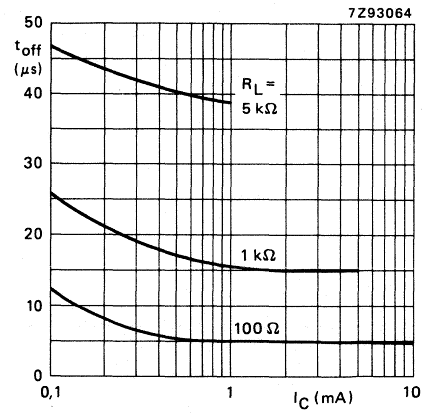


Fig. 24 $I_B = 0$; $V_{CC} = 5$ V; $T_{amb} = 25$ °C, typical values. (See also Fig. 25.)

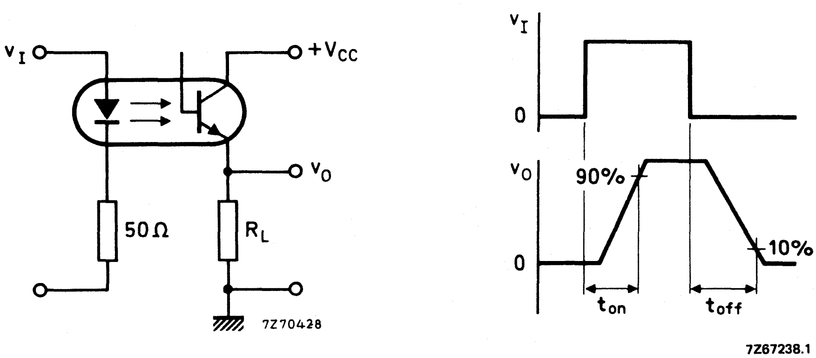


Fig. 25 Switching circuit and waveforms.

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

A VDE and UL version is available; see CNX48U.

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 = 2.5 kV DC diode: I_F = 0 (see also Fig. 2)	I_{CEW}	max.	1 μA
Isolation voltage DC	V_{IORM}	min.	4.4 kV
AC (RMS value)			3.12 kV

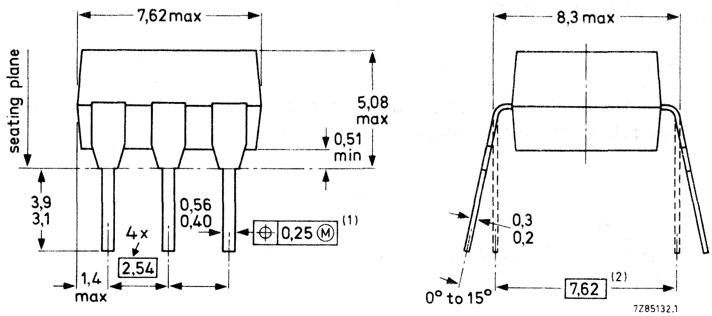
MECHANICAL DATA

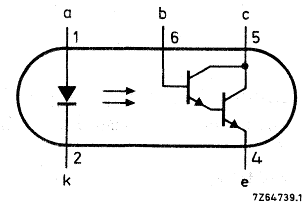
SOT90B (see Fig. 1).

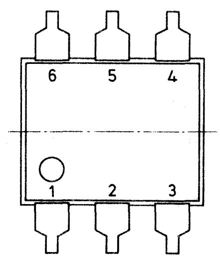
MECHANICAL DATA

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
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.	1.15 V
		max.	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. max.	20 nA 100 nA
$V_{CB} = 10$ V	I_{CEO}	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 = 2.5 kV DC	I_{CEW}	max.	1 μA
$V_{CC} = 10$ V; working voltage = 2.5 kV DC; $T_j = 70$ °C	I_{CEW}	max.	1000 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 AC (RMS value)	V_{IORM}	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.	0,6 pF
Insulation resistance between input and output $\pm V_{IO} = 1$ kV	R_{IO}	min. typ.	10 GΩ 1 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} t_{off}	typ. typ.	5 μs 30 μs
$I_{Fon} = 1$ mA; $V_{CC} = 5$ V; $R_E = 1$ kΩ; $R_{BE} = 10$ MΩ	t_{on} t_{off}	typ. typ.	50 μs 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.

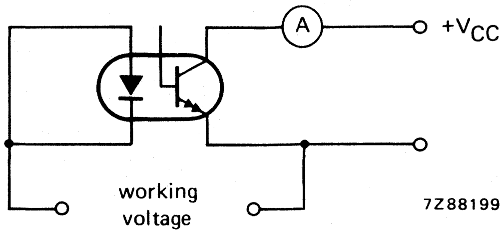


Fig. 2.

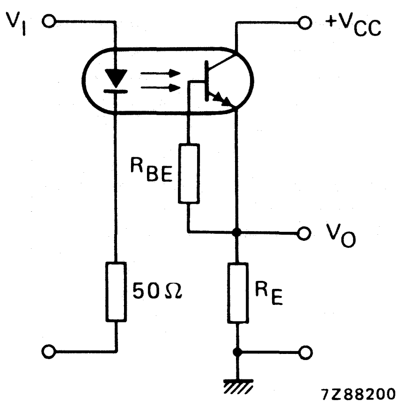


Fig. 3 Switching circuit.

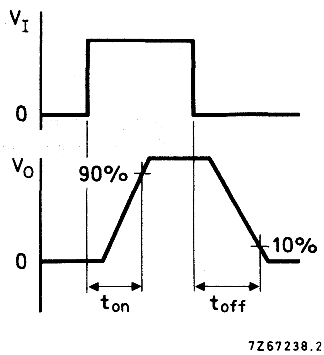


Fig. 4 Waveforms.

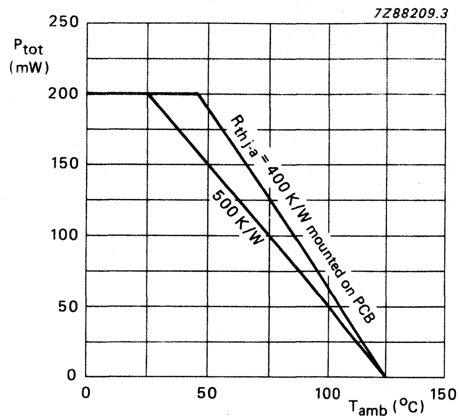


Fig. 5 Power derating curve for diode and transistor as a function of temperature.

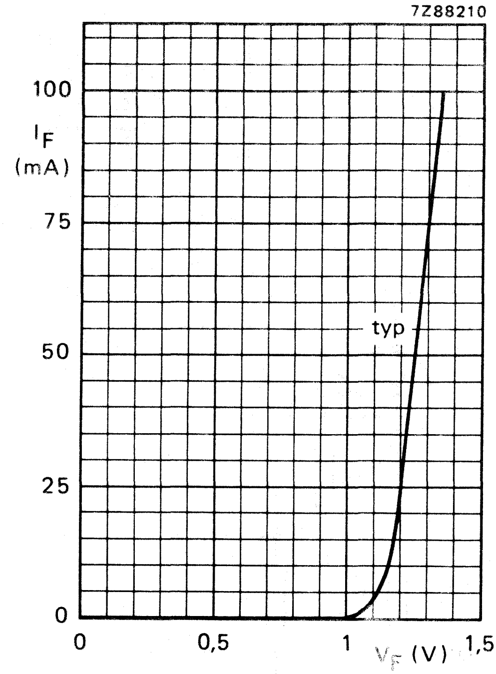


Fig. 6 T_{amb} = 25 °C.

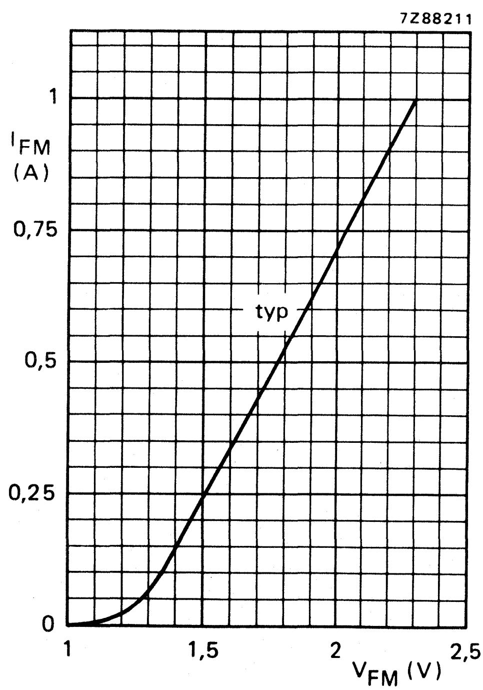


Fig. 7 T_{amb} = 25 °C; t_p = 10 μs; δ = 0.01.

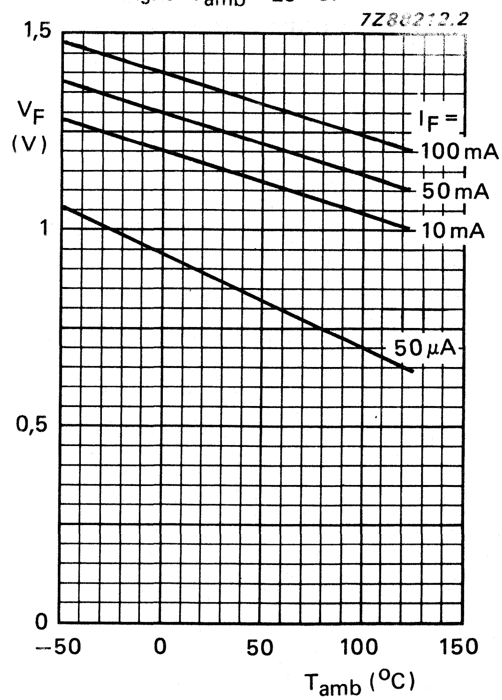


Fig. 8 Typical values.

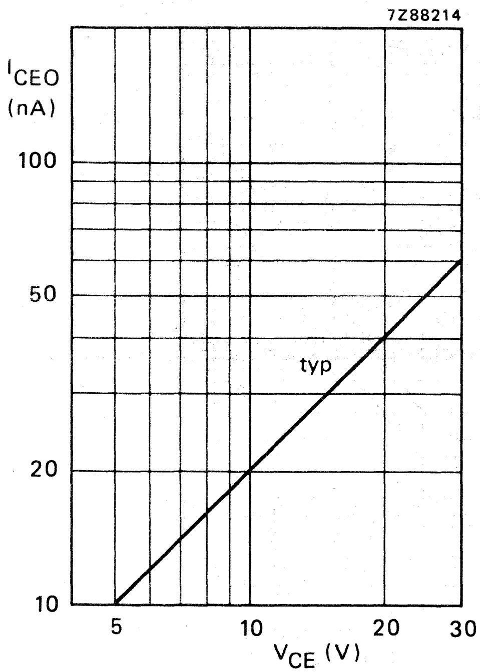


Fig. 9 $I_F = 0$; $T_j = 25\ ^oC$.

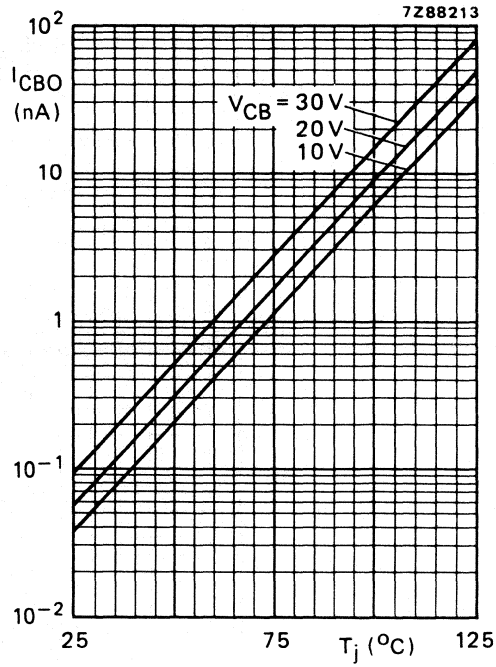


Fig. 10 Typical values.

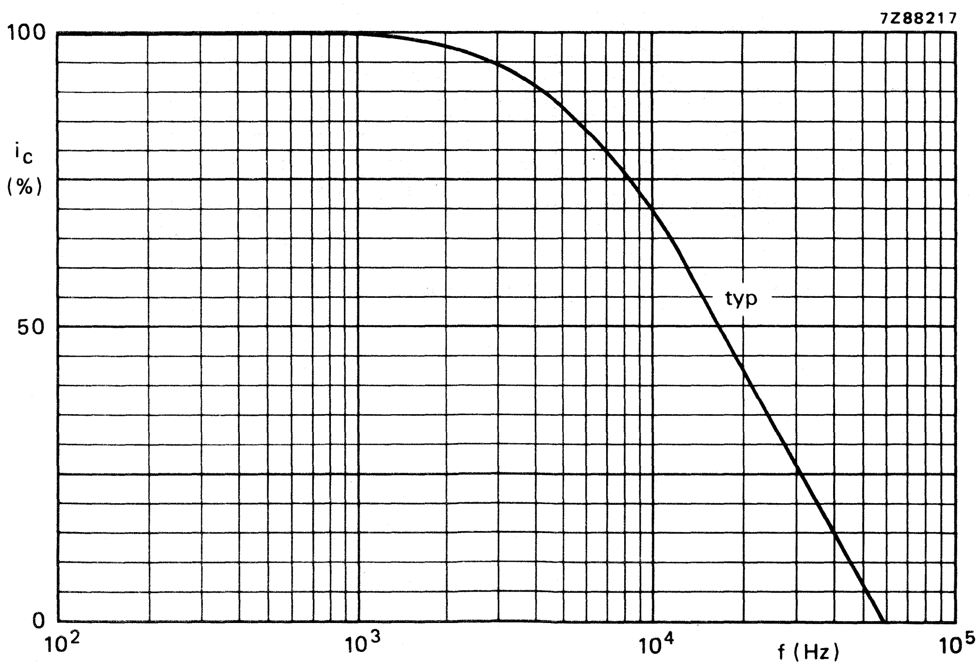


Fig. 11 $I_C = 10$ mA; $V_{CC} = 5$ V; $R_E = 100\ \Omega$; $R_{BE} = 1\ M\Omega$; see also Fig. 4.

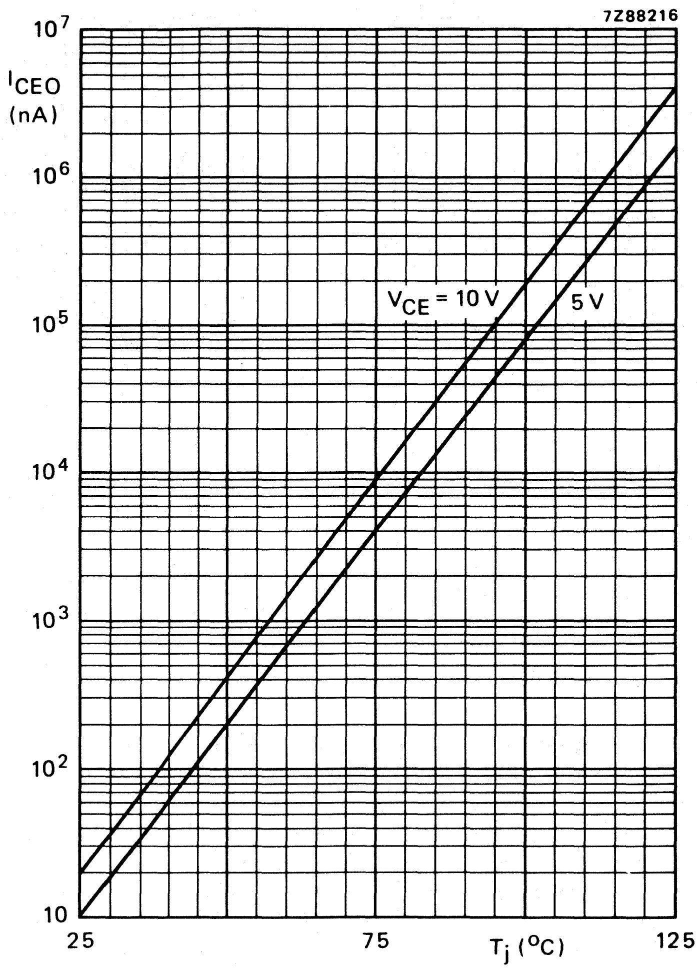


Fig. 12 $I_F = 0$; typical values.

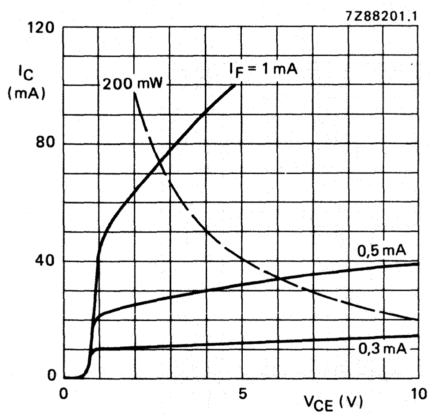


Fig. 13 Typical values; T_{amb} = 25 °C.

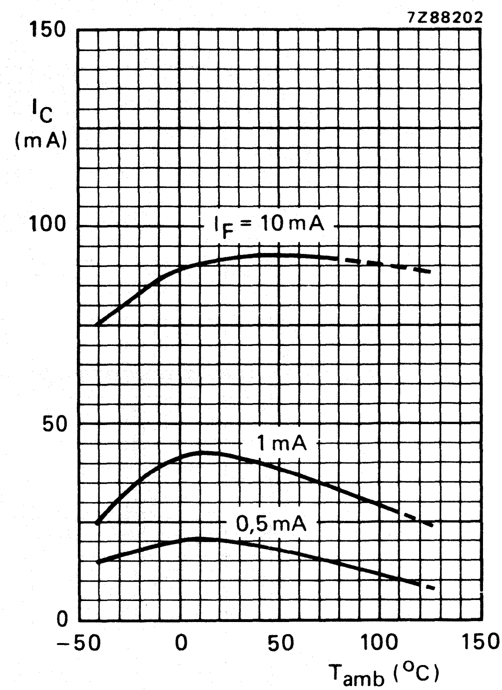


Fig. 14 Typical values; I_B = 0; V_{CE} = 1 V.

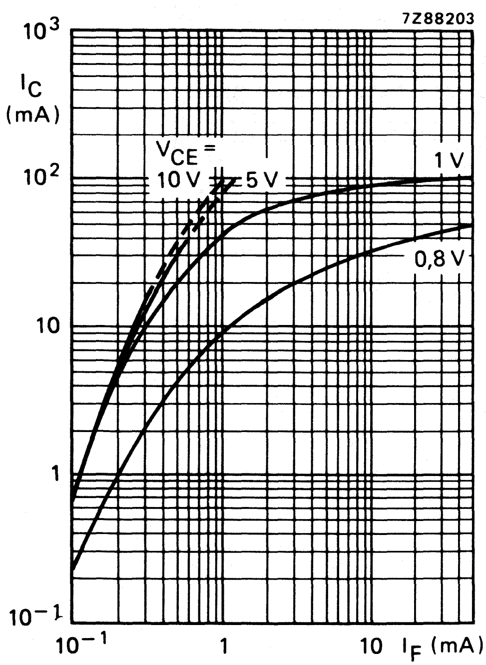


Fig. 15 Typical values; I_B = 0; T_{amb} = 25 °C.

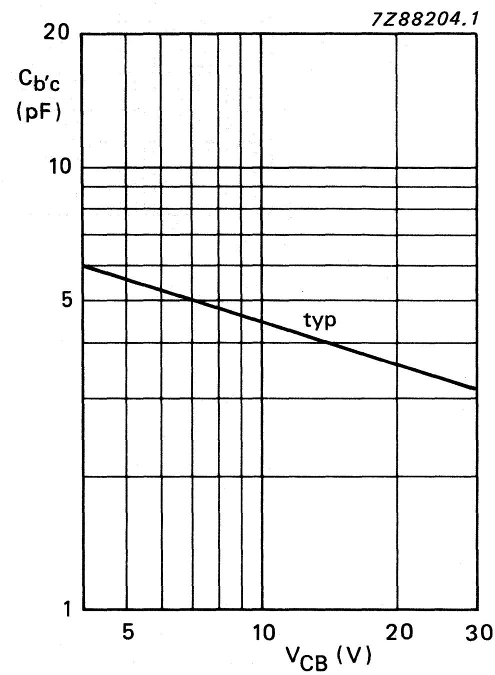


Fig. 16 I_E = I_e = 0; f = 1 MHz; T_{amb} = 25 °C.

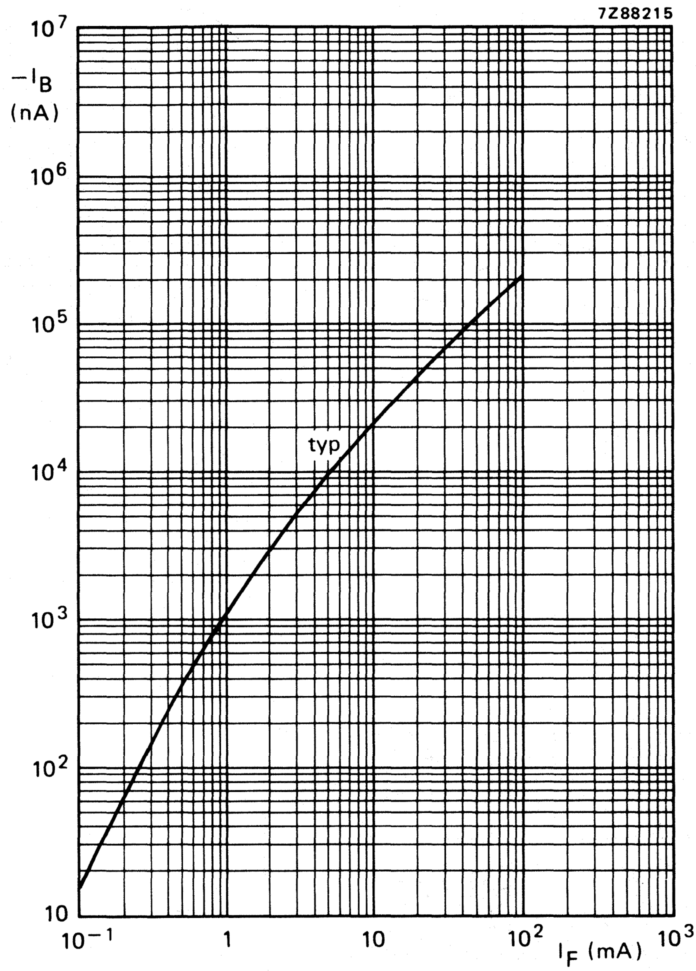


Fig. 17 $I_E = 0$; $V_{CB} = 5$ V; $T_{amb} = 25$ °C.

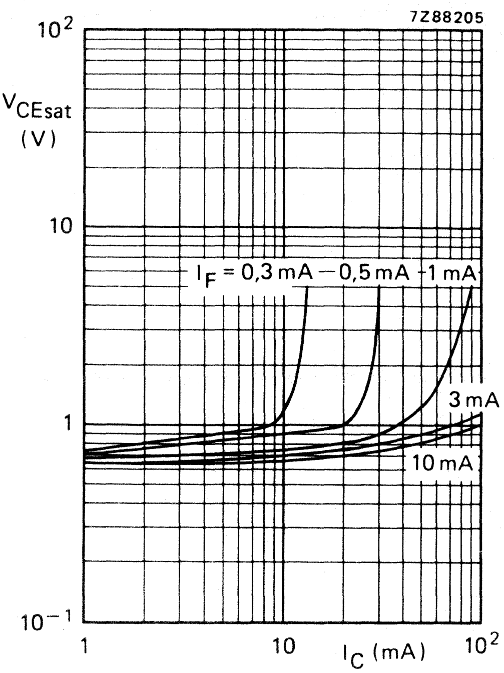


Fig. 18 Typical values; $I_B = 0$; $T_{amb} = 25$ °C.

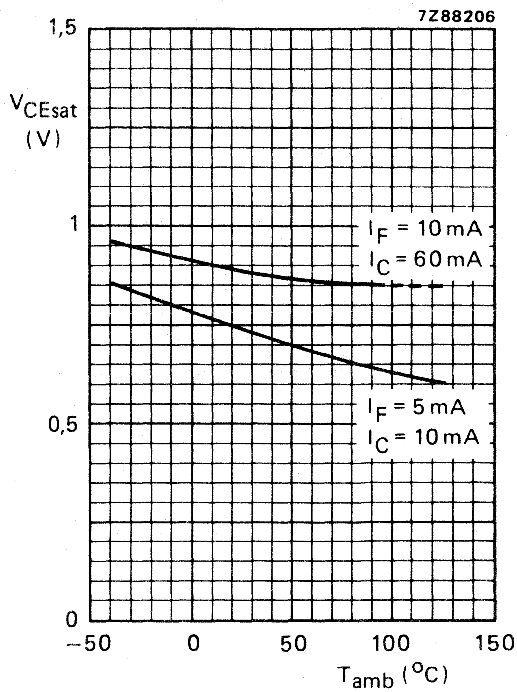


Fig. 19 Typical values; $I_B = 0$.

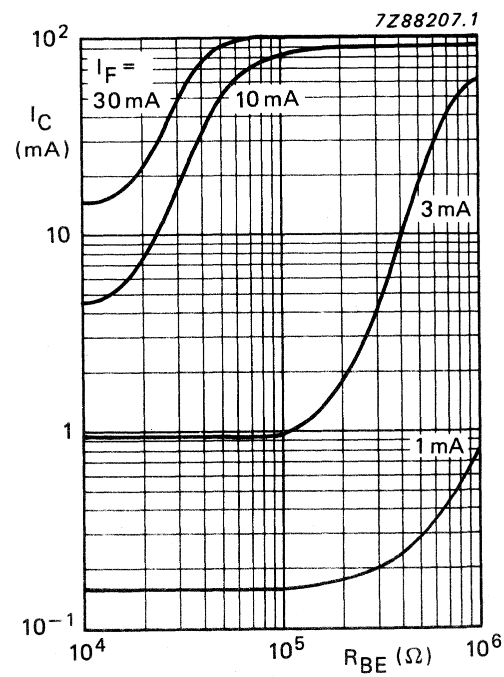


Fig. 20 Typ. values; $V_{CE} = 1$ V; $T_{amb} = 25$ °C.

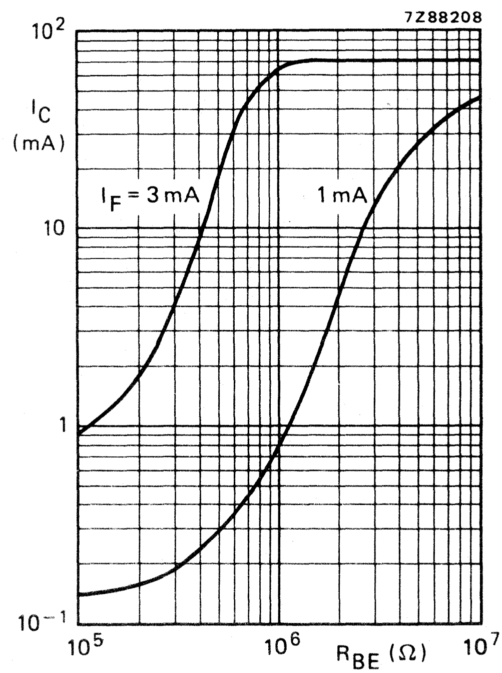


Fig. 21 Typ. values; $V_{CE} = 1$ V; $T_{amb} = 25$ °C.

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_{IORM}	min.	4,4 kV
AC (RMS value)			3,12 kV

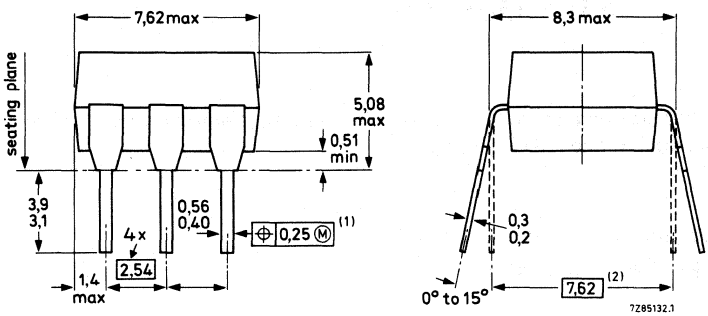
MECHANICAL DATA

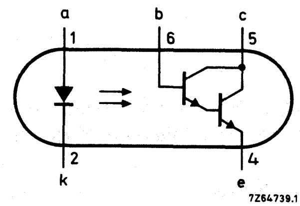
SOT90B (see Fig. 1).

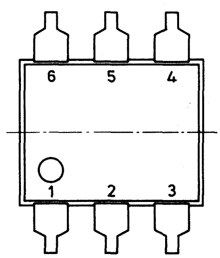
MECHANICAL DATA

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
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.	1,15 V
		max.	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_{CEO}	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.	1000 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_{IORM}	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
Insulation resistance between input and output ± V_{IO} = 1 kV	R_{IO}	min.	10 GΩ
		typ.	1 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.

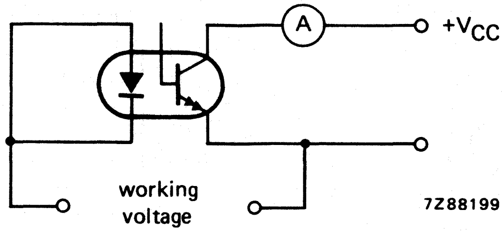


Fig. 2.

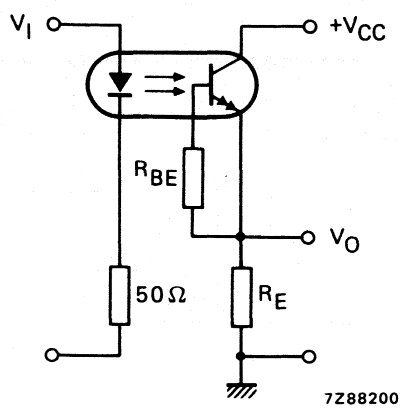


Fig. 3 Switching circuit.

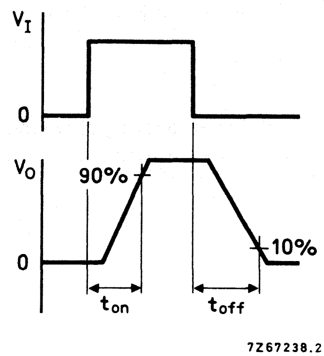


Fig. 4 Waveforms.

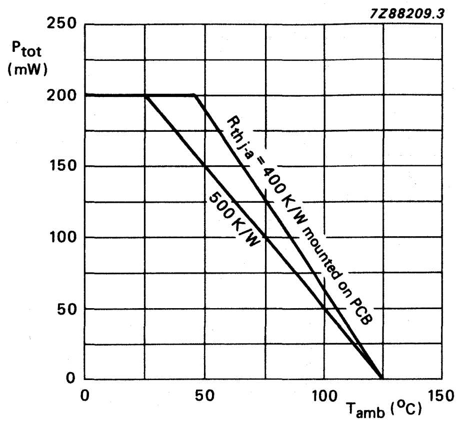


Fig. 5 Power derating curve for diode and transistor as a function of temperature.

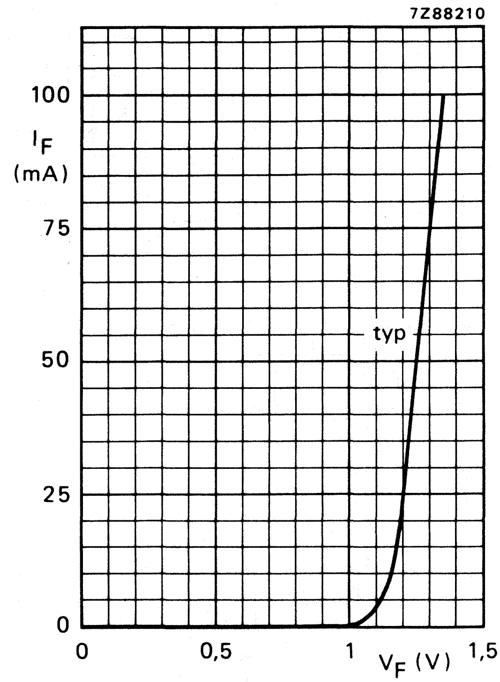


Fig. 6 T_{amb} = 25 °C.

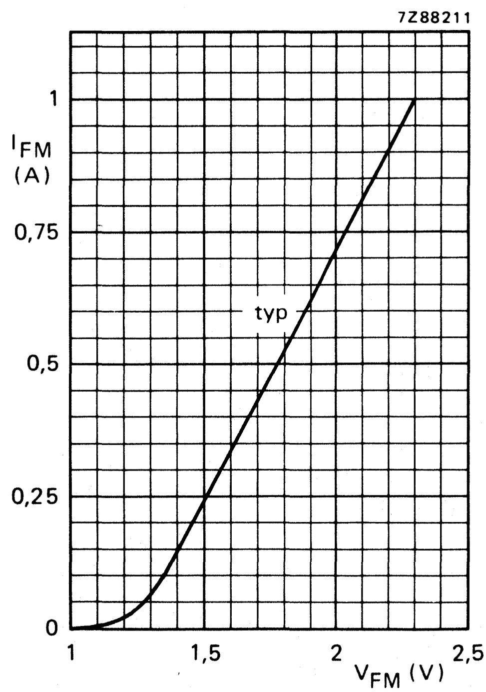


Fig. 7 T_{amb} = 25 °C; t_p = 10 μs; δ = 0,01.

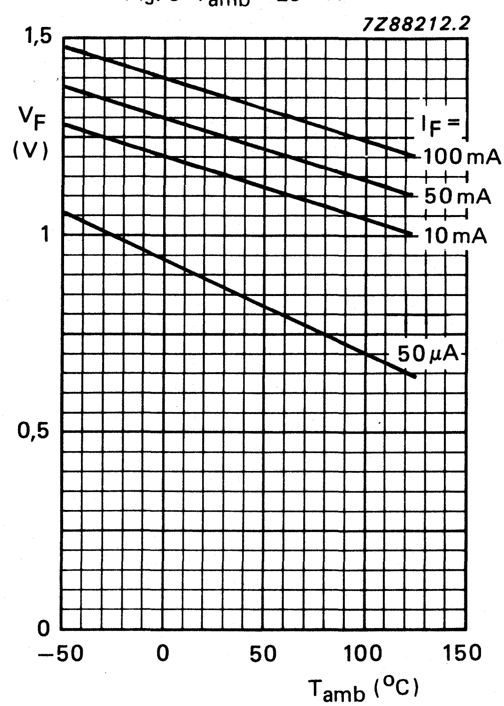


Fig. 8 Typical values.

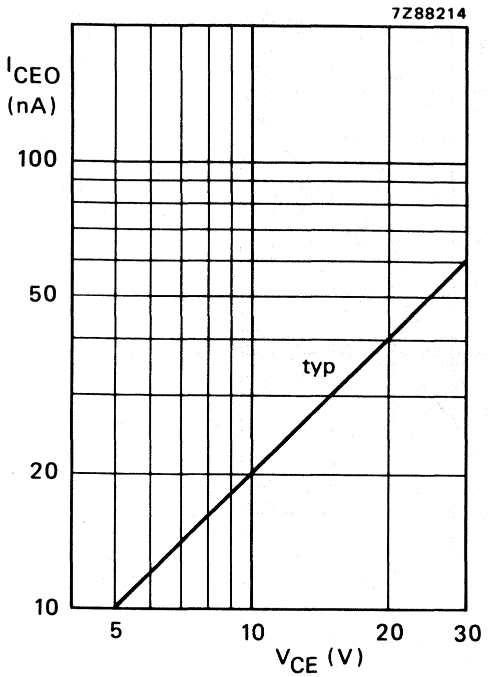


Fig. 9 $I_F = 0$; $T_j = 25$ °C.

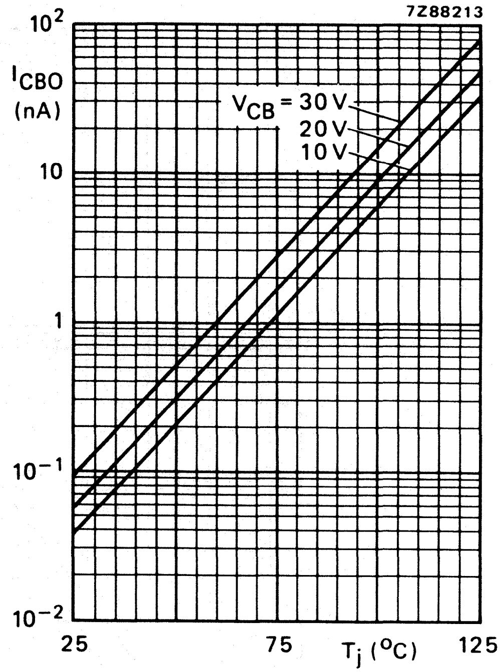


Fig. 10 Typical values.

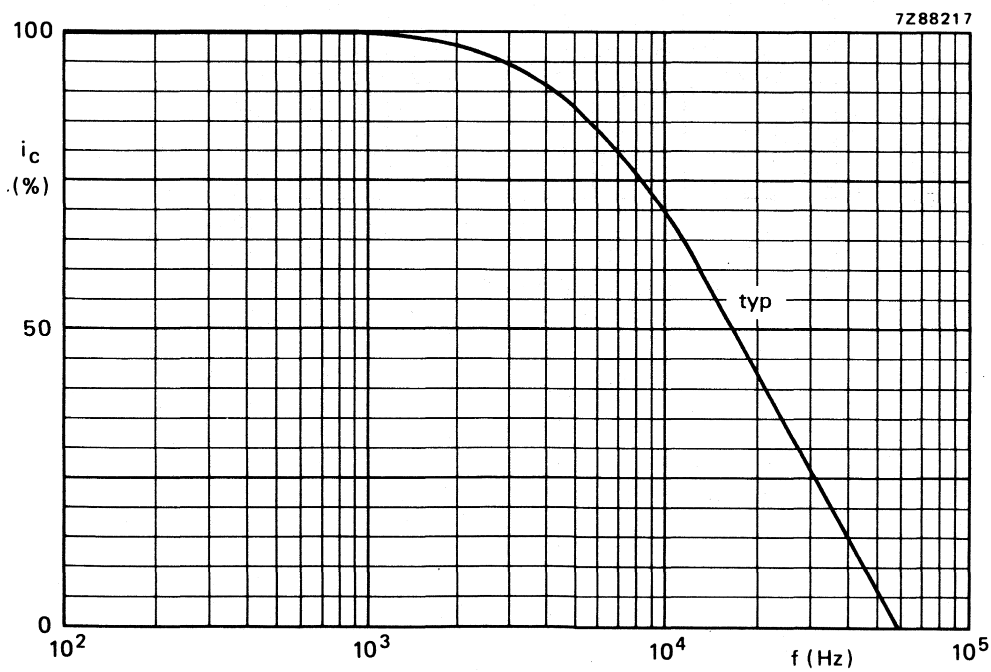


Fig. 11 $I_C = 10$ mA; $V_{CC} = 5$ V; $R_E = 100\ \Omega$; $R_{BE} = 1\ M\Omega$; see also Fig. 3.

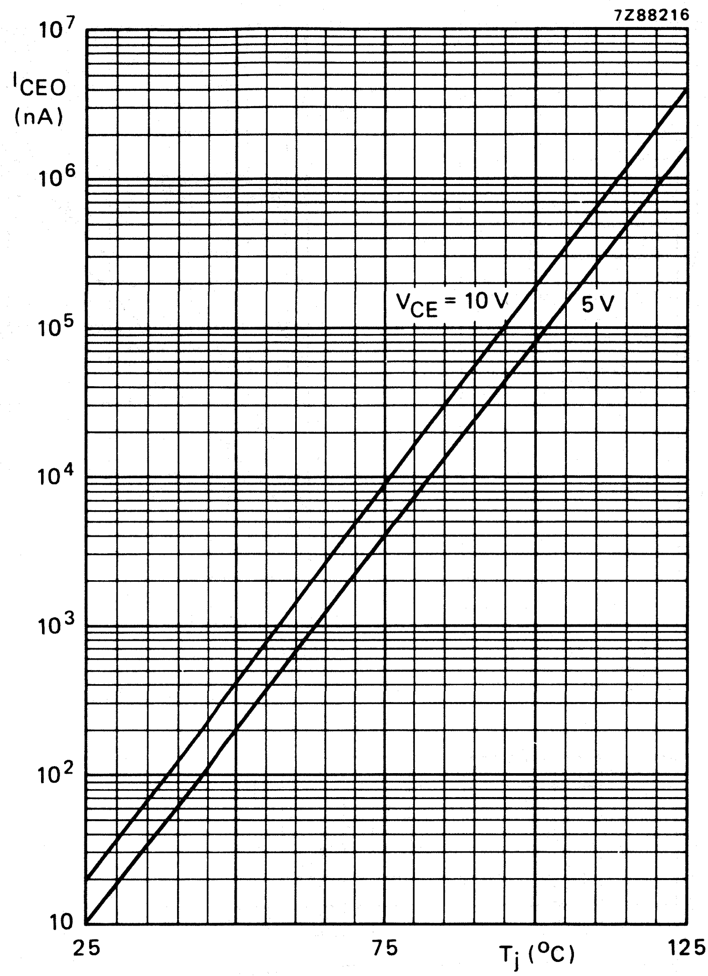


Fig. 12 $I_F = 0$; typical values.

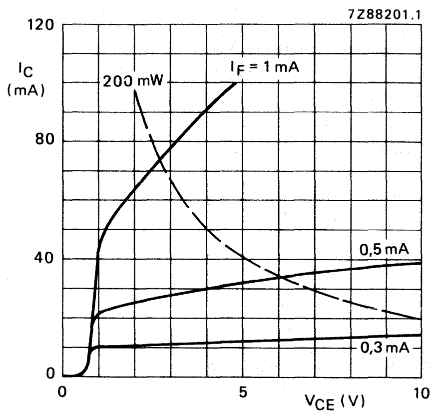


Fig. 13 Typical values; T_{amb} = 25 °C.

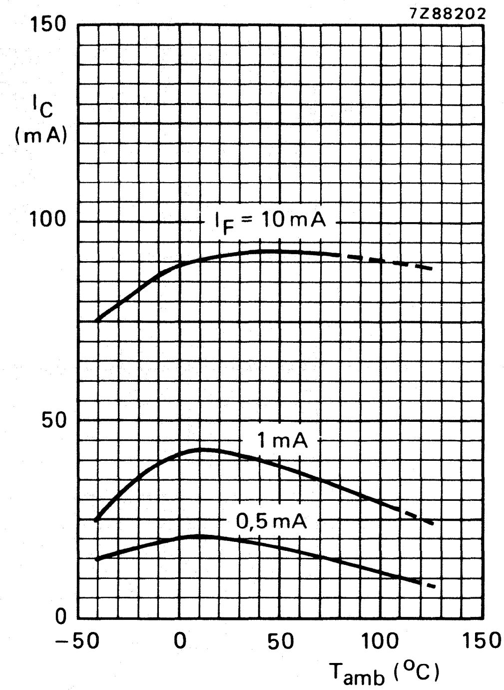


Fig. 14 Typical values; I_B = 0; V_{CE} = 1 V.

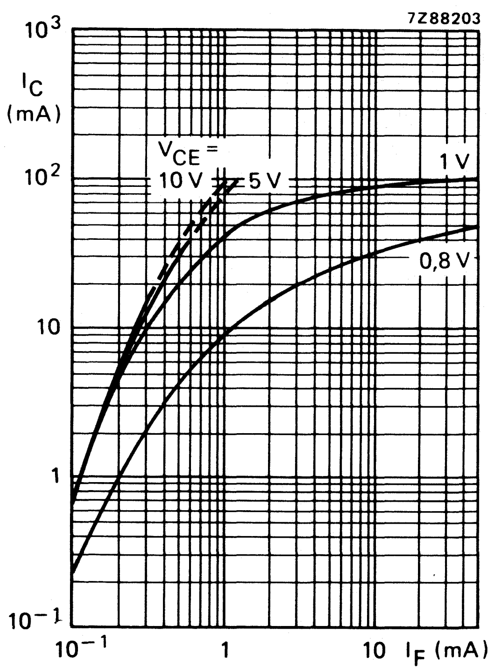


Fig. 15 Typical values; I_B = 0; T_{amb} = 25 °C.

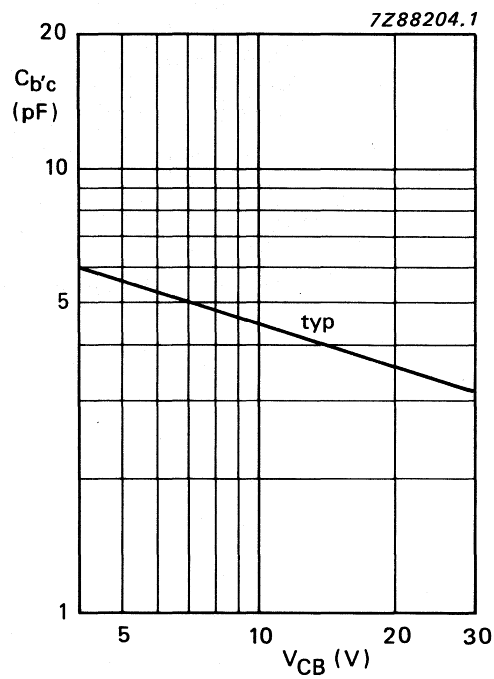


Fig. 16 $I_E = I_e = 0$; f = 1 MHz; T_{amb} = 25 °C.

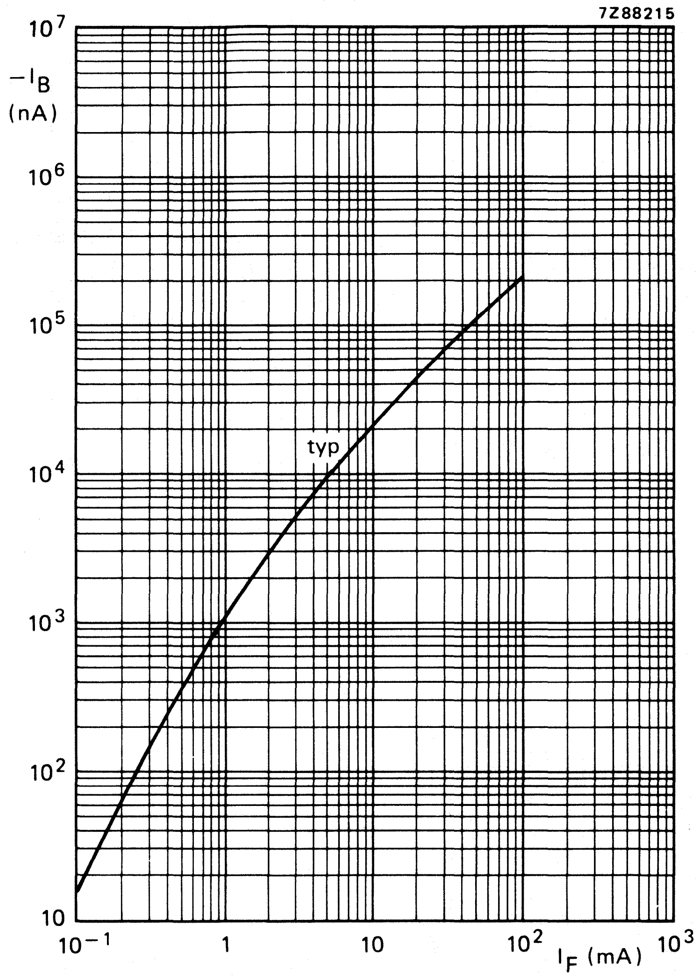


Fig. 17 $I_E = 0$; $V_{CB} = 5$ V; $T_{amb} = 25$ °C.

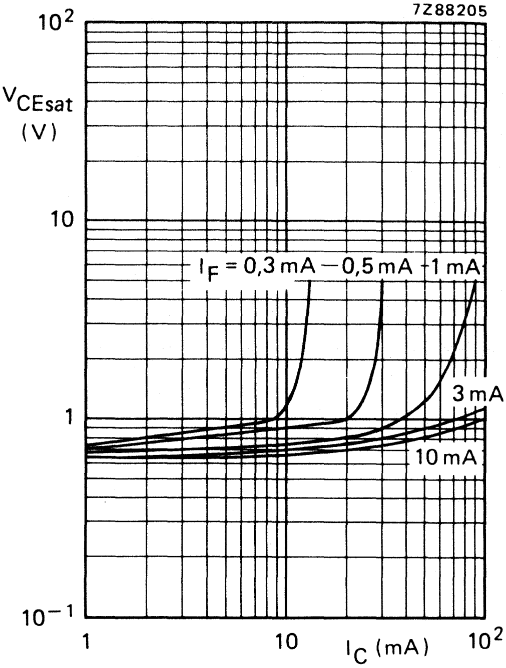


Fig. 18 Typical values; $I_B = 0$; $T_{amb} = 25$ °C.

