

X00126

# 2N5002 AND 2N5004

## 5 AMP

### HIGH SPEED NPN TRANSISTOR

## 100 VOLTS

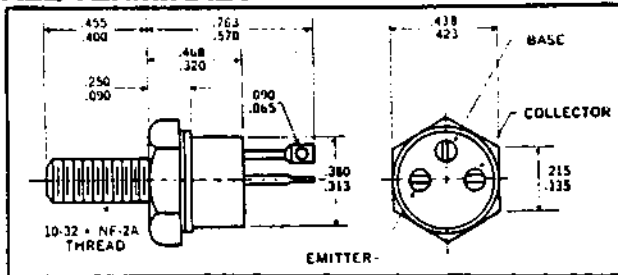


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#### CASE STYLE X

#### JEDEC TO-59

ALL TERMINALS ISOLATED FROM CASE



#### FEATURES

- RADIATION TOLERANT
- FAST SWITCHING, TYPICAL 200 NSEC ton
- HIGH FREQUENCY, TYPICAL  $f_T$  100 MHZ
- BVCEO 80 VOLTS MIN
- HIGH LINEAR GAIN, LOW SATURATION VOLTAGE
- 200°C OPERATING, GOLD EUTECTIC DIE ATTACH
- DESIGNED FOR COMPLEMENTARY USE WITH 2N5003 AND 2N5005

#### MAXIMUM RATINGS

| Rating  | Symbol         | Value       | Unit  |
|---|----------------|-------------|-------|
| Collector - Emitter Voltage                   | $V_{CEO}$      | 80          | Volts |
| Collector - Base Voltage                      | $V_{CBO}$      | 100         | Volts |
| Emitter - Base Voltage                        | $V_{EBO}$      | 6           | Volts |
| Collector Current                             | $I_C$          | 5           | Amps  |
| Base Current                                  | $I_B$          | 2           | Amps  |
| Total Device Dissipation @ $T_C = 50^\circ C$ | $P_D$          | 50          | Watts |
| Derate above 50 °C                            |                | 333         | mW/°C |
| Operating and Storage Temperature             | $T_j, T_{stg}$ | -65 to +200 | °C    |

#### THERMAL CHARACTERISTICS

| Characteristics                      | Symbol          | Value | Unit |
|--------------------------------------|-----------------|-------|------|
| Thermal Resistance, Junction to Case | $R_{\theta JC}$ | 3.0   | °C/W |

#### ELECTRICAL CHARACTERISTICS

| Characteristics  | Symbol       | Min. | Max. | Unit |
|--|--------------|------|------|------|
| Collector - Emitter Breakdown Voltage*<br>( $I_C = 100$ mA dc) | $BV_{CEO}^*$ | 80   |      | Vdc  |
| Collector - Base Breakdown Voltage<br>( $I_C = 200$ uA dc)     | $BV_{CBO}$   | 100  |      | Vdc  |
| Emitter - Base Breakdown Voltage<br>( $I_E = 200$ uA dc)       | $BV_{EBO}$   | 6    |      | Vdc  |

