

Optocouplers

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Philips Components



PHILIPS

OPTOCOUPERS

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SELECTION GUIDE

Optocouplers

OPTOCOUPPLERS

Standard types, UL recognized and VDE approved

Transistor output

type	case	CTR		VCEsat	VIORM	ton/toff (typ.)		V(BR)CEO	page
		min.	max.			ton (μs)	toff (μs)		
		IF = 10 mA VCE = 0,4 V		IF = 10 mA IC = 2 mA		IC = 2 mA; VCC = 5 V; RL = 100 Ω			
				max. (V)	kV (AC) peak value			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	—

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 ● Withdrawn types not included in this handbook, superseded by CNX35U.

High-voltage transistor output

type	case	CTR		VCEsat	VIORM	ton/toff (typ.)		V(BR)CEO	page
		min.	max.			ton (μs)	toff (μs)		
		IF = 10 mA VCE = 10 V		IF = 16 mA IC = 2 mA		IC = 4 mA; VCC = 5 V; RL = 100 Ω			
				max. (V)	kV (AC) peak value			min. (V)	
CNX38U	SOT90B	0,7	2,1	0,4	4,4	5	5	80	195

Darlington transistor output

type	case	CTR		VCEsat	VIORM	ton/toff (typ.)		V(BR)CEO	page
		min.	max.			ton (μs)	toff (μs)		
		IF = 1 mA VCE = 1 V		IF = 5 mA IC = 10 mA		IF = 10 mA; VCC = 5 V; RL = 100 Ω; RBE = 1 MΩ			
				max. (V)	kV (AC) peak value			min. (V)	
CNX48U	SOT90B	5,0		1,0	4,4	5	30	30	223

Standard types

Transistor output

type	case	CTR	VCEsat	VIORM	t _{on} /t _{off} (typ.)	V(BR)CEO	page
		I _F = 10 mA VCE = 0,4 V	I _F = 10 mA I _C = 2 mA	kV (AC) peak value	I _C = 2 mA; V _{CC} = 5 V; R _L = 100 Ω		
		min. max.	max. (V)		t _{on} (μs) t _{off} (μs)	min. (V)	
CNX35	SOT90B	0,4	0,4	4,4	3	30	143
CNX39	SOT90B	0,6	0,4	4,4	5,5	30	143
CNX36	SOT90B	0,8	0,4*	4,4	8	30	143
●CNY57	SOT90B	0,2	0,4	4,4	3	30	—
●CNY57A	SOT90B	0,4	0,4*	4,4	5*	30	—

* I_C = 4 mA

● withdrawn types not included in this handbook, superseded by CNX35.

High-voltage transistor output

type	case	CTR	VCEsat	VIORM	t _{on} /t _{off} (typ.)	V(BR)CEO	page
		I _F = 10 mA VCE = 10 V	I _F = 16 mA I _C = 2 mA	kV (AC) peak value	I _C = 4 mA; V _{CC} = 5 V; R _L = 100 Ω		
		min. max.	max. (V)		t _{on} (μs) t _{off} (μs)	min. (V)	
CNX38	SOT90B	0,7	0,4	4,4	5	80	179

Darlington transistor output

type	case	CTR	VCEsat	VIORM	t _{on} /t _{off} (typ.)	V(BR)CEO	page
		I _F = 1 V VCE = 1 V	I _F = 5 mA; I _C = 10 mA	kV (AC) peak value	I _F = 10 mA; V _{CC} = 5 V; R _L = 100 Ω; R _{BE} = 1 MΩ		
		min. max.	max. (V)		t _{on} (μs) t _{off} (μs)	min. (V)	
CNX48	SOT90B	5,0	1,0	4,4	5	30	211

Other standard types, UL recognized, VDE approved.

Transistor output

type	case	CTR		V _{CEsat}	V _{IORM}	ton/toff (typ.)		V _{(BR)CEO}	page
		min.	max.			t _{on} (μs)	t _{off} (μs)		
		IF = 10 mA V _{CE} = 10 V		IF = 50 mA IC = 2 mA	kV (AC) peak value	IC = 2 mA; V _{CC} = 10 V; RL = 100 Ω			
			max.	max. (V)				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}	ton/toff (typ.)		V _{(BR)CEO}	page
		min.	max.			t _{on} (μs)	t _{off} (μs)		
		IF = 10 mA V _{CE} = 10 V		IF = 10 mA IC = 0,5 mA	kV (AC) peak value	IC = 2 mA; V _{CC} = 10 V; RL = 100 Ω			
			max.	max. (V)				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
		IF = 10 mA VCE = 10 V	IF = 60 mA IC = 1,6 mA	kV (AC) peak value	IC = 2 mA; VCC = 10 V; RL = 100 Ω		
		min. max.	max. (V)				
MCT26	SOT90B	0,06	0,5	4,4	3*	30	333

* t_r/t_f.

type	case	CTR	V _{CEsat}	V _{IORM}	t _{on} /t _{off} (typ.)	V(BR)CEO	page
		IF = 10 mA VCE = 10 V	IF = 16 mA IC = 2 mA	kV (AC) peak value	IF = 20 mA; VCC = 5 V; RL = 2 kΩ; RBE = 100 kΩ		
		min. max.	max. (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
		IF = 10 mA VCE = 10 V	IF = 20 mA IC = 4 mA	kV (AC) peak value	IC = 2 mA; VCC = 10 V; RL = 100 Ω		
		min. max.	max. (V)				
4N38	SOT90B	0,2	1,0	2,820	5	80	417
4N38A	SOT90B	0,2	1,0	2,820	5	80	417

Other standard types, UL recognized, VDE approved.
High-voltage transistor output (cont.)

type	case	CTR		VCEsat	VIORM	ton/toff (typ.)		V(BR)CEO	page	
		IF = 10 mA VCE = 5 V	max.			IC = 2 mA; VCC = 10 V; RL = 100 Ω	toff (μs)			
CNY17-1	SOT90B	0,4	0,8	0,3	kV (AC) peak value	ton (μs)	toff (μs)	min. (V)		
CNY17-2	SOT90B	0,63	1,25	0,3		5 (< 10)	5 (< 10)			70
CNY17-3	SOT90B	1,0	2,0	0,3		5 (< 10)	5 (< 10)			70
CNY17-4	SOT90B	1,6	3,2	0,3		5 (< 10)	5 (< 10)			70

Darlington transistor output

type	case	CTR		VCEsat	VIORM	ton/toff (typ.)		V(BR)CEO	page	
		IF = 1 mA VCE = 5 V	max.			IC = 10 mA; VCC = 10 V; RL = 100 Ω	toff (μs)			
H11B1	SOT90B	5,0		1,0	kV (AC) peak value	ton (μs)	toff (μs)	min. (V)	309	
H11B2	SOT90B	2,0		1,0		125	100			25
H11B3	SOT90B	1,0		1,0		125	100			25

type	case	CTR		VCEsat	VIORM	ton/toff (typ.)		V(BR)CEO	page
		IF = 10 mA VCE = 5 V	max.			IC = 10 mA; VCC = 10 V; RL = 100 Ω	toff (μs)		
H11B255	SOT90B	1,0		1,0	kV (AC) peak value	ton (μs)	toff (μs)	min. (V)	315
						125	100		

Other standard types, UL recognized, VDE approved.

Darlington transistor output (cont.)

type	case	CTR	VCEsat	VIORM	t _{on} /t _{off} (typ.)	V(BR)CEO	page
		IF = 10 mA VCE = 5 V	IF = 50 mA; IC = 50 mA		IF = 10 mA; VCC = 5 V; RL = 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	VCEsat	VIORM	t _{on} /t _{off} (max.)	V(BR)CEO	page
		IF = 10 mA VCE = 10 V	IF = 8 mA IC = 2 mA		IF = 200 mA; VCC = 10 V RL = 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

* IF = 10 mA.

Types for mains applications, UL recognized, VDE approved

type	case	CTR		VCEsat		VIORM kV (AC) peak value	ton/toff (typ.)		V(BR)CEO	page
		min.	max.	max. (V)	max. (V)		t _{on} (μs)	t _{off} (μs)		
+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	VCEsat	VIORM	ton/toff (typ.)	V(BR)CEO	page
CNX21	SOT211	min. max. IF = 10 mA VCE = 0,4 V	max. (V) IF = 10 mA IC = 2 mA	kV (AC) peak value	ton (μs)	min. (V)	135
					toff (μs)		
		0,2	0,15*	10	3 3	30	

* Typ. value.

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

type	case	CTR	VCEsat	VIORM	ton/toff (max.)	V(BR)CEO	page
SL5500	SOT90B	min. max. IF = 2 mA VCE = 5 V	max. (V) IF = 50 mA IC = 10 mA	kV (AC) peak value	ton (μs)	min. (V)	357
					toff (μs)		
		0,4	0,4	3,5	20 50	30	

type	case	CTR	VCEsat	VIORM	ton/toff (max.)	V(BR)CEO	page
SL5501	SOT90B	min. max. IF = 2 mA VCE = 5 V	max. (V) IF = 2,0 mA IC = 2 mA	kV (AC) peak value	ton (μs)	min. (V)	357
					toff (μs)		
		0,15	0,4	3,5	20 50	30	

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

type	case	CTR	V _{CEsat}	V _{IORM}	ton/toff (max.)	V(BR)/CEO	page
		IF = 2 mA V _{CE} = 5 V	IF = 20 mA; IC = 2 mA		IC = 16 mA; V _{CC} = 5 V; R _L = 1 kΩ		
		min. max.	max. (V)	kV (AC) peak value	ton (μs) toff (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}	ton/toff (typ.)	V(BR)/CEO	page
		IF = 10 mA V _{CE} = 0,4 V	IF = 10 mA; IC = 2 mA		IC = 2 mA; V _{CC} = 5 V; R _L = 100 Ω		
		min. max.	max. (V)	kV (AC) peak value	ton (μs) toff (μs)	min. (V)	
CNG35	SOT90B	0,4	0,4	4,4	3 3	30	55
CNG36	SOT90B	0,8	0,4***	4,4	8 6	30	55
		1,4* 0,8**					

* Typ. value at IF = 2 mA.

** Typ. value at IF = 0,5 mA.

*** IC = 4 mA

Types for mains applications, UC recognized, VDE approved.

type	case	CTR	V _{CEsat}	V _{IORM}	ton/toff (typ.)	V(BR)/CEO	page
		IF = 10 mA V _{CE} = 0,4 V	IF = 10 mA IC = 4 mA		IC = 2 mA; V _{CC} = 5 V R _L = 100 Ω		
		min. max.	max. (V)	kV (AC) peak value	ton (μs) toff (μs)	min. (V)	
CNG82	SOT212	0,4	0,4	5,3	3 3	50	77
CNG83	SOT212	0,4	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}	ton/t _{off} (max.)	V _{(BR)CEO}	page
		I _F = 10 mA V _{CE} = 0,5 V	I _F = 10 mA I _C = 1 mA	kV (AC) peak value	I _C = 2 mA; V _{CC} = 10 V; R _L = 100 Ω		
		min. max.	max. (V)		t _{on} (μs) t _{off} (μs)	min. (V)	
PO40/44A	SOT90B	0,6 0,25*	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	kV (AC) peak value	I _F = 10 mA; V _{CC} = 5 V; R _L = 2,5 kΩ		
		min. max.	max. (V)		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	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	VCEsat	VIORM	ton/toff (max.)	V(BR)CEO	page
		IF = 1 mA VCE = 5 V	IF = 1 mA IC = 1 mA	kV (AC) peak value	IF = 0,5 mA; VCC = 5 V RL = 2,2 kΩ		
		min. max.	max. (V)		ton (μs) toff (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

* IC = 5 mA

** IF = 10 mA; RL = 220 Ω; tPHL/tPLH

DUAL OPTOCOUPLER

type	case	CTR	VCEsat	VIORM	ton/toff (typ.)	V(BR)CEO	page
		IF = 5 mA VCE = 5 V	IF = 10 mA IC = 2 mA	kV (AC) peak value	IC = 2 mA; VCC = 5 V RL = 100 Ω		
		min. max.	max. (V)		ton (μs) toff (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.

TYPE NUMBER SURVEY

		page
CNG35	GaAlAs Optocoupler, 4.4 kV, CTR > 0.4, SOT90B	55
CNG36	GaAlAs Optocoupler, 4.4 kV, CTR > 0.8, SOT90B	55
CNG40	GaAlAs Optocoupler, 5.3 kV, CTR > 5, SOT231	71
CNG82	GaAlAs Optocoupler, 5.3 kV, CTR > 0.4, SOT212	77
CNG83	GaAlAs Optocoupler, 5.3 kV, CTR > 0.4, SOT212	87
CNR36	GaAlAs Optocoupler, 3.5 kV, $t_{PHL/LH}$, 0.8, μ s, SOT97F	99
CNS35	Dual Optocoupler, 4.4 kV, CTR > 0.5, SOT97F	107
CNW82	Optocoupler, 8.34 kV, CTR > 0.4, SOT228	113
CNW83	Optocoupler, 8.34 kV, CTR > 0.4, SOT228	123
CNX21	Optocoupler, 10 kV, CTR > 0.2, SOT211	135
CNX35	Optocoupler, 4.4 kV, CTR > 0.4, SOT90B	143
CNX35U	Optocoupler, 4.4 kV, CTR > 0.4, SOT90B	161
CNX36	Optocoupler, 4.4 kV, CTR > 0.8, SOT90B	143
CNX36U	Optocoupler, 4.4 kV, CTR > 0.8, SOT90B	161
CNX38	Optocoupler, 4.4 kV, CTR > 0.7, SOT90B	179
CNX38U	Optocoupler, 4.4 kV, CTR > 0.7, SOT90B	195
CNX39	Optocoupler, 4.4 kV, CTR > 0.6, SOT90B	143
CNX39U	Optocoupler, 4.4 kV, CTR > 0.6, SOT90B	161
CNX48	Optocoupler, 4.4 kV, CTR > 5, SOT90B	211
CNX48U	Optocoupler, 4.4 kV, CTR > 5, SOT90B	223
CNX62	Optocoupler, 5.3 kV, CTR > 0.4, SOT174	235
CNX62A	Optocoupler, 5.3 kV, CTR > 0.4, SOT230	243
CNX71	Optocoupler, 5.3 kV, CTR > 0.4, SOT90B	253
CNX72A	Optocoupler, 5.3 kV, CTR > 0.4, SOT229	263
CNX82A	Optocoupler, 5.3 kV, CTR > 0.4, SOT231	275
CNX83A	Optocoupler, 5.3 kV, CTR > 0.4, SOT231	285
CNY17-1	Optocoupler, 4.4 kV, CTR > 0.4, SOT90B	297
CNY17-2	Optocoupler, 4.4 kV, CTR > 0.63, SOT90B	297
CNY17-3	Optocoupler, 4.4 kV, CTR > 1.0, SOT90B	297
CNY17-4	Optocoupler, 4.4 kV, CTR > 1.6, SOT90B	297
H11A1	Optocoupler, 2.82 kV, CTR > 0.5, SOT90B	303
H11A2	Optocoupler, 2.82 kV, CTR > 0.2, SOT90B	303
H11A3	Optocoupler, 2.82 kV, CTR > 0.2, SOT90B	303
H11A4	Optocoupler, 2.82 kV, CTR > 0.1, SOT90B	303
H11A5	Optocoupler, 2.82 kV, CTR > 0.3, SOT90B	303
H11B1	Optocoupler, 2.82 kV, CTR > 5.0, SOT90B	309
H11B2	Optocoupler, 2.82 kV, CTR > 2.0, SOT90B	309
H11B3	Optocoupler, 2.82 kV, CTR > 1.0, SOT90B	309
H11B255	Optocoupler, 2.82 kV, CTR > 1.0, SOT90B	315

MCA230	Optocoupler, 4.4 kV, CTR > 1.0, SOT90B	321
MCA231	Optocoupler, 4.4 kV, CTR > 2.0, SOT90B	321
MCA255	Optocoupler, 4.4 kV, CTR > 1.0, SOT90B	321
MCT2	Optocoupler, 4.4 kV, CTR > 0.2, SOT90B	327
MCT26	Optocoupler, 4.4 kV, CTR > 0.06, SOT90B	333
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GENERAL

Safety recommendations

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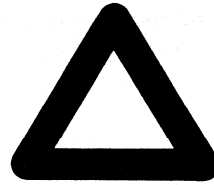
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GENERAL SAFETY RECOMMENDATIONS OPTOELECTRONIC DEVICES



1. GENERAL

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

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

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

2. DISPOSAL

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

3. FIRE

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

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

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

4. HANDLING

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

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

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

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

5. BERYLLIUM COMPOUNDS

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

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

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

→ **6. OTHER COMPOUNDS**

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

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

RATING SYSTEMS

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

DEFINITIONS OF TERMS USED

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

Note

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

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

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

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

Note

Limiting conditions may be either maxima or minima.

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

Note

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

ABSOLUTE MAXIMUM RATING SYSTEM

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

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

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

DESIGN MAXIMUM RATING SYSTEM

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

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

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

DESIGN CENTRE RATING SYSTEM

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

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

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

LETTER SYMBOLS FOR TRANSISTORS AND SIGNAL DIODES

based on IEC Publication 148

LETTER SYMBOLS FOR CURRENTS, VOLTAGES AND POWERS

Basic letters

The basic letters to be used are:

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

Lower-case basic letters shall be used for the representation of instantaneous values which vary with time.

In all other instances upper-case basic letters shall be used.

Subscripts

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

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

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

- a) continuous (d. c.) values (without signal)
Example I_B
- b) instantaneous total values
Example i_B
- c) average total values
Example $I_{B(AV)}$
- d) peak total values
Example I_{BM}
- e) root-mean-square total values
Example $I_{B(RMS)}$

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

- a) instantaneous values
Example i_b
- b) root-mean-square values
Example $I_{b(rms)}$
- c) peak values
Example I_{bm}
- d) average values
Example $I_{b(av)}$

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

Additional rules for subscripts

Subscripts for currents

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

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

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

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

Subscripts for voltages

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

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

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

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

Subscripts for supply voltages or supply currents

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

Examples: V_{CC} , I_{EE}

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

Example: V_{CCE}

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

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

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

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

Subscripts for multiple devices

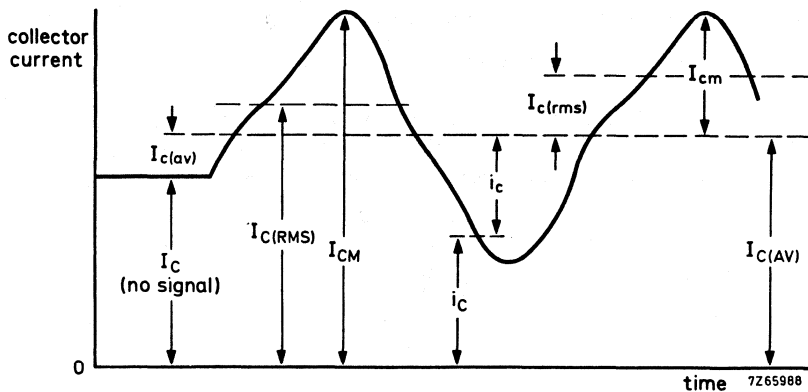
For multiple unit devices, the subscripts are modified by a number preceding the letter subscript; in the case of multiple subscripts, hyphens may be necessary to avoid misunderstanding.

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

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

Application of the rules

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



LETTER SYMBOLS FOR ELECTRICAL PARAMETER METER

Definition

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

Basic letters

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

- B, b = susceptance; imaginary part of an admittance
- C = capacitance
- G, g = conductance; real part of an admittance
- H, h = hybrid parameter
- L = inductance
- R, r = resistance; real part of an impedance
- X, x = reactance; imaginary part of an impedance
- Y, y = admittance;
- Z, z = impedance;

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

- a) electrical parameters of external circuits and of circuits in which the device forms only a part;
- b) all inductances and capacitances.

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

Subscripts

General subscripts

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

F, f	= forward; forward transfer
I, i (or 1)	= input
L, 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: $\text{Re}(h_{ib})$ etc. for the real part of h_{ib}
 $\text{Im}(h_{ib})$ 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 ($R_{th j-mb} > 15 K/W$)
- D. TRANSISTOR; power, audio frequency ($R_{th j-mb} \leq 15 K/W$)
- E. DIODE; tunnel
- F. TRANSISTOR; low power, high frequency ($R_{th j-mb} > 15 K/W$)
- G. MULTIPLE OF DISSIMILAR DEVICES — MISCELLANEOUS; e.g. oscillator
- H. DIODE; magnetic sensitive
- L. TRANSISTOR; power, high frequency ($R_{th j-mb} \leq 15 K/W$)
- N. PHOTO-COUPLER
- P. RADIATION DETECTOR; e.g. high sensitivity phototransistor
- Q. RADIATION GENERATOR; e.g. light-emitting diode (LED)
- R. CONTROL AND SWITCHING DEVICE; e.g. thyristor, low power ($R_{th j-mb} > 15 K/W$)
- S. TRANSISTOR; low power, switching ($R_{th j-mb} > 15 K/W$)
- T. CONTROL AND SWITCHING DEVICE; e.g. thyristor, power ($R_{th j-mb} \leq 15 K/W$)
- U. TRANSISTOR; power, switching ($R_{th j-mb} \leq 15 K/W$)
- X. DIODE: multiplier, e.g. varactor, step recovery
- Y. DIODE; rectifying, booster
- Z. DIODE; voltage reference or regulator (transient suppressor diode, with third letter W)

SERIAL NUMBER

Three figures, running from 100 to 999, for devices primarily intended for consumer equipment.*
One letter (Z, Y, X, etc.) and two figures, running from 10 to 99, for devices primarily intended for industrial/professional equipment.*

This letter has no fixed meaning except W, which is used for transient suppressor diodes.

VERSION LETTER

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

SUFFIX

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

1. VOLTAGE REFERENCE and VOLTAGE REGULATOR DIODES: *ONE LETTER and ONE NUMBER*

The LETTER indicates the nominal tolerance of the Zener (regulation, working or reference) voltage

- A. 1% (according to IEC 63: series E96)
- B. 2% (according to IEC 63: series E48)
- C. 5% (according to IEC 63: series E24)
- D. 10% (according to IEC 63: series E12)
- E. 20% (according to IEC 63: series E6)

The number denotes the typical operating (Zener) voltage related to the nominal current rating for the whole range.

The letter 'V' is used instead of the decimal point.

2. TRANSIENT SUPPRESSOR DIODES: *ONE NUMBER*

The NUMBER indicates the maximum recommended continuous reversed (stand-off) voltage V_R . The letter 'V' is used as above.

3. CONVENTIONAL and CONTROLLED AVALANCHE RECTIFIER DIODES and THYRISTORS: *ONE NUMBER*

The NUMBER indicates the rated maximum repetitive peak reverse voltage (V_{RRM}) or the rated repetitive peak off-state voltage (V_{DRM}), whichever is the lower. Reversed polarity is indicated by letter R, immediately after the number.

4. RADIATION DETECTORS: *ONE NUMBER*, preceded by a hyphen (-)

The NUMBER indicates the depletion layer in μm . The resolution is indicated by a version LETTER.

5. ARRAY OF RADIATION DETECTORS and GENERATORS: *ONE NUMBER*, preceded by a stroke (/).

The NUMBER indicates how many basic devices are assembled into the array.

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

DEFINITIONS FOR OPTOELECTRONIC DEVICES ACCORDING TO IEC 306

DEFINITIONS AND UNITS VALID FOR INFRARED RADIATION

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

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

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

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.

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

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.

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

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:

$$d\phi = I_v \cdot d\Omega \quad \text{unit: lumen, lm}$$

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.

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

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.

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

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.

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

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

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

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:

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

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.

Activity 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/m²).

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 response.

Note

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

Luminous sensitivity S_L

This may be expressed as either:

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

Dynamic sensitivity S_D

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

Note

Distinction is made between luminous dynamic sensitivity and radiant sensitivity.

Spectral sensitivity characteristics

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

Absolute spectral sensitivity characteristics

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

Relative spectral sensitivity characteristics

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

Quantum efficiency characteristic

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

DEFINITIONS OF TIME QUANTITIES

Rise time t_r

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

Fall time t_f

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

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

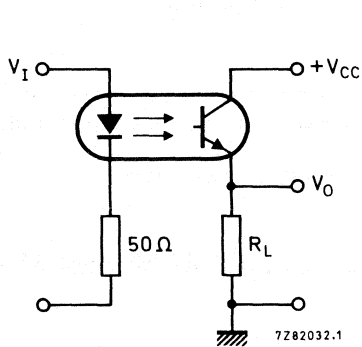


Fig. 1 Switching circuit.

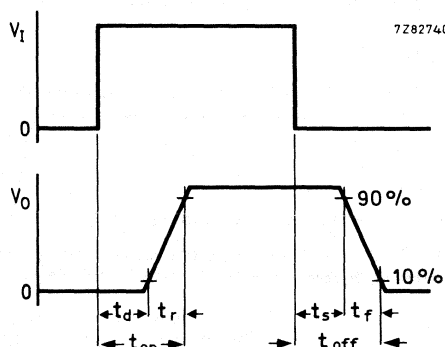


Fig. 2 Waveforms.

DEFINITIONS AND UNITS OF INFRARED SENSITIVE DEVICES

Emissivity

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

Absolute refractive index n

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

Detectivity

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

unit: 1/watts (1/W)

D^*

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

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

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 $V/\sqrt{\text{Hz}}$.

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

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.

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

Luminous exitance (luminous emittance) M_v

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

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

Luminance L_v

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

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

Steradian sr (see Fig. 3)

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

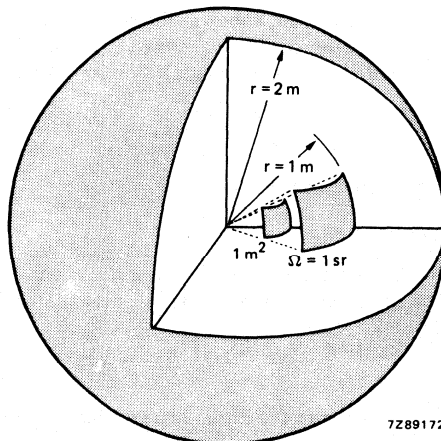


Fig. 3.

7Z89172

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

$$V_o/V_i = A$$

$$i_o/V_i = C$$

$$V_o \approx Bi_i$$

$$i_o \approx Di_i$$

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

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_{i0}

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.

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

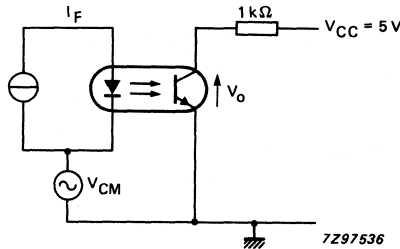


Fig. 1.

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.

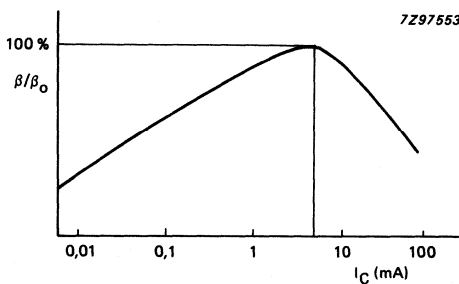


Fig. 2.

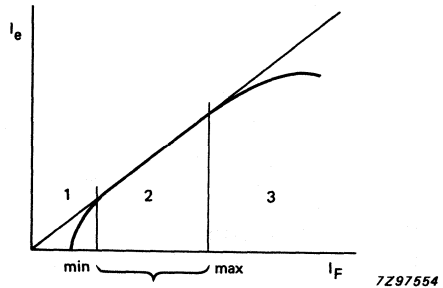


Fig. 3.

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 .

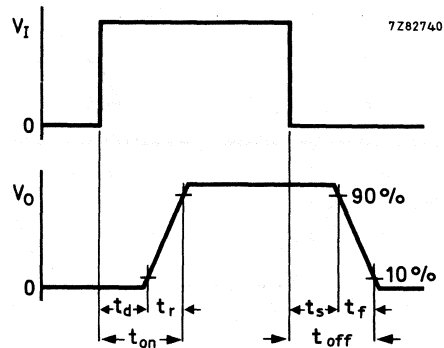


Fig. 4 Waveforms.

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.

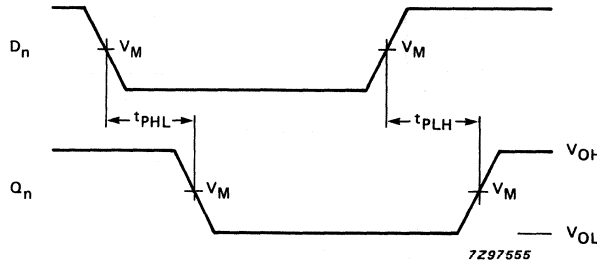


Fig. 5 TTL.

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.

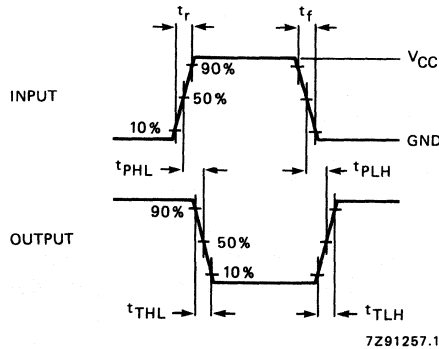


Fig. 6 CMOS.

PARAMETERS INFLUENCING THE CURRENT TRANSFER RATIO OF AN OPTOCOUPLER

Our optocouplers are frequently specified at $V_{CE} = 0,4 \text{ V}$, $I_F = 10 \text{ mA}$. Many other suppliers specify the transfer ratio at $V_{CE} = 5 \text{ V}$ 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 normalized at 1 for $I_F = 10 \text{ mA}$, $V_{CE} = 0,4 \text{ V}$ 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} .

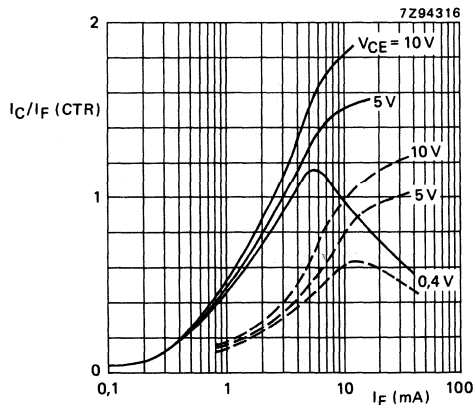


Fig. 1.

- Piece with a high I_C/I_F (CTR)
- - - Piece with a low I_C/I_F (CTR)

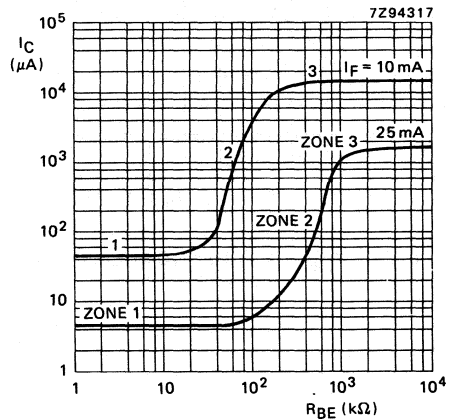


Fig. 2 $V_{CC} = 5 \text{ V}$; $T_{amb} = 25 \text{ }^\circ\text{C}$; typical values.

OPTOCOUPLER SWITCHING TIMES

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

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

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

Fig. 2 shows these times as a function of I_F without R_{BE} and with $R_{BE} = 100 \text{ k}\Omega$.

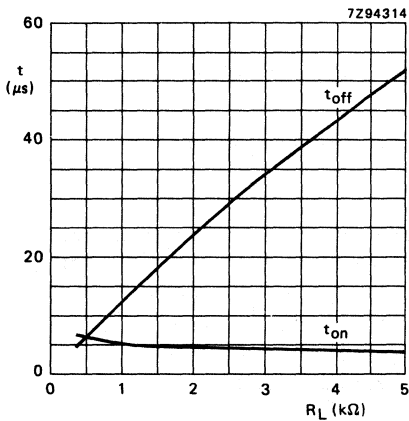


Fig. 1 $V_{CC} = 5 \text{ V}$; $I_F = 10 \text{ mA}$.

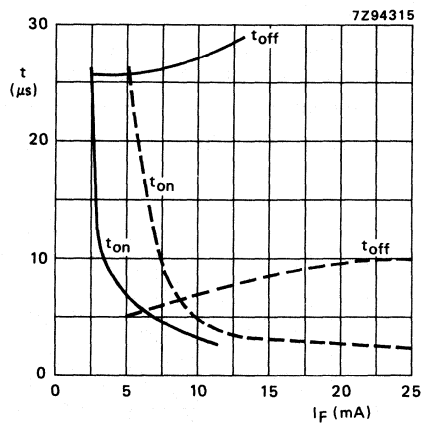


Fig. 2 $V_{CC} = 5 \text{ V}$; $R_L = 2,5 \text{ k}\Omega$.

— $R_{BE} = \infty$
 - - - $R_{BE} = 100 \text{ k}\Omega$

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					CECC 20004.003
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

GENERAL

	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

GaAIAs OPTOCOUPLERS

Optically coupled isolators consisting of an infrared emitting GaAIAs 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 diode, based on a special GaAIAs (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
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Optocoupler

Output/input DC current transfer ratio (CTR)

$I_F = 10 \text{ mA}; V_{CE} = 0.4 \text{ V}$

CNG35	I_C/I_F	min.	0.4 - 1.6
CNG36	I_C/I_F	min.	0.8 - 2.0

$I_F = 500 \mu\text{A}; V_{CE} = 0.4 \text{ V}$

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; $V_{CC} = 10 \text{ V}$

I_{CEW}	max.	200 nA
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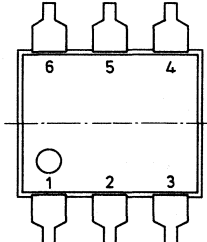
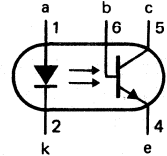
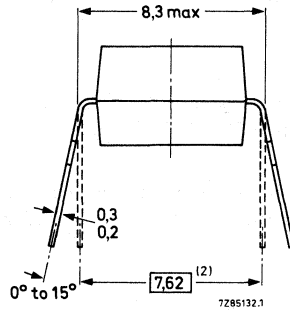
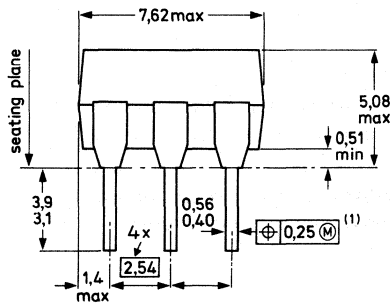
Isolation voltage
DC
AC (RMS value)

V_{IORM}	min.	4.4 kV
		3.12 kV

MECHANICAL DATA

Fig.1 SOT90B.

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 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 (peak value); $T_p = 10 \mu s$; $\delta = 0.01\%$	I_F	max.	100 mA
	I_{FRM}	max.	2.5 A
Total power dissipation up to $T_{amb} = 25^\circ C$	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 $T_{amb} = 25^\circ C$	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	$R_{th\ j-a}$	=	500 K/W
transistor	$R_{th\ j-a}$	=	500 K/W
From junction to ambient, device mounted on a printed circuit board diode	$R_{th\ j-a}$	=	400 K/W
transistor	$R_{th\ j-a}$	=	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 μ A

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 μ A
$V_{CB} = 10$ 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 $T_{amb} = 0\text{ }^{\circ}\text{C}$ to $70\text{ }^{\circ}\text{C}$

$V_F = 0.8\text{ V}$; $V_{CE} = 15\text{ V}$

$I_F = 2\text{ mA}$; $V_{CE} = 0.4\text{ V}$

$I_{CE(1)}$ max. $15\text{ }\mu\text{A}$

$I_{CE(2)}$ max. $250\text{ }\mu\text{A}$

Collector-emitter saturation voltage

$I_F = 10\text{ mA}$; $I_C = 2\text{ mA}$

CNG35

V_{CEsat} typ. 0.15 V
max. 0.4 V

$I_F = 10\text{ mA}$; $I_C = 4\text{ mA}$

CNG36

V_{CEsat} typ. 0.19 V
max. 0.4 V

Output capacitance

$V_{CB} = 10\text{ V}$; $f = 1\text{ MHz}$

$C_{b'c}$ typ. 4.5 pF

Collector current at working voltage

$V_W = 2.5\text{ kV DC}$ (notes 1 and 2)

$V_{CC} = 10\text{ V}$; $T_j = 25\text{ }^{\circ}\text{C}$

$V_{CC} = 10\text{ V}$; $T_j = 70\text{ }^{\circ}\text{C}$

I_{CEW} max. 200 nA

I_{CEW} max. $100\text{ }\mu\text{A}$

Isolation voltage DC

(note 3) $t = 1\text{ min}$; AC (RMS value)

V_{IORM} min. 4.4 kV
min. 3.12 kV

Capacitance between input and output

$V = 0$; $f = 1\text{ MHz}$

C_{io} typ. 0.6 pF
max. 1.3 pF

Insulation resistance between input and output

$\pm V_{IO} = 1\text{ kV}$

R_{IO} min. $10\text{ G}\Omega$
typ. $1\text{ T}\Omega$

Switching times (see Figs 3 and 4)

$I_C = 2\text{ mA}$; $V_{CC} = 5\text{ V}$; $R_L = 100\text{ }\Omega$

Turn-on time

CNG35

t_{on} typ. $3\text{ }\mu\text{s}$
max. $20\text{ }\mu\text{s}$

Turn-off time

t_{off} typ. $3\text{ }\mu\text{s}$
max. $20\text{ }\mu\text{s}$

$I_C = 2\text{ mA}$; $V_{CC} = 5\text{ V}$; $R_L = 1\text{ k}\Omega$

Turn-on time

CNG35

t_{on} typ. $12\text{ }\mu\text{s}$
max. $50\text{ }\mu\text{s}$

Turn-off time

t_{off} typ. $12\text{ }\mu\text{s}$
max. $50\text{ }\mu\text{s}$

$I_C = 2\text{ mA}$; $V_{CC} = 5\text{ V}$; $R_L = 100\text{ }\Omega$

Turn-on time

CNG36

t_{on} typ. $8\text{ }\mu\text{s}$
max. $20\text{ }\mu\text{s}$

Turn-off time

t_{off} typ. $6\text{ }\mu\text{s}$
max. $20\text{ }\mu\text{s}$

$I_C = 2\text{ mA}$; $V_{CC} = 5\text{ V}$; $R_L = 1\text{ k}\Omega$

Turn-on time

CNG36

t_{on} typ. $20\text{ }\mu\text{s}$
max. $50\text{ }\mu\text{s}$

Turn-off time

t_{off} typ. $18\text{ }\mu\text{s}$
max. $50\text{ }\mu\text{s}$

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.

DC current transfer ratio (CTR)

$I_F = 10 \text{ mA}; V_{CE} = 0.4 \text{ V}$

I_C/I_F min. 0.4
typ. 0.7
max. 1.6

CNG35 | CNG36

0.4 | 0.8
0.7 | 1.0
1.6 | 2.0

$I_F = 2 \text{ mA}; V_{CE} = 0.4 \text{ V}$

I_C/I_F typ. 0.9

0.9 | 1.4

$I_F = 0.5 \text{ mA}; V_{CE} = 0.4 \text{ V}$

I_C/I_F min. 0.1
typ. 0.5

0.1 | 0.2
0.5 | 0.8

$I_F = 2 \text{ mA}; V_{CE} = 5 \text{ V}$

I_C/I_F min. 0.3

0.3 | 0.3

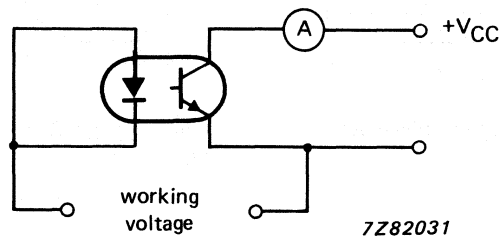


Fig.2.

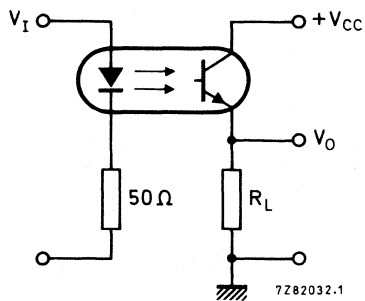


Fig.3 Switching circuit.

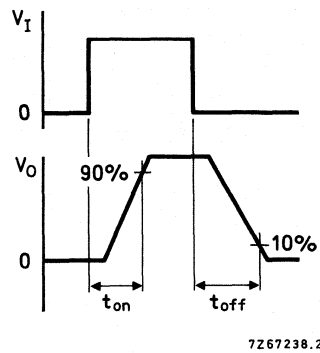


Fig.4 Waveforms.

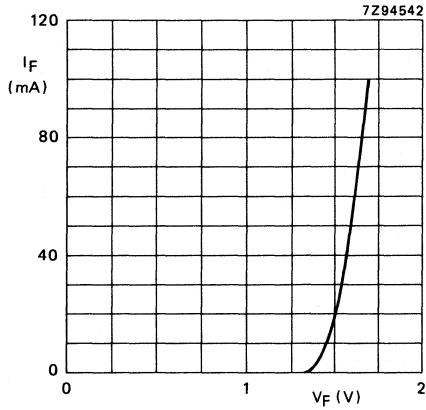


Fig. 5 $T_{amb} = 25\text{ }^\circ\text{C}$; typical values.

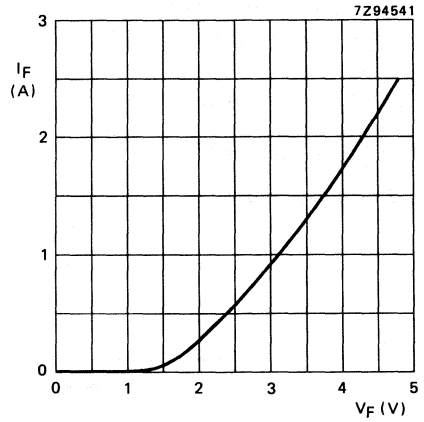


Fig. 6 $T_{amb} = 25\text{ }^\circ\text{C}$; $t_p = 10\text{ }\mu\text{s}$; $T = 1\text{ ms}$; typical values.

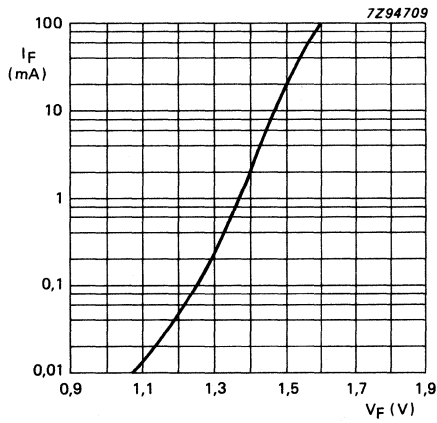


Fig. 7 $T_{amb} = 25\text{ }^\circ\text{C}$; typical values.

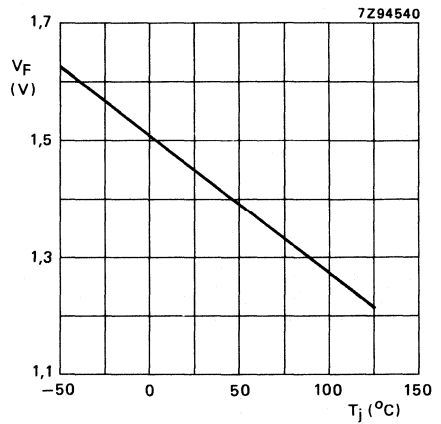


Fig. 8 $I_F = 10\text{ mA}$; typical values.

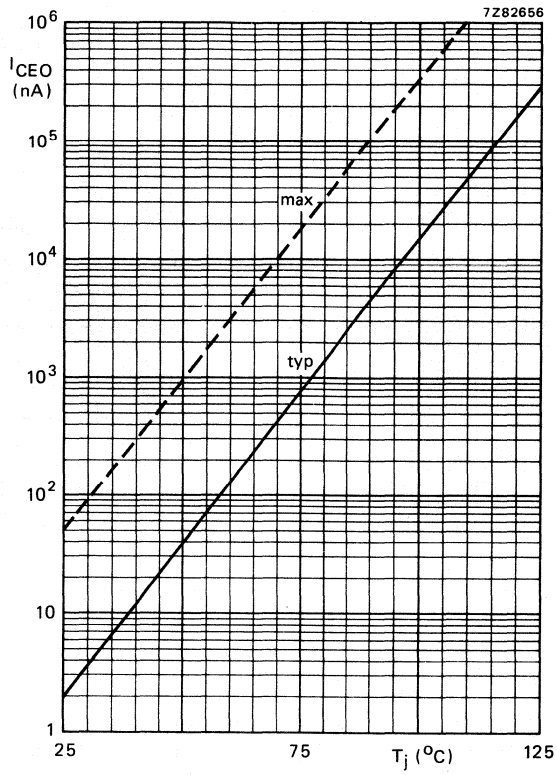


Fig. 9 $I_F = 0$; $V_{CE} = 10$ V.

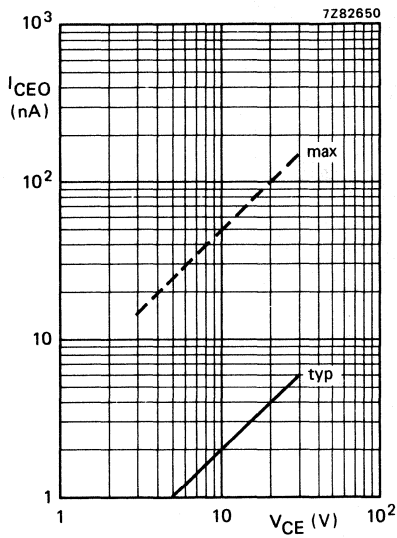


Fig. 10 $I_F = 0$; $T_j = 25^\circ\text{C}$.

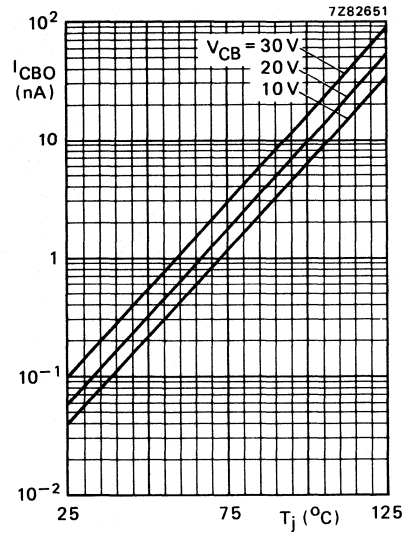


Fig. 11 Typical values.

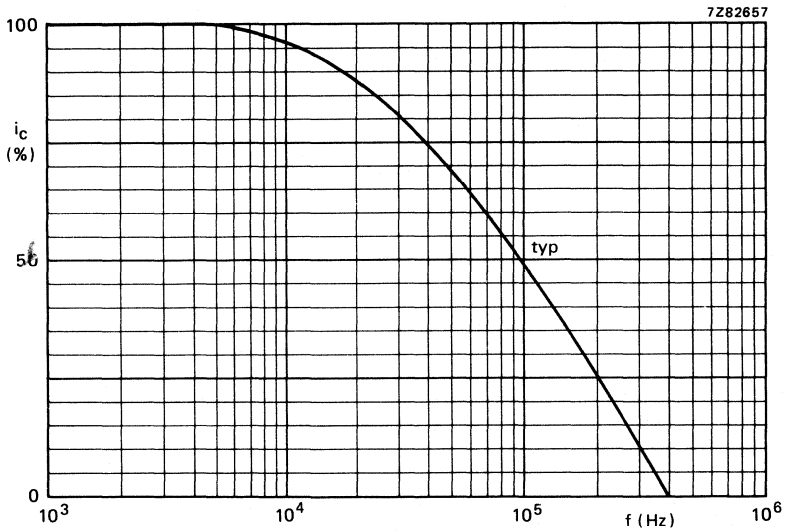


Fig. 12 $I_B = 0$; $I_C = 2\text{ mA}$; $V_{CC} = 5\text{ V}$; $R_L = 1\text{ k}\Omega$; $T_{amb} = 25^\circ\text{C}$.

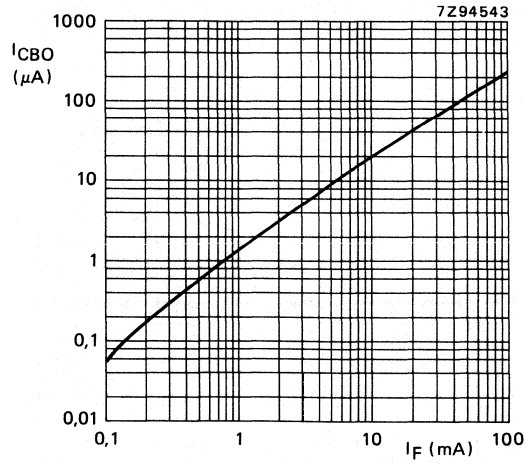


Fig. 13 $V_{CB} = 5 V$; $T_{amb} = 25 ^\circ C$; typical values.

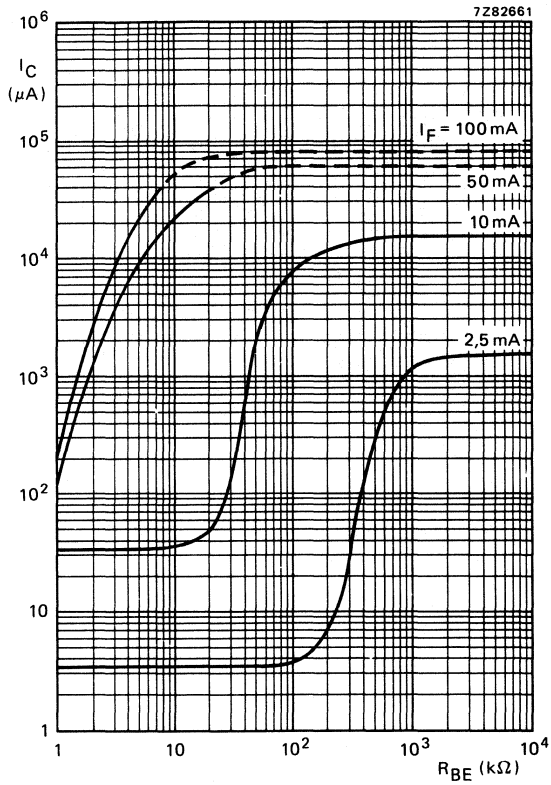


Fig. 14 $I_B = 0$; $V_{CE} = 5 \text{ V}$; $T_{amb} = 25 \text{ }^\circ\text{C}$; typical values.

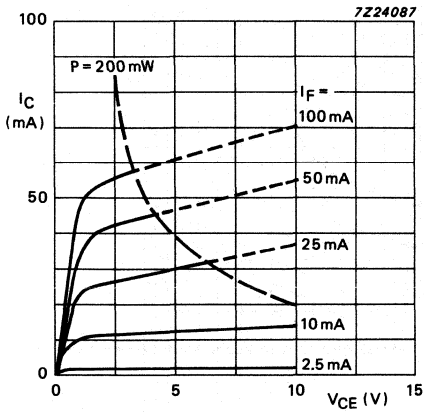


Fig.15 Collector current as a function of collector-emitter voltage; $T_{amb} = 25\text{ }^{\circ}\text{C}$; typical values; CNG35.

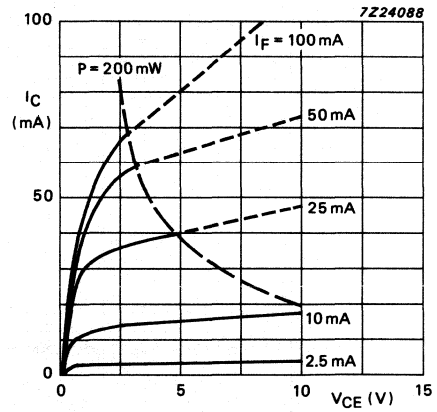


Fig.16 Collector current as a function of collector-emitter voltage; $T_{amb} = 25\text{ }^{\circ}\text{C}$; typical values; CNG36.

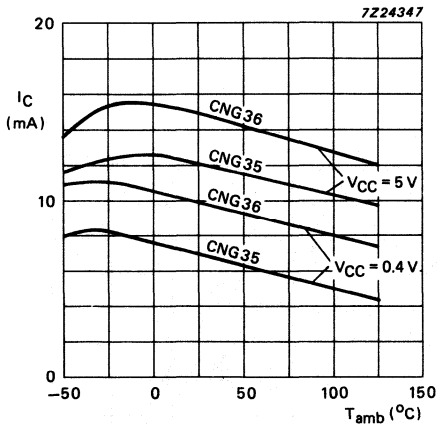


Fig.17 Collector current as a function of ambient temperature; $I_F = 10\text{ mA}$; typical values.

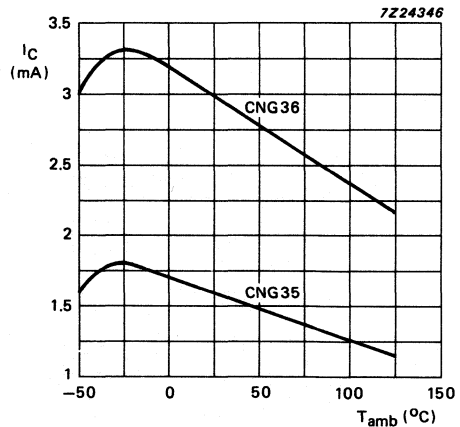


Fig.18 Collector current as a function of ambient temperature; $I_F = 2\text{ mA}$; $V_{CE} = 0.4\text{ V}$; typical values.

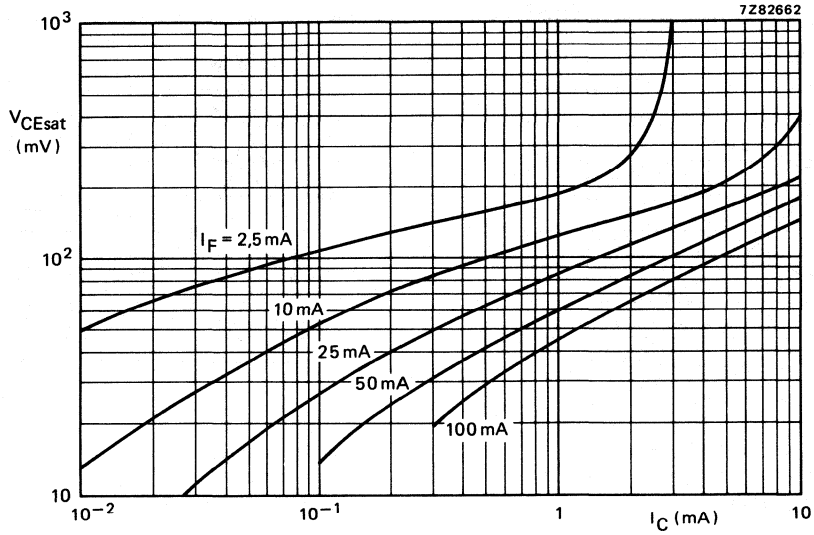


Fig.19 Collector-emitter saturation voltage as a function of collector current; $I_B = 0$; $T_{amb} = 25^\circ C$; typical values.

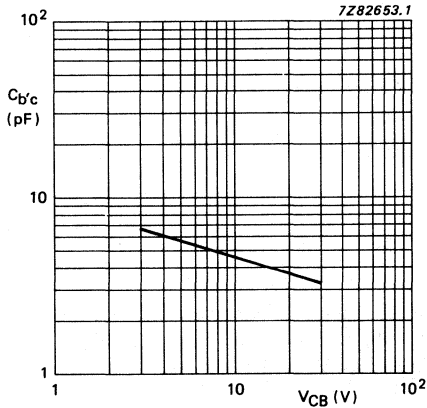


Fig.20 Output capacitance as a function of base-collector voltage; $f = 1$ MHz; $T_{amb} = 25^\circ C$.

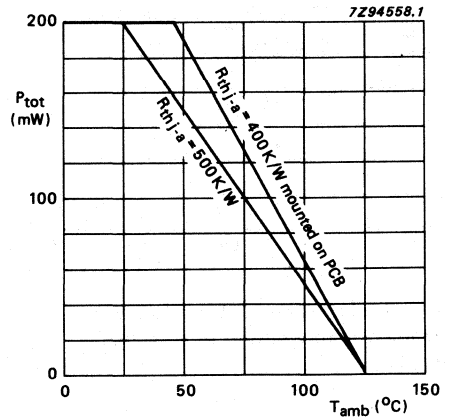


Fig.21 Total power dissipation as a function of ambient temperature.

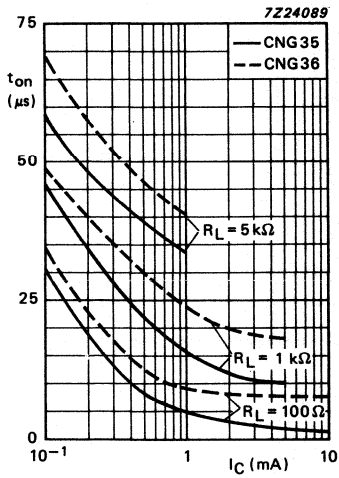


Fig.22 Turn-on time as a function of collector current; $I_B = 0$; $V_{CC} = 5\text{ V}$; $T_{amb} = 25\text{ }^\circ\text{C}$; typical values.

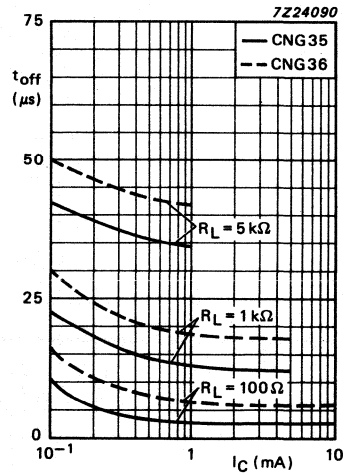


Fig.23 Turn-off time as a function of collector current; $I_B = 0$; $V_{CC} = 5\text{ V}$; $T_{amb} = 25\text{ }^\circ\text{C}$; typical values.

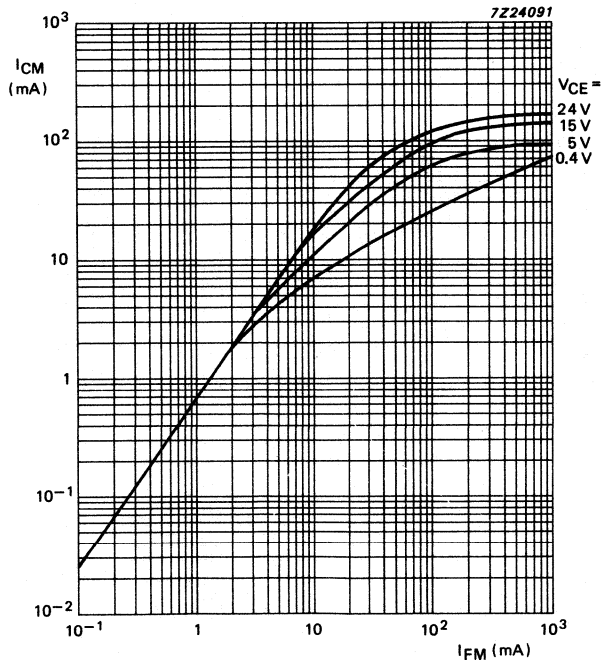


Fig.24 Maximum collector current as a function of maximum forward current; $T_{amb} = 25\text{ }^\circ\text{C}$; $t_p = 10\text{ }\mu\text{s}$; $T = 1\text{ ms}$; typical values; **CNG35**.

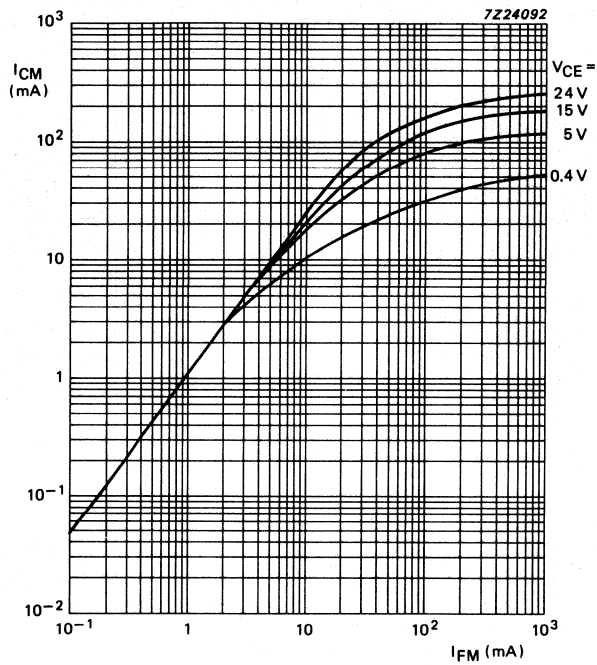


Fig.25 Maximum collector current as a function of maximum forward current; $T_{amb} = 25\text{ }^{\circ}\text{C}$; $t_p = 10\text{ }\mu\text{s}$; $T = 1\text{ ms}$; typical values; **CNG36**.

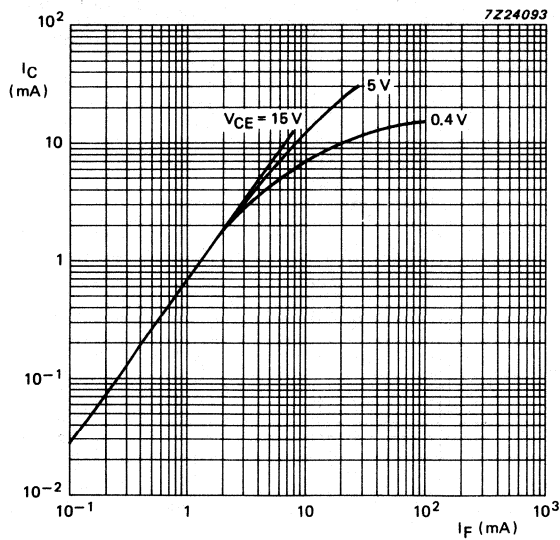


Fig.26 Collector current as a function of forward current; $T_{amb} = 25\text{ }^{\circ}\text{C}$; typical values; **CNG35**.

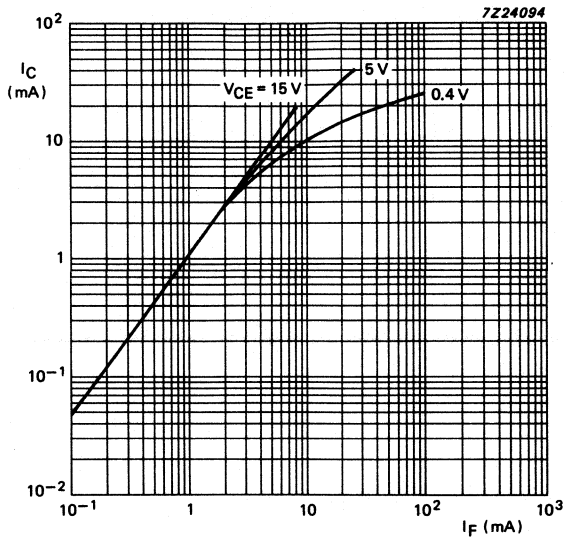


Fig.27 Collector current as a function of forward current;
 $T_{amb} = 25\text{ }^{\circ}\text{C}$; typical values; CNG36.

GaAIAs, 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 GaAIAs 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 input 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 $T_{amb} = 25\text{ }^\circ\text{C}$	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 $T_{amb} = 25\text{ }^\circ\text{C}$	P_{tot}	max.	200 mW

Optocoupler

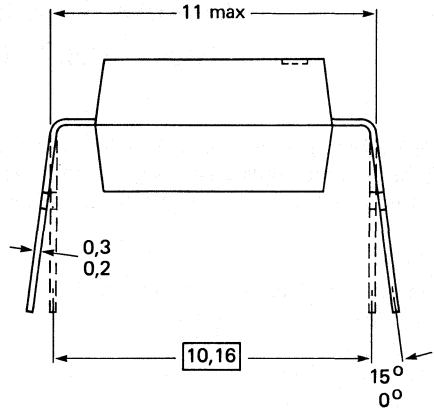
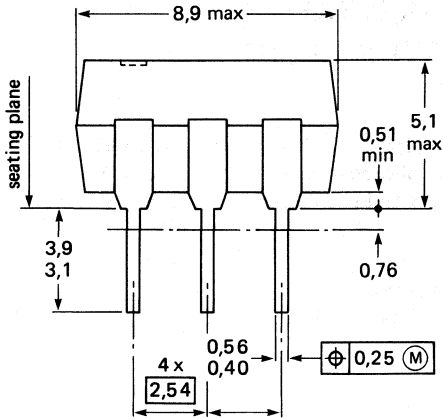
DC current transfer ratio (CTR)			
$I_F = 0.5\text{ mA}; V_{CE} = 1\text{ V}$	I_C/I_F	min.	3.5
$I_F = 1.0\text{ mA}; V_{CE} = 5\text{ V}$	I_C/I_F	min.	5.0
$I_F = 10\text{ mA}; V_{CE} = 1\text{ V}$	I_C/I_F	min.	5.0
		max.	*
Isolation voltage DC	V_{IORM}	max.	5300 V
AC (RMS value)			3750 V

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

7295839

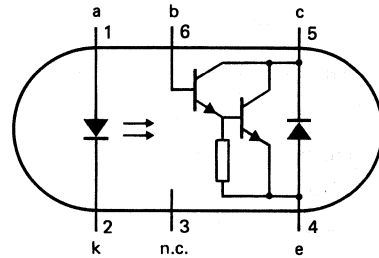
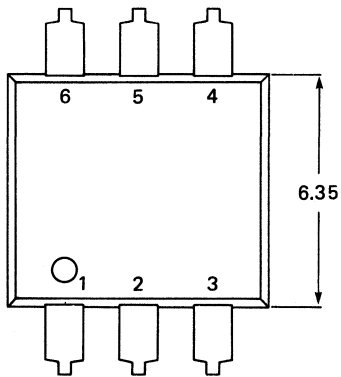


Fig. 1 SOT231.

RATINGS

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

Diode

- DC Forward current
- Forward current (peak: $t_{ON} = 10 \mu s$; $\delta = 0.01$)
- DC Reverse voltage
- Total power dissipation up to $T_{amb} = 25 \text{ }^\circ\text{C}$

I_F	max.	100 mA
I_{FRM}	max.	2.5 A
V_R	max.	5 V
P_{tot}	max.	200 mW

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 $T_{amb} = 25\text{ }^\circ\text{C}$	P_{tot}	max.	200 mW

Optocoupler

Total power dissipation up to $T_{amb} = 25\text{ }^\circ\text{C}$	P_{tot}	max.	250 mW
Storage temperature range	T_{stg}		-55 to + 150 $^\circ\text{C}$
Operating ambient temperature range	T_{amb}		-40 to + 100 $^\circ\text{C}$
Junction temperature	T_j	max.	125 $^\circ\text{C}$
Soldering temperature up to the seating plane; $t_{sld} < 10\text{ s}$	T_{sld}	max.	260 $^\circ\text{C}$

THERMAL RESISTANCE

From junction to ambient in free air	diode	$R_{th\ j-a}$	=	500 K/W
	transistor	$R_{th\ j-a}$	=	500 K/W
From junction to ambient when mounted on a PCB	diode	$R_{th\ j-a}$	=	400 K/W
	transistor	$R_{th\ j-a}$	=	400 K/W

ISOLATION RELATED VALUES

External air gap (clearance) input terminals to output terminals	$L(I/O1)$	min.	9.6 mm
External tracking path (creepage distance)	$L(I/O2)$	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

$T_j = 25\text{ }^\circ\text{C}$ unless otherwise specified

Diode

Forward voltage $I_F = 10\text{ mA}$	V_F	typ.	1.45 V
	V_F	max.	1.7 V
Reverse current $V_R = 5\text{ V}$	I_R	max.	10 A

Transistor

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

DEVELOPMENT DATA

CHARACTERISTICS (continued)

Emitter-base breakdown voltage

$I_E = 0.1 \text{ mA}$ $V_{(BR)EBO}$ min. 7 V

Collector-emitter cut-off current (dark)

$I_F = 0; V_{CE} = 10 \text{ V}$ I_{CEO} typ. * nA
max. 100 nA

Collector-base cut-off current

$I_F = 0; V_{CB} = 10 \text{ V}$ I_{CBO} max. 20 nA

Optocoupler

DC current transfer ratio (CTR)

$I_F = 0.5 \text{ mA}; V_{CE} = 1 \text{ V}$ I_C/I_F min. 3.5

$I_F = 1 \text{ mA}; V_{CE} = 5 \text{ V}$ I_C/I_F min. 5.0

$I_F = 10 \text{ mA}; V_{CE} = 1 \text{ V}$ I_C/I_F min. 5.0

max. *

Collector-emitter saturation voltage

$I_F = 1 \text{ mA}; I_C = 1 \text{ mA}$ V_{CEsat} max. 1.0 V
typ. * V

$I_F = 16 \text{ mA}; I_C = 50 \text{ mA}$ V_{CEsat} max. 1.0 V
typ. * V

Isolation voltage (see note 1) DC

$t = 1 \text{ min}$ AC (RMS value) V_{IORM} min. 5300 V
3750 V

Capacitance between input and output

$V_{IO} = 0; f = 1 \text{ MHz}$ C_{IO} typ. 0.4 pF
max. 1.0 pF

Insulation resistance between input and output

$V_{IO} = \pm 1000 \text{ V}$ R_{IO} min. 10 GΩ
typ. 1 TΩ

Switching times (see Figs 3 and 4)

$I_F = 0.5 \text{ mA}; V_{CC} = 5 \text{ V}; R_L = 2200 \Omega$

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)

$V_{IO} = 2500 \text{ V DC}; V_{CC} = 10 \text{ V}$ I_{CEW} max. * nA

$V_{IO} = 2500 \text{ V DC}; V_{CC} = 10 \text{ V}; T_{amb} = 70 \text{ }^\circ\text{C}$ I_{CEW} max. * μA

Output capacitance

$V_{CB} = 10 \text{ V}; f = 1 \text{ MHz}$ C_{bc} typ. 5 pF

* Value to be fixed.

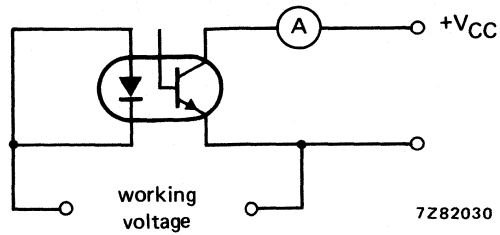


Fig. 2 Test circuit.

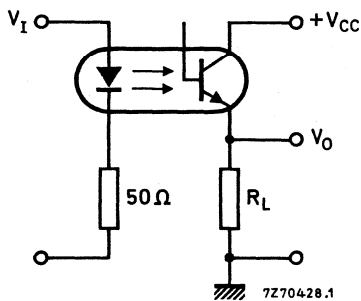


Fig. 3 Switching circuit.

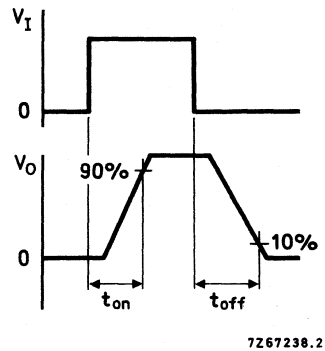


Fig. 4 Waveforms.

DEVELOPMENT DATA

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.

GaAIAs HIGH-VOLTAGE OPTOCOUPLER

Optically coupled isolator consisting of an infrared emitting GaAIAs 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 GaAIAs (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; $t_{ON} = 10 \mu s$; $\delta = 0.01$	I_{FRM}	max.	3.0 A
Total power dissipation up to $T_{amb} = 25^\circ C$ when mounted on a printed circuit board (PCB)	P_{tot}	max.	200 mW

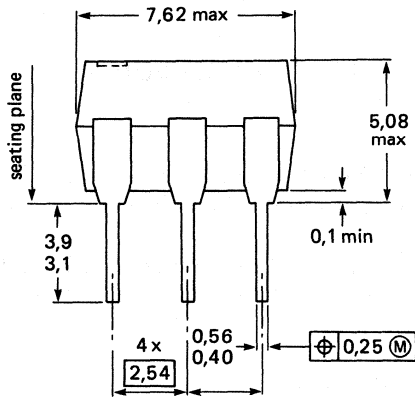
Transistor

Collector-emitter voltage (open base)	V_{CEO}	max.	50 V
Total power dissipation up to $T_{amb} = 25^\circ C$ when mounted on a PCB	P_{tot}	max.	200 mW

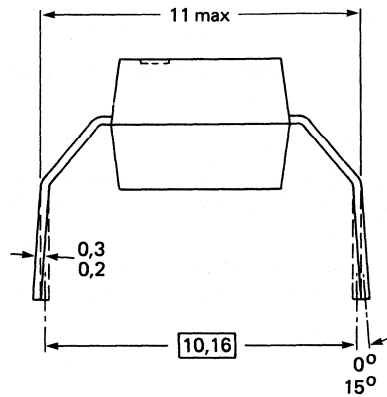
Optocoupler

Output/input DC current transfer ratio (CTR) $I_F = 10 \text{ mA}$; $V_{CE} = 0.4 \text{ V}$	I_C/I_F	min.	0.4
Collector cut-off current (dark) $V_{CC} = 10 \text{ V}$; working voltage = 2.5 kV DC I_F (diode) = 0 (see Fig. 4)	I_{CEW}	max.	200 nA
Collector-emitter saturation voltage $I_F = 10 \text{ mA}$; $I_C = 4 \text{ mA}$	V_{CEsat}	max.	0.4 V
Isolation voltage DC		min.	5.3 kV
AC (RMS value)	V_{IORM}	min.	3.75 kV

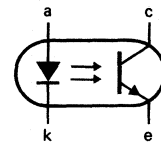
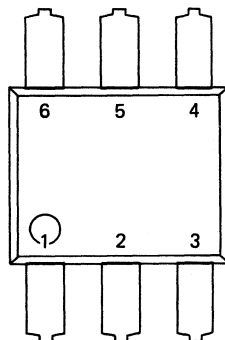
MECHANICAL DATA



Dimensions in mm



7Z95606.1



The base is not connected.

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; $t_{ON} = 10 \mu s$; $\delta = 0.01$	I_{FRM}	max.	3.0 A
Total power dissipation up to $T_{amb} = 25^\circ C$ 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 $T_{amb} = 25^\circ C$ 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
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	$R_{th\ j-a}$	=	500 K/W
transistor	$R_{th\ j-a}$	=	500 K/W
From junction to ambient, device mounted on a PCB			
diode	$R_{th\ j-a}$	=	400 K/W
transistor	$R_{th\ j-a}$	=	400 K/W

ISOLATION RELATED VALUES

External air gap (clearance) input terminals to output terminals	$L(I01)$	min.	9.6 mm
External tracking path (creepage distance) input terminals to output terminals	$L(I02)$	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 μ A

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 μ A

DEVELOPMENT DATA

Optocoupler

Output/input DC current transfer ratio (CTR)

$I_F = 10 \text{ mA}; V_{CE} = 0.4 \text{ V}$

I_C/I_F	min.	0.4
	max.	1.6

$I_F = 0.5 \text{ mA}; V_{CE} = 0.4 \text{ V}$

I_C/I_F	min.	0.1
-----------	------	-----

Collector cut-off current (light)

$T_{amb} \leq 70 \text{ }^\circ\text{C}; V_F = 0.8 \text{ V};$

$V_{CE} = 15 \text{ V}$

$I_{CE(L)}$	max.	15 μA
-------------	------	------------------

$T_{amb} \leq 70 \text{ }^\circ\text{C}; I_F = 2 \text{ mA};$

$V_{CE} = 0.4 \text{ V}$

$I_{CE(L)}$	min.	250 μA
-------------	------	-------------------

Collector-emitter saturation voltage

$I_F = 10 \text{ mA}; I_C = 4 \text{ mA}$

V_{CEsat}	typ.	0.19 V
	max.	0.40 V

Collector cut-off current (dark) at working voltage

$V_W = 2.5 \text{ kV}$ (DC value);

$V_{CC} = 10 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$ (see notes 1 and 2 and Fig. 4)

I_{CEW}	max.	200 nA
-----------	------	--------

$V_{CC} = 10 \text{ V}; T_j = 70 \text{ }^\circ\text{C}$ (see notes 1 and 2 and Fig. 4)

I_{CEW}	max.	100 μA
-----------	------	-------------------

Isolation voltage; $t = 1 \text{ min.}$

(note 3)

DC

AC (RMS value)

V_{IORM}	max.	5.3 kV
		3.75 kV

Capacitance between input and output

$V = 0; f = 1 \text{ MHz}$

C_{io}	typ.	0.6 pF
----------	------	--------

Insulation resistance between input and output

$V_{IO} = \pm 1 \text{ kV}$

R_{IO}	min.	10 G Ω
	typ.	1 T Ω

Switching times (see Figs 2 and 3)

Turn-on time

$I_C = 2 \text{ mA}; V_{CC} = 5 \text{ V}; R_L = 100 \text{ } \Omega$

$I_C = 2 \text{ mA}; V_{CC} = 5 \text{ V}; R_L = 1 \text{ k}\Omega$

t_{on}	typ.	3.0 μs
	typ.	12 μs

Turn-off time

$I_C = 2 \text{ mA}; V_{CC} = 5 \text{ V}; R_L = 100 \text{ } \Omega$

$I_C = 2 \text{ mA}; V_{CC} = 5 \text{ V}; R_L = 1 \text{ k}\Omega$

t_{off}	typ.	3.0 μs
	typ.	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.

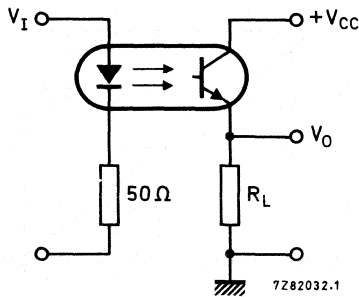


Fig. 2 Switching circuit.

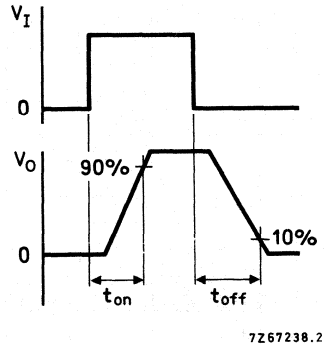


Fig. 3 Waveforms.

DEVELOPMENT DATA

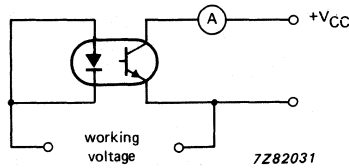


Fig. 4 Test circuit.

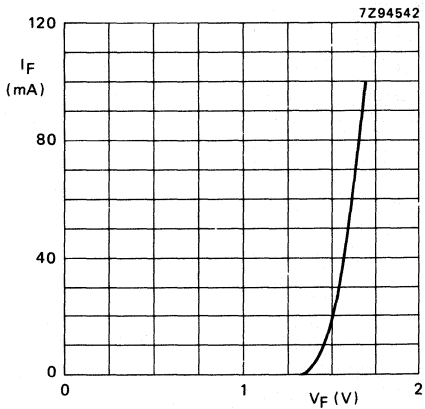


Fig. 5 Forward current as a function of forward voltage; $T_{amb} = 25\text{ }^{\circ}\text{C}$; typical values.

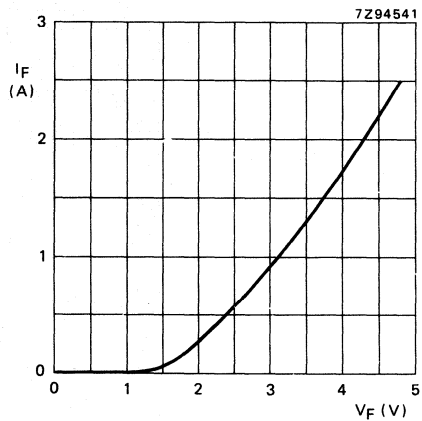


Fig. 6 Forward current as a function of forward voltage; $T_{amb} = 25\text{ }^{\circ}\text{C}$; $t_p = 1\text{ ms}$; typical values.

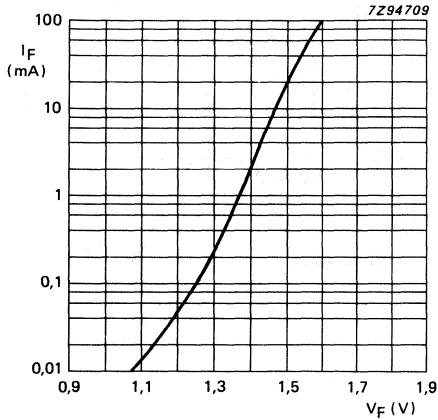


Fig. 7 Forward current as a function of forward voltage; $T_{amb} = 25\text{ }^\circ\text{C}$; typical values.

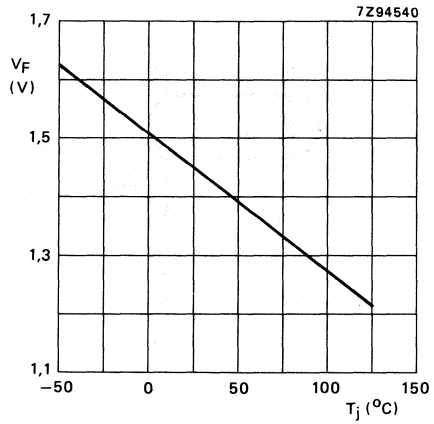


Fig. 8 Forward voltage as a function of temperature; $I_F = 10\text{ mA}$; typical values.

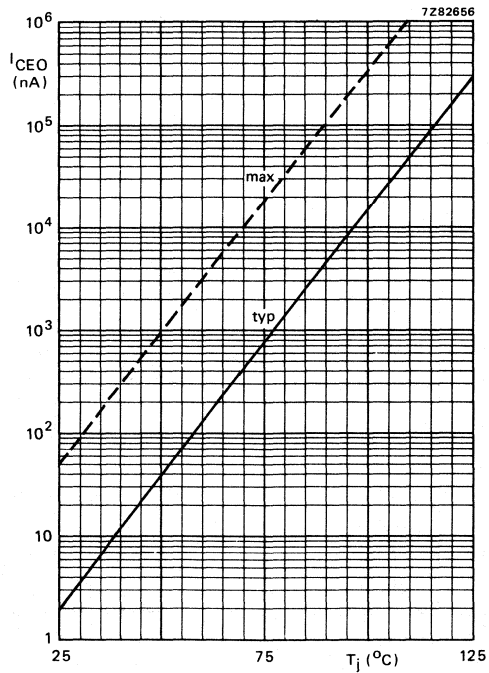


Fig. 9 Collector cut-off current as a function of temperature; $I_F = 0$; $V_{CE} = 10\text{ V}$.

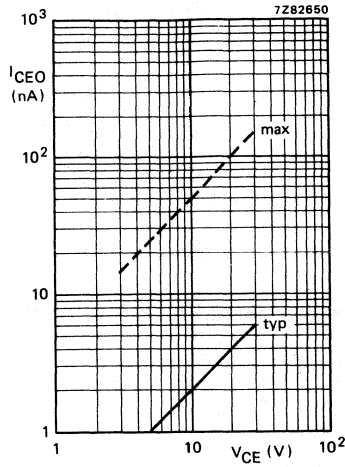


Fig. 10 Collector cut-off current as a function of collector-emitter voltage; $I_F = 0$; $T_j = 25^\circ\text{C}$.

DEVELOPMENT DATA

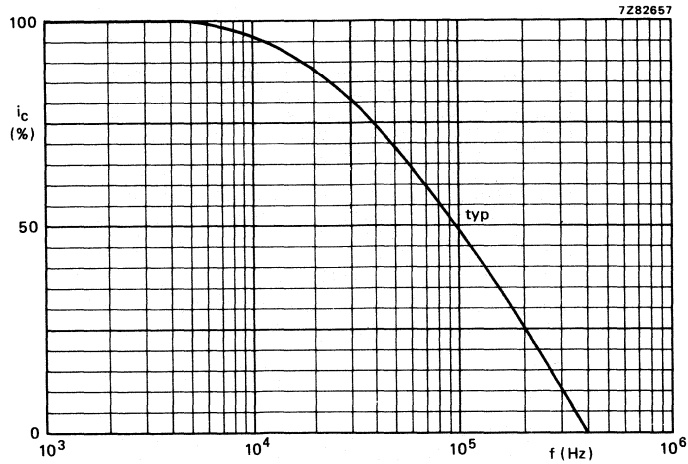


Fig. 11 Frequency response curve; $I_B = 0$; $I_C = 2\text{ mA}$; $V_{CC} = 5\text{ V}$; $R_L = 1\text{ k}\Omega$; $T_{amb} = 25^\circ\text{C}$.

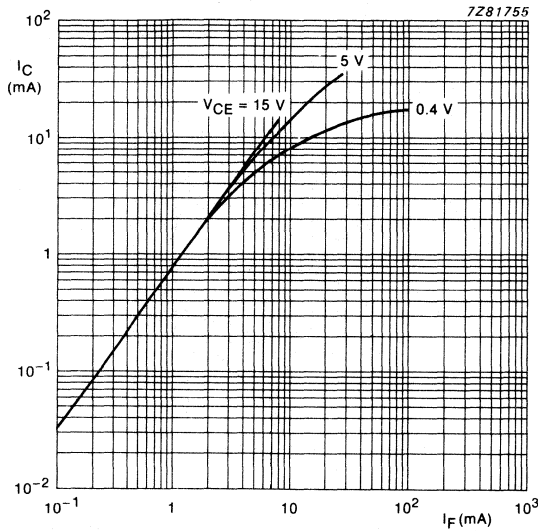


Fig. 12 Collector current as a function of forward current; $T_{amb} = 25^\circ\text{C}$; typical values.

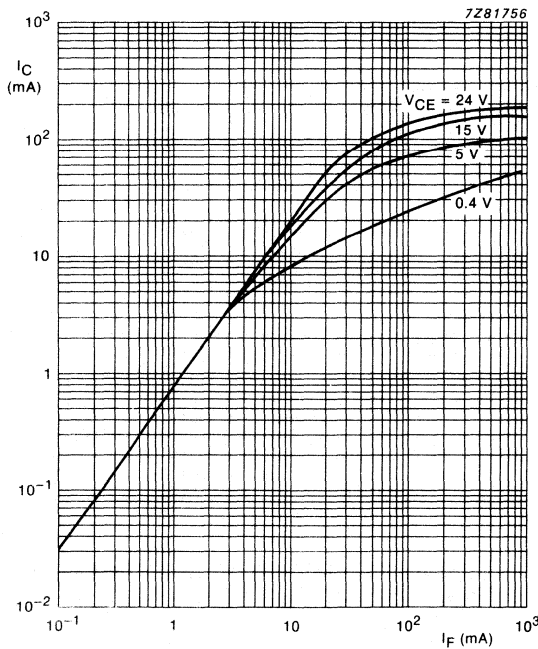


Fig. 13 Collector current (max.) as a function of forward current (max.); $T_{amb} = 25^\circ\text{C}$; $t_p = 10 \mu\text{s}$; $T = 1 \text{ ms}$; typical values.

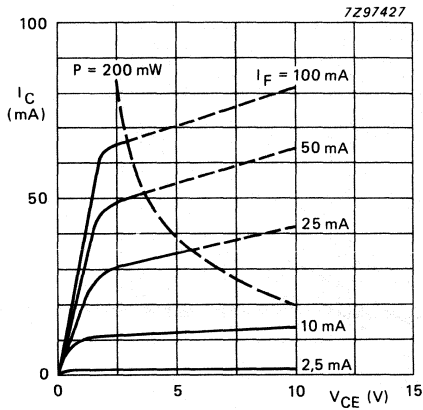


Fig. 14 Collector current as a function of collector-emitter voltage; $T_{amb} = 25$ °C; typical values.

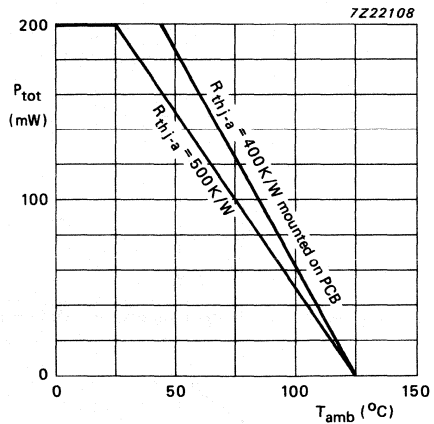


Fig. 15 Total power dissipation as a function of ambient temperature.

DEVELOPMENT DATA

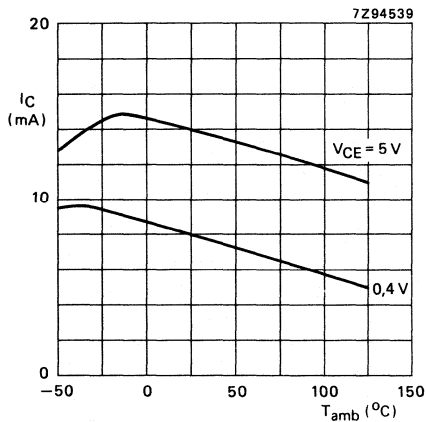


Fig. 16 Collector current as a function of ambient temperature; $I_F = 10$ mA; typical values.

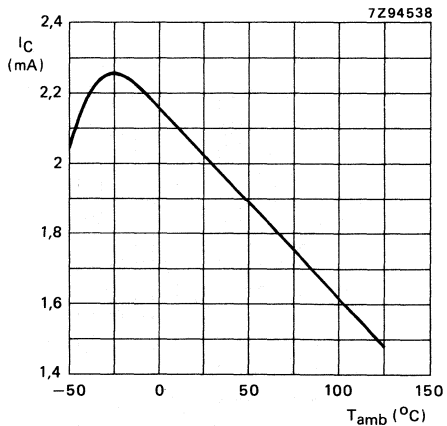


Fig. 17 Collector current as a function of ambient temperature; $I_F = 2$ mA; $V_{CE} = 0.4$ V; typical values.

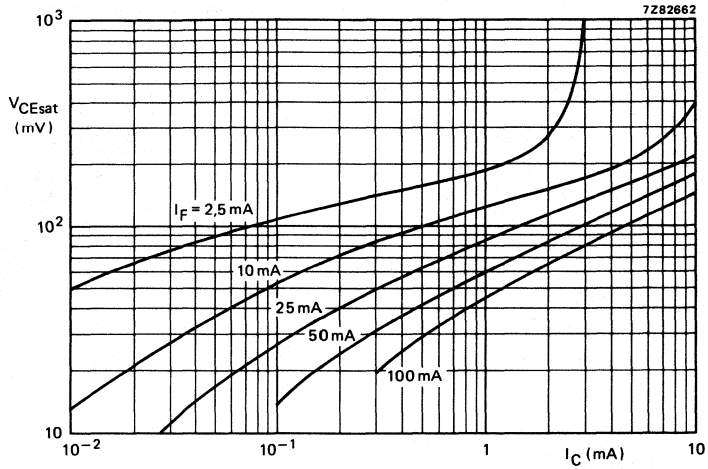


Fig. 18 Collector-emitter saturation voltage as a function of collector current; $I_B = 0$; $T_{amb} = 25^\circ C$; typical values.

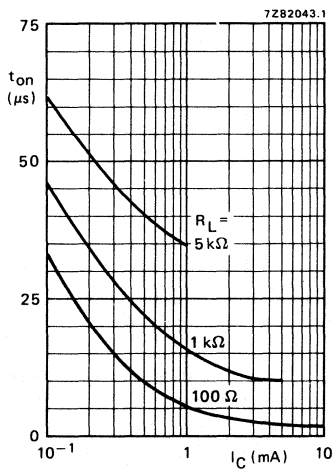


Fig. 19 Turn-on time as a function of collector current; $I_B = 0$; $V_{CC} = 5 V$; $T_{amb} = 25^\circ C$; typical values.

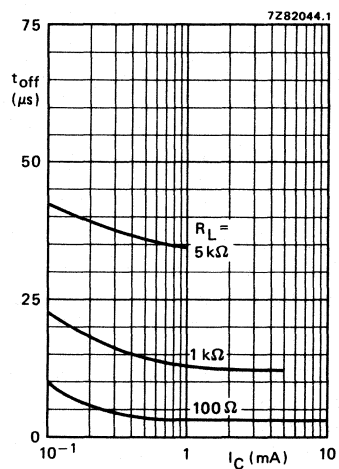


Fig. 20 Turn-off time as a function of collector current; $I_B = 0$; $V_{CC} = 5 V$; $T_{amb} = 25^\circ C$; typical values.

GaAIAs HIGH-VOLTAGE OPTOCOUPLER

Optically coupled isolator consisting of an infrared emitting GaAIAs 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 GaAIAs (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; $t_{on} = 10 \mu s$; $\delta = 0.01$	I_{FRM}	max.	3.0 A
Total power dissipation up to $T_{amb} = 25^\circ C$ when mounted on a printed circuit board (PCB)	P_{tot}	max.	200 mW

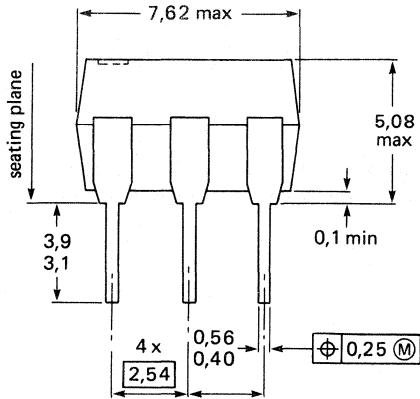
Transistor

Collector-emitter voltage (open base)	V_{CEO}	max.	50 V
Total power dissipation up to $T_{amb} = 25^\circ C$ when mounted on a PCB	P_{tot}	max.	200 mW

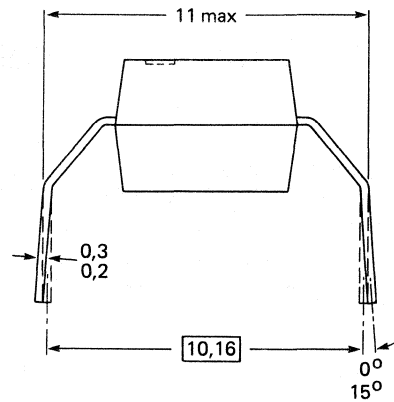
Optocoupler

Output/input DC current transfer ratio (CTR) $I_F = 10 \text{ mA}$; $V_{CE} = 0.4 \text{ V}$	I_C/I_F	min.	0.4
Collector cut-off current (dark) $V_{CC} = 10 \text{ V}$; working voltage = 2.5 kV DC I_F (diode) = 0 (see Fig. 4)	I_{CEW}	max.	200 nA
Collector-emitter saturation voltage $I_F = 10 \text{ mA}$; $I_C = 4 \text{ mA}$	V_{CEsat}	max.	0.4 V
Isolation voltage DC	V_{IORM}	min.	5.3 kV
AC (RMS value)		min.	3.75 kV

MECHANICAL DATA



Dimensions in mm



7295606.1

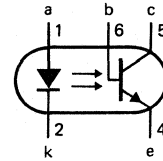
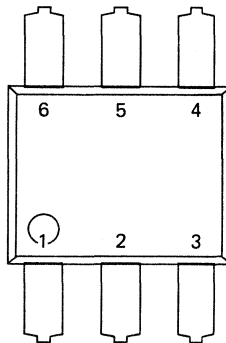


Fig. 1 SOT212.

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; $t_{on} = 10 \mu s$; $\delta = 0.01$	I_{FRM}	max.	3.0 A
Total power dissipation up to $T_{amb} = 25 \text{ }^\circ\text{C}$ 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 $T_{amb} = 25 \text{ }^\circ\text{C}$ 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	$R_{th\ j-a}$	=	500 K/W
transistor	$R_{th\ j-a}$	=	500 K/W
From junction to ambient when mounted on a PCB			
diode	$R_{th\ j-a}$	=	400 K/W
transistor	$R_{th\ j-a}$	=	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.	1.45 V
		max.	1.75 V
Reverse current			
$V_R = 5$ V	I_R	max.	10 μ A

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.	2.0 nA
		max.	50 nA
$V_{CE} = 10$ V; $T_{amb} = 70$ °C	I_{CEO}	max.	10 μ A
$V_{CB} = 10$ V	I_{CBO}	max.	20 nA

Optocoupler

Output/input DC current transfer ratio (CTR)

$I_F = 10 \text{ mA}; V_{CE} = 0.4 \text{ V}$

I_C/I_F	min.	0.4
	max.	1.6

$I_F = 0.5 \text{ mA}; V_{CE} = 0.4 \text{ V}$

I_C/I_F	min.	0.1
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Collector cut-off current (light)

$T_{amb} \leq 70 \text{ }^\circ\text{C}; V_{CE} = 15 \text{ V}; V_F = 0.8 \text{ V}$

$I_{CE(L)}$	max.	15 μA
-------------	------	------------------

$T_{amb} \leq 70 \text{ }^\circ\text{C}; I_F = 2 \text{ mA};$

$V_{CE} = 0.4 \text{ V}$

$I_{CE(L)}$	min.	250 μA
-------------	------	-------------------

Collector-emitter saturation voltage

$I_F = 10 \text{ mA}; I_C = 4 \text{ mA}$

V_{CEsat}	typ.	0.19 V
	max.	0.40 V

Collector cut-off current (dark) at working voltage

$V_W = 2.5 \text{ kV (DC value);}$

$V_{CC} = 10 \text{ V}; T_j = 25 \text{ }^\circ\text{C (notes 1 and 2, see Fig.4)}$

I_{CEW}	max.	200 nA
-----------	------	--------

$V_{CC} = 10 \text{ V}; T_j = 70 \text{ }^\circ\text{C (notes 1 and 2, see Fig.4)}$

I_{CEW}	max.	100 μA
-----------	------	-------------------

Isolation voltage; $t = 1 \text{ min.}$

(see note 3)

DC

AC (RMS value)

V_{IORM}	max.	5.3 kV
		3.75 kV

Output capacitance

$V_{CB} = 10 \text{ V}; f = 1 \text{ MHz}$

C_{bc}	typ.	4.5 pF
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Capacitance between input and output

$V = 0; f = 1 \text{ MHz}$

C_{io}	typ.	0.6 pF
----------	------	--------

Insulation resistance between input and output

$V_{IO} = \pm 1 \text{ kV}$

R_{IO}	min.	10 G Ω
	typ.	1 T Ω

Switching times (see Figs 2 and 3)

Turn-on time

$I_C = 2 \text{ mA}; V_{CC} = 5 \text{ V}; R_L = 100 \text{ } \Omega$

$I_C = 2 \text{ mA}; V_{CC} = 5 \text{ V}; R_L = 1 \text{ k}\Omega$

t_{on}	typ.	3.0 μs
	typ.	12 μs

Turn-off time

$I_C = 2 \text{ mA}; V_{CC} = 5 \text{ V}; R_L = 100 \text{ } \Omega$

$I_C = 2 \text{ mA}; V_{CC} = 5 \text{ V}; R_L = 1 \text{ k}\Omega$

t_{off}	typ.	3.0 μs
	typ.	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.

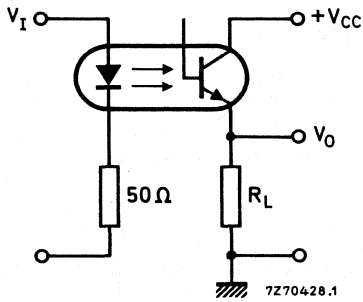


Fig. 2 Switching circuit.

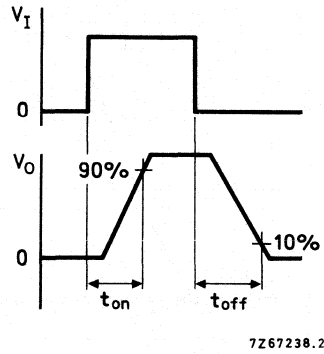


Fig. 3 Waveforms.

DEVELOPMENT DATA

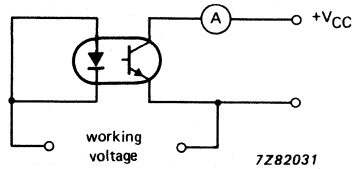


Fig. 4 Test circuit.

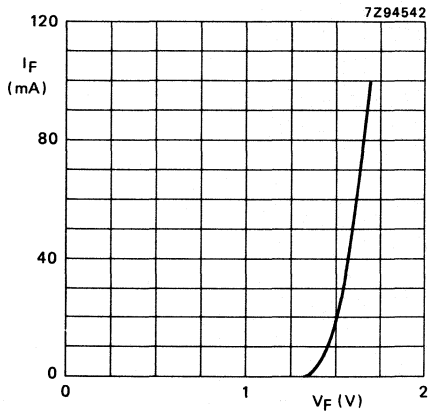


Fig. 5 Forward current as a function of forward voltage; $T_{amb} = 25\text{ }^{\circ}\text{C}$; typical values.

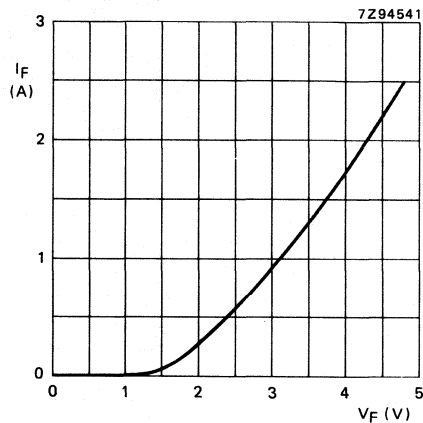


Fig. 6 Forward current as a function of forward voltage; $T_{amb} = 25\text{ }^{\circ}\text{C}$; $t_p = 1\text{ ms}$; typical values.

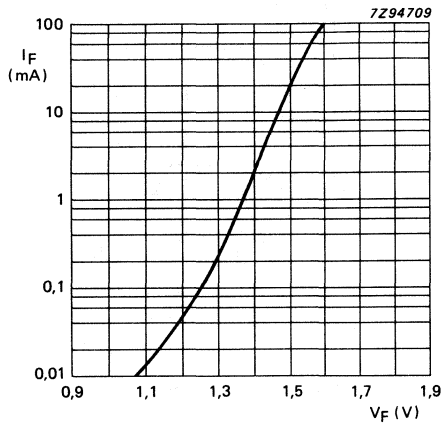


Fig. 7 Forward current as a function of forward voltage; $T_{amb} = 25\text{ }^\circ\text{C}$; typical values.

