T-41-83

High-voltage optocouplers

CNX82A/CNX83A

FEATURES

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

DESCRIPTION

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

PINNING - CNX82A

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

PINNING - CNX83A

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

APPROVALS

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

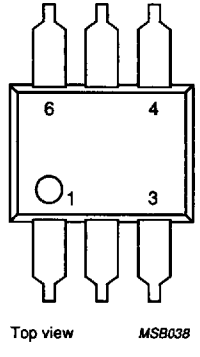


Fig.1 Simplified outline.

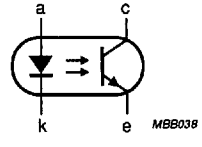


Fig.2 Symbol, CNX82A.

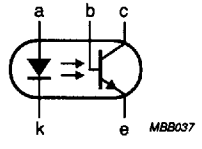


Fig.3 Symbol, CNX83A.

QUICK REFERENCE DATA

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

LIMITING VALUES

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

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

THERMAL RESISTANCE

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

ISOLATION RELATED VALUES

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

CLASSIFICATION CATEGORIES

Tracking resistance	KB-100/A

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

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

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

Notes

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

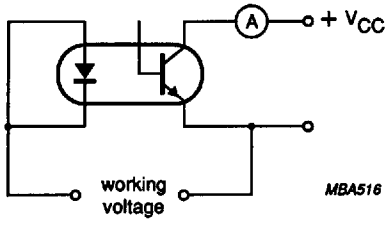


Fig.4 Test circuit.

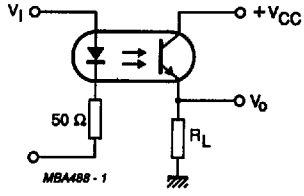


Fig.5 Switching circuit.

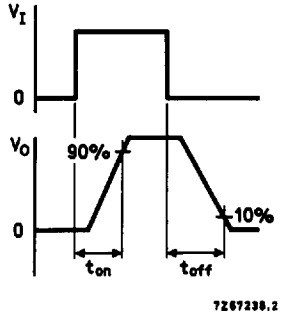


Fig.6 Waveforms.

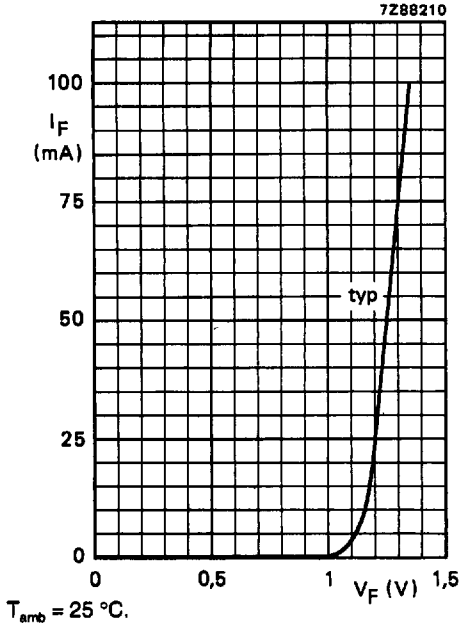


Fig.7 Forward current as a function of forward voltage, typical values.

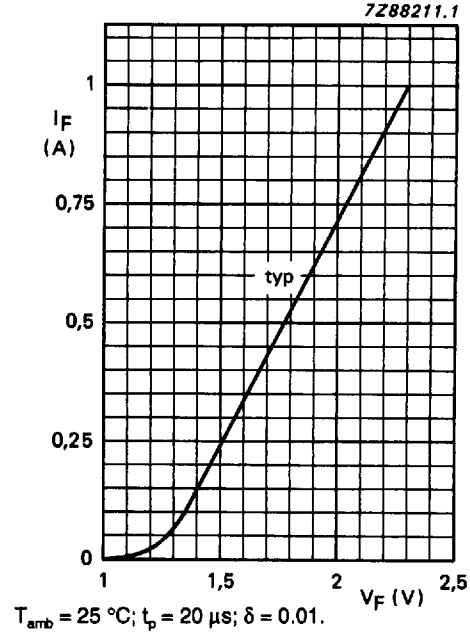


Fig.8 Forward current as a function of forward voltage, typical values.

