

# PZT3904T1

Preferred Device

## General Purpose Transistor NPN Silicon

### Features

- Pb-Free Package is 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	$I_C$	200	mAdc

### THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Total Device Dissipation (Note 1) $T_A = 25^\circ\text{C}$	$P_D$	1.5 12	W mW/ $^\circ\text{C}$
Thermal Resistance Junction-to-Ambient (Note 1)	$R_{\theta JA}$	83.3	$^\circ\text{C}/\text{W}$
Thermal Resistance Junction-to-Lead #4	$R_{\theta JA}$	35	$^\circ\text{C}/\text{W}$
Junction and Storage Temperature Range	$T_J, T_{stg}$	-55 to +150	$^\circ\text{C}$

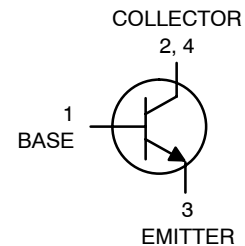
Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

1. FR-4 with 1 oz and 713 mm<sup>2</sup> of copper area.



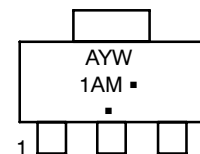
ON Semiconductor®

<http://onsemi.com>



SOT-223  
CASE 318E  
STYLE 1

### MARKING DIAGRAM



1AM = Specific Device Code  
A = Assembly Location  
Y = Year  
W = Work Week  
▪ = Pb-Free Package

(Note: Microdot may be in either location)

### ORDERING INFORMATION

Device	Package	Shipping†
PZT3904T1	SOT-223	1000 / Tape & Reel
PZT3904T1G	SOT-223 (Pb-Free)	1000 / Tape & Reel

†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.

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

# PZT3904T1

## ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = 25°C unless otherwise noted)

Characteristic	Symbol	Min	Max	Unit
<b>OFF CHARACTERISTICS</b> (Note 2)				
Collector – Emitter Breakdown Voltage (Note 3) (I <sub>C</sub> = 1.0 mA <sub>dc</sub> , I <sub>B</sub> = 0)	V <sub>(BR)CEO</sub>	40	–	Vdc
Collector – Base Breakdown Voltage (I <sub>C</sub> = 10 μA <sub>dc</sub> , I <sub>E</sub> = 0)	V <sub>(BR)CBO</sub>	60	–	
Emitter – Base Breakdown Voltage (I <sub>E</sub> = 10 μA <sub>dc</sub> , I <sub>C</sub> = 0)	V <sub>(BR)EBO</sub>	6.0	–	
Base Cutoff Current (V <sub>CE</sub> = 30 Vdc, V <sub>EB</sub> = 3.0 Vdc)	I <sub>BL</sub>	–	50	nA <sub>dc</sub>
Collector Cutoff Current (V <sub>CE</sub> = 30 Vdc, V <sub>EB</sub> = 3.0 Vdc)	I <sub>CEX</sub>	–	50	

## ON CHARACTERISTICS

 (Note 3)

DC Current Gain (Note 2) (I <sub>C</sub> = 0.1 mA <sub>dc</sub> , V <sub>CE</sub> = 1.0 Vdc) (I <sub>C</sub> = 1.0 mA <sub>dc</sub> , V <sub>CE</sub> = 1.0 Vdc) (I <sub>C</sub> = 10 mA <sub>dc</sub> , V <sub>CE</sub> = 1.0 Vdc) (I <sub>C</sub> = 50 mA <sub>dc</sub> , V <sub>CE</sub> = 1.0 Vdc) (I <sub>C</sub> = 100 mA <sub>dc</sub> , V <sub>CE</sub> = 1.0 Vdc)	H <sub>FE</sub>	40 70 100 60 30	– – 300 – –	–
Collector – Emitter Saturation Voltage (Note 3) (I <sub>C</sub> = 10 mA <sub>dc</sub> , I <sub>B</sub> = 1.0 mA <sub>dc</sub> ) (I <sub>C</sub> = 50 mA <sub>dc</sub> , I <sub>B</sub> = 5.0 mA <sub>dc</sub> )	V <sub>CE(sat)</sub>	– –	0.2 0.3	Vdc
Base – Emitter Saturation Voltage (Note 3) (I <sub>C</sub> = 10 mA <sub>dc</sub> , I <sub>B</sub> = 1.0 mA <sub>dc</sub> ) (I <sub>C</sub> = 50 mA <sub>dc</sub> , I <sub>B</sub> = 5.0 mA <sub>dc</sub> )	V <sub>BE(sat)</sub>	0.65 –	0.85 0.95	Vdc

