

PZT3904T1G, SPZT3904T1G

General Purpose Transistor

NPN Silicon

Features

- AEC-Q101 Qualified and PPAP Capable
- S Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant*

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 mm² of copper area.

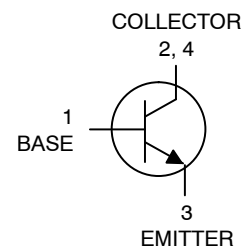


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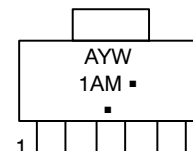
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SOT-223
CASE 318E
STYLE 1



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†
PZT3904T1G	SOT-223 (Pb-Free)	1,000 / Tape & Reel
SPZT3904T1G	SOT-223 (Pb-Free)	1,000 / 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.

*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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ELECTRICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$ unless otherwise noted)

Characteristic	Symbol	Min	Max	Unit
OFF CHARACTERISTICS (Note 2)				
Collector – Emitter Breakdown Voltage (Note 3) ($I_C = 1.0 \text{ mA}$, $I_B = 0$)	$V_{(BR)CEO}$	40	–	Vdc
Collector – Base Breakdown Voltage ($I_C = 10 \mu\text{A}$, $I_E = 0$)	$V_{(BR)CBO}$	60	–	
Emitter – Base Breakdown Voltage ($I_E = 10 \mu\text{A}$, $I_C = 0$)	$V_{(BR)EBO}$	6.0	–	
Base Cutoff Current ($V_{CE} = 30 \text{ Vdc}$, $V_{EB} = 3.0 \text{ Vdc}$)	I_{BL}	–	50	nAdc
Collector Cutoff Current ($V_{CE} = 30 \text{ Vdc}$, $V_{EB} = 3.0 \text{ Vdc}$)	I_{CEX}	–	50	

ON CHARACTERISTICS (Note 3)

DC Current Gain (Note 2) ($I_C = 0.1 \text{ mA}$, $V_{CE} = 1.0 \text{ Vdc}$) ($I_C = 1.0 \text{ mA}$, $V_{CE} = 1.0 \text{ Vdc}$) ($I_C = 10 \text{ mA}$, $V_{CE} = 1.0 \text{ Vdc}$) ($I_C = 50 \text{ mA}$, $V_{CE} = 1.0 \text{ Vdc}$) ($I_C = 100 \text{ mA}$, $V_{CE} = 1.0 \text{ Vdc}$)	H_{FE}	40 70 100 60 30	– – 300 – –	–
Collector – Emitter Saturation Voltage (Note 3) ($I_C = 10 \text{ mA}$, $I_B = 1.0 \text{ mA}$) ($I_C = 50 \text{ mA}$, $I_B = 5.0 \text{ mA}$)	$V_{CE(sat)}$	– –	0.2 0.3	Vdc
Base – Emitter Saturation Voltage (Note 3) ($I_C = 10 \text{ mA}$, $I_B = 1.0 \text{ mA}$) ($I_C = 50 \text{ mA}$, $I_B = 5.0 \text{ mA}$)	$V_{BE(sat)}$	0.65 –	0.85 0.95	Vdc

SMALL-SIGNAL CHARACTERISTICS

Current – Gain – Bandwidth Product ($I_C = 10 \text{ mA}$, $V_{CE} = 20 \text{ Vdc}$, $f = 100 \text{ MHz}$)	f_T	300	–	MHz
Output Capacitance ($V_{CB} = 5.0 \text{ Vdc}$, $I_E = 0$, $f = 1.0 \text{ MHz}$)	C_{obo}	–	5.0	pF
Input Capacitance ($V_{EB} = 0.5 \text{ Vdc}$, $I_C = 0$, $f = 1.0 \text{ MHz}$)	C_{ibo}	–	8.0	
Input Impedance ($V_{CE} = 10 \text{ Vdc}$, $I_C = 1.0 \text{ mA}$, $f = 1.0 \text{ kHz}$)	h_{ie}	1.0	10	k Ω
Voltage Feedback Ratio ($V_{CE} = 10 \text{ Vdc}$, $I_C = 1.0 \text{ mA}$, $f = 1.0 \text{ kHz}$)	h_{re}	0.5	8.0	$\times 10^{-4}$
Small – Signal Current Gain ($V_{CE} = 10 \text{ Vdc}$, $I_C = 1.0 \text{ mA}$, $f = 1.0 \text{ kHz}$)	h_{fe}	100	400	–
Output Admittance ($V_{CE} = 10 \text{ Vdc}$, $I_C = 1.0 \text{ mA}$, $f = 1.0 \text{ kHz}$)	h_{oe}	1.0	40	μMhos
Noise Figure ($V_{CE} = 5.0 \text{ Vdc}$, $I_C = 100 \mu\text{A}$, $R_S = 1.0 \text{ k}\Omega$, $f = 1.0 \text{ kHz}$)	nF	–	5.0	dB