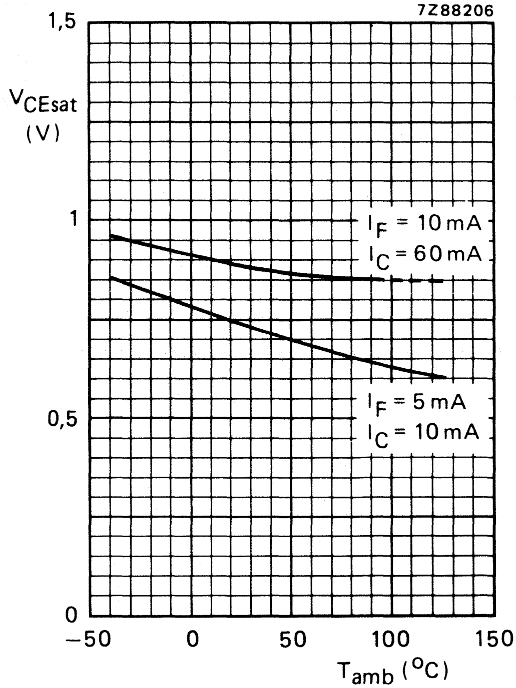


Fig. 19 Typical values; $I_B = 0$.

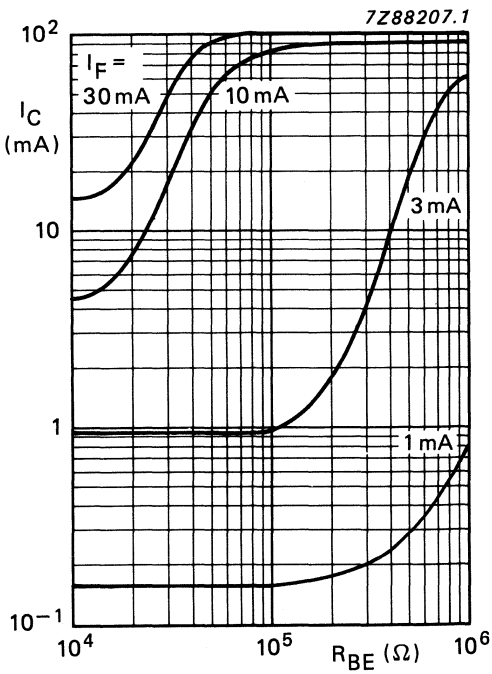


Fig. 20 Typ. values; $V_{CE} = 1$ V; $T_{amb} = 25$ °C.

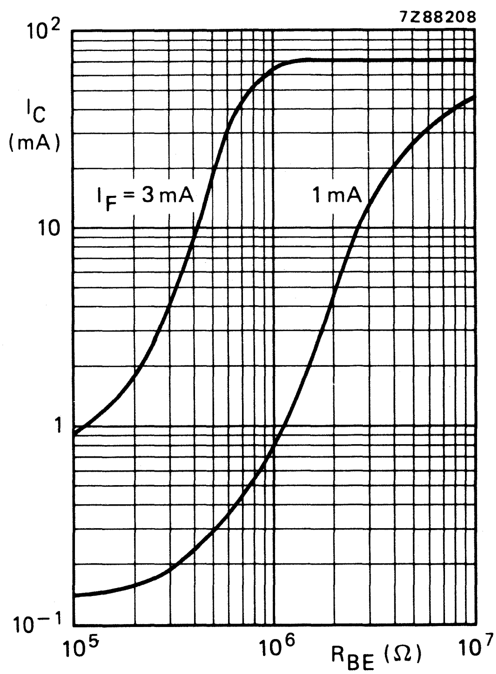


Fig. 21 Typ. values; $V_{CE} = 1$ V; $T_{amb} = 25$ °C.

HIGH-VOLTAGE OPTOCOUPLER

The CNX62 is an optocoupler consisting of an infrared emitting GaAs diode and a silicon npn phototransistor in a dual-in-line (DIL) plastic envelope. The base is not connected.

Features

- High current transfer ratio and a low saturation voltage 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)

UL — Covered under UL component recognition FILE E90700

VDE — Approved according to VDE 0883/6.80
Reference voltage (VDE 0110b Tab 4): AC 500 V/DC 600 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 ←

BSI — Certification according to BS415:1979 (Home appliance) ←

QUICK REFERENCE DATA

Diode				
Continuous reverse voltage	V_R	max.	5	V
DC forward current	I_F	max.	100	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.	50	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} = 0.4 V	I_C/I_F	min.	0.4	
Collector cut-off current (dark) V_{CC} = 10 V; working voltage = 2.5 kV DC I_F (diode) = 0 (see Fig.4)	I_{CEW}	max.	200	nA
Collector-emitter saturation voltage I_F = 10 mA; I_C = 4 mA	V_{CEsat}	max.	0.4	V
Isolation voltage DC	V_{IORM}	min.	5.3	kV
Isolation voltage AC (RMS value)	V_{IORM}	min.	3.75	kV

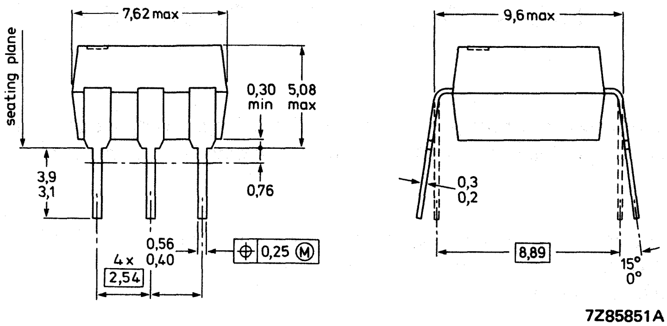
MECHANICAL DATA

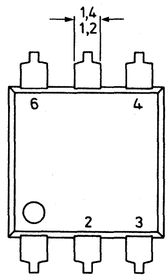
SOT174 (see Fig.1).

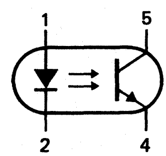
MECHANICAL DATA

Dimensions in mm

Fig.1 SOT174.







The base is not connected.

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_{on} = 10 μs; δ = 0.01	I_{FRM}	max.	3 A
Total power dissipation up to T_{amb} = 25 °C (when mounted on a printed circuit board: T_{amb} = 45 °C)	P_{tot}	max.	200 mW

Transistor

Collector-emitter voltage (open base)	V_{CEO}	max.	50 V
Emitter-collector voltage	V_{ECO}	max.	7 V
DC collector current	I_C	max.	100 mA
Total power dissipation up to T_{amb} = 25 °C (when mounted on a printed circuit board: T_{amb} = 45 °C)	P_{tot}	max.	200 mW

Optocoupler

Storage temperature range	T_{stg}	−55 to + 150	°C
Junction temperature	T_j	max. 125	°C
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 when mounted on PCB			
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. 8.4	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. 1.50	V
Reverse current $V_R = 5$ V	I_R	max. 10	μA

Transistor

Collector-emitter breakdown voltage $I_C = 1$ mA	$V_{(BR)CEO}$	min. 50	V
Emitter-collector breakdown voltage $I_E = 0.1$ mA	$V_{(BR)ECO}$	min. 7	V
Collector cut-off current (dark); diode $I_F = 0$			
$V_{CE} = 10$ V	I_{CEO}	typ. 2	nA
		max. 50	nA
$V_{CE} = 10$ V; $T_{amb} = 70$ °C	I_{CEO}	max. 10	μA

Optocoupler

Output/input DC current transfer ratio (CTR)			
$I_F = 10$ mA; $V_{CE} = 0.4$ V	I_C/I_F	min. 0.4	
		typ. 0.8	
$I_F = 10$ mA; $V_{CE} = 5$ V	I_C/I_F	typ. 1.5	
Collector cut-off current (light)			
$T_{amb} \leq 70$ °C; $V_F = 0.8$ V; $V_{CE} = 15$ V	$I_{CE(L)}$	max. 15	μA
$T_{amb} \leq 70$ °C; $I_F = 2$ mA; $V_{CE} = 0.4$ V	$I_{CE(L)}$	min. 150	μA

Optocoupler (continued)

Collector-emitter saturation voltage I_F = 10 mA; I_C = 4 mA	V_{CEsat}	typ. max.	0.19 V 0.40 V
Collector cut-off current (dark) at working voltage 2.5 kV DC; V_{CC} = 10 V; T_j = 25 °C (see Fig.4 and notes 1 and 2) V_{CC} = 10 V; T_j = 70 °C (see Fig.4 and notes 1 and 2)	I_{CEW}	max. max.	200 nA 100 μA
Isolation voltage; t = 1 min (see note 3) DC AC (RMS value)	V_{IORM}	min. min.	5.3 kV 3.75 kV
Capacitance between input and output V = 0; f = 1 MHz	C_{io}	typ.	0.6 pF
Insulation resistance between input and output V_{IO} = ± 1000 V	R_{IO}	min. typ.	10 GΩ 1 TΩ
Switching times (see Figs 2 and 3)			
Turn-on time I_C = 2 mA; V_{CC} = 5 V; R_L = 100 Ω I_C = 2 mA; V_{CC} = 5 V; R_L = 1 kΩ	t_{on}	typ. typ.	3 μs 12 μs
Turn-off time I_C = 2 mA; V_{CC} = 5 V; R_L = 100 Ω I_C = 2 mA; V_{CC} = 5 V; R_L = 1 kΩ	t_{off}	typ. typ.	3 μs 12 μs

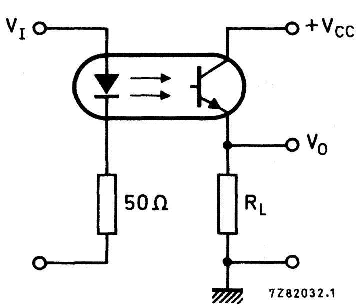


Fig.2 Switching circuit.

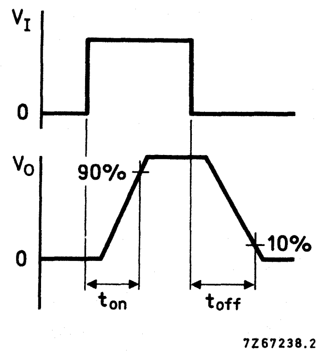


Fig.3 Waveforms.

Notes

1. The two parameters are tested on a sample basis for 1000 h.
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. Every single product is tested by applying an isolation test voltage of 4500 V (RMS) for 2 seconds between the shorted input (diode) leads and the shorted output (phototransistor) leads.

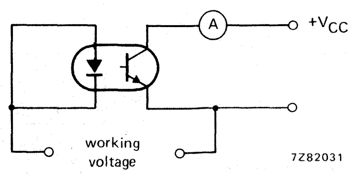


Fig. 4.

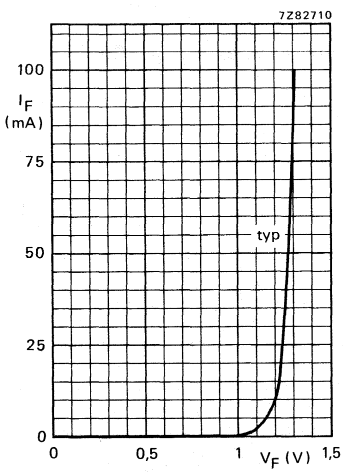


Fig. 5 T_{amb} = 25 °C.

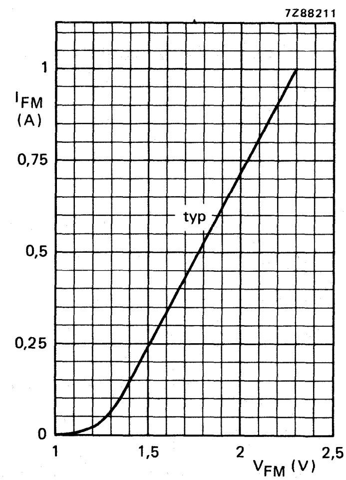


Fig. 6 T_{amb} = 25 °C; t_p = 10 μs; δ = 0.01.

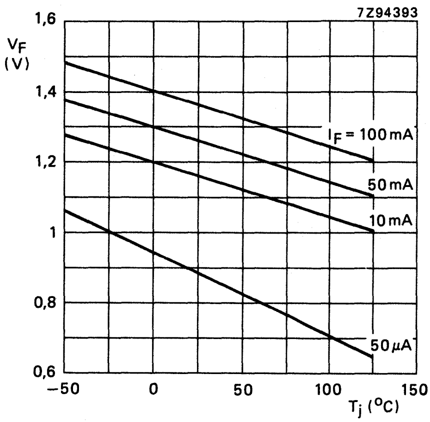


Fig.7 Typical values.

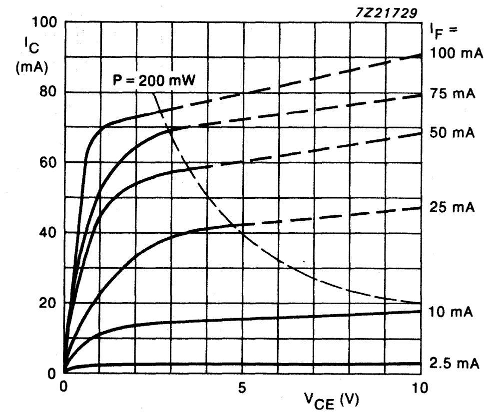


Fig.8 Typical values; T_{amb} = 25 °C.

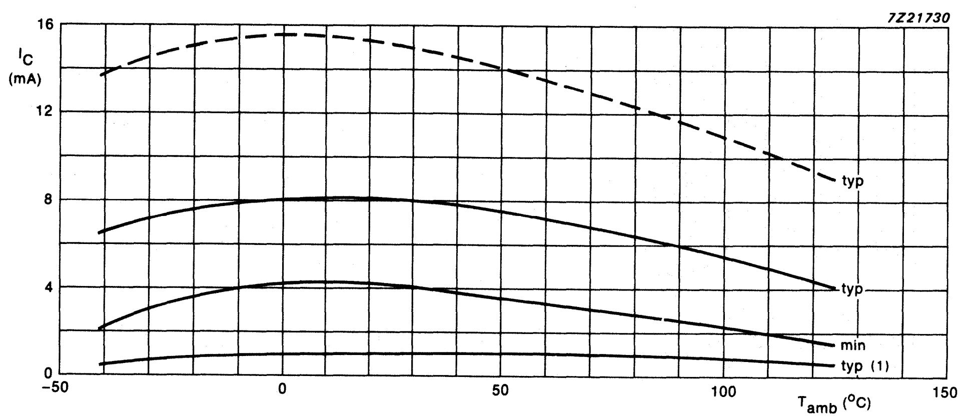


Fig.9 I_F = 10 mA; ——— V_{CE} = 0.4 V; – – – V_{CE} = 5 V.

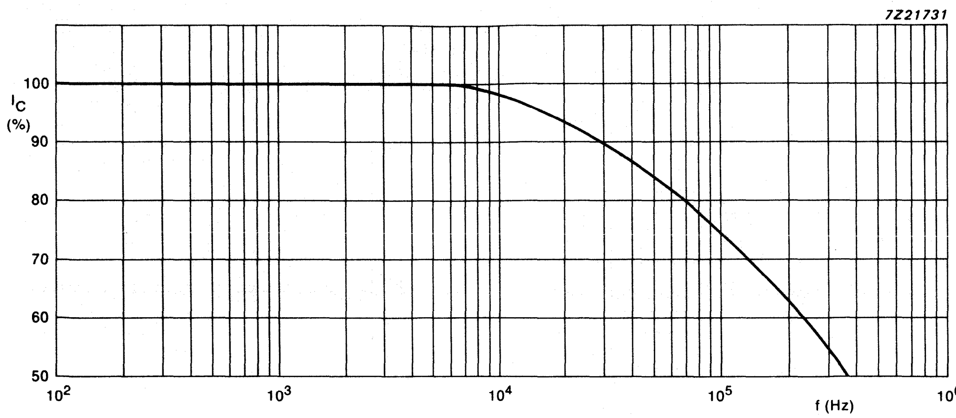


Fig.10 Typical values; R_L = 1 kΩ; I_C = 2 mA; V_{CC} = 5 V; T_{amb} = 25 °C.

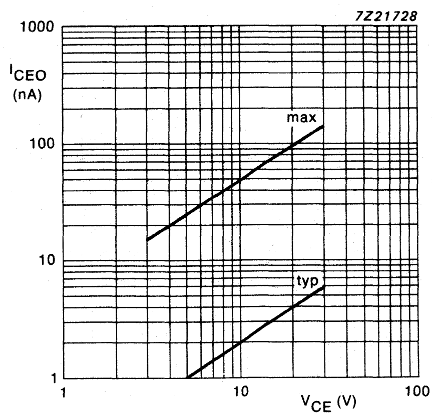


Fig.11 T_j = 25 °C.

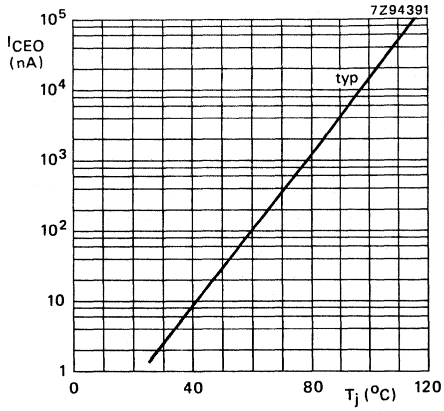


Fig. 12 V_{CE} = 10 V.

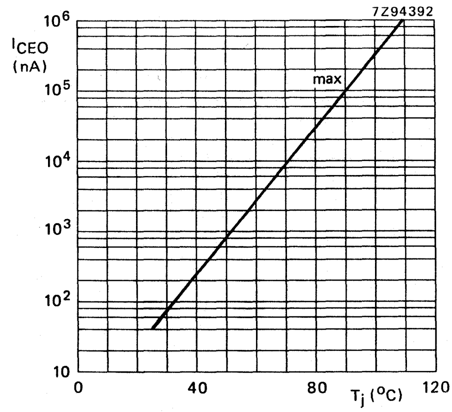


Fig. 13 V_{CE} = 10 V.

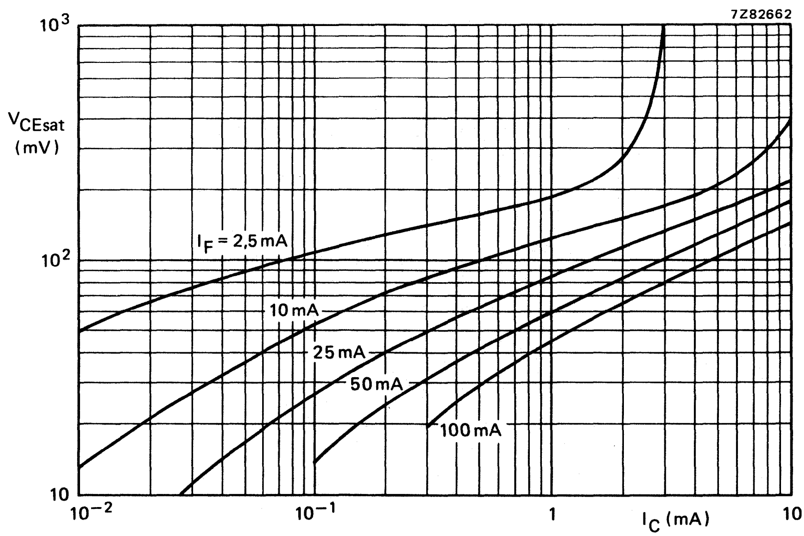


Fig. 14 T_{amb} = 25 °C; typical values.

HIGH-VOLTAGE OPTOCOUPLER

The CNX62A is a photocoupler consisting of an infrared emitting GaAs diode and a silicon npn phototransistor in a dual-in-line (DIL) plastic envelope SOT230.

Features

- High current transfer ratio and a low saturation voltage 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)

UL — Covered under UL component recognition FILE E90700
VDE — Approved according to 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/VDE 0805 "ENTWURF" NOV. 84
DIN 57804/VDE 0804/1.83 (Isolation group C)
DIN VDE 0860/8.86/HD 195 S4

BSI—Certification according to BS415: 1979 (Home appliances)
NORDIC, SETI, SEMKO, NEMKO — Acceptance for applications tested according to IEC65 (Electronic household equipments: TV AUDIO VIDEO excluding monitors)
DEMKO General approval IEC 664 (IEC 65 - 335 - 380 - 435 - 950)

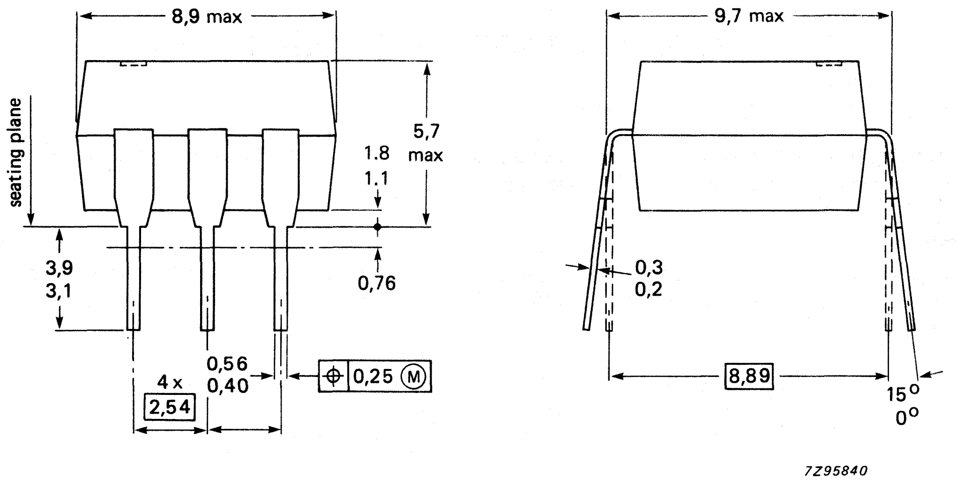
QUICK REFERENCE DATA

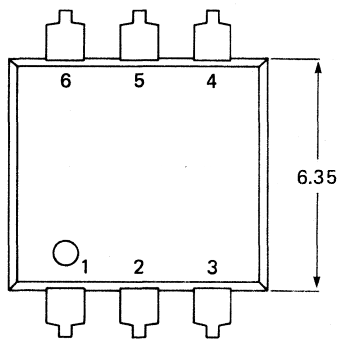
Diode				
Continuous reverse voltage	V_R	max.	5.0	V
DC forward current	I_F	max.	100	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	200	mW
Transistor				
Collector-emitter voltage (open base)	V_{CEO}	max.	50	V
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	200	mW
Photocoupler				
Output/input DC current transfer ratio I_F = 10 mA; V_{CE} = 0.4 V	I_C/I_F	min.	0.4	
Collector cut-off current (dark) V_{CC} = 10 V; working voltage = 2.5 kV DC diode; I_F = 0 (see Fig.4)	I_{CEW}	max.	200	nA
Test isolation voltage DC	V_{IORM}	max.	5.3	kV
Test isolation voltage AC (RMS value)	V_{IORM}	max.	3.75	kV

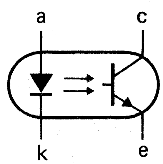
MECHANICAL DATA: SOT230 (see Fig.1).

MECHANICAL DATA

Dimensions in mm







Pinning:
1 = Anode
2 = Cathode
3 = Not connected
4 = Emitter
5 = Collector
6 = Not connected

Fig. 1 SOT230.

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_{on} = 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

Transistor

Collector-emitter voltage (open base)	V_{CEO}	max.	50 V
Emitter-collector voltage	V_{ECO}	max.	7.0 V
DC collector current	I_C	max.	100 mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	200 mW

Photocoupler

Storage temperature range	T_{stg}		–55 to + 150 °C
Junction temperature	T_j	max.	125 °C
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 when mounted on a PCB			
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.	8.4 mm
External tracking path (creepage distance) input terminals to output terminals	L(IO2)	min.	8.0 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. max.	1.15 V 1.5 V
Reverse current $V_R = 5$ V	I_R	max.	10 μA

Transistor

Collector-emitter breakdown voltage $I_C = 1$ mA	$V_{(BR)CEO}$	min.	50 V
Emitter-collector breakdown voltage $I_E = 0.1$ mA	$V_{(BR)ECO}$	min.	7.0 V
Collector cut-off current (dark); diode $I_F = 0$ $V_{CE} = 10$ V	I_{CEO}	typ. max.	2.0 nA 50 nA
$V_{CE} = 10$ V; $T_{amb} = 70$ °C	I_{CEO}	max.	10 μA

Photocoupler

Output/input DC current transfer ratio (CTR) $I_F = 10$ mA; $V_{CE} = 0.4$ V	I_C/I_F	min. typ.	0.4 0.8
$I_F = 10$ mA; $V_{CE} = 5$ V	I_C/I_F	typ.	1.5

Collector cut-off current (light)			
$T_{amb} \leqslant 70\ ^{o}C$; $V_F = 0.8$ V; $V_{CE} = 15$ V	$I_{CE(L)}$	max.	15 μA
$T_{amb} \leqslant 70\ ^{o}C$; $I_F = 2$ mA; $V_{CE} = 0.4$ V	$I_{CE(L)}$	min.	150 μA
Collector-emitter saturation voltage			
$I_F = 10$ mA; $I_C = 4$ mA	V_{CEsat}	typ.	0.19 V
		max.	0.40 V
Collector cut-off current (dark) at working voltage $V_W = 2.5$ kV (DC value)			
$V_{CC} = 10$ V; $T_j = 25\ ^{o}C$ (see notes 1 and 2)	I_{CEW}	max.	200 nA
$V_{CC} = 10$ V; $T_j = 70\ ^{o}C$ (see notes 1 and 2)		max.	100 μA
Test isolation voltage DC	V_{IORM}	max.	5.3 kV
t = 1 min (see note 3) AC (RMS value)		max.	3.75 kV
Capacitance between input and output			
V = 0; f = 1 MHz	C_{io}	typ.	0.4 pF
Insulation resistance between input and output			
$V_{IO} = \pm 1000$ V	R_{IO}	min.	10 GΩ
		typ.	1 TΩ
Switching times (see Figs 3 and 4)			
Turn-on time			
$I_C = 2$ mA; $V_{CC} = 5$ V; $R_L = 100\ \Omega$	t_{on}	typ.	3.0 μs
$I_C = 2$ mA; $V_{CC} = 5$ V; $R_L = 1$ kΩ		typ.	12 μs
Turn-off time			
$I_C = 2$ mA; $V_{CC} = 5$ V; $R_L = 100\ \Omega$	t_{off}	typ.	3.0 μs
$I_C = 2$ mA; $V_{CC} = 5$ V; $R_L = 1$ kΩ		typ.	12 μs

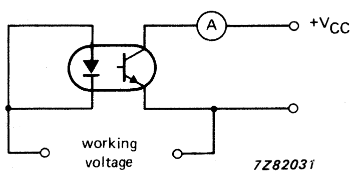


Fig. 2 Test circuit.

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 single product is tested by applying an isolation test voltage of 4500 V (RMS) for 2 seconds between the shorted input (diode) leads and the shorted output (phototransistor) leads.

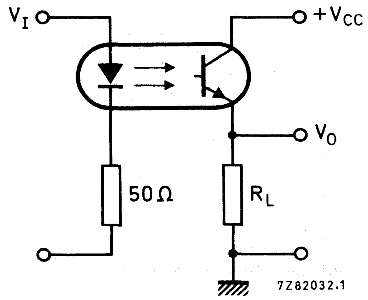


Fig. 3 Switching circuit.

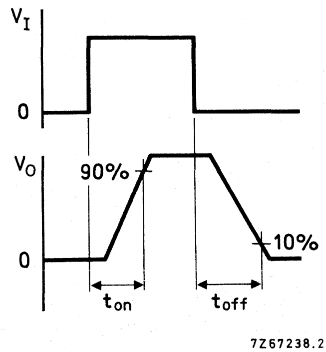


Fig. 4 Waveforms.

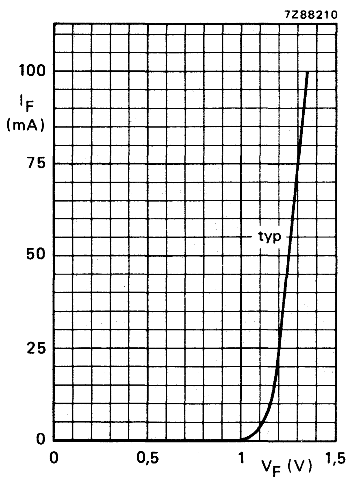


Fig. 5 Typical forward current as a function of forward voltage; T_{amb} = 25 °C.

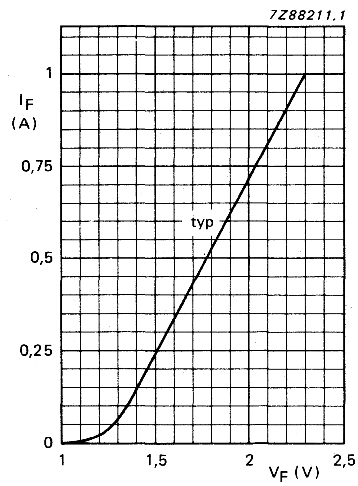


Fig. 6 Typical forward current as a function of forward voltage; T_{amb} = 25 °C; t_p = 20 μs; δ = 0.01.

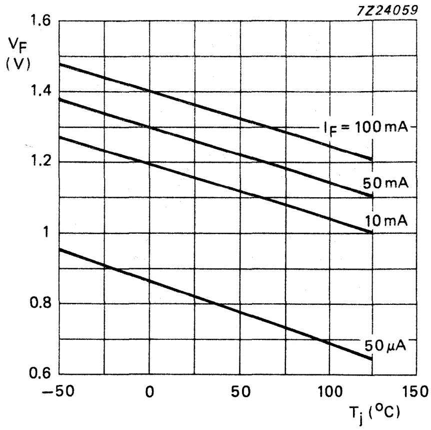


Fig. 7 Typical forward voltage as a function of junction temperature.

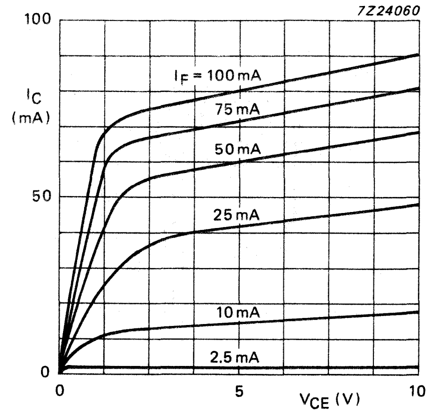


Fig. 8 Typical collector current as a function of collector-emitter voltage; T_{amb} = 25 °C.

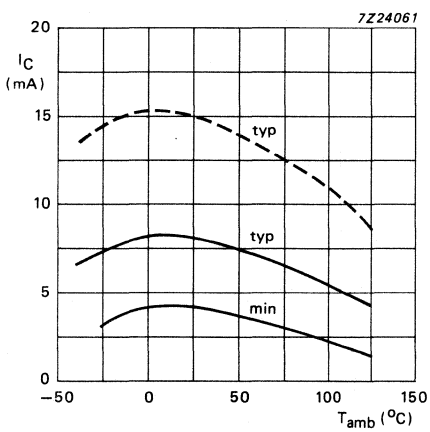


Fig. 9 Collector current as a function of ambient temperature; I_F = 10 mA.
– – – (V_{CE} = 5 V)
—— (V_{CE} = 0.4 V).

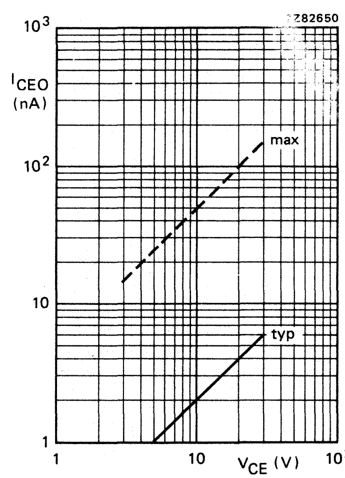


Fig. 10 Collector-emitter dark current as a function of collector-emitter voltage; T_{amb} = 25 °C.

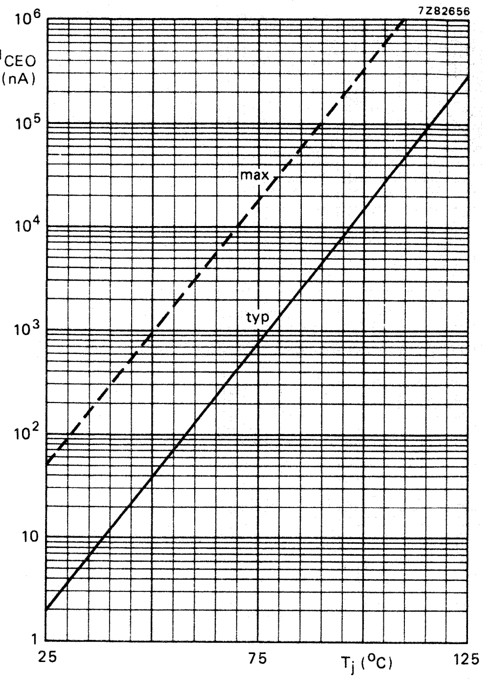


Fig. 11 Collector-emitter dark current as a function of junction temperature.

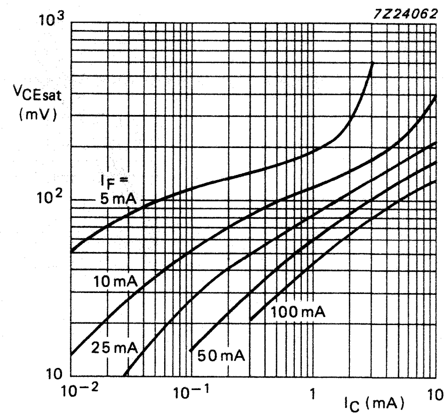


Fig. 12 Typical collector-emitter voltage as a function of collector current; T_{amb} = 25 °C.

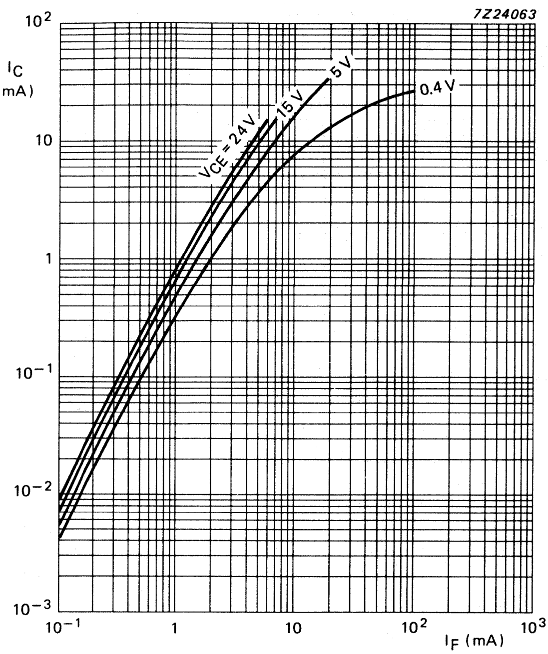


Fig. 13 Typical collector current as a function of forward current; T_{amb} = 25 °C.

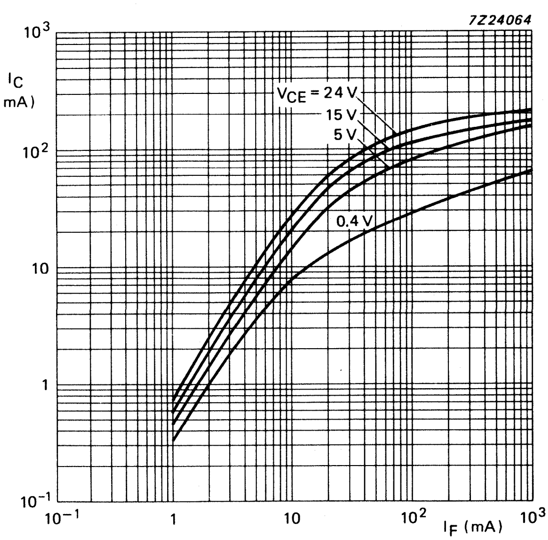


Fig. 14 Typical collector current as a function of forward current; T_{amb} = 25 °C; t_p = 10 μs; δ = 0.01.

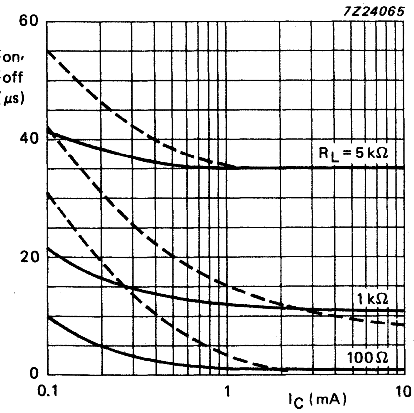


Fig. 15 Typical turn-on and turn-off times as a function of collector current; $T_{amb} = 25\ ^oC$.
– – – (t_{off});
—— (t_{on}).

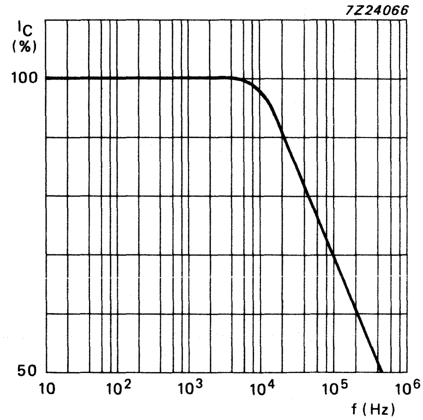


Fig. 16 Relative collector current as a function of frequency; $T_{amb} = 25\ ^oC$; $I_C = 2$ mA; $V_{CC} = 5$ V.

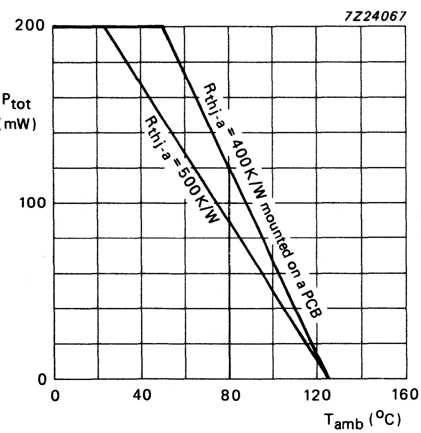


Fig. 17 Total power dissipation as a function of ambient temperature.

HIGH-VOLTAGE OPTOCOUPLER

The CNX71 is an optocoupler consisting of an infrared emitting GaAs diode and a silicon npn phototransistor in a dual-in-line (DIL) plastic envelope. The base is not connected.

Features

- High current transfer ratio and a low saturation voltage 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

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

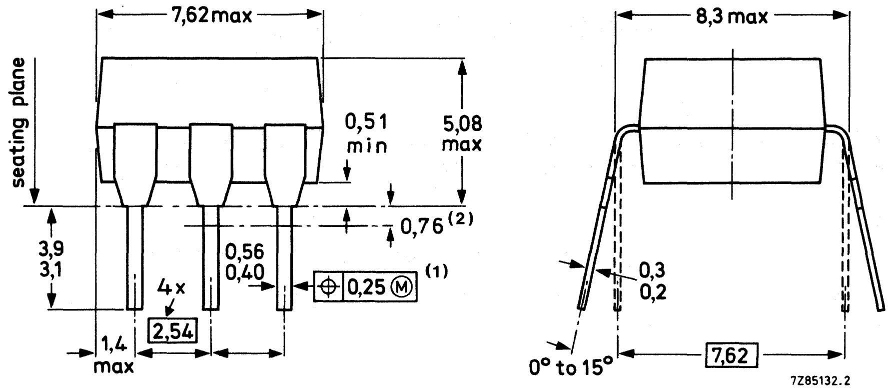
QUICK REFERENCE DATA

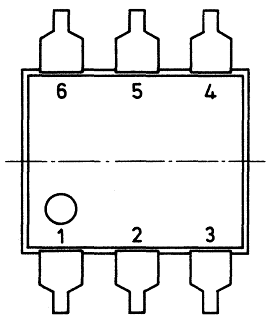
Diode				
Continuous reverse voltage	V_R	max.	5.0	V
DC forward current	I_F	max.	100	mA
peak value; t_{on} = 10 μs; δ = 0.01	I_{FRM}	max.	3.0	A
Total power dissipation up to T_{amb} = 25 ^oC when mounted on a PCB	P_{tot}	max.	200	mW
Transistor				
Collector-emitter voltage (open base)	V_{CEO}	max.	30	V
Total power dissipation up to T_{amb} = 25 ^oC when mounted on a PCB	P_{tot}	max.	200	mW
Optocoupler				
Output/input DC current transfer ratio (CTR) I_F = 10 mA; V_{CE} = 0.4 V	I_C/I_F	min.	0.4	
Collector cut-off current (dark) V_{CC} = 10 V; working voltage = 2.5 kV DC I_F (diode) = 0 (see Fig. 4)	I_{CEW}	max.	200	nA
Collector-emitter saturation voltage I_F = 10 mA; I_C = 4 mA	V_{CEsat}	max.	0.4	V
Isolation voltage * DC	V_{IORM}	min.	5.3	kV
AC (RMS value)			3.75	kV

* VDE approval for 4.4 kV DC/3.12 kV RMS

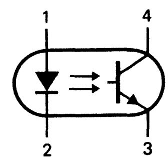
MECHANICAL DATA

Dimensions in mm





The base is not connected.



(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.

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_{on} = 10 μs; δ = 0.01	I_{FRM}	max.	3.0 A
Total power dissipation up to T_{amb} = 25 °C when mounted on a PCB	P_{tot}	max.	200 mW

Transistor

DC collector current	I_C	max.	100 mA
Collector-emitter voltage (open base)	V_{CEO}	max.	30 V
Emitter-collector voltage	V_{ECO}	max.	7.0 V
Total power dissipation up to T_{amb} = 25 °C when mounted on a PCB	P_{tot}	max.	200 mW

Optocoupler

Storage temperature range	T_{stg}		−55 to + 150 °C
Junction temperature	T_j	max.	125 °C
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 when mounted on a PCB			
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. max.	1.15 V 1.50 V
Reverse current V_R = 5 V	I_R	max.	10 μA

Transistor

Collector-emitter breakdown voltage I_C = 1 mA	$V_{(BR)CEO}$	min.	30 V
Emitter-collector breakdown voltage I_E = 0.1 mA	$V_{(BR)ECO}$	min.	7.0 V
Collector cut-off current (dark); diode I_F = 0 V_{CE} = 10 V	I_{CEO}	typ. max.	2.0 nA 50 nA
V_{CE} = 10 V; T_{amb} = 70 °C	I_{CEO}	max.	10 μA

CHARACTERISTICS (continued)

Optocoupler

Output/input DC current transfer ratio (CTR)			
I_F = 10 mA; V_{CE} = 0.4 V	I_C/I_F	min. max.	0.4 1.6
I_F = 10 mA; V_{CE} = 10 V	I_C/I_F	min.	0.5
Collector-emitter saturation voltage			
I_F = 10 mA; I_C = 4 mA	V_{CEsat}	typ. max.	0.19 V 0.40 V
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 cut-off current (dark) at			
working voltage V_W = 2.5 kV DC;			
V_{CC} = 10 V; T_j = 25 °C (see Fig. 4) V_{CC} = 10 V; T_j = 70 °C (see Fig. 4)	I_{CEW}	max. max.	200 nA 100 μA
Isolation voltage* DC t = 1 min (see note next page) AC(RMS value)	V_{IORM}	min.	5.3 kV 3.75 kV
Capacitance between input and output			
V = 0; f = 1 MHz	C_{io}	typ.	0.6 pF
Insulation resistance between input and output			
V_{IO} = ± 1000 V	R_{IO}	min. typ.	10 GΩ 1 TΩ
Switching times (see Figs 2 and 3)			
Turn-on time			
I_F = 10 mA; V_{CC} = 10 V; R_L = 4.7 kΩ	t_{on}	max.	20 μs
Turn-off time			
I_F = 10 mA; V_{CC} = 10 V; R_L = 4.7 kΩ	t_{off}	max.	120 μs
Turn-on time			
I_C = 2 mA; V_{CC} = 10 V; R_L = 100 Ω	t_{on}	max.	20 μs
Turn-off time			
I_C = 2 mA; V_{CC} = 10 V; R_L = 100 Ω	t_{off}	max.	20 μs

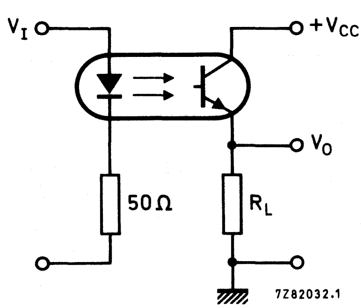


Fig. 2 Switching circuit.

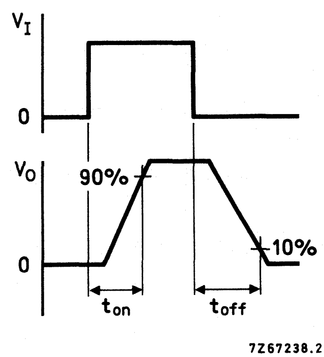


Fig. 3 Waveforms.

* VDE approval for 4.4 kV DC/3.12 kV RMS

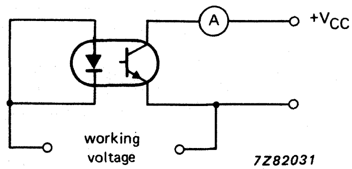


Fig. 4 Test circuit.

Note

Every single product is tested by applying an isolation test voltage of 4500 V (RMS) for 2 seconds between the shorted input (diode) leads and the shorted output (phototransistor) leads.

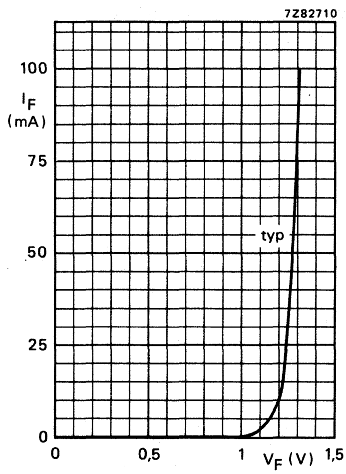


Fig. 5 Forward current as a function of forward voltage; T_{amb} = 25 °C.

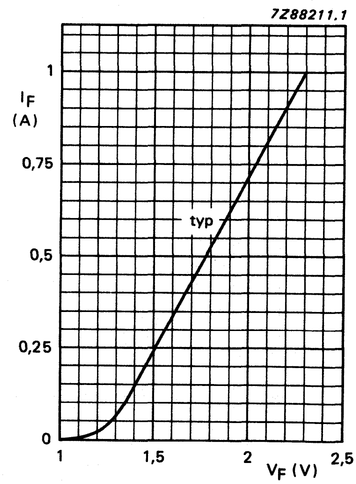


Fig. 6 Forward current as a function of forward voltage (max.); T_{amb} = 25 °C; t_p = 10 ms; δ = 0.01.

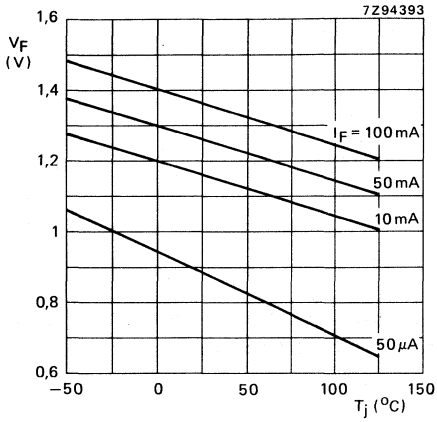


Fig. 7 Forward voltage as a function of temperature; typical values.

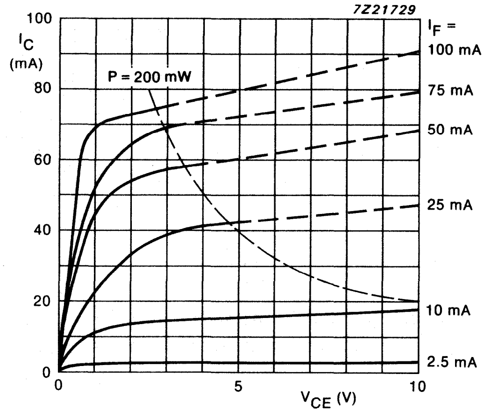


Fig. 8 Collector current as a function of collector-emitter voltage; typical values. T_{amb} = 25 °C.

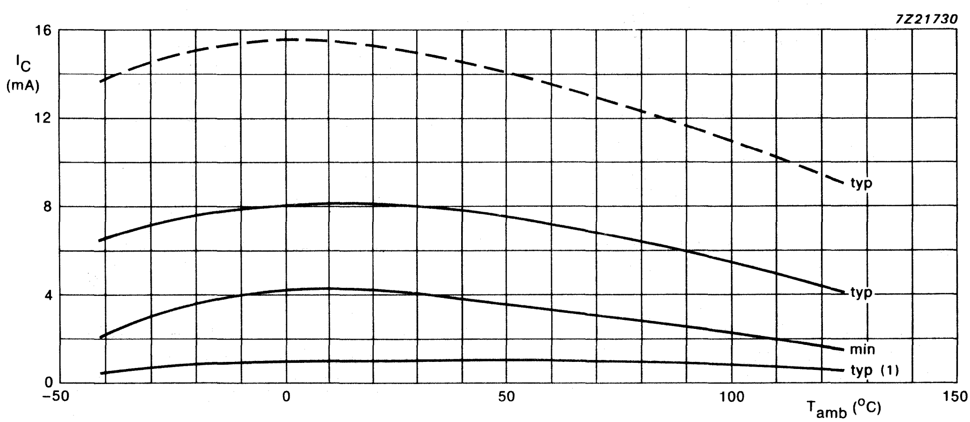


Fig. 9 Collector current as a function of ambient temperature; I_F = 10 mA; ——— V_{CE} = 0.4 V; – – – – V_{CE} = 5 V.

