
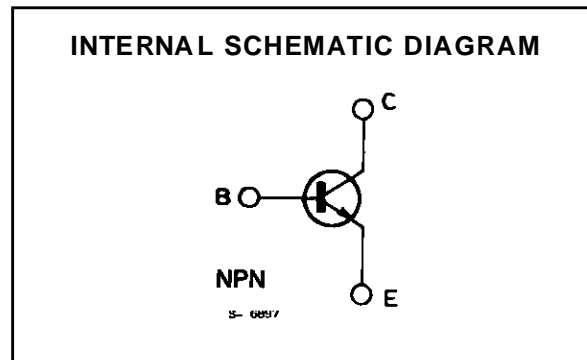
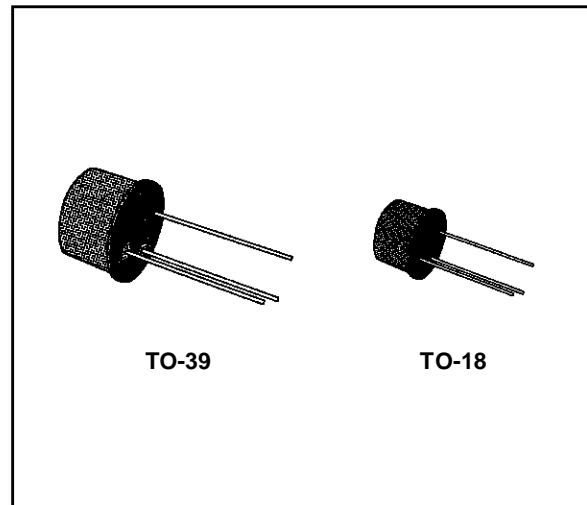


HIGH SPEED SWITCHES

DESCRIPTION

The 2N2218A, 2N2219A, 2N2221A and 2N2222A are silicon planar epitaxial NPN transistors in Jedec TO-39 (for 2N2218A and 2N2219A) and in Jedec TO-18 (for 2N2221A and 2N2222A) metal cases. They are designed for high-speed switching applications at collector currents up to 500 mA, and feature useful current gain over a wide range of collector current, low leakage currents and low saturation voltages.

 2N2218A/2N2219A approved to CECC 50002-100, 2N2221A/2N2222A approved to CECC 50002-101 available on request.



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V_{CBO}	Collector-base Voltage ($I_E = 0$)	75	V
V_{CEO}	Collector-emitter Voltage ($I_B = 0$)	40	V
V_{EBO}	Emitter-base Voltage ($I_C = 0$)	6	V
I_C	Collector Current	0.8	A
P_{tot}	Total Power Dissipation at $T_{amb} \leq 25^\circ C$ for 2N2218 A and 2N2219A for 2N2221 A and 2N2222A at $T_{case} \leq 25^\circ C$ for 2N2218 A and 2N2219A for 2N2221 A and 2N2222A	0.8	W
		0.5	W
		3	W
		1.8	W
T_{stg}	Storage Temperature	- 65 to 200	$^\circ C$
T_j	Junction Temperature	175	$^\circ C$

2N2218A-2N2219A-2N2221A-2N2222A

THERMAL DATA

			2N2218A 2N2219A	2N2221A 2N2222A
$R_{th\ j-case}$	Thermal Resistance Junction-case	Max	50 °C/W	83.3 °C/W
$R_{th\ j-amb}$	Thermal Resistance Junction-ambient	Max	187.5 °C/W	300 °C/W