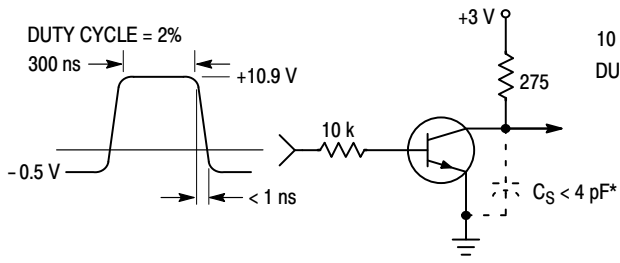
SWITCHING CHARACTERISTICS

Delay Time	$(V_{CC} = 3.0 \text{ Vdc}$, $V_{BE} = -0.5 \text{ Vdc}$, $I_C = 10 \text{ mA}$, $I_{B1} = 1.0 \text{ mA}$)	t_d	–	35	ns
Rise Time		t_r	–	35	
Storage Time	$(V_{CC} = 3.0 \text{ Vdc}$, $I_C = 10 \text{ mA}$, $I_{B1} = I_{B2} = 1.0 \text{ mA}$)	t_s	–	200	
Fall Time		t_f	–	50	

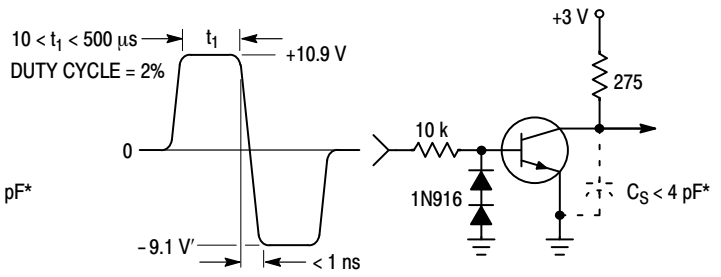
2. $FR-5 = 1.0 \times 0.75 \times 0.062 \text{ in.}$

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

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**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