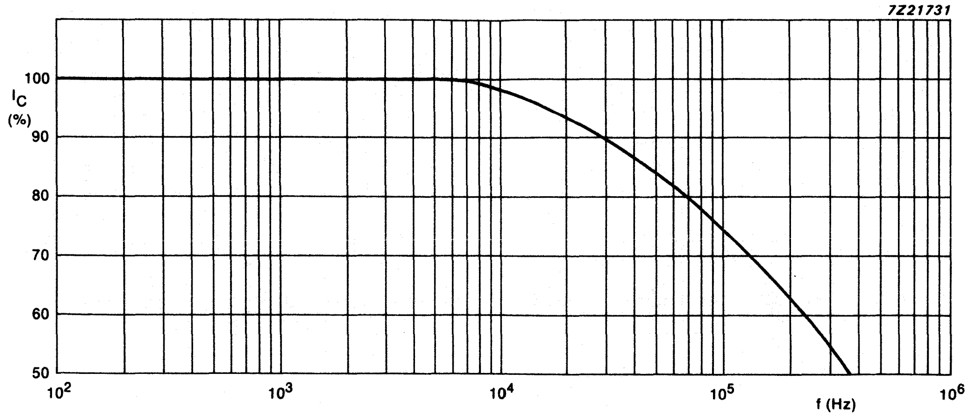


Fig. 10 Collector current as a function of frequency; typical values.
R_L = 1 kΩ; I_C = 2 mA; V_{CC} = 5 V; T_{amb} = 25 °C.

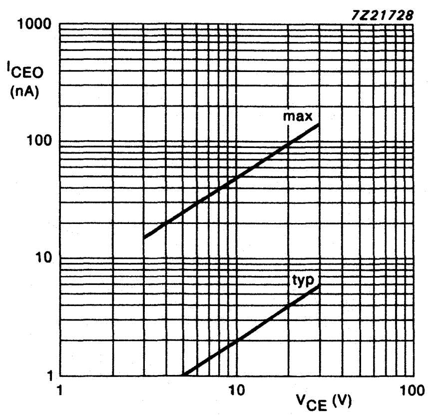


Fig. 11 Collector cut-off current as a function of collector-emitter voltage;
T_j = 25 °C.

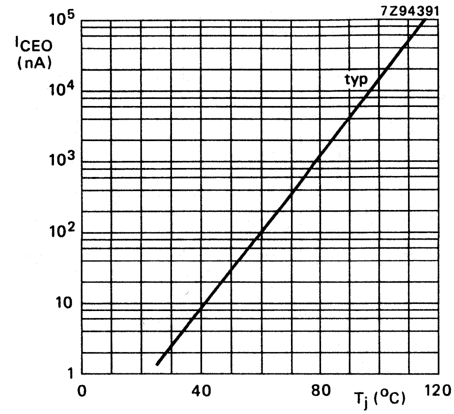


Fig. 12 Collector cut-off current as a function of temperature; V_{CE} = 10 V.

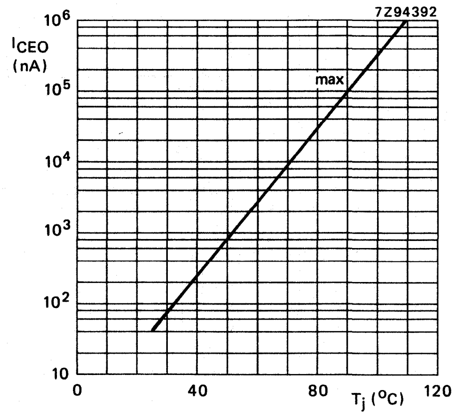


Fig. 13 Collector cut-off current as a function of temperature; V_{CE} = 10 V.

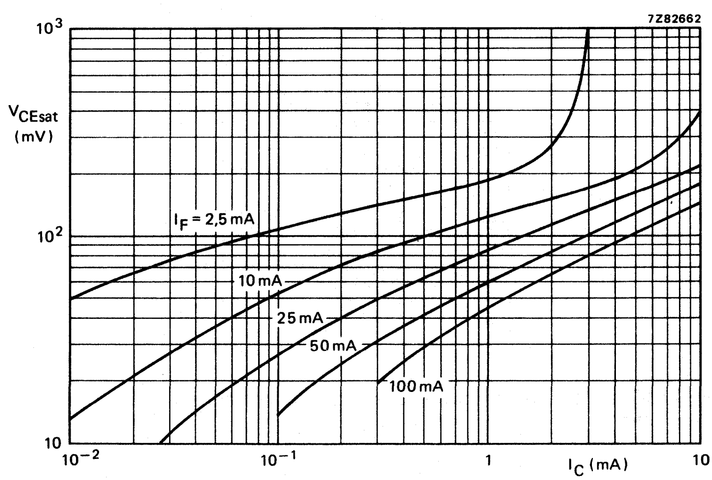


Fig. 14 Collector-emitter saturation voltage as a function of collector current; typical values; T_{amb} = 25 °C.

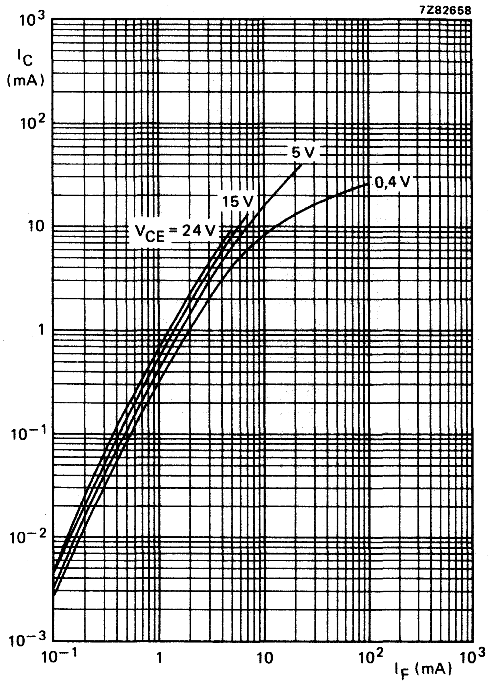


Fig. 15 Collector current as a function of forward current; typical values; T_{amb} = 25 °C.

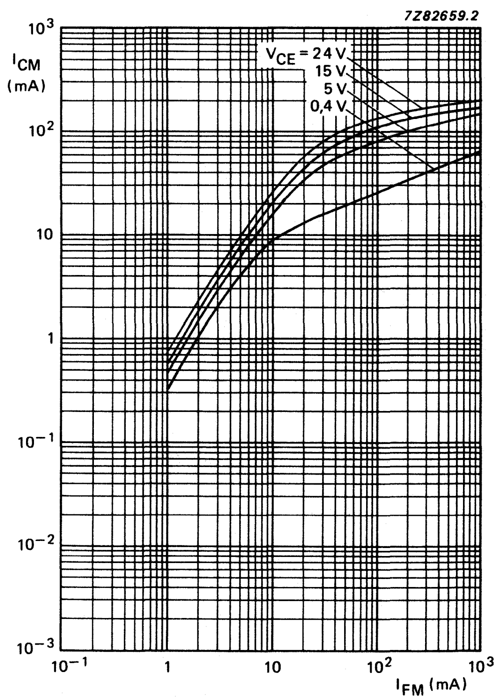


Fig. 16 Collector current as a function of forward current; typical values; T_{amb} = 25 °C; t_p = 10 μs; δ = 0.01.

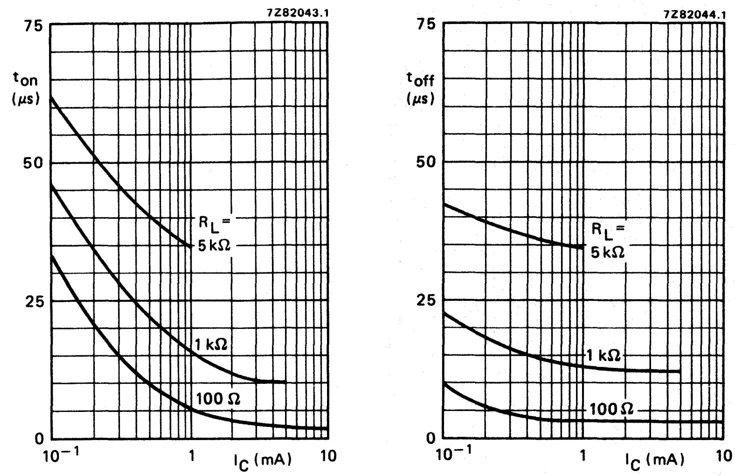


Fig. 17 Switching times as a function of collector current; typical values; T_{amb} = 25 ^oC; V_{CC} = 5 V.

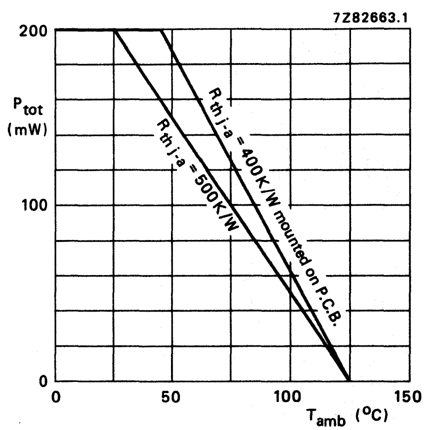


Fig. 18 Total power dissipation as a function of ambient temperature.

HIGH-VOLTAGE OPTOCOUPLER

The CNX72A is a photocoupler consisting of an infrared emitting GaAs diode and a silicon npn phototransistor in a dual-in-line (DIL) plastic envelope SOT229.

Features

- High current transfer ratio and a low saturation voltage 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)

UL — Covered under UL component recognition FILE E90700
VDE — Approved according to VDE 0883/6.80
Reference voltage (VDE 0110b TAB 4): 280 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

QUICK REFERENCE DATA

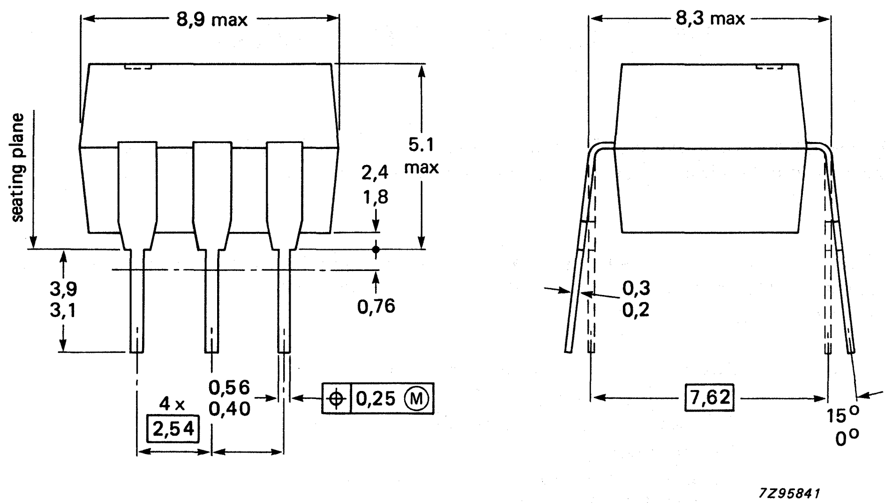
Diode				
DC forward current	I_F	max.	100	mA
Transistor				
Collector-emitter voltage (open base)	V_{CEO}	max.	30	V
Photocoupler				
Output/input DC current transfer ratio (CTR) I_F = 10 mA; V_{CE} = 0.4 V	I_C/I_F	min.	0.4	
		max.	1.6	
Collector cut-off current (dark) V_{CC} = 10 V; working voltage = 2.5 kV DC	I_{CEW}	max.	200	nA
Test isolation voltage DC	V_{IORM}	max.	5.3	kV
AC (RMS value)		max.	3.75	kV

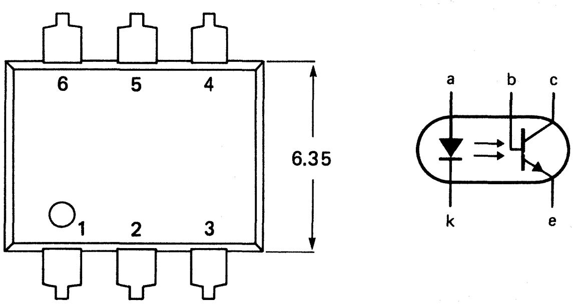
MECHANICAL DATA

SOT229 (see Fig.1).

MECHANICAL DATA

Dimensions in mm





Pinning:
1 = Anode
2 = Cathode
3 = Not connected
4 = Emitter
5 = Collector
6 = Base

Fig. 1 SOT229.

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_{on} = 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
Transistor				
Collector-emitter voltage (open base)	V_{CEO}	max.	30	V
Emitter-collector voltage	V_{ECO}	max.	7.0	V
Collector-base voltage	V_{CBO}	max.	70	V
DC collector current	I_C	max.	100	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	200	mW

Photocoupler

Storage temperature range	T_{stg}		−55 to + 150 °C
Junction temperature	T_j	max.	125 °C
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 when mounted on a PCB			
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.	8.0 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. max.	1.15 V 1.5 V
Reverse current $V_R = 5$ V	I_R	max.	10 μA

Transistor

Collector-emitter breakdown voltage $I_C = 1$ mA	$V_{(BR)CEO}$	min.	30 V
Emitter-collector breakdown voltage $I_E = 0.1$ mA	$V_{(BR)ECO}$	min.	7.0 V
Collector-base breakdown voltage $I_C = 0.1$ mA	$V_{(BR)CBO}$	min.	70 V
Collector cut-off current (dark); diode $I_F = 0$ $V_{CE} = 10$ V	I_{CEO}	typ. max.	2.0 nA 50 nA
$V_{CE} = 10$ V; $T_{amb} = 70$ °C	I_{CEO}	max.	10 μA
$V_{CB} = 10$ V	I_{CBO}	max.	20 nA

CHARACTERISTICS (continued)

Photocoupler

Output/input DC current transfer ratio (CTR) I_F = 10 mA; V_{CE} = 0.4 V	I_C/I_F	min. max.	0.4 1.6	
Collector cut-off current (light) $T_{amb} \leq 70\ ^oC$; V_F = 0.8 V; V_{CE} = 15 V	$I_{CE(L)}$	max.	15	μA
$T_{amb} \leq 70\ ^oC$; I_F = 2 mA; V_{CE} = 0.4 V	$I_{CE(L)}$	min.	150	μA
Collector-emitter saturation voltage I_F = 10 mA; I_C = 4 mA	V_{CEsat}	typ. max.	0.19 0.40	V V
Collector cut-off current (dark) at working voltage V_W = 2.5 kV DC V_{CC} = 10 V; T_j = 25 ^oC (see notes 1 and 2)	I_{CEW}	max.	200	nA
V_{CC} = 10 V; T_j = 70 ^oC (see notes 1 and 2)	I_{CEW}	max.	100	μA
Output capacitance V_{CB} = 10 V; f = 1 MHz	$C_{b'c}$	max.	5.5	pF
Test isolation voltage t = 1 min (see notes 3 and 4) DC	V_{IORM}	max.	5.3	kV
AC (RMS value)	V_{IORM}	max.	3.75	kV
Capacitance between input and output V = 0; f = 1 MHz	C_{io}	typ.	0.4	pF
Insulation resistance between input and output V_{IO} = ± 1000 V	R_{IO}	min. typ.	10 1	GΩ TΩ
Switching times (see Figs 3 and 4)				
Turn-on time I_C = 2 mA; V_{CC} = 5 V; R_L = 1 kΩ R_{BE} = 56 kΩ	t_{on}	max.	26	μs
Turn-off time I_C = 2 mA; V_{CC} = 5 V; R_L = 1 kΩ R_{BE} = 56 kΩ	t_{off}	max.	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 on a sample basis for 1000 hours.
3. Every single product is tested by applying an isolation test voltage of 4500 V (RMS) for 2 seconds between the shorted input (diode) leads and the shorted output (phototransistor) leads.
4. VDE approval for 4400 V (DC)/3120 V (RMS).

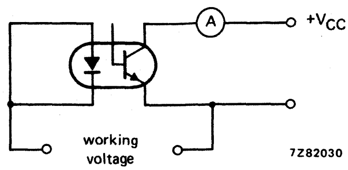


Fig.2 Test circuit.

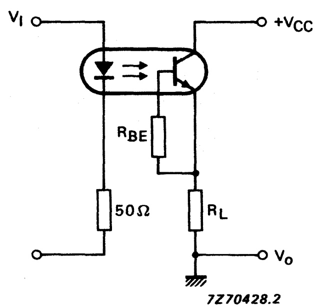


Fig.3 Switching circuit.

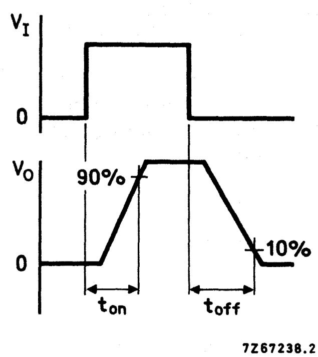


Fig.4 Waveforms.

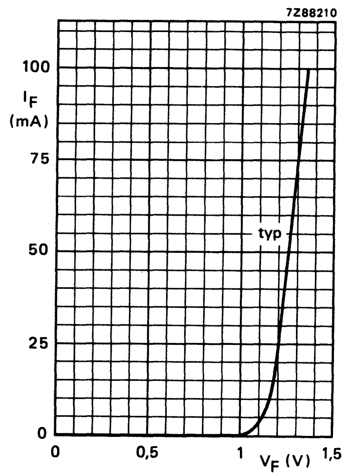


Fig. 5 Typical forward current as a function of forward voltage; T_{amb} = 25 °C.

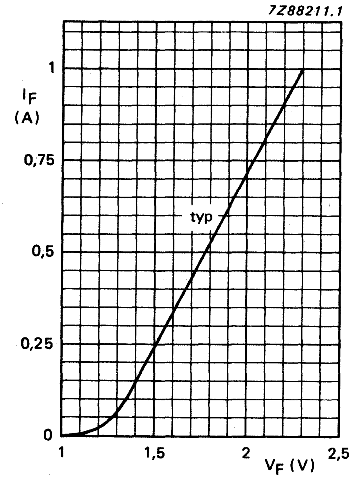


Fig. 6 Typical forward current as a function of forward voltage; T_{amb} = 25 °C; t_p = 20 μs; δ = 0.01.

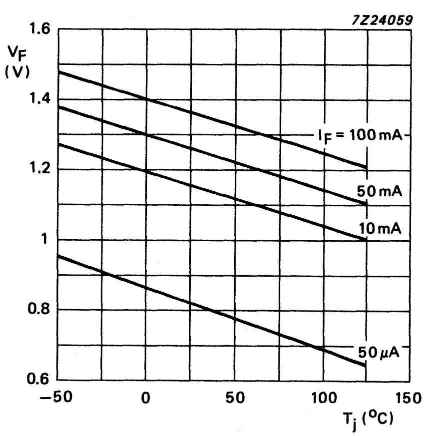


Fig. 7 Typical forward voltage as a function of junction temperature.

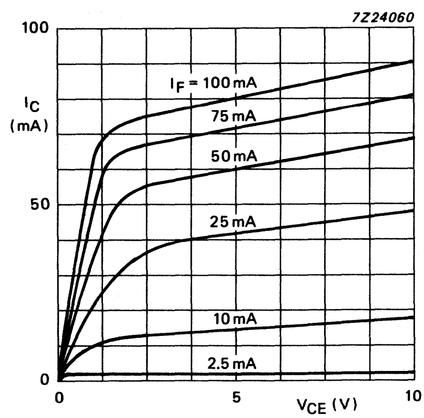


Fig. 8 Typical collector current as a function of collector-emitter voltage; T_{amb} = 25 °C.

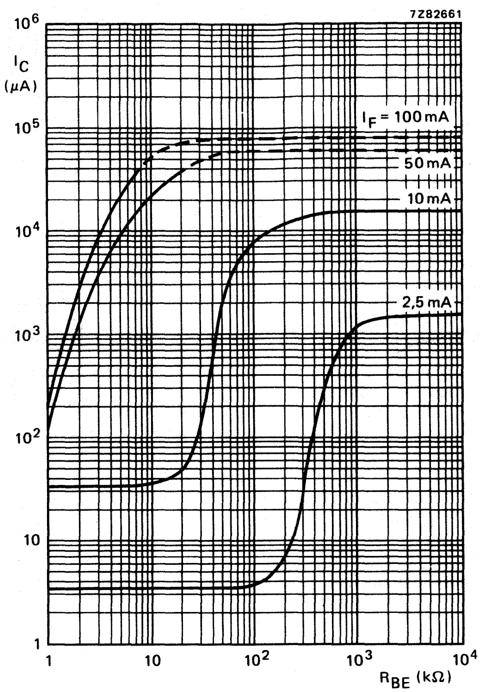
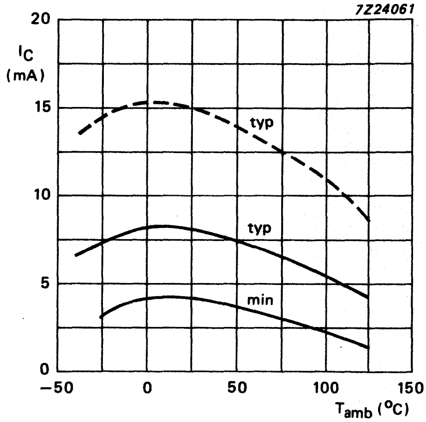


Fig. 9 Collector current as a function of base-emitter resistance; $I_B = 0$; $V_{CE} = 5$ V; $T_{amb} = 25$ °C; typical values.



—— I_F = 10 mA; V_{CE} = 0.4 V
– – – I_F = 10 mA; V_{CE} = 5 V

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

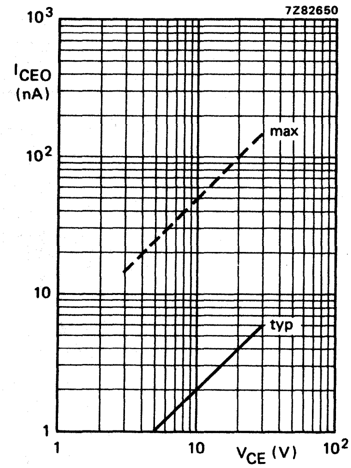


Fig. 11 Collector-emitter dark current as a function of collector-emitter voltage; T_{amb} = 25 °C.

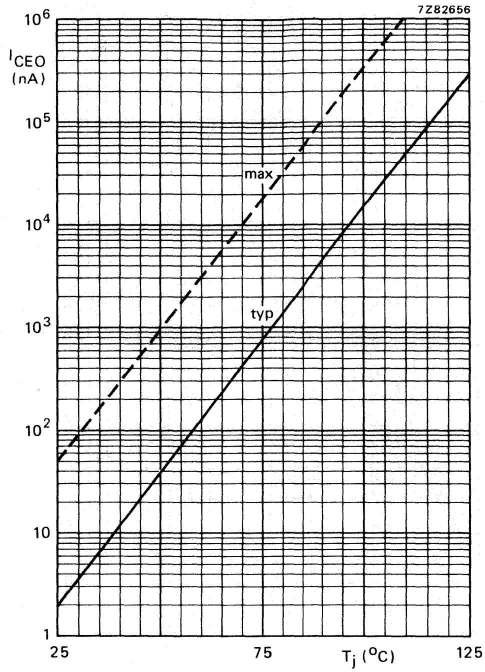


Fig. 12 Collector-emitter dark current as a function of junction temperature.

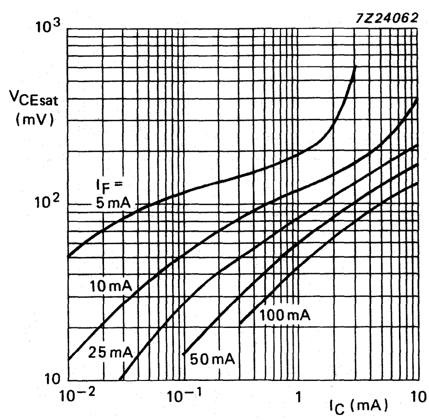


Fig. 13 Typical collector-emitter saturation voltage as a function of collector current; T_{amb} = 25 °C.

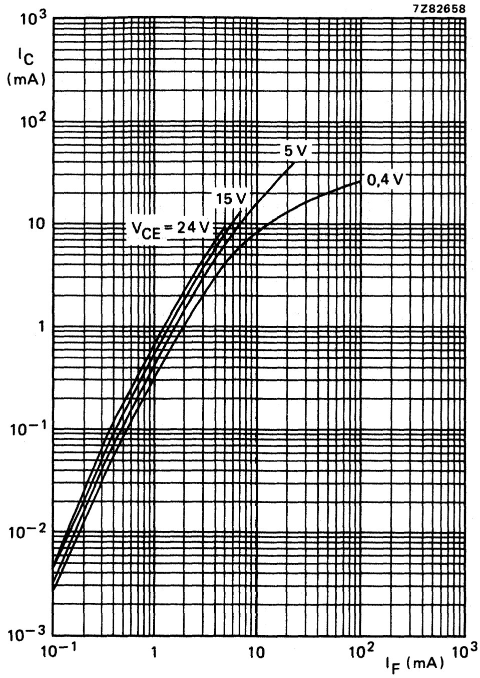


Fig. 14 Typical collector current as a function of forward current; T_{amb} = 25 °C.

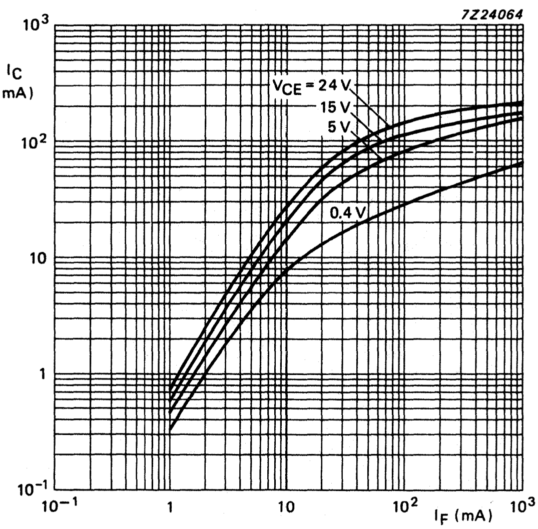
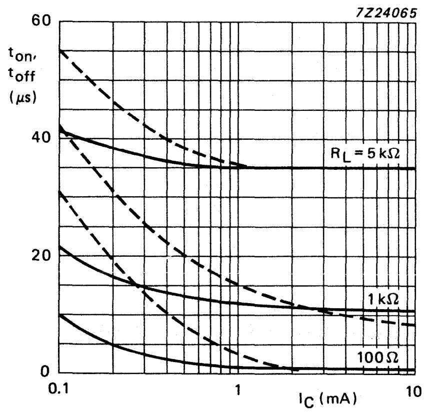


Fig. 15 Typical collector current as a function of forward current; T_{amb} = 25 °C; t_p = 10 μs; δ = 0.01.



——— = t_{off}; – – – = t_{on}

Fig. 16 Typical turn-on and turn-off times as a function of collector current; $T_{amb} = 25\ ^oC$.

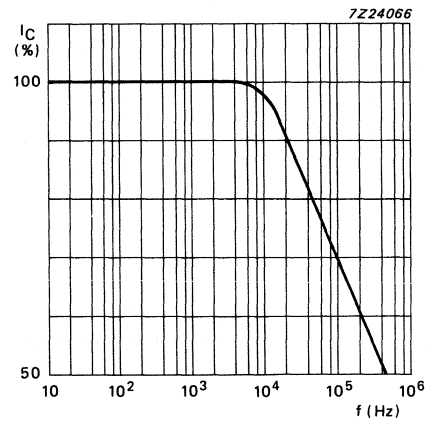


Fig. 17 Relative collector current as a function of frequency; $T_{amb} = 25\ ^oC$; $I_C = 2\ mA$; $V_{CC} = 5\ V$.

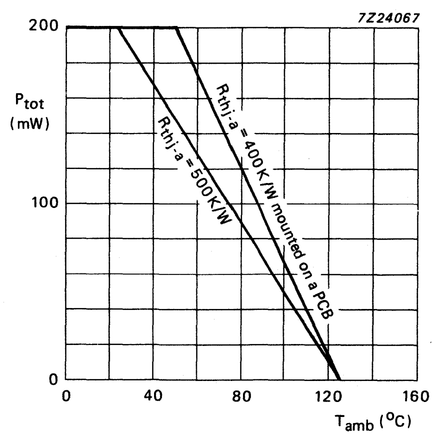


Fig. 18 Total power dissipation as a function of ambient temperature.

HIGH-VOLTAGE OPTOCOUPLER

The CNX82A is a photocoupler consisting of an infrared emitting GaAs diode and a silicon npn photo-transistor, with base unconnected, in a dual-in-line (DIL) plastic envelope SOT231.

Features

- High current transfer ratio and a low saturation voltage 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)

UL — Covered under UL component recognition FILE E90700
VDE — Approved according to 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/VDE 0805 "ENTWURF" NOV. 84
DIN 57804/VDE 0804/1.83 (Isolation group C)
DIN VDE 0860/8.86/HD 195 S4

BSI—Certification according to BS415: 1979 (Home appliances)
NORDIC, SETI, SEMKO, NEMKO — Accepted for applications tested according to
IEC 65 (Electronic household equipments: TV AUDIO VIDEO excluding monitors)
DEMKO General approval IEC 664 (IEC 65 - 335 - 380 - 435 - 950).

QUICK REFERENCE DATA

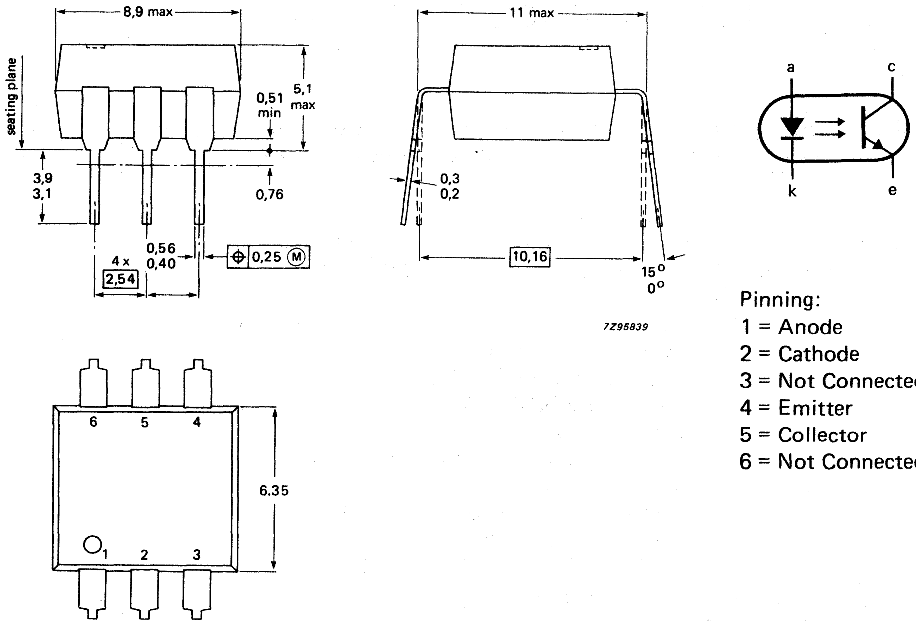
Diode				
DC forward current	I_F	max.	100	mA
Transistor				
Collector-emitter voltage (open base)	V_{CEO}	max.	50	V
Photocoupler				
Output/input DC current transfer ratio (CTR) $I_F = 10$ mA; $V_{CE} = 0.4$ V	I_C/I_F	min.	0.4	
Collector cut-off current (dark) $V_{CC} = 10$ V; working voltage = 2.5 kV DC	I_{CEW}	max.	200	nA
Test isolation voltage DC	V_{IORM}	max.	5.3	kV
Test isolation voltage AC (RMS value)	V_{IORM}	max.	3.75	kV

MECHANICAL DATA

SOT231 (see Fig.1).

MECHANICAL DATA

Dimensions in mm



Pinning:
1 = Anode
2 = Cathode
3 = Not Connected
4 = Emitter
5 = Collector
6 = Not Connected

Fig.1 SOT231.

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_{on} = 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
Transistor			
Collector-emitter voltage (open base)	V_{CEO}	max.	50 V
Emitter-collector voltage	V_{ECO}	max.	7.0 V
DC collector current	I_C	max.	100 mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	200 mW

Photocoupler

Storage temperature	T_{stg}	−55 to + 150	°C
Junction temperature	T_j	max. 125	°C
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 when mounted on printed circuit board (PCB)			
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. 9.6	mm
External tracking path (creepage distance) input terminals to output terminals	L(IO2)	min. 8.0	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. 1.15 max. 1.5	V V
Reverse current V_R = 5 V	I_R	max. 10	μA

Transistor

Collector-emitter breakdown voltage I_C = 1 mA	$V_{(BR)CEO}$	min. 50	V
Emitter-collector breakdown voltage I_E = 0.1 mA	$V_{(BR)ECO}$	min. 7.0	V
Collector cut-off current (dark); diode I_F = 0 V_{CE} = 10 V	I_{CEO}	typ. 2.0 max. 50	nA nA
V_{CE} = 10 V; T_{amb} = 70 °C	I_{CEO}	max. 10	μA

Photocoupler

Output/input DC current transfer ratio I_F = 10 mA; V_{CE} = 0.4 V	I_C/I_F	min. 0.4 typ. 0.8	
I_F = 10 mA; V_{CE} = 5 V	I_C/I_F	typ. 1.5	

CHARACTERISTICS (continued)

Collector cut-off current (light)			
$T_{amb} \leqslant 70\ ^oC$; $V_F = 0.8$ V; $V_{CE} = 15$ V	$I_{CE(L)}$	max.	15 μA
$T_{amb} \leqslant 70\ ^oC$; $I_F = 2$ mA; $V_{CE} = 0.4$ V	$I_{CE(L)}$	min.	150 μA
Collector-emitter saturation voltage			
$I_F = 10$ mA; $I_C = 4$ mA	V_{CEsat}	typ.	0.19 V
		max.	0.40 V
Collector cut-off current (dark) at working voltage $V_W = 2.5$ kV (DC value);			
$V_{CC} = 10$ V; $T_j = 25\ ^oC$ (see notes 1 and 2)	I_{CEW}	max.	200 nA
$V_{CC} = 10$ V; $T_j = 70\ ^oC$ (see notes 1 and 2)		max.	100 μA
Test isolation voltage DC	V_{IORM}	max.	5.3 kV
t = 1 min (see note 3) AC (RMS value)		max.	3.75 kV
Capacitance between input and output			
V = 0; f = 1 MHz	C_{io}	typ.	0.4 pF
Insulation resistance between input and output			
$V_{IO} = \pm\ 1000$ V	R_{IO}	min.	10 GΩ
		typ.	1 TΩ
Switching times (see Figs 3 and 4)			
Turn-on time			
$I_C = 2$ mA; $V_{CC} = 5$ V; $R_L = 100\ \Omega$	t_{on}	typ.	3.0 μs
$I_C = 2$ mA; $V_{CC} = 5$ V; $R_L = 1\ k\Omega$		typ.	12 μs
Turn-off time			
$I_C = 2$ mA; $V_{CC} = 5$ V; $R_L = 100\ \Omega$	t_{off}	typ.	3.0 μs
$I_C = 2$ mA; $V_{CC} = 5$ V; $R_L = 1\ k\Omega$		typ.	12 μs

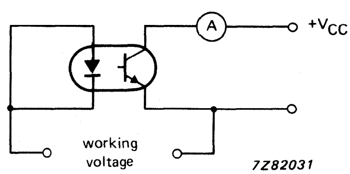


Fig. 2 Test circuit.

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 single product is tested by applying an isolation test voltage of 4500 V (RMS) for 2 seconds between the shorted input (diode) leads and the shorted output (phototransistor) leads.

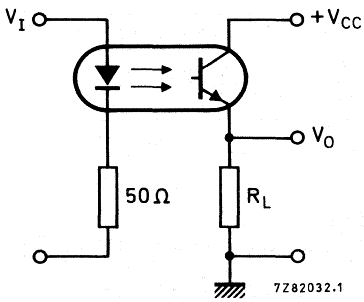


Fig. 3 Switching circuit.

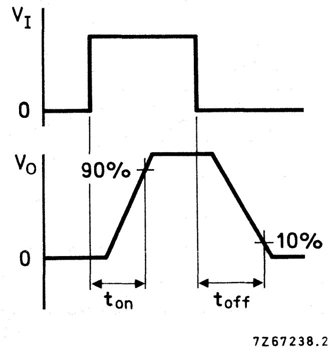


Fig. 4 Waveforms.

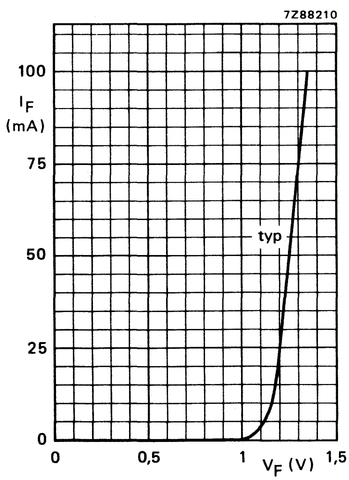


Fig. 5 Typical forward current as a function of forward voltage; $T_{amb} = 25\ ^{o}C$.

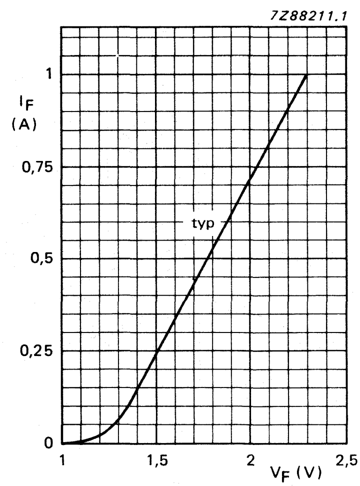


Fig. 6 Typical forward current as a function of forward voltage; $T_{amb} = 25\ ^{o}C$; $t_p = 20\ \mu s$; $\delta = 0.01$.

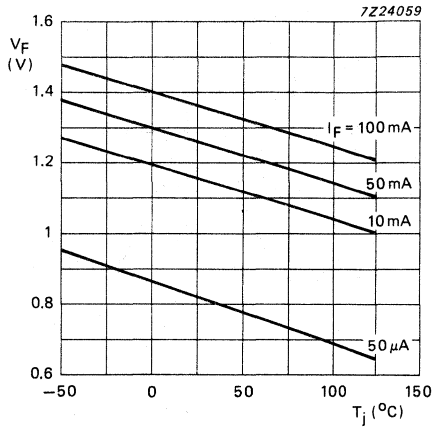


Fig. 7 Typical forward voltage as a function of junction temperature.

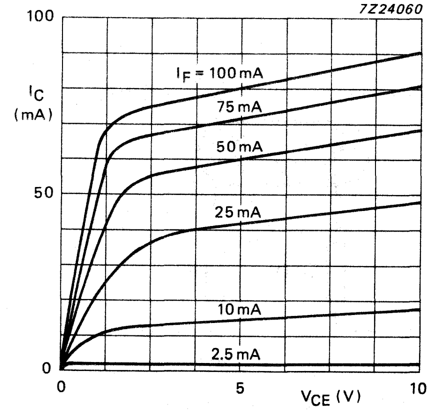
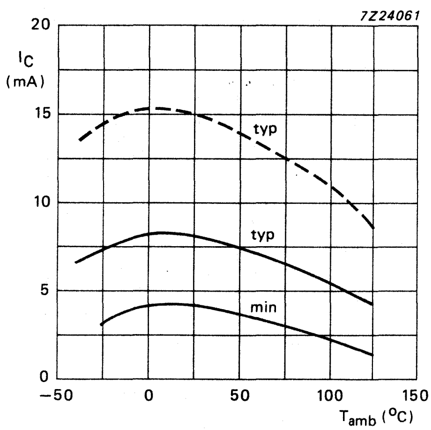


Fig. 8 Typical collector current as a function of collector-emitter voltage; T_{amb} = 25 °C.



——— = I_F = 10 mA, V_{CE} = 0.4 V
– – – – = I_F = 10 mA; V_{CE} = 5.0 V

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

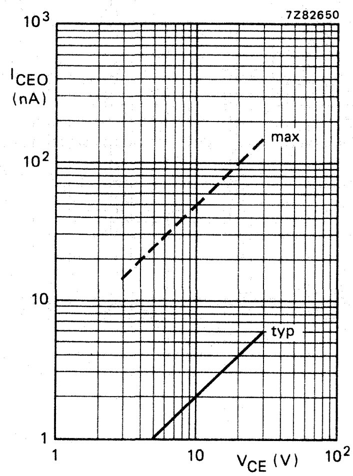


Fig. 10 Collector-emitter dark current as a function of collector-emitter voltage; T_{amb} = 25 °C.

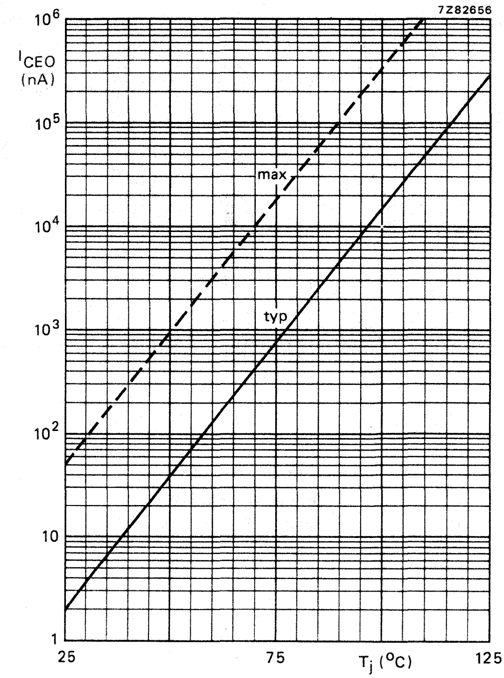


Fig. 11 Collector-emitter dark current as a function of junction temperature.

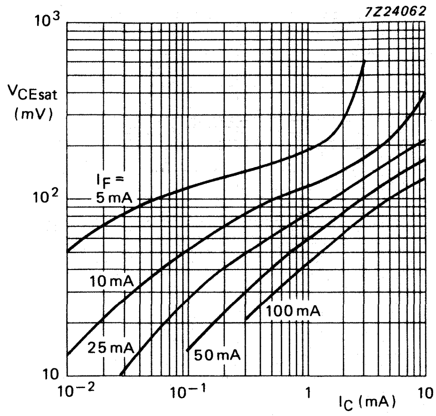


Fig. 12 Typical collector-emitter saturation voltage as a function of collector current; T_{amb} = 25 °C.

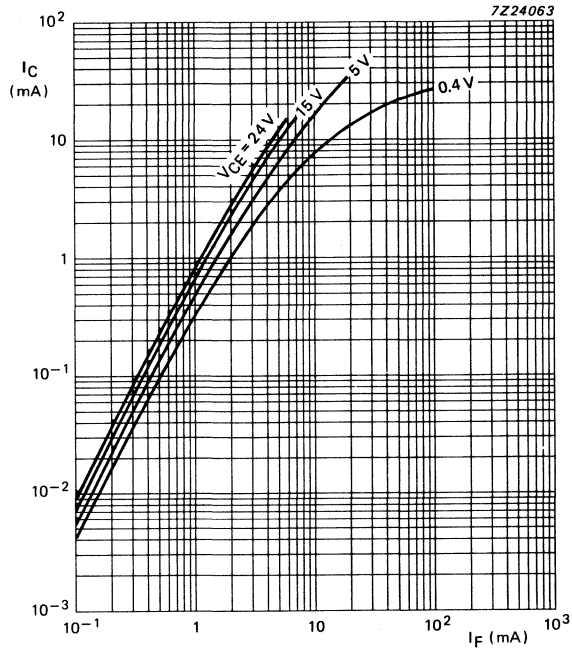


Fig. 13 Typical collector current as a function of forward current; T_{amb} = 25 °C.

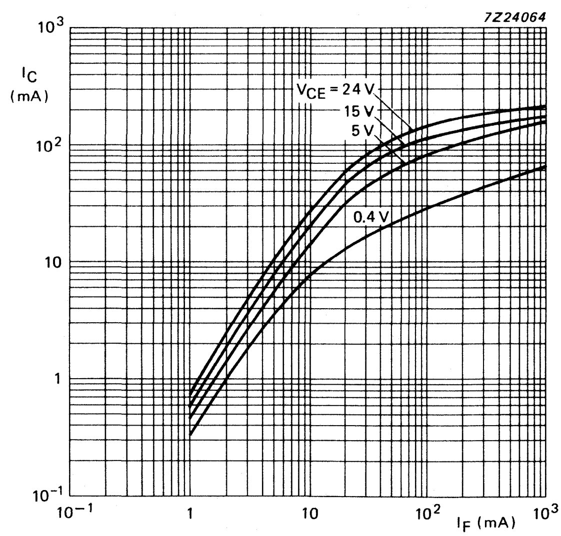
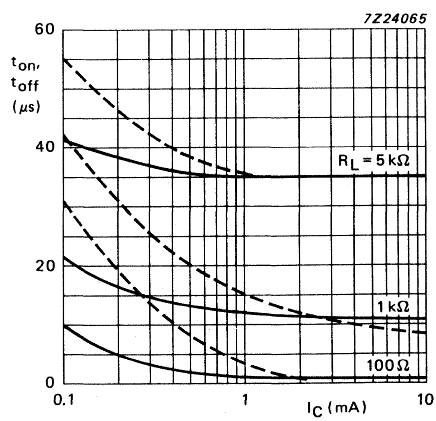


Fig. 14 Typical collector current as a function of forward current; T_{amb} = 25 °C; t_p = 10 µs; δ = 0.01.



——— = t_{off}
– – – – = t_{on}

Fig. 15 Typical turn-on and turn-off times as a function of collector current; T_{amb} = 25 °C.

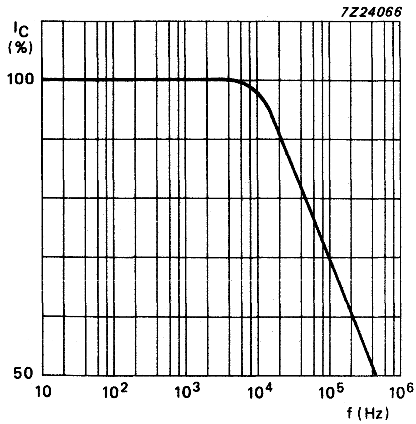


Fig. 16 Relative collector current as a function of frequency; T_{amb} = 25 °C; I_C = 2 mA; V_{CC} = 5 V.

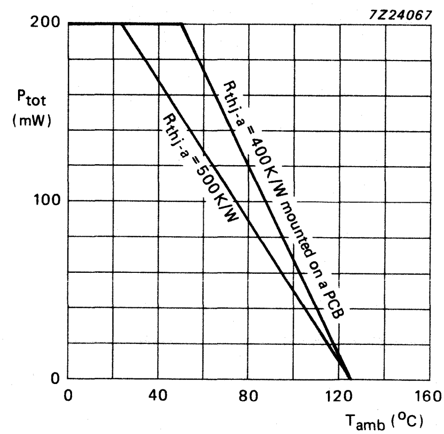


Fig. 17 Total power dissipation as a function of ambient temperature.

HIGH-VOLTAGE OPTOCOUPLER

The CNX83A is a photocoupler consisting of an infrared emitting GaAs diode and a silicon npn phototransistor, in an dual-in-line (DIL) plastic envelope SOT231.

Features

- High current transfer ratio and a low saturation voltage 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)

UL — Covered under UL component recognition FILE E90700
VDE — Approved according to 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/VDE 0805 "ENTWURF" NOV. 84
DIN 57804/VDE 0804/1.83 (Isolation group C)
DIN VDE 0860/8.86/HD 195 S4

BSI—Certification according to BS415: 1979 (Home appliances)
NORDIC, SETI, SEMKO, NEMKO — Accepted for applications tested according to IEC 65 (Electronic household equipments: TV AUDIO VIDEO excluding monitors)
DEMKO General approval IEC 664 (IEC 65 - 335 - 380 - 950).

