

# Medium-Power Plastic PNP Silicon Transistors

... designed for driver circuits, switching, and amplifier applications. These high-performance plastic devices feature:

- Low Saturation Voltage —  $V_{CE(sat)} = 0.6 \text{ Vdc (Max) @ } I_C = 1.0 \text{ Amp}$
- Excellent Power Dissipation Due to Thermopad Construction —  $P_D = 30 \text{ W @ } T_C = 25^\circ\text{C}$
- Excellent Safe Operating Area
- Gain Specified to  $I_C = 1.0 \text{ Amp}$
- Complement to NPN 2N4921, 2N4922, 2N4923

**\*MAXIMUM RATINGS**

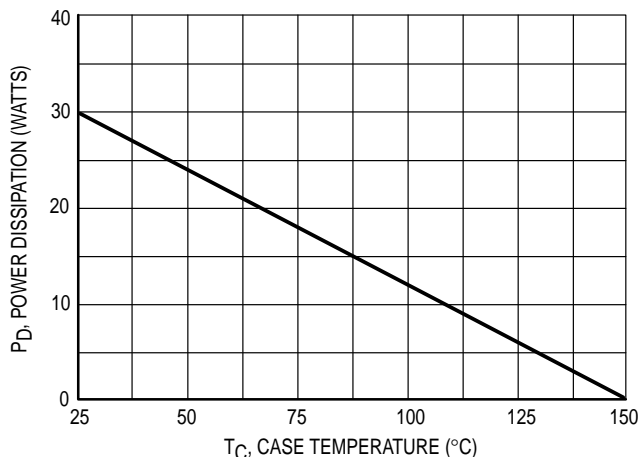
| Ratings   | Symbol         | 2N4918      | 2N4919 | 2N4920 | Unit                         |
|---|----------------|-------------|--------|--------|------------------------------|
| Collector-Emitter Voltage   | $V_{CEO}$      | 40          | 60     | 80     | Vdc                          |
| Collector-Base Voltage  | $V_{CB}$       | 40          | 60     | 80     | Vdc                          |
| Emitter-Base Voltage  | $V_{EB}$       | 5.0         |        |        | Vdc                          |
| Collector Current — Continuous (1)  | $I_C^*$        | 1.0<br>3.0  |        |        | Adc                          |
| Base Current  | $I_B$          | 1.0         |        |        | Adc                          |
| Total Power Dissipation @ $T_C = 25^\circ\text{C}$<br>Derate above $25^\circ\text{C}$ | $P_D$          | 30<br>0.24  |        |        | Watts<br>W/ $^\circ\text{C}$ |
| Operating & Storage Junction<br>Temperature Range                                     | $T_J, T_{stg}$ | -65 to +150 |        |        | $^\circ\text{C}$             |

**THERMAL CHARACTERISTICS (2)**

| Characteristic                       | Symbol        | Max  | Unit               |
|--------------------------------------|---------------|------|--------------------|
| Thermal Resistance, Junction to Case | $\theta_{JC}$ | 4.16 | $^\circ\text{C/W}$ |

\* Indicates JEDEC Registered Data for 2N4918 Series.

- (1) The 1.0 Amp maximum  $I_C$  value is based upon JEDEC current gain requirements. The 3.0 Amp maximum value is based upon actual current-handling capability of the device (See Figure 5).
- (2) Recommend use of thermal compound for lowest thermal resistance.



**Figure 1. Power Derating**

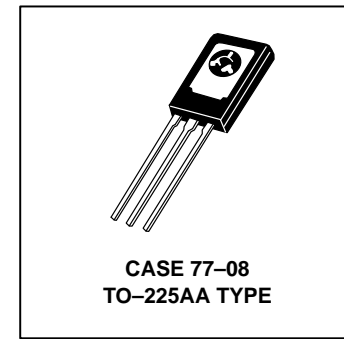
Preferred devices are Motorola recommended choices for future use and best overall value.