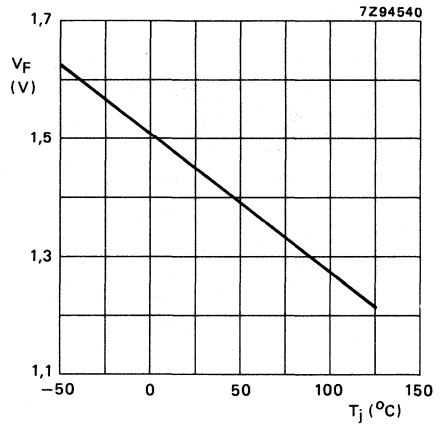


Fig. 8 Forward voltage as a function of temperature; $I_F = 10\text{ mA}$; typical values.

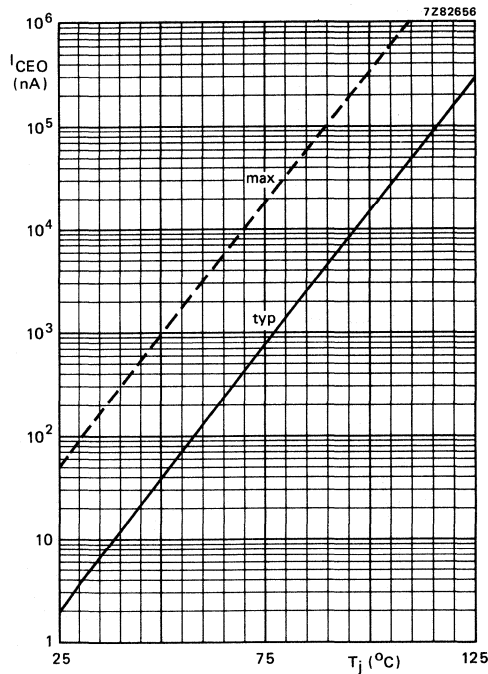


Fig. 9 Collector cut-off current as a function of temperature; $I_F = 0$; $V_{CE} = 10\text{ V}$.

DEVELOPMENT DATA

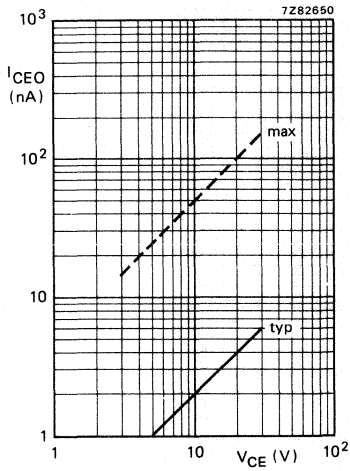


Fig. 10 Collector cut-off current as a function of collector-emitter voltage; $I_F = 0$; $T_j = 25^\circ\text{C}$.

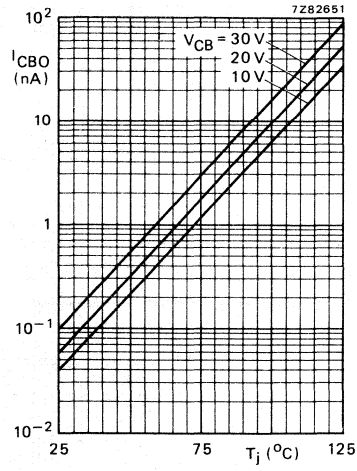


Fig. 11 Collector cut-off current as a function of temperature; typical values.

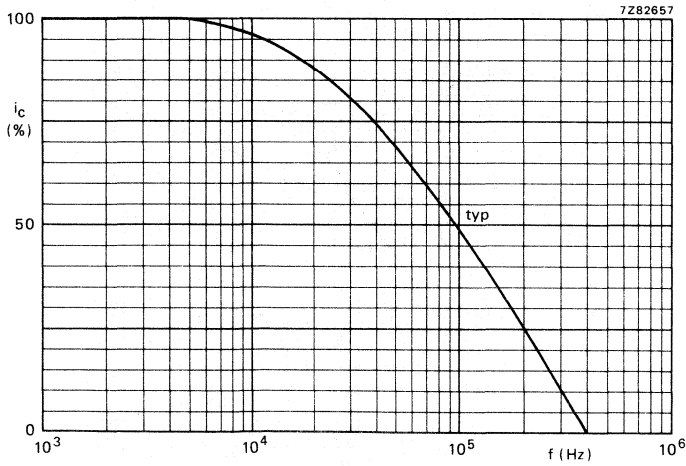


Fig. 12 Frequency response curve; $I_B = 0$; $I_C = 2\text{ mA}$; $V_{CC} = 5\text{ V}$; $R_L = 1\text{ k}\Omega$; $T_{amb} = 25^\circ\text{C}$.

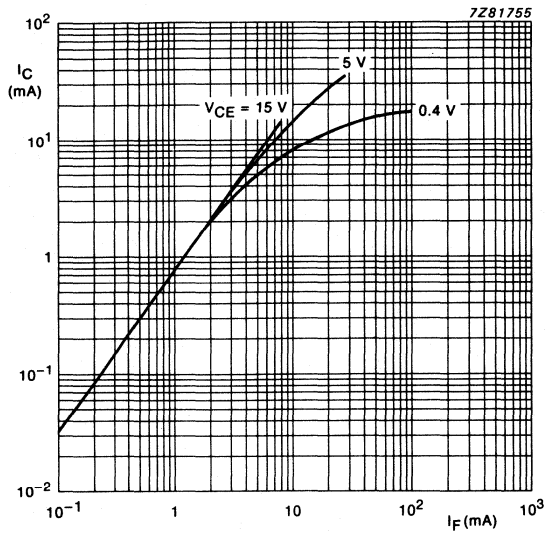


Fig. 13 Collector current as a function of forward current; $T_{amb} = 25^\circ\text{C}$; typical values.

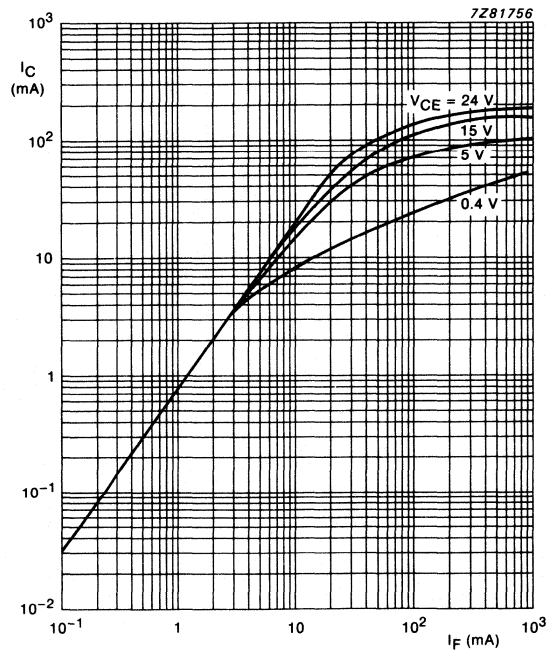


Fig. 14 Collector current (max.) as a function of forward current (max.); $T_{amb} = 25^\circ\text{C}$; $t_p = 10 \mu\text{s}$; $T = 1 \text{ ms}$; typical values.

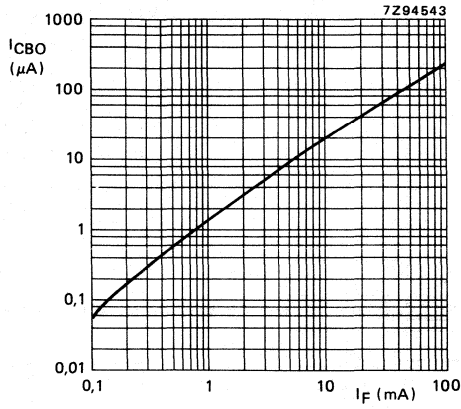


Fig. 15 Collector-base current as a function of forward current; $V_{CB} = 5 V$; $T_{amb} = 25^\circ C$; typical values.

DEVELOPMENT DATA

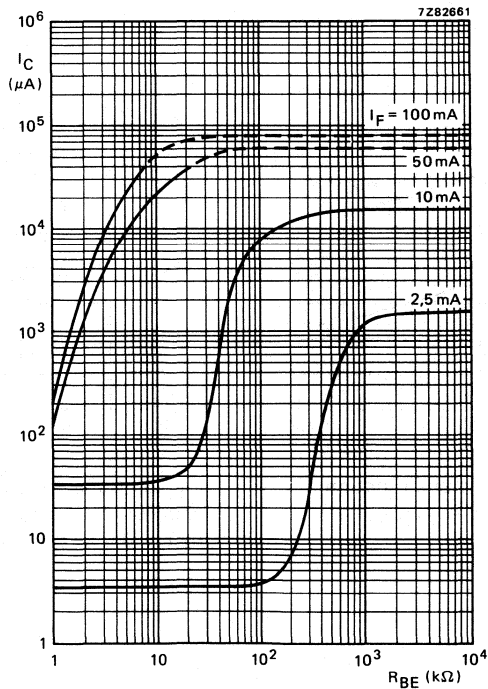


Fig. 16 Collector current as a function of base-emitter resistance; $I_B = 0$; $V_{CE} = 5 V$; $T_{amb} = 25^\circ C$; typical values.

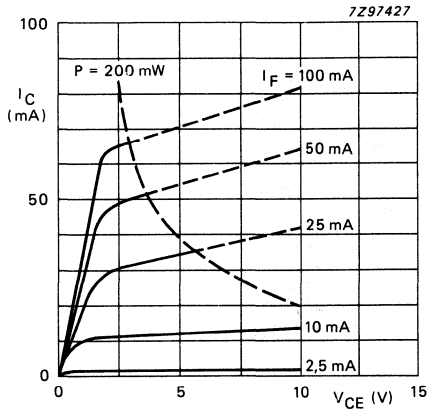


Fig. 17 Collector current as a function of collector-emitter voltage; $T_{amb} = 25^\circ\text{C}$; typical values.

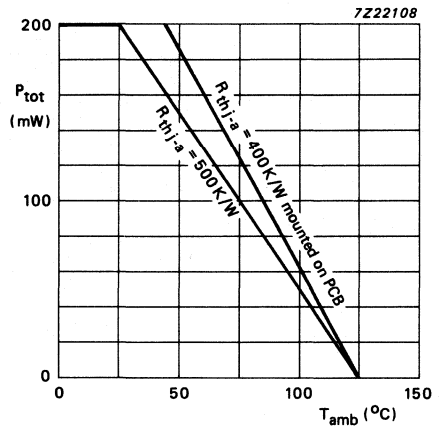


Fig. 18 Total power dissipation as a function of ambient temperature.

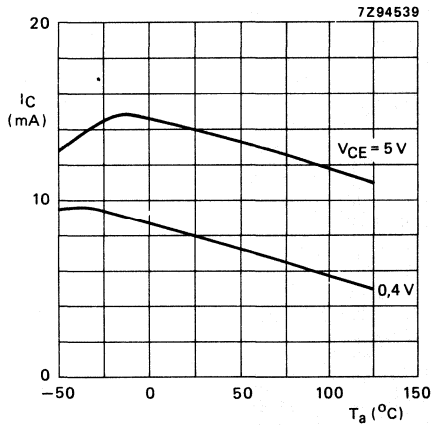


Fig. 19 Collector current as a function of ambient temperature; $I_F = 10 \text{ mA}$; typical values.

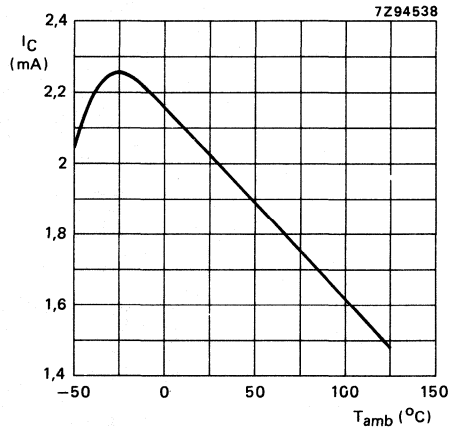


Fig. 20 Collector current as a function of ambient temperature; $I_F = 2 \text{ mA}$; $V_{CE} = 0.4 \text{ V}$; typical values.

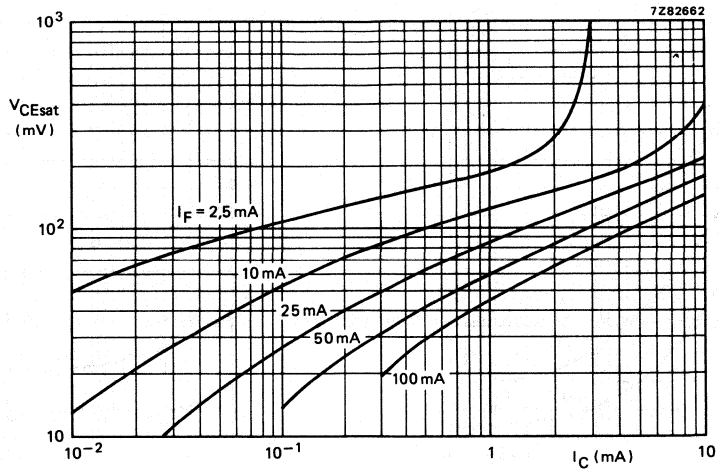


Fig. 21 Collector-emitter saturation voltage as a function of collector current; $I_B = 0$; $T_{amb} = 25^\circ\text{C}$; typical values.

DEVELOPMENT DATA

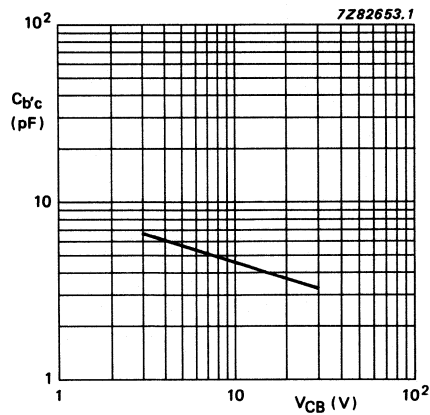


Fig. 22 Collector capacitance as a function of collector-base voltage; $f = 1$ MHz; $T_{amb} = 25^\circ\text{C}$.

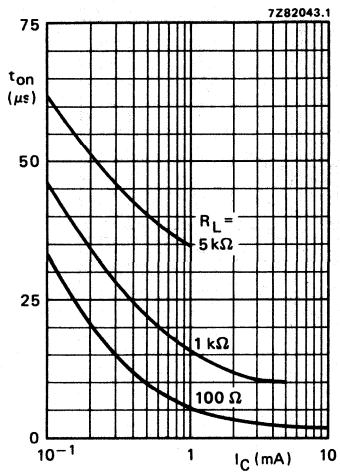


Fig. 23 Turn-on time as a function of collector current; $I_B = 0$; $V_{CC} = 5\text{ V}$; $T_{amb} = 25\text{ }^\circ\text{C}$; typical values.

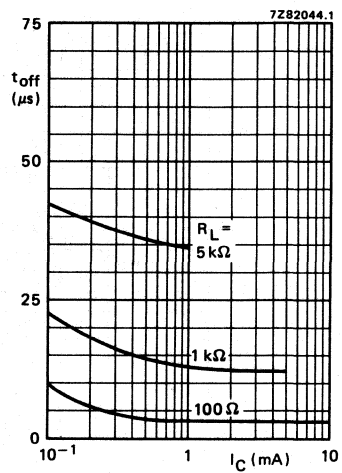


Fig. 24 Turn-off time as a function of collector current; $I_B = 0$; $V_{CC} = 5\text{ V}$; $T_{amb} = 25\text{ }^\circ\text{C}$; typical values.

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; $t_{on} = 1 \mu s$	I_{FRM}	max.	1 A

Transistor

Collector-emitter breakdown voltage $I_C = 10 \text{ mA}$	$V_{(BR)CEO}$	min.	18 V
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Optocoupler

Output current $I_F = 10 \text{ mA}; V_{CC} = 4.5 \text{ V}; V_O = 0.4 \text{ V}$	I_{OL}	min. typ.	2 mA 4 mA
Logic low output voltage $I_F = 10 \text{ mA}; V_{CC} = 4.5 \text{ V}; I_O = 2 \text{ mA}$	V_{OL}	typ. max.	0.2 V 0.4 V
Propagation delay time	t_{PHL} t_{PLH}	max.	0.8 μs 0.8 μs
Common mode transient immunity	$\pm CM$	min.	1 kV/ μs
Isolation voltage DC AC (RMS value)	V_{IORM}	min.	3.5 kV 2.5 kV

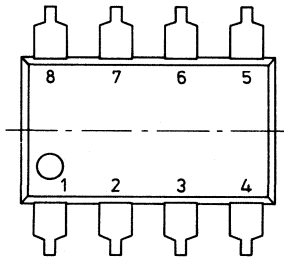
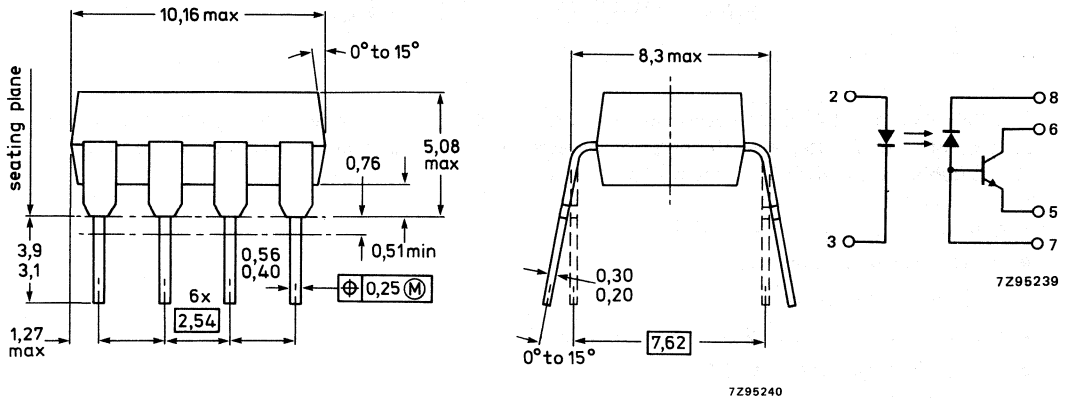
MECHANICAL DATA

SOT97F (see Fig.1).

MECHANICAL DATA

Fig.1 SOT97F.

Dimensions in mm



⊕ Positional accuracy.

Ⓜ Maximum Material Condition.

- (1) Centre-lines of all leads are within $\pm 0,125$ 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 (peak value); $t_p = 1 \mu s$	I_F	max.	100 mA
	I_{FRM}	max.	1 A
Total power dissipation up to $T_{amb} = 25 \text{ }^\circ\text{C}$	P_{tot}	max.	250 mW

Transistor

Collector-emitter breakdown voltage $I_C = 10 \text{ mA}$	$V_{(BR)CEO}$	min.	18 V
Emitter-base breakdown voltage $I_E = 0.1 \text{ mA}$	$V_{(BR)EBO}$	min.	5 V
DC collector current	I_C	max.	10 mA
Total power dissipation up to $T_{amb} = 85 \text{ }^\circ\text{C}$	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	$R_{th\ j-a}$	=	500 K/W
transistor	$R_{th\ j-a}$	=	500 K/W
From junction to ambient, with the device mounted on a printed circuit board diode	$R_{th\ j-a}$	=	400 K/W
transistor	$R_{th\ j-a}$	=	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 μ A

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 $I_C = 100$ μ A	$V_{(BR)CBh}$	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 μ A
Logic high supply current $I_F = 0$; $I_O = 0$; $V_{CC} = 15$ V	I_{CCH}	max.	1 μ A
Logic low supply current $I_F = 10$ mA; $V_{CC} = 15$ V; $I_O = 0$	I_{CCL}	typ.	20 μ A ←

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
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* Cathode connected to collector

DEVELOPMENT DATA

Logic low output voltage

$I_F = 10 \text{ mA}; V_{CC} = 4.5 \text{ V}; I_O = 2 \text{ mA}$

Isolation voltage (note 1) DC
 $t = 1 \text{ min}$ AC (RMS value)

Capacitance between input and output
 $f = 1 \text{ MHz}$

Insulation resistance between input and output
 $\pm V_{IO} = 1 \text{ kV}$

Switching times (see Figs 2 and 3)

$I_F = 10 \text{ mA}; V_{CC} = 5 \text{ V}; R_L = 2.5 \text{ k}\Omega$

Propagation delay time to logic low
 at output

Propagation delay time to logic high
 at output

V_{OL} typ. 0.2 V
 max. 0.4 V

V_{IORM} min. 3.5 kV
 2.5 kV

C_{io} typ. 0.6 pF

r_{IO} min. 10 G Ω
 typ. 1 T Ω

t_{PHL} typ. 0.5 μs
 max. 0.8 μs

t_{PLH} typ. 0.4 μs
 max. 0.8 μs

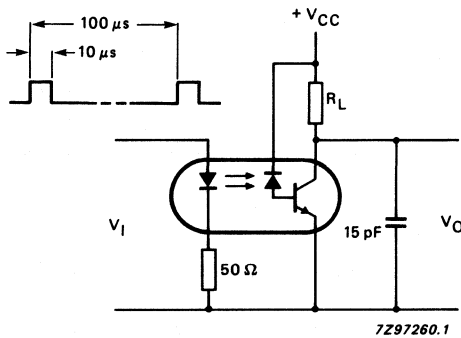


Fig. 2 Switching circuit.

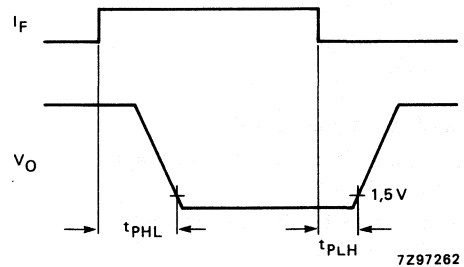


Fig. 3 Waveforms.

Switching times (see Figs 4 and 5)

$I_{Con} = 2 \text{ mA}; V_{CC} = 5 \text{ V}; R_L = 100 \Omega$

Turn-on time
 Turn-off time

t_{on} typ. 0.85 μs
 t_{off} typ. 0.85 μs

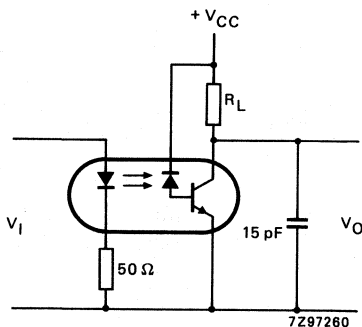


Fig. 4 Switching circuit.

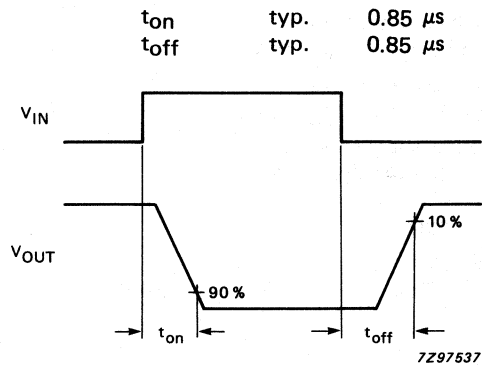


Fig. 5 Waveforms.

Transient immunity

 $V_{CC} = 5 \text{ V}; V_{CM} = 10 \text{ V}_{pp}; R_L = 2.5 \text{ k}\Omega$

Common mode transient immunity at logic low

 $I_F = 10 \text{ mA}$
CML min. $-1 \text{ kV}/\mu\text{s}$

Common mode transient immunity at logic high

 $I_F = 0$
CMH min. $1 \text{ kV}/\mu\text{s}$

Logic high output current (note 2, see Fig. 6)

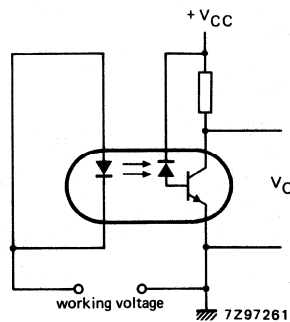
 $V_{CC} = 5.5 \text{ V}; \text{working voltage} = 2.5 \text{ kV DC};$
 $T_{amb} = 70 \text{ }^\circ\text{C}$
IOHW max. $100 \mu\text{A}$ 

Fig.6.

DEVELOPMENT DATA

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.

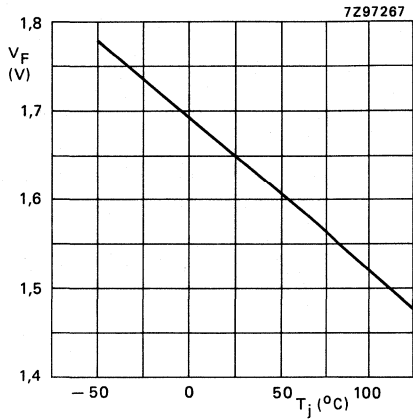


Fig. 7 $I_F = 10$ mA; typical values.

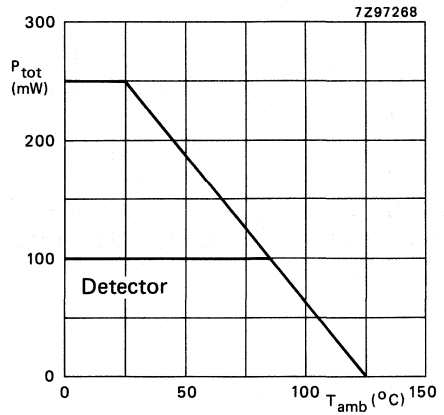


Fig. 8.

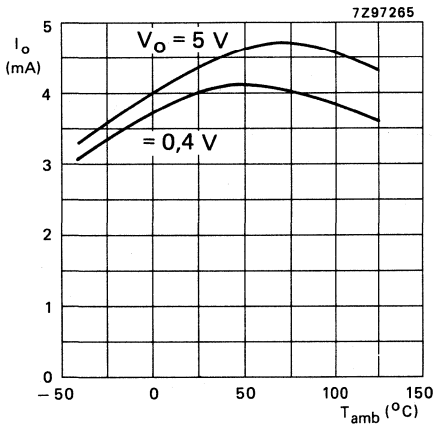


Fig. 9 $V_{CC} = 5$ V; $I_F = 10$ mA; typical values.

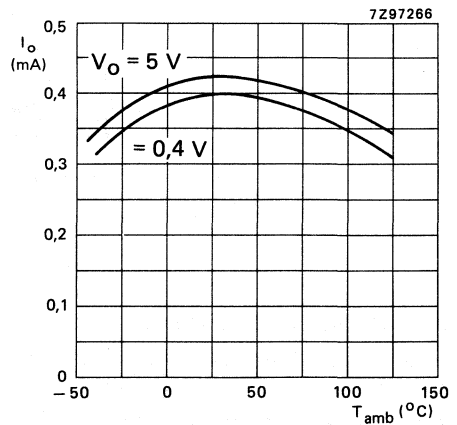


Fig. 10 $V_{CC} = 5$ V; $I_F = 2$ mA; typical values.

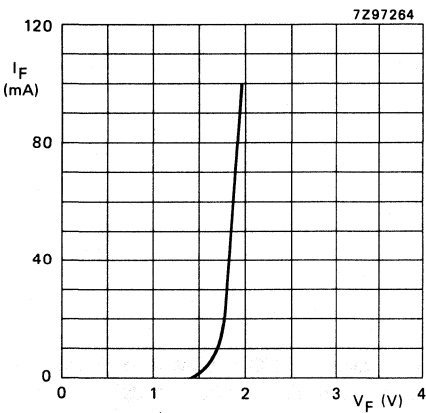


Fig. 11 $T_{amb} = 25$ °C; typical values.

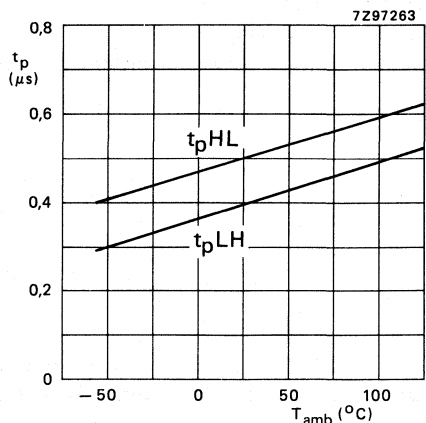


Fig. 12 $I_F = 10$ mA; $V_{CC} = 5$ V; $R_L = 2.5$ kΩ; typical values.

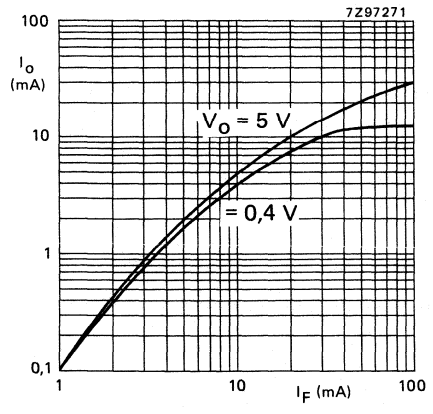


Fig. 13 $V_{CC} = 5\text{ V}$; typical values.

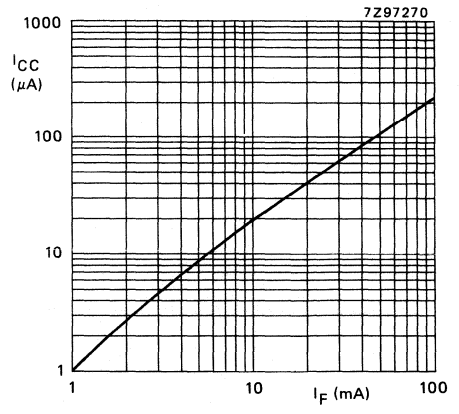


Fig. 14 $V_{CC} = 15\text{ V}$; $I_o = 0$; typical values.

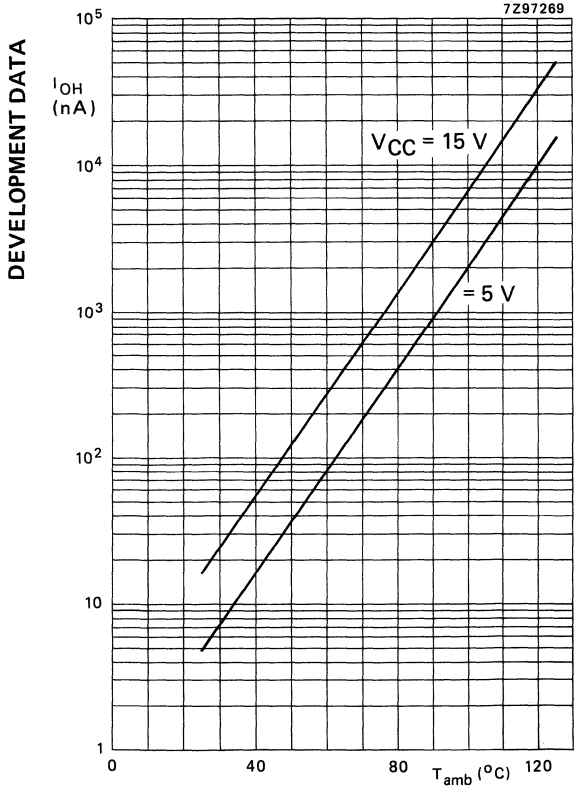


Fig. 15 Typical values.

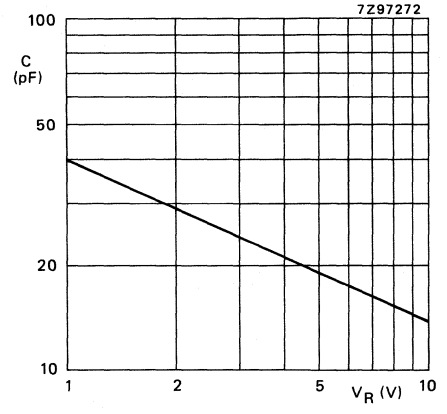


Fig. 16 $T_{amb} = 25\text{ }^{\circ}\text{C}$; typical values.
Photodiode capacitance

DEVELOPMENT DATA

This data sheet contains advance information and specifications are subject to change without notice.

CNS35

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 $T_{amb} = 25\text{ }^\circ\text{C}$	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 $T_{amb} = 25\text{ }^\circ\text{C}$	P_{tot}	max.	200 mW

Optocoupler

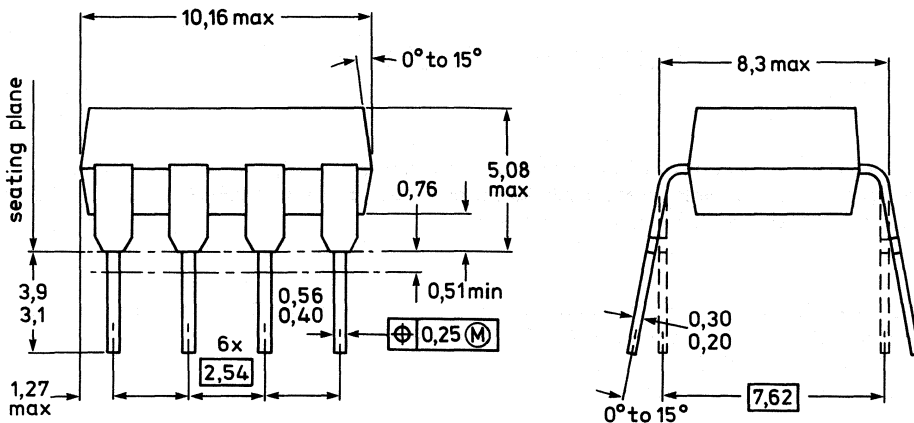
DC current transfer ratio (CTR) $I_F = 5.0\text{ mA}; V_{CE} = 5\text{ V}$	I_C/I_F	min. max.	0.5 6.0
Crosstalk between channels $I_F^1 = 0; I_F^2 = 5\text{ mA}; V_{CE}^1 = V_{CE}^2 = 5\text{ V}$	I_C^1/I_C^2	max.	1 %
$I_F^2 = 0; I_F^1 = 5\text{ mA}; V_{CE}^1 = V_{CE}^2 = 5\text{ V}$	I_C^2/I_C^1	max.	1 %
Isolation voltage DC AC (RMS value)	V_{IORM}	max.	4400 V 3120 V

MECHANICAL DATA

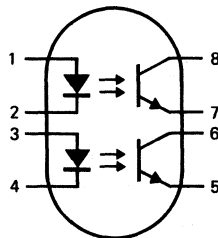
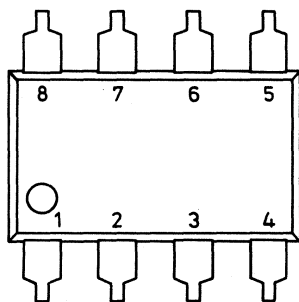
SOT97F (see Fig.1).

MECHANICAL DATA

Dimensions in mm



7Z95240.1



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: $t_{ON} = 100 \mu s$, $f = 100$ Hz)	I_{FRM}	max.	1.0 A
DC reverse voltage	V_R	max.	5 V
Total power dissipation up to $T_{amb} = 25 \text{ }^\circ\text{C}$	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 $T_{amb} = 25 \text{ }^\circ\text{C}$	P_{tot}	max.	200 mW

Optocoupler

Total power dissipation up to $T_{amb} = 25\text{ }^{\circ}\text{C}$
 Storage temperature range
 Operating ambient temperature range
 Junction temperature
 Soldering temperature
 up to the seating plane; $T_{sld} < 10\text{ s}$

P_{tot}	max.	250 mW
T_{stg}		-55 to +150 $^{\circ}\text{C}$
T_{amb}		-40 to +100 $^{\circ}\text{C}$
T_j	max.	125 $^{\circ}\text{C}$
T_{sld}	max.	260 $^{\circ}\text{C}$

THERMAL RESISTANCE

From junction to ambient in free air
 diode
 transistor
 From junction to ambient when mounted on a PCB
 diode
 transistor

$R_{th\ j-a}$	=	500 K/W
$R_{th\ j-a}$	=	500 K/W
$R_{th\ j-a}$	=	400 K/W
$R_{th\ j-a}$	=	400 K/W

ISOLATION RELATED VALUES

External air gap (clearance)
 input terminals to output terminals
 External tracking path (creepage distance)
 Tracking resistance (KB value)
 Internal plastic gap (clearance)
 isolation thickness between emitter and receiver

L(IO1)	min.	7.2 mm
L(IO2)	min.	7.0 mm
		KB-100/A
	min.	1.0 mm

CHARACTERISTICS

$T_j = 25\text{ }^{\circ}\text{C}$ unless otherwise specified

Diode

Forward voltage
 $I_F = 10\text{ mA}$
 Reverse current
 $V_R = 5\text{ V}$

V_F	typ.	1.15 V
	max.	1.5 V
I_R	max.	10 μA

Transistor

Collector-emitter breakdown voltage
 $I_C = 1\text{ mA}$
 Emitter-collector breakdown voltage
 $I_E = 0.1\text{ mA}$
 Collector-emitter cut-off current (dark)
 $I_F = 0; V_{CE} = 10\text{ V}$
 $I_F = 0; V_{CE} = 10\text{ V}; T_{amb} = 70\text{ }^{\circ}\text{C}$

$V_{(BR)CEO}$	min.	35 V
$V_{(BR)ECO}$	min.	7 V
I_{CEO}	typ.	2 nA
	max.	50 nA
I_{CEO}	max.	10 μA

DEVELOPMENT DATA

Optocoupler

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

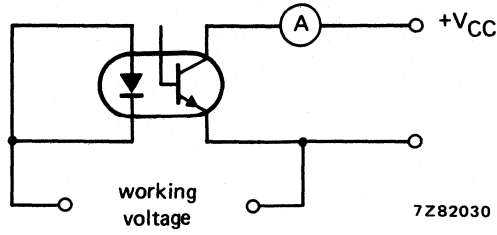


Fig.2 Test circuit.

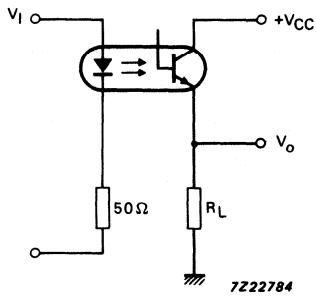


Fig.3 Switching circuit.

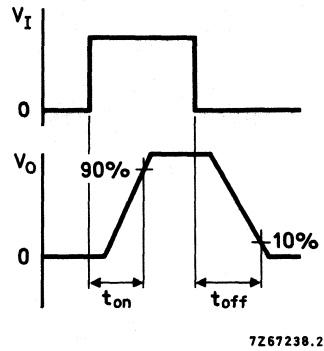


Fig.4 Waveforms.

DEVELOPMENT DATA

HIGH-VOLTAGE OPTOCOUPLER

The CNW82 is a photocoupler consisting of an infrared emitting GaAs diode and a silicon npn photo-transistor, 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-SET1, 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_{CE0} max. 50 V

Photocoupler

Output/input DC current transfer ratio

$I_F = 10 \text{ mA}; V_{CE} = 0.4 \text{ V}$ I_C/I_F min. 0.4

Collector cut-off current (dark)

$V_{CC} = 10 \text{ V}; \text{working voltage} = 2.5 \text{ kV DC}$ I_{CEW} max. 200 nA

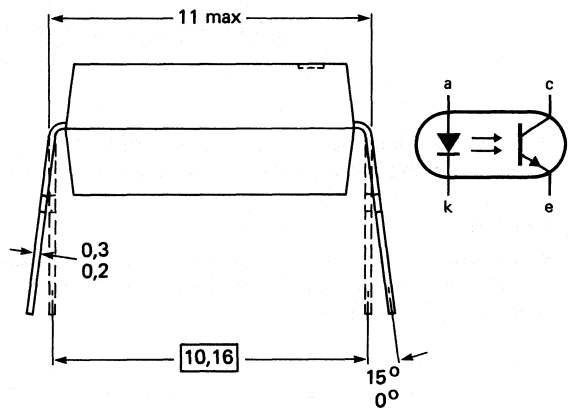
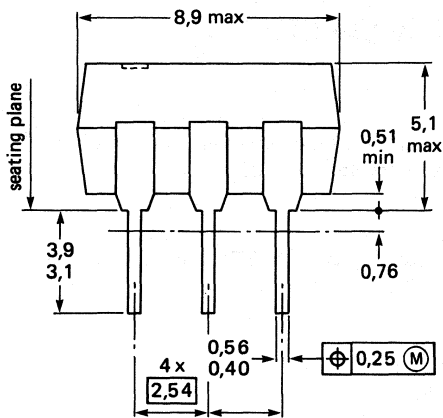
Test isolation voltage DC V_{IORM} max. 8.34 kV
 AC (RMS value) max. 5.9 kV

MECHANICAL DATA

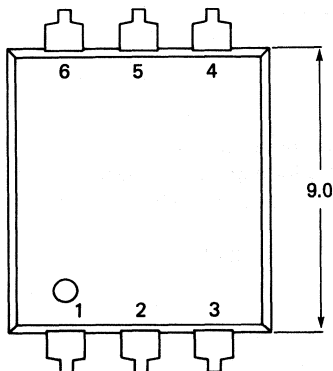
SOT228 (see Fig. 1).

MECHANICAL DATA

Dimensions in mm



7295838



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; $t_{ON} = 10 \mu s$; $\delta = 0.01$

I_{FRM} max. 3.0 A

Total power dissipation up to $T_{amb} = 25 \text{ }^\circ\text{C}$

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 $T_{amb} = 25 \text{ }^\circ\text{C}$

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_{thj-a}	=	500 K/W
transistor	R_{thj-a}	=	500 K/W
From junction to ambient when mounted on a PCB			
diode	R_{thj-a}	=	400 K/W
transistor	R_{thj-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.	1.15 V
		max.	1.5 V
Reverse current $V_R = 5$ V	I_R	max.	10 μ A

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 nA
		max.	50 nA
$V_{CE} = 10$ V; $T_{amb} = 70$ °C	I_{CEO}	max.	10 μ A

CHARACTERISTICS (continued)

Photocoupler

Output/input DC current transfer ratio

$I_F = 10 \text{ mA}; V_{CE} = 0.4 \text{ V}$	I_C/I_F	min.	0.4
		typ.	0.8
$I_F = 10 \text{ mA}; V_{CE} = 5 \text{ V}$	I_C/I_F	typ.	1.5

Collector cut-off current (light)

$T_{amb} \leq 70 \text{ }^\circ\text{C}; V_F = 0.8 \text{ V}; V_{CE} = 15 \text{ V}$	$I_{CE(L)}$	max.	15 μA
$T_{amb} \leq 70 \text{ }^\circ\text{C}; I_F = 2 \text{ mA}; V_{CE} = 0.4 \text{ V}$	$I_{CE(L)}$	min.	150 μA

Collector-emitter saturation voltage

$I_F = 10 \text{ mA}; I_C = 4 \text{ mA}$	V_{CEsat}	typ.	0.19 V
		max.	0.40 V

Collector cut-off current (dark) at
 working voltage $V_W = 2.5 \text{ kV}$ (DC value);
 $V_{CC} = 10 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$ (see notes 1 and 2)
 $V_{CC} = 10 \text{ V}; T_j = 70 \text{ }^\circ\text{C}$ (see notes 1 and 2)

I_{CEW}	max.	200 nA
I_{CEW}	max.	100 μA

Test isolation voltage DC
 $t = 1 \text{ min}$ (see note 3) AC (RMS value)

V_{IORM}	max.	8.34 kV
	max.	5.9 kV

Capacitance between input and output

$V = 0; f = 1 \text{ MHz}$	C_{io}	typ.	0.4 pF
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Insulation resistance between input and output

$V_{IO} = \pm 1000 \text{ V}$	R_{IO}	min.	10 G Ω
		typ.	1 T Ω

Switching times (see Figs 3 and 4)

Turn-on time

$I_C = 2 \text{ mA}; V_{CC} = 5 \text{ V}; R_L = 100 \text{ } \Omega$	t_{on}	typ.	3.0 μs
$I_C = 2 \text{ mA}; V_{CC} = 5 \text{ V}; R_L = 1 \text{ k}\Omega$		typ.	12 μs

Turn-off time

$I_C = 2 \text{ mA}; V_{CC} = 5 \text{ V}; R_L = 100 \text{ } \Omega$	t_{off}	typ.	3.0 μs
$I_C = 2 \text{ mA}; V_{CC} = 5 \text{ V}; R_L = 1 \text{ k}\Omega$		typ.	12 μs

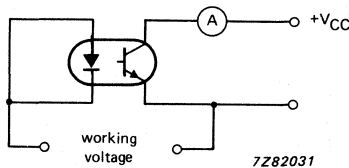


Fig. 2 Test circuit.

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 7080 V (RMS) for 2 seconds between the shorted input (diode) leads and the shorted output (phototransistor) leads.

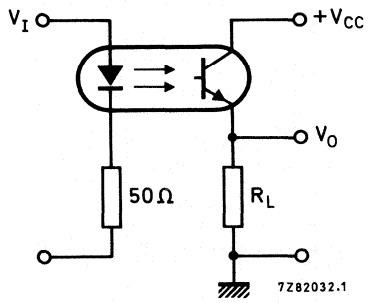


Fig. 3 Switching circuit.

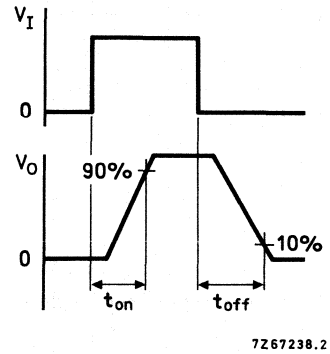


Fig. 4 Waveforms.

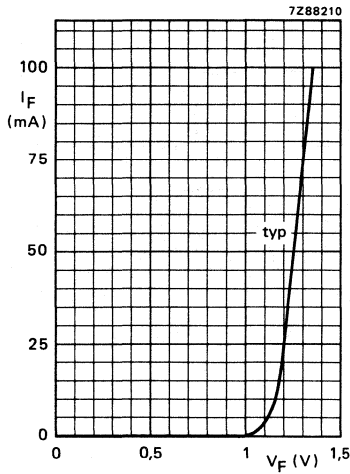


Fig. 5 Typical forward current as a function of forward voltage; $T_{amb} = 25^\circ\text{C}$.

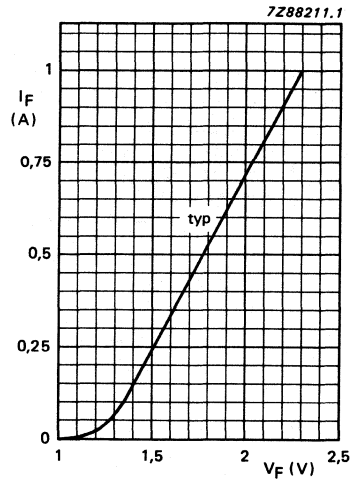


Fig. 6 Typical forward current as a function of forward voltage; $T_{amb} = 25^\circ\text{C}$; $t_p = 20 \mu\text{s}$; $\delta = 0.01$.

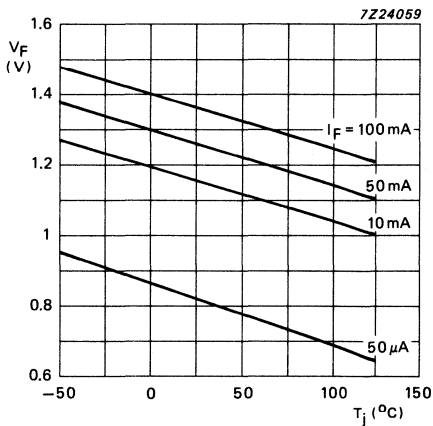


Fig. 7 Typical forward voltage as a function of junction temperature.

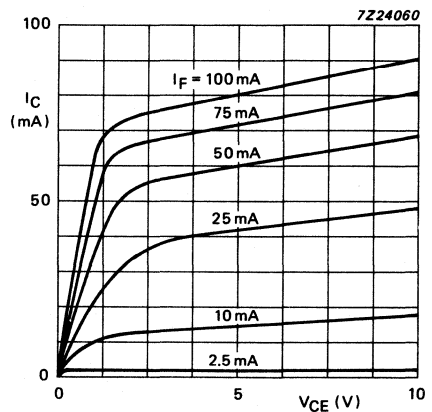


Fig. 8 Typical collector current as a function of collector-emitter voltage; $T_{amb} = 25^\circ\text{C}$.

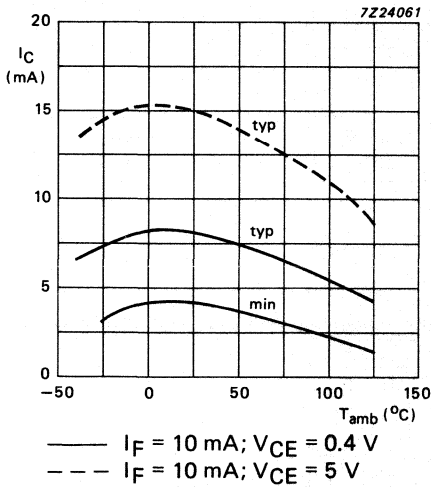


Fig. 9 Collector current as a function of ambient temperature.

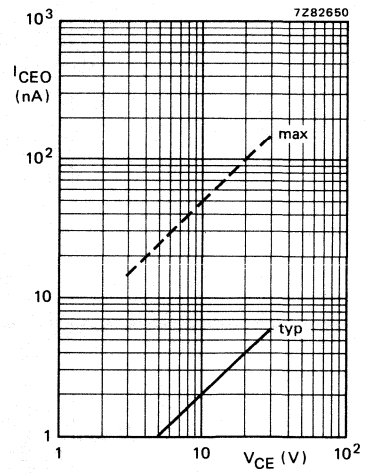


Fig. 10 Collector-emitter dark current as a function of collector-emitter voltage; $T_{amb} = 25$ $^{\circ}C$.

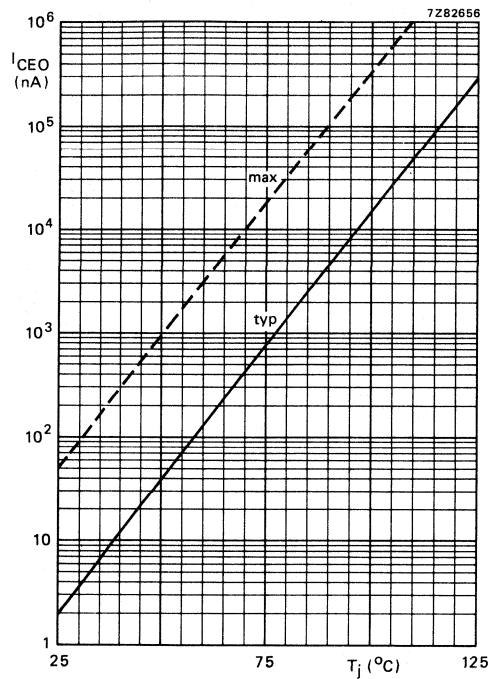


Fig. 11 Collector-emitter dark current as a function of junction temperature.

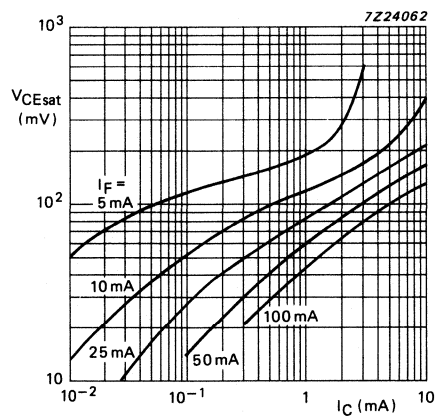


Fig. 12 Typical collector-emitter saturation voltage as a function of collector current; $T_{amb} = 25^{\circ}C$.

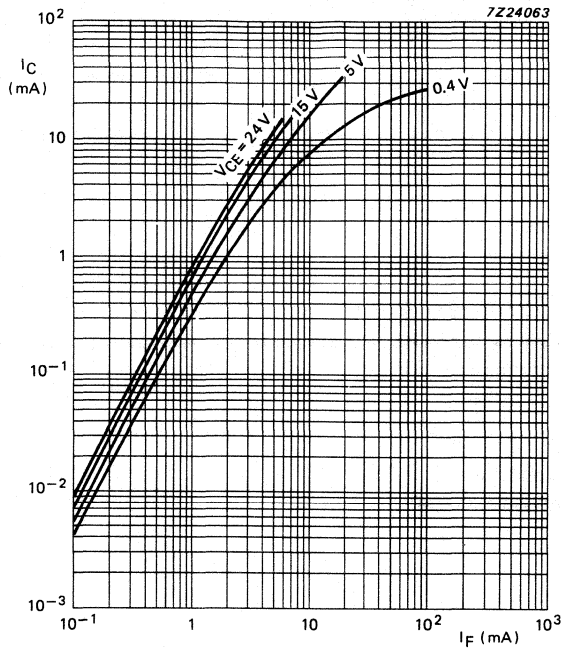


Fig. 13 Typical collector current as a function of forward current; $T_{amb} = 25\text{ }^\circ\text{C}$.

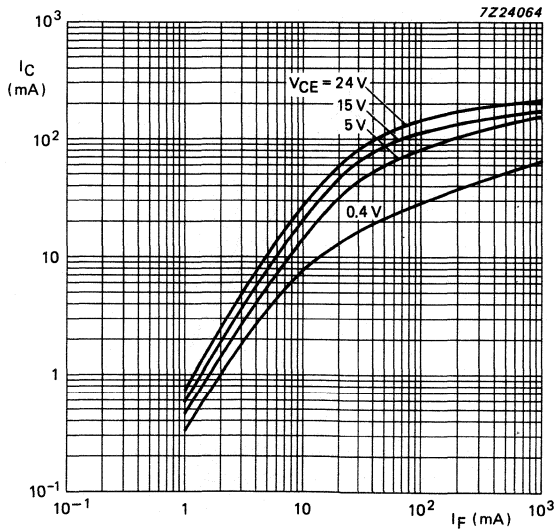


Fig. 14 Typical collector current as a function of forward current; $T_{amb} = 25\text{ }^\circ\text{C}$; $t_p = 10\text{ }\mu\text{s}$; $\delta = 0.01$.

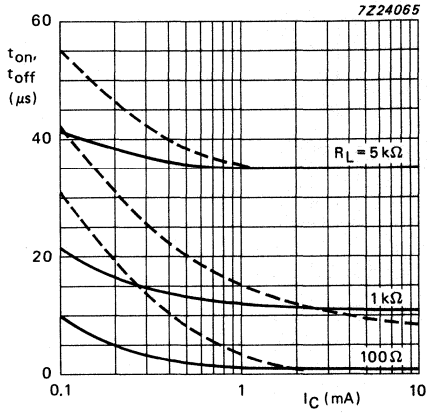


Fig. 15 Typical turn-on and turn-off times as a function of collector current; $T_{amb} = 25^\circ C$.

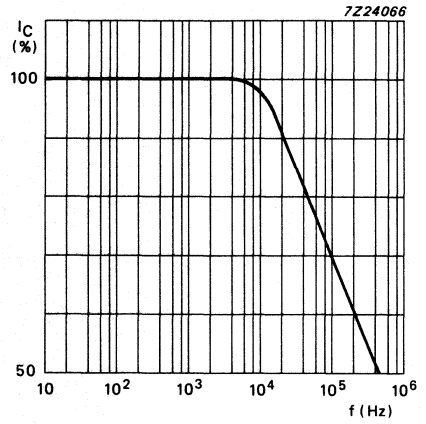


Fig. 16 Relative collector current as a function of frequency; $T_{amb} = 25^\circ C$; $I_C = 2 mA$; $V_{CC} = 5 V$.

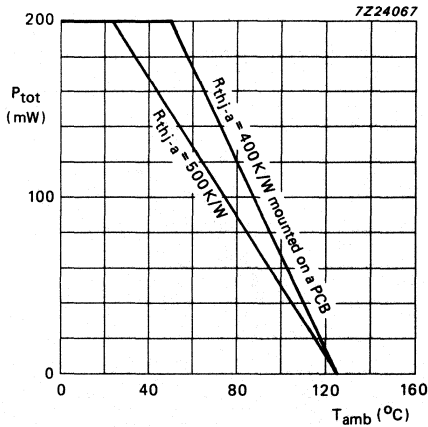


Fig. 17 Total power dissipation as a function of ambient temperature.

HIGH-VOLTAGE OPTOCOUPLER

The CNW83 is a photocoupler consisting of an infrared emitting GaAs diode and a silicon npn photo-transistor, 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 — SET1, 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

$I_F = 10 \text{ mA}; V_{CE} = 0.4 \text{ V}$ I_C/I_F min. 0.4

Collector cut-off current (dark)

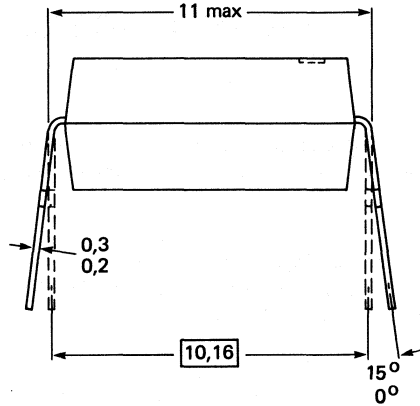
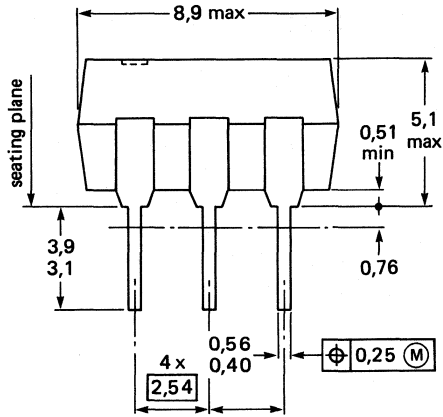
$V_{CC} = 10 \text{ V}; \text{working voltage} = 2.5 \text{ kV DC}$ I_{CEW} max. 200 nA

Test isolation voltage DC

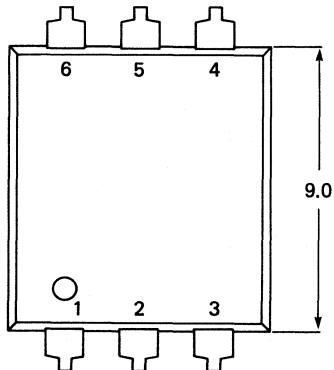
AC (RMS value) V_{IORM} max. 8.34 kV
 max. 5.9 kV

MECHANICAL DATA

Dimensions in mm



7Z95838



Pinning:

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

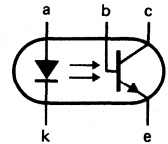


Fig. 1 SOT228.

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; $t_{ON} = 10 \mu s$; $\delta = 0.01$	I_{FRM}	max.	3.0 A
Total power dissipation up to $T_{amb} = 25 \text{ }^\circ\text{C}$	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 $T_{amb} = 25 \text{ }^\circ\text{C}$	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	$R_{th j-a}$	=	500 K/W
transistor	$R_{th j-a}$	=	500 K/W
From junction to ambient when mounted on a PCB			
diode	$R_{th j-a}$	=	400 K/W
transistor	$R_{th j-a}$	=	400 K/W

ISOLATION RELATED VALUES

External air gap (clearance) input terminals to output terminals	$L(1O1)$	min.	9.6 mm
External tracking path (creepage distance) input terminals to output terminals	$L(1O2)$	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.	1.15 V
		max.	1.5 V
Reverse current $V_R = 5$ V	I_R	max.	10 μ A

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.	2.0 nA
		max.	50 nA
$V_{CE} = 10$ V; $T_{amb} = 70$ °C	I_{CEO}	max.	10 μ A
$V_{CB} = 10$ V	I_{CBO}	max.	20 nA

CHARACTERISTICS (continued)

Photocoupler

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

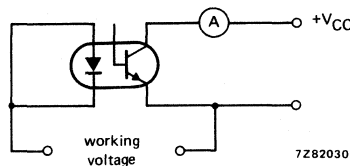


Fig. 2 Test circuit.

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 7080 V (RMS) for 2 seconds between the shorted input (diode) leads and the shorted output (phototransistor) leads.

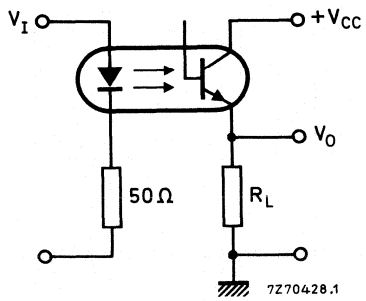


Fig. 3 Switching circuit.

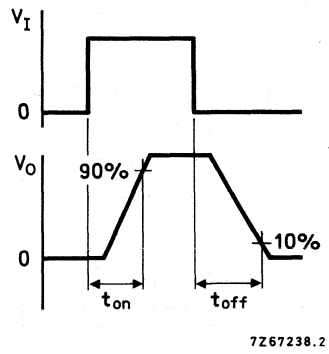


Fig. 4 Waveforms.

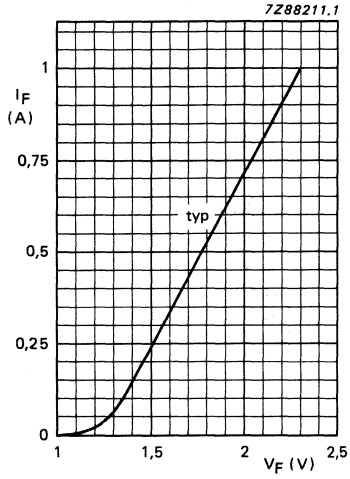


Fig. 5 Typical forward current as a function of forward voltage; $T_{amb} = 25\text{ }^\circ\text{C}$.

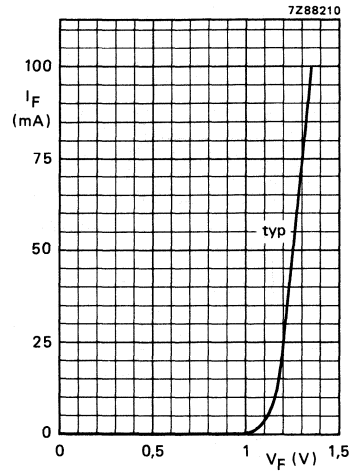


Fig. 6 Typical forward current as a function of forward voltage; $T_{amb} = 25\text{ }^\circ\text{C}$; $t_p = 20\text{ }\mu\text{s}$; $\delta = 0.01$.

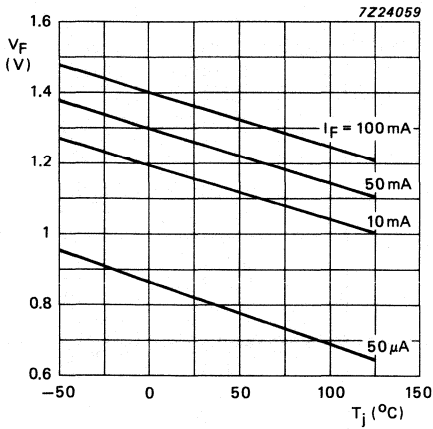


Fig. 7 Typical forward voltage as a function of junction temperature.

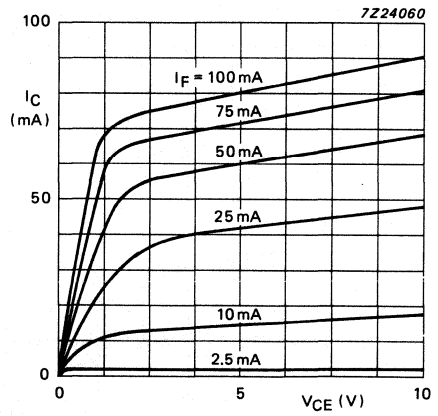


Fig. 8 Typical collector current as a function of collector-emitter voltage; $T_{amb} = 25^{\circ}\text{C}$.

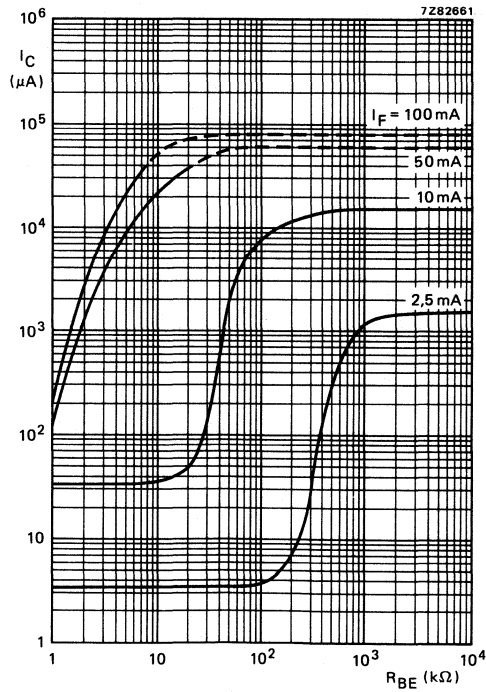
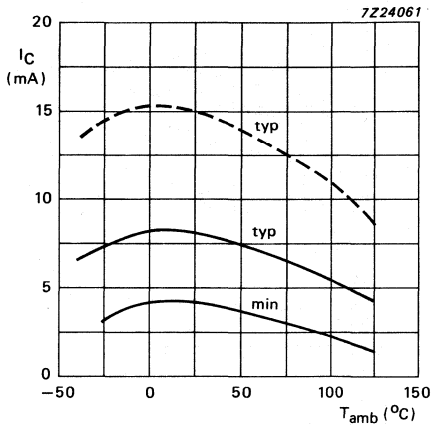


Fig. 9 Collector current as a function of base-emitter resistance; $I_B = 0$; $V_{CE} = 5\text{ V}$; $T_{amb} = 25^{\circ}\text{C}$; typical values.



— $I_F = 10 \text{ mA}; V_{CE} = 0.4 \text{ V}$
 - - - $I_F = 10 \text{ mA}; V_{CE} = 5 \text{ V}$

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

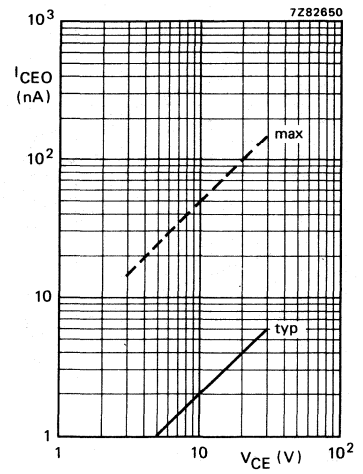


Fig. 11 Collector-emitter dark current as a function of collector-emitter voltage; $T_{amb} = 25 \text{ }^\circ\text{C}$.

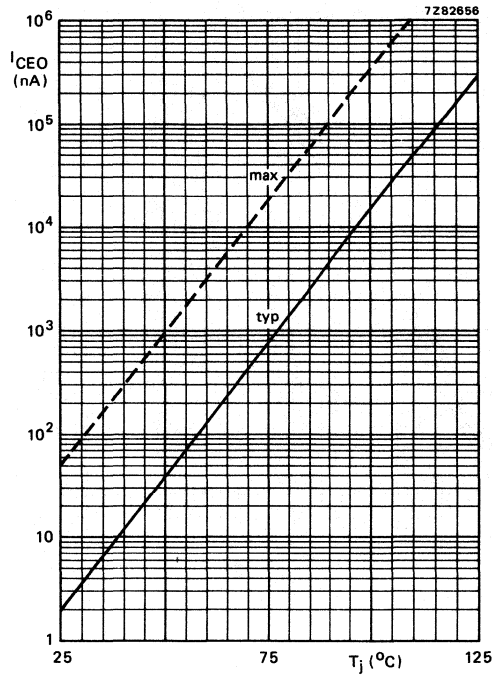


Fig. 12 Collector-emitter dark current as a function of junction temperature.

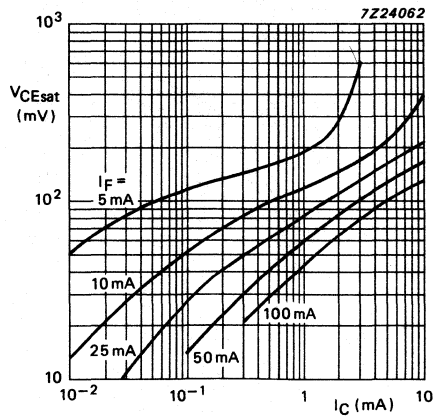


Fig. 13 Typical collector-emitter saturation voltage as a function of collector current; $T_{amb} = 25^{\circ}\text{C}$.

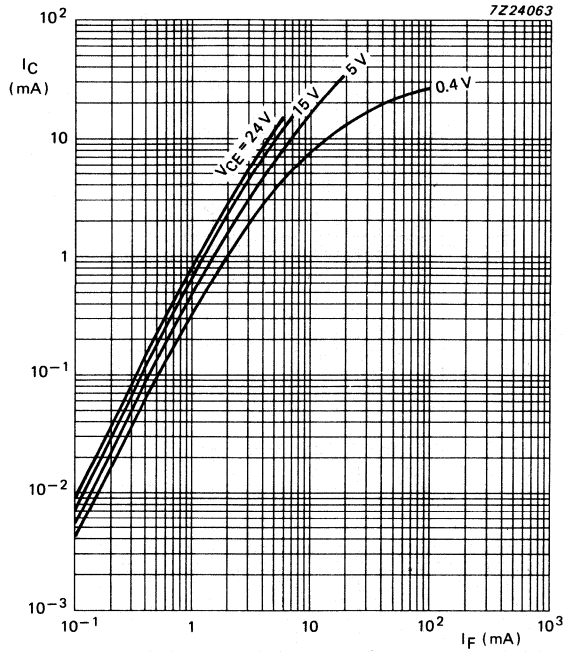


Fig. 14 Typical collector current as a function of forward current; $T_{amb} = 25^\circ C$.

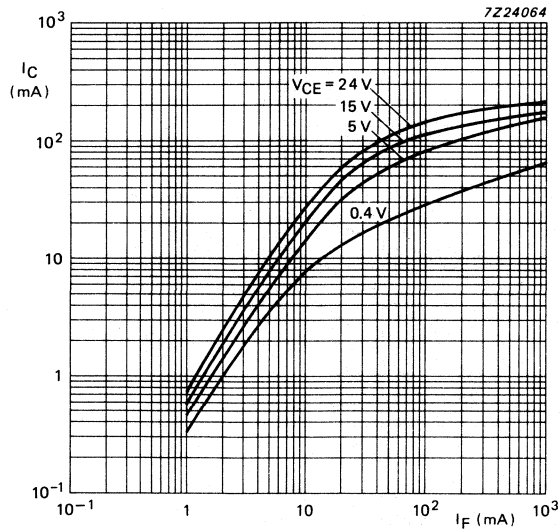


Fig. 15 Typical collector current as a function of forward current; $T_{amb} = 25^\circ C$; $t_p = 10 \mu s$; $\delta = 0.01$.

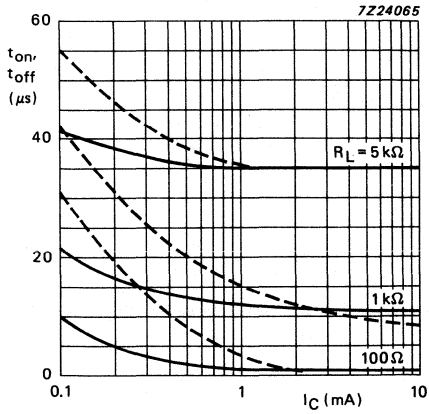


Fig. 16 Typical turn-on and turn-off times as a function of collector current; $T_{amb} = 25^\circ C$.

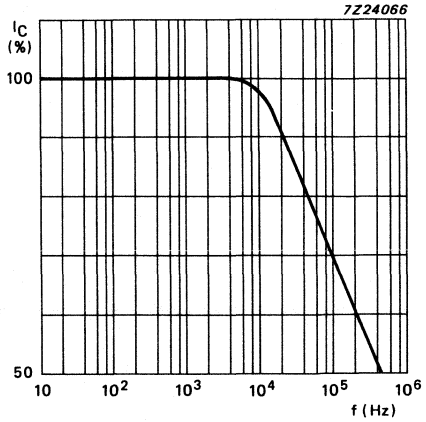


Fig. 17 Relative collector current as a function of frequency; $T_{amb} = 25^\circ C$; $I_C = 2 mA$; $V_{CC} = 5 V$.

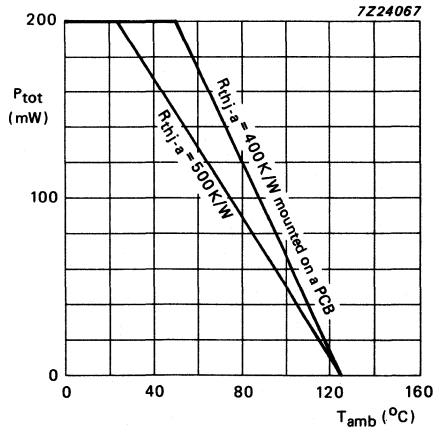


Fig. 18 Total power dissipation as a function of ambient temperature.

HIGH-VOLTAGE OPTOCOUPLER

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

Features of this product:

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

QUICK REFERENCE DATA

Diode

Continuous reverse voltage	V_R	max.	5 V
Forward current d.c. (peak value); $t_p = 10 \mu s$; $\delta = 0,01$	I_F	max.	50 mA
	I_{FRM}	max.	3 A
Total power dissipation up to $T_{amb} = 25 \text{ }^\circ\text{C}$	P_{tot}	max.	100 mW

Transistor

Collector-emitter voltage (open base)	V_{CEO}	max.	30 V
Total power dissipation up to $T_{amb} = 25 \text{ }^\circ\text{C}$	P_{tot}	max.	100 mW

Optocoupler

Output/input d.c. current transfer ratio (C.T.R.) $I_F = 10 \text{ mA}$; $V_{CE} = 0,4 \text{ V}$; ($I_B = 0$)	I_C/I_F	>	0,2
Collector cut-off current (dark) $V_{CC} = 10 \text{ V}$; 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

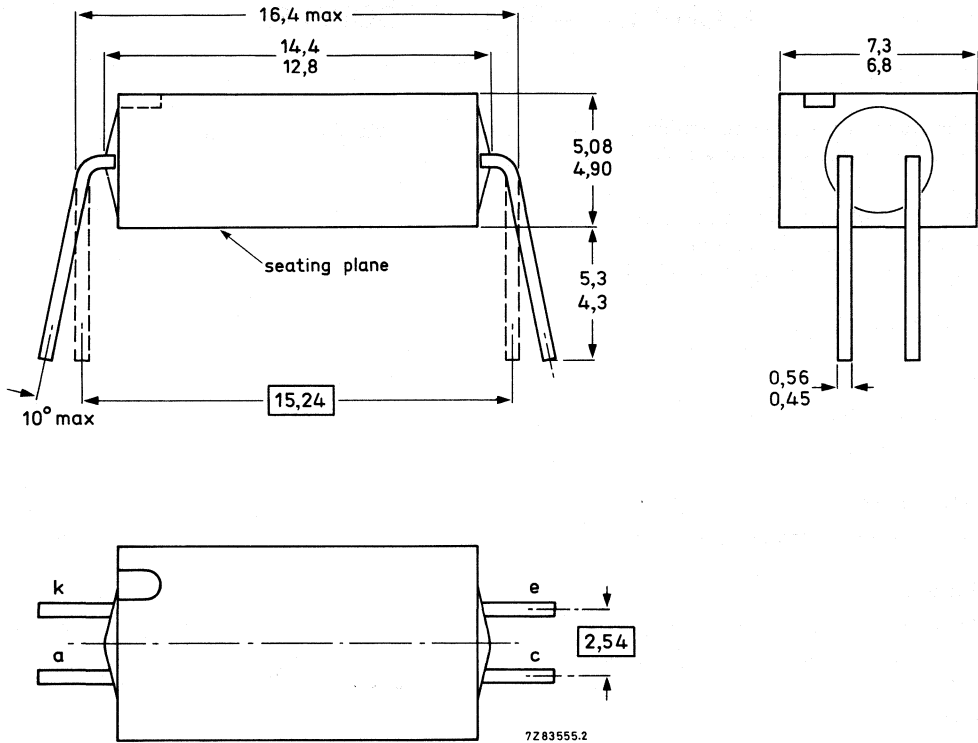
MECHANICAL DATA

SOT-211 (see Fig. 1)

MECHANICAL DATA

Fig. 1 SOT-211.

Dimensions in mm



RATINGS

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

Diode

Continuous reverse voltage	V_R	max.	5 V
Forward current	I_F	max.	50 mA
d.c.	I_{FRM}	max.	3 A
(peak value); $t_p = 10 \mu s$; $\delta = 0,01$	P_{tot}	max.	100 mW
Total power dissipation up to $T_{amb} = 25 \text{ }^\circ\text{C}$			

Transistor

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

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	$R_{th\ j-a}$	max.	750 K/W
transistor	$R_{th\ j-a}$	max.	750 K/W
From junction to ambient, device mounted on a printed circuit board diode	$R_{th\ j-a}$	max.	400 K/W
transistor	$R_{th\ j-a}$	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 μ A
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. typ.	0,2 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

$$I_F = 0; V = 0; f = 1 \text{ MHz}$$

C_{io} typ. 0,15 pF

Insulation resistance between input and output

$$\pm V_{IO} = 1 \text{ kV}$$

r_{IO} > $10^{11} \Omega$
 $12^{12} \Omega$

Common mode rejection (see Fig. 3)

$$I_C = 2 \text{ mA}; f = 10 \text{ kHz}$$

CMRR typ. 85 dB

Switching times (see Fig. 13)

$$I_{Con} = 2 \text{ mA}; V_{CC} = 5 \text{ V}; R_L = 100 \Omega$$

Turn-on time

t_{on} typ. 3 μs

Turn-off time

t_{off} typ. 3 μs

$$I_{Con} = 2 \text{ mA}; V_{CC} = 5 \text{ V}; R_L = 1 \text{ k}\Omega$$

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

$$V_{CC} = 10 \text{ V}; \text{working voltage (d.c.)} = 10 \text{ kV}$$

I_{CEW} < 200 nA*

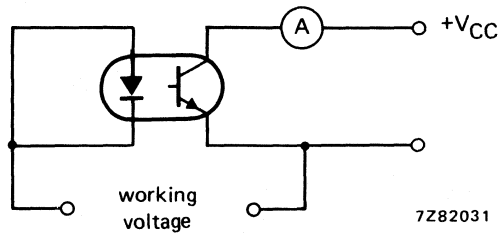


Fig. 2.

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

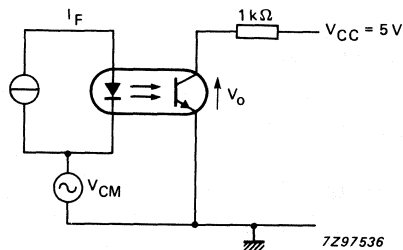


Fig. 3.

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

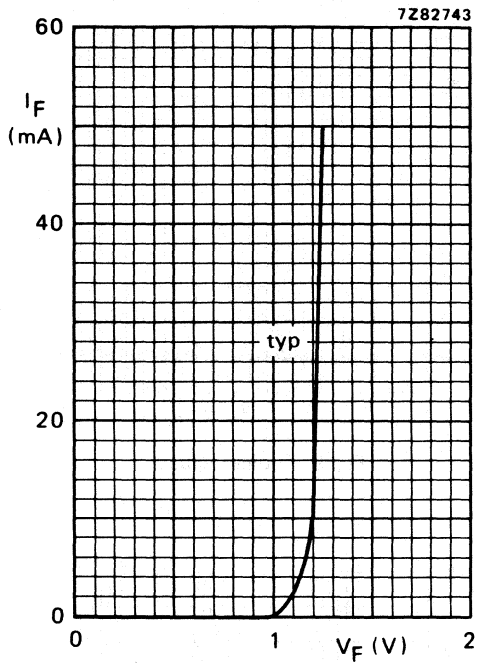


Fig. 4 $T_j = 25^\circ\text{C}$.

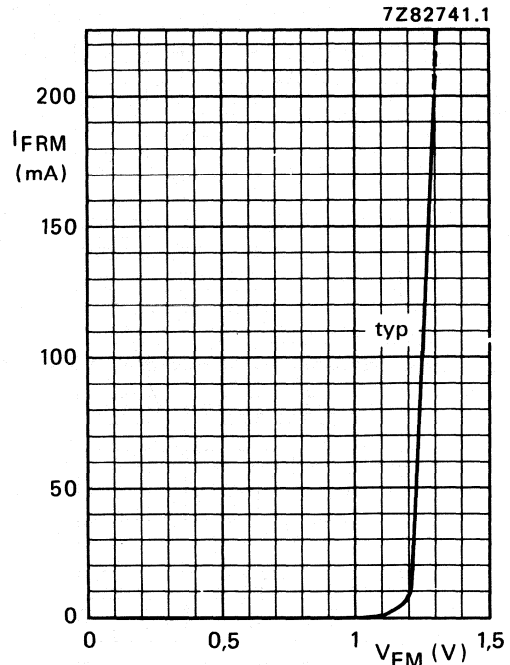


Fig. 5 $T_{amb} = 25^\circ\text{C}$; $t_p = 10\ \mu\text{s}$; $T = 1\ \text{ms}$.

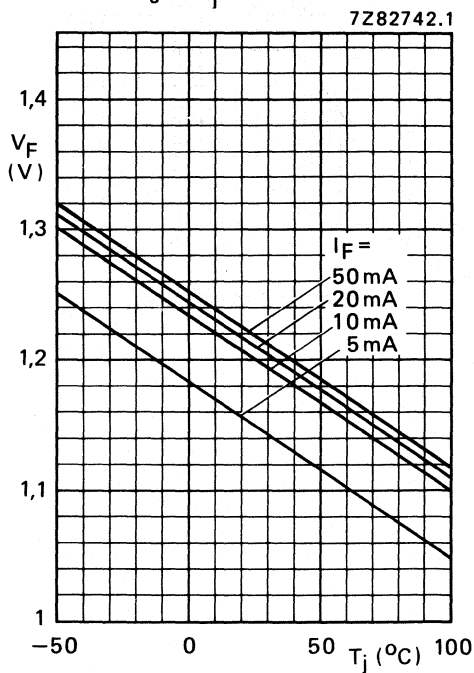


Fig. 6 Typical values.

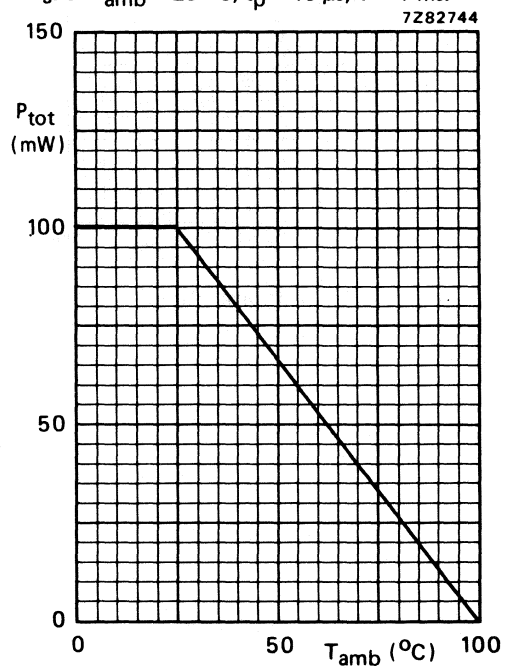


Fig. 7 Power derating curve for diode and transistor versus ambient temperature.

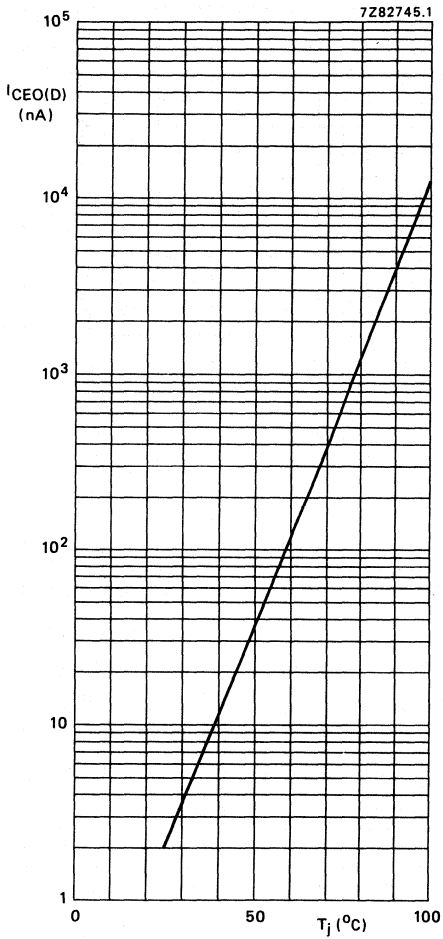


Fig. 8 Typical values.

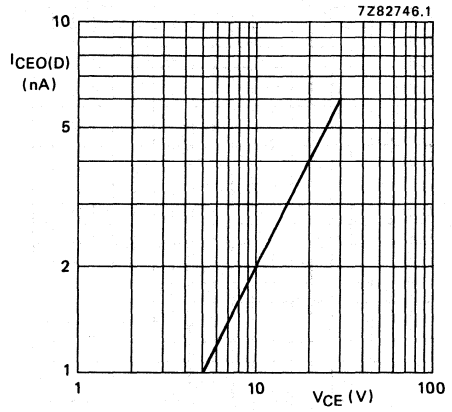


Fig. 9 Typical values.

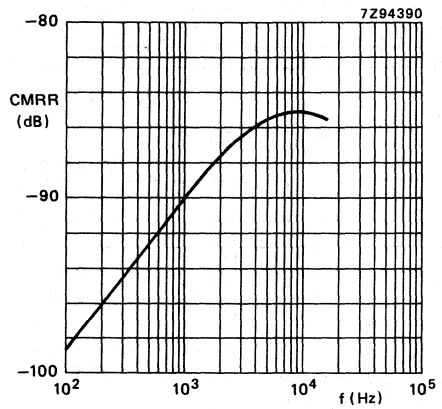


Fig. 10 Typical values.

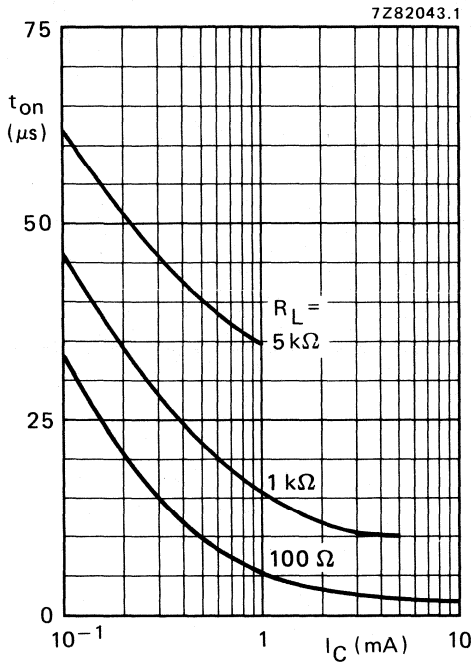


Fig. 11 $I_B = 0$; $V_{CC} = 5 \text{ V}$; $T_{amb} = 25 \text{ }^\circ\text{C}$; typical values. See also Fig. 13.

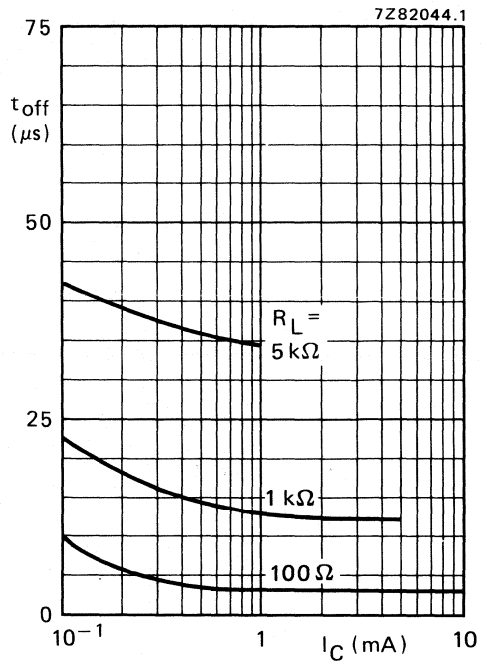


Fig. 12 $I_B = 0$; $V_{CC} = 5 \text{ V}$; $T_{amb} = 25 \text{ }^\circ\text{C}$; typical values. See also Fig. 13.

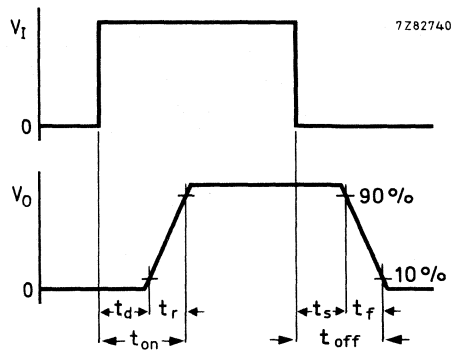
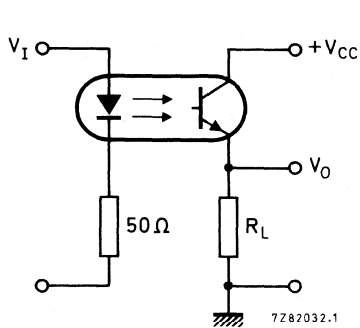


Fig. 13 Switching circuit and waveforms.

OPTOCOUPERS

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 (peak value); $t_p = 10 \mu s$; $\delta = 0.01$	I_F	max.	100 mA
	I_{FRM}	max.	3 A
Total power dissipation up to $T_{amb} = 25^\circ C$	P_{tot}	max.	200 mW

Transistor

Collector-emitter voltage (open base)	V_{CEO}	max.	30 V
Total power dissipation up to $T_{amb} = 25^\circ C$	P_{tot}	max.	200 mW

Optocoupler

Output/input DC current transfer ratio (CTR) $I_F = 10 \text{ mA}$; $V_{CE} = 0.4 \text{ V}$; ($I_B = 0$)	CNX35 CNX39 CNX36	I_C/I_F	0.4 to 1.6 0.6 to 1.0 0.8 to 2.0
Collector cut-off current (dark) $V_{CC} = 10 \text{ V}$; working voltage = 2.5 kV DC diode: $I_F = 0$ (see also Fig.2)		I_{CEW}	max. 200 nA
Isolation voltage DC AC (RMS value)		V_{IORM}	min. 4.4 kV 3.12 kV

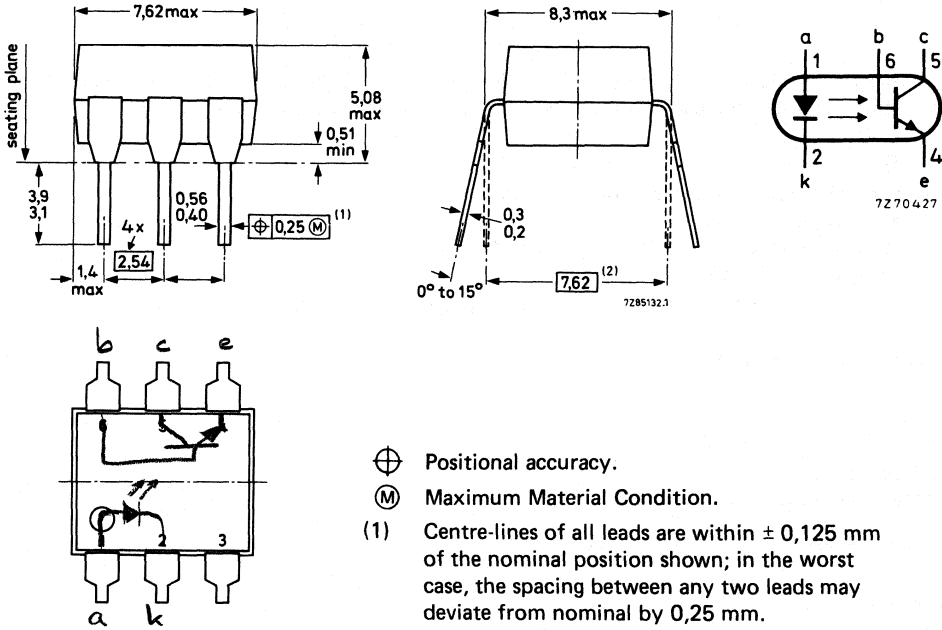
MECHANICAL DATA

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 $\pm 0,125$ 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 (peak value); $t_p = 10 \mu s$; $\delta = 0.01$	I_F	max.	100 mA
	I_{FRM}	max.	3 A
Total power dissipation up to $T_{amb} = 25 \text{ }^\circ\text{C}$	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 $T_{amb} = 25 \text{ }^\circ\text{C}$	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	$R_{th\ j-a}$	=	500 K/W
transistor	$R_{th\ j-a}$	=	500 K/W
From junction to ambient, device mounted on a printed-circuit board diode	$R_{th\ j-a}$	=	400 K/W
transistor	$R_{th\ j-a}$	=	400 K/W

ISOLATION RELATED VALUES

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

CHARACTERISTICS

$T_j = 25$ °C unless otherwise specified

Diode

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

Transistor ($I_F = 0$)

Collector cut-off current (dark) $V_{CE} = 10$ V	I_{CEO}	typ. max.	2 nA 50 nA
$V_{CE} = 10$ V; $T_{amb} = 70$ °C	I_{CEO}	max.	10 μ A
$V_{CB} = 10$ 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)

$I_F = 10 \text{ mA}; V_{CE} = 0.4 \text{ V}$

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)

$I_F = 2 \text{ mA}; V_{CE} = 5 \text{ V}$
 $I_F = 10 \text{ mA}; V_{CE} = 5 \text{ V}$

I_C/I_F	min.	0.15
I_C/I_F	typ.	1.5

Collector-emitter saturation voltage

$I_F = 10 \text{ mA}; I_C = 2 \text{ mA}$

CNX35	V_{CEsat}	max.	0.4
CNX39	V_{CEsat}	typ.	0.15

$I_F = 10 \text{ mA}; I_C = 4 \text{ mA}$

CNX36	V_{CEsat}	max.	0.4
		typ.	0.19

Isolation voltage $t = 1 \text{ min}$ DC AC (RMS value)

V_{IORM}	min.	4.4 kV
		3.12 kV

Collector cut-off current (light) at $T_{amb} = 0 \text{ }^\circ\text{C}$ to $70 \text{ }^\circ\text{C}$

$V_F = 0.8 \text{ V}; V_{CE} = 15 \text{ V}$
 $I_F = 2 \text{ mA}; V_{CE} = 0.4 \text{ V}$

$I_{CE(L)}$	max.	15 μA
$I_{CE(L)}$	min.	150 μA

Collector capacitance at $f = 1 \text{ MHz}$

$I_E = I_e = 0; V_{CB} = 10 \text{ V}$

$C_{b'c}$	typ.	4.5 pF
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Capacitance between input and output

$I_F = 0; V = 0; f = 1 \text{ MHz}$

C_{io}	typ.	0.6 pF
	max.	1.3 pF

Insulation resistance between input and output
 $\pm V_{IO} = 1 \text{ kV}$

R_{IO}	min.	10 G Ω
	typ.	1 T Ω

Switching times (see Figs 2 and 3)

$I_{C on} = 2 \text{ mA}; V_{CC} = 5 \text{ V}; R_L = 100 \text{ } \Omega$

	CNX35	CNX39	CNX36
Turn-on time t_{on}	typ. 3 max. 20	5.5 20	8 μs 20 μs
Turn-off time t_{off}	typ. 3 max. 20	4 20	6 μs 20 μs

$I_{C on} = 2 \text{ mA}; V_{CC} = 5 \text{ V}; R_L = 1 \text{ k}\Omega$

Turn-on time

t_{on}	typ. 12 max. 50	14 50	20 μs 50 μs
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Turn-off time

t_{off}	typ. 12 max. 50	12 50	18 μs 50 μs
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Collector cut-off current (dark) see Fig.4

$V_{CC} = 10 \text{ V};$ working voltage = 2.5 kV DC
 $V_{CC} = 10 \text{ V};$ working voltage = 2.5 kV DC; $T_j = 70 \text{ }^\circ\text{C}$

I_{CEW}	max.	200 nA (note 2)
I_{CEW}	max.	100 μA (note 2)

DC current gain

$I_C = 1 \text{ mA}; V_{CE} = 5 \text{ V}$

h_{FE}	150 to 1500
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Notes

- Where the phototransistor receives light from the diode the O (for open base) has been omitted from the symbols.
- As quality assurance (on a sample basis), these parameters are covered by a 1000 h reliability test.
- 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.

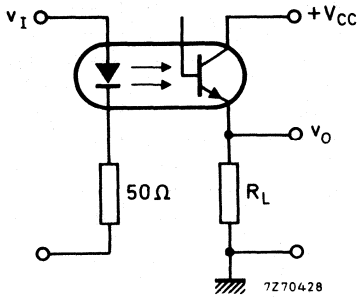
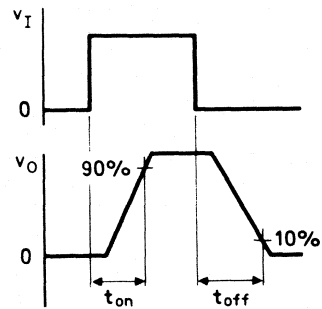


Fig. 2 Switching circuit.



7267238.1

Fig. 3 Waveforms.

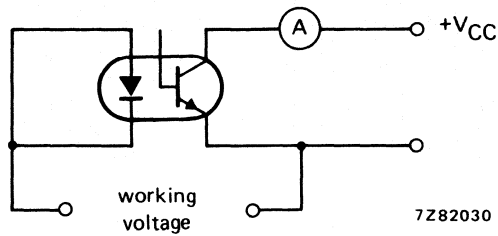


Fig. 4.

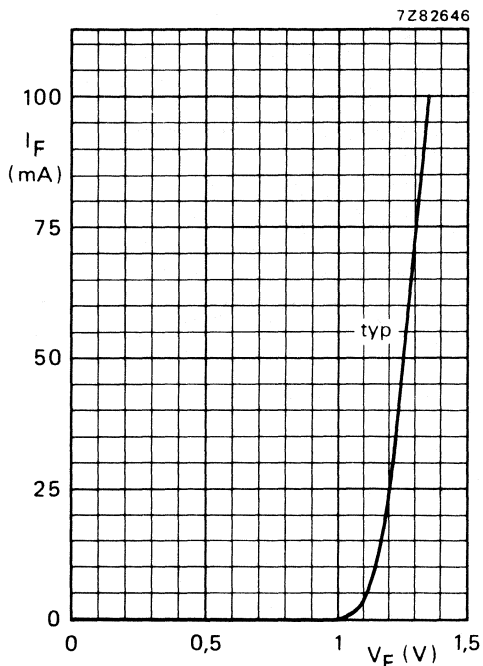


Fig. 5 $T_{amb} = 25\text{ }^\circ\text{C}$.

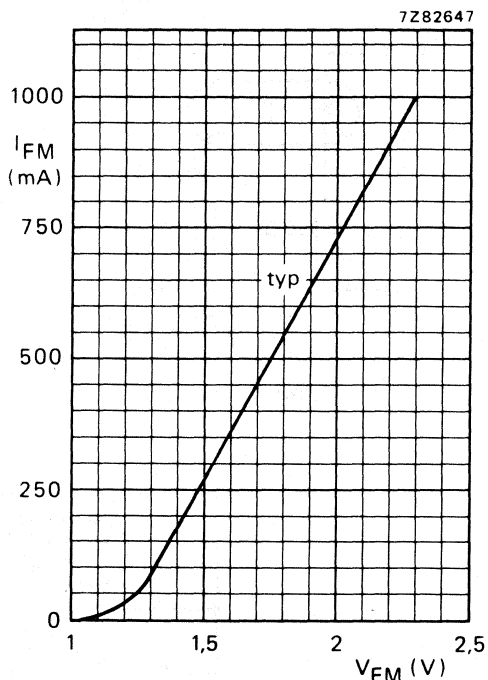


Fig. 6 $T_{amb} = 25\text{ }^\circ\text{C}$; $t_p = 10\text{ }\mu\text{s}$; $T = 1\text{ ms}$.

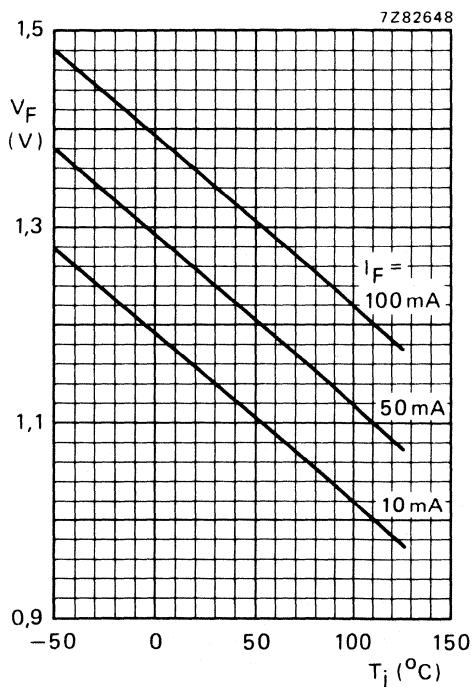


Fig. 7 Typical values.

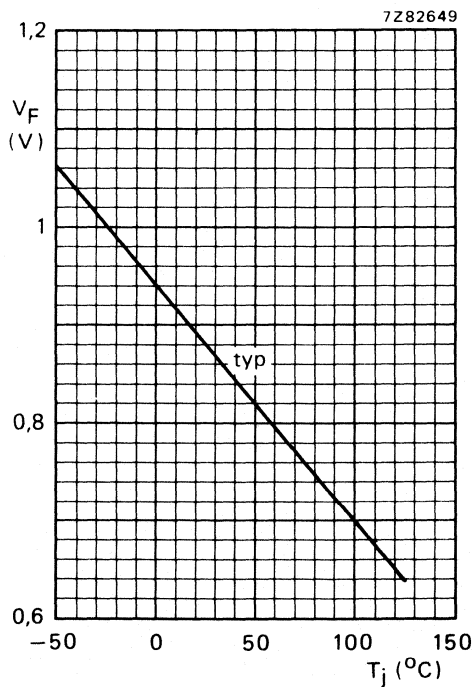


Fig. 8 $I_F = 50\text{ }\mu\text{A}$.

