EN - For pricing and availability in your local country please visit one of the below links:

DE - Informationen zu Preisen und Verfügbarkeit in Ihrem Land erhalten Sie über die unten aufgeführten Links:

FR - Pour connaître les tarifs et la disponibilité dans votre pays, cliquez sur l'un des liens suivants:

2N4401TAR	MMSZ4V3T1G.	MMSZ4V3T1G	2N4401G	2N4401RLRPG
2N4401RLRAG.	2N4401RLRAG			

EN
This Datasheet is presented by the manufacturer

DE
Dieses Datenblatt wird vom Hersteller bereitgestellt

FR
Cette fiche technique est présentée par le fabricant

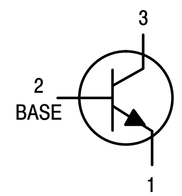
2N4401

General Purpose Transistors

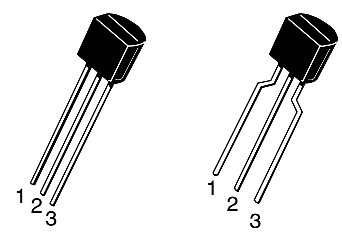
NPN Silicon

Features

- Pb−Free Packages are Available*



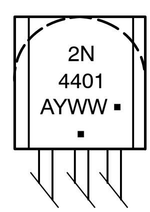
TO−92
CASE 29
STYLE 1



STRAIGHT LEAD
BULK PACK

BENT LEAD
TAPE & REEL
AMMO PACK

MARKING DIAGRAM



2N4401	= Device Code
A	= Assembly Location
Y	= Year
WW	= Work Week
▪	= Pb−Free Package

(Note: Microdot may be in either location)

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°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

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

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.

ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 2 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.

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)	$V_{(BR)CBO}$	60	–	Vdc
Emitter−Base Breakdown Voltage	(I_E = 0.1 mAdc, I_C = 0)	$V_{(BR)EBO}$	6.0	–	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 (Note 1)					
DC Current Gain		h_{FE}			–
	(I_C = 0.1 mAdc, V_{CE} = 1.0 Vdc)		20	–	
	(I_C = 1.0 mAdc, V_{CE} = 1.0 Vdc)		40	–	
	(I_C = 10 mAdc, V_{CE} = 1.0 Vdc)		80	–	
	(I_C = 150 mAdc, V_{CE} = 1.0 Vdc)		100	300	
	(I_C = 500 mAdc, V_{CE} = 2.0 Vdc)		40	–	
Collector−Emitter Saturation Voltage	(I_C = 150 mAdc, I_B = 15 mAdc)	$V_{CE(sat)}$	–	0.4	Vdc
	(I_C = 500 mAdc, I_B = 50 mAdc)		–	0.75	
Base−Emitter Saturation Voltage	(I_C = 150 mAdc, I_B = 15 mAdc)	$V_{BE(sat)}$	0.75	0.95	Vdc
	(I_C = 500 mAdc, I_B = 50 mAdc)		–	1.2	
SMALL−SIGNAL CHARACTERISTICS					
Current−Gain − Bandwidth Product	(I_C = 20 mAdc, V_{CE} = 10 Vdc, f = 100 MHz)	f_T	250	–	MHz
Collector−Base Capacitance	(V_{CB} = 5.0 Vdc, I_E = 0, f = 1.0 MHz)	C_{cb}	–	6.5	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}	1.0	15	k Ω
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}	40	500	–
Output Admittance	(I_C = 1.0 mAdc, V_{CE} = 10 Vdc, f = 1.0 kHz)	h_{oe}	1.0	30	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} = I_{B2} = 15 mAdc)	t_s	–	225	ns
Fall Time		t_f	–	30	ns

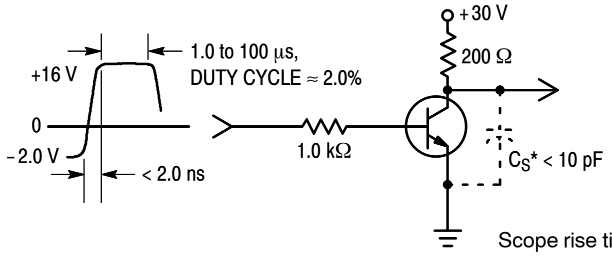
1. Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2.0%.

