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NPN - 2N6515, 2N6517; PNP - 2N6520



ON Semiconductor®

<http://onsemi.com>

High Voltage Transistors NPN and PNP

Features

- Voltage and Current are Negative for PNP Transistors
- These are Pb-Free Devices*

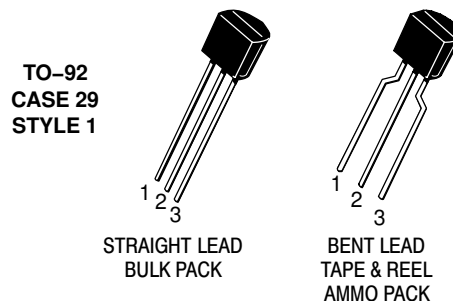
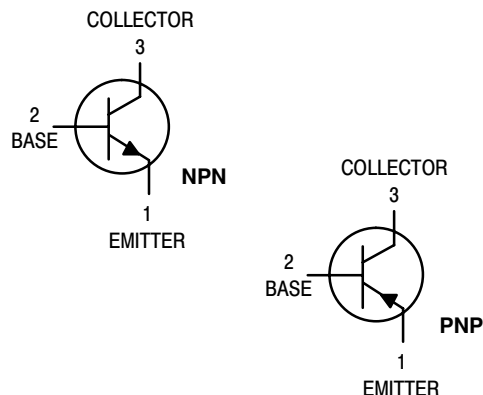
MAXIMUM RATINGS

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

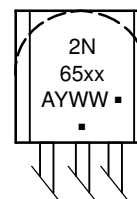
THERMAL CHARACTERISTICS

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

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.



MARKING DIAGRAM



- xx = 15, 17, or 20
- A = Assembly Location
- Y = Year
- WW = Work Week
- = Pb-Free Package

(Note: Microdot may be in either location)

ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 6 of this data sheet.

*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

NPN – 2N6515, 2N6517; PNP – 2N6520

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

| Characteristic | Symbol | Min | Max | Unit | |
|--|--------------------------|----------------------|------------|----------|------------------|
| OFF CHARACTERISTICS | | | | | |
| Collector–Emitter Breakdown Voltage (Note 1) (I _C = 1.0 mA _{dc} , I _B = 0) | 2N6515 2N6517, 2N6520 | V _{(BR)CEO} | 250 350 | – – | V _{dc} |
| Collector–Base Breakdown Voltage (I _C = 100 μA _{dc} , I _E = 0) | 2N6515 2N6517, 2N6520 | V _{(BR)CBO} | 250 350 | – – | V _{dc} |
| Emitter–Base Breakdown Voltage (I _E = 10 μA _{dc} , I _C = 0) | 2N6515, 2N6517 2N6520 | V _{(BR)EBO} | 6.0 5.0 | – – | V _{dc} |
| Collector Cutoff Current (V _{CB} = 150 V _{dc} , I _E = 0) (V _{CB} = 250 V _{dc} , I _E = 0) | 2N6515 2N6517, 2N6520 | I _{CBO} | – – | 50 50 | nA _{dc} |
| Emitter Cutoff Current (V _{EB} = 5.0 V _{dc} , I _C = 0) (V _{EB} = 4.0 V _{dc} , I _C = 0) | 2N6515, 2N6517 2N6520 | I _{EBO} | – – | 50 50 | nA _{dc} |

ON CHARACTERISTICS (Note 1)