ELECTRICAL CHARACTERISTICS ($T_{amb} = 25\text{ °C}$ unless otherwise specified)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector Cutoff Current ($I_E = 0$)	$V_{CB} = 60\text{ V}$			10	nA
		$V_{CB} = 6.0\text{ V}$ $T_{amb} = 150\text{ °C}$			10	μA
I_{CEX}	Collector Cutoff Current ($V_{BE} = -3\text{ V}$)	$V_{CE} = 6.0\text{ V}$			10	nA
I_{EBO}	Emitter Cutoff Current ($I_C = 0$)	$V_{EB} = 3\text{ V}$			10	nA
I_{BEX}	Base Cutoff Current ($V_{BE} = -3\text{ V}$)	$V_{CE} = 6.0\text{ V}$			20	nA
$V_{(BR)\ CBO}$	Collector-base Breakdown Voltage ($I_E = 0$)	$I_C = 1.0\ \mu\text{A}$	5			V
$V_{(BR)\ CEO}^*$	Collector-emitter Breakdown Voltage ($I_B = 0$)	$I_C = 1.0\text{ mA}$	40			V
$V_{(BR)\ EBO}$	Emitter-base Breakdown Voltage ($I_C = 0$)	$I_E = 1.0\ \mu\text{A}$				V
$V_{CE(sat)}^*$	Collector-emitter Saturation Voltage	$I_C = 1.50\text{ mA}$ $I_B = 1.5\text{ mA}$			0.3	V
		$I_C = 5.00\text{ mA}$ $I_B = 5.0\text{ mA}$			1	V
$V_{BE(sat)}^*$	Base-emitter Saturation Voltage	$I_C = 1.50\text{ mA}$ $I_B = 1.5\text{ mA}$	0.6		1.2	V
		$I_C = 5.00\text{ mA}$ $I_B = 5.0\text{ mA}$			2	V
h_{FE}^*	DC Current Gain	for 2N2218A and 2N2221A				
		$I_C = 0.1\text{ mA}$ $V_{CE} = 1.0\text{ V}$	20			
		$I_C = 1\text{ mA}$ $V_{CE} = 1.0\text{ V}$	25			
		$I_C = 1.0\text{ mA}$ $V_{CE} = 1.0\text{ V}$	35			
		$I_C = 1.50\text{ mA}$ $V_{CE} = 1.0\text{ V}$	40		120	
		$I_C = 5.00\text{ mA}$ $V_{CE} = 1.0\text{ V}$	25			
		$I_C = 1.50\text{ mA}$ $V_{CE} = 1\text{ V}$	20			
		$I_C = 1.0\text{ mA}$ $V_{CE} = 1.0\text{ V}$	15			
h_{FE}^*	DC Current Gain	for 2N2219A and 2N2222A				
		$I_C = 0.1\text{ mA}$ $V_{CE} = 1.0\text{ V}$	35			
		$I_C = 1\text{ mA}$ $V_{CE} = 1.0\text{ V}$	50			
		$I_C = 1.0\text{ mA}$ $V_{CE} = 1.0\text{ V}$	75			
		$I_C = 1.50\text{ mA}$ $V_{CE} = 1.0\text{ V}$	100		300	
		$I_C = 5.00\text{ mA}$ $V_{CE} = 1.0\text{ V}$	40			
		$I_C = 1.50\text{ mA}$ $V_{CE} = 1\text{ V}$	50			
		$I_C = 1.0\text{ mA}$ $V_{CE} = 1.0\text{ V}$	35			
	$T_{amb} = -55\text{ °C}$					

* Pulsed : pulse duration = 300 μs , duty cycle = 1 %.

ELECTRICAL CHARACTERISTICS (continued)