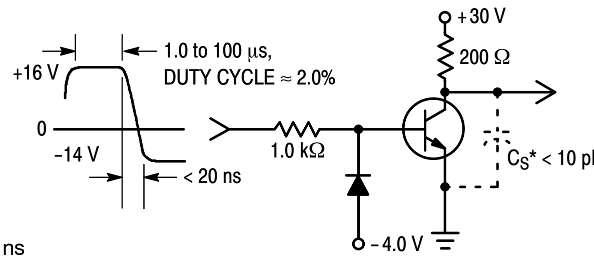
ORDERING INFORMATION

Device	Package	Shipping†
2N4401	TO−92	5000 Units / Bulk
2N4401G	TO−92 (Pb−Free)	5000 Units / Bulk
2N4401RLRA	TO−92	2000 / Tape & Reel
2N4401RLRAG	TO−92 (Pb−Free)	2000 / Tape & Reel
2N4401RLRMG	TO−92 (Pb−Free)	2000 / Tape & Ammo Box
2N4401RLRP	TO−92	2000 / Tape & Ammo Box
2N4401RLRPG	TO−92 (Pb−Free)	2000 / Tape & Ammo Box

†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





Scope rise time < 4.0 ns

*Total shunt capacitance of test jig connectors, and oscilloscope

Figure 1. Turn−On Time **Figure 2. Turn−Off Time**

TRANSIENT CHARACTERISTICS

25°C (solid) 100°C (dashed)