| | | | | | |
|--|--------------------------|----------------------|------------------|-----------------------------|-----------------|
| DC Current Gain (I _C = 1.0 mA _{dc} , V _{CE} = 10 V _{dc}) | 2N6515 2N6517, 2N6520 | h _{FE} | 35 20 | – – | – |
| (I _C = 10 mA _{dc} , V _{CE} = 10 V _{dc}) | 2N6515 2N6517, 2N6520 | | 50 30 | – – | |
| (I _C = 30 mA _{dc} , V _{CE} = 10 V _{dc}) | 2N6515 2N6517, 2N6520 | | 50 30 | 300 200 | |
| (I _C = 50 mA _{dc} , V _{CE} = 10 V _{dc}) | 2N6515 2N6517, 2N6520 | | 45 20 | 220 200 | |
| (I _C = 100 mA _{dc} , V _{CE} = 10 V _{dc}) | 2N6515 2N6517, 2N6520 | | 25 15 | – – | |
| Collector–Emitter Saturation Voltage (I _C = 10 mA _{dc} , I _B = 1.0 mA _{dc}) (I _C = 20 mA _{dc} , I _B = 2.0 mA _{dc}) (I _C = 30 mA _{dc} , I _B = 3.0 mA _{dc}) (I _C = 50 mA _{dc} , I _B = 5.0 mA _{dc}) | | V _{CE(sat)} | – – – – | 0.30 0.35 0.50 1.0 | V _{dc} |
| Base–Emitter Saturation Voltage (I _C = 10 mA _{dc} , I _B = 1.0 mA _{dc}) (I _C = 20 mA _{dc} , I _B = 2.0 mA _{dc}) (I _C = 30 mA _{dc} , I _B = 3.0 mA _{dc}) | | V _{BE(sat)} | – – – | 0.75 0.85 0.90 | V _{dc} |
| Base–Emitter On Voltage (I _C = 100 mA _{dc} , V _{CE} = 10 V _{dc}) | | V _{BE(on)} | – | 2.0 | V _{dc} |

SMALL-SIGNAL CHARACTERISTICS

| | | | | | |
|---|--------------------------|-----------------|--------|-----------|-----|
| Current–Gain – Bandwidth Product (Note 1) (I _C = 10 mA _{dc} , V _{CE} = 20 V _{dc} , f = 20 MHz) | | f _T | 40 | 200 | MHz |
| Collector–Base Capacitance (V _{CB} = 20 V _{dc} , I _E = 0, f = 1.0 MHz) | | C _{cb} | – | 6.0 | pF |
| Emitter–Base Capacitance (V _{EB} = 0.5 V _{dc} , I _C = 0, f = 1.0 MHz) | 2N6515, 2N6517 2N6520 | C _{eb} | – – | 80 100 | pF |

SWITCHING CHARACTERISTICS

| | | | | | |
|--|--|------------------|---|-----|----|
| Turn–On Time (V _{CC} = 100 V _{dc} , V _{BE(off)} = 2.0 V _{dc} , I _C = 50 mA _{dc} , I _{B1} = 10 mA _{dc}) | | t _{on} | – | 200 | μs |
| Turn–Off Time (V _{CC} = 100 V _{dc} , I _C = 50 mA _{dc} , I _{B1} = I _{B2} = 10 mA _{dc}) | | t _{off} | – | 3.5 | μs |

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

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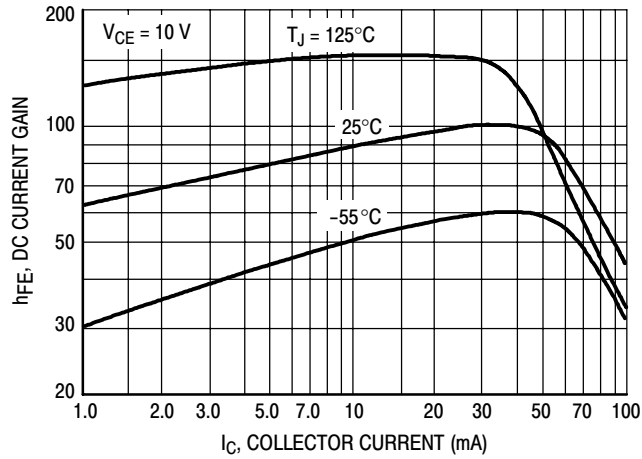