## SMALL-SIGNAL CHARACTERISTICS

Current – Gain – Bandwidth Product (I <sub>C</sub> = 10 mA <sub>dc</sub> , V <sub>CE</sub> = 20 Vdc, f = 100 MHz)	f <sub>T</sub>	300	–	MHz
Output Capacitance (V <sub>CB</sub> = 5.0 Vdc, I <sub>E</sub> = 0, f = 1.0 MHz)	C <sub>obo</sub>	–	5.0	pF
Input Capacitance (V <sub>EB</sub> = 0.5 Vdc, I <sub>C</sub> = 0, f = 1.0 MHz)	C <sub>ibo</sub>	–	8.0	
Input Impedance (V <sub>CE</sub> = 10 Vdc, I <sub>C</sub> = 1.0 mA <sub>dc</sub> , f = 1.0 kHz)	h <sub>ie</sub>	1.0	10	kΩ
Voltage Feedback Ratio (V <sub>CE</sub> = 10 Vdc, I <sub>C</sub> = 1.0 mA <sub>dc</sub> , f = 1.0 kHz)	h <sub>re</sub>	0.5	8.0	X 10 <sup>-4</sup>
Small – Signal Current Gain (V <sub>CE</sub> = 10 Vdc, I <sub>C</sub> = 1.0 mA <sub>dc</sub> , f = 1.0 kHz)	h <sub>fe</sub>	100	400	–
Output Admittance (V <sub>CE</sub> = 10 Vdc, I <sub>C</sub> = 1.0 mA <sub>dc</sub> , f = 1.0 kHz)	h <sub>oe</sub>	1.0	40	μMhos
Noise Figure (V <sub>CE</sub> = 5.0 Vdc, I <sub>C</sub> = 100 μA <sub>dc</sub> , R <sub>S</sub> = 1.0 kΩ, f = 1.0 kHz)	nF	–	5.0	dB

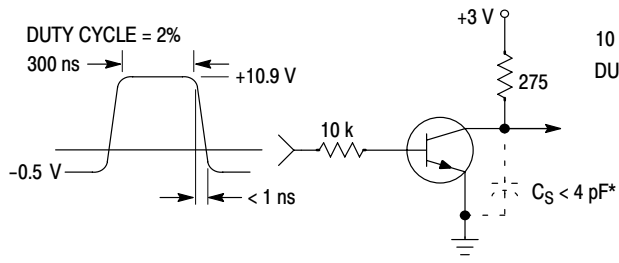
## SWITCHING CHARACTERISTICS

Delay Time	(V <sub>CC</sub> = 3.0 Vdc, V <sub>BE</sub> = -0.5 Vdc, I <sub>C</sub> = 10 mA <sub>dc</sub> , I <sub>B1</sub> = 1.0 mA <sub>dc</sub> )	t <sub>d</sub>	–	35	ns
Rise Time		t <sub>r</sub>	–	35	
Storage Time	(V <sub>CC</sub> = 3.0 Vdc, I <sub>C</sub> = 10 mA <sub>dc</sub> , I <sub>B1</sub> = I <sub>B2</sub> = 1.0 mA <sub>dc</sub> )	t <sub>s</sub>	–	200	
Fall Time		t <sub>f</sub>	–	50	