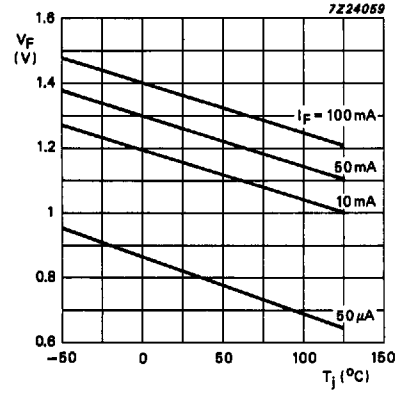


Fig.9 Forward voltage as a function of junction temperature, typical values.

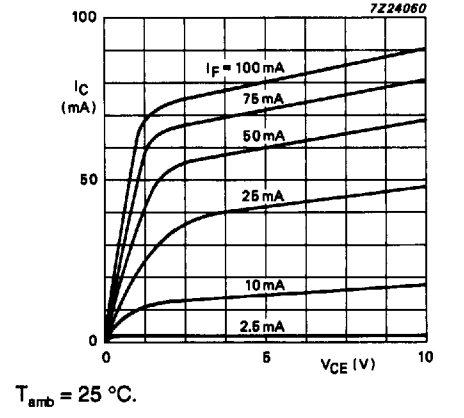
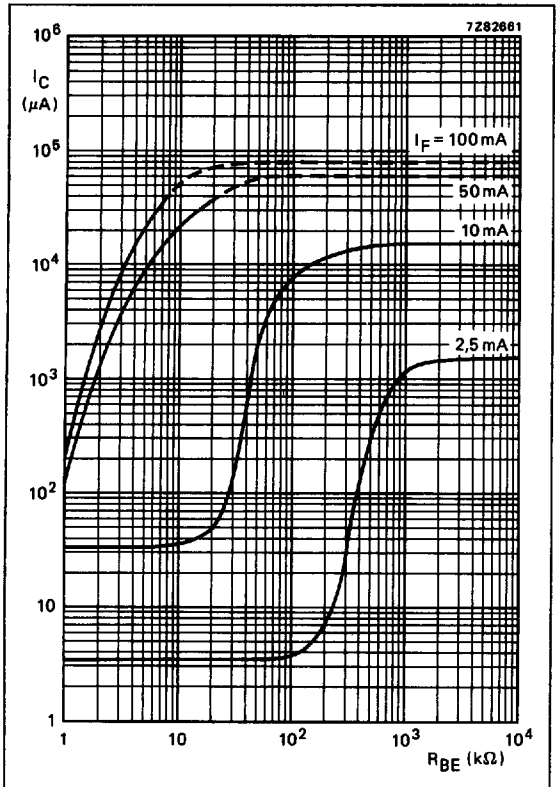
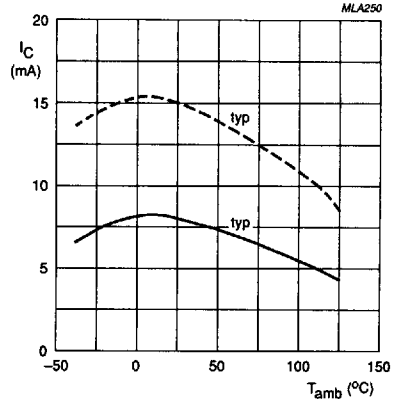


Fig.10 Collector current as a function of collector-emitter voltage, typical values.



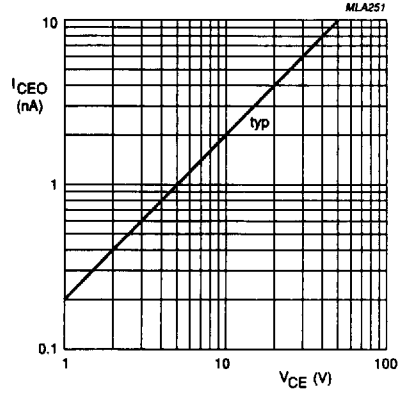
CNX83A; $I_B = 0$; $V_{CE} = 5$ V; $T_{amb} = 25$ °C.

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



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

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



T_{amb} = 25 °C.

