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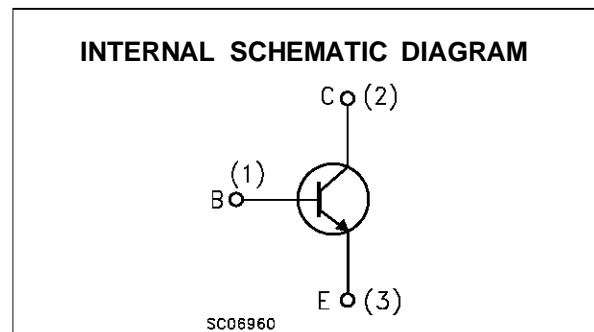
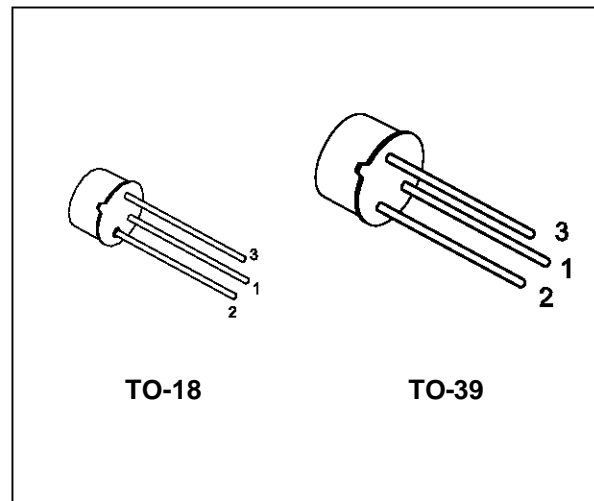
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## HIGH SPEED SWITCHES

### 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 $T_{amb} \leq 25^\circ C$<br>for <b>2N2219A</b><br>for <b>2N2222A</b><br>at $T_{case} \leq 25^\circ C$<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 | $^\circ C$ |
| $T_j$     | Max. Operating Junction Temperature   | 175        | $^\circ C$ |

## 2N2219A/2N2222A

### THERMAL DATA

|                       |                                     |     | TO-39 | TO-18 |      |
|-----------------------|-------------------------------------|-----|-------|-------|------|
| R <sub>thj-case</sub> | Thermal Resistance Junction-Case    | Max | 50    | 83.3  | °C/W |
| R <sub>thj-amb</sub>  | Thermal Resistance Junction-Ambient | Max | 187.5 | 300   | °C/W |

