

# General Purpose Transistor

## NPN Silicon

### PZT3904T1G

#### Features

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

#### MAXIMUM RATINGS

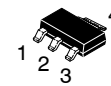
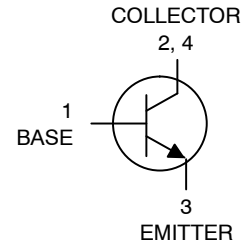
Rating	Symbol	Value	Unit
Collector – Emitter Voltage	$V_{CEO}$	40	Vdc
Collector – Base Voltage	$V_{CBO}$	60	Vdc
Emitter – Base Voltage	$V_{EBO}$	6.0	Vdc
Collector Current – Continuous	$I_C$	200	mAdc

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

#### THERMAL CHARACTERISTICS

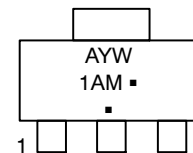
Characteristic	Symbol	Max	Unit
Total Device Dissipation (Note 1) $T_A = 25^\circ\text{C}$	$P_D$	1.5 12	W mW/ $^\circ\text{C}$
Thermal Resistance Junction-to-Ambient (Note 1)	$R_{\theta JA}$	83.3	$^\circ\text{C}/\text{W}$
Thermal Resistance Junction-to-Lead #4	$R_{\theta JA}$	35	$^\circ\text{C}/\text{W}$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

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



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.

# PZT3904T1G

## 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 mAdc, I <sub>B</sub> = 0)	V <sub>(BR)CEO</sub>	40	–	Vdc
Collector – Base Breakdown Voltage (I <sub>C</sub> = 10 µAdc, I <sub>E</sub> = 0)	V <sub>(BR)CBO</sub>	60	–	
Emitter – Base Breakdown Voltage (I <sub>E</sub> = 10 µAdc, 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	nAdc
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 mAdc, V <sub>CE</sub> = 1.0 Vdc) (I <sub>C</sub> = 1.0 mAdc, V <sub>CE</sub> = 1.0 Vdc) (I <sub>C</sub> = 10 mAdc, V <sub>CE</sub> = 1.0 Vdc) (I <sub>C</sub> = 50 mAdc, V <sub>CE</sub> = 1.0 Vdc) (I <sub>C</sub> = 100 mAdc, 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 mAdc, I <sub>B</sub> = 1.0 mAdc) (I <sub>C</sub> = 50 mAdc, I <sub>B</sub> = 5.0 mAdc)	V <sub>CE(sat)</sub>	– –	0.2 0.3	Vdc
Base – Emitter Saturation Voltage (Note 3) (I <sub>C</sub> = 10 mAdc, I <sub>B</sub> = 1.0 mAdc) (I <sub>C</sub> = 50 mAdc, I <sub>B</sub> = 5.0 mAdc)	V <sub>BE(sat)</sub>	0.65 –	0.85 0.95	Vdc

## SMALL-SIGNAL CHARACTERISTICS

Current – Gain – Bandwidth Product (I <sub>C</sub> = 10 mAdc, 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 mAdc, 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 mAdc, 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 mAdc, f = 1.0 kHz)	h <sub>fe</sub>	100	400	–
Output Admittance (V <sub>CE</sub> = 10 Vdc, I <sub>C</sub> = 1.0 mAdc, 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 µAdc, R <sub>S</sub> = 1.0 kΩ, f = 1.0 kHz)	nF	–	5.0	dB

## SWITCHING CHARACTERISTICS

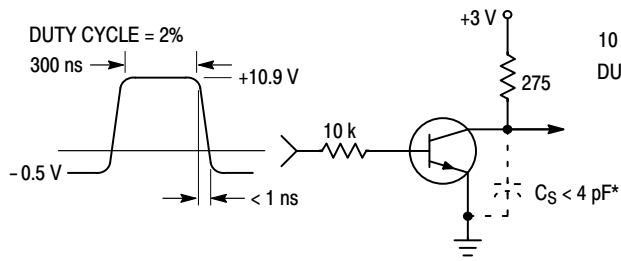
Delay Time	(V <sub>CC</sub> = 3.0 Vdc, V <sub>BE</sub> = –0.5 Vdc, I <sub>C</sub> = 10 mAdc, I <sub>B1</sub> = 1.0 mAdc)	t <sub>d</sub>	–	35	ns
Rise Time		t <sub>r</sub>	–	35	
Storage Time	(V <sub>CC</sub> = 3.0 Vdc, I <sub>C</sub> = 10 mAdc, I <sub>B1</sub> = I <sub>B2</sub> = 1.0 mAdc)	t <sub>s</sub>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