QUICK REFERENCE DATA

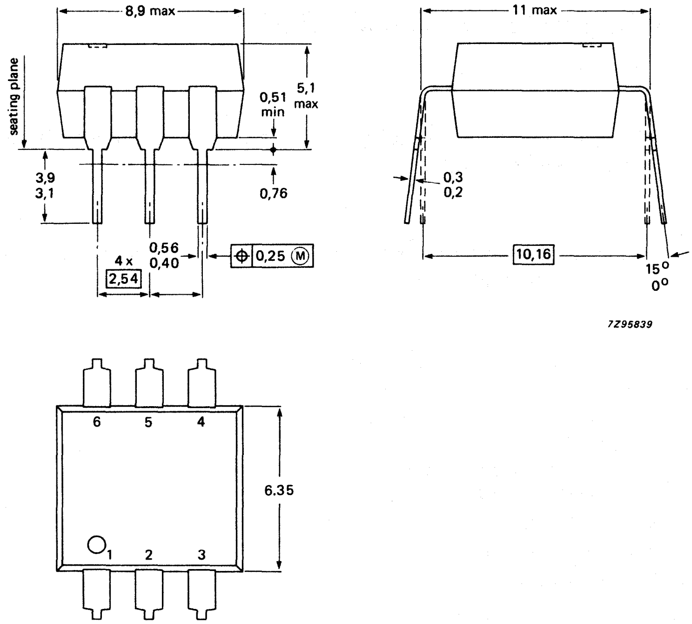
Diode			
DC forward current	I_F	max.	100 mA
Transistor			
Collector-emitter voltage (open base)	V_{CEO}	max.	50 V
Photocoupler			
Output/input DC current transfer ratio I_F = 10 mA; V_{CE} = 0.4 V	I_C/I_F	min.	0.4
Collector cut-off current (dark) V_{CC} = 10 V; working voltage = 2.5 kV DC	I_{CEW}	max.	200 nA
Test isolation voltage DC	V_{IORM}	max.	5.3 kV
AC (RMS value)		max.	3.75 kV

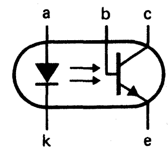
MECHANICAL DATA

SOT231 (see Fig.1).

MECHANICAL DATA

Dimensions in mm





Pinning:
1 = Anode
2 = Cathode
3 = Not Connected
4 = Emitter
5 = Collector
6 = Base

Fig.1 SOT231.

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_{on} = 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
Transistor			
Collector-emitter voltage (open base)	V_{CEO}	max.	50 V
Emitter-collector voltage	V_{ECO}	max.	7.0 V
Collector-base voltage	V_{CBO}	max.	70 V
DC collector current	I_C	max.	100 mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	200 mW

Photocoupler

Storage temperature range	T_{stg}	−55 to + 150	°C
Junction temperature	T_j	max. 125	°C
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 when mounted on printed circuit board (PCB)			
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.	9.6 mm
External tracking path (creepage distance) input terminals to output terminals	L(IO2)	min.	8.0 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. max.	1.15 V 1.5 V
Reverse current $V_R = 5$ V	I_R	max.	10 μA

Transistor

Collector-emitter breakdown voltage $I_C = 1$ mA	$V_{(BR)CEO}$	min.	50 V
Emitter-collector breakdown voltage $I_E = 0.1$ mA	$V_{(BR)ECO}$	min.	7.0 V
Collector-base breakdown voltage $I_C = 0.1$ mA	$V_{(BR)CBO}$	min.	70 V
Collector cut-off current (dark); diode $I_F = 0$ $V_{CE} = 10$ V	I_{CEO}	typ. max.	2.0 nA 50 nA
$V_{CE} = 10$ V; $T_{amb} = 70$ °C	I_{CEO}	max.	10 μA
$V_{CB} = 10$ V	I_{CBO}	max.	20 nA

CHARACTERISTICS (continued)

Photocoupler

Output/input DC current transfer ratio (CTR)			
I_F = 10 mA; V_{CE} = 0.4 V	I_C/I_F	min. typ.	0.4 0.8
I_F = 10 mA; V_{CE} = 5 V	I_C/I_F	typ.	1.5
Collector cut-off current (light)			
$T_{amb} \leqslant 70\ ^{o}C$; V_F = 0,8 V; V_{CE} = 15 V	$I_{CE(L)}$	max.	15 μA
$T_{amb} \leqslant 70\ ^{o}C$; I_F = 2 mA; V_{CE} = 0.4 V	$I_{CE(L)}$	min	150 μA
Collector-emitter saturation voltage			
I_F = 10 mA; I_C = 4 mA	V_{CEsat}	typ. max.	0.19 V 0.40 V
Collector cut-off current (dark) at working voltage V_W = 2.5 kV (DC value);			
V_{CC} = 10 V; T_j = 25 ^{o}C (see notes 1 and 2)	I_{CEW}	max.	200 nA
V_{CC} = 10 V; T_j = 70 ^{o}C (see notes 1 and 2)	I_{CEW}	max.	100 μA
Output capacitance			
V_{CB} = 10 V; f = 1 MHz	C_{bc}	max.	5.5 pF
Test isolation voltage DC	V_{IORM}	max.	5.3 kV
t = 1 min (see note 3) AC (RMS value)	V_{IORM}	max.	3.75 kV
Capacitance between input and output			
V = 0; f = 1 MHz	C_{io}	typ.	0.4 pF
Insulation resistance between input and output			
V_{IO} = ± 1000 V	R_{IO}	min. typ.	10 GΩ 1 TΩ
Switching times (see Figs 3 and 4)			
Turn-on time			
I_C = 2 mA; V_{CC} = 5 V; R_L = 100 Ω	t_{on}	typ.	3.0 μs
I_C = 2 mA; V_{CC} = 5 V; R_L = 1 kΩ	t_{on}	typ.	12 μs
Turn-off time			
I_C = 2 mA; V_{CC} = 5 V; R_L = 100 Ω	t_{off}	typ.	3.0 μs
I_C = 2 mA; V_{CC} = 5 V; R_L = 1 kΩ	t_{off}	typ.	12 μs

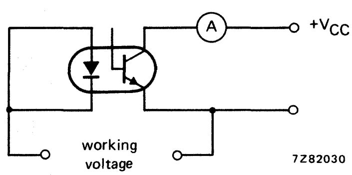


Fig. 2 Test circuit.

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 single product is tested by applying an isolation test voltage of 4500 V (RMS) for 2 seconds between the shorted input (diode) leads and the shorted output (phototransistor) leads.

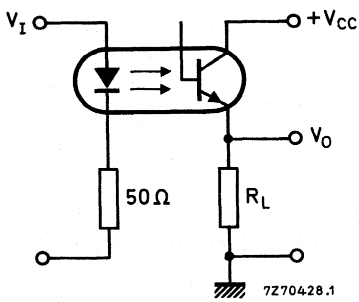


Fig. 3 Switching circuit.

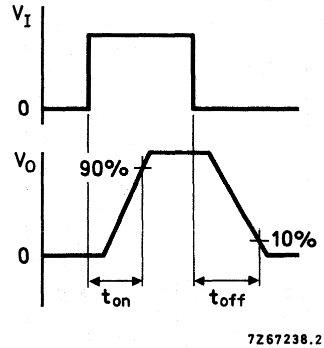


Fig. 4 Waveforms.

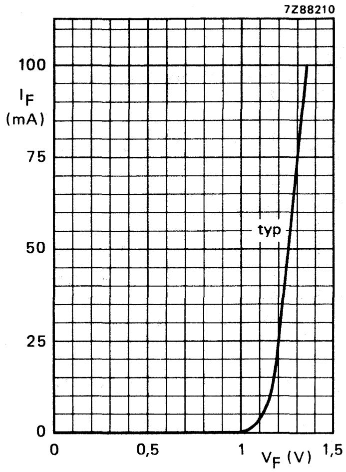


Fig. 5 Typical forward current as a function of forward voltage; T_{amb} = 25 °C.

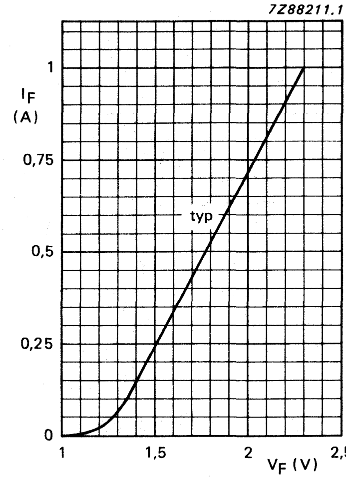


Fig. 6 Typical forward current as a function of forward voltage; T_{amb} = 25 °C; t_p = 20 μs; δ = 0.01.

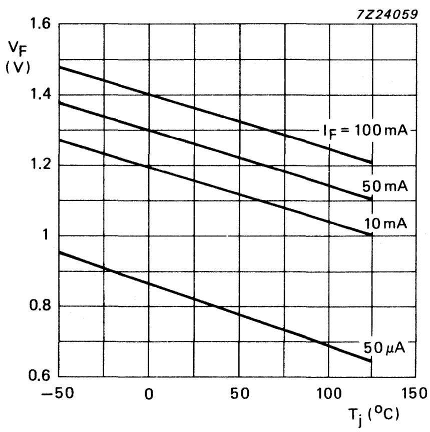


Fig. 7 Typical forward voltage as a function of junction temperature.

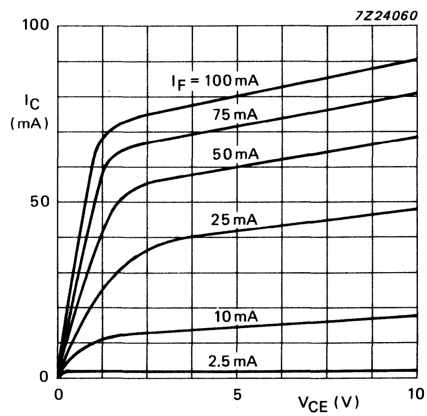


Fig. 8 Typical collector current as a function of collector-emitter voltage; T_{amb} = 25 °C.

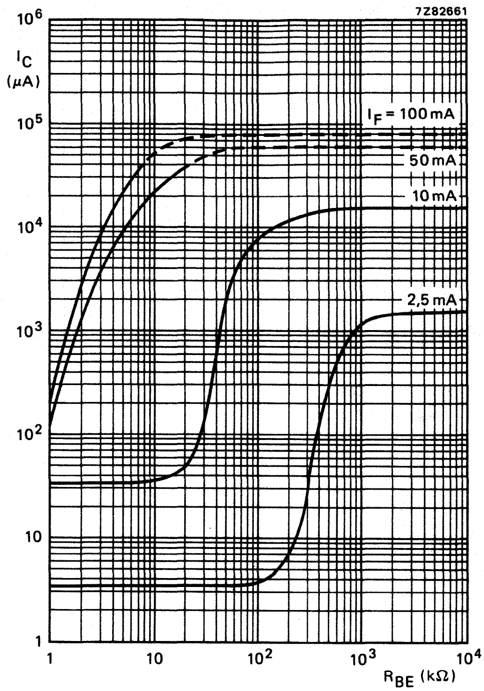
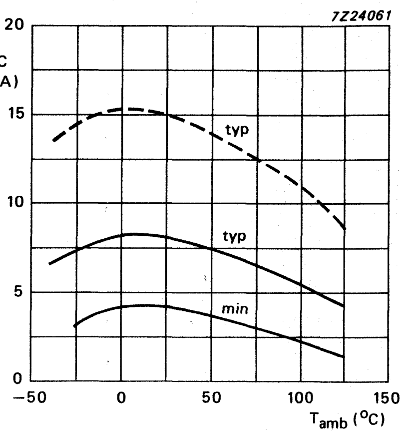


Fig. 9 Collector current as a function of base-emitter resistance;
$I_B = 0$; $V_{CE} = 5$ V; $T_{amb} = 25$ °C; typical values.



——— I_F = 10 mA; V_{CE} = 0.4 V
– – – – I_F = 10 mA; V_{CE} = 5 V

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

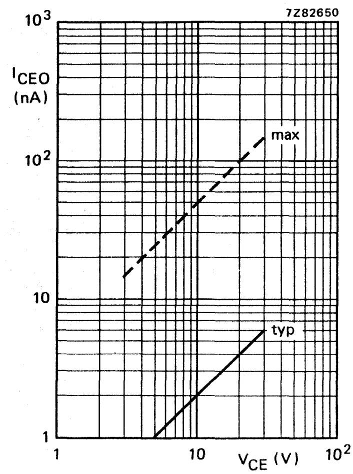


Fig. 11 Collector-emitter dark current as a function of collector-emitter voltage; T_{amb} = 25 °C.

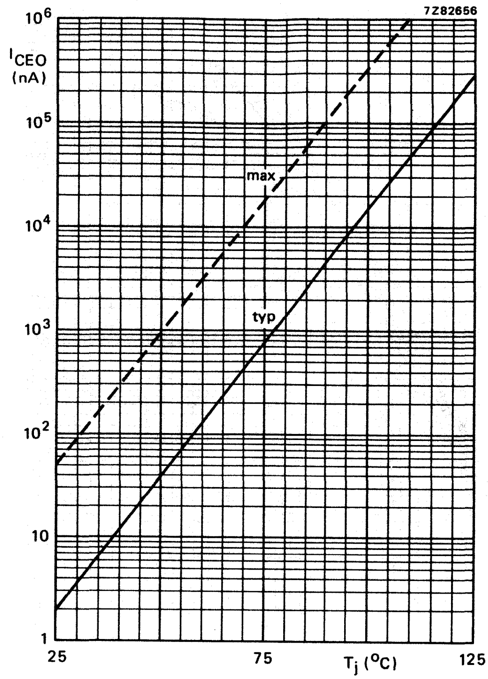


Fig. 12 Collector-emitter dark current as a function of junction temperature.

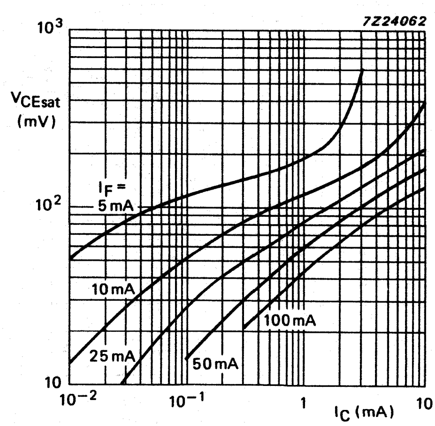


Fig. 13 Typical collector-emitter saturation voltage as a function of collector current; T_{amb} = 25 °C.

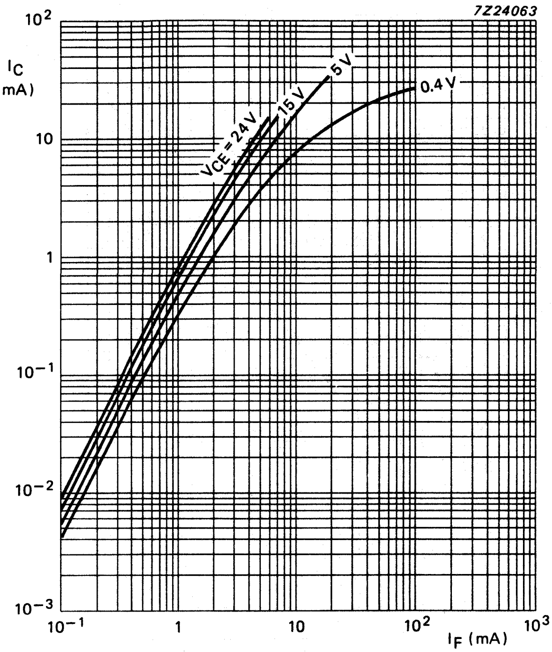


Fig. 14 Typical collector current as a function of forward current; T_{amb} = 25 °C.

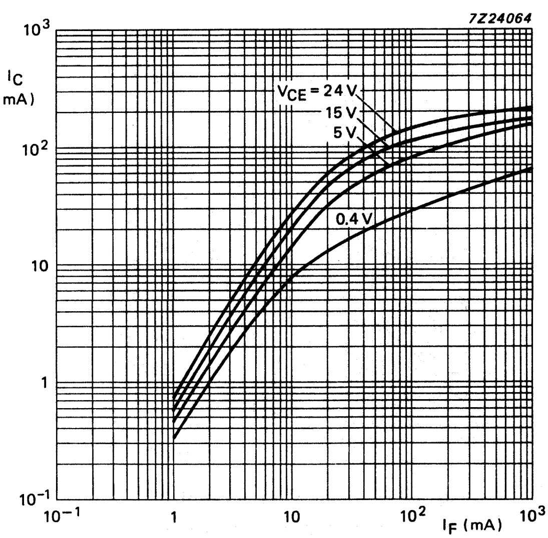
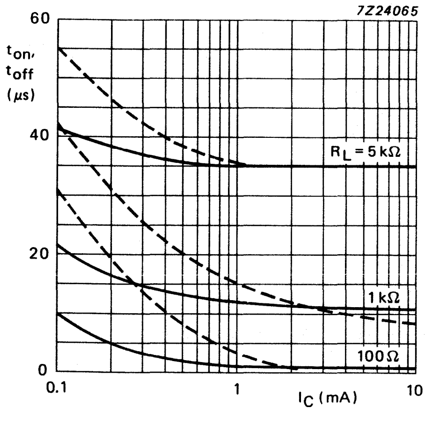


Fig. 15 Typical collector current as a function of forward current; T_{amb} = 25 °C; t_p = 10 μs; δ = 0.01.



——— = t_{off}; – – – – = t_{on}

Fig. 16 Typical turn-on and turn-off times as a function of collector current; T_{amb} = 25 °C.

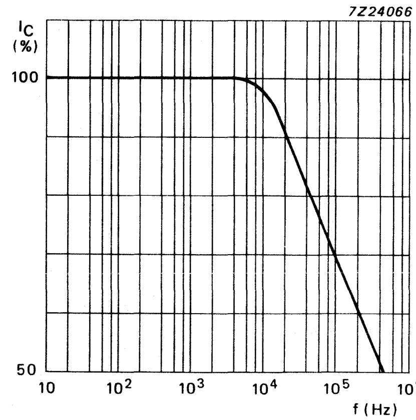


Fig. 17 Relative collector current as a function of frequency; T_{amb} = 25 °C; I_C = 2 mA; V_{CC} = 5 V.

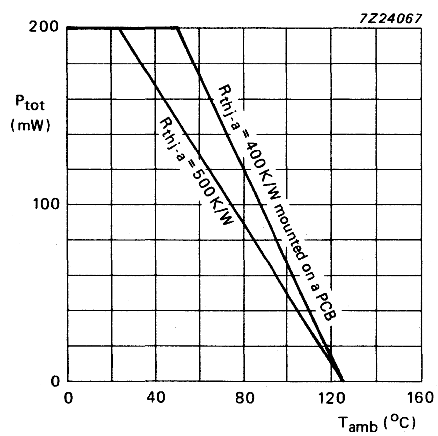


Fig. 18 Total power dissipation as a function of ambient temperature.

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

- Fast switching
- Low saturation voltage
- High output/input DC current transfer ratio
- High isolation voltage of 3.12 kV RMS and 4.4 kV DC
- High maximum output voltage

UL — Covered under UL component recognition FILE E90700

VDE — Approved according to VDE 0883/6.83
Reference voltage (VDE 0110b Tab. 4): 380 V AC/450 V DC (isolation group C)
Complied for reinforced isolation at 250 V AC with:
DIN57804/VDE 0804/1.83
DIN/VDE 0860/8.86/HD195 S4

QUICK REFERENCE DATA

Diode				
Continuous reverse voltage		V_R	max.	6 V
DC forward current		I_F	max.	90 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.	150 mW
Transistor				
Collector-emitter voltage (open base)		V_{CEO}	max.	70 V
Total power dissipation up to T_{amb} = 25 °C		P_{tot}	max.	150 mW
Optocoupler				
DC current transfer ratio (CTR) I_F = 10 mA; V_{CE} = 5 V	CNY17-1	I_C/I_F	min. / max.	0.40 / 0.80
	CNY17-2	I_C/I_F	min. / max.	0.63 / 1.25
	CNY17-3	I_C/I_F	min. / max.	1.0 / 2.0
	CNY17-4	I_C/I_F	min. / max.	1.6 / 3.2
Switching times I_C = 2 mA; V_{CC} = 10 V; R_L = 100 Ω		t_{on}, t_{off}	max.	10 μs
Isolation voltage DC		V_{IORM}	min.	4.4 kV
Isolation voltage AC (RMS value)		V_{IORM}	min.	3.12 kV

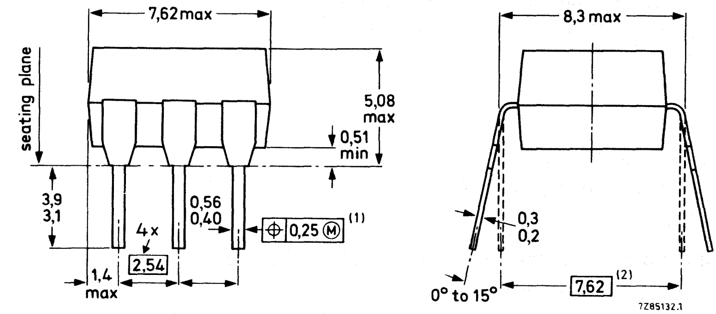
MECHANICAL DATA

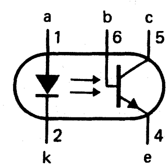
SOT90B (see Fig.1).

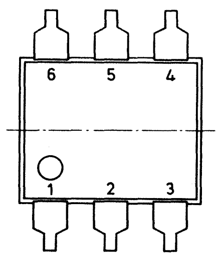
MECHANICAL DATA

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 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.	90	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.	150	mW
Transistor				
Collector-emitter voltage (open base)	V_{CEO}	max.	70	V
Collector-base voltage (open emitter)	V_{CBO}	max.	70	V
Emitter-base voltage (open collector)	V_{EBO}	max.	7	V
DC collector current	I_C	max.	150	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 junction temperature range	T_j		−55 to + 125 °C
Soldering temperature up to the seating plane; $t_{sld} < 10$ s	T_{sld}	max.	260 °C

LINEAR DERATING FACTOR

Above 25 °C			
diode			2.0 mW/K
transistor			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 $I_F = 10$ 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 $I_C = 10$ mA	$V_{(BR)CEO}$	min.	70 V
Collector-base breakdown voltage $I_C = 0.1$ mA	$V_{(BR)CBO}$	min.	70 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.	2.0 nA
		max.	50 nA

Optocoupler

DC current transfer ratio (CTR) I_F = 10 mA; V_{CE} = 5 V	CNY17-1	I_C/I_F	min. 0.40 max. 0.80	
	CNY17-2	I_C/I_F	min. 0.63 max. 1.25	
	CNY17-3	I_C/I_F	min. 1.0 max. 2.0	
→	CNY17-4	I_C/I_F	min. 1.6 max. 3.2	
Collector-emitter saturation voltage I_F = 10 mA; I_C = 2.5 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 (note 1) DC		V_{IORM}	min. 4.4	kV
t = 1 min AC (RMS value)			min. 3.12	kV
Capacitance between input and output V_O = 0; f = 1 MHz		C_{io}	max. 2.0 typ. 0.6	pF pF
Insulation resistance between input and output ± V_{IO} = 500 V		R_{IO}	min. 100 typ. 10	GΩ TΩ
Switching times (see Figs 2 and 3) I_C = 2 mA; V_{CC} = 10 V; R_L = 100 Ω Turn-on time		t_{on}	typ. 5 max. 10	μs μs
Turn-off time		t_{off}	typ. 5 max. 10	μs μs

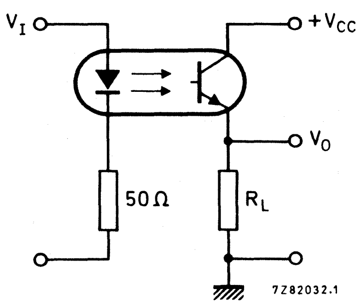


Fig.2 Switching circuit.

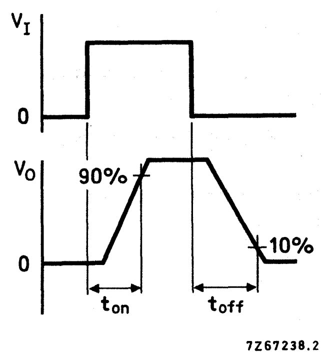


Fig.3 Waveforms.

Note

1. 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.

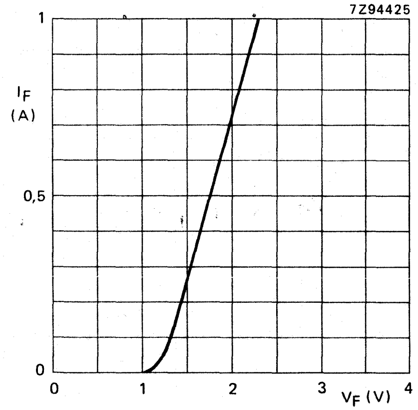


Fig. 4 T_{amb} = 25 °C; t_{on} = 20 μs; δ = 0,01; typical values.

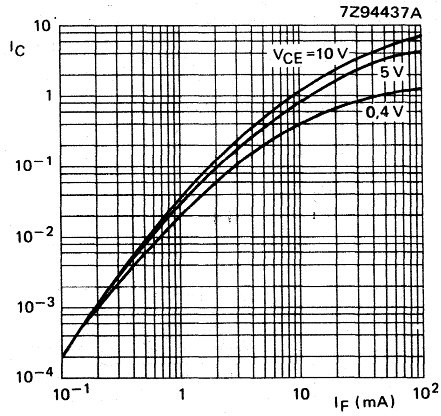


Fig. 5 Normalized to I_F = 10 mA; V_{CE} = 10 V; typical values.

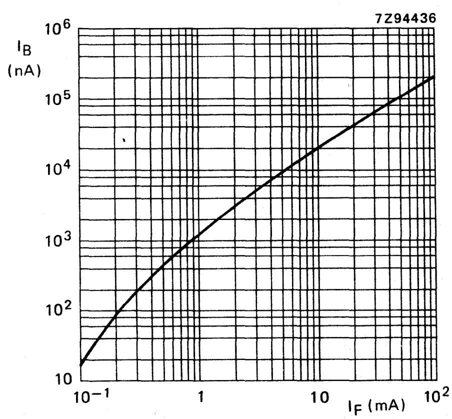


Fig. 6 V_{CB} = 10 V; T_{amb} = 25 °C; typical values.

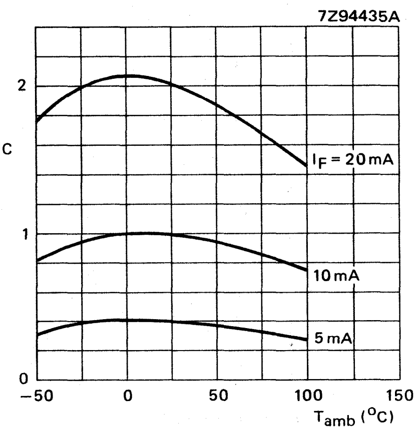


Fig. 7 Normalized to I_F = 10 mA; V_{CE} = 10 V; typical values.

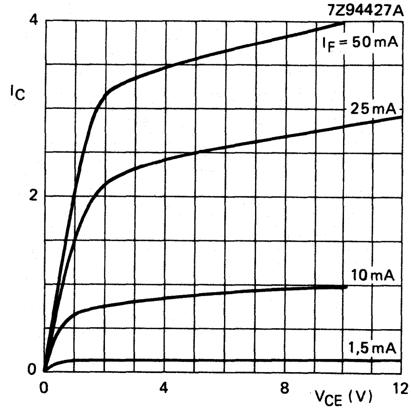


Fig. 8 Normalized to I_F = 10 mA; V_{CE} = 10 V; typical values.

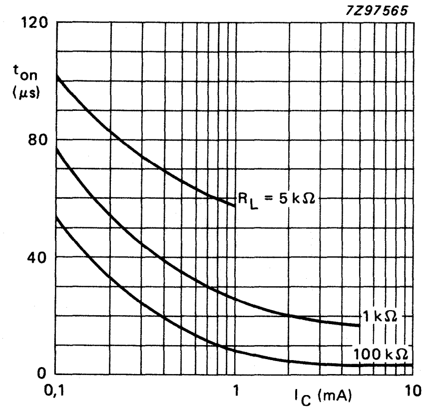


Fig. 9 V_{CC} = 10 V; T_{amb} = 25 °C; typical values.

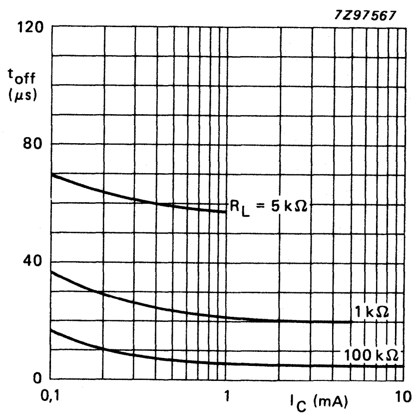


Fig. 10 V_{CC} = 10 V; T_{amb} = 25 °C; typical values.

OPTOCOUPLERS

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.

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_{IORM}	min.	2	kV
AC (RMS value)			min.	2.82	kV

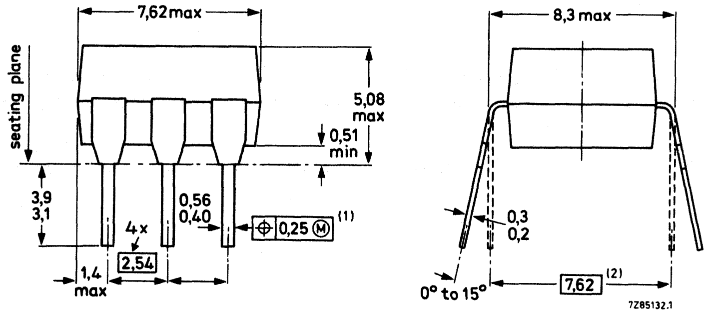
MECHANICAL DATA

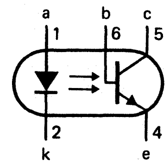
SOT90B (see Fig.1).

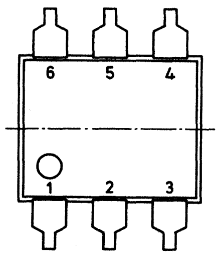
MECHANICAL DATA

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 junction temperature range	T_j		−55 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_{IORM}	min.	2 kV
AC (RMS value)			min.	2.82 kV
Capacitance between input and output V = 0; f = 1 MHz		C_{io}	max.	2 pF
			typ.	0.6 pF
Insulation resistance between input and output V_{IO} = 500 V		R_{IO}	min.	100 GΩ
			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

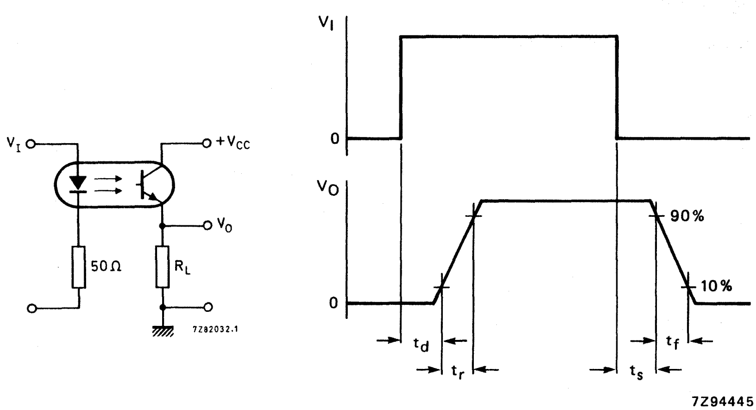


Fig.2 Measuring circuit and waveforms.

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.

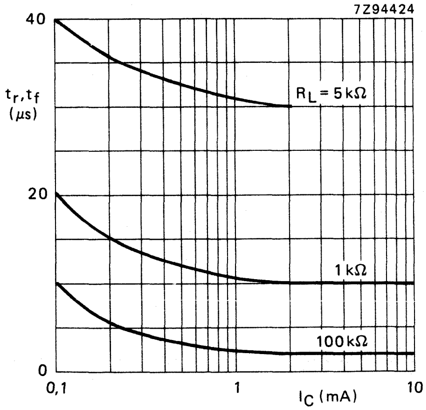


Fig. 3 V_{CC} = 10 V; T_{amb} = 25 °C; typical values.

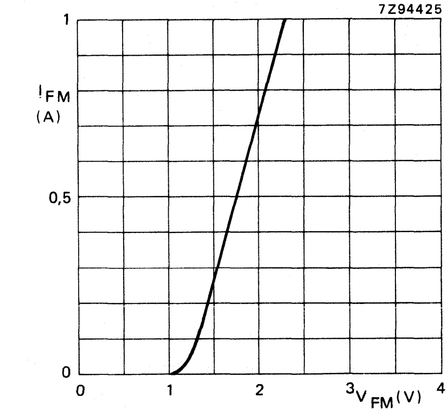


Fig. 4 T_{amb} = 25 °C; t_{on} = 20 μs; δ = 0,01; typical values.

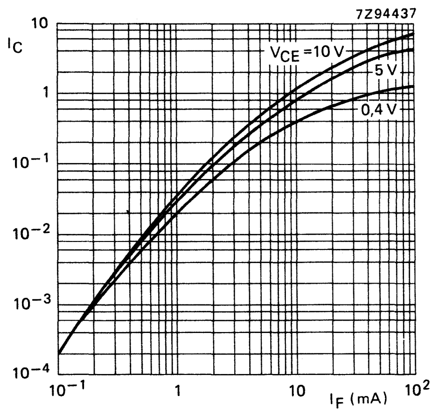


Fig. 5 Normalized to I_F = 10 mA; V_{CE} = 10 V; typical values.

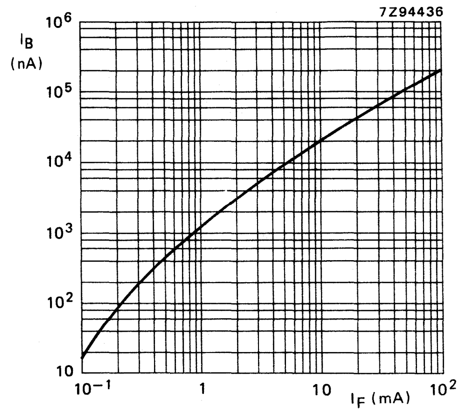


Fig. 6 V_{CB} = 10 V; T_{amb} = 25 °C; typical values.

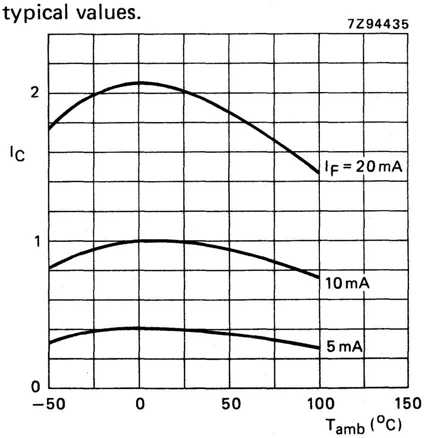


Fig. 7 Normalized at I_F = 10 mA; V_{CE} = 10V; typical values.

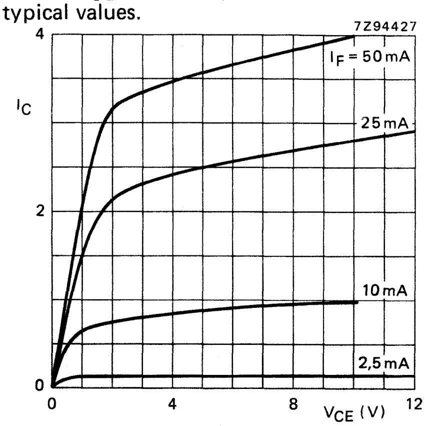


Fig. 8 Normalized at 10 mA; V_{CE} = 10 V; T_{amb} = 25 °C; typical values.

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 ^oC		P_{tot}	max.	100	mW
Transistor					
Collector-emitter voltage (open base)		V_{CEO}	max.	25	V
Total power dissipation up to T_{amb} = 25 ^oC		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_{IORM}	min.	2.82	kV
Isolation voltage AC (RMS value)			min.	2.0	kV

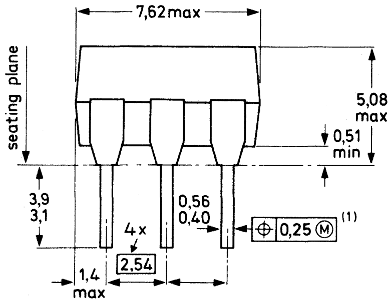
MECHANICAL DATA

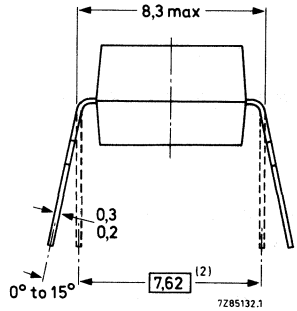
SOT90B (see Fig.1).

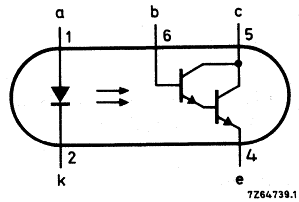
MECHANICAL DATA

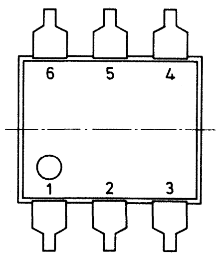
Dimensions in mm

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 junction temperature	T_j		−55 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		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. max.	20 nA 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	V_{IORM}	min.	2,82	kV
(see note)	AC (RMS value)		min.	2,0	kV
Capacitance between input and output					
V_O = 0; f = 1 MHz		C_{io}	max.	2,0	pF
			typ.	0,6	pF
Insulation resistance between input and output					
± V_{IO} = 500 V		r_{IO}	min.	100	GΩ
			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

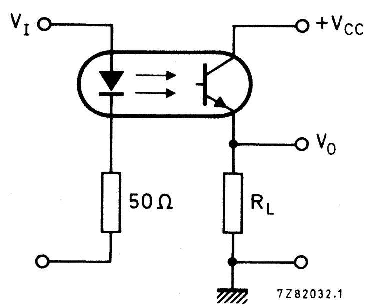


Fig. 2 Switching circuit.

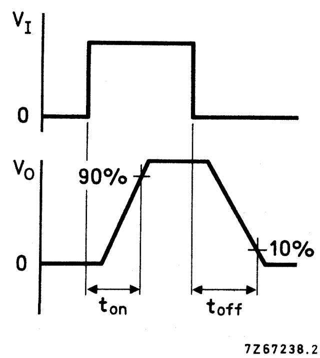


Fig. 3 Waveforms.

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.

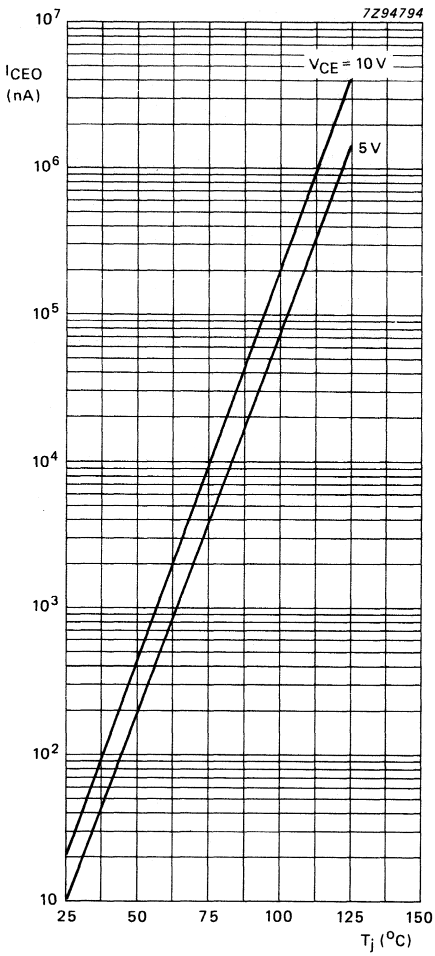


Fig. 4 Typical values.

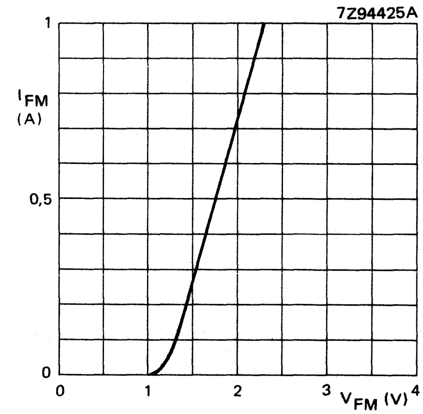


Fig. 5 T_{amb} = 25 °C; t_{on} = 20 μs; δ = 0,01; typical values.

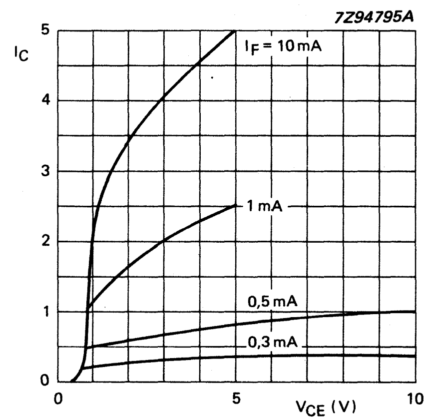


Fig. 6 Normalized to I_F = 0,5 mA; V_{CE} = 10 V; typical values.

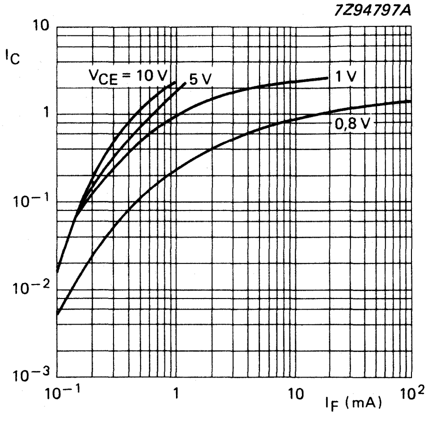


Fig. 7 Normalized to I_F = 0,5 mA; V_{CE} = 10 V; T_{amb} = 25 °C; typical values.

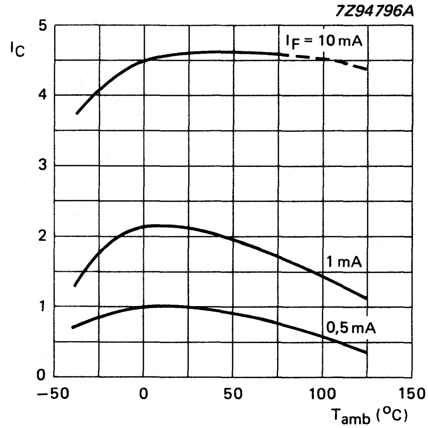


Fig. 8 Normalized to I_F = 0,5 mA; V_{CE} = 10 V; T_{amb} = 25 °C; typical values.

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_{IORM}	min.	2,82	kV
AC (RMS value)		min.	2,0	kV

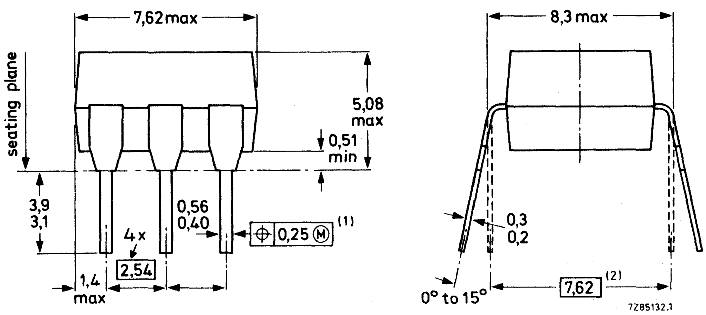
MECHANICAL DATA

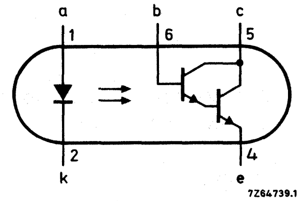
SOT 90B (see Fig. 1).

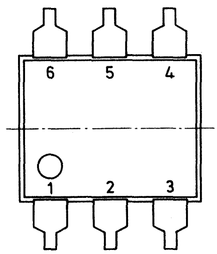
MECHANICAL DATA

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 °C	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 °C	P_{tot}	max.	210 mW

Optocoupler

Storage temperature	T_{stg}		−55 to + 150 °C
Operating junction temperature	T_j		−55 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_{IORM}	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.	2,0 pF
		typ.	0,6 pF
Insulation resistance between input and output ± V_{IO} = 500 V	r_{IO}	min.	100 GΩ
		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

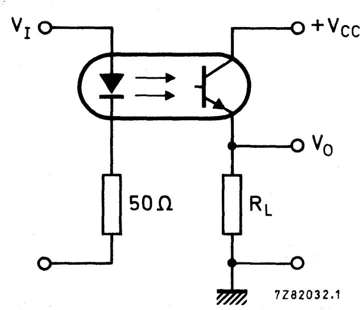


Fig. 2 Switching circuit.

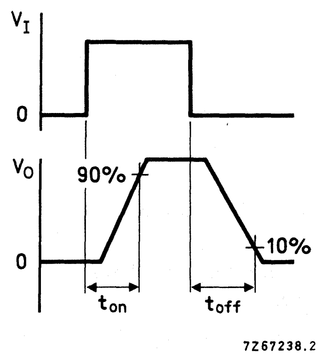


Fig. 3 Waveforms.

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.

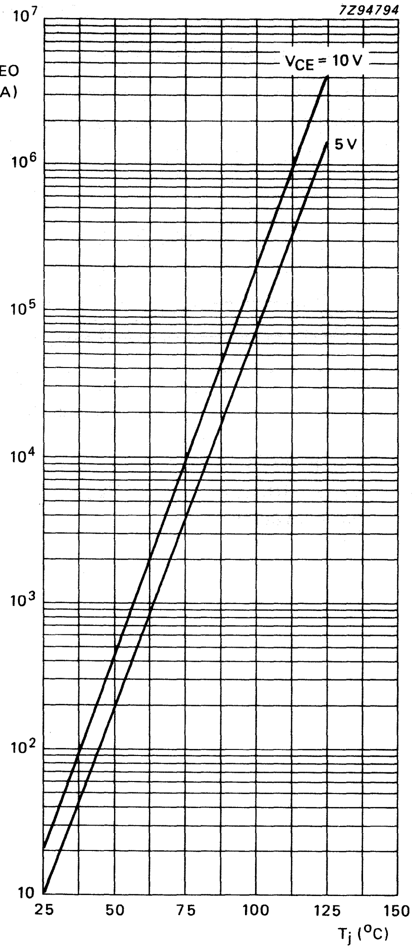


Fig. 4 Typical values.

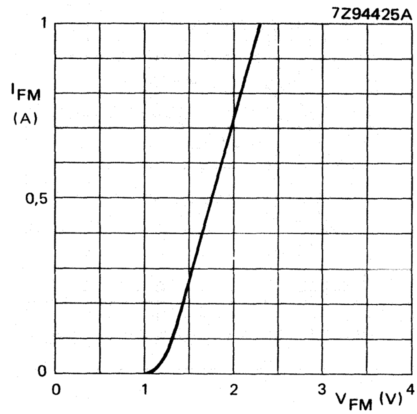


Fig. 5 T_{amb} = 25 °C; t_{on} = 20 μs; δ = 0,01; typical values.

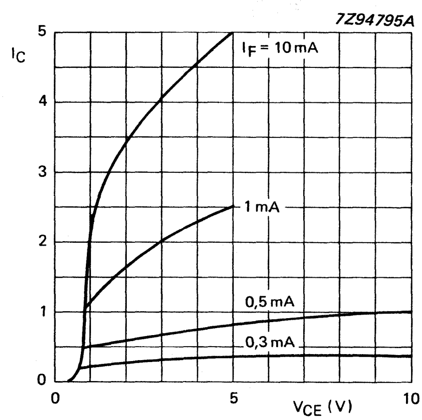


Fig. 6 Normalized to I_F = 0,5 mA; V_{CE} = 10 V; typical values.

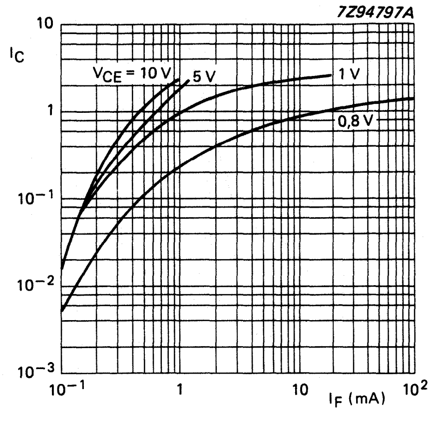


Fig. 7 Normalized to I_F = 0,5 mA; V_{CE} = 10 V; T_{amb} = 25 °C; typical values.

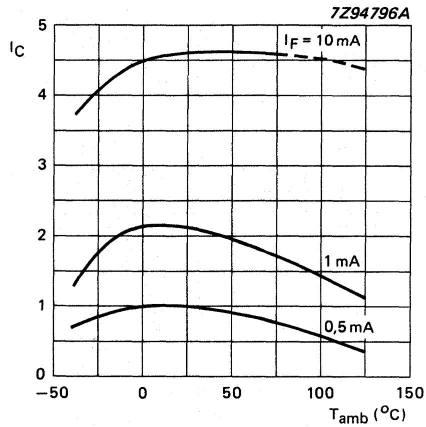


Fig. 8 Normalized to I_F = 0,5 mA; V_{CE} = 10 V; T_{amb} = 25 °C; typical values.