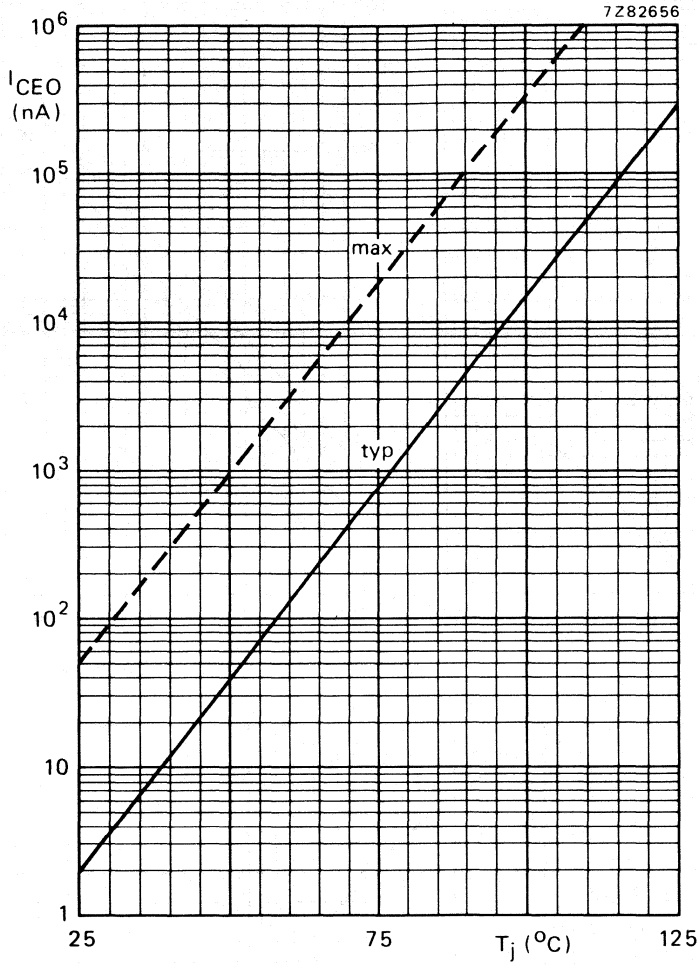


Fig. 9 $I_F = 0$; $V_{\text{CE}} = 10 \text{ V}$.

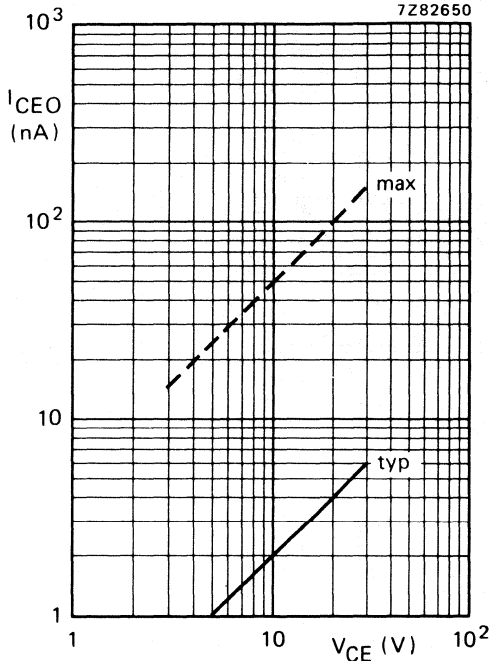


Fig. 10 $I_F = 0$; $T_j = 25^\circ\text{C}$.

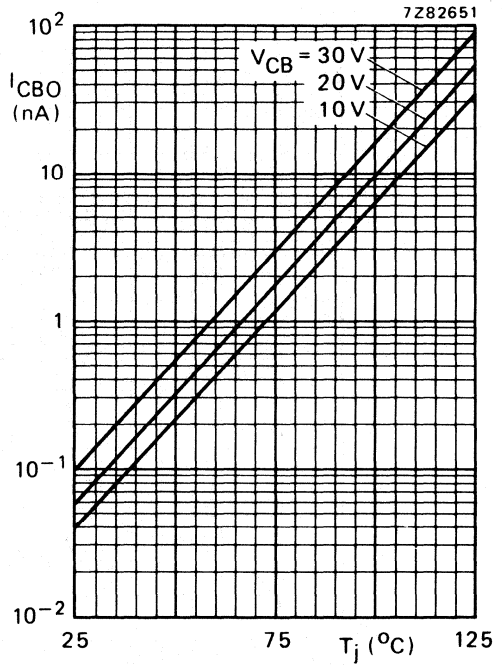


Fig. 11 Typical values.

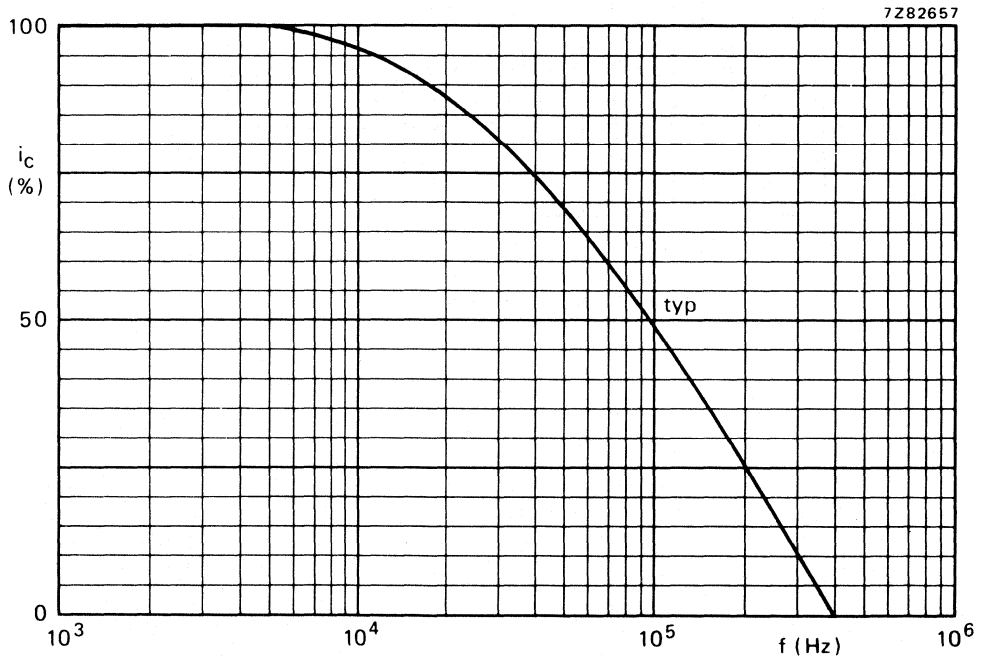


Fig. 12 $I_B = 0$; $I_C = 2\text{ mA}$; $V_{CC} = 5\text{ V}$; $R_L = 1\text{ k}\Omega$; $T_{\text{amb}} = 25^\circ\text{C}$.

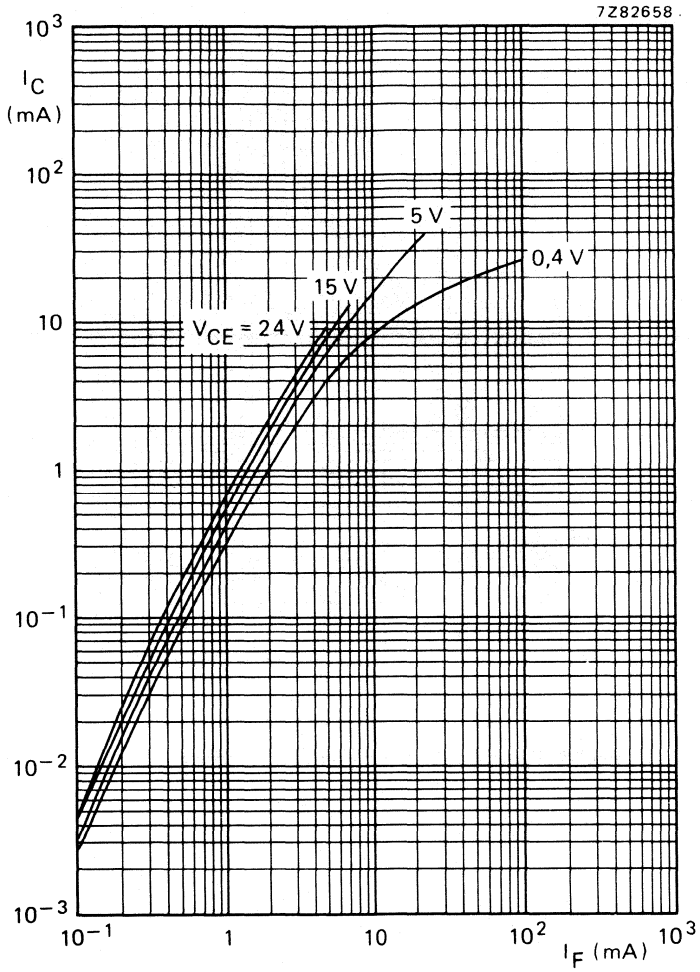


Fig. 13 $T_{amb} = 25$ °C, typical values.

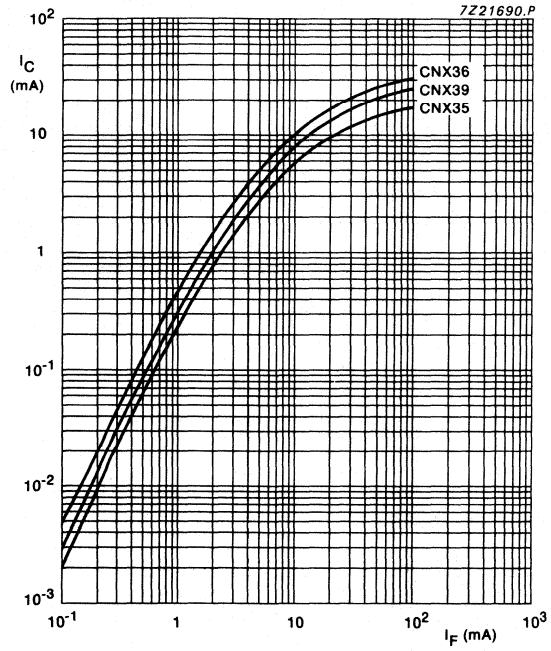


Fig.14 Typical collector current versus forward current.

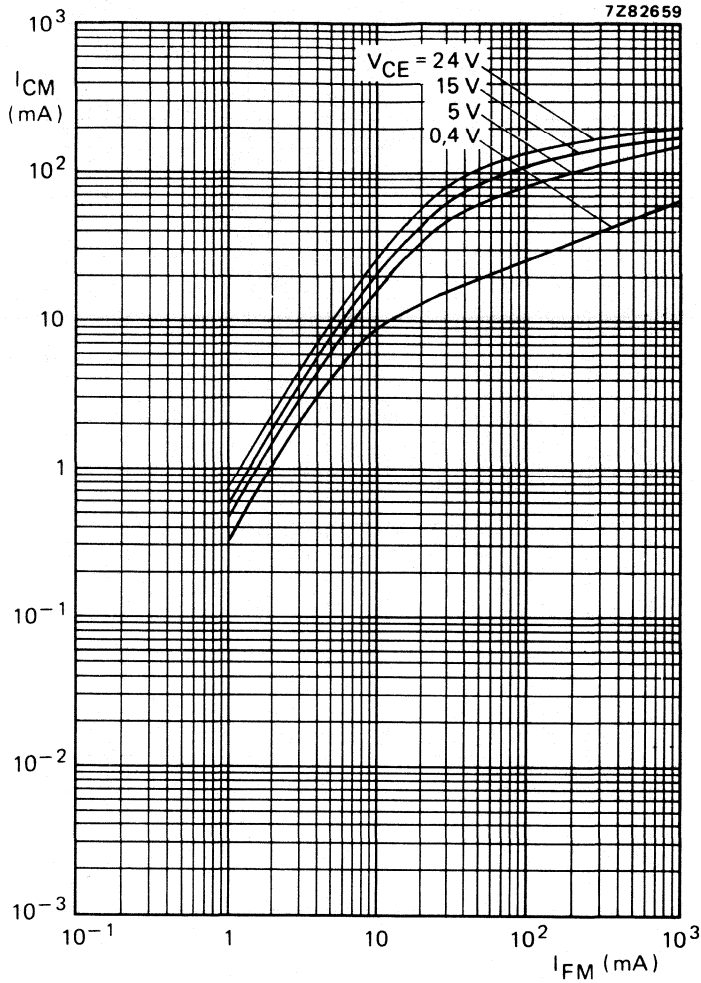


Fig. 15 $T_{amb} = 25^{\circ}C$; $t_p = 10 \mu s$; $T = 1$ ms; typical values.

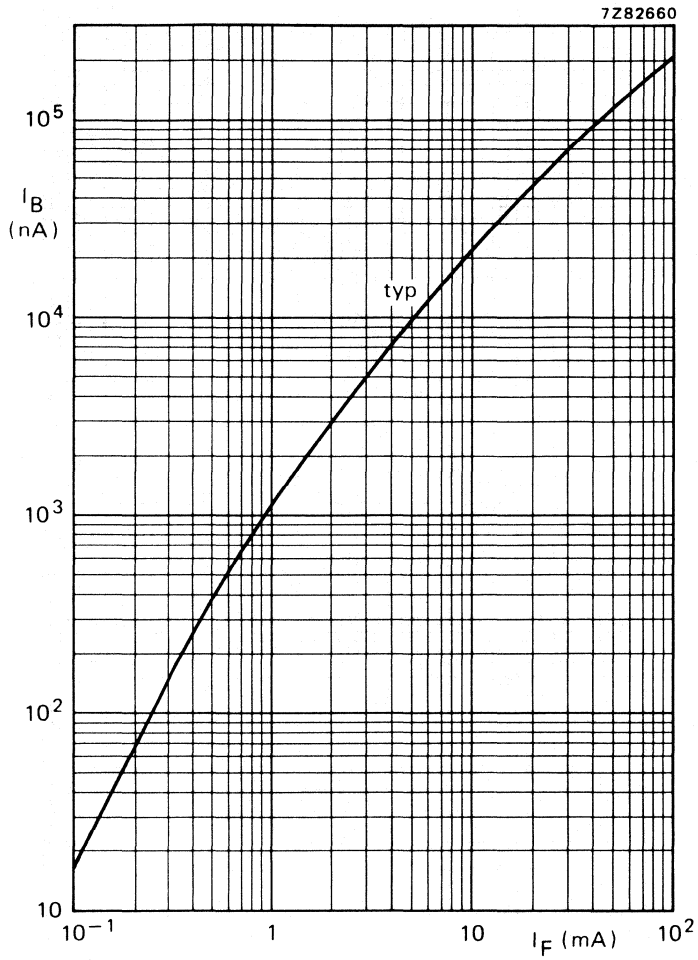


Fig. 16 $V_{CB} = 5 \text{ V}$; $T_{amb} = 25 \text{ }^\circ\text{C}$.

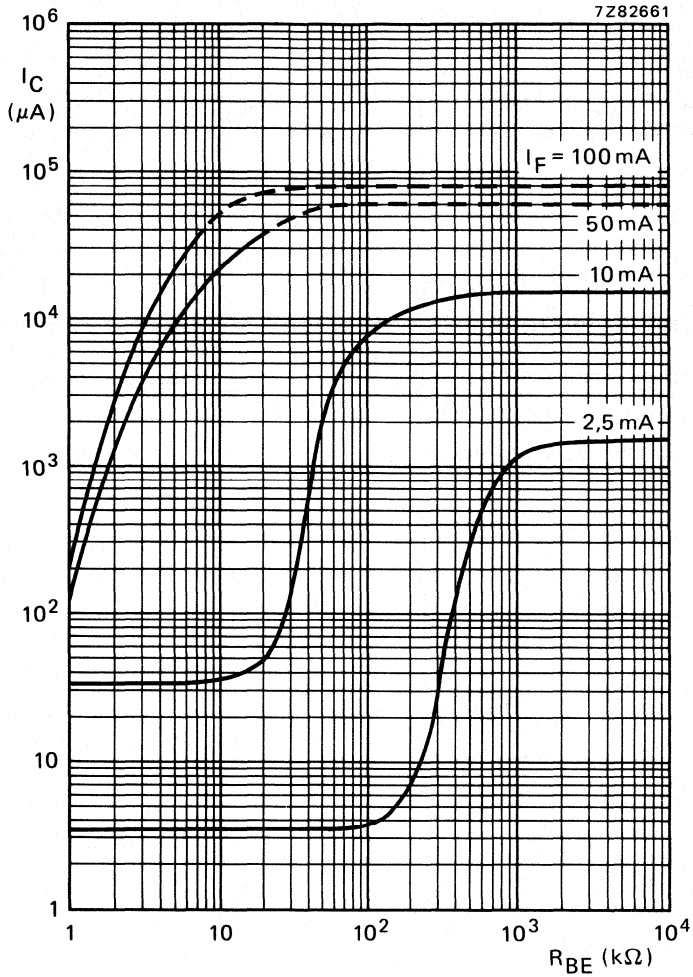


Fig. 17 $I_B = 0$; $V_{CE} = 5 \text{ V}$; $T_{amb} = 25 \text{ }^\circ\text{C}$; typical values.

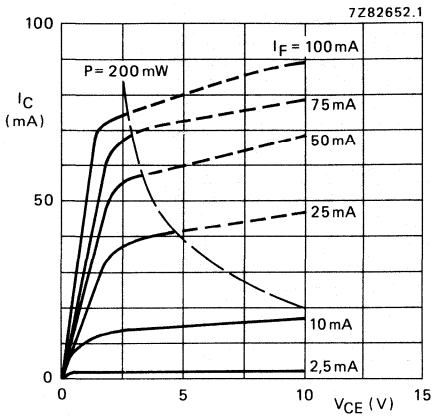


Fig. 18 $T_{amb} = 25 \text{ }^\circ\text{C}$; typical values.

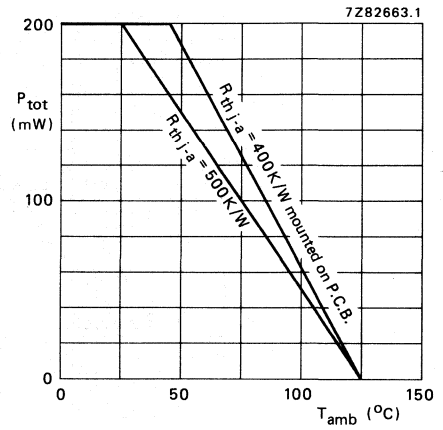


Fig. 19.

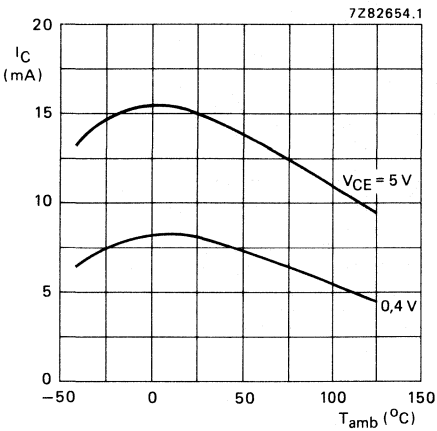


Fig. 20 $I_F = 10 \text{ mA}$; typical values.

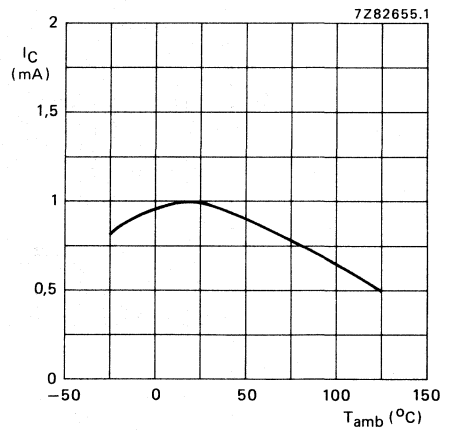


Fig. 21 $I_F = 2 \text{ mA}$; $V_{CE} = 0.4 \text{ V}$; typical values.

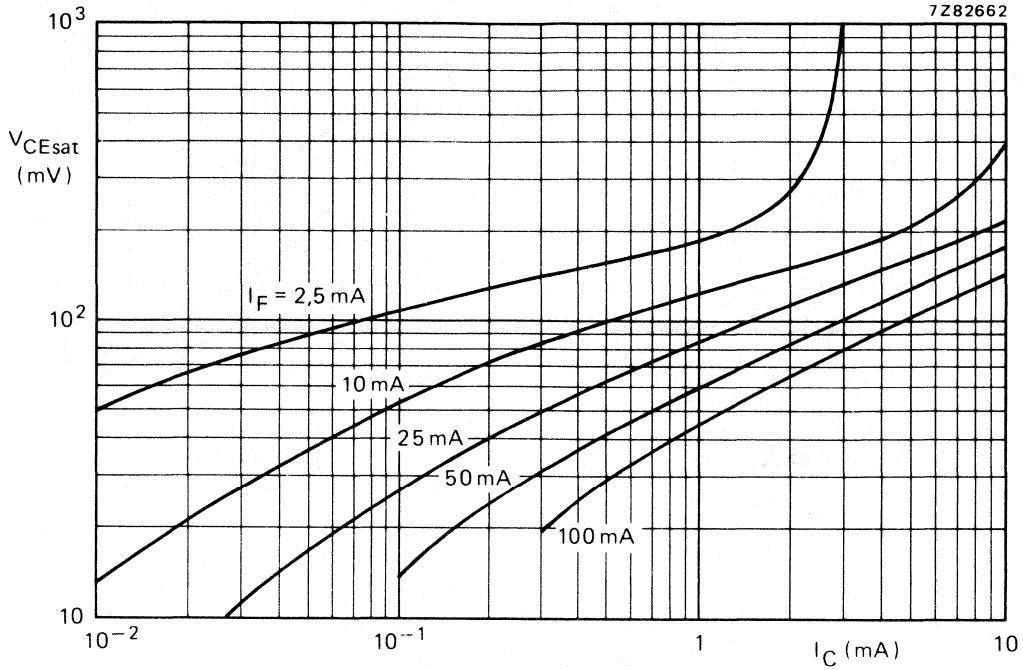


Fig. 22 $I_B = 0$; $T_{amb} = 25^\circ C$; typical values.

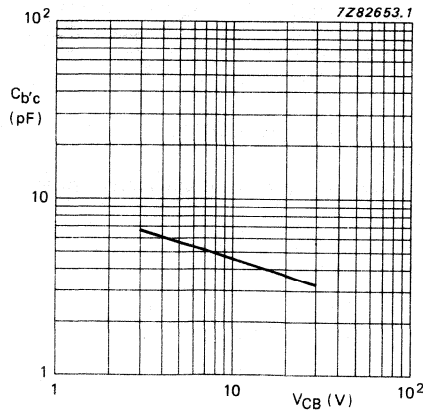


Fig. 23 $f = 1$ MHz; $T_{amb} = 25^\circ C$.

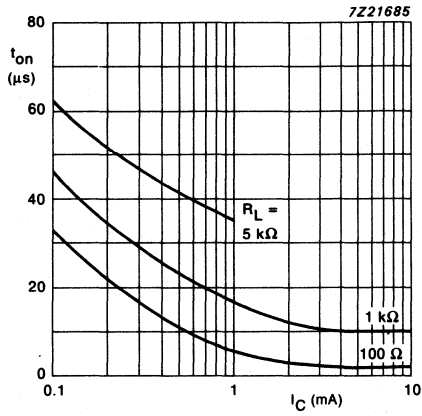


Fig.24 CNX35.

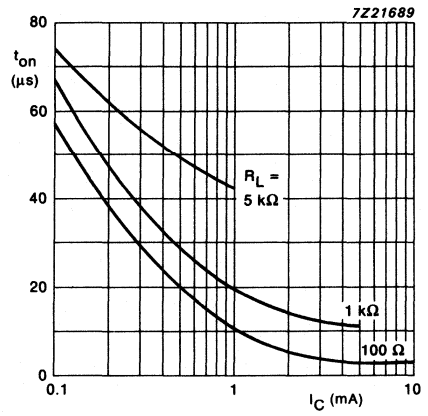


Fig.25 CNX39.

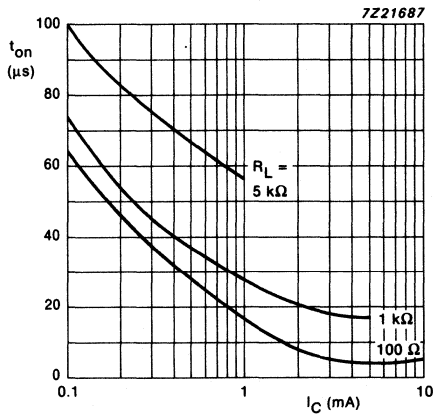


Fig.26 CNX36.

Typical turn-on time versus collector current.

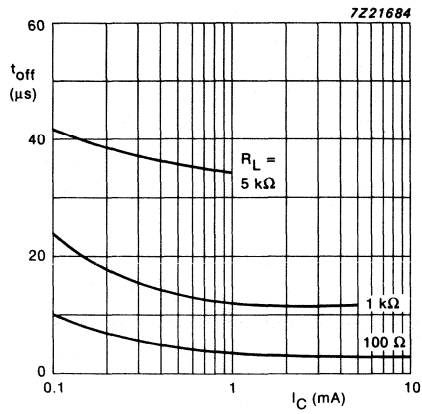


Fig.27 CNX35.

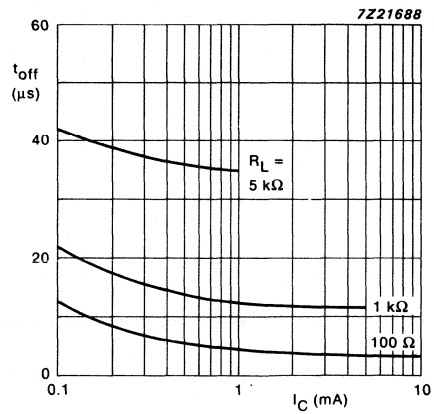


Fig.28 CNX39.

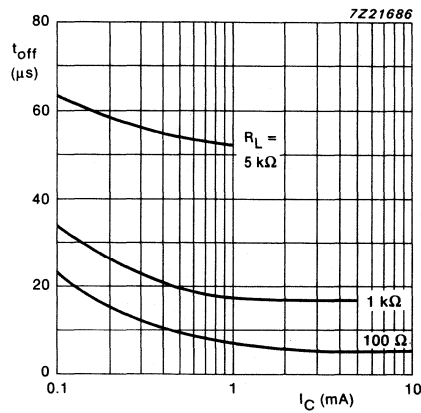


Fig.29 CNX36.

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); $t_p = 10 \mu s$; $\delta = 0.01$	I_{FRM}	max.	3 A
Total power dissipation up to $T_{amb} = 25^\circ C$	P_{tot}	max.	200 mW

Transistor

Collector-emitter voltage (open base)	V_{CEO}	max.	30 V
Total power dissipation up to $T_{amb} = 25^\circ C$	P_{tot}	max.	200 mW

Optocoupler

Output/input DC current transfer ratio (CTR) $I_F = 10 \text{ mA}$; $V_{CE} = 0.4 \text{ V}$; ($I_B = 0$)	CNX35U CNX39U CNX36U	I_C/I_F	0.4 to 1.6 0.6 to 1.0 0.8 to 2.0	←
Collector cut-off current (dark) $V_{CC} = 10 \text{ V}$; 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

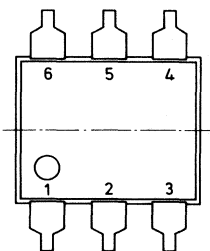
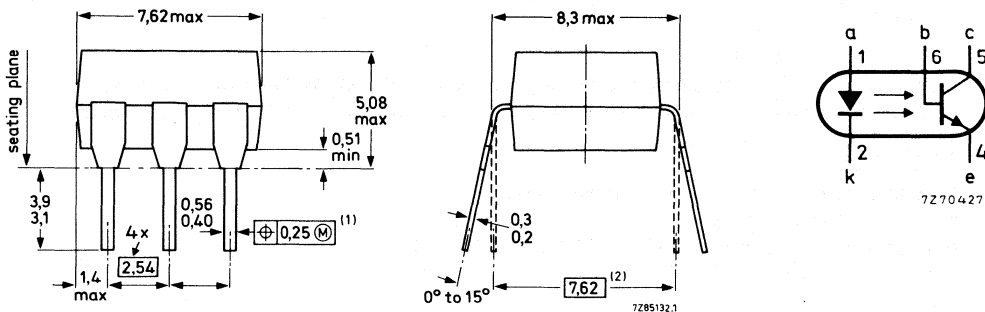
MECHANICAL DATA

SOT90B (see Fig.1).

MECHANICAL DATA

Fig.1 SOT90B.

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 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 (peak value); $t_p = 10 \mu s$; $\delta = 0.01$	I_F	max.	100 mA
	I_{FRM}	max.	3 A
Total power dissipation up to $T_{amb} = 25 \text{ }^\circ\text{C}$	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 $T_{amb} = 25 \text{ }^\circ\text{C}$	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_{thj-a}	=	500 K/W
transistor	R_{thj-a}	=	500 K/W
From junction to ambient, device mounted on a printed-circuit board diode	R_{thj-a}	=	400 K/W
transistor	R_{thj-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 μ A

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 μ A
$V_{CB} = 10$ 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)

$I_F = 10 \text{ mA}; V_{CE} = 0.4 \text{ V}$

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)

$I_F = 10 \text{ mA}; V_{CE} = 5 \text{ V}$

$I_F = 2 \text{ mA}; V_{CE} = 5 \text{ V}$

I_C/I_F	typ.	1.5
I_C/I_F	min.	0.15

Collector-emitter saturation voltage

$I_F = 10 \text{ mA}; I_C = 2 \text{ mA}$

CNX35U	V_{CEsat}	max.	0.4 V
CNX39U	V_{CEsat}	typ.	0.15 V
CNX36U	V_{CEsat}	max.	0.4 V
		typ.	0.19 V

$I_F = 10 \text{ mA}; I_C = 4 \text{ mA}$

Isolation voltage; DC

$t = 1 \text{ min}; AC \text{ (RMS value) (note 2)}$

V_{IORM}	min.	4.4 kV
V_{IORM}	min.	3.12 kV

Collector cut-off current (light) at $T_{amb} = 0 \text{ }^\circ\text{C}$ to $70 \text{ }^\circ\text{C}$

$V_F = 0.8 \text{ V}; V_{CE} = 15 \text{ V}$

$I_F = 2 \text{ mA}; V_{CE} = 0.4 \text{ V}$

$I_{CE(L)}$	max.	15 μA
$I_{CE(L)}$	min.	150 μA

Collector capacitance at $f = 1 \text{ MHz}$

$I_E = I_e = 0; V_{CB} = 10 \text{ V}$

$C_{b'c}$	typ.	4.5 pF
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Capacitance between input and output

$I_F = 0; V = 0; f = 1 \text{ MHz}$

C_{io}	typ.	0.6 pF
	max.	1.3 pF

Insulation resistance between input and output

$\pm V_{IO} = 1 \text{ kV}$

R_{IO}	min.	10 G Ω
	typ.	1 T Ω

Switching times (see Figs 2 and 3)

$I_{Con} = 2 \text{ mA}; V_{CC} = 5 \text{ V}; R_L = 100 \text{ } \Omega$

Turn-on time

	CNX35U	CNX39U	CNX36U
t_{on}	typ. 3	5.5	8 μs
	max. 20	20	20 μs
t_{off}	typ. 3	4	6 μs
	max. 20	20	20 μs
t_{on}	typ. 12	14	20 μs
	max. 50	50	50 μs
t_{off}	typ. 12	12	18 μs
	max. 50	50	50 μs

Turn-off time

$I_{Con} = 2 \text{ mA}; V_{CC} = 5 \text{ V}; R_L = 1 \text{ k}\Omega$

Turn-on time

Turn-off time

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

$V_{CC} = 10 \text{ V}; \text{working voltage (DC)} = 2.5 \text{ kV}$

$V_{CC} = 10 \text{ V}; \text{working voltage (DC)} = 2.5 \text{ kV}; T_j = 70 \text{ }^\circ\text{C}$

I_{CEW}	max.	200 nA (note 3)
I_{CEW}	max.	100 μA (note 3)

DC current gain

$I_C = 1 \text{ mA}; V_{CE} = 5 \text{ V}$

h_{FE}	150 to 1500
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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.

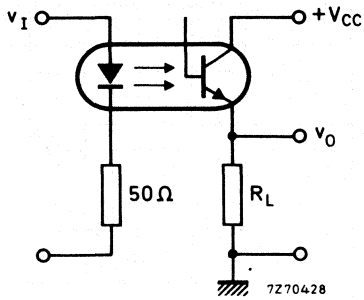


Fig. 2 Switching circuit.

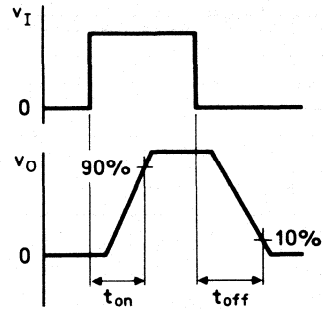


Fig. 3 Waveforms.

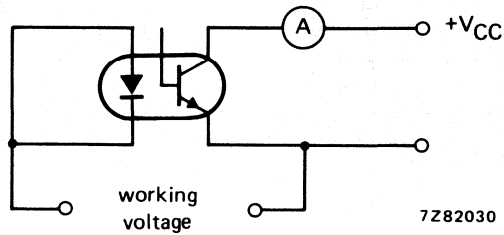
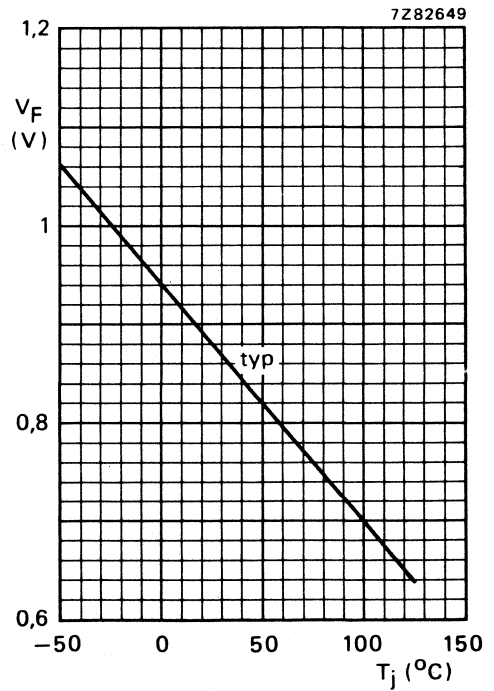
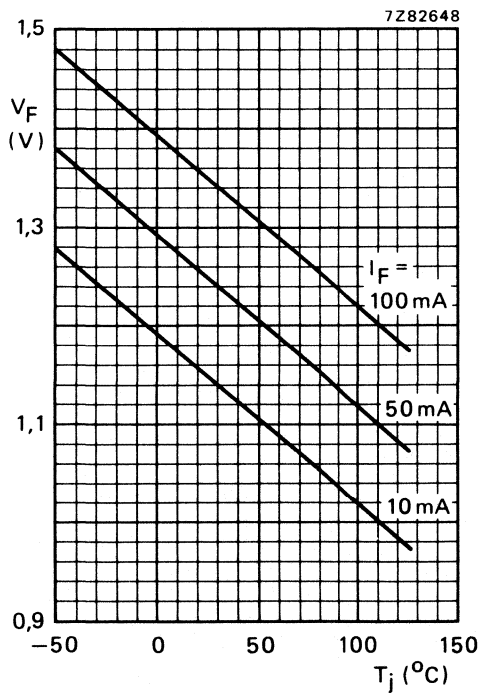
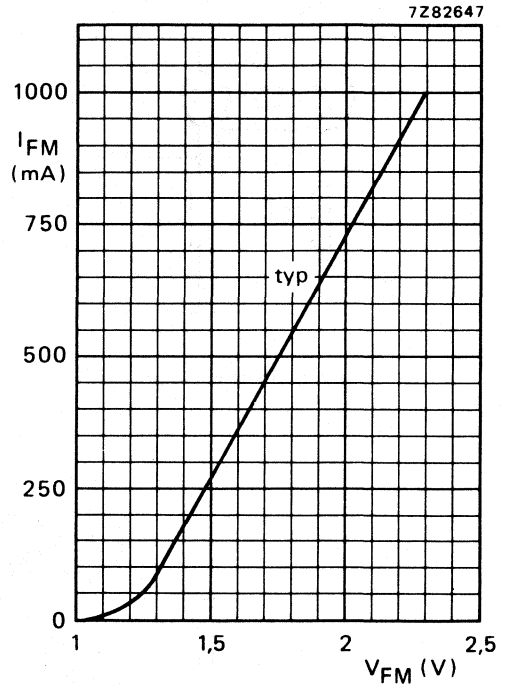
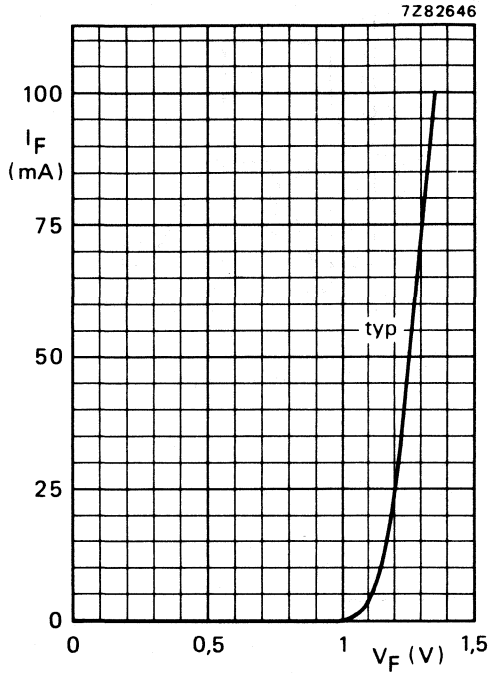


Fig. 4.



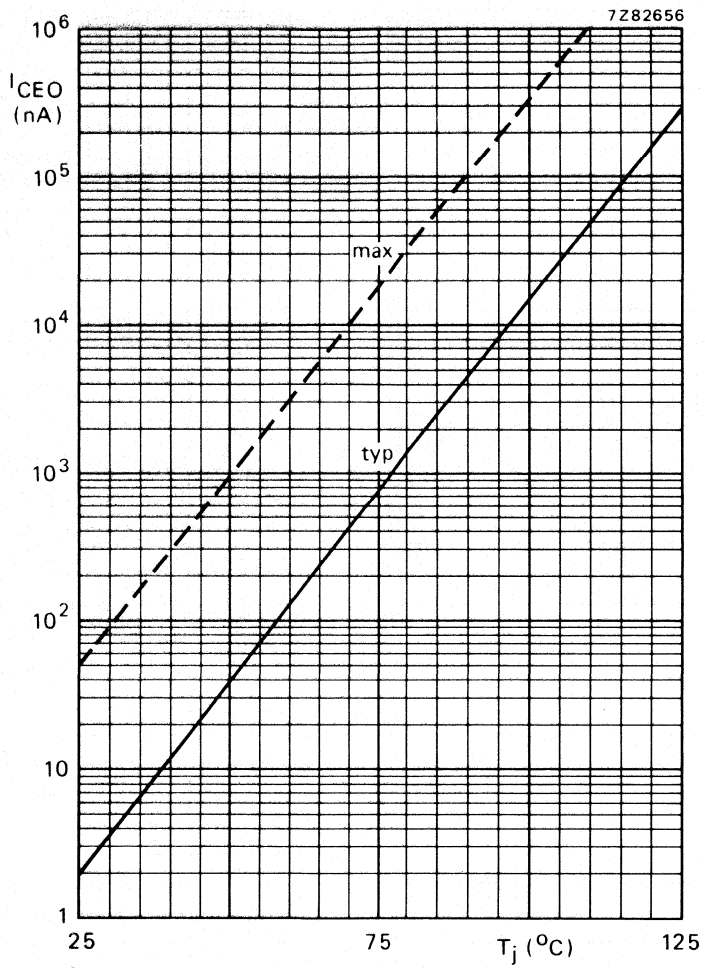


Fig. 9 $I_F = 0$; $V_{CE} = 10$ V.

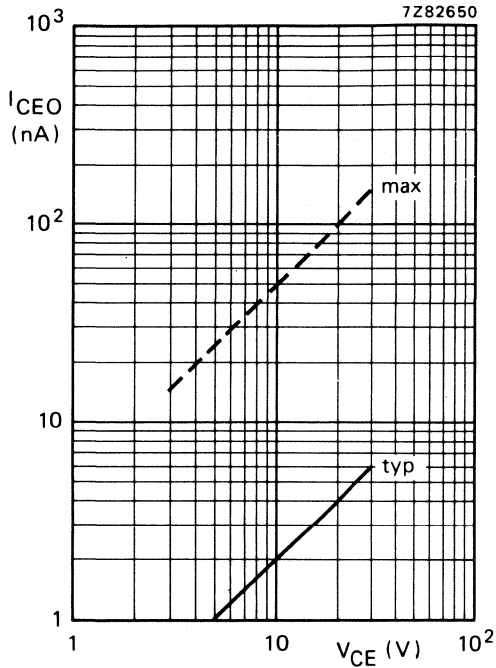


Fig. 10 $I_F = 0$; $T_j = 25\text{ }^\circ\text{C}$.

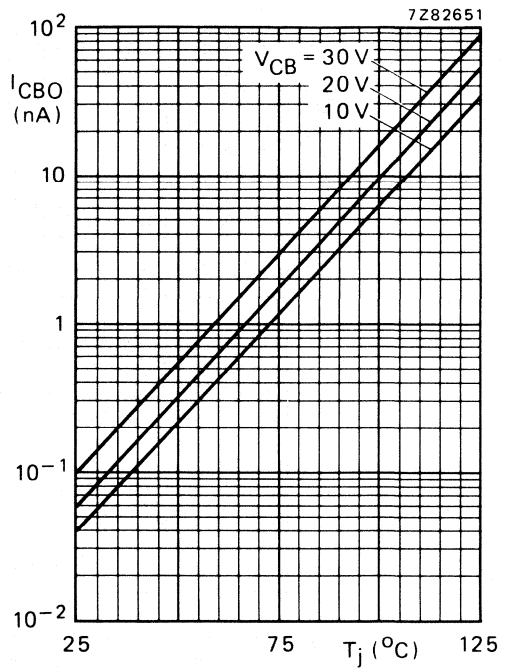


Fig. 11 Typical values.

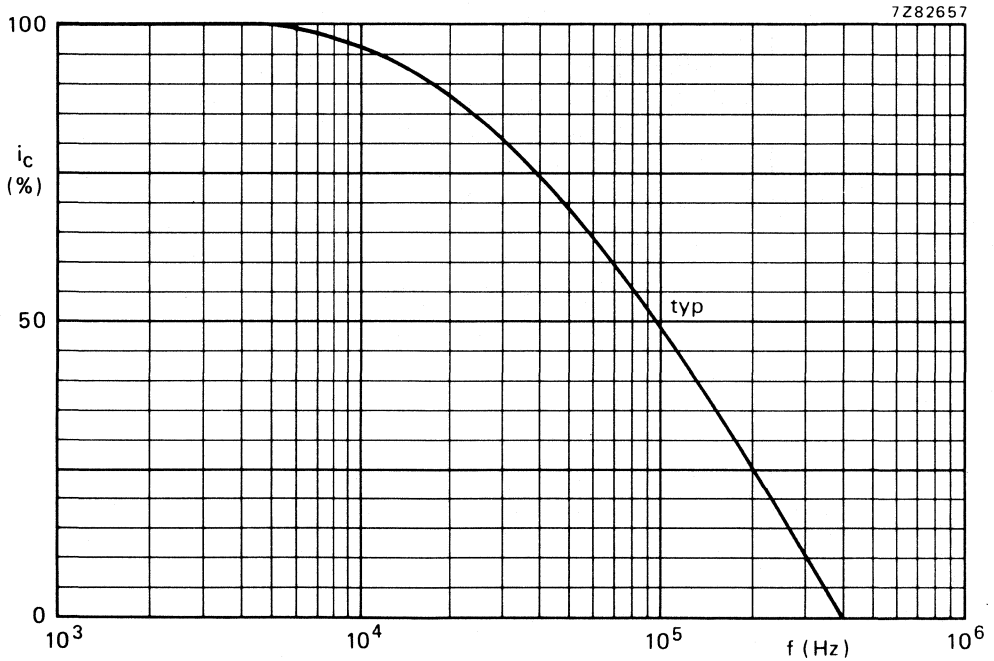


Fig. 12 $I_B = 0$; $I_C = 2\text{ mA}$; $V_{CC} = 5\text{ V}$; $R_L = 1\text{ k}\Omega$; $T_{amb} = 25\text{ }^\circ\text{C}$.

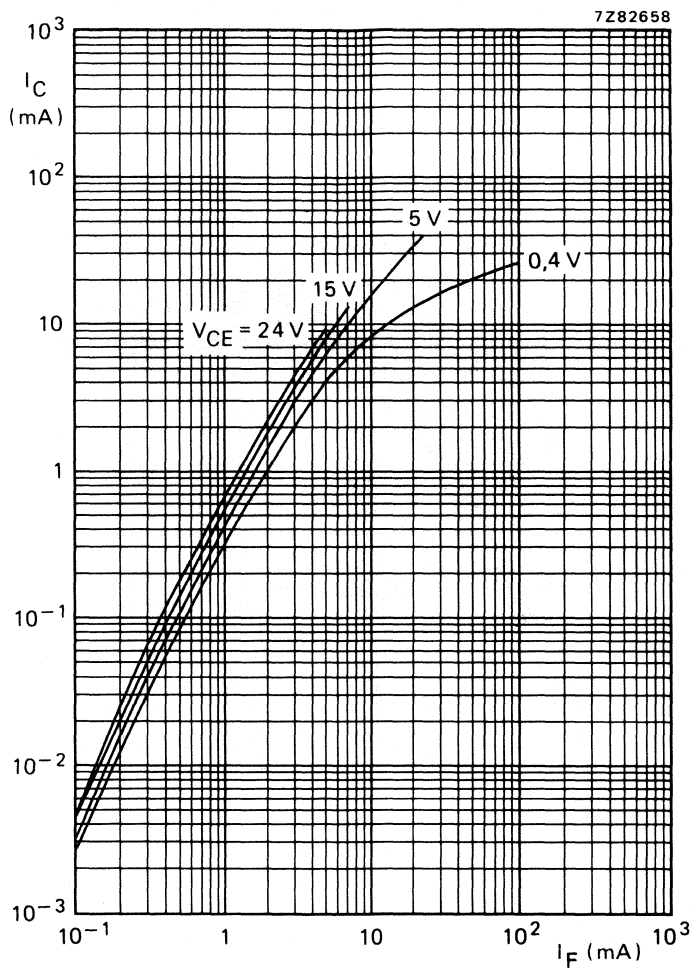


Fig. 13 $T_{amb} = 25$ °C, typical values.

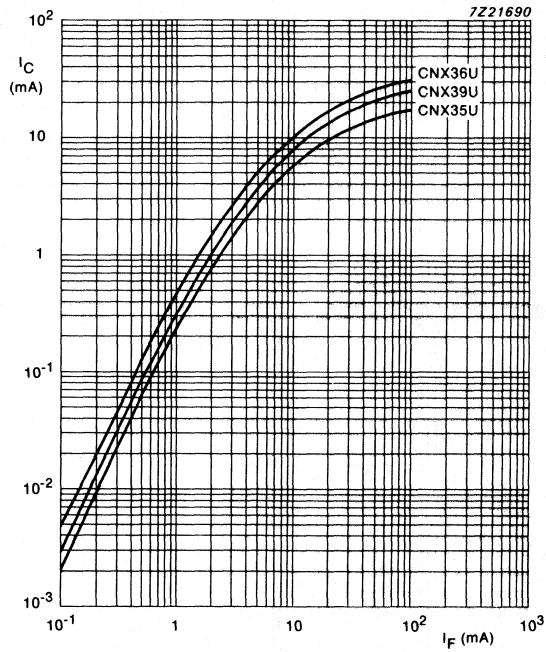


Fig. 14 Typical collector current as a component of forward current.

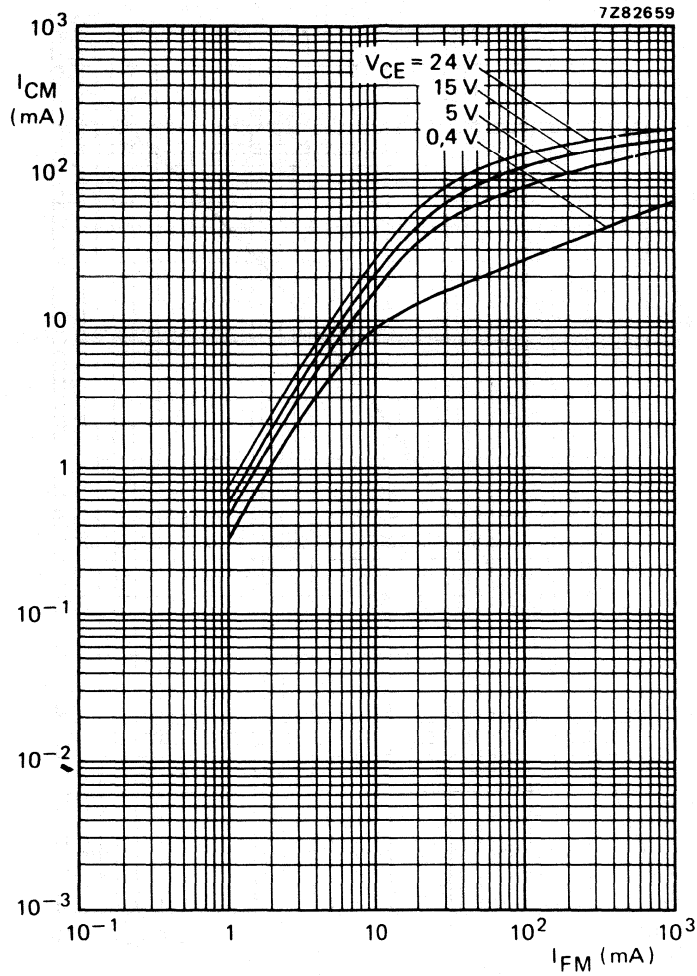


Fig. 15 $T_{amb} = 25\text{ }^{\circ}\text{C}$; $t_p = 10\text{ }\mu\text{s}$; $T = 1\text{ ms}$; typical values.

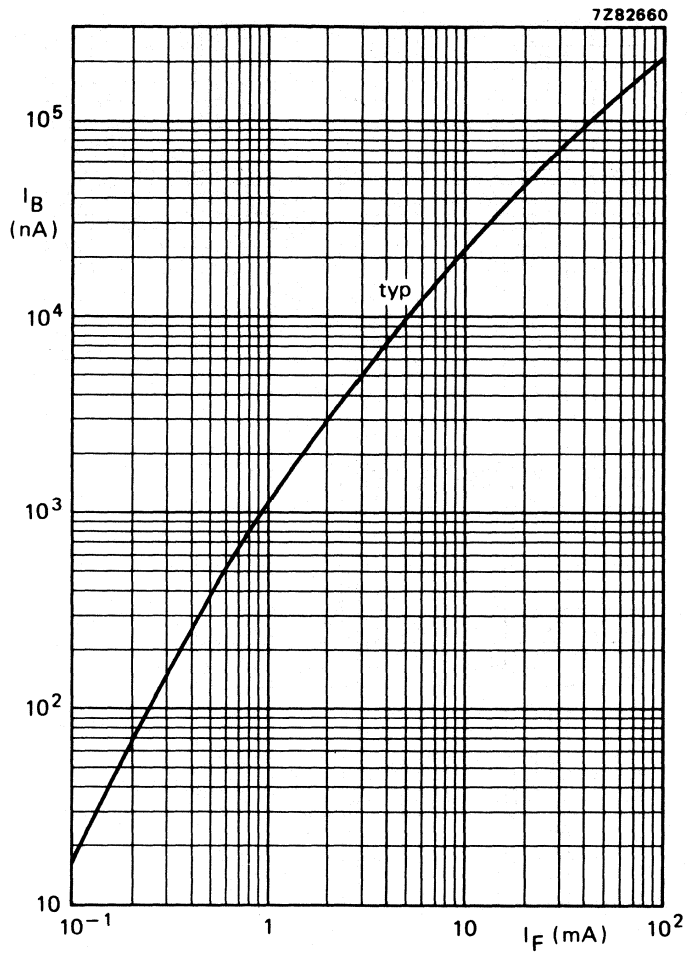


Fig. 16 $V_{CB} = 5$ V; $T_{amb} = 25$ °C.

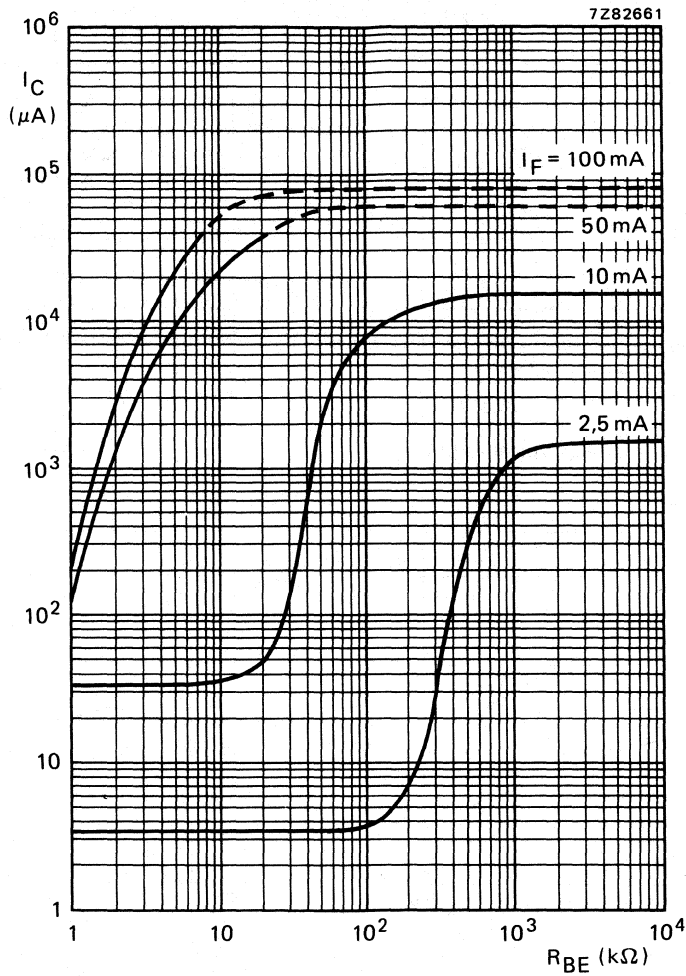


Fig. 17 $I_B = 0$; $V_{CE} = 5 \text{ V}$; $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$; typical values.

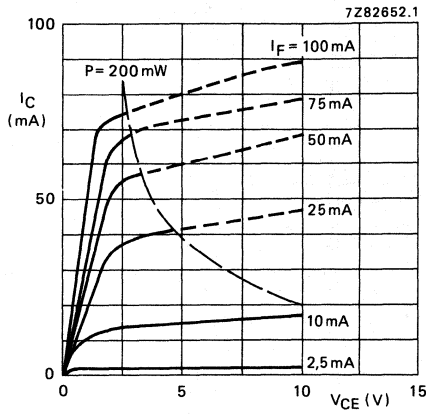


Fig. 18 $T_{amb} = 25 \text{ }^\circ\text{C}$; typical values.

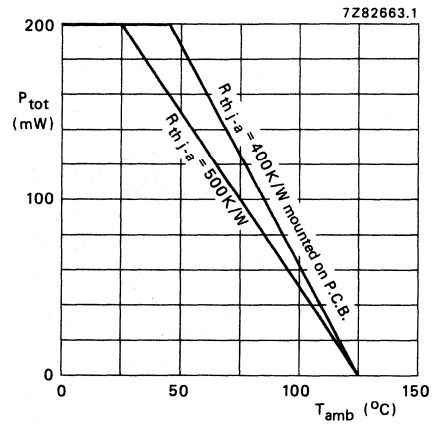


Fig. 19.

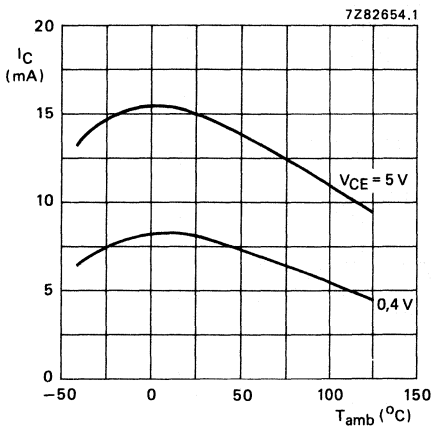


Fig. 20 $I_F = 10 \text{ mA}$; typical values.

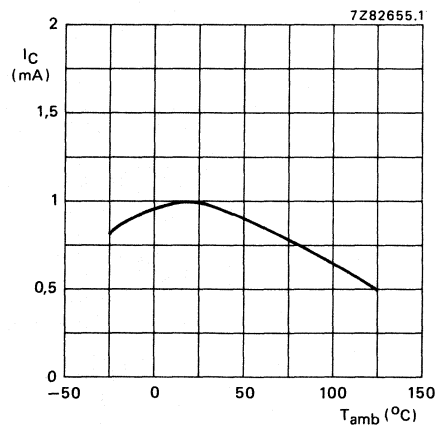


Fig. 21 $I_F = 2 \text{ mA}$; $V_{CE} = 0,4 \text{ V}$; typical values.

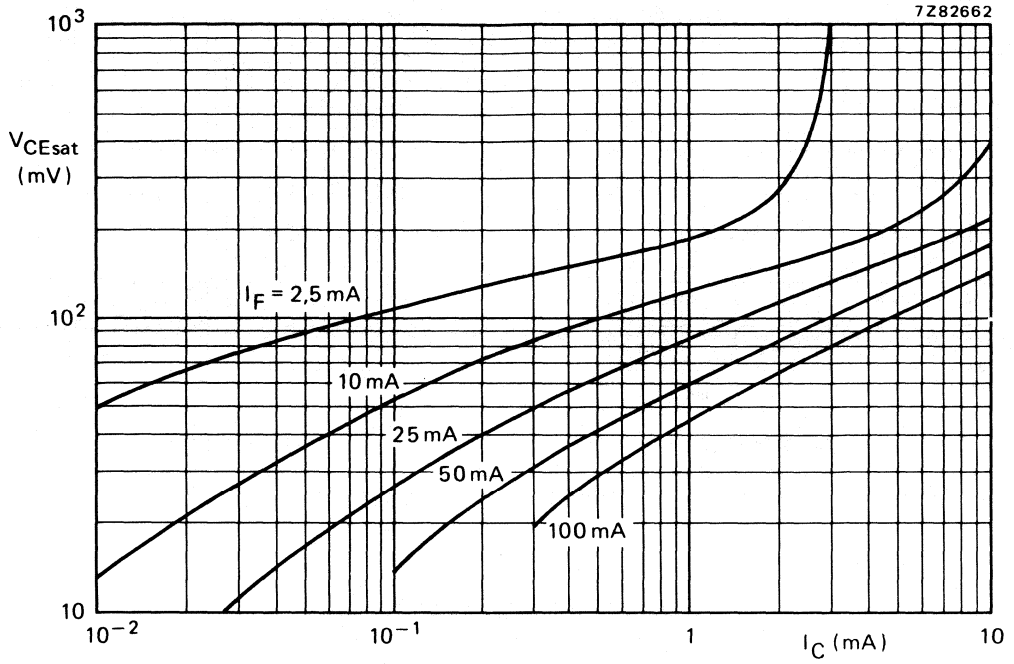


Fig. 22 $I_B = 0$; $T_{amb} = 25^\circ C$; typical values.

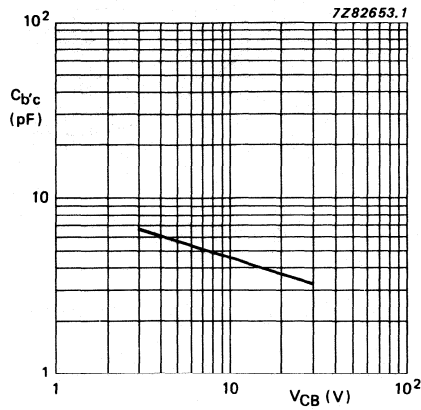


Fig. 23 $f = 1$ MHz; $T_{amb} = 25^\circ C$.

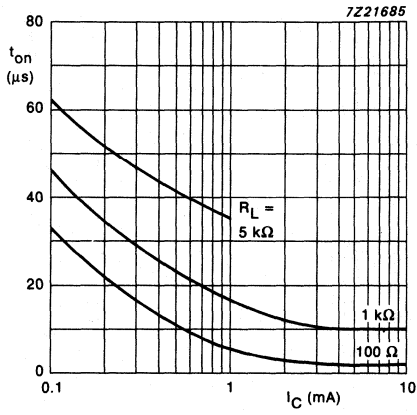


Fig. 24 CNX35U.

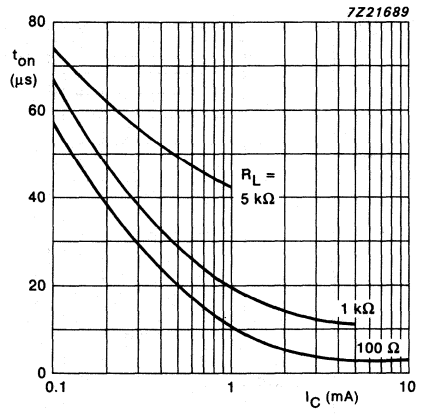


Fig. 25 CNX39U.

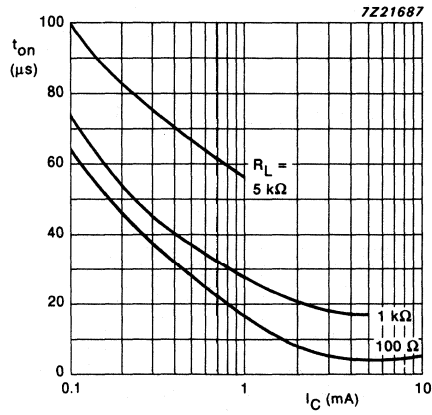


Fig. 26 CNX36U.

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

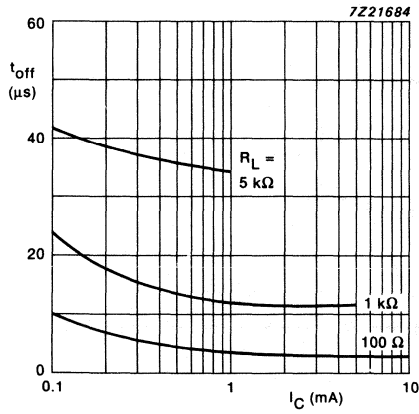


Fig. 27 CNX35U.

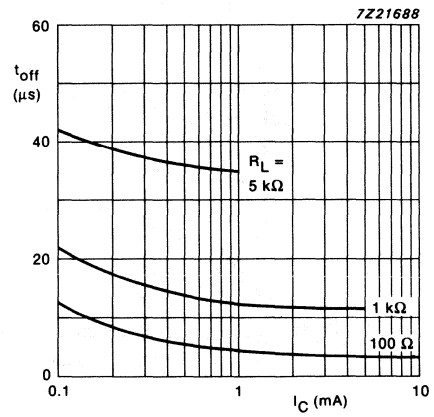


Fig. 28 CNX39U.

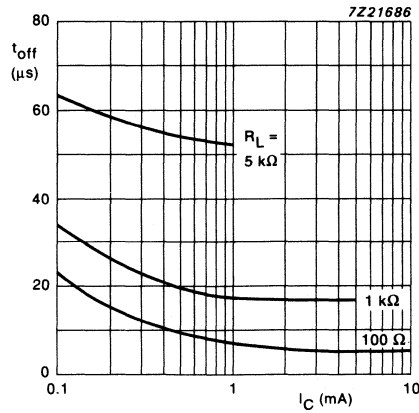


Fig. 29 CNX36U.

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

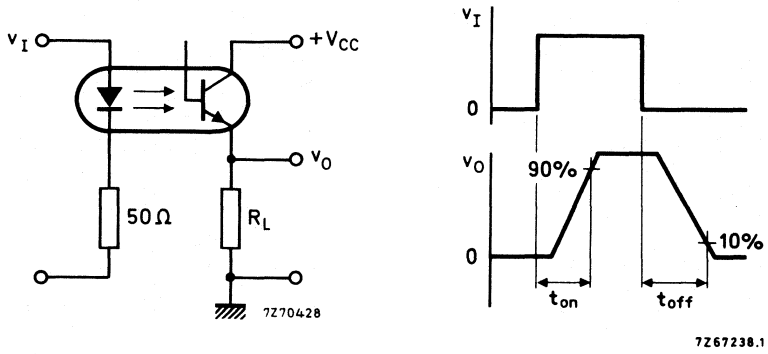


Fig. 30 Switching circuit and waveforms.

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); $t_p = 10 \mu\text{s}$; $\delta = 0.01$	I_{FRM}	max.	3 A

Transistor

Collector-emitter voltage (open base)	V_{CE0}	max.	80 V
Total power dissipation up to $T_{amb} = 25^\circ\text{C}$	P_{tot}	max.	200 mW

Optocoupler

Output/input DC current transfer ratio (CTR) $I_F = 10 \text{ mA}$; $V_{CE} = 10 \text{ V}$; ($I_B = 0$)	I_C/I_F		0.7 to 2.1
Collector cut-off current (dark) $V_{CC} = 10 \text{ V}$; working voltage = 2.5 kV DC diode; $I_F = 0$ (see also Fig.4)	I_{CEW}	max.	200 nA
Isolation voltage DC		min.	4.4 kV
AC (RMS value)	V_{IORM}	min.	3.12 kV

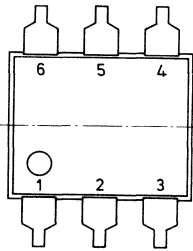
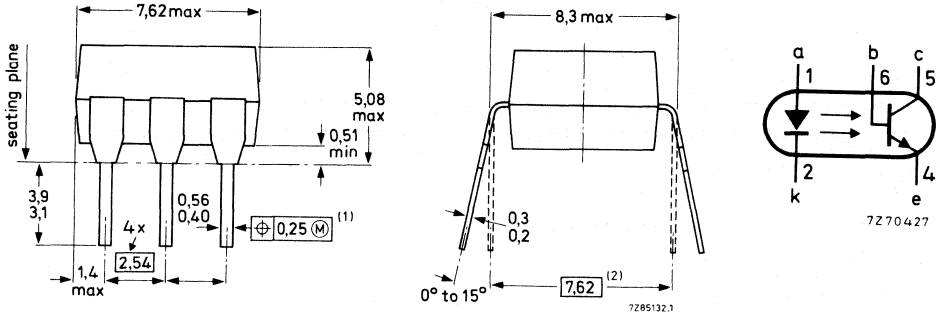
MECHANICAL DATA

SOT90B (see Fig.1).

MECHANICAL DATA

Fig.1 SOT90B.

Dimensions in mm



⊕ Positional accuracy.

Ⓜ Maximum Material Condition.

- (1) Centre-lines of all leads are within $\pm 0,125$ 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); $t_p = 10 \mu s$; $\delta = 0.01$	I_{FRM}	max.	3 A
Total power dissipation up to $T_{amb} = 25 \text{ }^\circ\text{C}$	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 $T_{amb} = 25 \text{ }^\circ\text{C}$	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	$R_{th\ j-a}$	=	500 K/W
transistor	$R_{th\ j-a}$	=	500 K/W
From junction to ambient, device mounted on a printed-circuit board diode	$R_{th\ j-a}$	=	400 K/W
transistor	$R_{th\ j-a}$	=	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 μ A

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 μ A
$V_{CB} = 10$ 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)

$I_F = 10 \text{ mA}; V_{CE} = 10 \text{ V}$

$I_F = 16 \text{ mA}; V_{CE} = 0.4 \text{ V}$

$I_F = 2 \text{ mA}; V_{CE} = 5 \text{ V}$

I_C/I_F 0.7 to 2.1

I_C/I_F min. 0.5

I_C/I_F min. 0.15

Collector-emitter saturation voltage

$I_F = 16 \text{ mA}; I_C = 2 \text{ mA}$

V_{CEsat} typ. 0.2 V

max. 0.4 V

Isolation voltage; $t = 1 \text{ min}$ DC
(see note 2) AC (RMS value)

V_{IORM} min. 4.4 kV

min. 3.12 kV

Collector capacitance at $f = 1 \text{ MHz}$

$I_E = I_e = 0; V_{CB} = 10 \text{ V}$

$C_{b'c}$ typ. 4.5 pF

Capacitance between input and output

$I_F = 0; V = 0; f = 1 \text{ MHz}$

C_{io} typ. 0.6 pF

max. 1.3 pF

Insulation resistance between input and output

$V_{IO} = 1 \text{ kV}$

R_{IO} min. 10 G Ω

typ. 1 T Ω

Switching times (see Figs 2 and 3)

$I_{Con} = 4 \text{ mA}; V_{CC} = 5 \text{ V}; R_L = 100 \Omega$

Turn-on time

t_{on} typ. 5 μs

max. 20 μs

Turn-off time

t_{off} typ. 5 μs

max. 20 μs

$I_{Con} = 4 \text{ mA}; V_{CC} = 5 \text{ V}; R_L = 1 \text{ k}\Omega$

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

$V_F = 0.8 \text{ V}; -V_{CE} = 15 \text{ V}$

$T_{amb} = 0 \text{ }^\circ\text{C to } +70 \text{ }^\circ\text{C}$

I_{CE1} max. 15 μA

Collector cut-off current

at $I_F = 2 \text{ mA}; -V_{CE} = 0.4 \text{ V}$

$T_{amb} = 0 \text{ }^\circ\text{C to } +70 \text{ }^\circ\text{C}$

I_{CE2} min. 150 μA

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

$V_{CC} = 10 \text{ V};$ working voltage = 1.5 kV DC

$V_{CC} = 10 \text{ V};$ working voltage = 1.5 kV DC; $T_j = 70 \text{ }^\circ\text{C}$

I_{CEW} max. 200 nA (note 3)

I_{CEW} max. 100 μA (note 3)

DC current gain

$I_C = 1 \text{ mA}; V_{CE} = 5 \text{ V}$

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.

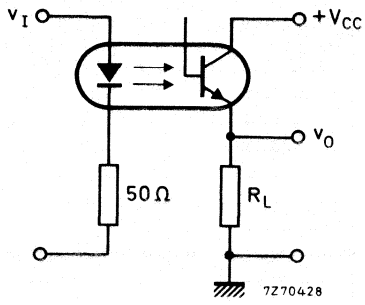


Fig. 2 Switching circuit.

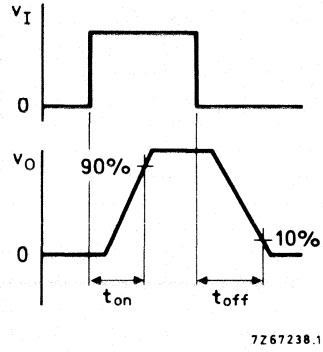


Fig. 3 Waveforms.

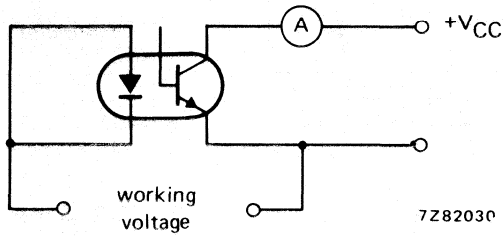


Fig. 4.

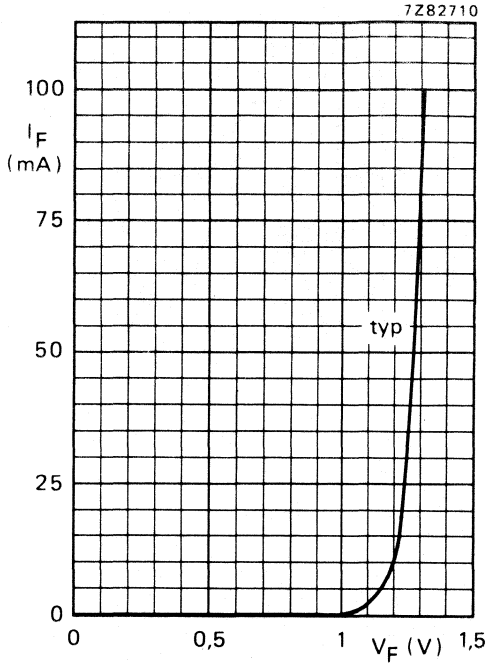


Fig. 5 $T_{amb} = 25\text{ }^\circ\text{C}$.

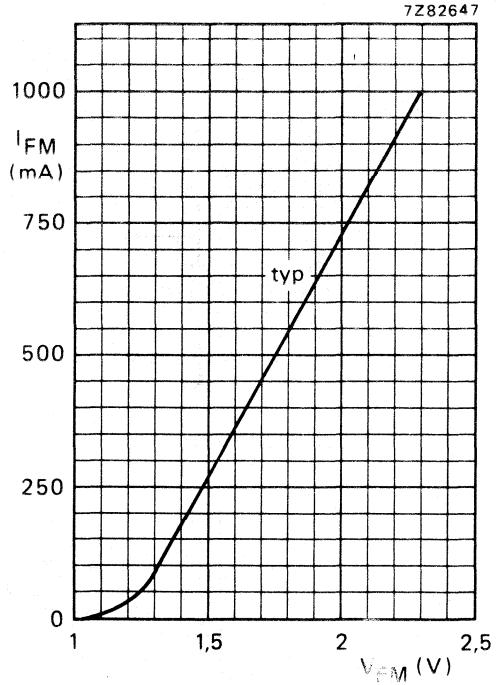


Fig. 6 $T_{amb} = 25\text{ }^\circ\text{C}$; $t_p = 10\text{ }\mu\text{s}$; $t = 1\text{ ms}$.

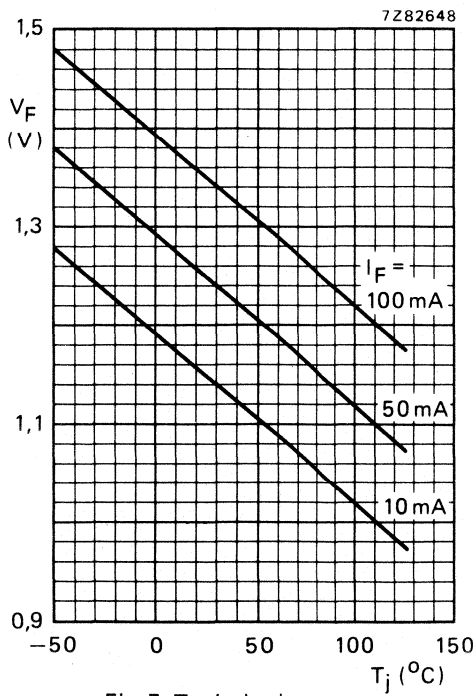


Fig. 7 Typical values.

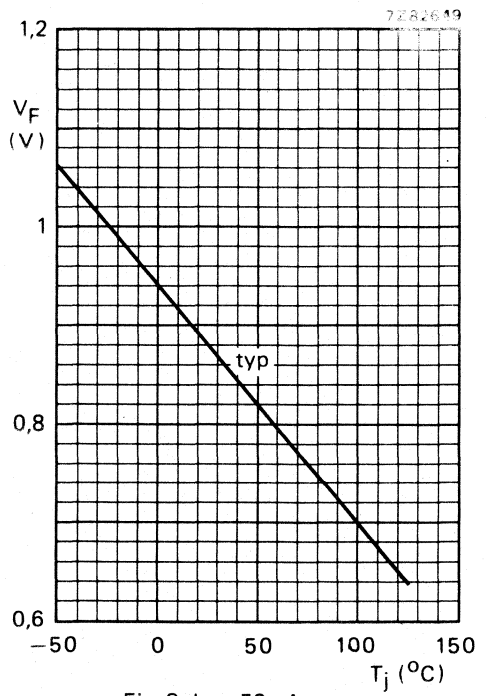


Fig. 8 $I_F = 50\text{ }\mu\text{A}$.

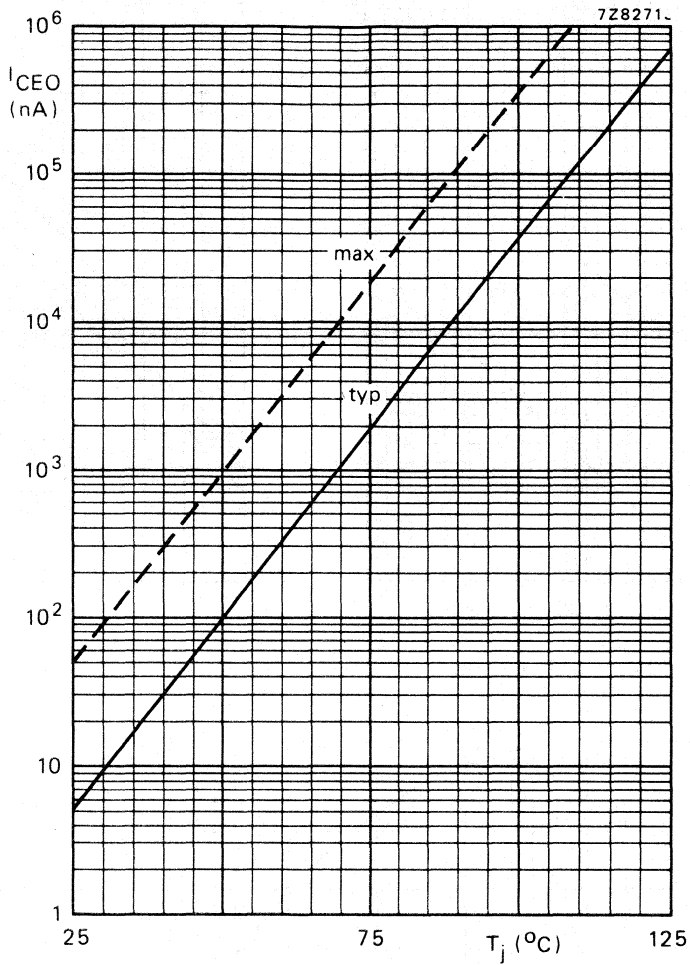


Fig. 9 $I_F = 0$; $V_{\text{CE}} = 10 \text{ V}$.

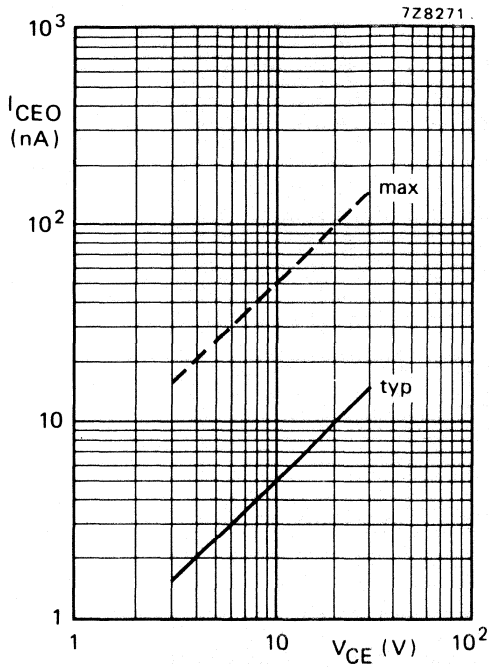


Fig. 10 $I_F = 0$; $T_j = 25^\circ\text{C}$.

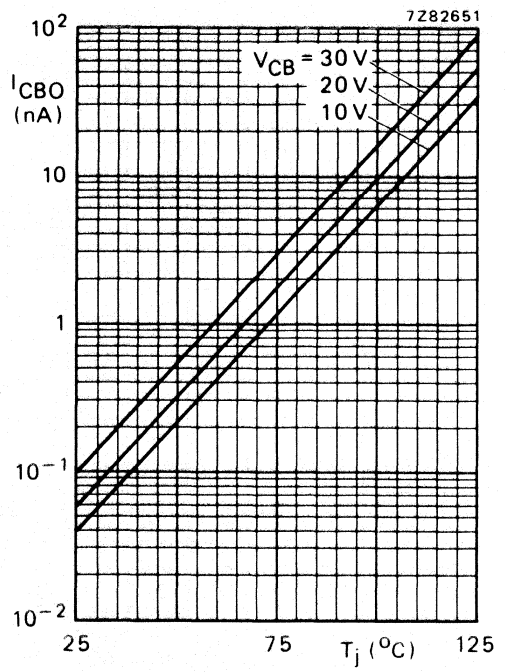


Fig. 11 Typical values.

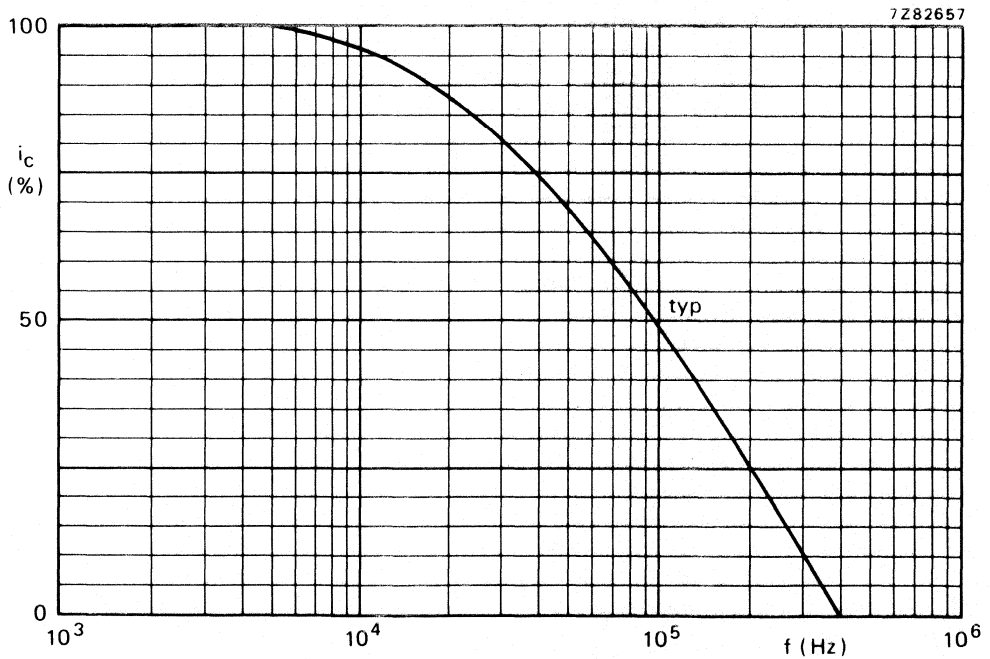


Fig. 12 $I_B = 0$; $I_C = 2\text{ mA}$; $V_{CC} = 5\text{ V}$, $R_L = 1\text{ k}\Omega$; $T_{\text{amb}} = 25^\circ\text{C}$.

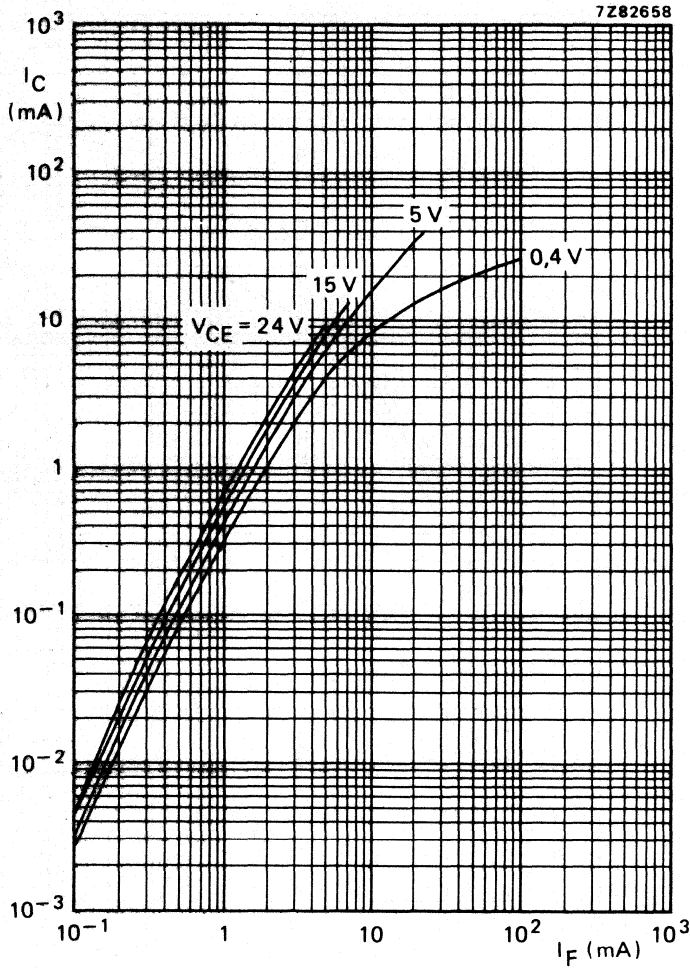


Fig. 13 $T_{amb} = 25^{\circ}C$, typical values.

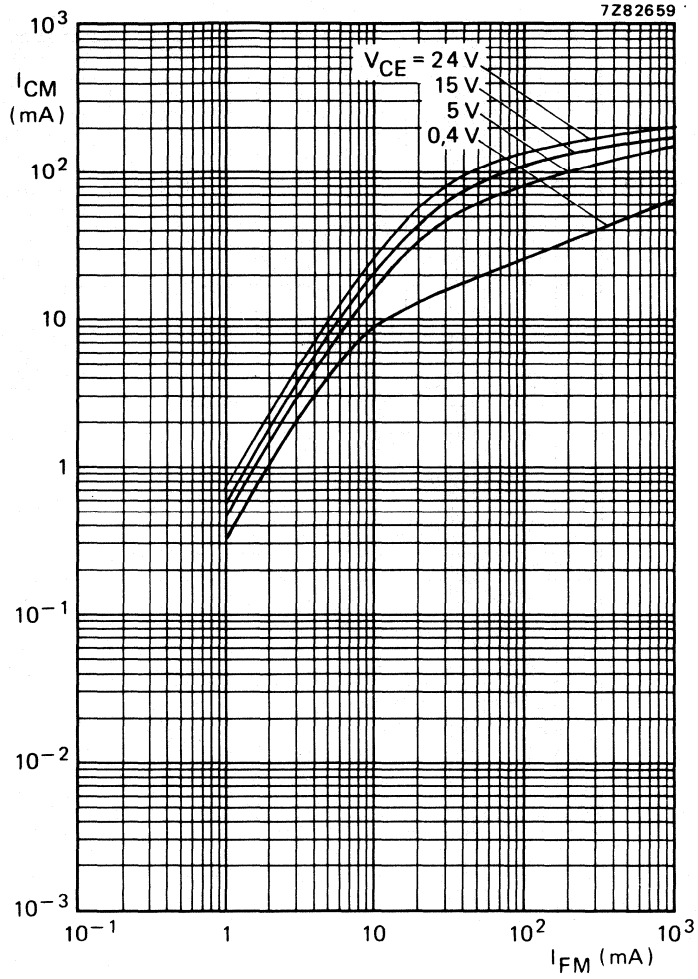


Fig. 14 $T_{amb} = 25^{\circ}C$; $t_p = 20 \mu s$; $T = 2$ ms; typical values.

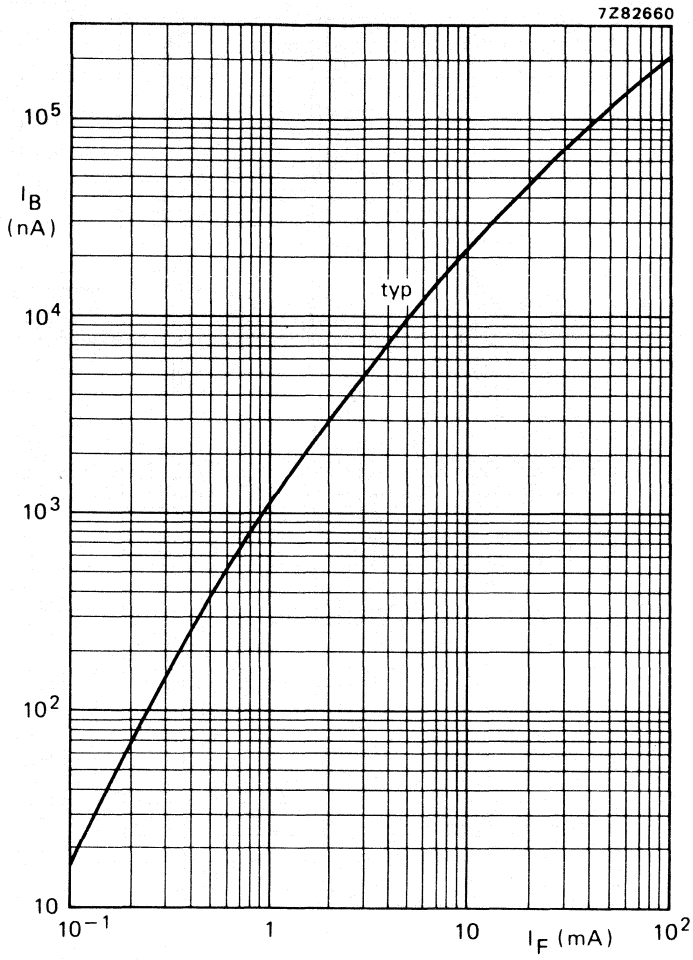


Fig. 15 $V_{CB} = 5\text{ V}$; $T_{amb} = 25\text{ }^\circ\text{C}$.

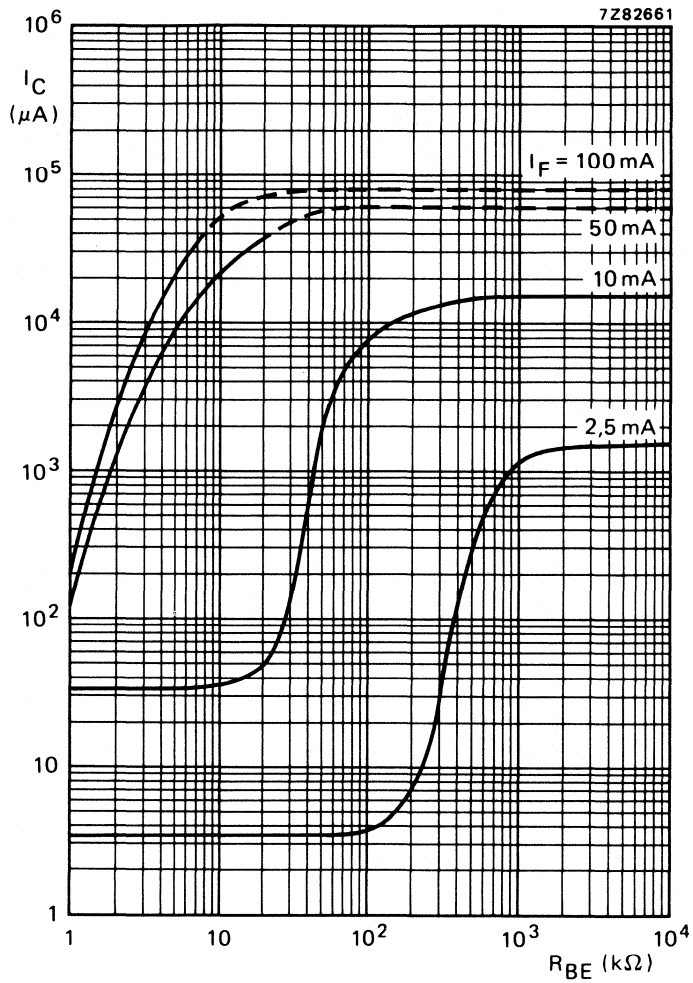


Fig. 16 $I_B = 0$; $V_{CE} = 5 \text{ V}$; $T_{amb} = 25 \text{ }^\circ\text{C}$; typical values.

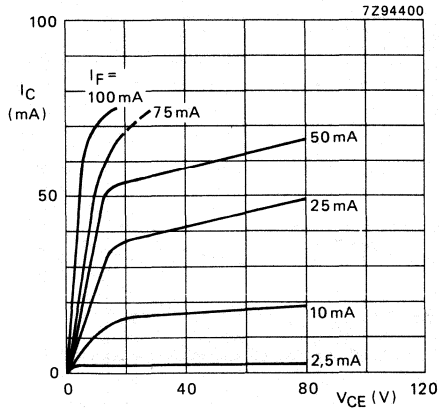


Fig. 17 $T_{amb} = 25\text{ }^\circ\text{C}$; typical values.

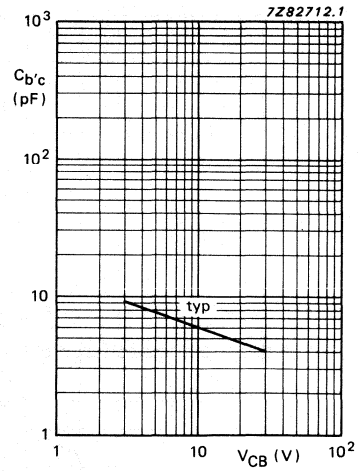


Fig. 18 $f = 1\text{ MHz}$; $T_{amb} = 25\text{ }^\circ\text{C}$.

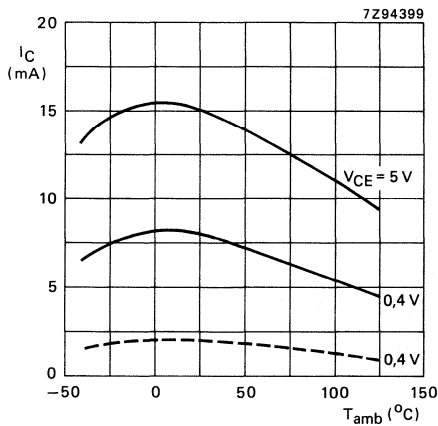


Fig. 19 $I_F = 10\text{ mA}$; typical values.
--- min. values.

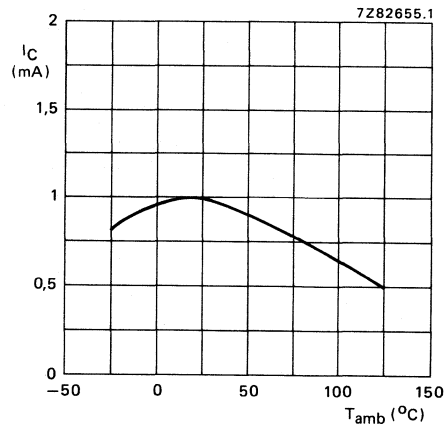


Fig. 20 $I_F = 2\text{ mA}$; typical values.
 $V_{CE} = 0.4\text{ V}$.

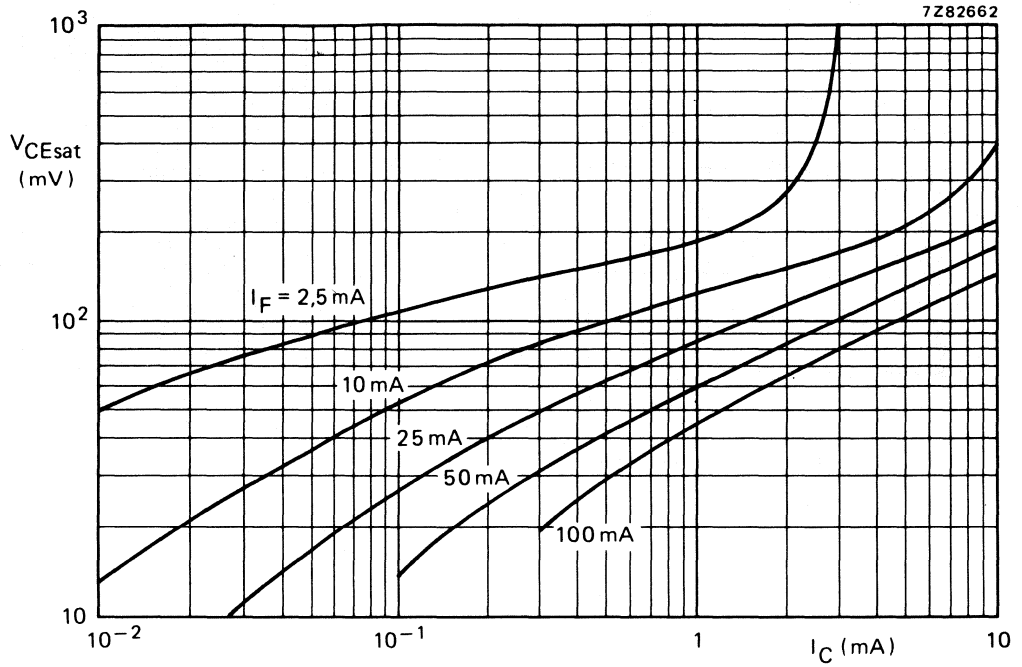


Fig. 21 $I_B = 0$; $T_{amb} = 25^\circ C$; typical values.

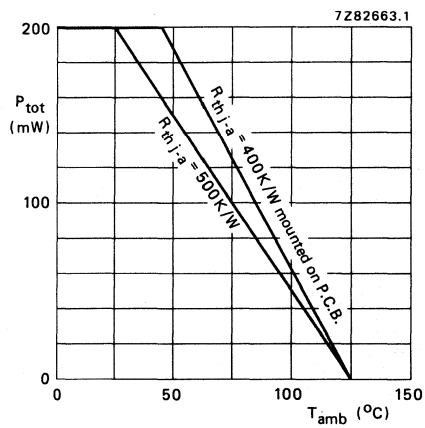


Fig. 22 Max. permissible power dissipation for total device versus ambient temperature.

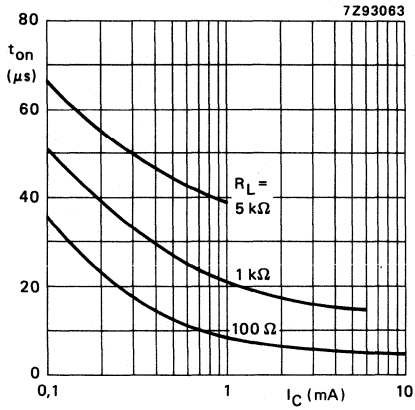


Fig. 23 $I_B = 0$; $V_{CC} = 5\text{ V}$; $T_{amb} = 25\text{ }^\circ\text{C}$; typical values. (See also Fig. 25.)

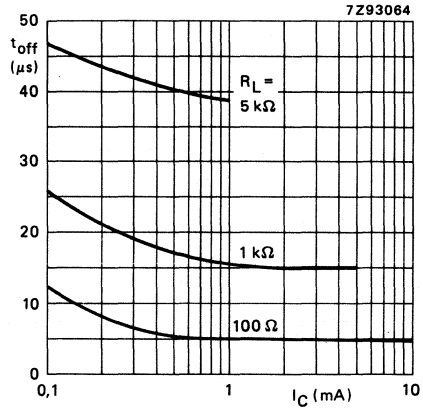


Fig. 24 $I_B = 0$; $V_{CC} = 5\text{ V}$; $T_{amb} = 25\text{ }^\circ\text{C}$; typical values. (See also Fig. 25.)

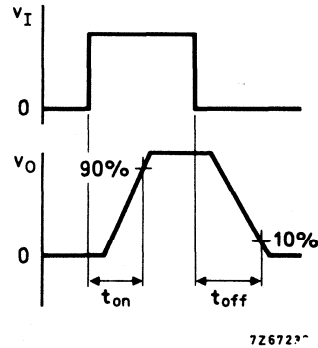
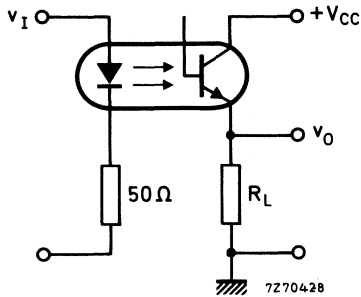


Fig. 25 Switching circuit and waveforms.

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); $t_p = 10 \mu s$; $\delta = 0.01$	I_{FRM}	max.	3 A
Total power dissipation up to $T_{amb} = 25^\circ C$	P_{tot}	max.	200 mW

Transistor

Collector-emitter voltage (open base)	V_{CEO}	max.	80 V
Total power dissipation up to $T_{amb} = 25^\circ C$	P_{tot}	max.	200 mW

Optocoupler

Output/input DC current transfer ratio (CTR) $I_F = 10 \text{ mA}$; $V_{CE} = 10 \text{ V}$; ($I_B = 0$)	I_C/I_F	0.7 to 2.1	
Collector cut-off current (dark) $V_{CC} = 10 \text{ V}$; 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
AC (RMS value)		min.	3.12 kV

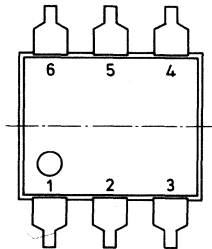
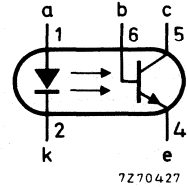
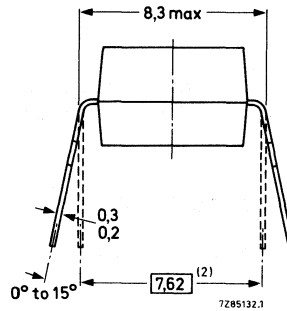
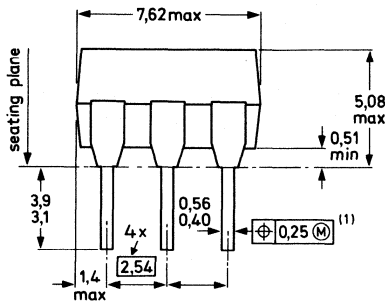
MECHANICAL DATA

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.	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 $T_{amb} = 25^\circ C$	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 $T_{amb} = 25^\circ C$	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	$R_{th\ j-a}$	=	500 K/W
transistor	$R_{th\ j-a}$	=	500 K/W
From junction to ambient, device mounted on a printed-circuit board diode	$R_{th\ j-a}$	=	400 K/W
transistor	$R_{th\ j-a}$	=	400 K/W

ISOLATION RELATED VALUES

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

CHARACTERISTICS

$T_j = 25$ °C unless otherwise specified

Diode

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

Transistor ($I_F = 0$)

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

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

Output/input DC current transfer ratio (CTR)

$I_F = 10 \text{ mA}; V_{CE} = 10 \text{ V}$

$I_F = 16 \text{ mA}; V_{CE} = 0.4 \text{ V}$

$I_F = 2 \text{ mA}; V_{CE} = 5 \text{ V}$

I_C/I_F	0.7 to 2.1
I_C/I_F	min. 0.5
I_C/I_F	min. 0.15

Collector-emitter saturation voltage

$I_F = 16 \text{ mA}; I_C = 2 \text{ mA}$

V_{CEsat}	typ. 0.2 V
	max. 0.4 V

→ Isolation voltage; $t = 1 \text{ min}$ DC
(see note 2) AC (RMS value)

V_{IORM}	min. 4.4 kV
	3.12 kV

Collector capacitance at $f = 1 \text{ MHz}$

$I_E = I_e = 0; V_{CB} = 10 \text{ V}$

$C_{b'c}$	typ. 4.5 pF
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Capacitance between input and output

$I_F = 0; V = 0; f = 1 \text{ MHz}$

C_{io}	typ. 0.6 pF
	max. 1.3 pF

Insulation resistance between input and output

$\pm V_{IO} = 1 \text{ kV}$

R_{IO}	min. 100 G Ω
	typ. 1 T Ω

Switching times (see Figs 2 and 3)

$I_{Con} = 4 \text{ mA}; V_{CC} = 5 \text{ V}; R_L = 100 \Omega$

Turn-on time

t_{on}	typ. 5 μs
	max. 20 μs

Turn-off time

t_{off}	typ. 5 μs
	max. 20 μs

→ $I_{Con} = 4 \text{ mA}; V_{CC} = 5 \text{ V}; R_L = 1 \text{ k}\Omega$
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

$V_F = 0.8 \text{ V}; -V_{CE} = 15 \text{ V}$

$T_{amb} = 0 \text{ }^\circ\text{C to } +70 \text{ }^\circ\text{C}$

I_{CE1}	max. 15 μA
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Collector cut-off current

at $I_F = 2 \text{ mA}; -V_{CE} = 0.4 \text{ V}$

$T_{amb} = 0 \text{ }^\circ\text{C to } +70 \text{ }^\circ\text{C}$

I_{CE2}	min. 150 μA
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Collector cut-off current (dark) see Fig.4

$V_{CC} = 10 \text{ V};$ working voltage = 1.5 kV DC

$V_{CC} = 10 \text{ V};$ working voltage = 1.5 kV DC; $T_j = 70 \text{ }^\circ\text{C}$

I_{CEW}	max. 200 nA (note 3)
I_{CEW}	max. 100 μA (note 3)

DC current gain

$I_C = 1 \text{ mA}; V_{CE} = 5 \text{ V}$

h_{FE}	150 to 1500
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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.