REV 7

**2N4918  
thru  
2N4920\***

\*Motorola Preferred Device

**3 AMPERE  
GENERAL-PURPOSE  
POWER TRANSISTORS  
40-80 VOLTS  
30 WATTS**



# 2N4918 thru 2N4920

## ELECTRICAL CHARACTERISTICS ( $T_C = 25^\circ\text{C}$ unless otherwise noted)

| Characteristic   | Symbol        | Min            | Max               | Unit |
|--|---------------|----------------|-------------------|------|
| <b>OFF CHARACTERISTICS</b>   |               |                |                   |      |
| Collector–Emitter Sustaining Voltage (1)<br>( $I_C = 0.1 \text{ Adc}$ , $I_B = 0$ )  | $V_{CE(sus)}$ | 40<br>60<br>80 | —                 | Vdc  |
| Collector Cutoff Current<br>( $V_{CE} = 20 \text{ Vdc}$ , $I_B = 0$ )<br>( $V_{CE} = 30 \text{ Vdc}$ , $I_B = 0$ )<br>( $V_{CE} = 40 \text{ Vdc}$ , $I_B = 0$ )  | $I_{CEO}$     | —<br>—<br>—    | 0.5<br>0.5<br>0.5 | mAdc |
| Collector Cutoff Current<br>( $V_{CE} = \text{Rated } V_{CEO}$ , $V_{BE(off)} = 1.5 \text{ Vdc}$ )<br>( $V_{CE} = \text{Rated } V_{CEO}$ , $V_{BE(off)} = 1.5 \text{ Vdc}$ , $T_C = 125^\circ\text{C}$ ) | $I_{CEX}$     | —<br>—         | 0.1<br>0.5        | mAdc |
| Collector Cutoff Current<br>( $V_{CB} = \text{Rated } V_{CB}$ , $I_E = 0$ )  | $I_{CBO}$     | —              | 0.1               | mAdc |
| Emitter Cutoff Current<br>( $V_{BE} = 5.0 \text{ Vdc}$ , $I_C = 0$ )   | $I_{EBO}$     | —              | 1.0               | mAdc |

## ON CHARACTERISTICS

|  |               |                |               |     |
|--|---------------|----------------|---------------|-----|
| DC Current Gain (1)<br>( $I_C = 50 \text{ mAdc}$ , $V_{CE} = 1.0 \text{ Vdc}$ )<br>( $I_C = 500 \text{ mAdc}$ , $V_{CE} = 1.0 \text{ Vdc}$ )<br>( $I_C = 1.0 \text{ Adc}$ , $V_{CE} = 1.0 \text{ Vdc}$ ) | $h_{FE}$      | 40<br>30<br>10 | —<br>150<br>— | —   |
| Collector–Emitter Saturation Voltage (1)<br>( $I_C = 1.0 \text{ Adc}$ , $I_B = 0.1 \text{ Adc}$ )  | $V_{CE(sat)}$ | —              | 0.6           | Vdc |
| Base–Emitter Saturation Voltage (1)<br>( $I_C = 1.0 \text{ Adc}$ , $I_B = 0.1 \text{ Adc}$ )   | $V_{BE(sat)}$ | —              | 1.3           | Vdc |
| Base–Emitter On Voltage (1)<br>( $I_C = 1.0 \text{ Adc}$ , $V_{CE} = 1.0 \text{ Vdc}$ )  | $V_{BE(on)}$  | —              | 1.3           | Vdc |

## SMALL–SIGNAL CHARACTERISTICS

|   |          |     |     |     |
|---|----------|-----|-----|-----|
| Current–Gain — Bandwidth Product ( $I_C = 250 \text{ mAdc}$ , $V_{CE} = 10 \text{ Vdc}$ , $f = 1.0 \text{ MHz}$ ) | $f_T$    | 3.0 | —   | MHz |
| Output Capacitance ( $V_{CB} = 10 \text{ Vdc}$ , $I_E = 0$ , $f = 100 \text{ kHz}$ )                              | $C_{ob}$ | —   | 100 | pF  |
| Small–Signal Current Gain ( $I_C = 250 \text{ mAdc}$ , $V_{CE} = 10 \text{ Vdc}$ , $f = 1.0 \text{ kHz}$ )        | $h_{fe}$ | 25  | —   | —   |

\* Indicates JEDEC Registered Data.