Figure 1. DC Current Gain
NPN 2N6515

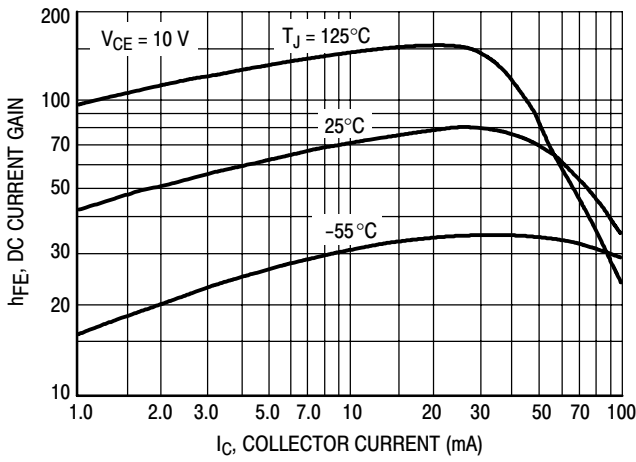


Figure 2. DC Current Gain
NPN 2N6517

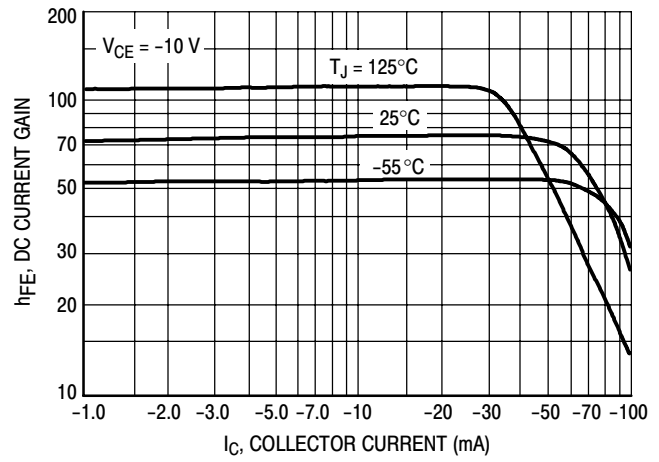


Figure 3. DC Current Gain
PNP 2N6520

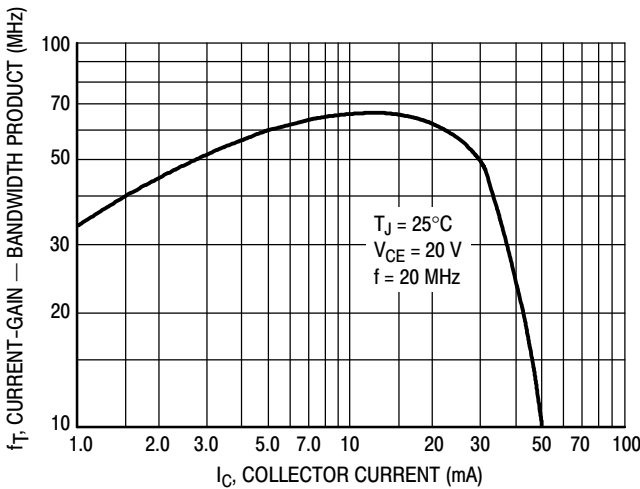


Figure 4. Current-Gain – Bandwidth Product
NPN 2N6515, 2N6517

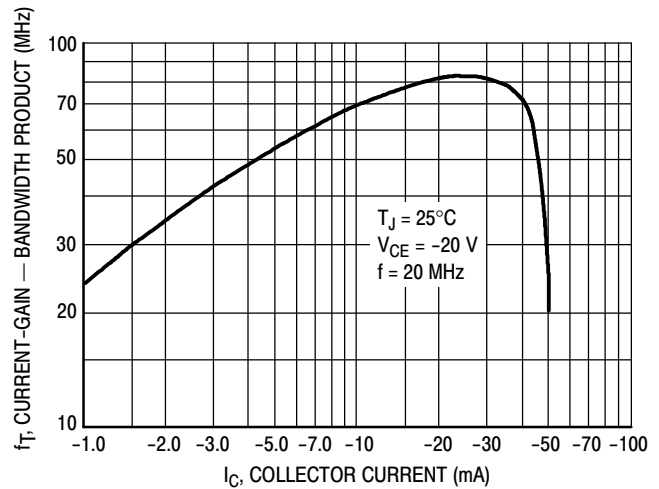


