T-41-85

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 $T_{amb} = 25\ ^oC$	P_{tot}	max.	200 mW
Transistor			
Collector-emitter voltage (open base)	V_{CEO}	max.	30 V
Total power dissipation up to $T_{amb} = 25\ ^oC$	P_{tot}	max.	200 mW
Optocoupler			
Output/input DC current transfer ratio (CTR) $I_F = 1$ mA; $V_{CE} = 1$ V; ($I_B = 0$)	I_C/I_F	min.	5
Collector-cut-off current (dark) $V_{CC} = 10$ V; working voltage = 2.5 kV DC diode: $I_F = 0$ (see also Fig. 2)	I_{CEW}	max.	1 μA
Isolation voltage			
DC	V_{IORM}	min.	4.4 kV
AC (RMS value)			3.12 kV

MECHANICAL DATA

SOT90B (see Fig. 1).

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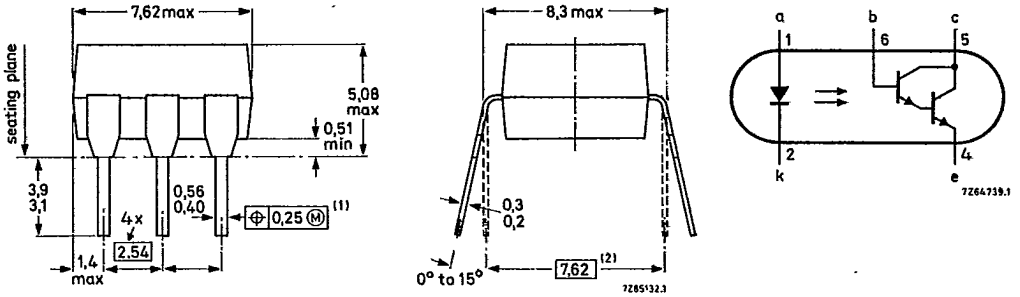
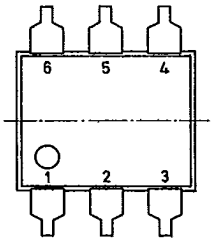
MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT90B.





⊕ Positional accuracy.

Ⓜ Maximum material condition.

(1) Centre-lines of all leads are within ± 0.125 mm of the nominal position shown; in the worst case, the spacing between any two leads may deviate from nominal by 0.25 mm.

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

RATINGS

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

Diode

Continuous reverse voltage	V_R	max.	5 V
DC forward current	I_F	max.	100 mA
(peak value); t_p = 10 μs; δ = 0.01	I_{FRM}	max.	3 A
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	200 mW
Junction temperature	T_j	max.	125 °C

Transistor			
Collector-emitter breakdown voltage I_C = 1 mA	$V_{(BR)CEO}$	min.	30 V
Collector-base breakdown voltage I_C = 0.1 mA	$V_{(BR)CBO}$	min.	30 V
Emitter-collector breakdown voltage I_E = 0.1 mA	$V_{(BR)ECO}$	min.	6 V
DC collector current	I_C	max.	100 mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	200 mW
Junction temperature	T_j	max.	125 °C
Optocoupler			
Storage temperature range	T_{stg}		−55 to + 150 °C
Operating ambient temperature range	T_{amb}		−40 to + 100 °C
Lead soldering temperature up to the seating plane; $t_{sld} < 10$ s	T_{sld}	max.	260 °C
THERMAL RESISTANCE			
From junction to ambient in free air diode and transistor	$R_{th\ j\text{-}a}$	=	500 K/W
From junction to ambient, device mounted on a printed-circuit board diode and transistor	$R_{th\ j\text{-}a}$	=	400 K/W
ISOLATION RELATED VALUES			
External air gap (clearance) input terminals to output terminals	L(IO1)	min.	7.2 mm
External tracking path (creepage distance) input terminals to output terminals	L(IO2)	min.	7.0 mm
Tracking resistance (KB value)			KB-100/A
Internal plastic gap (clearance) isolation thickness between emitter and receiver		min.	1 mm
CHARACTERISTICS			
T_j = 25 °C unless otherwise specified			
Diode			
Forward voltage I_F = 10 mA	V_F	typ. max.	1.15 V 1.3 V
Reverse current V_R = 5 V	I_R	max.	10 μA

