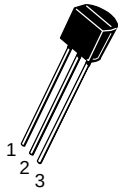
# High Voltage Transistors

**NPN**
**2N6515**
**2N6517**
**PNP**
**2N6520**

**Voltage and current are negative for PNP transistors**



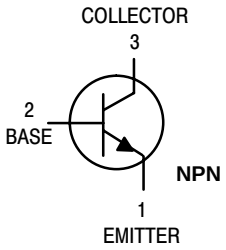

**CASE 29–04, STYLE 1**
**TO–92 (TO–226AA)**

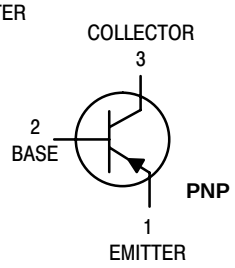
**MAXIMUM RATINGS**

| Rating | Symbol | 2N6515 | 2N6517 2N6520 | Unit |
|---|---|---|---|---|
| Collector–Emitter Voltage | $V_{CEO}$ | 250 | 350 | Vdc |
| Collector–Base Voltage | $V_{CBO}$ | 250 | 350 | Vdc |
| Emitter–Base Voltage 2N6515, 2N6516, 2N6517 2N6519, 2N6520 | $V_{EBO}$ | 6.0 5.0 | | Vdc |
| Base Current | $I_B$ | 250 | | mAdc |
| Collector Current – Continuous | $I_C$ | 500 | | mAdc |
| Total Device Dissipation @ $T_A$ = 25°C Derate above 25°C | $P_D$ | 625 5.0 | | mW mW/°C |
| Total Device Dissipation @ $T_C$ = 25°C Derate above 25°C | $P_D$ | 1.5 12 | | Watts mW/°C |
| Operating and Storage Junction Temperature Range | $T_J$, $T_{stg}$ | –55 to +150 | | °C |

**THERMAL CHARACTERISTICS**

| Characteristic | Symbol | Max | Unit |
|---|---|---|---|
| Thermal Resistance, Junction to Ambient | $R_{\theta JA}$ | 200 | °C/W |
| Thermal Resistance, Junction to Case | $R_{\theta JC}$ | 83.3 | °C/W |




**ELECTRICAL CHARACTERISTICS** ($T_A$ = 25°C unless otherwise noted)

| Characteristic | | Symbol | Min | Max | Unit |
|---|---|---|---|---|---|
| **OFF CHARACTERISTICS** | | | | | |
| Collector–Emitter Breakdown Voltage[1] ($I_C$ = 1.0 mAdc, $I_B$ = 0) | 2N6515<br>2N6517, 2N6520 | $V_{(BR)CEO}$ | <br>250<br>350 | <br>–<br>– | Vdc |
| Collector–Base Breakdown Voltage ($I_C$ = 100 μAdc, $I_E$ = 0 ) | 2N6515<br>2N6517, 2N6520 | $V_{(BR)CBO}$ | <br>250<br>350 | <br>–<br>– | Vdc |
| Emitter–Base Breakdown Voltage ($I_E$ = 10 μAdc, $I_C$ = 0) | 2N6515, 2N6517<br>2N6520 | $V_{(BR)EBO}$ | <br>6.0<br>5.0 | <br>–<br>– | Vdc |

1. Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2.0%.



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Publication Order Number:
2N6515/D

