2N4403

Preferred Device

General Purpose Transistors

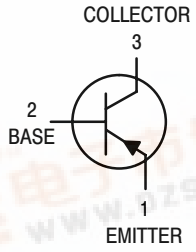
PNP Silicon

ON Semiconductor®

http://onsemi.com

Features

- Pb−Free Packages are Available*



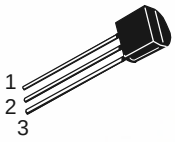
MAXIMUM RATINGS

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°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	W mW/°C
Operating and Storage Junction Temperature Range	T_J, T_{stg}	−55 to +150	°C

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.

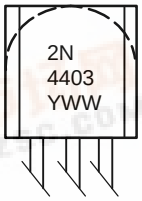
THERMAL CHARACTERISTICS

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



TO−92
CASE 29
STYLE 1

MARKING DIAGRAM



Y = Year
WW = Work Week

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.

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

Publication Order Number:

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 mAdc, I_B = 0)	$V_{(BR)CEO}$	40	−	Vdc
Collector−Base Breakdown Voltage (I_C = 0.1 mAdc, I_E = 0)	$V_{(BR)CBO}$	40	−	Vdc
Emitter−Base Breakdown Voltage (I_E = 0.1 mAdc, I_C = 0)	$V_{(BR)EBO}$	5.0	−	Vdc
Base Cutoff Current (V_{CE} = 35 Vdc, V_{EB} = 0.4 Vdc)	I_{BEV}	−	0.1	μAdc
Collector Cutoff Current (V_{CE} = 35 Vdc, V_{EB} = 0.4 Vdc)	I_{CEX}	−	0.1	μAdc
ON CHARACTERISTICS				
DC Current Gain	h_{FE}			−
(I_C = 0.1 mAdc, V_{CE} = 1.0 Vdc)		30	−	
(I_C = 1.0 mAdc, V_{CE} = 1.0 Vdc)		60	−	
(I_C = 10 mAdc, V_{CE} = 1.0 Vdc)		100	−	
(I_C = 150 mAdc, V_{CE} = 2.0 Vdc) (Note 1)		100	300	
(I_C = 500 mAdc, V_{CE} = 2.0 Vdc) (Note 1)		20	−	
Collector−Emitter Saturation Voltage (Note 1)	$V_{CE(sat)}$			Vdc
(I_C = 150 mAdc, I_B = 15 mAdc)		−	0.4	
(I_C = 500 mAdc, I_B = 50 mAdc)		−	0.75	
Base−Emitter Saturation Voltage (Note 1)	$V_{BE(sat)}$			Vdc
(I_C = 150 mAdc, I_B = 15 mAdc)		0.75	0.95	
(I_C = 500 mAdc, I_B = 50 mAdc)		−	1.3	
SMALL−SIGNAL CHARACTERISTICS				
Current−Gain − Bandwidth Product (I_C = 20 mAdc, V_{CE} = 10 Vdc, f = 100 MHz)	f_T	200	−	MHz
Collector−Base Capacitance (V_{CB} = 10 Vdc, I_E = 0, f = 1.0 MHz)	C_{cb}	−	8.5	pF
Emitter−Base Capacitance (V_{EB} = 0.5 Vdc, I_C = 0, f = 1.0 MHz)	C_{eb}	−	30	pF
Input Impedance (I_C = 1.0 mAdc, V_{CE} = 10 Vdc, f = 1.0 kHz)	h_{ie}	1.5 k	15 k	ohms
Voltage Feedback Ratio (I_C = 1.0 mAdc, V_{CE} = 10 Vdc, f = 1.0 kHz)	h_{re}	0.1	8.0	X 10^{-4}
Small−Signal Current Gain (I_C = 1.0 mAdc, V_{CE} = 10 Vdc, f = 1.0 kHz)	h_{fe}	60	500	−
Output Admittance (I_C = 1.0 mAdc, V_{CE} = 10 Vdc, f = 1.0 kHz)	h_{oe}	1.0	100	μmhos
SWITCHING CHARACTERISTICS				
Delay Time	(V_{CC} = 30 Vdc, V_{BE} = +2.0 Vdc, I_C = 150 mAdc, I_{B1} = 15 mAdc) t_d	−	15	ns
Rise Time		t_r	−	20	ns
Storage Time	(V_{CC} = 30 Vdc, I_C = 150 mAdc, I_{B1} = 15 mA, I_{B2} = 15 mA) t_s	−	225	ns
Fall Time		t_f	−	30	ns

