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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	$^\circ\text{C}/\text{W}$

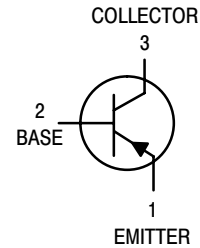
Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

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

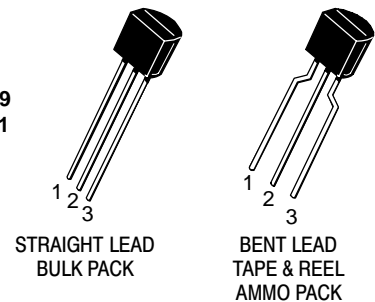


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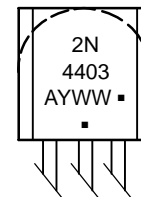
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TO-92
CASE 29
STYLE 1



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

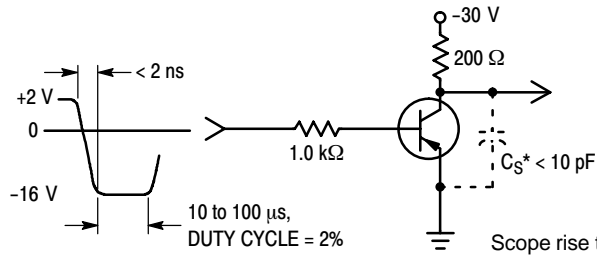


Figure 1. Turn-On Time

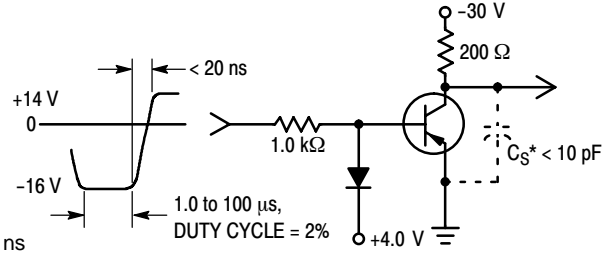


Figure 2. Turn-Off Time

Scope rise time <math>< 4.0\text{ ns}</math>
 *Total shunt capacitance of test jig connectors, and oscilloscope