**ELECTRICAL CHARACTERISTICS** ($T_A$ = 25°C unless otherwise noted) (Continued)

| Characteristic | | Symbol | Min | Max | Unit |
|---|---|---|---|---|---|
| **OFF CHARACTERISTICS** (Continued) | | | | | |
| Collector Cutoff Current | | $I_{CBO}$ | | | nAdc |
| ($V_{CB}$ = 150 Vdc, $I_E$ = 0) | 2N6515 | | – | 50 | |
| ($V_{CB}$ = 250 Vdc, $I_E$ = 0) | 2N6517, 2N6520 | | – | 50 | |
| Emitter Cutoff Current | | $I_{EBO}$ | | | nAdc |
| ($V_{EB}$ = 5.0 Vdc, $I_C$ = 0) | 2N6515, 2N6517 | | – | 50 | |
| ($V_{EB}$ = 4.0 Vdc, $I_C$ = 0) | 2N6520 | | – | 50 | |
| **ON CHARACTERISTICS**(1) | | | | | |
| DC Current Gain | | $h_{FE}$ | | | – |
| ($I_C$ = 1.0 mAdc, $V_{CE}$ = 10 Vdc) | 2N6515 | | 35 | – | |
| | 2N6517, 2N6520 | | 20 | – | |
| ($I_C$ = 10 mAdc, $V_{CE}$ = 10 Vdc) | 2N6515 | | 50 | – | |
| | 2N6517, 2N6520 | | 30 | – | |
| ($I_C$ = 30 mAdc, $V_{CE}$ = 10 Vdc) | 2N6515 | | 50 | 300 | |
| | 2N6517, 2N6520 | | 30 | 200 | |
| ($I_C$ = 50 mAdc, $V_{CE}$ = 10 Vdc) | 2N6515 | | 45 | 220 | |
| | 2N6517, 2N6520 | | 20 | 200 | |
| ($I_C$ = 100 mAdc, $V_{CE}$ = 10 Vdc) | 2N6515 | | 25 | – | |
| | 2N6517, 2N6520 | | 15 | – | |
| Collector–Emitter Saturation Voltage | | $V_{CE(sat)}$ | | | Vdc |
| ($I_C$ = 10 mAdc, $I_B$ = 1.0 mAdc) | | | – | 0.30 | |
| ($I_C$ = 20 mAdc, $I_B$ = 2.0 mAdc) | | | – | 0.35 | |
| ($I_C$ = 30 mAdc, $I_B$ = 3.0 mAdc) | | | – | 0.50 | |
| ($I_C$ = 50 mAdc, $I_B$ = 5.0 mAdc) | | | – | 1.0 | |
| Base–Emitter Saturation Voltage | | $V_{BE(sat)}$ | | | Vdc |
| ($I_C$ = 10 mAdc, $I_B$ = 1.0 mAdc) | | | – | 0.75 | |
| ($I_C$ = 20 mAdc, $I_B$ = 2.0 mAdc) | | | – | 0.85 | |
| ($I_C$ = 30 mAdc, $I_B$ = 3.0 mAdc) | | | – | 0.90 | |
| Base–Emitter On Voltage | | $V_{BE(on)}$ | – | 2.0 | Vdc |
| ($I_C$ = 100 mAdc, $V_{CE}$ = 10 Vdc) | | | | | |
| **SMALL–SIGNAL CHARACTERISTICS** | | | | | |
| Current–Gain – Bandwidth Product(1) | | $f_T$ | 40 | 200 | MHz |
| ($I_C$ = 10 mAdc, $V_{CE}$ = 20 Vdc, f = 20 MHz) | | | | | |
| Collector–Base Capacitance | | $C_{cb}$ | – | 6.0 | pF |
| ($V_{CB}$ = 20 Vdc, $I_E$ = 0, f = 1.0 MHz) | | | | | |
| Emitter–Base Capacitance | | $C_{eb}$ | | | pF |
| ($V_{EB}$ = 0.5 Vdc, $I_C$ = 0, f = 1.0 MHz) | 2N6515, 2N6517 | | – | 80 | |
| | 2N6520 | | – | 100 | |
| **SWITCHING CHARACTERISTICS** | | | | | |
| Turn–On Time | | $t_{on}$ | – | 200 | μs |
| ($V_{CC}$ = 100 Vdc, $V_{BE(off)}$ = 2.0 Vdc, $I_C$ = 50 mAdc, $I_{B1}$ = 10 mAdc) | | | | | |
| Turn–Off Time | | $t_{off}$ | – | 3.5 | μs |
| ($V_{CC}$ = 100 Vdc, $I_C$ = 50 mAdc, $I_{B1}$ = $I_{B2}$ = 10 mAdc) | | | | | |

1. Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2.0%.

