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Stocking Distributor

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[ON Semiconductor](#)
[2N4401RLRM](#)

For any questions, you can email us directly:

sales@integrated-circuit.com

2N4401

Preferred Device

General Purpose Transistors

NPN 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} | 60 | Vdc |
| Emitter – Base Voltage | V_{EBO} | 6.0 | 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/°C |
| Total Device Dissipation @ $T_C = 25^\circ\text{C}$ Derate above 25°C | P_D | 1.5 12 | W 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 |

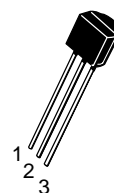
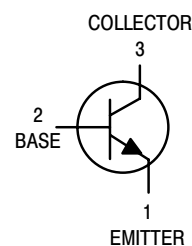
Maximum ratings are those values beyond which device damage can occur. Maximum ratings applied to the device are individual stress limit values (not normal operating conditions) and are not valid simultaneously. If these limits are exceeded, device functional operation is not implied, damage may occur and reliability may be affected.

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



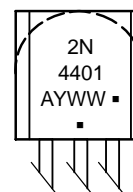
ON Semiconductor®

<http://onsemi.com>



TO-92
CASE 29
STYLE 1

MARKING DIAGRAM



2N4401 = 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 3 of this data sheet.

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

2N4401

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 ($I_C = 0.1\text{ mAdc}$, $I_E = 0$) | $V_{(BR)CBO}$ | 60 | – | Vdc |
| Emitter–Base Breakdown Voltage ($I_E = 0.1\text{ mAdc}$, $I_C = 0$) | $V_{(BR)EBO}$ | 6.0 | – | 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 (Note 1)

| | | | | |
|---|---------------|-----------------------------|-------------------------|-----|
| DC Current Gain ($I_C = 0.1\text{ mAdc}$, $V_{CE} = 1.0\text{ Vdc}$) ($I_C = 1.0\text{ mAdc}$, $V_{CE} = 1.0\text{ Vdc}$) ($I_C = 10\text{ mAdc}$, $V_{CE} = 1.0\text{ Vdc}$) ($I_C = 150\text{ mAdc}$, $V_{CE} = 1.0\text{ Vdc}$) ($I_C = 500\text{ mAdc}$, $V_{CE} = 2.0\text{ Vdc}$) | h_{FE} | 20 40 80 100 40 | – – – 300 – | – |
| Collector–Emitter Saturation Voltage ($I_C = 150\text{ mAdc}$, $I_B = 15\text{ mAdc}$) ($I_C = 500\text{ mAdc}$, $I_B = 50\text{ mAdc}$) | $V_{CE(sat)}$ | – – | 0.4 0.75 | Vdc |
| Base–Emitter Saturation Voltage ($I_C = 150\text{ mAdc}$, $I_B = 15\text{ mAdc}$) ($I_C = 500\text{ mAdc}$, $I_B = 50\text{ mAdc}$) | $V_{BE(sat)}$ | 0.75 – | 0.95 1.2 | Vdc |

SMALL–SIGNAL CHARACTERISTICS

| | | | | |
|---|----------|-----|-----|------------------|
| Current–Gain – Bandwidth Product ($I_C = 20\text{ mAdc}$, $V_{CE} = 10\text{ Vdc}$, $f = 100\text{ MHz}$) | f_T | 250 | – | MHz |
| Collector–Base Capacitance ($V_{CB} = 5.0\text{ Vdc}$, $I_E = 0$, $f = 1.0\text{ MHz}$) | C_{cb} | – | 6.5 | 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} | 1.0 | 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} | 40 | 500 | – |
| Output Admittance ($I_C = 1.0\text{ mAdc}$, $V_{CE} = 10\text{ Vdc}$, $f = 1.0\text{ kHz}$) | h_{oe} | 1.0 | 30 | 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 | $(V_{CC} = 30\text{ Vdc}$, $I_C = 150\text{ mAdc}$, $I_{B1} = I_{B2} = 15\text{ mAdc}$) | t_s | – | 225 | ns |
| Fall Time | | t_f | – | 30 | ns |