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_{IORM}	min.	4.4	kV
AC (RMS value)			min.	3.12	kV

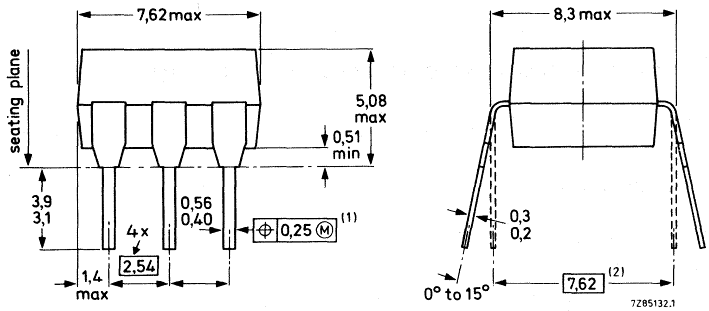
MECHANICAL DATA

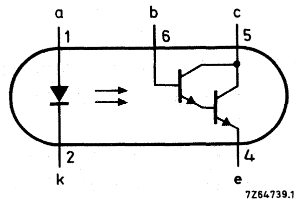
SOT90B (see Fig.1)

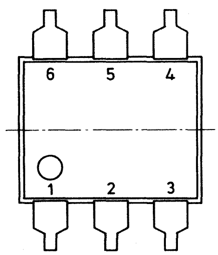
MECHANICAL DATA

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 junction temperature range		T_j		−55 to +125 °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_{IORM}	min.	4.4 kV
	AC (RMS value)	V_{IORM}	min.	3.12 kV
Capacitance between input and output V_O = 0; f = 1 MHz		C_{io}	max.	2.0 pF
		C_{io}	typ.	0.6 pF
Insulation resistance between input and output $\pm V_{IO}$ = 500 V		R_{IO}	min.	100 GΩ
		R_{IO}	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

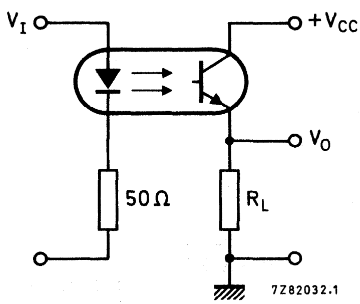


Fig. 2 Switching circuit.

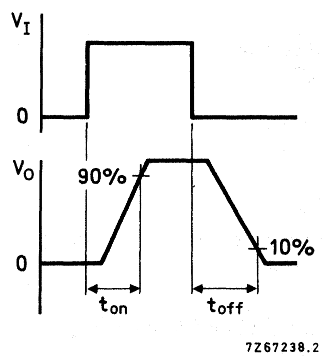


Fig. 3 Waveforms.

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).

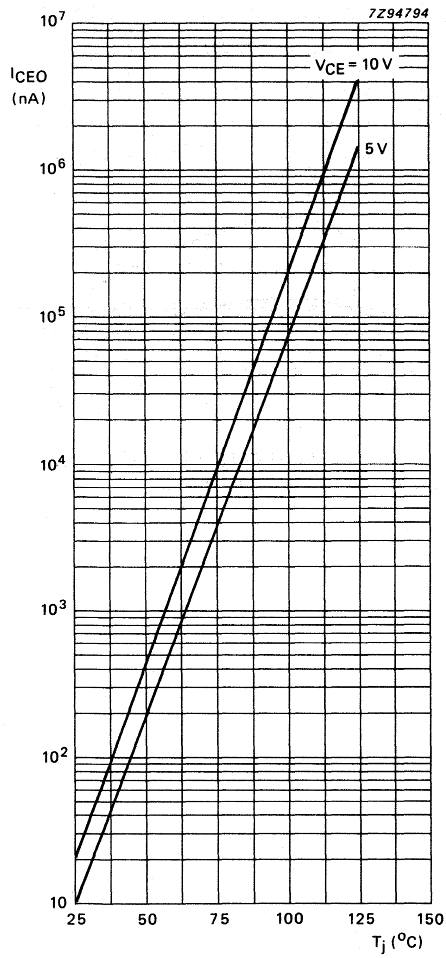


Fig. 4 Typical values.

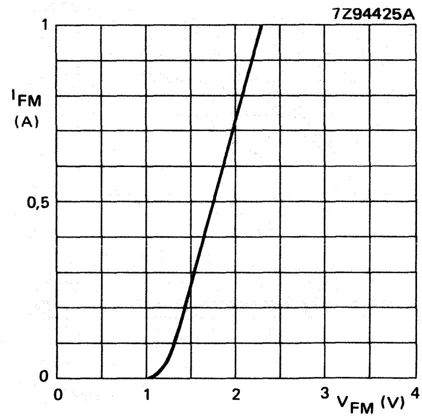


Fig. 5 T_{amb} = 25 °C; t_{on} = 20 μs; δ = 0.01; typical values.

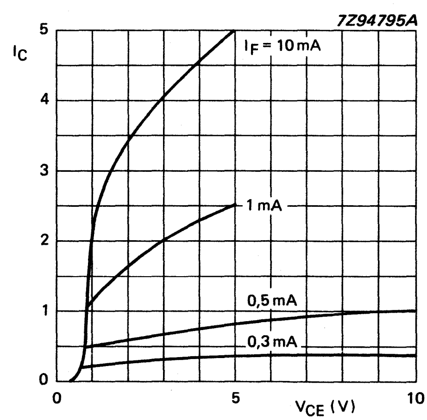


Fig. 6 Normalized to I_F = 0.5 mA; V_{CE} = 10 V; typical values.

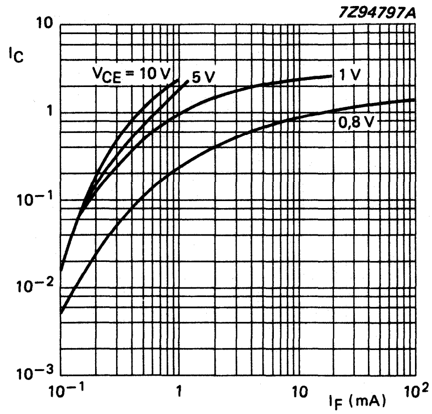


Fig. 7 Normalized to I_F = 0.5 mA; V_{CE} = 10 V; T_{amb} = 25 °C; typical values.

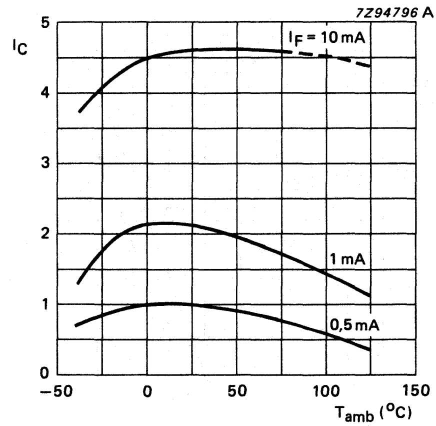


Fig. 8 Normalized to I_F = 0.5 mA; V_{CE} = 10 V; T_{amb} = 25 °C; typical values.

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.

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_{IORM}	min.	4,4	kV
AC (RMS value)			3,12	kV

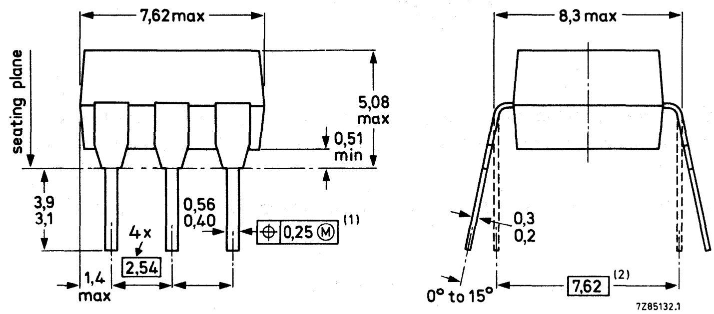
MECHANICAL DATA

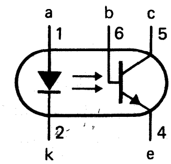
SOT90B (see Fig. 1).

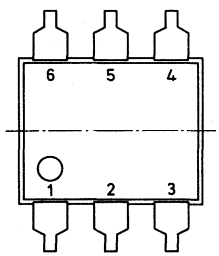
MECHANICAL DATA

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.	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 range	T_j		−55 to + 125 °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.	1,2 V
		max.	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.	2 nA
		max.	50 nA
V_{CB} = 10 V	I_{CBO}	max.	20 nA

DC current gain $I_C = 100\ \mu A$; $V_{CE} = 5\ V$	h_{FE}	typ.	300
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_{IORM}	min.	4,4 kV 3,12 kV
Capacitance between input and output V = 0; f = 1 MHz	C_{io}	typ. max.	0,6 pF 2 pF
Insulation resistance between input and output $V_{IO} = \pm 500\ V$	R_{IO}	min. typ.	100 GΩ 1 TΩ
Turn-on time (saturated) see Fig. 2 (TTL def.) $I_F = 15\ mA$; $V_{CC} = 5\ V$; $R_L = 2\ k\Omega$ $R_{BE} = \infty$	t_{on}	typ.	5 μs
$I_F = 20\ mA$; $V_{CC} = 5\ V$; $R_L = 2\ k\Omega$ $R_{BE} = 100\ k\Omega$	t_{on}	typ.	5 μs
Turn-off time (saturated) see Fig. 2 (TTL def.) $I_F = 15\ mA$; $V_{CC} = 5\ V$; $R_L = 2\ k\Omega$ $R_{BE} = \infty$	t_{off}	typ.	30 μs
$I_F = 20\ mA$; $V_{CC} = 5\ V$; $R_L = 2\ k\Omega$ $R_{BE} = 100\ k\Omega$	t_{off}	typ.	10 μs
Bandwidth $I_C = 2\ mA$; $V_{CE} = 10\ V$; $R_L = 100\ k\Omega$	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.

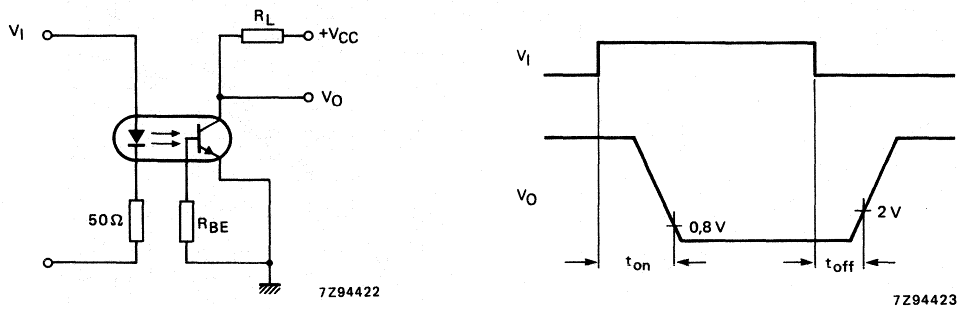


Fig. 2 Measuring circuit and waveforms.

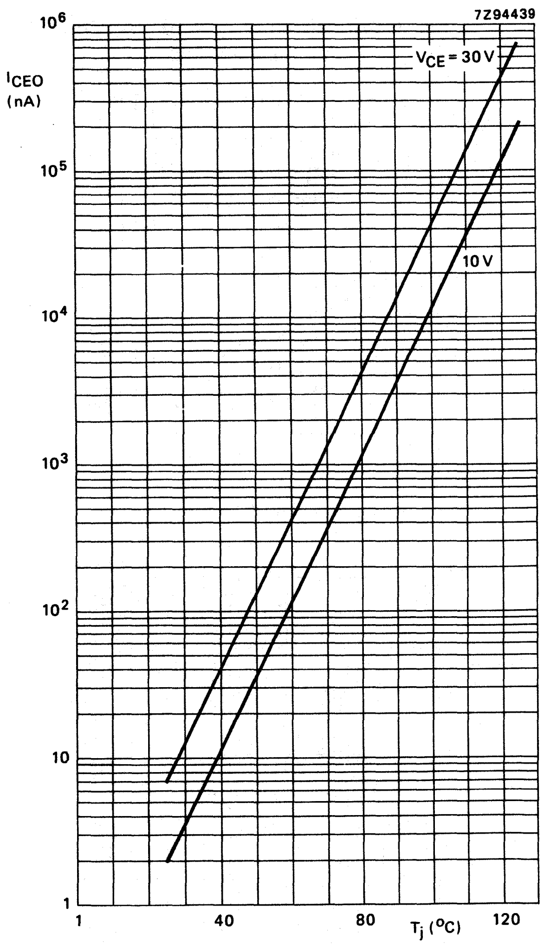


Fig. 3 Typical values.

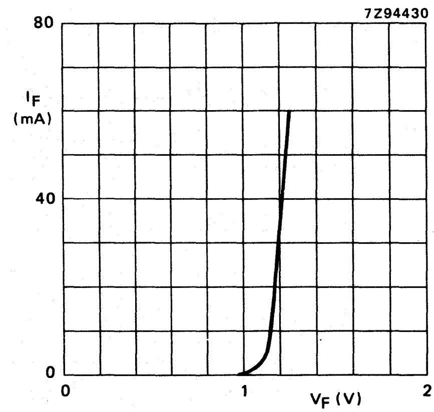


Fig. 4 T_{amb} = 25 °C; typical values.

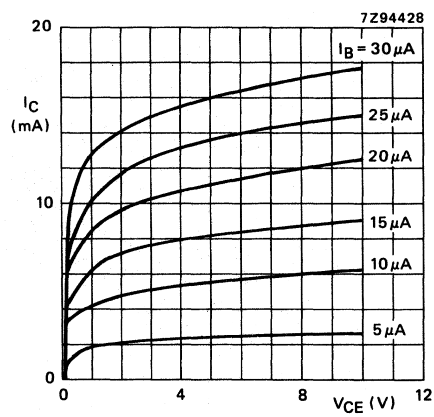


Fig. 5 T_{amb} = 25 °C; typical values.

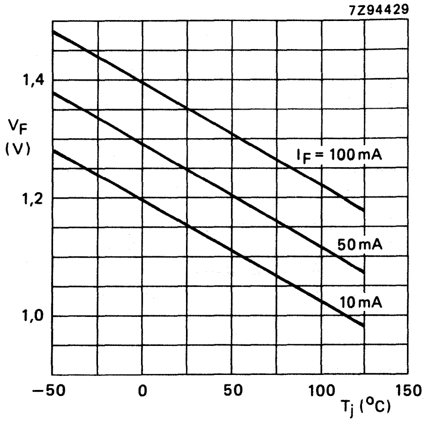


Fig. 6 Typical values.

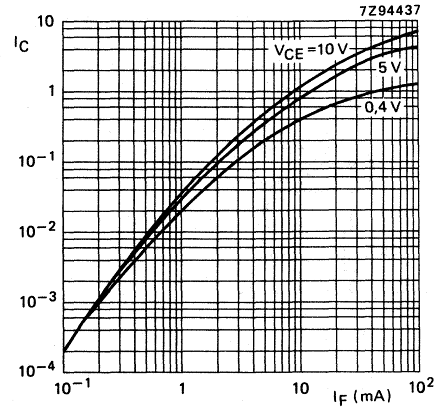


Fig. 7 Normalized to I_F = 10 mA; V_{CE} = 10 V; T_{amb} = 25 °C; typical values.

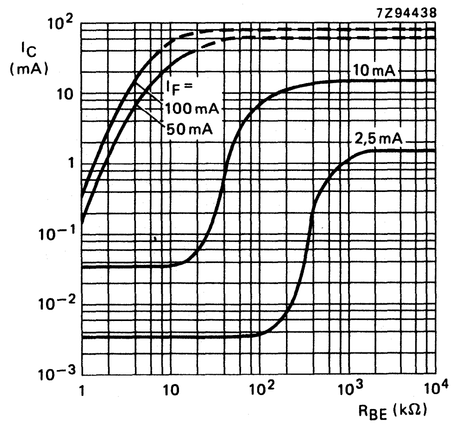


Fig. 8 V_{CE} = 5 V; T_{amb} = 25 °C; typical values.

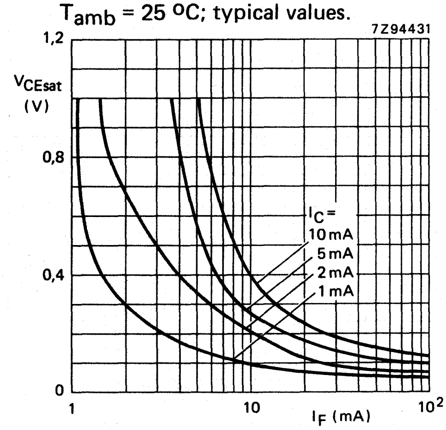


Fig. 9 T_{amb} = 25 °C; typical values.

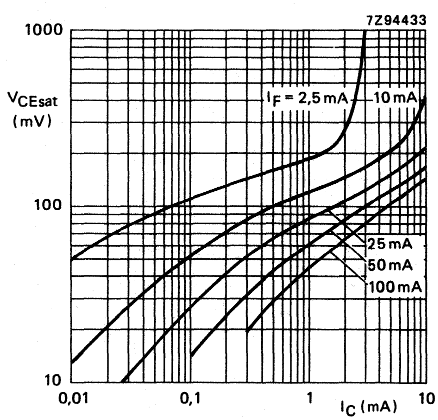


Fig. 10 T_{amb} = 25 °C; typical values.

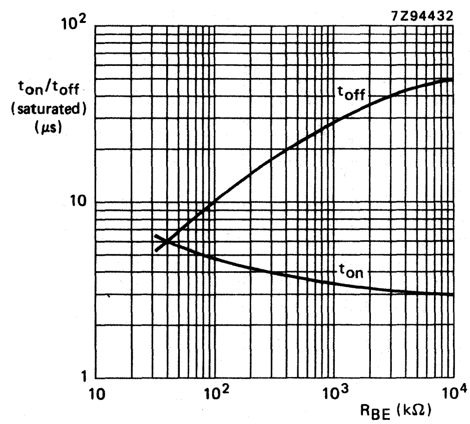


Fig. 11 I_F = 20 mA; R_L = 2 kΩ; T_{amb} = 25 °C; typical values.

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

QUICK REFERENCE DATA

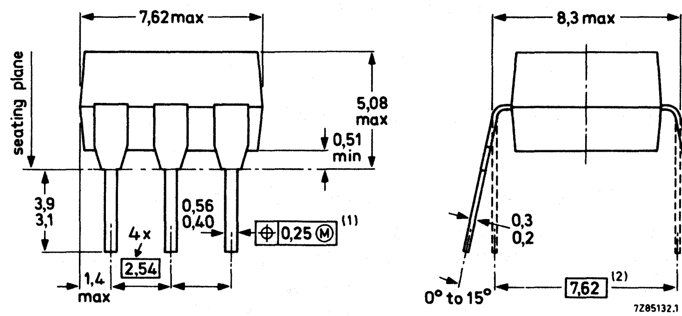
Collector-emitter voltage of phototransistor	V_{CEO}	max.	30	V
DC forward current of infrared emitting diode	I_F	max.	60	mA
Output/input DC current transfer ratio (CTR) I_F = 10 mA; V_{CE} = 10 V	I_C/I_F	min.	0.06	
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	250	mW
Isolation voltage DC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

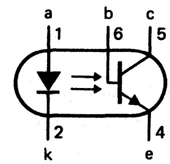
MECHANICAL DATA

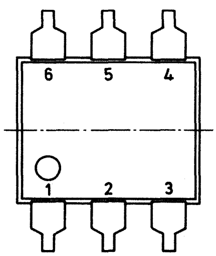
SOT90B (see Fig. 1).

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 junction temperature range	T_j		−55 to +125 °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
DC current gain			
I_C = 100 μA; V_{CE} = 5 V	h_{FE}	typ.	300

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_{IORM}	min.	4.4 kV 3.12 kV
Capacitance between input and output V = 0; f = 1 MHz	C_{io}	typ. max.	0.6 pF 2 pF
Insulation resistance between input and output V_{IO} = 500 V	R_{IO}	min. typ.	100 GΩ 1 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

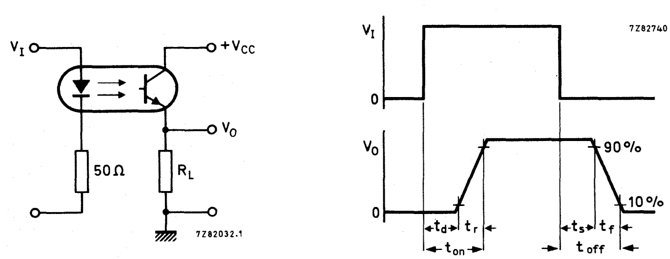


Fig. 2 Measuring circuit and waveforms.

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.

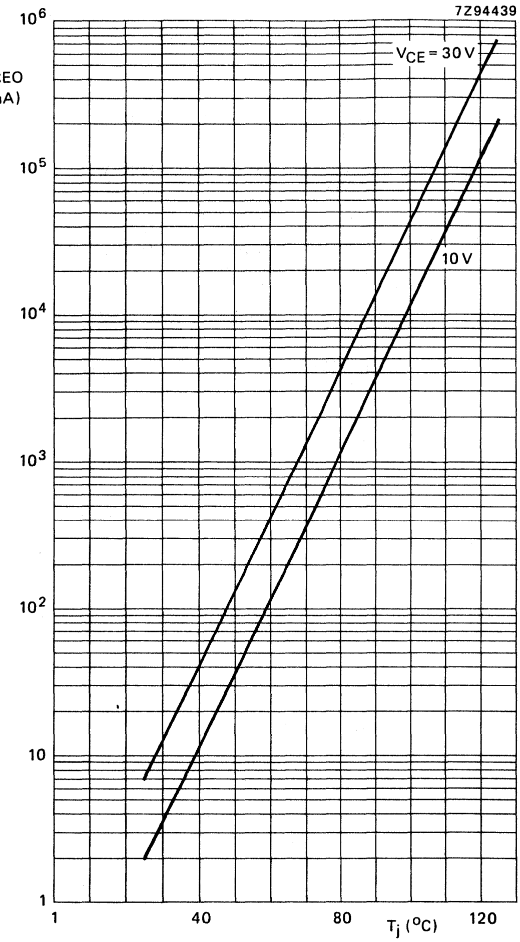


Fig. 3 Typical values.

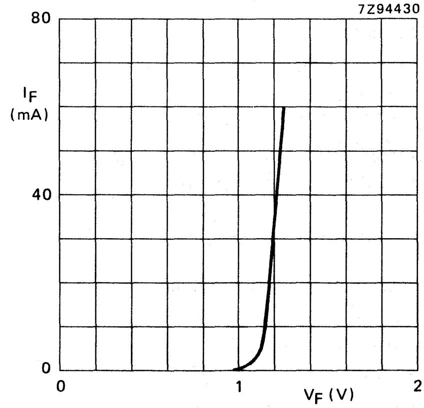


Fig. 4 T_{amb} = 25 °C; typical values.

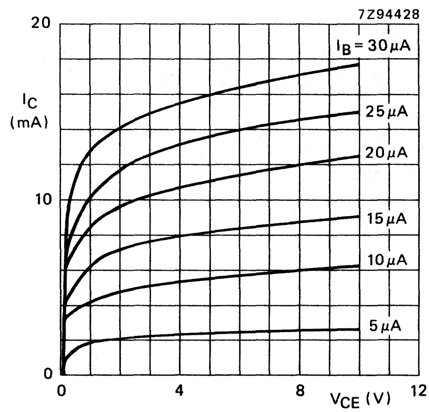


Fig. 5 T_{amb} = 25 °C; typical values.

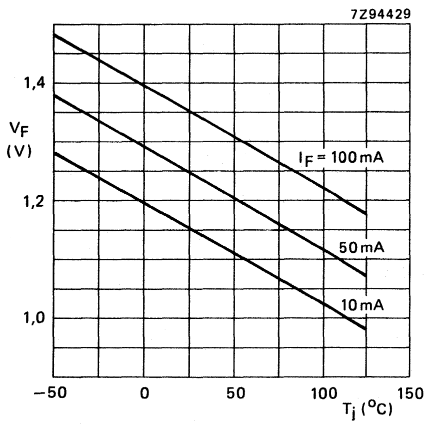


Fig. 6 Typical values.

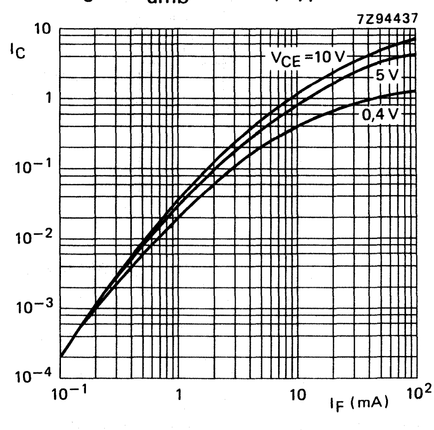


Fig. 7 Normalized to I_F = 10 mA; V_{CE} = 10 V; T_{amb} = 25 °C; typical values.

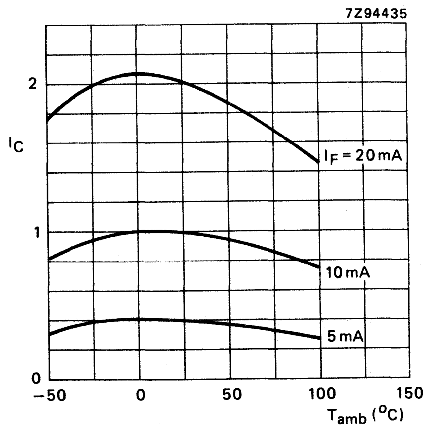


Fig. 8 Normalized to I_F = 10 mA; V_{CE} = 10 V; T_{amb} = 25 °C; typical values.

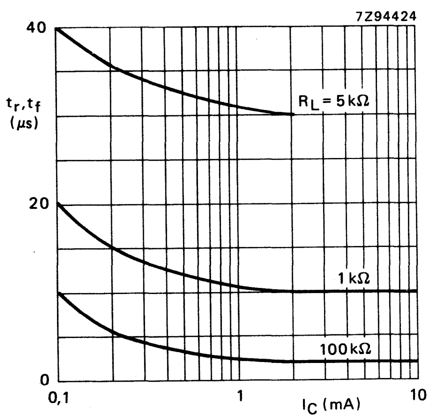


Fig. 9 T_{amb} = 25 °C; typical values.

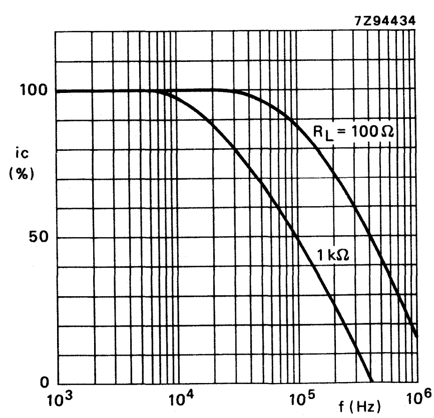


Fig. 10 I_C = 2 mA; V_{CC} = 10 V; T_{amb} = 25 °C; typical values.

OPTOCOUPLER

Optically coupled isolator consisting of an infrared emitting GaAlAs diode and a silicon npn photo-transistor 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

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_{IORM}	min.	3.5	kV
Isolation voltage AC (RMS value)	V_{IORM}	min.	2.5	kV

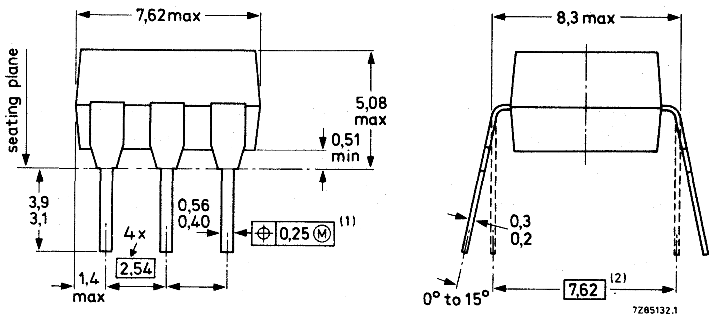
MECHANICAL DATA

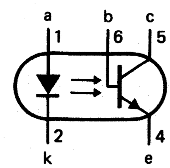
SOT90B (see Fig.1).

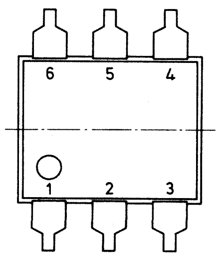
MECHANICAL DATA

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}		−55 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.	100 μA
Isolation voltage; t = 1 min (note 3) DC AC (RMS value)	V_{IORM}	min.	3,5 kV 2,5 kV
Capacitance between input and output			
V = 0; f = 1 MHz	C_{io}	typ.	0,6 pF
Insulation resistance between input and output			
$\pm V_{IO}$ = 1 kV	R_{IO}	min. typ.	10 GΩ 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.

* Internal specification.

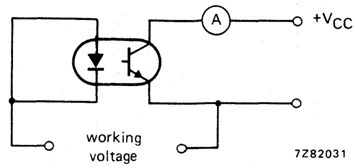


Fig. 2.

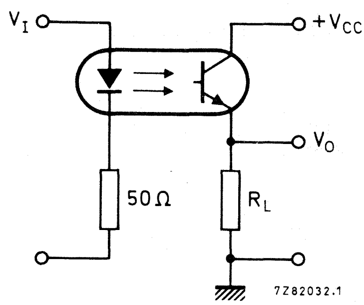


Fig. 3 Switching circuit.

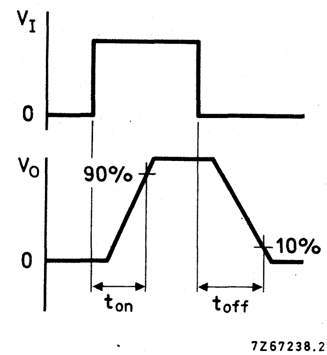


Fig. 4 Waveforms.

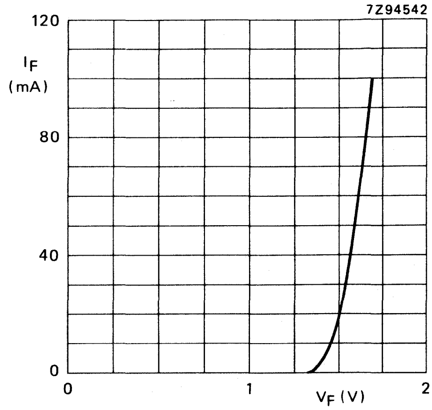


Fig. 5 T_{amb} = 25 °C; typical values.

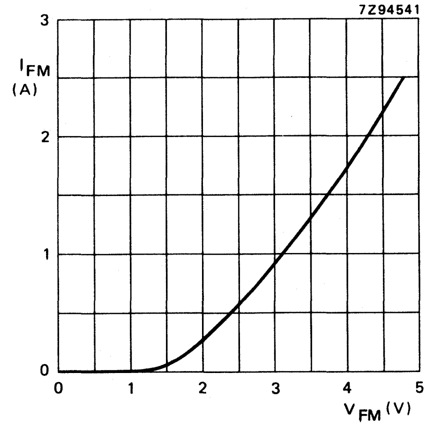


Fig. 6 T_{amb} = 25 °C; t_p = 10 μs; T = 1 ms; typical values.

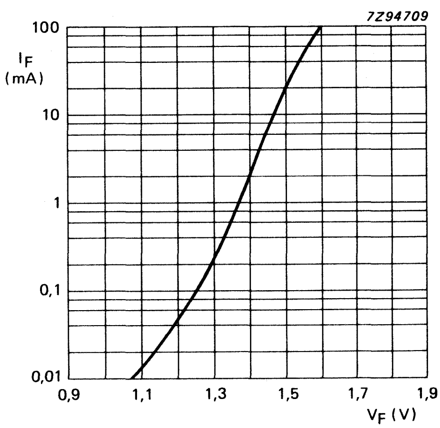


Fig. 7 T_{amb} = 25 °C; typical values.

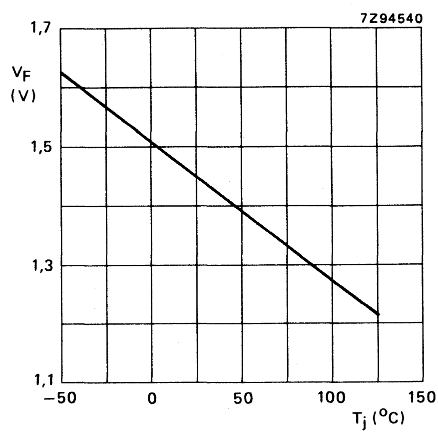


Fig. 8 I_F = 10 mA; typical values.

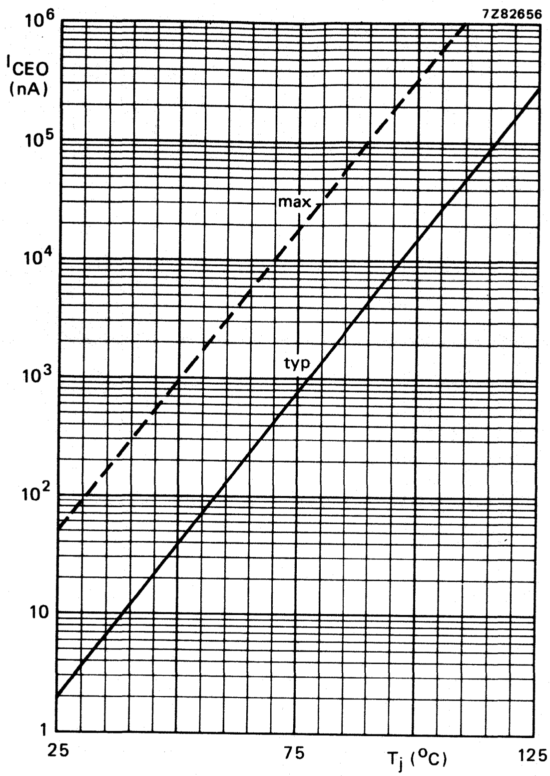


Fig. 9 $I_F = 0$; $V_{CE} = 10$ V; typical values.

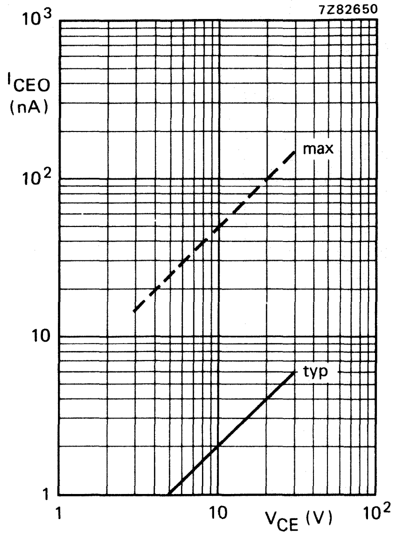


Fig. 10 $I_F = 0$; $T_j = 25\ ^oC$.

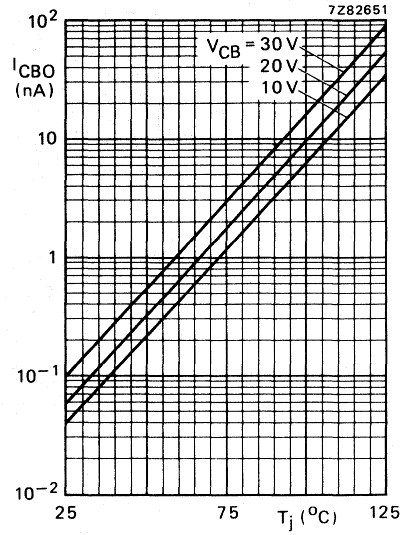


Fig. 11 Typical values.

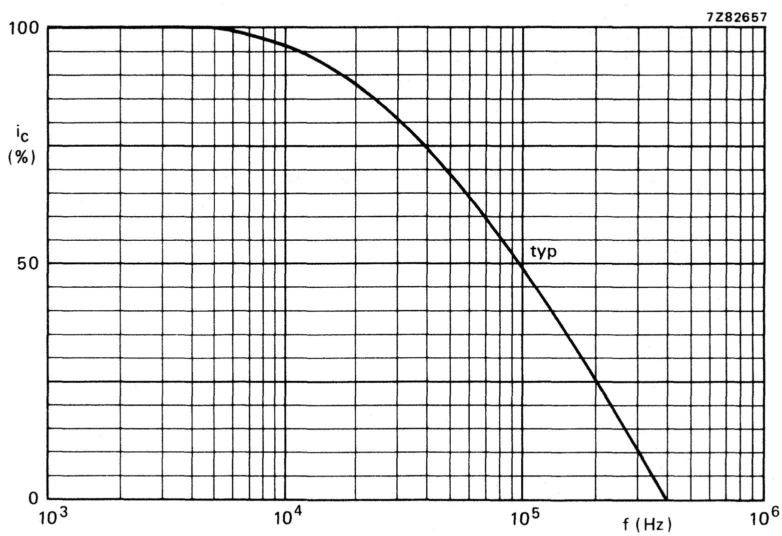


Fig. 12 $I_B = 0$; $I_C = 2$ mA; $V_{CC} = 5$ V; $R_L = 1\ k\Omega$; $T_{amb} = 25\ ^oC$.

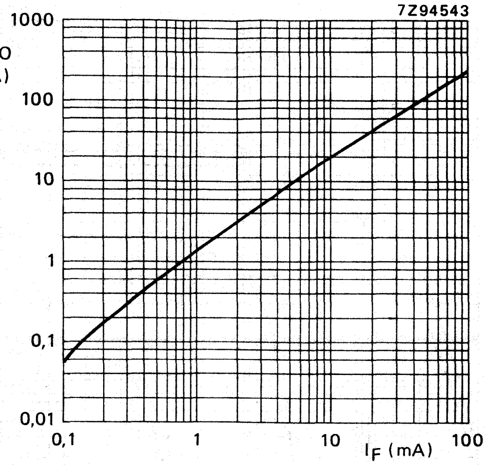


Fig. 13 V_{CB} = 5 V; T_{amb} = 25 °C; typical values.

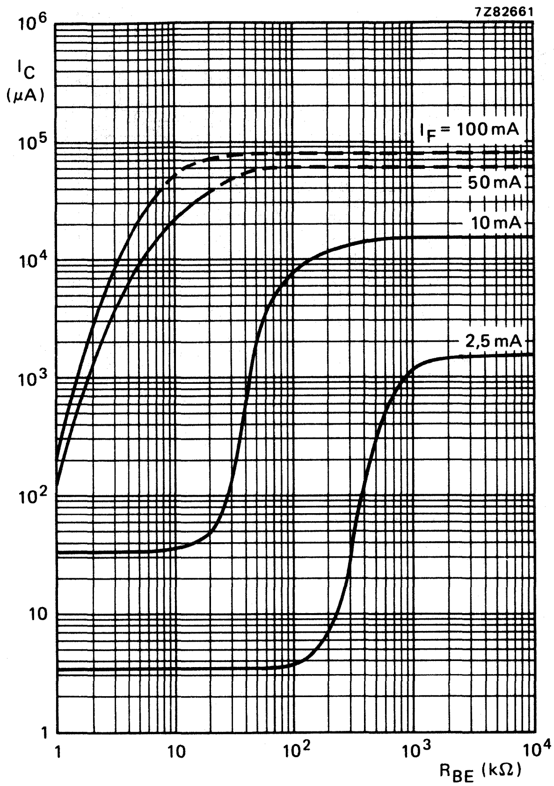


Fig. 14 $I_B = 0$; $V_{CE} = 5$ V; $T_{amb} = 25$ °C; typical values.

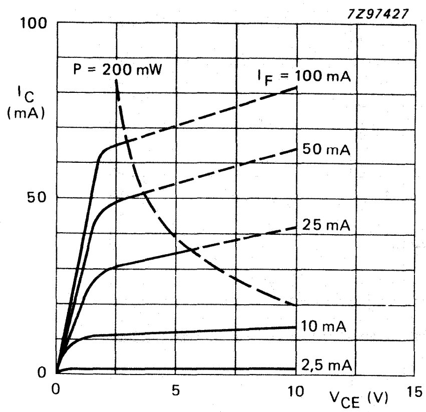


Fig. 15 T_{amb} = 25 °C; typical values.

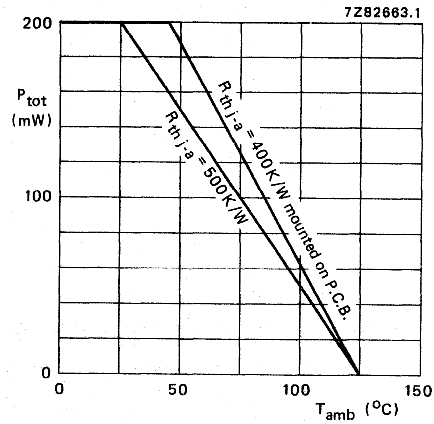


Fig. 16.

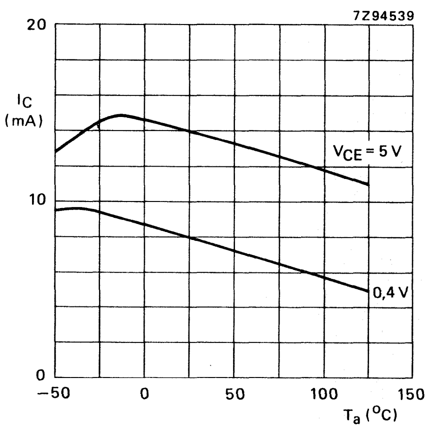


Fig. 17 I_F = 10 mA; typical values.

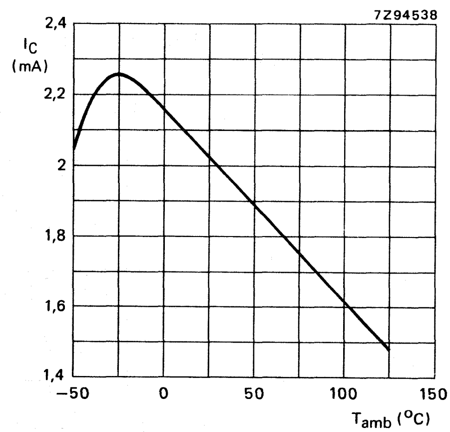


Fig. 18 I_F = 2 mA; V_{CE} = 0,4 V; typical values.

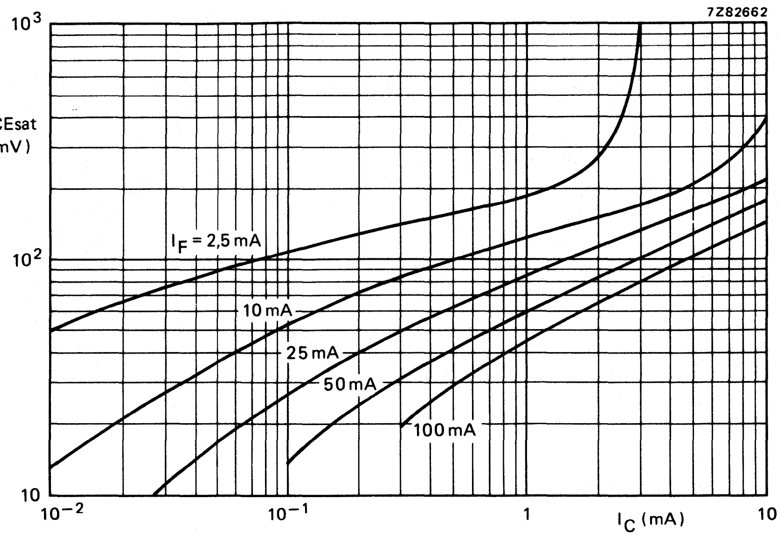


Fig. 19 $I_B = 0$; $T_{amb} = 25\ ^oC$; typical values.

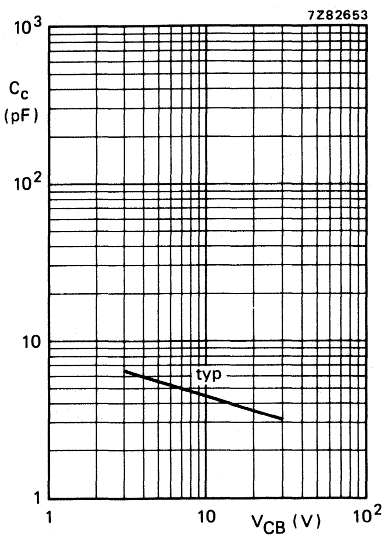


Fig.20 f = 1 MHz; $T_{amb} = 25\ ^oC$.

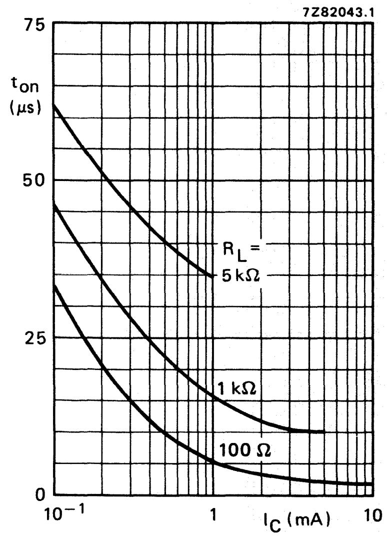


Fig. 21 $I_B = 0$; $V_{CC} = 5$ V; $T_{amb} = 25$ °C; typical values (see also Fig.23).

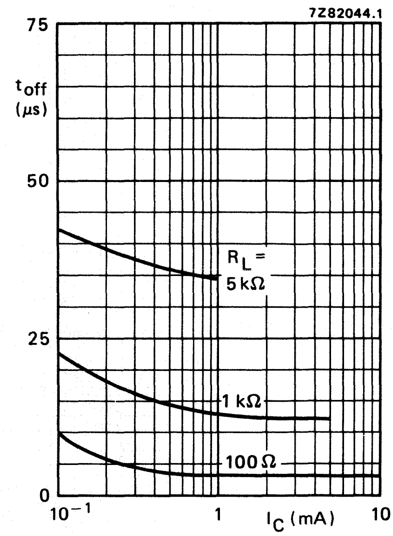
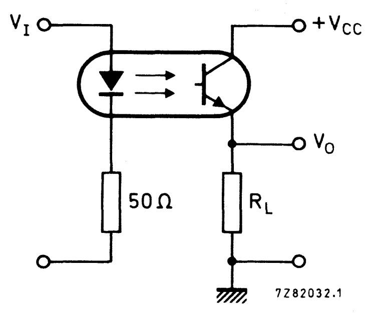


Fig. 22 $I_B = 0$; $V_{CC} = 5$ V; $T_{amb} = 25$ °C; typical values (see also Fig.23).



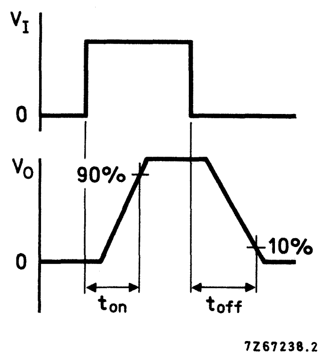


Fig. 23 Switching circuit and waveforms.

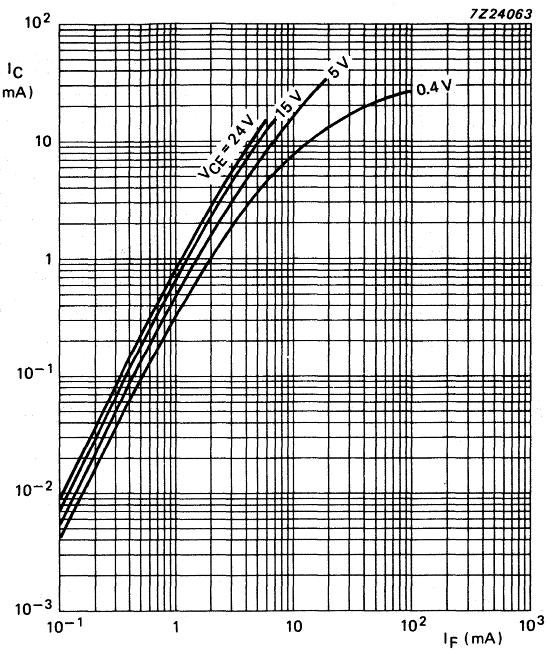


Fig. 24 T_{amb} = 25 °C, typical values.

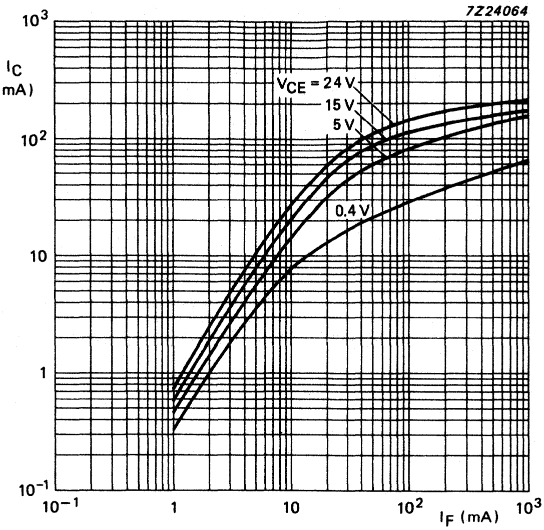


Fig. 25 T_{amb} = 25 °C; t_p = 10 μs; T = 1 ms; Typical values.