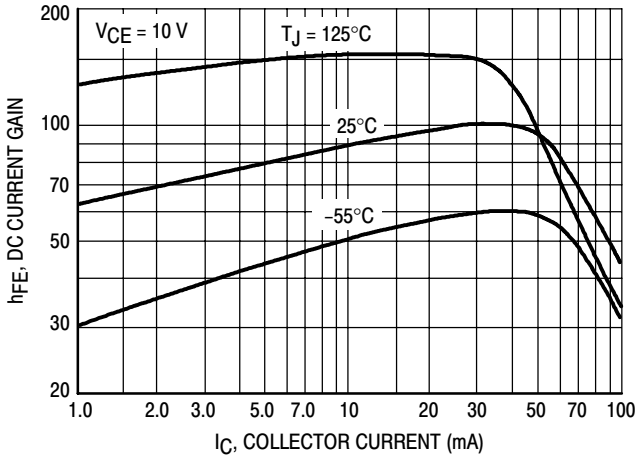



**Figure 1. DC Current Gain – NPN 2N6515**

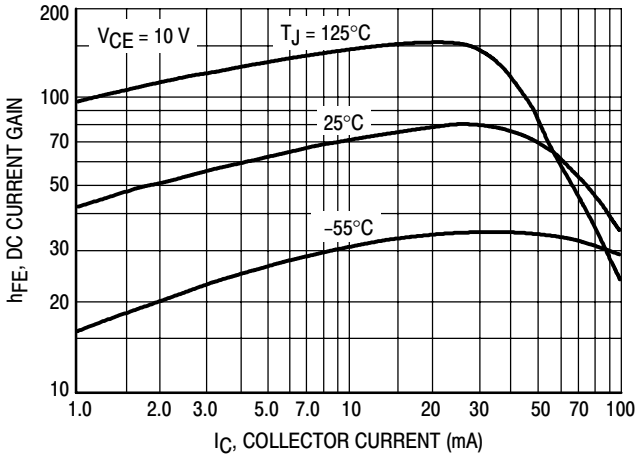



**Figure 2. DC Current Gain – NPN 2N6517**

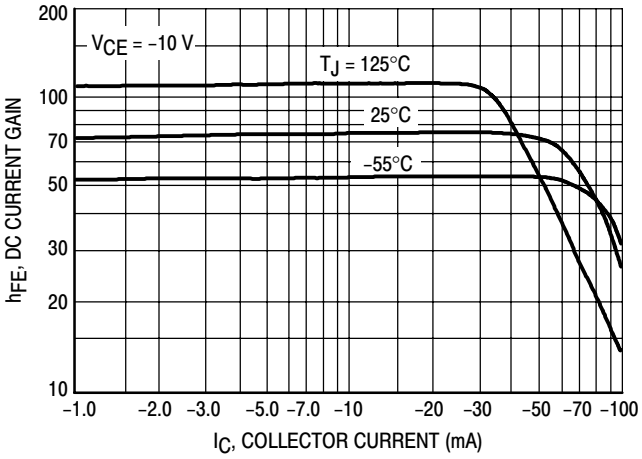



**Figure 3. DC Current Gain – PNP 2N6520**

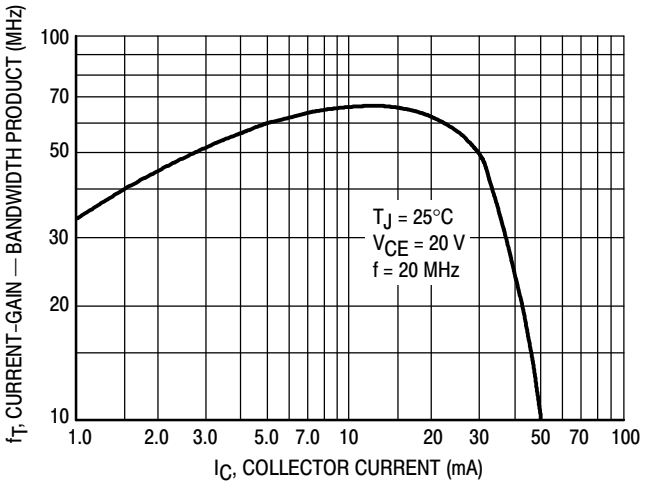



**Figure 4. Current–Gain – Bandwidth Product – NPN 2N6515, 2N6517**

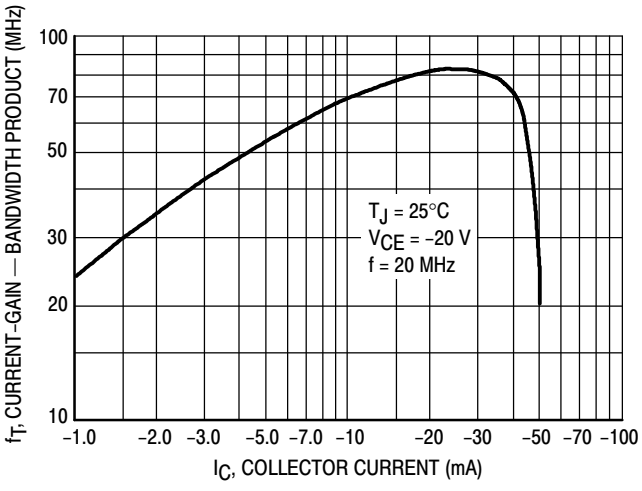



