

2N4403

Preferred Device

General Purpose Transistors

PNP Silicon

Features

- Pb-Free Packages are Available*

MAXIMUM RATINGS

| Rating | Symbol | Value | Unit |
|----------------------------------------------------------------------------------------|----------------|-------------|----------------------------|
| Collector – Emitter Voltage | V_{CEO} | 40 | Vdc |
| Collector – Base Voltage | V_{CBO} | 40 | Vdc |
| Emitter – Base Voltage | V_{EBO} | 5.0 | Vdc |
| Collector Current – Continuous | I_C | 600 | 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 | $^\circ\text{C}/\text{W}$ |

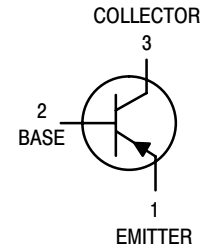
Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

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

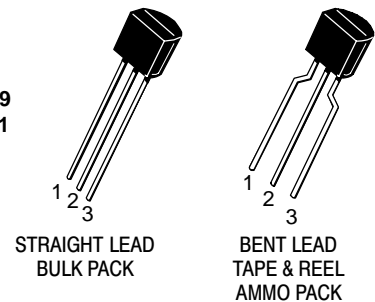


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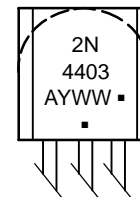
TO-92
CASE 29
STYLE 1



STRAIGHT LEAD
BULK PACK

BENT LEAD
TAPE & REEL
AMMO PACK

MARKING DIAGRAM



2N4403 = Device Code
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 2 of this data sheet.

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

2N4403

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

| Characteristic | Symbol | Min | Max | Unit | |
|----------------------------------------------|-------------------------------------------------------|---------------|-----|------|-----------------|
| OFF CHARACTERISTICS | | | | | |
| Collector–Emitter Breakdown Voltage (Note 1) | $(I_C = 1.0 \text{ mAdc}, I_B = 0)$ | $V_{(BR)CEO}$ | 40 | – | Vdc |
| Collector–Base Breakdown Voltage | $(I_C = 0.1 \text{ mAdc}, I_E = 0)$ | $V_{(BR)CBO}$ | 40 | – | Vdc |
| Emitter–Base Breakdown Voltage | $(I_E = 0.1 \text{ mAdc}, I_C = 0)$ | $V_{(BR)EBO}$ | 5.0 | – | Vdc |
| Base Cutoff Current | $(V_{CE} = 35 \text{ Vdc}, V_{EB} = 0.4 \text{ Vdc})$ | I_{BEV} | – | 0.1 | μAdc |
| Collector Cutoff Current | $(V_{CE} = 35 \text{ Vdc}, V_{EB} = 0.4 \text{ Vdc})$ | I_{CEX} | – | 0.1 | μAdc |

ON CHARACTERISTICS

| | | | | | |
|-----------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|------------------------------|-------------------------|-----|
| DC Current Gain | $(I_C = 0.1 \text{ mAdc}, V_{CE} = 1.0 \text{ Vdc})$ $(I_C = 1.0 \text{ mAdc}, V_{CE} = 1.0 \text{ Vdc})$ $(I_C = 10 \text{ mAdc}, V_{CE} = 1.0 \text{ Vdc})$ $(I_C = 150 \text{ mAdc}, V_{CE} = 2.0 \text{ Vdc})$ (Note 1) $(I_C = 500 \text{ mAdc}, V_{CE} = 2.0 \text{ Vdc})$ (Note 1) | h_{FE} | 30 60 100 100 20 | – – – 300 – | – |
| Collector–Emitter Saturation Voltage (Note 1) | $(I_C = 150 \text{ mAdc}, I_B = 15 \text{ mAdc})$ $(I_C = 500 \text{ mAdc}, I_B = 50 \text{ mAdc})$ | $V_{CE(sat)}$ | – – | 0.4 0.75 | Vdc |
| Base–Emitter Saturation Voltage (Note 1) | $(I_C = 150 \text{ mAdc}, I_B = 15 \text{ mAdc})$ $(I_C = 500 \text{ mAdc}, I_B = 50 \text{ mAdc})$ | $V_{BE(sat)}$ | 0.75 – | 0.95 1.3 | Vdc |