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

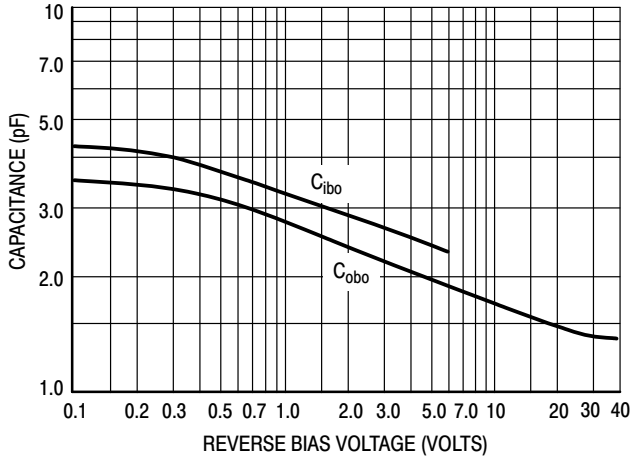


Figure 3. Capacitance

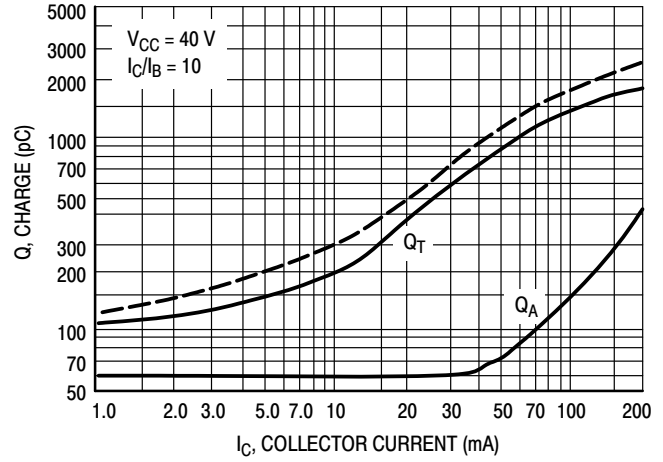


Figure 4. Charge Data

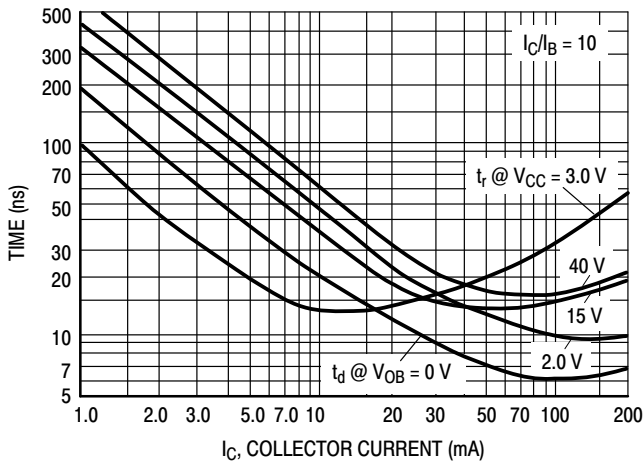


Figure 5. Turn-On Time

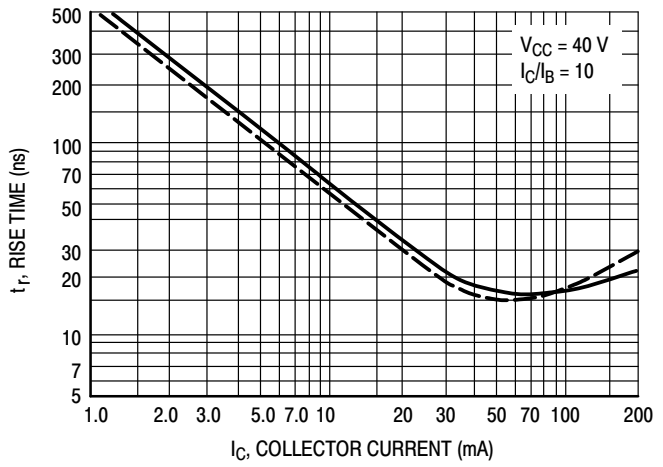


Figure 6. Rise Time