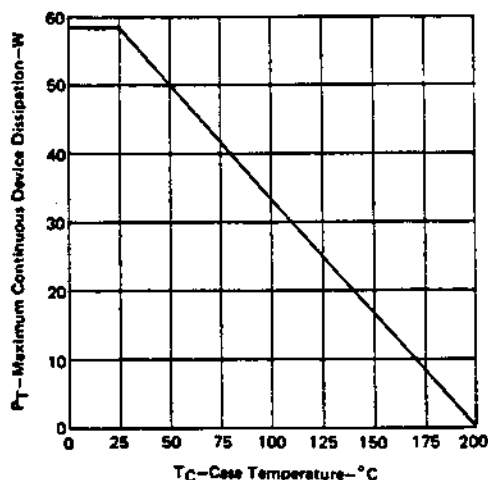
# ELECTRICAL CHARACTERISTICS

| Characteristics   |  | Symbol                 | Min.     | Max.  | Unit                               |
|---|--|------------------------|----------|---|------------------------------------|
| Collector Cutoff Current<br>( $V_{CE} = 60 \text{ Vdc}$ , $V_{BE} = 2 \text{ Vdc}$ , $T_C = 150^\circ\text{C}$ )<br>( $V_{CE} = 40 \text{ Vdc}$ ) |  | $I_{CEV}$<br>$I_{CEO}$ |          | 500<br>50                                     | $\mu\text{Adc}$<br>$\mu\text{Adc}$ |
| Collector Cutoff Current<br>( $V_{CE} = 60 \text{ Vdc}$ )<br>( $V_{CE} = 100 \text{ Vdc}$ )   |  | $I_{CES}$              |          | 1.0<br>1.0                                    | $\mu\text{Adc}$<br>$\text{mAdc}$   |
| Emitter Cutoff Current<br>( $V_{EB} = 5 \text{ Vdc}$ )<br>( $V_{EB} = 6 \text{ Vdc}$ )  |  | $I_{EBO}$              |          | 1.0<br>1.0                                    | $\mu\text{Adc}$<br>$\text{mAdc}$   |
| DC Current Gain*  |  | $h_{FE}$               |          | 20<br>50<br>30<br>90<br>70<br>200<br>20<br>40 |                                    |
| $I_C = 50 \text{ mAdc}$ , $V_{CE} = 5 \text{ Vdc}$  | 2N5002   |                        |          |   |                                    |
| $I_C = 2.5 \text{ Adc}$ , $V_{CE} = 5 \text{ Vdc}$  | 2N5004   |                        |          |   |                                    |
| $I_C = 5 \text{ Adc}$ , $V_{CE} = 5 \text{ Vdc}$  | 2N5002<br>2N5004   |                        |          |   |                                    |
| Collector - Emitter Saturation Voltage*   |  | $V_{CE (SAT)}$         |          | 0.75<br>1.5                                   | $\text{Vdc}$                       |
| $I_C = 2.5 \text{ Adc}$ , $I_B = 250 \text{ mAdc}$  |  |                        |          |   |                                    |
| $I_C = 5 \text{ Adc}$ , $I_B = 500 \text{ mAdc}$  |  |                        |          |   |                                    |
| Base - Emitter Saturation Voltage*  |  | $V_{BE (SAT)}$         |          | 1.45<br>2.2                                   | $\text{Vdc}$                       |
| $I_C = 2.5 \text{ Adc}$ , $I_B = 250 \text{ mAdc}$  |  |                        |          |   |                                    |
| $I_C = 5 \text{ Adc}$ , $I_B = 500 \text{ mAdc}$  |  |                        |          |   |                                    |
| Current - Gain - Bandwidth Product<br>( $I_C = 500 \text{ mAdc}$ , $V_{CE} = 5 \text{ Vdc}$ , $f = 20 \text{ MHz}$ )                              |  | $f_T$                  | 60<br>70 |   | $\text{MHz}$                       |
| Output Capacitance<br>( $V_{CB} = 10 \text{ Vdc}$ , $I_E = 0.1 = 1 \text{ MHz}$ )   |  | $C_{ob}$               |          | 250   | $\text{pF}$                        |
| Base - Emitter Voltage*<br>( $V_{CE} = 5 \text{ Vdc}$ , $I_C = 2.5 \text{ Adc}$ )   |  | $V_{BE (ON)}$ *        |          | 1.45  | $\text{Vdc}$                       |
| Delay Time  | $(V_{CC} = 30 \text{ Vdc}$ ,<br>$I_C = 5 \text{ Adc}$ ,<br>$V_{EB(Off)} = 3.7 \text{ Vdc}$ ,<br>$I_{B1} = I_{B2} = 500 \text{ mAdc}$ ,<br>$R_L = 6 \text{ Ohms}$ ) | $t_d$<br>$t_r$ +       |          | 500   | $\text{ns}$                        |
| Rise Time   |  |                        |          |   |                                    |
| Storage Time  |  | $t_s$<br>$t_f$ +       |          | 1.3   | $\mu\text{s}$                      |
| Fall Time   |  |                        |          |   |                                    |

\*Pulse Test: Pulse width = 300  $\mu\text{s}$ , DutyCycle = 2%

## TYPICAL OPERATING CURVES

DISSIPATION DERATING CURVE



FORWARD BIAS DC SAFE OPERATION AREA (S.O.A. CURVE)  
CURVES APPLY BELOW RATED  $V_{CEO}$ ,  $T_C = 25^\circ\text{C}$