### ELECTRICAL CHARACTERISTICS (T<sub>case</sub> = 25 °C unless otherwise specified)

| Symbol                 | Parameter  | Test Conditions  | Min.                                    | Typ. | Max.       | Unit     |
|------------------------|--|--|---|------|------------|----------|
| I <sub>CBO</sub>       | Collector Cut-off Current (I <sub>E</sub> = 0)           | V <sub>CB</sub> = 60 V<br>V <sub>CB</sub> = 60 V T <sub>case</sub> = 150 °C  |   |      | 10<br>10   | nA<br>μA |
| I <sub>CEX</sub>       | Collector Cut-off Current (V <sub>BE</sub> = -3V)        | V <sub>CE</sub> = 60 V   |   |      | 10         | nA       |
| I <sub>BEX</sub>       | Base Cut-off Current (V <sub>BE</sub> = -3V)             | V <sub>CE</sub> = 60 V   |   |      | 20         | nA       |
| I <sub>EBO</sub>       | Emitter Cut-off Current (I <sub>C</sub> = 0)             | V <sub>EB</sub> = 3 V  |   |      | 10         | nA       |
| V <sub>(BR)CBO</sub> * | Collector-Base Breakdown Voltage (I <sub>E</sub> = 0)    | I <sub>C</sub> = 10 μA   | 75                                      |      |            | V        |
| V <sub>(BR)CEO</sub> * | Collector-Emitter Breakdown Voltage (I <sub>B</sub> = 0) | I <sub>C</sub> = 10 mA   | 40                                      |      |            | V        |
| V <sub>(BR)EBO</sub> * | Emitter-Base Breakdown Voltage (I <sub>C</sub> = 0)      | I <sub>E</sub> = 10 μA   | 6                                       |      |            | V        |
| V <sub>CE(sat)</sub> * | Collector-Emitter Saturation Voltage                     | I <sub>C</sub> = 150 mA I <sub>B</sub> = 15 mA<br>I <sub>C</sub> = 500 mA I <sub>B</sub> = 50 mA   |   |      | 0.3<br>1   | V<br>V   |
| V <sub>BE(sat)</sub> * | Base-Emitter Saturation Voltage                          | I <sub>C</sub> = 150 mA I <sub>B</sub> = 15 mA<br>I <sub>C</sub> = 500 mA I <sub>B</sub> = 50 mA   | 0.6                                     |      | 1.2<br>2   | V<br>V   |
| h <sub>FE</sub> *      | DC Current Gain  | I <sub>C</sub> = 0.1 mA V <sub>CE</sub> = 10 V<br>I <sub>C</sub> = 1 mA V <sub>CE</sub> = 10 V<br>I <sub>C</sub> = 10 mA V <sub>CE</sub> = 10 V<br>I <sub>C</sub> = 150 mA V <sub>CE</sub> = 10 V<br>I <sub>C</sub> = 500 mA V <sub>CE</sub> = 10 V<br>I <sub>C</sub> = 150 mA V <sub>CE</sub> = 1 V<br>I <sub>C</sub> = 10 mA V <sub>CE</sub> = 10 V<br>T <sub>amb</sub> = -55 °C | 35<br>50<br>75<br>100<br>40<br>50<br>35 |      | 300        |          |
| h <sub>fe</sub> *      | Small Signal Current Gain                                | I <sub>C</sub> = 1 mA V <sub>CE</sub> = 10 V f = 1KHz<br>I <sub>C</sub> = 10 mA V <sub>CE</sub> = 10 V f = 1KHz  | 50<br>75                                |      | 300<br>375 |          |
| f <sub>T</sub>         | Transition Frequency                                     | I <sub>C</sub> = 20 mA V <sub>CE</sub> = 20 V<br>f = 100 MHz   | 300                                     |      |            | MHz      |
| C <sub>EBO</sub>       | Emitter Base Capacitance                                 | I <sub>C</sub> = 0 V <sub>EB</sub> = 0.5 V f = 100KHz  |   |      | 25         | pF       |
| C <sub>CBO</sub>       | Collector Base Capacitance                               | I <sub>E</sub> = 0 V <sub>CB</sub> = 10 V f = 100 KHz  |   |      | 8          | pF       |
| R <sub>e(hie)</sub>    | Real Part of Input Impedance                             | I <sub>C</sub> = 20 mA V <sub>CE</sub> = 20 V<br>f = 300MHz  |   |      | 60         | Ω        |

\* Pulsed: Pulse duration = 300 μs, duty cycle ≤ 1 %

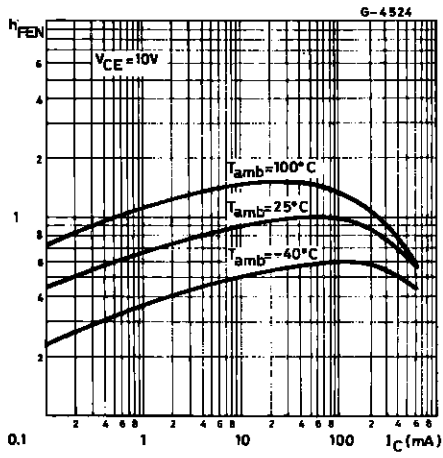
## ELECTRICAL CHARACTERISTICS (continued)

| 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 | $\Omega$<br>$\Omega$           |
| $h_{re}$              | 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                             |

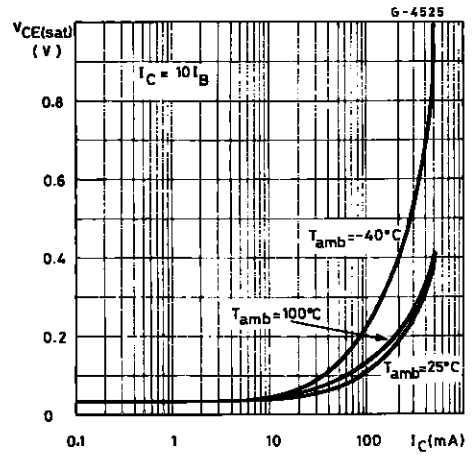
\* Pulsed: Pulse duration = 300  $\mu\text{s}$ , duty cycle  $\leq 1\%$ 

\*\* See test circuit

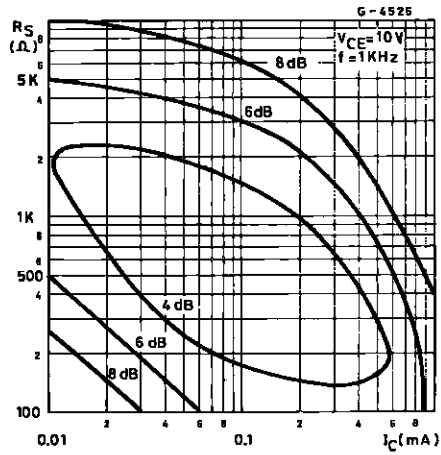
Normalized DC Current Gain.