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 approved: particular specification CECC 20004-001/UTE C 86504
standard CECC 20000/NF.C.86500.

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_{IORM}	min.	3.5	kV
Isolation voltage AC (RMS value)		V_{IORM}	min.	2.5	kV

MECHANICAL DATA

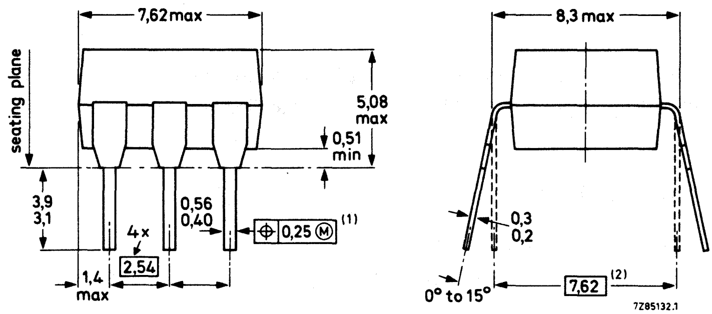
SOT90B (see Fig.1).

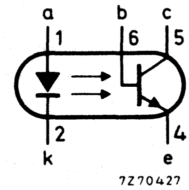
Products approved to CECC 20 004-001

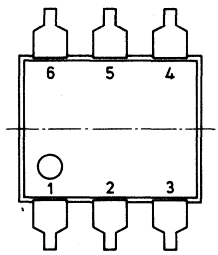
MECHANICAL DATA

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 ^oC	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 ^oC	P_{tot}	max.	150 mW

Optocoupler

Storage temperature range	T_{stg}		–40 to + 100	°C
Operating ambient temperature range	T_j		–25 to + 70	°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

DC current gain: I_C = 4 mA; V_{CE} = 0.4 V	h_{FE}		200 to 1200	
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	V_{CEsat}	max.	0.4 V
Isolation voltage; DC value				3.5 kV
t = 1 min. (see note 2) AC (RMS value)		V_{IORM}	min.	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} = ± 1000 V		R_{IO}	min.	1 GΩ
			typ.	1 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.

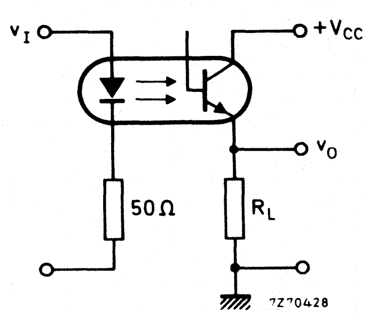


Fig. 2 Switching circuit.

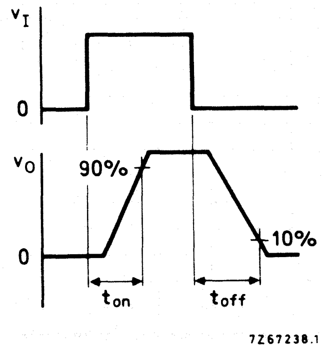


Fig. 3 Waveforms.

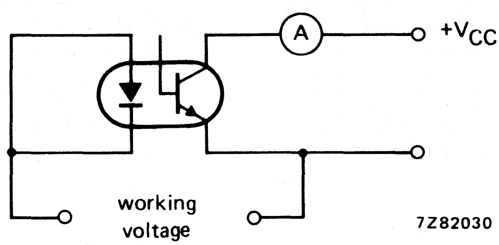


Fig. 4.

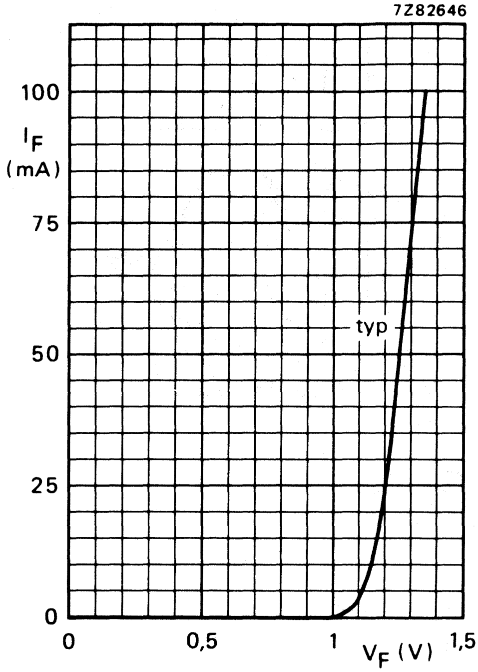


Fig. 5 T_{amb} = 25 °C.

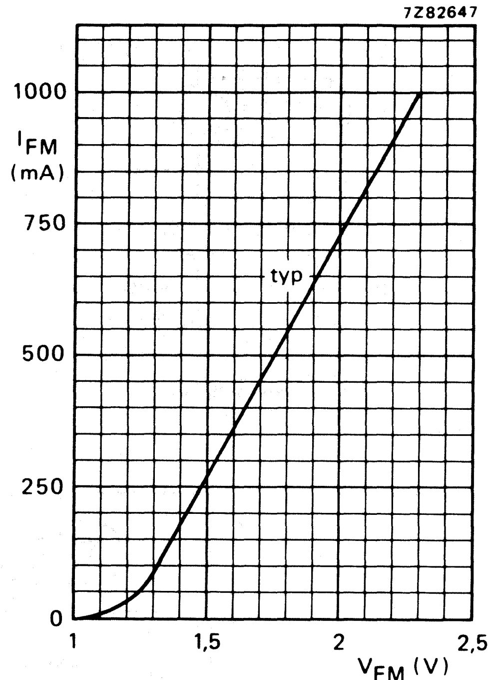


Fig. 6 T_{amb} = 25 °C; t_p = 10 μs; T = 1 ms.

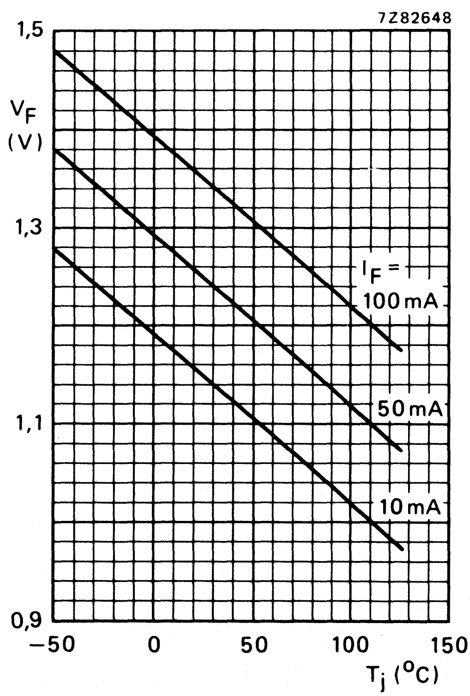


Fig. 7 Typical values.

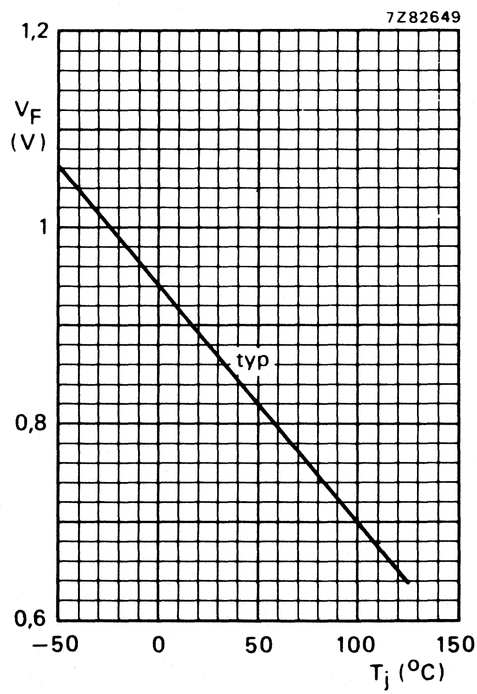


Fig. 8 I_F = 50 μA.

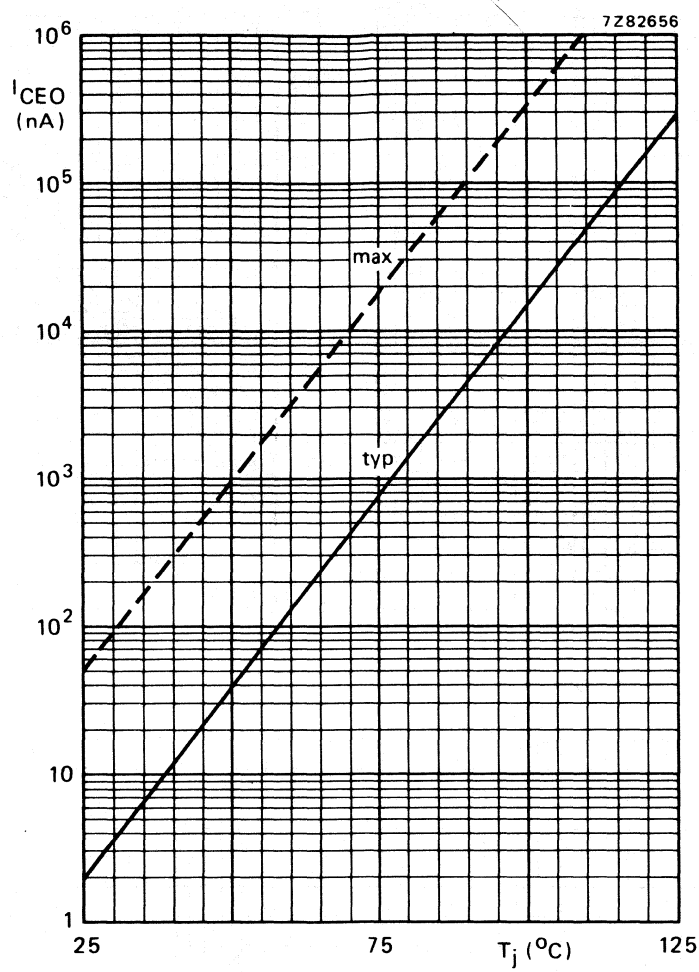


Fig. 9 $I_F = 0$; $V_{CE} = 10$ V.

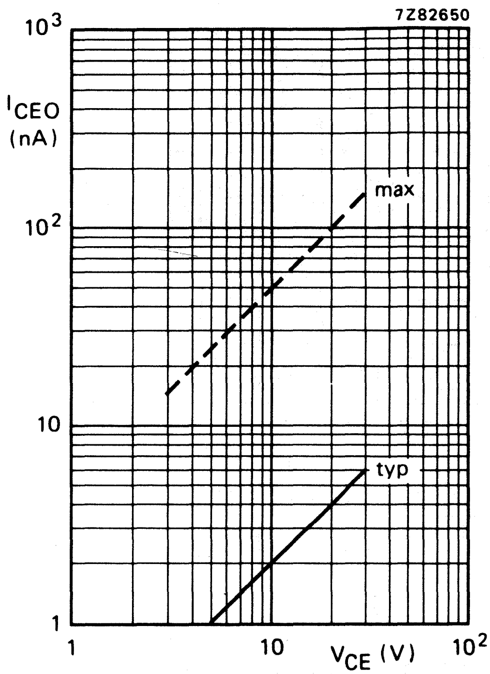


Fig. 10 $I_F = 0$; $T_j = 25\ ^oC$.

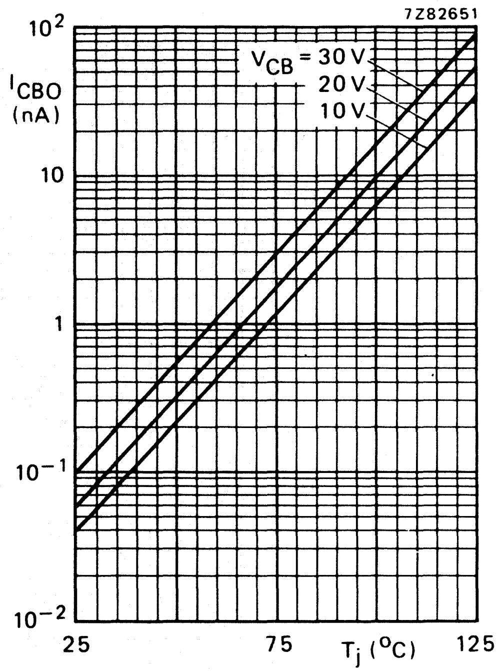


Fig. 11 Typical values.

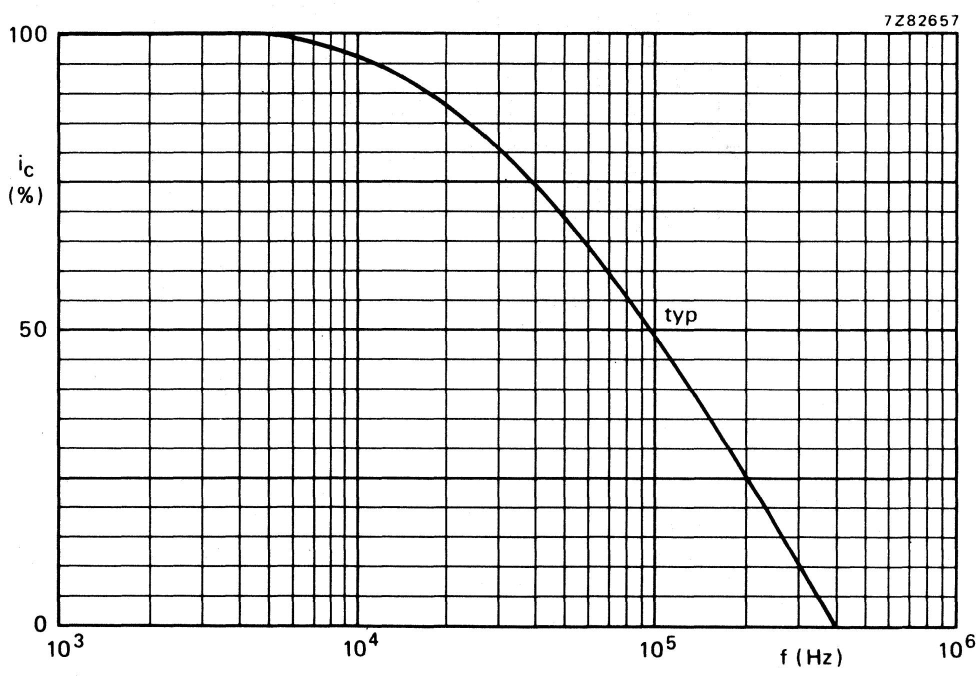


Fig. 12 $I_B = 0$; $I_C = 2$ mA; $V_{CC} = 5$ V; $R_L = 1$ kΩ; $T_{amb} = 25\ ^oC$.

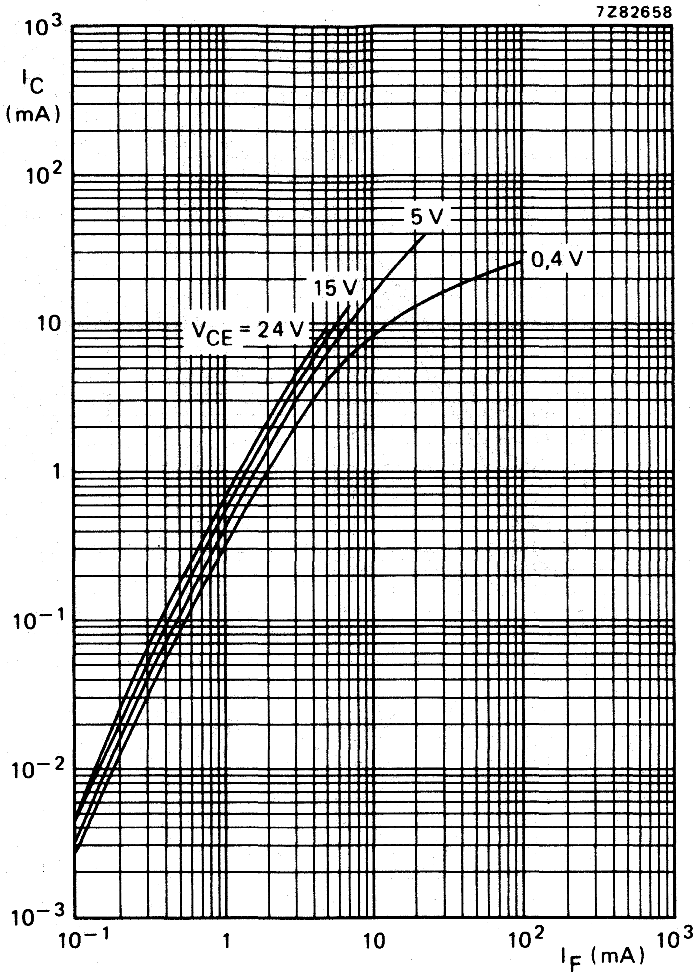


Fig. 13 T_{amb} = 25 °C, typical values.

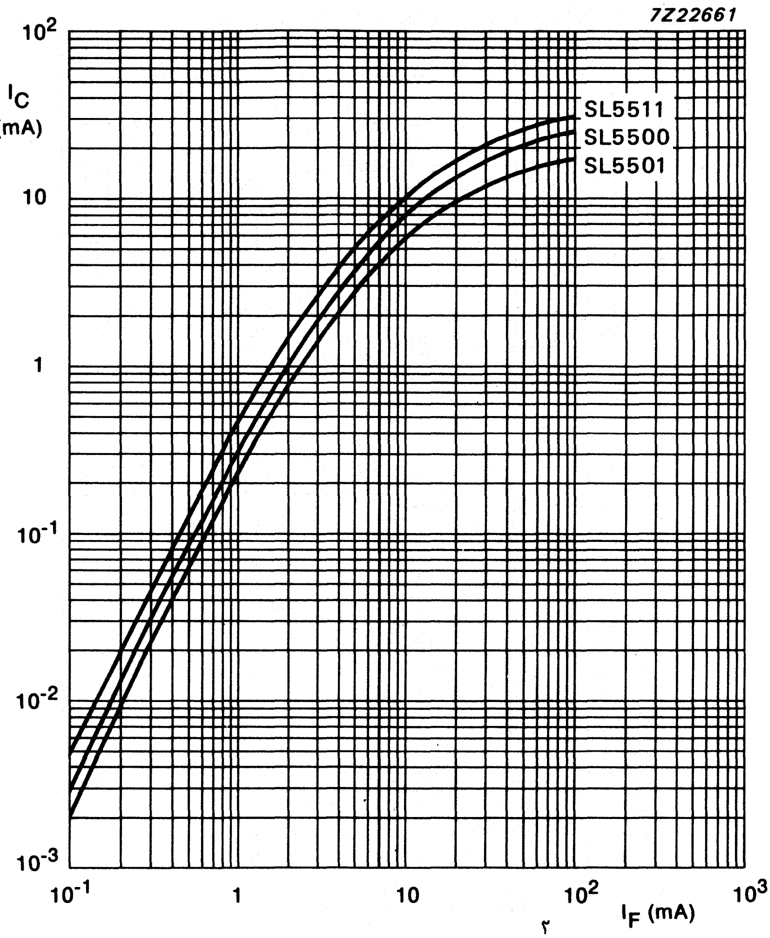


Fig. 14 Typical collector current versus forward current.

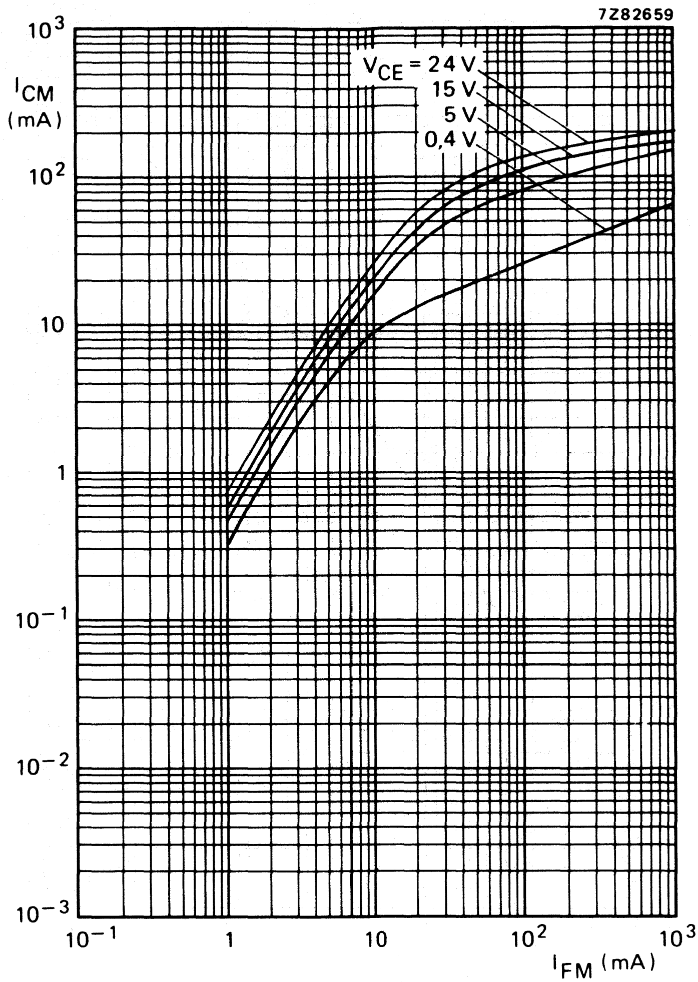


Fig. 15 T_{amb} = 25 °C; t_p = 10 μs; T = 1 ms; typical values.

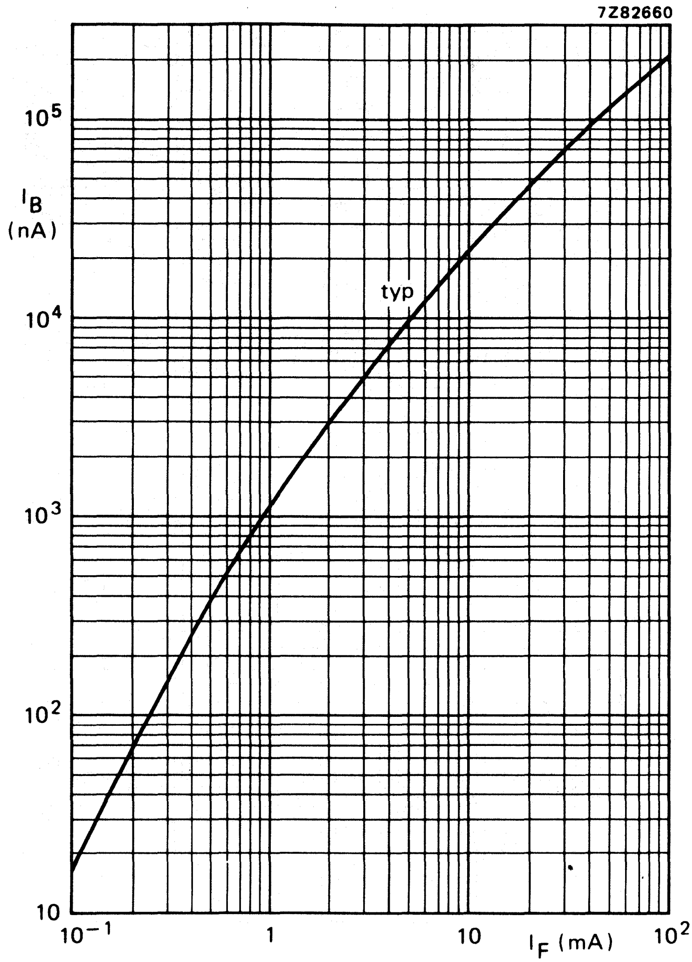


Fig. 16 V_{CB} = 5 V; T_{amb} = 25 °C.

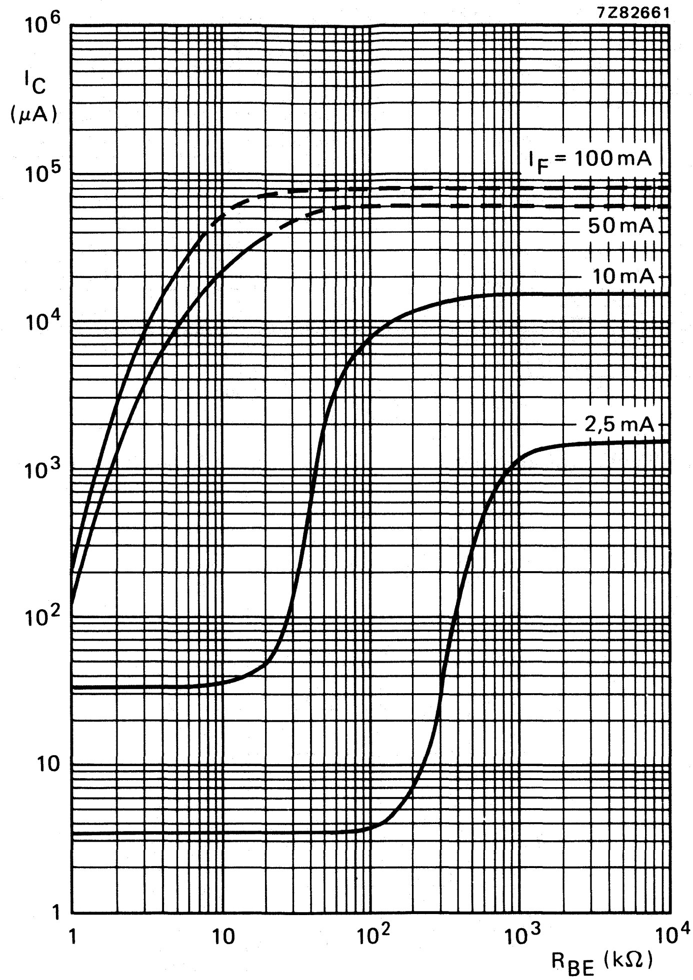


Fig. 17 $I_B = 0$; $V_{CE} = 5$ V; $T_{amb} = 25$ °C; typical values.

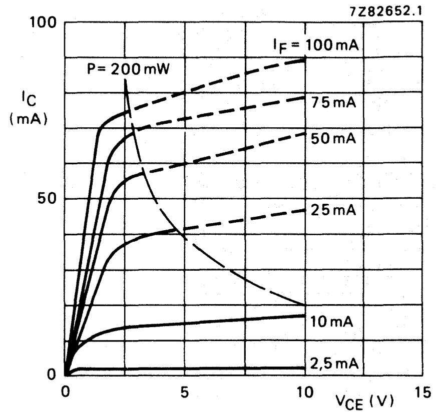


Fig. 18 T_{amb} = 25 °C; typical values.

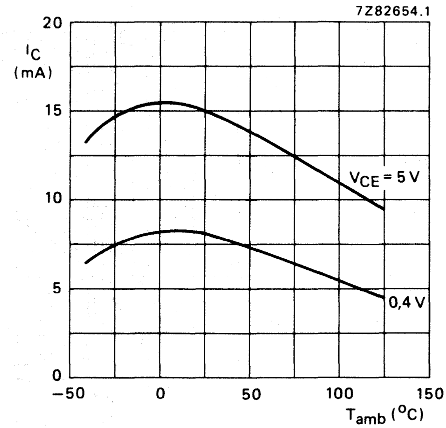


Fig. 19 I_F = 10 mA; typical values.

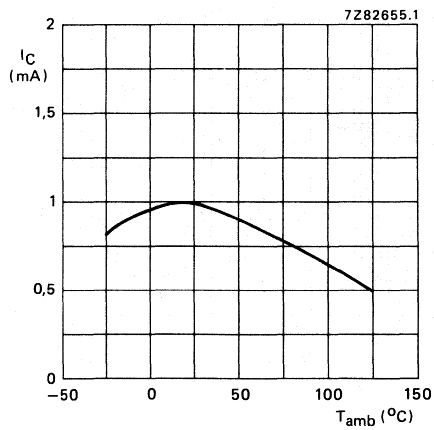


Fig. 20 I_F = 2 mA; V_{CE} = 0.4 V; typical values.

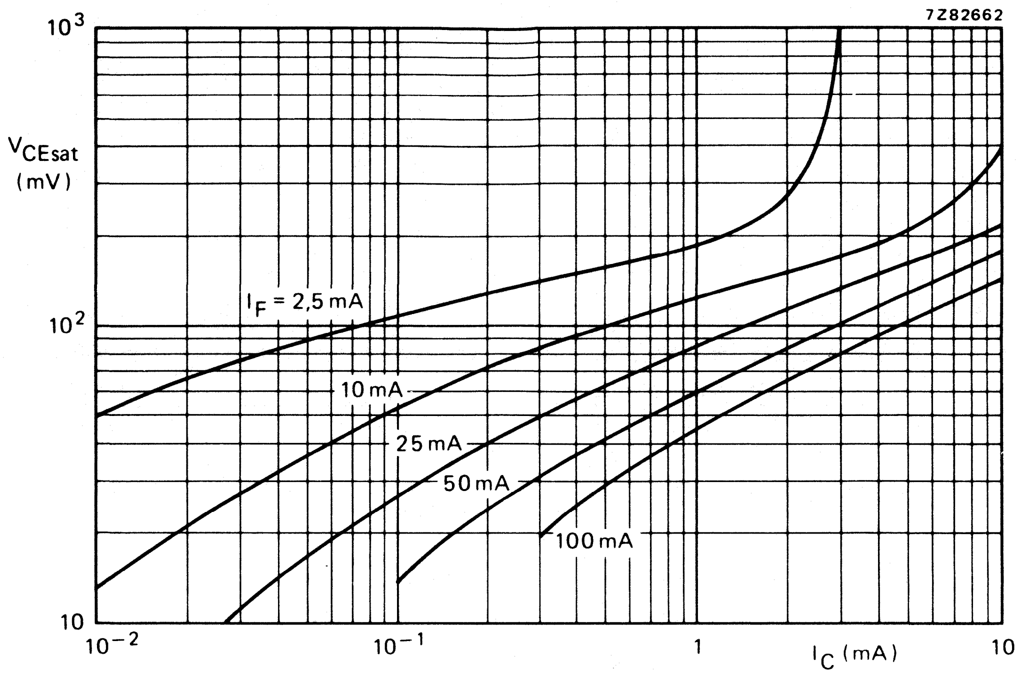


Fig. 21 $I_B = 0$; $T_{amb} = 25\ ^oC$; typical values.

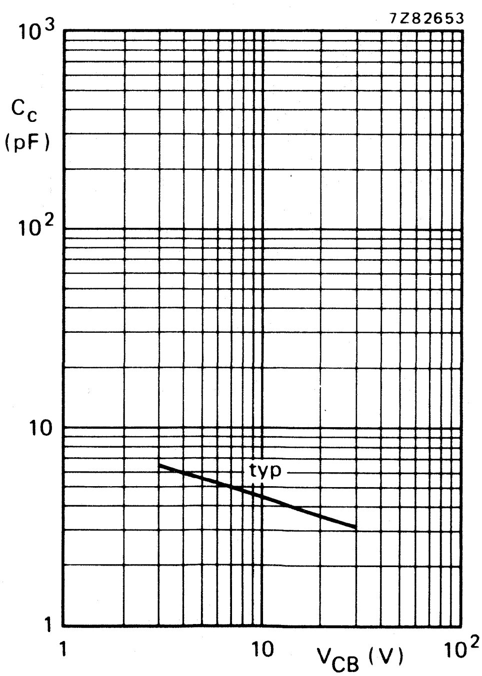


Fig. 22 f = 1 MHz; $T_{amb} = 25\ ^oC$.

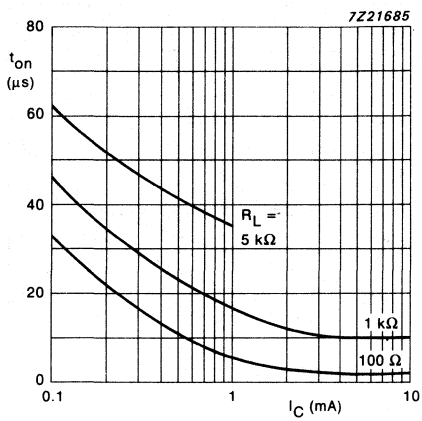


Fig. 23 SL5501.

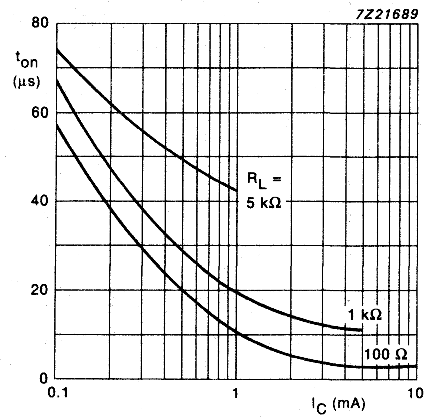


Fig. 24 SL5500.

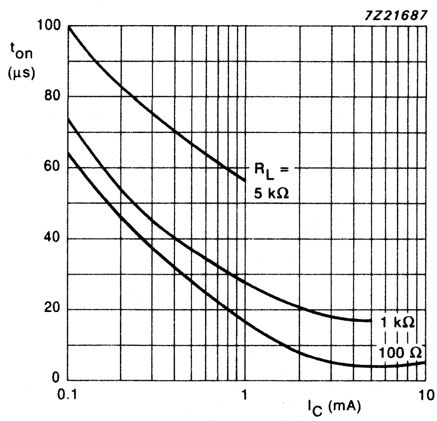


Fig. 25 SL5511.

Typical turn-on time versus collector current.

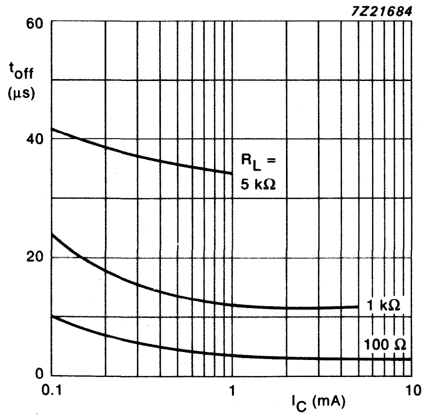


Fig. 26 SL5501.

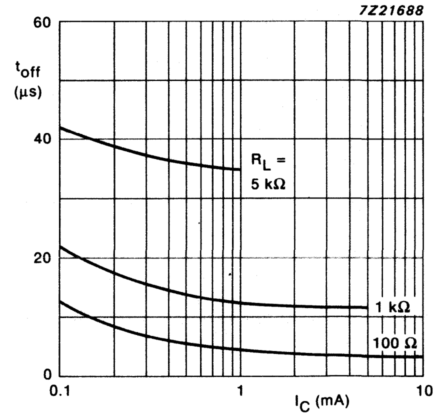


Fig. 27 SL5500.

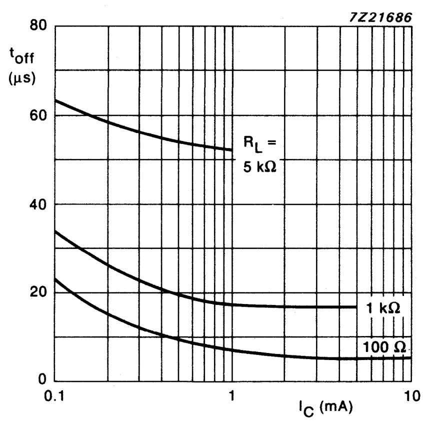


Fig. 28 SL5511.

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 approved: particular specification CECC 20004-001/UTE C 86504
standard CECC 20000/NF.C.86500.

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)	SL5504	I_C/I_F	min.	0.15	
DC continuous voltage between input and output		V_{IOWM}	max.	800	V
Isolation voltage ;		V_{IORM}	min.	3.5	kV
; (RMS value)				2.5	kV

MECHANICAL DATA

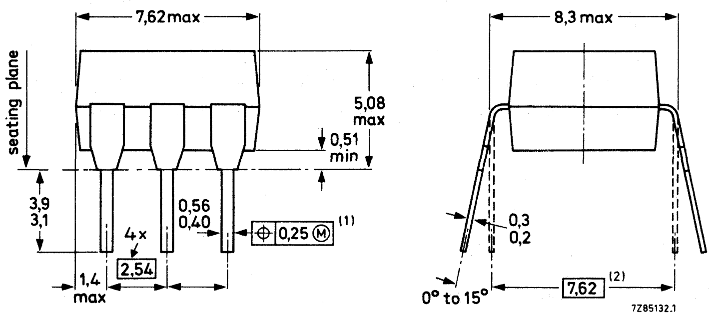
SOT90B (see Fig. 1).

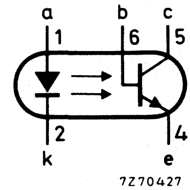
Products approved to CECC 20 004-001

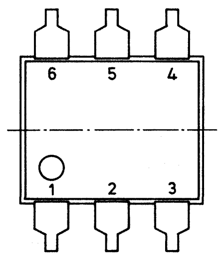
MECHANICAL DATA

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_j		−25 to + 70 °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

DC current gain; I_C = 4 mA; V_{CE} = 0.4 V	h_{FE}		200 to 1200
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_{IORM}	min.	3.5 kV
Isolation voltage, RMS value t = 1 min. (see note 2)	V_{IORM}	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 $V_{IO} = \pm 1000$ V	R_{IO}	min. typ.	1 GΩ 1 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.

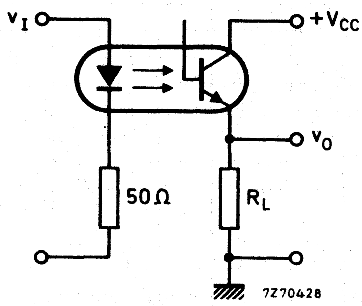


Fig. 2 Switching circuit.

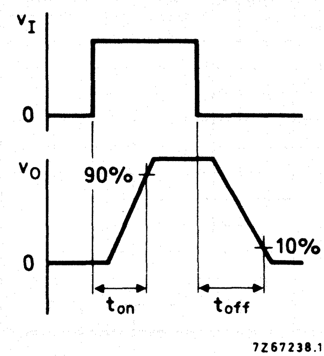


Fig. 3 Waveforms.

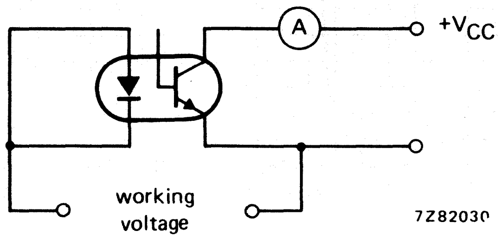


Fig. 4.

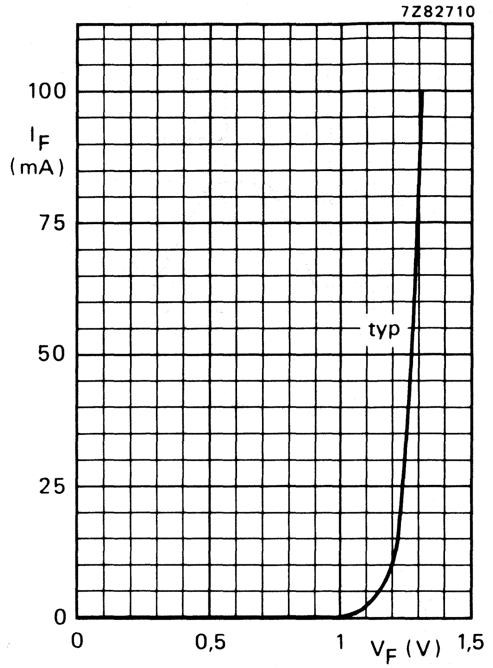


Fig. 5 $T_{amb} = 25\,^oC$.

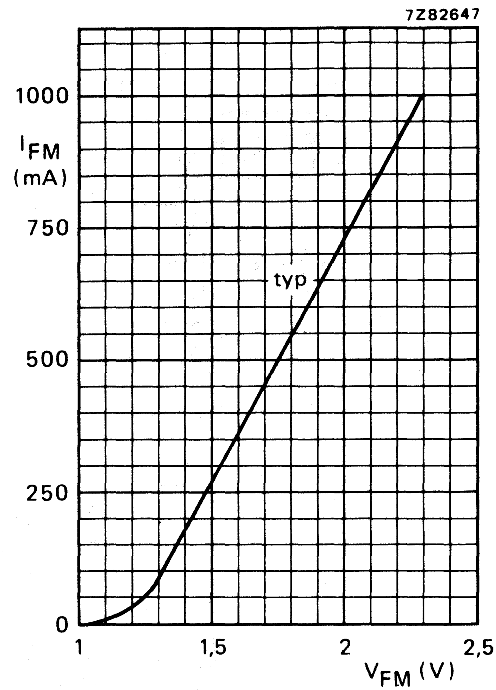


Fig. 6 $T_{amb} = 25\,^oC$; $t_p = 10\,\mu s$; $T = 1$ ms.

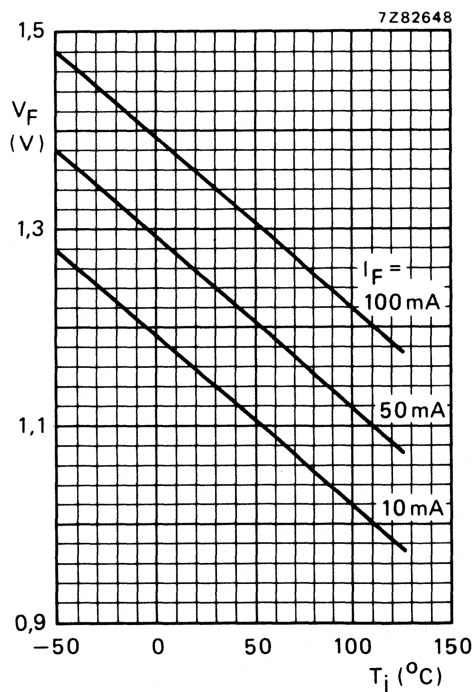


Fig. 7 Typical values.

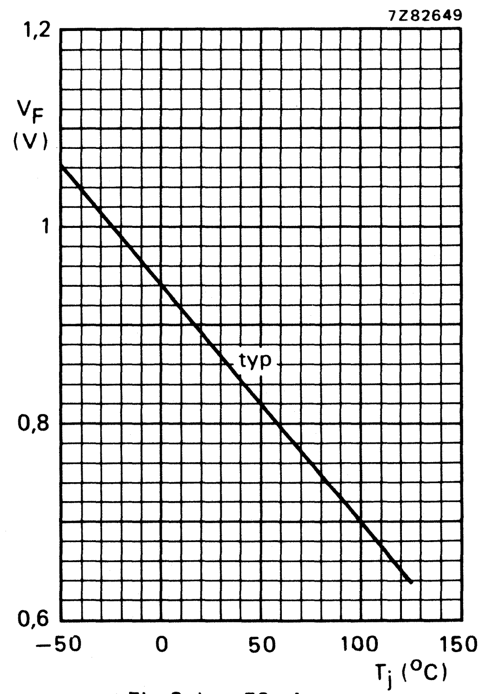


Fig. 8 $I_F = 50\,\mu A$.

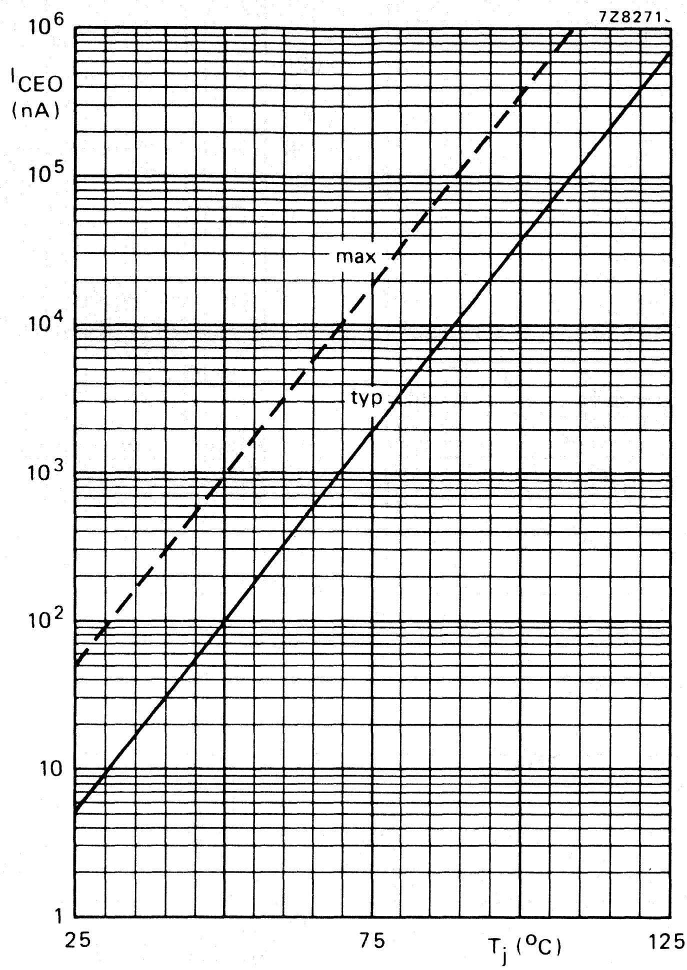


Fig. 9 $I_F = 0$; $V_{CE} = 50$ V.

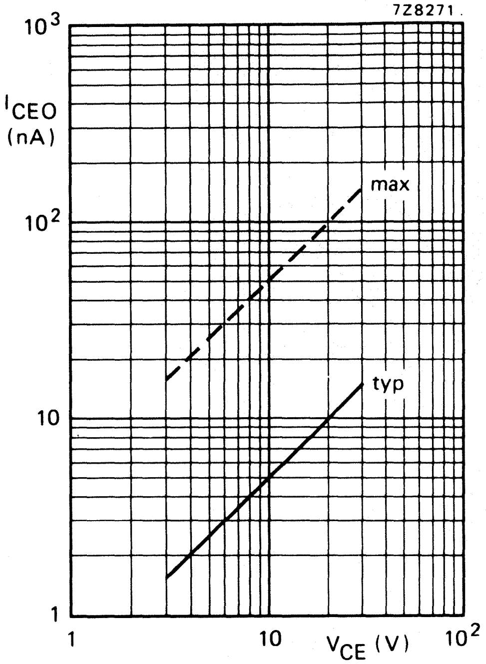


Fig. 10 $I_F = 0$; $T_j = 25\ ^oC$.

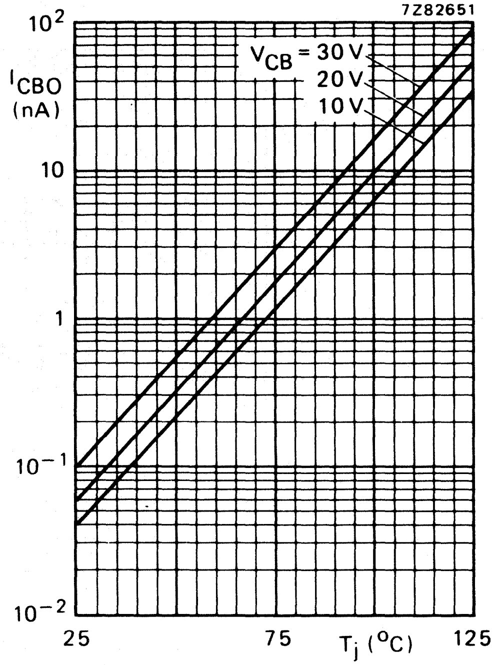


Fig. 11 Typical values.

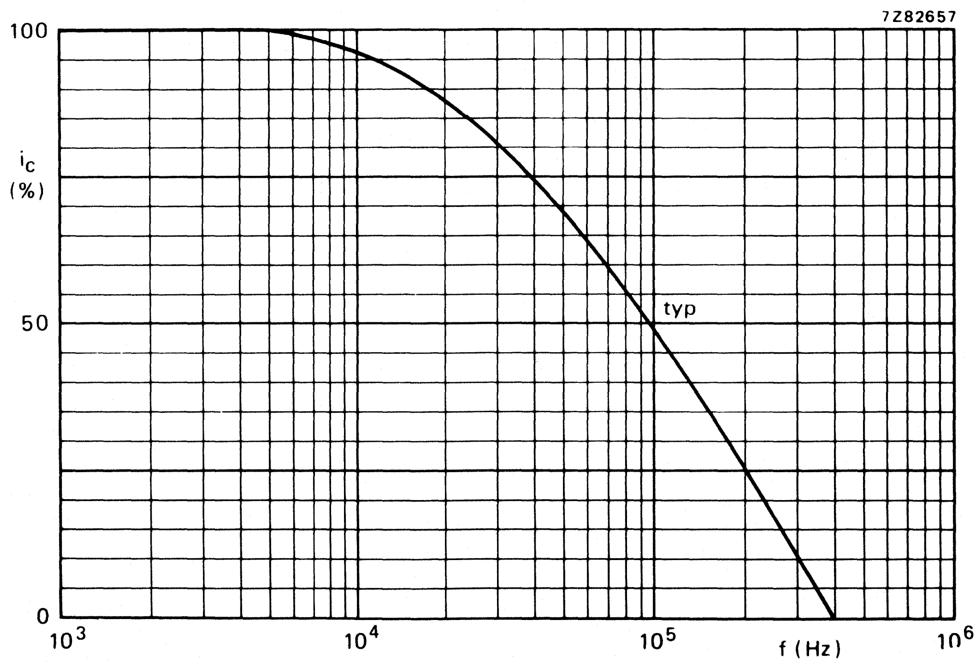


Fig. 12 $I_B = 0$; $I_C = 2\ mA$; $V_{CC} = 5\ V$, $R_L = 1\ k\Omega$; $T_{amb} = 25\ ^oC$.