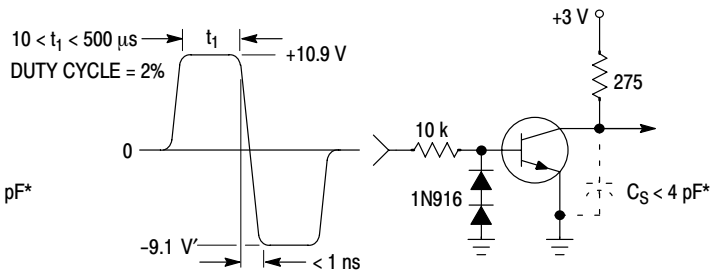
2. FR-5 = 1.0 × 0.75 × 0.062 in.

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

# PZT3904T1



**Figure 1. Delay and Rise Time  
Equivalent Test Circuit**



**Figure 2. Storage and Fall Time  
Equivalent Test Circuit**

\* Total shunt capacitance of test jig and connectors

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## TYPICAL TRANSIENT CHARACTERISTICS

—  $T_J = 25^\circ\text{C}$   
 - - -  $T_J = 125^\circ\text{C}$

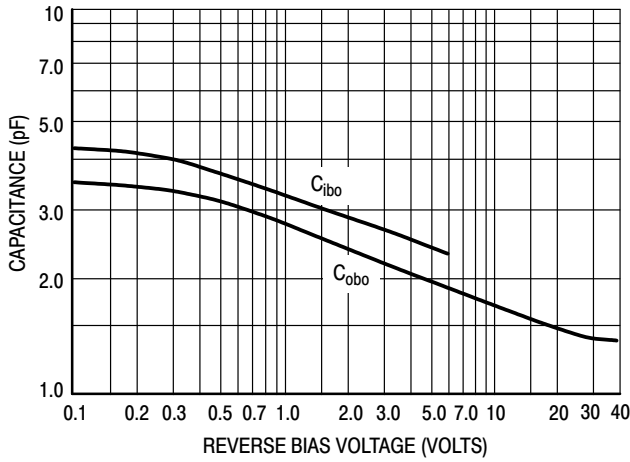


