
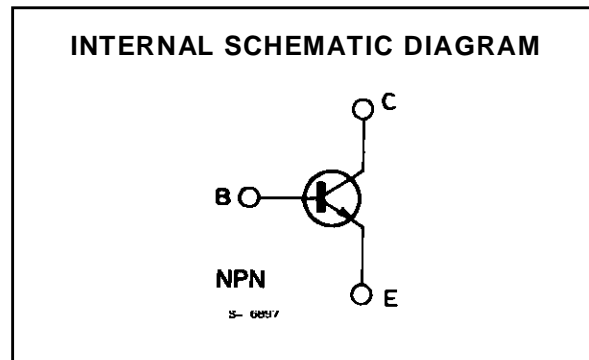
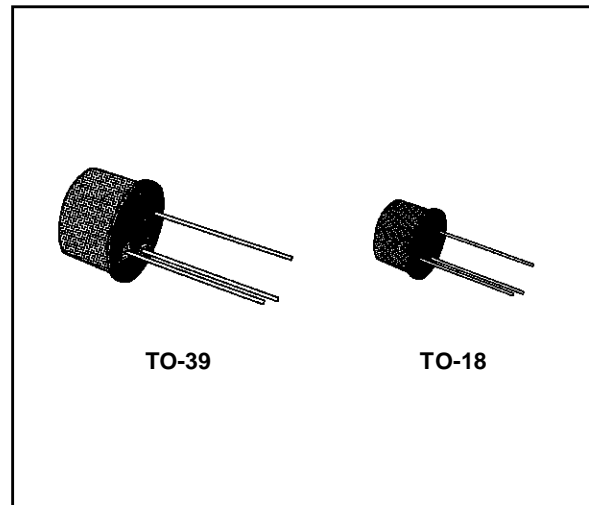


**HIGH SPEED SWITCHES**

**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 $T_{amb} \leq 25\text{ }^\circ\text{C}$ for <b>2N2218A</b> and <b>2N2219A</b> for <b>2N2221A</b> and <b>2N2222A</b> at $T_{case} \leq 25\text{ }^\circ\text{C}$ for <b>2N2218A</b> and <b>2N2219A</b> for <b>2N2221A</b> and <b>2N2222A</b>	0.8	W
		0.5	W
		3	W
		1.8	W
$T_{stg}$	Storage Temperature	- 65 to 200	$^\circ\text{C}$
$T_j$	Junction Temperature	175	$^\circ\text{C}$