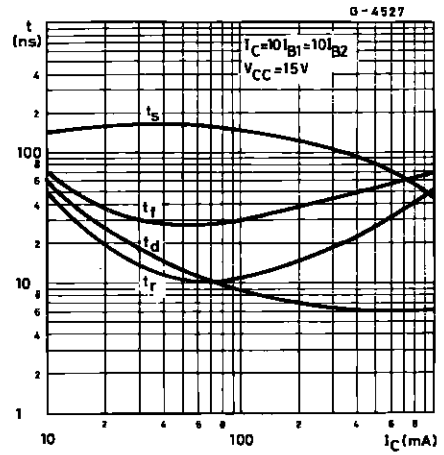
Collector-emitter Saturation Voltage.



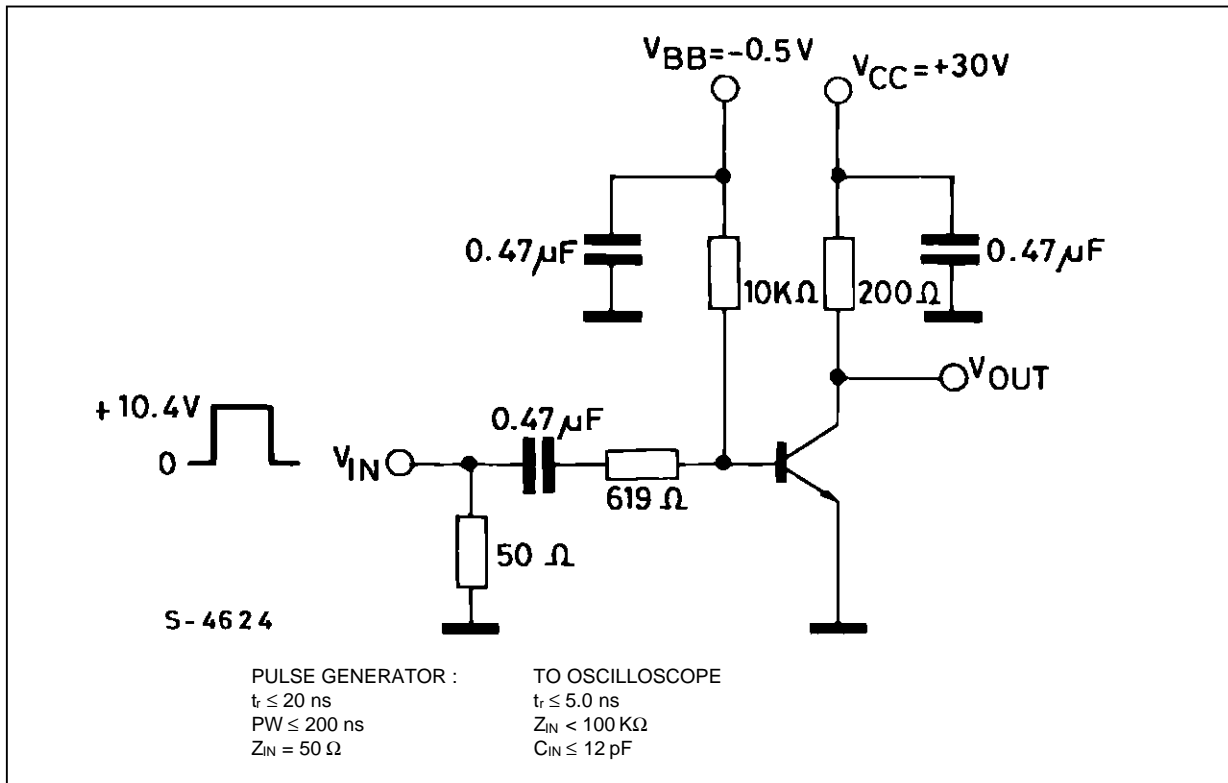
Contours of Constant Narrow Band Noise Figure.