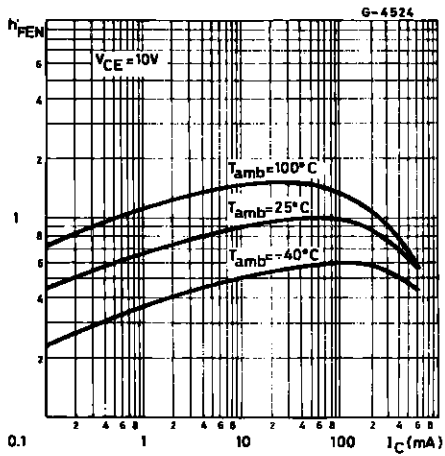
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
h_{fe}	Small Signal Current Gain	$I_C = 1 \text{ mA}$ $V_{CE} = 10 \text{ V}$ $f = 1 \text{ kHz}$ for 2N2218A and 2N2221A for 2N2219A and 2N2222A $I_C = 10 \text{ mA}$ $V_{CE} = 10 \text{ V}$ $f = 1 \text{ kHz}$ for 2N2218A and 2N2221A for 2N2219A and 2N2222A	30 50 50 75		150 300 300 375	
f_T	Transition Frequency	$I_C = 20 \text{ mA}$ $V_{CE} = 2.0 \text{ V}$ $f = 100 \text{ MHz}$ for 2N2218A and 2N2221A for 2N2219A and 2N2222A	250 300			MHz MHz
C_{EBO}	Emitter-base Capacitance	$I_C = 0$ $f = 100 \text{ kHz}$ $V_{EB} = 0.5 \text{ V}$			25	pF
C_{CBO}	Collector-base Capacitance	$I_E = 0$ $f = 100 \text{ kHz}$ $V_{CB} = 1.0 \text{ V}$			8	pF
$R_{e(hie)}$	Real Part of Input Impedance	$I_C = 2.0 \text{ mA}$ $f = 300 \text{ MHz}$ $V_{CE} = 2.0 \text{ V}$			60	Ω
NF	Noise Figure	$I_C = 1.00 \mu\text{A}$ $V_{CE} = 1.0 \text{ V}$ $R_g = 1 \text{ k}\Omega$ $f = 1 \text{ kHz}$		4d		B
h_{ie}^{**}	Input Impedance	$I_C = 1 \text{ mA}$ $V_{CE} = 1.0 \text{ V}$ for 2N2218A and 2N2221A for 2N2219A and 2N2222A $I_C = 1.0 \text{ mA}$ $V_{CE} = 1.0 \text{ V}$ for 2N2218A and 2N2221A for 2N2219A and 2N2222A	1 2 0.2 0.25		3.5 8 1 1.25	Ω Ω Ω Ω
h_{re}^{**}	Reverse Voltage Ratio	$I_C = 1 \text{ mA}$ $V_{CE} = 1.0 \text{ V}$ for 2N2218A and 2N2221A for 2N2219A and 2N2222A $I_C = 1.0 \text{ mA}$ $V_{CE} = 1.0 \text{ V}$ for 2N2218A and 2N2221A for 2N2219A and 2N2222A			5×10^{-4} 8×10^{-4} 2.5×10^{-4} 4×10^{-4}	
h_{oe}^{**}	Output Admittance	$I_C = 1 \text{ mA}$ $V_{CE} = 1.0 \text{ V}$ for 2N2218A and 2N2221A for 2N2219A and 2N2222A $I_C = 1.0 \text{ mA}$ $V_{CE} = 1.0 \text{ V}$ for 2N2218A and 2N2221A for 2N2219A and 2N2222A	3 5 10 25		15 35 100 200	μS μS μS μS
t_d^{***}	Delay Time	$I_C = 1.50 \text{ mA}$ $V_{CC} = 3.0 \text{ V}$ $I_{B1} = 1.5 \text{ mA}$ $V_{BB} = -0.5 \text{ V}$			10	ns
t_r^{***}	Rise Time	$I_C = 1.50 \text{ mA}$ $V_{CC} = 3.0 \text{ V}$ $I_{B1} = 1.5 \text{ mA}$ $V_{BB} = -0.5 \text{ V}$			25	ns
t_s^{***}	Storage Time	$I_C = 1.50 \text{ mA}$ $V_{CC} = 3.0 \text{ V}$ $I_{B1} = -I_{B2} = 1.5 \text{ mA}$			225	ns
t_f^{***}	Fall Time	$I_C = 1.50 \text{ mA}$ $V_{CC} = 3.0 \text{ V}$ $I_{B1} = -I_{B2} = 1.5 \text{ mA}$			60	ns
$r_{bb} \cdot C_{b'c}$	Feedback Time Constant	$I_C = 2.0 \text{ mA}$ $f = 31.8 \text{ MHz}$ $V_{CE} = 20 \text{ V}$			150	ps