## 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
		$V_{CB} = 60\text{ V}$ $T_{amb} = 150\text{ °C}$			10	$\mu\text{A}$
$I_{CEX}$	Collector Cutoff Current ( $V_{BE} = -3\text{ V}$ )	$V_{CE} = 60\text{ V}$			10	nA
$I_{EBO}$	Emitter Cutoff Current ( $I_C = 0$ )	$V_{EB} = 3\text{ V}$			10	nA
$I_{BEX}$	Base Cutoff Current ( $V_{BE} = -3\text{ V}$ )	$V_{CE} = 60\text{ V}$			20	nA
$V_{(BR)\ CBO}$	Collector-base Breakdown Voltage ( $I_E = 0$ )	$I_C = 10\ \mu\text{A}$	75			V
$V_{(BR)\ CEO}^*$	Collector-emitter Breakdown Voltage ( $I_B = 0$ )	$I_C = 10\text{ mA}$	40			V
$V_{(BR)\ EBO}$	Emitter-base Breakdown Voltage ( $I_C = 0$ )	$I_E = 10\ \mu\text{A}$	6			V
$V_{CE(sat)}^*$	Collector-emitter Saturation Voltage	$I_C = 150\text{ mA}$ $I_B = 15\text{ mA}$			0.3	V
		$I_C = 500\text{ mA}$ $I_B = 50\text{ mA}$			1	V
$V_{BE(sat)}^*$	Base-emitter Saturation Voltage	$I_C = 150\text{ mA}$ $I_B = 15\text{ mA}$	0.6		1.2	V
		$I_C = 500\text{ mA}$ $I_B = 50\text{ mA}$			2	V
$h_{FE}^*$	DC Current Gain	for <b>2N2218A</b> and <b>2N2221A</b>				
		$I_C = 0.1\text{ mA}$ $V_{CE} = 10\text{ V}$	20			
		$I_C = 1\text{ mA}$ $V_{CE} = 10\text{ V}$	25			
		$I_C = 10\text{ mA}$ $V_{CE} = 10\text{ V}$	35			
		$I_C = 150\text{ mA}$ $V_{CE} = 10\text{ V}$	40		120	
		$I_C = 500\text{ mA}$ $V_{CE} = 10\text{ V}$	25			
		$I_C = 150\text{ mA}$ $V_{CE} = 1\text{ V}$	20			
		$I_C = 10\text{ mA}$ $V_{CE} = 10\text{ V}$	15			
$h_{FE}^*$	DC Current Gain	for <b>2N2219A</b> and <b>2N2222A</b>				
		$I_C = 0.1\text{ mA}$ $V_{CE} = 10\text{ V}$	35			
		$I_C = 1\text{ mA}$ $V_{CE} = 10\text{ V}$	50			
		$I_C = 10\text{ mA}$ $V_{CE} = 10\text{ V}$	75			
		$I_C = 150\text{ mA}$ $V_{CE} = 10\text{ V}$	100		300	
		$I_C = 500\text{ mA}$ $V_{CE} = 10\text{ V}$	40			
		$I_C = 150\text{ mA}$ $V_{CE} = 1\text{ V}$	50			
		$I_C = 10\text{ mA}$ $V_{CE} = 10\text{ V}$	35			
		$T_{amb} = -55\text{ °C}$				

\* Pulsed : pulse duration = 300  $\mu\text{s}$ , duty cycle = 1 %.

ELECTRICAL CHARACTERISTICS (continued)

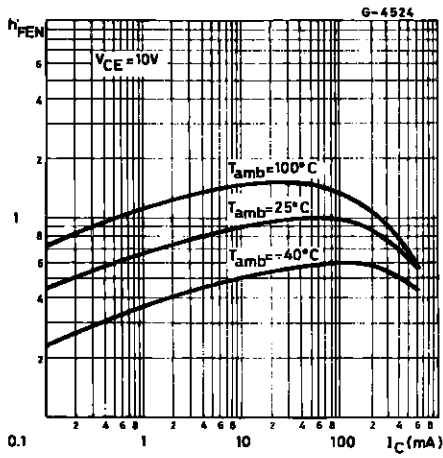
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$h_{fe}$	Small Signal Current Gain	$I_C = 1 \text{ mA}$ $V_{CE} = 10 \text{ V}$ $f = 1 \text{ kHz}$ for <b>2N2218A</b> and <b>2N2221A</b> for <b>2N2219A</b> and <b>2N2222A</b> $I_C = 10 \text{ mA}$ $V_{CE} = 10 \text{ V}$ $f = 1 \text{ kHz}$ for <b>2N2218A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

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

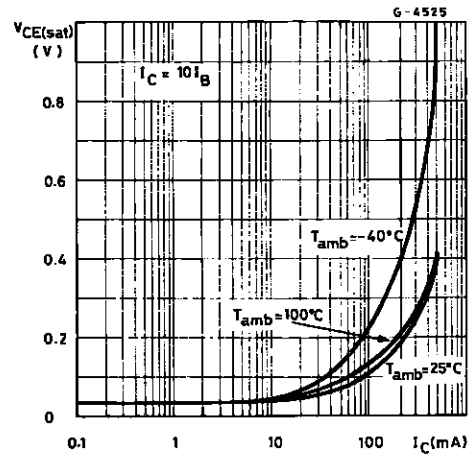
\*\*\* see test circuit.