TRANSIENT CHARACTERISTICS

— 25°C - - - 100°C

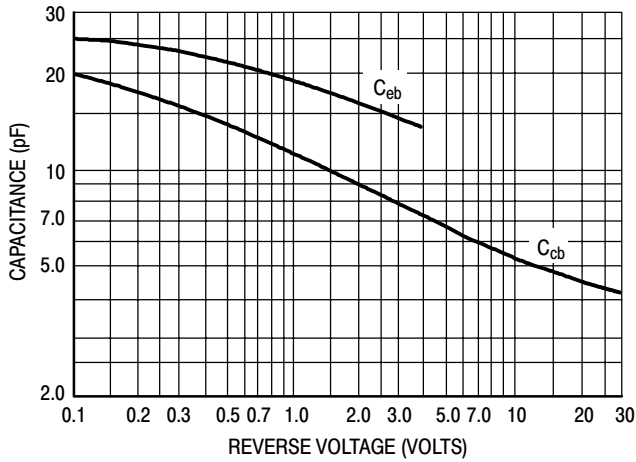


Figure 3. Capacitances

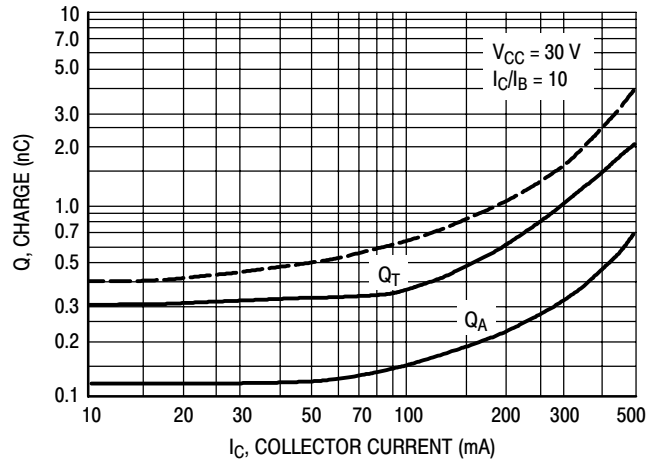


Figure 4. Charge Data

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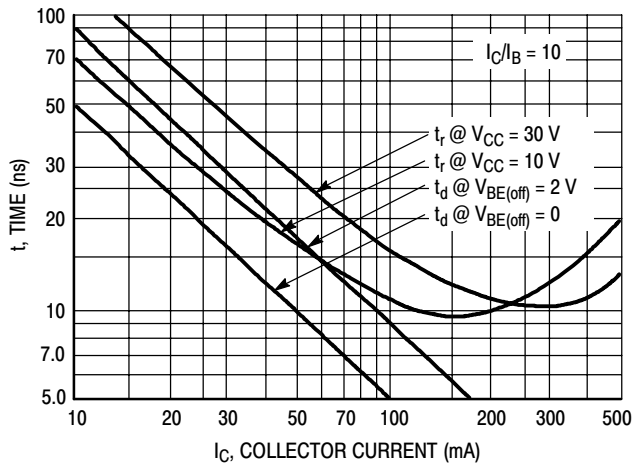