SMALL–SIGNAL CHARACTERISTICS

| | | | | | |
|----------------------------------|--------------------------------------------------------------------------|----------|-------|------|------------------|
| Current–Gain – Bandwidth Product | $(I_C = 20 \text{ mAdc}, V_{CE} = 10 \text{ Vdc}, f = 100 \text{ MHz})$ | f_T | 200 | – | MHz |
| Collector–Base Capacitance | $(V_{CB} = 10 \text{ Vdc}, I_E = 0, f = 1.0 \text{ MHz})$ | C_{cb} | – | 8.5 | pF |
| Emitter–Base Capacitance | $(V_{EB} = 0.5 \text{ Vdc}, I_C = 0, f = 1.0 \text{ MHz})$ | C_{eb} | – | 30 | pF |
| Input Impedance | $(I_C = 1.0 \text{ mAdc}, V_{CE} = 10 \text{ Vdc}, f = 1.0 \text{ kHz})$ | h_{ie} | 1.5 k | 15 k | Ω |
| Voltage Feedback Ratio | $(I_C = 1.0 \text{ mAdc}, V_{CE} = 10 \text{ Vdc}, f = 1.0 \text{ kHz})$ | h_{re} | 0.1 | 8.0 | $\times 10^{-4}$ |
| Small–Signal Current Gain | $(I_C = 1.0 \text{ mAdc}, V_{CE} = 10 \text{ Vdc}, f = 1.0 \text{ kHz})$ | h_{fe} | 60 | 500 | – |
| Output Admittance | $(I_C = 1.0 \text{ mAdc}, V_{CE} = 10 \text{ Vdc}, f = 1.0 \text{ kHz})$ | h_{oe} | 1.0 | 100 | μmhos |

SWITCHING CHARACTERISTICS

| | | | | | |
|--------------|---------------------------------------------------------------------------------------------------------------|-------|---|-----|----|
| Delay Time | $(V_{CC} = 30 \text{ Vdc}, V_{BE} = +2.0 \text{ Vdc},$ $I_C = 150 \text{ mAdc}, I_{B1} = 15 \text{ mAdc})$ | t_d | – | 15 | ns |
| Rise Time | | t_r | – | 20 | ns |
| Storage Time | $(V_{CC} = 30 \text{ Vdc}, I_C = 150 \text{ mAdc},$ $I_{B1} = 15 \text{ mA}, I_{B2} = 15 \text{ mA})$ | t_s | – | 225 | ns |
| Fall Time | | t_f | – | 30 | ns |

1. Pulse Test: Pulse Width $\leq 300 \mu\text{s}$, Duty Cycle $\leq 2.0\%$.

ORDERING INFORMATION

| Device | Package | Shipping† |
|-------------|--------------------|--------------------|
| 2N4403 | TO–92 | 5000 Units / Bulk |
| 2N4403G | TO–92 (Pb–Free) | 5000 Units / Bulk |
| 2N4403RLRA | TO–92 | 2000 / Tape & Reel |
| 2N4403RLRAG | TO–92 (Pb–Free) | 2000 / Tape & Reel |
| 2N4403RLRM | TO–92 | 2000 / Ammo Pack |
| 2N4403RLRMG | TO–92 (Pb–Free) | 2000 / Ammo Pack |
| 2N4403RLRPG | TO–92 (Pb–Free) | 2000 / Ammo Pack |

†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.