Transistor (I_F = 0)			
Collector cut-off current (dark)			
V_{CE} = 10 V	I_{CEO}	typ.	20 nA
		max.	100 nA
V_{CB} = 10 V	I_{CEO}	max.	20 nA
Collector-emitter breakdown voltage			
at I_C = 1 mA	$V_{(BR)CEO}$	min.	30 V
Collector-base breakdown voltage			
at I_C = 0.1 mA	$V_{(BR)CBO}$	min.	30 V
Emitter-base breakdown voltage			
at I_E = 0.1 mA	$V_{(BR)ECO}$	min.	6 V
Optocoupler (I_B = 0) (note 1)			
Output/input DC current transfer ratio (CTR)			
I_F = 0.5 mA; V_{CE} = 1 V	I_C/I_F	min.	3.5
I_F = 1.0 mA; V_{CE} = 1 V	I_C/I_F	min.	5
I_F = 10 mA; V_{CE} = 1 V	I_C/I_F	min.	6
Collector cut-off current (dark); see Fig. 2 (note 2)			
V_{CC} = 10 V; working voltage = 2.5 kV DC	I_{CEW}	max.	1 μA
V_{CC} = 10 V; working voltage = 2.5 kV DC; T_j = 70 °C	I_{CEW}	max.	1000 μA
Collector-emitter saturation voltage			
I_F = 5 mA; I_C = 10 mA	V_{CEsat}	max.	1 V
Isolation voltage (note 3)			
t = 1 min			
DC	V_{IORM}	min.	4.4 kV
AC (RMS value)			3.12 kV
Collector capacitance at f = 1 MHz			
$I_E = I_e$ = 0; V_{CB} = 10 V	$C_{b'c}$	typ.	4.5 pF
Capacitance between input and output			
I_F = 0; V = 0; f = 1 MHz	C_{io}	typ.	0,6 pF
Insulation resistance between input and output			
± V_{IO} = 1 kV	R_{IO}	min.	10 GΩ
		typ.	1 TΩ
Switching times (see Figs 3 and 4)			
I_{Fon} = 10 mA; V_{CC} = 5 V; R_E = 100 Ω; R_{BE} = 1 MΩ	t_{on}	typ.	5 μs
	t_{off}	typ.	30 μs
I_{Fon} = 1 mA; V_{CC} = 5 V; R_E = 1 kΩ; R_{BE} = 10 MΩ	t_{on}	typ.	50 μs
	t_{off}	typ.	250 μs

Notes

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

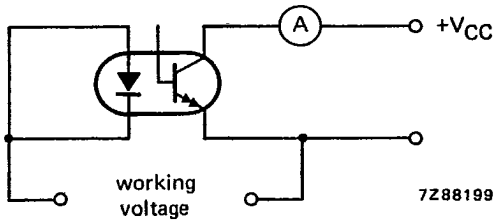


Fig. 2.

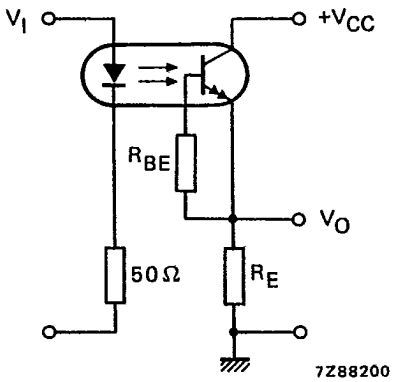


Fig. 3 Switching circuit.

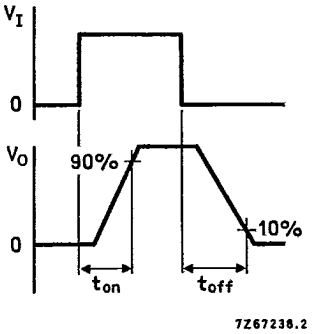


Fig. 4 Waveforms.

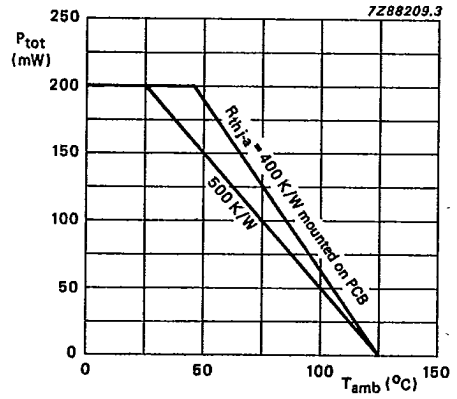


Fig. 5 Power derating curve for diode and transistor as a function of temperature.