2N2218A-2N2219A-2N2221A-2N2222A

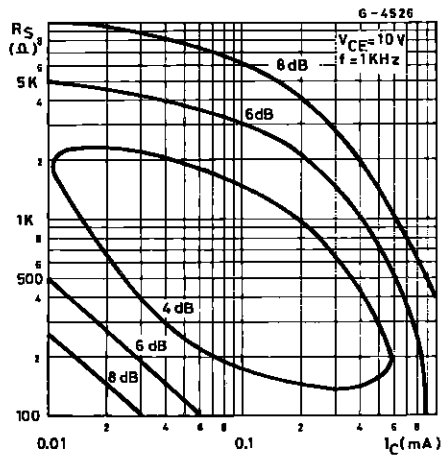
Normalized DC Current Gain.



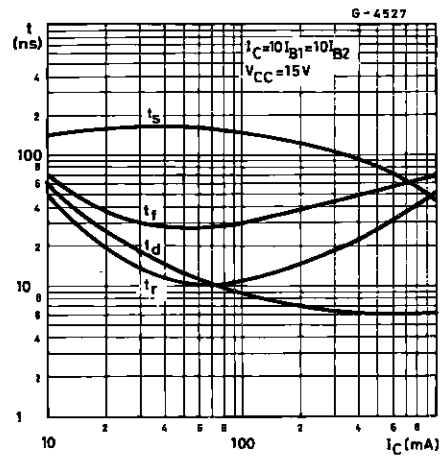
Collector-emitter Saturation Voltage.



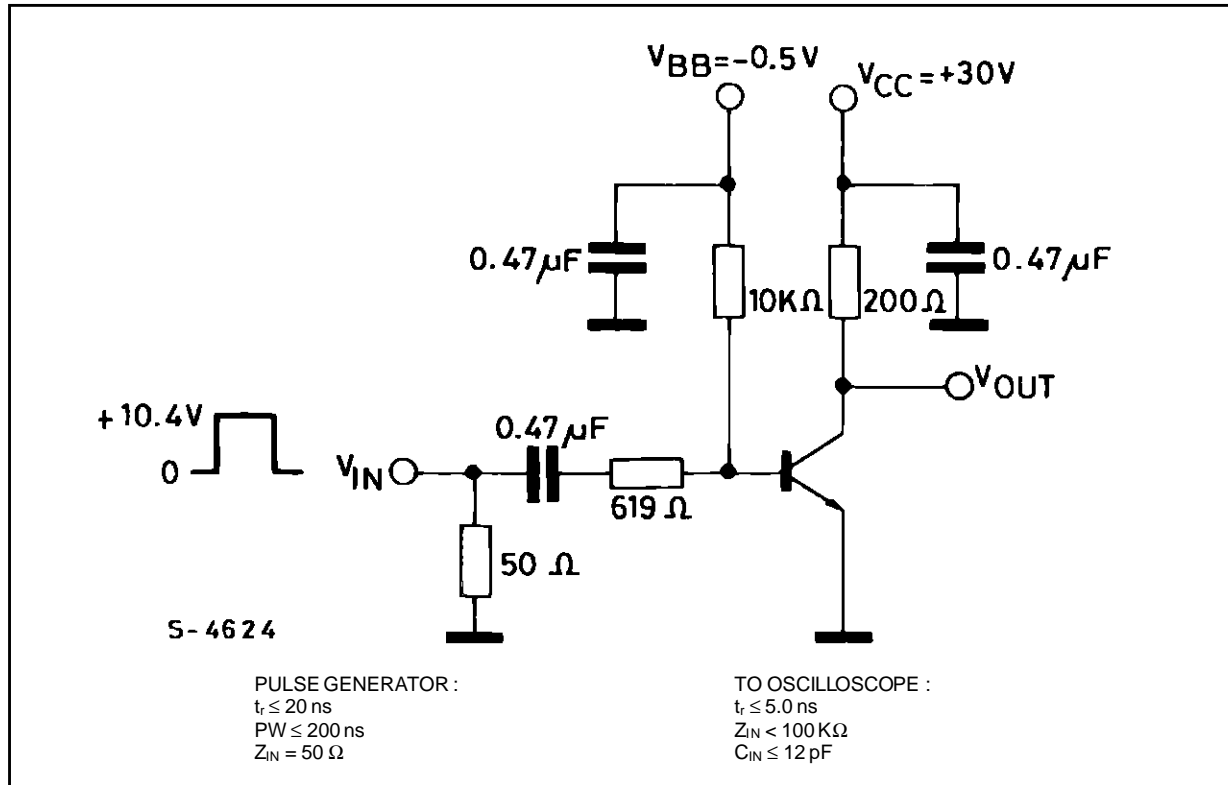
Contours of Constant Narrow Band Noise Figure.



