
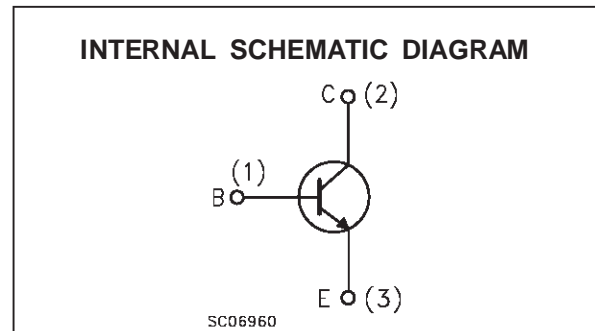
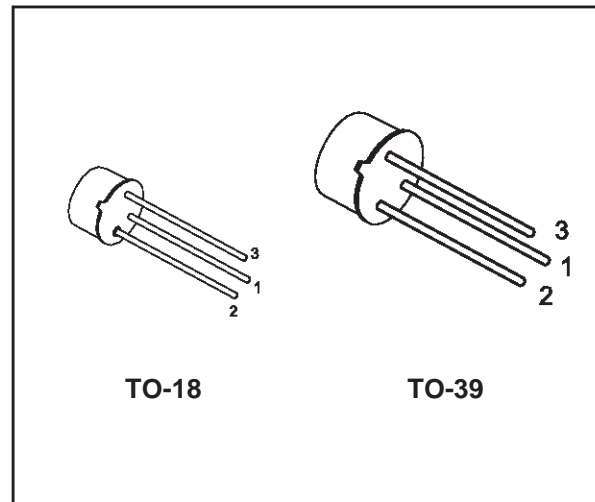


## HIGH SPEED SWITCHES

### DESCRIPTION

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

 2N2219A approved to CECC 50002-100,  
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 Dissipation at $T_{amb} \leq 25\text{ }^\circ\text{C}$<br>for <b>2N2219A</b><br>for <b>2N2222A</b><br>at $T_{case} \leq 25\text{ }^\circ\text{C}$<br>for <b>2N2219A</b><br>for <b>2N2222A</b> | 0.8        | W                |
|           |   | 0.5        | W                |
|           |   | 3          | W                |
|           |   | 1.8        | W                |
| $T_{stg}$ | Storage Temperature   | -65 to 200 | $^\circ\text{C}$ |
| $T_j$     | Max. Operating Junction Temperature   | 175        | $^\circ\text{C}$ |

## THERMAL DATA

|                |                                     |     | TO-39 | TO-18 |               |
|----------------|-------------------------------------|-----|-------|-------|---------------|
| $R_{thj-case}$ | Thermal Resistance Junction-Case    | Max | 50    | 83.3  | $^{\circ}C/W$ |
| $R_{thj-amb}$  | Thermal Resistance Junction-Ambient | Max | 187.5 | 300   | $^{\circ}C/W$ |

ELECTRICAL CHARACTERISTICS ( $T_{case} = 25^{\circ}C$  unless otherwise specified)