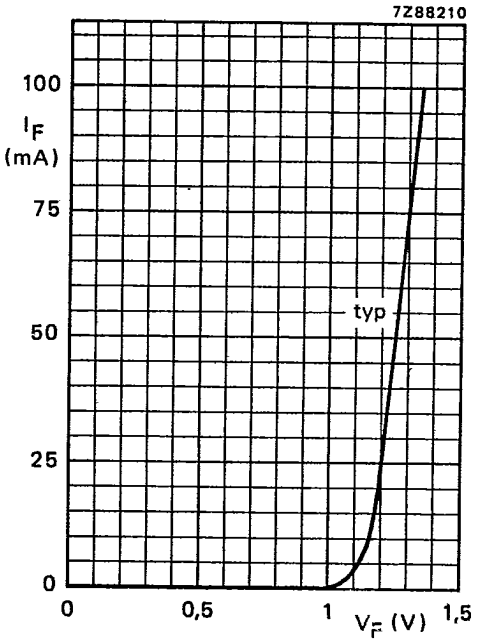


Fig. 6 T_{amb} = 25 °C.

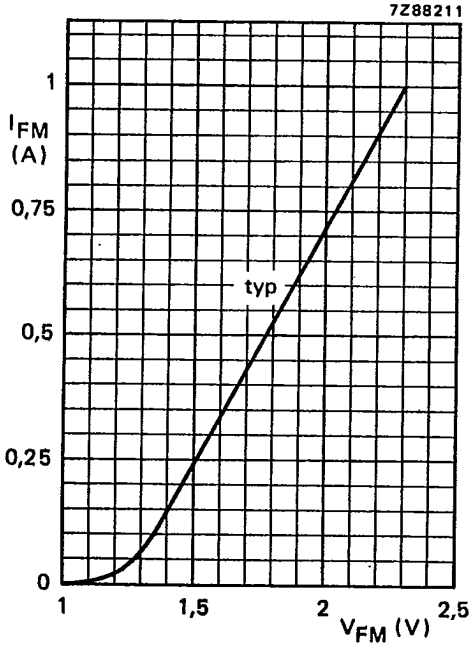


Fig. 7 T_{amb} = 25 °C; t_p = 10 μs; δ = 0.01.

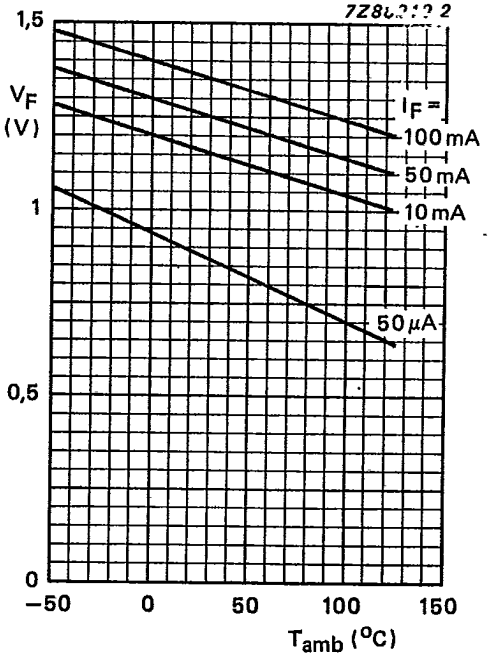


Fig. 8 Typical values.

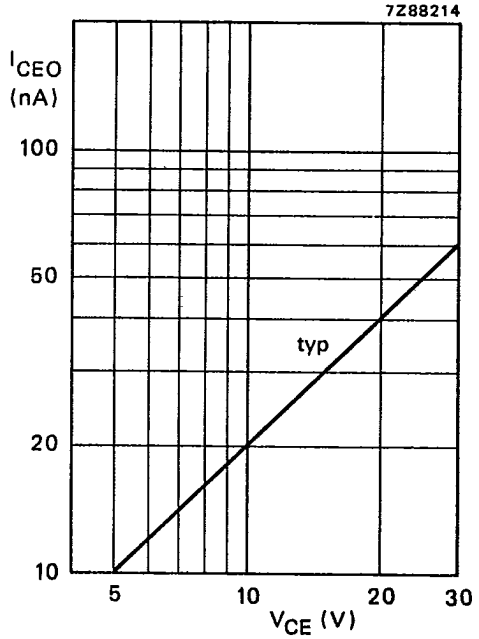


Fig. 9 $I_F = 0$; $T_j = 25\ ^oC$.