SWITCHING TIME EQUIVALENT TEST CIRCUIT

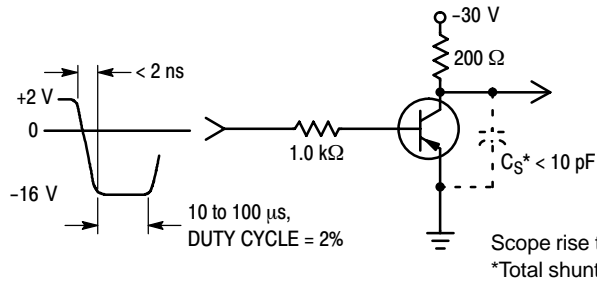


Figure 1. Turn-On Time

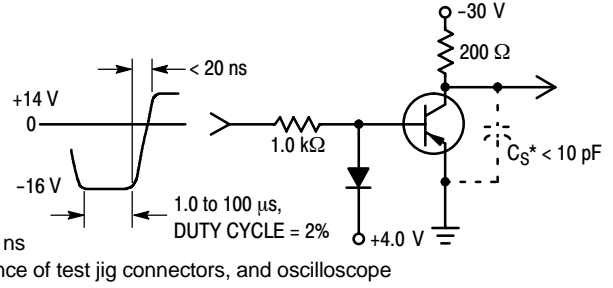


Figure 2. Turn-Off Time

TRANSIENT CHARACTERISTICS

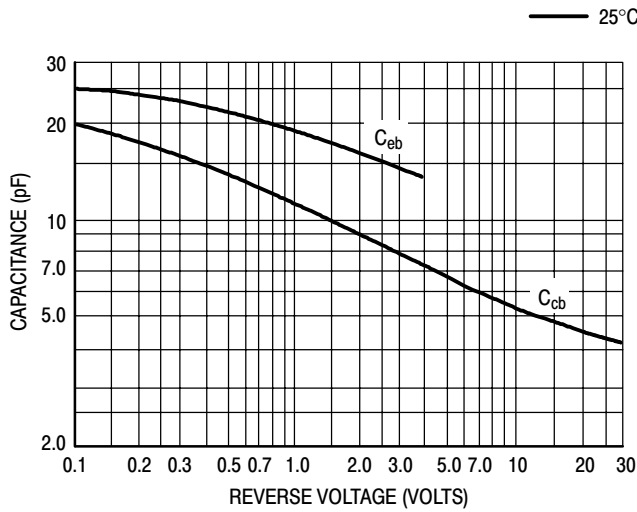


Figure 3. Capacitances

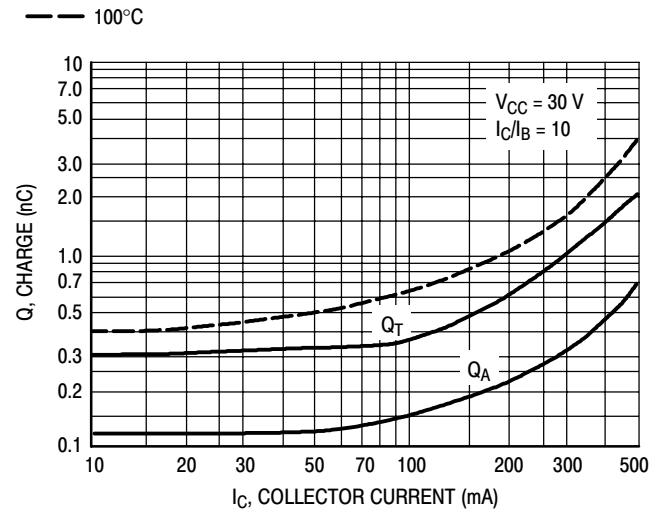


Figure 4. Charge Data

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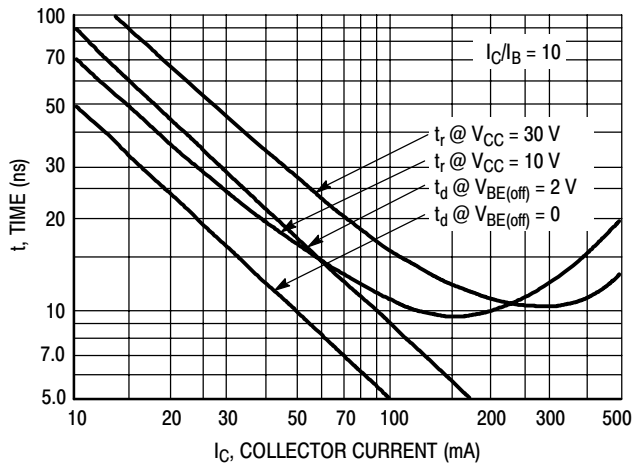