| Symbol          | Parameter   | Test Conditions   | Min.                                    | Typ. | Max.       | Unit          |
|-----------------|---|---|---|------|------------|---------------|
| $I_{CBO}$       | Collector Cut-off Current ( $I_E = 0$ )           | $V_{CB} = 60 V$<br>$V_{CB} = 60 V$ $T_{case} = 150^{\circ}C$  |   |      | 10<br>10   | nA<br>$\mu A$ |
| $I_{CEX}$       | Collector Cut-off Current ( $V_{BE} = -3V$ )      | $V_{CE} = 60 V$   |   |      | 10         | nA            |
| $I_{BEX}$       | Base Cut-off Current ( $V_{BE} = -3V$ )           | $V_{CE} = 60 V$   |   |      | 20         | nA            |
| $I_{EBO}$       | Emitter Cut-off Current ( $I_C = 0$ )             | $V_{EB} = 3 V$  |   |      | 10         | nA            |
| $V_{(BR)CBO}^*$ | Collector-Base Breakdown Voltage ( $I_E = 0$ )    | $I_C = 10 \mu A$  | 75                                      |      |            | V             |
| $V_{(BR)CEO}^*$ | Collector-Emitter Breakdown Voltage ( $I_B = 0$ ) | $I_C = 10 mA$   | 40                                      |      |            | V             |
| $V_{(BR)EBO}^*$ | Emitter-Base Breakdown Voltage ( $I_C = 0$ )      | $I_E = 10 \mu A$  | 6                                       |      |            | V             |
| $V_{CE(sat)}^*$ | Collector-Emitter Saturation Voltage              | $I_C = 150 mA$ $I_B = 15 mA$<br>$I_C = 500 mA$ $I_B = 50 mA$  |   |      | 0.3<br>1   | V<br>V        |
| $V_{BE(sat)}^*$ | Base-Emitter Saturation Voltage                   | $I_C = 150 mA$ $I_B = 15 mA$<br>$I_C = 500 mA$ $I_B = 50 mA$  | 0.6                                     |      | 1.2<br>2   | V<br>V        |
| $h_{FE}^*$      | DC Current Gain                                   | $I_C = 0.1 mA$ $V_{CE} = 10 V$<br>$I_C = 1 mA$ $V_{CE} = 10 V$<br>$I_C = 10 mA$ $V_{CE} = 10 V$<br>$I_C = 150 mA$ $V_{CE} = 10 V$<br>$I_C = 500 mA$ $V_{CE} = 10 V$<br>$I_C = 150 mA$ $V_{CE} = 1 V$<br>$I_C = 10 mA$ $V_{CE} = 10 V$<br>$T_{amb} = -55^{\circ}C$ | 35<br>50<br>75<br>100<br>40<br>50<br>35 |      | 300        |               |
| $h_{fe}^*$      | Small Signal Current Gain                         | $I_C = 1 mA$ $V_{CE} = 10 V$ $f = 1KHz$<br>$I_C = 10 mA$ $V_{CE} = 10 V$ $f = 1KHz$   | 50<br>75                                |      | 300<br>375 |               |
| $f_T$           | Transition Frequency                              | $I_C = 20 mA$ $V_{CE} = 20 V$<br>$f = 100 MHz$  | 300                                     |      |            | MHz           |
| $C_{EBO}$       | Emitter Base Capacitance                          | $I_C = 0$ $V_{EB} = 0.5 V$ $f = 100KHz$   |   |      | 25         | pF            |
| $C_{CBO}$       | Collector Base Capacitance                        | $I_E = 0$ $V_{CB} = 10 V$ $f = 100 KHz$   |   |      | 8          | pF            |
| $R_{e(hie)}$    | Real Part of Input Impedance                      | $I_C = 20 mA$ $V_{CE} = 20 V$<br>$f = 300MHz$   |   |      | 60         | $\Omega$      |

\* Pulsed: Pulse duration = 300  $\mu s$ , duty cycle  $\leq 1\%$

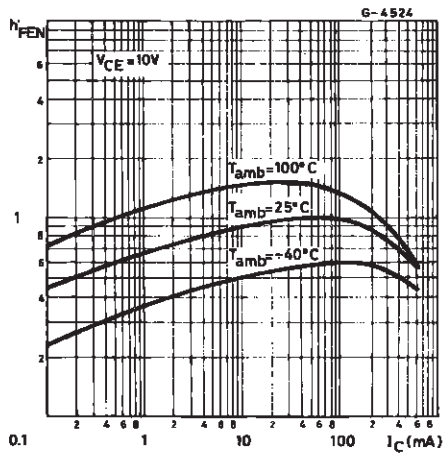
## ELECTRICAL CHARACTERISTICS (continued)