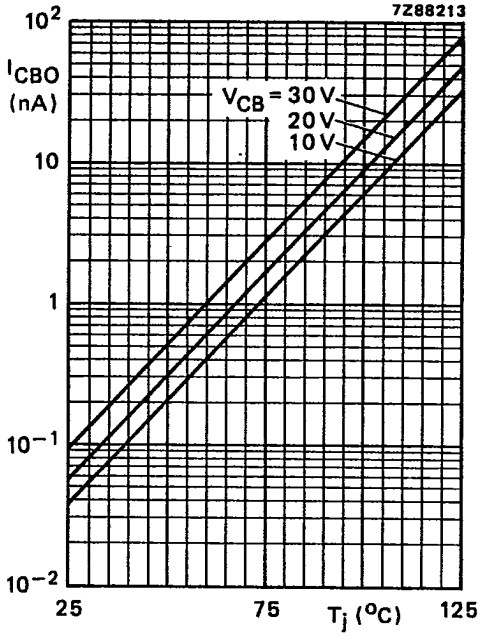


Fig. 10 Typical values.

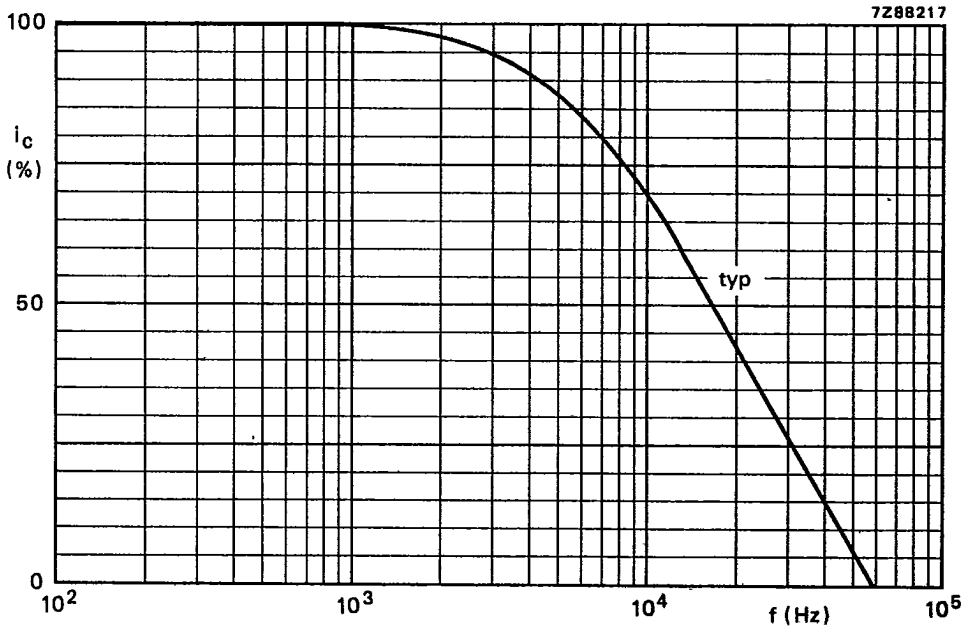


Fig. 11 $I_C = 10$ mA; $V_{CC} = 5$ V; $R_E = 100\ \Omega$; $R_{BE} = 1\ M\Omega$; see also Fig. 4.