Figure 3. Capacitance

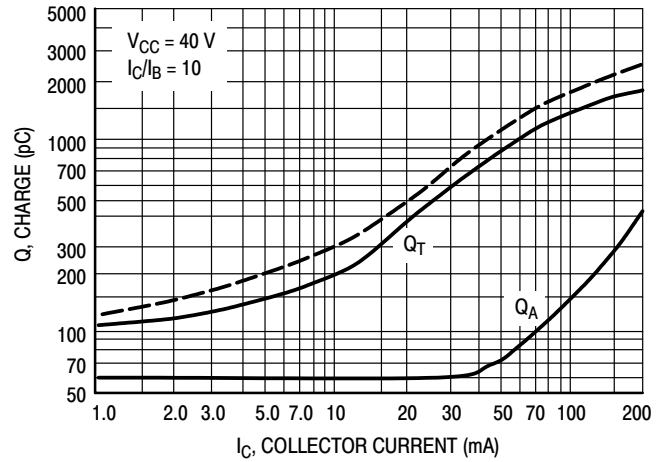


Figure 4. Charge Data

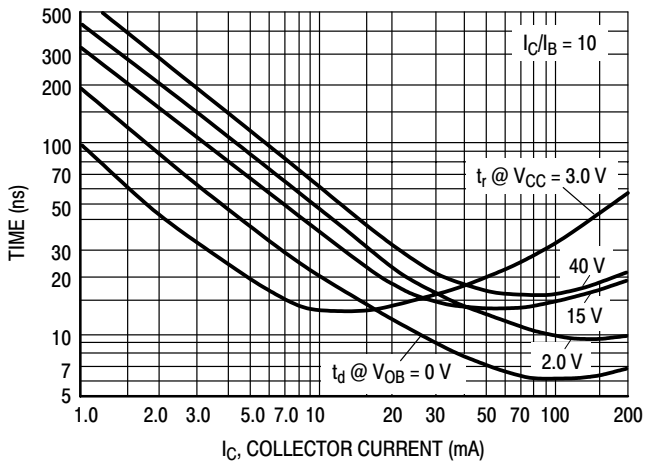


Figure 5. Turn-On Time

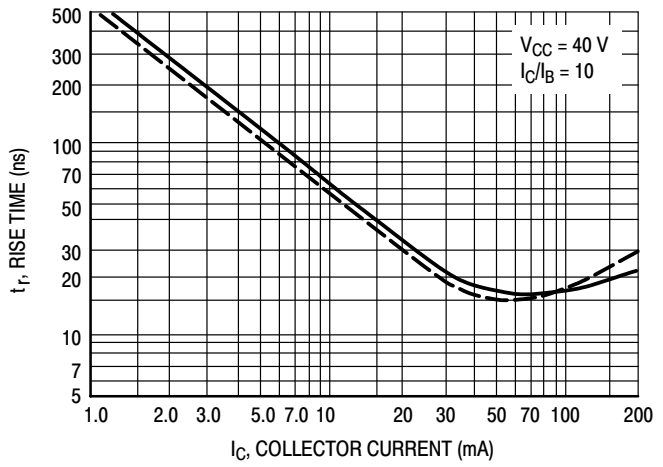


Figure 6. Rise Time

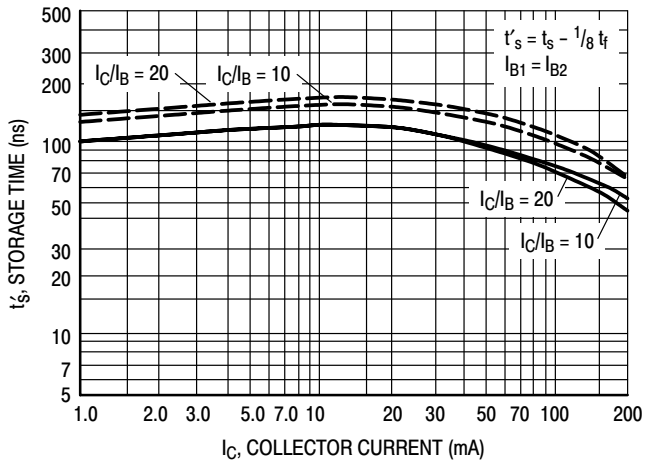


Figure 7. Storage Time

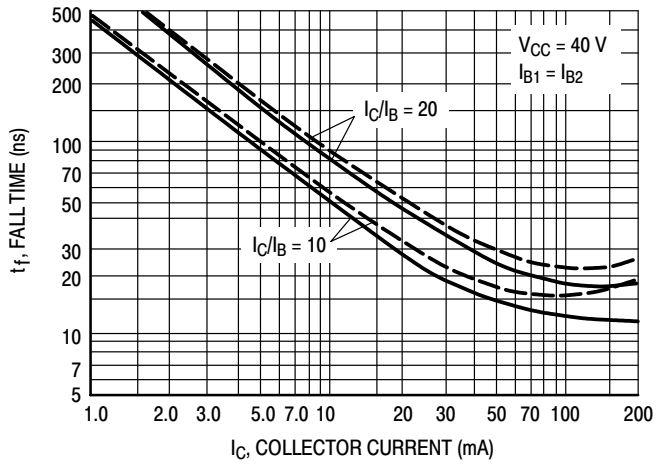


Figure 8. Fall Time

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## TYPICAL AUDIO SMALL-SIGNAL CHARACTERISTICS NOISE FIGURE VARIATIONS

( $V_{CE} = 5.0$  Vdc,  $T_A = 25^\circ\text{C}$ , Bandwidth = 1.0 Hz)