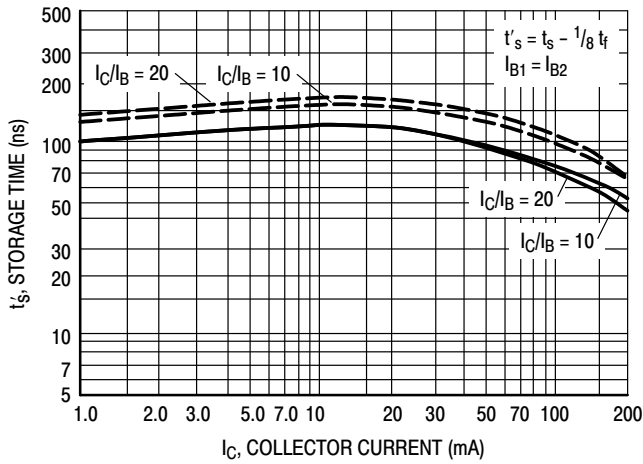


Figure 7. Storage Time

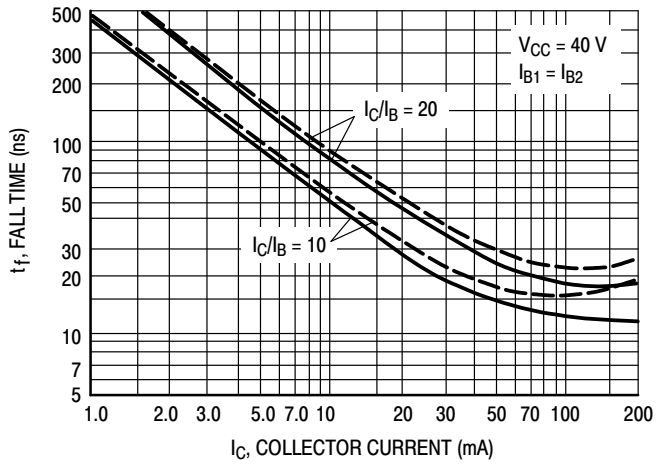


Figure 8. Fall Time

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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)

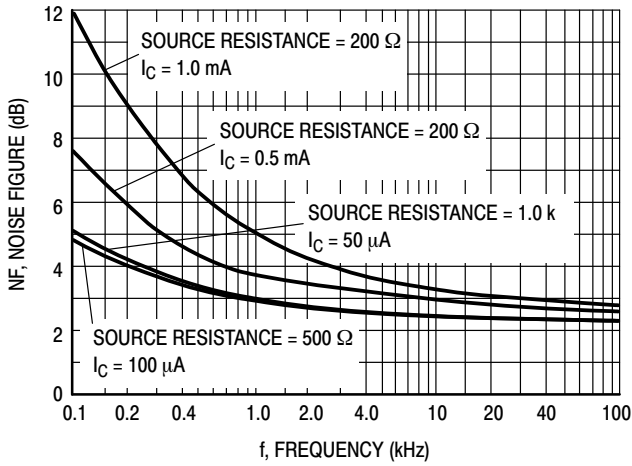


Figure 9.

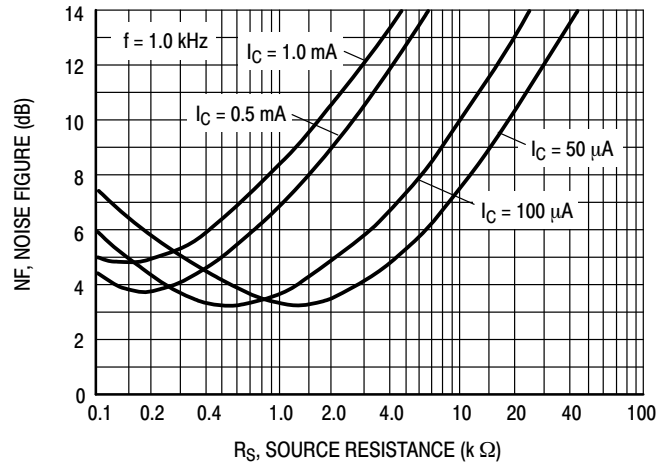


Figure 10.