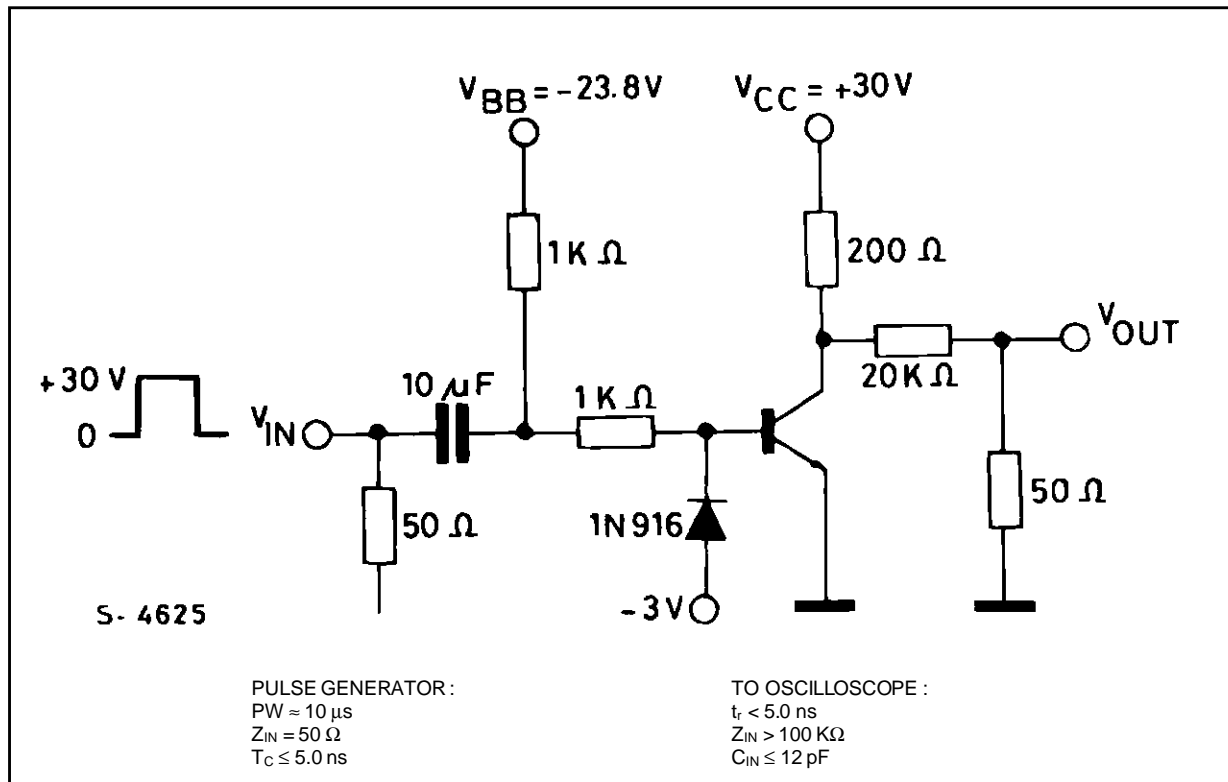
Switching Time vs. Collector Current.



Test Circuit for  $t_d$ ,  $t_r$ .