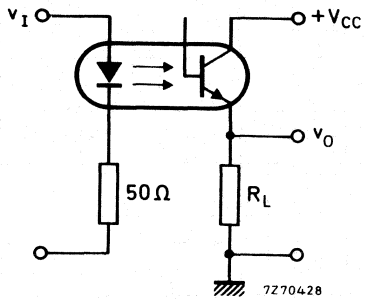


Fig. 2 Switching circuit.

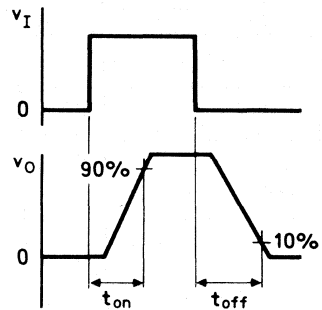


Fig. 3 Waveforms.

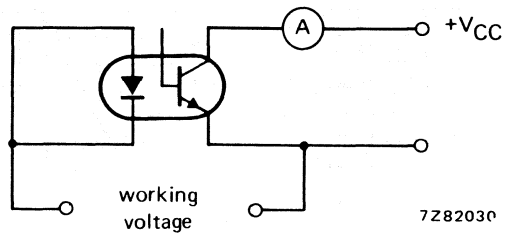


Fig. 4.

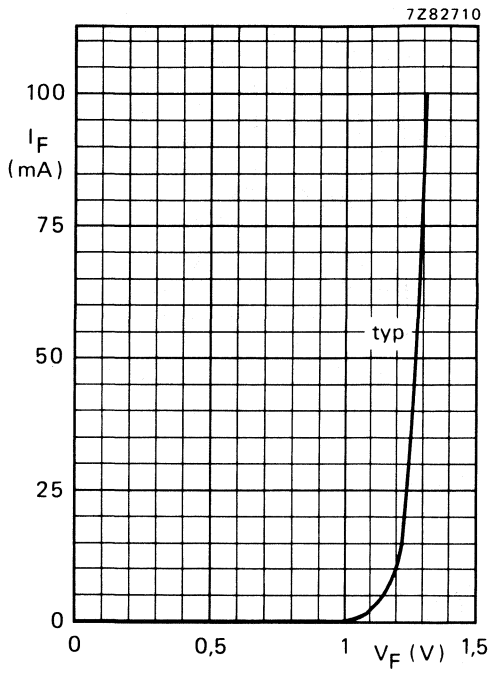


Fig. 5 $T_{amb} = 25\text{ }^{\circ}\text{C}$.

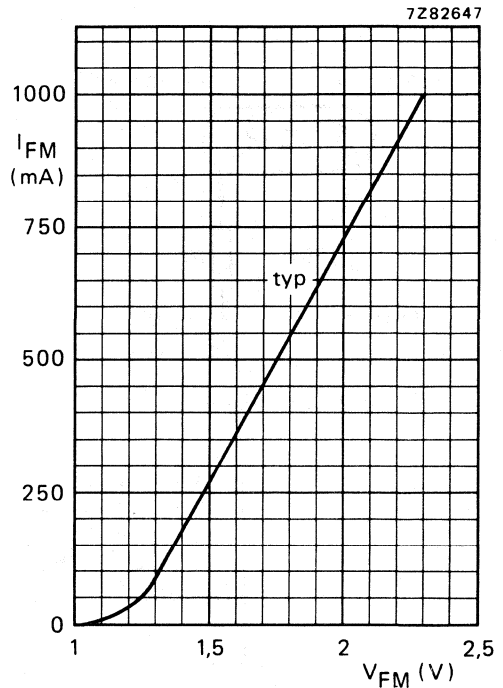


Fig. 6 $T_{amb} = 25\text{ }^{\circ}\text{C}$; $t_p = 10\text{ }\mu\text{s}$; $T = 1\text{ ms}$.

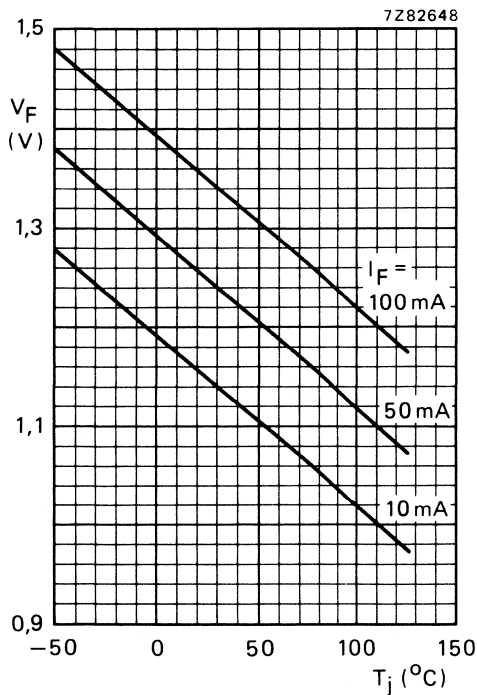


Fig. 7 Typical values.

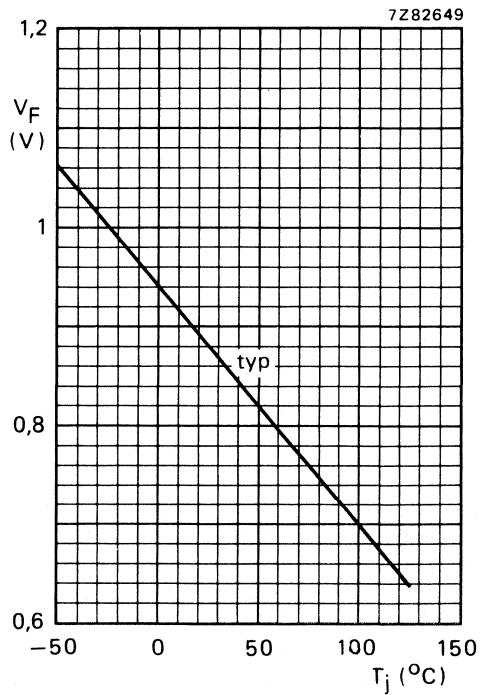


Fig. 8 $I_F = 50\text{ }\mu\text{A}$.

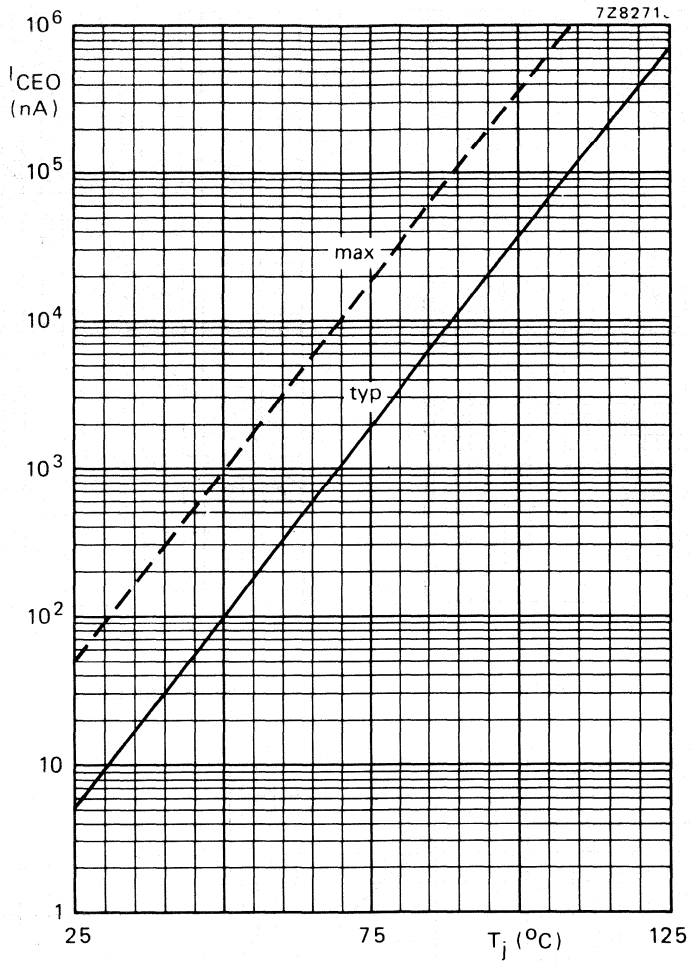


Fig. 9 $I_F = 0$; $V_{CE} = 10$ V.

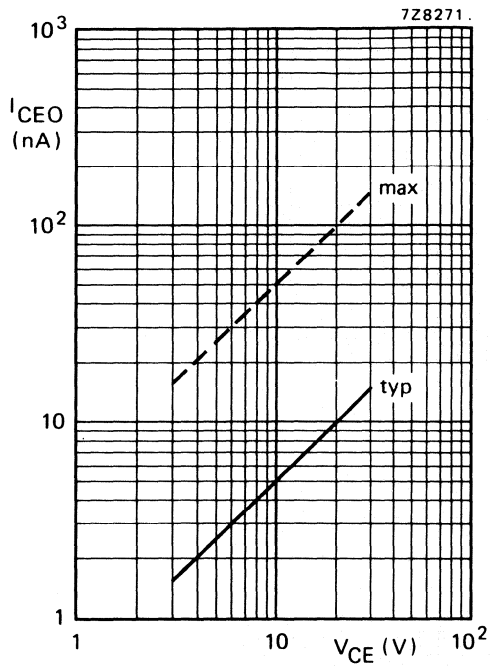


Fig. 10 $I_F = 0$; $T_j = 25^\circ\text{C}$.

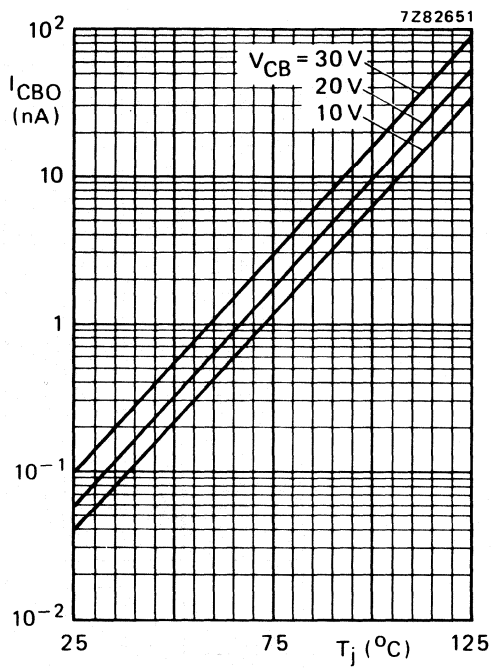


Fig. 11 Typical values.

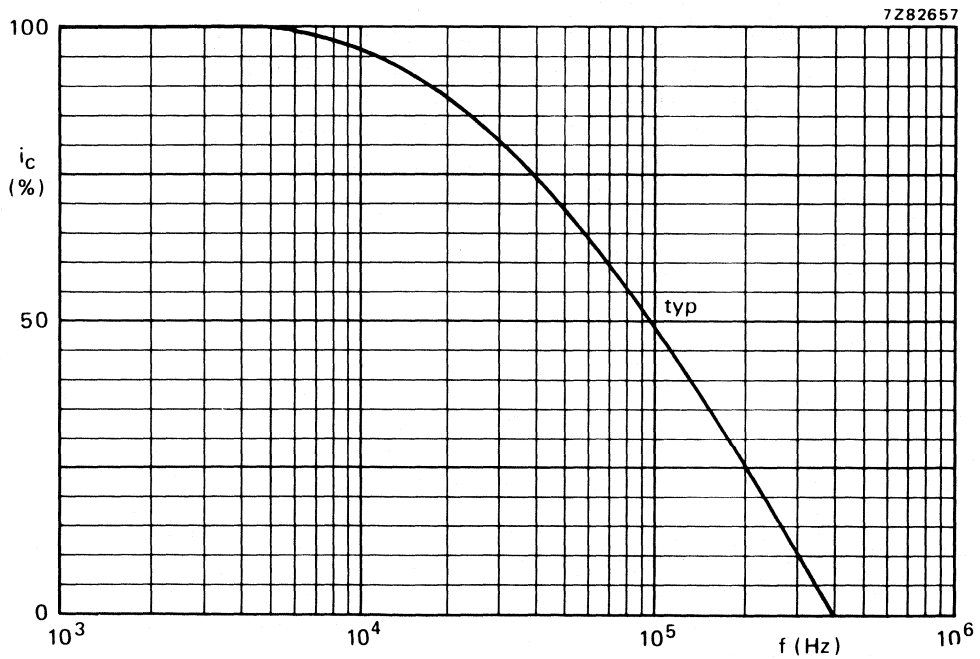


Fig. 12 $I_B = 0$; $I_C = 2\text{mA}$; $V_{CC} = 5\text{V}$, $R_L = 1\text{k}\Omega$; $T_{amb} = 25^\circ\text{C}$.

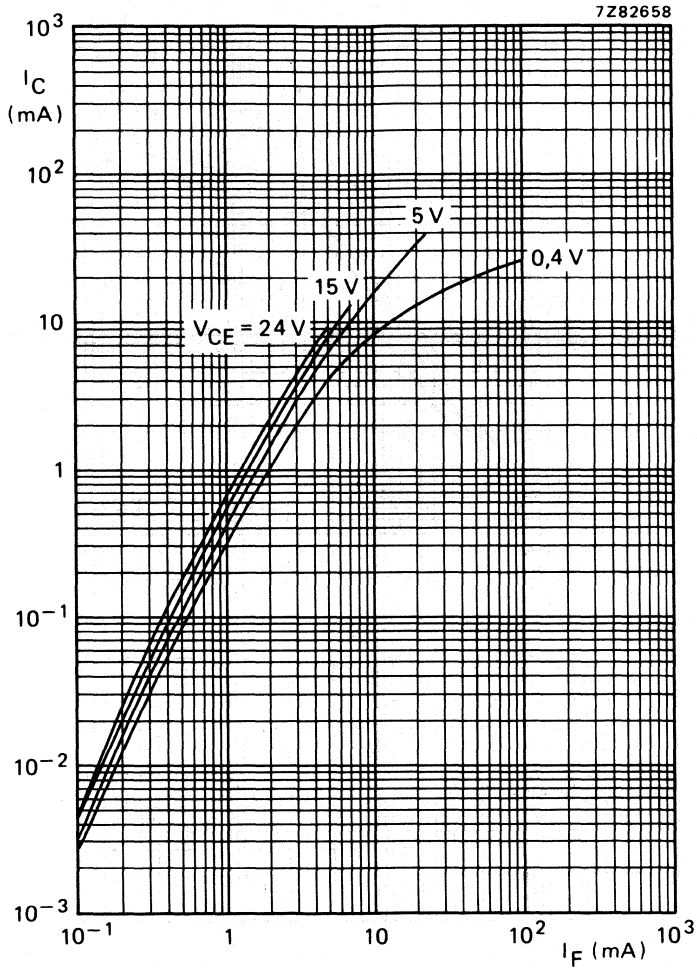


Fig. 13 $T_{amb} = 25\text{ }^{\circ}\text{C}$, typical values.

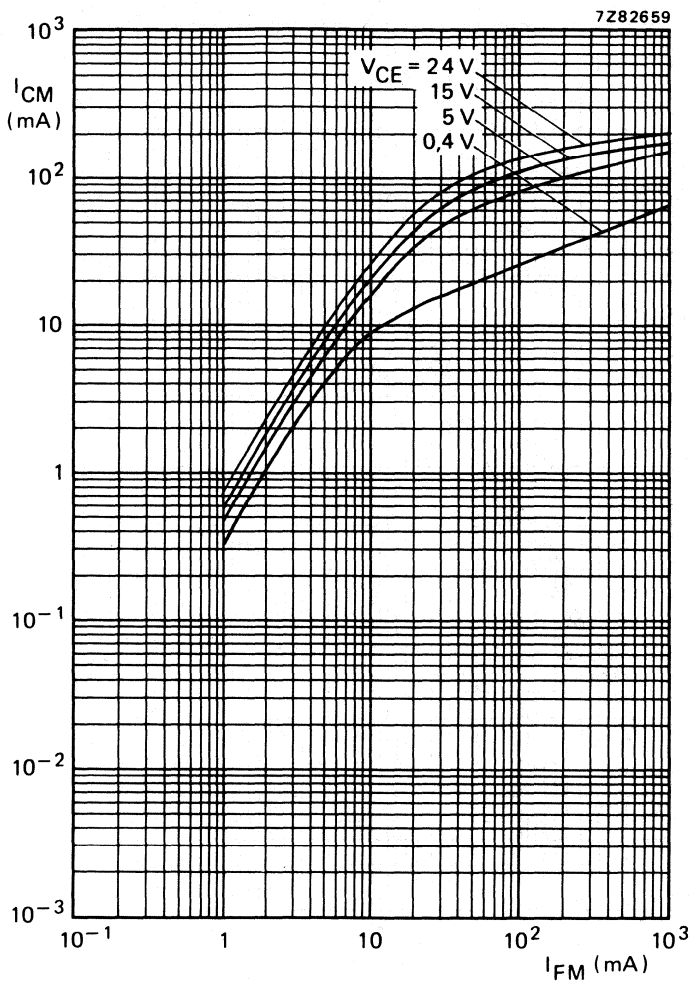


Fig. 14 $T_{amb} = 25\text{ }^{\circ}\text{C}$; $t_p = 20\text{ }\mu\text{s}$; $T = 2\text{ ms}$; typical values.

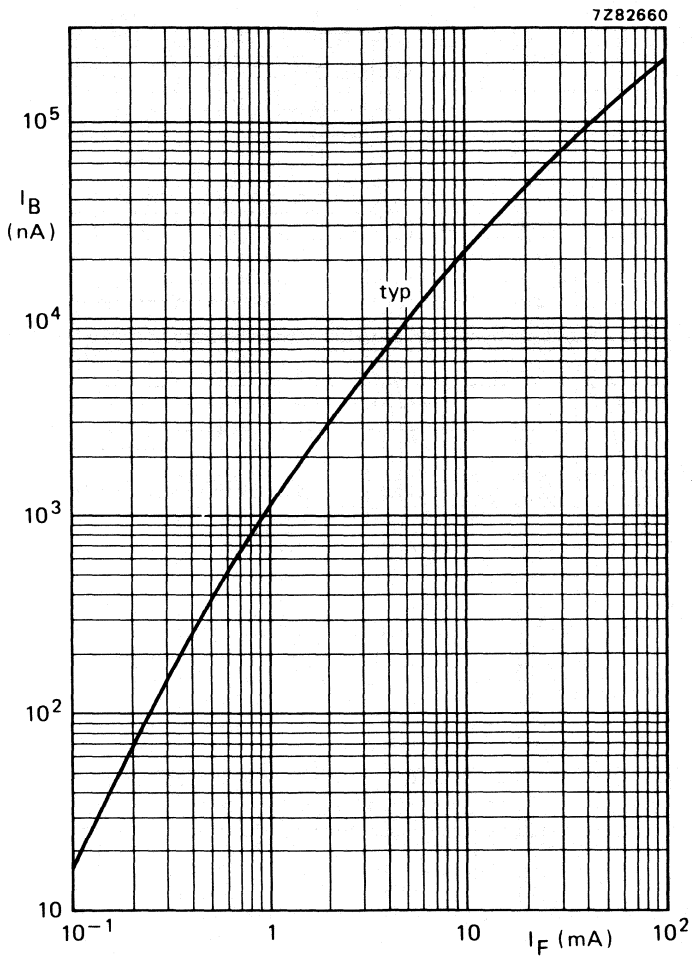


Fig. 15 $V_{CB} = 5 \text{ V}$; $T_{amb} = 25 \text{ }^\circ\text{C}$.

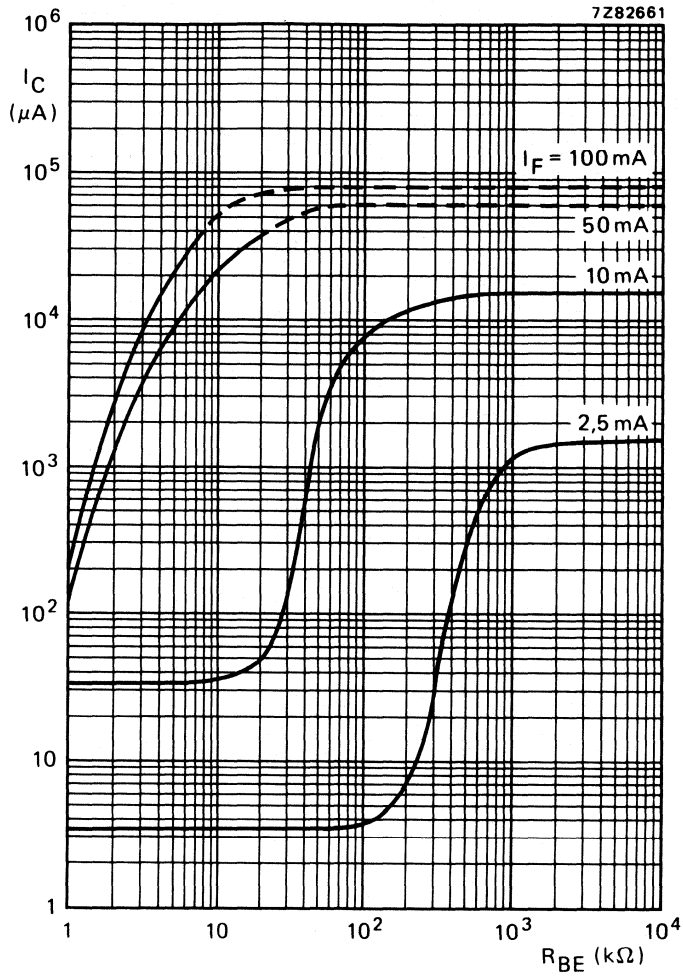


Fig. 16 $I_B = 0$; $V_{CE} = 5 \text{ V}$; $T_{amb} = 25 \text{ }^\circ\text{C}$; typical values.

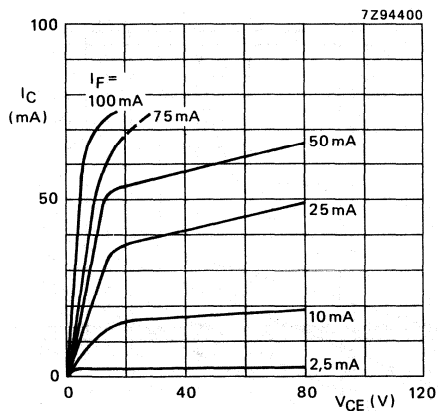


Fig. 17 $T_{amb} = 25^\circ\text{C}$; typical values.

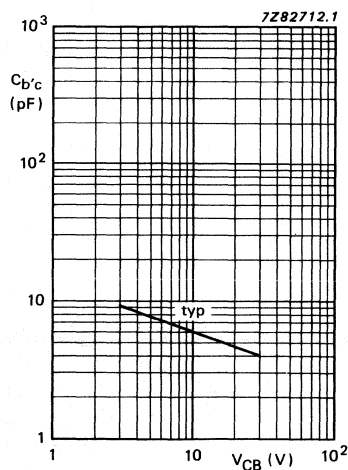


Fig. 18 $f = 1$ MHz; $T_{amb} = 25^\circ\text{C}$.

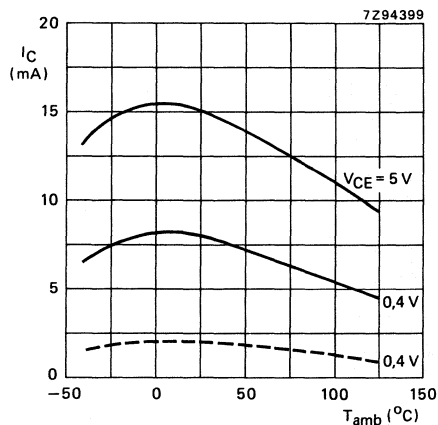


Fig. 19 $I_F = 10$ mA; typical values.
--- min. values.

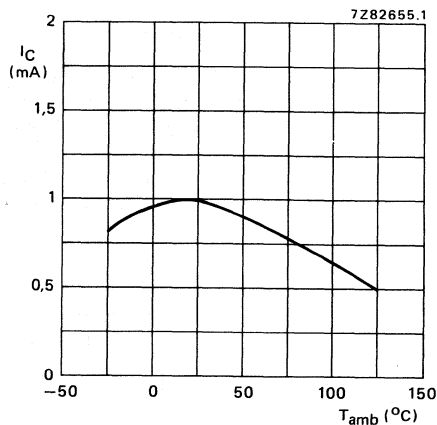


Fig. 20 $I_F = 2$ mA; typical values.
 $V_{CE} = 0.4$ V.

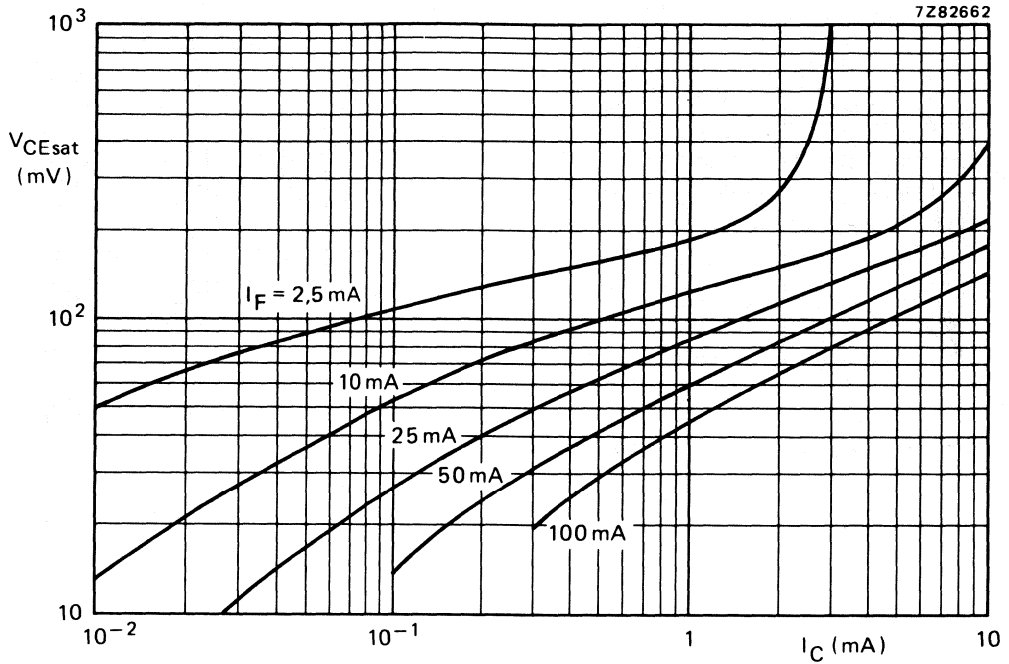


Fig. 21 $I_B = 0$; $T_{amb} = 25^\circ\text{C}$; typical values.

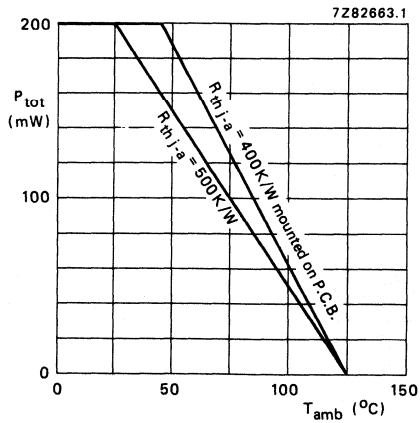


Fig. 22 Max. permissible power dissipation for total device versus ambient temperature.

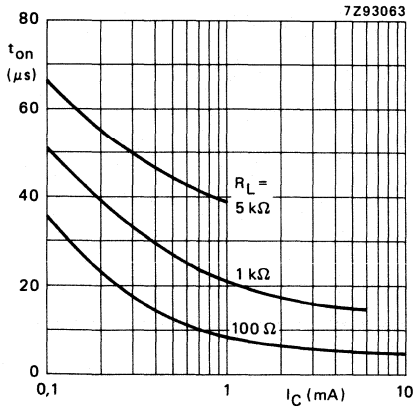


Fig. 23 $I_B = 0$; $V_{CC} = 5 V$; $T_{amb} = 25 ^\circ C$; typical values. (See also Fig. 25.)

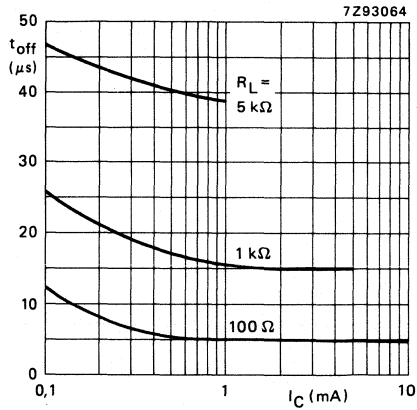


Fig. 24 $I_B = 0$; $V_{CC} = 5 V$; $T_{amb} = 25 ^\circ C$; typical values. (See also Fig. 25.)

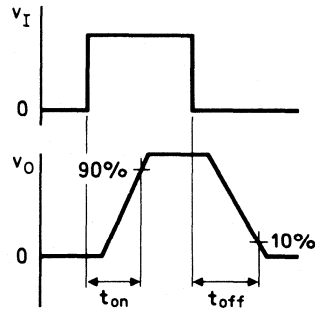
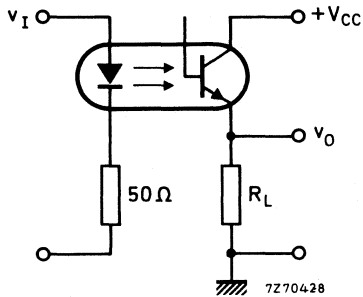


Fig. 25 Switching circuit and waveforms.

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); $t_p = 10 \mu s$; $\delta = 0.01$	I_{FRM}	max.	3 A
Total power dissipation up to $T_{amb} = 25^\circ C$	P_{tot}	max.	200 mW

Transistor

Collector-emitter voltage (open base)	V_{CEO}	max.	30 V
Total power dissipation up to $T_{amb} = 25^\circ C$	P_{tot}	max.	200 mW

Optocoupler

Output/input DC current transfer ratio (CTR) $I_F = 1 \text{ mA}$; $V_{CE} = 1 \text{ V}$; ($I_B = 0$)	I_C/I_F	min.	5
Collector-cut-off current (dark) $V_{CC} = 10 \text{ V}$; 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

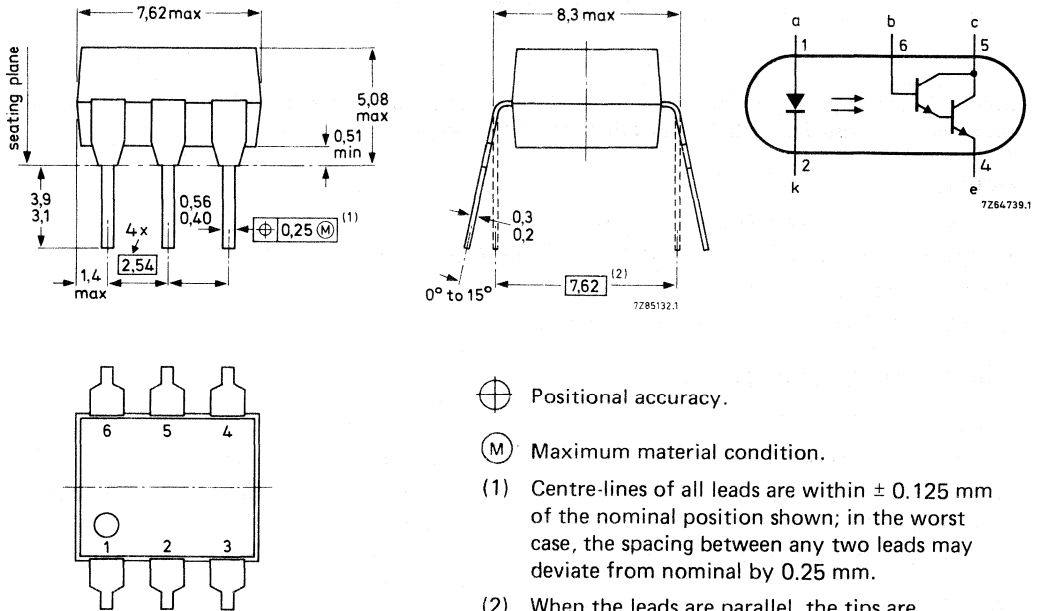
MECHANICAL DATA

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); $t_p = 10 \mu s$; $\delta = 0.01$	I_{FRM}	max.	3 A
Total power dissipation up to $T_{amb} = 25 \text{ }^\circ\text{C}$	P_{tot}	max.	200 mW
Junction temperature	T_j	max.	125 $^\circ\text{C}$

Transistor

Collector-emitter breakdown voltage $I_C = 1 \text{ mA}$	$V_{(BR)CEO}$	min.	30 V
Collector-base breakdown voltage $I_C = 0.1 \text{ mA}$	$V_{(BR)CBO}$	min.	30 V
Emitter-collector breakdown voltage $I_E = 0.1 \text{ mA}$	$V_{(BR)ECO}$	min.	6 V
DC collector current	I_C	max.	100 mA
Total power dissipation up to $T_{amb} = 25 \text{ }^\circ\text{C}$	P_{tot}	max.	200 mW
Junction temperature	T_j	max.	125 $^\circ\text{C}$

Optocoupler

Storage temperature range	T_{stg}		-55 to + 150 $^\circ\text{C}$
Operating ambient temperature range	T_{amb}		-40 to + 100 $^\circ\text{C}$
Lead soldering temperature up to the seating plane; $t_{slid} < 10 \text{ s}$	T_{slid}	max.	260 $^\circ\text{C}$

THERMAL RESISTANCE

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

$T_j = 25 \text{ }^\circ\text{C}$ unless otherwise specified

Diode

Forward voltage $I_F = 10 \text{ mA}$	V_F	typ. max.	1.15 V 1.3 V
Reverse current $V_R = 5 \text{ V}$	I_R	max.	10 μA

Transistor ($I_F = 0$)

Collector cut-off current (dark)

$V_{CE} = 10 \text{ V}$

I_{CEO}	typ.	20 nA
	max.	100 nA

$V_{CB} = 10 \text{ V}$

I_{CEO}	max.	20 nA
-----------	------	-------

Collector-emitter breakdown voltage

at $I_C = 1 \text{ mA}$

$V_{(BR)CEO}$	min.	30 V
---------------	------	------

Collector-base breakdown voltage

at $I_C = 0.1 \text{ mA}$

$V_{(BR)CBO}$	min.	30 V
---------------	------	------

Emitter-base breakdown voltage

at $I_E = 0.1 \text{ mA}$

$V_{(BR)ECO}$	min.	6 V
---------------	------	-----

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

Output/input DC current transfer ratio (CTR)

$I_F = 0.5 \text{ mA}; V_{CE} = 1 \text{ V}$

I_C/I_F	min.	3.5
-----------	------	-----

$I_F = 1.0 \text{ mA}; V_{CE} = 1 \text{ V}$

I_C/I_F	min.	5
-----------	------	---

$I_F = 10 \text{ mA}; V_{CE} = 1 \text{ V}$

I_C/I_F	min.	6
-----------	------	---

Collector cut-off current (dark); see Fig. 2 (note 2)

$V_{CC} = 10 \text{ V};$ working voltage = 2.5 kV DC

I_{CEW}	max.	1 μA
-----------	------	-----------------

$V_{CC} = 10 \text{ V};$ working voltage = 2.5 kV DC; $T_j = 70 \text{ }^\circ\text{C}$

I_{CEW}	max.	1000 μA
-----------	------	--------------------

Collector-emitter saturation voltage

$I_F = 5 \text{ mA}; I_C = 10 \text{ mA}$

V_{CEsat}	max.	1 V
-------------	------	-----

Isolation voltage (note 3)

$t = 1 \text{ min}$

DC

V_{IORM}	min.	4.4 kV
------------	------	--------

AC (RMS value)

		3.12 kV
--	--	---------

Collector capacitance at $f = 1 \text{ MHz}$

$I_E = I_e = 0; V_{CB} = 10 \text{ V}$

$C_{b'c}$	typ.	4.5 pF
-----------	------	--------

Capacitance between input and output

$I_F = 0; V = 0; f = 1 \text{ MHz}$

C_{io}	typ.	0,6 pF
----------	------	--------

Insulation resistance between input and output

$\pm V_{IO} = 1 \text{ kV}$

R_{IO}	min.	10 G Ω
	typ.	1 T Ω

Switching times (see Figs 3 and 4)

$I_{Fon} = 10 \text{ mA}; V_{CC} = 5 \text{ V}; R_E = 100 \text{ } \Omega; R_{BE} = 1 \text{ M}\Omega$

t_{on}	typ.	5 μs
----------	------	-----------------

t_{off}	typ.	30 μs
-----------	------	------------------

$I_{Fon} = 1 \text{ mA}; V_{CC} = 5 \text{ V}; R_E = 1 \text{ k}\Omega; R_{BE} = 10 \text{ M}\Omega$

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.

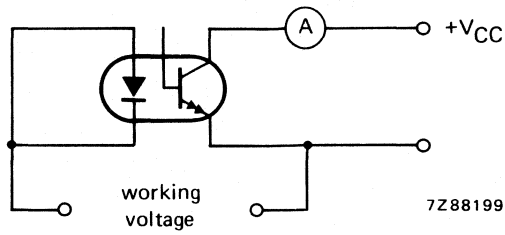


Fig. 2.

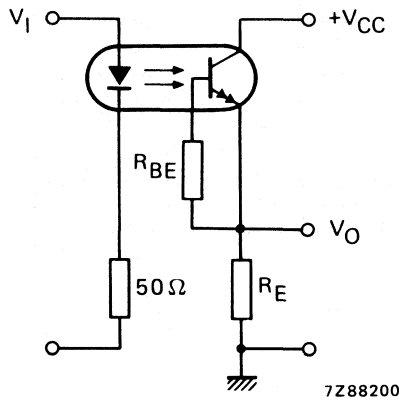
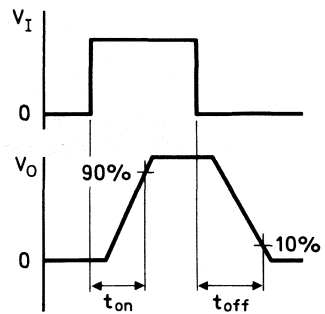


Fig. 3 Switching circuit.



7Z67238.2

Fig. 4 Waveforms.

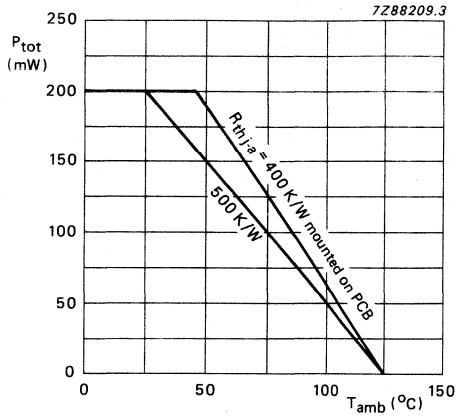


Fig. 5 Power derating curve for diode and transistor as a function of temperature.

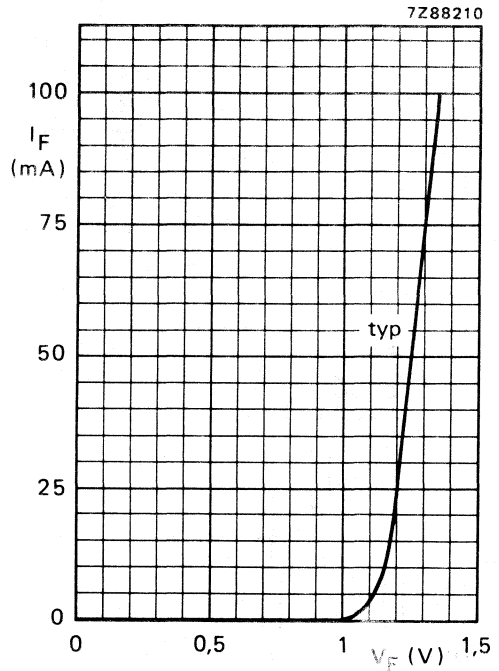


Fig. 6 $T_{amb} = 25\text{ }^{\circ}\text{C}$.

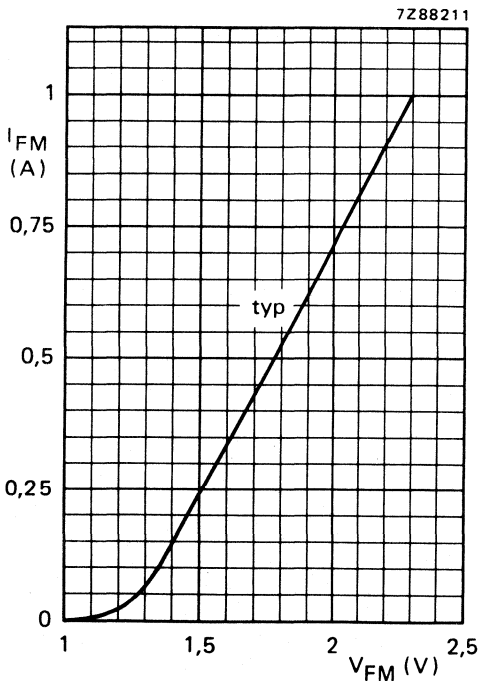


Fig. 7 $T_{amb} = 25\text{ }^{\circ}\text{C}$; $t_p = 10\text{ }\mu\text{s}$; $\delta = 0.01$.

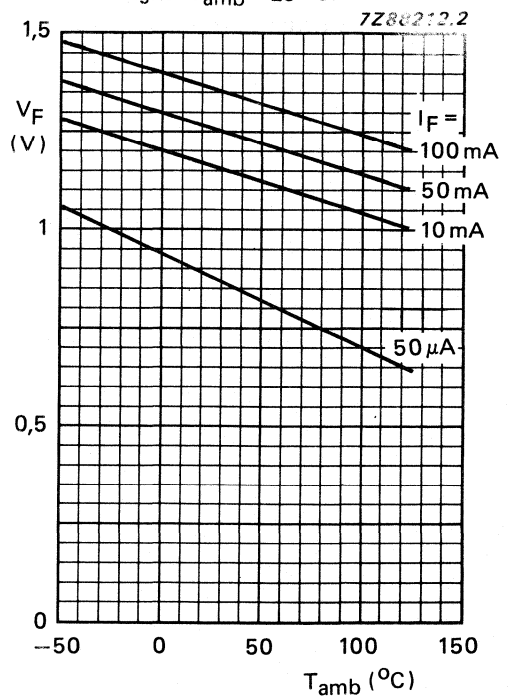


Fig. 8 Typical values.

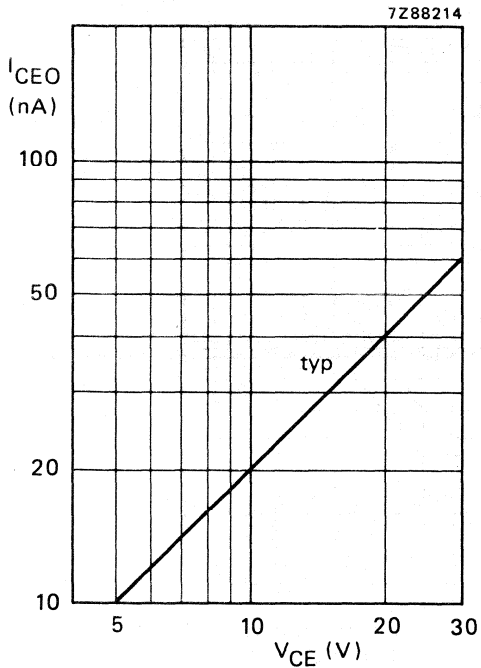


Fig. 9 $I_F = 0$; $T_j = 25^\circ\text{C}$.

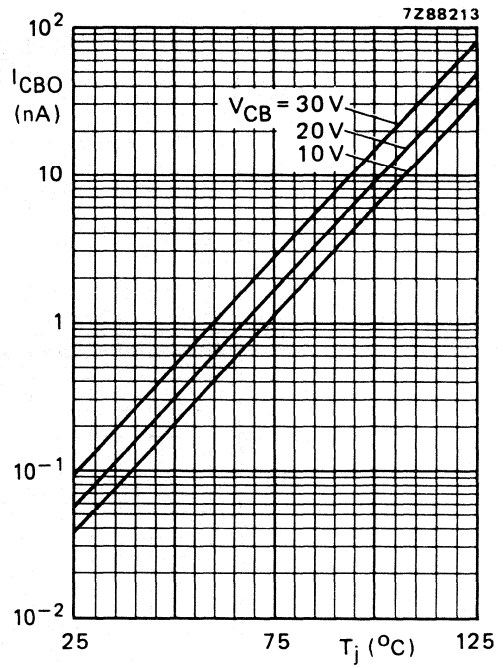


Fig. 10 Typical values.

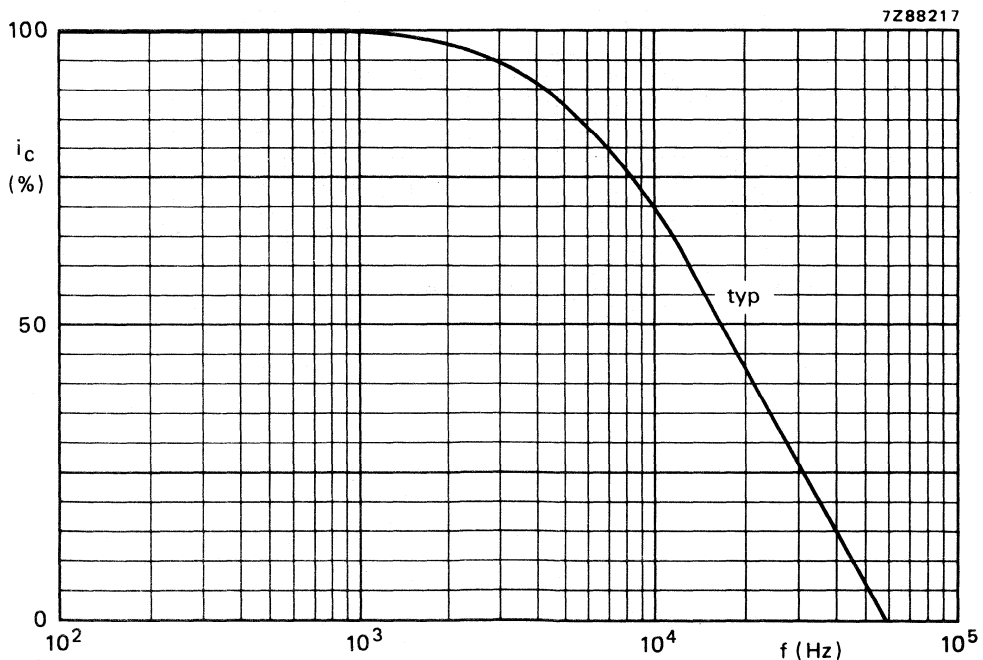


Fig. 11 $I_C = 10$ mA; $V_{CC} = 5$ V; $R_E = 100 \Omega$; $R_{BE} = 1 \text{ M}\Omega$; see also Fig. 4.

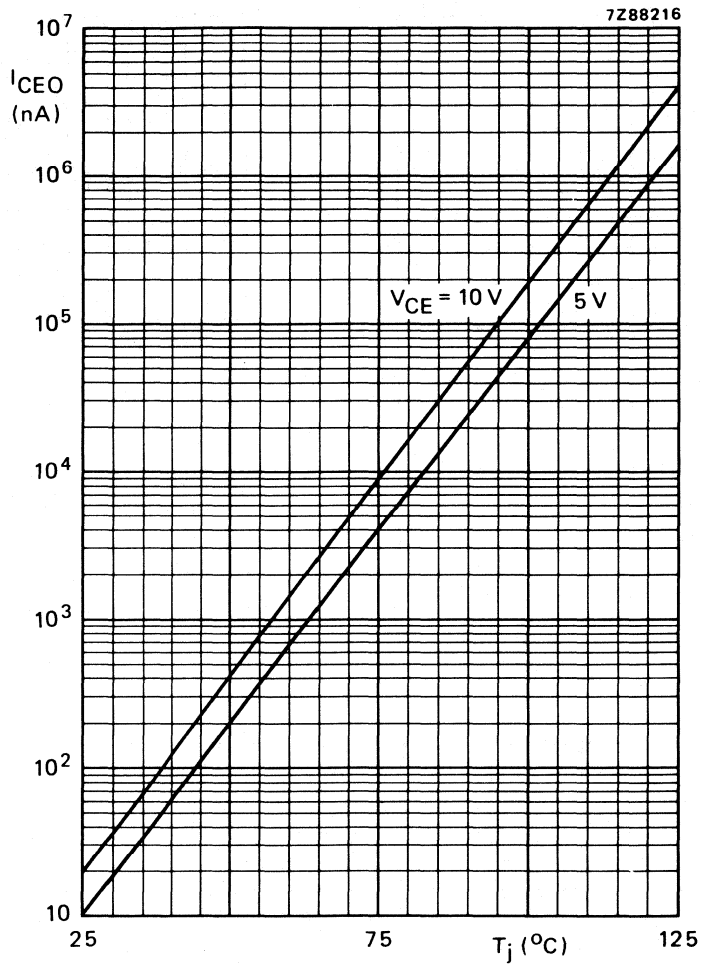


Fig. 12 $I_F = 0$; typical values.

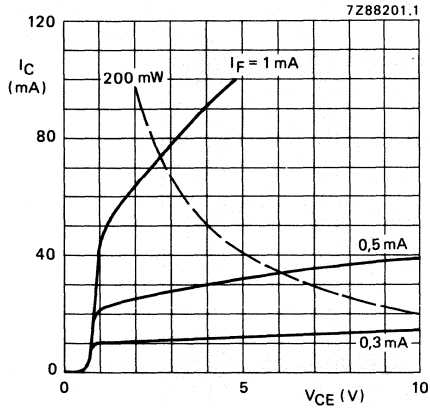


Fig. 13 Typical values; $T_{amb} = 25^\circ C$.

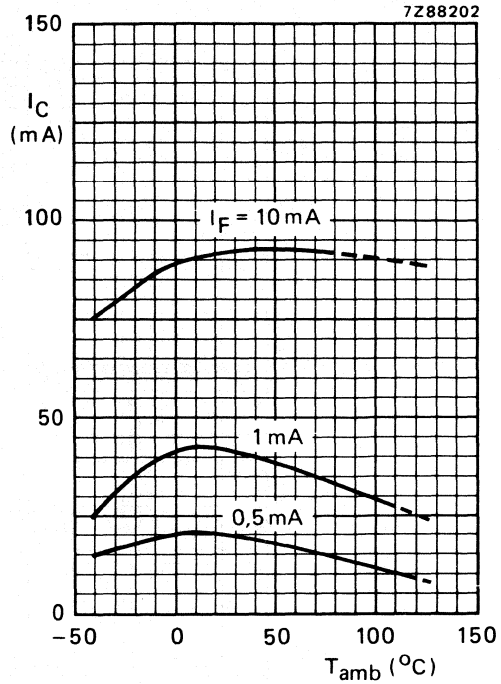


Fig. 14 Typical values; $I_B = 0$; $V_{CE} = 1$ V.

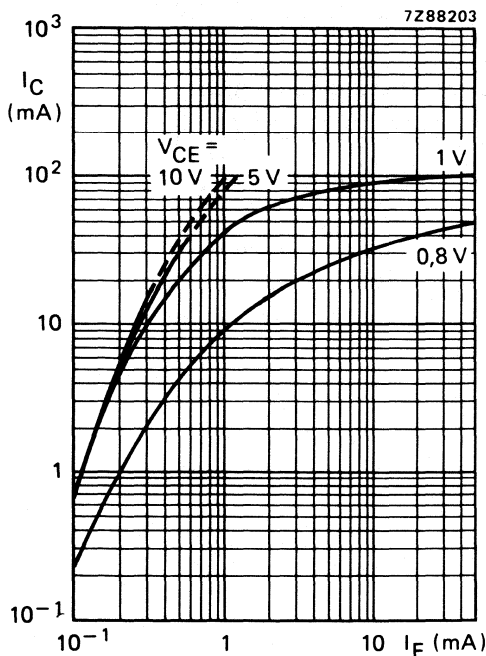


Fig. 15 Typical values; $I_B = 0$; $T_{amb} = 25^\circ C$.

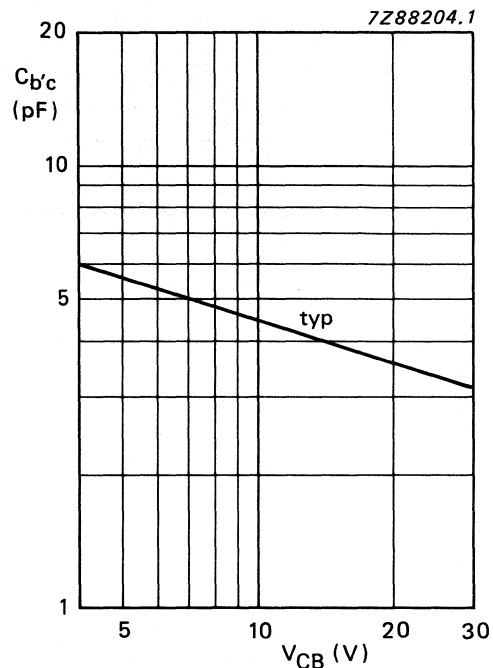


Fig. 16 $I_E = I_e = 0$; $f = 1$ MHz; $T_{amb} = 25^\circ C$.

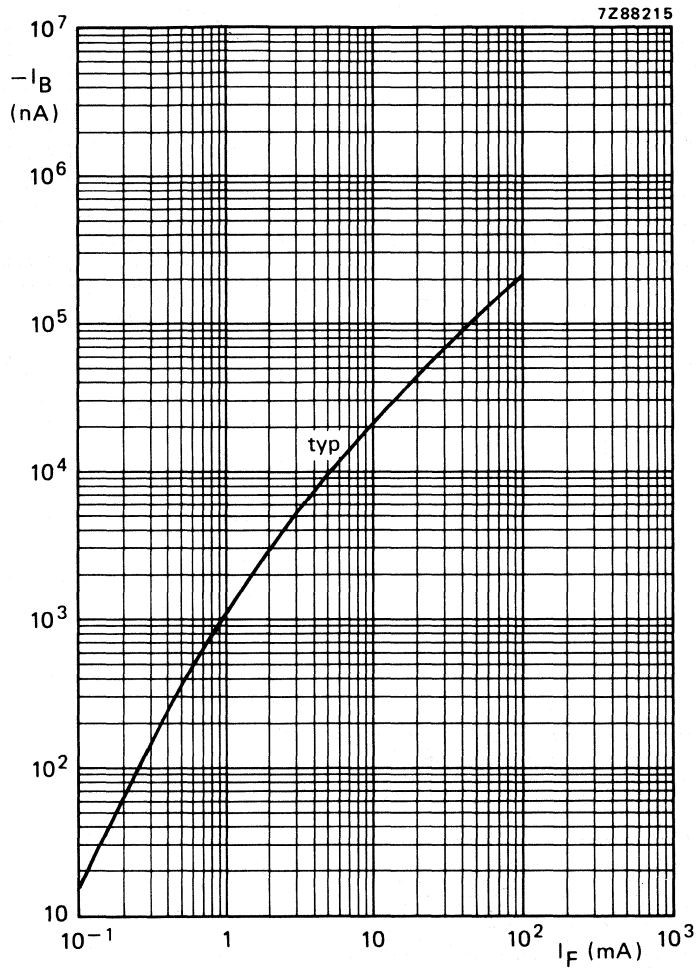


Fig. 17 $I_E = 0$; $V_{CB} = 5$ V; $T_{amb} = 25$ °C.

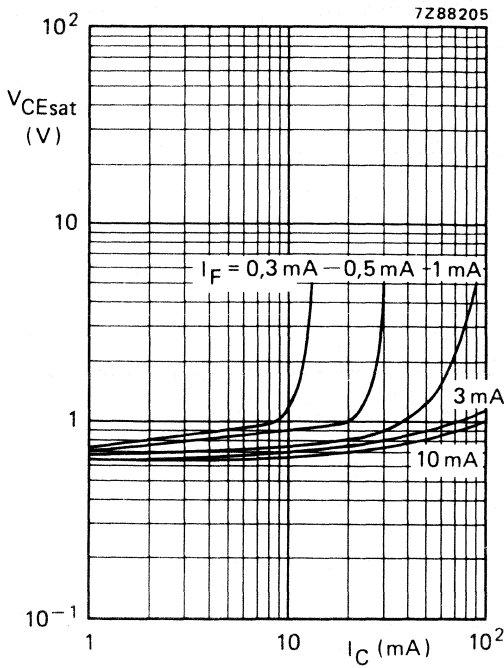


Fig. 18 Typical values; $I_B = 0$; $T_{amb} = 25^\circ C$.

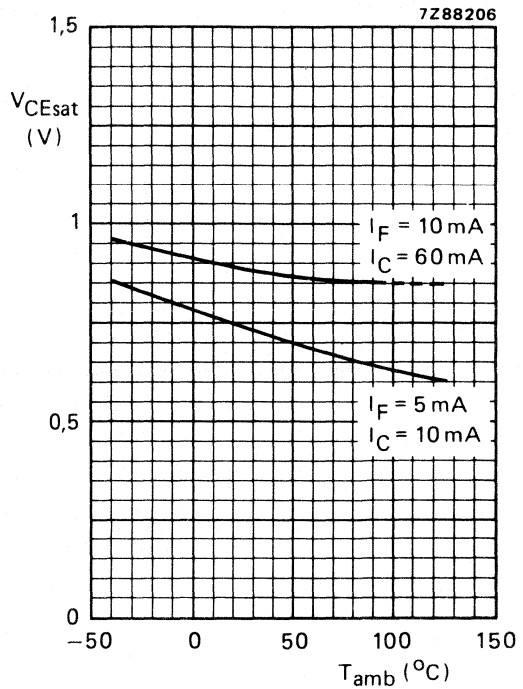


Fig. 19 Typical values; $I_B = 0$.

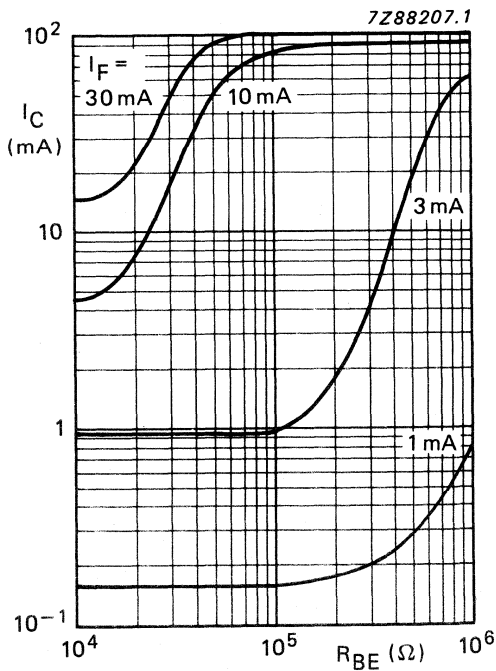


Fig. 20 Typ. values; $V_{CE} = 1$ V; $T_{amb} = 25^\circ C$.

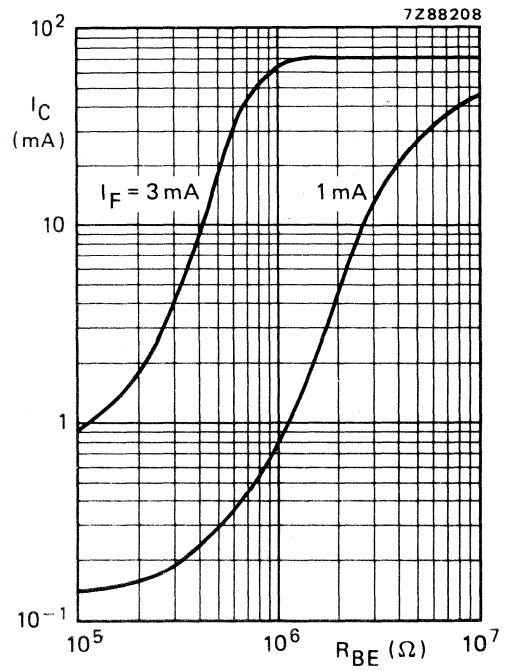


Fig. 21 Typ. values; $V_{CE} = 1$ V; $T_{amb} = 25^\circ C$.

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); $t_p = 10 \mu\text{s}$; $\delta = 0,01$	I_{FRM}	max.	3 A
Total power dissipation up to $T_{amb} = 25 \text{ }^\circ\text{C}$	P_{tot}	max.	200 mW

Transistor

Collector-emitter voltage (open base)	V_{CEO}	max.	30 V
Total power dissipation up to $T_{amb} = 25 \text{ }^\circ\text{C}$	P_{tot}	max.	200 mW

Optocoupler

Output/input DC current transfer ratio (CTR) $I_F = 1 \text{ mA}$; $V_{CE} = 1 \text{ V}$; ($I_B = 0$)	I_C/I_F	min.	5
Collector-cut-off current (dark) $V_{CC} = 10 \text{ V}$; working voltage = 1,5 kV DC diode: $I_F = 0$ (see also Fig. 2)	I_{CEW}	max.	1 μA
Isolation voltage DC AC (RMS value)	V_{IORM}	min.	4,4 kV 3,12 kV

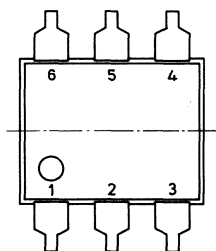
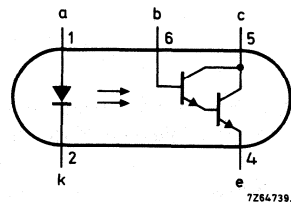
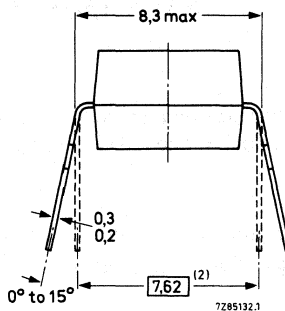
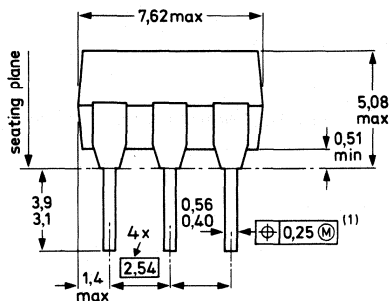
MECHANICAL DATA

SOT90B (see Fig. 1).

MECHANICAL DATA

Fig. 1 SOT90B.

Dimensions in mm



⊕ Positional accuracy.

Ⓜ Maximum material condition.

- (1) Centre-lines of all leads are within $\pm 0,125$ 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); $t_p = 10 \mu s$; $\delta = 0,01$

I_{FRM} max. 3 A

Total power dissipation up to $T_{amb} = 25 \text{ }^\circ\text{C}$

P_{tot} max. 200 mW

Junction temperature

T_j max. 125 $^\circ\text{C}$

Transistor

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

Optocoupler

Storage temperature range	T_{stg}		-55 to + 150 $^\circ\text{C}$
Operating ambient temperature range	T_{amb}		-40 to + 100 $^\circ\text{C}$
Lead soldering temperature up to the seating plane; $t_{sld} < 10 \text{ s}$	T_{sld}	max.	260 $^\circ\text{C}$

THERMAL RESISTANCE

From junction to ambient in free air diode and transistor	$R_{th j-a}$	=	500 K/W
From junction to ambient, device mounted on a printed-circuit board diode and transistor	$R_{th j-a}$	=	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 mm

CHARACTERISTICS

$T_j = 25 \text{ }^\circ\text{C}$ unless otherwise specified

Diode

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

Transistor ($I_F = 0$)

Collector cut-off current (dark)

$V_{CE} = 10\text{ V}$

I_{CEO}	typ.	20 nA
	max.	100 nA

$V_{CB} = 10\text{ V}$

I_{CEO}	max.	20 nA
-----------	------	-------

Collector-emitter breakdown voltage

at $I_C = 1\text{ mA}$

$V_{(BR)CEO}$	min.	30 V
---------------	------	------

Collector-base breakdown voltage

at $I_C = 0,1\text{ mA}$

$V_{(BR)CBO}$	min.	30 V
---------------	------	------

Emitter-base breakdown voltage

at $I_E = 0,1\text{ mA}$

$V_{(BR)ECO}$	min.	6 V
---------------	------	-----

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

Output/input DC current transfer ratio (CTR)

$I_F = 0,5\text{ mA}; V_{CE} = 1\text{ V}$

I_C/I_F	min.	3,5
-----------	------	-----

$I_F = 1,0\text{ mA}; V_{CE} = 1\text{ V}$

I_C/I_F	min.	5
-----------	------	---

$I_F = 10\text{ mA}; V_{CE} = 1\text{ V}$

I_C/I_F	min.	6
-----------	------	---

Collector cut-off current (dark); see Fig. 2 (note 2)

$V_{CC} = 10\text{ V};$ working voltage = 1,5 kV DC

I_{CEW}	max.	1 μA
-----------	------	-----------------

$V_{CC} = 10\text{ V};$ working voltage = 1,5 kV DC; $T_j = 70\text{ }^\circ\text{C}$

I_{CEW}	max.	1000 μA
-----------	------	--------------------

Collector-emitter saturation voltage

$I_F = 5\text{ mA}; I_C = 10\text{ mA}$

V_{CEsat}	max.	1 V
-------------	------	-----

Isolation voltage (note 3)

$t = 1\text{ min}$

DC

V_{IORM}	min.	4,4 kV
------------	------	--------

AC (RMS value)

		3,12 kV
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Collector capacitance at $f = 1\text{ MHz}$

$I_E = I_e = 0; V_{CB} = 10\text{ V}$

$C_{b'c}$	typ.	4,5 pF
-----------	------	--------

Capacitance between input and output

$I_F = 0; V = 0; f = 1\text{ MHz}$

C_{io}	typ.	0,6 pF
----------	------	--------

Insulation resistance between input and output

$\pm V_{IO} = 1\text{ kV}$

R_{IO}	min.	10 G Ω
	typ.	1 T Ω

Switching times (see Figs 3 and 4)

$I_{Fon} = 10\text{ mA}; V_{CC} = 5\text{ V}; R_E = 100\text{ }\Omega; R_{BE} = 1\text{ M}\Omega$

t_{on}	typ.	5 μs
----------	------	-----------------

t_{off}	typ.	30 μs
-----------	------	------------------

$I_{Fon} = 1\text{ mA}; V_{CC} = 5\text{ V}; R_E = 1\text{ k}\Omega; R_{BE} = 10\text{ M}\Omega$

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.

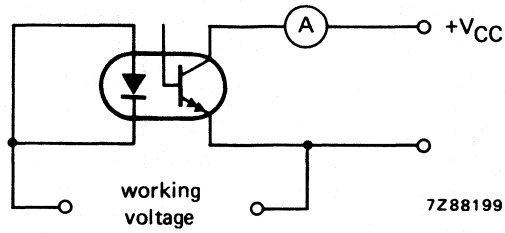


Fig. 2.

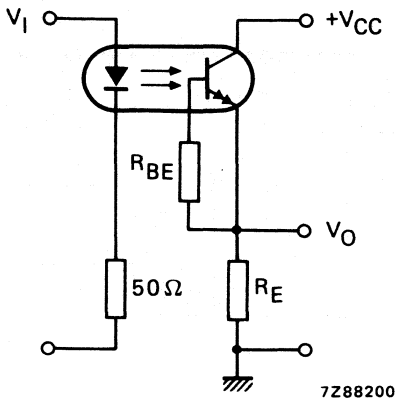
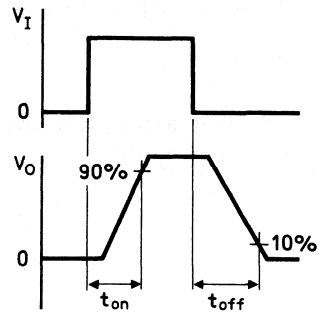


Fig. 3 Switching circuit.



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Fig. 4 Waveforms.

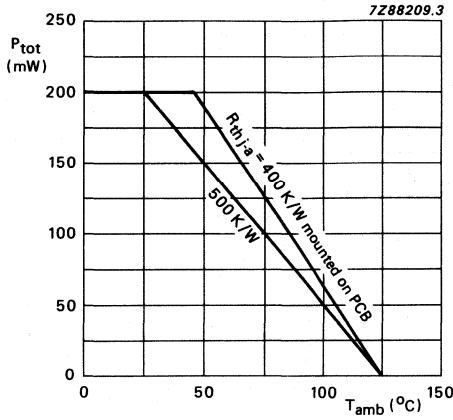


Fig. 5 Power derating curve for diode and transistor as a function of temperature.

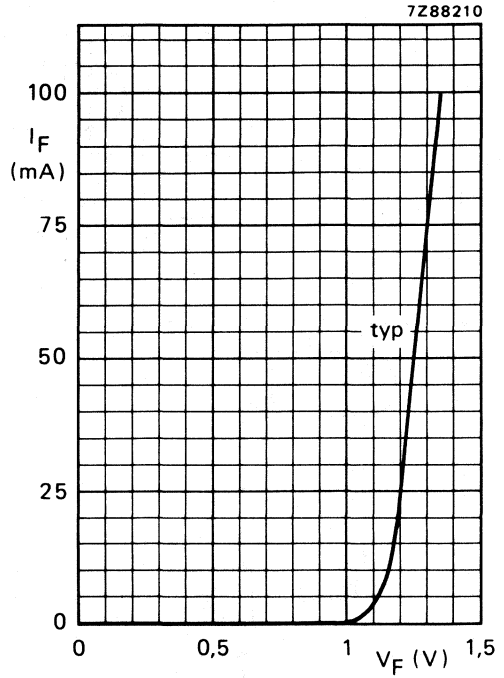


Fig. 6 $T_{amb} = 25\text{ }^{\circ}\text{C}$.

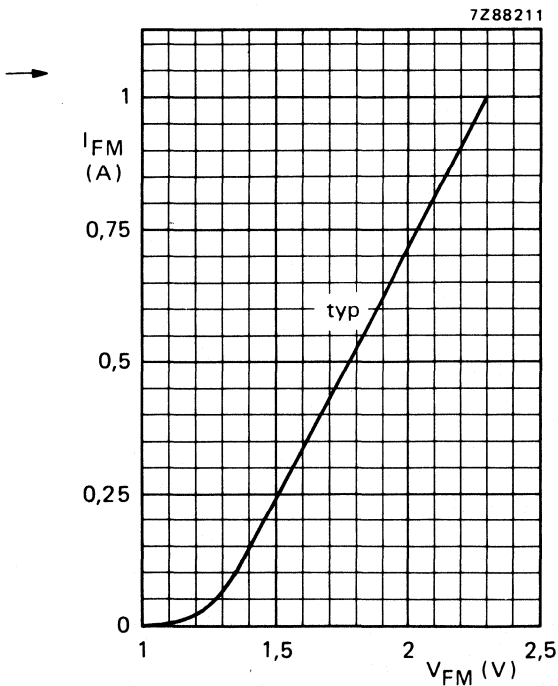


Fig. 7 $T_{amb} = 25\text{ }^{\circ}\text{C}$; $t_p = 10\text{ }\mu\text{s}$; $\delta = 0,01$.

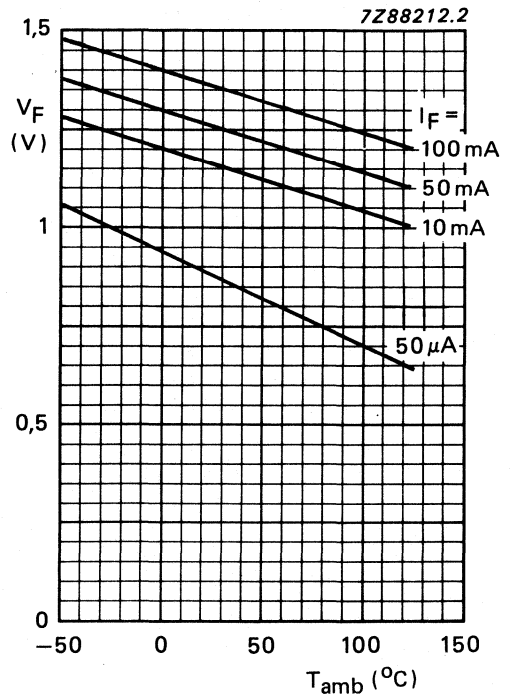


Fig. 8 Typical values.

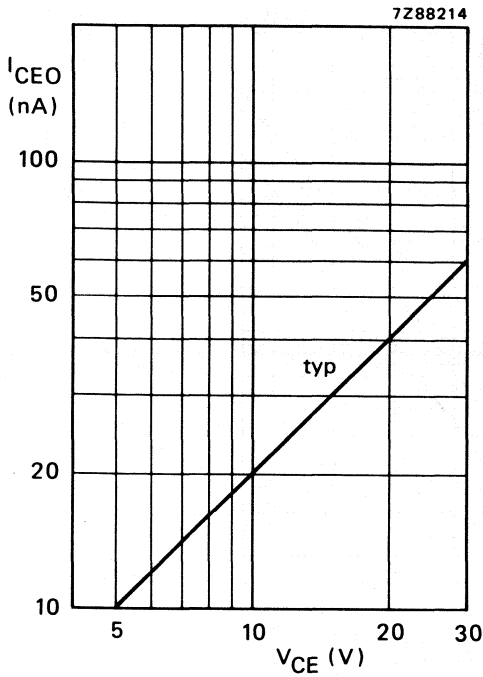


Fig. 9 $I_F = 0$; $T_j = 25^\circ\text{C}$.

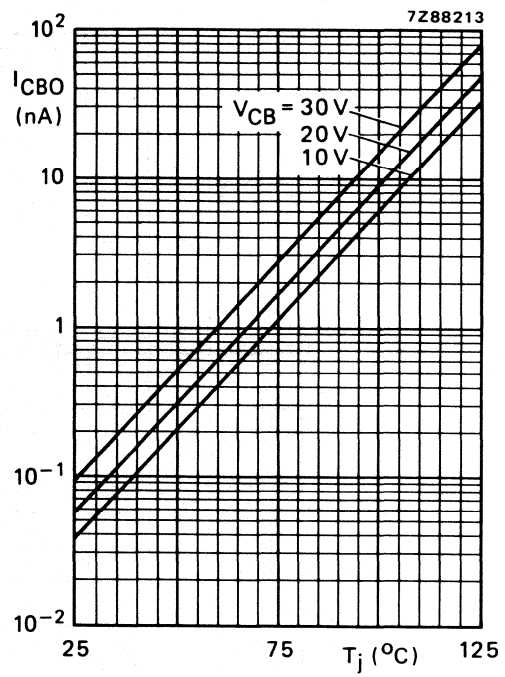


Fig. 10 Typical values.

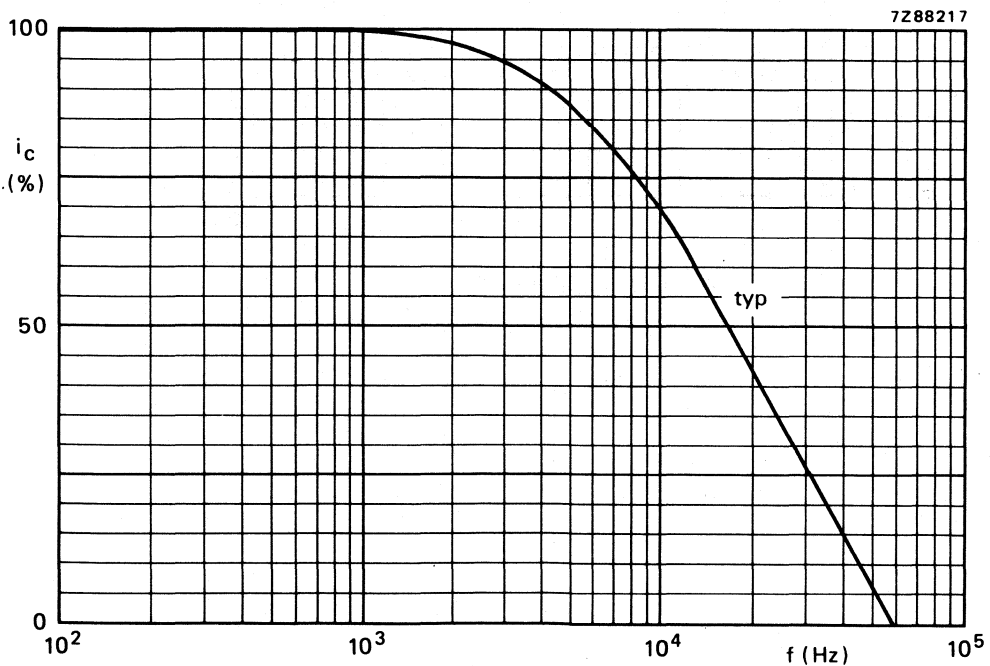


Fig. 11 $I_C = 10\text{ mA}$; $V_{CC} = 5\text{ V}$; $R_E = 100\ \Omega$; $R_{BE} = 1\ \text{M}\Omega$; see also Fig. 3.

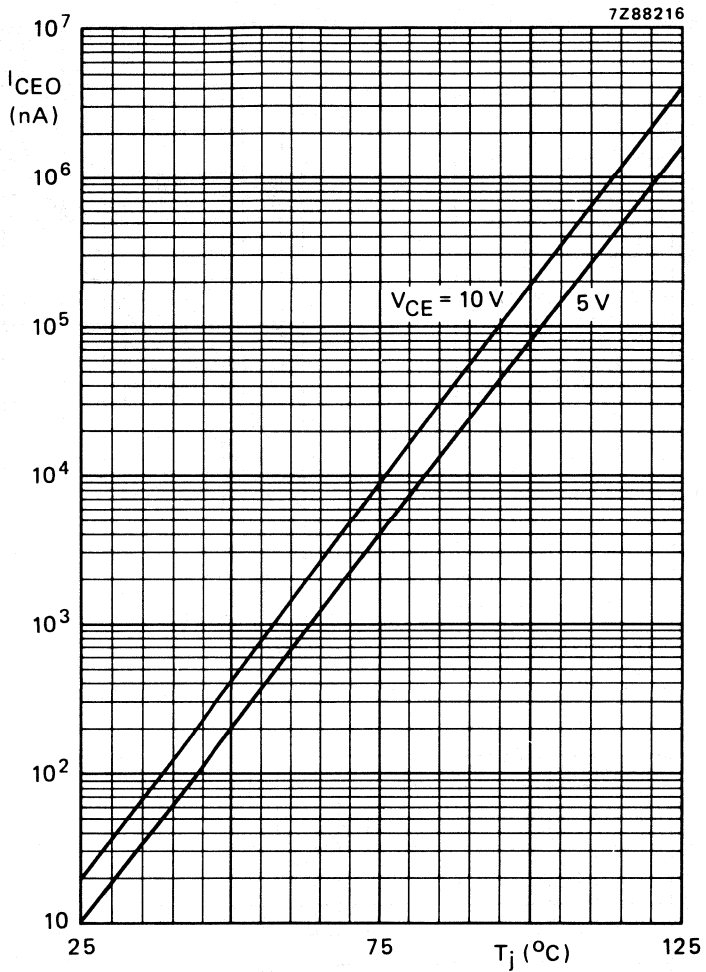


Fig. 12 $I_F = 0$; typical values.

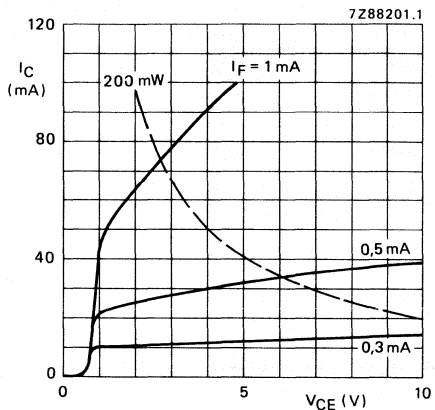


Fig. 13 Typical values; $T_{amb} = 25\text{ }^\circ\text{C}$.

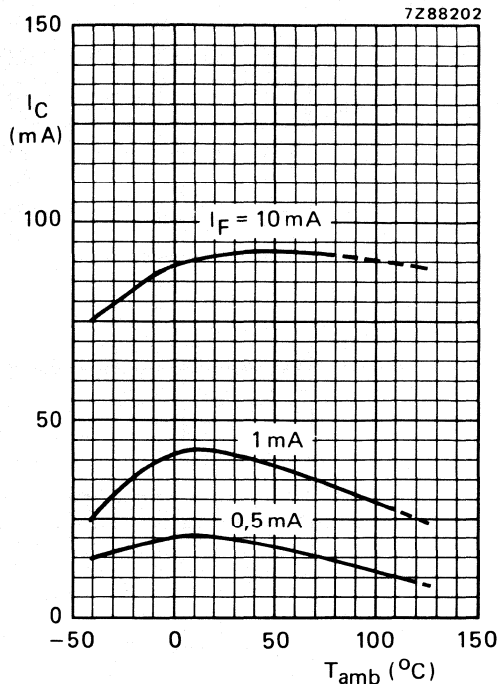


Fig. 14 Typical values; $I_B = 0$; $V_{CE} = 1\text{ V}$.

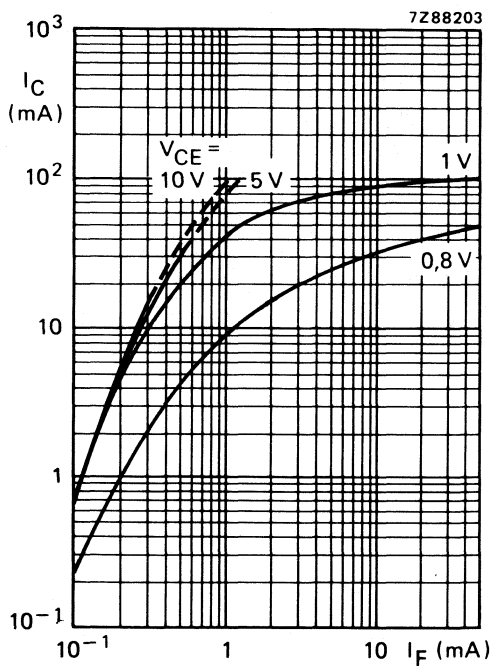


Fig. 15 Typical values; $I_B = 0$; $T_{amb} = 25\text{ }^\circ\text{C}$.

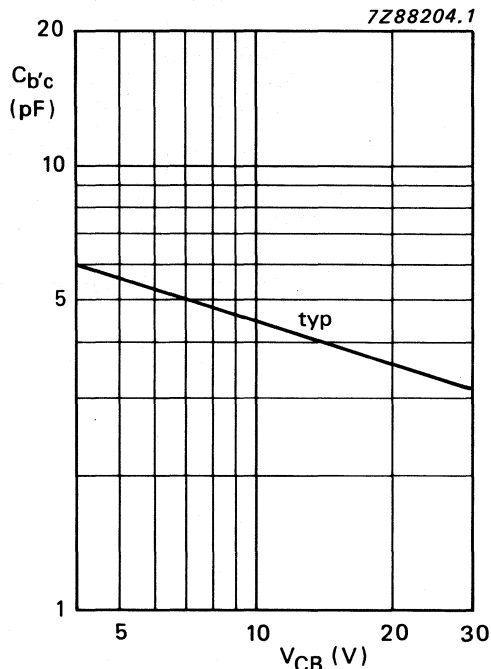


Fig. 16 $I_E = I_e = 0$; $f = 1\text{ MHz}$; $T_{amb} = 25\text{ }^\circ\text{C}$.

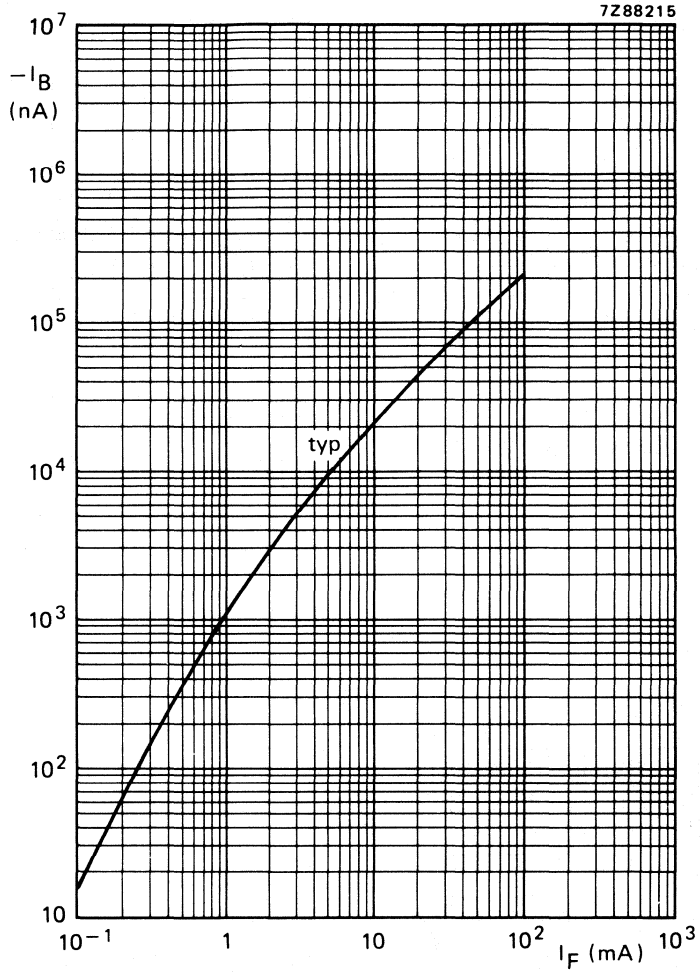


Fig. 17 $I_E = 0$; $V_{CB} = 5$ V; $T_{amb} = 25$ °C.

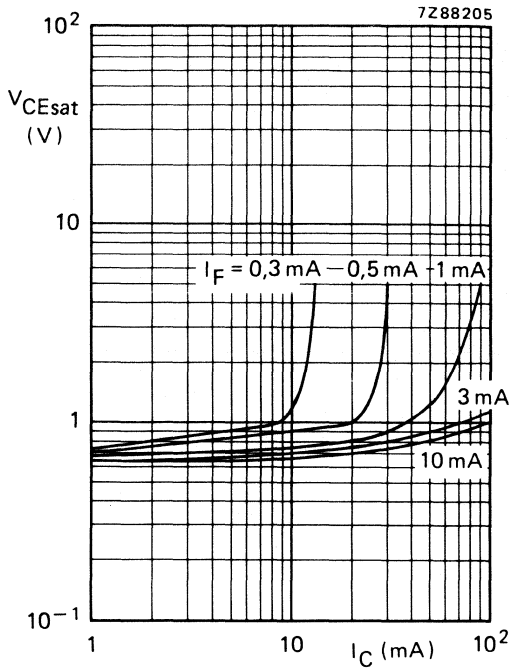


Fig. 18 Typical values; $I_B = 0$; $T_{amb} = 25^\circ C$.

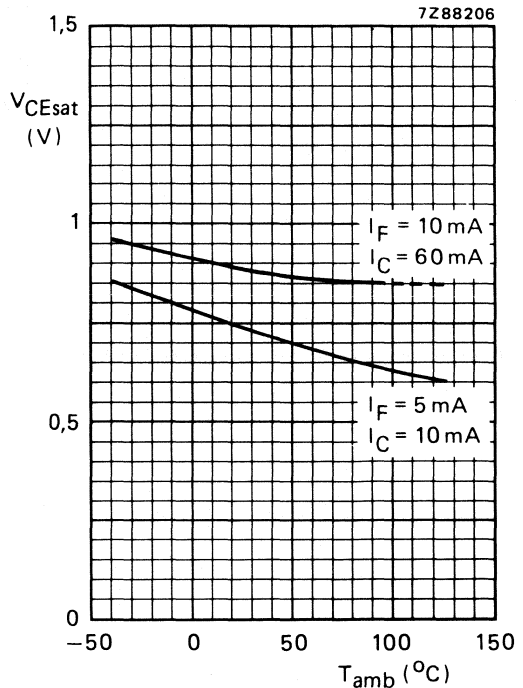


Fig. 19 Typical values; $I_B = 0$.

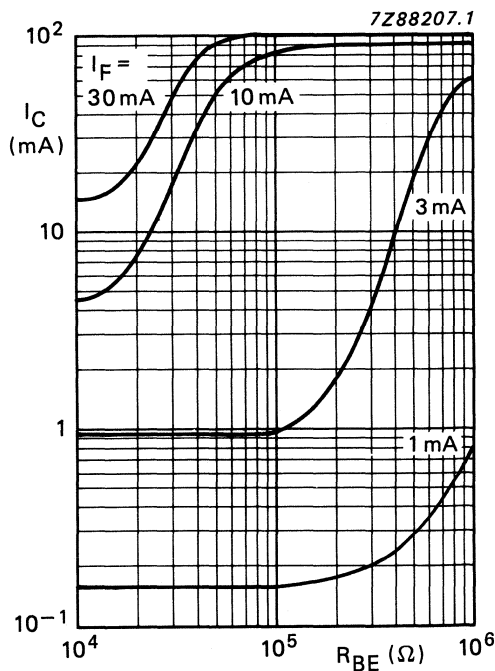


Fig. 20 Typ. values; $V_{CE} = 1$ V; $T_{amb} = 25^\circ C$.

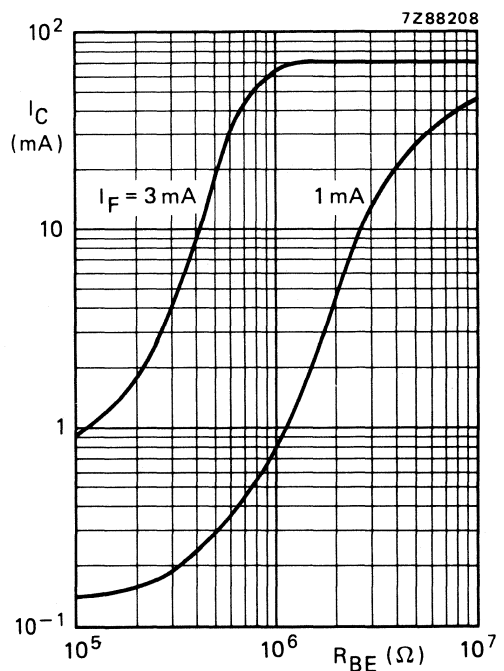


Fig. 21 Typ. values; $V_{CE} = 1$ V; $T_{amb} = 25^\circ C$.

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; $t_{ON} = 10 \mu s$; $\delta = 0.01$	I_{FRM}	max.	3 A
Total power dissipation up to $T_{amb} = 25 \text{ }^\circ\text{C}$	P_{tot}	max.	200 mW

Transistor

Collector-emitter voltage (open base)	V_{CEO}	max.	50 V
Total power dissipation up to $T_{amb} = 25 \text{ }^\circ\text{C}$	P_{tot}	max.	200 mW

Optocoupler

Output/input DC current transfer ratio (CTR) $I_F = 10 \text{ mA}$; $V_{CE} = 0.4 \text{ V}$	I_C/I_F	min.	0.4
Collector cut-off current (dark) $V_{CC} = 10 \text{ V}$; working voltage = 2.5 kV DC I_F (diode) = 0 (see Fig.4)	I_{CEW}	max.	200 nA
Collector-emitter saturation voltage $I_F = 10 \text{ mA}$; $I_C = 4 \text{ mA}$	V_{CEsat}	max.	0.4 V
Isolation voltage DC	V_{IORM}	min.	5.3 kV
AC (RMS value)		min.	3.75 kV

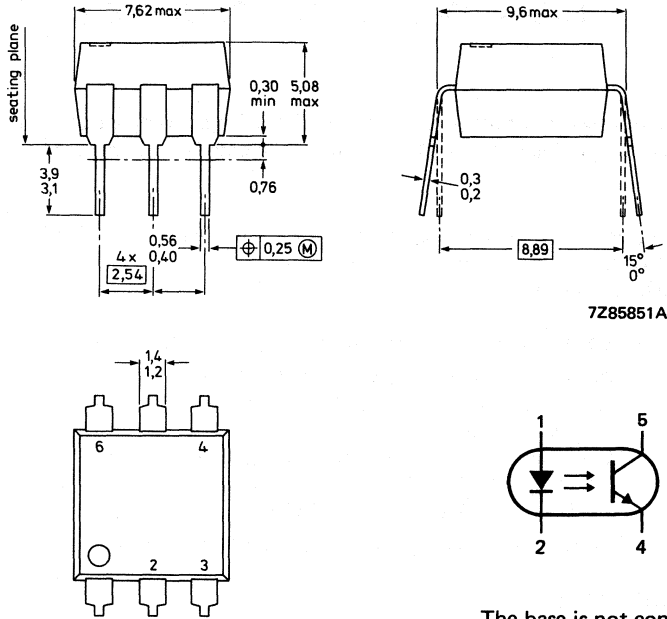
MECHANICAL DATA

SOT174 (see Fig.1).

MECHANICAL DATA

Fig.1 SOT174.

Dimensions in mm



7Z85851A

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; $t_{on} = 10 \mu s$; $\delta = 0.01$	I_{FRM}	max.	3 A
Total power dissipation up to $T_{amb} = 25 \text{ }^\circ\text{C}$ (when mounted on a printed circuit board: $T_{amb} = 45 \text{ }^\circ\text{C}$)	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 $T_{amb} = 25 \text{ }^\circ\text{C}$ (when mounted on a printed circuit board: $T_{amb} = 45 \text{ }^\circ\text{C}$)	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	$R_{th\ j-a}$	=	500 K/W
transistor	$R_{th\ j-a}$	=	500 K/W
From junction to ambient when mounted on PCB			
diode	$R_{th\ j-a}$	=	400 K/W
transistor	$R_{th\ j-a}$	=	400 K/W

ISOLATION RELATED VALUES

External air gap (clearance) input terminals to output terminals	$L(1O1)$	min.	8.4 mm
External tracking path (creepage distance) input terminals to output terminals	$L(1O2)$	min.	7.0 mm
Tracking resistance (KB-value)			KB-100/A
Internal plastic gap (clearance) isolation thickness between emitter and receiver		min.	1 mm

CHARACTERISTICS

$T_j = 25$ °C unless otherwise specified

Diode

Forward voltage $I_F = 10$ mA	V_F	typ. max.	1.15 V 1.50 V
Reverse current $V_R = 5$ V	I_R	max.	10 μ A

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. max.	2 nA 50 nA
$V_{CE} = 10$ V; $T_{amb} = 70$ °C	I_{CEO}	max.	10 μ A

Optocoupler

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) $T_{amb} \leq 70$ °C; $V_F = 0.8$ V; $V_{CE} = 15$ V	$I_{CE(L)}$	max.	15 μ A
$T_{amb} \leq 70$ °C; $I_F = 2$ mA; $V_{CE} = 0.4$ V	$I_{CE(L)}$	min.	150 μ A

Optocoupler (continued)

Collector-emitter saturation voltage

$I_F = 10 \text{ mA}; I_C = 4 \text{ mA}$

V_{CEsat}	typ.	0.19 V
	max.	0.40 V

Collector cut-off current (dark) at working voltage 2.5 kV DC;

$V_{CC} = 10 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$ (see Fig.4 and notes 1 and 2)

$V_{CC} = 10 \text{ V}; T_j = 70 \text{ }^\circ\text{C}$ (see Fig.4 and notes 1 and 2)

I_{CEW}	max.	200 nA
	max.	100 μA

Isolation voltage; $t = 1 \text{ min}$
(see note 3)

DC
AC (RMS value)

V_{IORM}	min.	5.3 kV
	min.	3.75 kV

Capacitance between input and output

$V = 0; f = 1 \text{ MHz}$

C_{io}	typ.	0.6 pF
----------	------	--------

Insulation resistance between input and output

$V_{IO} = \pm 1000 \text{ V}$

R_{IO}	min.	10 G Ω
	typ.	1 T Ω

Switching times (see Figs 2 and 3)

Turn-on time

$I_C = 2 \text{ mA}; V_{CC} = 5 \text{ V}; R_L = 100 \text{ } \Omega$

$I_C = 2 \text{ mA}; V_{CC} = 5 \text{ V}; R_L = 1 \text{ k}\Omega$

t_{on}	typ.	3 μs
	typ.	12 μs

Turn-off time

$I_C = 2 \text{ mA}; V_{CC} = 5 \text{ V}; R_L = 100 \text{ } \Omega$

$I_C = 2 \text{ mA}; V_{CC} = 5 \text{ V}; R_L = 1 \text{ k}\Omega$

t_{off}	typ.	3 μs
	typ.	12 μs

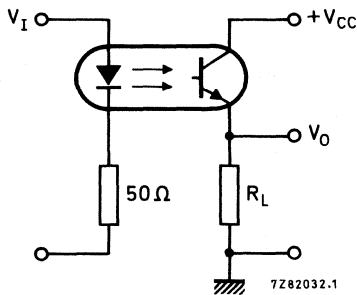


Fig.2 Switching circuit.

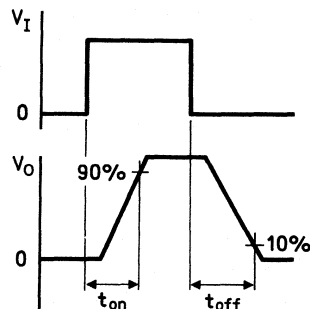


Fig.3 Waveforms.

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.

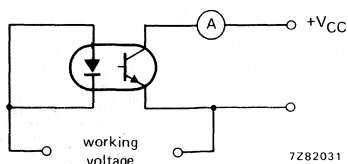


Fig. 4.

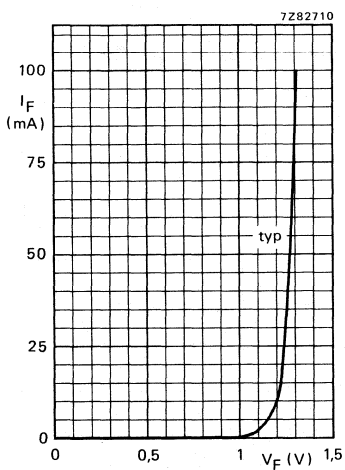


Fig. 5 $T_{amb} = 25\text{ }^\circ\text{C}$.

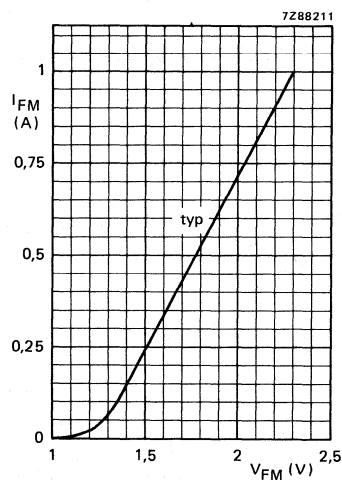


Fig. 6 $T_{amb} = 25\text{ }^\circ\text{C}$; $t_p = 10\text{ }\mu\text{s}$; $\delta = 0.01$.

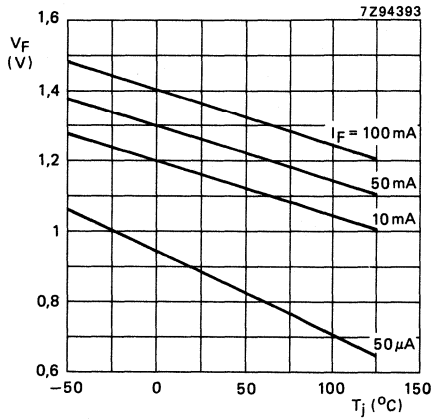


Fig. 7 Typical values.

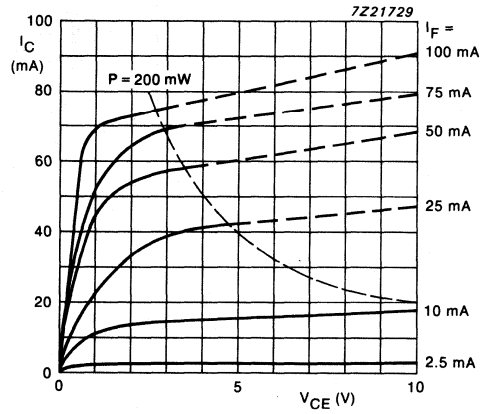


Fig. 8 Typical values; $T_{amb} = 25\ ^{\circ}\text{C}$.