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

2N4401

ORDERING INFORMATION

| Device | Package | Shipping† |
|-------------|--------------------|--------------------|
| 2N4401 | TO-92 | 5,000 Units / Box |
| 2N4401G | TO-92 (Pb-Free) | 5,000 Units / Box |
| 2N4401RLRA | TO-92 | 2000 / Tape & Reel |
| 2N4401RLRAG | TO-92 (Pb-Free) | 2000 / Tape & Reel |
| 2N4401RLRM | TO-92 | 2000 / Ammo Pack |
| 2N4401RLRMG | TO-92 (Pb-Free) | 2000 / Ammo Pack |
| 2N4401RLRP | TO-92 | 2000 / Ammo Pack |
| 2N4401RLRPG | 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 CIRCUITS

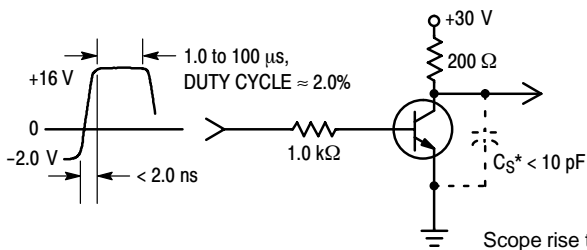


Figure 1. Turn-On Time

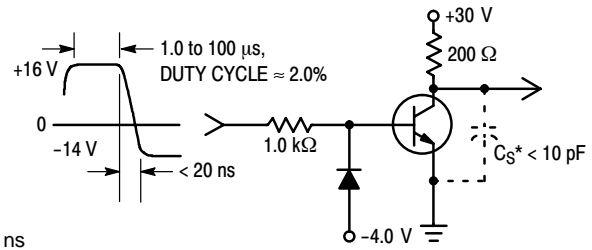


Figure 2. Turn-Off Time

TRANSIENT CHARACTERISTICS

— 25°C - - - 100°C

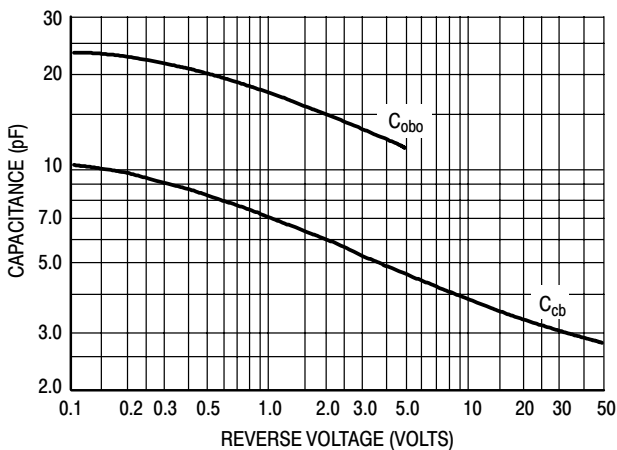