(1) Pulse Test:  $PW \approx 300 \mu\text{s}$ , Duty Cycle  $\approx 2.0\%$

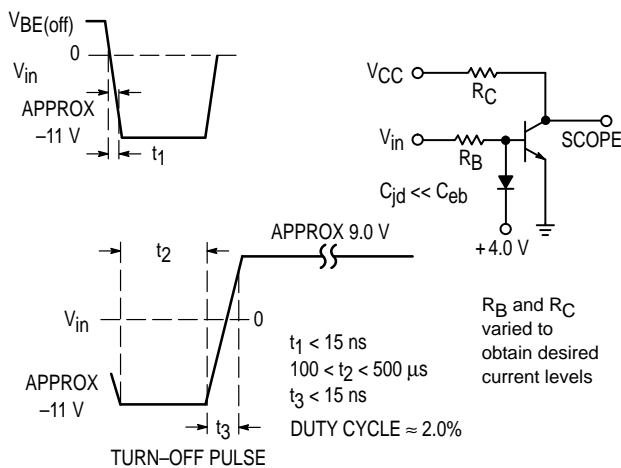


Figure 2. Switching Time Equivalent Test Circuit

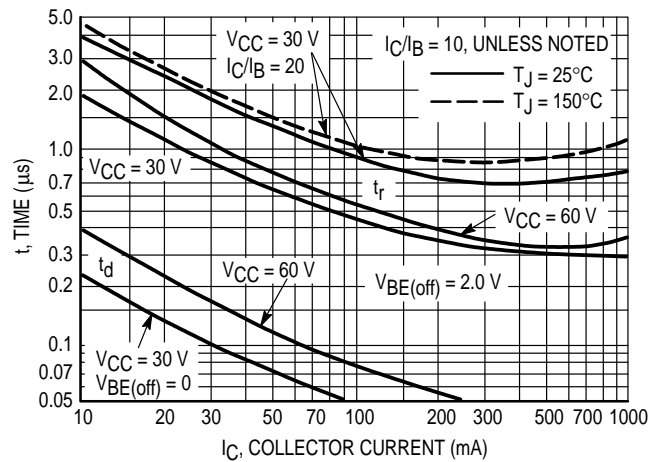


Figure 3. Turn-On Time

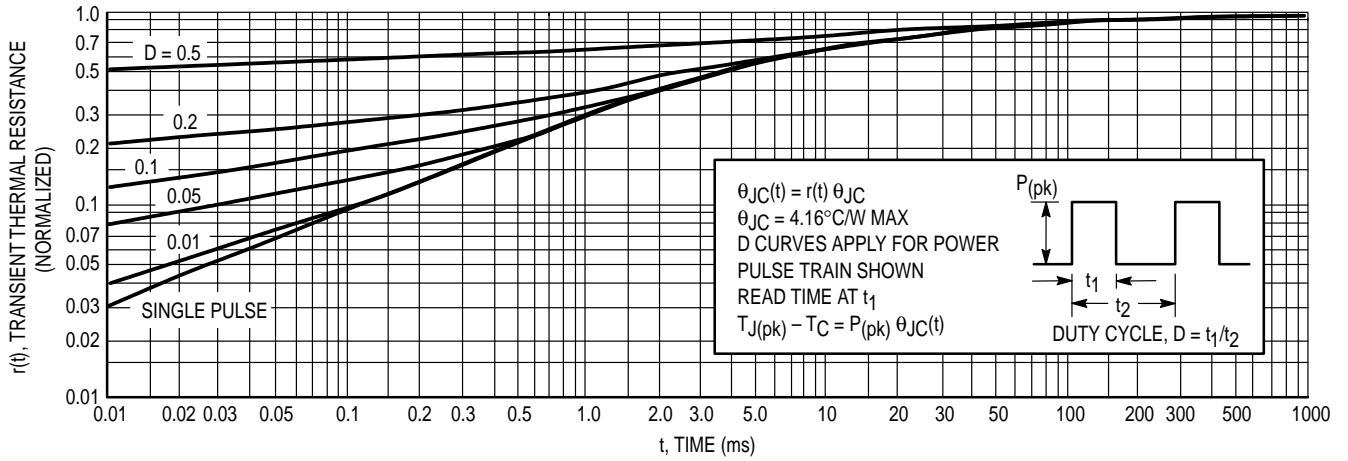


Figure 4. Thermal Response

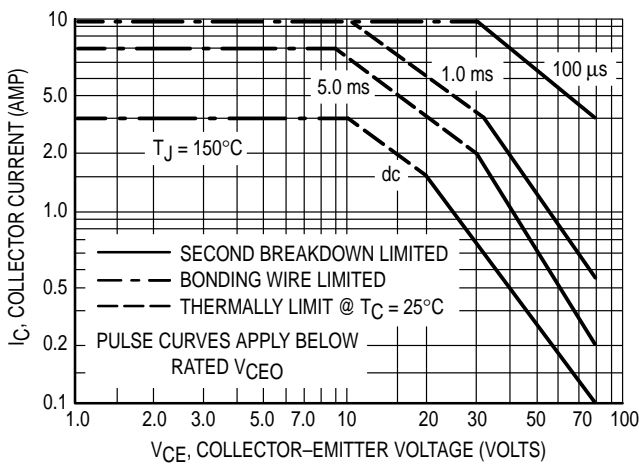


Figure 5. Active-Region Safe Operating Area

There are two limitations on the power handling ability of a transistor: average junction temperature and second breakdown. Safe operating area curves indicate  $I_C - V_{CE}$  operation i.e., the transistor must not be subjected to greater dissipation than the curves indicate.

The data of Figure 5 is based on  $T_{J(pk)} = 150^\circ\text{C}$ ;  $T_C$  is variable depending on conditions. Second breakdown pulse limits are valid for duty cycles to 10% provided  $T_{J(pk)} \leq 150^\circ\text{C}$ . At high case temperatures, thermal limitations will reduce the power that can be handled to values less than the limitations imposed by second breakdown.