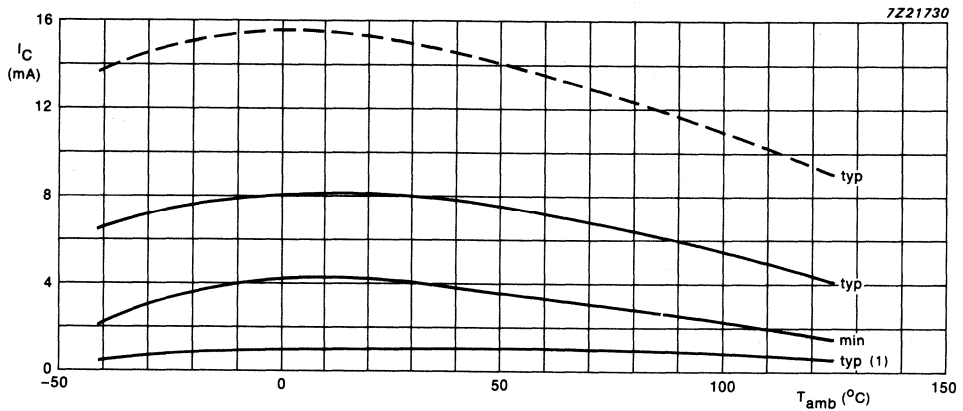


Fig. 9 $I_F = 10\text{ mA}$; — $V_{CE} = 0.4\text{ V}$; - - - $V_{CE} = 5\text{ V}$.

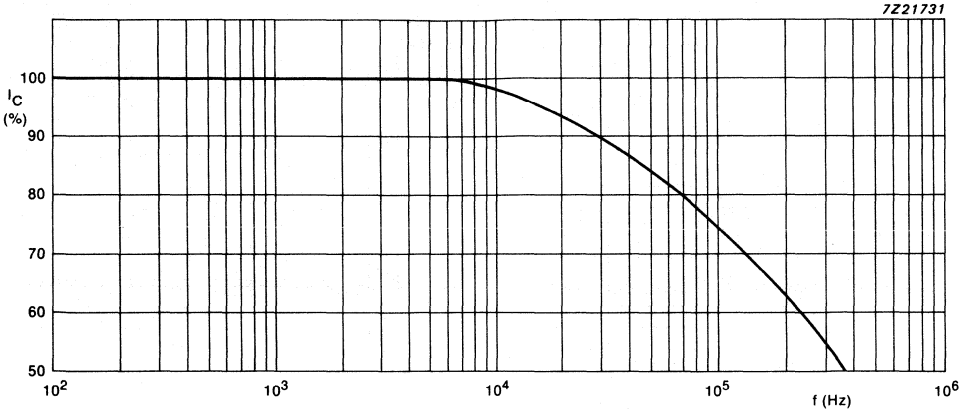


Fig.10 Typical values; R_L = 1 kΩ; I_C = 2 mA; V_{CC} = 5 V; T_{amb} = 25 °C.

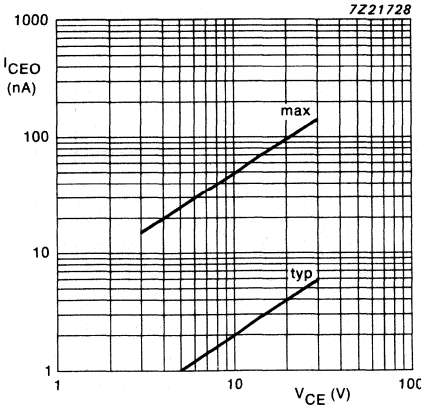


Fig.11 T_j = 25 °C.

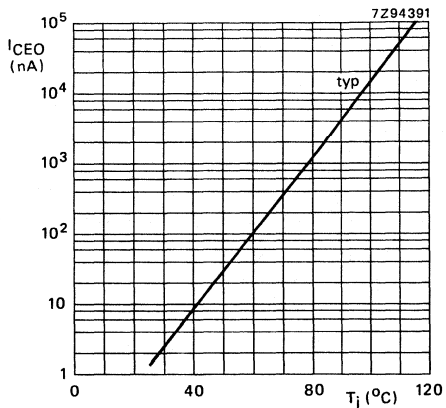


Fig. 12 $V_{CE} = 10$ V.

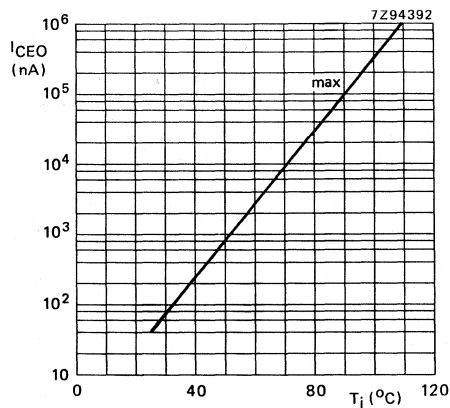


Fig. 13 $V_{CE} = 10$ V.

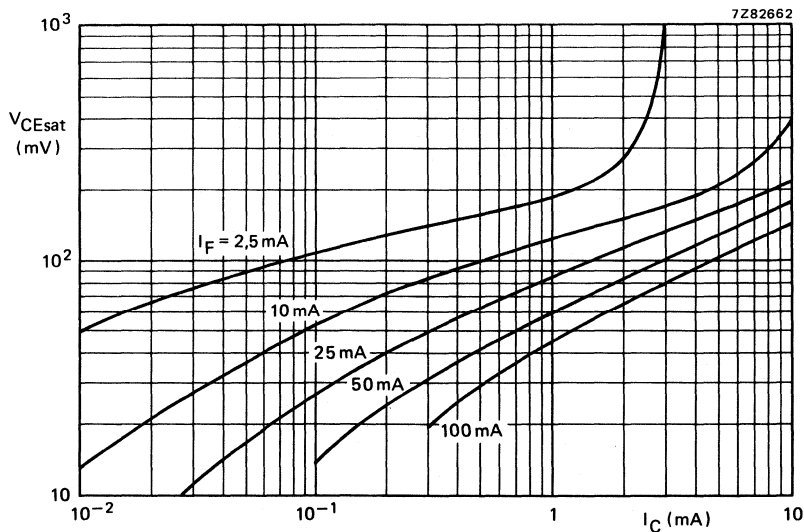


Fig. 14 $T_{amb} = 25$ °C; typical values.

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 $T_{amb} = 25\text{ }^\circ\text{C}$	P_{tot}	max.	200 mW

Transistor

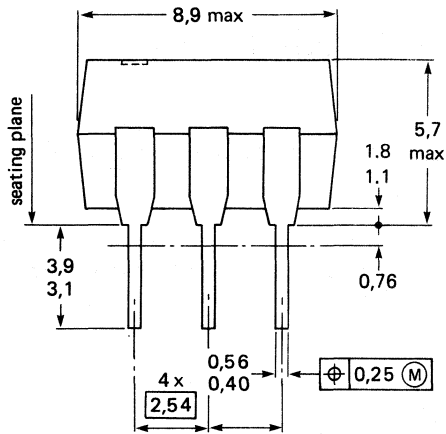
Collector-emitter voltage (open base)	V_{CEO}	max.	50 V
Total power dissipation up to $T_{amb} = 25\text{ }^\circ\text{C}$	P_{tot}	max.	200 mW

Photocoupler

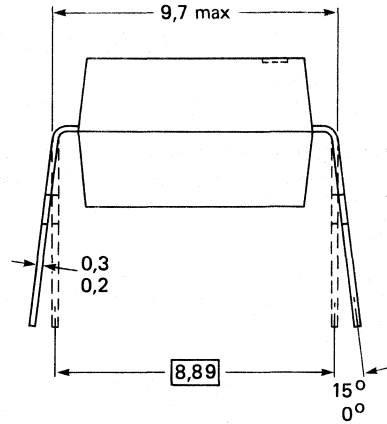
Output/input DC current transfer ratio $I_F = 10\text{ mA}; V_{CE} = 0.4\text{ V}$	I_C/I_F	min.	0.4
Collector cut-off current (dark) $V_{CC} = 10\text{ V};$ working voltage = 2.5 kV DC diode; $I_F = 0$ (see Fig.4)	I_{CEW}	max.	200 nA
Test isolation voltage DC	V_{IORM}	max.	5.3 kV
AC (RMS value)		max.	3.75 kV

MECHANICAL DATA: SOT230 (see Fig.1).

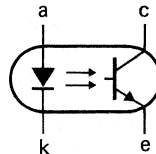
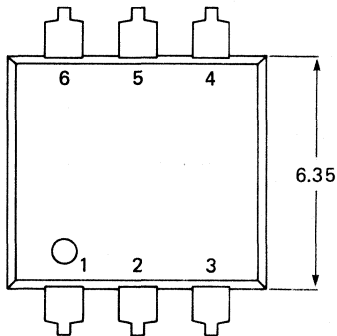
MECHANICAL DATA



Dimensions in mm



7295840



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; $t_{ON} = 10 \mu s$; $\delta = 0.01$

I_{FRM} max. 3.0 A

Total power dissipation up to $T_{amb} = 25^\circ C$

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 $T_{amb} = 25^\circ C$

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	$R_{th\ j-a}$	=	500 K/W
transistor	$R_{th\ j-a}$	=	500 K/W
From junction to ambient when mounted on a PCB diode	$R_{th\ j-a}$	=	400 K/W
transistor	$R_{th\ j-a}$	=	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 μ A

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 μ A

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)

$T_{amb} \leq 70\text{ }^{\circ}\text{C}$; $V_F = 0.8\text{ V}$; $V_{CE} = 15\text{ V}$

$T_{amb} \leq 70\text{ }^{\circ}\text{C}$; $I_F = 2\text{ mA}$; $V_{CE} = 0.4\text{ V}$

Collector-emitter saturation voltage

$I_F = 10\text{ mA}$; $I_C = 4\text{ mA}$

Collector cut-off current (dark) at working voltage $V_W = 2.5\text{ kV}$ (DC value)

$V_{CC} = 10\text{ V}$; $T_j = 25\text{ }^{\circ}\text{C}$ (see notes 1 and 2)

$V_{CC} = 10\text{ V}$; $T_j = 70\text{ }^{\circ}\text{C}$ (see notes 1 and 2)

Test isolation voltage DC

$t = 1\text{ min}$ (see note 3) AC (RMS value)

Capacitance between input and output

$V = 0$; $f = 1\text{ MHz}$

Insulation resistance between input and output

$V_{IO} = \pm 1000\text{ V}$

Switching times (see Figs 3 and 4)

Turn-on time

$I_C = 2\text{ mA}$; $V_{CC} = 5\text{ V}$; $R_L = 100\text{ }\Omega$

$I_C = 2\text{ mA}$; $V_{CC} = 5\text{ V}$; $R_L = 1\text{ k}\Omega$

Turn-off time

$I_C = 2\text{ mA}$; $V_{CC} = 5\text{ V}$; $R_L = 100\text{ }\Omega$

$I_C = 2\text{ mA}$; $V_{CC} = 5\text{ V}$; $R_L = 1\text{ k}\Omega$

$I_{CE(L)}$ max. 15 μA

$I_{CE(L)}$ min. 150 μA

V_{CEsat} typ. 0.19 V
max. 0.40 V

I_{CEW} max. 200 nA

max. 100 μA

V_{IORM} max. 5.3 kV
max. 3.75 kV

C_{io} typ. 0.4 pF

R_{IO} min. 10 G Ω
typ. 1 T Ω

t_{on} typ. 3.0 μs

typ. 12 μs

t_{off} typ. 3.0 μs

typ. 12 μs

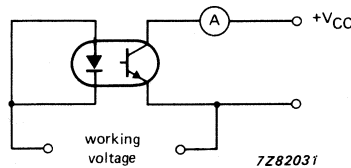


Fig. 2 Test circuit.

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.

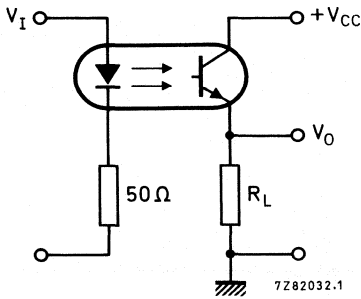


Fig. 3 Switching circuit.

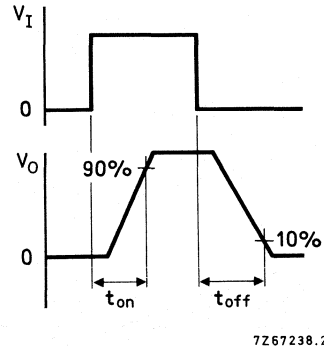


Fig. 4 Waveforms.

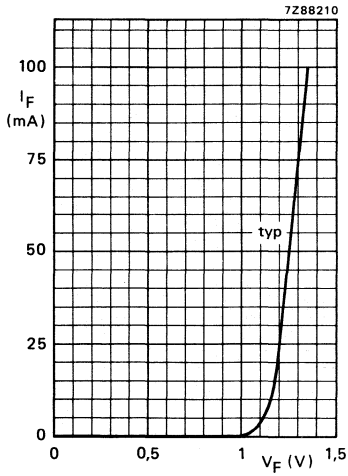


Fig. 5 Typical forward current as a function of forward voltage; $T_{amb} = 25\text{ °C}$.

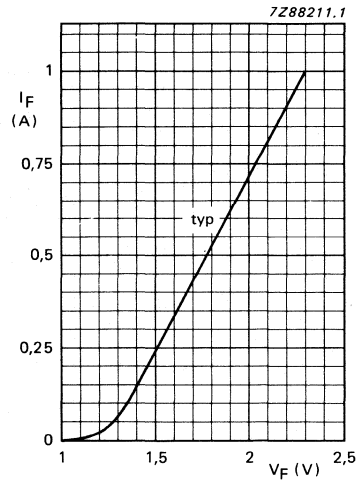


Fig. 6 Typical forward current as a function of forward voltage; $T_{amb} = 25\text{ °C}$; $t_p = 20\text{ μs}$; $\delta = 0.01$.

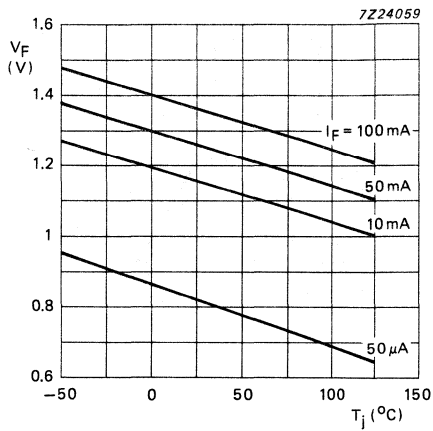


Fig. 7 Typical forward voltage as a function of junction temperature.

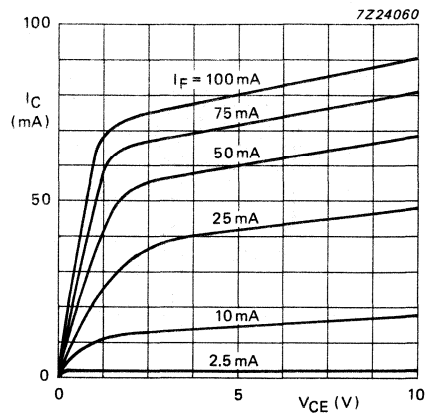


Fig. 8 Typical collector current as a function of collector-emitter voltage; $T_{amb} = 25\text{ }^{\circ}\text{C}$.

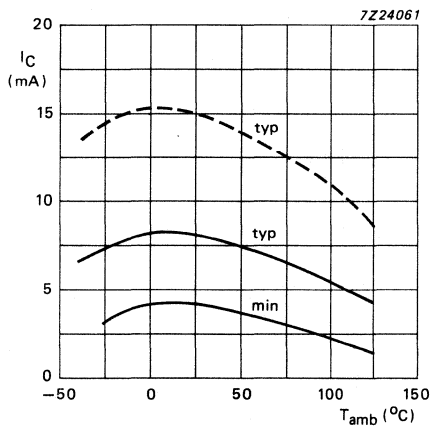


Fig. 9 Collector current as a function of ambient temperature; $I_F = 10\text{ mA}$.
 - - - ($V_{CE} = 5\text{ V}$)
 — ($V_{CE} = 0.4\text{ V}$).

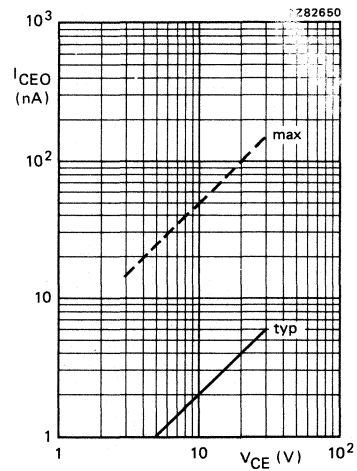


Fig. 10 Collector-emitter dark current as a function of collector-emitter voltage; $T_{amb} = 25\text{ }^{\circ}\text{C}$.

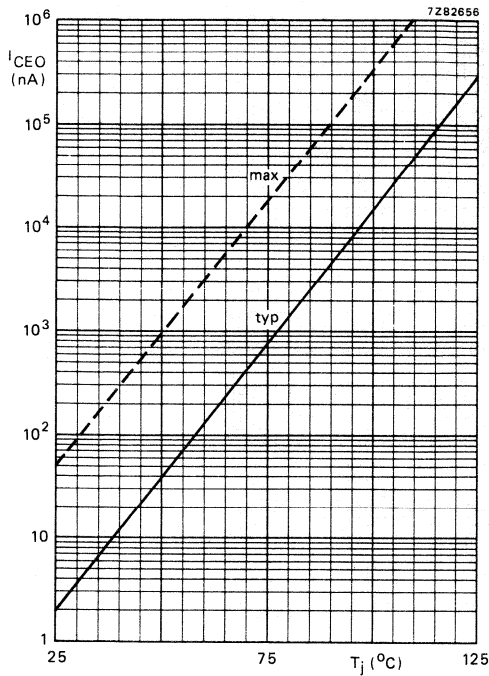


Fig. 11 Collector-emitter dark current as a function of junction temperature.

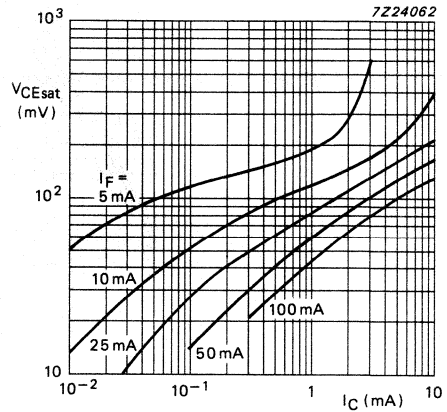


Fig. 12 Typical collector-emitter voltage as a function of collector current; $T_{amb} = 25^{\circ}C$.

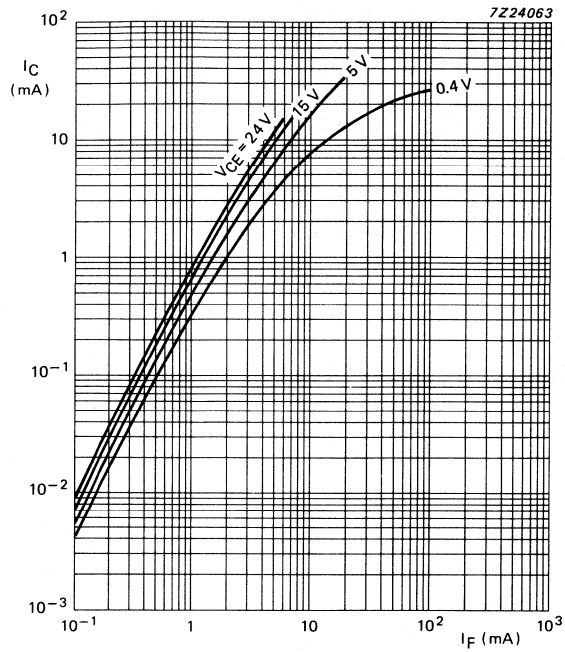


Fig. 13 Typical collector current as a function of forward current; $T_{amb} = 25^\circ\text{C}$.

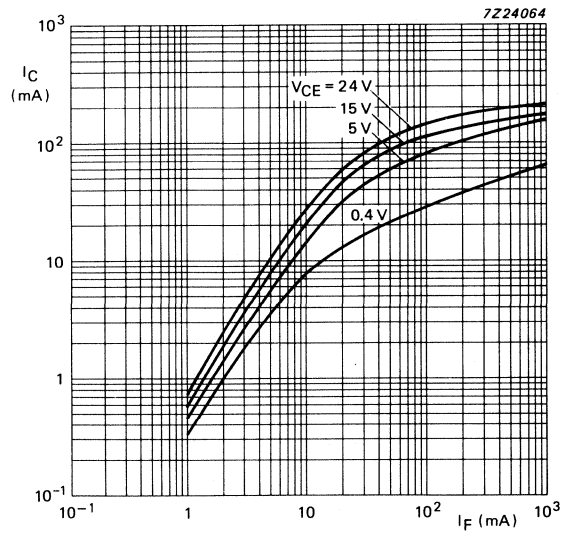


Fig. 14 Typical collector current as a function of forward current; $T_{amb} = 25^\circ\text{C}$; $t_p = 10 \mu\text{s}$; $\delta = 0.01$.

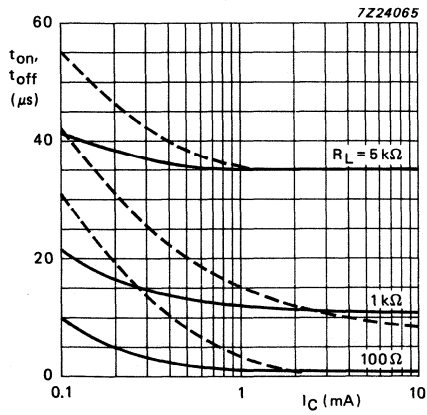


Fig. 15 Typical turn-on and turn-off times as a function of collector current; $T_{amb} = 25^\circ C$.
 --- (t_{off});
 — (t_{on}).

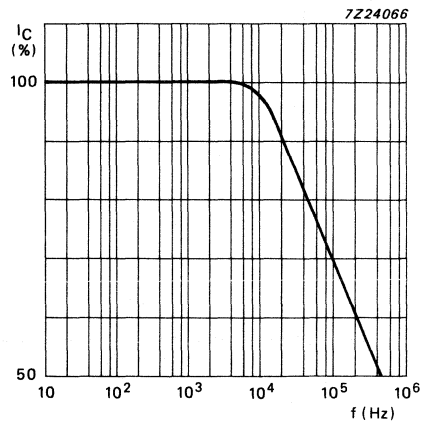


Fig. 16 Relative collector current as a function of frequency; $T_{amb} = 25^\circ C$; $I_C = 2$ mA; $V_{CC} = 5$ V.

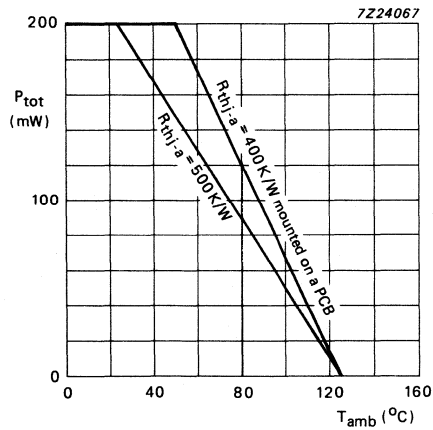


Fig. 17 Total power dissipation as a function of ambient temperature.

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; $t_{on} = 10 \mu s$; $\delta = 0.01$	I_{FRM}	max.	3.0 A
Total power dissipation up to $T_{amb} = 25 \text{ }^\circ\text{C}$ 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 $T_{amb} = 25 \text{ }^\circ\text{C}$ when mounted on a PCB	P_{tot}	max.	200 mW

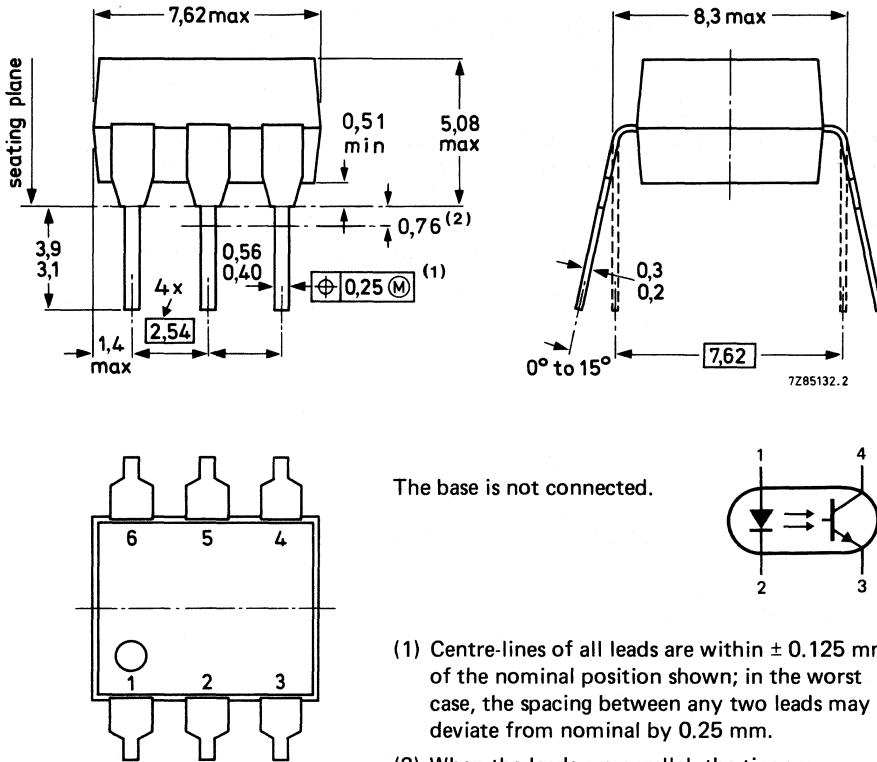
Optocoupler

Output/input DC current transfer ratio (CTR) $I_F = 10 \text{ mA}$; $V_{CE} = 0.4 \text{ V}$	I_C/I_F	min.	0.4
Collector cut-off current (dark) $V_{CC} = 10 \text{ V}$; working voltage = 2.5 kV DC I_F (diode) = 0 (see Fig. 4)	I_{CEW}	max.	200 nA
Collector-emitter saturation voltage $I_F = 10 \text{ mA}$; $I_C = 4 \text{ mA}$	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; $t_{on} = 10 \mu s$; $\delta = 0.01$	I_{FRM}	max.	3.0 A
Total power dissipation up to $T_{amb} = 25^\circ C$ 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 $T_{amb} = 25^\circ C$ 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	$R_{th\ j-a}$	=	500 K/W
transistor	$R_{th\ j-a}$	=	500 K/W
From junction to ambient when mounted on a PCB			
diode	$R_{th\ j-a}$	=	400 K/W
transistor	$R_{th\ j-a}$	=	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. max.	1.15 V 1.50 V
Reverse current $V_R = 5$ V	I_R	max.	10 μ A

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 μ A

CHARACTERISTICS (continued)

Optocoupler

Output/input DC current transfer ratio (CTR)

$I_F = 10 \text{ mA}; V_{CE} = 0.4 \text{ V}$

I_C/I_F	min.	0.4
	max.	1.6

$I_F = 10 \text{ mA}; V_{CE} = 10 \text{ V}$

I_C/I_F	min.	0.5
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Collector-emitter saturation voltage

$I_F = 10 \text{ mA}; I_C = 4 \text{ mA}$

V_{CEsat}	typ.	0.19 V
	max.	0.40 V

Collector cut-off current (light) at

$T_{amb} = 0^\circ\text{C to } 70^\circ\text{C}$

$V_F = 0.8 \text{ V}; V_{CE} = 15 \text{ V}$

$I_F = 2 \text{ mA}; V_{CE} = 0.4 \text{ V}$

$I_{CE(L)}$	max.	15 μA
$I_{CE(L)}$	min.	150 μA

Collector cut-off current (dark) at

working voltage $V_W = 2.5 \text{ kV DC};$

$V_{CC} = 10 \text{ V}; T_j = 25^\circ\text{C}$ (see Fig. 4)

$V_{CC} = 10 \text{ V}; T_j = 70^\circ\text{C}$ (see Fig. 4)

I_{CEW}	max.	200 nA
	max.	100 μA

Isolation voltage* DC

$t = 1 \text{ min}$ (see note next page) AC(RMS value)

V_{IORM}	min.	5.3 kV
		3.75 kV

Capacitance between input and output

$V = 0; f = 1 \text{ MHz}$

C_{io}	typ.	0.6 pF
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Insulation resistance between input and output

$V_{IO} = \pm 1000 \text{ V}$

R_{IO}	min.	10 G Ω
	typ.	1 T Ω

Switching times (see Figs 2 and 3)

Turn-on time

$I_F = 10 \text{ mA}; V_{CC} = 10 \text{ V}; R_L = 4.7 \text{ k}\Omega$

t_{on}	max.	20 μs
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Turn-off time

$I_F = 10 \text{ mA}; V_{CC} = 10 \text{ V}; R_L = 4.7 \text{ k}\Omega$

t_{off}	max.	120 μs
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Turn-on time

$I_C = 2 \text{ mA}; V_{CC} = 10 \text{ V}; R_L = 100 \Omega$

t_{on}	max.	20 μs
----------	------	------------------

Turn-off time

$I_C = 2 \text{ mA}; V_{CC} = 10 \text{ V}; R_L = 100 \Omega$

t_{off}	max.	20 μs
-----------	------	------------------

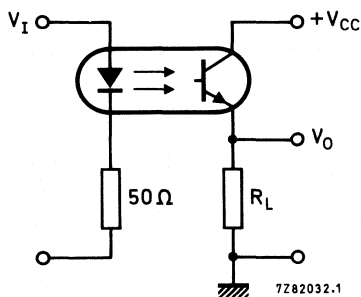


Fig. 2 Switching circuit.

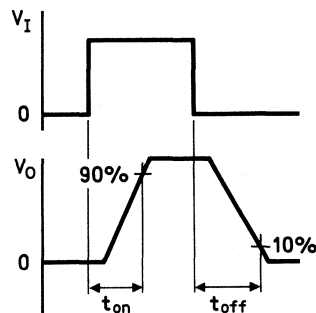


Fig. 3 Waveforms.

* VDE approval for 4.4 kV DC/3.12 kV RMS

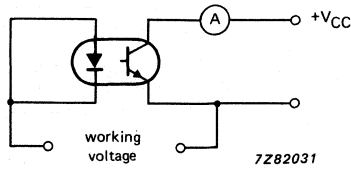


Fig. 4 Test circuit.

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.

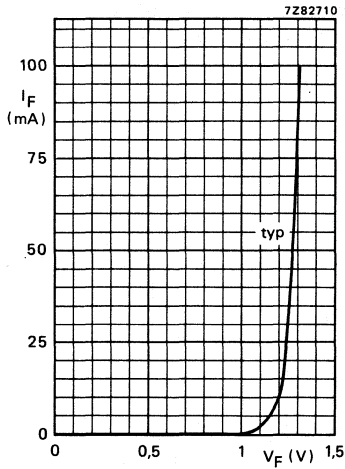


Fig. 5 Forward current as a function of forward voltage; $T_{amb} = 25\text{ }^\circ\text{C}$.

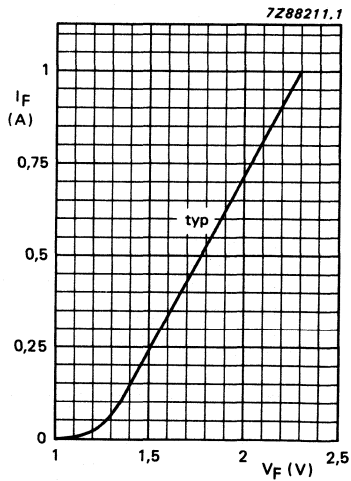


Fig. 6 Forward current as a function of forward voltage (max.); $T_{amb} = 25\text{ }^\circ\text{C}$; $t_p = 10\text{ ms}$; $\delta = 0.01$.

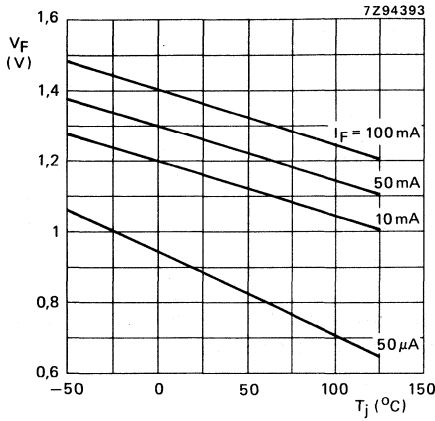


Fig. 7 Forward voltage as a function of temperature; typical values.

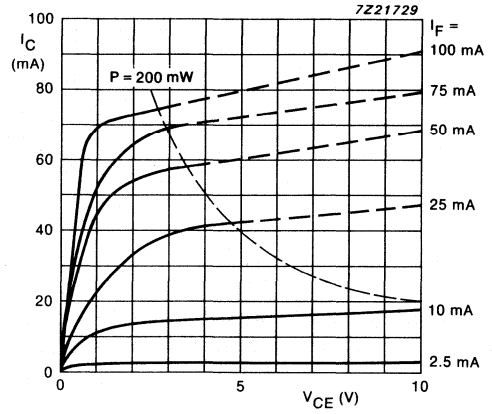


Fig. 8 Collector current as a function of collector-emitter voltage; typical values. $T_{amb} = 25^{\circ}C$.

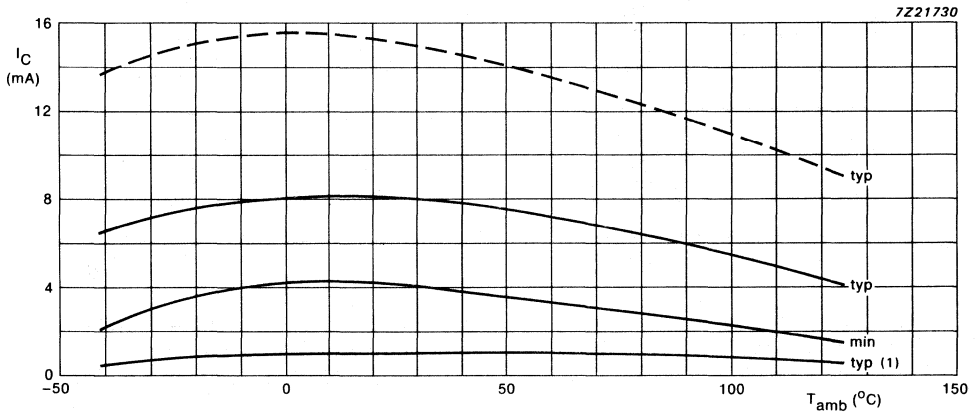


Fig. 9 Collector current as a function of ambient temperature; $I_F = 10$ mA; ——— $V_{CE} = 0.4$ V; - - - - - $V_{CE} = 5$ V.

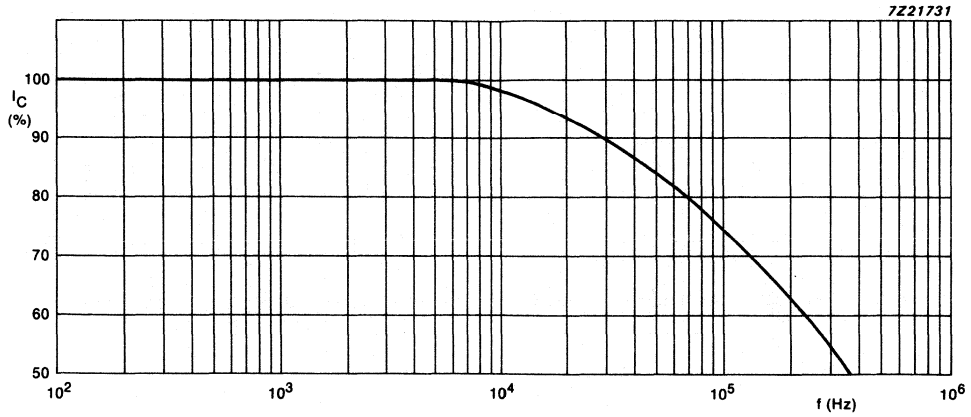


Fig. 10 Collector current as a function of frequency; typical values.
 $R_L = 1 \text{ k}\Omega$; $I_C = 2 \text{ mA}$; $V_{CC} = 5 \text{ V}$; $T_{amb} = 25 \text{ }^\circ\text{C}$.

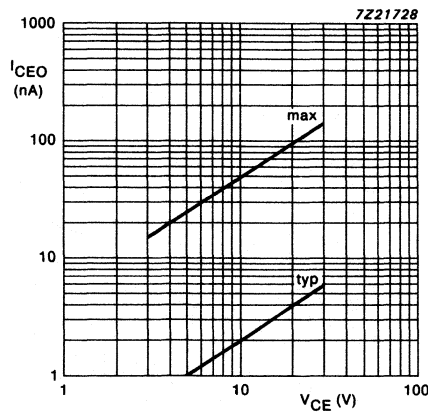


Fig. 11 Collector cut-off current as a function of collector-emitter voltage;
 $T_j = 25 \text{ }^\circ\text{C}$.

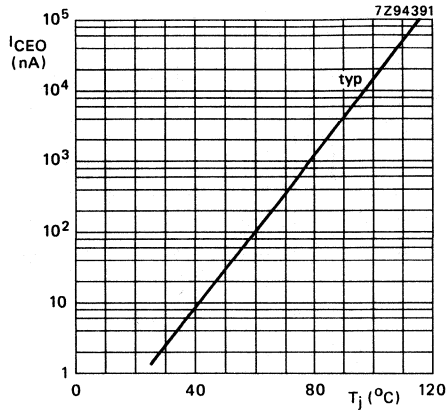


Fig. 12 Collector cut-off current as a function of temperature; $V_{CE} = 10$ V.

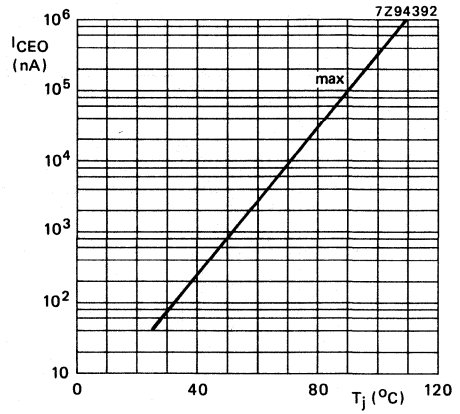


Fig. 13 Collector cut-off current as a function of temperature; $V_{CE} = 10$ V.

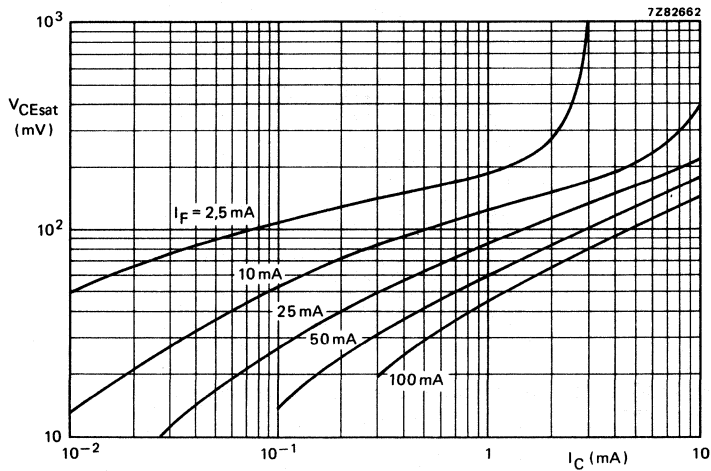


Fig. 14 Collector-emitter saturation voltage as a function of collector current; typical values; $T_{amb} = 25$ °C.

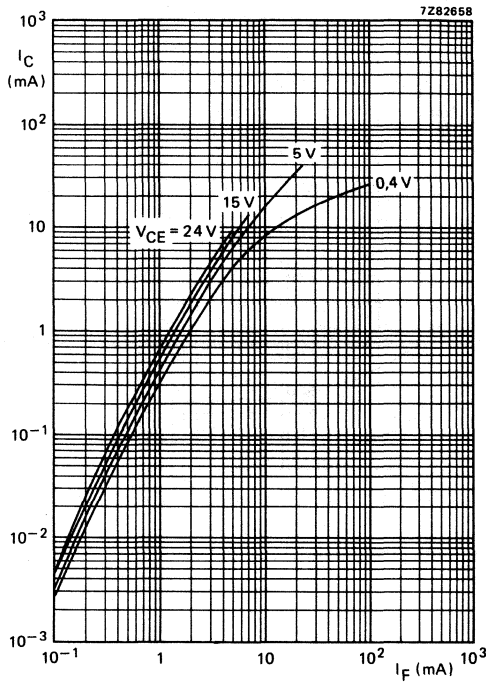


Fig. 15 Collector current as a function of forward current; typical values; $T_{amb} = 25^\circ\text{C}$.

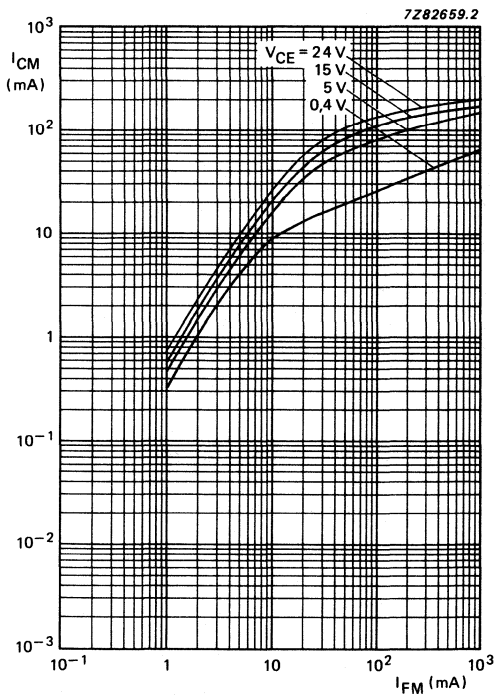


Fig. 16 Collector current as a function of forward current; typical values; $T_{amb} = 25^\circ\text{C}$; $t_p = 10 \mu\text{s}$; $\delta = 0.01$.

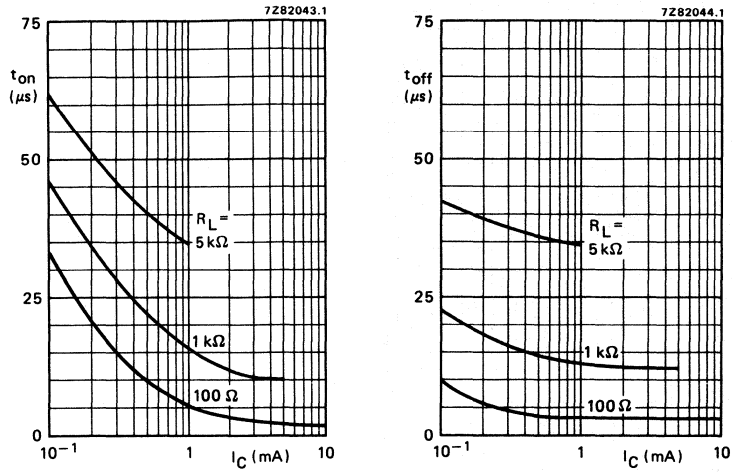


Fig. 17 Switching times as a function of collector current; typical values; $T_{\text{amb}} = 25\text{ }^\circ\text{C}$; $V_{\text{CC}} = 5\text{ V}$.

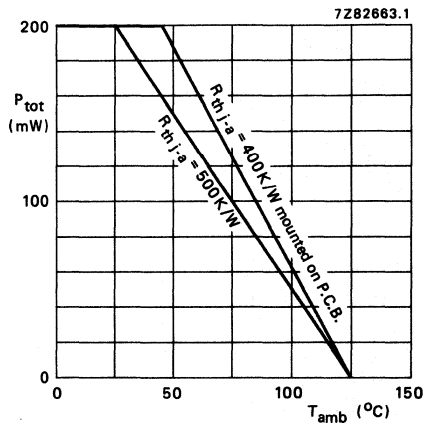


Fig. 18 Total power dissipation as a function of ambient temperature.

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
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Transistor

Collector-emitter voltage (open base)	V_{CEO}	max.	30 V
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Photocoupler

Output/input DC current transfer ratio (CTR)

$I_F = 10 \text{ mA}; V_{CE} = 0.4 \text{ V}$

I_C/I_F	min.	0.4
	max.	1.6

Collector cut-off current (dark)

$V_{CC} = 10 \text{ V}; \text{working voltage} = 2.5 \text{ kV DC}$

I_{CEW}	max.	200 nA
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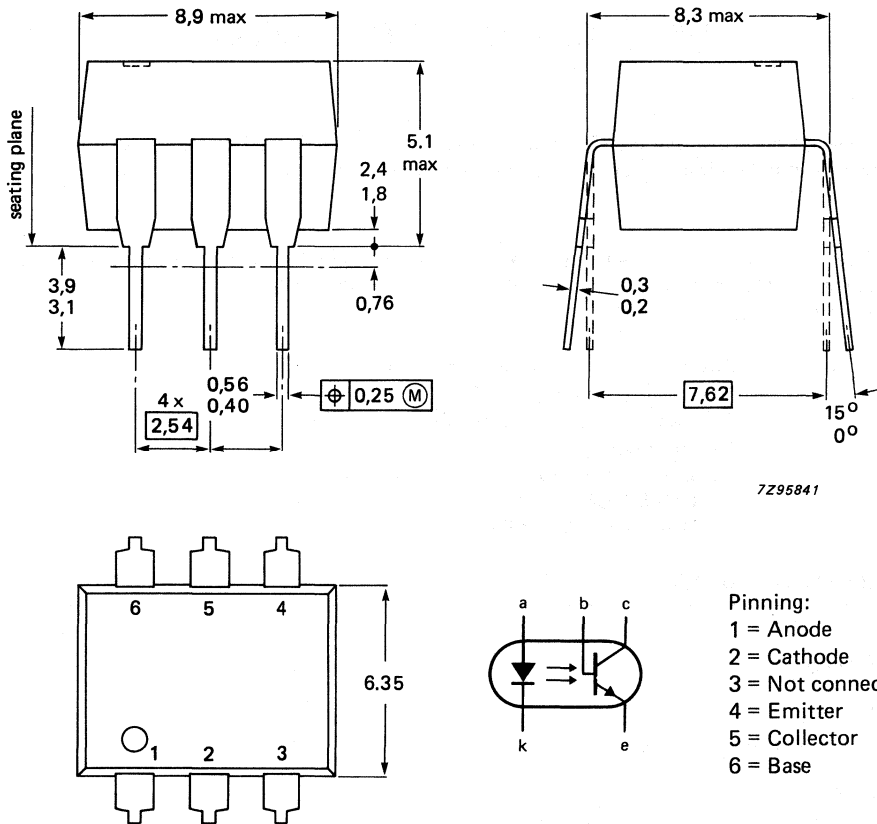
Test isolation voltage DC		max.	5.3 kV
AC (RMS value)	V_{IORM}	max.	3.75 kV

MECHANICAL DATA

SOT229 (see Fig.1).

MECHANICAL DATA

Dimensions in mm



7295841

- 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; $t_{on} = 10 \mu s$; $\delta = 0.01$	I_{FRM}	max.	3.0 A
Total power dissipation up to $T_{amb} = 25 \text{ }^\circ\text{C}$	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 $T_{amb} = 25 \text{ }^\circ\text{C}$	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_{thj-a}	=	500 K/W
transistor	R_{thj-a}	=	500 K/W
From junction to ambient when mounted on a PCB			
diode	R_{thj-a}	=	400 K/W
transistor	R_{thj-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 μ A

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 μ A
$V_{CB} = 10$ V	I_{CBO}	max.	20 nA

CHARACTERISTICS (continued)

Photocoupler

Output/input DC current transfer ratio (CTR) $I_F = 10 \text{ mA}; V_{CE} = 0.4 \text{ V}$	I_C/I_F	min. max.	0.4 1.6
Collector cut-off current (light) $T_{amb} \leq 70 \text{ }^\circ\text{C}; V_F = 0.8 \text{ V}; V_{CE} = 15 \text{ V}$	$I_{CE(L)}$	max.	15 μA
$T_{amb} \leq 70 \text{ }^\circ\text{C}; I_F = 2 \text{ mA}; V_{CE} = 0.4 \text{ V}$	$I_{CE(L)}$	min.	150 μA
Collector-emitter saturation voltage $I_F = 10 \text{ mA}; I_C = 4 \text{ mA}$	V_{CEsat}	typ. max.	0.19 V 0.40 V
Collector cut-off current (dark) at working voltage $V_W = 2.5 \text{ kV DC}$ $V_{CC} = 10 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$ (see notes 1 and 2) $V_{CC} = 10 \text{ V}; T_j = 70 \text{ }^\circ\text{C}$ (see notes 1 and 2)	I_{CEW}	max. max.	200 nA 100 μA
Output capacitance $V_{CB} = 10 \text{ V}; f = 1 \text{ MHz}$	$C_{b'c}$	max.	5.5 pF
Test isolation voltage DC $t = 1 \text{ min}$ (see notes 3 and 4) AC (RMS value)	V_{IORM}	max. max.	5.3 kV 3.75 kV
Capacitance between input and output $V = 0; f = 1 \text{ MHz}$	C_{io}	typ.	0.4 pF
Insulation resistance between input and output $V_{IO} = \pm 1000 \text{ V}$	R_{IO}	min. typ.	10 G Ω 1 T Ω
Switching times (see Figs 3 and 4)			
Turn-on time $I_C = 2 \text{ mA}; V_{CC} = 5 \text{ V}; R_L = 1 \text{ k}\Omega$ $R_{BE} = 56 \text{ k}\Omega$	t_{on}	max.	26 μs
Turn-off time $I_C = 2 \text{ mA}; V_{CC} = 5 \text{ V}; R_L = 1 \text{ k}\Omega$ $R_{BE} = 56 \text{ k}\Omega$	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).

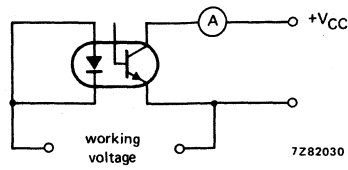


Fig.2 Test circuit.

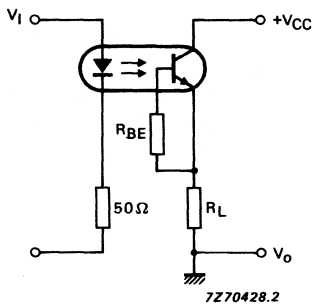


Fig.3 Switching circuit.

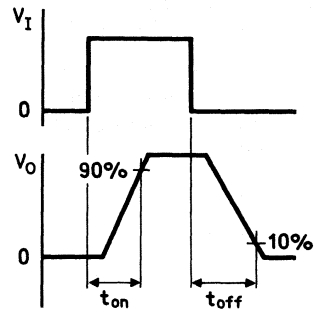


Fig.4 Waveforms.

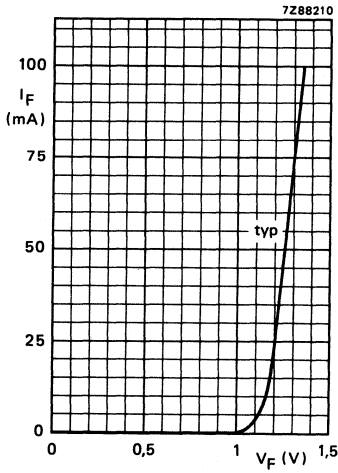


Fig. 5 Typical forward current as a function of forward voltage; $T_{amb} = 25^\circ\text{C}$.

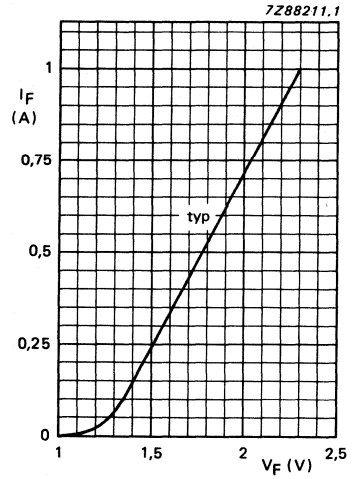


Fig. 6 Typical forward current as a function of forward voltage; $T_{amb} = 25^\circ\text{C}$; $t_p = 20 \mu\text{s}$; $\delta = 0.01$.

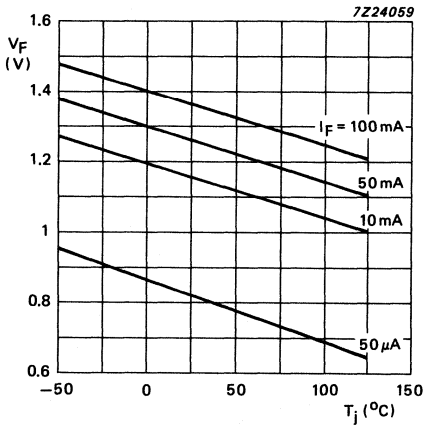


Fig. 7 Typical forward voltage as a function of junction temperature.

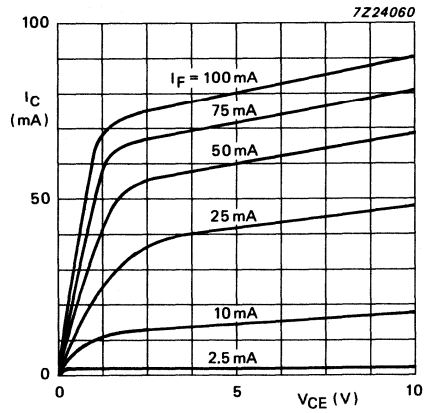


Fig. 8 Typical collector current as a function of collector-emitter voltage; $T_{amb} = 25^\circ\text{C}$.

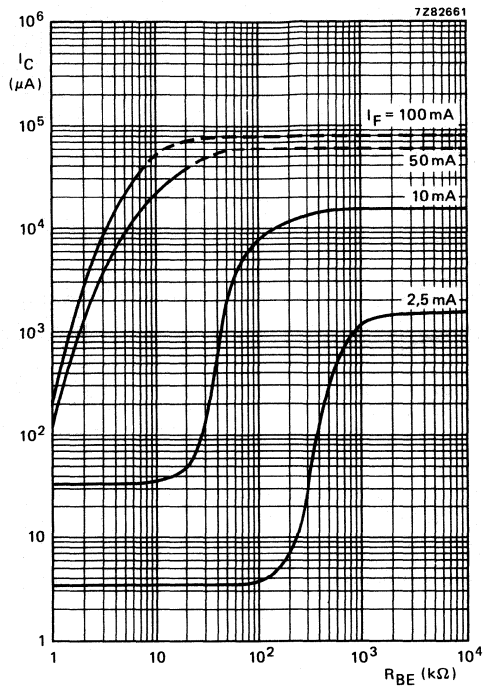
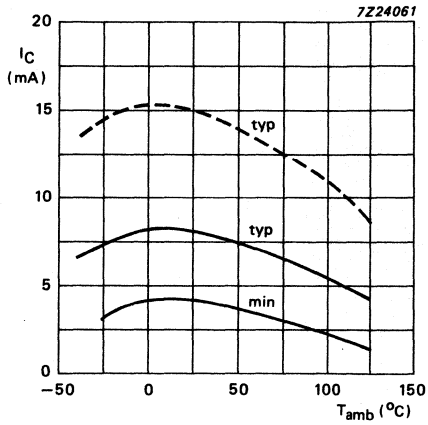


Fig. 9 Collector current as a function of base-emitter resistance; $I_B = 0$; $V_{CE} = 5 \text{ V}$; $T_{amb} = 25 \text{ }^\circ\text{C}$; typical values.



— $I_F = 10 \text{ mA}; V_{CE} = 0.4 \text{ V}$
 - - - $I_F = 10 \text{ mA}; V_{CE} = 5 \text{ V}$

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

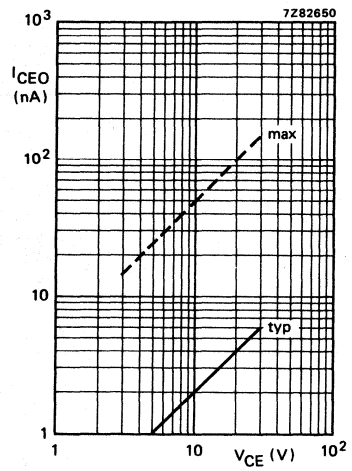


Fig. 11 Collector-emitter dark current as a function of collector-emitter voltage; $T_{amb} = 25 \text{ }^\circ\text{C}$.

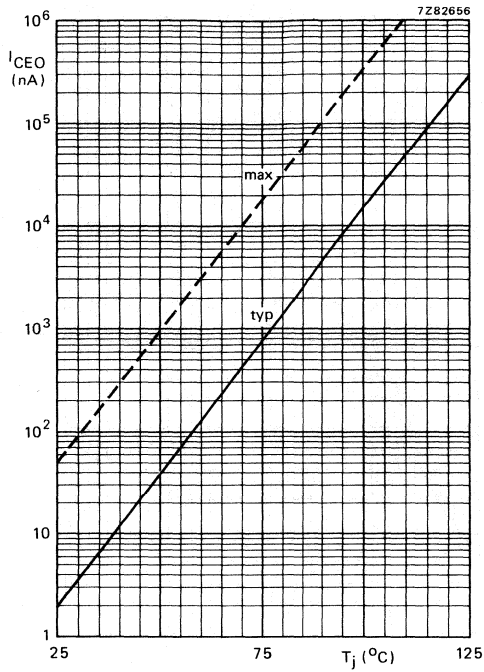


Fig. 12 Collector-emitter dark current as a function of junction temperature.

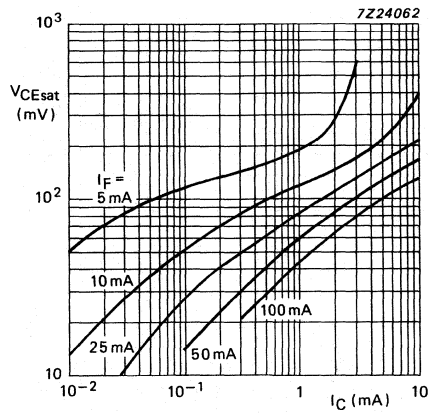


Fig. 13 Typical collector-emitter saturation voltage as a function of collector current; $T_{amb} = 25\text{ }^\circ\text{C}$.

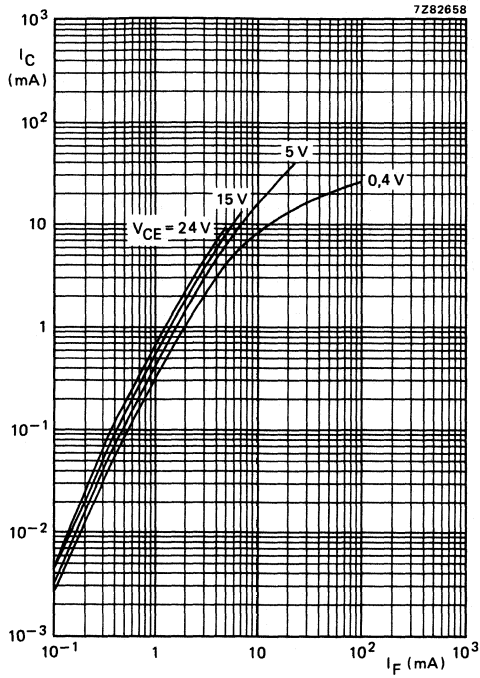


Fig. 14 Typical collector current as a function of forward current; $T_{amb} = 25\text{ }^\circ\text{C}$.

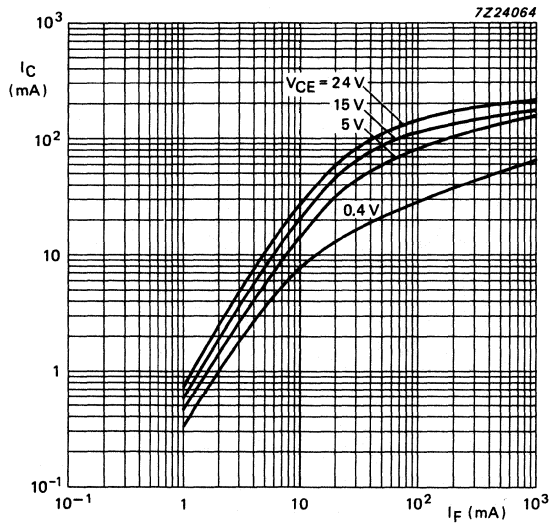


Fig. 15 Typical collector current as a function of forward current; $T_{amb} = 25\text{ }^\circ\text{C}$; $t_p = 10\text{ }\mu\text{s}$; $\delta = 0.01$.

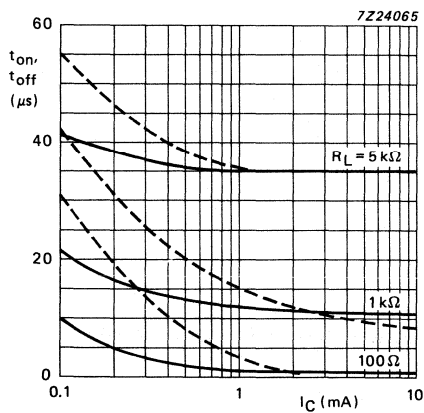


Fig. 16 Typical turn-on and turn-off times as a function of collector current; $T_{amb} = 25\text{ }^\circ\text{C}$.

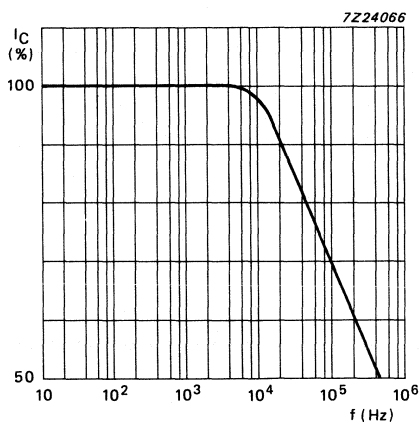


Fig. 17 Relative collector current as a function of frequency; $T_{amb} = 25\text{ }^\circ\text{C}$; $I_C = 2\text{ mA}$; $V_{CC} = 5\text{ V}$.

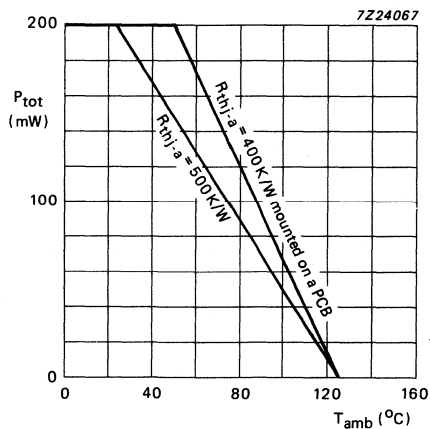


Fig. 18 Total power dissipation as a function of ambient temperature.

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
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Transistor

Collector-emitter voltage (open base)	V_{CEO}	max.	50 V
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Photocoupler

Output/input DC current transfer ratio (CTR)

$$I_F = 10 \text{ mA}; V_{CE} = 0.4 \text{ V}$$

I_C/I_F	min.	0.4
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Collector cut-off current (dark)

$$V_{CC} = 10 \text{ V}; \text{ working voltage} = 2.5 \text{ kV DC}$$

I_{CEW}	max.	200 nA
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Test isolation voltage DC

AC (RMS value)

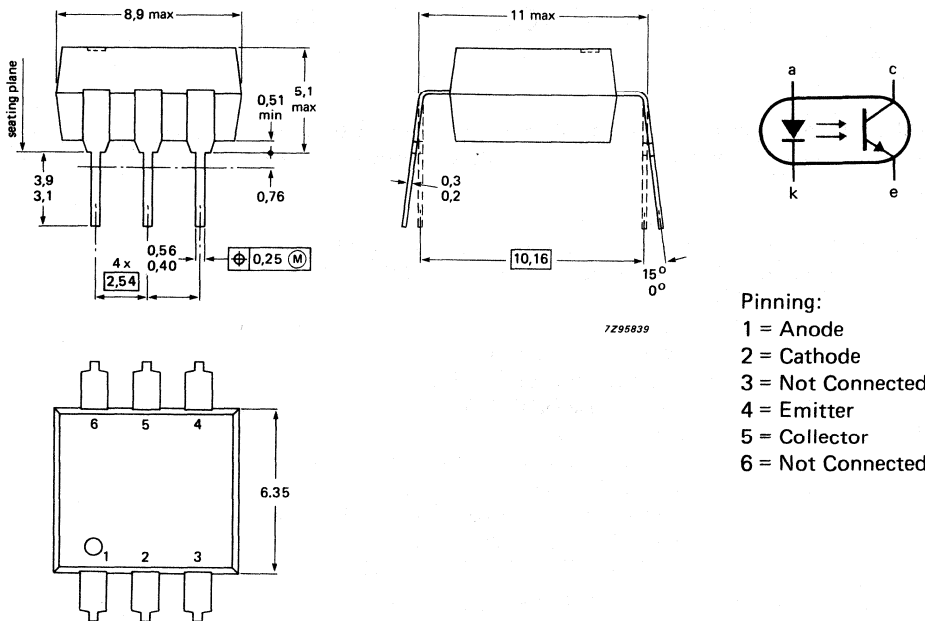
V_{IORM}	max.	5.3 kV
	max.	3.75 kV

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; $t_{on} = 10 \mu s$; $\delta = 0.01$	I_{FRM}	max.	3.0 A
Total power dissipation up to $T_{amb} = 25 \text{ }^\circ\text{C}$	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 $T_{amb} = 25 \text{ }^\circ\text{C}$	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_{thj-a}	=	500 K/W
transistor	R_{thj-a}	=	500 K/W
From junction to ambient when mounted on printed circuit board (PCB) diode	R_{thj-a}	=	400 K/W
transistor	R_{thj-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 V
		max.	1.5 V
Reverse current $V_R = 5$ V	I_R	max.	10 μ A

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 nA
		max.	50 nA
$V_{CE} = 10$ V; $T_{amb} = 70$ °C	I_{CEO}	max.	10 μ A

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)

$T_{amb} \leq 70\text{ }^{\circ}\text{C}; V_F = 0.8\text{ V}; V_{CE} = 15\text{ V}$
 $T_{amb} \leq 70\text{ }^{\circ}\text{C}; I_F = 2\text{ mA}; V_{CE} = 0.4\text{ V}$

$I_{CE(L)}$	max.	15 μA
$I_{CE(L)}$	min.	150 μA

Collector-emitter saturation voltage

$I_F = 10\text{ mA}; I_C = 4\text{ mA}$

V_{CEsat}	typ.	0.19 V
	max.	0.40 V

Collector cut-off current (dark) at

working voltage $V_W = 2.5\text{ kV}$ (DC value);
 $V_{CC} = 10\text{ V}; T_j = 25\text{ }^{\circ}\text{C}$ (see notes 1 and 2)
 $V_{CC} = 10\text{ V}; T_j = 70\text{ }^{\circ}\text{C}$ (see notes 1 and 2)

I_{CEW}	max.	200 nA
	max.	100 μA

Test isolation voltage DC

$t = 1\text{ min}$ (see note 3) AC (RMS value)

V_{IORM}	max.	5.3 kV
	max.	3.75 kV

Capacitance between input and output

$V = 0; f = 1\text{ MHz}$

C_{io}	typ.	0.4 pF
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Insulation resistance between input and output

$V_{IO} = \pm 1000\text{ V}$

R_{IO}	min.	10 G Ω
	typ.	1 T Ω

Switching times (see Figs 3 and 4)

Turn-on time

$I_C = 2\text{ mA}; V_{CC} = 5\text{ V}; R_L = 100\text{ }\Omega$
 $I_C = 2\text{ mA}; V_{CC} = 5\text{ V}; R_L = 1\text{ k}\Omega$

t_{on}	typ.	3.0 μs
	typ.	12 μs

Turn-off time

$I_C = 2\text{ mA}; V_{CC} = 5\text{ V}; R_L = 100\text{ }\Omega$
 $I_C = 2\text{ mA}; V_{CC} = 5\text{ V}; R_L = 1\text{ k}\Omega$

t_{off}	typ.	3.0 μs
	typ.	12 μs

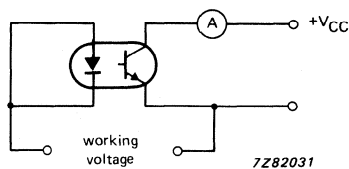


Fig. 2 Test circuit.

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.

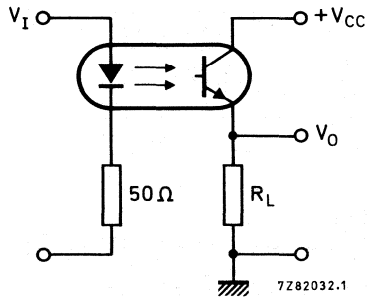


Fig. 3 Switching circuit.

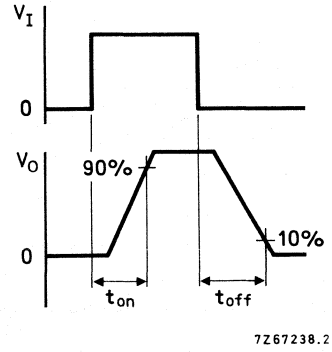


Fig. 4 Waveforms.

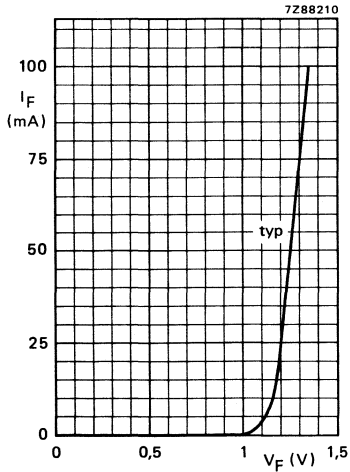


Fig. 5 Typical forward current as a function of forward voltage; $T_{amb} = 25\text{ }^{\circ}\text{C}$.

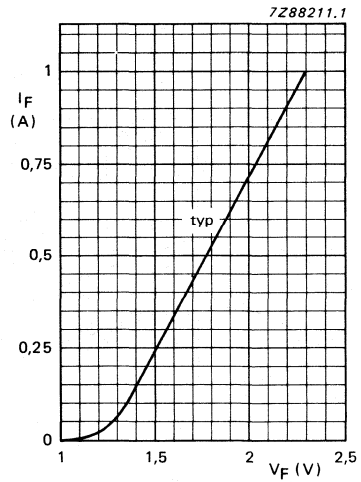


Fig. 6 Typical forward current as a function of forward voltage; $T_{amb} = 25\text{ }^{\circ}\text{C}$; $t_p = 20\text{ }\mu\text{s}$; $\delta = 0.01$.

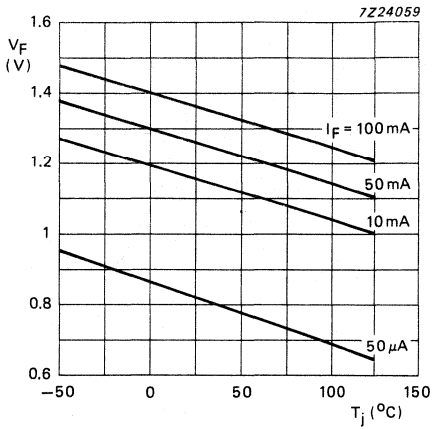


Fig. 7 Typical forward voltage as a function of junction temperature.

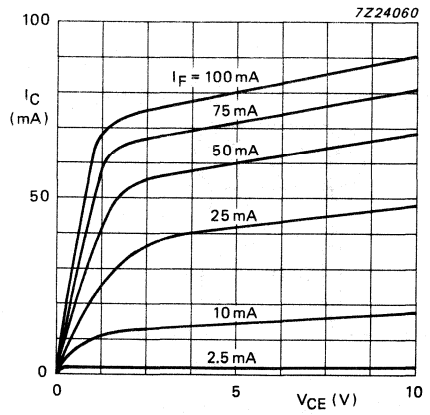
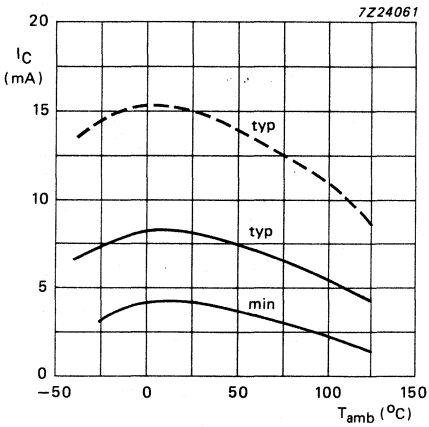


Fig. 8 Typical collector current as a function of collector-emitter voltage; $T_{\text{amb}} = 25^{\circ}\text{C}$.



———— = $I_F = 10\text{ mA}$, $V_{CE} = 0.4\text{ V}$
 - - - - - = $I_F = 10\text{ mA}$; $V_{CE} = 5.0\text{ V}$

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

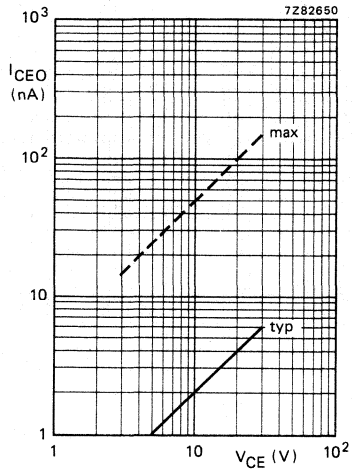


Fig. 10 Collector-emitter dark current as a function of collector-emitter voltage; $T_{amb} = 25\text{ }^{\circ}\text{C}$.

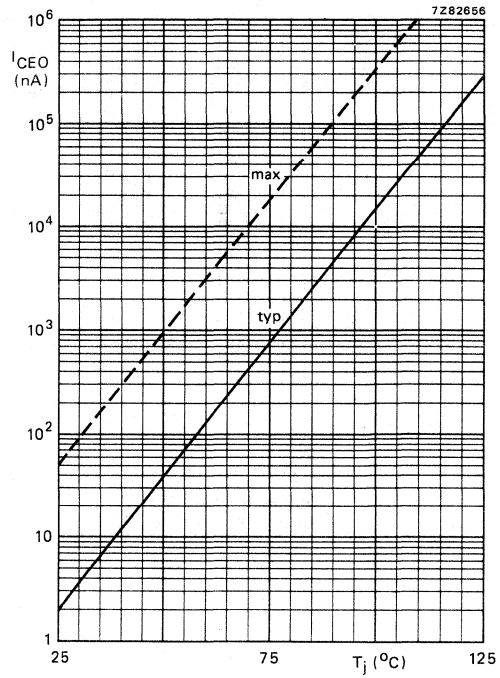


Fig. 11 Collector-emitter dark current as a function of junction temperature.

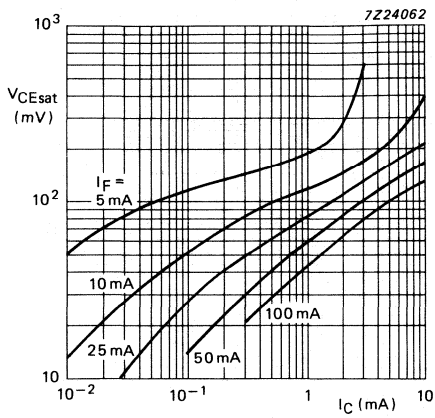


Fig. 12 Typical collector-emitter saturation voltage as a function of collector current; $T_{amb} = 25\text{ }^{\circ}\text{C}$.

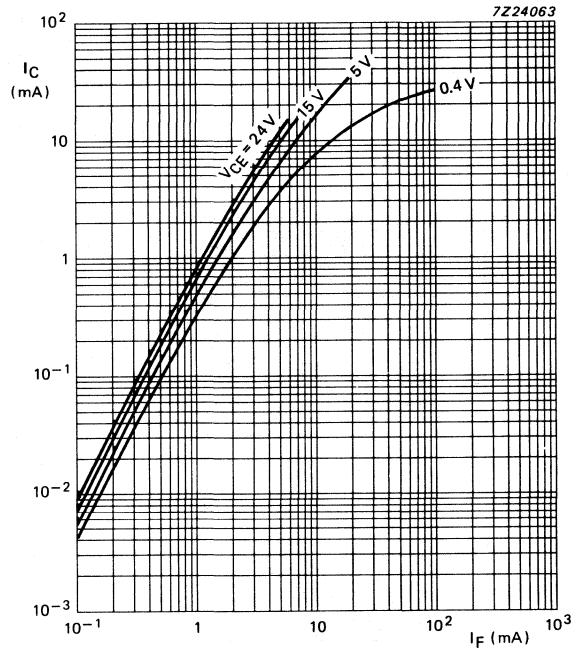


Fig. 13 Typical collector current as a function of forward current; $T_{amb} = 25\text{ }^{\circ}\text{C}$.

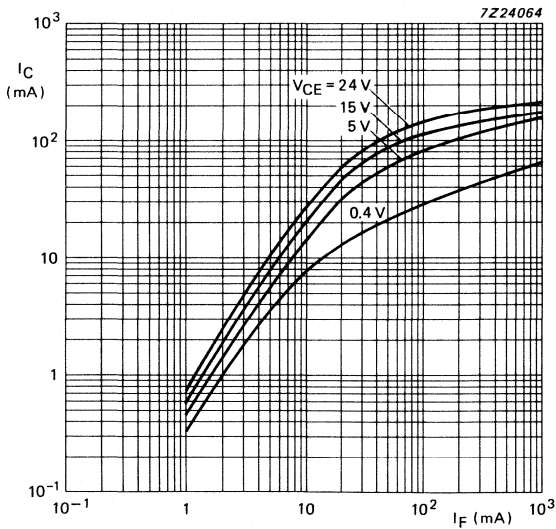


Fig. 14 Typical collector current as a function of forward current; $T_{amb} = 25\text{ }^{\circ}\text{C}$; $t_p = 10\text{ }\mu\text{s}$; $\delta = 0.01$.

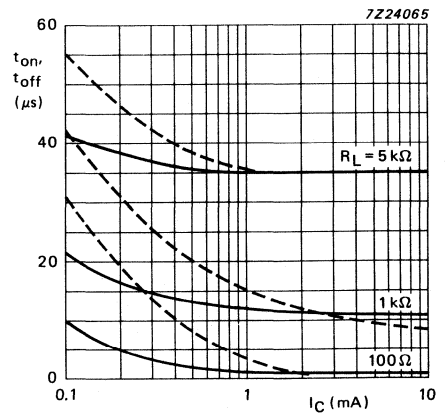


Fig. 15 Typical turn-on and turn-off times as a function of collector current; $T_{amb} = 25\text{ }^{\circ}\text{C}$.

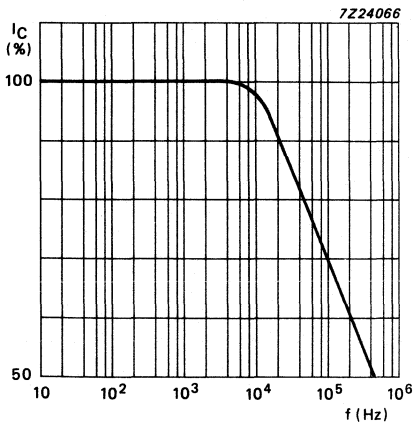


Fig. 16 Relative collector current as a function of frequency; $T_{amb} = 25\text{ }^\circ\text{C}$; $I_C = 2\text{ mA}$; $V_{CC} = 5\text{ V}$.

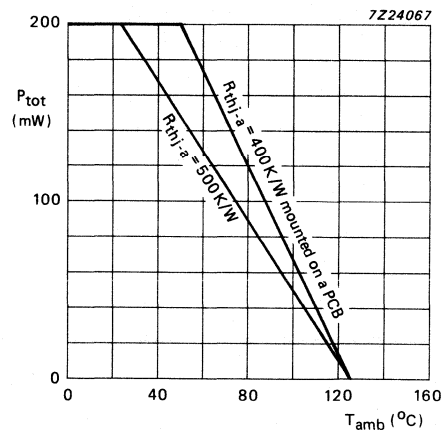


Fig. 17 Total power dissipation as a function of ambient temperature.

HIGH-VOLTAGE OPTOCOUPLER

The CNX83A is a photocoupler consisting of an infrared emitting GaAs diode and a silicon npn photo-transistor, 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
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Transistor

Collector-emitter voltage (open base)	V_{CEO}	max.	50 V
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Photocoupler

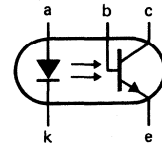
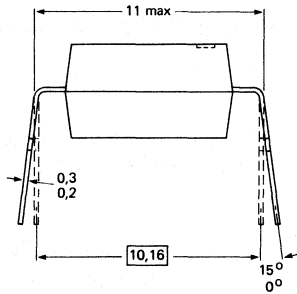
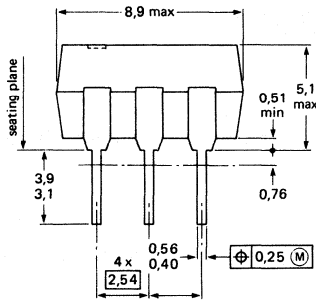
Output/input DC current transfer ratio $I_F = 10 \text{ mA}; V_{CE} = 0.4 \text{ V}$	I_C/I_F	min.	0.4
Collector cut-off current (dark) $V_{CC} = 10 \text{ V}; \text{working voltage} = 2.5 \text{ kV DC}$	I_{CEW}	max.	200 nA
Test isolation voltage DC AC (RMS value)	V_{IORM}	max.	5.3 kV 3.75 kV

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

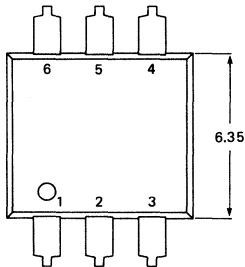


Fig.1 SOT231.

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; $t_{ON} = 10 \mu s$; $\delta = 0.01$	I_{FRM}	max.	3.0 A
Total power dissipation up to $T_{amb} = 25^\circ C$	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 $T_{amb} = 25^\circ C$	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_{thj-a}	=	500 K/W
transistor	R_{thj-a}	=	500 K/W
From junction to ambient when mounted on printed circuit board (PCB)			
diode	R_{thj-a}	=	400 K/W
transistor	R_{thj-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 V
		max.	1.5 V
Reverse current $V_R = 5$ V	I_R	max.	10 μ A

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.	2.0 nA
		max.	50 nA
$V_{CE} = 10$ V; $T_{amb} = 70$ °C	I_{CEO}	max.	10 μ A
$V_{CB} = 10$ V	I_{CBO}	max.	20 nA

CHARACTERISTICS (continued)

Photocoupler

Output/input DC current transfer ratio (CTR)

$I_F = 10 \text{ mA}; V_{CE} = 0.4 \text{ V}$

I_C/I_F	min.	0.4
	typ.	0.8

$I_F = 10 \text{ mA}; V_{CE} = 5 \text{ V}$

I_C/I_F	typ.	1.5
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Collector cut-off current (light)

$T_{amb} \leq 70 \text{ }^\circ\text{C}; V_F = 0.8 \text{ V}; V_{CE} = 15 \text{ V}$

$T_{amb} \leq 70 \text{ }^\circ\text{C}; I_F = 2 \text{ mA}; V_{CE} = 0.4 \text{ V}$

$I_{CE(L)}$	max.	15 μA
$I_{CE(L)}$	min.	150 μA

Collector-emitter saturation voltage

$I_F = 10 \text{ mA}; I_C = 4 \text{ mA}$

V_{CEsat}	typ.	0.19 V
	max.	0.40 V

Collector cut-off current (dark) at

working voltage $V_W = 2.5 \text{ kV}$ (DC value);

$V_{CC} = 10 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$ (see notes 1 and 2)

$V_{CC} = 10 \text{ V}; T_j = 70 \text{ }^\circ\text{C}$ (see notes 1 and 2)

I_{CEW}	max.	200 nA
	max.	100 μA

Output capacitance

$V_{CB} = 10 \text{ V}; f = 1 \text{ MHz}$

C_{bc}	max.	5.5 pF
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Test isolation voltage DC

$t = 1 \text{ min}$ (see note 3) AC (RMS value)

V_{IORM}	max.	5.3 kV
	max.	3.75 kV

Capacitance between input and output

$V = 0; f = 1 \text{ MHz}$

C_{io}	typ.	0.4 pF
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Insulation resistance between input and output

$V_{IO} = \pm 1000 \text{ V}$

R_{IO}	min.	10 G Ω
	typ.	1 T Ω

Switching times (see Figs 3 and 4)

Turn-on time

$I_C = 2 \text{ mA}; V_{CC} = 5 \text{ V}; R_L = 100 \text{ } \Omega$

$I_C = 2 \text{ mA}; V_{CC} = 5 \text{ V}; R_L = 1 \text{ k}\Omega$

t_{on}	typ.	3.0 μs
	typ.	12 μs

Turn-off time

$I_C = 2 \text{ mA}; V_{CC} = 5 \text{ V}; R_L = 100 \text{ } \Omega$

$I_C = 2 \text{ mA}; V_{CC} = 5 \text{ V}; R_L = 1 \text{ k}\Omega$

t_{off}	typ.	3.0 μs
	typ.	12 μs

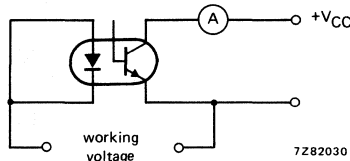


Fig. 2 Test circuit.

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.

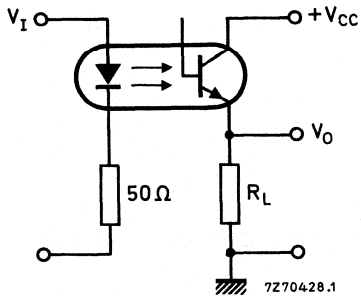


Fig. 3 Switching circuit.

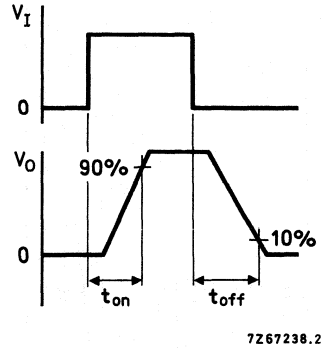


Fig. 4 Waveforms.

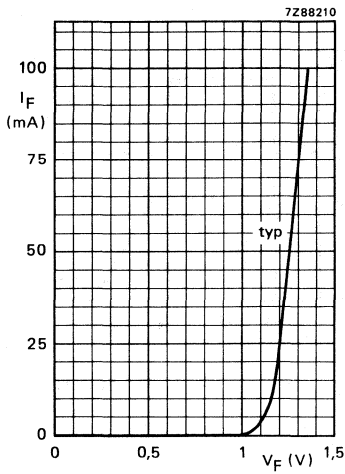


Fig. 5 Typical forward current as a function of forward voltage; $T_{amb} = 25^\circ\text{C}$.

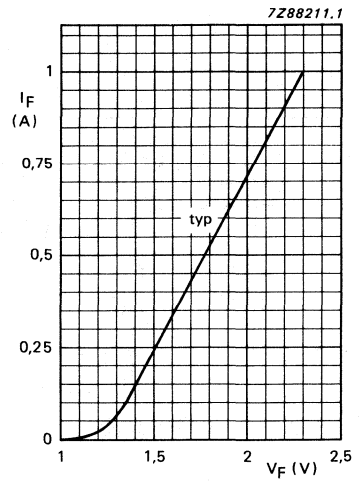


Fig. 6 Typical forward current as a function of forward voltage; $T_{amb} = 25^\circ\text{C}$; $t_p = 20 \mu\text{s}$; $\delta = 0.01$.

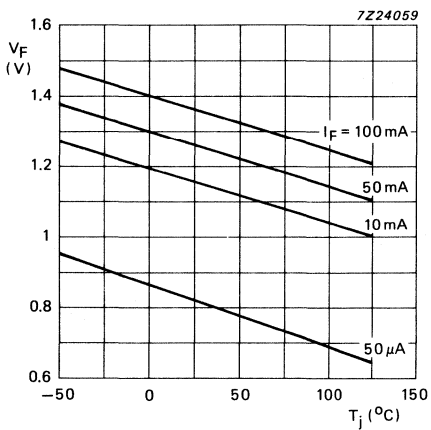


Fig. 7 Typical forward voltage as a function of junction temperature.

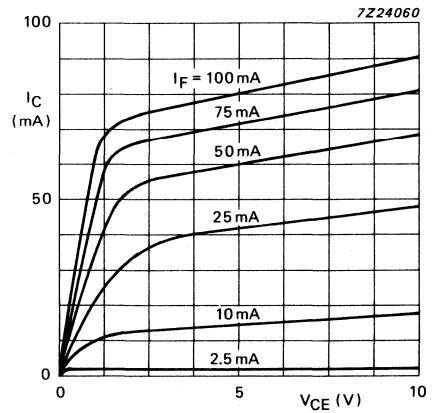


Fig. 8 Typical collector current as a function of collector-emitter voltage; $T_{amb} = 25^\circ\text{C}$.

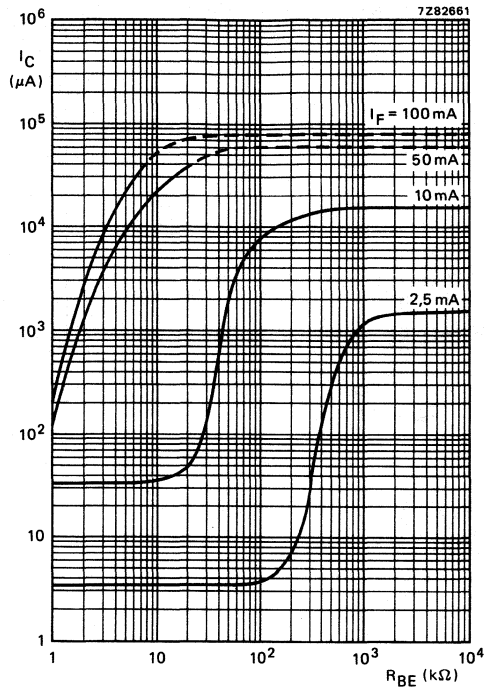
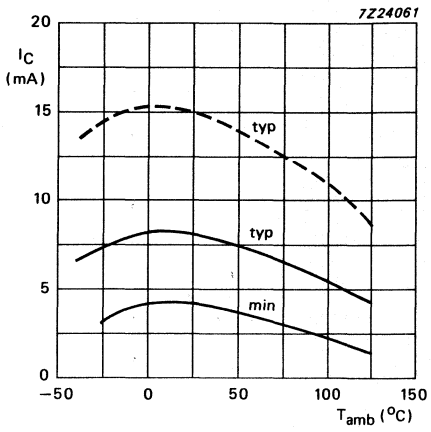


Fig. 9 Collector current as a function of base-emitter resistance; $I_B = 0$; $V_{CE} = 5 \text{ V}$; $T_{amb} = 25 \text{ }^\circ\text{C}$; typical values.



— $I_F = 10 \text{ mA}; V_{CE} = 0.4 \text{ V}$
 - - - $I_F = 10 \text{ mA}; V_{CE} = 5 \text{ V}$

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

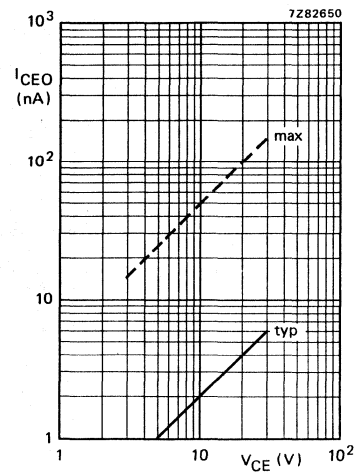


Fig. 11 Collector-emitter dark current as a function of collector-emitter voltage; $T_{amb} = 25 \text{ }^\circ\text{C}$.

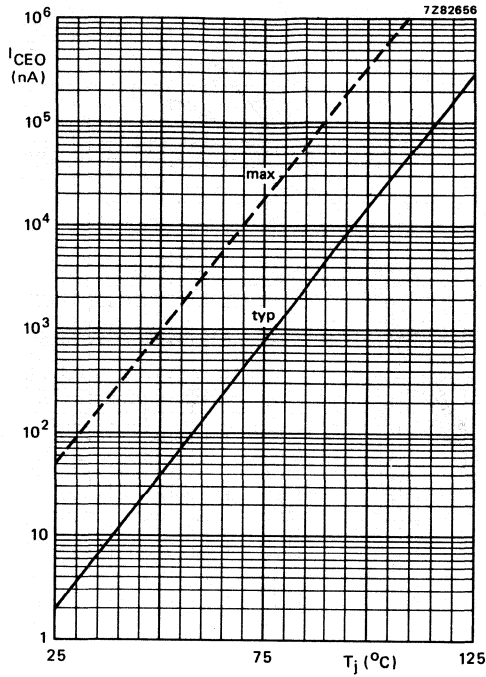


Fig. 12 Collector-emitter dark current as a function of junction temperature.

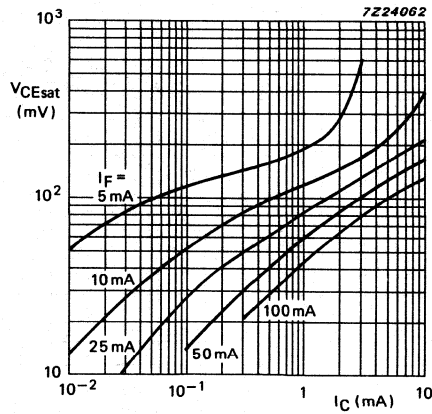


Fig. 13 Typical collector-emitter saturation voltage as a function of collector current; $T_{amb} = 25$ °C.

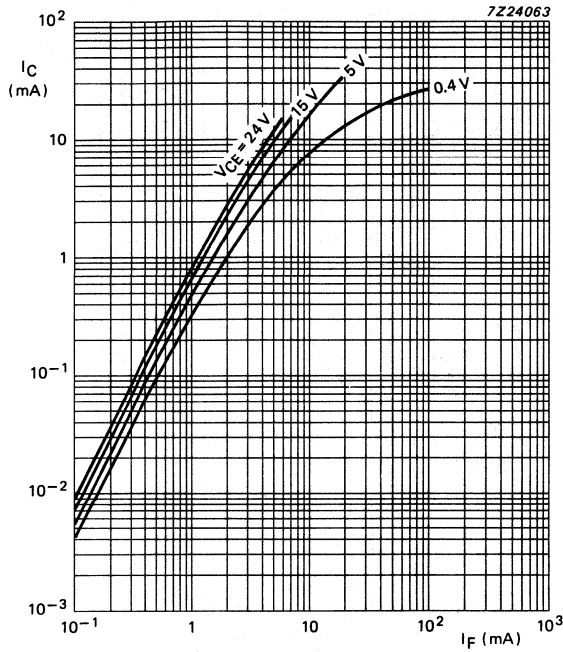


Fig. 14 Typical collector current as a function of forward current; $T_{amb} = 25\text{ }^\circ\text{C}$.

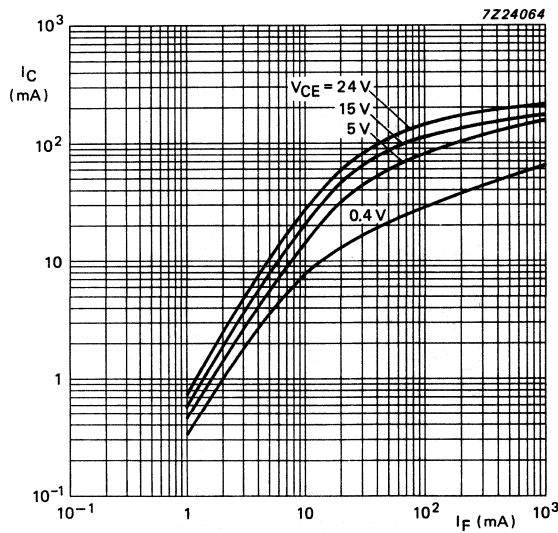


Fig. 15 Typical collector current as a function of forward current; $T_{amb} = 25\text{ }^\circ\text{C}$; $t_p = 10\text{ }\mu\text{s}$; $\delta = 0.01$.

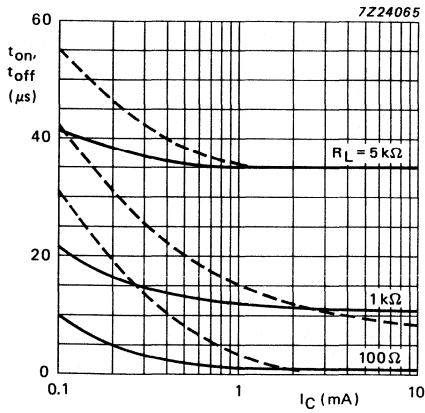


Fig. 16 Typical turn-on and turn-off times as a function of collector current; $T_{amb} = 25^\circ C$.

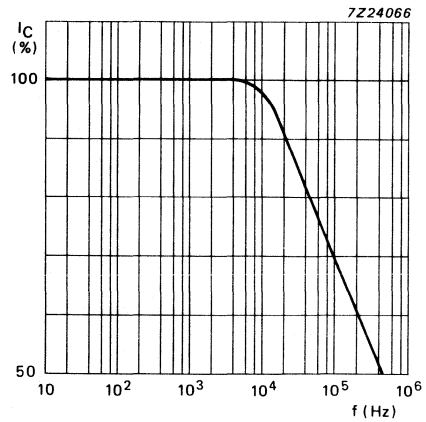


Fig. 17 Relative collector current as a function of frequency; $T_{amb} = 25^\circ C$; $I_C = 2$ mA; $V_{CC} = 5$ V.

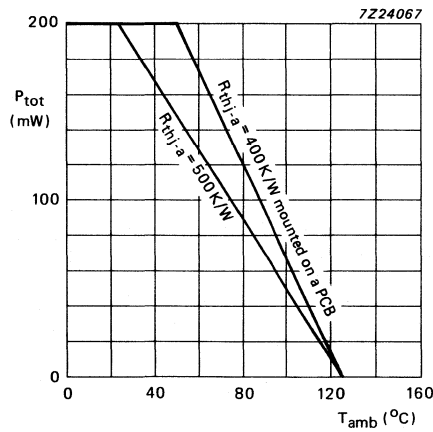


Fig. 18 Total power dissipation as a function of ambient temperature.

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) $t_p = 1 \mu s$; $f = 300$ Hz	I_{FRM}	max.	3 A
Total power dissipation up to $T_{amb} = 25^\circ C$	P_{tot}	max.	150 mW

Transistor

Collector-emitter voltage (open base)	V_{CEO}	max.	70 V
Total power dissipation up to $T_{amb} = 25^\circ C$	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. 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

Switching times $I_C = 2$ mA; $V_{CC} = 10$ V; $R_L = 100 \Omega$	t_{on} t_{off}	max.	10 μs
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Isolation voltage DC AC (RMS value)	V_{IORM}	min.	4.4 kV 3.12 kV
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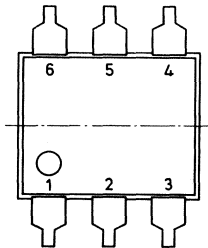
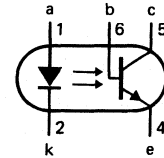
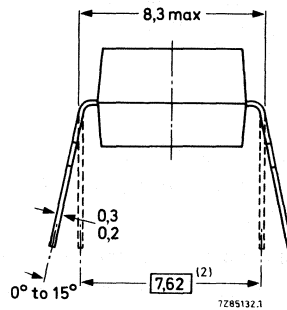
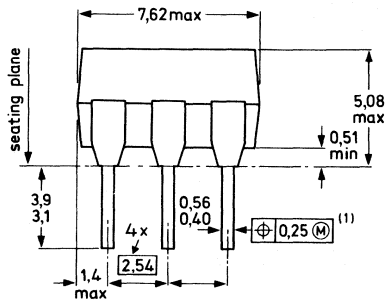
MECHANICAL DATA

SOT90B (see Fig.1).

MECHANICAL DATA

Fig.1 SOT90B.

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 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; $t_p = 1 \mu s$; $f = 300$ Hz	I_{FRM}	max.	3 A
Total power dissipation	P_{tot}	max.	150 mW
up to $T_{amb} = 25^\circ C$			

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	P_{tot}	max.	150 mW
up to $T_{amb} = 25^\circ C$			

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 μ A

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)

$I_F = 10 \text{ mA}; V_{CE} = 5 \text{ V}$

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

$I_F = 10 \text{ mA}; I_C = 2.5 \text{ mA}$

V_{CEsat}	max.	0.3 V
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Output capacitance at $f = 1 \text{ MHz}$

$V_{CE} = 10 \text{ V}$

C_{ce}	typ.	2.0 pF
----------	------	--------

Isolation voltage (note 1) DC

$t = 1 \text{ min}$ AC (RMS value)

V_{IORM}	min.	4.4 kV
	min.	3.12 kV

Capacitance between input and output

$V_O = 0; f = 1 \text{ MHz}$

C_{io}	max.	2.0 pF
	typ.	0.6 pF

Insulation resistance between

input and output

$\pm V_{IO} = 500 \text{ V}$

R_{IO}	min.	100 G Ω
	typ.	10 T Ω

Switching times (see Figs 2 and 3)

$I_C = 2 \text{ mA}; V_{CC} = 10 \text{ V}; R_L = 100 \Omega$

Turn-on time

t_{on}	typ.	5 μs
	max.	10 μs

Turn-off time

t_{off}	typ.	5 μs
	max.	10 μs

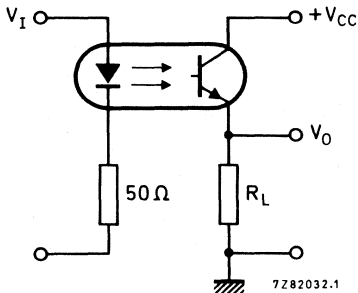


Fig.2 Switching circuit.

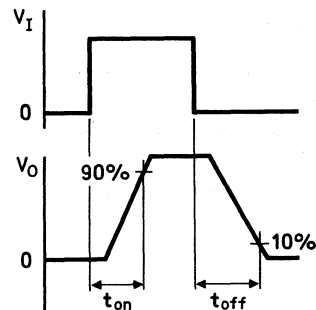


Fig.3 Waveforms.

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.