Figure 3. Capacitances

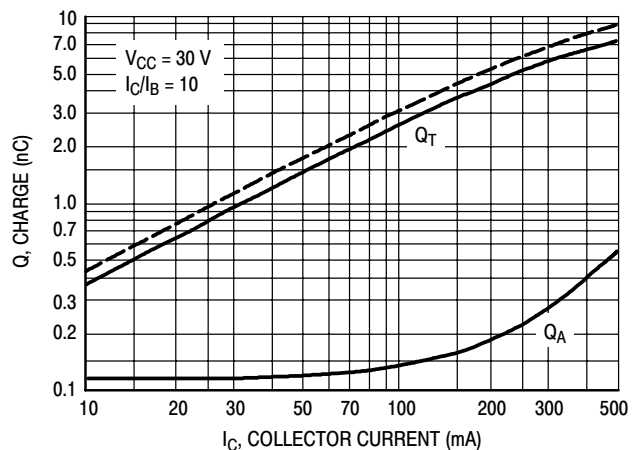


Figure 4. Charge Data

2N4401

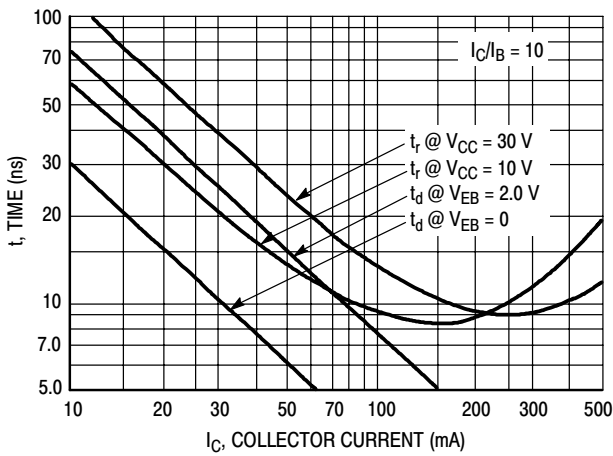


Figure 5. Turn-On Time

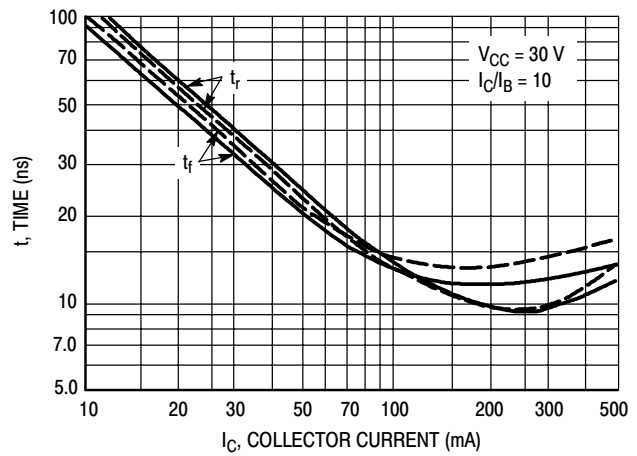


Figure 6. Rise and Fall Times

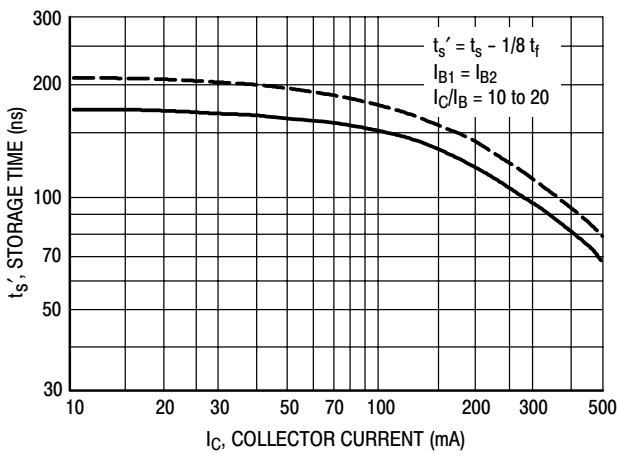


Figure 7. Storage Time

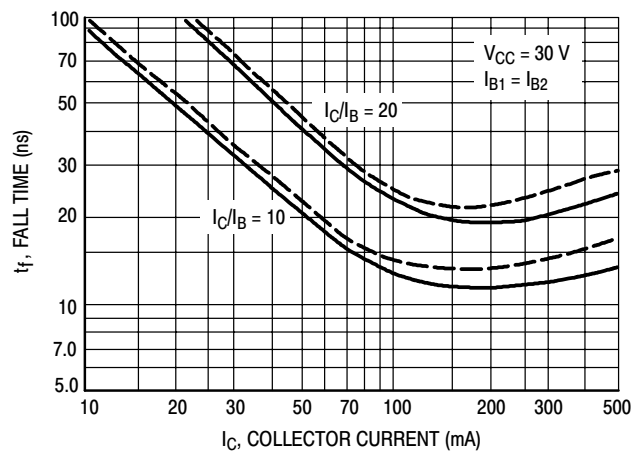


Figure 8. Fall Time

SMALL-SIGNAL CHARACTERISTICS

NOISE FIGURE

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

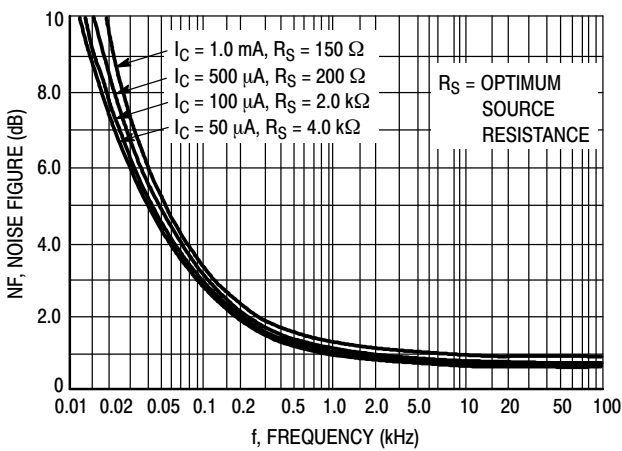


Figure 9. Frequency Effects

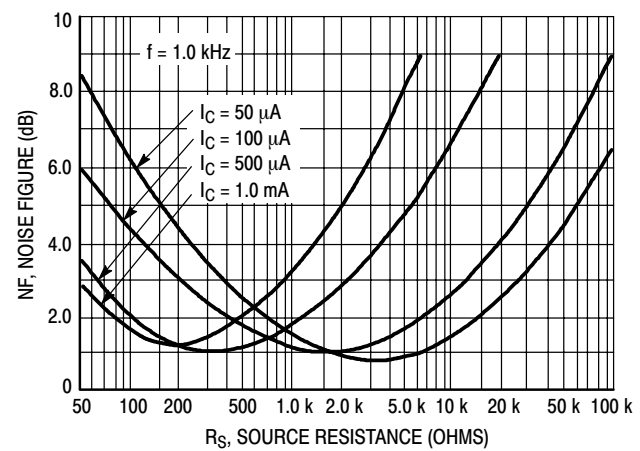


Figure 10. Source Resistance Effects

2N4401

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 2N4401 lines, and the same units were used to develop the correspondingly numbered curves on each graph.