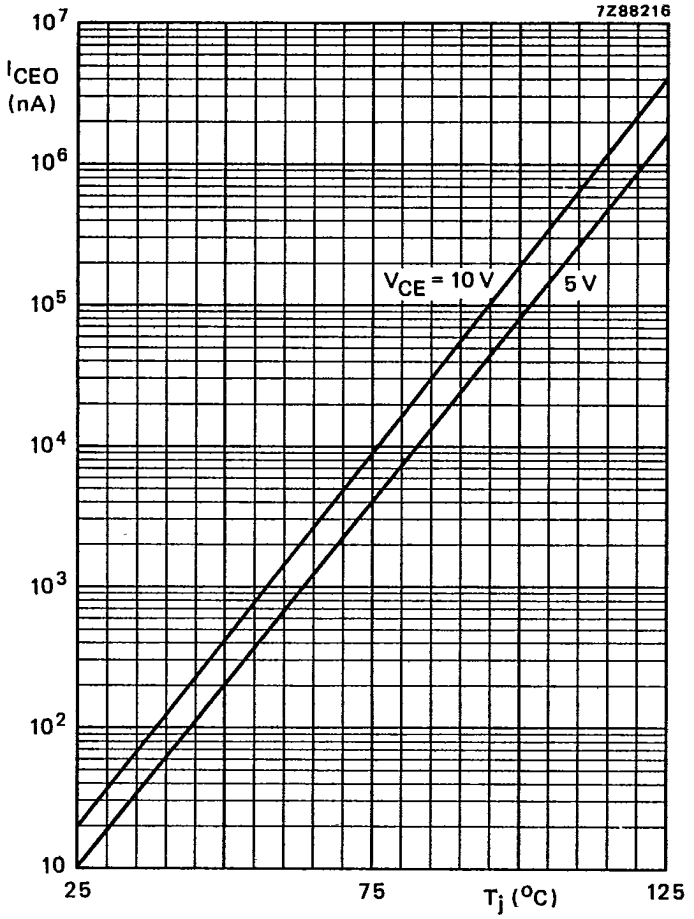


Fig. 12 I_F = 0; typical values.

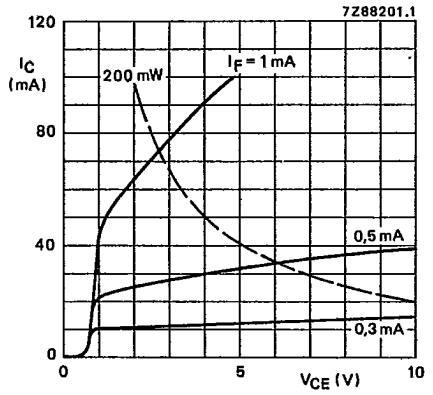


Fig. 13 Typical values; T_{amb} = 25 °C.

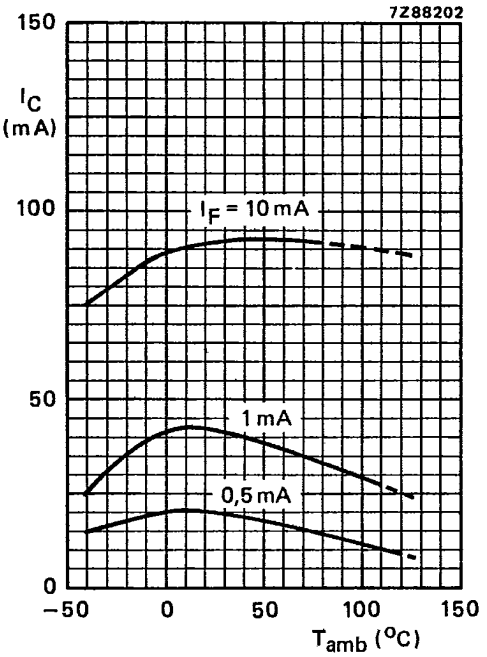


Fig. 14 Typical values; I_B = 0; V_{CE} = 1 V.

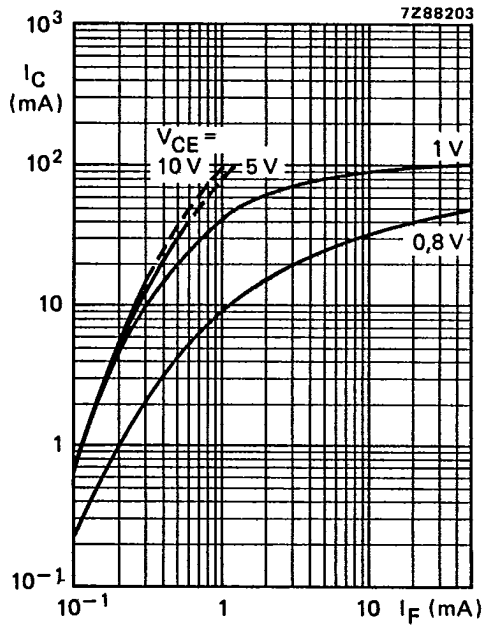


Fig. 15 Typical values; I_B = 0; T_{amb} = 25 °C.