h PARAMETERS

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

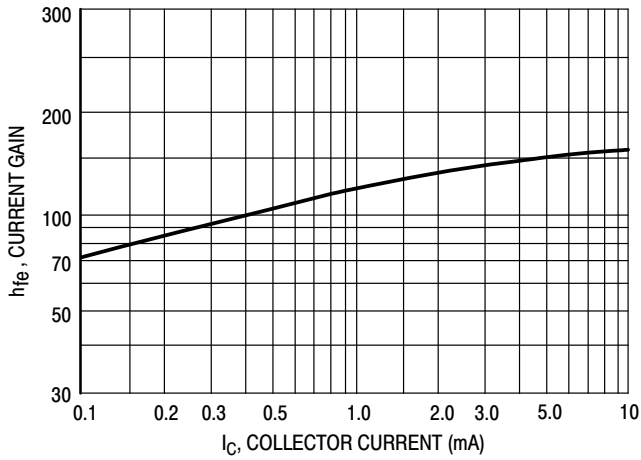


Figure 11. Current Gain

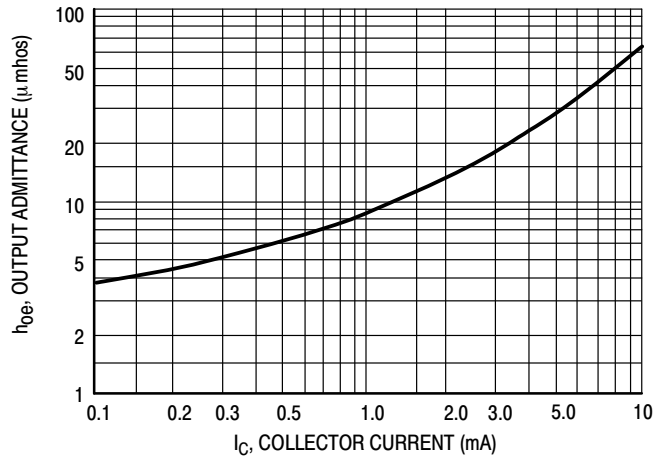


Figure 12. Output Admittance

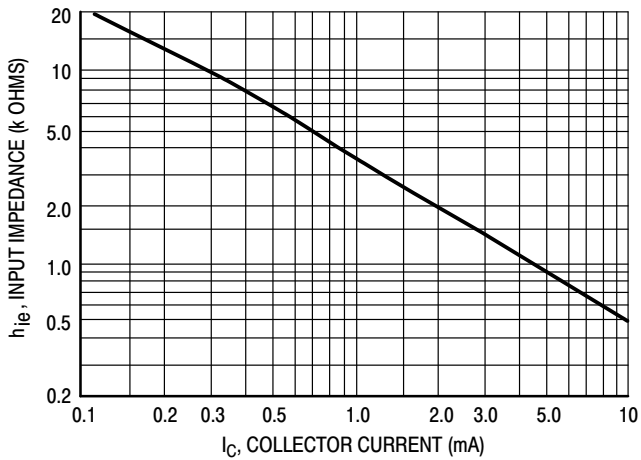


Figure 13. Input Impedance

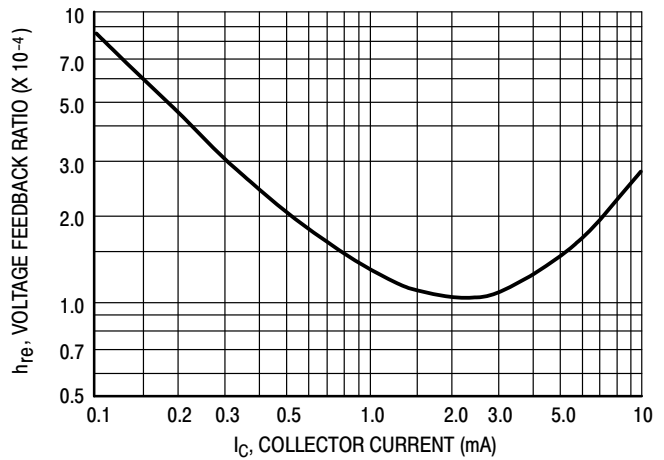


Figure 14. Voltage Feedback Ratio

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TYPICAL STATIC CHARACTERISTICS