Figure 5. Turn-On Time

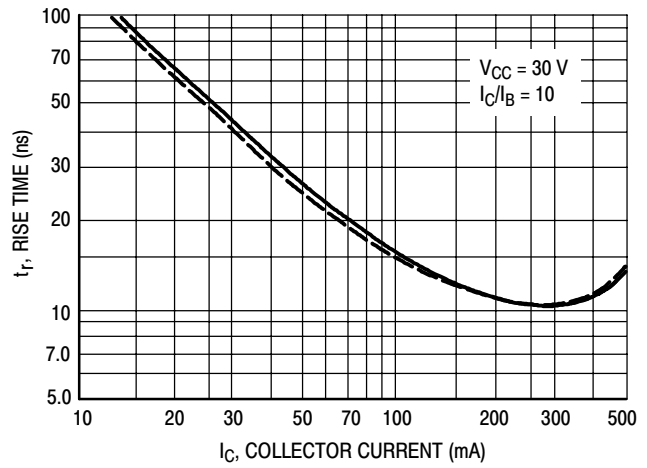


Figure 6. Rise Time

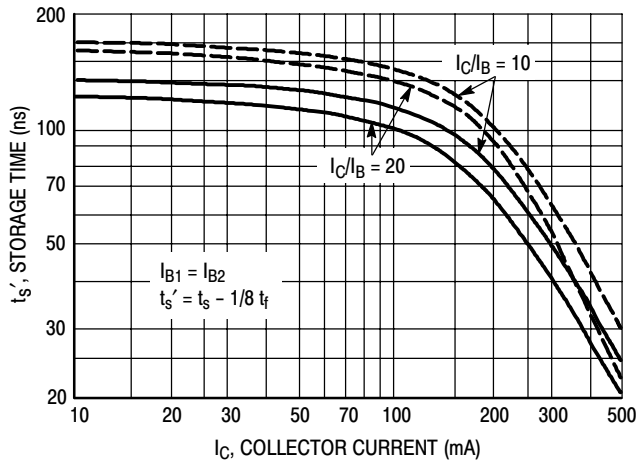


Figure 7. Storage Time

SMALL-SIGNAL CHARACTERISTICS NOISE FIGURE

$V_{CE} = -10$ Vdc, $T_A = 25^\circ\text{C}$; Bandwidth = 1.0 Hz

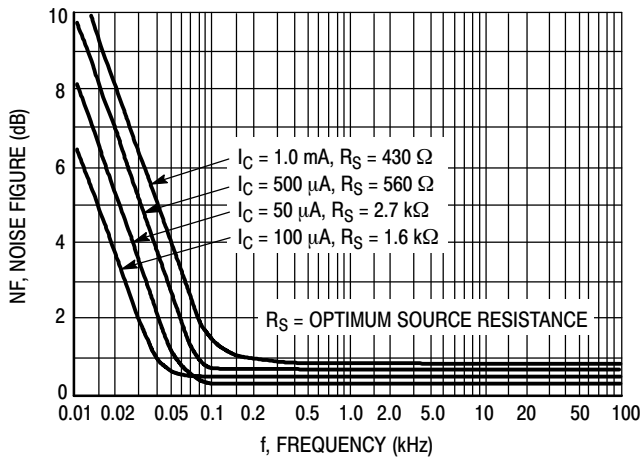


Figure 8. Frequency Effects

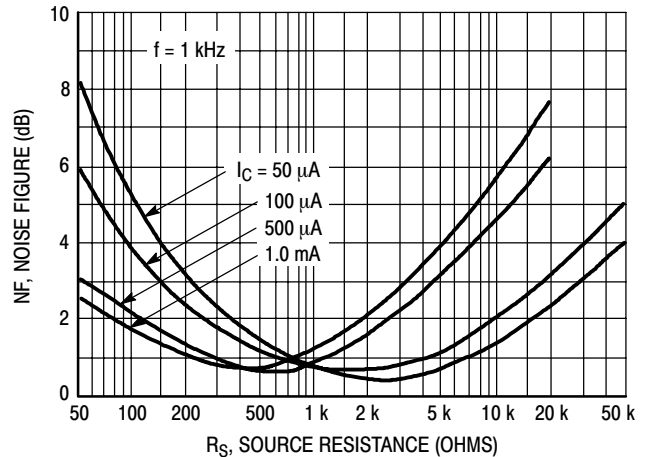


Figure 9. Source Resistance Effects

2N4403

h PARAMETERS

$V_{CE} = -10 \text{ Vdc}$, $f = 1.0 \text{ kHz}$, $T_A = 25^\circ\text{C}$

This group of graphs illustrates the relationship between h_{fe} and other "h" parameters for this series of transistors. To obtain these curves, a high-gain and a low-gain unit were

selected from the 2N4403 lines, and the same units were used to develop the correspondingly-numbered curves on each graph.