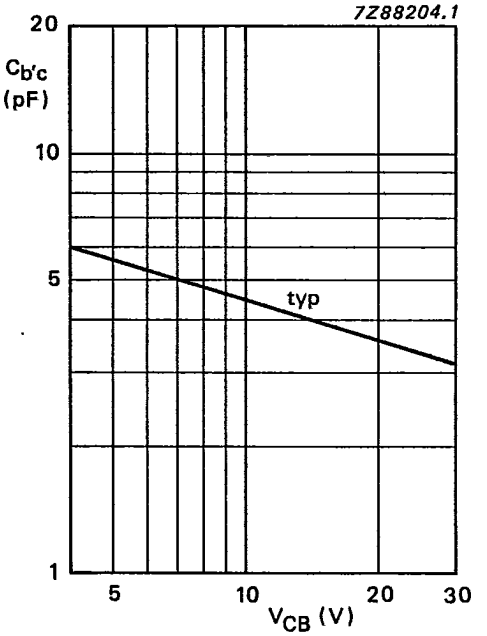


Fig. 16 $I_E = I_e$ = 0; f = 1 MHz; T_{amb} = 25 °C.

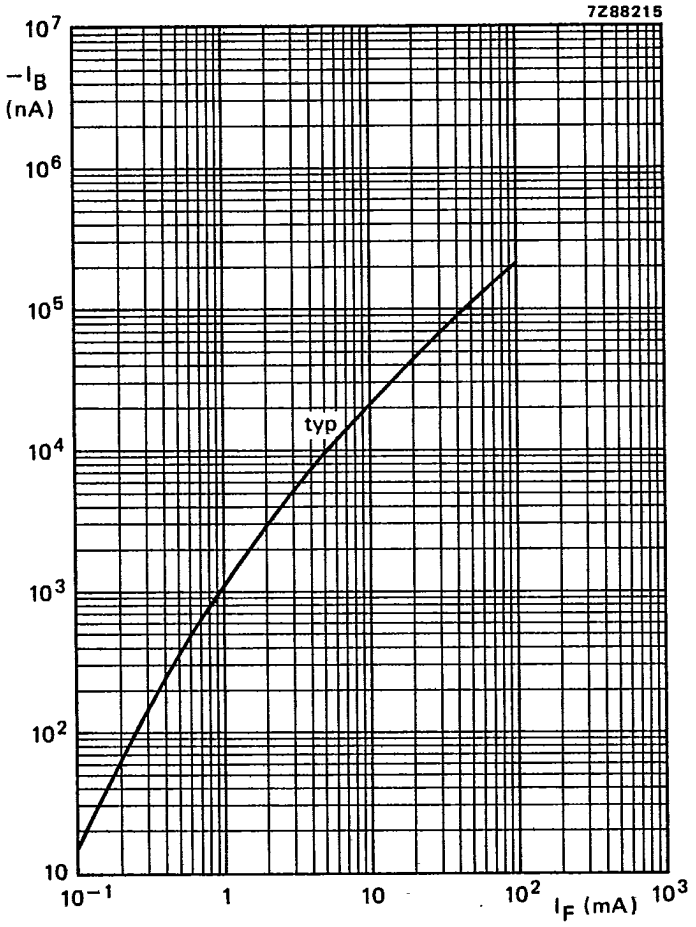


Fig. 17 $I_E = 0$; $V_{CB} = 5$ V; $T_{amb} = 25$ °C.