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

ORDERING INFORMATION

Device	Package	Shipping†
2N4403	TO−92	5,000 Units / Box
2N4403G	TO−92 (Pb−Free)	5,000 Units / Box
2N4403RL	TO−92	2,000 / Tape & Reel
2N4403RLRA	TO−92	2,000 / Tape & Reel
2N4403RLRAG	TO−92 (Pb−Free)	2,000 / Tape & Reel
2N4403RLRM	TO−92	2,000 / Ammo Pack
2N4403RLRP	TO−92	2,000 / Ammo Pack
2N4403RLRPG	TO−92 (Pb−Free)	2,000 / Ammo Pack
2N4403ZL1	TO−92	2,000 / 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

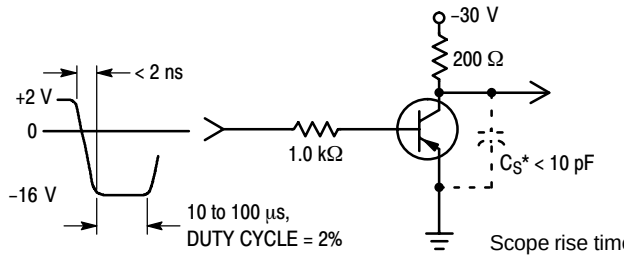


Figure 1. Turn−On Time

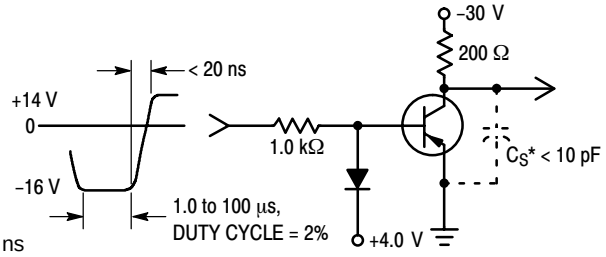


Figure 2. Turn−Off Time

Scope rise time < 4.0 ns
*Total shunt capacitance of test jig connectors, and oscilloscope