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

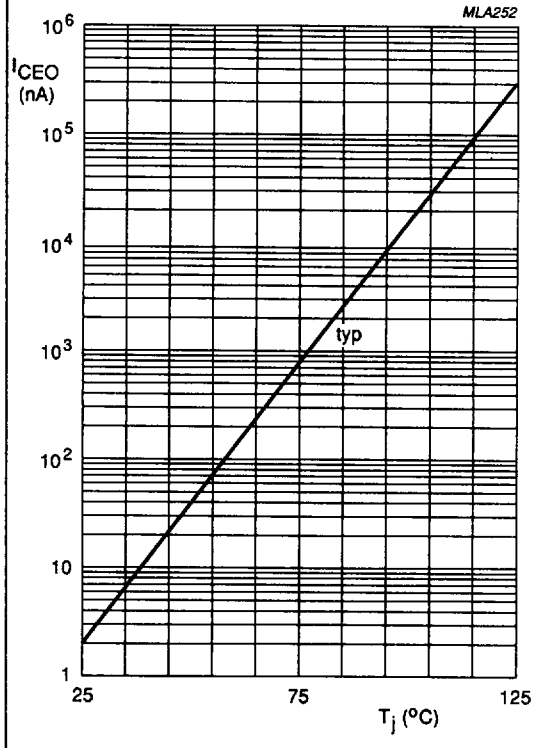
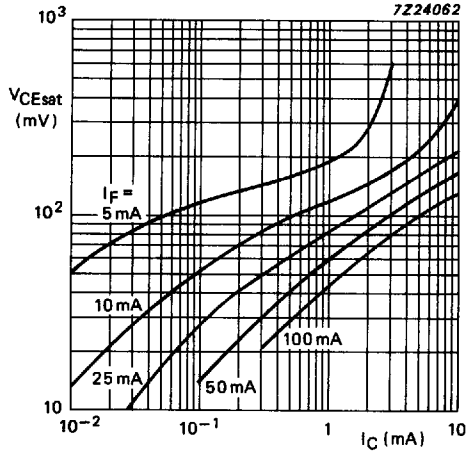
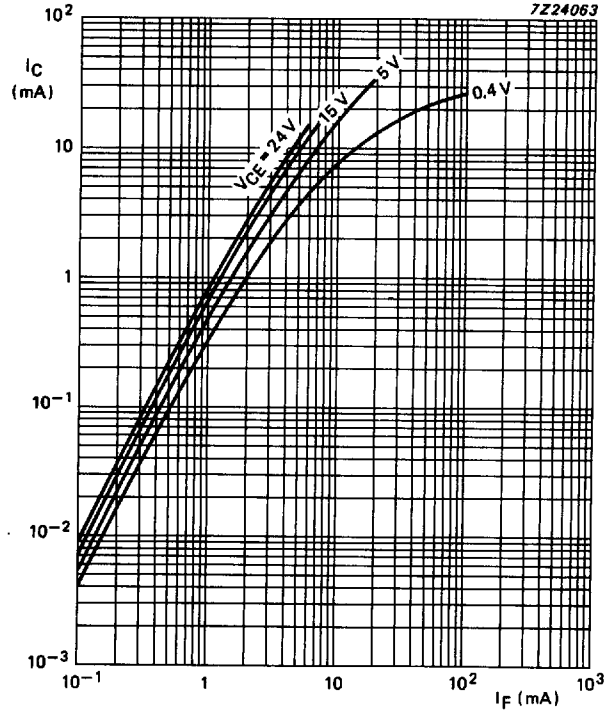


Fig.14 Collector-emitter dark current as a function of junction temperature.



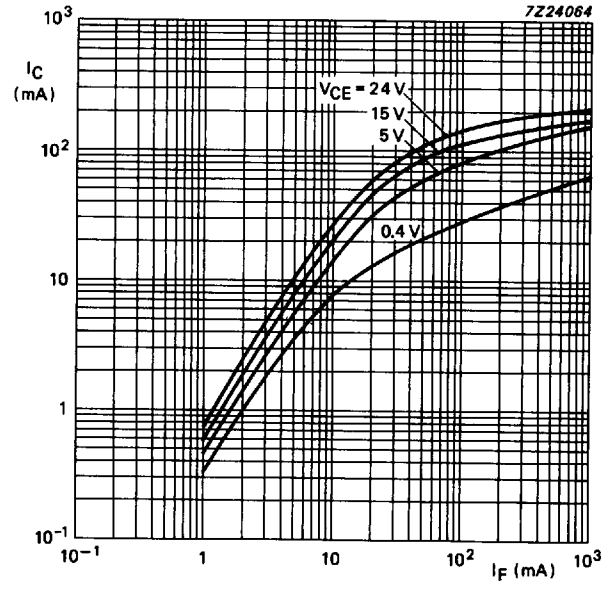
T_{amb} = 25 °C.