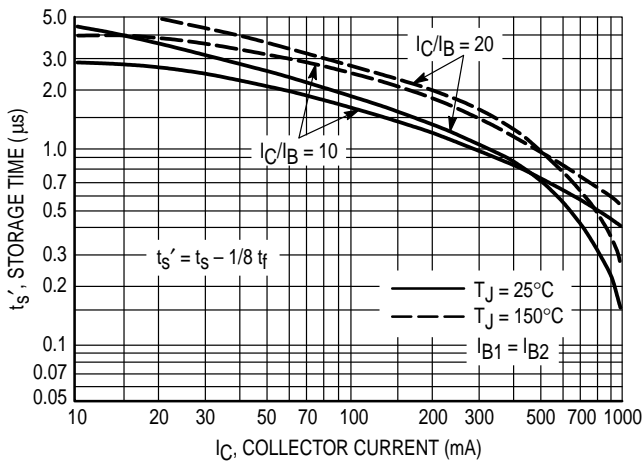


Figure 6. Storage Time

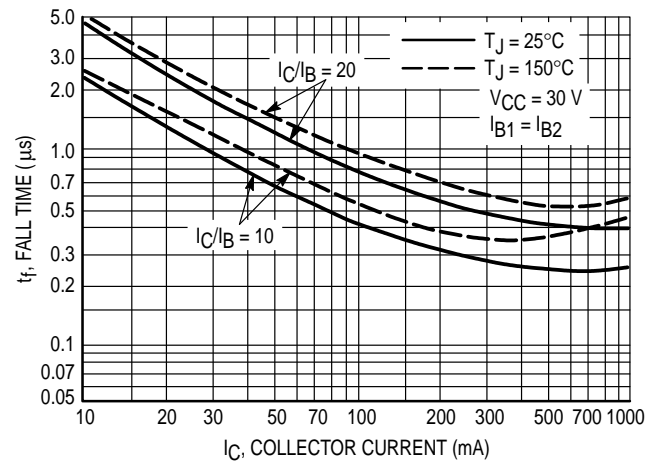


Figure 7. Fall Time

TYPICAL DC CHARACTERISTICS

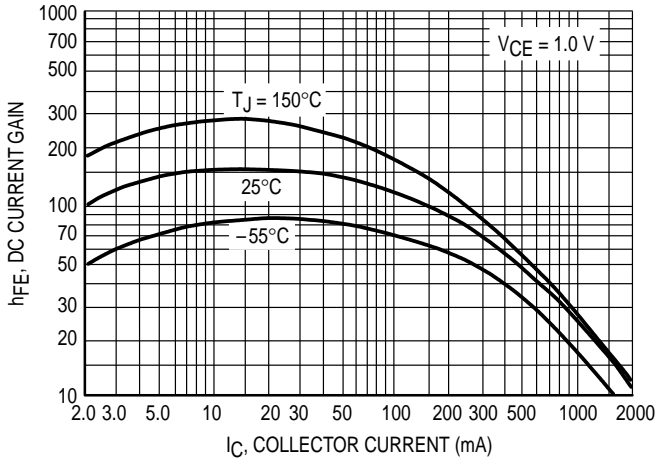


Figure 8. Current Gain

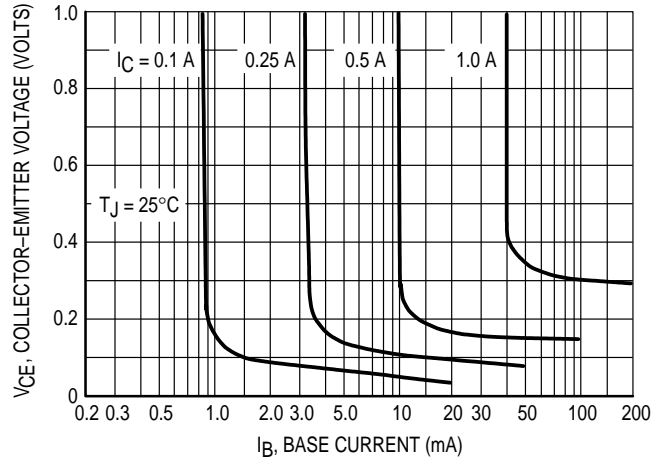


Figure 9. Collector Saturation Region

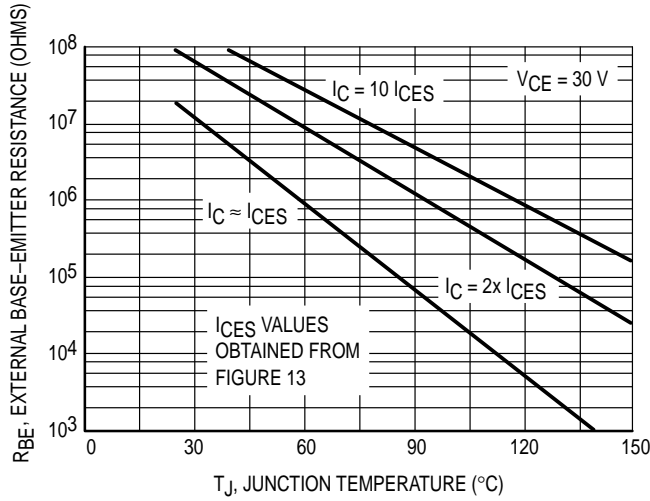


Figure 10. Effects of Base-Emitter Resistance

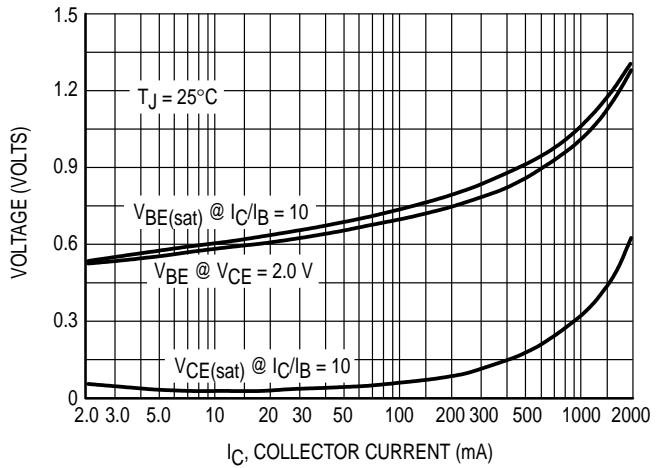


Figure 11. "On" Voltage

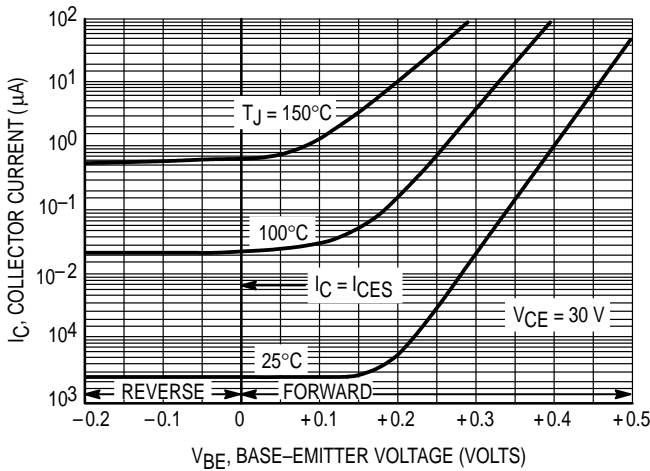


Figure 12. Collector Cut-Off Region

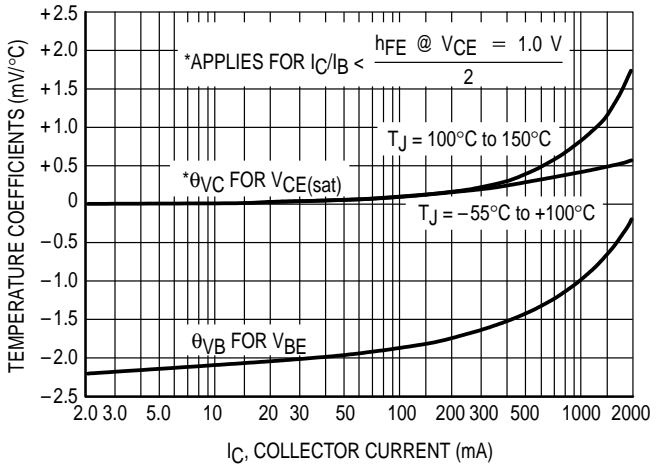
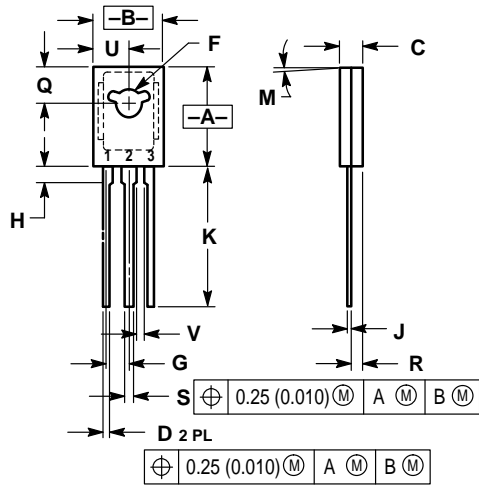