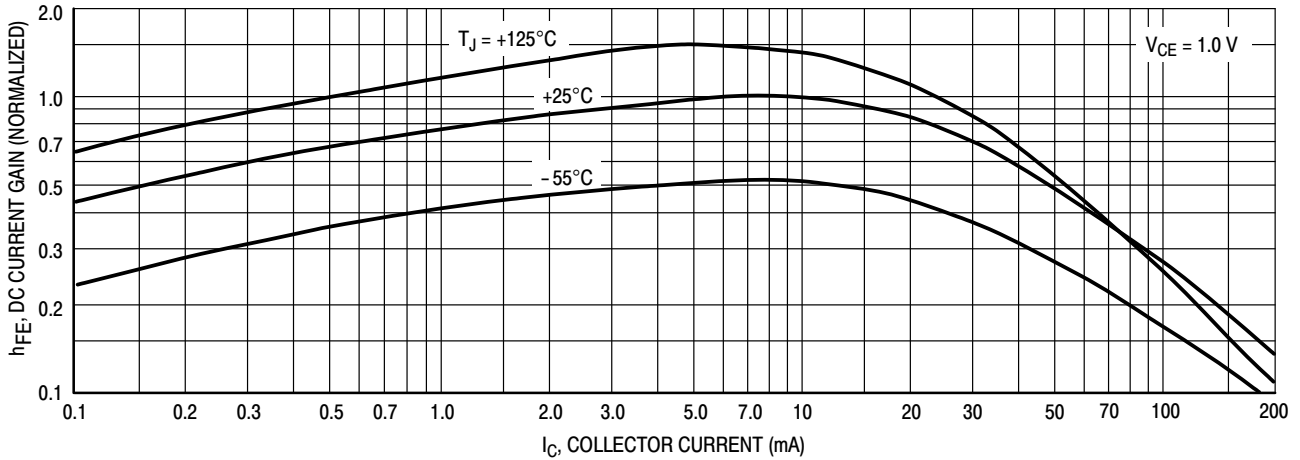


Figure 15. DC Current Gain

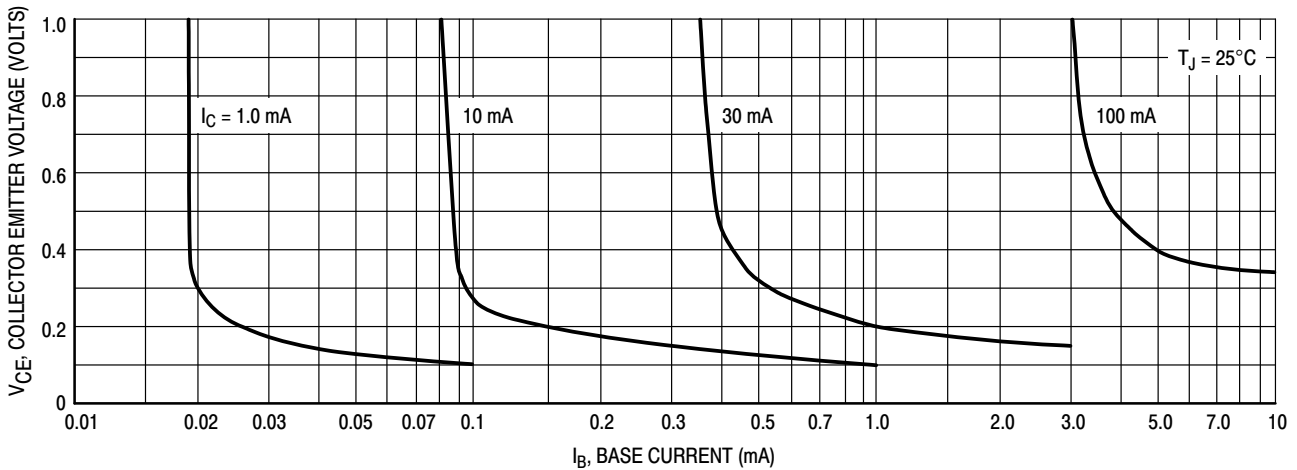


Figure 16. Collector Saturation Region

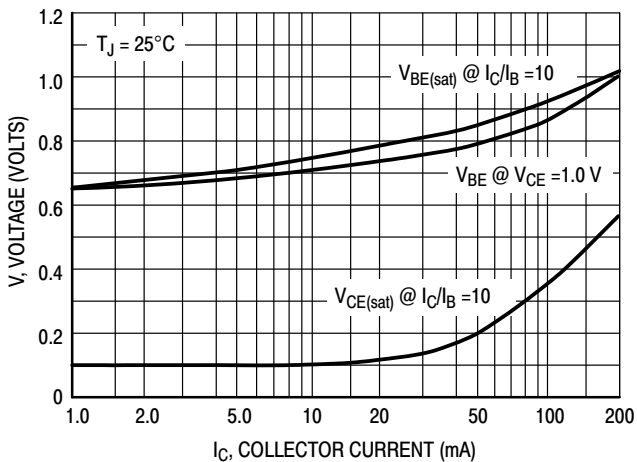


Figure 17. "ON" Voltages

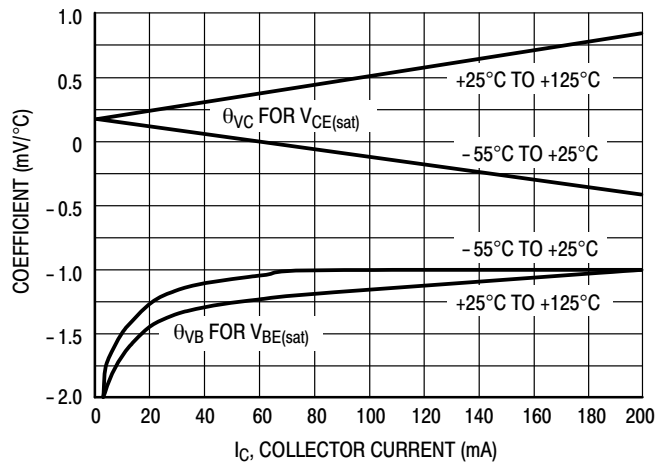


Figure 18. Temperature Coefficients

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TYPICAL CHARACTERISTICS

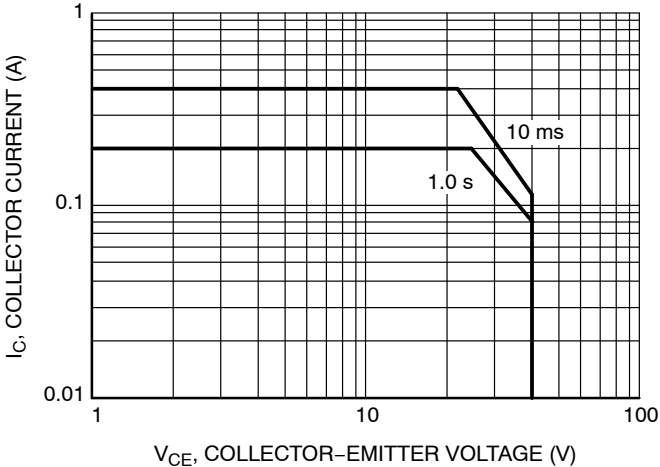
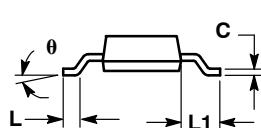