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



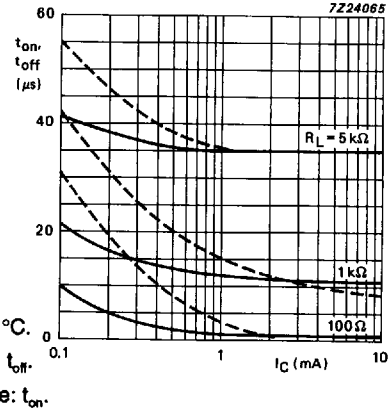
T_{amb} = 25 °C.

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



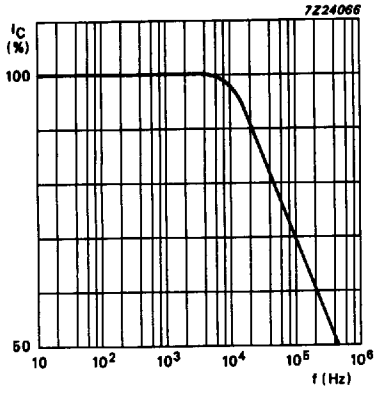
T_{amb} = 25 °C; t_p = 10 µs; δ = 0.01.

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



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

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



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

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

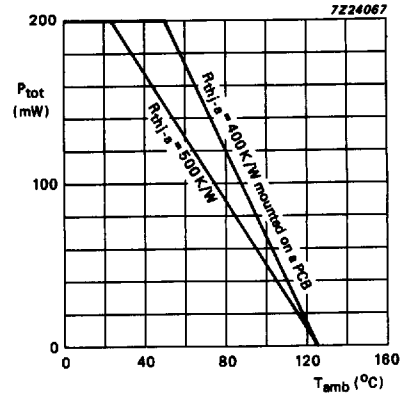


Fig.20 Total power dissipation as a function of ambient temperature.

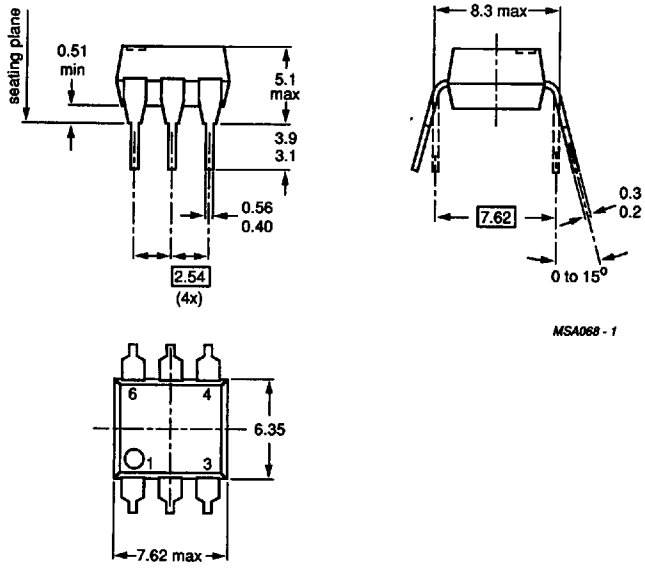


Fig.1 SOT90B.

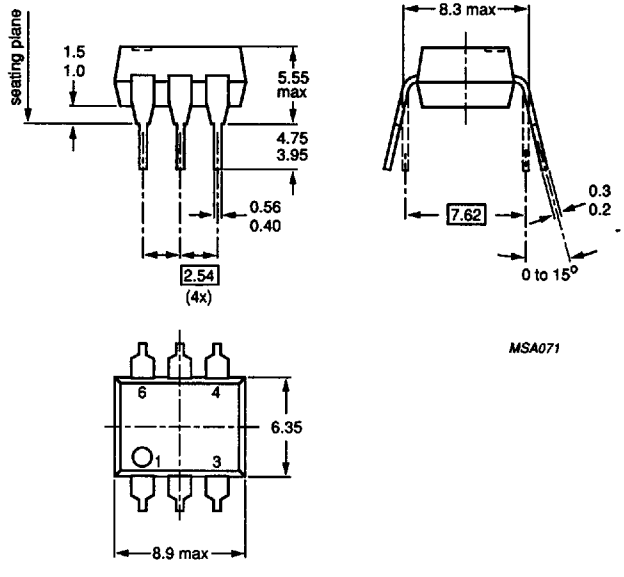


Fig.2 SOT229B.