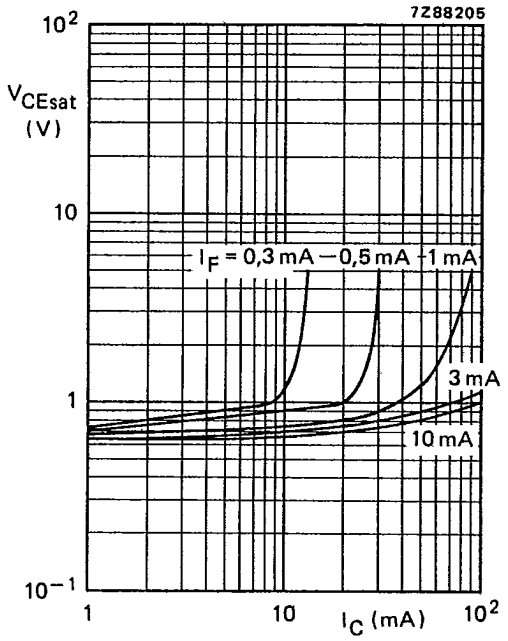


Fig. 18 Typical values; $I_B = 0$; $T_{amb} = 25\ ^oC$.

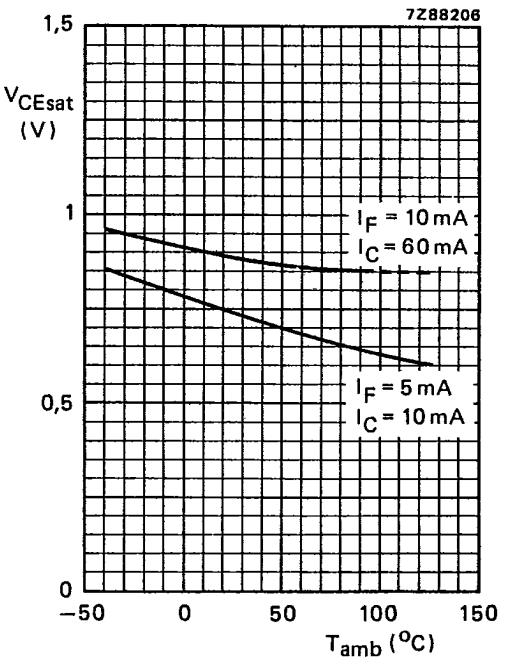


Fig. 19 Typical values; $I_B = 0$.

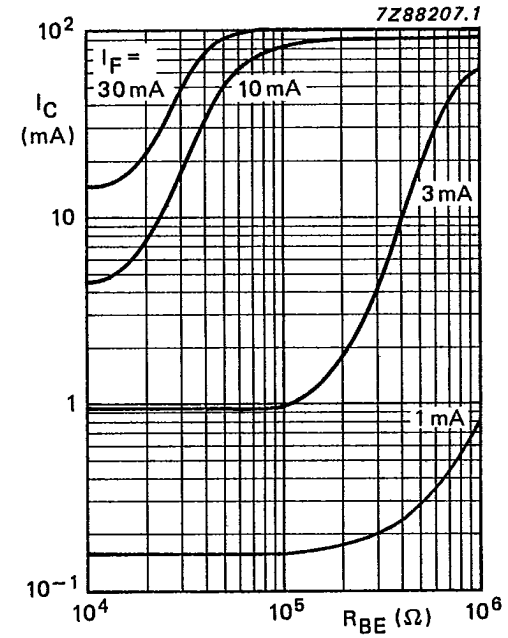


Fig. 20 Typ. values; $V_{CE} = 1$ V; $T_{amb} = 25\ ^oC$.

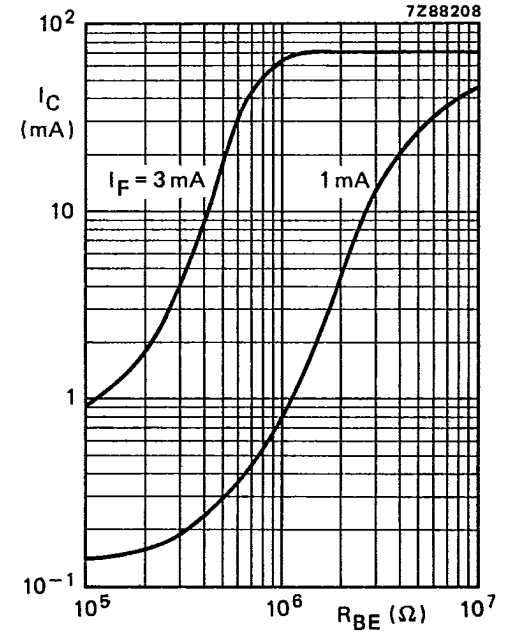


Fig. 21 Typ. values; $V_{CE} = 1$ V; $T_{amb} = 25\ ^oC$.