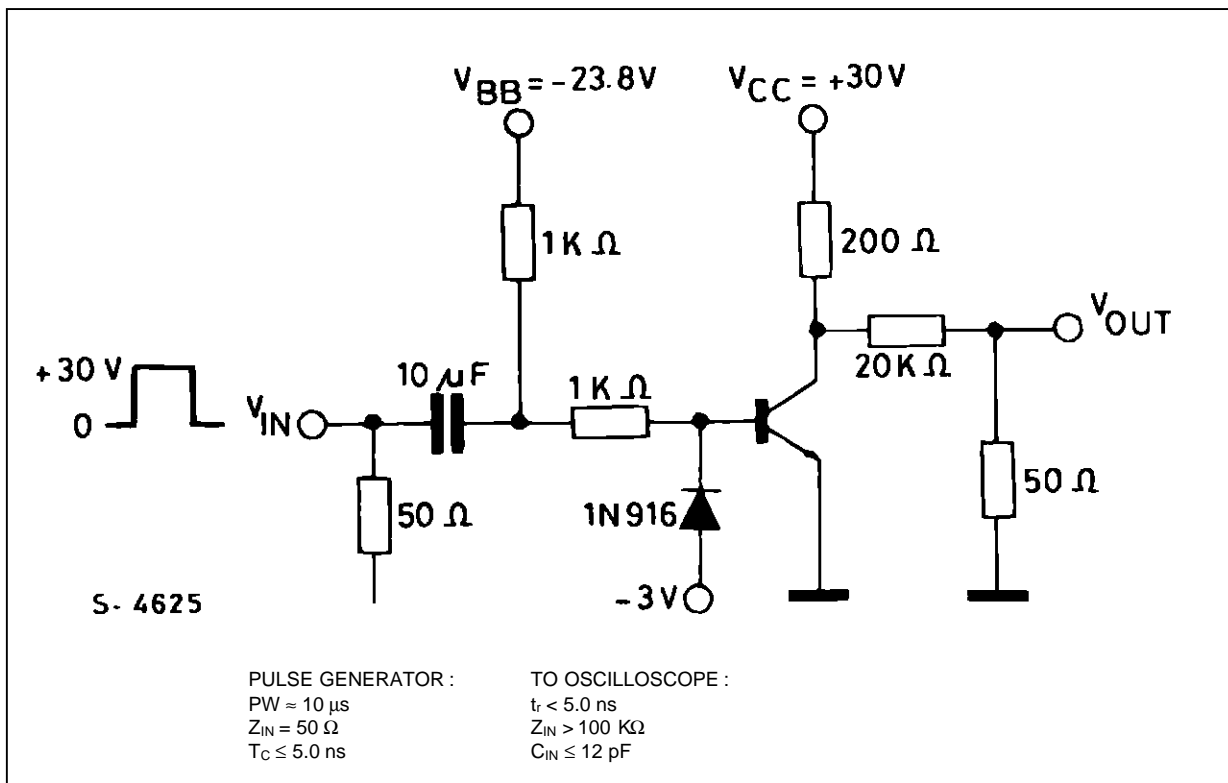
Switching Time vs. Collector Current.



Test Circuit for  $t_d$ ,  $t_r$ .