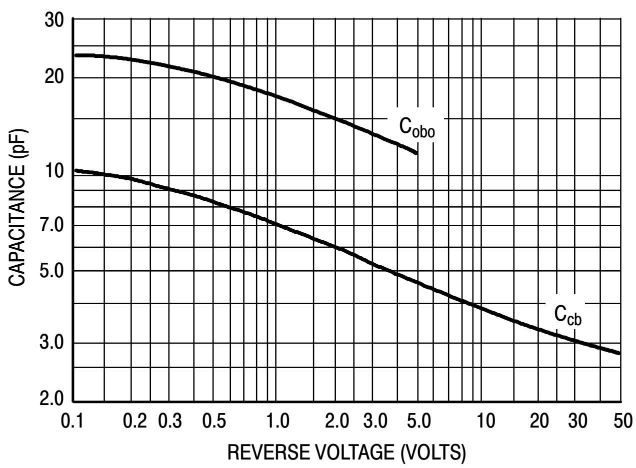


Figure 3. Capacitances

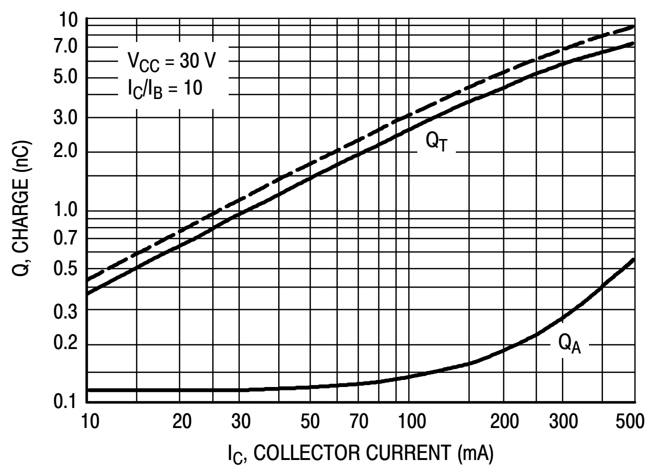


Figure 4. Charge Data

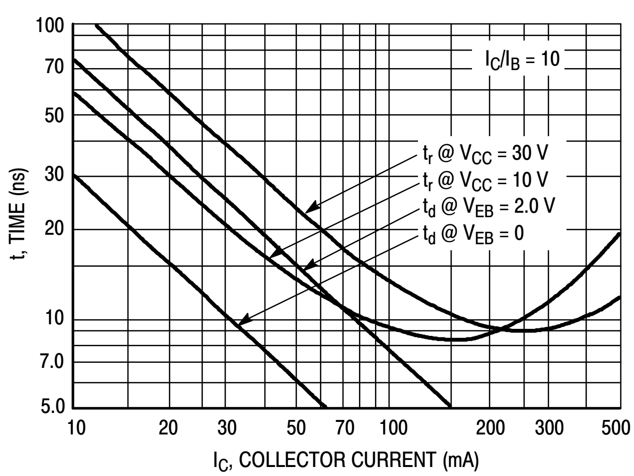


Figure 5. Turn−On Time

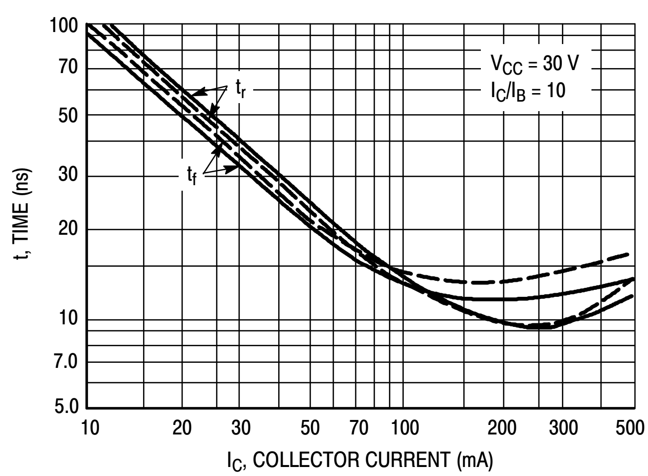


Figure 6. Rise and Fall Times

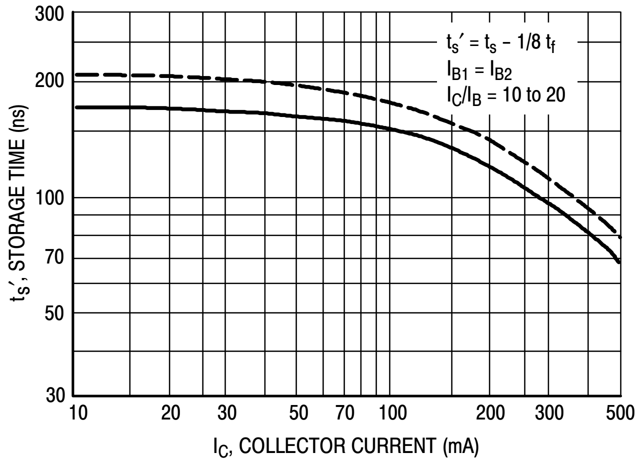


Figure 7. Storage Time

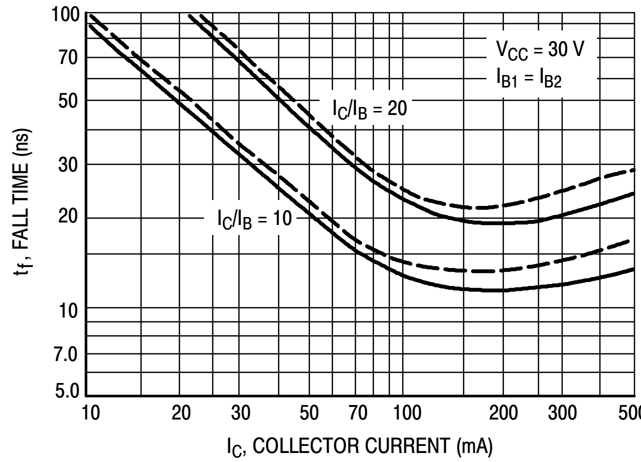


Figure 8. Fall Time

SMALL–SIGNAL CHARACTERISTICS

NOISE FIGURE

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