| Symbol            | Parameter              | Test Conditions  | Min.      | Typ. | Max.      | Unit                                 |
|-------------------|------------------------|--|-----------|------|-----------|--------------------------------------|
| NF                | Noise Figure           | $I_C = 0.1 \text{ mA}$ $V_{CE} = 10 \text{ V}$<br>$f = 1\text{KHz}$ $R_g = 1\text{K}\Omega$          |           | 4    |           | dB                                   |
| $h_{ie}$          | Input Impedance        | $I_C = 1 \text{ mA}$ $V_{CE} = 10 \text{ V}$<br>$I_C = 10 \text{ mA}$ $V_{CE} = 10 \text{ V}$        | 2<br>0.25 |      | 8<br>1.25 | $\text{k}\Omega$<br>$\text{k}\Omega$ |
| $h_{re}$          | Reverse Voltage Ratio  | $I_C = 1 \text{ mA}$ $V_{CE} = 10 \text{ V}$<br>$I_C = 10 \text{ mA}$ $V_{CE} = 10 \text{ V}$        |           |      | 8<br>4    | $10^{-4}$<br>$10^{-4}$               |
| $h_{oe}$          | Output Admittance      | $I_C = 1 \text{ mA}$ $V_{CE} = 10 \text{ V}$<br>$I_C = 10 \text{ mA}$ $V_{CE} = 10 \text{ V}$        | 5<br>25   |      | 35<br>200 | $\mu\text{S}$<br>$\mu\text{S}$       |
| $t_d^{**}$        | Delay Time             | $V_{CC} = 30 \text{ V}$ $I_C = 150 \text{ mA}$<br>$I_{B1} = 15 \text{ mA}$ $V_{BB} = -0.5 \text{ V}$ |           |      | 10        | ns                                   |
| $t_r^{**}$        | Rise Time              | $V_{CC} = 30 \text{ V}$ $I_C = 150 \text{ mA}$<br>$I_{B1} = 15 \text{ mA}$ $V_{BB} = -0.5 \text{ V}$ |           |      | 25        | ns                                   |
| $t_s^{**}$        | Storage Time           | $V_{CC} = 30 \text{ V}$ $I_C = 150 \text{ mA}$<br>$I_{B1} = -I_{B2} = 15 \text{ mA}$                 |           |      | 225       | ns                                   |
| $t_f^{**}$        | Fall Time              | $V_{CC} = 30 \text{ V}$ $I_C = 150 \text{ mA}$<br>$I_{B1} = -I_{B2} = 15 \text{ mA}$                 |           |      | 60        | ns                                   |
| $r_{bb}, C_{b'c}$ | Feedback Time Constant | $I_C = 20 \text{ mA}$ $V_{CE} = 20 \text{ V}$<br>$f = 31.8\text{MHz}$                                |           |      | 150       | ps                                   |

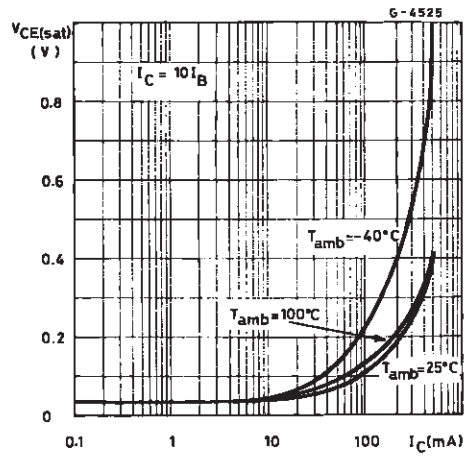
\* Pulsed: Pulse duration = 300  $\mu\text{s}$ , duty cycle  $\leq 1\%$ 

\*\* See test circuit

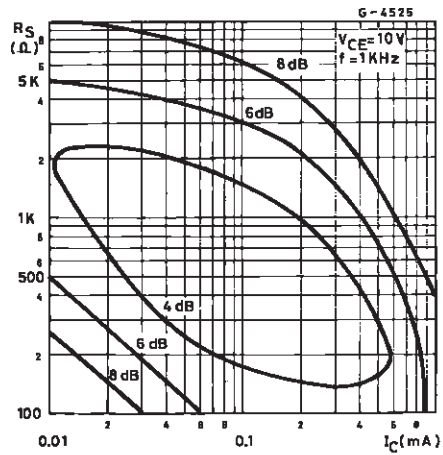
Normalized DC Current Gain.



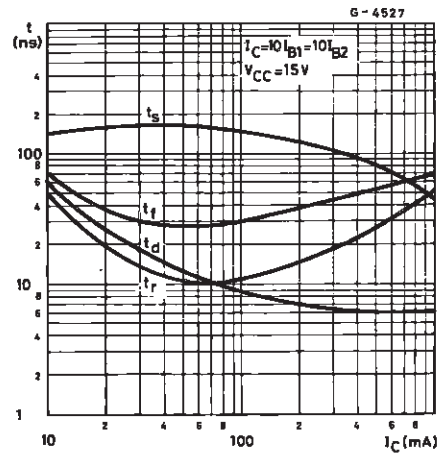
Collector-emitter Saturation Voltage.