** $f = 1 \text{ kHz}$

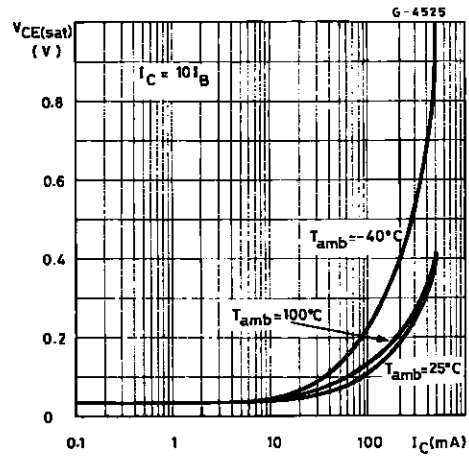
*** see test circuit.

2N2218A-2N2219A-2N2221A-2N2222A

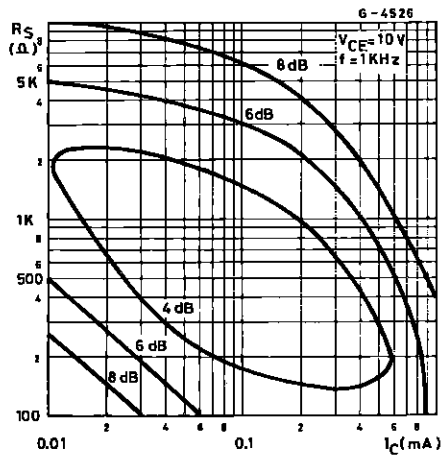
Normalized DC Current Gain.



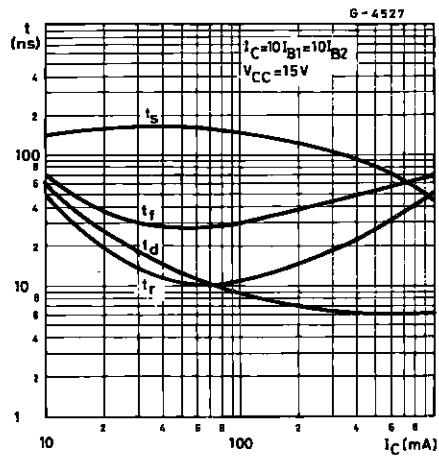
Collector-emitter Saturation Voltage.