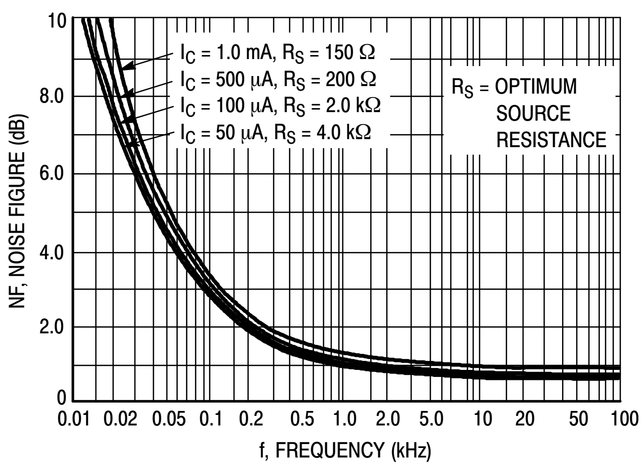


Figure 9. Frequency Effects

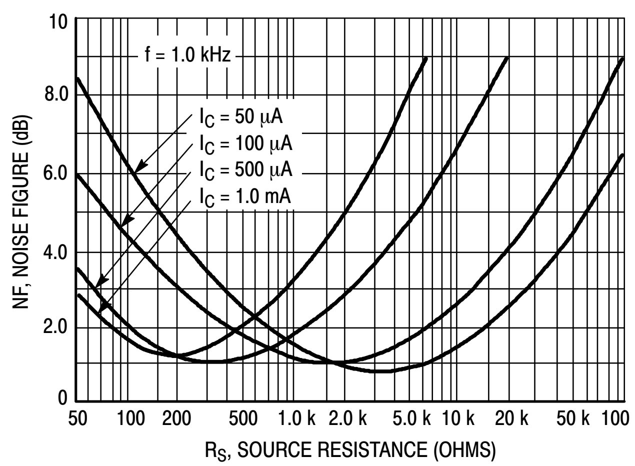


Figure 10. Source Resistance Effects

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

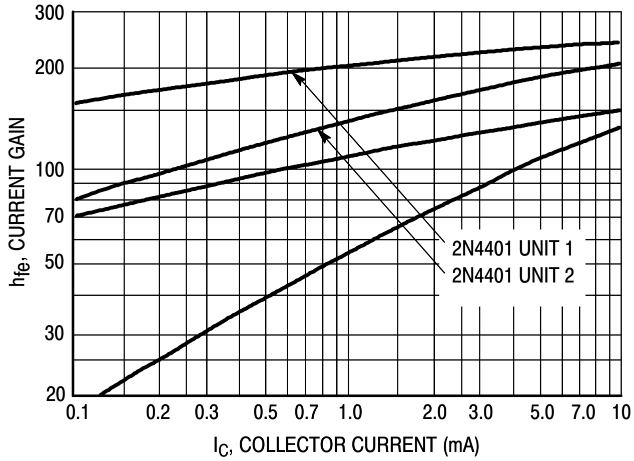


Figure 11. Current Gain

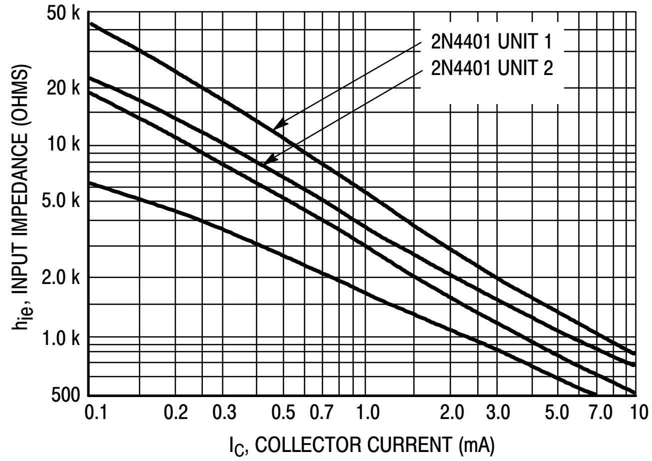


Figure 12. Input Impedance

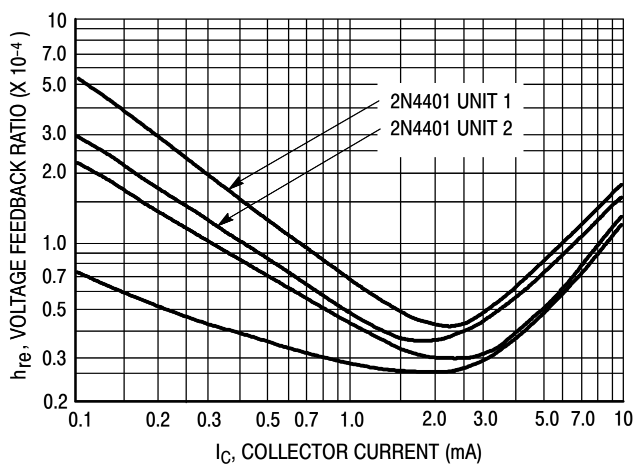


Figure 13. Voltage Feedback Ratio

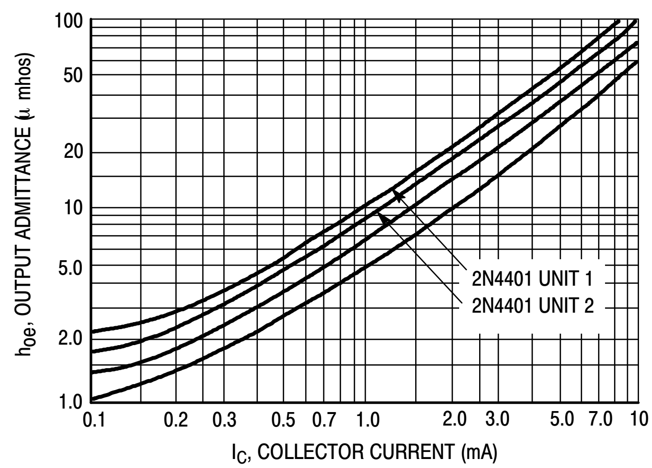


Figure 14. Output Admittance

STATIC CHARACTERISTICS