TRANSIENT CHARACTERISTICS

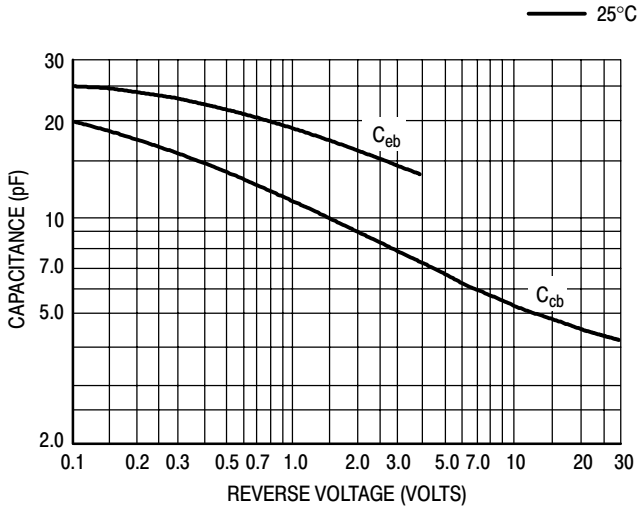


Figure 3. Capacitances

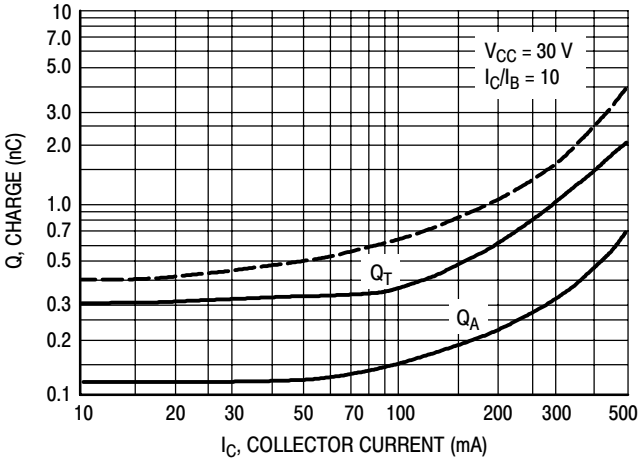


Figure 4. Charge Data

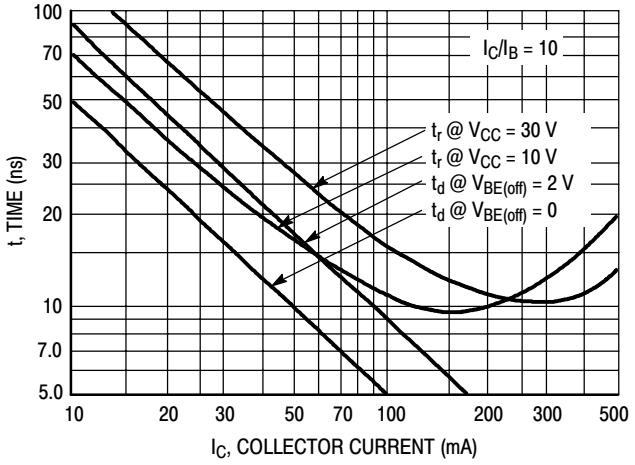


Figure 5. Turn−On Time

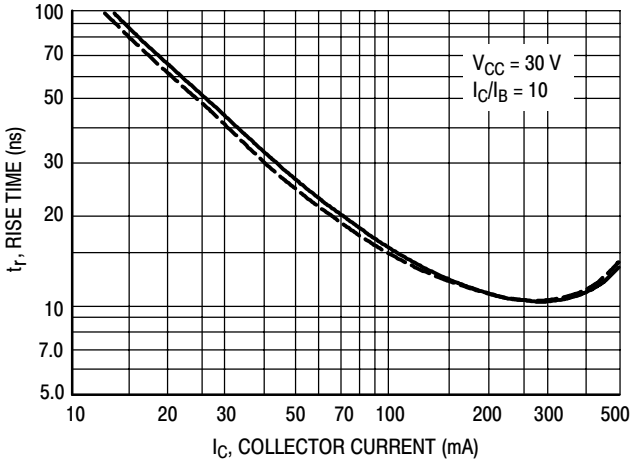


Figure 6. Rise Time

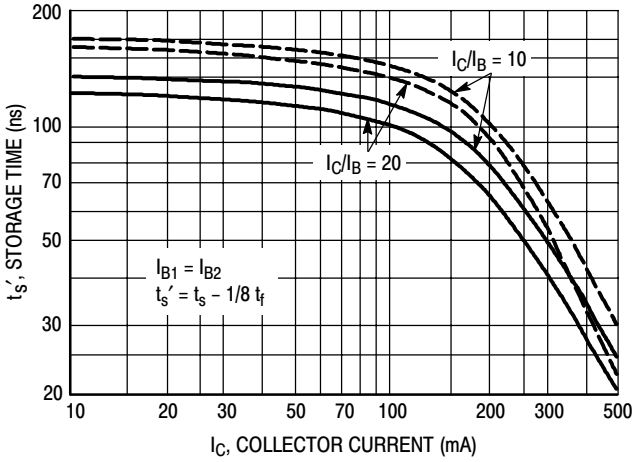


Figure 7. Storage Time

SMALL−SIGNAL CHARACTERISTICS

NOISE FIGURE

V_{CE} = −10 Vdc, T_A = 25°C; Bandwidth = 1.0 Hz

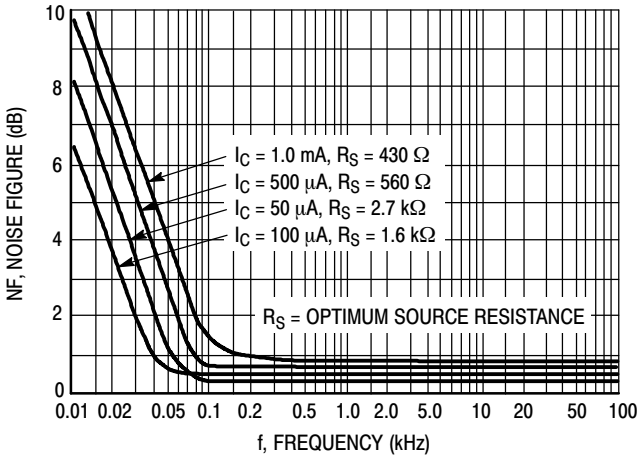


Figure 8. Frequency Effects

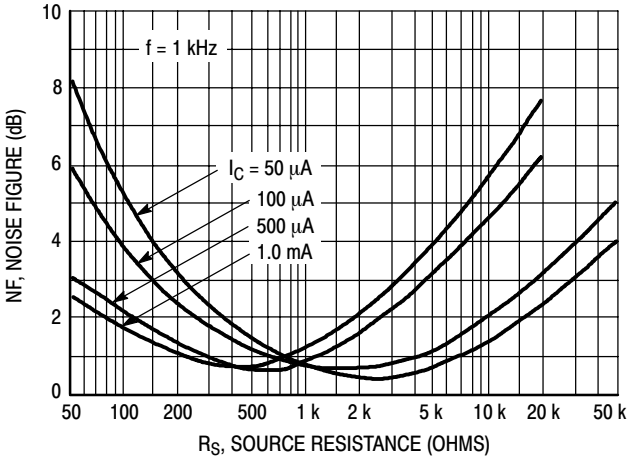


Figure 9. Source Resistance Effects

h PARAMETERS

V_{CE} = −10 Vdc, f = 1.0 kHz, T_A = 25°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.