Figure 13. Temperature Coefficients

PACKAGE DIMENSIONS




- NOTES:  
 1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.  
 2. CONTROLLING DIMENSION: INCH.

| DIM | INCHES    |       | MILLIMETERS |       |
|-----|-----------|-------|-------------|-------|
|     | MIN       | MAX   | MIN         | MAX   |
| A   | 0.425     | 0.435 | 10.80       | 11.04 |
| B   | 0.295     | 0.305 | 7.50        | 7.74  |
| C   | 0.095     | 0.105 | 2.42        | 2.66  |
| D   | 0.020     | 0.026 | 0.51        | 0.66  |
| F   | 0.115     | 0.130 | 2.93        | 3.30  |
| G   | 0.094 BSC |       | 2.39 BSC    |       |
| H   | 0.050     | 0.095 | 1.27        | 2.41  |
| J   | 0.015     | 0.025 | 0.39        | 0.63  |
| K   | 0.575     | 0.655 | 14.61       | 16.63 |
| M   | 5° TYP    |       | 5° TYP      |       |
| Q   | 0.148     | 0.158 | 3.76        | 4.01  |
| R   | 0.045     | 0.055 | 1.15        | 1.39  |
| S   | 0.025     | 0.035 | 0.64        | 0.88  |
| U   | 0.145     | 0.155 | 3.69        | 3.93  |
| V   | 0.040     | —     | 1.02        | —     |

- STYLE 1:  
 PIN 1. EMITTER  
 2. COLLECTOR  
 3. BASE

CASE 77-08  
 TO-225AA TYPE  
 ISSUE V

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