Figure 5. Turn-On Time

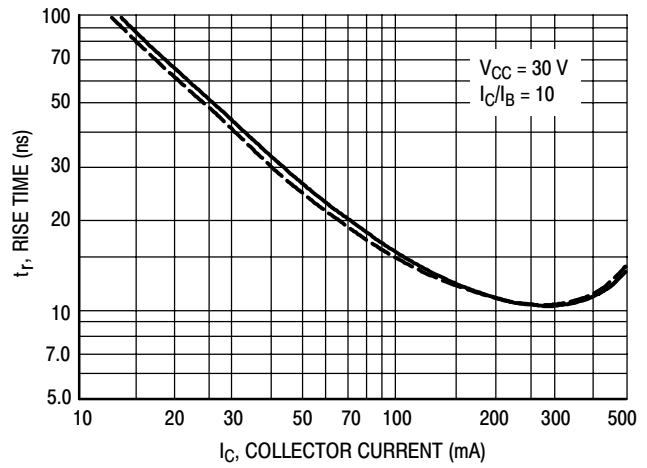


Figure 6. Rise Time

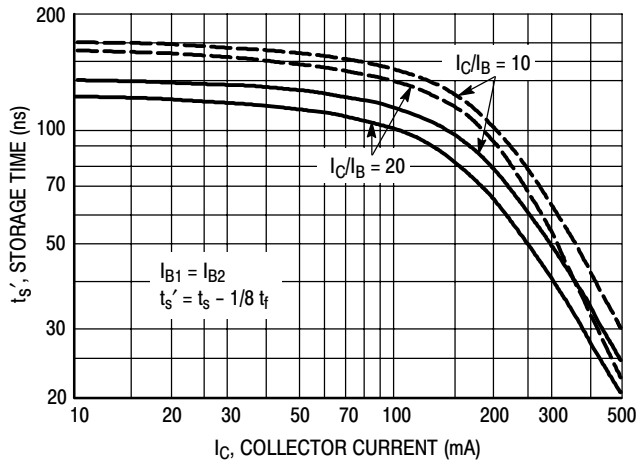


Figure 7. Storage Time

SMALL-SIGNAL CHARACTERISTICS NOISE FIGURE

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

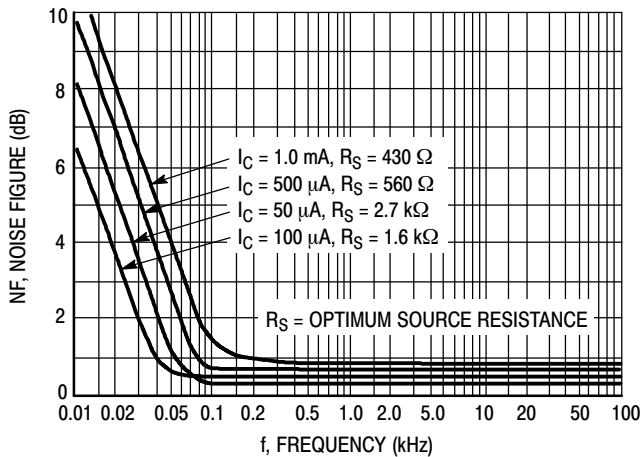


Figure 8. Frequency Effects

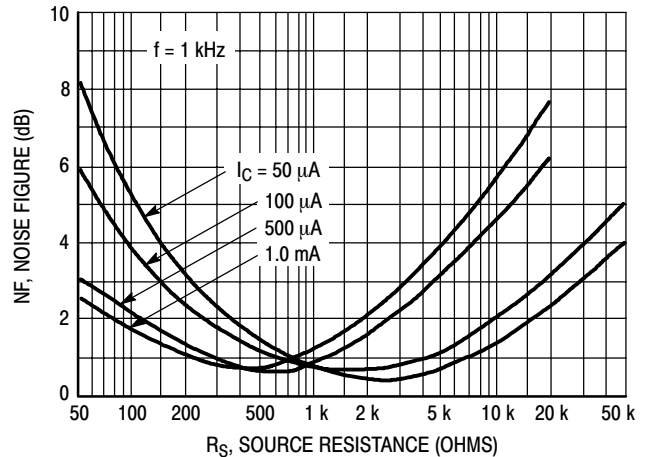


Figure 9. Source Resistance Effects

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h PARAMETERS

$V_{CE} = -10$ Vdc, $f = 1.0$ 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.