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

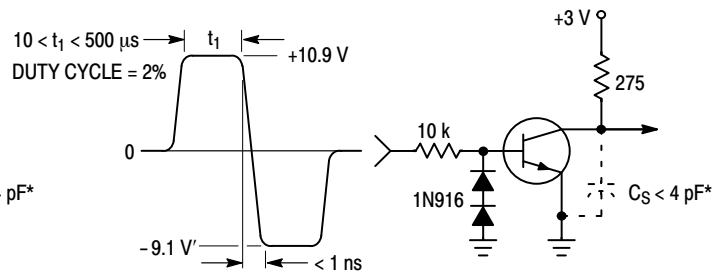
2. FR–5 = 1.0 × 0.75 × 0.062 in.

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

TYPICAL TRANSIENT CHARACTERISTICS

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

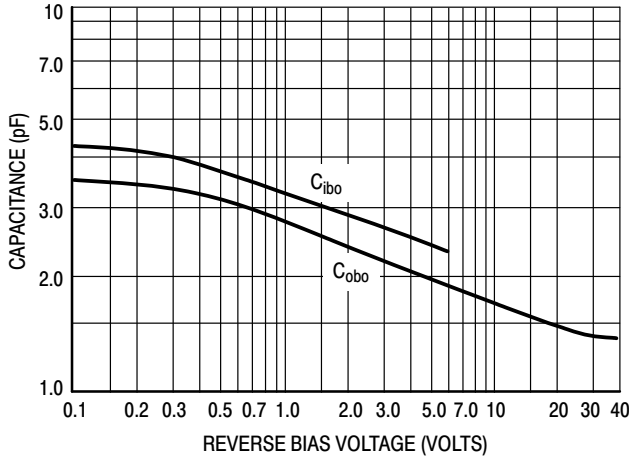


Figure 3. Capacitance

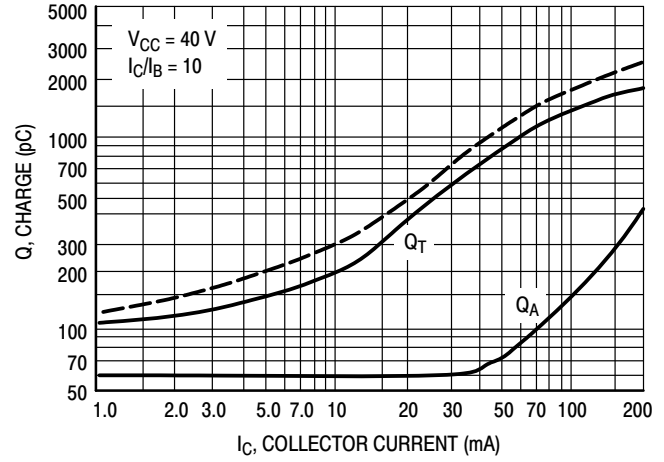


Figure 4. Charge Data

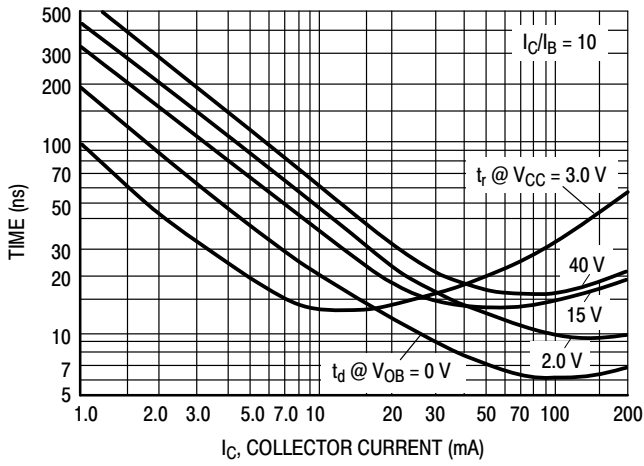