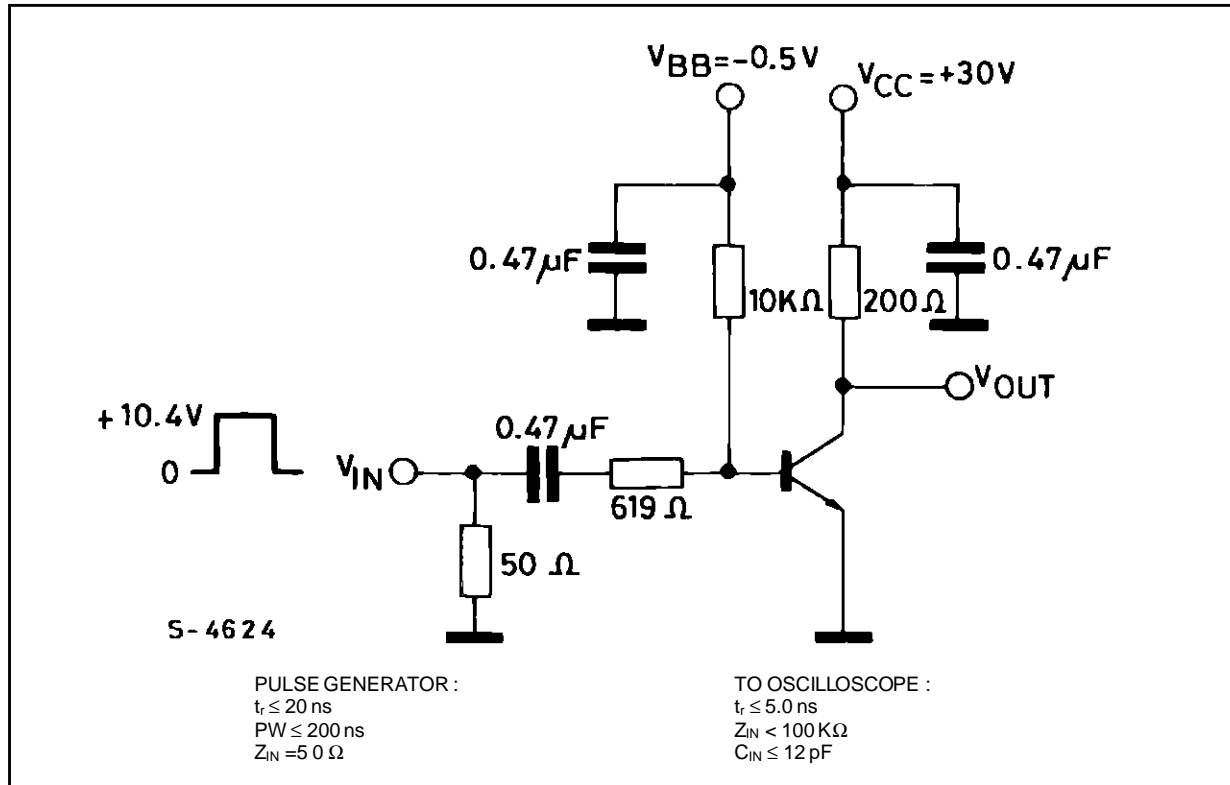
Contours of Constant Narrow Band Noise Figure.



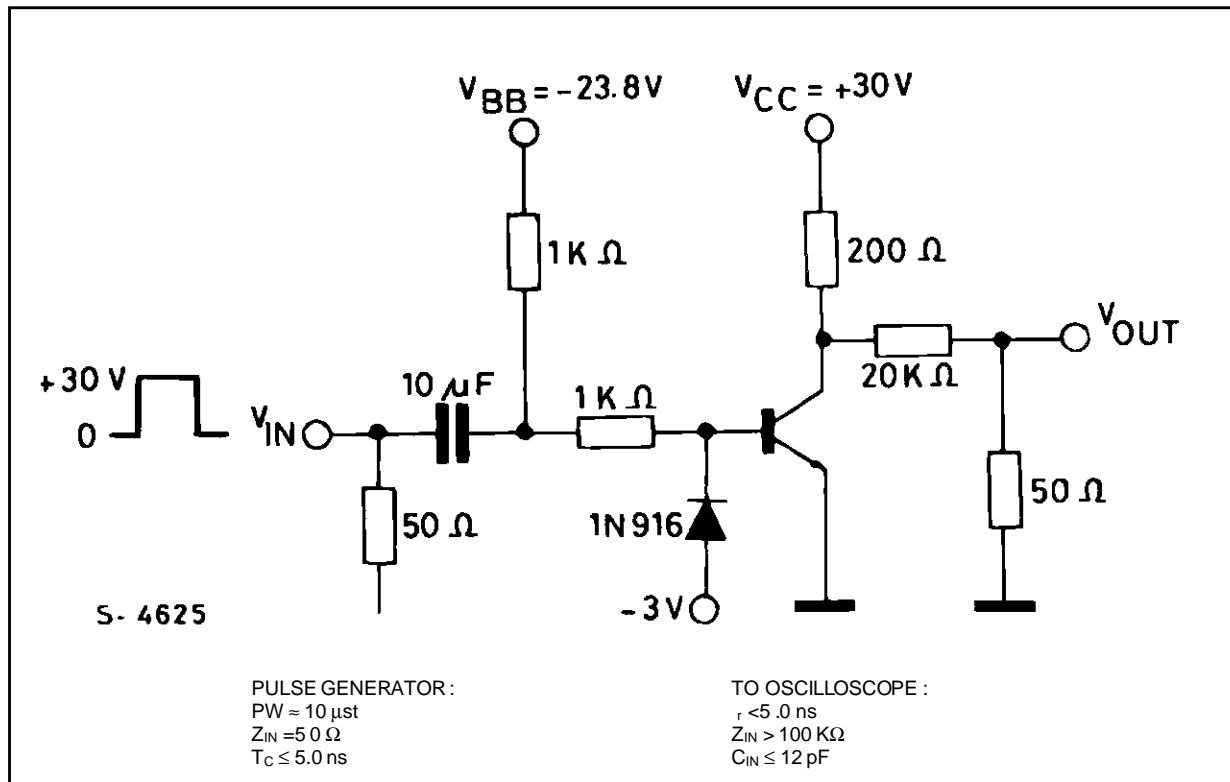
Switching Time vs. Collector Current.