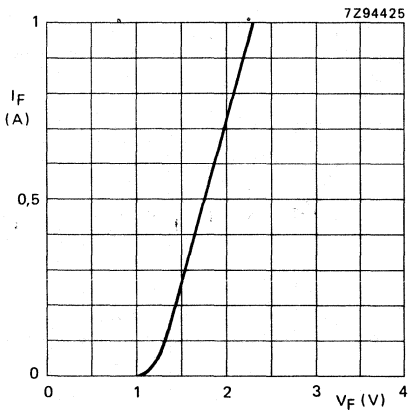


Fig. 4 $T_{amb} = 25\text{ }^\circ\text{C}$; $t_{on} = 20\text{ }\mu\text{s}$;
 $\delta = 0,01$; typical values.

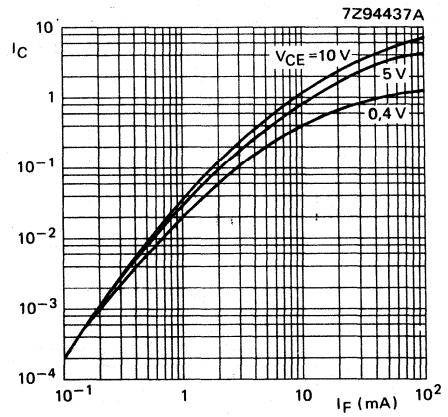


Fig. 5 Normalized to $I_F = 10\text{ mA}$;
 $V_{CE} = 10\text{ V}$; typical values.

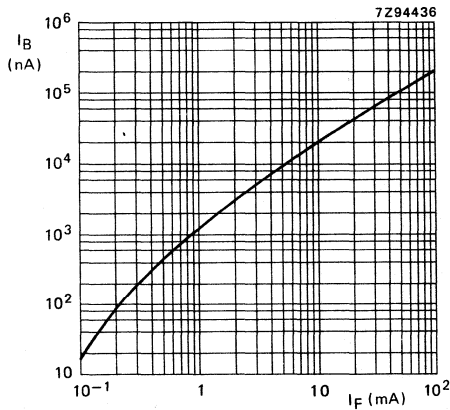


Fig. 6 $V_{CB} = 10\text{ V}$; $T_{amb} = 25\text{ }^\circ\text{C}$;
typical values.

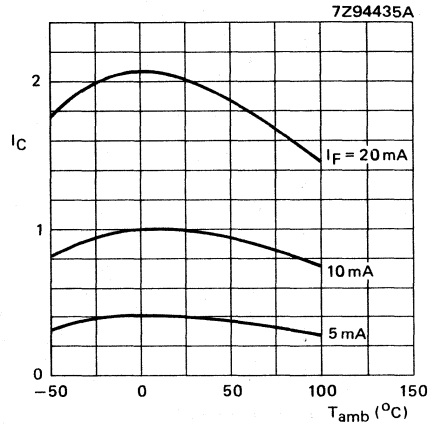


Fig. 7 Normalized to $I_F = 10\text{ mA}$;
 $V_{CE} = 10\text{ V}$; typical values.

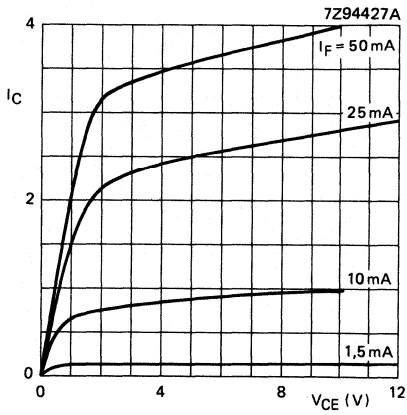


Fig. 8 Normalized to $I_F = 10$ mA;
 $V_{CE} = 10$ V; typical values.

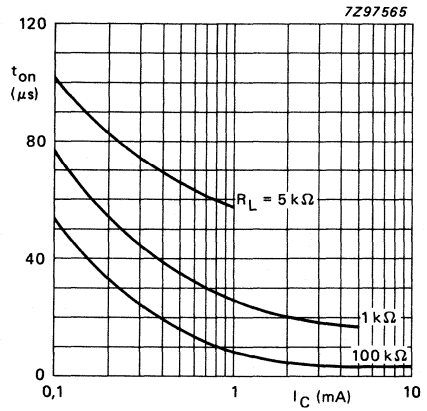


Fig. 9 $V_{CC} = 10$ V; $T_{amb} = 25$ °C;
 typical values.

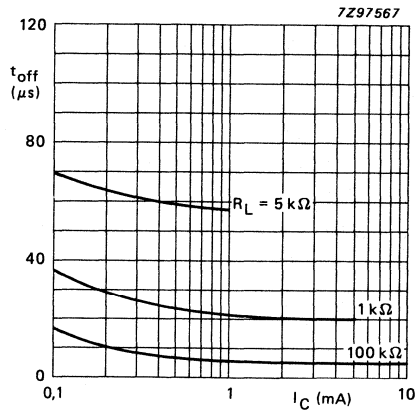


Fig. 10 $V_{CC} = 10$ V; $T_{amb} = 25$ °C;
 typical values.

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_{CE0}	max.	30 V
DC forward current of infrared emitting diode	I_F	max.	60 mA
DC current transfer ratio at $I_F = 10 \text{ mA}; V_{CE} = 10 \text{ V}$	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 $T_{amb} = 25 \text{ }^\circ\text{C}$	P_{tot}	max.	250 mW
Isolation voltage DC	V_{IORM}	min.	2 kV
AC (RMS value)		min.	2.82 kV

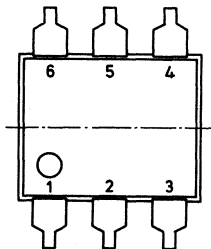
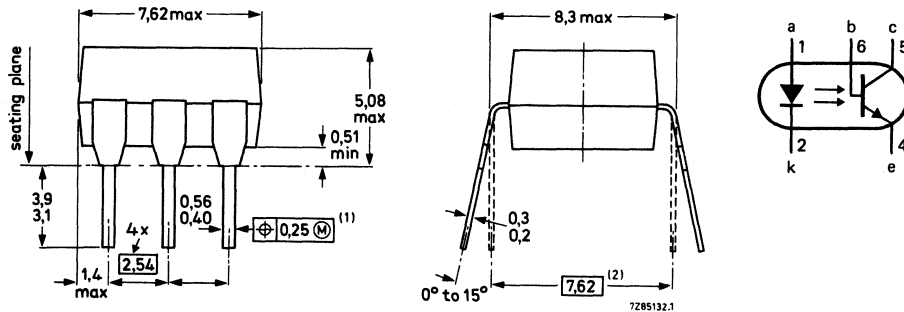
MECHANICAL DATA

SOT90B (see Fig.1).

MECHANICAL DATA

Fig.1 SOT90B.

Dimensions in mm



⊕ Positional accuracy.

Ⓜ Maximum Material Condition.

- (1) Centre-lines of all leads are within $\pm 0,125$ 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; $t_{on} = 10 \mu s$; $\delta = 0.01$	I_{FRM}	max.	3 A
Total power dissipation up to $T_{amb} = 25^\circ C$	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 $T_{amb} = 25^\circ C$	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_{thj-a}	=	500 K/W
transistor	R_{thj-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 μ A
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. max.	2 nA 50 nA

Optocoupler

Output/input DC current transfer ratio

$I_F = 10 \text{ mA}; V_{CE} = 10 \text{ V}$

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

$I_F = 10 \text{ mA}; I_C = 0.5 \text{ mA}$

V_{CEsat}	max.	0.4 V
	typ.	0.1 V

Output capacitance at $f = 1 \text{ MHz}$

$V_{CE} = 10 \text{ V}$

C_{CE}	typ.	2 pF
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Isolation voltage DC (note 1) AC (RMS value)

V_{IORM}	min.	2 kV
	min.	2.82 kV

Capacitance between input and output

$V = 0; f = 1 \text{ MHz}$

C_{io}	max.	2 pF
	typ.	0.6 pF

Insulation resistance between input and output

$V_{IO} = 500 \text{ V}$

R_{IO}	min.	100 G Ω
	typ.	10 T Ω

Rise time

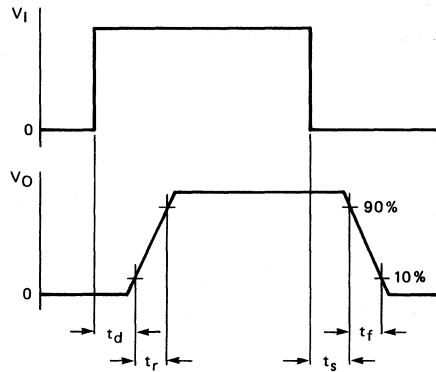
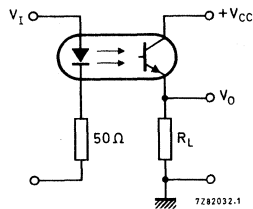
$I_C = 2 \text{ mA}; V_{CC} = 10 \text{ V}; R_L = 100 \Omega$

t_r	typ.	3 μs
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Fall time

$I_C = 2 \text{ mA}; V_{CC} = 10 \text{ V}; R_L = 100 \Omega$

t_f	typ.	3 μs
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7Z94445

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.

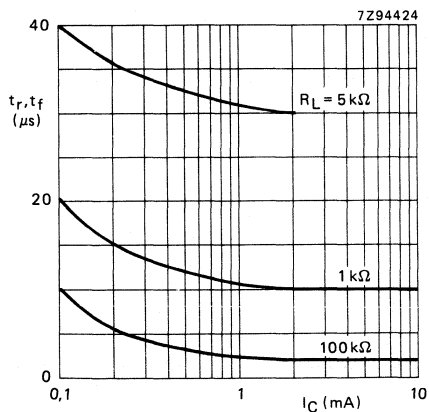


Fig. 3 $V_{CC} = 10\text{ V}$; $T_{amb} = 25\text{ }^{\circ}\text{C}$; typical values.

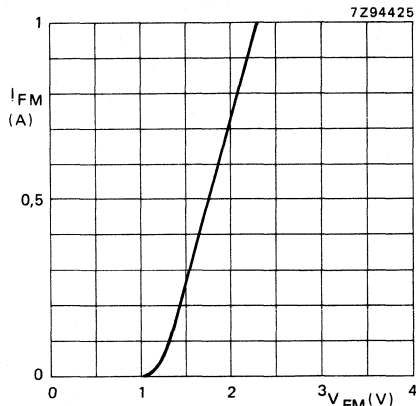


Fig. 4 $T_{amb} = 25\text{ }^{\circ}\text{C}$; $t_{on} = 20\text{ }\mu\text{s}$; $\delta = 0,01$; typical values.

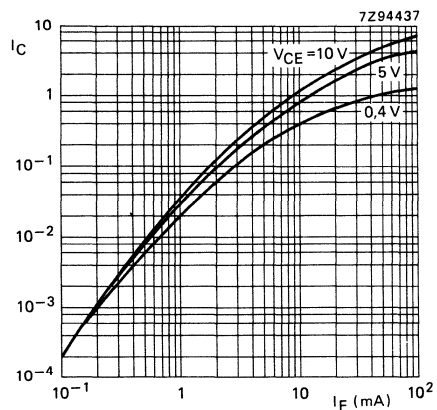


Fig. 5 Normalized to $I_F = 10\text{ mA}$; $V_{CE} = 10\text{ V}$; typical values.

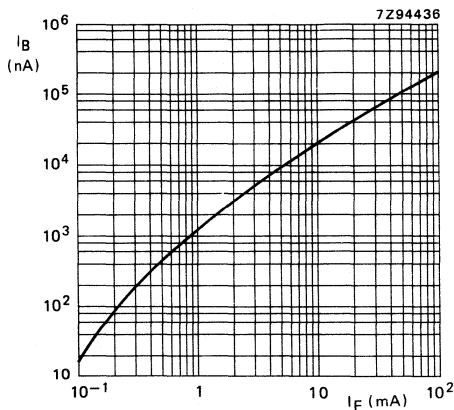


Fig. 6 $V_{CB} = 10\text{ V}$; $T_{amb} = 25\text{ }^{\circ}\text{C}$; typical values.

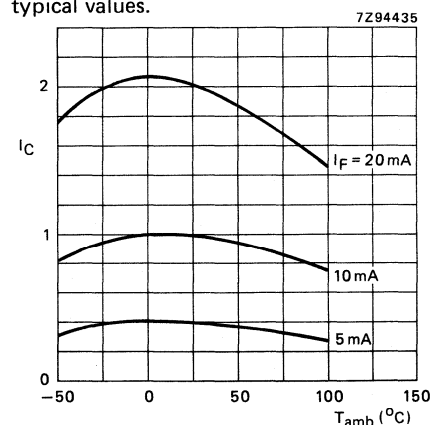


Fig. 7 Normalized at $I_F = 10\text{ mA}$; $V_{CE} = 10\text{ V}$; typical values.

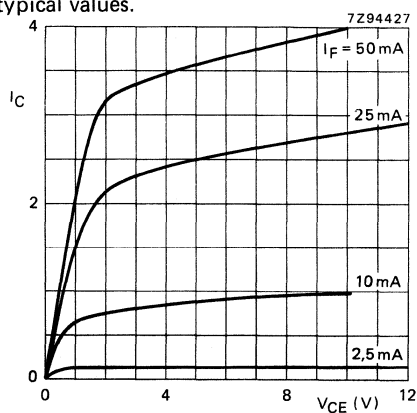


Fig. 8 Normalized at 10 mA ; $V_{CE} = 10\text{ V}$; $T_{amb} = 25\text{ }^{\circ}\text{C}$; typical values.

OPTOCOUPERS

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); $t_p = 1 \mu s$; $f = 300 \text{ Hz}$	I_{FRM}	max.	3 A
Total power dissipation up to $T_{amb} = 25 \text{ }^\circ\text{C}$	P_{tot}	max.	100 mW

Transistor

Collector-emitter voltage (open base)	V_{CEO}	max.	25 V
Total power dissipation up to $T_{amb} = 25 \text{ }^\circ\text{C}$	P_{tot}	max.	150 mW

Optocoupler

DC current transfer ratio (CTR)			
$I_F = 1 \text{ mA}$; $V_{CE} = 5 \text{ V}$	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			
$I_C = 10 \text{ mA}$; $V_{CC} = 10 \text{ V}$; $R_L = 100 \Omega$		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

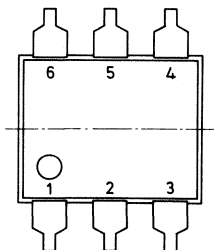
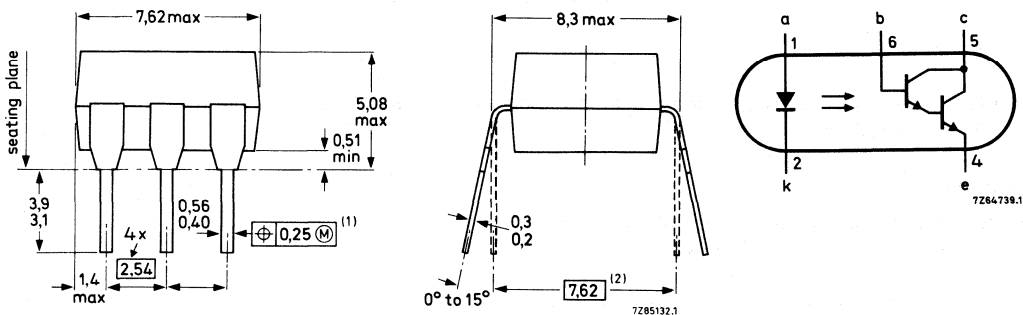
MECHANICAL DATA

SOT90B (see Fig.1).

MECHANICAL DATA

Fig.1 SOT90B.

Dimensions in mm



- ⊕ Positional accuracy.
- (M) Maximum Material Condition.

- (1) Centre-lines of all leads are within $\pm 0,125$ 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; $t_p = 1 \mu s$; $f = 300$ Hz	I_{FRM}	max.	3 A
Total power dissipation	P_{tot}	max.	100 mW
up to $T_{amb} = 25^\circ C$			

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	P_{tot}	max.	150 mW
up to $T_{amb} = 25^\circ C$			

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 μ A

Transistor

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

Optocoupler

DC current transfer ratio (CTR)

$I_F = 1 \text{ mA}; V_{CE} = 5 \text{ V}$	H11B1
	H11B2
	H11B3

I_C/I_F	min.	5,0
I_C/I_F	min.	2,0
I_C/I_F	min.	1,0

Collector-emitter saturation voltage

$I_F = 1 \text{ mA}; I_C = 1 \text{ mA}$

V_{CEsat}	max.	1,0 V
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Output capacitance at $f = 1 \text{ MHz}$

$V_{CE} = 10 \text{ V}$

C_{ce}	typ.	2,0 pF
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Isolation voltage $t = 1 \text{ min DC}$

(see note) AC (RMS value)

V_{IORM}	min.	2,82 kV
	min.	2,0 kV

Capacitance between input and output

$V_O = 0; f = 1 \text{ MHz}$

C_{io}	max.	2,0 pF
	typ.	0,6 pF

Insulation resistance between

input and output

$\pm V_{IO} = 500 \text{ V}$

r_{IO}	min.	100 G Ω
	typ.	10 T Ω

Switching times (see Figs 2 and 3)

$I_C = 10 \text{ mA}; V_{CC} = 10 \text{ V}; R_L = 100 \Omega$

Turn-on time

t_{on}	typ.	125 μs
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Turn-off time

t_{off}	typ.	100 μs
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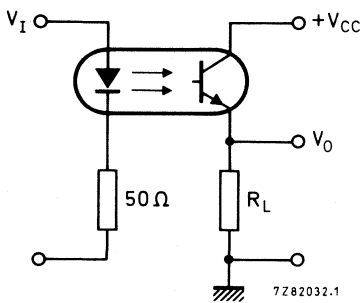


Fig. 2 Switching circuit.

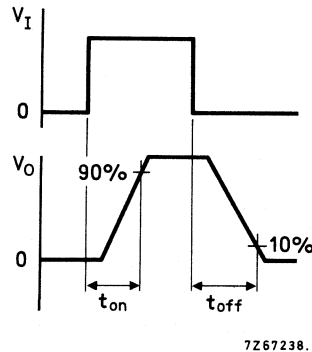


Fig. 3 Waveforms.

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.

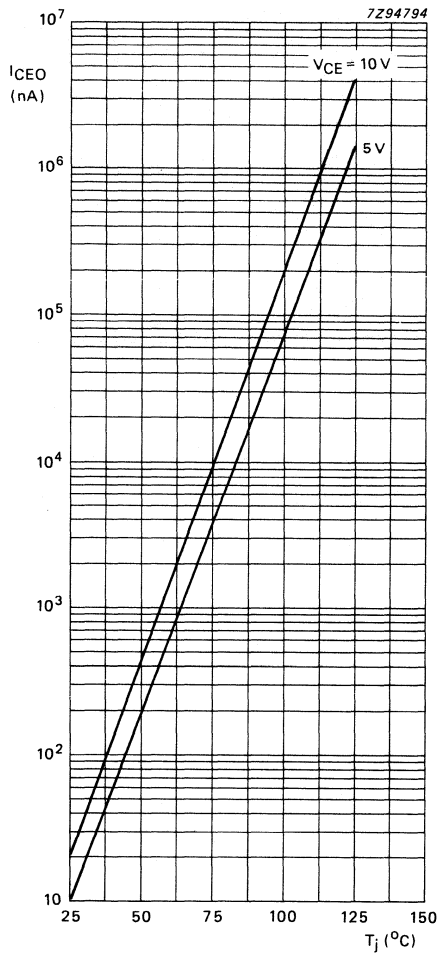


Fig. 4 Typical values.

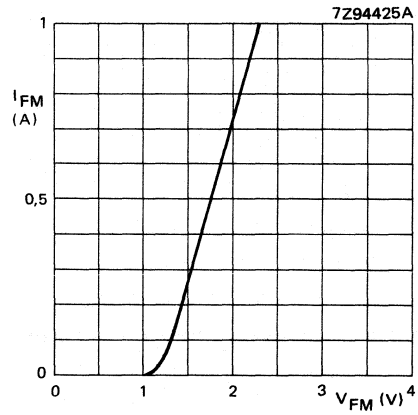


Fig. 5 $T_{amb} = 25^\circ C$; $t_{on} = 20 \mu s$;
 $\delta = 0,01$; typical values.

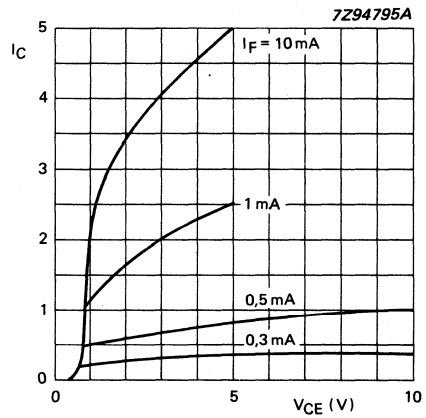


Fig. 6 Normalized to $I_F = 0,5 mA$;
 $V_{CE} = 10 V$; typical values.

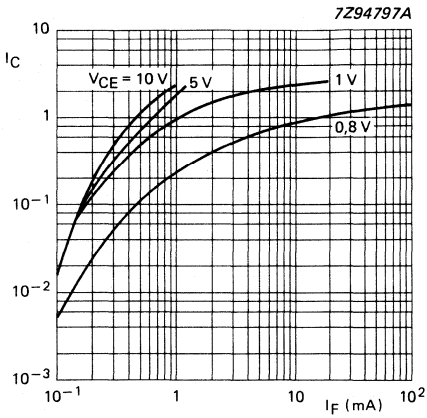


Fig. 7 Normalized to $I_F = 0,5 \text{ mA}$;
 $V_{CE} = 10 \text{ V}$; $T_{amb} = 25 \text{ }^\circ\text{C}$;
typical values.

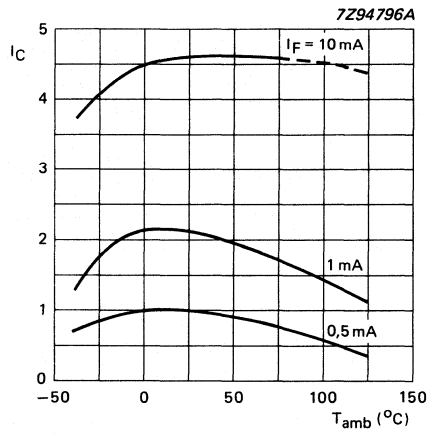


Fig. 8 Normalized to $I_F = 0,5 \text{ mA}$;
 $V_{CE} = 10 \text{ V}$; $T_{amb} = 25 \text{ }^\circ\text{C}$;
typical values.

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) $t_p = 1 \mu s$; $f = 300 \text{ Hz}$	I_{FRM}	max.	3 A
Total power dissipation up to $T_{amb} = 25 \text{ }^\circ\text{C}$	P_{tot}	max.	90 mW

Transistor

Collector-emitter voltage (open base)	V_{CEO}	max.	55 V
Total power dissipation up to $T_{amb} = 25 \text{ }^\circ\text{C}$	P_{tot}	max.	210 mW

Optocoupler

DC current transfer ratio (CTR) $I_F = 10 \text{ mA}$; $V_{CE} = 5 \text{ V}$	I_C/I_F	min.	1,0
Switching times $I_C = 10 \text{ mA}$; $V_{CC} = 10 \text{ V}$; $R_L = 100 \Omega$	t_{on}	typ.	125 μs
	t_{off}	typ.	100 μs
Isolation voltage DC AC (RMS value)	V_{IORM}	min.	2,82 kV
		min.	2,0 kV

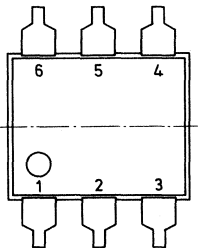
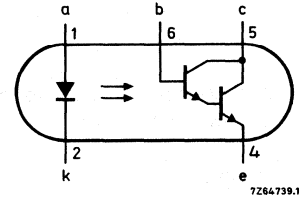
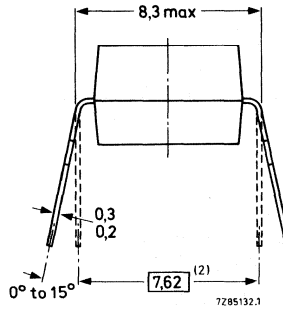
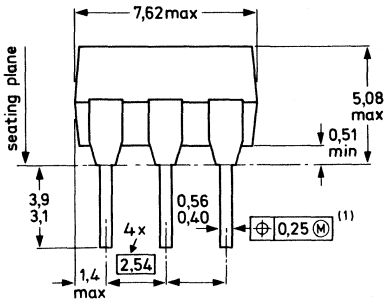
MECHANICAL DATA

SOT 90B (see Fig. 1).

MECHANICAL DATA

Fig. 1 SOT 90B.

Dimensions in mm



⊕ Positional accuracy.

(M) Maximum Material Condition.

- (1) Centre-lines of all leads are within $\pm 0,125$ 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; $t_p = 1 \mu s$; $f = 300$ Hz	I_{FRM}	max.	3 A
Total power dissipation up to $T_{amb} = 25 \text{ }^\circ\text{C}$	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 $T_{amb} = 25 \text{ }^\circ\text{C}$	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(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 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 μ A

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)

$$I_F = 10 \text{ mA}; V_{CE} = 5 \text{ V}$$

Collector-emitter saturation voltage

$$I_F = 50 \text{ mA}; I_C = 50 \text{ mA}$$

Output capacitance at $f = 1 \text{ MHz}$

$$V_{CE} = 10 \text{ V}$$

Isolation voltage $t = 1 \text{ min.}$ DC
(see note) AC (RMS value)

Capacitance between input and output

$$V_O = 0; f = 1 \text{ MHz}$$

Insulation resistance between

input and output

$$\pm V_{IO} = 500 \text{ V}$$

Switching times (see Figs 2 and 3)

$$I_C = 10 \text{ mA}; V_{CC} = 10 \text{ V}; R_L = 100 \Omega$$

Turn-on time

Turn-off time

$$I_C/I_F \quad \text{min.} \quad 1,0$$

$$V_{CEsat} \quad \text{max.} \quad 1,0 \text{ V}$$

$$C_{ce} \quad \text{typ.} \quad 2,0 \text{ pF}$$

$$V_{IORM} \quad \text{min.} \quad 2,82 \text{ kV}$$

$$\text{min.} \quad 2,0 \text{ kV}$$

$$C_{io} \quad \text{max.} \quad 2,0 \text{ pF}$$

$$\text{typ.} \quad 0,6 \text{ pF}$$

$$r_{IO} \quad \text{min.} \quad 100 \text{ G}\Omega$$

$$\text{typ.} \quad 10 \text{ T}\Omega$$

$$t_{on} \quad \text{typ.} \quad 125 \mu\text{s}$$

$$t_{off} \quad \text{typ.} \quad 100 \mu\text{s}$$

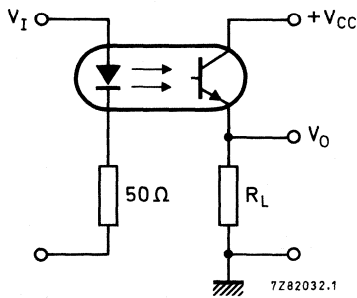


Fig. 2 Switching circuit.

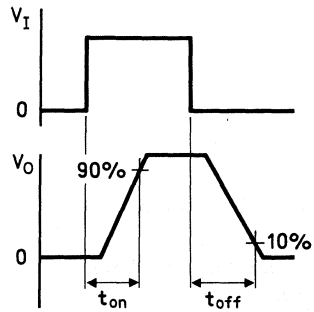


Fig. 3 Waveforms.

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.

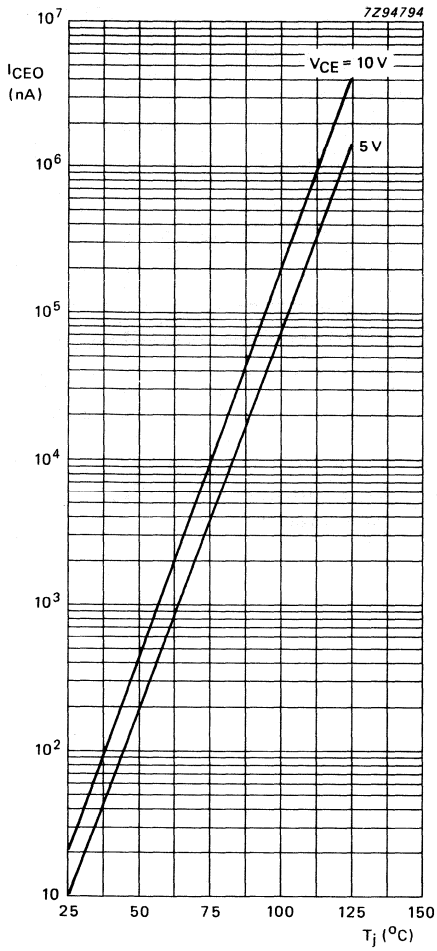


Fig. 4 Typical values.

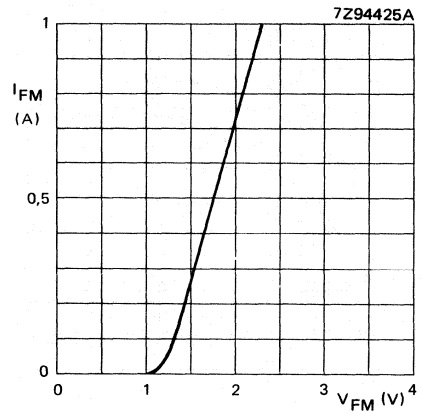


Fig. 5 $T_{amb} = 25^\circ C$; $t_{on} = 20 \mu s$; $\delta = 0,01$; typical values.

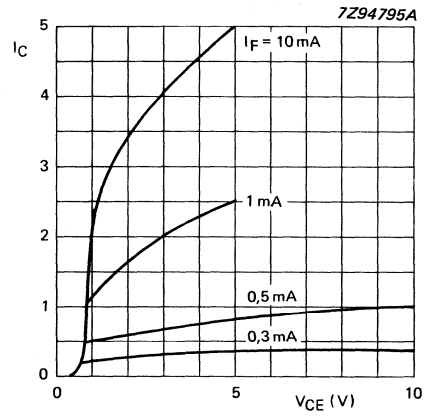


Fig. 6 Normalized to $I_F = 0,5 mA$; $V_{CE} = 10 V$; typical values.

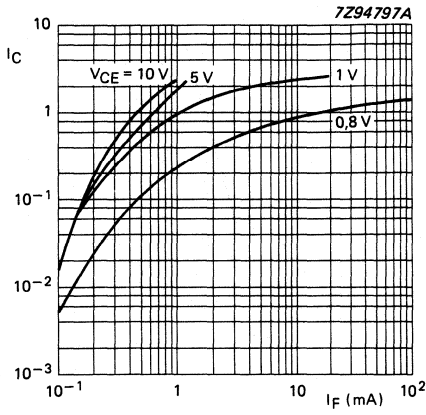


Fig. 7 Normalized to $I_F = 0,5$ mA;
 $V_{CE} = 10$ V; $T_{amb} = 25$ °C;
 typical values.

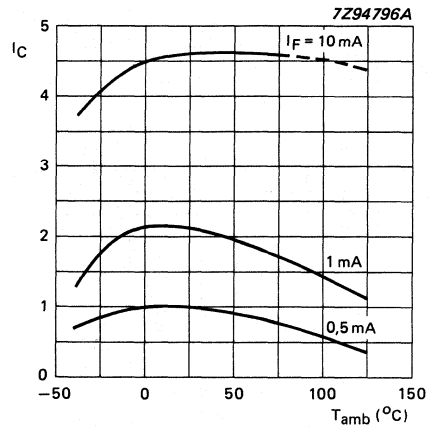


Fig. 8 Normalized to $I_F = 0,5$ mA;
 $V_{CE} = 10$ V; $T_{amb} = 25$ °C;
 typical values.

OPTOCOUPERS

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 (peak value); $t_{ON} = 300 \mu s$; $\delta = 0.02$		I_F	max.	60 mA
		I_{FRM}	max.	0.5 A
Total power dissipation up to $T_{amb} = 25^\circ C$		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 $T_{amb} = 25^\circ C$		P_{tot}	max.	210 mW

Optocoupler

DC current transfer ratio (CTR) $I_F = 10 \text{ mA}$; $V_{CE} = 5 \text{ V}$	MCA230/255	I_C/I_F	min.	1.0
	MCA231	I_C/I_F	min.	2.0
Switching times $I_C = 10 \text{ mA}$; $V_{CC} = 5 \text{ V}$; $R_L = 100$		t_{on}	typ.	5 μs
		t_{off}	typ.	100 μs
Isolation voltage DC AC (RMS value)		V_{IORM}	min.	4.4 kV
			min.	3.12 kV

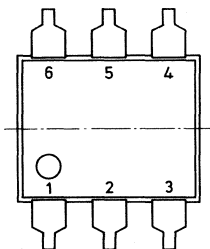
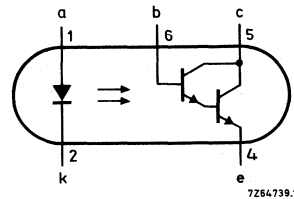
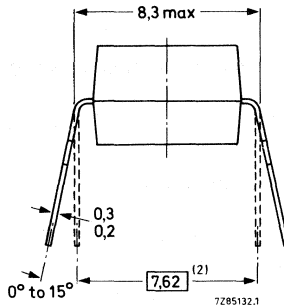
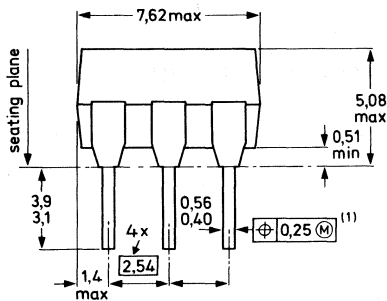
MECHANICAL DATA

SOT90B (see Fig.1)

MECHANICAL DATA

Fig. 1 SOT90B.

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 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; $t_p = 300 \mu s$; $\delta = 0.02$	I_{FRM}	max.	0.5 A
peak value; $t_p = 1 \mu s$; $f = 300$ Hz	I_{FRM}	max.	3 A
Total power dissipation up to $T_{amb} = 25^\circ C$	P_{tot}	max.	100 mW

Transistor

Collector-emitter voltage (open base)	MCA230/231	V_{CE0}	max.	30 V
	MCA255	V_{CE0}	max.	55 V
Collector-base voltage (open emitter)	MCA230/231	V_{CB0}	max.	30 V
	MCA255	V_{CB0}	max.	55 V
Emitter-base voltage (open collector)		V_{EB0}	max.	8 V
DC collector current		I_C	max.	150 mA
Total power dissipation up to $T_{amb} = 25^\circ C$		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. max.	1.1 V 1.5 V
Reverse current $V_R = 6$ V	I_R	max.	10 μ A

Transistor

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

Optocoupler

DC current transfer ratio (CTR)

$I_F = 10 \text{ mA}; V_{CE} = 5 \text{ V}$

MCA230/255	I_C/I_F	min.	1.0
MCA231	I_C/I_F	min.	2.0

Collector-emitter saturation voltage

$I_F = 1 \text{ mA}; I_C = 2 \text{ mA}$

$I_F = 5 \text{ mA}; I_C = 10 \text{ mA}$

$I_F = 10 \text{ mA}; I_C = 50 \text{ mA}$

$I_F = 50 \text{ mA}; I_C = 50 \text{ mA}$

MCA231	V_{CEsat}	max.	1.0 V
MCA231	V_{CEsat}	max.	1.0 V
MCA231	V_{CEsat}	max.	1.2 V
MCA230/255	V_{CEsat}	max.	1.0 V

Isolation voltage $t = 1 \text{ min}$

(see note)

DC
AC (RMS value)

V_{IORM}	min.	4.4 kV
		3.12 kV

Capacitance between input and output

$V_O = 0; f = 1 \text{ MHz}$

C_{io}	max.	2.0 pF
	typ.	0.6 pF

Insulation resistance between input and output

$\pm V_{IO} = 500 \text{ V}$

R_{IO}	min.	100 G Ω
	typ.	10 T Ω

Switching times (see Figs 2 and 3)

$I_F = 10 \text{ mA}; V_{CC} = 5 \text{ V}; R_L = 100 \Omega$

Turn-on time

Turn-off time

t_{on}	typ.	5 μs
t_{off}	typ.	100 μs

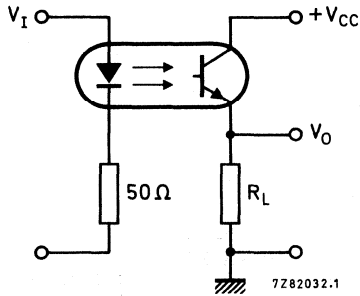


Fig. 2 Switching circuit.

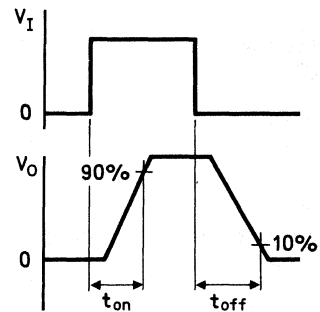


Fig. 3 Waveforms.

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).

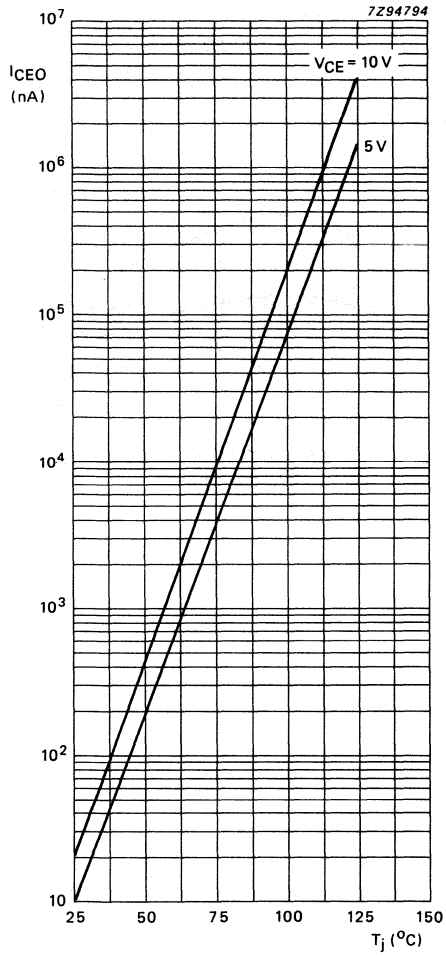


Fig. 4 Typical values.

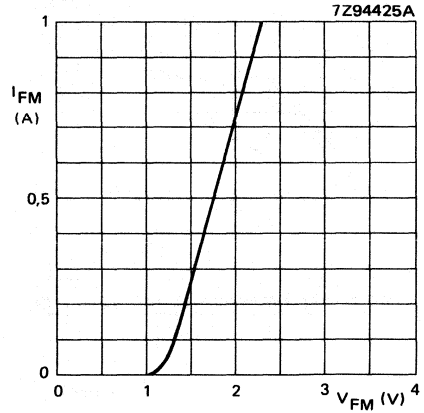


Fig. 5 $T_{amb} = 25\text{ }^\circ\text{C}$; $t_{on} = 20\text{ }\mu\text{s}$; $\delta = 0.01$; typical values.

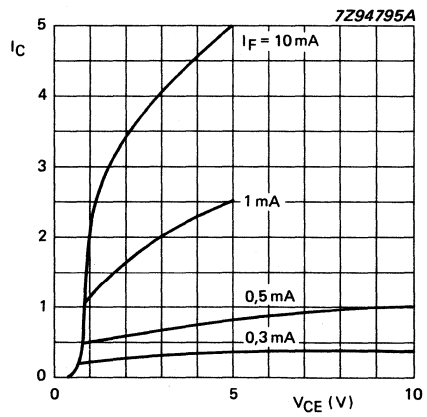


Fig. 6 Normalized to $I_F = 0.5\text{ mA}$; $V_{CE} = 10\text{ V}$; typical values.

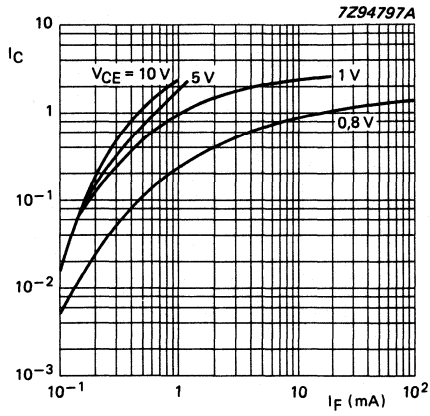


Fig. 7 Normalized to $I_F = 0.5$ mA; $V_{CE} = 10$ V; $T_{amb} = 25$ °C; typical values.

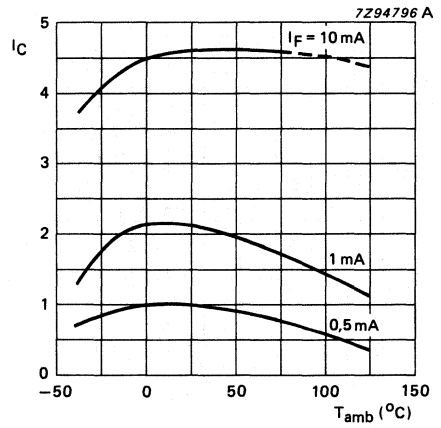


Fig. 8 Normalized to $I_F = 0.5$ mA; $V_{CE} = 10$ V; $T_{amb} = 25$ °C; typical values.

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 $I_F = 10 \text{ mA}; V_{CE} = 10 \text{ V}$	I_C/I_F	min.	0,2
Total power dissipation up to $T_{amb} = 25 \text{ }^\circ\text{C}$	P_{tot}	max.	250 mW
Isolation voltage			
DC			4,4 kV
AC (RMS value)	V_{IORM}	min.	3,12 kV

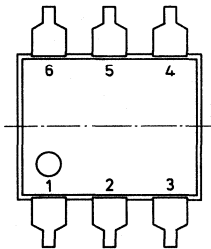
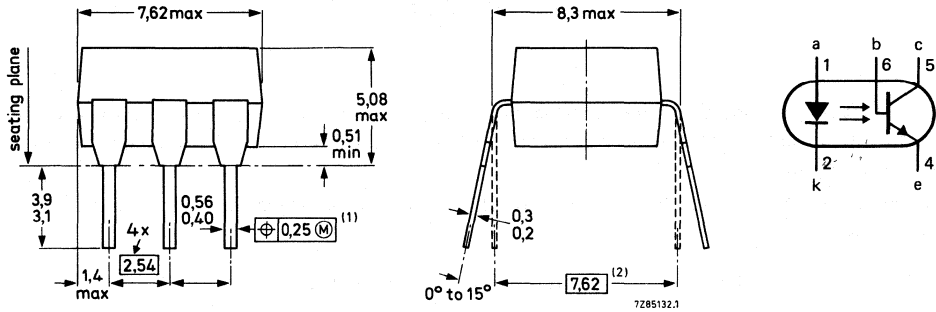
MECHANICAL DATA

SOT90B (see Fig. 1).

MECHANICAL DATA

Fig. 1 SOT90B.

Dimensions in mm



⊕ Positional accuracy.

(M) Maximum Material Condition.

- (1) Centre-lines of all leads are within $\pm 0,125$ 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; $t_{ON} = 10 \mu s$; $\delta = 0,01$	I_{FRM}	max.	3 A
Total power dissipation	P_{tot}	max.	200 mW
up to $T_{amb} = 25 \text{ }^\circ\text{C}$			

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	P_{tot}	max.	200 mW
up to $T_{amb} = 25 \text{ }^\circ\text{C}$			

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

LINEAR DERATING FACTORS

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

ISOLATION RELATED VALUES

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

CHARACTERISTICS

$T_j = 25$ °C unless otherwise specified

Diode

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

Transistor

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

MCT2

DC current gain $I_C = 100 \mu\text{A}; V_{CE} = 5 \text{ V}$	h_{FE}	typ.	300
Optocoupler			
Output/input DC current transfer ratio $I_F = 10 \text{ mA}; V_{CE} = 10 \text{ V}$	I_C/I_F	typ. min.	0,6 0,2
Collector-emitter saturation voltage $I_F = 16 \text{ mA}; I_C = 2 \text{ mA}$	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 $f = 1 \text{ MHz}$ $V_{CB} = 10 \text{ V}$	$C_{b'c}$	typ.	4,5 pF
Collector-emitter capacitance $V_{CE} = 0$	C_{ce}	typ.	8 pF
Isolation voltage (see note) $t = 1 \text{ min}$ DC AC (RMS value)	V_{IORM}	min.	4,4 kV 3,12 kV
Capacitance between input and output $V = 0; f = 1 \text{ MHz}$	C_{io}	typ. max.	0,6 pF 2 pF
Insulation resistance between input and output $V_{IO} = \pm 500 \text{ V}$	R_{IO}	min. typ.	100 G Ω 1 T Ω
Turn-on time (saturated) see Fig. 2 (TTL def.) $I_F = 15 \text{ mA}; V_{CC} = 5 \text{ V}; R_L = 2 \text{ k}\Omega$ $R_{BE} = \infty$	t_{on}	typ.	5 μs
$I_F = 20 \text{ mA}; V_{CC} = 5 \text{ V}; R_L = 2 \text{ k}\Omega$ $R_{BE} = 100 \text{ k}\Omega$	t_{on}	typ.	5 μs
Turn-off time (saturated) see Fig. 2 (TTL def.) $I_F = 15 \text{ mA}; V_{CC} = 5 \text{ V}; R_L = 2 \text{ k}\Omega$ $R_{BE} = \infty$	t_{off}	typ.	30 μs
$I_F = 20 \text{ mA}; V_{CC} = 5 \text{ V}; R_L = 2 \text{ k}\Omega$ $R_{BE} = 100 \text{ k}\Omega$	t_{off}	typ.	10 μs
Bandwidth $I_C = 2 \text{ mA}; V_{CE} = 10 \text{ V}; R_L = 100 \text{ k}\Omega$	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.

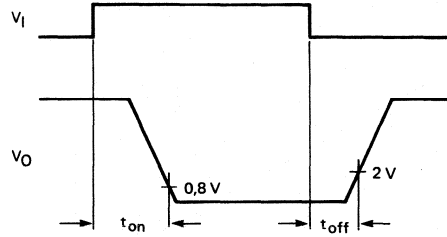
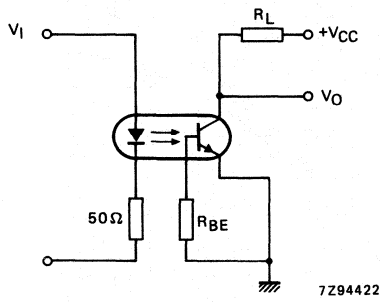


Fig. 2 Measuring circuit and waveforms.

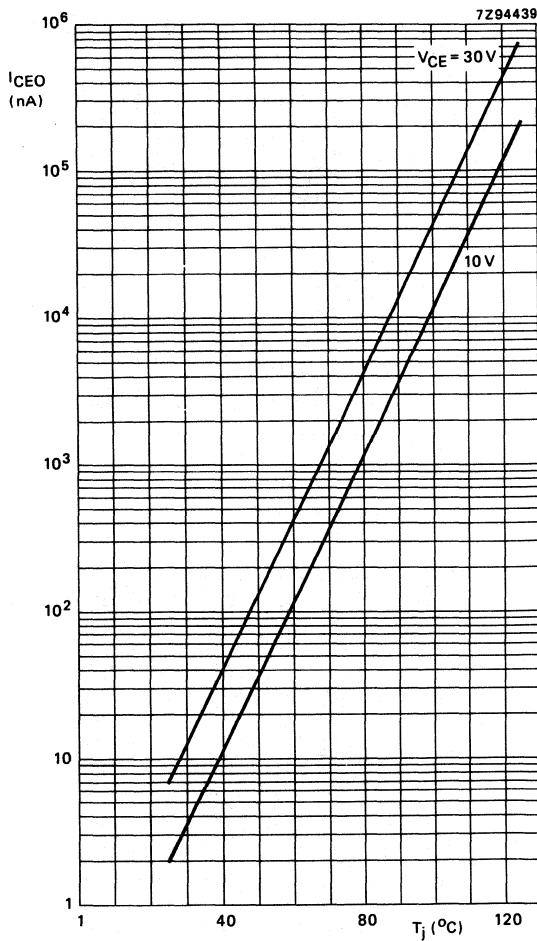


Fig. 3 Typical values.

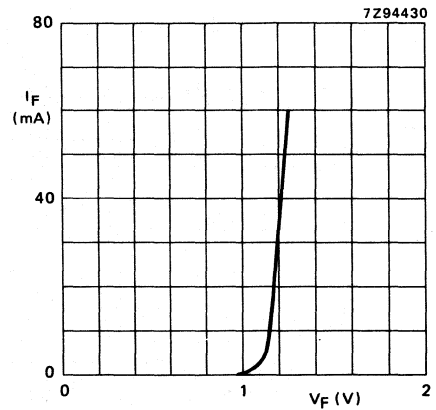


Fig. 4 $T_{amb} = 25\text{ }^{\circ}\text{C}$; typical values.

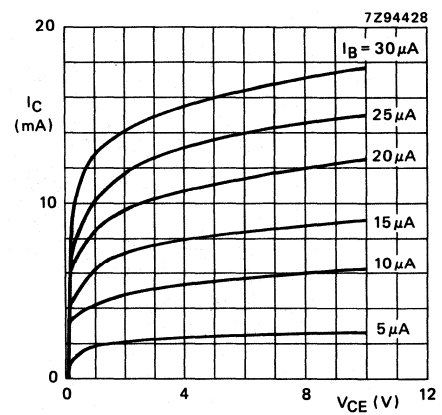


Fig. 5 $T_{amb} = 25\text{ }^{\circ}\text{C}$; typical values.

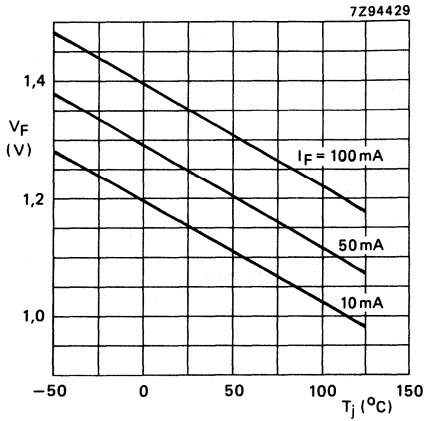


Fig. 6 Typical values.

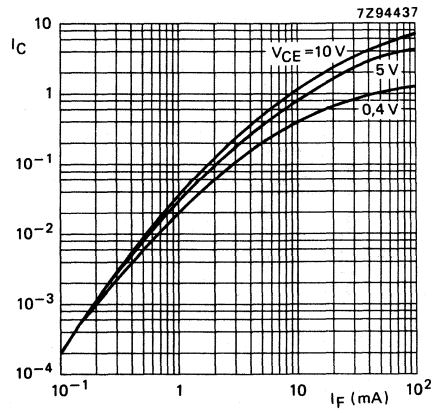


Fig. 7 Normalized to $I_F = 10 \text{ mA}$; $V_{CE} = 10 \text{ V}$; $T_{amb} = 25 \text{ }^\circ\text{C}$; typical values.

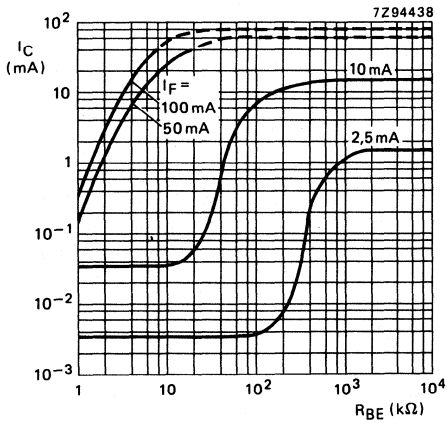


Fig. 8 $V_{CE} = 5 \text{ V}$; $T_{amb} = 25 \text{ }^\circ\text{C}$; typical values.

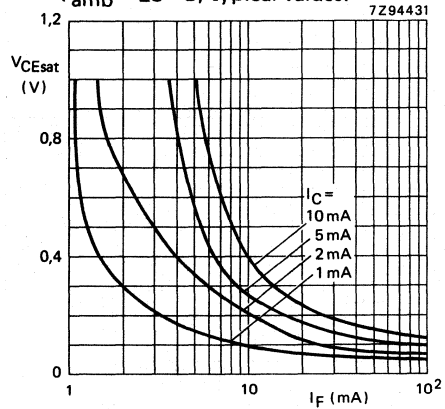


Fig. 9 $T_{amb} = 25 \text{ }^\circ\text{C}$; typical values.

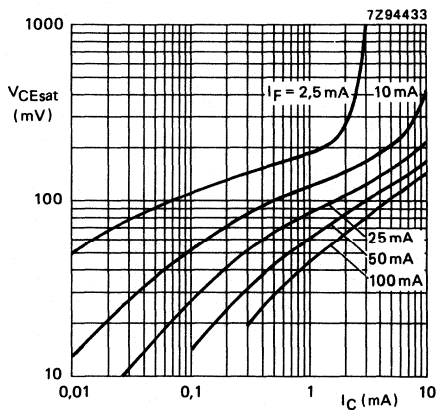


Fig. 10 $T_{amb} = 25 \text{ }^\circ\text{C}$; typical values.

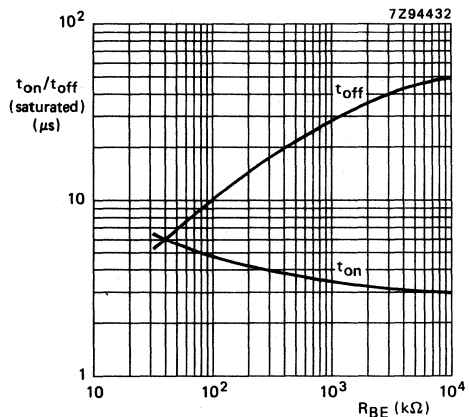


Fig. 11 $I_F = 20 \text{ mA}$; $R_L = 2 \text{ k}\Omega$; $T_{amb} = 25 \text{ }^\circ\text{C}$; typical values.

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_{CE0}	max.	30 V
DC forward current of infrared emitting diode	I_F	max.	60 mA
Output/input DC current transfer ratio (CTR) $I_F = 10 \text{ mA}; V_{CE} = 10 \text{ V}$	I_C/I_F	min.	0.06
Total power dissipation up to $T_{amb} = 25 \text{ }^\circ\text{C}$	P_{tot}	max.	250 mW
Isolation voltage DC AC (RMS value)	V_{IORM}	min.	4.4 kV 3.12 kV

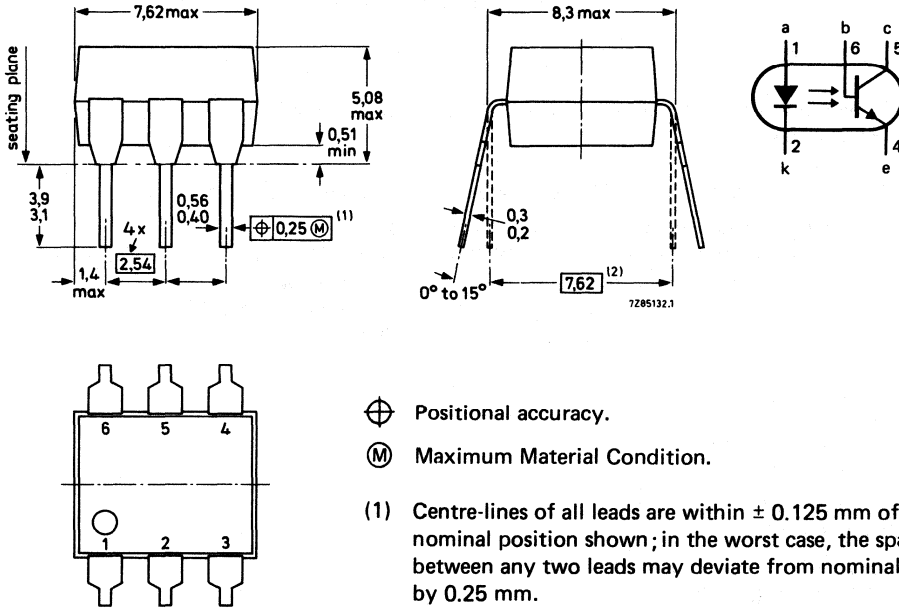
MECHANICAL DATA

SOT90B (see Fig. 1).

MECHANICAL DATA

Fig.1 SOT90B.

Dimensions in mm



⊕ Positional accuracy.

(M) Maximum Material Condition.

- (1) Centre-lines of all leads are within ± 0.125 mm of the nominal position shown ; in the worst case, the spacing between any two leads may deviate from nominal by 0.25 mm.
- (2) When the leads are parallel, the tips 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; $t_{on} = 10 \mu s$; $\delta = 0.01$	I_{FRM}	max.	3 A
Total power dissipation up to $T_{amb} = 25 \text{ }^\circ\text{C}$	P_{tot}	max.	200 mW

Transistor

Collector-emitter voltage (open base)	V_{CE0}	max.	30 V
Collector-base voltage (open emitter)	V_{CB0}	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 $T_{amb} = 25 \text{ }^\circ\text{C}$	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	$R_{th\ j-a}$	=	500 K/W
transistor	$R_{th\ j-a}$	=	500 K/W

LINEAR DERATING FACTORS

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

ISOLATION RELATED VALUES

External air gap (clearance)			
input terminals to output terminals	L(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 mm

CHARACTERISTICS

$T_j = 25\text{ }^\circ\text{C}$ unless otherwise specified

Diode

Forward voltage

$I_F = 20\text{ mA}$

V_F

typ.
max.

1.2 V
1.5 V

Reverse current

$V_R = 5\text{ V}$

I_R

max.

10 μA

Capacitance at $f = 1\text{ MHz}$

$V = 0$

C_d

typ.

50 pF

Transistor

Collector-emitter breakdown voltage

$I_C = 1\text{ mA}$

$V_{(BR)CEO}$

min.

30 V

Collector-base breakdown voltage

$I_C = 0,01\text{ mA}$

$V_{(BR)CBO}$

min.

30 V

Emitter-collector breakdown voltage

$I_E = 0,1\text{ mA}$

$V_{(BR)ECO}$

min.

7 V

Dark current

$V_{CE} = 5\text{ V}$

I_{CEO}

typ.
max.

2 nA
100 nA

$V_{CB} = 5\text{ V}$

I_{CBO}

max.

100 nA

DC current gain

$I_C = 100\text{ }\mu\text{A}; V_{CE} = 5\text{ V}$

h_{FE}

typ.

300

Optocoupler

Output/input DC current transfer ratio

$I_F = 10 \text{ mA}; V_{CE} = 10 \text{ V}$

I_C/I_F min. 0.06

Collector-emitter saturation voltage

$I_F = 20 \text{ mA}; I_C = 0.25 \text{ mA}$

V_{CEsat} max. 0.3 V
typ. 0.1 V

$I_F = 60 \text{ mA}; I_C = 1.6 \text{ mA}$

V_{CEsat} max. 0.5 V
typ. 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

$V = 0; f = 1 \text{ MHz}$

C_{io} typ. 0.6 pF
max. 2 pF

Insulation resistance between input and output

$V_{IO} = 500 \text{ V}$

R_{IO} min. 100 G Ω
typ. 1 T Ω

Rise time (see Fig. 2)

$I_C = 2 \text{ mA}; V_{CC} = 10 \text{ V}; R_L = 100 \Omega$

t_r typ. 3 μs

Fall time (see Fig. 2)

$I_C = 2 \text{ mA}; V_{CC} = 10 \text{ V}; R_L = 100 \Omega$

t_f typ. 3 μs

Bandwidth

$I_C = 2 \text{ mA}; V_{CE} = 10 \text{ V}; R_L = 100 \Omega$

BW typ. 300 kHz

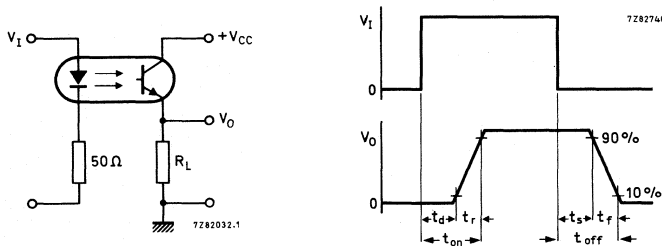


Fig. 2 Measuring circuit and waveforms.

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.

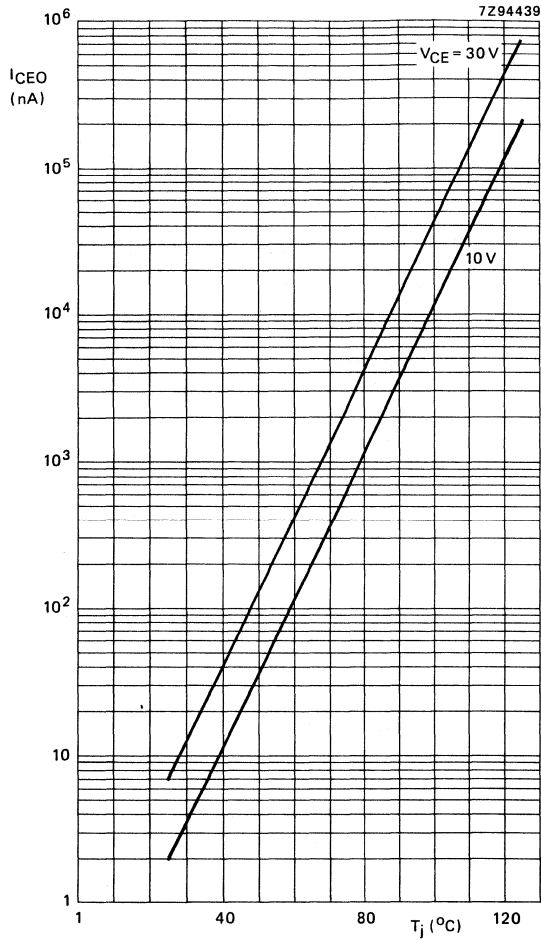


Fig. 3 Typical values.

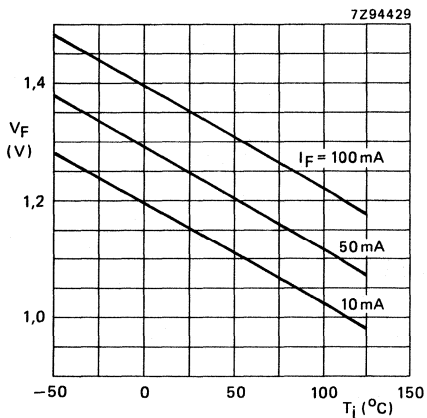


Fig. 6 Typical values.

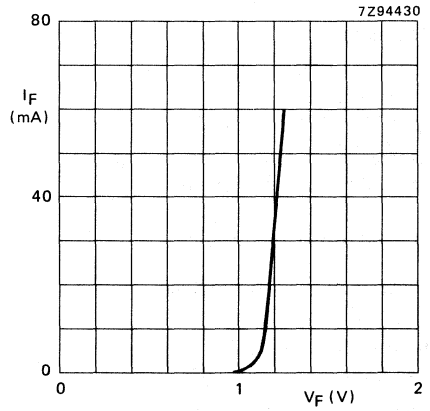


Fig. 4 $T_{amb} = 25\text{ }^\circ\text{C}$; typical values.

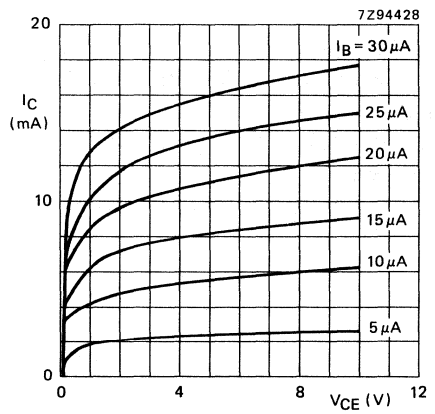


Fig. 5 $T_{amb} = 25\text{ }^\circ\text{C}$; typical values.

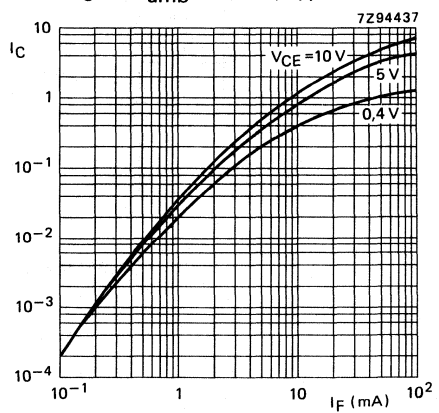


Fig. 7 Normalized to $I_F = 10\text{ mA}$; $V_{CE} = 10\text{ V}$; $T_{amb} = 25\text{ }^\circ\text{C}$; typical values.

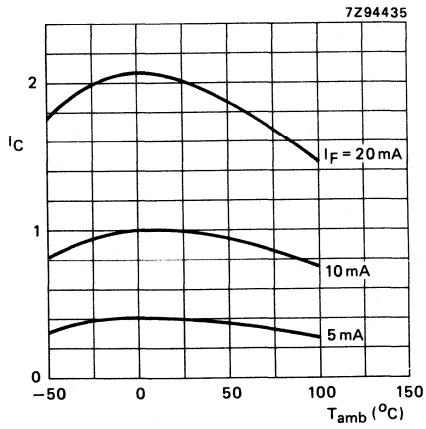


Fig. 8 Normalized to $I_F = 10$ mA; $V_{CE} = 10$ V; $T_{amb} = 25$ $^{\circ}C$; typical values.

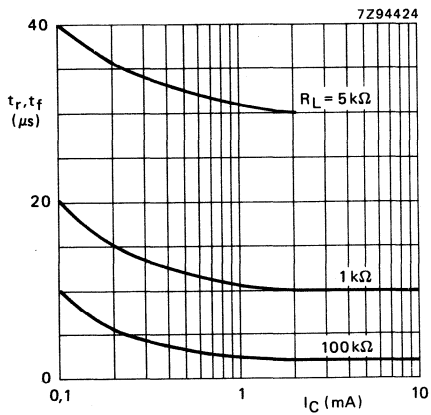


Fig. 9 $T_{amb} = 25$ $^{\circ}C$; typical values.

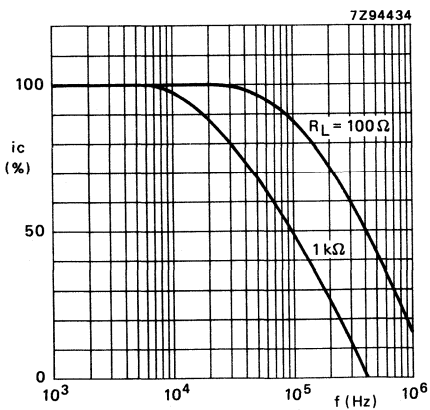


Fig. 10 $I_C = 2$ mA; $V_{CC} = 10$ V; $T_{amb} = 25$ $^{\circ}C$; typical values.

OPTOCOUPLER

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

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

The PO40/44A is selected according to British Telecom specifications for telephony and can serve for each individual specification PO40A, PO41A, PO42A, PO43A, PO44A and is BT approved.

Features

- High output/input DC current transfer ratio
- Low saturation voltage
- High insulation (3.5 kV DC and 2.5 kV RMS)
- High working voltage (2.5 kV DC)

UL — Covered under UL component recognition FILE E90700

QUICK REFERENCE DATA**Diode**

DC forward current	I_F	max.	100 mA
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Transistor

Collector-emitter voltage (open base)	V_{CEO}	max.	30 V
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Optocoupler

Output/input DC current transfer ratio (CTR)

$I_F = 0.5 \text{ mA}; V_{CE} = 5 \text{ V}$	I_C/I_F	min.	0.1
$I_F = 1.0 \text{ mA}; V_{CE} = 0.4 \text{ V}$	I_C/I_F	min.	0.25
$I_F = 10 \text{ mA}; V_{CE} = 0.5 \text{ V}$	I_C/I_F	min.	0.6

Leakage current under working voltage 2.5 kV (DC value)

$V_{CC} = 10 \text{ V}$	I_{CEW}	max.	200 nA
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Isolation voltage	DC	V_{IORM}	min.	3.5 kV
	AC (RMS value)			2.5 kV

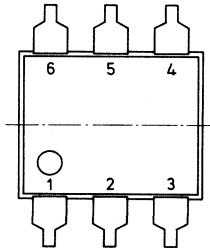
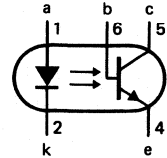
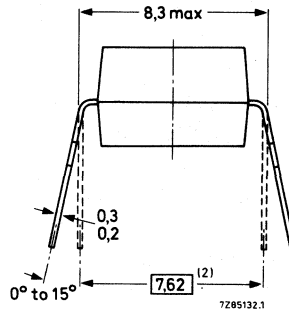
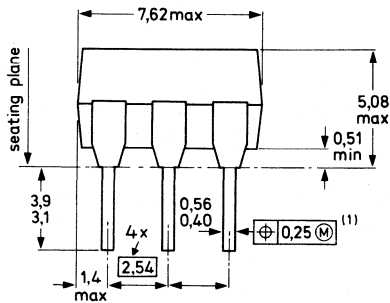
MECHANICAL DATA

SOT90B (see Fig.1).

MECHANICAL DATA

Fig. 1 SOT90B.

Dimensions in mm



⊕ Positional accuracy.

Ⓜ Maximum Material Condition.

- (1) Centre-lines of all leads are within $\pm 0,125$ 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 (peak value); $t_p = 10 \mu s$; $\delta = 0.01$	I_F I_{FRM}	max.	100 mA 2,5 A
Total power dissipation up to $T_{amb} = 25 \text{ }^\circ\text{C}$	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 $T_{amb} = 25 \text{ }^\circ\text{C}$	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	$R_{th j-a}$	=	500 K/W
transistor	$R_{th j-a}$	=	500 K/W
From junction to ambient, device mounted on a printed circuit board diode	$R_{th j-a}$	=	400 K/W
transistor	$R_{th j-a}$	=	400 K/W

ISOLATION RELATED VALUES

External air gap (clearance) input terminals to output terminals	$L(1O1)$	min.	7,2 mm
External tracking path (creepage distance) input terminals to output terminals	$L(1O2)$	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 μ A

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)

$I_F = 10 \text{ mA}; V_{CE} = 0,5 \text{ V}$

I_C/I_F min. 0,6
max. 1,5

$I_F = 1 \text{ mA}; V_{CE} = 0,4 \text{ V}$

I_C/I_F min. 0,25

$I_F = 0,5 \text{ mA}; V_{CE} = 5 \text{ V}$

I_C/I_F min. 0,1

$I_F = 3 \text{ mA}; V_{CE} = 1 \text{ V}$

I_C/I_F min. 0,3

$I_F = 5 \text{ mA}; V_{CE} = 5 \text{ V}$

I_C/I_F min. 0,3

$I_F = 10 \text{ mA}; V_{CE} = 10 \text{ V}$

I_C/I_F min. 0,25

$I_F = 20 \text{ mA}; V_{CE} = 0,5 \text{ V}$

I_C/I_F min. 0,25

Collector current

$I_F = 0,1 \text{ mA}; V_{CE} = 5 \text{ V}$

I_{CE} max. 150 μA^*

DC current gain

$I_C = 0,4 \text{ mA}; V_{CE} = 1 \text{ V}$

h_{FE} min. 200

Collector-emitter saturation voltage

$I_F = 10 \text{ mA}; I_C = 1 \text{ mA}$

V_{CEsat} max. 0,5 V

Output capacitance

$V_{CB} = 10 \text{ V}; f = 1 \text{ MHz}$

$C_{b'c}$ typ. 4,5 pF

Collector cut-off current (dark) at working voltage $V_W = 2,5 \text{ kV}$; (DC value) (notes 1 and 2)

$V_{CC} = 10 \text{ V};$

$V_{CC} = 10 \text{ V}; T_j = 70 \text{ }^\circ\text{C}$

I_{CEW} max. 200 nA

I_{CEW} max. 100 μA

Isolation voltage; $t = 1 \text{ min}$ DC

(note 3)

AC (RMS value)

V_{IORM} min. 3,5 kV
2,5 kV

Capacitance between input and output

$V = 0; f = 1 \text{ MHz}$

C_{io} typ. 0,6 pF

Insulation resistance between input and output

$\pm V_{IO} = 1 \text{ kV}$

R_{IO} min. 10 G Ω
typ. 10 T Ω

Switching times (see Figs 3 and 4)

$I_C = 2 \text{ mA}; V_{CC} = 10 \text{ V}; R_L = 100 \text{ } \Omega$

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.

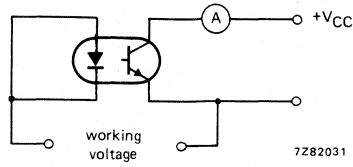


Fig. 2.

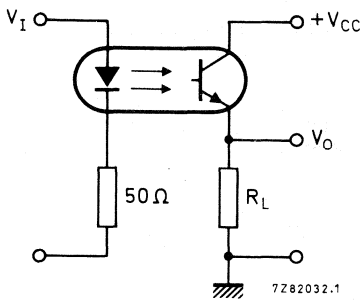
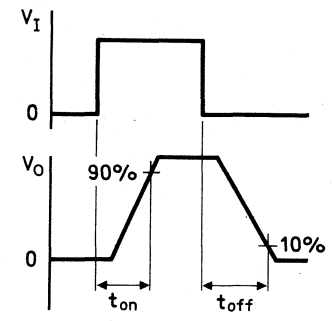


Fig. 3 Switching circuit.



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Fig. 4 Waveforms.

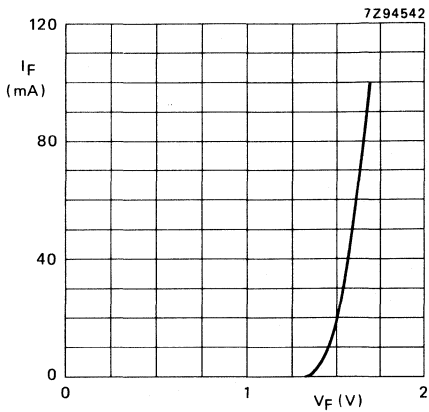


Fig. 5 $T_{amb} = 25\text{ }^{\circ}\text{C}$; typical values.

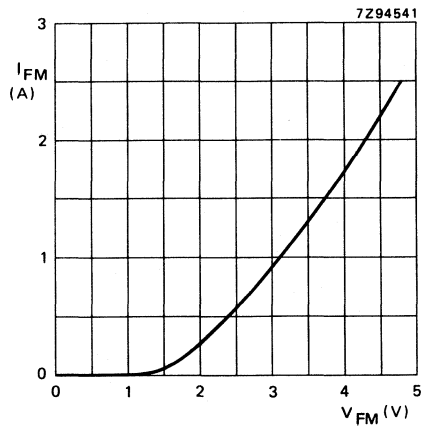


Fig. 6 $T_{amb} = 25\text{ }^{\circ}\text{C}$; $t_p = 10\text{ }\mu\text{s}$; $T = 1\text{ ms}$; typical values.

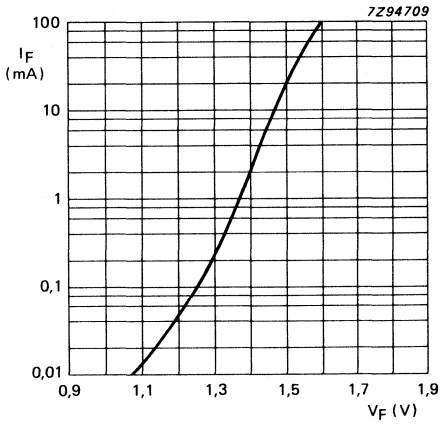


Fig. 7 $T_{amb} = 25\text{ }^{\circ}\text{C}$; typical values.

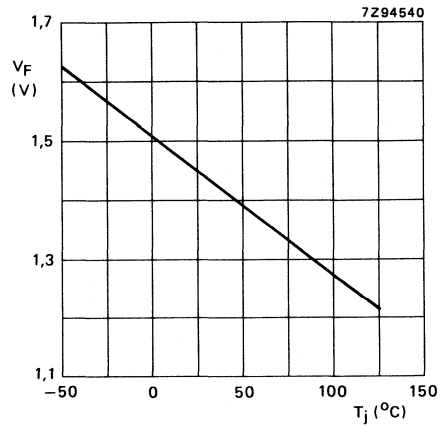


Fig. 8 $I_F = 10\text{ mA}$; typical values.

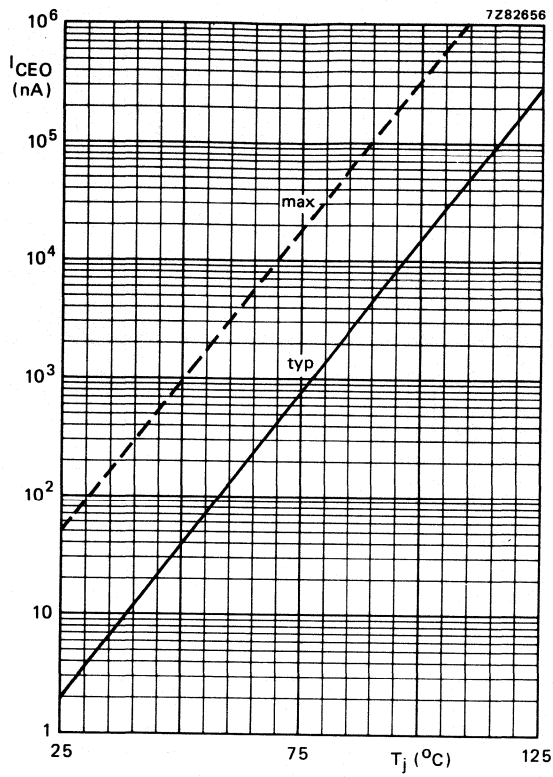


Fig. 9 $I_F = 0$; $V_{CE} = 10$ V; typical values.

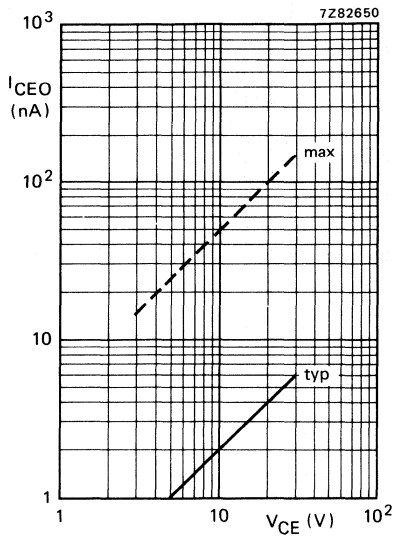


Fig. 10 $I_F = 0$; $T_j = 25^\circ\text{C}$.

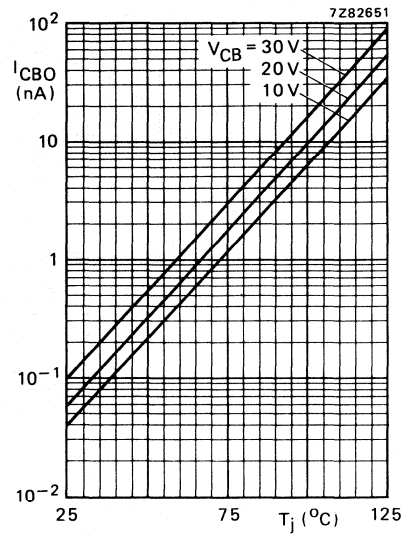


Fig. 11 Typical values.

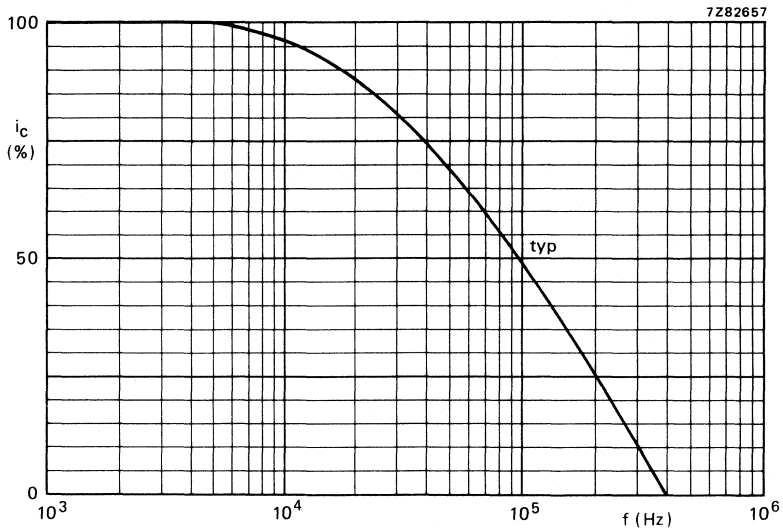


Fig. 12 $I_B = 0$; $I_C = 2\text{ mA}$; $V_{CC} = 5\text{ V}$; $R_L = 1\text{ k}\Omega$; $T_{amb} = 25^\circ\text{C}$.

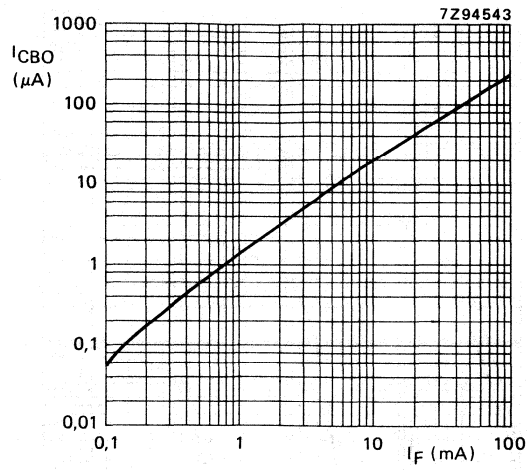


Fig. 13 $V_{CB} = 5 V$; $T_{amb} = 25 ^\circ C$;
typical values.

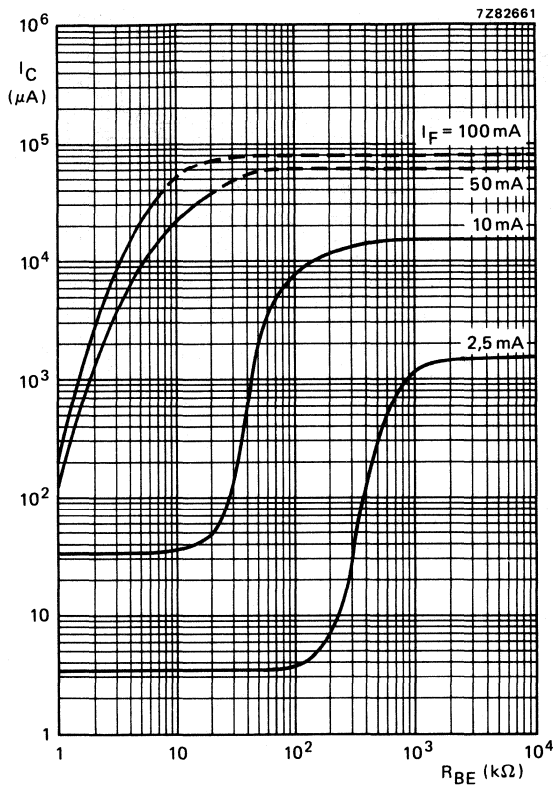


Fig. 14 $I_B = 0$; $V_{CE} = 5 \text{ V}$; $T_{amb} = 25 \text{ }^\circ\text{C}$; typical values.

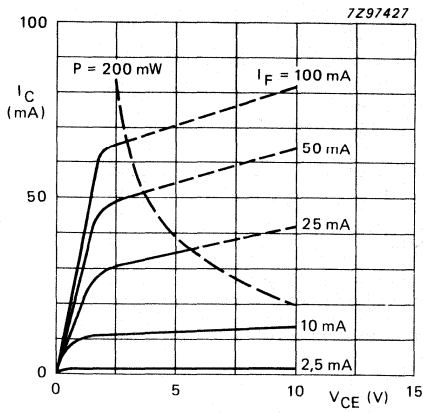


Fig. 15 $T_{amb} = 25 \text{ }^\circ\text{C}$; typical values.

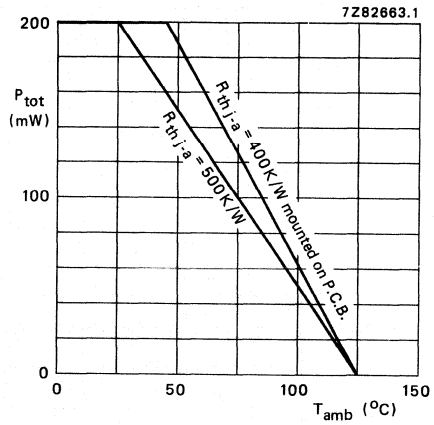


Fig. 16.

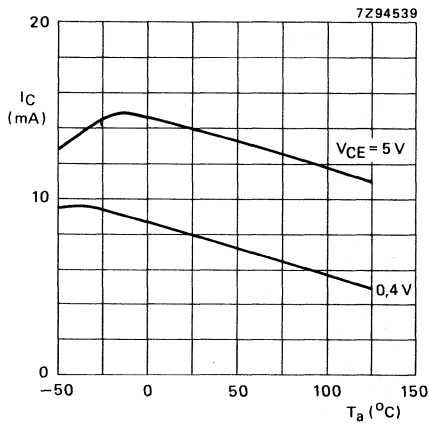


Fig. 17 $I_F = 10 \text{ mA}$; typical values.

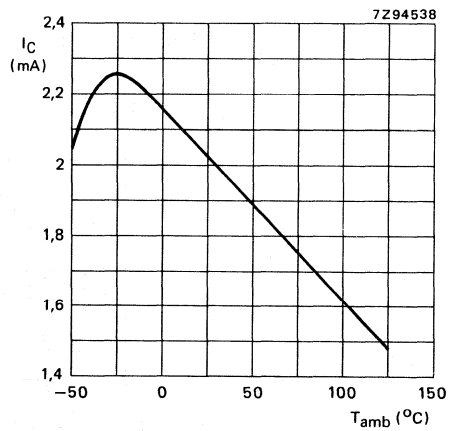


Fig. 18 $I_F = 2 \text{ mA}$; $V_{CE} = 0,4 \text{ V}$; typical values.

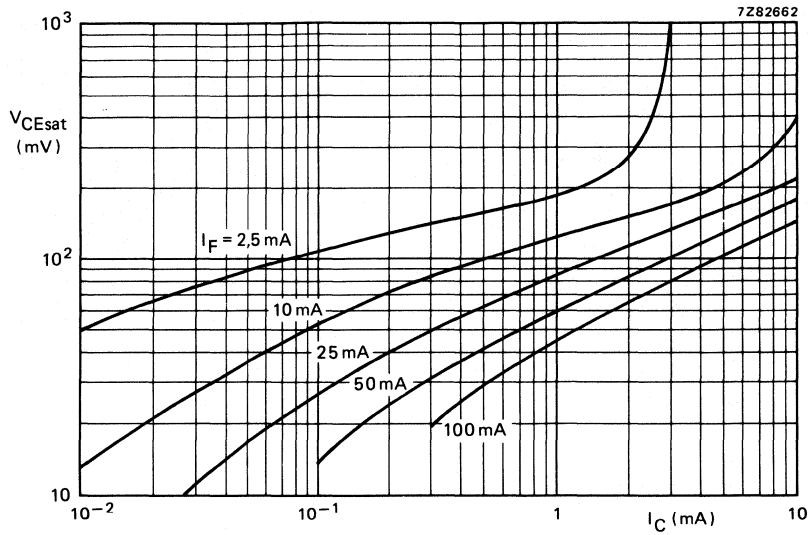


Fig. 19 $I_B = 0$; $T_{amb} = 25^\circ C$; typical values.

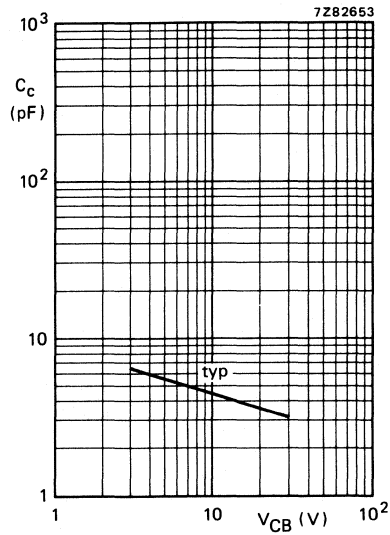


Fig. 20 $f = 1\text{ MHz}$; $T_{amb} = 25^\circ C$.

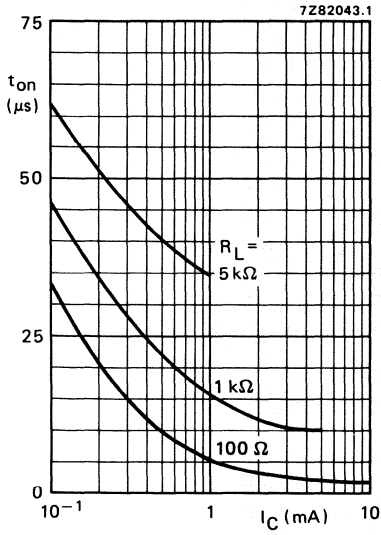


Fig. 21 $I_B = 0$; $V_{CC} = 5\text{ V}$; $T_{amb} = 25\text{ }^\circ\text{C}$; typical values (see also Fig.23).

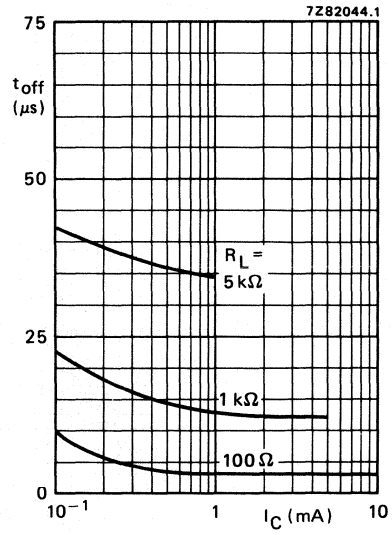


Fig. 22 $I_B = 0$; $V_{CC} = 5\text{ V}$; $T_{amb} = 25\text{ }^\circ\text{C}$; typical values (see also Fig.23).

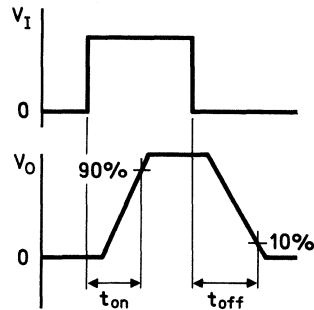
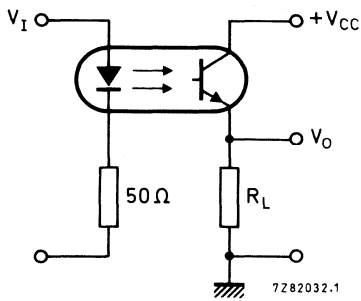


Fig. 23 Switching circuit and waveforms.

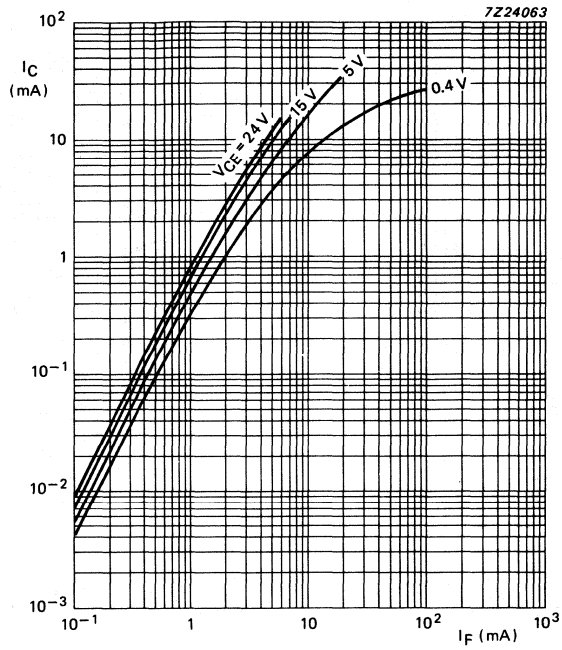


Fig. 24 $T_{amb} = 25\text{ }^{\circ}\text{C}$, typical values.

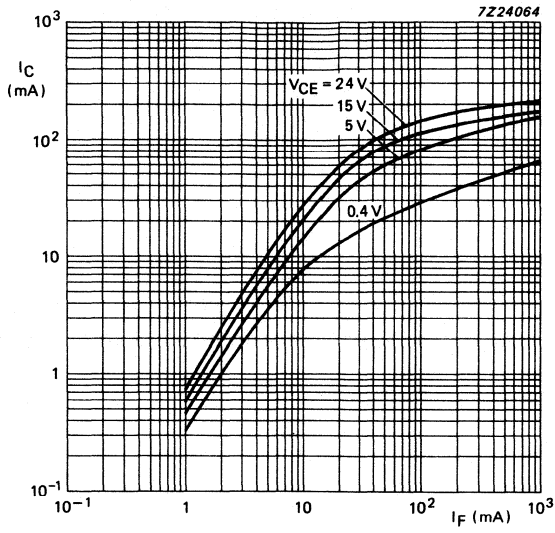


Fig. 25 $T_{amb} = 25\text{ }^{\circ}\text{C}$; $t_p = 10\text{ }\mu\text{s}$; $T = 1\text{ ms}$; Typical values.



OPTOCOUPERS

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 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; $t_p = 10 \mu s$; $\delta = 0.01$	I_{FRM}	max.	3 A
Total power dissipation up to $T_{amb} = 25 \text{ }^\circ\text{C}$	P_{tot}	max.	100 mW

Transistor

Collector-emitter voltage (open base)	V_{CEO}	max.	30 V
Total power dissipation up to $T_{amb} = 25 \text{ }^\circ\text{C}$	P_{tot}	max.	150 mW

Optocoupler

Output/input DC current transfer ratio (CTR); $I_F = 2 \text{ mA}$; $V_{CE} = 5 \text{ V}$; ($I_B = 0$)	SL5500 SL5501 SL5511	I_C/I_F	min. 0.4 min. 0.15 min. 0.25
Continuous DC voltage between input and output		V_{IOWM}	max. 800 V
Isolation voltage DC AC (RMS value)		V_{IORM}	min. 3.5 kV 2.5 kV

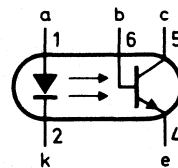
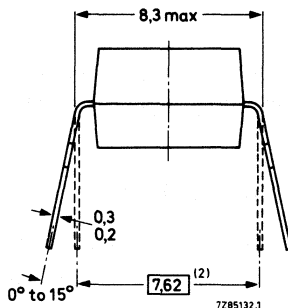
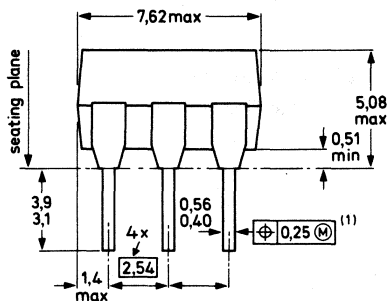
MECHANICAL DATA

SOT90B (see Fig.1).

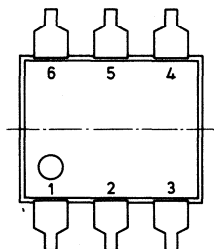
MECHANICAL DATA

Dimensions in mm

Fig.1 SOT90B.



7270427



- ⊕ 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; $t_p = 10 \mu s$; $\delta = 0.01$	I_{FRM}	max.	3 A
Total power dissipation up to $T_{amb} = 25^\circ C$	P_{tot}	max.	100 mW

Transistor

Collector-emitter voltage (open base)	V_{CEO}	max.	30 V
Collector-base voltage (open emitter)	V_{CBO}	max.	70 V
Emitter-collector voltage (open base)	V_{ECO}	max.	7 V
Emitter-base voltage (open collector)	V_{EBO}	max.	7 V
DC collector current	I_C	max.	100 mA
Total power dissipation up to $T_{amb} = 25^\circ C$	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	$R_{th\ j-a}$	=	750 K/W
transistor	$R_{th\ j-a}$	=	650 K/W
optocoupler	$R_{th\ j-a}$	=	500 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 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 μ A

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 μ A
$V_{CE} = 10$ V; $T_{amb} = 70$ °C	I_{CEO}	max.	500 nA
$V_{CB} = 30$ V	I_{CBO}	max.	50 μ A
Collector-emitter breakdown voltage $I_C = 10$ μ A	$V_{(BR)CEO}$	min.	30 V
Collector-base breakdown voltage $I_C = 10$ μ A	$V_{(BR)CBO}$	min.	30 V
Emitter-collector breakdown voltage $I_E = 10$ μ A	$V_{(BR)ECO}$	min.	7 V
Emitter-base breakdown voltage $I_E = 10$ μ A	$V_{(BR)EBO}$	min.	7 V

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

Output/input DC current transfer ratio (CTR)

$I_F = 10 \text{ mA}; V_{CE} = 0.4 \text{ V}; T_{amb} = 25 \text{ }^\circ\text{C}$	SL5500	I_C/I_F	0.5 to 3
$T_{amb} = 70 \text{ }^\circ\text{C}$	SL5500	I_C/I_F	0.4 to 3
$T_{amb} = 25 \text{ to } 70 \text{ }^\circ\text{C}$	SL5501	I_C/I_F	0.25 to 4
$I_F = 2 \text{ mA}; V_{CE} = 5 \text{ V}; T_{amb} = 25 \text{ }^\circ\text{C}$	SL5500	I_C/I_F	min. 0.4
$T_{amb} = 70 \text{ }^\circ\text{C}$	SL5500	I_C/I_F	min. 0.3
$T_{amb} = 25 \text{ to } 70 \text{ }^\circ\text{C}$	SL5501	I_C/I_F	min. 0.15
$T_{amb} = 25 \text{ to } 70 \text{ }^\circ\text{C}$	SL5511	I_C/I_F	min. 0.25
$I_F = 0.5 \text{ mA}; V_{CE} = 0.4 \text{ V}; T_{amb} = 25 \text{ to } 70 \text{ }^\circ\text{C}$	SL5511	I_C/I_F	min. 0.2

Collector-emitter saturation voltage

$I_F = 50 \text{ mA}; I_C = 10 \text{ mA}$	SL5500	V_{CEsat}	max. 0.4 V
$I_F = 20 \text{ mA}; I_C = 2 \text{ mA}$	SL5501	V_{CEsat}	max. 0.4 V
	SL5511	V_{CEsat}	max. 0.4 V

Isolation voltage; DC value

$t = 1 \text{ min. (see note 2) AC (RMS value)}$		V_{IORM}	min. 3.5 kV
			2.5 kV

Collector capacitance; $I_E = I_e = 0$;

$V_{CB} = 10 \text{ V}; f = 1 \text{ MHz}$		$C_{b'c}$	typ. 4.5 pF
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Capacitance between input and output

$V = 0; f = 1 \text{ MHz}$		C_{io}	typ. 0.6 pF
			max. 1.3 pF

Insulation resistance between input and output

$V_{IO} = \pm 1000 \text{ V}$		R_{IO}	min. 1 G Ω
			typ. 1 T Ω

Switching times (see Figs 2 and 3)

$I_F = 16 \text{ mA}; V_{CC} = 5 \text{ V}; R_L = 1 \text{ k}\Omega$

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.

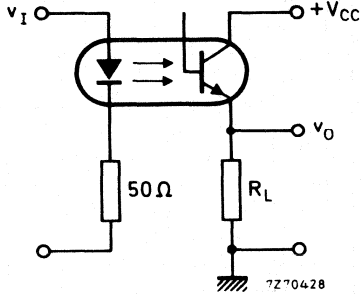


Fig. 2 Switching circuit.

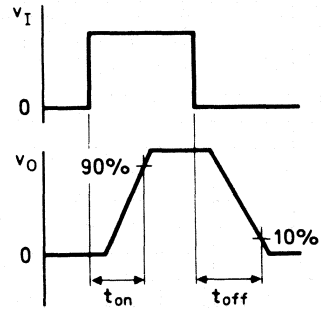


Fig. 3 Waveforms.

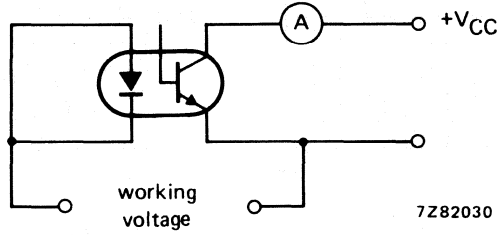
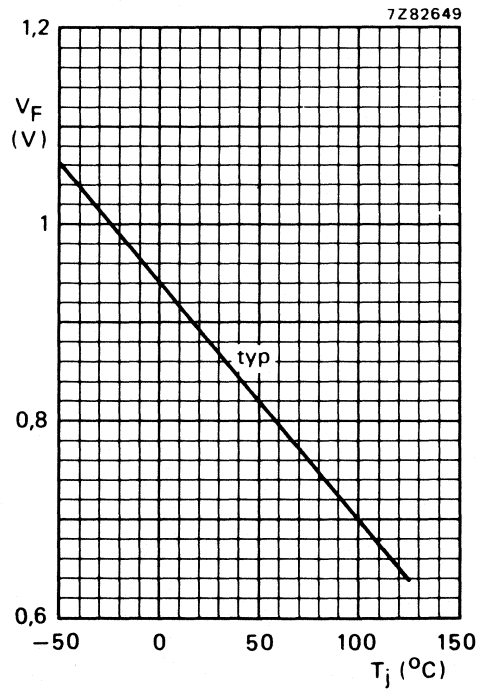
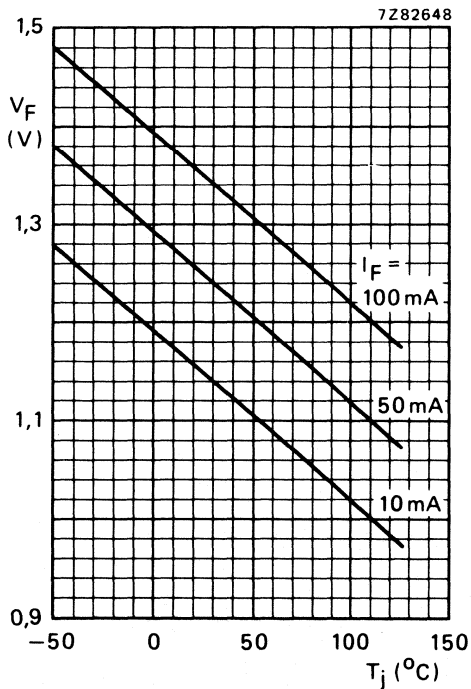
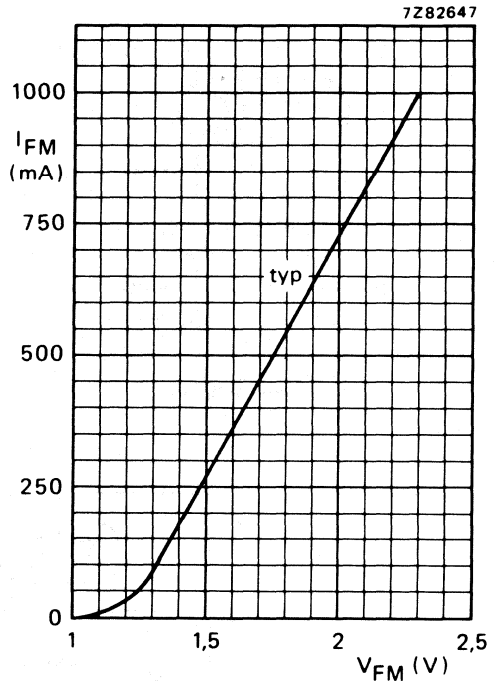
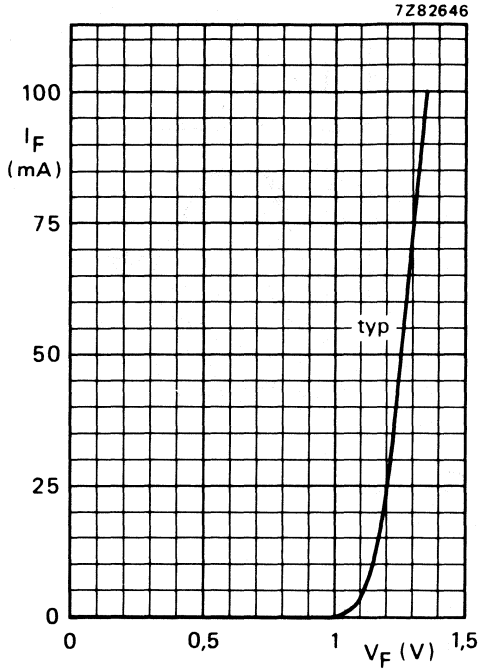


Fig. 4.