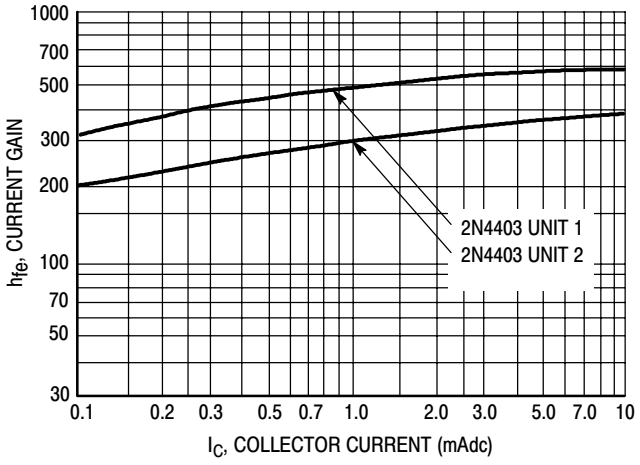


Figure 10. Current Gain

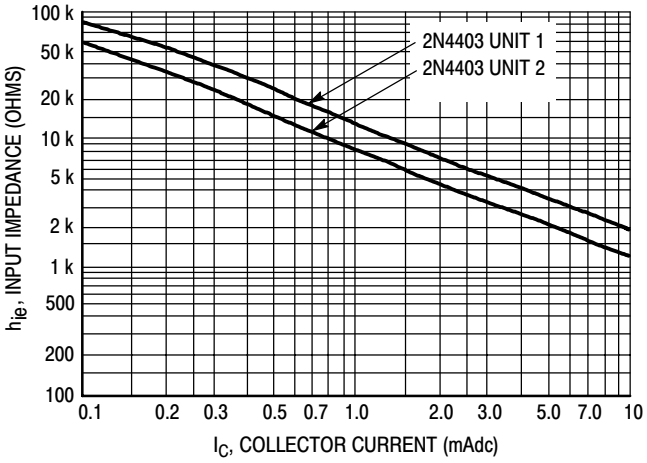


Figure 11. Input Impedance

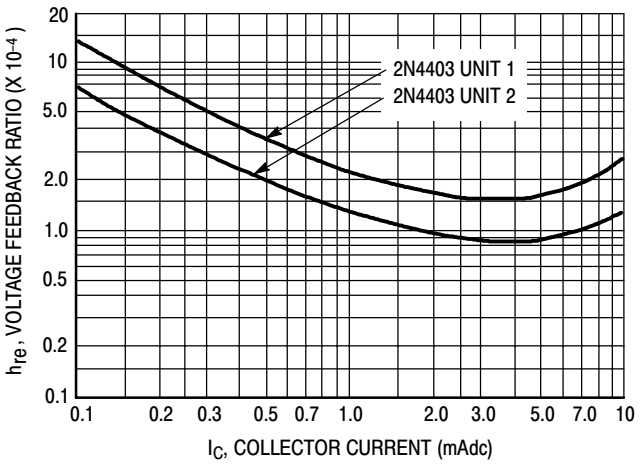


Figure 12. Voltage Feedback Ratio

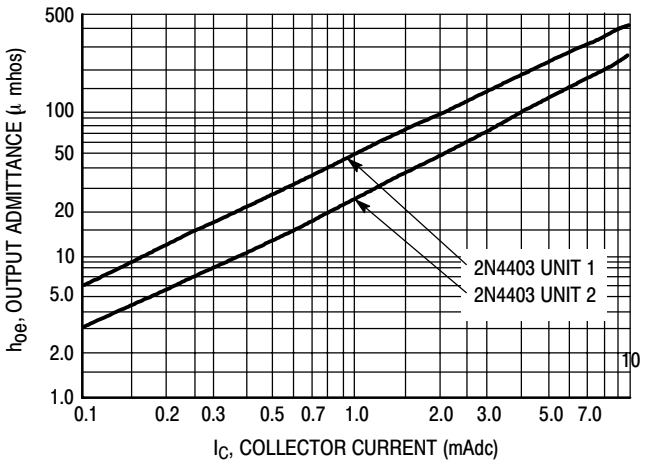


Figure 13. Output Admittance

STATIC CHARACTERISTICS

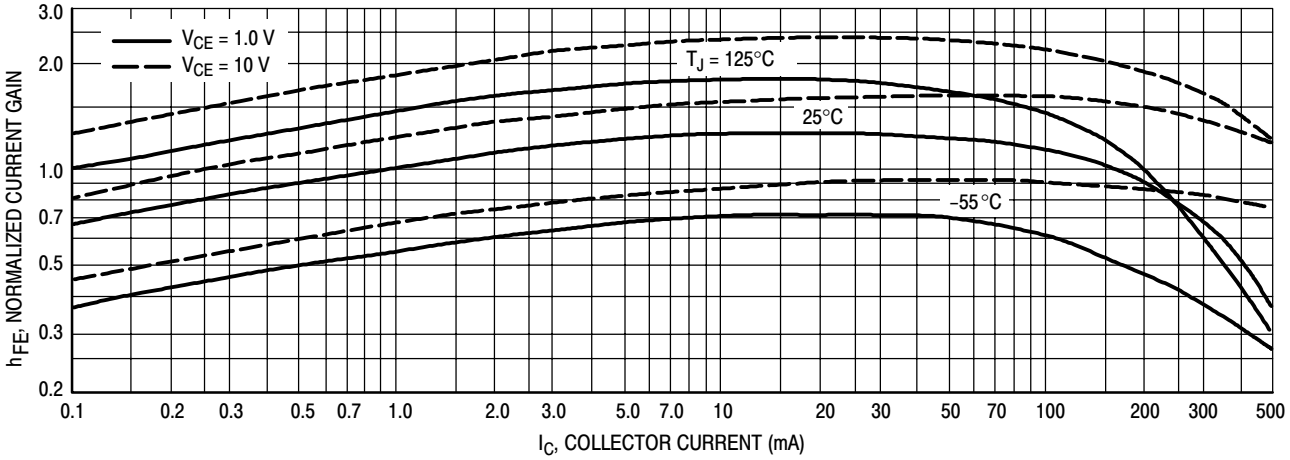


Figure 14. DC Current Gain

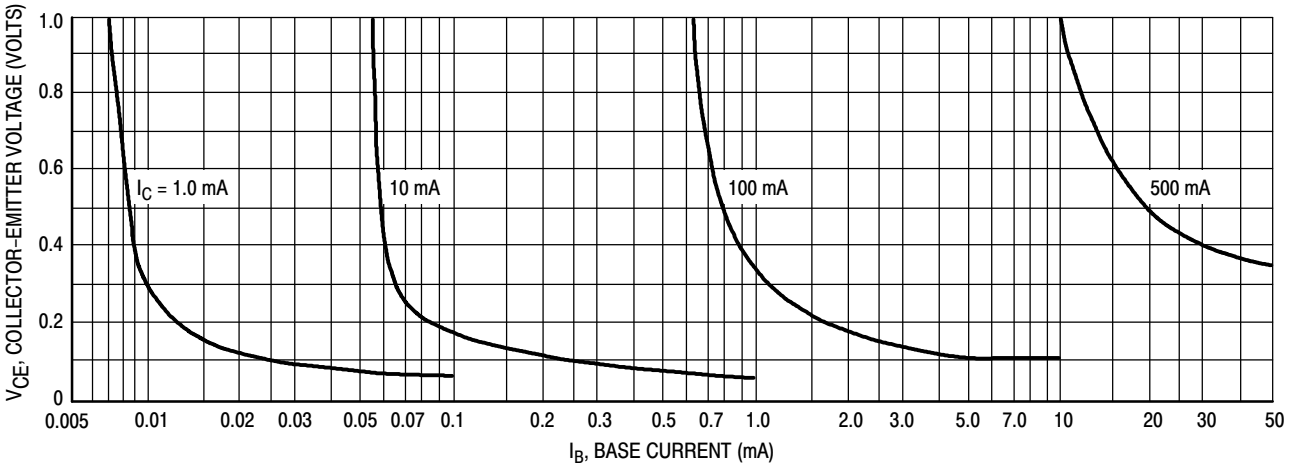


Figure 15. Collector Saturation Region

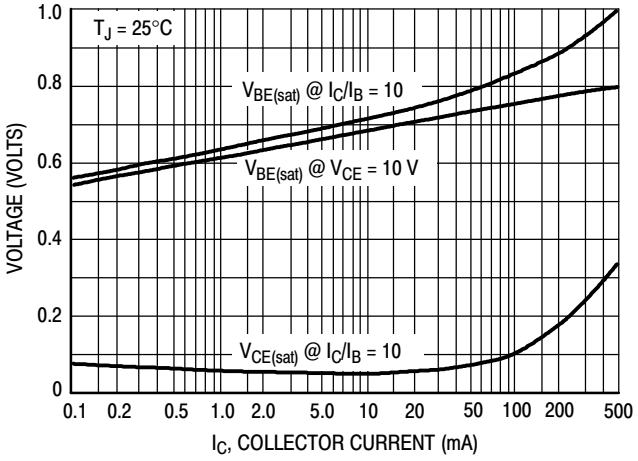