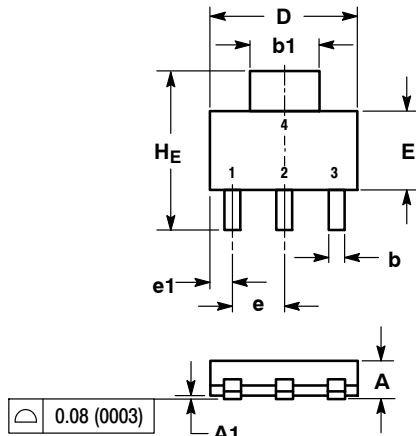


Figure 19. Safe Operating Area

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PACKAGE DIMENSIONS

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

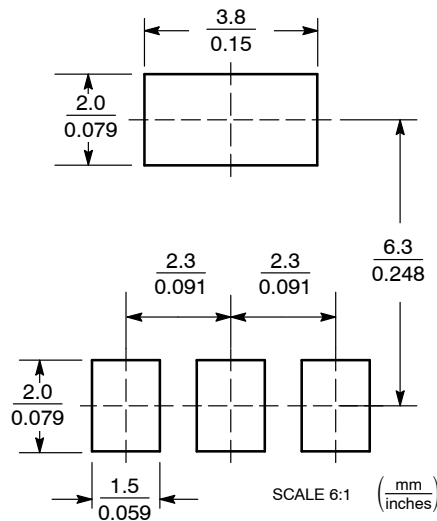


NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: INCH.

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
L	0.20	---	---	0.008	---	---
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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