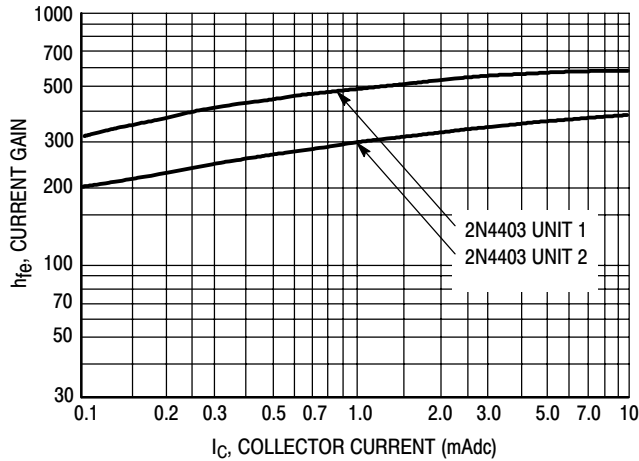


Figure 10. Current Gain

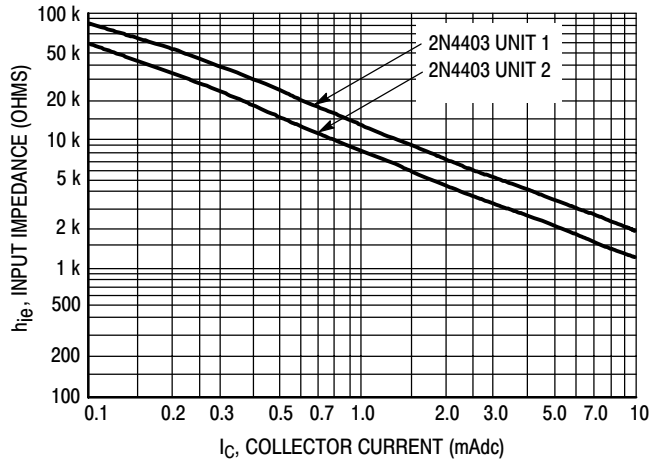


Figure 11. Input Impedance

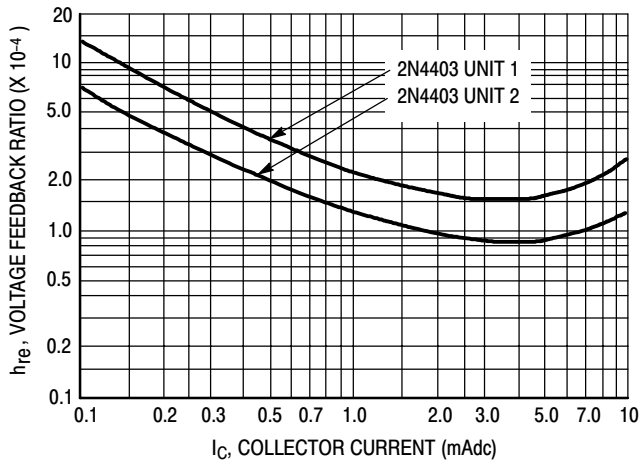


Figure 12. Voltage Feedback Ratio

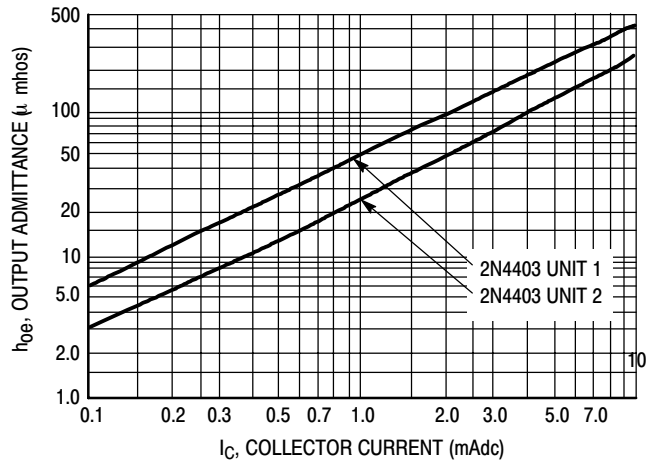


Figure 13. Output Admittance

2N4403

STATIC CHARACTERISTICS

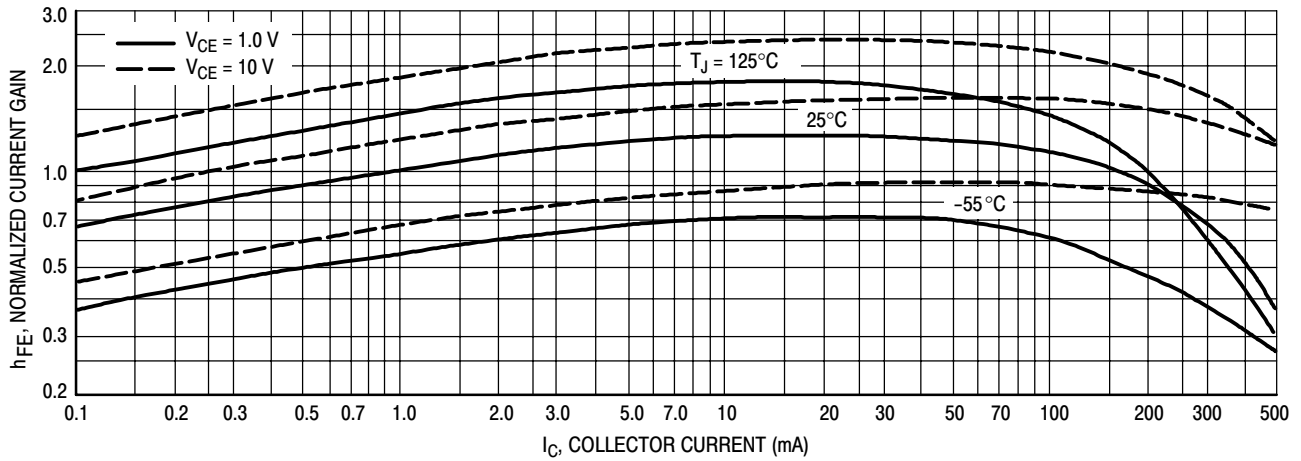