Figure 5. Current-Gain – Bandwidth Product
PNP 2N6520

NPN – 2N6515, 2N6517; PNP – 2N6520

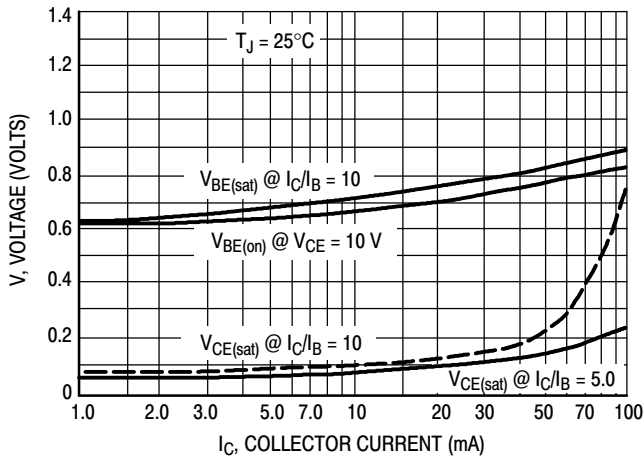


Figure 6. "On" Voltages
NPN 2N6515, 2N6517

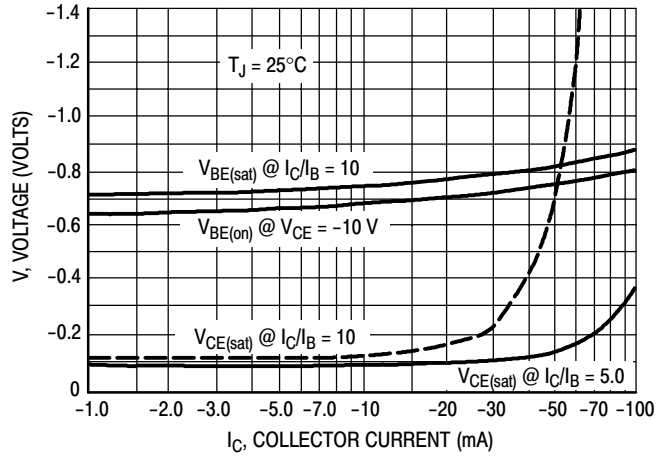


Figure 7. "On" Voltages
PNP 2N6520

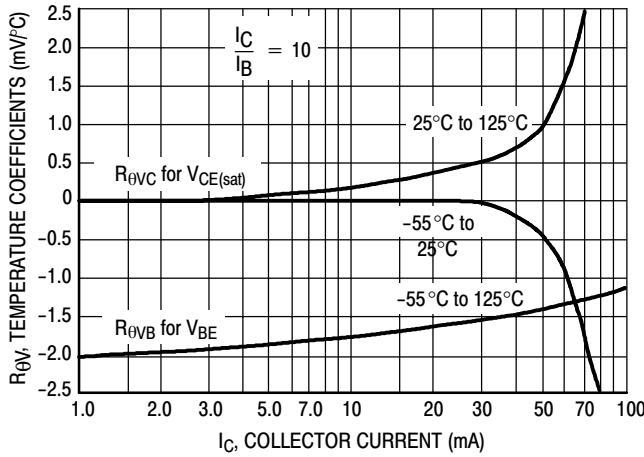


Figure 8. Temperature Coefficients