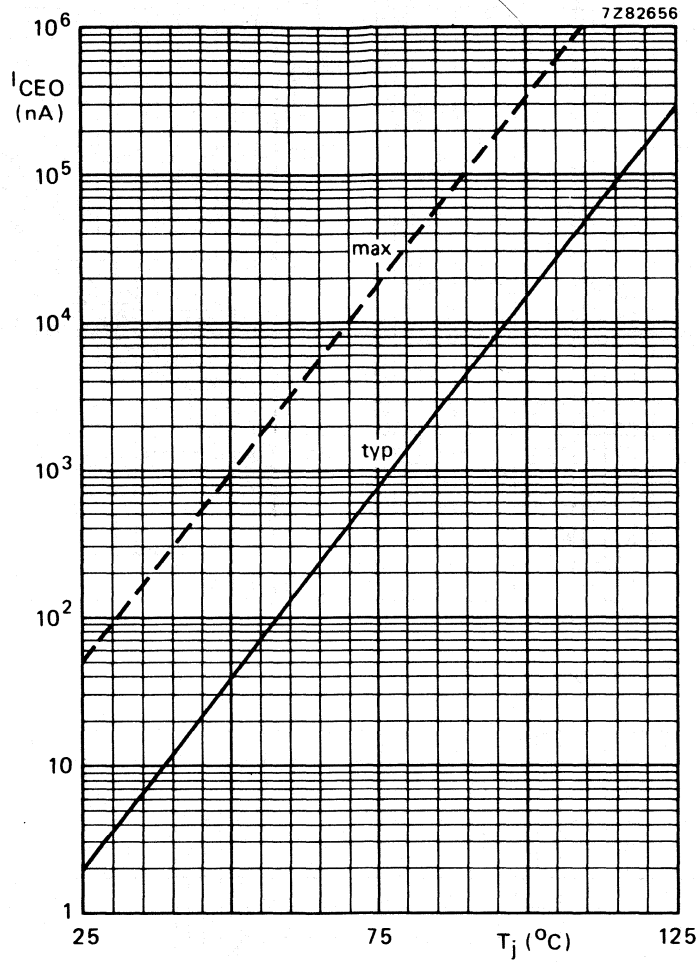


Fig. 9 $I_F = 0$; $V_{CE} = 10$ V.

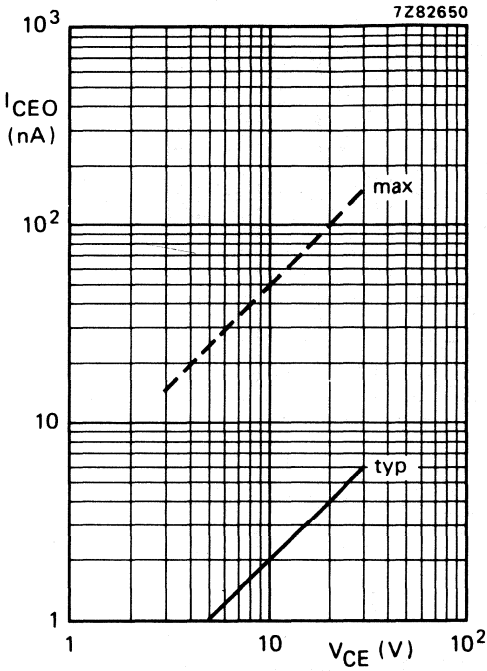


Fig. 10 $I_F = 0$; $T_j = 25^\circ\text{C}$.

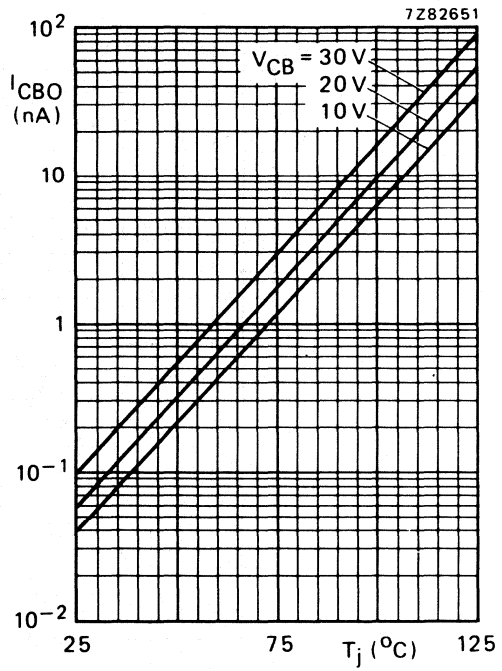


Fig. 11 Typical values.

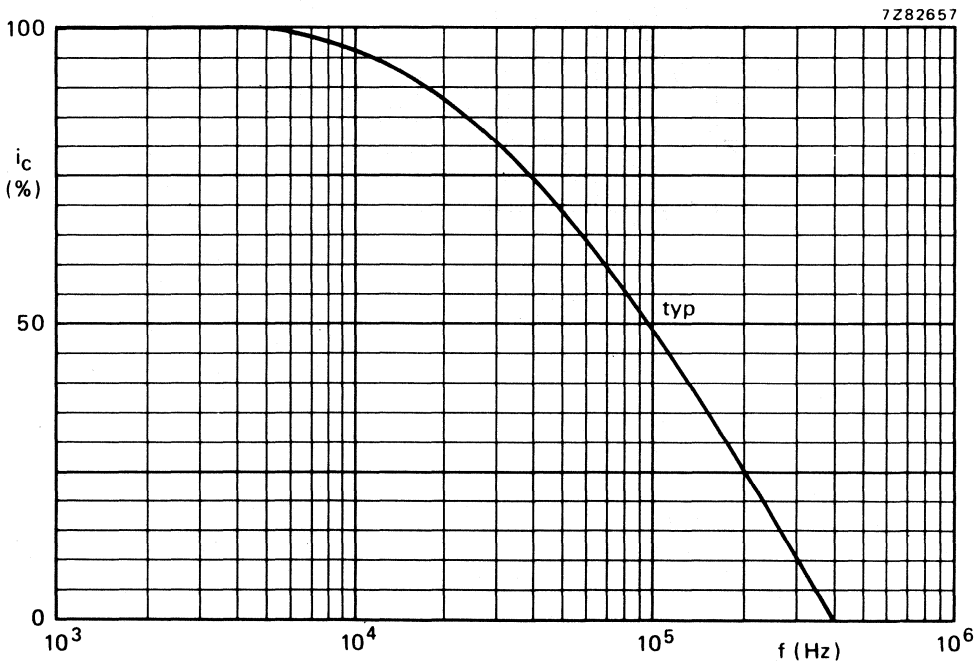


Fig. 12 $I_B = 0$; $I_C = 2\text{ mA}$; $V_{CC} = 5\text{ V}$; $R_L = 1\text{ k}\Omega$; $T_{amb} = 25^\circ\text{C}$.

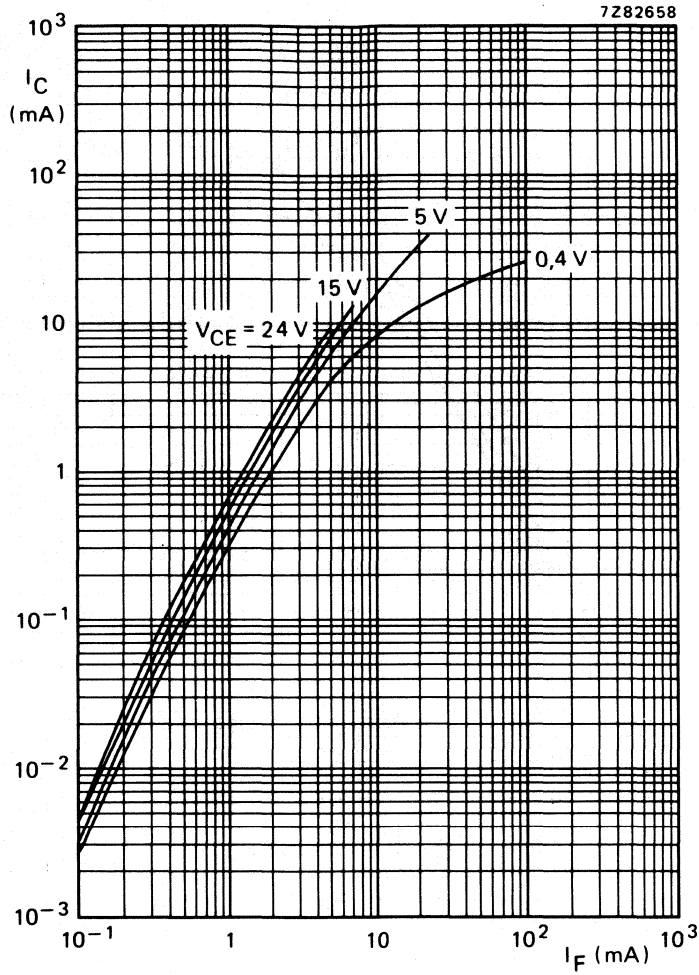


Fig. 13 $T_{amb} = 25\text{ }^{\circ}\text{C}$, typical values.

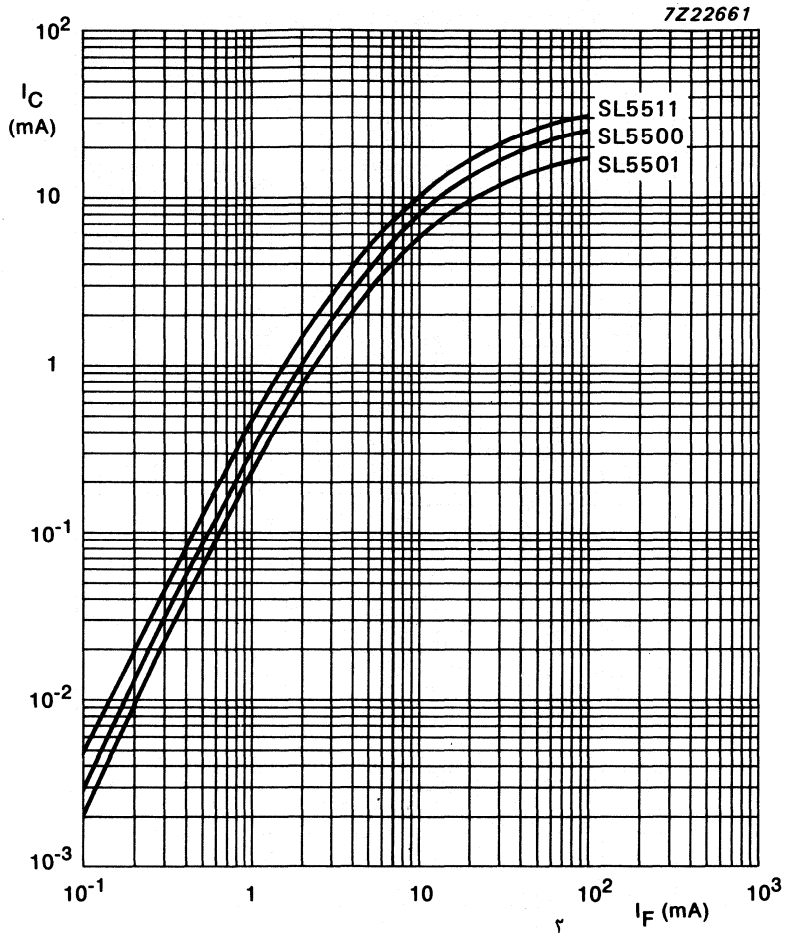


Fig. 14 Typical collector current versus forward current.

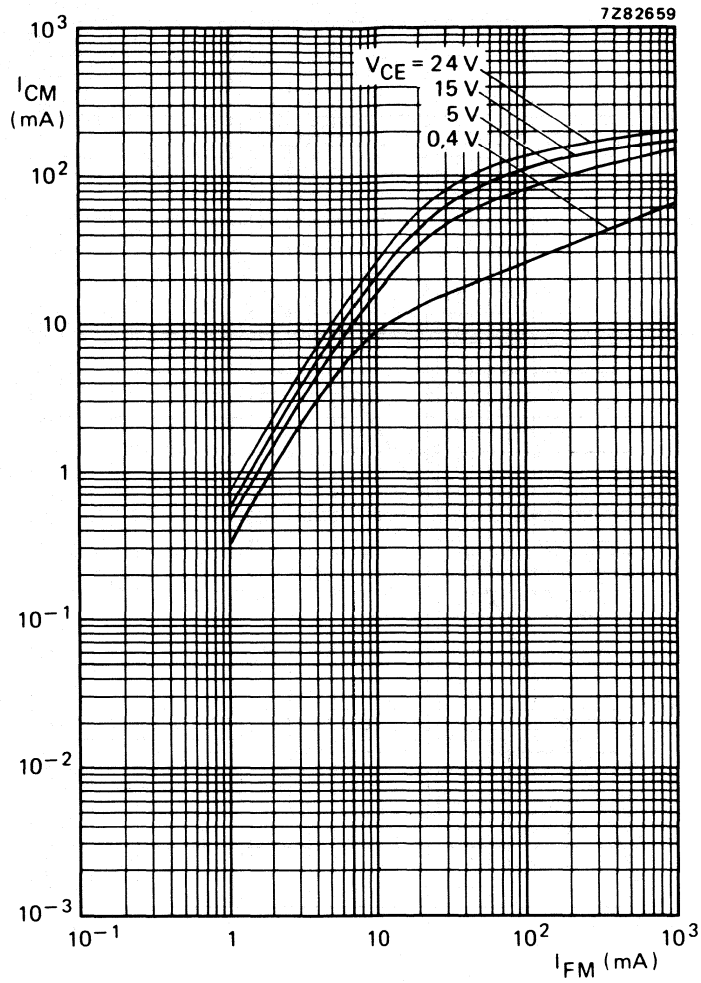


Fig. 15 $T_{amb} = 25\text{ }^{\circ}\text{C}$; $t_p = 10\text{ }\mu\text{s}$; $T = 1\text{ ms}$; typical values.

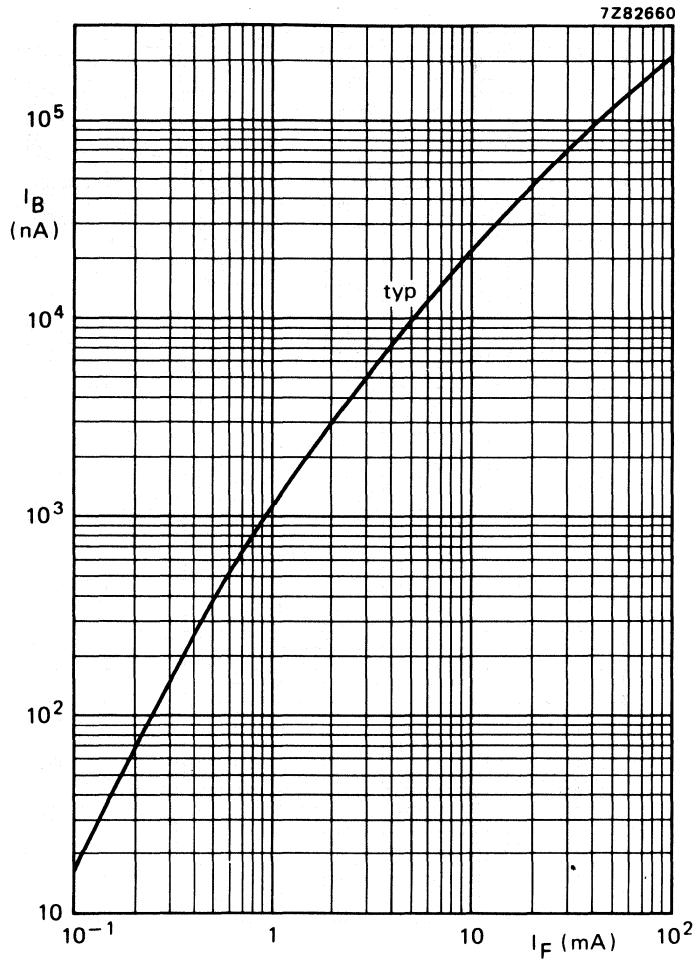


Fig. 16 $V_{CB} = 5$ V; $T_{amb} = 25$ °C.

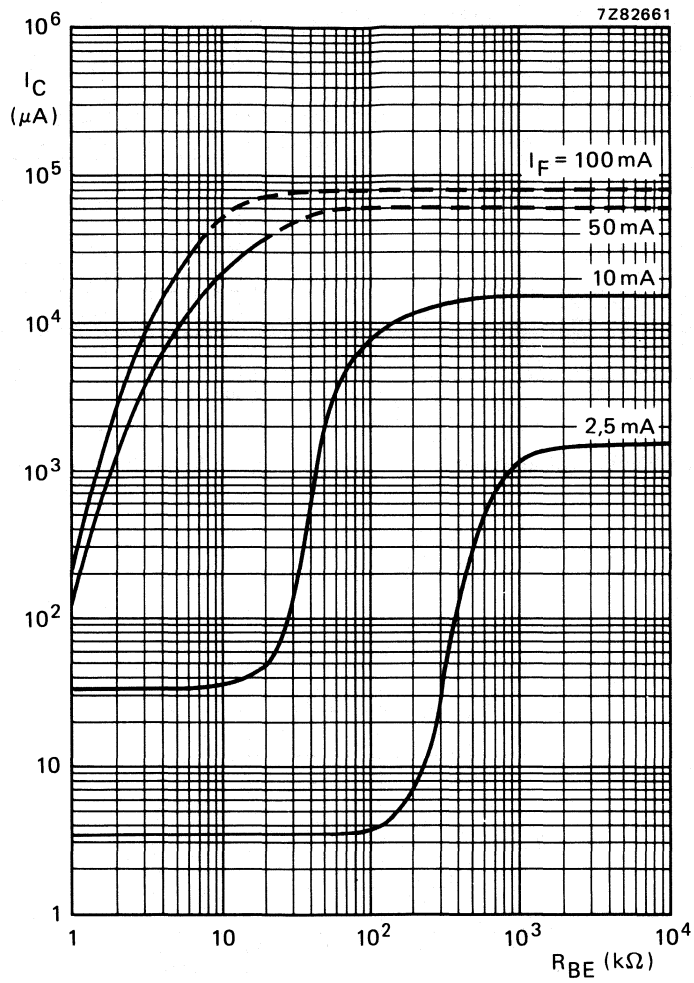


Fig. 17 $I_B = 0$; $V_{CE} = 5 \text{ V}$; $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$; typical values.

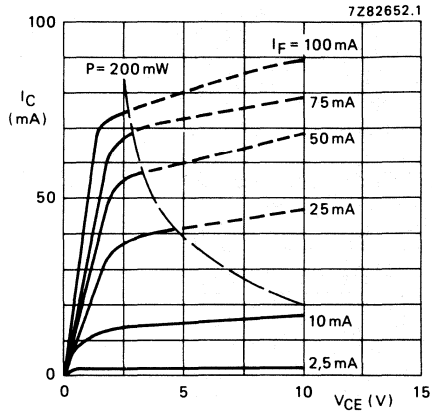


Fig. 18 $T_{amb} = 25^\circ\text{C}$; typical values.

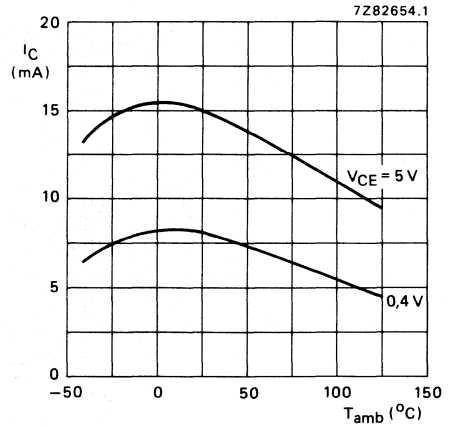


Fig. 19 $I_F = 10 \text{ mA}$; typical values.

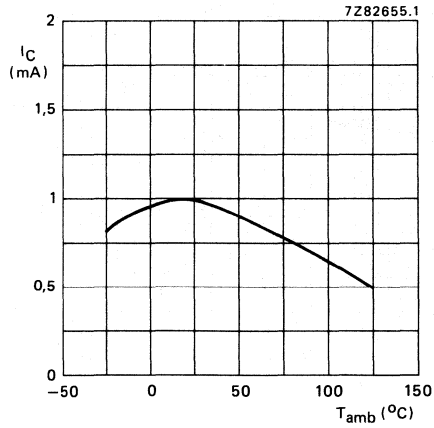


Fig. 20 $I_F = 2 \text{ mA}$; $V_{CE} = 0.4 \text{ V}$; typical values.

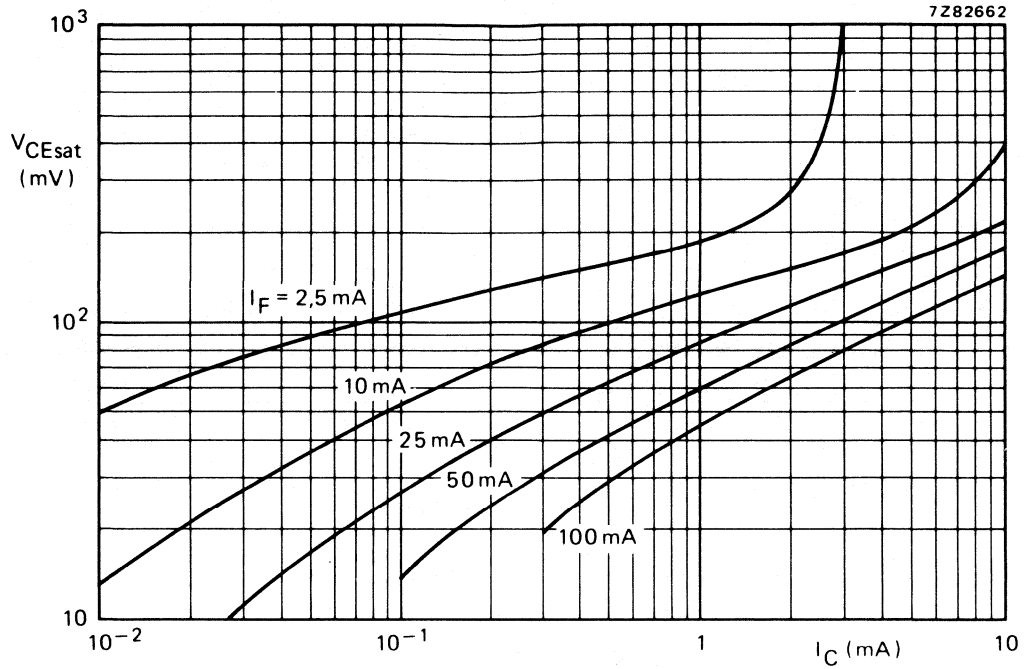


Fig. 21 $I_B = 0$; $T_{amb} = 25^\circ C$; typical values.

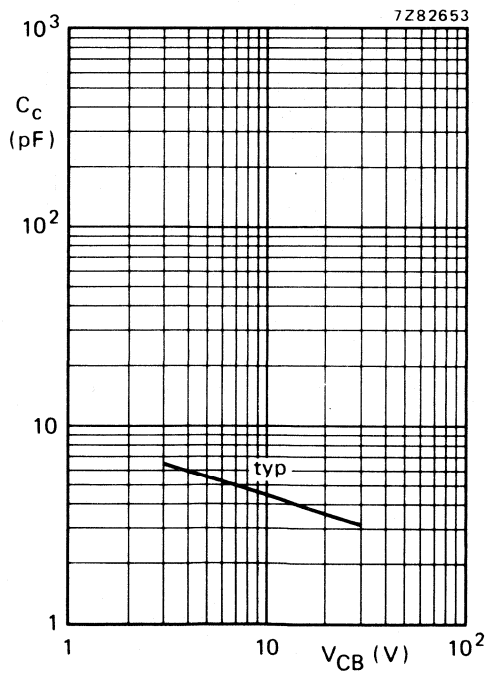


Fig. 22 $f = 1$ MHz; $T_{amb} = 25^\circ C$.

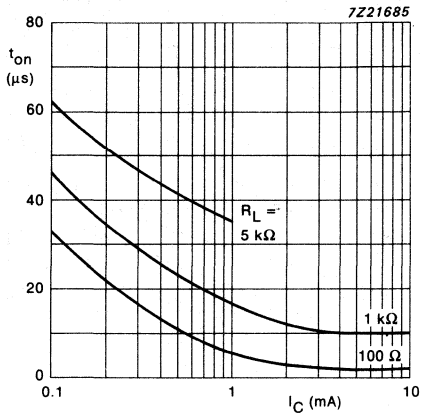


Fig. 23 SL5501.

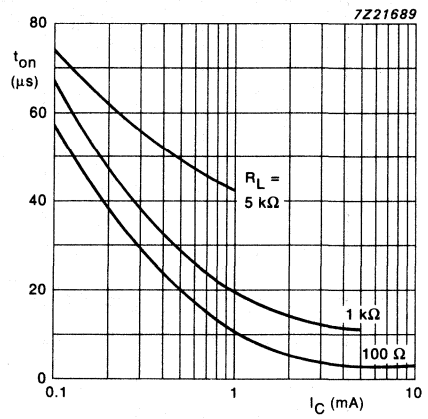


Fig. 24 SL5500.

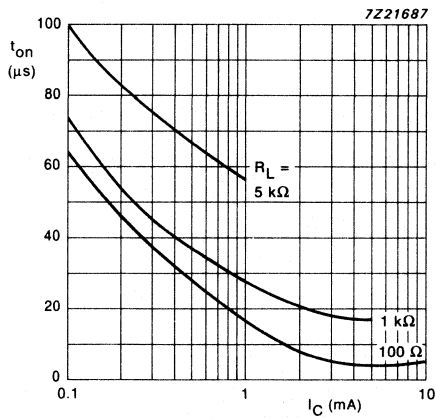


Fig. 25 SL5511.

Typical turn-on time versus collector current.

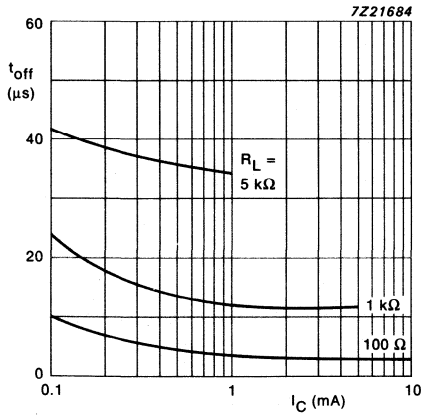


Fig. 26 SL5501.

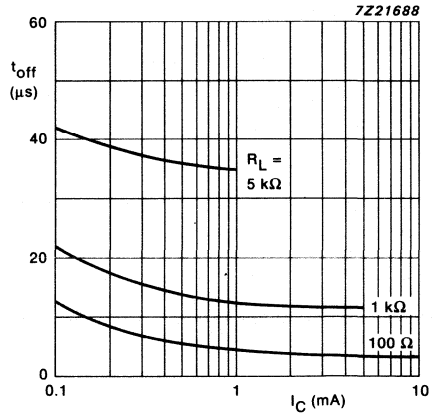


Fig. 27 SL5500.

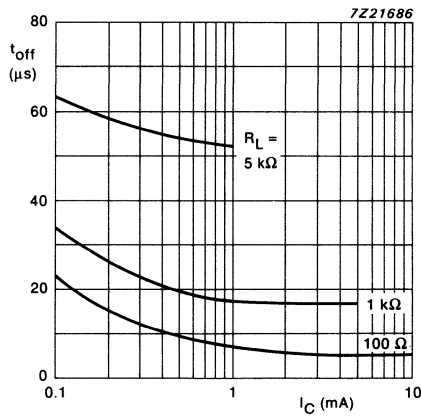


Fig. 28 SL5511.

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 (peak value); $t_p = 10 \mu s$; $\delta = 0.01$	I_F	max.	60 mA
	I_{FRM}	max.	3 A
Total power dissipation up to $T_{amb} = 25 \text{ }^\circ\text{C}$	P_{tot}	max.	100 mW

Transistor

Collector-emitter voltage (open base)	V_{CEO}	max.	80 V
Total power dissipation up to $T_{amb} = 25 \text{ }^\circ\text{C}$	P_{tot}	max.	150 mW

Optocoupler

Output/input DC current transfer ratio (CTR); $I_F = 2 \text{ mA}$; $V_{CE} = 5 \text{ V}$; ($I_B = 0$)	SL5504	I_C/I_F	min.	0.15
DC continuous voltage between input and output		V_{IOWM}	max.	800 V
Isolation voltage ; (RMS value)		V_{IORM}	min.	3.5 kV 2.5 kV

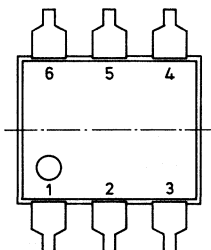
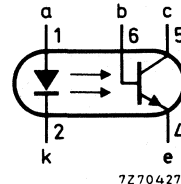
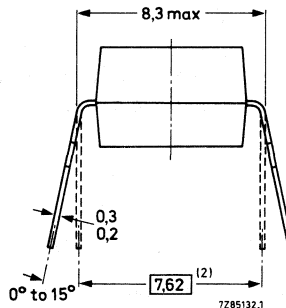
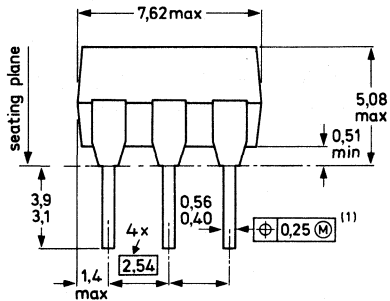
MECHANICAL DATA

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 $\pm 0,125$ 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); $t_p = 10 \mu s$; $\delta = 0.01$

I_{FRM} max. 3 A

Total power dissipation up to $T_{amb} = 25 \text{ }^\circ\text{C}$

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 $T_{amb} = 25 \text{ }^\circ\text{C}$

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	$R_{th\ j-a}$	=	750 K/W
transistor	$R_{th\ j-a}$	=	650 K/W
optocoupler	$R_{th\ j-a}$	=	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 μ A

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 μ A
$V_{CE} = 50$ V; $T_{amb} = 70$ °C	I_{CEO}	max.	500 nA
$V_{CE} = 30$ V	I_{CBO}	max.	50 nA
Collector-emitter breakdown voltage $I_C = 10$ μ A	$V_{(BR)CEO}$	min.	80 V
Collector-base breakdown voltage $I_C = 10$ μ A	$V_{(BR)CBO}$	min.	120 V
Emitter-collector breakdown voltage $I_E = 10$ μ A	$V_{(BR)ECO}$	min.	7 V
Emitter-base breakdown voltage $I_E = 10$ μ A	$V_{(BR)EBO}$	min.	7 V

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

Output/input DC current transfer ratio (CTR)

 $I_F = 2 \text{ mA}; V_{CE} = 5 \text{ V}; T_{amb} = 25 \text{ to } 70 \text{ }^\circ\text{C}$ I_C/I_F min. 0.15 $I_F = 10 \text{ mA}; V_{CE} = 0.4 \text{ V}; T_{amb} = 25 \text{ to } 70 \text{ }^\circ\text{C}$ I_C/I_F min. 0.25 to 4

Collector-emitter saturation voltage

 $I_F = 20 \text{ mA}; I_C = 2 \text{ mA}$ V_{CEsat} max. 0.4 V

Isolation voltage, DC value

 $t = 1 \text{ min. (see note 2)}$ V_{IORM} min. 3.5 kV

Isolation voltage, RMS value

 $t = 1 \text{ min. (see note 2)}$ V_{IORM} min. 2.5 kVCollector capacitance; $I_E = I_c = 0$; $V_{CB} = 10 \text{ V}; f = 1 \text{ MHz}$ C_{bc} typ. 4.5 pF

Capacitance between input and output

 $V = 0; f = 1 \text{ MHz}$ C_{io} typ. 0.6 pF
max. 1.3 pF

Insulation resistance between input and output

 $V_{IO} = \pm 1000 \text{ V}$ R_{IO} min. 1 G Ω
typ. 1 T Ω

Switching times (see Figs 2 and 3)

 $I_F = 16 \text{ mA}; V_{CC} = 5 \text{ V}; R_L = 1 \text{ k}\Omega$

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.

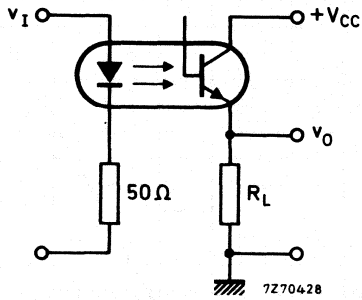


Fig. 2 Switching circuit.

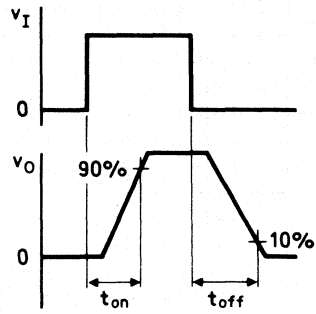


Fig. 3 Waveforms.

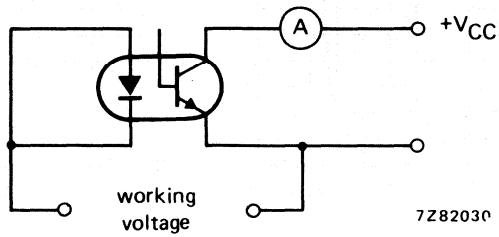


Fig. 4.

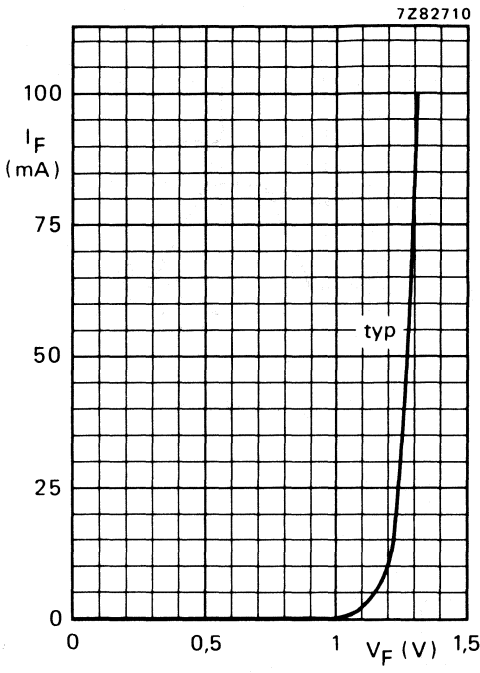


Fig. 5 $T_{amb} = 25\text{ }^{\circ}\text{C}$.

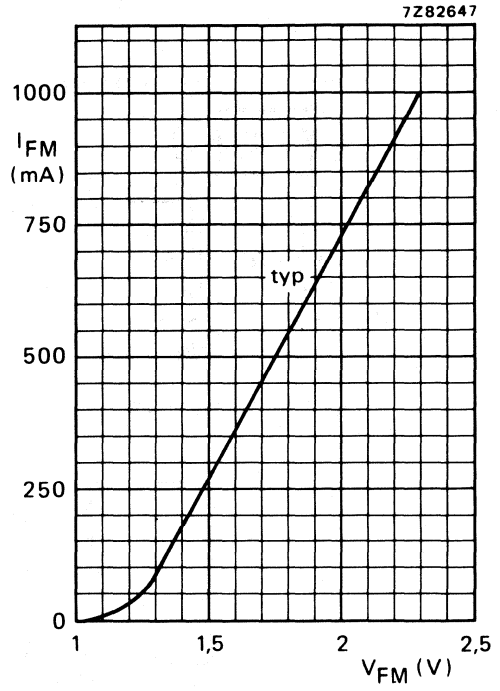


Fig. 6 $T_{amb} = 25\text{ }^{\circ}\text{C}$; $t_p = 10\text{ }\mu\text{s}$; $T = 1\text{ ms}$.

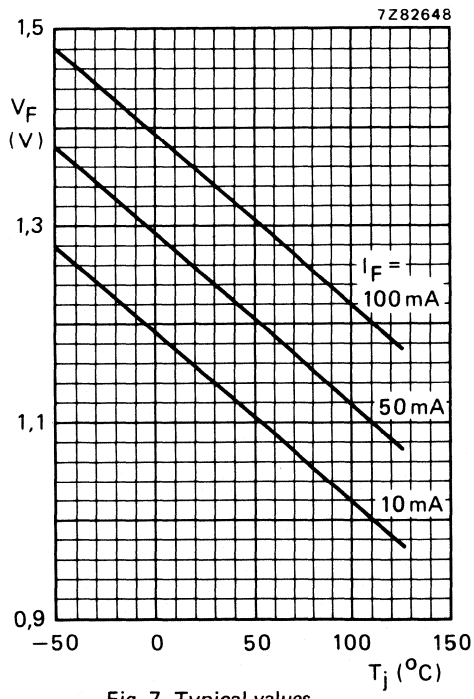


Fig. 7 Typical values.

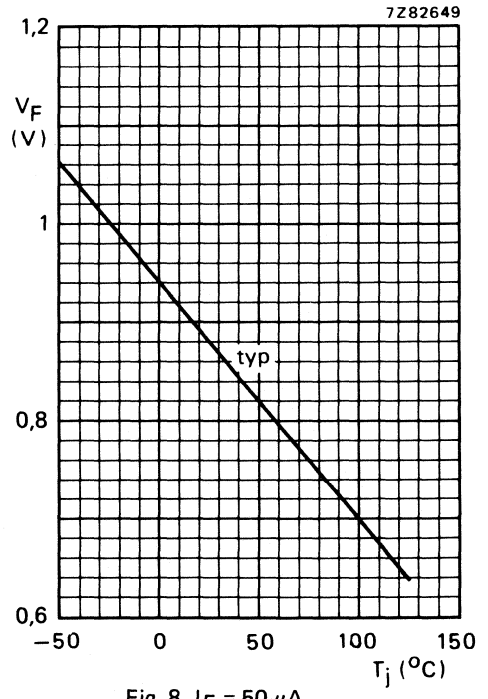


Fig. 8 $I_F = 50\text{ }\mu\text{A}$.

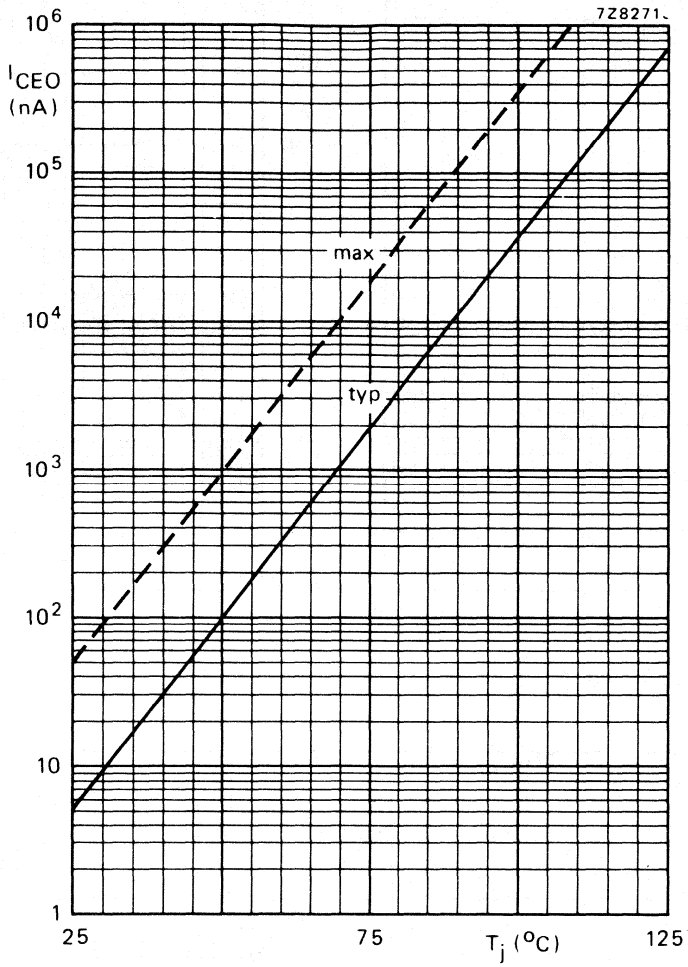


Fig. 9 $I_F = 0$; $V_{\text{CE}} = 50 \text{ V}$.

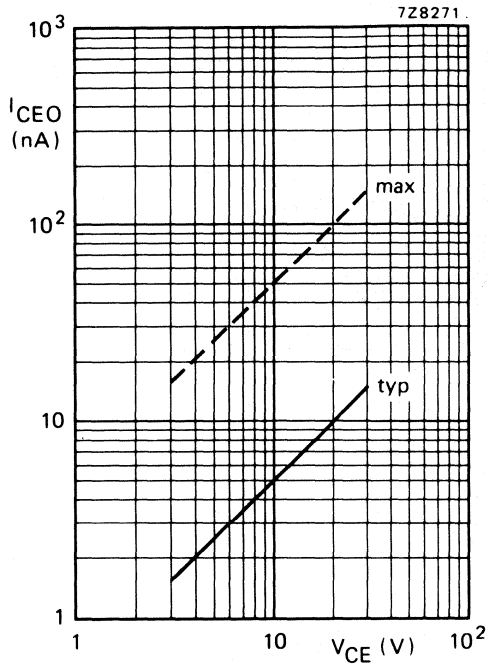


Fig. 10 $I_F = 0$; $T_j = 25$ °C.

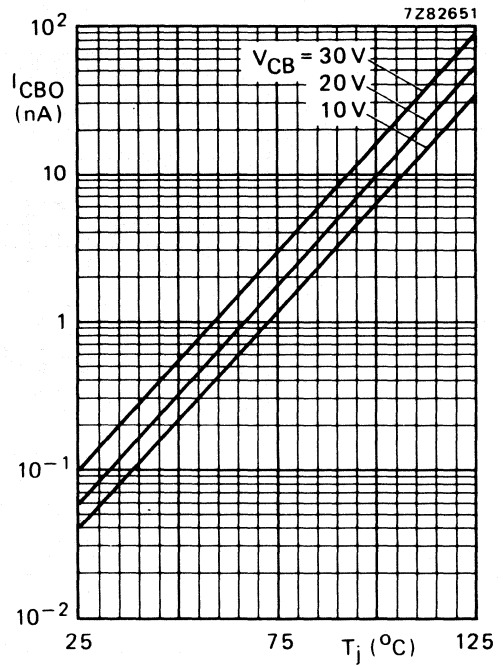


Fig. 11 Typical values.

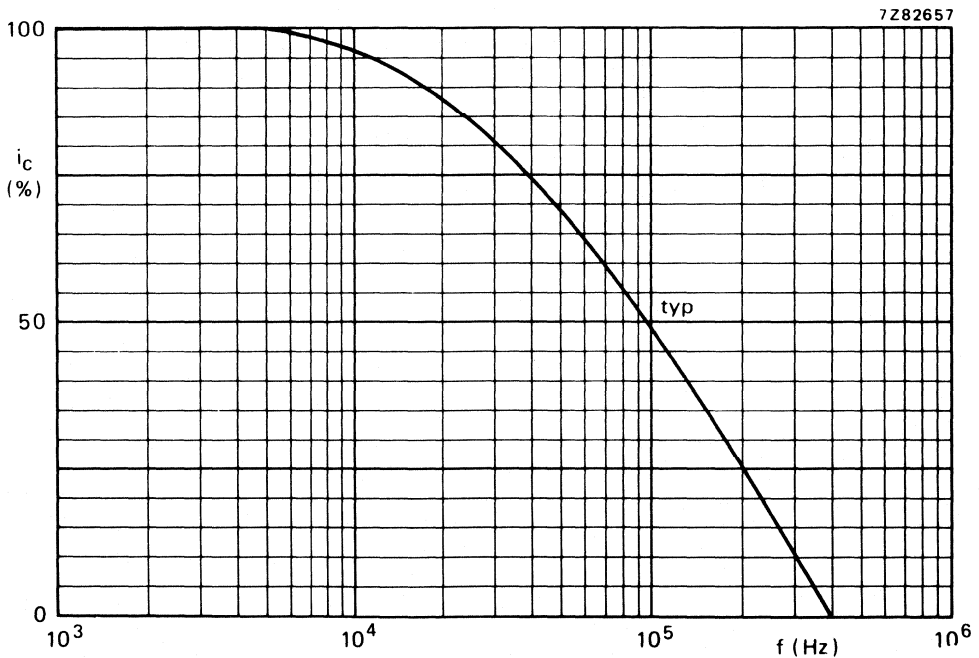


Fig. 12 $I_B = 0$; $I_C = 2$ mA; $V_{CC} = 5$ V, $R_L = 1$ kΩ; $T_{amb} = 25$ °C.

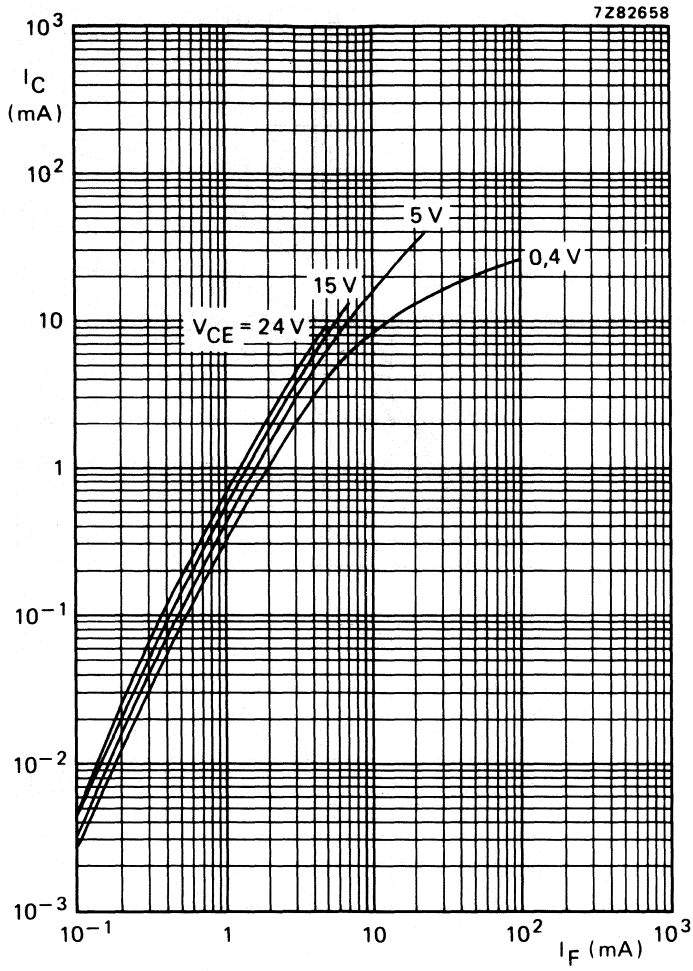


Fig. 13 $T_{amb} = 25\text{ }^{\circ}\text{C}$, typical values.

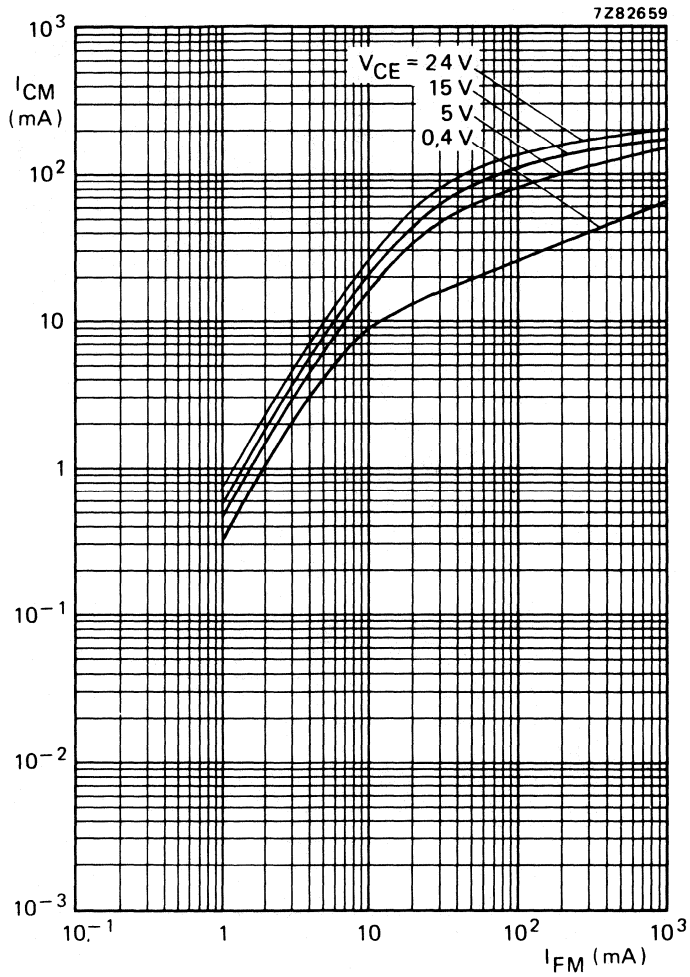


Fig. 14 $T_{amb} = 25^{\circ}\text{C}$; $t_p = 20 \mu\text{s}$; $T = 2 \text{ ms}$; typical values.

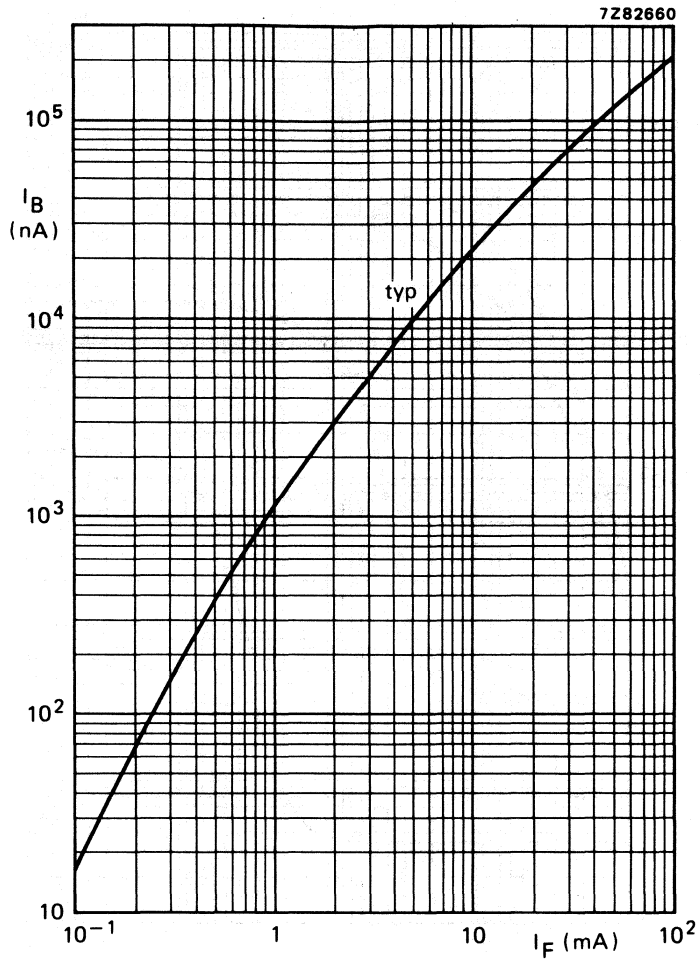


Fig. 15 $V_{CB} = 5\text{ V}$; $T_{amb} = 25\text{ }^\circ\text{C}$.

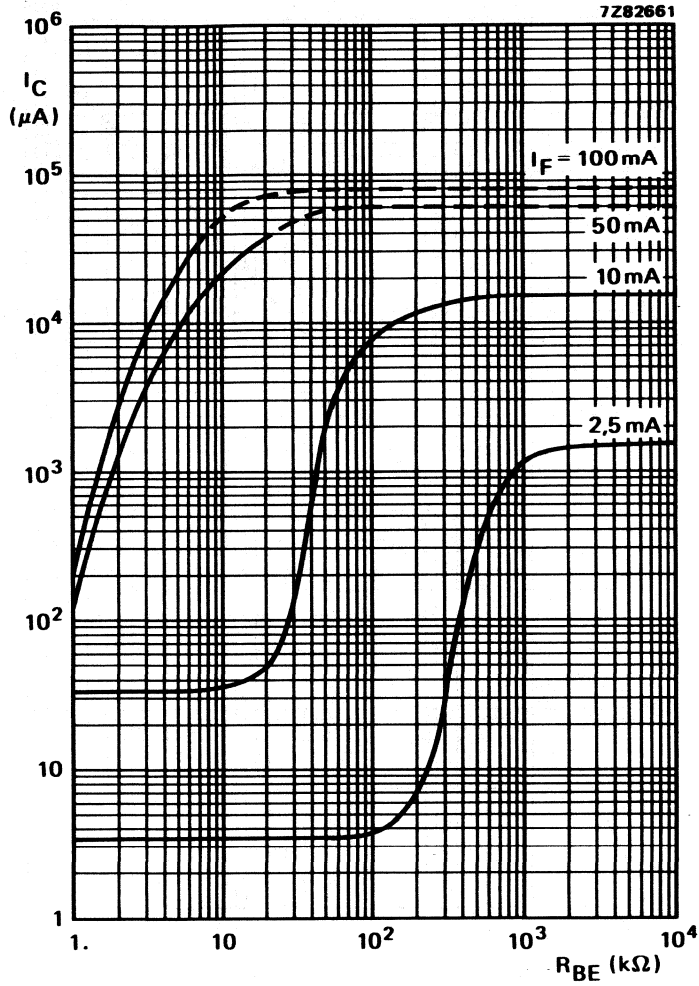


Fig. 16 $I_B = 0$; $V_{CE} = 5 \text{ V}$; $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$; typical values.

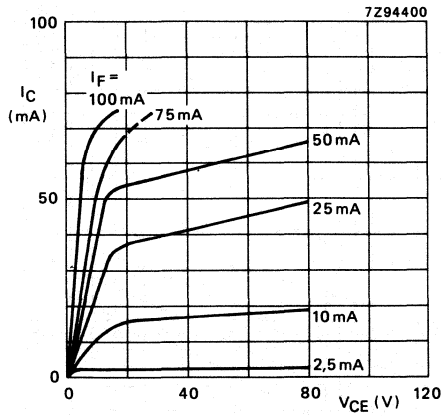


Fig. 17 $T_{amb} = 25^\circ C$; typical values.

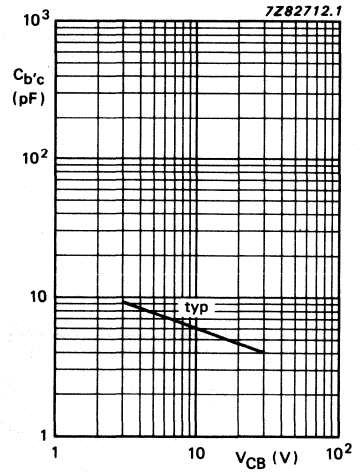


Fig. 18 $f = 1\text{ MHz}$; $T_{amb} = 25^\circ C$.

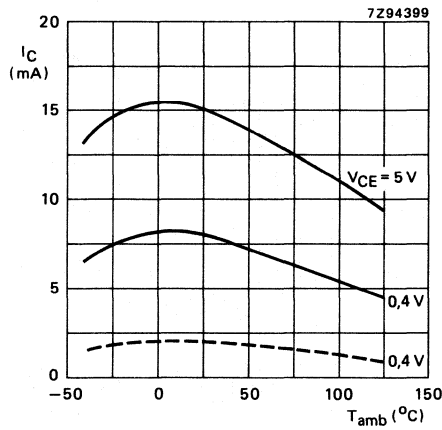


Fig. 19 $I_F = 10\text{ mA}$; typical values.
--- min. values.

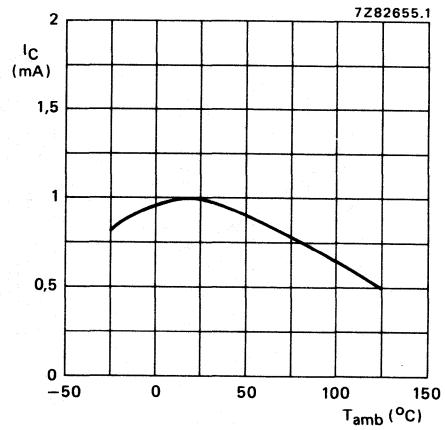


Fig. 20 $I_F = 2\text{ mA}$; typical values.
 $V_{CE} = 0.4\text{ V}$.

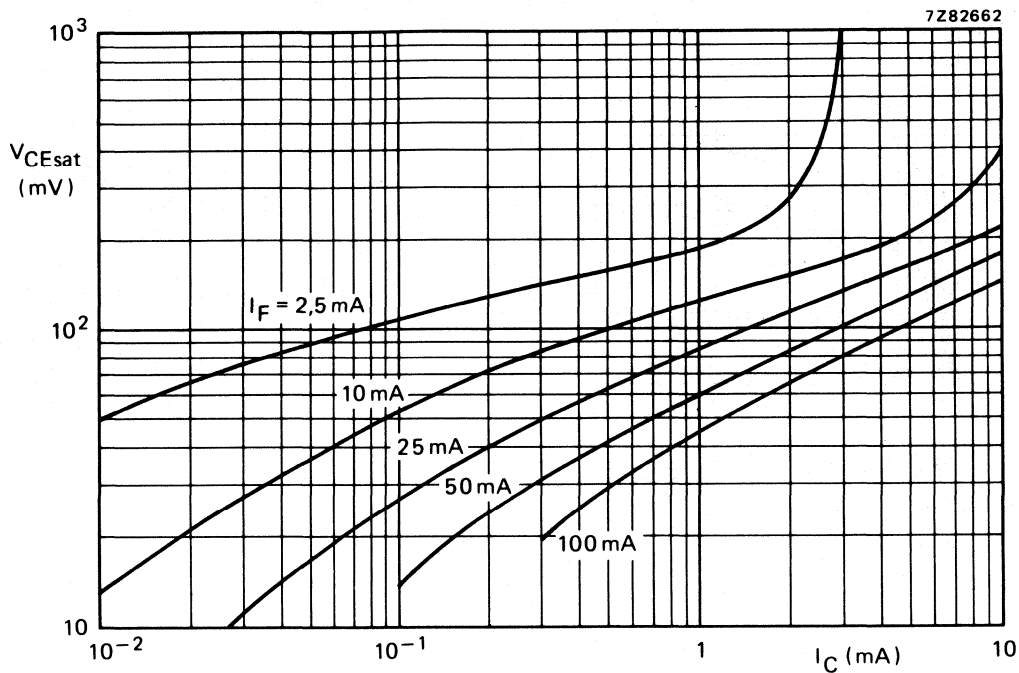


Fig. 21 $I_B = 0$; $T_{amb} = 25^\circ C$; typical values.

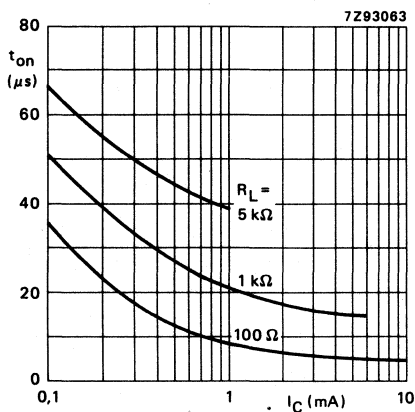


Fig. 22 $I_B = 0$; $V_{CC} = 5 V$; $T_{amb} = 25^\circ C$; typical values. (See also Fig. 25.)

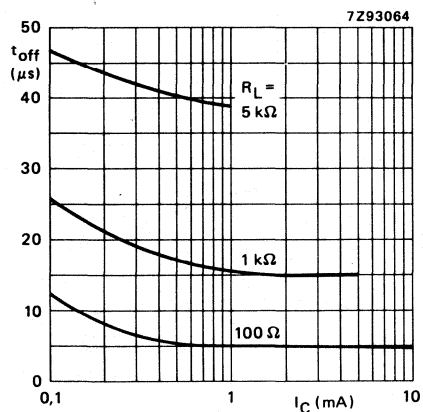


Fig. 23 $I_B = 0$; $V_{CC} = 5 V$; $T_{amb} = 25^\circ C$; typical values. (See also Fig. 25.)

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; $t_{on} = 1 \mu s$; (d = 0.3%)	I_{FRM}	max.	1 A

Transistor

Collector-emitter breakdown voltage $I_C = 10 \text{ mA}$	$V_{(BR)CEO}$	min.	18 V
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Optocoupler

Output current $I_F = 10 \text{ mA}$; $V_{CC} = 4.5 \text{ V}$; $V_O = 0.4 \text{ V}$	I_{OL}	min.	2 mA
		typ.	4 mA
		max.	40 mA

Logic low output voltage $I_F = 10 \text{ mA}$; $V_{CC} = 4.5 \text{ V}$; $I_O = 2 \text{ mA}$	V_{OL}	typ.	0.2 V
		max.	0.4 V

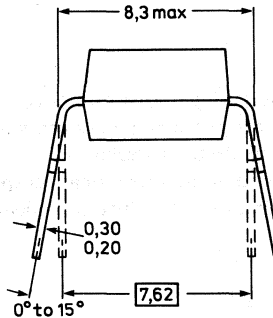
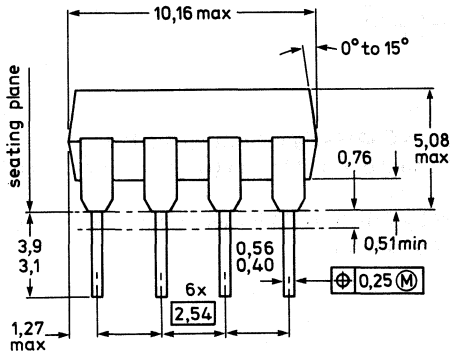
Isolation voltage DC	V_{IORM}	min.	3.5 kV
AC (RMS value)			2.5 kV

Propagation delay time	t_{PHL}	max.	0.8 μs
	t_{PLH}	max.	0.8 μs

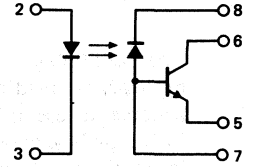
Common mode transient immunity	$\pm CM$	min.	1 kV/ μs
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MECHANICAL DATA

Fig.1 SOT97F.

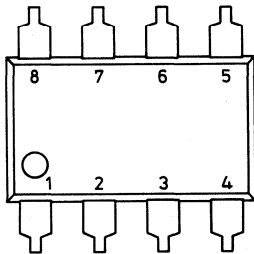


Dimensions in mm



7Z95239

7Z95240.1



⊕ 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; $T_p = 1 \mu s$; $d = 0.3\%$	I_{FRM}	max.	1 A
Total power dissipation up to $T_{amb} = 25 \text{ }^\circ\text{C}$	P_{tot}	max.	250 mW

Transistor

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

Optocoupler

Storage temperature range	T_{stg}		-55 to $+150 \text{ }^\circ\text{C}$
Operating ambient temperature range	T_{amb}		-25 to $+70 \text{ }^\circ\text{C}$
Junction temperature	T_j	max.	125 $^\circ\text{C}$
Lead soldering temperature	T_{sld}	max.	260 $^\circ\text{C}$
up to the seating plane; $t_{sld} < 10 \text{ s}$			

THERMAL RESISTANCE

From junction to ambient in free air

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

From junction to ambient, with the device mounted on a printed-circuit board

diode	$R_{th\ j-a}$	=	400 K/W
transistor	$R_{th\ j-a}$	=	400 K/W

CHARACTERISTICS $T_j = 25\text{ }^\circ\text{C}$ unless otherwise specified**Diode**

Forward voltage

$I_F = 10\text{ mA}$	V_F	typ.	1.65 V
		max.	1.9 V

Reverse current

$V_R = 5\text{ V}$	I_R	max.	10 μA
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Transistor (diode: $I_F = 0$)

Collector-emitter breakdown voltage

at $I_C = 10\text{ mA}$	$V_{(BR)CEO}$	min.	18 V
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Collector-base breakdown voltage (note 1)

at $I_C = 10\text{ }\mu\text{A}$	$V_{(BR)CBh}$	min.	30 V
----------------------------------	---------------	------	------

Emitter-base breakdown voltage

at $I_E = 10\text{ }\mu\text{A}$	$V_{(BR)EBO}$	min.	5 V
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Logic HIGH output current

$I_F = 0; V_O = V_{CC} = 5.5\text{ V}$	I_{OH}	typ.	5 nA
		max.	50 nA

Logic HIGH output current

$I_F = 0; V_O = V_{CC} = 15\text{ V}$	I_{OH}	max.	10 μA
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Logic HIGH supply current

$I_F = 0; I_O = 0; V_{CC} = 15\text{ V}$	I_{CCH}	max.	1 μA
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Logic LOW supply current

$I_F = 10\text{ mA}; I_O = 0; V_{CC} = 15\text{ V}$	I_{CCL}	typ.	20 μA
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DC current gain

$I_C = 3\text{ mA}; V_{CE} = 5\text{ V}$	h_{FE}		100 to 400
--	----------	--	------------

Note

1. Cathode connected to collector.

Optocoupler

Output current

$I_F = 10 \text{ mA}; V_{CC} = 4.5 \text{ V}; V_O = 0.4 \text{ V}$

$I_F = 2 \text{ mA}; V_{CC} = 4.5 \text{ V}; V_O = 5 \text{ V}$

Collector-emitter cut-off current

$V_{CE} = 10 \text{ V}$

Collector-base cut-off current

$V_{CB} = 22 \text{ V}$

Logic LOW output voltage

$I_F = 10 \text{ mA}; V_{CC} = 4.5 \text{ V}; I_O = 2 \text{ mA}$

Isolation voltage (note 1); DC

$t = 1 \text{ min}$ AC (RMS value)

Capacitance between input and output

$f = 1 \text{ MHz}$

Insulation resistance between input and output

$\pm V_{IO} = 1 \text{ kV}$

Switching times (Figs 2 and 3)

$I_F = 10 \text{ mA}; V_{CC} = 5 \text{ V}; R_L = 2.5 \text{ k}\Omega$

Propagation delay time to logic LOW at output

Propagation delay time to logic HIGH at output

I_{OL}	min.	2 mA
	max.	40 mA
	typ.	4 mA
I_{OL}	min.	0.2 mA
	max.	50 nA
I_{CEO}	max.	50 nA
	max.	50 nA
I_{CBO}	typ.	0.2 V
	max.	0.4 V
V_{OL}	min.	3.5 kV
	max.	2.5 kV
V_{IORM}	typ.	0.6 pF
	max.	1.3 pF
C_{io}	min.	10 G Ω
	typ.	1 T Ω
R_{IO}	typ.	0.5 μs
	max.	0.8 μs
t_{on}	typ.	0.4 μs
	max.	0.8 μs

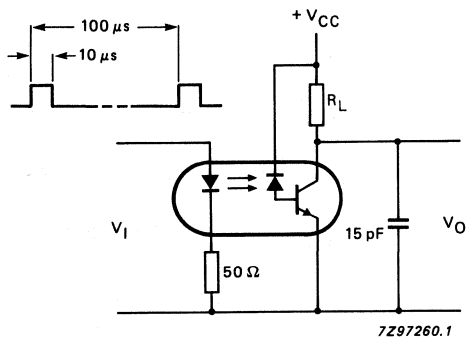


Fig. 2 Switching circuit.

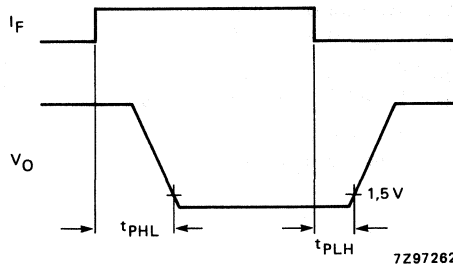


Fig. 3 Waveforms.

Transient immunity

$V_{CC} = 5\text{ V}$; $V_{CM} = 10\text{ Vpp}$; $R_L = 2.5\text{ k}\Omega$

Common mode transient immunity at logic LOW

$I_F = 10\text{ mA}$

CML min. $-1\text{ kV}/\mu\text{s}$

Common mode transient immunity at logic HIGH

$I_F = 0$

CMH min. $1\text{ kV}/\mu\text{s}$

Logic HIGH output current (note 2, Fig.4)

$V_{CC} = 5.5\text{ V}$; working voltage = 2.5 kV DC

$T_{amb} = 70\text{ }^\circ\text{C}$

IOHW max. $100\text{ }\mu\text{A}$

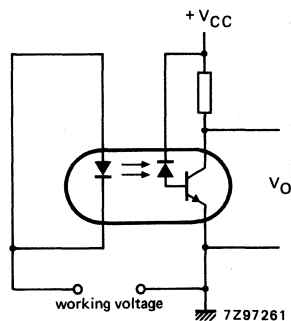


Fig.4 Transient immunity.

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

- 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.
- 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.

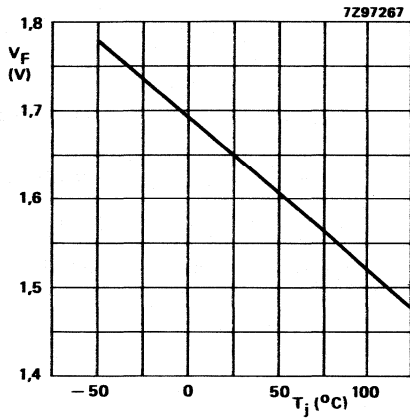


Fig.5 $I_F = 10$ mA; typical values.

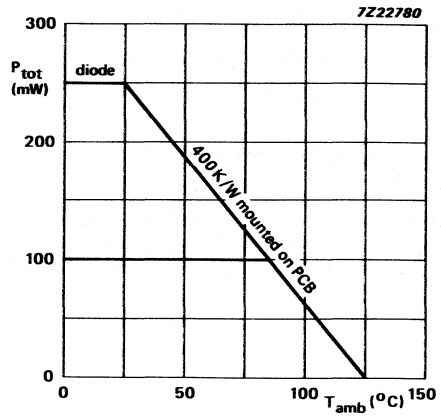


Fig.6.

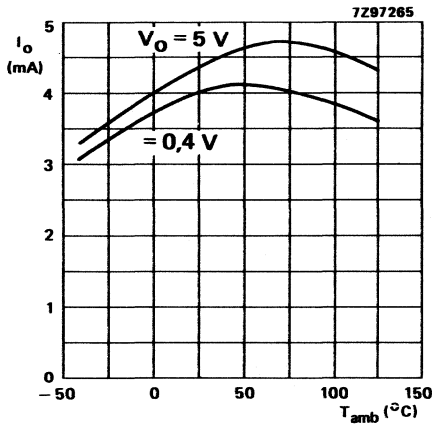


Fig.7 $V_{CC} = 5$ V; $I_F = 10$ mA; typical values.

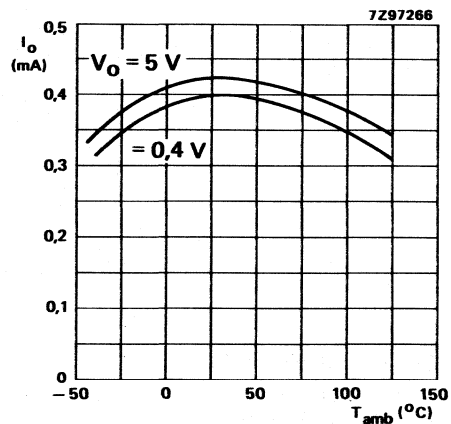


Fig.8 $V_{CC} = 5$ V; $I_F = 2$ mA; typical values.

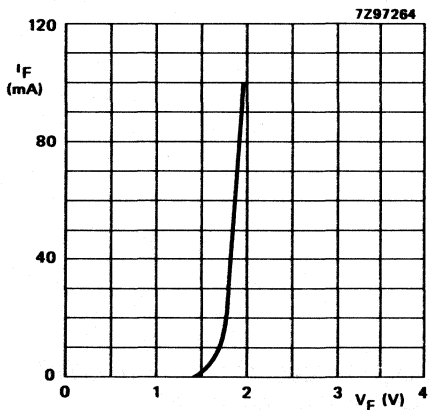


Fig.9 $T_{amb} = 25$ °C; typical values.

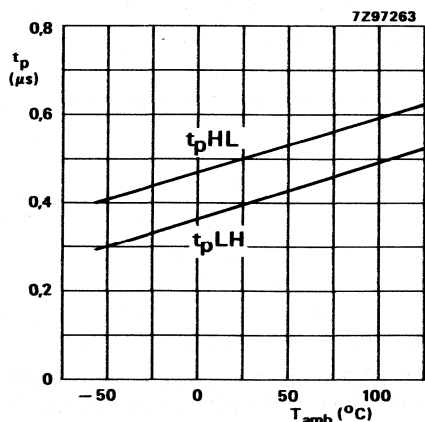


Fig.10 $I_F = 10$ mA; $V_{CC} = 5$ V; $R_L = 2.5$ kΩ; typical values.

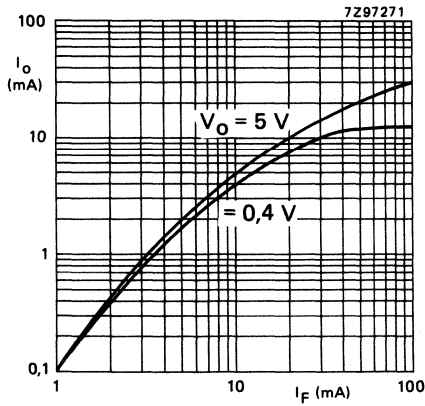


Fig.11 $V_{CC} = 5\text{ V}$; typical values.

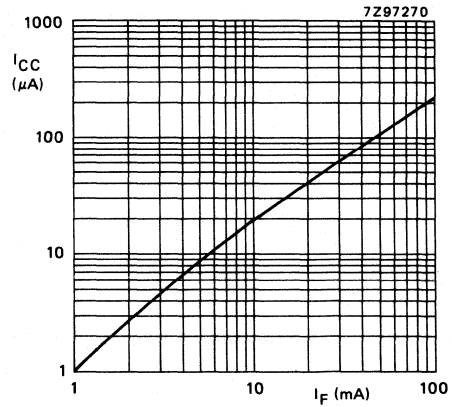


Fig.12 $V_{CC} = 15\text{ V}$; $I_o = 0$; typical values.

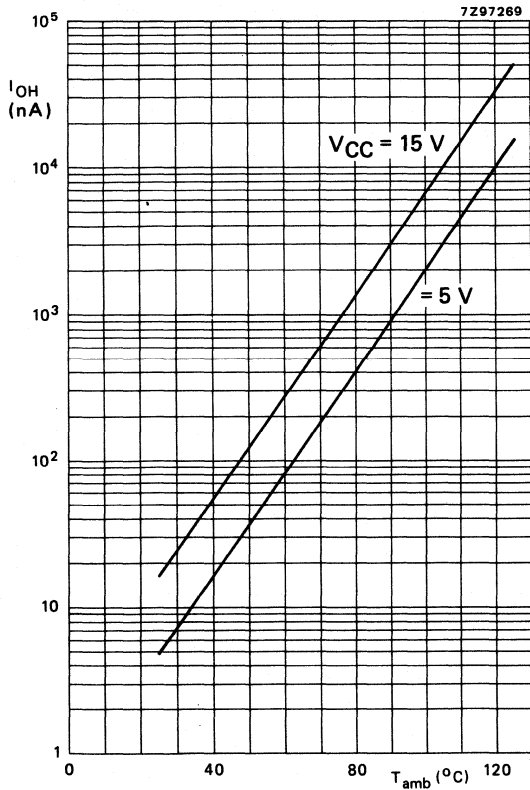


Fig.13 Typical values.

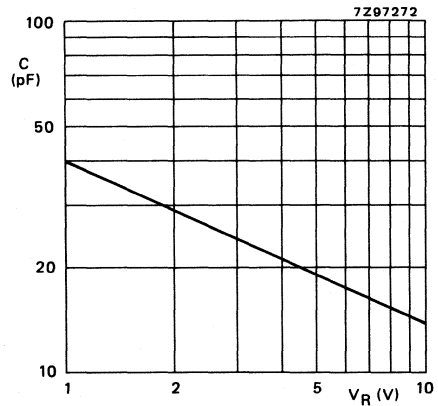


Fig.14 $T_{amb} = 25\text{ }^{\circ}\text{C}$; typical values.

Photodiode capacitance

OPTOCOUPERS

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 $I_F = 10 \text{ mA}; V_{CE} = 10 \text{ V}$ (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 $T_{amb} = 25 \text{ }^\circ\text{C}$		P_{tot}	max.	250 mW
Isolation voltage DC AC (RMS value)		V_{IORM}	min.	2.82 kV
				2.0 kV

MECHANICAL DATA

SOT90B (see Fig.1).

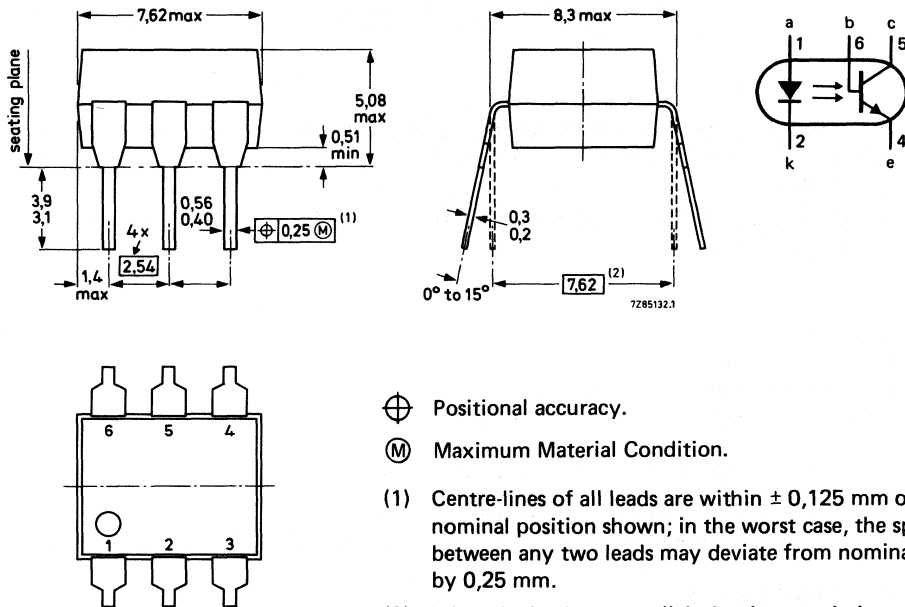
Note

JEDEC registered data.

MECHANICAL DATA

Fig.1 SOT90B.

Dimensions in mm



⊕ Positional accuracy.

(M) Maximum Material Condition.

- (1) Centre-lines of all leads are within $\pm 0,125$ 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; $t_{ON} = 300 \mu s$; $\delta = 0.02$

I_{FRM} max. 3 A

Total power dissipation

P_{tot} max. 150 mW

up to $T_{amb} = 25^\circ C$ (note 1)

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

P_{tot} max. 150 mW

up to $T_{amb} = 25^\circ C$ (note 1)

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	$R_{th\ j-a}$	=	500 K/W
transistor	$R_{th\ j-a}$	=	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 μ A
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

- JEDEC registered data.
- JEDEC registered data is at $V_R = 3$ V.

4N25 4N25A
4N26 4N27
4N28

Dark current (note 1)				
$V_{CE} = 10\text{ V}$	4N25 to 4N27	I_{CEO}	typ.	2 nA
			max.	50 nA
	4N28	I_{CEO}	max.	100 nA
$V_{CB} = 10\text{ V}$		I_{CBO}	max.	20 nA

Optocoupler

Output/input DC current transfer ratio (note 1)				
$I_F = 10\text{ mA}; V_{CE} = 10\text{ V}$	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)				
$I_F = 50\text{ mA}; I_C = 2\text{ mA}$		V_{CEsat}	max.	0.5 V
			typ.	0.1 V
Isolation voltage; $t = 1\text{ min}$ DC (see notes 2 and 3) AC (RMS value)		V_{IORM}	min.	2.82 kV 2.0 kV
Capacitance between input and output $V_{IO} = 0; f = 1\text{ MHz}$		C_{io}	typ.	0.6 pF
Insulation resistance between input and output $V_{IO} = 500\text{ V}$		R_{IO}	typ.	10 T Ω
Bandwidth $-I_C = 2\text{ mA}; V_{CE} = 10\text{ V}$ $R_L = 100\ \Omega$		BW	typ.	300 kHz
Switching times (unsaturated) see Fig. 2				
Rise time $I_C = 2\text{ mA}; V_{CC} = 10\text{ V}; R_L = 100\ \Omega$		t_r	typ.	3 μs
Fall time $I_C = 2\text{ mA}; V_{CC} = 10\text{ V}; R_L = 100\ \Omega$		t_f	typ.	3 μs
Switching times (saturated) see Fig. 3				
Turn-on time (TTL defined) $I_F = 15\text{ mA}; V_{CC} = 5\text{ V}; R_L = 2\text{ k}\Omega$ $R_{BE} = \infty$		t_{on}	typ.	5 μs
$I_F = 20\text{ mA}; V_{CC} = 5\text{ V}; R_L = 2\text{ k}\Omega$ $R_{BE} = 100\text{ k}\Omega$		t_{on}	typ.	5 μs
Turn-off time (TTL defined) $I_F = 15\text{ mA}; V_{CC} = 5\text{ V}; R_L = 2\text{ k}\Omega$ $R_{BE} = \infty$		t_{off}	typ.	30 μs
$I_F = 20\text{ mA}; V_{CC} = 5\text{ V}; R_L = 2\text{ k}\Omega$ $R_{BE} = 100\text{ k}\Omega$		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.

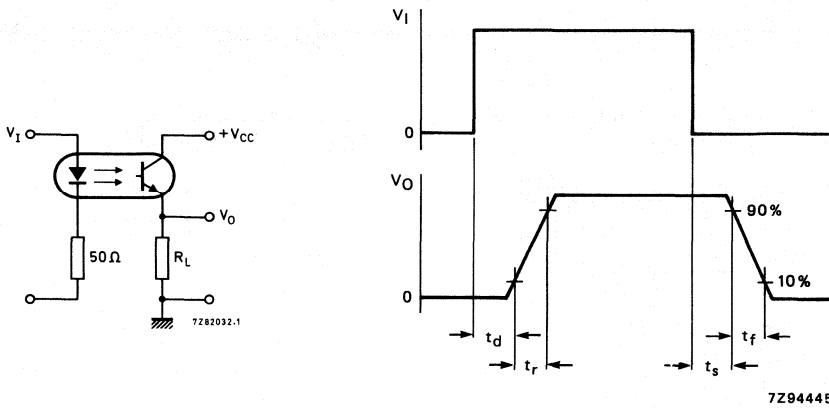


Fig. 2 Measuring circuit and waveforms.

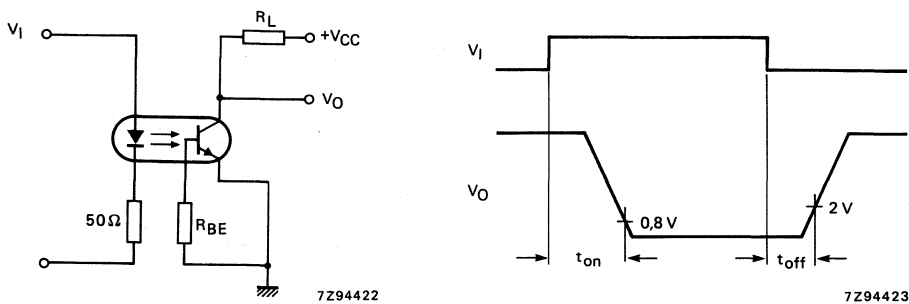


Fig. 3 Measuring circuit and waveforms.

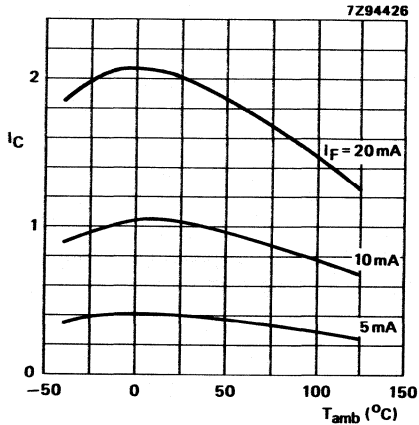


Fig. 4 Normalized at $I_F = 10\text{ mA}$; $V_{CE} = 10\text{ V}$; $T_{amb} = 25\text{ °C}$; typical values.

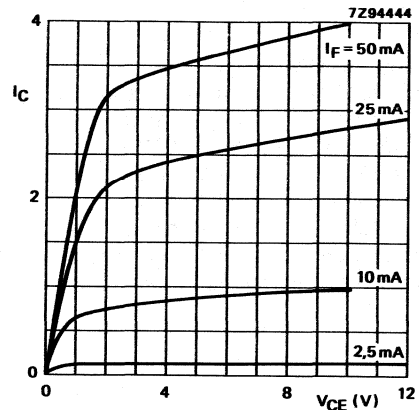


Fig. 5 Normalized at $I_C = 1\text{ mA}$; $I_F = 10\text{ mA}$; $V_{CE} = 10\text{ V}$; typical values.

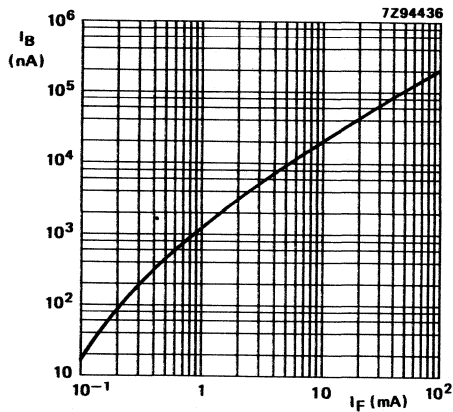


Fig. 6 $V_{CB} = 10\text{ V}$; $T_{amb} = 25\text{ °C}$; typical values.

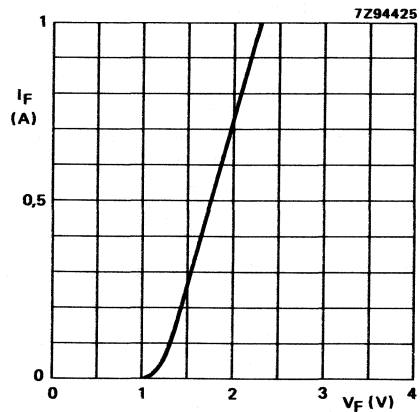


Fig. 7 $T_{amb} = 25\text{ °C}$; $t_{on} = 20\text{ }\mu\text{s}$; $\delta = 0,01$; typical values.

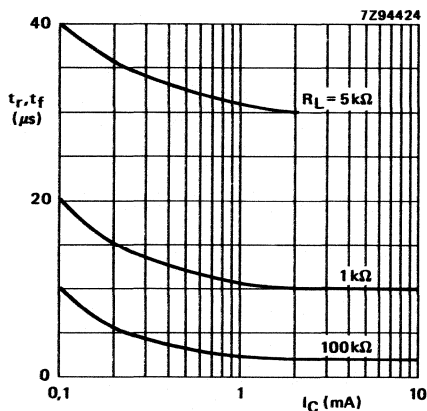


Fig. 8 Normalized at $I_F = 10\text{ mA}$; $V_{CE} = 10\text{ V}$; $T_{amb} = 25\text{ °C}$; typical values.

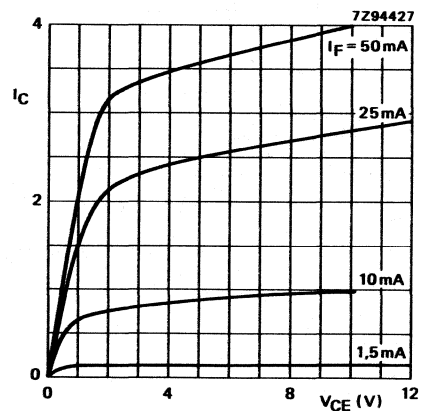


Fig. 9 $T_{amb} = 25\text{ °C}$; typical values.

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; $t_p = 10 \mu s$; $\delta = 0.01$	I_{FRM}	max.	3.0 A
Total power dissipation	P_{tot}	max.	200 mW
up to $T_{amb} = 25^\circ C$			

Transistor

Collector-emitter voltage (open base)	V_{CEO}	max.	30 V
Total power dissipation	P_{tot}	max.	200 mW
up to $T_{amb} = 25^\circ C$			

Optocoupler

Output/input DC current transfer ratio (CTR)

$I_F = 10 \text{ mA}$; $V_{CE} = 10 \text{ V}$; ($I_B = 0$)

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)

$V_{CC} = 10 \text{ V}$; working voltage = 2.5 kV DC
diode: $I_F = 0$ (see Fig. 2)

I_{CEW} max. 1.0 μA

Isolation voltage DC

AC (RMS value)

V_{IORM} max. 4.4 kV
3.12 kV

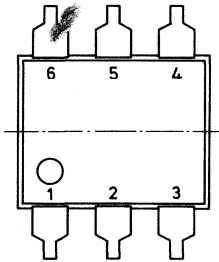
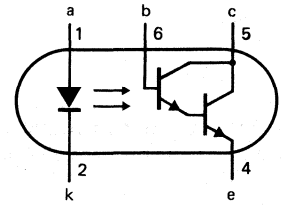
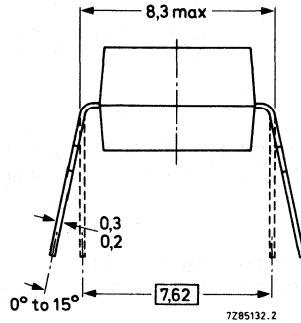
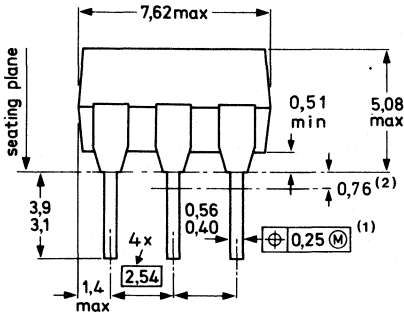
MECHANICAL DATA

SOT90B (see Fig.1).

4N29 4N32
 4N30 4N33
 4N31

MECHANICAL DATA

Dimensions in mm



⊕ Positional accuracy.

Ⓜ Maximum Material Condition.

(1) Centre-lines of all leads are within $\pm 0,127$ mm of the nominal position shown; in the worst case, the spacing between any two leads may deviate from nominal by $\pm 0,254$ 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; $t_p = 10 \mu s$; $\delta = 0.01$	I_{FRM}	max.	3.0 A
Total power dissipation up to $T_{amb} = 25 \text{ }^\circ\text{C}$	P_{tot}	max.	200 mW
Junction temperature	T_j	max.	125 $^\circ\text{C}$

Transistor

Collector-emitter breakdown voltage $I_C = 1 \text{ mA}$ (see note 1)	$V_{(BR)CEO}$	min.	30 V
Collector-base breakdown voltage $I_C = 0.1 \text{ mA}$ (see note 1)	$V_{(BR)CBO}$	min.	30 V
Emitter-collector breakdown voltage $I_E = 0.1 \text{ mA}$ (see note 1)	$V_{(BR)ECO}$	min.	5.0 V

Optocoupler

**4N29 4N32
4N30 4N33
4N31**

DC collector current	I_C	max.	100 mA
Total power dissipation up to $T_{amb} = 25\text{ }^\circ\text{C}$	P_{tot}	max.	200 mW
Junction temperature	T_j	max.	125 $^\circ\text{C}$

Optocoupler

Storage temperature range	T_{stg}		-55 to + 150 $^\circ\text{C}$
Lead soldering temperature up to the seating plane; $t_{sld} < 10\text{ s}$	T_{sld}	max.	260 $^\circ\text{C}$

THERMAL RESISTANCE

From junction to ambient in free air diode and transistor	$R_{th\ j-a}$	=	500 K/W
From junction to ambient, device mounted on a PCB; diode and transistor	$R_{th\ j-a}$	=	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

$T_j = 25\text{ }^\circ\text{C}$ unless otherwise specified

Diode

Forward voltage (see note 1) $I_F = 10\text{ mA}$	V_F	typ. max.	1.15 V 1.5 V
Reverse current (see note 2) $V_R = 5\text{ V}$	I_R	max.	10 μA
Capacitance at $f = 1\text{ MHz}$ $V_R = 0$	C_d	typ.	50 pF

Transistor ($I_F = 0$)

Collector cut-off current (dark) $V_{CE} = 10\text{ V}$ (see note 1)	I_{CEO}	typ. max.	20 nA 100 nA
$V_{CB} = 10\text{ V}$	I_{CEO}	max.	20 nA
DC current gain $I_C = 500\text{ }\mu\text{A}; V_{CE} = 5\text{ V}$	h_{FE}	typ.	1000

CHARACTERISTICS (continued)

Optocoupler

Output/input DC current transfer ratio (CTR) (see note 1)

$I_F = 10 \text{ mA}; V_{CE} = 10 \text{ V}$	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)

$V_{CC} = 10 \text{ V};$ working voltage (DC) = 2.5 kV I_{CEW} max. 1.0 μA

$V_{CC} = 10 \text{ V};$ working voltage (DC) = 2.5 kV;
 $T_j = 70 \text{ }^\circ\text{C}$ I_{CEW} max. 1000 μA

Collector-emitter saturation voltage (see note 1)

$I_F = 8 \text{ mA}; I_C = 2 \text{ mA}$	4N29,30,32,33	V_{CEsat}	max.	1.0 V
	4N31	V_{CEsat}	max.	1.2 V

Isolation voltage; DC

AC (RMS value)

$t = 1 \text{ min}$ (see notes 3 and 5) V_{IORM} min. 4.4 kV

$t = 1 \text{ min}$ (see notes 3 and 5) V_{IORM} min. 3.12 kV

Collector capacitance at $f = 1 \text{ MHz}$

$I_E = I_e = 0; V_{CB} = 10 \text{ V}$ C_{bc} typ. 4.5 pF

Capacitance between input and output

$I_F = 0; V = 0; f = 1 \text{ MHz}$ C_{io} typ. 0.6 pF

Insulation resistance between input and output

$\pm V_{IO} = 1 \text{ kV}$ R_{IO} min. 10 $\text{G}\Omega$
typ. 1 $\text{T}\Omega$

Switching times (see Figs 3 and 4 and note 1)

$I_{Fon} = 200 \text{ mA}; V_{CC} = 10 \text{ V};$
 $R_L = 180 \text{ }\Omega; I_C = 50 \text{ mA}$ 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 $V_R = 3 \text{ V}$ 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.

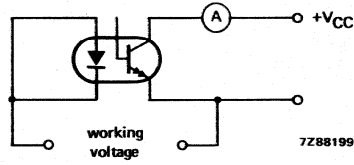


Fig. 2 Test circuit.

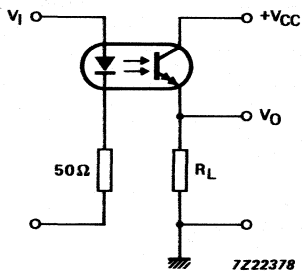


Fig. 3 Switching circuit.

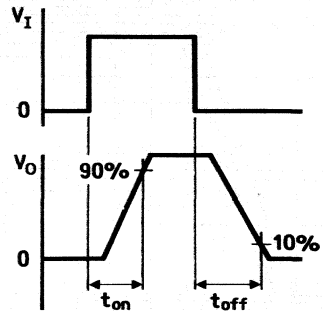


Fig. 4 Waveforms.

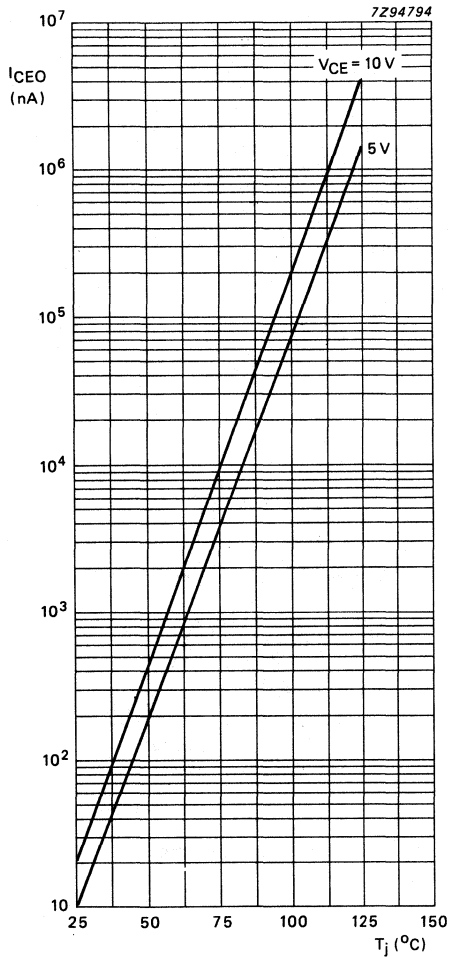


Fig. 5 Collector-emitter voltage as a function of junction temperature; typical values.

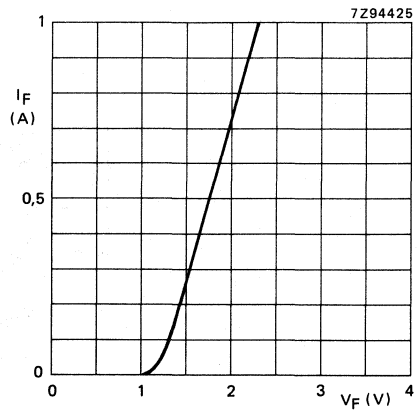


Fig. 6 Forward current as a function of forward voltage; $T_{amb} = 25^{\circ}C$; $t_{on} = 20 \mu s$; $\delta = 0.01$; typical values.

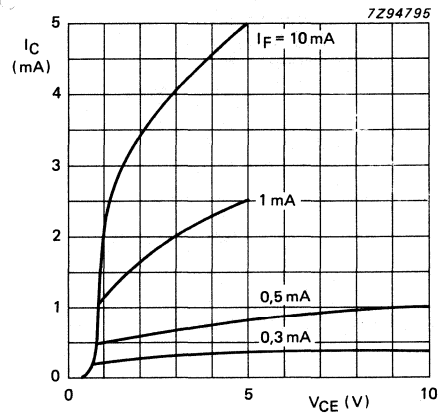


Fig. 7 Collector current as a function of collector-emitter voltage; normalized to $I_F = 0.5 mA$; $V_{CE} = 10 V$; typical values.

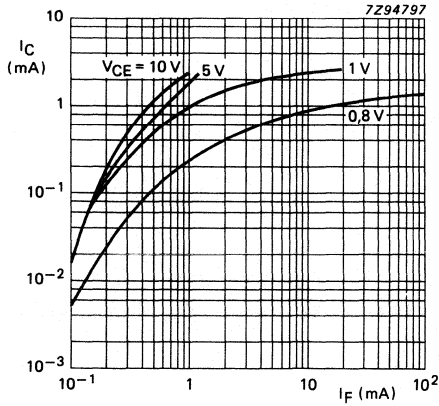


Fig. 8 Collector current as a function of forward current; normalized to $I_F = 0.5$ mA; $V_{CE} = 10$ V; $T_{amb} = 25$ °C; typical values.

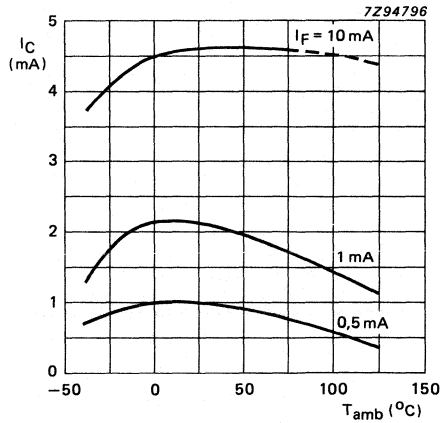


Fig. 9 Collector current as a function of ambient temperature; normalized to $I_F = 0.5$ mA; $V_{CE} = 10$ V; $T_{amb} = 25$ °C; typical values.

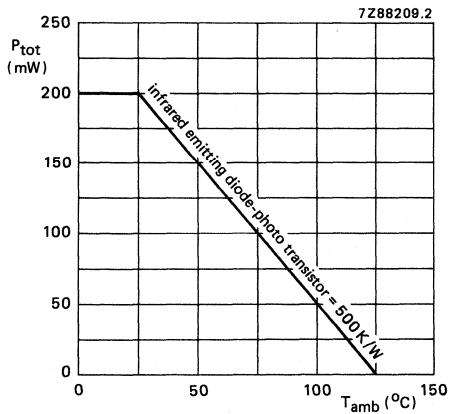


Fig. 10 Power derating curve for diode and transistor as a function of temperature.