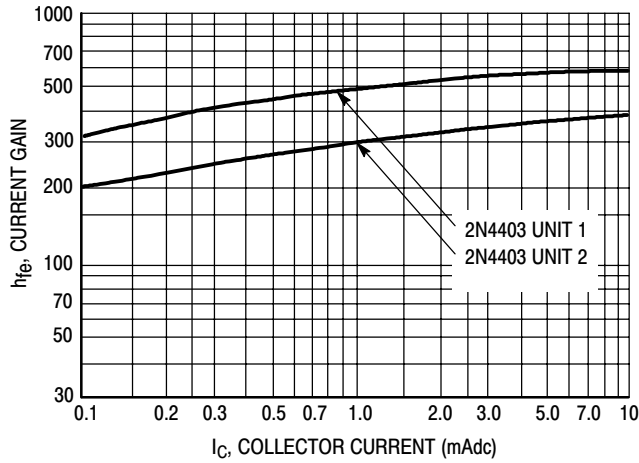


Figure 10. Current Gain

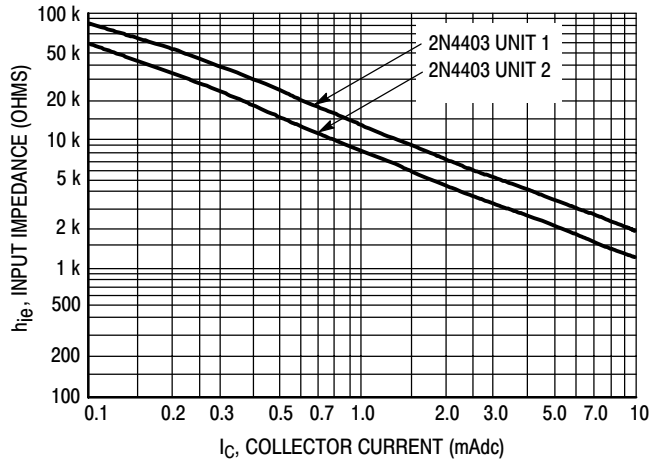


Figure 11. Input Impedance

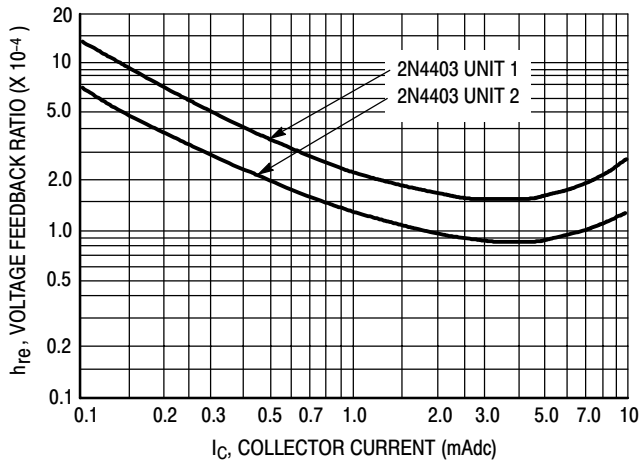


Figure 12. Voltage Feedback Ratio

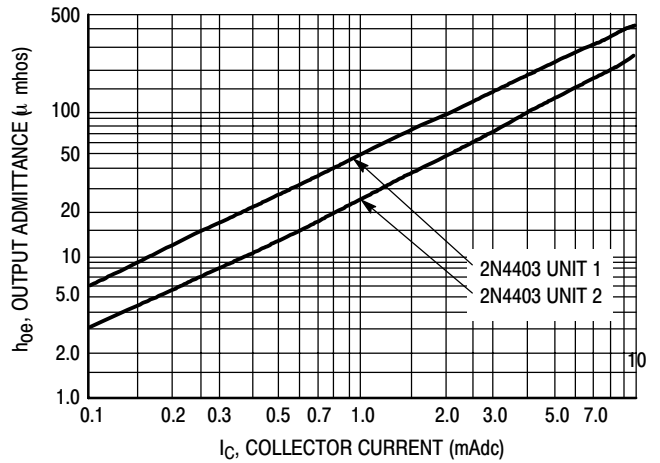


Figure 13. Output Admittance

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STATIC CHARACTERISTICS

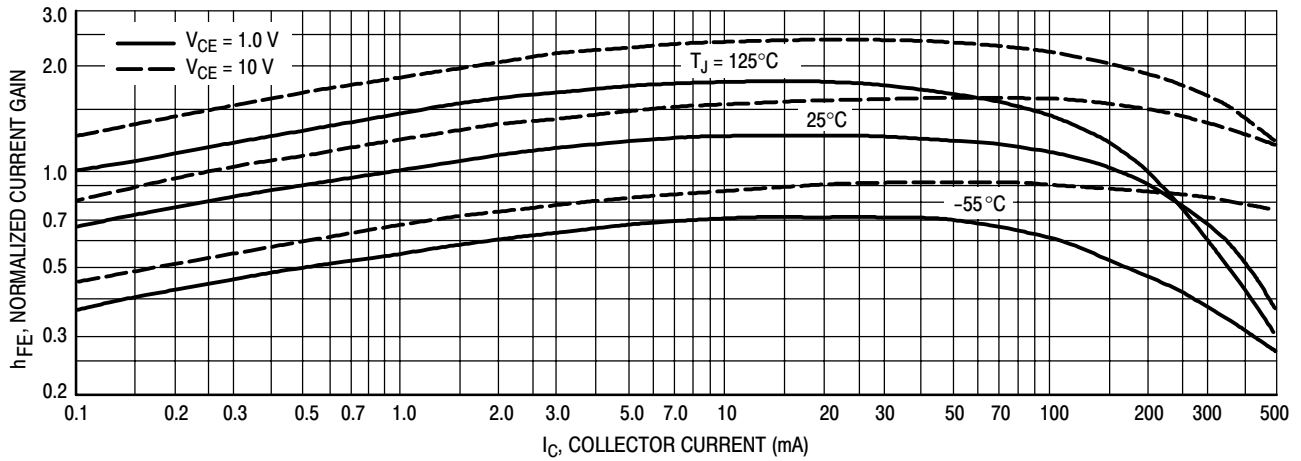


Figure 14. DC Current Gain

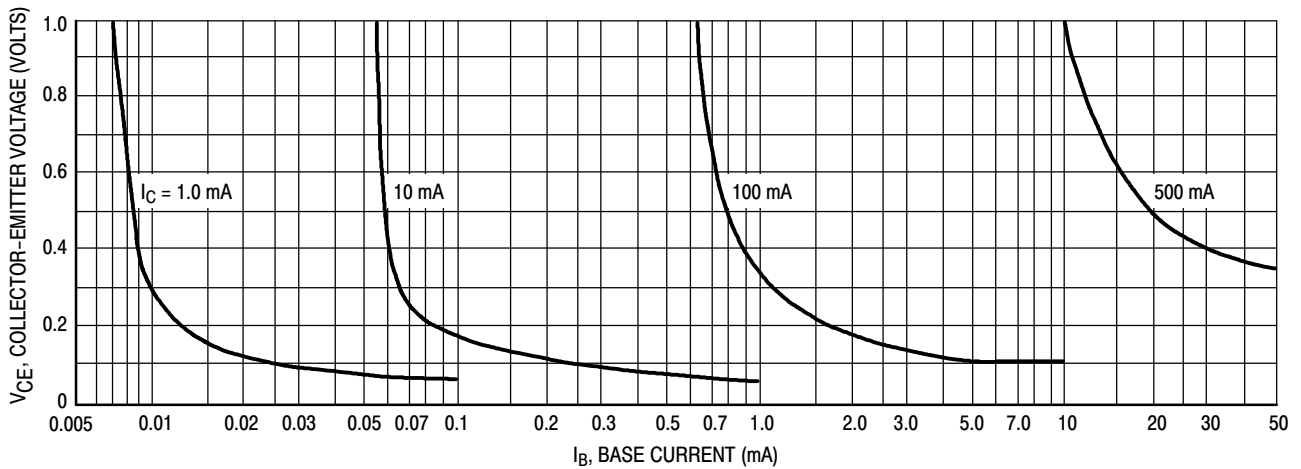


Figure 15. Collector Saturation Region

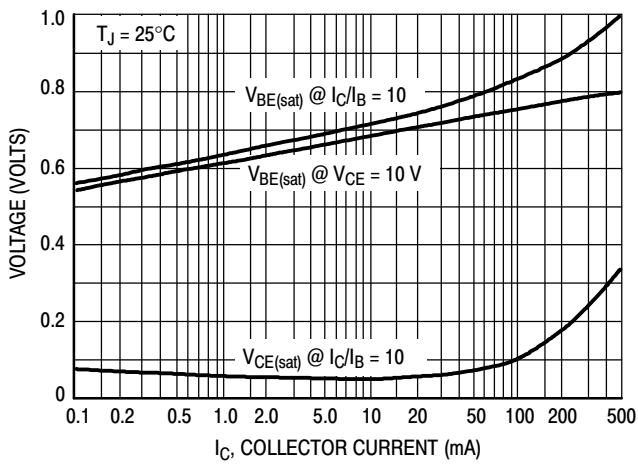


Figure 16. "On" Voltages

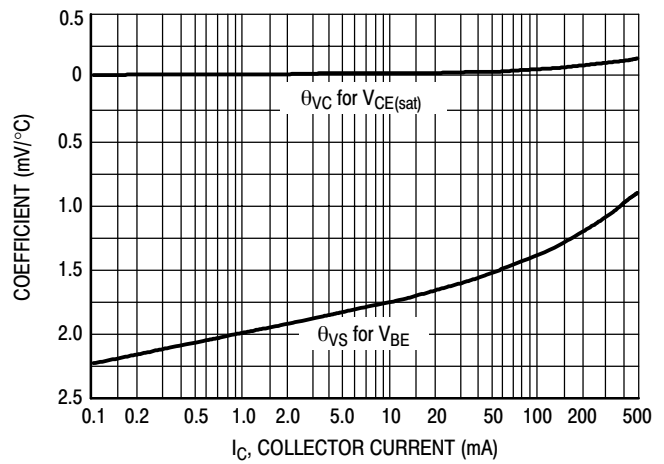