NPN 2N6515, 2N6517

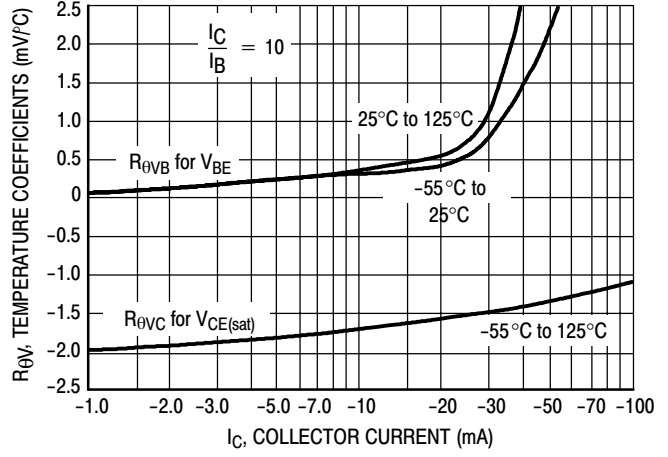


Figure 9. Temperature Coefficients
PNP 2N6520

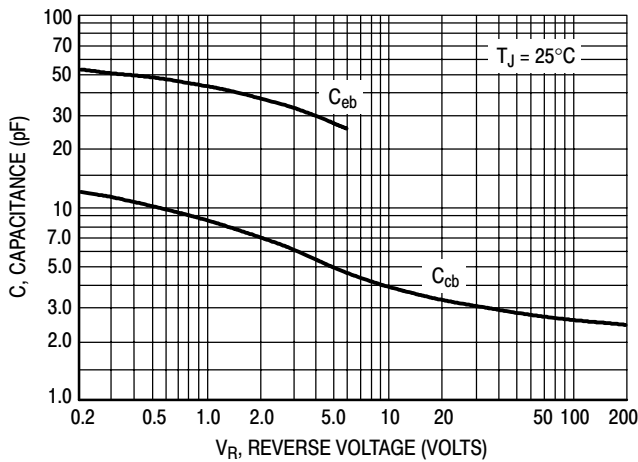


Figure 10. Capacitance
NPN 2N6515, 2N6517

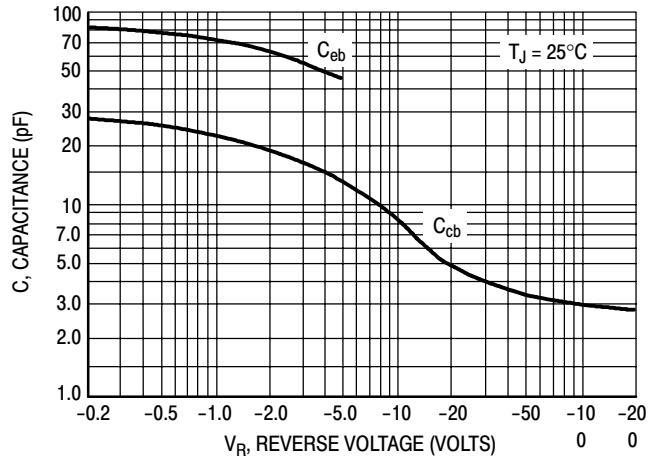
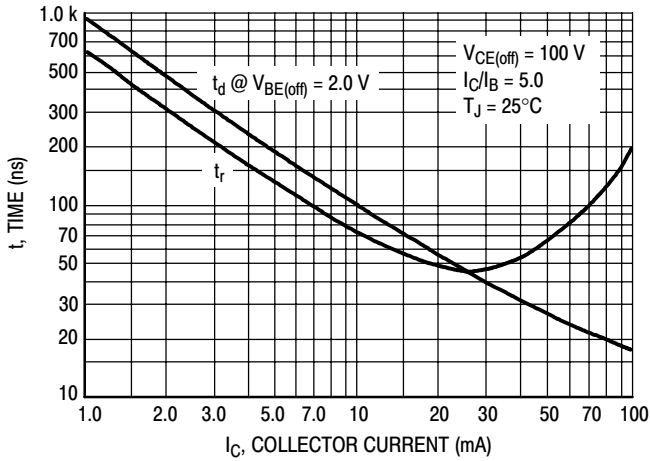
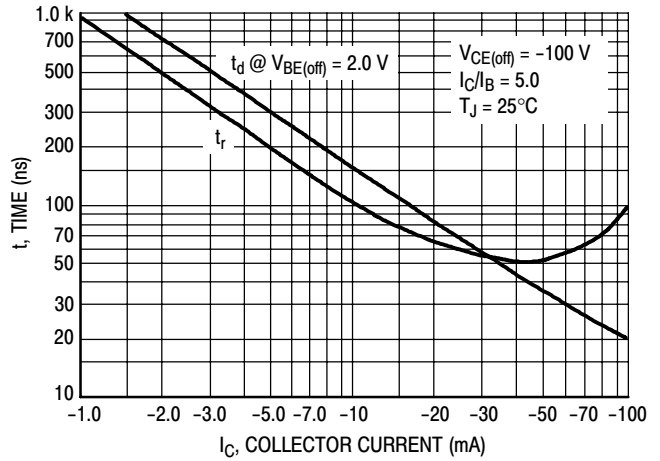