Figure 16. “On” Voltages

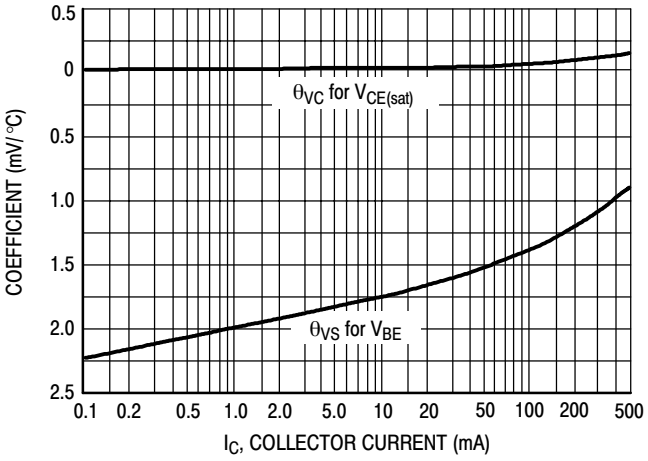
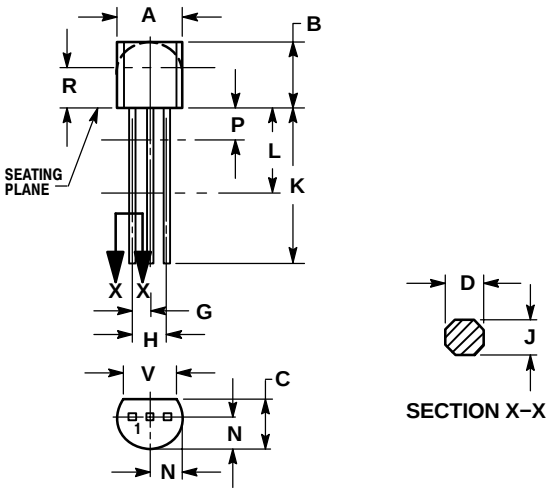


Figure 17. Temperature Coefficients

2N4403

PACKAGE DIMENSIONS

TO−92
TO−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.

	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	0.021	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:
PIN 1. EMITTER
2. BASE
3. COLLECTOR

2N4403

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:
Literature Distribution Center for ON Semiconductor
P.O. Box 61312, Phoenix, Arizona 85082−1312 USA
Phone: 480−829−7710 or 800−344−3860 Toll Free USA/Canada
Fax: 480−829−7709 or 800−344−3867 Toll Free USA/Canada
Email: orderlit@onsemi.com

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Japan: ON Semiconductor, Japan Customer Focus Center
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Phone: 81−3−5773−3850

ON Semiconductor Website: http://onsemi.com

Order Literature: http://www.onsemi.com/litorder

For additional information, please contact your local Sales Representative.

2N4403/D