Figure 5. Turn-On Time

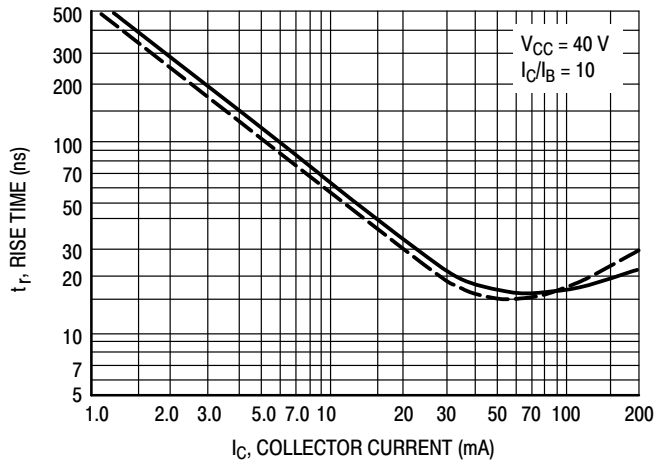


Figure 6. Rise Time

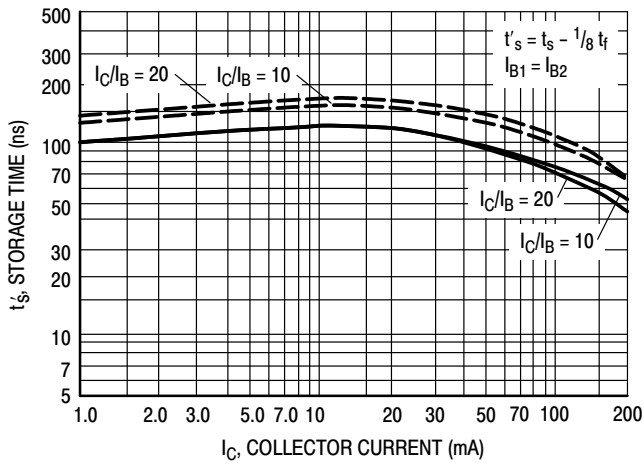


Figure 7. Storage Time

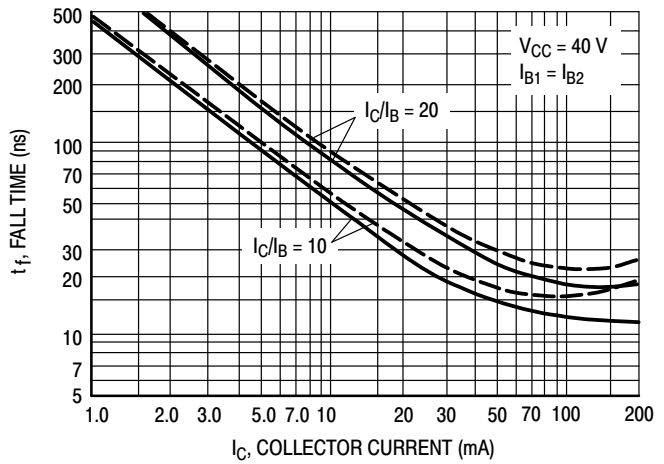


Figure 8. Fall Time

# TYPICAL AUDIO SMALL-SIGNAL CHARACTERISTICS NOISE FIGURE VARIATIONS

( $V_{CE} = 5.0$  VDC,  $T_A = 25^\circ\text{C}$ , BANDWIDTH = 1.0 HZ)

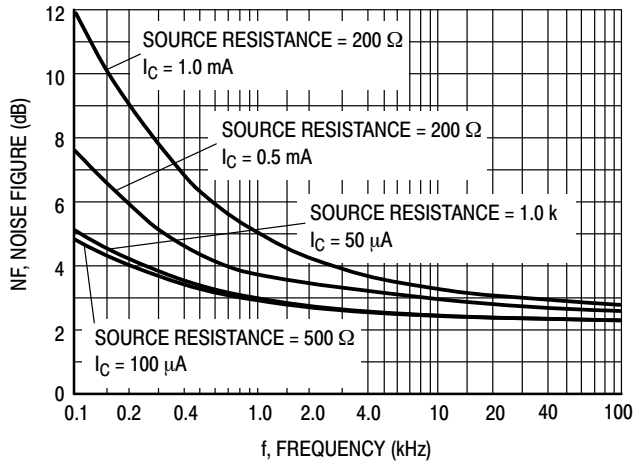


Figure 9.