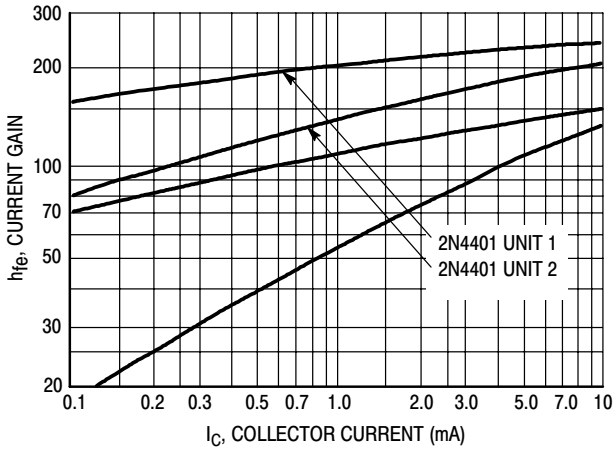


Figure 11. Current Gain

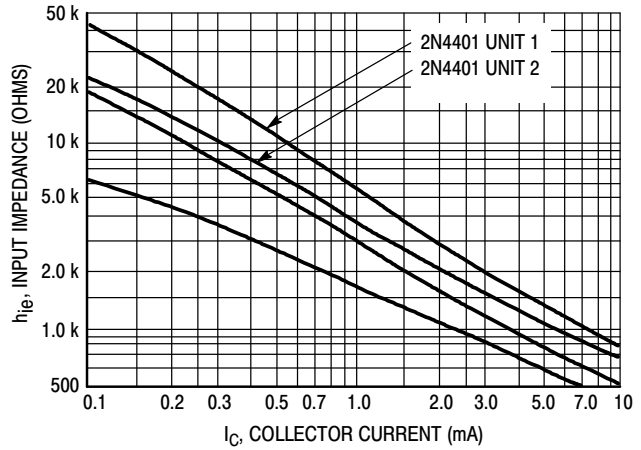


Figure 12. Input Impedance

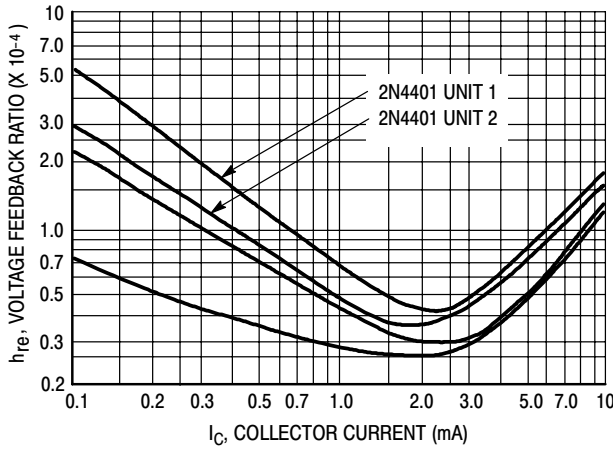


Figure 13. Voltage Feedback Ratio

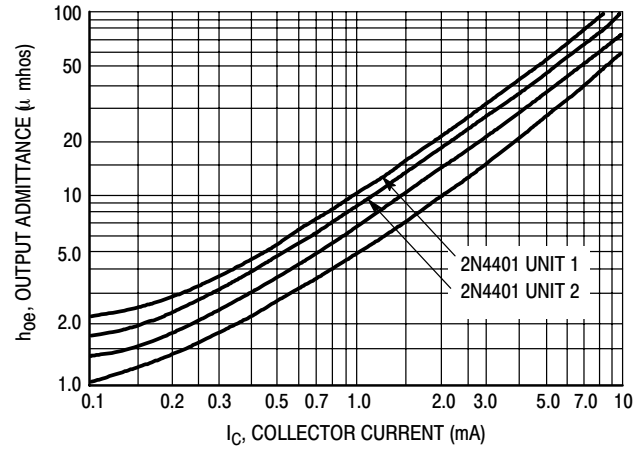


Figure 14. Output Admittance

2N4401

STATIC CHARACTERISTICS