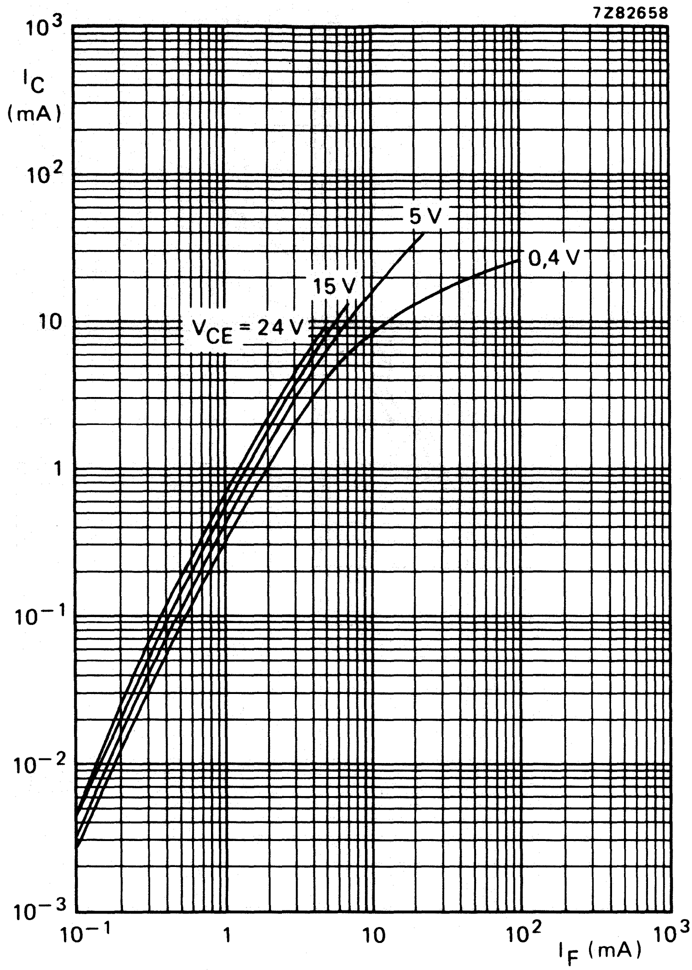


Fig. 13 T_{amb} = 25 °C, typical values.

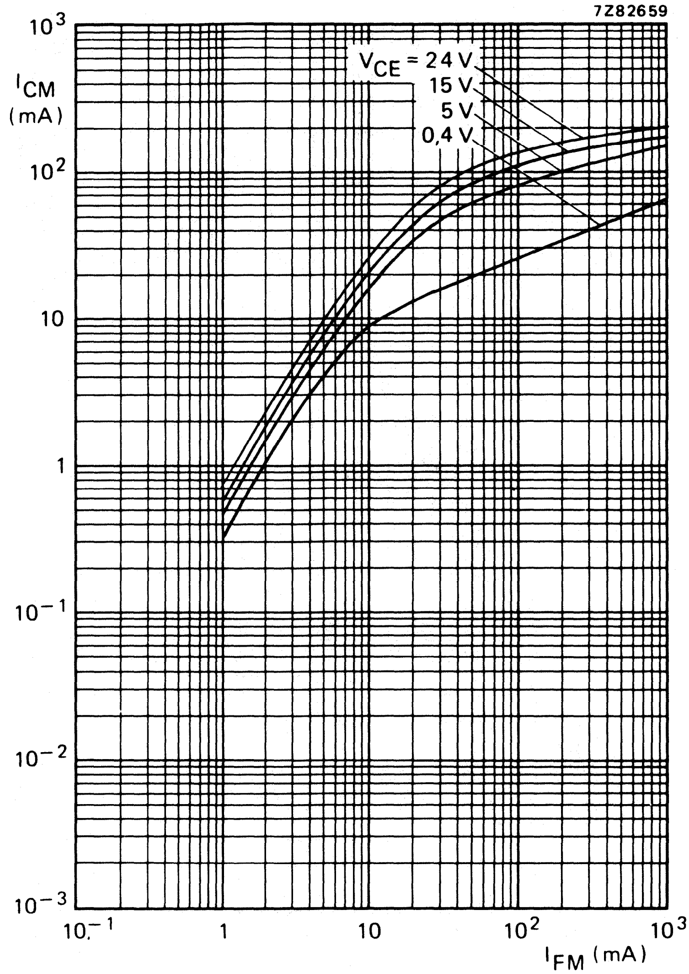


Fig. 14 T_{amb} = 25 °C; t_p = 20 μs; T = 2 ms; typical values.

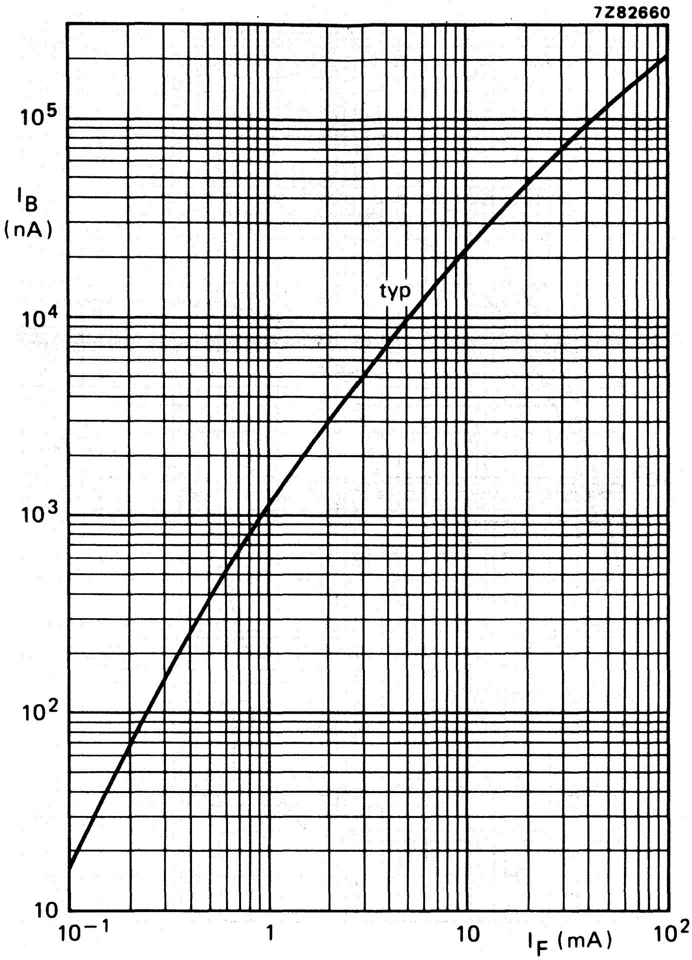


Fig. 15 V_{CB} = 5 V; T_{amb} = 25 °C.

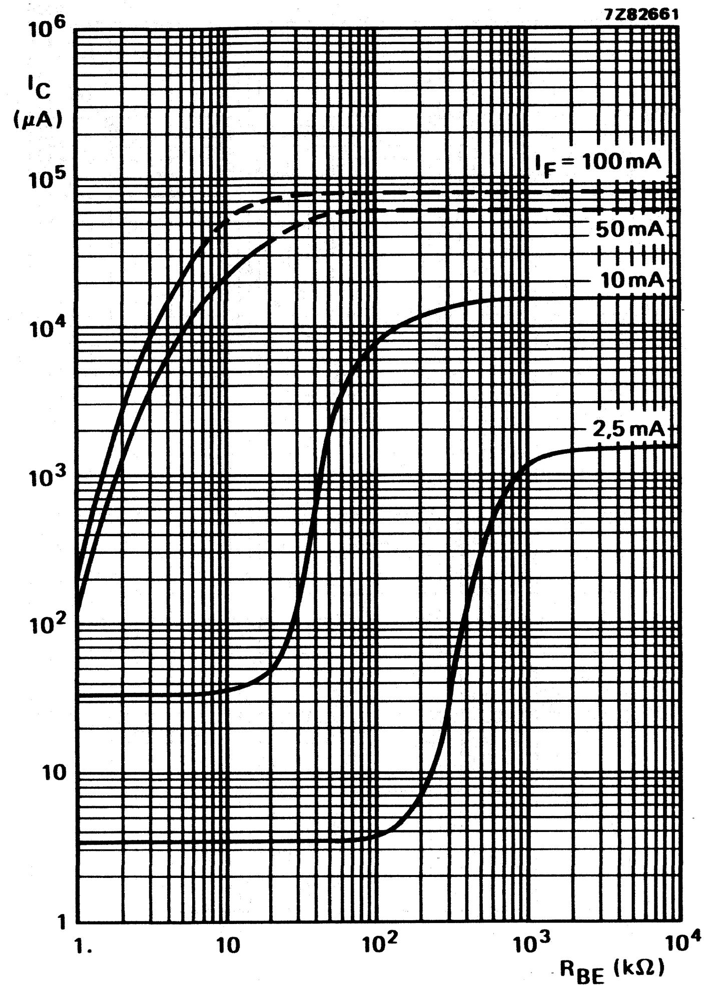


Fig. 16 $I_B = 0$; $V_{CE} = 5$ V; $T_{amb} = 25$ °C; typical values.

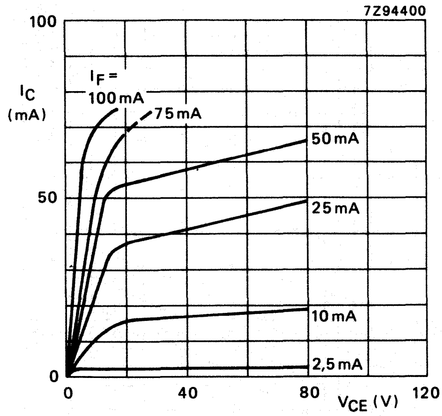


Fig. 17 T_{amb} = 25 °C; typical values.

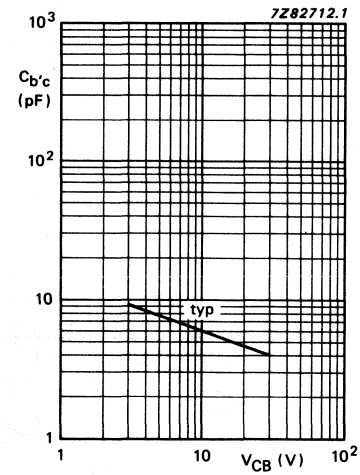


Fig. 18 f = 1 MHz; T_{amb} = 25 °C.

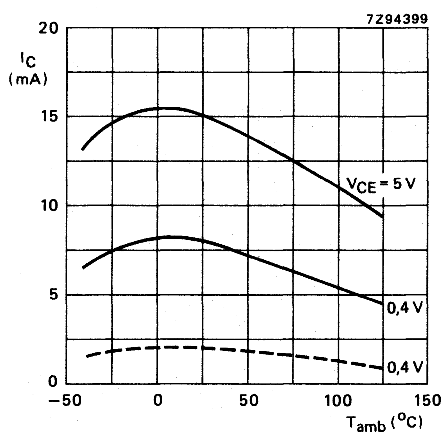


Fig. 19 I_F = 10 mA; typical values.
— — — min. values.

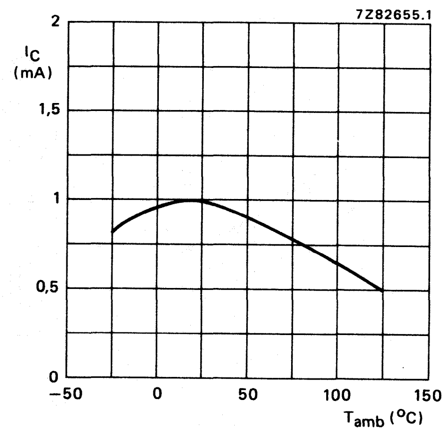


Fig. 20 I_F = 2 mA; typical values.
V_{CE} = 0.4 V.

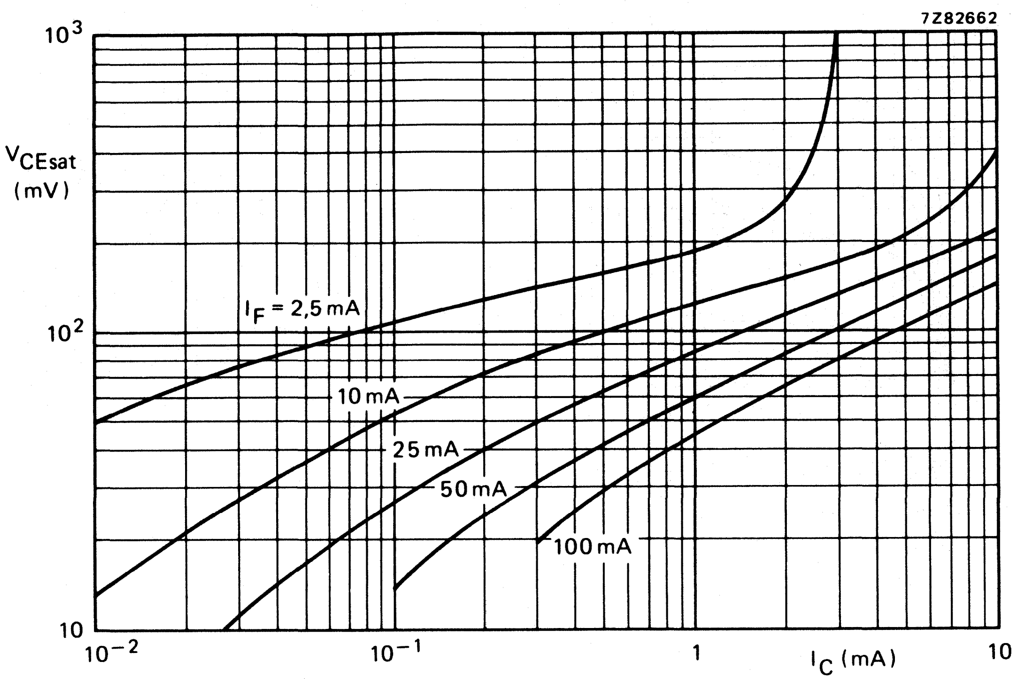


Fig. 21 $I_B = 0$; $T_{amb} = 25\ ^oC$; typical values.

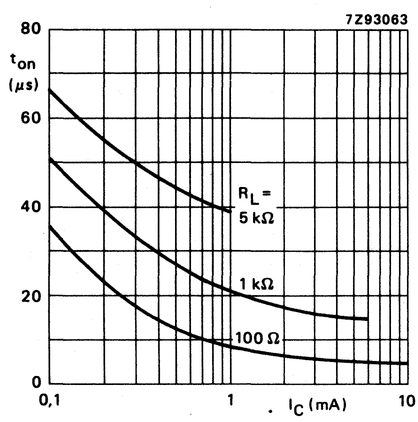


Fig. 22 $I_B = 0$; $V_{CC} = 5$ V; $T_{amb} = 25\ ^oC$; typical values. (See also Fig. 25.)

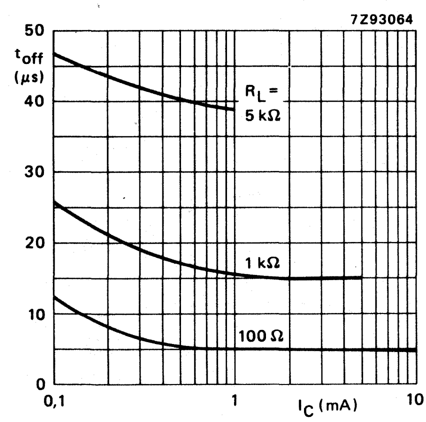


Fig. 23 $I_B = 0$; $V_{CC} = 5$ V; $T_{amb} = 25\ ^oC$, typical values. (See also Fig. 25.)

PHOTOCOUPLER

The SL5505S is a fast switching photocoupler consisting of a GaAlAs light emitting diode which is optically coupled to an integrated silicon photodetector in an 8-pin dual-in-line (DIL) envelope. It is suitable for use in TTL integrated circuits.
This type is selected according to a specification approved by FRENCH CNET and is intended for use in telephone, telegraph and general telecommunications applications.

Features

- Short propagation delay times
- Low saturation voltage
- High isolation voltage of 2.5 kV RMS and 3.5 kV DC
- Working voltage of 2.5 kV DC
- High transient immunity

CNET APPROVAL — Requests for UL recognition and VDE approval are pending.

Class T: climatic class (5 °C - 70 °C 56 days) 864.

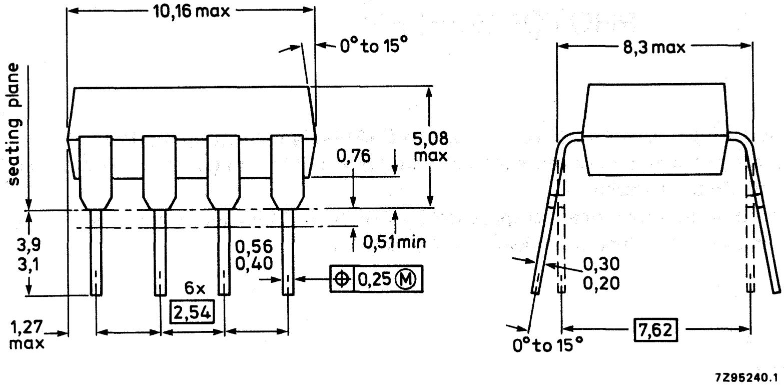
QUICK REFERENCE DATA

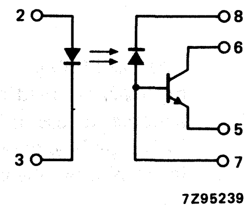
Diode				
Continuous reverse voltage	V_R	max.	5	V
DC forward current	I_F	max.	100	mA
peak value; t_{on} = 1 μs; (d = 0.3%)	I_{FRM}	max.	1	A
Transistor				
Collector-emitter breakdown voltage I_C = 10 mA	$V_{(BR)CEO}$	min.	18	V
Optocoupler				
Output current I_F = 10 mA; V_{CC} = 4.5 V; V_O = 0.4 V	I_{OL}	min.	2	mA
		typ.	4	mA
		max.	40	mA
Logic low output voltage I_F = 10 mA; V_{CC} = 4.5 V; I_o = 2 mA	V_{OL}	typ.	0.2	V
		max.	0.4	V
Isolation voltage DC	V_{IORM}	min.	3.5	kV
Isolation voltage AC (RMS value)	V_{IORM}	min.	2.5	kV
Propagation delay time	t_{PHL}	max.	0.8	μs
	t_{PLH}	max.	0.8	μs
Common mode transient immunity	± CM	min.	1	kV/μs

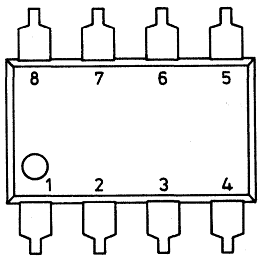
MECHANICAL DATA

Dimensions in mm

Fig.1 SOT97F.







⌖ 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 the nominal by 0.25 mm.

(2) When the leads are parallel, the tips remain 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 = 1 μs; d = 0.3%	I_{FRM}	max.	1	A
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	250	mW
Transistor				
Collector-emitter breakdown voltage I_C = 10 mA	$V_{(BR)CEO}$	min.	18	V
Emitter-base breakdown voltage; I_E = 10 μA	$V_{(BR)EBO}$	min.	5	V
DC collector current	I_C	max.	10	mA
Total power dissipation up to T_{amb} = 85 °C	P_{tot}	max.	100	mW
Optocoupler				
Storage temperature range	T_{stg}		–55 to + 150	°C
Operating ambient temperature range	T_{amb}		–25 to + 70	°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, with the 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

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Diode

Forward voltage I_F = 10 mA	V_F	typ.	1.65 V
		max.	1.9 V
Reverse current V_R = 5 V	I_R	max.	10 μA

Transistor (diode: I_F = 0)

Collector-emitter breakdown voltage at I_C = 10 mA	$V_{(BR)CEO}$	min.	18 V
Collector-base breakdown voltage (note 1) at I_C = 10 μA	$V_{(BR)CBh}$	min.	30 V
Emitter-base breakdown voltage at I_E = 10 μA	$V_{(BR)EBO}$	min.	5 V
Logic HIGH output current I_F = 0; V_o = V_{CC} = 5.5 V	I_{OH}	typ.	5 nA
		max.	50 nA
Logic HIGH output current I_F = 0; V_o = V_{CC} = 15V	I_{OH}	max.	10 μA
Logic HIGH supply current I_F = 0; I_o = 0; V_{CC} = 15V	I_{CCH}	max.	1 μA
Logic LOW supply current I_F = 10 mA; I_o = 0; V_{CC} = 15 V	I_{CCL}	typ.	20 μA
DC current gain I_C = 3 mA; V_{CE} = 5 V	h_{FE}		100 to 400

Note

1. Cathode connected to collector.

Optocoupler

Output current I_F = 10 mA; V_{CC} = 4.5 V; V_O = 0.4 V	I_{OL}	min. max.	2 mA 40 mA
I_F = 2 mA; V_{CC} = 4.5 V; V_O = 5 V	I_{OL}	typ. min.	4 mA 0.2 mA
Collector-emitter cut-off current V_{CE} = 10 V	I_{CEO}	max.	50 nA
Collector-base cut-off current V_{CB} = 22 V	I_{CBO}	max.	50 nA
Logic LOW output voltage I_F = 10 mA; V_{CC} = 4.5 V; I_O = 2 mA	V_{OL}	typ. max.	0.2 V 0.4 V
Isolation voltage (note 1); DC t = 1 min AC (RMS value)	V_{IORM}	min.	3.5 kV 2.5 kV
Capacitance between input and output f = 1 MHz	C_{io}	typ. max.	0.6 pF 1.3 pF
Insulation resistance between input and output ± V_{IO} = 1 kV	R_{IO}	min. typ.	10 GΩ 1 TΩ
Switching times (Figs 2 and 3) I_F = 10 mA; V_{CC} = 5 V; R_L = 2.5 kΩ			
Propagation delay time to logic LOW at output	t_{on}	typ. max.	0.5 μs 0.8 μs
Propagation delay time to logic HIGH at output	t_{off}	typ. max.	0.4 μs 0.8 μs

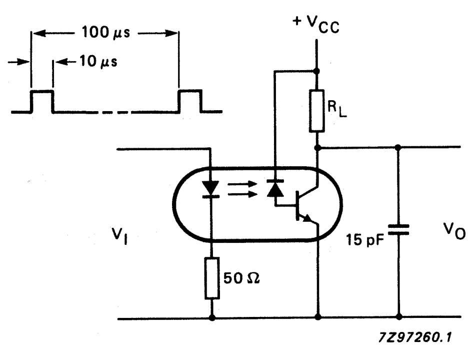


Fig. 2 Switching circuit.

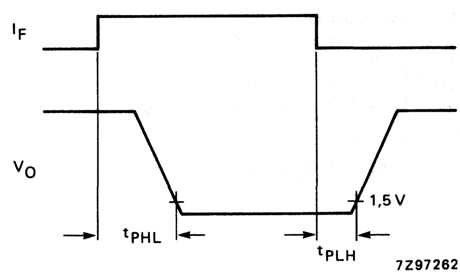


Fig. 3 Waveforms.

Transient immunity			
V_{CC} = 5 V; V_{CM} = 10 V_{PP}; R_L = 2.5 kΩ			
Common mode transient immunity at logic LOW			
I_F = 10 mA	C_{ML}	min.	−1 kV/μs
Common mode transient immunity at logic HIGH			
I_F = 0	C_{MH}	min.	1 kV/μs
Logic HIGH output current (note 2, Fig.4)			
V_{CC} = 5.5 V; working voltage = 2.5 kV DC			
T_{amb} = 70 °C	I_{OHW}	max.	100 μA

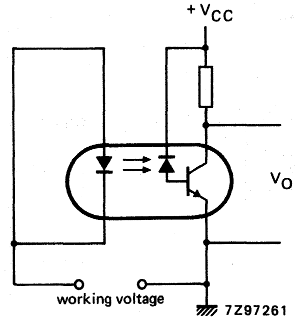


Fig.4 Transient immunity.

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

Notes

1. Every single product is tested by applying an isolation test voltage of 3000 V RMS for two seconds between the shorted input (diode) leads and the shorted output (phototransistor) leads.
2. This parameter is the working collector-emitter leakage current measured when a logic HIGH voltage is applied between the emitter and the short-circuited diode leads.

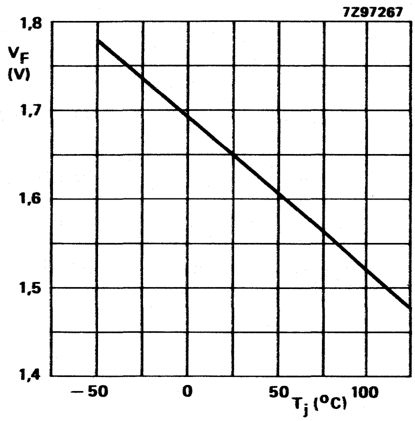


Fig.5 I_F = 10 mA; typical values.

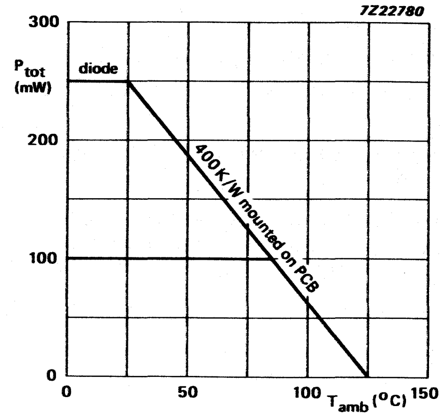


Fig.6.

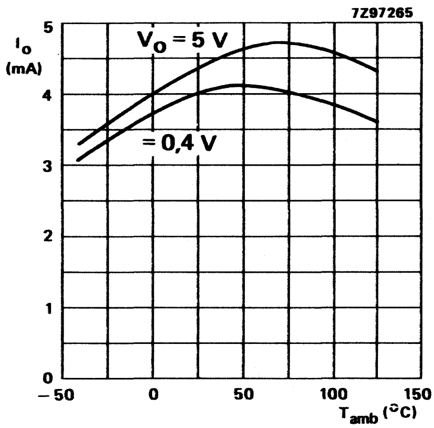


Fig.7 V_{CC} = 5 V; I_F = 10 mA; typical values.

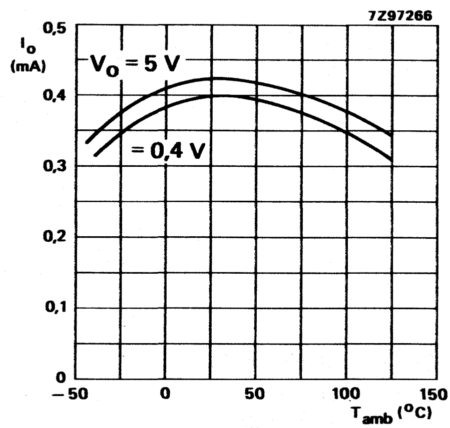


Fig.8 V_{CC} = 5 V; I_F = 2 mA; typical values.

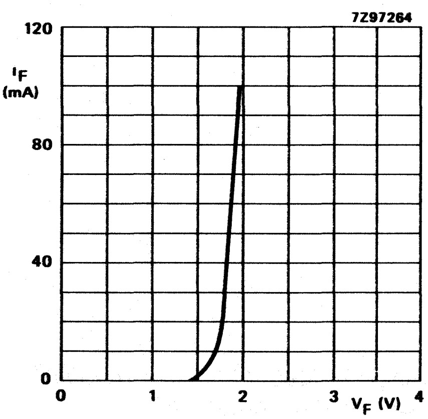


Fig.9 T_{amb} = 25 °C; typical values.

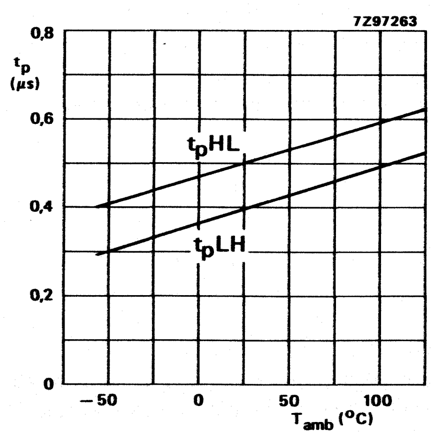


Fig.10 I_F = 10 mA; V_{CC} = 5 V; R_L = 2.5 kΩ; typical values.

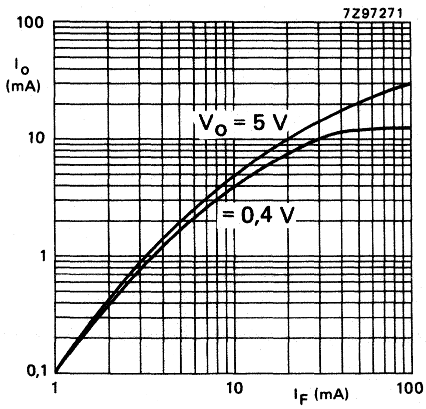


Fig.11 V_{CC} = 5 V; typical values.

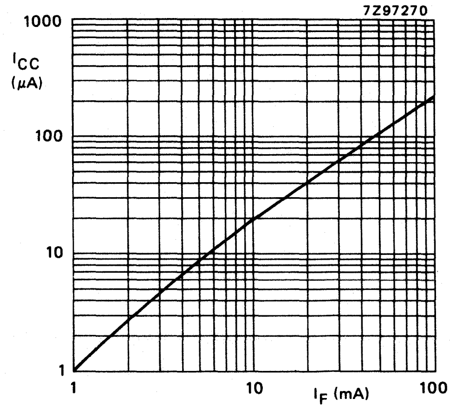


Fig.12 V_{CC} = 15 V; I_o = 0; typical values.

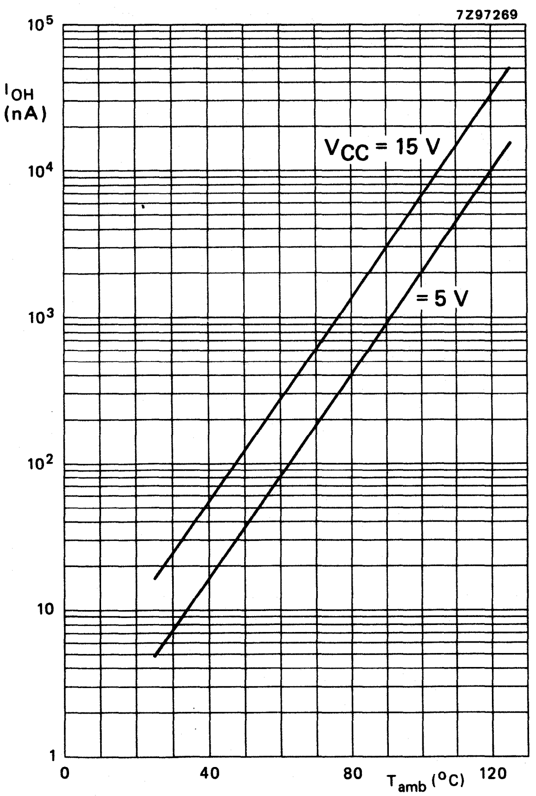


Fig.13 Typical values.

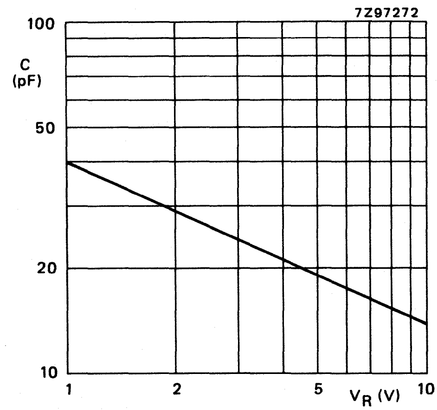


Fig.14 T_{amb} = 25 °C; typical values.

Photodiode capacitance

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

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_{IORM}	min.	2.82	kV
AC (RMS value)				2.0	kV

MECHANICAL DATA

SOT90B (see Fig.1).

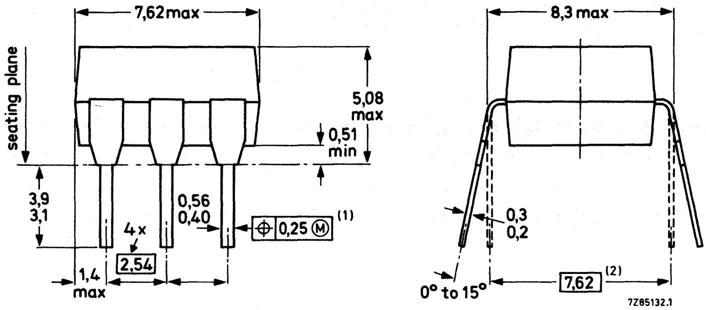
Note

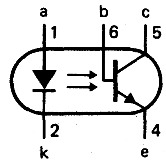
JEDEC registered data.

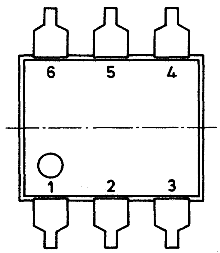
MECHANICAL DATA

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 junction temperature range (note 1)	T_j		−55 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.	1.15 V
		max.	1.5 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 (see notes 2 and 3)	DC	V_{IORM}	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
Insulation resistance between input and output					
V_{IO} = 500 V		R_{IO}	typ.	10	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.

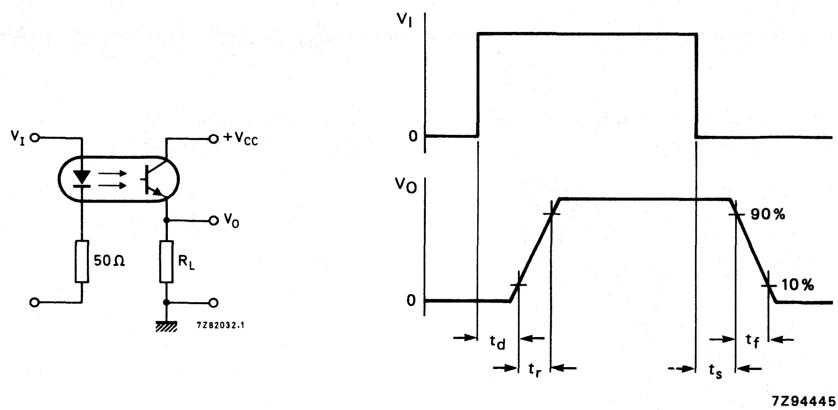


Fig. 2 Measuring circuit and waveforms.

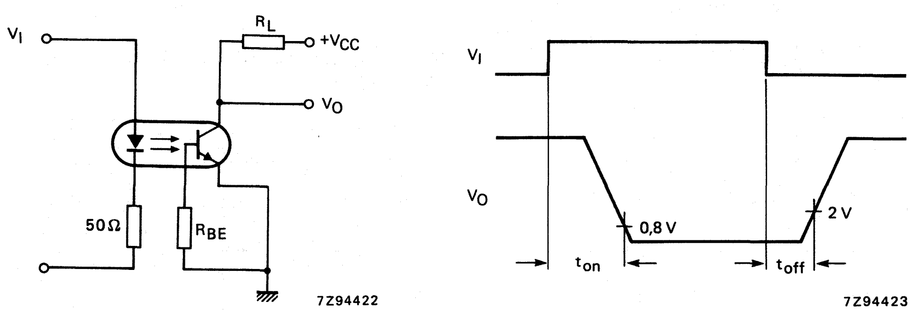


Fig. 3 Measuring circuit and waveforms.

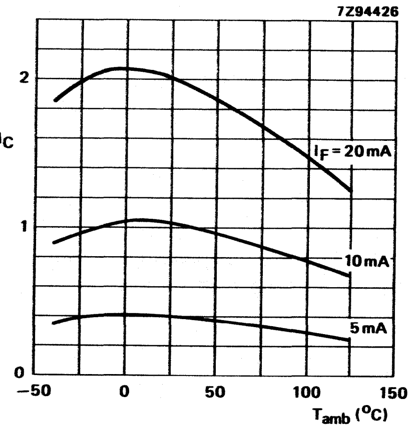


Fig. 4 Normalized at I_F = 10 mA; V_{CE} = 10 V; T_{amb} = 25 °C; typical values.

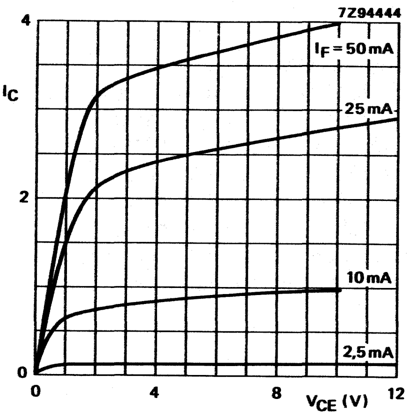


Fig. 5 Normalized at I_C = 1 mA; I_F = 10 mA; V_{CE} = 10 V; typical values.

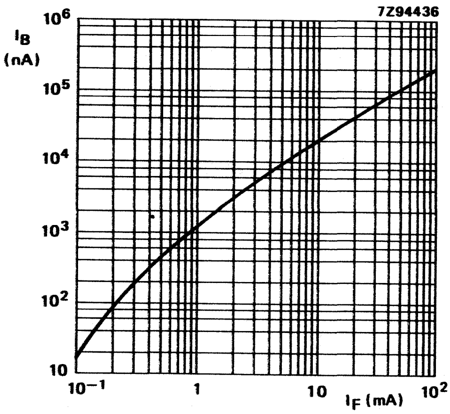


Fig. 6 V_{CB} = 10 V; T_{amb} = 25 °C; typical values.

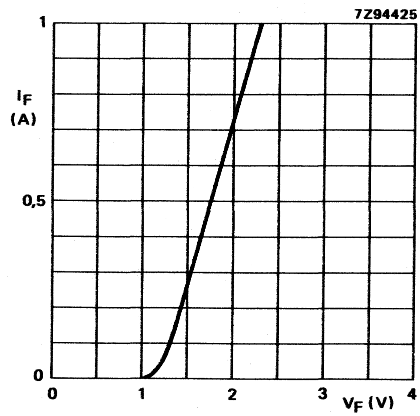


Fig. 7 T_{amb} = 25 °C; t_{on} = 20 μs; δ = 0,01; typical values.

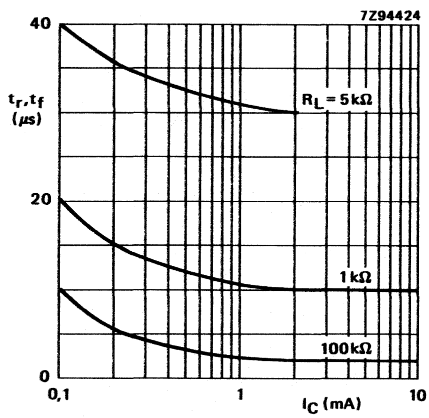


Fig. 8 Normalized at I_F = 10 mA; V_{CE} = 10 V; T_{amb} = 25 °C; typical values.

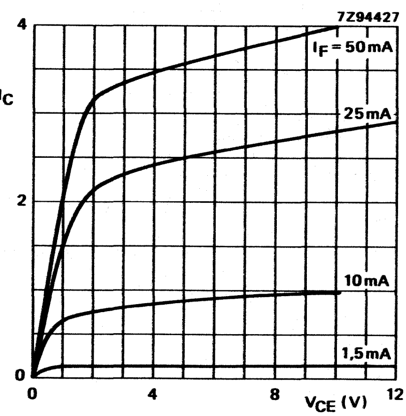


Fig. 9 T_{amb} = 25 °C; typical values.

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

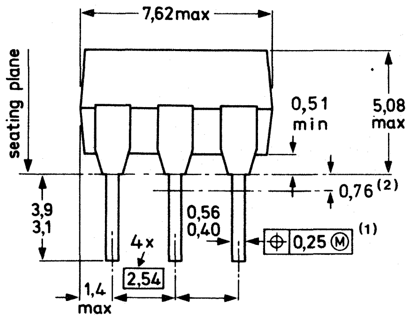
Diode				
Continuous reverse voltage		V_R	max.	5.0 V
DC forward current		I_F	max.	100 mA
peak value; t_p = 10 μs; δ = 0.01		I_{FRM}	max.	3.0 A
Total power dissipation up to T_{amb} = 25 ^oC		P_{tot}	max.	200 mW
Transistor				
Collector-emitter voltage (open base)		V_{CEO}	max.	30 V
Total power dissipation 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_{IORM}	max.	4.4 KV
AC (RMS value)				3.12 kV

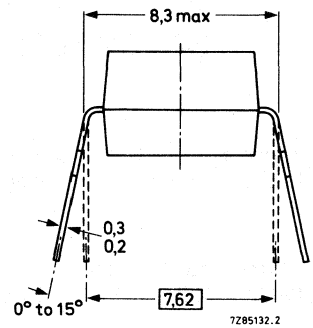
MECHANICAL DATA

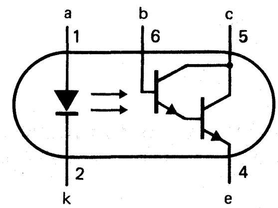
SOT90B (see Fig.1).

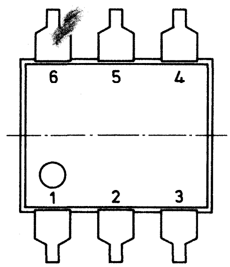
MECHANICAL DATA

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
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. max.	1.15 V 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. max.	20 nA 100 nA
V_{CB} = 10 V	I_{CEO}	max.	20 nA
DC current gain I_C = 500 μA; V_{CE} = 5 V	h_{FE}	typ.	1000

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.	1000	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_{IORM}	min.	4.4	kV
AC (RMS value)			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
Insulation resistance between input and output					
± V_{IO} = 1 kV		R_{IO}	min.	10	GΩ
			typ.	1	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_{IORM} 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.

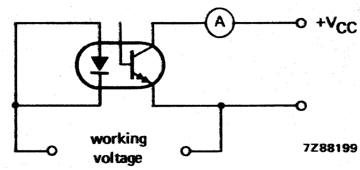


Fig. 2 Test circuit.

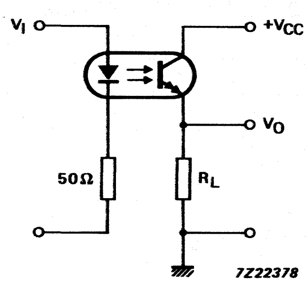


Fig. 3 Switching circuit.

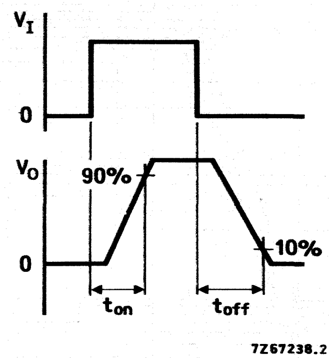


Fig. 4 Waveforms.

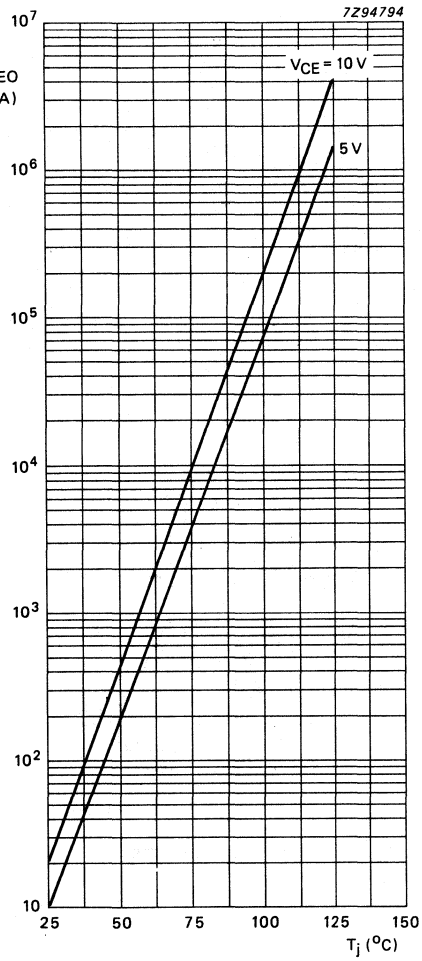


Fig. 5 Collector-emitter voltage as a function of junction temperature; typical values.

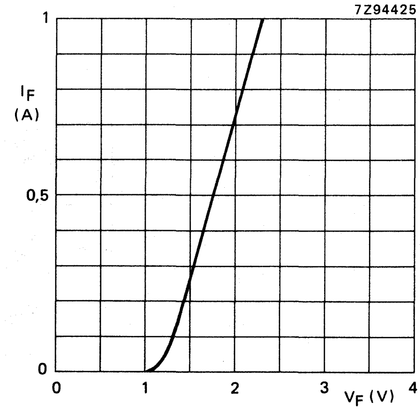


Fig. 6 Forward current as a function of forward voltage; T_{amb} = 25 °C; t_{on} = 20 μs; δ = 0.01; typical values.

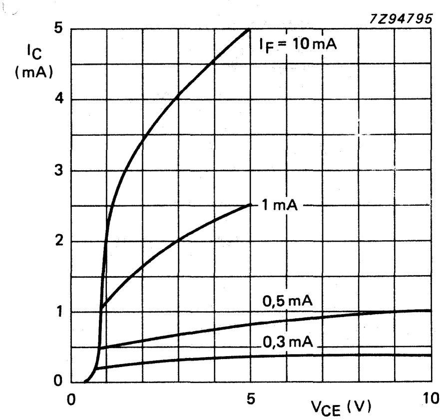


Fig. 7 Collector current as a function of collector-emitter voltage; normalized to I_F = 0.5 mA; V_{CE} = 10 V; typical values.

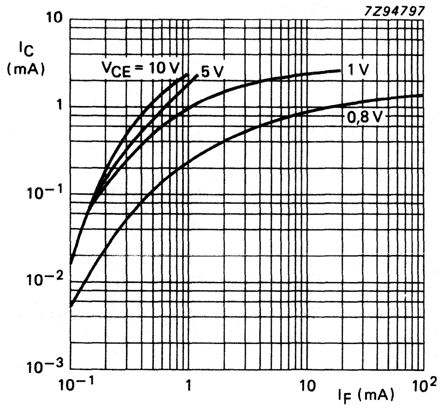


Fig. 8 Collector current as a function of forward current; normalized to I_F = 0.5 mA; V_{CE} = 10 V; T_{amb} = 25 °C; typical values.

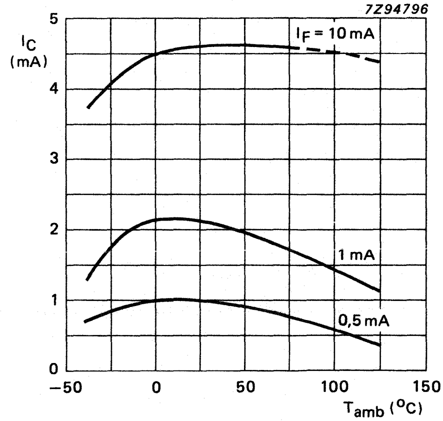


Fig. 9 Collector current as a function of ambient temperature; normalized to I_F = 0.5 mA; V_{CE} = 10 V; T_{amb} = 25 °C; typical values.

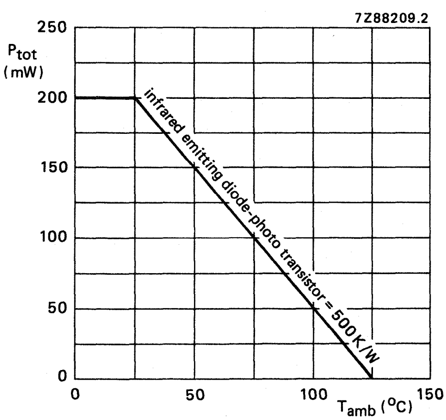


Fig. 10 Power derating curve for diode and transistor as a function of temperature.

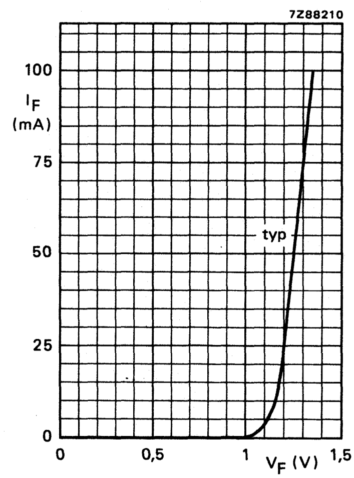


Fig. 11 Forward current as a function of forward voltage; T_{amb} = 25 °C.