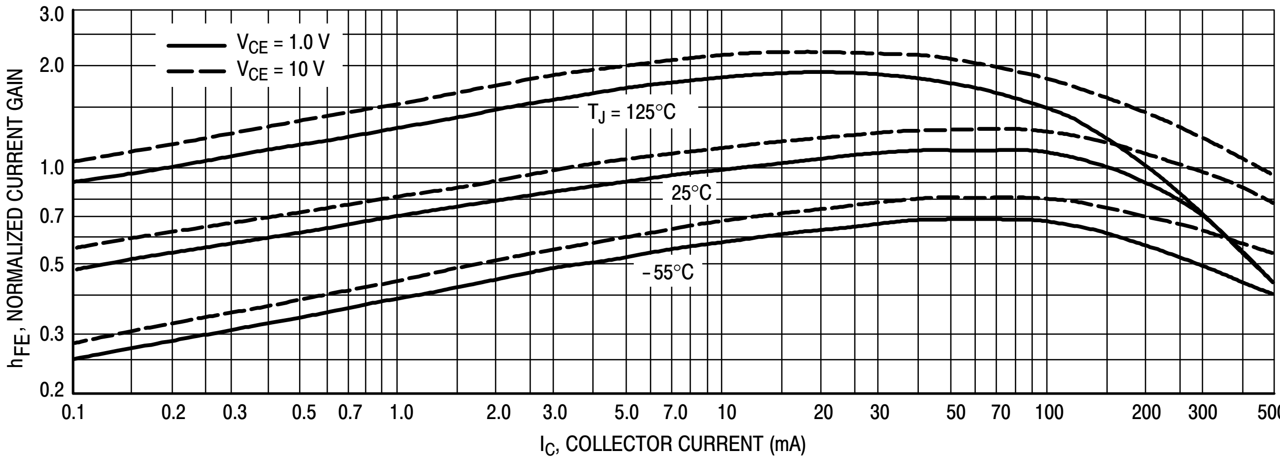


Figure 15. DC Current Gain

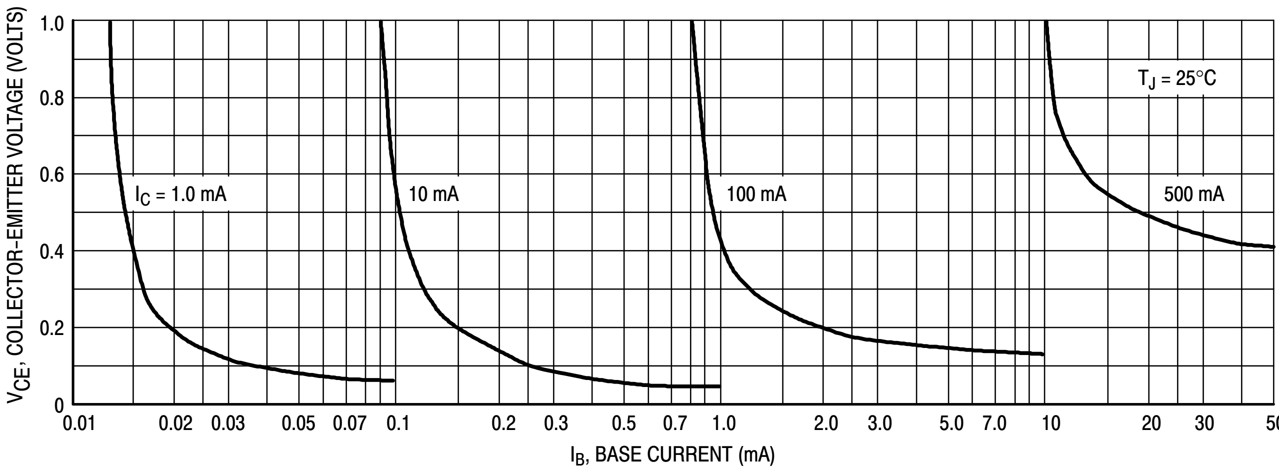


Figure 16. Collector Saturation Region

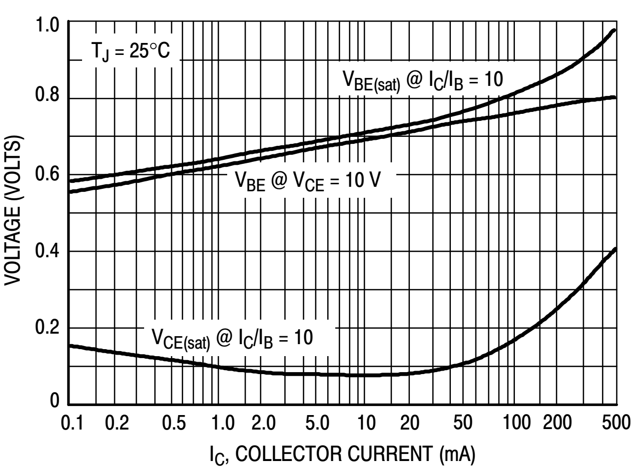


Figure 17. “On” Voltages

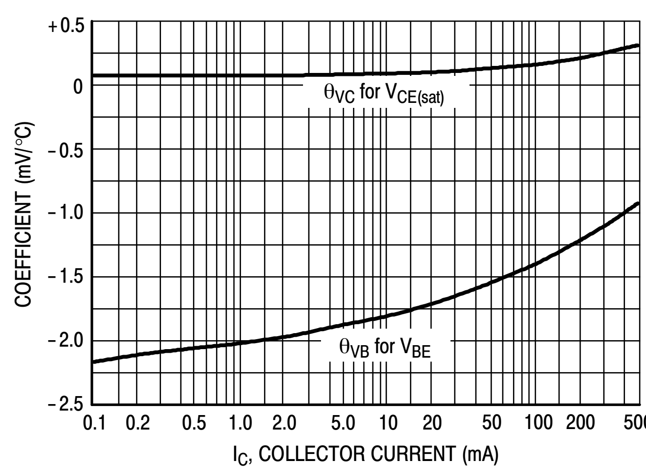
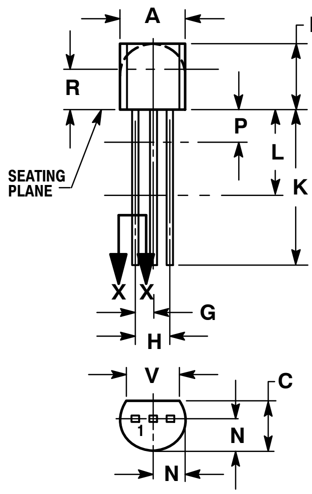


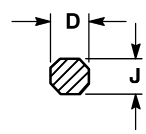
Figure 18. Temperature Coefficients

PACKAGE DIMENSIONS

TO−92 (TO−226)
CASE 29−11
ISSUE AM



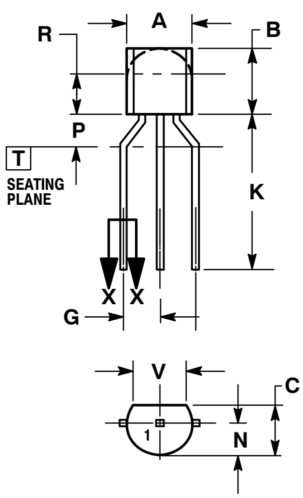
STRAIGHT LEAD
BULK PACK



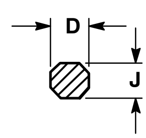
SECTION X−X

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.

	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	---



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.

	MILLIMETERS	
DIM	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:
PIN 1. EMITTER
2. BASE
3. COLLECTOR

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:
Literature Distribution Center for ON Semiconductor
P.O. Box 5163, Denver, Colorado 80217 USA
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