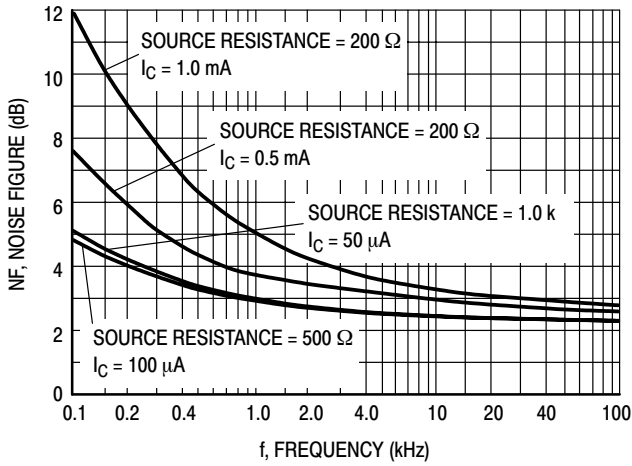


Figure 9.

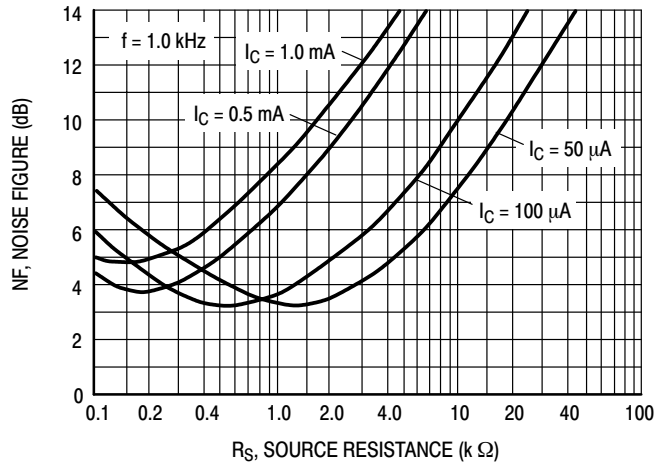


Figure 10.