Figure 11. Capacitance
PNP 2N6520

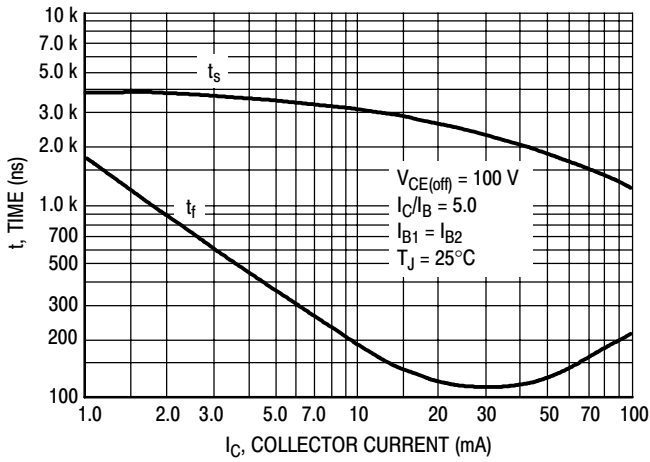
NPN – 2N6515, 2N6517; PNP – 2N6520



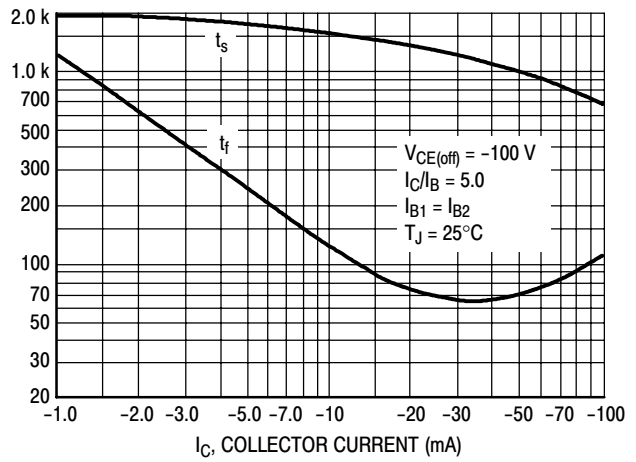
**Figure 12. Turn-On Time
NPN 2N6515, 2N6517**