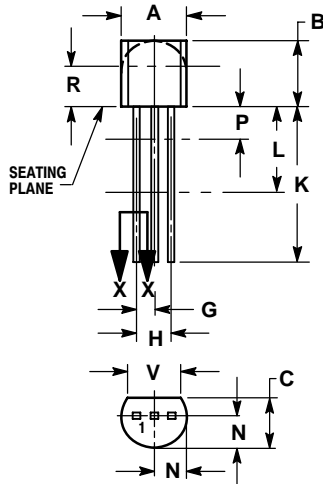


Figure 17. Temperature Coefficients

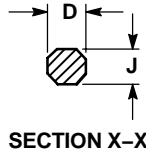
2N4403

PACKAGE DIMENSIONS

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



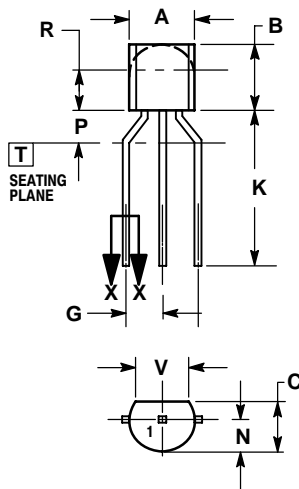
STRAIGHT LEAD
BULK PACK



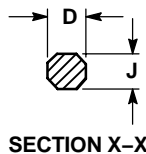
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1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. CONTOUR OF PACKAGE BEYOND DIMENSION R IS UNCONTROLLED.
4. LEAD DIMENSION IS UNCONTROLLED IN P AND BEYOND DIMENSION K MINIMUM.

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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