**Figure 5. Current–Gain – Bandwidth Product – PNP 2N6520**

**NPN**

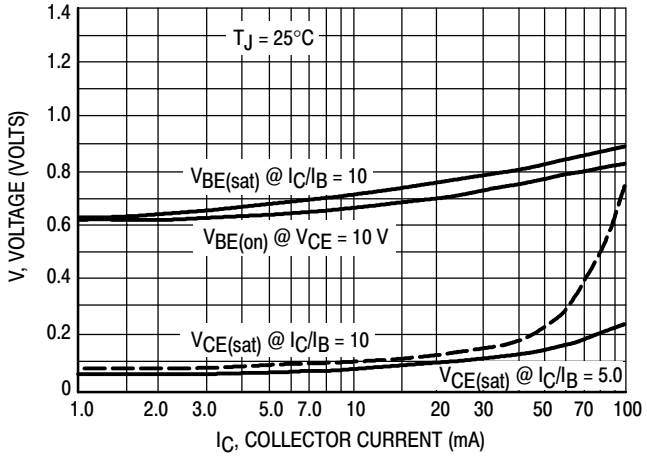



**Figure 6. “On” Voltages – NPN 2N6515, 2N6517**

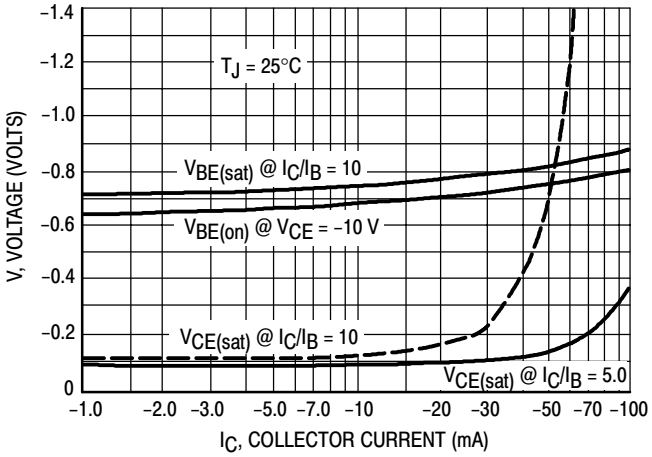



**Figure 7. “On” Voltages – PNP 2N6520**

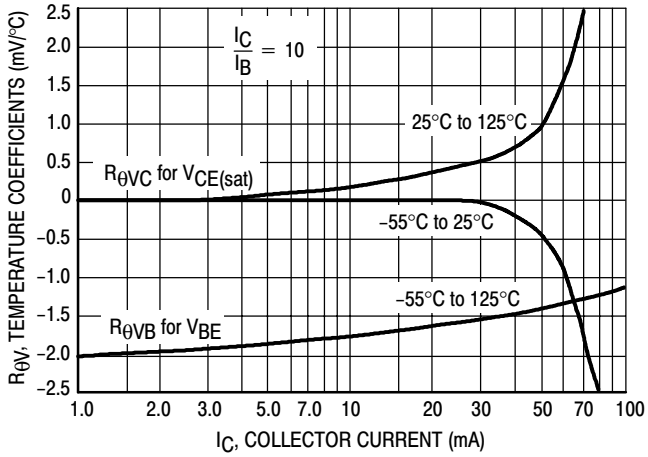



**Figure 8. Temperature Coefficients – NPN 2N6515, 2N6517**

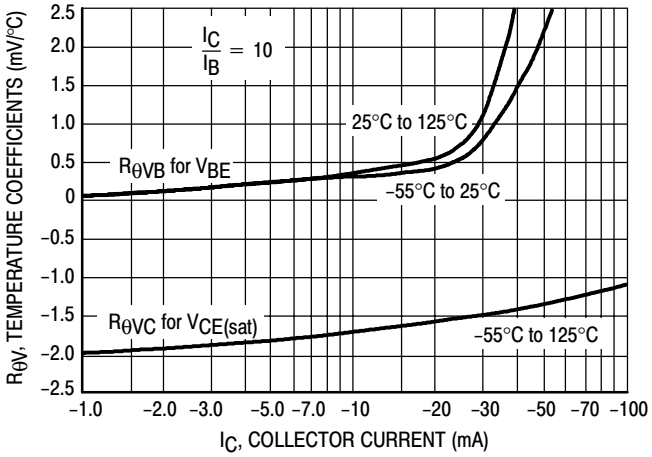



**Figure 9. Temperature Coefficients – PNP 2N6520**

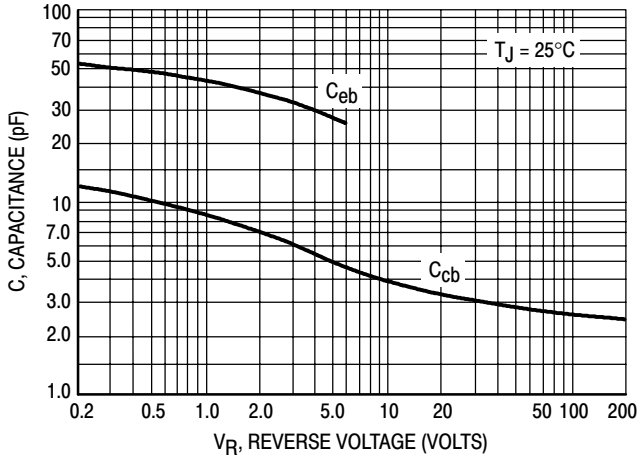