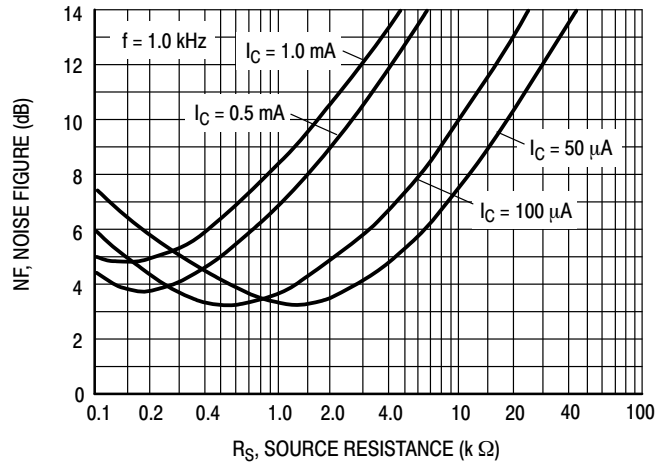


Figure 10.

## H PARAMETERS

( $V_{CE} = 10$  VDC,  $F = 1.0$  KHZ,  $T_A = 25^\circ\text{C}$ )

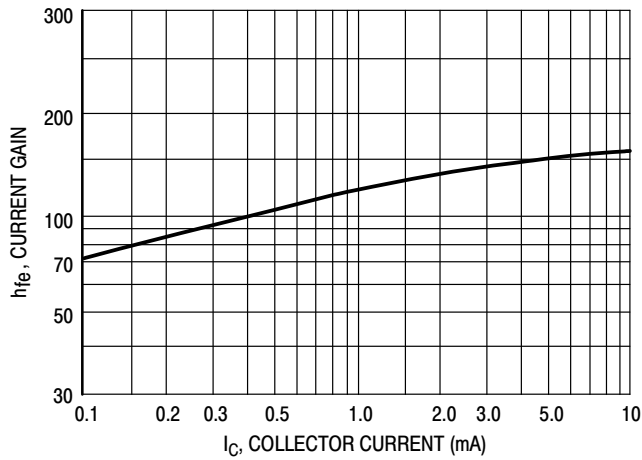


Figure 11. Current Gain

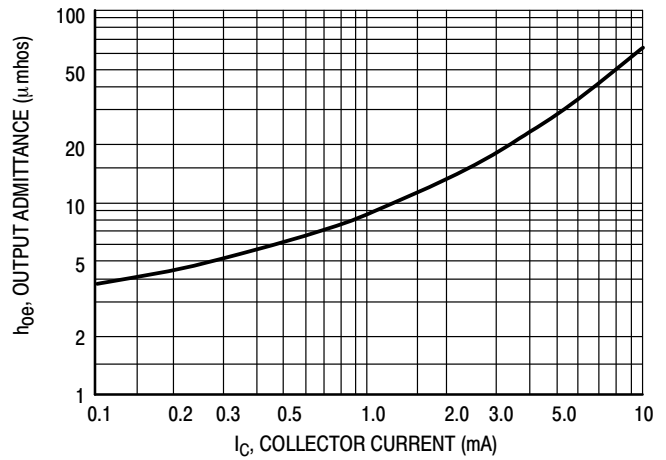


Figure 12. Output Admittance

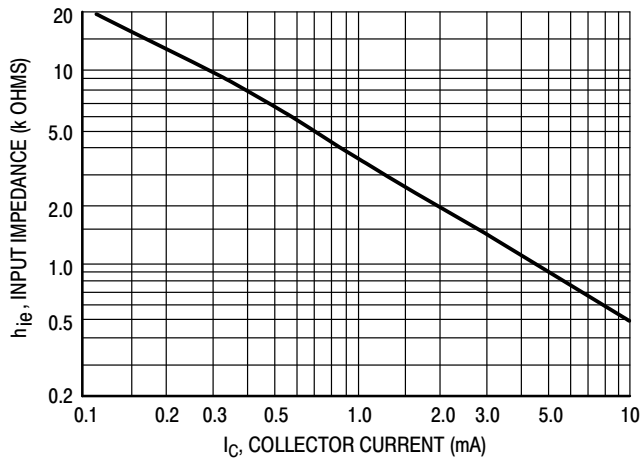


Figure 13. Input Impedance

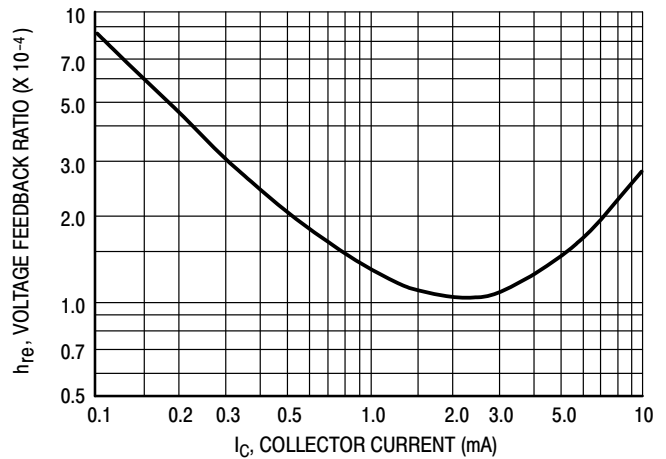


Figure 14. Voltage Feedback Ratio

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## TYPICAL STATIC CHARACTERISTICS