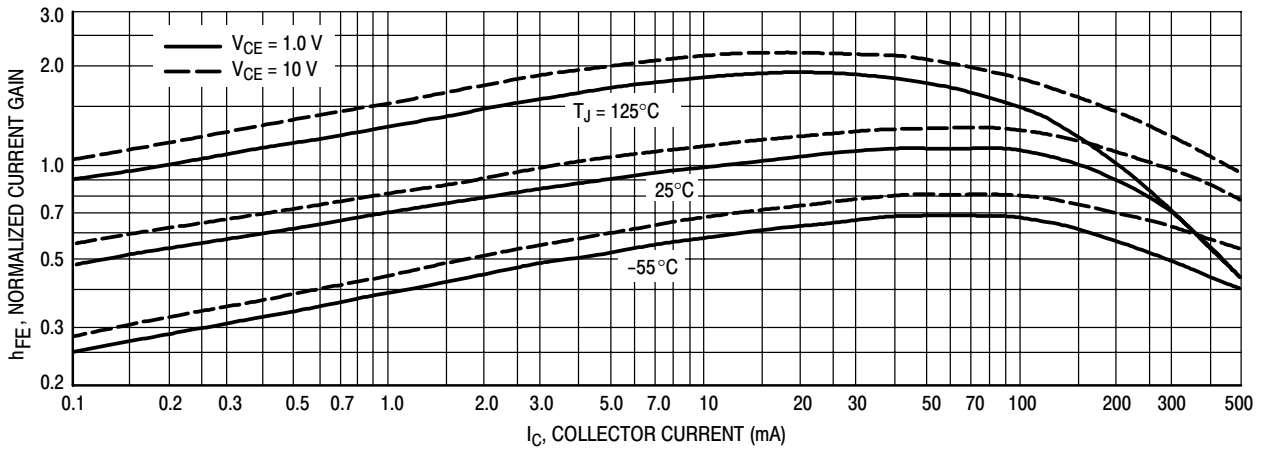


Figure 15. DC Current Gain

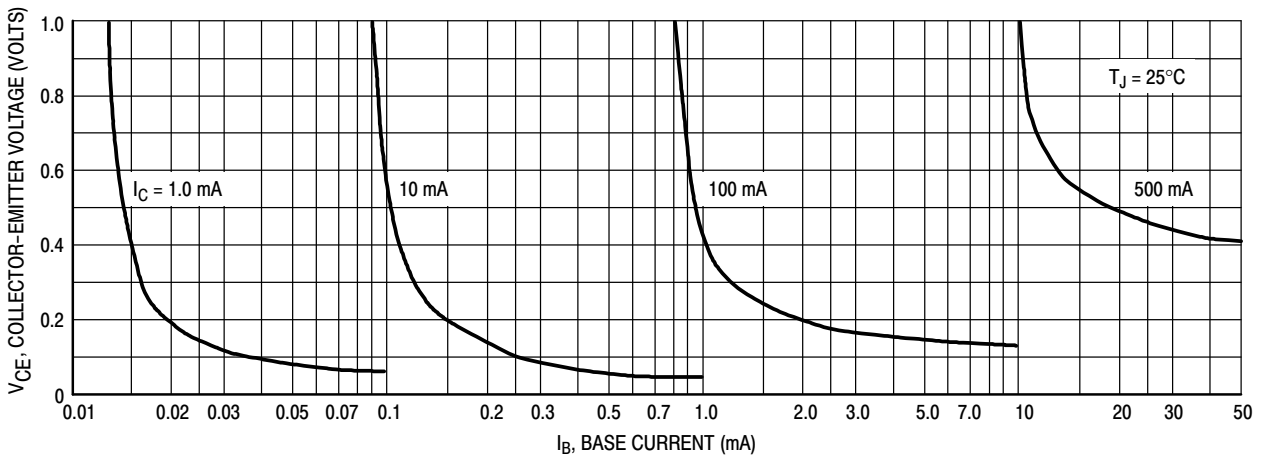


Figure 16. Collector Saturation Region

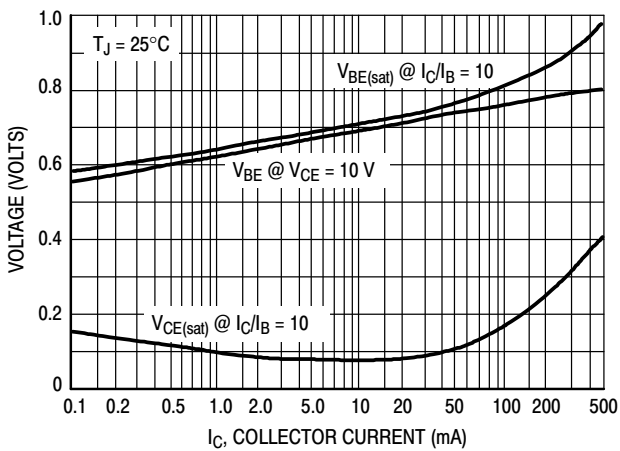


Figure 17. "On" Voltages

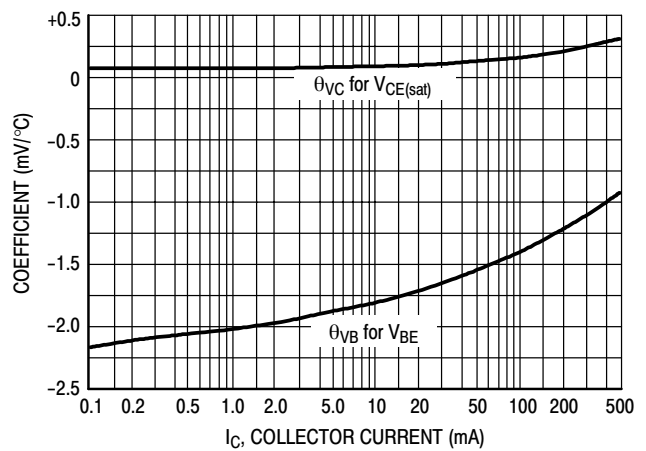
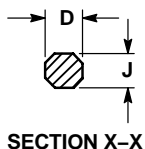
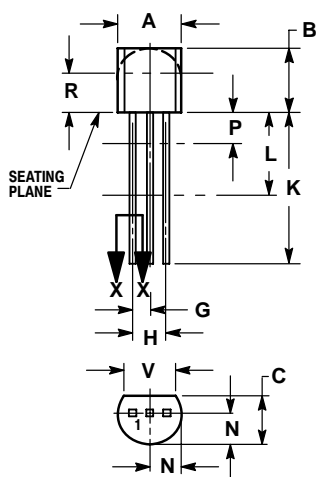


Figure 18. Temperature Coefficients

2N4401

PACKAGE DIMENSIONS

TO-92
TO-226AA
CASE 29-11
ISSUE AL




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 | --- |

STYLE 1:

1. EMITTER
2. BASE
3. COLLECTOR

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