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



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



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

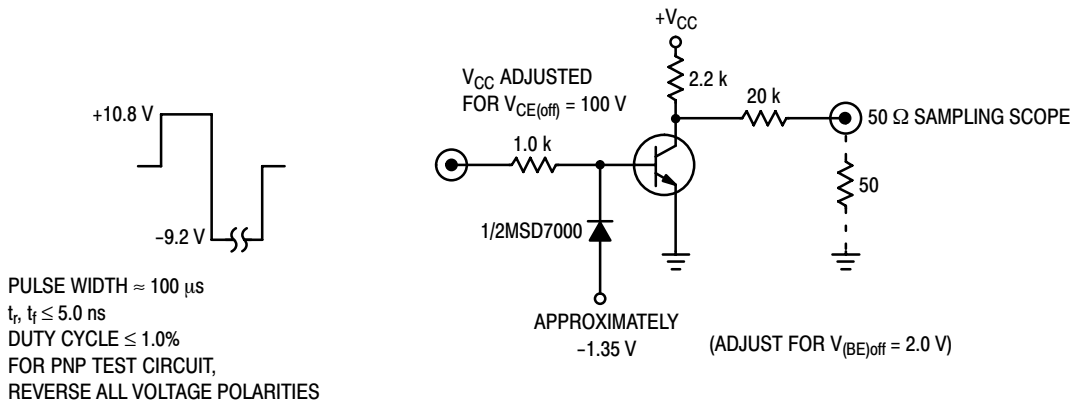


Figure 16. Switching Time Test Circuit

NPN – 2N6515, 2N6517; PNP – 2N6520

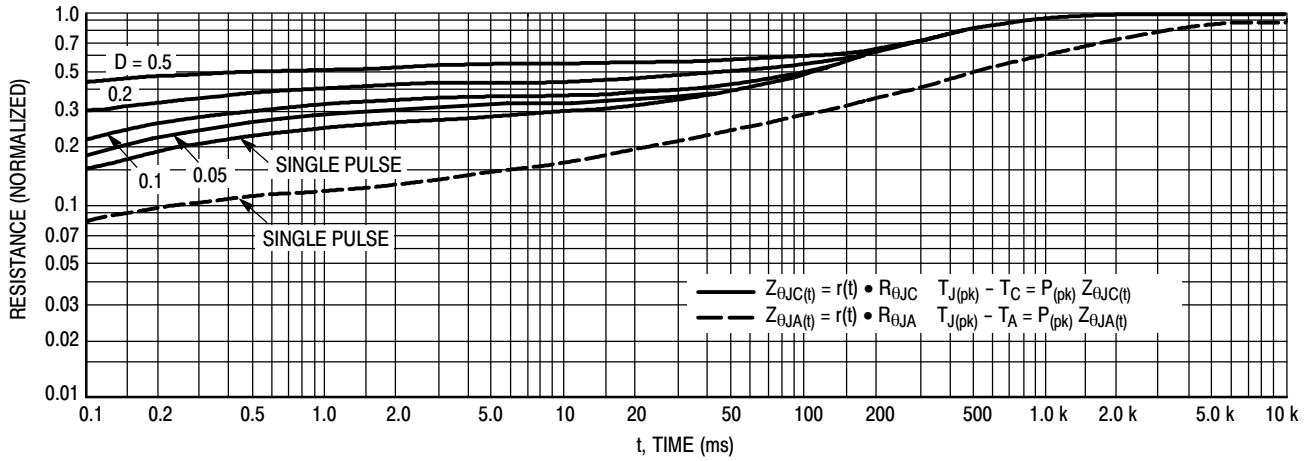


Figure 17. Thermal Response

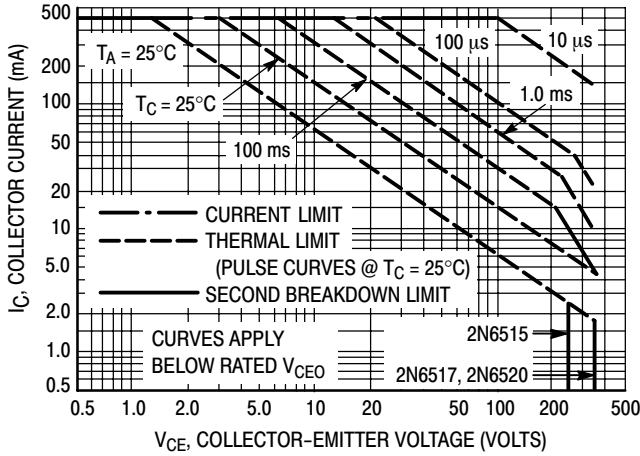
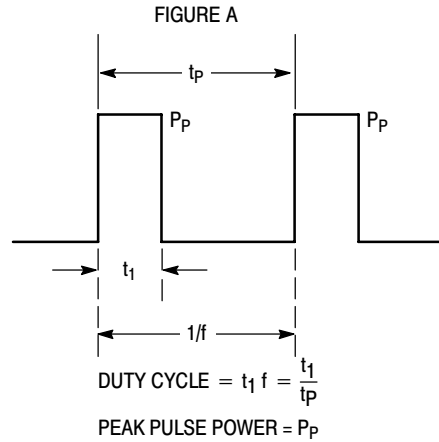