## h PARAMETERS

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

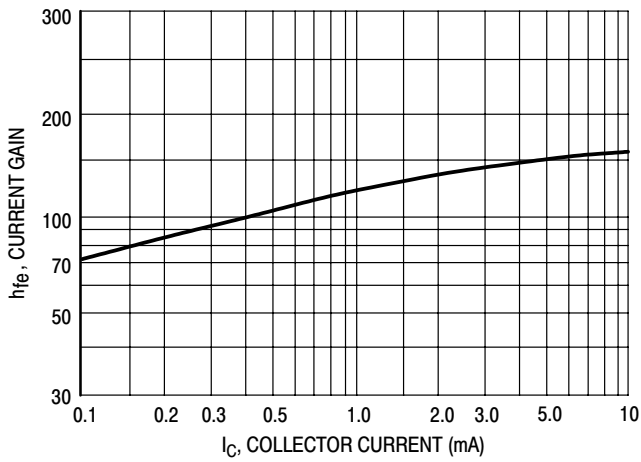


Figure 11. Current Gain

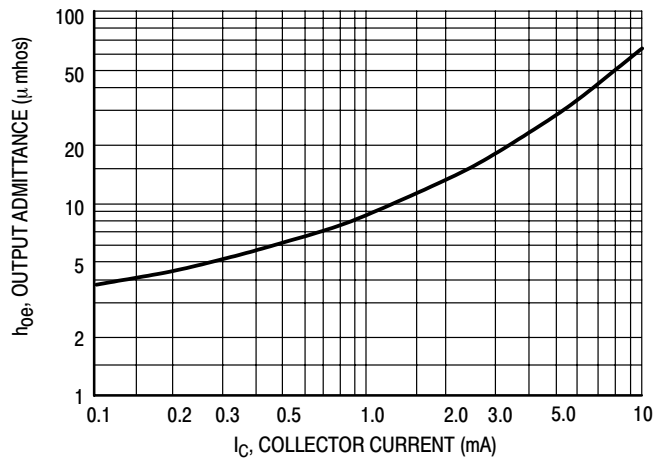


Figure 12. Output Admittance

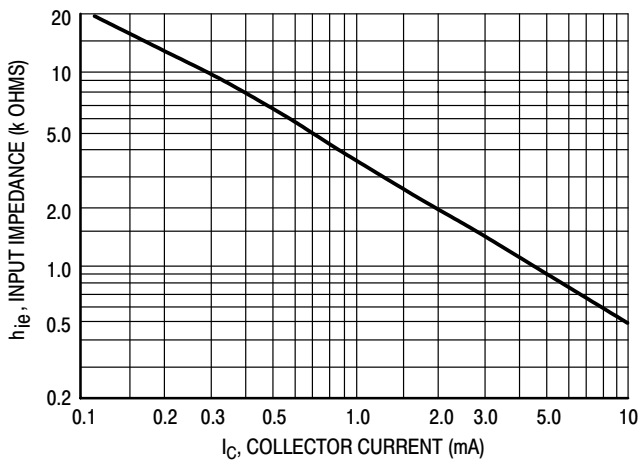


Figure 13. Input Impedance

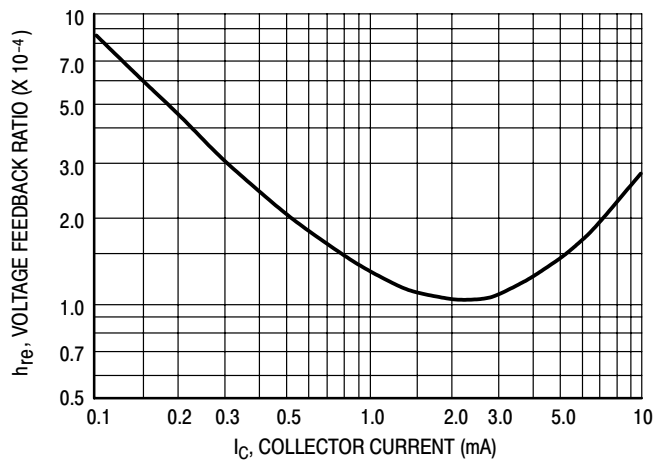


Figure 14. Voltage Feedback Ratio

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## TYPICAL STATIC CHARACTERISTICS