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

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_{IORM}	min.	4.4	kV
AC (RMS value)				3.12	kV
DC	4N36/37	V_{IORM}	min.	2.82	kV
AC (RMS value)				2.0	kV

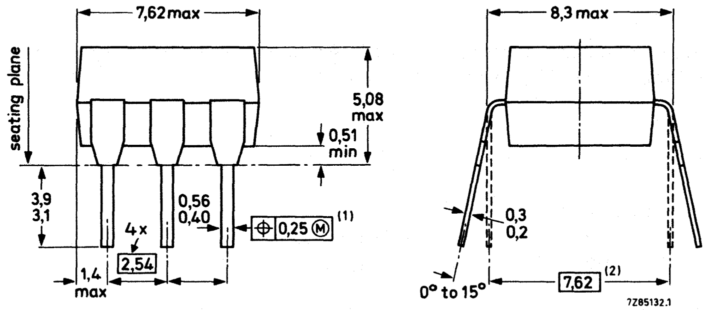
MECHANICAL DATA: SOT90B (see Fig. 1).

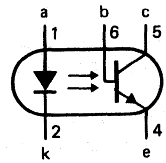
Note: JEDEC registered data.

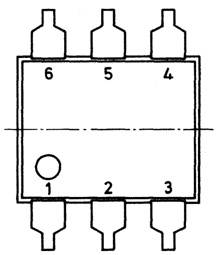
MECHANICAL DATA

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 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		−55 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_{IORM}	min.	4.4 kV
AC (RMS value)				3.12 kV
DC	4N36/37	V_{IORM}	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.	2.0 pF
			typ.	0.6 pF
Insulation resistance between input and output (see note 1)				
$\pm V_{IO}$ = 500 V		R_{IO}	min.	100 GΩ
			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.
3. JEDEC registered data is:

4N35	V_{IORM}	min.	3.55 kV peak
4N36	V_{IORM}	min.	2.5 kV peak
4N37	V_{IORM}	min.	1.5 kV peak

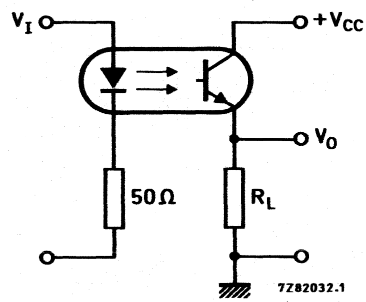


Fig. 2 Switching circuit.

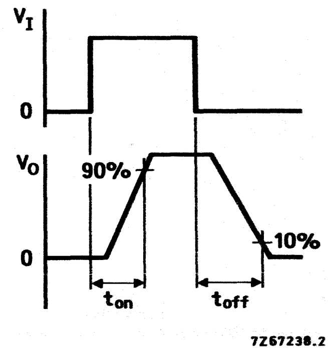


Fig. 3 Waveforms.

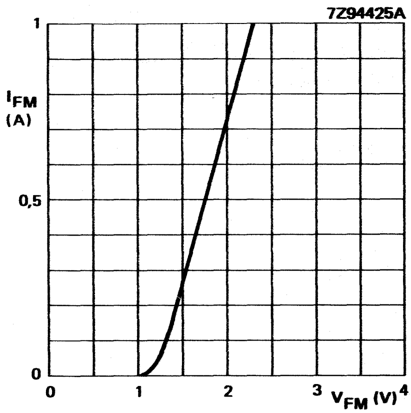


Fig. 4 T_{amb} = 25 °C; t_{on} = 20 μs; δ = 0,01; typical values.

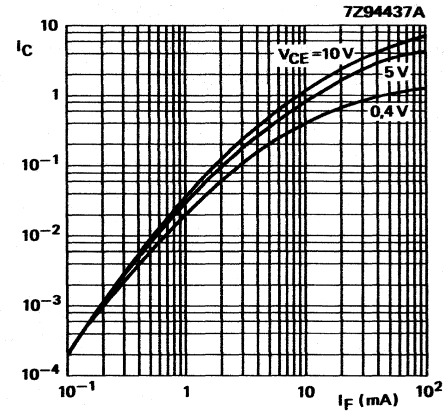


Fig. 5 Normalized to I_F = 10 mA; V_{CE} = 10 V; typical values.

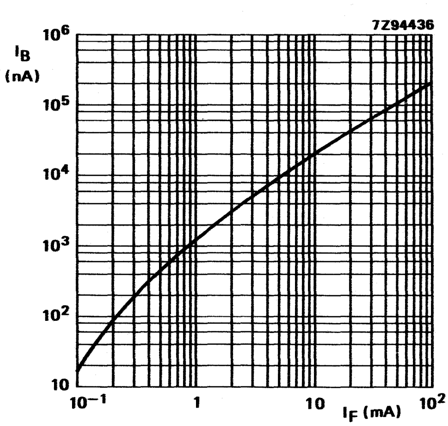


Fig. 6 V_{CB} = 10 V; T_{amb} = 25 °C; typical values.

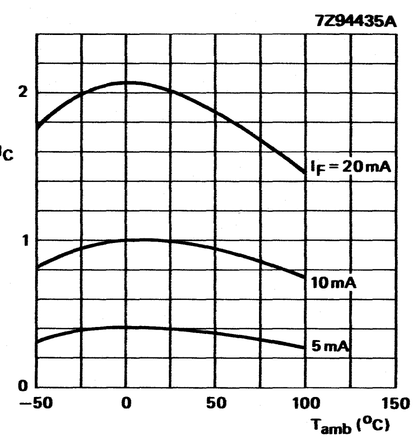


Fig.7 Normalized to I_F = 10 mA; V_{CE} = 10 V; T_{amb} = 25 °C; typical values.

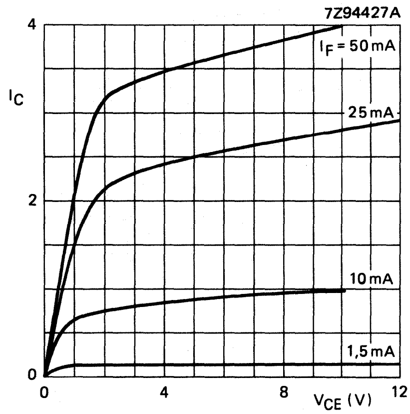


Fig. 8 Normalized to I_F = 10 mA; V_{CE} = 10 V; T_{amb} = 25 °C; typical values.

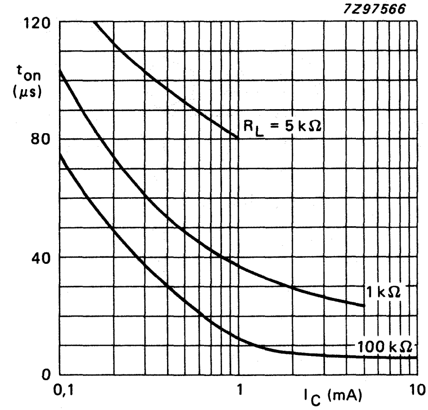


Fig. 9 V_{CC} = 10 V; T_{amb} = 25 °C; typical values.

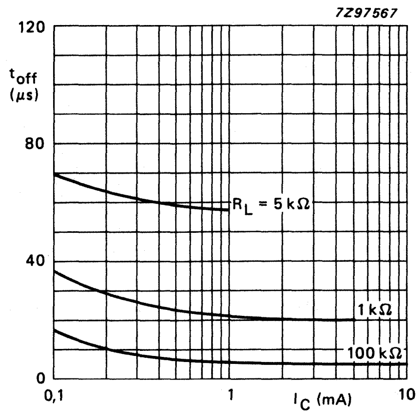


Fig. 10 V_{CC} = 10 V; T_{amb} = 25 °C; typical values.

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.

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_{IORM}	min.	2.82	kV
Isolation voltage AC (RMS value)	V_{IORM}	min.	2.0	kV

MECHANICAL DATA

SOT90B (see Fig.1).

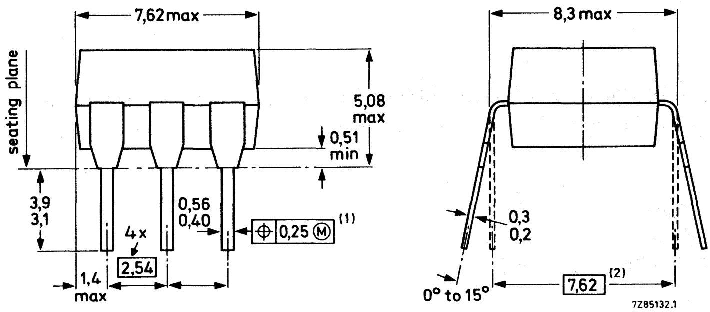
Notes

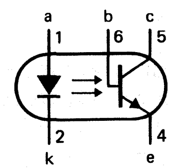
1. Indicates JEDEC registered data.
2. JEDEC registered data is 3 V.

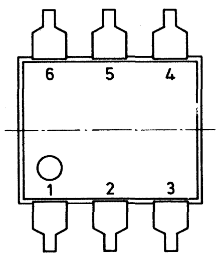
MECHANICAL DATA

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		−55 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_{IORM}	min.	2.82 kV
AC (RMS value)	V_{IORM}	min.	2.0 kV
Capacitance between input and output (see note 3)			
V_O = 0; f = 1 MHz	C_{io}	typ.	0.6 pF
Insulation resistance between input and output (see note 3)			
$\pm V_{IO}$ = 500 V	R_{IO}	min.	100 GΩ
		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.
2. JEDEC registered data is:

4N38	V_{IORM}	min.	1.5 kV peak
4N38A	V_{IORM}	min.	2.5 kV peak

3. Indicates JEDEC registered data.

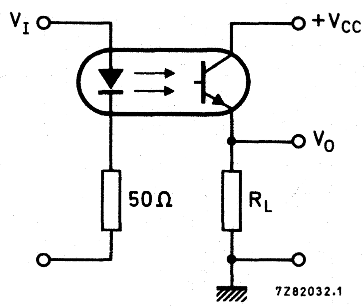


Fig. 2 Switching circuit.

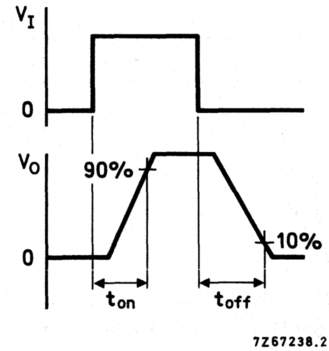


Fig. 3 Waveforms.

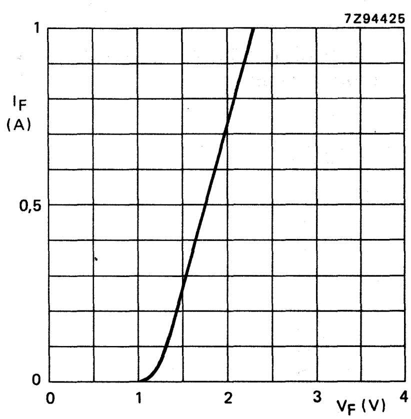


Fig. 4 T_{amb} = 25 °C; t_{on} = 20 μs; δ = 0.01; typical values.

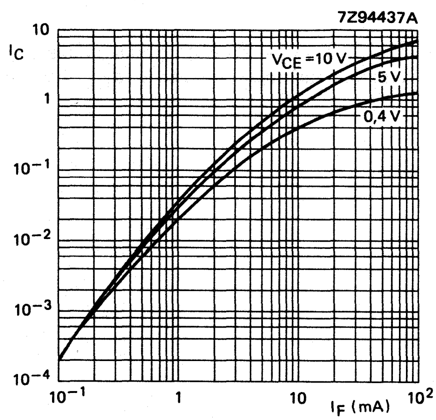


Fig. 5 Normalized to I_F = 10 mA; V_{CE} = 10 V; typical values.

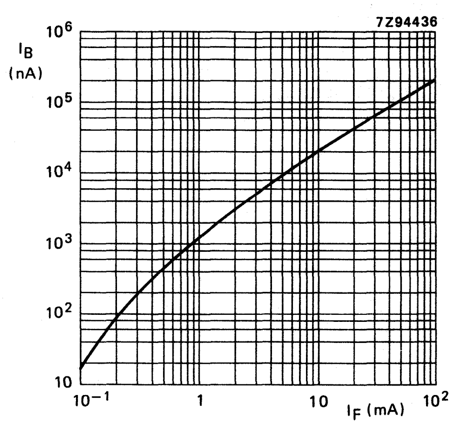


Fig. 6 V_{CB} = 10 V; T_{amb} = 25 °C; typical values.

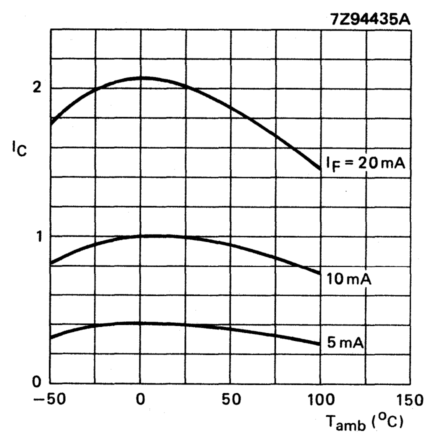


Fig. 7 Normalized to I_F = 10 mA; V_{CE} = 10 V; T_{amb} = 25 °C; typical values.

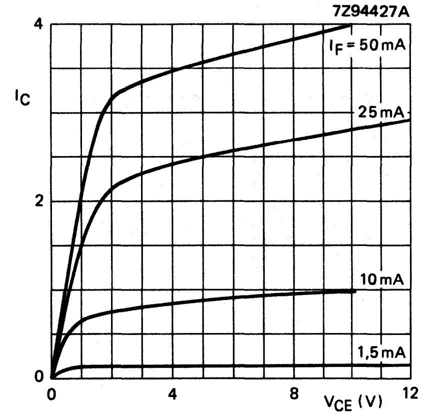


Fig. 8 T_{amb} = 25 °C; typical values. Normalized to I_F = 10 mA; V_{CE} = 10 V.

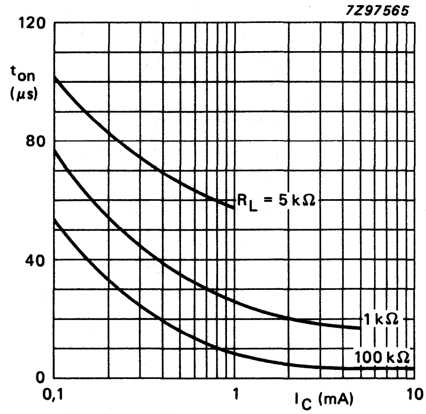


Fig. 9 V_{CC} = 10 V; T_{amb} = 25 °C; typical values.

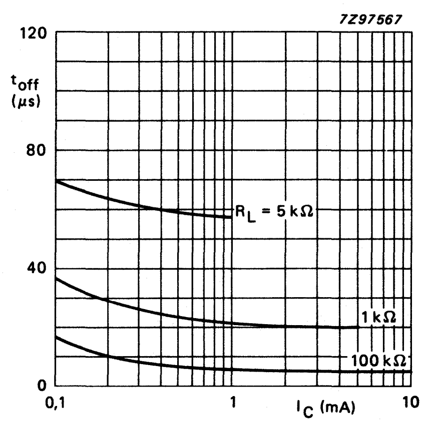


Fig. 10 V_{CC} = 10 V; T_{amb} = 25 °C; typical values.

GaAlAs, RESISTOR-DARLINGTON, OPTOCOUPLER

The 4N46 is an optocoupler in a dual-in-line (DIL) 6 pin plastic SOT229 envelope. It consits of a GaAlAs infrared emitter optically coupled to a silicon npn photodarlington. The output transistor has an integral base-emitter resistor to optimize switching speeds and elevate temperature characteristics.

Features

- High current transfer ratio/high sensitivity at low input current
- High degree of AC and DC insulation (3120 V RMS and 4400 V DC)
- Working voltage of 2.5 kV DC
- Collector-emitter breakdown voltage of 80 V
- Long operational life

Applications

- Telephone, telegraph and general telecommunication
- CMOS compatible
- Low input current TTL interface
- General purpose switching
- Power supply isolation

QUICK REFERENCE DATA

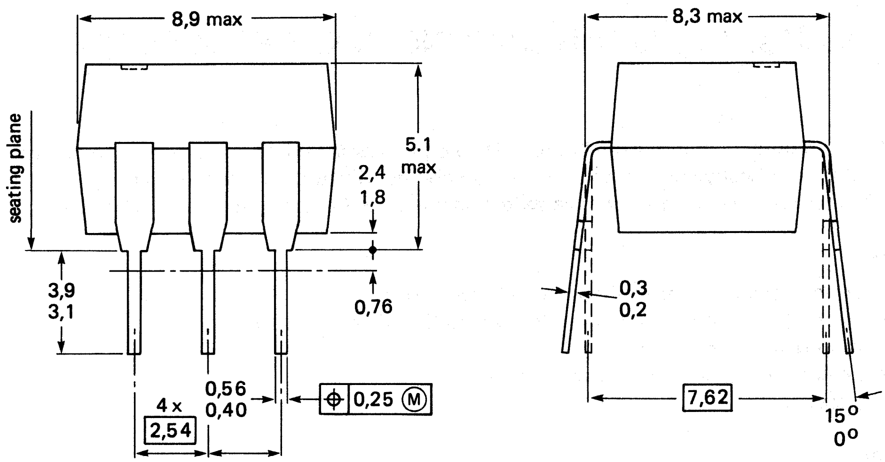
Diode			
DC Forward current	I_F	max.	100 mA
DC Reverse voltage	V_R	max.	5 V
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	200 mW
Transistor			
DC Collector current	I_C	max.	100 mA
Collector-emitter voltage (open base)	V_{CEO}	max.	30 V
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	200 mW
Optocoupler			
DC current transfer ratio (CTR)			
I_F = 0.5 mA; V_{CE} = 1 V; 0 to 70 °C	I_C/I_F	min.	3.5
I_F = 1.0 mA; V_{CE} = 1 V; 0 to 70 °C	I_C/I_F	min.	5.0
I_F = 10 mA; V_{CE} = 1.2 V; 0 to 70 °C	I_C/I_F	min.	2.0
Isolation voltage DC	V_{IORM}	max.	4.4 kV
AC (RMS value)			3.12 kV

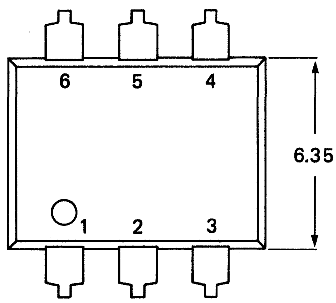
MECHANICAL DATA

SOT229 (see Fig.1)

MECHANICAL DATA

Dimensions in mm





Pinning

1 = Anode	4 = Emitter
2 = Cathode	5 = Collector
3 = Not connected	6 = Base

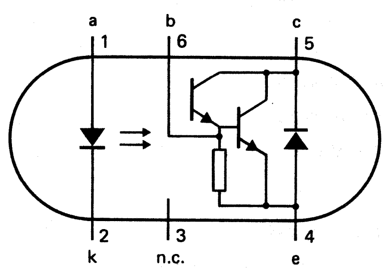


Fig.1 SOT229.

RATINGS

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

Diode

DC Forward current	I_F	max.	100 mA
(peak: t_{on} = 10 μs, d = 0.01)	I_{FRM}	max.	2.5 A
DC Reverse voltage	V_R	max.	5 V
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	200 mW

Transistor

DC Collector current	I_C	max.	100 mA
Collector-emitter voltage (open base)	V_{CEO}	max.	30 V
Emitter-collector voltage (open base)	V_{ECO}	max.	0.5 V
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	200 mW

Optocoupler

Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	250 mW
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
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 when mounted on a PCB			
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)	L(IO2)	min.	8.0 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	V_F	typ.	1.35 V
I_F = 1 mA	V_F	max.	1.7 V
I_F = 10 mA	V_F	max.	1.7 V
Reverse current V_R = 5 V	I_R	max.	10 µA
Diode capacitance V_R = 0 V; f = 1 MHz	C_d	typ.	200 pF

DEVELOPMENT DATA

CHARACTERISTICS (continued)

Transistor

Collector-emitter breakdown voltage $I_C = 1$ mA	$V_{(BR)CEO}$	min.	30 V
Logic HIGH output current $V_{CE} = 18$ V; $T_{amb} = 0$ to 70 °C	I_{OH}	max.	100 μA
Collector-emitter cut-off current (dark) $I_F = 0$; $V_{CE} = 10$ V	I_{CEO}	typ. max.	* nA 100 nA
Collector-base cut-off current $I_F = 0$; $V_{CB} = 10$ V	I_{CBO}	max.	20 nA

Optocoupler

DC current transfer ratio (CTR)			
$I_F = 0.5$ mA; $V_O = 1$ V; 0 to 70 °C	I_O/I_F	min.	3.5
$I_F = 1$ mA; $V_O = 1$ V; 0 to 70 °C	I_O/I_F	min.	5.0
$I_F = 10$ mA; $V_O = 1.2$ V; 0 to 70 °C	I_O/I_F	min.	2.0
Logic LOW output voltage			
$I_F = 0.5$ mA; $I_{OL} = 1.75$ mA; 0 to 70 °C	V_{OL}	typ. max.	* V 1.0 V
$I_F = 1$ mA; $I_{OL} = 5$ mA; 0 to 70 °C	V_{OL}	typ. max.	* V 1.0 V
$I_F = 10$ mA; $I_{OL} = 20$ mA; 0 to 70 °C	V_{OL}	typ. max.	* V 1.2 V
Isolation voltage (see next page) t = 1 min DC AC (RMS value)	V_{IORM}	min. min.	4.4 kV 3.12 kV
Capacitance between input and output $V_{IO} = 0$; f = 1 MHz	C_{IO}	typ. max.	0.4 pF 1.0 pF
Insulation resistance between input and output $V_{IO} = 1000$ V	R_{IO}	min. typ.	10 GΩ 1 TΩ
Switching times (see Fig.2) $V_{CC} = 5$ V			
Propagation delay time to logic LOW output			
$I_F = 1$ mA; $R_L = 10$ kΩ	T_{PHL}	typ.	* μs
$I_F = 10$ mA; $R_L = 220$ Ω	T_{PHL}	typ. max.	* μs 50 μs
Propagation delay time to logic HIGH output			
$I_F = 1$ mA; $R_L = 10$ kΩ	T_{PHL}	typ.	* μs
$I_F = 10$ mA; $R_L = 220$ Ω	T_{PHL}	typ. max.	* μs 500 μs

* Value to be fixed

Transient immunity (see Fig.3)			
V_{CC} = 5 V; R_L = 10 kΩ; V_{CM} = 10 $V_{p\text{-}p}$			
Common mode transient immunity at logic LOW			
I_F = 1 mA	C_{ML}	typ.	500 V/μs
Common mode transient immunity at logic HIGH			
I_F = 0 mA	C_{MH}	typ.	500 V/μs

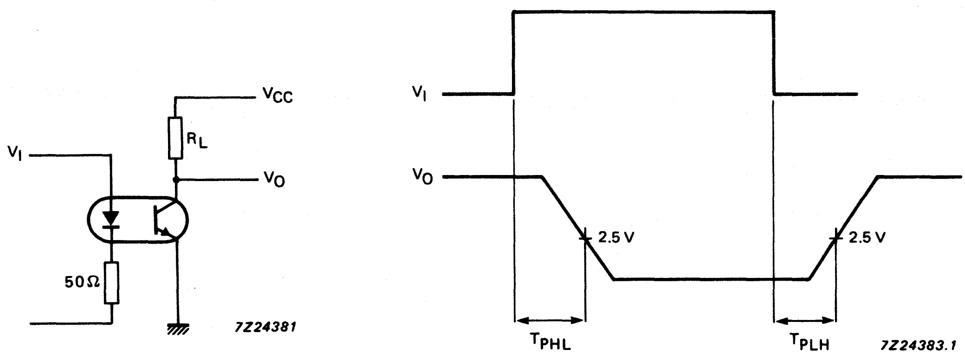
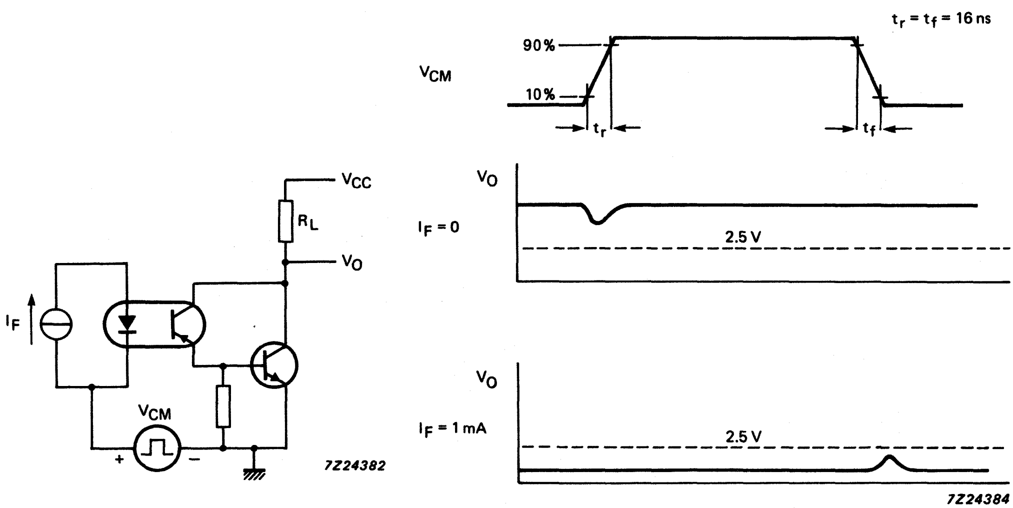


Fig.2 Test circuit: Switching times.



The output voltage V_O must not cross the 2.5 V line with I_F = 0 or the I_F = 1 mA.

Fig.3 Transient immunity.

Notes

1. 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.

DEVELOPMENT DATA

HIGH-SPEED OPTOCOUPLERS

Fast switching optocouplers consisting of a GaAlAs light emitting diode which is optically coupled to a silicon photodetector in a 8-pin dual-in-line (DIL) envelope SOT97F.
It is suitable for use with TTL integrated circuits.

Features

- Short propagation delay times
- Low saturation voltage
- High isolation voltage of 2.5 kV RMS and 3.5 kV DC for 6N135/3.12 kV RMS and 4.4 kV DC for 6N136
- Working voltage of 2.5 kV DC
- High transient immunity
- Requests for UL recognition and VDE approval are pending

QUICK REFERENCE DATA

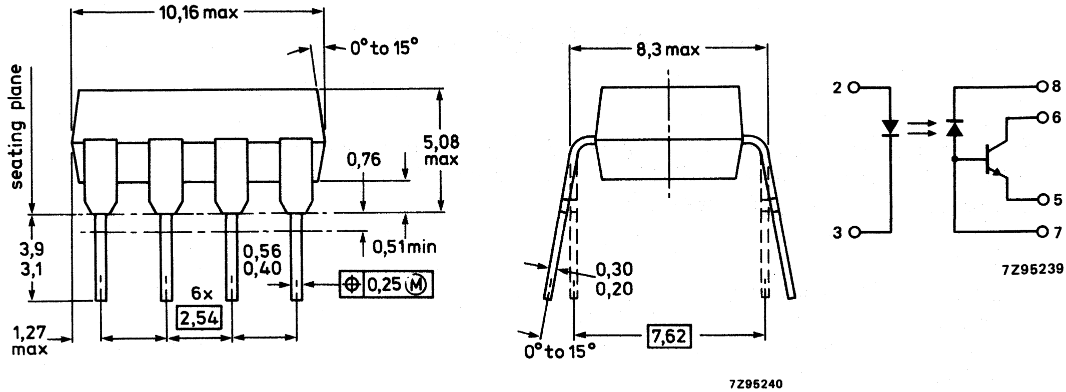
Diode					
Continuous reverse voltage		V_R	max.	5.0	V
DC forward current		I_F	max.	100	mA
(peak value) t_p = 1 μs; f = 300 Hz		I_{FRM}	max.	1.0	A
Transistor					
Collector-emitter breakdown voltage I_C = 10 mA		$V_{(BR)CEO}$	max.	15	V
Optocoupler					
DC current transfer ratio (CTR) I_F = 16 mA; V_O = 0.4 V; V_{CC} = 4.5 V	6N135	I_C/I_F	min.	0.07	
	6N136	I_C/I_F	min.	0.19	
Propagation delay time	6N135	t_{PHL}, t_{PLH}	max.	1.5	μs
	6N136	t_{PHL}, t_{PLH}	max.	0.8	μs
Common mode transient immunity		±CM	min.	1.0	kV/μs
Isolation voltage DC	6N135	V_{IORM}	min.	3.5	kV
Isolation voltage AC (RMS value)	6N135	V_{IORM}	min.	2.5	kV
Isolation voltage DC	6N136	V_{IORM}	min.	4.4	kV
Isolation voltage AC (RMS value)	6N136	V_{IORM}	min.	3.12	kV

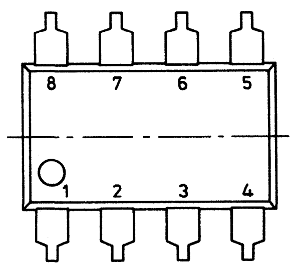
MECHANICAL DATA

SOT97F (see Fig.1).

MECHANICAL DATA

Dimensions in mm





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 the nominal by 0.25 mm.

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

Fig. 1 SOT97F.

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 = 1 μs; f = 300 Hz	I_{FRM}	max.	1.0 A
Total power dissipation up to T_{amb} = 70 °C	P_{tot}	max.	250 mW
Transistor			
Collector-emitter voltage (pins 6-5)	V_{CEO}	max.	15 V
Emitter-base voltage (pins 7-5)	V_{EBO}	max.	5.0 V
Supply voltage (pins 8-5)	V_{CC}		−0.5 to +15 V

DC collector current	I_C	max.	10 mA
Total power dissipation up to T_{amb} = 70 °C	P_{tot}	max.	100 mW

Optocoupler

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

THERMAL RESISTANCE

From junction to ambient			
diode	$R_{th\,j\text{-}a}$	=	500 K/W
transistor	$R_{th\,j\text{-}a}$	=	500 K/W
From junction to ambient with the device mounted on a PCB			
diode	$R_{th\,j\text{-}a}$	=	400 K/W
transistor	$R_{th\,j\text{-}a}$	=	400 K/W

LINEAR DERATING FACTOR

Above 70 °C	
diode	2.0 mW/K
transistor	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.	1.0 mm

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Diode

Forward voltage I_F = 16 mA		V_F	typ. max.	1.55 V 1.7 V
Reverse current V_R = 5 V		I_R	max.	10 μA

Transistor

Collector-emitter breakdown voltage I_C = 10 mA		$V_{(BR)CEO}$	min.	15 V
Emitter-base breakdown voltage I_E = 0.1 mA		$V_{(BR)EBO}$	min.	5.0 V
Logic HIGH output current I_F = 0; V_O = V_{CC} = 5.5 V		I_{OH}	typ. max.	5.0 nA 500 nA
Logic HIGH output current I_F = 0; V_O = V_{CC} = 15 V		I_{OH}	max.	100 μA
Logic HIGH supply current I_F = 0; I_O = 0; V_{CC} = 15 V		I_{CCH}	max.	1.0 μA
Logic LOW supply current I_F = 16 mA; I_O = 0; V_{CC} = 15 V		I_{CCL}	typ.	30 μA

Optocoupler

DC current transfer ratio (CTR) I_F = 16 mA; V_O = 0.4 V; V_{CC} = 4.5 V	6N135	I_C/I_F	min. typ.	0.07 0.18
	6N136	I_C/I_F	min. typ.	0.19 0.5
Logic LOW output voltage I_F = 16 mA; I_C = 1.1 mA; V_{CC} = 4.5 V	6N135	V_{OL}	typ. max.	0.2 V 0.4 V
I_F = 16 mA; I_C = 2.4 mA; V_{CC} = 4.5 V	6N136	V_{OL}	typ. max.	0.2 V 0.4 V

Isolation voltage (t = 1 min) (see note 1)	DC AC (RMS value)	6N135	V_{IORM}	min.	3.5 2.5	kV kV
	DC AC (RMS value)	6N136	V_{IORM}	min.	4.4 3.12	kV kV
Capacitance between input and output $V_{IO} = 0$; f = 1 MHz			C_{io}	typ.	0.6	pF
Insulation resistance between input and output $\pm V_{IO} = 1$ kV			R_{IO}	typ. min.	1 10	TΩ GΩ
Switching times (see Figs 2 and 3) $I_F = 16$ mA; $V_{CC} = 5$ V; $R_L = 4.1$ kΩ; $T_{amb} = 25$ °C						
Propagation delay time to logic LOW at output		6N135	t_{PHL}	typ. max.	0.2 1.5	μs μs
Propagation delay time to logic HIGH at output		6N135	t_{PLH}	typ. max.	0.6 1.5	μs μs
Switching times (see Figs 2 and 3) $I_F = 16$ mA; $V_{CC} = 5$ V $R_L = 1.9$ kΩ; $T_{amb} = 25$ °C						
Propagation delay time to logic LOW at output		6N136	t_{PHL}	typ. max.	0.4 0.8	μs μs
Propagation delay time to logic HIGH at output		6N136	t_{PLH}	typ. max.	0.6 0.8	μs μs
Transient immunity (see Fig. 4). $V_{CC} = 5$ V; $V_{CM} = 10\ V_{(p\text{-}p)}$; $T_{amb} = 25$ °C	$R_L = 4.1$ kΩ(6N135) $R_L = 1.9$ kΩ(6N136)					
Common mode transient immunity at logic HIGH $I_F = 0$			CM_H	min.	1.0	kV/μs
Common mode transient immunity at logic LOW $I_F = 16$ mA			CM_L	min.	−1.0	kV/μs
Logic HIGH output current (note 2) $V_{CC} = 5.5$ V; working voltage = 2.5 kV DC; $T_{amb} = 70$ °C (see Fig.5)			I_{OHW}	max.	100	μA

DEVELOPMENT DATA

Notes

1. Every single procut is tested by applying an isolation AC test voltage of 3.0 kV (RMS) for 6N135 and 3.75 kV AC (RMS) for 6N136 for 2 seconds between the shorted input (diode) and the shorted output (phototransistor) leads.
2. This parameter is the maximum collector-emitter leakage current measured when a logic HIGH DC voltage is applied between the emitter and the two shorted diode leads.

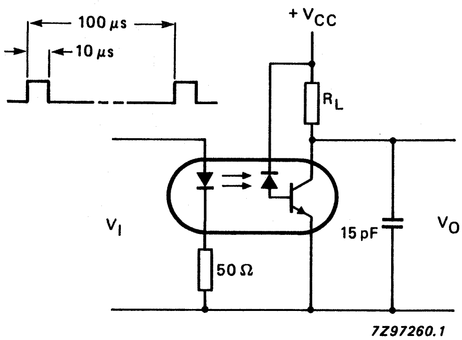


Fig. 2 Switching circuit.

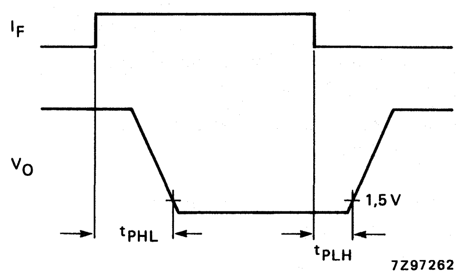


Fig. 3 Waveforms.

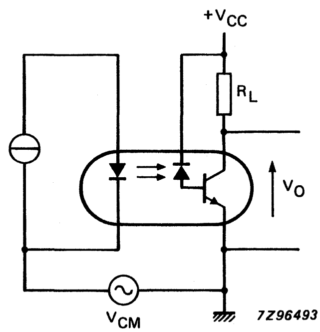


Fig. 4 Test circuit.

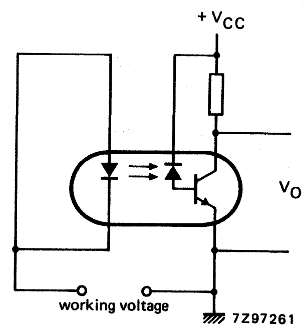


Fig. 5 Test circuit.

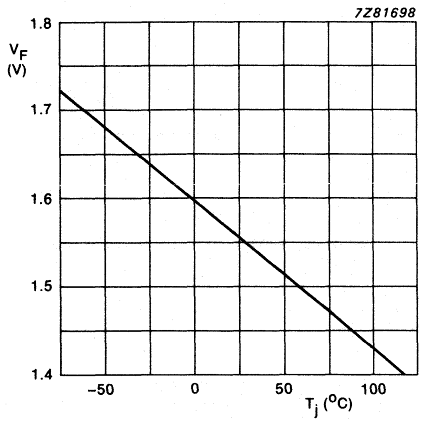


Fig. 6 Typical forward voltage as a function of junction temperature; I_F = 16 mA; typical values.

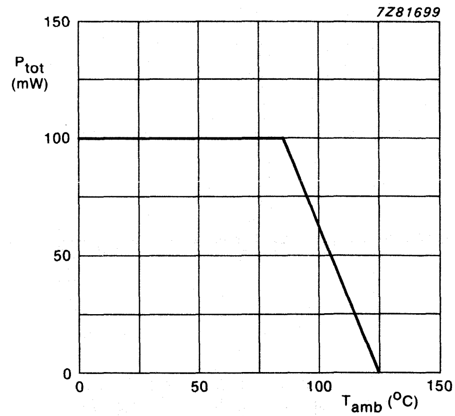


Fig. 7 Total power dissipation as a function of ambient temperature.

DEVELOPMENT DATA

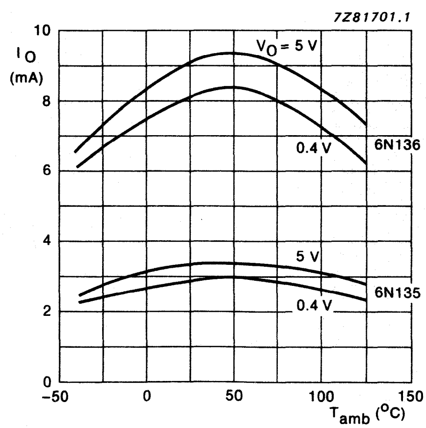


Fig. 8 Output current as a function of ambient temperature; V_{CC} = 5 V; I_F = 16 mA; typical values.

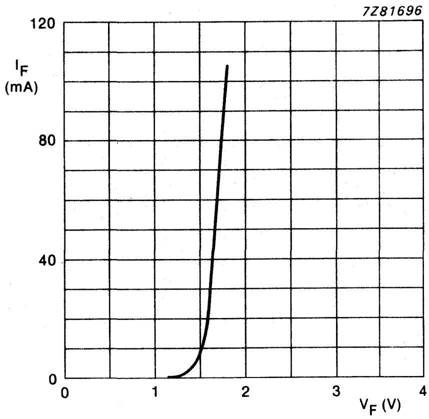


Fig. 9 Forward current as a function of forward voltage; T_{amb} = 25 °C; typical values.

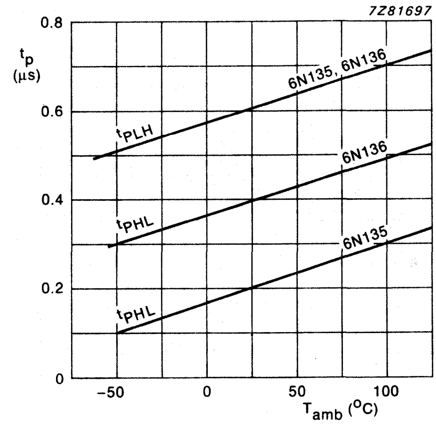


Fig. 10 Propagation delay times as functions of ambient temperature; I_F = 16 mA; V_{CC} = 5 V; R_L = 4.1 kΩ for 6N135; R_L = 1.9 kΩ for 6N136; typical values.

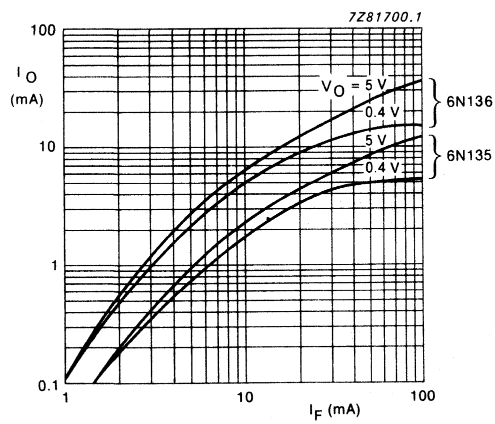


Fig. 11 Output current as a function of forward current; V_{CC} = 4.5 V; typical values.

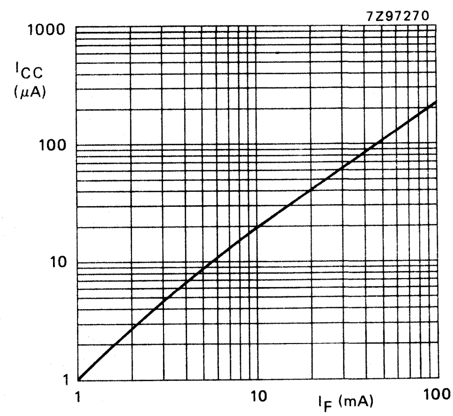


Fig. 12 I_{CC} as a function of forward current; V_{CC} = 15 V; I_O=0; typical values.

DEVELOPMENT DATA

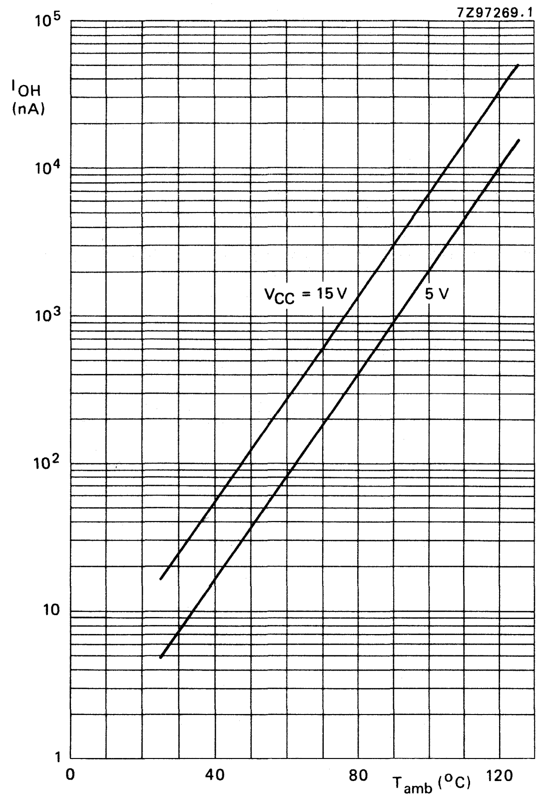


Fig. 13 Logic HIGH output current as a function of ambient temperature; typical values.

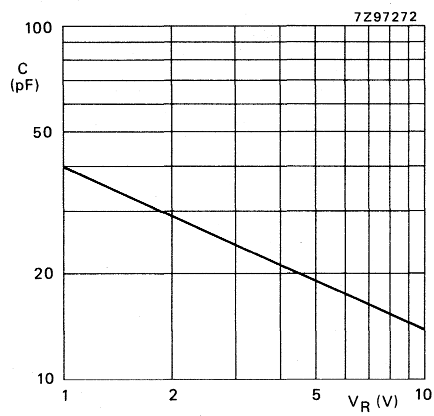


Fig. 14 Photodiode capacitance as a function of reverse voltage; T_{amb} = 25 °C; typical values.

INDEX OF TYPE NUMBERS

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

Key to handbook sections

A = Accessories
FET = Field-effect transistors
I = Infrared devices
LED = Light-emitting diodes
LCD = Liquid crystal displays
Mm = Surface-mounted devices
M = Microwave transistors
P = Low-frequency power transistors and modules
PDT = Photodiodes or transistors
Ph = Photoconductive devices
PhC = Photocouplers
PM = PowerMOS transistors
R = Rectifier diodes
RFP = RF power transistors and modules
RT = Triplers
SEN = Semiconductor sensors
SD = Small-signal diodes
Sm = Small-signal transistors
Sp = Special diodes
SP = Low-frequency switching power diodes
St = Rectifier stacks
T = Tuner diodes
Th = Thyristors
Tri = Triacs
TS = Transient suppressor diodes
Vrf = Voltage reference diodes
Vrg = Voltage regulator diodes
WBT = Wideband hybrid IC transistors
WBM = Wideband hybrid IC modules

* series.

NOTES

NOTES

DATA HANDBOOK SYSTEM

DATA HANDBOOK SYSTEM

Our Data Handbook System comprises more than 60 books with specifications on electronic components, subassemblies and materials. It is made up of six series of handbooks:

INTEGRATED CIRCUITS

DISCRETE SEMICONDUCTORS

DISPLAY COMPONENTS

PASSIVE COMPONENTS*

PROFESSIONAL COMPONENTS**

MATERIALS*

The contents of each series are listed on pages iii to viii.

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

When ratings or specifications differ from those published in the preceding edition they are indicated with arrows in the page margin. Where application is given it is advisory and does not form part of the product specification.

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Product specialists are at your service and enquiries will be answered promptly.

* Will replace the Components and materials (green) series of handbooks.
** Will replace the Electron tubes (blue) series of handbooks.

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This series of handbooks comprises:

code	handbook title
IC01	**Radio, audio and associated systems** Bipolar, MOS
IC02a/b	**Video and associated systems** Bipolar, MOS
IC03	**ICs for Telecom** Bipolar, MOS Subscriber sets, Cordless Telephones
IC04	**HE4000B logic family** CMOS
IC05	**not yet issued**
IC06	**High-speed CMOS; PC74HC/HCT/HCU** Logic family
IC07	**Advanced CMOS logic (ACL)**
IC08	**ECL 10K and 100K logic families**
IC09N	**TTL logic series**
IC10	**Memories** MOS, TTL, ECL
IC11	**Linear Products**
Supplement to IC11	**Linear Products**
IC12	**I^2C-bus compatible ICs**
IC13	**Semi-custom** Programmable Logic Devices (PLD)
IC14	**Microcontrollers** NMOS, CMOS
IC15	**FAST TTL logic series**
IC16	**CMOS integrated circuits for clocks and watches**
IC17	**ICs for Telecom** Bipolar, MOS Radio pagers Mobile telephones ISDN
IC18	**Microprocessors and peripherals**
IC19	**Data communication products**

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S2b	**SC03***	**Thyristors and triacs**
S3	**SC04***	**Small-signal transistors**
S4a	**SC05**	**Low-frequency power transistors and hybrid IC power modules**
S4b	**SC06**	**High-voltage and switching power transistors**
S5	**SC07***	**Small-signal field-effect transistors**
S6	**SC08*** **SC09**	**RF power transistors** **RF power modules**
S7	**SC10**	**Surface mounted semiconductors**
S8a	**SC11***	**Light emitting diodes**
S8b	**SC12**	**Optocouplers**
S9	**SC13***	**PowerMOS transistors**
S10	**SC14***	**Wideband transistors and wideband hybrid IC modules**
S11	**SC15**	**Microwave transistors**
S15**	**SC16**	**Laser diodes**
S13	**SC17**	**Semiconductor sensors**
S14	**SC18***	**Liquid crystal displays and driver ICs for LCDs**

* Not yet issued with the new code in this series of handbooks.

** New handbook in this series; will be issued shortly.

DISPLAY COMPONENTS

This series of data handbooks comprises:

current code	new code	handbook title
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T16	**DC02***	**Monochrome tubes and deflection units**
C2	**DC03***	**Television tuners, coaxial aerial input assemblies**
C3	**DC04***	**Loudspeakers**
C20	**DC05***	**Wire-wound components for TVs and monitors**

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C11	**PA02***	**Varistors, thermistors and sensors**
C12	**PA03***	**Potentiometers, encoders and switches**
C7	**PA04***	**Variable capacitors**
C22	**PA05***	**Film capacitors**
C15	**PA06***	**Ceramic capacitors**
C9	**PA07***	**Piezoelectric quartz devices**
C13	**PA08***	**Fixed resistors**

* Not yet issued with the new code in this series of handbooks.

PROFESSIONAL COMPONENTS

This series of data handbooks comprises:

current code	new code	handbook title
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T2a	*	**Transmitting tubes for communications, glass types**
T2b	*	**Transmitting tubes for communications, ceramic types**
T3	**PC01****	**High-power klystrons**
T4	*	**Magnetrons for microwave heating**
T5	**PC02****	**Cathode-ray tubes**
T6	**PC03****	**Geiger-Müller tubes**
T9	**PC04****	**Photo and electron multipliers**
T10	**PC05****	**Plumbicon camera tubes and accessories**
T11	**PC06****	**Microwave diodes and sub-assemblies**
T12	**PC07**	**Vidicon and Newvicon camera tubes and deflection units**
T13	**PC08**	**Image intensifiers**
T15	**PC09****	**Dry reed switches**
C8	**PC10**	**Variable mains transformers; annular fixed transformers**
	PC11	**Solid state image sensors and peripheral integrated circuits**

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MATERIALS

This series of data handbooks comprises:

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C16	MA02**	**Permanent magnet materials**
C19	MA03**	**Piezoelectric ceramics**

* Handbooks C4 and C5 will be reissued as one handbook having the new code MA01.

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