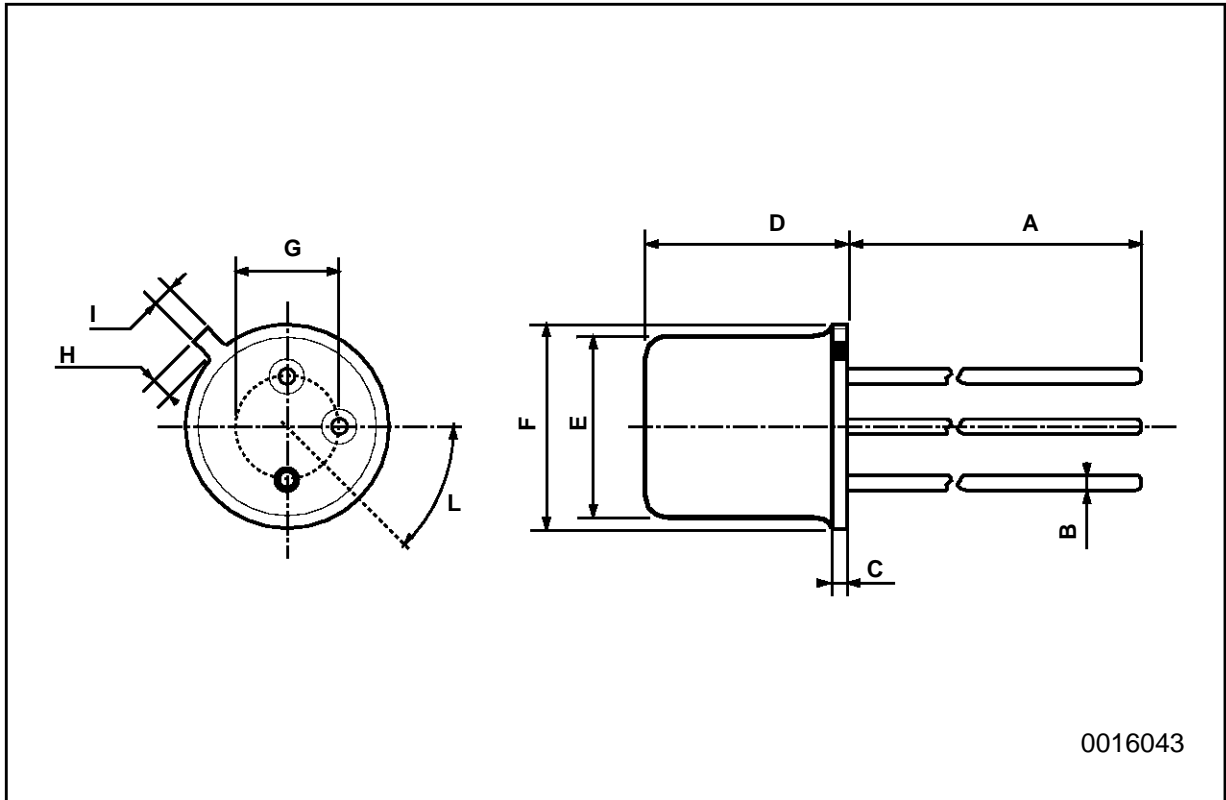


Test Circuit for  $t_d$ ,  $t_r$ .



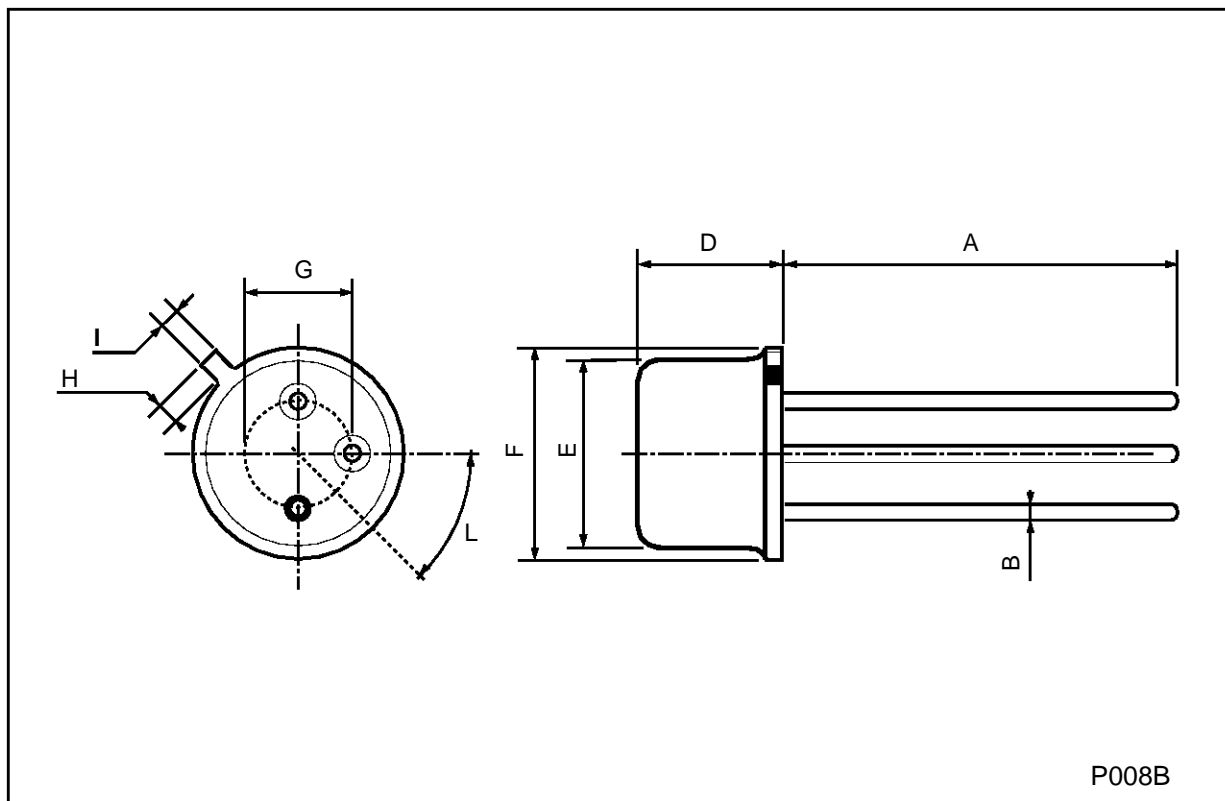
**TO-18 MECHANICAL DATA**

| 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°   |       |       |



## 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.) |      |      |       |      |       |



P008B



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