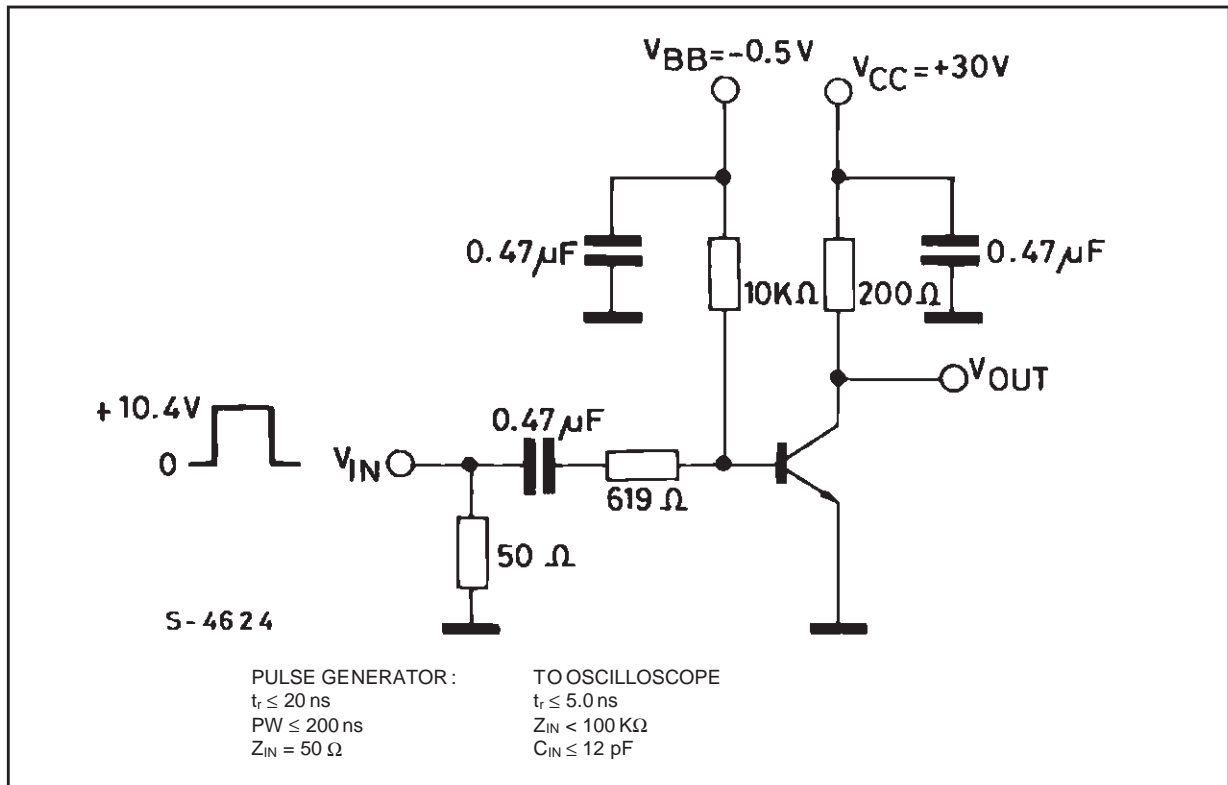
Contours of Constant Narrow Band Noise Figure.