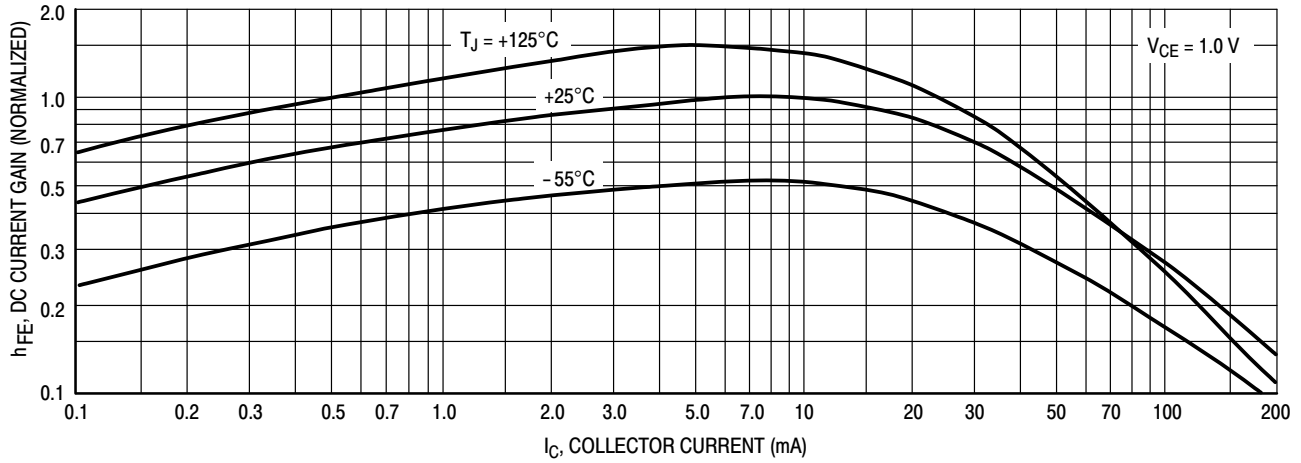


Figure 15. DC Current Gain

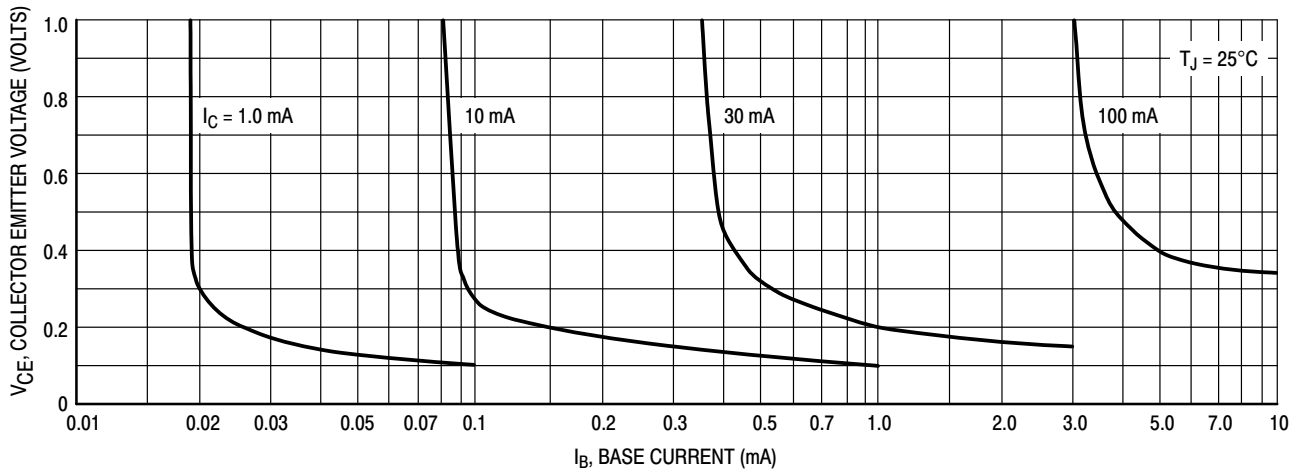


Figure 16. Collector Saturation Region

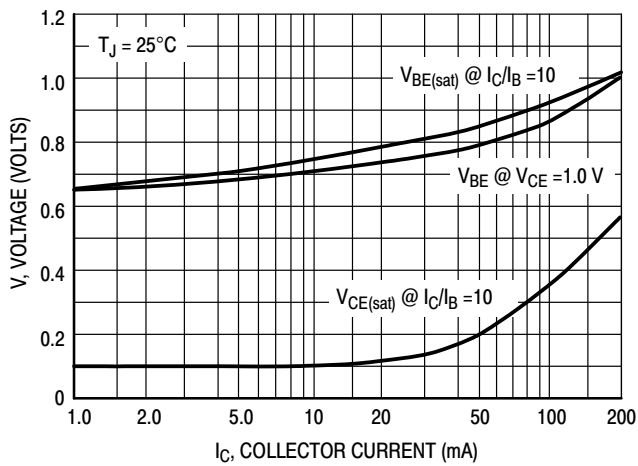


Figure 17. "ON" Voltages

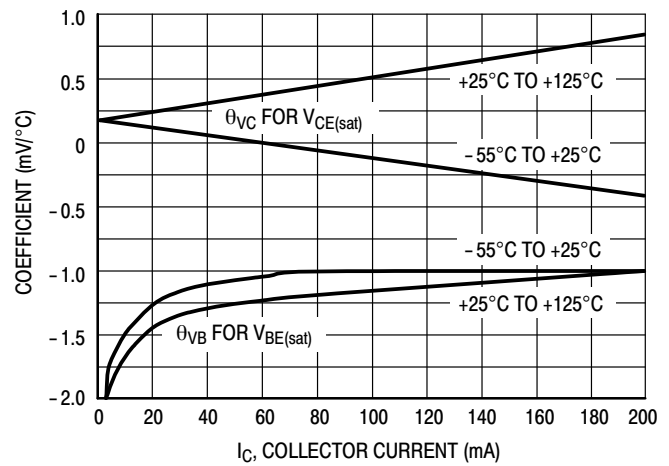
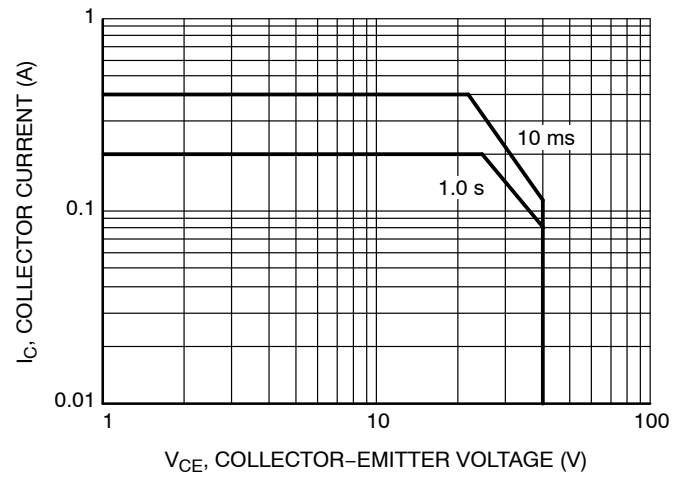


Figure 18. Temperature Coefficients

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## TYPICAL CHARACTERISTICS



**Figure 19. Safe Operating Area**

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