**Figure 10. Capacitance – NPN 2N6515, 2N6517**

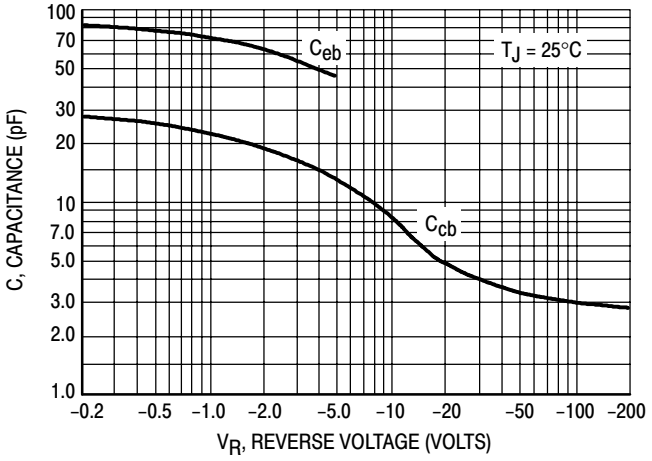



**Figure 11. Capacitance – PNP 2N6520**

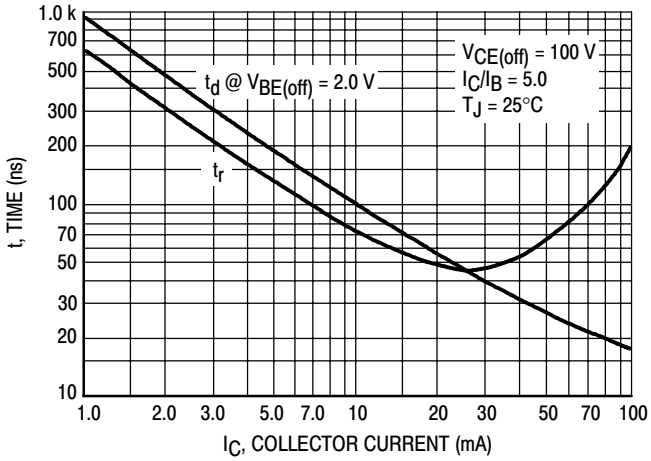



**Figure 12. Turn–On Time – NPN 2N6515, 2N6517**

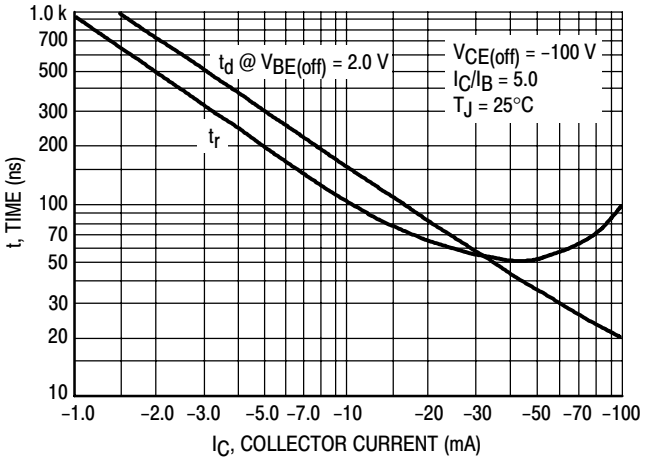



**Figure 13. Turn–On Time – PNP 2N6520**

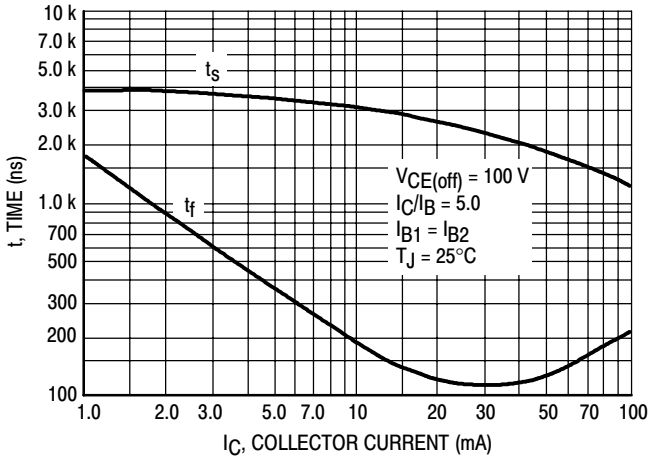



**Figure 14. Turn–Off Time – NPN 2N6515, 2N6517**

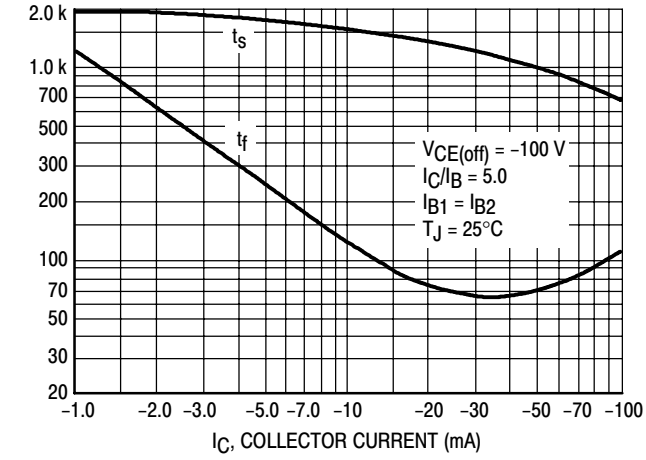



**Figure 15. Turn–Off Time – PNP 2N6520**

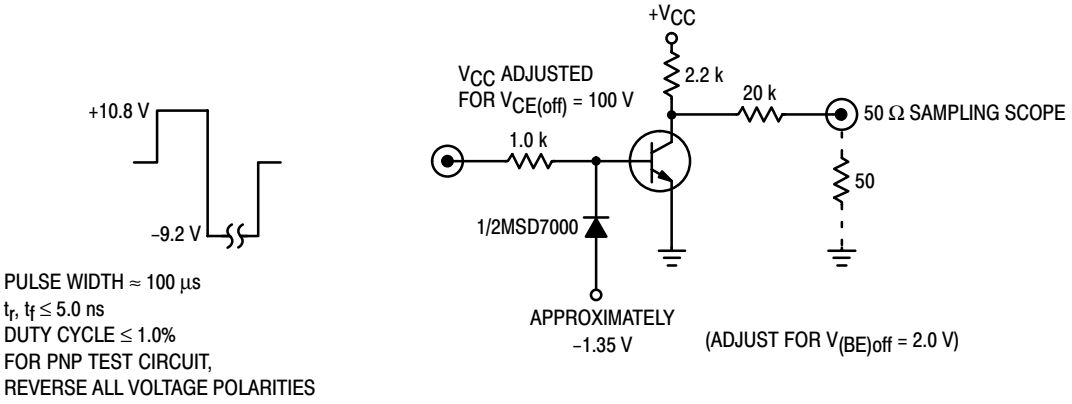