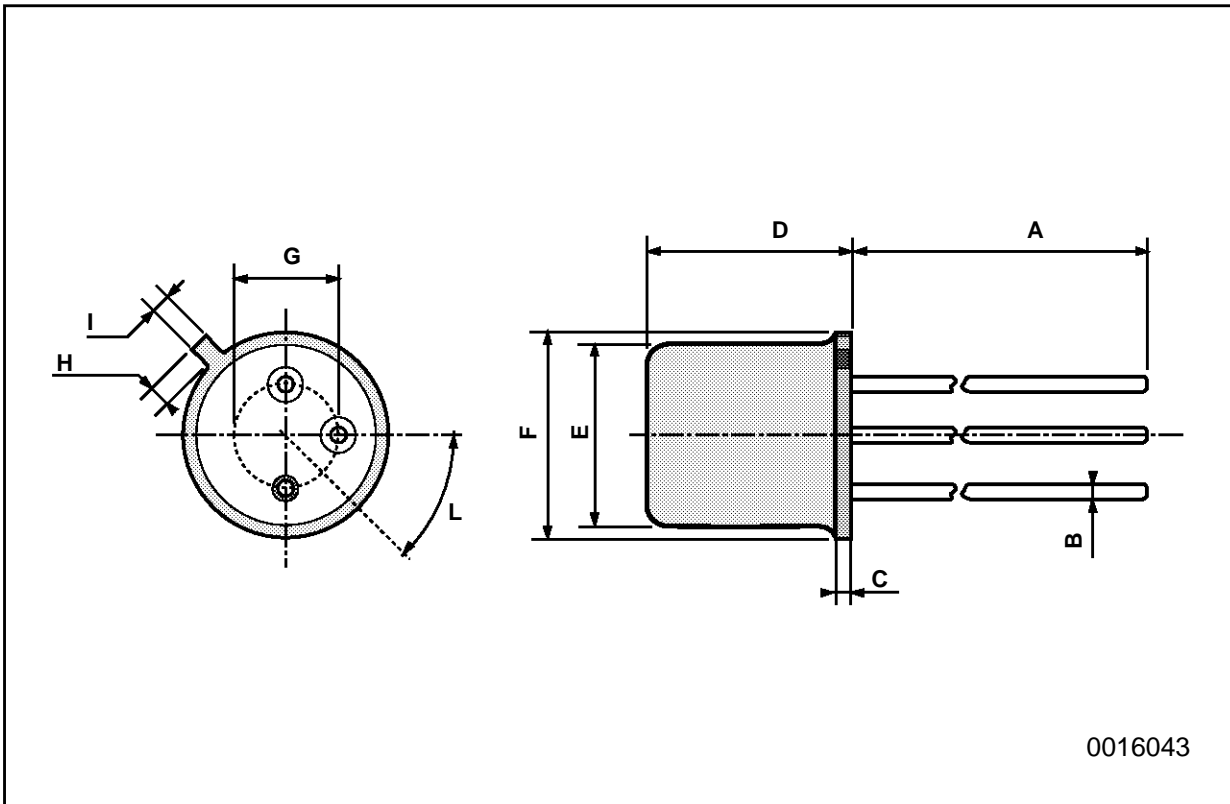


Test Circuit for  $t_d$ ,  $t_r$ .



**TO-18 MECHANICAL DATA**

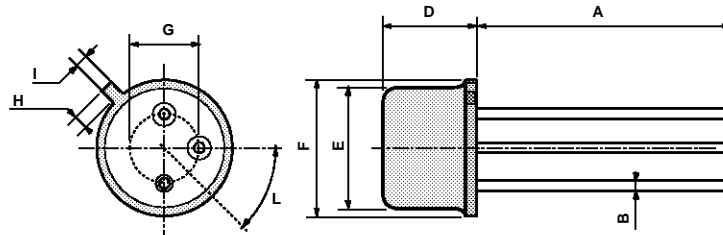
DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A		12.7			0.500	
B			0.49			0.019
D			5.3			0.208
E			4.9			0.193
F			5.8			0.228
G	2.54			0.100		
H			1.2			0.047
I			1.16			0.045
L	45°			45°		



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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