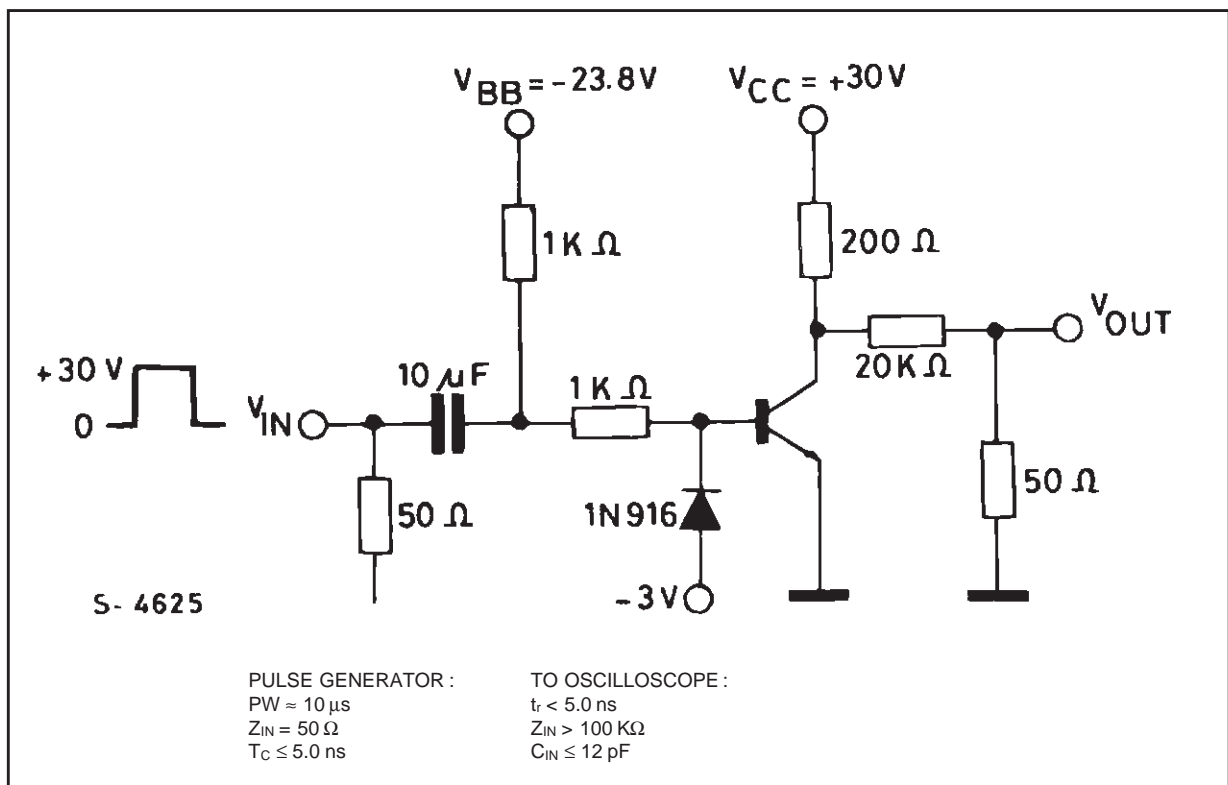
Switching Time vs. Collector Current.



Test Circuit for  $t_d$ ,  $t_r$ .