Figure 18. Active Region Safe Operating Area



Design Note: Use of Transient Thermal Resistance Data

ORDERING INFORMATION

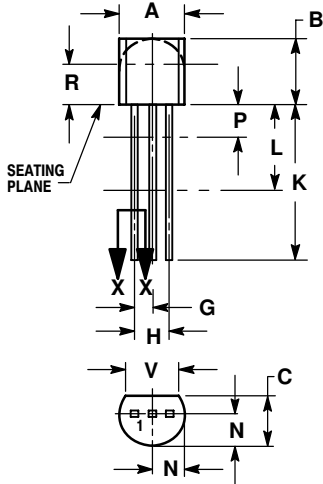
| Device | Package | Shipping† |
|-------------|--------------------|------------------|
| 2N6515RLRMG | TO-92 (Pb-Free) | 2000 Ammo Pack |
| 2N6517G | TO-92 (Pb-Free) | 5000 Unit / Bulk |
| 2N6517RLRPG | TO-92 (Pb-Free) | 2000 Ammo Pack |
| 2N6520RLRAG | TO-92 (Pb-Free) | 2000 Tape & Reel |

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

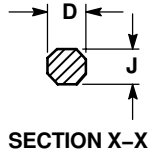
NPN – 2N6515, 2N6517; PNP – 2N6520

PACKAGE DIMENSIONS

TO-92 (TO-226)
CASE 29-11
ISSUE AM



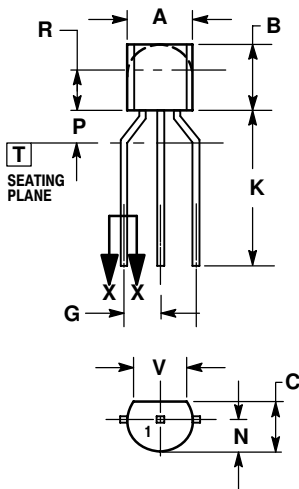
STRAIGHT LEAD
BULK PACK



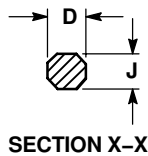
NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. CONTOUR OF PACKAGE BEYOND DIMENSION R IS UNCONTROLLED.
4. LEAD DIMENSION IS UNCONTROLLED IN P AND BEYOND DIMENSION K MINIMUM.

| DIM | INCHES | | MILLIMETERS | |
|-----|--------|-------|-------------|-------|
| | 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 | 0.021 | 0.407 | 0.533 |
| 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 | --- |



BENT LEAD
TAPE & REEL
AMMO PACK



NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. CONTOUR OF PACKAGE BEYOND DIMENSION R IS UNCONTROLLED.
4. LEAD DIMENSION IS UNCONTROLLED IN P AND BEYOND DIMENSION K MINIMUM.

| DIM | MILLIMETERS | |
|-----|-------------|------|
| | MIN | MAX |
| A | 4.45 | 5.20 |
| B | 4.32 | 5.33 |
| C | 3.18 | 4.19 |
| D | 0.40 | 0.54 |
| G | 2.40 | 2.80 |
| J | 0.39 | 0.50 |
| K | 12.70 | --- |
| N | 2.04 | 2.66 |
| P | 1.50 | 4.00 |
| R | 2.93 | --- |
| V | 3.43 | --- |

STYLE 1:

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

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