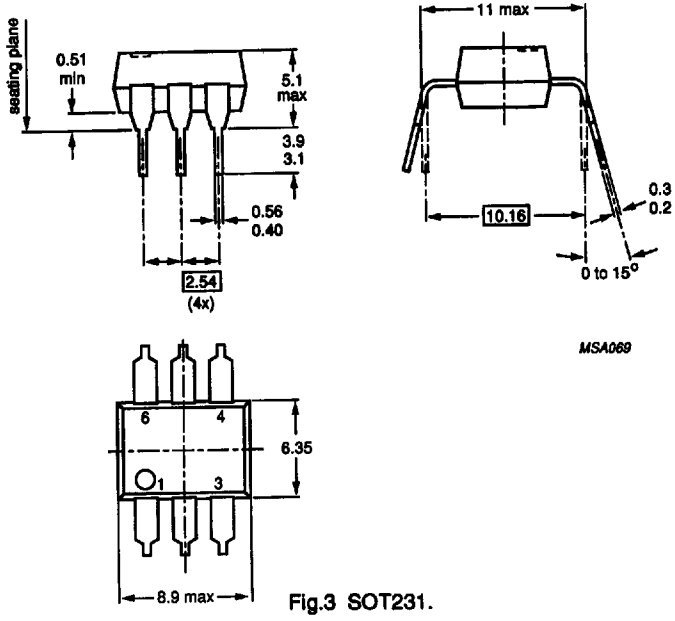


Fig.3 SOT231.

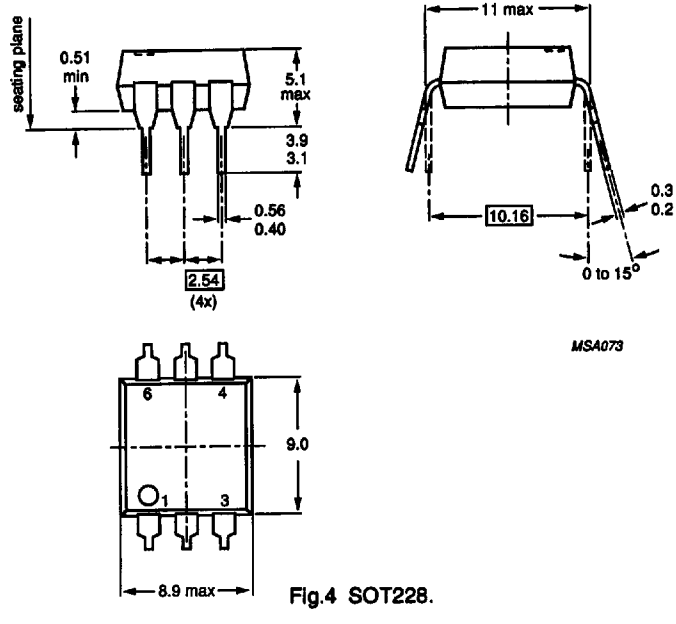


Fig.4 SOT228.

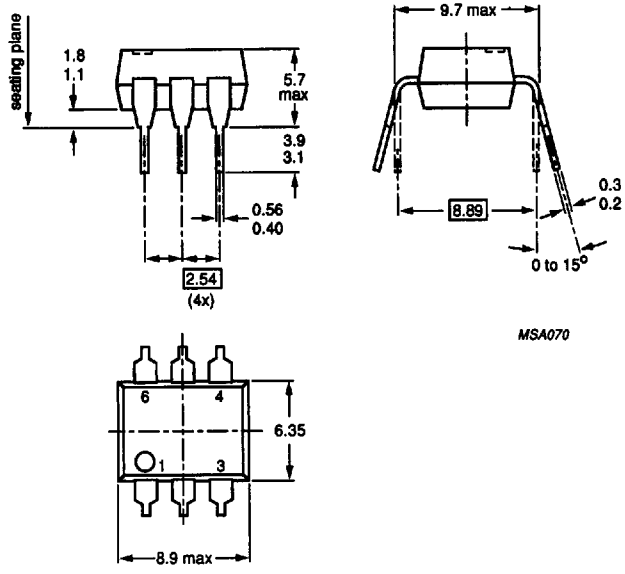


Fig.5 SOT230.