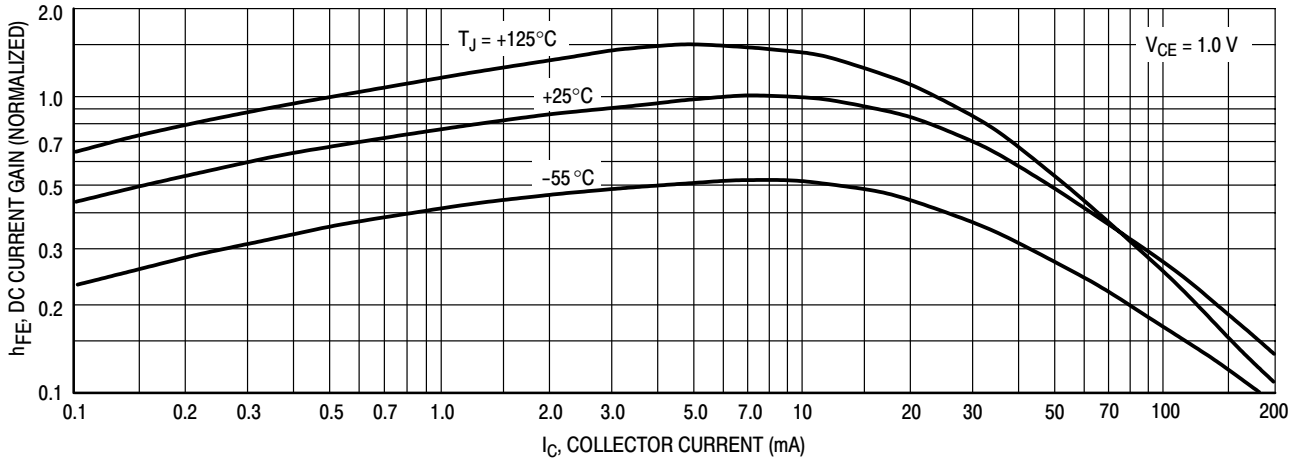


Figure 15. DC Current Gain

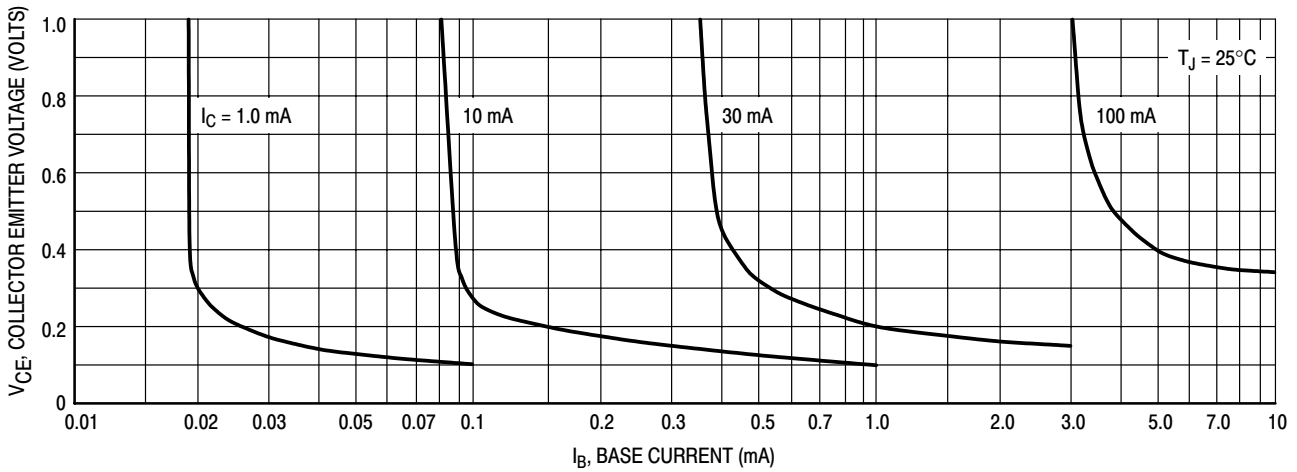


Figure 16. Collector Saturation Region

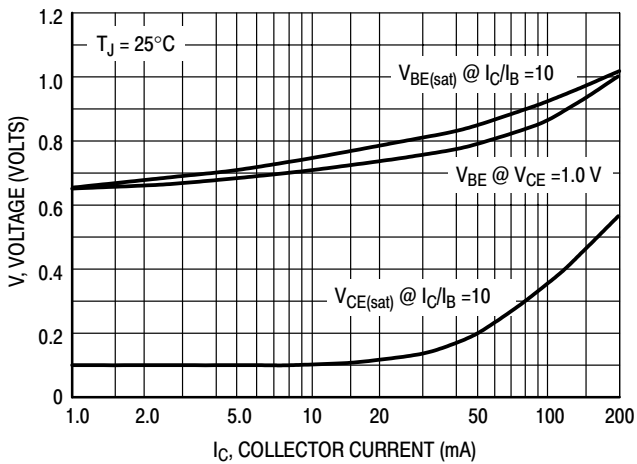


Figure 17. "ON" Voltages

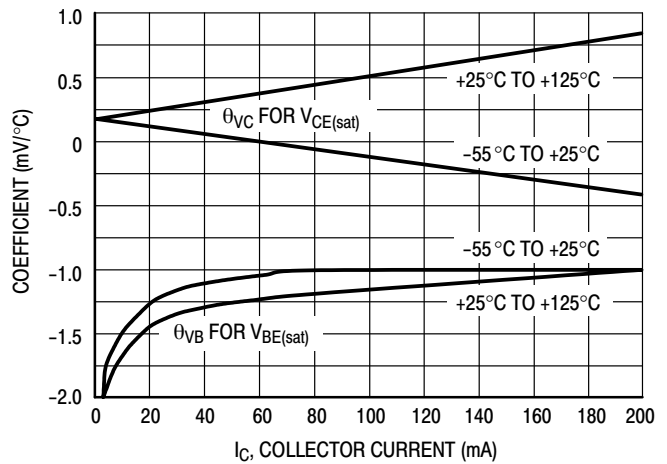
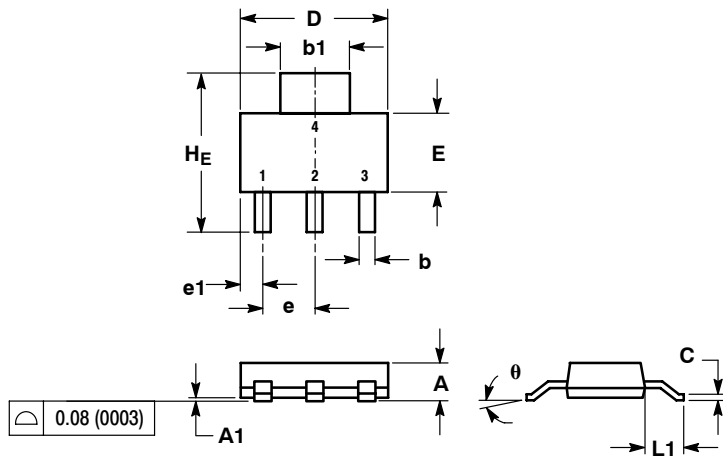


Figure 18. Temperature Coefficients

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## PACKAGE DIMENSIONS

SOT-223 (TO-261)  
CASE 318E-04  
ISSUE L

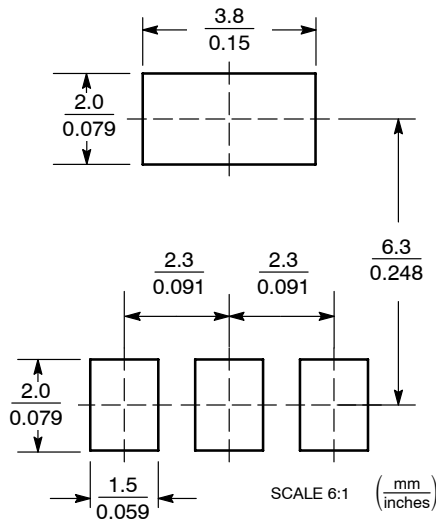


- NOTES:
- DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  - CONTROLLING DIMENSION: INCH.

DIM	MILLIMETERS			INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	1.50	1.63	1.75	0.060	0.064	0.068
A1	0.02	0.06	0.10	0.001	0.002	0.004
b	0.60	0.75	0.89	0.024	0.030	0.035
b1	2.90	3.06	3.20	0.115	0.121	0.126
c	0.24	0.29	0.35	0.009	0.012	0.014
D	6.30	6.50	6.70	0.249	0.256	0.263
E	3.30	3.50	3.70	0.130	0.138	0.145
e	2.20	2.30	2.40	0.087	0.091	0.094
e1	0.85	0.94	1.05	0.033	0.037	0.041
L1	1.50	1.75	2.00	0.060	0.069	0.078
HE	6.70	7.00	7.30	0.264	0.276	0.287
θ	0°	-	10°	0°	-	10°

- STYLE 1:  
PIN 1: BASE  
2: COLLECTOR  
3: EMITTER  
4: COLLECTOR

### SOLDERING FOOTPRINT\*



\*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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