Test Circuit for t_d , t_r .

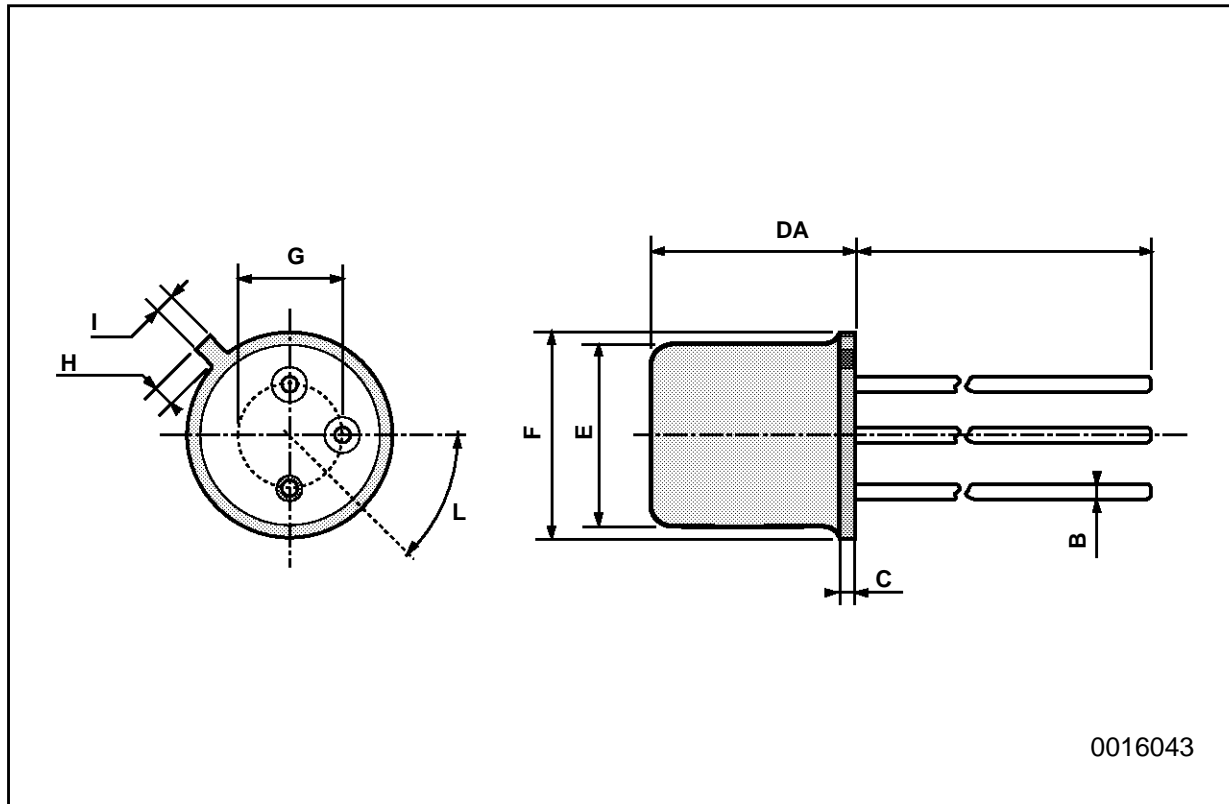


Test Circuit for t_d , t_r .