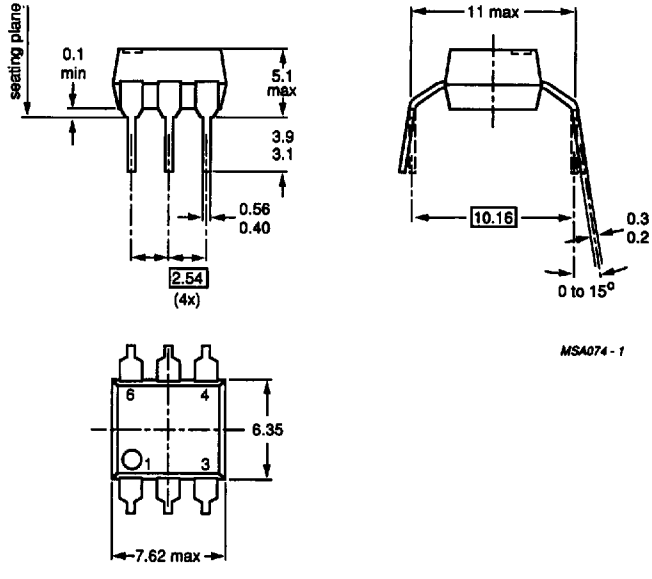


Fig.6 SOT212.

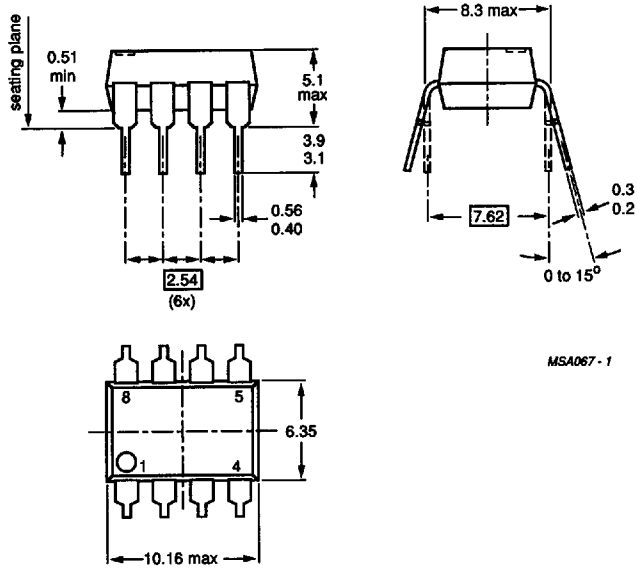


Fig.7 SOT97F.

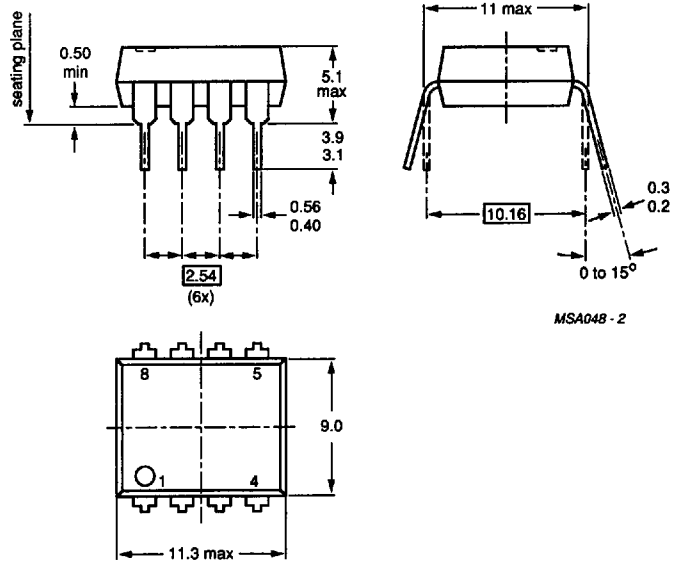


Fig.8 SOT271.

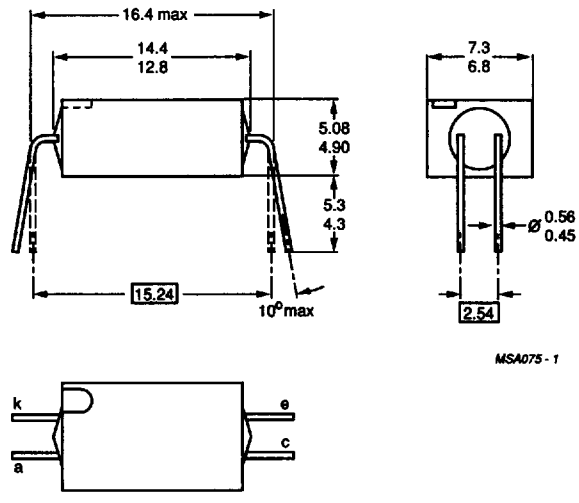


Fig.9 SOT211.