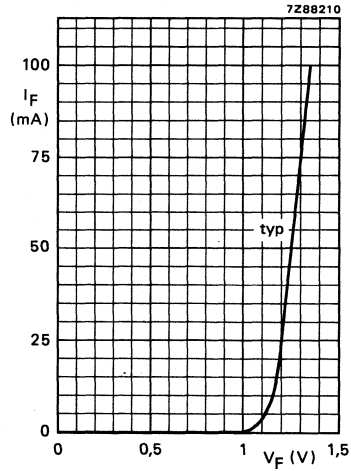


Fig. 11 Forward current as a function of forward voltage; $T_{amb} = 25$ °C.

OPTOCOUPERS

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) $t_p = 1 \mu s$; $f = 300 \text{ Hz}$	I_{FRM}	max.	3 A
Total power dissipation up to $T_{amb} = 25 \text{ }^\circ\text{C}$ (see note)	P_{tot}	max.	100 mW

Transistor

Collector-emitter voltage (open base) (see note)	V_{CE0}	max.	30 V
Total power dissipation up to $T_{amb} = 25 \text{ }^\circ\text{C}$ (see note)	P_{tot}	max.	300 mW

Optocoupler

DC current transfer ratio (CTR) (see note)			
$I_F = 10 \text{ mA}$; $V_{CE} = 10 \text{ V}$	I_C/I_F	min.	1.0
Switching times (see note)			
$I_C = 2 \text{ mA}$; $V_{CC} = 10 \text{ V}$; $R_L = 100 \Omega$	t_{on}	max.	10 μs
	t_{off}	max.	10 μs
Isolation voltage			
DC			
AC (RMS value)	4N35	V_{IORM}	min. 4.4 kV 3.12 kV
DC			
AC (RMS value)	4N36/37	V_{IORM}	min. 2.82 kV 2.0 kV

MECHANICAL DATA: SOT90B (see Fig. 1).

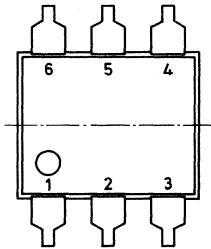
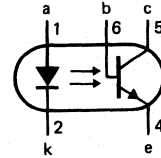
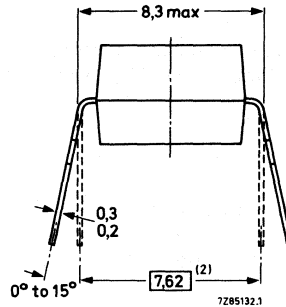
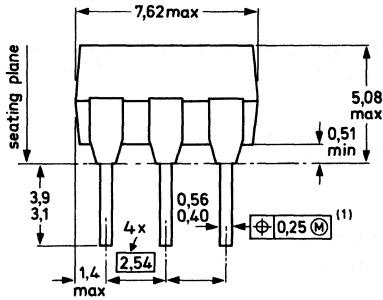
Note: JEDEC registered data.

4N35
4N36
4N37

MECHANICAL DATA

Fig. 1 SOT90B.

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 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; $t_p = 1 \mu s$; $f = 300$ Hz

I_{FRM} max. 3 A

Total power dissipation up to $T_{amb} = 25^\circ C$ (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 $T_{amb} = 25^\circ C$ (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 μ A
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) $I_E = 0.1$ 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 μ A
$V_{CE} = 10$ V; $T_{amb} = 70$ °C	I_{CEO}	max.	10 μ A

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)

$I_F = 10 \text{ mA}; V_{CE} = 10 \text{ V}$	I_C/I_F	min.	1.0
$I_F = 10 \text{ mA}; V_{CE} = 10 \text{ V}; T_{amb} = -55^\circ\text{C}$	I_C/I_C	min.	0.4
$I_F = 10 \text{ mA}; V_{CE} = 10 \text{ V}; T_{amb} = 100^\circ\text{C}$	I_F/I_C	min.	0.4

Collector-emitter saturation voltage (see note 1)

$I_F = 10 \text{ mA}; I_C = 0.5 \text{ mA}$	V_{CEsat}	max.	0.3 V
---	-------------	------	-------

Output capacitance at $f = 1 \text{ MHz}$

$V_{CE} = 10 \text{ V}$	C_{ce}	typ.	2.0 pF
-------------------------	----------	------	--------

Isolation voltage (see notes 2 and 3)

$t = 1 \text{ min}$

DC					
AC (RMS value)	4N35	V_{IORM}	min.	4.4 kV	3.12 kV
DC					
AC (RMS value)	4N36/37	V_{IORM}	min.	2.82 kV	2.0 kV

Capacitance between input and output (see note 1)

$V_O = 0; f = 1 \text{ MHz}$	C_{io}	max.	2.0 pF
		typ.	0.6 pF

Insulation resistance between input and output (see note 1)

$\pm V_{IO} = 500 \text{ V}$	R_{IO}	min.	100 G Ω
		typ.	10 T Ω

Switching times (see Figs 2 and 3 and note 1)

$I_C = 2 \text{ mA}; V_{CC} = 10 \text{ V}; R_L = 100 \Omega$

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

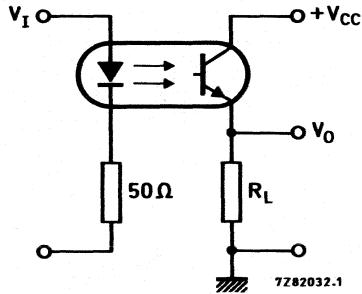


Fig. 2 Switching circuit.

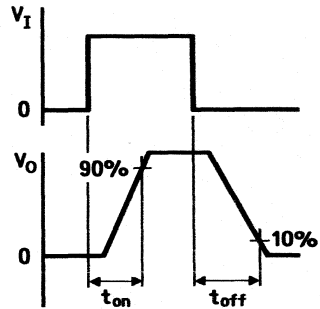


Fig. 3 Waveforms.

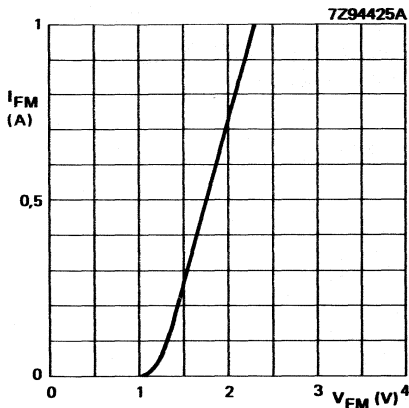


Fig. 4 $T_{amb} = 25\text{ }^{\circ}\text{C}$; $t_{on} = 20\text{ }\mu\text{s}$; $\delta = 0.01$; typical values.

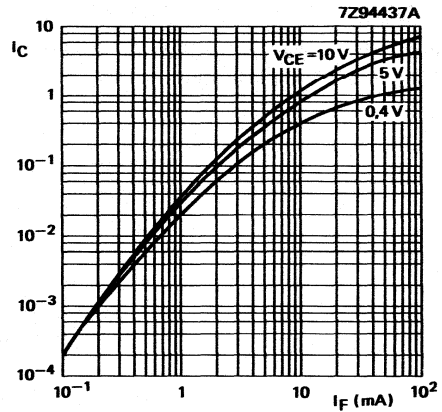


Fig. 5 Normalized to $I_F = 10\text{ mA}$; $V_{CE} = 10\text{ V}$; typical values.

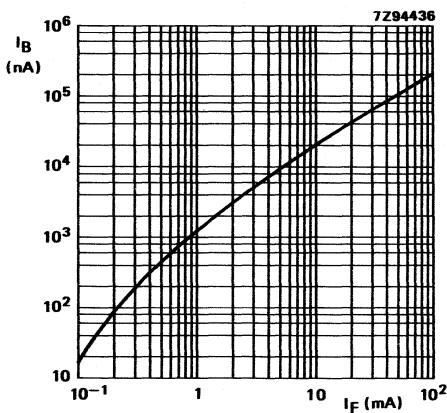


Fig. 6 $V_{CB} = 10\text{ V}$; $T_{amb} = 25\text{ }^{\circ}\text{C}$; typical values.

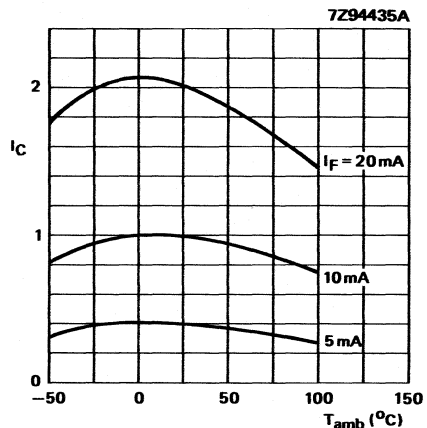


Fig. 7 Normalized to $I_F = 10\text{ mA}$; $V_{CE} = 10\text{ V}$; $T_{amb} = 25\text{ }^{\circ}\text{C}$; typical values.

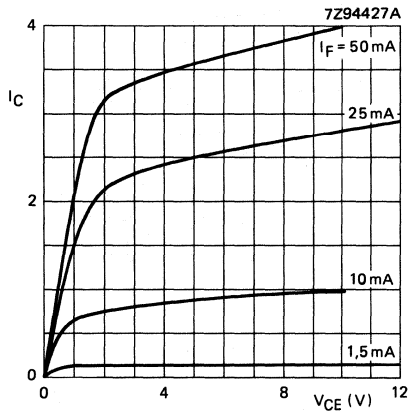


Fig. 8 Normalized to $I_F = 10$ mA; $V_{CE} = 10$ V; $T_{amb} = 25$ °C; typical values.

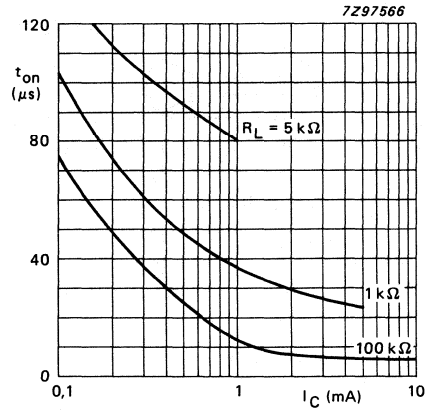


Fig. 9 $V_{CC} = 10$ V; $T_{amb} = 25$ °C; typical values.

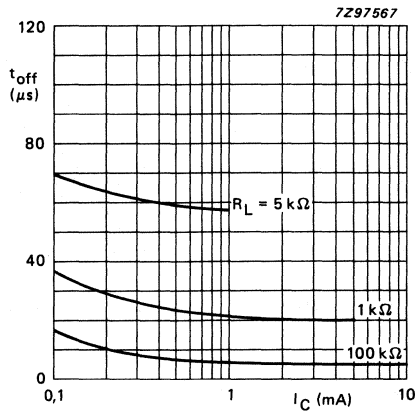


Fig. 10 $V_{CC} = 10$ V; $T_{amb} = 25$ °C; typical values.

OPTOCOUPERS

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) $t_p = 300 \mu s$; $\delta = 0.02$	I_{FRM}	max.	3 A
Total power dissipation up to $T_{amb} = 25 \text{ }^\circ\text{C}$	P_{tot}	max.	150 mW

Transistor

Collector-emitter voltage (open base) (see note 1)	V_{CEO}	max.	80 V
Total power dissipation up to $T_{amb} = 25 \text{ }^\circ\text{C}$ (see note 1)	P_{tot}	max.	150 mW

Optocoupler

DC current transfer ratio (CTR) (see note 1)	I_C/I_F	min.	0.2
$I_F = 10 \text{ mA}$; $V_{CE} = 10 \text{ V}$			
Switching times (see note 1)	t_{on}, t_{off}	typ.	5 μs
$I_C = 2 \text{ mA}$; $V_{CC} = 10 \text{ V}$; $R_L = 100 \Omega$			
Isolation voltage	V_{IORM}	min.	2.82 kV
DC			2.0 kV
AC (RMS value)			

MECHANICAL DATA

SOT90B (see Fig.1).

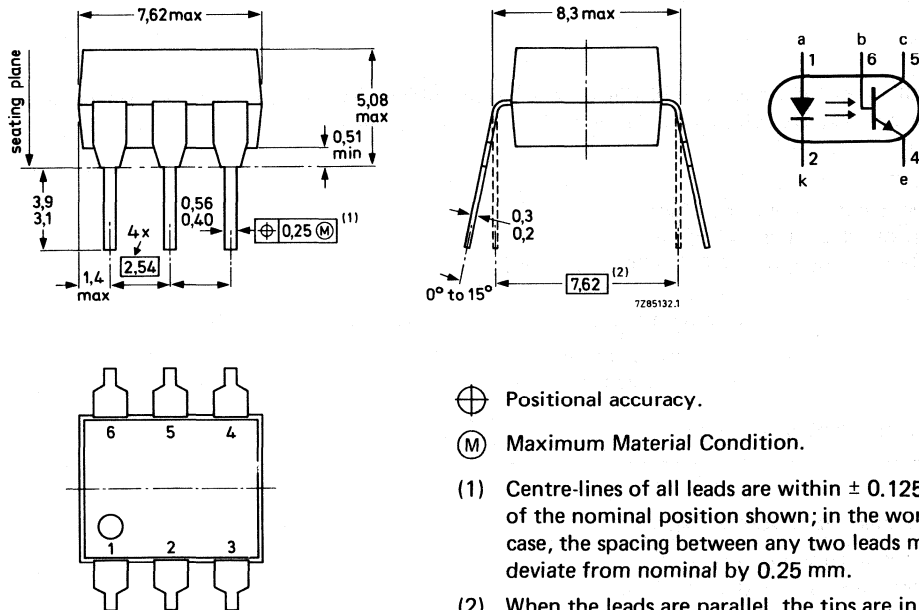
Notes

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

MECHANICAL DATA

Fig.1 SOT90B.

Dimensions in mm



⊕ Positional accuracy.

(M) Maximum Material Condition.

- (1) Centre-lines of all leads are within ± 0.125 mm of the nominal position shown; in the worst case, the spacing between any two leads may deviate from nominal by 0.25 mm.
- (2) When the leads are parallel, the tips are in position for automatic insertion.

RATINGS

Limiting 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; $t_p = 300 \mu s$; $\delta = 0.02$	I_{FRM}	max.	3 A
Total power dissipation up to $T_{amb} = 25^\circ C$	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 $T_{amb} = 25^\circ C$ (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; $t_{slid} < 10$ s	T_{slid}	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 μ A

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) $I_C = 1$ μ A	$V_{(BR)CBO}$	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)

$I_F = 10 \text{ mA}; V_{CE} = 10 \text{ V}$

I_C/I_F min. 0.2

Collector-emitter saturation voltage (see note 3)

$I_F = 20 \text{ mA}; I_C = 4 \text{ mA}$

V_{CEsat} max. 1.0 V

Output capacitance at $f = 1 \text{ MHz}$

$V_{CE} = 10 \text{ V}$

C_{ce} typ. 2.0 pF

Isolation voltage; $t = 1 \text{ min}$

(see notes 1 and 2)

DC

AC (RMS value)

V_{IORM} min. 2.82 kV
2.0 kV

Capacitance between input and output (see note 3)

$V_O = 0; f = 1 \text{ MHz}$

C_{io} typ. 0.6 pF

Insulation resistance between input and output (see note 3)

$\pm V_{IO} = 500 \text{ V}$

R_{IO} min. 100 G Ω
typ. 10 T Ω

Switching times (see Figs 2 and 3 and note 3)

$I_C = 2 \text{ mA}; V_{CC} = 10 \text{ V}; R_L = 100 \Omega$

Turn-on time

t_{on} typ. 5 μs

Turn-off time

t_{off} typ. 5 μs

Notes

- 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.
- JEDEC registered data is:

4N38	V_{IORM}	min.	1.5 kV peak
4N38A	V_{IORM}	min.	2.5 kV peak
- Indicates JEDEC registered data.

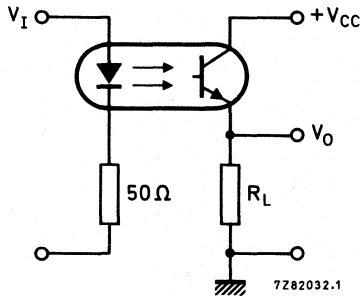
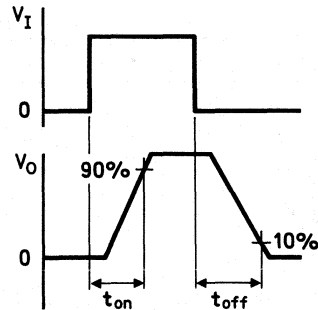


Fig. 2 Switching circuit.



7Z67238.2

Fig. 3 Waveforms.

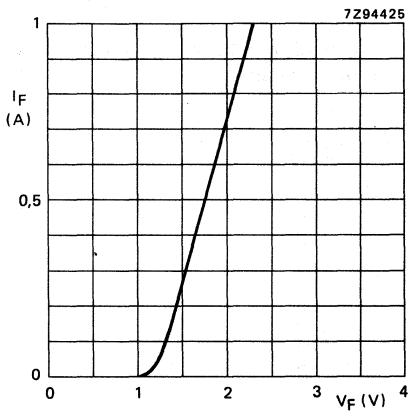


Fig. 4 $T_{amb} = 25\text{ }^{\circ}\text{C}$; $t_{on} = 20\text{ }\mu\text{s}$; $\delta = 0.01$; typical values.

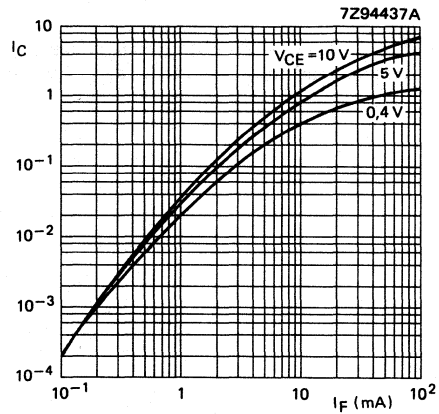


Fig. 5 Normalized to $I_F = 10\text{ mA}$; $V_{CE} = 10\text{ V}$; typical values.

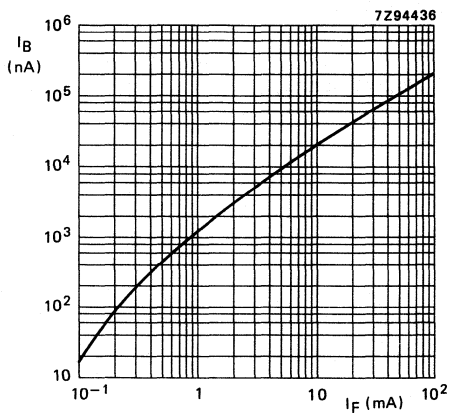


Fig. 6 $V_{CB} = 10\text{ V}$; $T_{amb} = 25\text{ }^{\circ}\text{C}$; typical values.

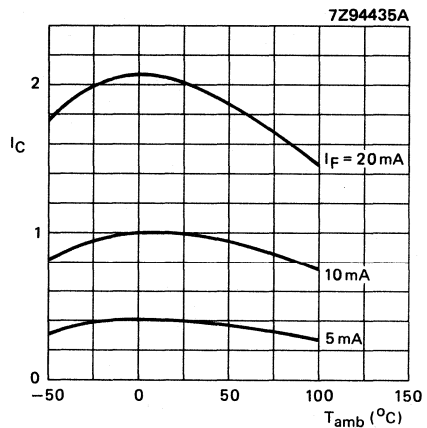


Fig. 7 Normalized to $I_F = 10\text{ mA}$; $V_{CE} = 10\text{ V}$; $T_{amb} = 25\text{ }^{\circ}\text{C}$; typical values.

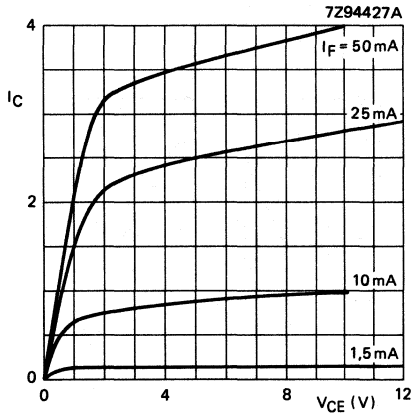


Fig. 8 $T_{amb} = 25\text{ }^\circ\text{C}$; typical values.
Normalized to $I_F = 10\text{ mA}$; $V_{CE} = 10\text{ V}$.

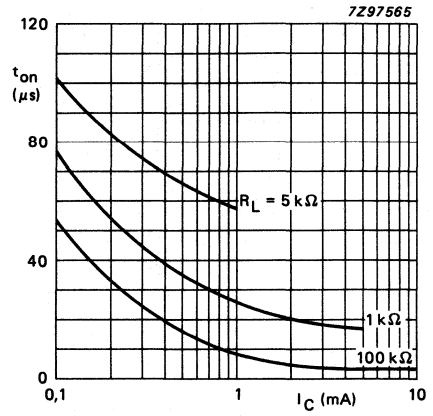


Fig. 9 $V_{CC} = 10\text{ V}$; $T_{amb} = 25\text{ }^\circ\text{C}$;
typical values.

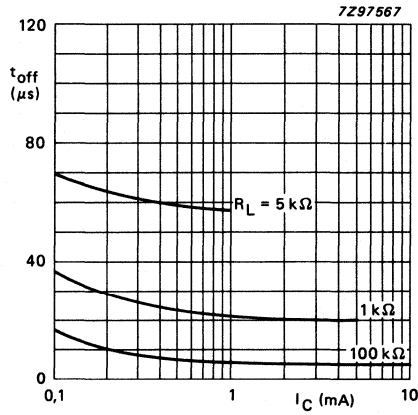


Fig. 10 $V_{CC} = 10\text{ V}$; $T_{amb} = 25\text{ }^\circ\text{C}$; typical values.

DEVELOPMENT DATA

This data sheet contains advance information and specifications are subject to change without notice.

4N46

GaAlAs, RESISTOR-DARLINGTON, OPTOCOUPLER

The 4N46 is an optocoupler in a dual-in-line (DIL) 6 pin plastic SOT229 envelope. It consists 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 $T_{amb} = 25^\circ\text{C}$	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 $T_{amb} = 25^\circ\text{C}$	P_{tot}	max.	200 mW

Optocoupler

DC current transfer ratio (CTR)

- $I_F = 0.5\text{ mA}; V_{CE} = 1\text{ V}; 0\text{ to }70^\circ\text{C}$
- $I_F = 1.0\text{ mA}; V_{CE} = 1\text{ V}; 0\text{ to }70^\circ\text{C}$
- $I_F = 10\text{ mA}; V_{CE} = 1.2\text{ V}; 0\text{ to }70^\circ\text{C}$

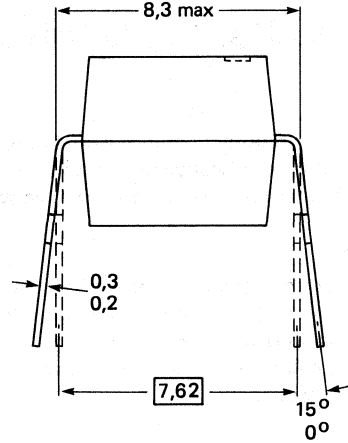
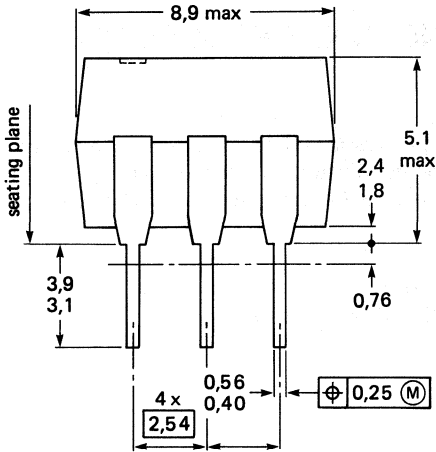
I_C/I_F	min.	3.5
I_C/I_F	min.	5.0
I_C/I_F	min.	2.0
Isolation voltage DC		4.4 kV
AC (RMS value)	V_{IORM}	max. 3.12 kV

MECHANICAL DATA

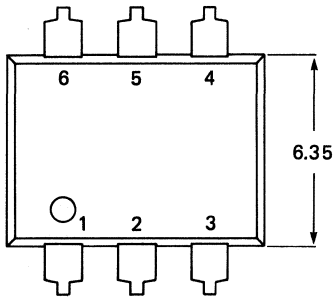
SOT229 (see Fig.1)

MECHANICAL DATA

Dimensions in mm



7Z95841



Pinning

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

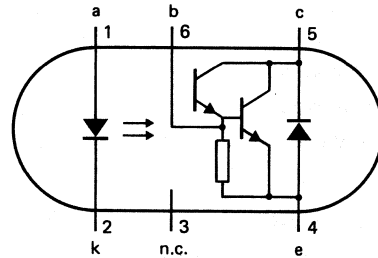


Fig.1 SOT229.

RATINGS

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

Diode

DC Forward current
 (peak: $t_{on} = 10 \mu s, d = 0.01$)
 DC Reverse voltage
 Total power dissipation up to $T_{amb} = 25 \text{ }^\circ C$

I_F	max.	100 mA
I_{FRM}	max.	2.5 A
V_R	max.	5 V
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 $T_{amb} = 25\text{ }^\circ\text{C}$	P_{tot}	max.	200 mW

Optocoupler

Total power dissipation up to $T_{amb} = 25\text{ }^\circ\text{C}$	P_{tot}	max.	250 mW
Storage temperature range	T_{stg}		-55 to + 150 $^\circ\text{C}$
Operating ambient temperature range	T_{amb}		-40 to + 100 $^\circ\text{C}$
Junction temperature	T_j	max.	125 $^\circ\text{C}$
Soldering temperature up to the seating plane; $t_{sld} < 10\text{ s}$	T_{sld}	max.	260 $^\circ\text{C}$

THERMAL RESISTANCE

From junction to ambient in free air	diode	$R_{th\ j-a}$	=	500 K/W
	transistor	$R_{th\ j-a}$	=	500 K/W
From junction to ambient when mounted on a PCB	diode	$R_{th\ j-a}$	=	400 K/W
	transistor	$R_{th\ j-a}$	=	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)	$L(I02)$	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

$T_j = 25\text{ }^\circ\text{C}$ unless otherwise specified

Diode

Forward voltage $I_F = 1\text{ mA}$ $I_F = 10\text{ mA}$	V_F	typ.	1.35 V
	V_F	max.	1.7 V
	V_F	max.	1.7 V
Reverse current $V_R = 5\text{ V}$	I_R	max.	10 μA
Diode capacitance $V_R = 0\text{ V}; f = 1\text{ MHz}$	C_d	typ.	200 pF

DEVELOPMENT DATA

CHARACTERISTICS (continued)

Transistor

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

Optocoupler

DC current transfer ratio (CTR)

$I_F = 0.5 \text{ mA}; V_O = 1 \text{ V}; 0 \text{ to } 70 \text{ }^\circ\text{C}$	I_O/I_F	min.	3.5
$I_F = 1 \text{ mA}; V_O = 1 \text{ V}; 0 \text{ to } 70 \text{ }^\circ\text{C}$	I_O/I_F	min.	5.0
$I_F = 10 \text{ mA}; V_O = 1.2 \text{ V}; 0 \text{ to } 70 \text{ }^\circ\text{C}$	I_O/I_F	min.	2.0

Logic LOW output voltage

$I_F = 0.5 \text{ mA}; I_{OL} = 1.75 \text{ mA}; 0 \text{ to } 70 \text{ }^\circ\text{C}$	V_{OL}	typ. max.	* V 1.0 V
$I_F = 1 \text{ mA}; I_{OL} = 5 \text{ mA}; 0 \text{ to } 70 \text{ }^\circ\text{C}$	V_{OL}	typ. max.	* V 1.0 V
$I_F = 10 \text{ mA}; I_{OL} = 20 \text{ mA}; 0 \text{ to } 70 \text{ }^\circ\text{C}$	V_{OL}	typ. max.	* V 1.2 V

Isolation voltage (see next page)

$t = 1 \text{ min}$	DC AC (RMS value)	V_{IORM}	min. min.	4.4 kV 3.12 kV
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Capacitance between input and output

$V_{IO} = 0; f = 1 \text{ MHz}$	C_{IO}	typ. max.	0.4 pF 1.0 pF
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Insulation resistance between input and output

$V_{IO} = 1000 \text{ V}$	R_{IO}	min. typ.	10 G Ω 1 T Ω
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Switching times (see Fig.2)

$V_{CC} = 5 \text{ V}$

Propagation delay time to logic LOW output

$I_F = 1 \text{ mA}; R_L = 10 \text{ k}\Omega$	T_{PHL}	typ.	* μs
$I_F = 10 \text{ mA}; R_L = 220 \Omega$	T_{PHL}	typ. max.	* μs 50 μs

Propagation delay time to logic HIGH output

$I_F = 1 \text{ mA}; R_L = 10 \text{ k}\Omega$	T_{PHL}	typ.	* μs
$I_F = 10 \text{ mA}; R_L = 220 \Omega$	T_{PHL}	typ. max.	* μs 500 μs

* Value to be fixed

Transient immunity (see Fig.3)

$V_{CC} = 5\text{ V}; R_L = 10\text{ k}\Omega; V_{CM} = 10\text{ V}_{p-p}$

Common mode transient immunity at logic LOW

$I_F = 1\text{ mA}$

CML typ. 500 V/ μ s

Common mode transient immunity at logic HIGH

$I_F = 0\text{ mA}$

CMH typ. 500 V/ μ s

DEVELOPMENT DATA

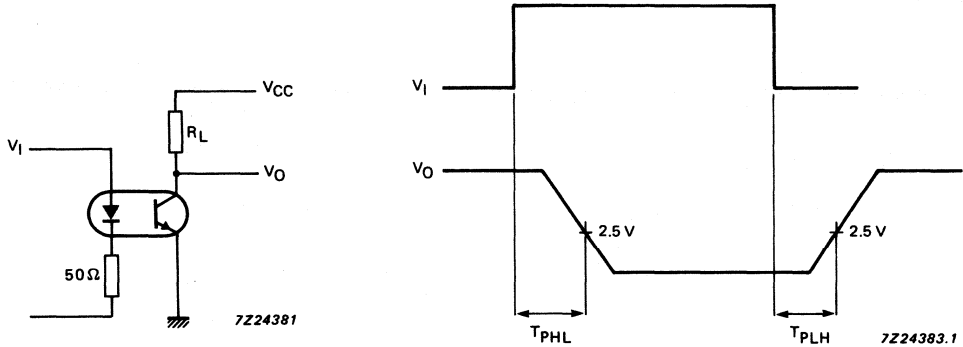
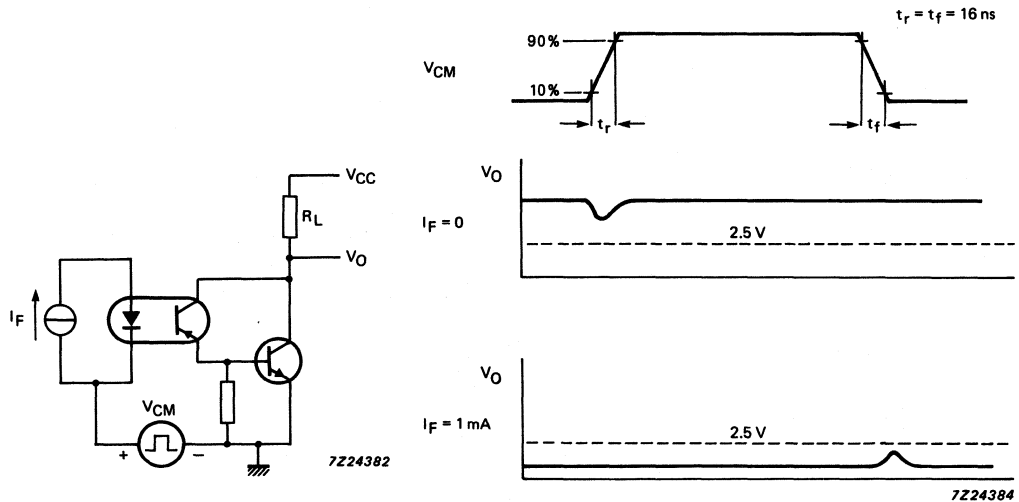


Fig.2 Test circuit: Switching times.



The output voltage V_O must not cross the 2.5 V line with $I_F = 0$ or the $I_F = 1\text{ mA}$.

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

This data sheet contains advance information and specifications are subject to change without notice.

6N135
6N136

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) $t_p = 1 \mu s$; $f = 300$ Hz	I_{FRM}	max.	1.0 A

Transistor

Collector-emitter breakdown voltage $I_C = 10$ mA	$V_{(BR)CEO}$	max.	15 V
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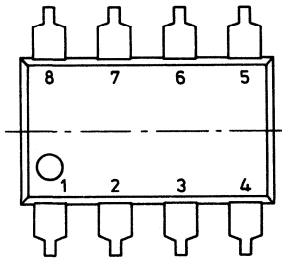
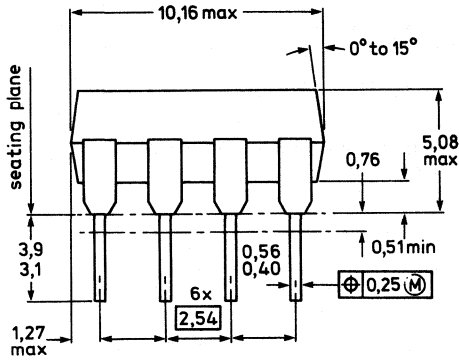
Optocoupler

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}	max.	1.5 μs	
		t_{PLH}			
	6N136	t_{PHL}	max.	0.8 μs	
		t_{PLH}			
Common mode transient immunity		$\pm CM$	min.	1.0 kV/ μs	
Isolation voltage	DC AC (RMS value)	6N135	V_{IORM}	min.	3.5 kV
				2.5 kV	
	DC AC (RMS value)	6N136	V_{IORM}	min.	4.4 kV
				3.12 kV	

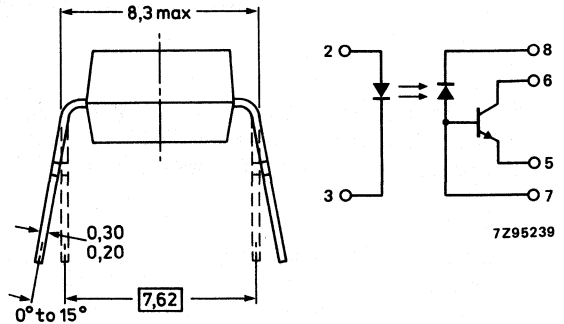
MECHANICAL DATA

SOT97F (see Fig. 1).

MECHANICAL DATA



Dimensions in mm



7295240

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; $t_p = 1 \mu s$; $f = 300$ Hz

I_{FRM} max. 1.0 A

Total power dissipation

P_{tot} max. 250 mW

up to $T_{amb} = 70$ °C

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 $T_{amb} = 70\text{ }^\circ\text{C}$	P_{tot}	max.	100 mW

Optocoupler

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

THERMAL RESISTANCE

From junction to ambient diode	R_{thj-a}	=	500 K/W
transistor	R_{thj-a}	=	500 K/W
From junction to ambient with the device mounted on a PCB diode	R_{thj-a}	=	400 K/W
transistor	R_{thj-a}	=	400 K/W

LINEAR DERATING FACTOR

Above 70 $^\circ\text{C}$ diode		2.0 mW/K
transistor		2.0 mW/K

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

DEVELOPMENT DATA

Isolation voltage (t = 1 min) (see note 1)	DC	6N135	V_{IORM}	min.	3.5 kV
	AC (RMS value)				2.5 kV
	DC	6N136	V_{IORM}	min.	4.4 kV
	AC (RMS value)				3.12 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 T Ω 10 G Ω
Switching times (see Figs 2 and 3) $I_F = 16$ mA; $V_{CC} = 5$ V; $R_L = 4.1$ k Ω ; $T_{amb} = 25$ °C					
Propagation delay time to logic LOW at output		6N135	t_{PHL}	typ. max.	0.2 μ s 1.5 μ s
Propagation delay time to logic HIGH at output		6N135	t_{PLH}	typ. max.	0.6 μ s 1.5 μ s
Switching times (see Figs 2 and 3) $I_F = 16$ mA; $V_{CC} = 5$ V; $R_L = 1.9$ k Ω ; $T_{amb} = 25$ °C					
Propagation delay time to logic LOW at output		6N136	t_{PHL}	typ. max.	0.4 μ s 0.8 μ s
Propagation delay time to logic HIGH at output		6N136	t_{PLH}	typ. max.	0.6 μ s 0.8 μ s
Transient immunity (see Fig. 4). $V_{CC} = 5$ V; $V_{CM} = 10$ V(p-p); $T_{amb} = 25$ °C					
					$R_L = 4.1$ k Ω (6N135) $R_L = 1.9$ k Ω (6N136)
Common mode transient immunity at logic HIGH $I_F = 0$			CM_H	min.	1.0 kV/ μ s
Common mode transient immunity at logic LOW $I_F = 16$ mA			CM_L	min.	-1.0 kV/ μ s
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 μ A

Notes

- 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.
- 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.

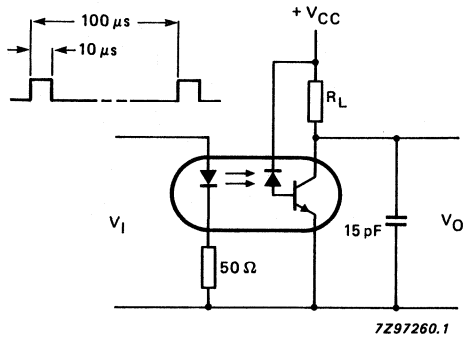


Fig. 2 Switching circuit.

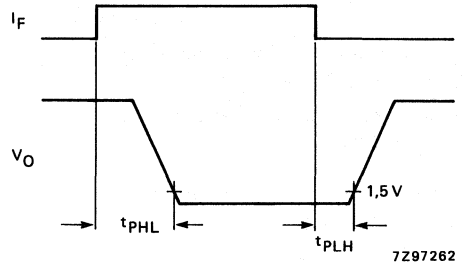


Fig. 3 Waveforms.

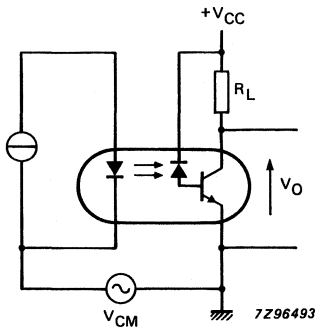


Fig. 4 Test circuit.

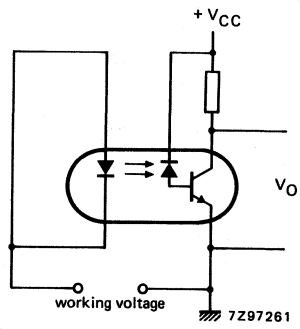


Fig. 5 Test circuit.

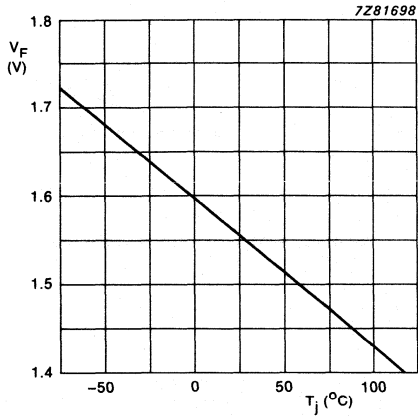


Fig. 6 Typical forward voltage as a function of junction temperature; $I_F = 16 \text{ mA}$; typical values.

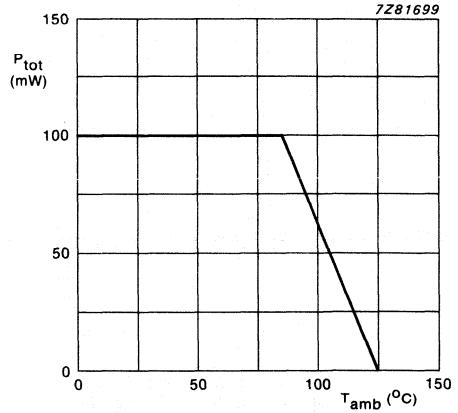


Fig. 7 Total power dissipation as a function of ambient temperature.

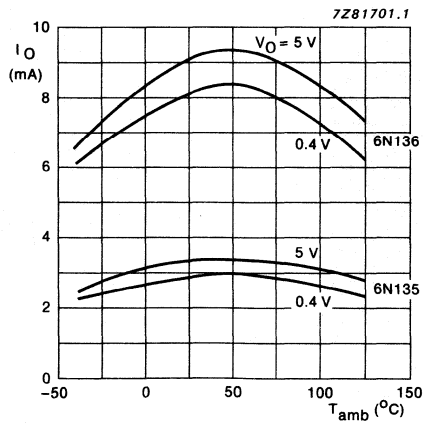


Fig. 8 Output current as a function of ambient temperature; $V_{CC} = 5 \text{ V}$; $I_F = 16 \text{ mA}$; typical values.

6N135 6N136

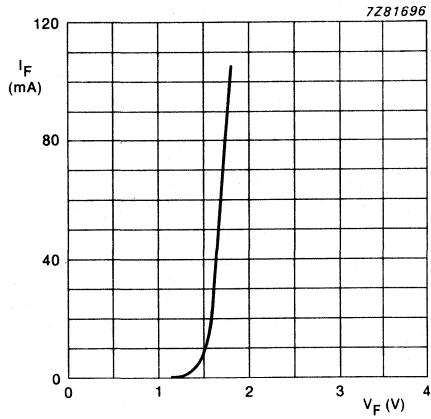


Fig. 9 Forward current as a function of forward voltage; $T_{amb} = 25^{\circ}C$; typical values.

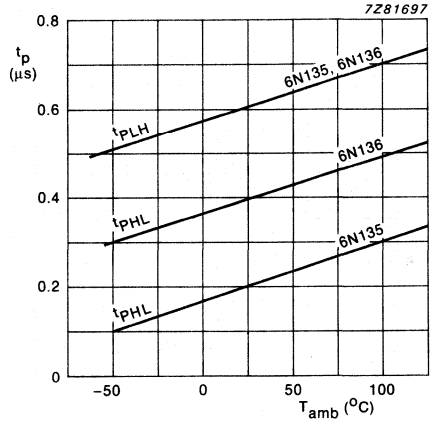


Fig. 10 Propagation delay times as functions of ambient temperature; $I_F = 16\text{ mA}$; $V_{CC} = 5\text{ V}$; $R_L = 4.1\text{ k}\Omega$ for 6N135; $R_L = 1.9\text{ k}\Omega$ for 6N136; typical values.

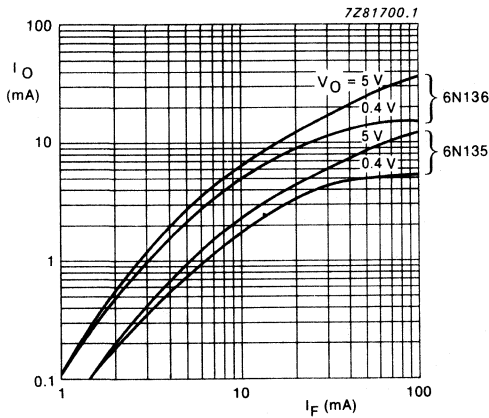


Fig. 11 Output current as a function of forward current; $V_{CC} = 4.5\text{ V}$; typical values.

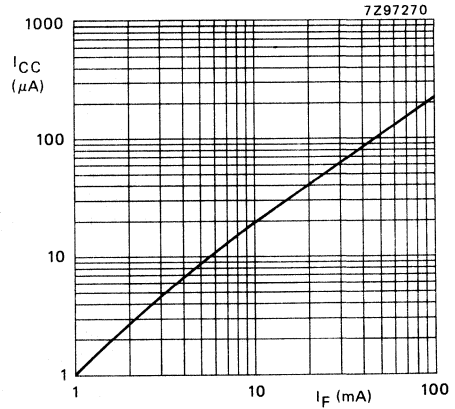


Fig. 12 I_{CC} as a function of forward current; $V_{CC} = 15\text{ V}$; $I_O = 0$; typical values.

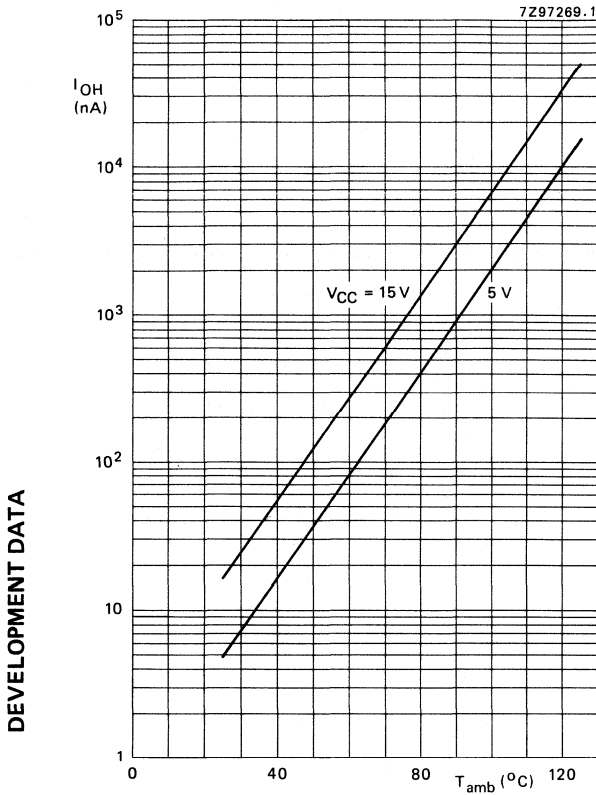


Fig. 13 Logic HIGH output current as a function of ambient temperature; typical values.

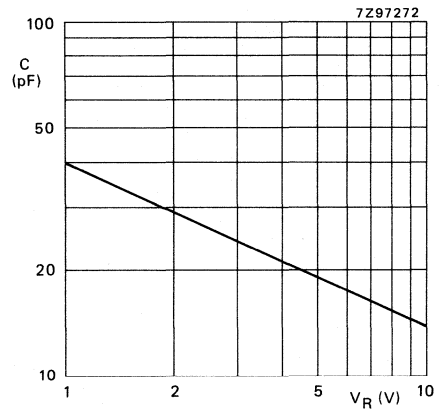


Fig. 14 Photodiode capacitance as a function of reverse voltage; $T_{amb} = 25^{\circ}C$; typical values.

INDEX OF TYPE NUMBERS

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

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BA221	SC01	SD	BAS29	SC01/10	SD/Mm	BAV70	SC01/10	SD/Mm
BA223	SC01	T	BAS31	SC01/10	SD/Mm	BAV74	SC01	SD
BA281	SC01	SD	BAS32	SC01/10	SD/Mm	BAV99	SC01/10	SD/Mm
BA314	SC01	Vrg	BAS32L	SC01/10	SD/Mm	BAV100	SC01/10	SD/Mm
BA315	SC01	Vrg	BAS35	SC01/10	SD/Mm	BAV101	SC01/10	SD/Mm
BA316	SC01	SD	BAS45	SC01	SD	BAV102	SC01/10	SD/Mm
BA317	SC01	SD	BAS45L	SC01/10	SD/Mm	BAV103	SC01/10	SD/Mm
BA318	SC01	SD	BAS56	SC01/10	SD/Mm	BAV105	SC01/10	SD/Mm
BA423	SC01	T	BAS85	SC01	SD	BAW56	SC01/10	SD/Mm
BA423L	SC01	T	BAT17	SC01/10	T/Mm	BAW62	SC01	SD
BA480	SC01	T	BAT18	SC01/10	T/Mm	BAX12	SC01	SD
BA481	SC01	T	BAT54	SC01/10	SD/Mm	BAX14	SC01	SD
BA482	SC01	T	BAT74	SC01/10	SD/Mm	BAX18	SC01	SD
BA483	SC01	T	BAT81	SC01	T	BAY80	SC01	SD
BA484	SC01	T	BAT82	SC01	T	BB112	SC01	T
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BA683	SC01/10	T/Mm	BAT85	SC01	T	BB130	SC01	T
BAS11	SC01	SD	BAT86	SC01	T	BB204B	SC01	T
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BA516	SC01/10	SD/Mm	BAV18	SC01	SD	BB212	SC01	T
BA517	SC01/10	Vrg/Mm	BAV19	SC01	SD	BB215	SC01/10	SD/Mm
BA519	SC01/10	SD/Mm	BAV20	SC01	SD	BB219	SC01/10	SD/Mm
BA520	SC01/10	SD/Mm	BAV21	SC01	SD	BB240	SC01/10	T/Mm
BA521	SC01/10	SD/Mm	BAV23	SC01/10	SD/Mm	BB241	SC01/10	T/Mm

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

* series.

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

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BB809	SC01	T	BC636	SC04	Sm	BCV63	SC10	Mm
BB909A	SC01	T	BC637	SC04	Sm	BCV64	SC10	Mm
BB909B	SC01	T	BC638	SC04	Sm	BCV65	SC10	Mm
BB910	SC01	T	BC639	SC04	Sm	BCV71;R	SC10	Mm
BB911	SC01	T	BC640	SC04	Sm	BCV72;R	SC10	Mm
BBY31	SC01/10	T/Mm	BC807	SC10	Mm	BCW29;R	SC10	Mm
BBY39	SC01	T	BC808	SC10	Mm	BCW30;R	SC10	Mm
BBY40	SC01/10	T/Mm	BC817	SC10	Mm	BCW31;R	SC10	Mm
BBY42	SC01	T	BC818	SC10	Mm	BCW32;R	SC10	Mm
BBY62	SC01	T	BC846	SC10	Mm	BCW33;R	SC10	Mm
BC107	SC04	Sm	BC847	SC10	Mm	BCW60*	SC10	Mm
BC108	SC04	Sm	BC848	SC10	Mm	BCW61*	SC10	Mm
BC109	SC04	Sm	BC849	SC10	Mm	BCW69;R	SC10	Mm
BC140	SC04	Sm	BC850	SC10	Mm	BCW70;R	SC10	Mm
BC141	SC04	Sm	BC856	SC10	Mm	BCW71;R	SC10	Mm
BC160	SC04	Sm	BC857	SC10	Mm	BCW72;R	SC10	Mm
BC161	SC04	Sm	BC858	SC10	Mm	BCW81;R	SC10	Mm
BC177	SC04	Sm	BC859	SC10	Mm	BCW89;R	SC10	Mm
BC178	SC04	Sm	BC860	SC10	Mm	BCX17;R	SC10	Mm
BC179	SC04	Sm	BC868	SC10	Mm	BCX18;R	SC10	Mm
BC264A	SC07	FET	BC869	SC10	Mm	BCX19;R	SC10	Mm
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BC264C	SC07	FET	BCF30;R	SC10	Mm	BCX51	SC10	Mm
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BC368	SC04	Sm	BCP52	SC10	Mm	BCX58	SC04	Sm
BC369	SC04	Sm	BCP53	SC10	Mm	BCX59	SC04	Sm
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BC376	SC04	Sm	BCP55	SC10	Mm	BCX71*	SC10	Mm
BC516	SC04	Sm	BCP56	SC10	Mm	BCX78	SC04	Sm
BC517	SC04	Sm	BCP68	SC10	Mm	BCX79	SC04	Sm
BC546	SC04	Sm	BCP69	SC10	Mm	BCY56	SC04	Sm
BC547	SC04	Sm	BCV26	SC10	Mm	BCY57	SC04	Sm
BC548	SC04	Sm	BCV27	SC10	Mm	BCY58	SC04	Sm
BC549	SC04	Sm	BCV28	SC10	Mm	BCY59	SC04	Sm
BC550	SC04	Sm	BCV29	SC10	Mm	BCY65	SC04	Sm
BC556	SC04	Sm	BCV46	SC10	Mm	BCY70	SC04	Sm
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BD228	SC05	P	BD434	SC05	P	BD933;F	SC05	P
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BD240C	SC05	P	BD677	SC05	P	BD950;F	SC05	P
BD241	SC05	P	BD678	SC05	P	BD951;F	SC05	P
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BD241C	SC05	P	BD681	SC05	P	BD954;F	SC05	P
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BDT31C;F	SC05	P	BDT88;F	SC05	P	BDX63C	SC05	P
BDT31DF	SC05	P	BDT91;F	SC05	P	BDX64	SC05	P
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BDT32A;F	SC05	P	BDT93;F	SC05	P	BDX64B	SC05	P
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BDT32C;F	SC05	P	BDT95;F	SC05	P	BDX65	SC05	P
BDT32DF	SC05	P	BDT96;F	SC05	P	BDX65A	SC05	P
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BDT42A;F	SC05	P	BDV65	SC05	P	BDX66B	SC05	P
BDT42B;F	SC05	P	BDV65A	SC05	P	BDX66C	SC05	P
BDT42C;F	SC05	P	BDV65B	SC05	P	BDX67	SC05	P
BDT60;F	SC05	P	BDV65C	SC05	P	BDX67A	SC05	P
BDT60A;F	SC05	P	BDV66A	SC05	P	BDX67B	SC05	P
BDT60B;F	SC05	P	BDV66B	SC05	P	BDX67C	SC05	P
BDT60C;F	SC05	P	BDV66C	SC05	P	BDX68	SC05	P
BDT61;F	SC05	P	BDV66D	SC05	P	BDX68A	SC05	P
BDT61A;F	SC05	P	BDV67A	SC05	P	BDX68B	SC05	P
BDT61B;F	SC05	P	BDV67B	SC05	P	BDX68C	SC05	P
BDT61C;F	SC05	P	BDV67C	SC05	P	BDX69	SC05	P
BDT62;F	SC05	P	BDV67D	SC05	P	BDX69A	SC05	P
BDT62A;F	SC05	P	BDV91	SC05	P	BDX69B	SC05	P
BDT62B;F	SC05	P	BDV92	SC05	P	BDX69C	SC05	P
BDT62C;F	SC05	P	BDV93	SC05	P	BDX77;F	SC05	P
BDT63;F	SC05	P	BDV94	SC05	P	BDX78;F	SC05	P
BDT63A;F	SC05	P	BDV95	SC05	P	BDX91	SC05	P
BDT63B;F	SC05	P	BDV96	SC05	P	BDX92	SC05	P
BDT63C;F	SC05	P	BDX35	SC05	P	BDX93	SC05	P
BDT64;F	SC05	P	BDX36	SC05	P	BDX94	SC05	P
BDT64A;F	SC05	P	BDX37	SC05	P	BDX95	SC05	P
BDT64B;F	SC05	P	BDX42	SC05	P	BDX96	SC05	P
BDT64C;F	SC05	P	BDX43	SC05	P	BDY90	SC05	P
BDT65;F	SC05	P	BDX44	SC05	P	BDY91	SC05	P
BDT65A;F	SC05	P	BDX45	SC05	P	BDY92	SC05	P

type no.	book	section	type no.	book	section	type no.	book	section
BF198	SC04	Sm	BF720	SC10	Mm	BFG90A	SC14	WBT
BF199	SC04	Sm	BF721	SC10	Mm	BFG91A	SC14	WBT
BF240	SC04	Sm	BF722	SC10	Mm	BFG92A	SC14	WBT
BF241	SC04	Sm	BF723	SC10	Mm	BFG93A	SC14	WBT
BF245A	SC07	FET	BF763	SC14	WBT	BFG96	SC14	WBT
BF245B	SC07	FET	BF820	SC10	Mm	BFG97	SC14/10	WBT/Mm
BF245C	SC07	FET	BF821	SC10	Mm	BFG135	SC14/10	WBT/Mm
BF247A	SC07	FET	BF822	SC10	Mm	BFG195	SC14	WBT
BF247B	SC07	FET	BF823	SC10	Mm	BFG198	SC14/10	WBT/Mm
BF247C	SC07	FET	BF824	SC10	Mm	BFP90A	SC14	WBT
BF256A	SC07	FET	BF840	SC10	Mm	BFP91A	SC14	WBT
BF256B	SC07	FET	BF841	SC10	Mm	BFP96	SC14	WBT
BF256C	SC07	FET	BF926	SC04	Sm	BFQ10	SC07	FET
BF324	SC04	Sm	BF936	SC04	Sm	BFQ11	SC07	FET
BF370	SC04	Sm	BF939	SC04	Sm	BFQ12	SC07	FET
BF410A	SC07	FET	BF960	SC07	FET	BFQ13	SC07	FET
BF410B	SC07	FET	BF964S	SC07	FET	BFQ14	SC07	FET
BF410C	SC07	FET	BF965	SC07	FET	BFQ15	SC07	FET
BF410D	SC07	FET	BF966S	SC07	FET	BFQ16	SC07	FET
BF420	SC04	Sm	BF967	SC04	Sm	BFQ17	SC14/10	WBT/Mm
BF421	SC04	Sm	BF970	SC04	Sm	BFQ18A	SC14/10	WBT/Mm
BF422	SC04	Sm	BF970A	SC04	Sm	BFQ19	SC14/10	WBT/Mm
BF423	SC04	Sm	BF979	SC04	Sm	BFQ22S	SC14	WBT
BF450	SC04	Sm	BF980	SC07	FET	BFQ23	SC14	WBT
BF451	SC04	Sm	BF980A	SC07	FET	BFQ23C	SC14	WBT
BF483	SC04	Sm	BF981	SC07	FET	BFQ24	SC14	WBT
BF485	SC04	Sm	BF982	SC07	FET	BFQ32	SC14	WBT
BF487	SC04	Sm	BF989	SC07/10	FET/Mm	BFQ32C	SC14	WBT
BF494	SC04	Sm	BF990A	SC07/10	FET/Mm	BFQ32M	SC14	WBT
BF495	SC04	Sm	BF990AR	SC07/10	FET/Mm	BFQ32S	SC14	WBT
BF496	SC04	Sm	BF991	SC07/10	FET/Mm	BFQ33	SC14	WBT
BF510	SC07/10	FET/Mm	BF992	SC07/10	FET/Mm	BFQ33C	SC14	WBT
BF511	SC07/10	FET/Mm	BF992R	SC07/10	FET/Mm	BFQ34	SC14	WBT
BF512	SC07/10	FET/Mm	BF994S	SC07/10	FET/Mm	BFQ34T	SC14	WBT
BF513	SC07/10	FET/Mm	BF994SR	SC07/10	FET/Mm	BFQ42	SC08	RFP
BF550;R	SC10	Mm	BF996S	SC07/10	FET/Mm	BFQ43	SC08	RFP
BF569	SC10	Mm	BF996SR	SC07/10	FET/Mm	BFQ43S	SC08	RFP
BF570	SC10	Mm	BF997	SC07/10	FET/Mm	BFQ51	SC14	WBT
BF579	SC10	Mm	BFG23	SC14	WBT	BFQ51C	SC14	WBT
BF620	SC10	Mm	BFG32	SC14	WBT	BFQ52	SC14	WBT
BF621	SC10	Mm	BFG34	SC14	WBT	BFQ53	SC14	WBT
BF622	SC10	Mm	BFG35	SC14/10	WBT/Mm	BFQ63	SC14	WBT
BF623	SC10	Mm	BFG51	SC14	WBT	BFQ65	SC14	WBT
BF660;R	SC10	Mm	BFG65	SC14	WBT	BFQ66	SC14	WBT
BF689K	SC14	WBT	BFG67	SC14/10	WBT/Mm	BFQ67	SC14/10	WBT/Mm

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BFQ68	SC14	WBT	BFW17A	SC14	WBT	BGY49A	SC09	RFP
BFQ136	SC14	WBT	BFW30	SC14	WBT	BGY49B	SC09	RFP
BFR29	SC07	FET	BFW61	SC07	FET	BGY50	SC14	WBM
BFR30	SC07/10	FET/Mm	BFW92	SC14	WBT	BGY51	SC14	WBM
BFR31	SC07/10	FET/Mm	BFW92A	SC14	WBT	BGY52	SC14	WBM
BFR49	SC14	WBT	BFW93	SC14	WBT	BGY53	SC14	WBM
BFR53	SC14/10	WBT/Mm	BFX34	SC04	Sm	BGY54	SC14	WBM
BFR54	SC04	Sm	BFX89	SC14	WBT	BGY55	SC14	WBM
BFR64	SC14	WBT	BFY50	SC04	Sm	BGY56	SC14	WBM
BFR65	SC14	WBT	BFY51	SC04	Sm	BGY57	SC14	WBM
BFR84	SC07	FET	BFY52	SC04	Sm	BGY58	SC14	WBM
BFR90	SC14	WBT	BFY55	SC04	Sm	BGY58A	SC14	WBM
BFR90A	SC14	WBT	BFY90	SC14	WBT	BGY59	SC14	WBM
BFR91	SC14	WBT	BG2000	SC01	RT	BGY60	SC14	WBM
BFR91A	SC14	WBT	BG2097	SC01	RT	BGY61	SC14	WBM
BFR92	SC14/10	WBT/Mm	BGD102	SC14	WBM	BGY65	SC14	WBM
BFR92A	SC14/10	WBT/Mm	BGD102E	SC14	WBM	BGY67	SC14	WBM
BFR93	SC14/10	WBT/Mm	BGD104	SC14	WBM	BGY67A	SC14	WBM
BFR93A	SC14/10	WBT/Mm	BGD104E	SC14	WBM	BGY70	SC14	WBM
BFR94	SC14	WBT	BGD502	SC14	WBM	BGY71	SC14	WBM
BFR95	SC14	WBT	BGD504	SC14	WBM	BGY74	SC14	WBM
BFR96	SC14	WBT	BGX885	SC14	WBM	BGY75	SC14	WBM
BFR96S	SC14	WBT	BGY22	SC09	RFP	BGY78	SC14	WBM
BFR101A;B	SC07/10	FET/Mm	BGY22A	SC09	RFP	BGY84	SC14	WBM
BFS17	SC14/10	WBT/Mm	BGY23	SC09	RFP	BGY84A	SC14	WBM
BFS17A	SC14	WBT	BGY23A	SC09	RFP	BGY85	SC14	WBM
BFS18;R	SC10	Mm	BGY32	SC09	RFP	BGY85A	SC14	WBM
BFS19;R	SC10	Mm	BGY33	SC09	RFP	BGY86	SC14	WBM
BFS20;R	SC10	Mm	BGY35	SC09	RFP	BGY87	SC14	WBM
BFS21	SC07	FET	BGY36	SC09	RFP	BGY88	SC14	WBM
BFS21A	SC07	FET	BGY40A	SC09	RFP	BGY90A	SC09	RFP
BFS22A	SC08	RFP	BGY40B	SC09	RFP	BGY90B	SC09	RFP
BFS23A	SC08	RFP	BGY41A	SC09	RFP	BGY91A	SC09	RFP
BFT24	SC14	WBT	BGY41B	SC09	RFP	BGY91B	SC09	RFP
BFT25	SC14/10	WBT/Mm	BGY43	SC09	RFP	BGY93A	SC09	RFP
BFT44	SC04	Sm	BGY45A	SC09	RFP	BGY93B	SC09	RFP
BFT45	SC04	Sm	BGY45B	SC09	RFP	BGY93C	SC09	RFP
BFT46	SC07/10	FET/Mm	BGY45C	SC09	RFP	BGY94A	SC09	RFP
BFT92	SC14/10	WBT/Mm	BGY46A	SC09	RFP	BGY94B	SC09	RFP
BFT93	SC14/10	WBT/Mm	BGY46B	SC09	RFP	BGY94C	SC09	RFP
BFW10	SC07	FET	BGY47A	SC09	RFP	BGY95A	SC09	RFP
BFW11	SC07	FET	BGY47F	SC09	RFP	BGY95B	SC09	RFP
BFW12	SC07	FET	BGY48A	SC09	RFP	BGY96A	SC09	RFP
BFW13	SC07	FET	BGY48B	SC09	RFP	BGY96B	SC09	RFP
BFW16A	SC14	WBT	BGY48C	SC09	RFP	BGY110A	SC09	RFP

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BGY110B	SC09	RFP	BLV94	SC08	RFP	BLX92A	SC08	RFP
BGY584A	SC14	WBM	BLV95	SC08	RFP	BLX93A	SC08	RFP
BGY585A	SC14	WBM	BLV97	SC08	RFP	BLX94A	SC08	RFP
BGY586	SC14	WBM	BLV98	SC08	RFP	BLX94C	SC08	RFP
BGY587	SC14	WBM	BLV99	SC08	RFP	BLX95	SC08	RFP
BLF242	SC08	RFP/FET	BLW29	SC08	RFP	BLX96	SC08	RFP
BLF244	SC08	RFP/FET	BLW31	SC08	RFP	BLX97	SC08	RFP
BLF245	SC08	RFP/FET	BLW32	SC08	RFP	BLX98	SC08	RFP
BLT90/SL	SC08	RFP	BLW33	SC08	RFP	BLY87A	SC08	RFP
BLT91/SL	SC08	RFP	BLW34	SC08	RFP	BLY87C	SC08	RFP
BLT92/SL	SC08	RFP	BLW50F	SC08	RFP	BLY88A	SC08	RFP
BLU20/12	SC08	RFP	BLW60	SC08	RFP	BLY88C	SC08	RFP
BLU30/12	SC08	RFP	BLW60C	SC08	RFP	BLY89A	SC08	RFP
BLU45/12	SC08	RFP	BLW76	SC08	RFP	BLY89C	SC08	RFP
BLU50	SC08	RFP	BLW77	SC08	RFP	BLY90	SC08	RFP
BLU51	SC08	RFP	BLW78	SC08	RFP	BLY91A	SC08	RFP
BLU52	SC08	RFP	BLW79	SC08	RFP	BLY91C	SC08	RFP
BLU53	SC08	RFP	BLW80	SC08	RFP	BLY92A	SC08	RFP
BLU60/12	SC08	RFP	BLW81	SC08	RFP	BLY92C	SC08	RFP
BLU97	SC08	RFP	BLW83	SC08	RFP	BLY93A	SC08	RFP
BLU98	SC08	RFP	BLW84	SC08	RFP	BLY93C	SC08	RFP
BLU99	SC08	RFP	BLW85	SC08	RFP	BLY94	SC08	RFP
BLV10	SC08	RFP	BLW86	SC08	RFP	BPF24	SC12	PDT
BLV11	SC08	RFP	BLW87	SC08	RFP	BPW22A	S8a/b	PDT
BLV20	SC08	RFP	BLW89	SC08	RFP	BPW50	S8a/b	PDT
BLV21	SC08	RFP	BLW90	SC08	RFP	BPW71	SC12	PDT
BLV25	SC08	RFP	BLW91	SC08	RFP	BPX25	SC12	PDT
BLV30	SC08	RFP	BLW95	SC08	RFP	BPX29	SC12	PDT
BLV30/12	SC08	RFP	BLW96	SC08	RFP	BPX40	SC12	PDT
BLV31	SC08	RFP	BLW97	SC08	RFP	BPX41	SC12	PDT
BLV32F	SC08	RFP	BLW98	SC08	RFP	BPX42	SC12	PDT
BLV33	SC08	RFP	BLW99	SC08	RFP	BPX61	SC12	PDT
BLV33F	SC08	RFP	BLX13	SC08	RFP	BPX61P	SC12	PDT
BLV36	SC08	RFP	BLX13C	SC08	RFP	BPX71	SC12	PDT
BLV45/12	SC08	RFP	BLX14	SC08	RFP	BPX72	SC12	PDT
BLV57	SC08	RFP	BLX15	SC08	RFP	BR100/03	S2b	Th
BLV59	SC08	RFP	BLX39	SC08	RFP	BR101	SC04	Sm
BLV75/12	SC08	RFP	BLX65	SC08	RFP	BR210*	S2a	Th
BLV80/28	SC08	RFP	BLX65E	SC08	RFP	BR216*	S2a	Th
BLV90	SC08	RFP	BLX65ES	SC08	RFP	BR220*	S2a	Th
BLV90/SL	SC08	RFP	BLX67	SC08	RFP	BRY39	SC04	Sm
BLV91	SC08	RFP	BLX68	SC08	RFP	BRY56	SC04	Sm
BLV91/SL	SC08	RFP	BLX69A	SC08	RFP	BRY61	SC10	Mm
BLV92	SC08	RFP	BLX91A	SC08	RFP	BRY62	SC10	Mm
BLV93	SC08	RFP	BLX91CB	SC08	RFP	BS107	SC07	FET

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BS107A	SC07	FET	BSR15;R	SC10	Mm	BSS87	SC07	FET
BS170	SC07	FET	BSR16;R	SC10	Mm	BSS89	SC07	FET
BS250	SC07	FET	BSR17;R	SC10	Mm	BSS91	SC07	FET
BSD10	SC07	FET	BSR17A;R	SC10	Mm	BSS92	SC07	FET
BSD12	SC07	FET	BSR18;R	SC10	Mm	BST15	SC10	Mm
BSD20	SC07/10	FET/Mm	BSR18A;R	SC10	Mm	BST16	SC10	Mm
BSD22	SC07/10	FET/Mm	BSR19	SC10	Mm	BST39	SC10	Mm
BSD212	SC07	FET	BSR19A	SC10	Mm	BST40	SC10	Mm
BSD213	SC07	FET	BSR20	SC10	Mm	BST50	SC10	Mm
BSD214	SC07	FET	BSR20A	SC10	Mm	BST51	SC10	Mm
BSD215	SC07	FET	BSR30	SC10	Mm	BST52	SC10	Mm
BSJ111	SC07	FET	BSR31	SC10	Mm	BST60	SC10	Mm
BSJ112	SC07	FET	BSR32	SC10	Mm	BST61	SC10	Mm
BSJ113	SC07	FET	BSR33	SC10	Mm	BST62	SC10	Mm
BSJ174	SC07	FET	BSR40	SC10	Mm	BST70A	SC07	FET
BSJ175	SC07	FET	BSR41	SC10	Mm	BST72A	SC07	FET
BSJ176	SC07	FET	BSR42	SC10	Mm	BST74A	SC07	FET
BSJ177	SC07	FET	BSR43	SC10	Mm	BST76A	SC07	FET
BSN205	SC07	FET	BSR50	SC04	Sm	BST78	SC07	FET
BSN205A	SC07	FET	BSR51	SC04	Sm	BST80	SC07/10	FET/Mm
BSN254	SC07	FET	BSR52	SC04	Sm	BST82	SC07/10	FET/Mm
BSN254A	SC07	FET	BSR56	SC07/10	FET/Mm	BST84	SC07/10	FET/Mm
BSP15	SC10	Mm	BSR57	SC07/10	FET/Mm	BST86	SC07/10	FET/Mm
BSP16	SC10	Mm	BSR58	SC07/10	FET/Mm	BST95	SC07	FET
BSP19	SC10	Mm	BSR60	SC04	Sm	BST97	SC07	FET
BSP20	SC10	Mm	BSR61	SC04	Sm	BST100	SC07	FET
BSP30	SC10	Mm	BSR62	SC04	Sm	BST110	SC07	FET
BSP31	SC10	Mm	BSR111	SC07/10	FET/Mm	BST120	SC07/10	FET/Mm
BSP32	SC10	Mm	BSR112	SC07/10	FET/Mm	BST122	SC07/10	FET/Mm
BSP33	SC10	Mm	BSR113	SC07/10	FET/Mm	BSV15	SC04	Sm
BSP40	SC10	Mm	BSR174	SC07/10	FET/Mm	BSV16	SC04	Sm
BSP41	SC10	Mm	BSR175	SC07/10	FET/Mm	BSV17	SC04	Sm
BSP42	SC10	Mm	BSR176	SC07/10	FET/Mm	BSV52;R	SC10	Mm
BSP43	SC10	Mm	BSR177	SC07/10	FET/Mm	BSV64	SC04	Sm
BSP50	SC10	Mm	BSS38	SC04	Sm	BSV78	SC07	FET
BSP51	SC10	Mm	BSS50	SC04	Sm	BSV79	SC07	FET
BSP52	SC10	Mm	BSS51	SC04	Sm	BSV80	SC07	FET
BSP60	SC10	Mm	BSS52	SC04	Sm	BSV81	SC07	FET
BSP61	SC10	Mm	BSS60	SC04	Sm	BSW66A	SC04	Sm
BSP62	SC10	Mm	BSS61	SC04	Sm	BSW67A	SC04	Sm
BSP204	SC07	FET	BSS62	SC04	Sm	BSW68A	SC04	Sm
BSP204A	SC07	FET	BSS63;R	SC10	Mm	BSX19	SC04	Sm
BSR12;R	SC10	Mm	BSS64;R	SC10	Mm	BSX20	SC04	Sm
BSR13;R	SC10	Mm	BSS68	SC04	Sm	BSX32	SC04	Sm
BSR14;R	SC10	Mm	BSS83	SC07/10	FET/Mm	BSX45	SC04	Sm

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BSX46	SC04	Sm	BU306F	SC06	SP	BUV48;A	SC06	SP
BSX47	SC04	Sm	BU505	SC06	SP	BUV82	SC06	SP
BSX59	SC04	Sm	BU506	SC06	SP	BUV83	SC06	SP
BSX60	SC04	Sm	BU506D	SC06	SP	BUV89	SC06	SP
BSX61	SC04	Sm	BU508A	SC06	SP	BUV90	SC06	SP
BT136*	S2b	Tri	BU508D	SC06	SP	BUV90F	SC06	SP
BT136F*	S2b	Tri	BU705	SC06	SP	BUV98(V);A	SC06	SP
BT137*	S2b	Tri	BU706	SC06	SP	BUV298(V);A	SC06	SP
BT137F*	S2b	Tri	BU706D	SC06	SP	BUW11;A	SC06	SP
BT138*	S2b	Tri	BU806	SC06	SP	BUW12;A	SC06	SP
BT138F*	S2b	Tri	BU807	SC06	SP	BUW12F;AF	SC06	SP
BT139*	S2b	Tri	BU808	SC06	SP	BUW13;A	SC06	SP
BT139F*	S2b	Tri	BU824	SC06	SP	BUW13F;AF	SC06	SP
BT145*	S2b	Tri	BU826	SC06	SP	BUW84	SC06	SP
BT149*	S2b	Th	BUP22*	SC06	SP	BUW85	SC06	SP
BT150	S2b	Th	BUP23*	SC06	SP	BUW86	SC06	SP
BT151*	S2b	Th	BUS11;A	SC06	SP	BUW87;A	SC06	SP
BT151F*	S2b	Th	BUS12;A	SC06	SP	BUW131*	SC06	SP
BT152*	S2b	Th	BUS13;A	SC06	SP	BUW132*	SC06	SP
BT153	S2b	Th	BUS14;A	SC06	SP	BUW133*	SC06	SP
BT157*	S2b	Th	BUS21*	SC06	SP	BUX46;A	SC06	SP
BT169*	S2b	Th	BUS22*	SC06	SP	BUX47;A	SC06	SP
BTA140*	S2b	Tri	BUS23*	SC06	SP	BUX48;A	SC06	SP
BTR59*	S2b	Tri	BUS24*	SC06	SP	BUX84	SC06	SP
BTS59*	S2b	Tri	BUS131*	SC06	SP	BUX84F	SC06	SP
BTV58*	S2b	Th	BUS132*	SC06	SP	BUX85	SC06	SP
BTV59*	S2b	Th	BUS133*	SC06	SP	BUX85F	SC06	SP
BTV59D*	S2b	Th	BUT11;A	SC06	SP	BUX86	SC06	SP
BTV60*	S2b	Th	BUT11F;AF	SC06	SP	BUX87	SC06	SP
BTV60D*	S2b	Th	BUT12;A	SC06	SP	BUX88	SC06	SP
BTW70*	S2b	Th	BUT12F;AF	SC06	SP	BUX98;A	SC06	SP
BTW70D*	S2b	Th	BUT18;A	SC06	SP	BUX99	SC06	SP
BTW23*	S2b	Th	BUT18F;AF	SC06	SP	BUY89	SC06	SP
BTW38*	S2b	Th	BUT21B;C	SC06	SP	BUZ10	S9	PM
BTW40*	S2b	Th	BUT21BF;CF	SC06	SP	BUZ11	S9	PM
BTW42*	S2b	Th	BUT22B;C	SC06	SP	BUZ11A	S9	PM
BTW43*	S2b	Tri	BUT22BF;CF	SC06	SP	BUZ14	S9	PM
BTW45*	S2b	Th	BUT131	SC06	SP	BUZ15	S9	PM
BTW58*	S2b	Th	BUV26;A	SC06	SP	BUZ20	S9	PM
BTW62*	S2b	Th	BUV26F;AF	SC06	SP	BUZ21	S9	PM
BTW62D*	S2b	Th	BUV27;A	SC06	SP	BUZ23	S9	PM
BTW63*	S2b	Th	BUV27F;AF	SC06	SP	BUZ24	S9	PM
BTY79*	S2b	Th	BUV28;A	SC06	SP	BUZ25	S9	PM
BTY91*	S2b	Th	BUV28F;AF	SC06	SP	BUZ31	S9	PM
BU306	SC06	SP	BUV47;A	SC06	SP	BUZ32	S9	PM

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BUZ34	S9	PM	BUZ347	S9	PM	BY714	SC01	R
BUZ35	S9	PM	BUZ348	S9	PM	BY715	SC01	R
BUZ36	S9	PM	BUZ349	S9	PM	BY716	SC01	R
BUZ41A	S9	PM	BUZ350	S9	PM	BY717	SC01	R
BUZ42	S9	PM	BUZ351	S9	PM	BY718	SC01	R
BUZ45	S9	PM	BUZ355	S9	PM	BY719	SC01	R
BUZ45A	S9	PM	BUZ356	S9	PM	BY720	SC01	R
BUZ45B	S9	PM	BUZ357	S9	PM	BY721	SC01	R
BUZ50A	S9	PM	BUZ358	S9	PM	BY722	SC01	R
BUZ50B	S9	PM	BUZ384	S9	PM	BY723	SC01	R
BUZ50C	S9	PM	BUZ385	S9	PM	BY724	SC01	R
BUZ53A	S9	PM	BY224*	S2a	R	BYD11 *	SC01	R
BUZ54	S9	PM	BY225*	S2a	R	BYD13 *	SC01	R
BUZ54A	S9	PM	BY228	SC01	R	BYD14 *	SC01	R
BUZ60	S9	PM	BY229*	S2a	R	BYD17 *	SC01/10	R/Mm
BUZ63	S9	PM	BY229F*	S2a	R	BYD31 *	SC01	R
BUZ64	S9	PM	BY249*	S2a	R	BYD33 *	SC01	R
BUZ71	S9	PM	BY260*	S2a	R	BYD34 *	SC01	R
BUZ71A	S9	PM	BY261*	S2a	R	BYD37 *	SC01/10	R/Mm
BUZ72	S9	PM	BY328	SC01	SD	BYD73 *	SC01	R
BUZ72A	S9	PM	BY329*	S2a	R	BYD74 *	SC01	R
BUZ73	S9	PM	BY359*	S2a	R	BYD77 *	SC01	R
BUZ73A	S9	PM	BY438	SC01	R	BYM26 *	SC01	R
BUZ74	S9	PM	BY448	SC01	R	BYM36 *	SC01	R
BUZ74A	S9	PM	BY458	SC01	R	BYM56 *	SC01	R
BUZ76	S9	PM	BY505	SC01	R	BYP21*	S2a	R
BUZ76A	S9	PM	BY509	SC01	R	BYP22*	S2a	R
BUZ78	S9	PM	BY527	SC01	R	BYP59*	S2a	R
BUZ80	S9	PM	BY584	SC01	R	BYQ27*	SC01	R
BUZ80A	S9	PM	BY588	SC01	R	BYQ28*	S2a	R
BUZ83	S9	PM	BY609	SC01	R	BYR29*	S2a	R
BUZ83A	S9	PM	BY610	SC01	R	BYR29F*	S2a	R
BUZ84	S9	PM	BY614	SC01	R	BYR30*	SC01	R
BUZ84A	S9	PM	BY619	SC01	R	BYR79*	SC01	R
BUZ90	S9	PM	BY620	SC01	R	BYT28*	S2a	R
BUZ90A	S9	PM	BY627	SC01	R	BYT79*	S2a	R
BUZ94	S9	PM	BY705	SC01	R	BYT230PIV	SC01	R
BUZ211	S9	PM	BY706	SC01	R	BYV10*	SC01	R
BUZ307	S9	PM	BY707	SC01	R	BYV18*	S2a	R
BUZ308	S9	PM	BY708	SC01	R	BYV19*	S2a	R
BUZ310	S9	PM	BY709	SC01	R	BYV20*	S2a	R
BUZ311	S9	PM	BY710	SC01	R	BYV21*	S2a	R
BUZ326	S9	PM	BY711	SC01	R	BYV22*	S2a	R
BUZ330	S9	PM	BY712	SC01	R	BYV23*	S2a	R
BUZ331	S9	PM	BY713	SC01	R	BYV24*	S2a	R

type no.	book	section	type no.	book	section	type no.	book	section
BYV26 *	SC01/S2a	R	BYX10G	SC01	R	CNX21	SC12	PhC
BYV27*	SC01/S2a	R	BYX25*	S2a	R	CNX35	SC12	PhC
BYV28*	SC01/S2a	R	BYX30*	S2a	R	CNX35U	SC12	PhC
BYV29*	S2a	R	BYX32*	S2a	R	CNX36	SC12	PhC
BYV29F*	S2a	R	BYX38*	S2a	R	CNX36U	SC12	PhC
BYV30*	S2a	R	BYX39*	S2a	R	CNX38	SC12	PhC
BYV31*	S2a	R	BYX42*	S2a	R	CNX38U	SC12	PhC
BYV32*	S2a	R	BYX46*	S2a	R	CNX39	SC12	PhC
BYV32F*	S2a	R	BYX50*	S2a	R	CNX39U	SC12	PhC
BYV33*	S2a	R	BYX52*	S2a	R	CNX44	SC12	PhC
BYV33F*	S2a	R	BYX56*	S2a	R	CNX44A	SC12	PhC
BYV34*	S2a	R	BYX90G	SC01	R	CNX46	SC12	PhC
BYV36 *	SC01	R	BYX96*	S2a	R	CNX48	SC12	PhC
BYV39*	S2a	R	BYX97*	S2a	R	CNX48U	SC12	PhC
BYV42*	S2a	R	BYX98*	S2a	R	CNX62	SC12	PhC
BYV43*	S2a	R	BYX99*	S2a	R	CNX72	SC12	PhC
BYV43F*	S2a	R	BZD23	SC01	Vrg	CNX82	SC12	PhC
BYV44*	S2a	R	BZD27	SC01/10	Vrg/Mm	CNX83	SC12	PhC
BYV54V	SC01	R	BZT03	SC01	Vrg	CNX91	SC12	PhC
BYV60*	S2a	R	BZV10	SC01	Vrf	CNX92	SC12	PhC
BYV72*	S2a	R	BZV11	SC01	Vrf	CNY17-1	SC12	PhC
BYV73*	S2a	R	BZV12	SC01	Vrf	CNY17-2	SC12	PhC
BYV74*	S2a	R	BZV13	SC01	Vrf	CNY17-3	SC12	PhC
BYV79*	S2a	R	BZV14	SC01	Vrf	CNY50	SC12	PhC
BYV92*	S2a	R	BZV37	SC01	Vrf	CNY57	SC12	PhC
BYV95A	SC01	R	BZV49*	SC01/10	Vrg/Mm	CNY57A	SC12	PhC
BYV95B	SC01	R	BZV55*	SC10	Mm	CNY57AU	SC12	PhC
BYV95C	SC01	R	BZV60	SC01	Vrg	CNY57U	SC12	PhC
BYV96D	SC01	R	BZV80	SC01	Vrf	CNY62	SC12	PhC
BYV96E	SC01	R	BZV81	SC01	Vrf	CNY63	SC12	PhC
BYW25*	S2a	R	BZV85*	SC01	Vrg	CQF24	SC12	Ph
BYW29*	S2a	R	BZV86	SC01	SD	CQL10A	SC12	Ph
BYW29F*	S2a	R	BZW03*	SC01	Vrg	CQL13A	SC12	Ph
BYW30*	S2a	R	BZW14	SC01	Vrg	CQL16	SC12	Ph
BYW31*	S2a	R	BZW86*	S2a	TS	CQW58A	S8a	I
BYW54	SC01	R	BZX55*	SC01	Vrg	CQW89A	S8a	I
BYW55	SC01	R	BZX70*	S2a	Vrg	CQW89B	S8a	I
BYW56	SC01	R	BZX75*	SC01	Vrg	CQY58A	S8a	I
BYW92*	S2a	R	BZX79*	SC01	Vrg	CQY89A	S8a	I
BYW93*	S2a	R	BZX84*	SC01/10	Vrg/Mm	CQY89F	S8a	I
BYW95A	SC01	R	BZY91*	S2a	Vrg	ESM3045A(V)	SC06	SP
BYW95B	SC01	R	BZY93*	S2a	Vrg	ESM3045D(V)	SC06	SP
BYW95C	SC01	R	CNG35	SC12	PhC	ESM4045A(V)	SC06	SP
BYW96D	SC01	R	CNG36	SC12	PhC	ESM4045D(V)	SC06	SP
BYW96E	SC01	R	CNR36	SC12	PhC	ESM5045D(V)	SC06	SP

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type no.	book	section	type no.	book	section	type no.	book	section
ESM6045A(V)	SC06	SP	LKE2015T	SC15	M	MPS6515	SC04	Sm
ESM6045D(V)	SC06	SP	LKE21004R	SC15	M	MPS6517	SC04	Sm
Fresnel-lens	SC12	A	LKE21015T	SC15	M	MPS6518	SC04	Sm
H11A1	SC12	PhC	LKE21050T	SC15	M	MPS6519	SC04	Sm
H11A2	SC12	PhC	LKE27010R	SC15	M	MPS6520	SC04	Sm
H11A3	SC12	PhC	LKE27025R	SC15	M	MPS6521	SC04	Sm
H11A4	SC12	PhC	LKE32002T	SC15	M	MPS6522	SC04	Sm
H11A5	SC12	PhC	LKE32004T	SC15	M	MPS6523	SC04	Sm
H11B1	SC12	PhC	LTE21009R	SC15	M	MPSA05	SC04	Sm
H11B2	SC12	PhC	LTE21015R	SC15	M	MPSA06	SC04	Sm
H11B3	SC12	PhC	LTE21025R	SC15	M	MPSA13	SC04	Sm
H11B255	SC12	PhC	LTE4002S	SC15	M	MPSA14	SC04	Sm
KMZ10A	SC13	SEN	LTE42005S	SC15	M	MPSA42	SC04	Sm
KMZ10B	SC13	SEN	LTE42008R	SC15	M	MPSA43	SC04	Sm
KMZ10C	SC13	SEN	LTE42012R	SC15	M	MPSA55	SC04	Sm
KP100A	SC13	SEN	LUE2003S	SC15	M	MPSA56	SC04	Sm
KP101A	SC13	SEN	LUE2009S	SC15	M	MPSA63	SC04	Sm
KPZ20G	SC13	SEN	LV1721E50R	SC15	M	MPSA64	SC04	Sm
KPZ21G	SC13	SEN	LV2024E45R	SC15	M	MPSA92	SC04	Sm
KTY81-100*	SC13	SEN	LV2327E40R	SC15	M	MPSA93	SC04	Sm
KTY81-200*	SC13	SEN	LV2931E50S	SC15	M	MRB11080Y	SC15	M
KTY83-100*	SC13	SEN	LV3742E16R	SC15	M	MRB11175Y	SC15	M
KTY84-100*	SC13	SEN	LV3742E24R	SC15	M	MRB11350Y	SC15	M
KTY85-100*	SC10	SEN	LVE21050R	SC15	M	MRB12175YR	SC15	M
LAE2001R	SC15	M	LWE2015R	SC15	M	MRB12350YR	SC15	M
LAE4000Q	SC15	M	LWE2025R	SC15	M	MS1011B700Y	SC15	M
LAE4001R	SC15	M	LZ1418E100R	SC15	M	MS6075B800Z	SC15	M
LAE4002S	SC15	M	MCA230	SC12	PhC	MSB11900Y	SC15	M
LAE6000Q	SC15	M	MCA231	SC12	PhC	MSB12900Y	SC15	M
LBE1004R	SC15	M	MCA255	SC12	PhC	MZ0912B75Y	SC15	M
LBE1010R	SC15	M	MCT2	SC12	PhC	MZ0912B150Y	SC15	M
LBE2003S	SC15	M	MCT26	SC12	PhC	OM286; M	SC13	SEN
LBE2005Q	SC15	M	MJE13004	SC06	SP	OM287; M	SC13	SEN
LBE2008T	SC15	M	MJE13005	SC06	SP	OM320	SC14	WBM
LBE2009S	SC15	M	MJE13006	SC06	SP	OM321	SC14	WBM
LCE1004R	SC15	M	MJE13007	SC06	SP	OM322	SC14	WBM
LCE1010R	SC15	M	MJE13008	SC06	SP	OM323	SC14	WBM
LCE2003S	SC15	M	MJE13009	SC06	SP	OM323A	SC14	WBM
LCE2005Q	SC15	M	MKB12040WS	SC15	M	OM335	SC14	WBM
LCE2008T	SC15	M	MKB12100WS	SC15	M	OM336	SC14	WBM
LCE2009S	SC15	M	MKB12140W	SC15	M	OM337	SC14	WBM
LJE42002T	SC15	M	M06075B200Z	SC15	M	OM337A	SC14	WBM
LKE1004R	SC15	M	M06075B400Z	SC15	M	OM339	SC14	WBM
LKE2002T	SC15	M	MPS6513	SC04	Sm	OM345	SC14	WBM
LKE2004T	SC15	M	MPS6514	SC04	Sm	OM350	SC14	WBM

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OM360	SC14	WBM	PKB3003U	SC15	M	PLED-TR12E	S8a	LED
OM361	SC14	WBM	PKB3005U	SC15	M	PLED-TR12F	S8a	LED
OM370	SC14	WBM	PKB12005U	SC15	M	PLED-TR12G	S8a	LED
OM386B	SC13	SEN	PKB20010U	SC15	M	PLED-TR42DL	S8a	LED
OM386M	SC13	SEN	PKB23001U	SC15	M	PLED-Y313A	S8a	LED
OM387B	SC13	SEN	PKB23003U	SC15	M	PLED-Y313N	S8a	LED
OM387M	SC13	SEN	PKB23005U	SC15	M	PLED-Y314A	S8a	LED
OM388B	SC13	SEN	PKB25006T	SC15	M	PLED-Y314N	S8a	LED
OM389B	SC13	SEN	PKB32001U	SC15	M	PLED-Y511C	S8a	LED
OM931	SC05	P	PKB32003U	SC15	M	PLED-Y513C	S8a	LED
OM961	SC05	P	PKB32005U	SC15	M	PLED-Y513M	S8a	LED
OSB9115	S2a	St	PLED-G313A	S8a	LED	PLED-Y514B	S8a	LED
OSB9215	S2a	St	PLED-G313N	S8a	LED	PLED-Y514M	S8a	LED
OSB9415	S2a	St	PLED-G314A	S8a	LED	PLED-Y544KL	S8a	LED
OSM9115	S2a	St	PLED-G314N	S8a	LED	PLED-Y544LL	S8a	LED
OSM9215	S2a	St	PLED-G511C	S8a	LED	PLED-YR14E	S8a	LED
OSM9415	S2a	St	PLED-G513C	S8a	LED	PLED-YR14F	S8a	LED
OSM9510	S2a	St	PLED-G513M	S8a	LED	PLED-YR14G	S8a	LED
OSM9511	S2a	St	PLED-G514B	S8a	LED	PLED-YR44DL	S8a	LED
OSM9512	S2a	St	PLED-G514M	S8a	LED	PMBD914	SC01	SD
OSS9115	S2a	St	PLED-G544KL	S8a	LED	PMBD2835	SC01	SD
OSS9215	S2a	St	PLED-G544LL	S8a	LED	PMBD2836	SC01	SD
OSS9415	S2a	St	PLED-GR14E	S8a	LED	PMBD2837	SC01	SD
P2105	SC12	I	PLED-GR14F	S8a	LED	PMBD2838	SC01	SD
PDE1001U	SC15	M	PLED-GR14G	S8a	LED	PMBD6050	SC01	SD
PDE1003U	SC15	M	PLED-GR44DL	S8a	LED	PMBD6100	SC01	SD
PDE1005U	SC15	M	PLED-H313A	S8a	LED	PMBD7000	SC01	SD
PDE1010U	SC15	M	PLED-H314A	S8a	LED	PMBF170	SC07/10	FET/Mm
PEE1001U	SC15	M	PLED-H511C	S8a	LED	PMBF4391	SC07/10	FET/Mm
PEE1003U	SC15	M	PLED-H514B	S8a	LED	PMBF4392	SC07/10	FET/Mm
PEE1005U	SC15	M	PLED-H544KL	S8a	LED	PMBF4393	SC07/10	FET/Mm
PEE1010U	SC15	M	PLED-H544LL	S8a	LED	PMBFJ174	SC07/10	FET/Mm
PH2222/A	SC04	Sm	PLED-HR14E	S8a	LED	PMBFJ175	SC07/10	FET/Mm
PH2369	SC04	Sm	PLED-HR14F	S8a	LED	PMBFJ176	SC07/10	FET/Mm
PH2907	SC04	Sm	PLED-HR14G	S8a	LED	PMBFJ177	SC07/10	FET/Mm
PH2907A	SC04	Sm	PLED-HR44DL	S8a	LED	PMBT2222	SC10	Mm
PH5415	SC04	Sm	PLED-O313N	S8a	LED	PMBT2222A	SC10	Mm
PH5416	SC04	Sm	PLED-O314N	S8a	LED	PMBT2369	SC10	Mm
PH6659	SC07	FET	PLED-O513M	S8a	LED	PMBT2907	SC10	Mm
PH6660	SC07	FET	PLED-O514M	S8a	LED	PMBT2907A	SC10	Mm
PH6661	SC07	FET	PLED-P313N	S8a	LED	PMBT3903	SC10	Mm
PH13002	SC06	SP	PLED-P314N	S8a	LED	PMBT3904	SC10	Mm
PH13003	SC06	SP	PLED-P513M	S8a	LED	PMBT3906	SC10	Mm
PHSD51	S2a	R	PLED-P514M	S8a	LED	PMBT4401	SC10	Mm
PKB3001U	SC15	M	PLED-T512B	S8a	LED	PMBT4403	SC10	Mm

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PMBT5088	SC10	Mm	PTB23003X	SC15	M	PZTA93	SC10	Mm
PMBT5401	SC10	Mm	PTB23005X	SC15	M	RPY97	SC12	I
PMBT5550	SC10	Mm	PTB32001X	SC15	M	RPY100	SC12	I
PMBT5551	SC10	Mm	PTB32003X	SC15	M	RPY101	SC12	I
PMBT6428	SC10	Mm	PTB32005X	SC15	M	RPY102	SC12	I
PMBT6429	SC10	Mm	PTB42001X	SC15	M	RPY103	SC12	I
PMBTA05	SC10	Mm	PTB42002X	SC15	M	RPY107	SC12	I
PMBTA06	SC10	Mm	PTB42003X	SC15	M	RPY109	SC12	I
PMBTA13	SC10	Mm	PV3742B4X	SC15	M	RV2833B5X	SC15	M
PMBTA14	SC10	Mm	PVB42004X	SC15	M	RV3135B5X	SC15	M
PMBTA42	SC10	Mm	PXT2222	SC10	Mm	RX1011B250Y	SC15	M
PMBTA43	SC10	Mm	PXT2222A	SC10	Mm	RX1011B350Y	SC15	M
PMBTA55	SC10	Mm	PXT2907	SC10	Mm	RX1214B150Y	SC15	M
PMBTA56	SC10	Mm	PXT2907A	SC10	Mm	RX1214B300Y	SC15	M
PMBTA63	SC10	Mm	PXT3904	SC10	Mm	RX2731B90W	SC15	M
PMBTA64	SC10	Mm	PXT3906	SC10	Mm	RX3034B70W	SC15	M
PMBTA92	SC10	Mm	PXT4401	SC10	Mm	RXB12350Y	SC15	M
PMBTA93	SC10	Mm	PXT4403	SC10	Mm	RZ1214B35Y	SC15	M
PMBZ5226	SC01	SD	PXTA14	SC10	Mm	RZ1214B65Y	SC15	M
PMLL4148	SC01/10	SD/Mm	PXTA27	SC10	Mm	RZ1214B125Y	SC15	M
PMLL4150	SC01/10	SD/Mm	PXTA64	SC10	Mm	RZ1214B150Y	SC15	M
PMLL4151	SC01/10	SD/Mm	PXTA77	SC10	Mm	RZ2731B45W	SC15	M
PMLL4153	SC01/10	SD/Mm	PZ1418B15U	SC15	M	RZ2731B60W	SC15	M
PMLL4446	SC01/10	SD/Mm	PZ1418B30U	SC15	M	RZ2833B15W	SC15	M
PMLL4448	SC01/10	SD/Mm	PZ1721B12U	SC15	M	RZ2833B30W	SC15	M
PMLL5225B to			PZ1721B25U	SC15	M	RZ2833B45W	SC15	M
PMLL5267B	SC01/10	SD/Mm	PZ2024B10U	SC15	M	RZ2833B60W	SC15	M
PN2222	SC04	Sm	PZ2024B20U	SC15	M	RZ3135B15W	SC15	M
PN2222A	SC04	Sm	PZ2327B15U	SC15	M	RZ3135B30W	SC15	M
PN2369	SC04	Sm	PZB16035U	SC15	M	RZ3135B40W	SC15	M
PN2369A	SC04	Sm	PZB16040U	SC15	M	RZ3135B50W	SC15	M
PN2907	SC04	Sm	PZB27020U	SC15	M	RZB12050Y	SC15	M
PN2907A	SC04	Sm	PZT2222	SC10	Mm	RZB12100Y	SC15	M
PN3439	SC04	Sm	PZT2222A	SC10	Mm	RZB12250Y	SC15	M
PN3440	SC04	Sm	PZT2907	SC10	Mm	SL5500	SC12	PhC
PN4391	SC07	FET	PZT2907A	SC10	Mm	SL5501	SC12	PhC
PN4392	SC07	FET	PZT3904	SC10	Mm	SL5502R	SC12	PhC
PN4393	SC07	FET	PZT3906	SC10	Mm	SL5504	SC12	PhC
PN5415	SC04	Sm	PZTA13	SC10	Mm	SL5504S	SC12	PhC
PN5416	SC04	Sm	PZTA14	SC10	Mm	SL5505S	SC12	PhC
PO44	SC12	PhC	PZTA42	SC10	Mm	SL5511	SC12	PhC
PO44A	SC12	PhC	PZTA43	SC10	Mm	TIP29*	SC05	P
PPC5001T	SC15	M	PZTA63	SC10	Mm	TIP30*	SC05	P
PQC5001T	SC15	M	PZTA64	SC10	Mm	TIP31*	SC05	P
PTB23001X	SC15	M	PZTA92	SC10	Mm	TIP32*	SC05	P

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TIP33*	SC05	P	1N3883	S2a	R	2N2219	SC04	Sm
TIP34*	SC05	P	1N3889	S2a	R	2N2219A	SC04	Sm
TIP41*	SC05	P	1N3890	S2a	R	2N2222	SC04	Sm
TIP42*	SC05	P	1N3891	S2a	R	2N2222A	SC04	Sm
TIP47	SC06	P	1N3892	S2a	R	2N2297	SC04	Sm
TIP48	SC06	P	1N3893	S2a	R	2N2369	SC04	Sm
TIP49	SC06	P	1N3909	S2a	R	2N2369A	SC04	Sm
TIP50	SC06	P	1N3910	S2a	R	2N2483	SC04	Sm
TIP110	SC05	P	1N3911	S2a	R	2N2484	SC04	Sm
TIP111	SC05	P	1N3912	S2a	R	2N2904	SC04	Sm
TIP112	SC05	P	1N3913	S2a	R	2N2904A	SC04	Sm
TIP115	SC05	P	1N4001D	SC01	R	2N2905	SC04	Sm
TIP116	SC05	P	1N4002D	SC01	R	2N2905A	SC04	Sm
TIP117	SC05	P	1N4003D	SC01	R	2N2906	SC04	Sm
TIP120	SC05	P	1N4004D	SC01	R	2N2906A	SC04	Sm
TIP121	SC05	P	1N4005D	SC01	R	2N2907	SC04	Sm
TIP122	SC05	P	1N4006D	SC01	R	2N2907A	SC04	Sm
TIP125	SC05	P	1N4007D	SC01	R	2N3019	SC04	Sm
TIP126	SC05	P	1N4001G	SC01	R	2N3020	SC04	Sm
TIP127	SC05	P	1N4002G	SC01	R	2N3053	SC04	Sm
TIP130	SC05	P	1N4003G	SC01	R	2N3375	SC08	RFP
TIP131	SC05	P	1N4004G	SC01	R	2N3553	SC08	RFP
TIP132	SC05	P	1N4005G	SC01	R	2N3632	SC08	RFP
TIP135	SC05	P	1N4006G	SC01	R	2N3822	SC07	FET
TIP136	SC05	P	1N4007G	SC01	R	2N3823	SC07	FET
TIP137	SC05	P	1N4148	SC01	SD	2N3866	SC08	RFP
TIP140	SC05	P	1N4150	SC01	SD	2N3903	SC04	Sm
TIP141	SC05	P	1N4151	SC01	SD	2N3904	SC04	Sm
TIP142	SC05	P	1N4153	SC01	SD	2N3905	SC04	Sm
TIP145	SC05	P	1N4446	SC01	SD	2N3906	SC04	Sm
TIP146	SC05	P	1N4448	SC01	SD	2N3924	SC08	RFP
TIP147	SC05	P	1N4531	SC01	SD	2N3926	SC08	RFP
TIP2955;T	SC05	P	1N4532	SC01	SD	2N3927	SC08	RFP
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1N823;A	SC01	Vrf	1N5060	SC01	R	2N4031	SC04	Sm
1N825;A	SC01	Vrf	1N5061	SC01	R	2N4032	SC04	Sm
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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.

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* 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
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IC02a/b	Video and associated systems Bipolar, MOS
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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	I²C-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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S2a	SC02*	Power diodes
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*	RF power transistors
	SC09	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.

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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

* These handbooks are currently issued in another series; they are not yet issued in the Display Components series of handbooks.

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current code	new code	handbook title
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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

* These handbooks will not be reissued.

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

MATERIALS

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

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