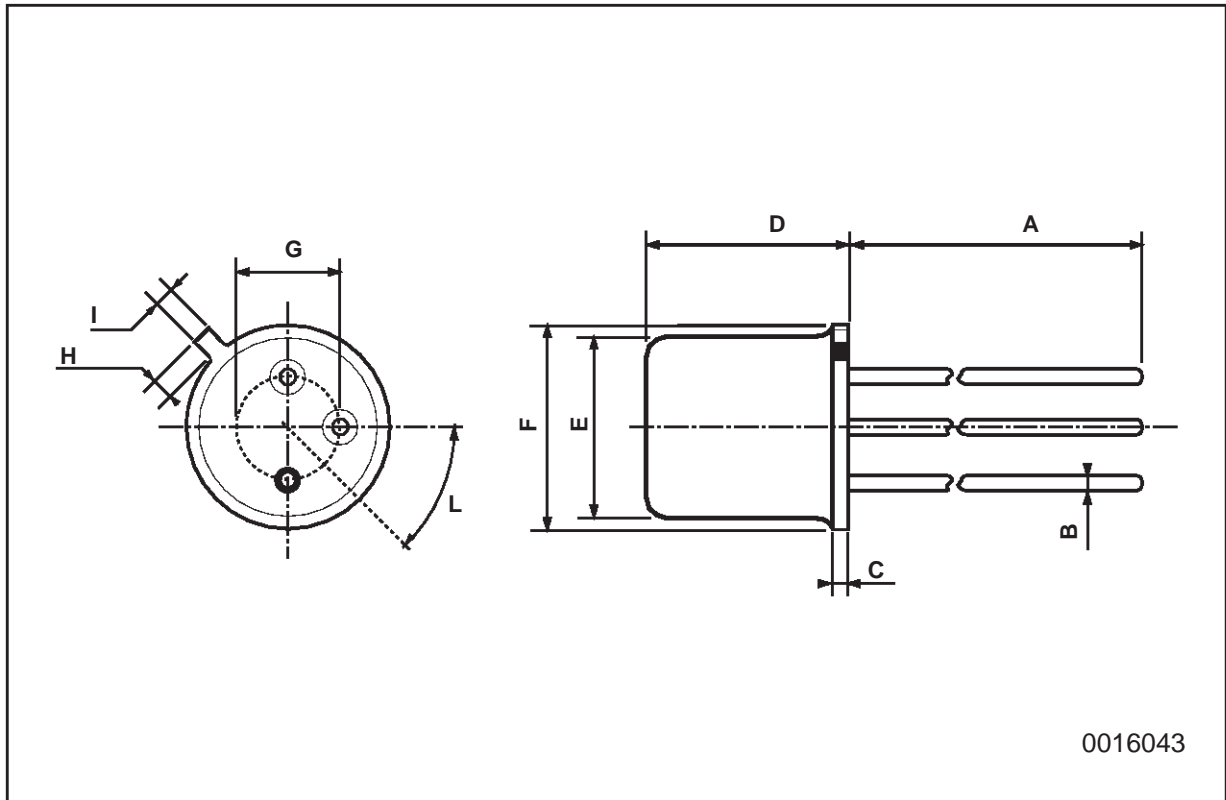


Test Circuit for  $t_d$ ,  $t_r$ .



**TO-18 MECHANICAL DATA**

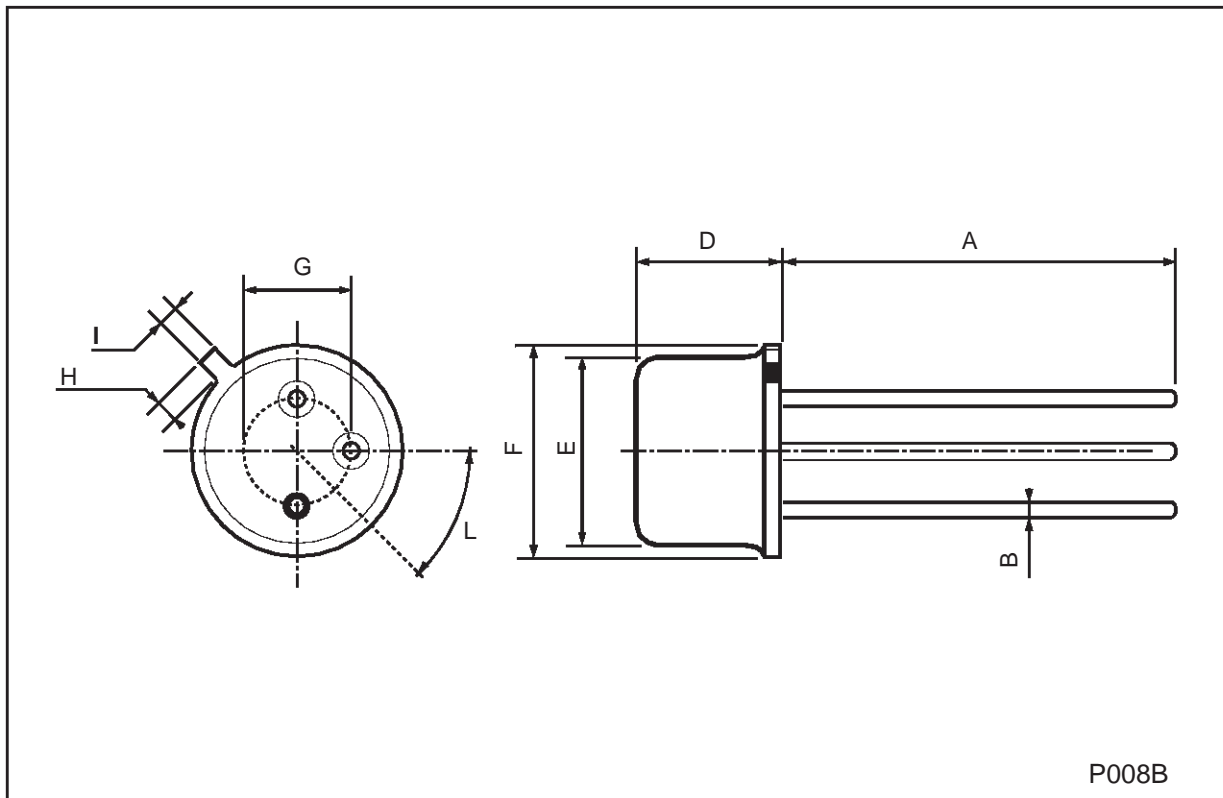
| DIM. | mm   |      |      | inch  |       |       |
|------|------|------|------|-------|-------|-------|
|      | MIN. | TYP. | MAX. | MIN.  | TYP.  | MAX.  |
| A    |      | 12.7 |      |       | 0.500 |       |
| B    |      |      | 0.49 |       |       | 0.019 |
| D    |      |      | 5.3  |       |       | 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°   |       |       |



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## TO-39 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.) |      |      |       |      |       |



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