**Figure 16. Switching Time Test Circuit**

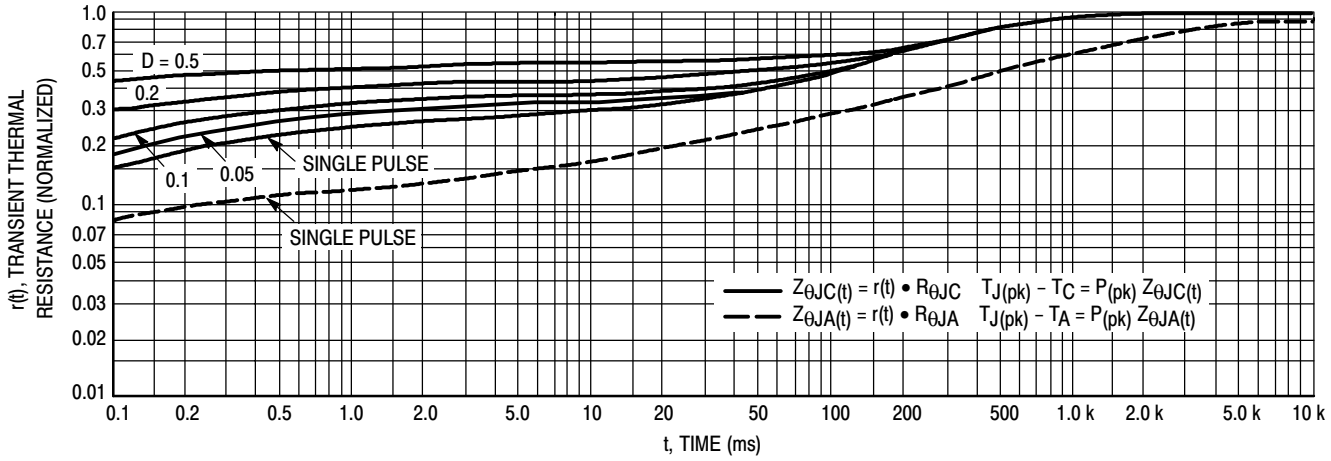



**Figure 17. Thermal Response**

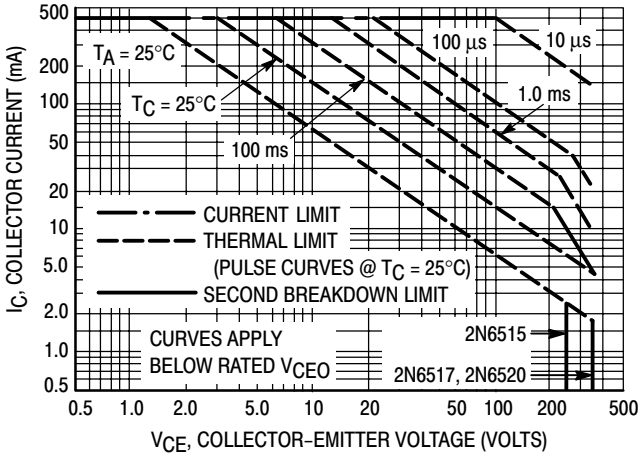
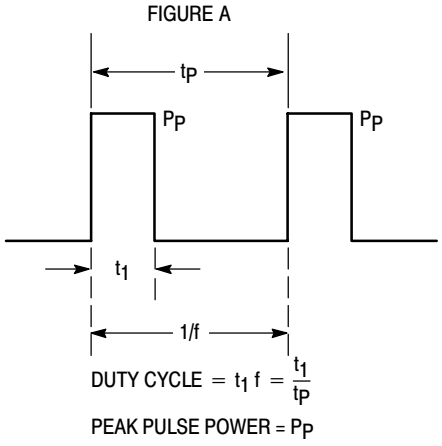


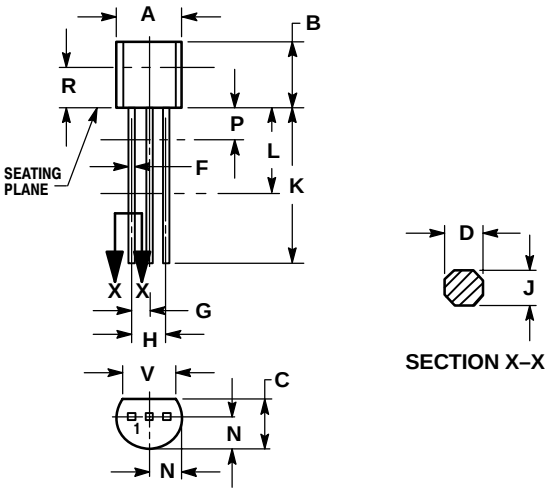

**Figure 18. Active Region Safe Operating Area**




**Design Note: Use of Transient Thermal Resistance Data**

## PACKAGE DIMENSIONS

**CASE 029–04**
**(TO–226AA)**
**ISSUE AD**




NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. CONTOUR OF PACKAGE BEYOND DIMENSION R IS UNCONTROLLED.
4. DIMENSION F APPLIES BETWEEN P AND L. DIMENSION D AND J APPLY BETWEEN L AND K MINIMUM. LEAD DIMENSION IS UNCONTROLLED IN P AND BEYOND DIMENSION K MINIMUM.

| | INCHES | | MILLIMETERS | |
|---|---|---|---|---|
| DIM | MIN | MAX | MIN | MAX |
| A | 0.175 | 0.205 | 4.45 | 5.20 |
| B | 0.170 | 0.210 | 4.32 | 5.33 |
| C | 0.125 | 0.165 | 3.18 | 4.19 |
| D | 0.016 | 0.022 | 0.41 | 0.55 |
| F | 0.016 | 0.019 | 0.41 | 0.48 |
| G | 0.045 | 0.055 | 1.15 | 1.39 |
| H | 0.095 | 0.105 | 2.42 | 2.66 |
| J | 0.015 | 0.020 | 0.39 | 0.50 |
| K | 0.500 | --- | 12.70 | --- |
| L | 0.250 | --- | 6.35 | --- |
| N | 0.080 | 0.105 | 2.04 | 2.66 |
| P | --- | 0.100 | --- | 2.54 |
| R | 0.115 | --- | 2.93 | --- |
| V | 0.135 | --- | 3.43 | --- |

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

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