TO-18 MECHANICAL DATA

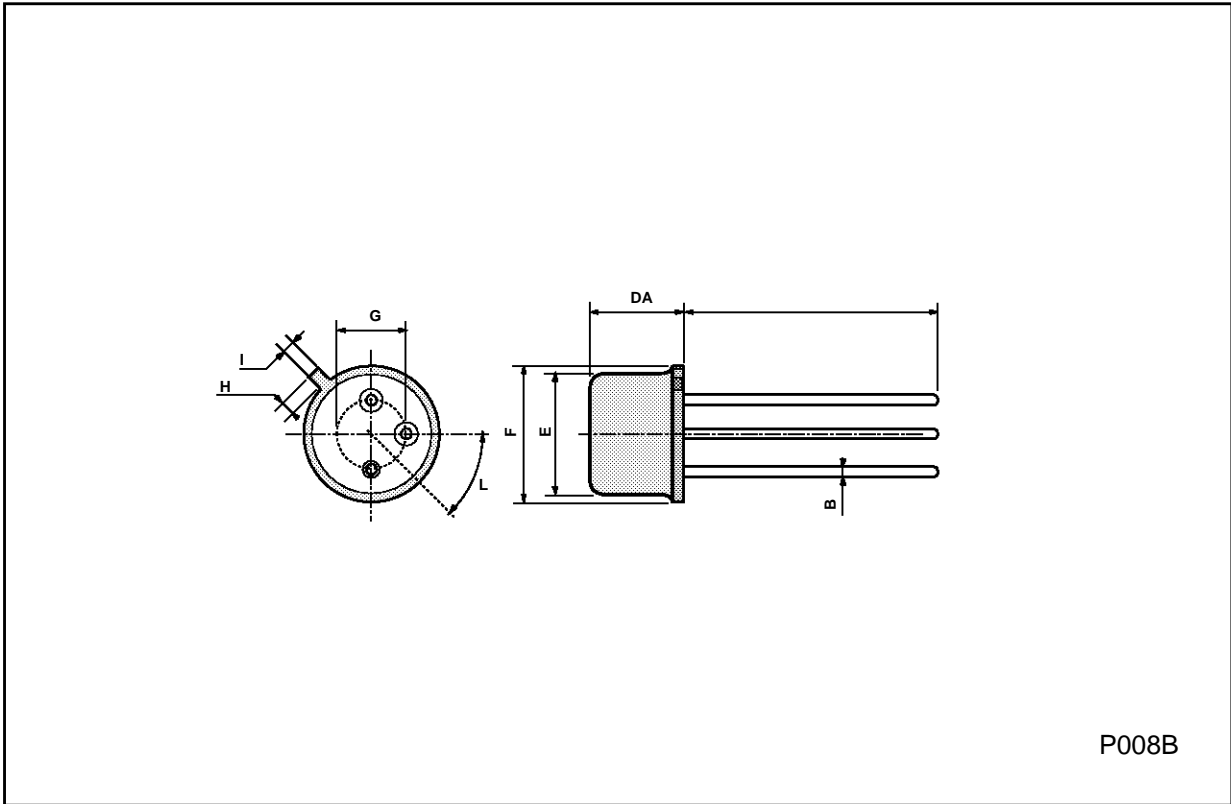
DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A		12.7			0.500	
B			0.49			0.019
D			5.3			0.208
E			4.9			0.193
F			5.8			0.228
G	2.54			0.100		
H			1.2			0.047
I			1.16			0.045
L	45°			45°		



0016043

TO39 MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	12.7			0.500		
B			0.49			0.019
D			6.6			0.260
E			8.5			0.334
F			9.4			0.370
G	5.08			0.200		
H			1.2			0.047
I			0.9			0.035
L	45° (typ.)					



P008B

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