Figure 14. DC Current Gain

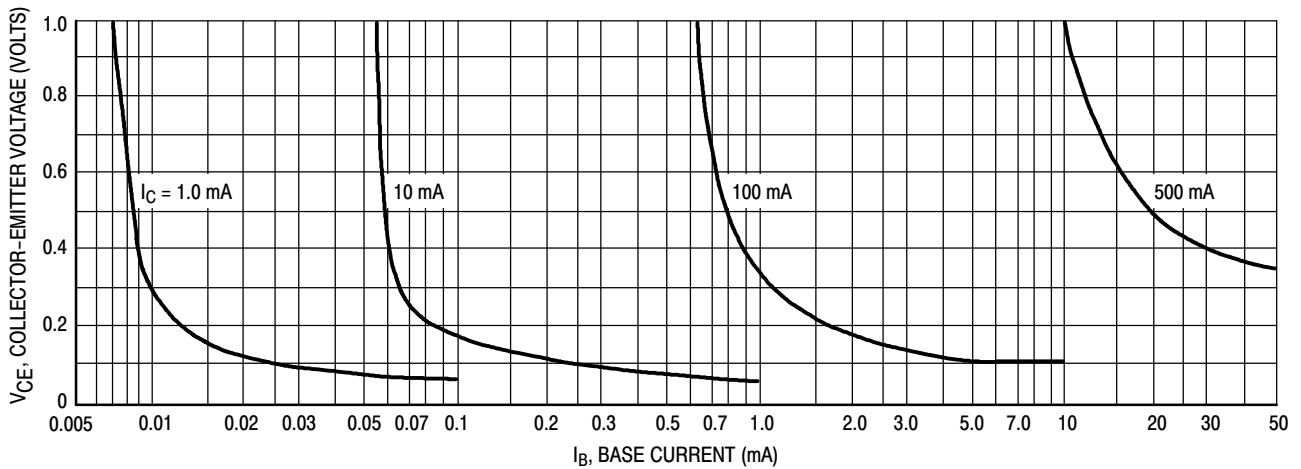


Figure 15. Collector Saturation Region

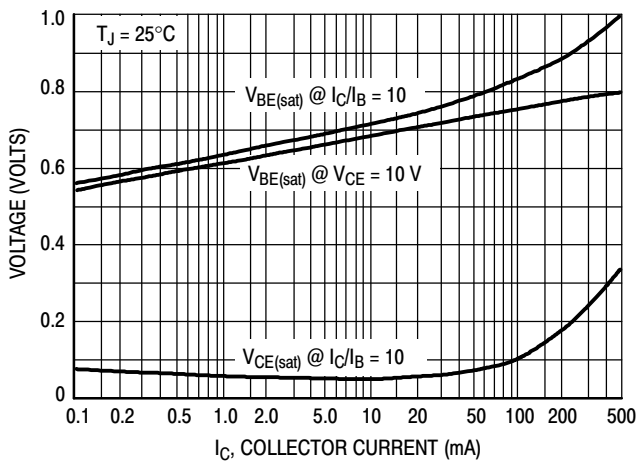


Figure 16. "On" Voltages

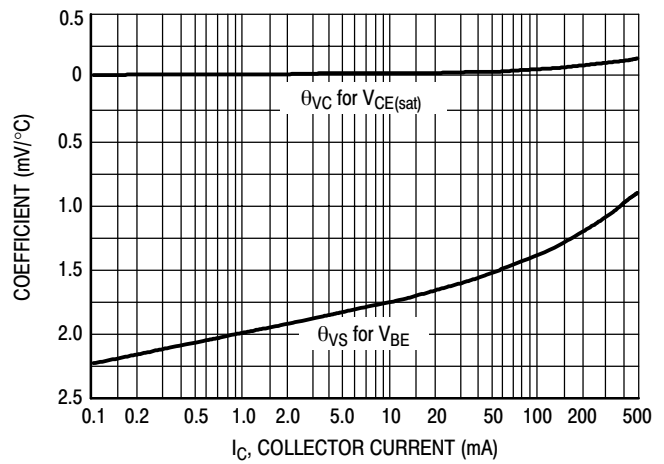
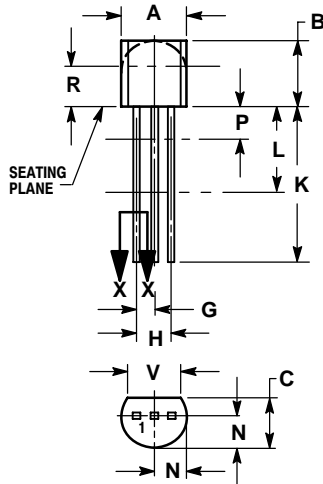


Figure 17. Temperature Coefficients

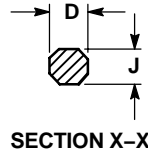
2N4403

PACKAGE DIMENSIONS

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



STRAIGHT LEAD
BULK PACK

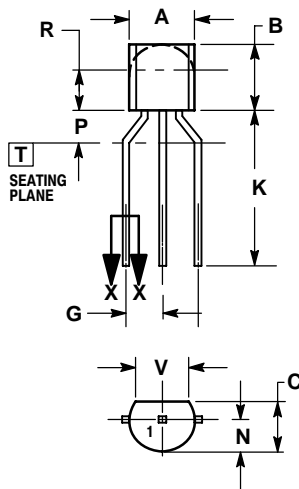


SECTION X-X

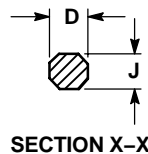
NOTES:

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



SECTION X-X

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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