

# MMBT3906LT1

Preferred Device

## General Purpose Transistor

### PNP Silicon

#### 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	$I_C$	–200	mAdc

#### THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Total Device Dissipation FR–5 Board (Note 1) @ $T_A = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	225 1.8	mW mW/ $^\circ\text{C}$
Thermal Resistance, Junction–to–Ambient	$R_{\theta JA}$	556	$^\circ\text{C/W}$
Total Device Dissipation Alumina Substrate, (Note 2) @ $T_A = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	300 2.4	mW mW/ $^\circ\text{C}$
Thermal Resistance, Junction–to–Ambient	$R_{\theta JA}$	417	$^\circ\text{C/W}$
Junction and Storage Temperature	$T_J, T_{stg}$	–55 to +150	$^\circ\text{C}$

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.

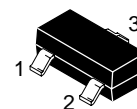
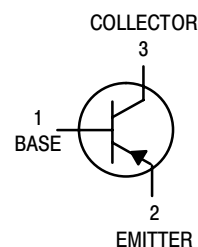
1. FR–5 =  $1.0 \times 0.75 \times 0.062$  in.

2. Alumina =  $0.4 \times 0.3 \times 0.024$  in. 99.5% alumina.



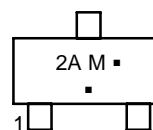
ON Semiconductor®

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SOT-23 (TO-236)  
CASE 318  
STYLE 6

#### MARKING DIAGRAM



2A = Specific Device Code

M = Date Code\*

■ = Pb-Free Package

(Note: Microdot may be in either location)

\*Date Code orientation and/or overbar may vary depending upon manufacturing location.

#### ORDERING INFORMATION

Device	Package	Shipping†
MMBT3906LT1	SOT-23	3,000 / Tape & Reel
MMBT3906LT1G	SOT-23 (Pb-Free)	3,000 / Tape & Reel
MMBT3906LT3	SOT-23	10,000 / Tape & Reel
MMBT3906LT3G	SOT-23 (Pb-Free)	10,000 / 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.

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

# MMBT3906LT1

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

Characteristic	Symbol	Min	Max	Unit
<b>OFF CHARACTERISTICS</b>				
Collector–Emitter Breakdown Voltage ( $I_C = -1.0\text{ mAdc}$ , $I_E = 0$ )	$V_{(BR)CEO}$	-40	–	Vdc
Collector–Base Breakdown Voltage ( $I_C = -10\text{ }\mu\text{Adc}$ , $I_E = 0$ )	$V_{(BR)CBO}$	-40	–	Vdc
Emitter–Base Breakdown Voltage ( $I_E = -10\text{ }\mu\text{Adc}$ , $I_C = 0$ )	$V_{(BR)EBO}$	-5.0	–	Vdc
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	nAdc

## ON CHARACTERISTICS (Note 3)

DC Current Gain ( $I_C = -0.1\text{ mAdc}$ , $V_{CE} = -1.0\text{ Vdc}$ ) ( $I_C = -1.0\text{ mAdc}$ , $V_{CE} = -1.0\text{ Vdc}$ ) ( $I_C = -10\text{ mAdc}$ , $V_{CE} = -1.0\text{ Vdc}$ ) ( $I_C = -50\text{ mAdc}$ , $V_{CE} = -1.0\text{ Vdc}$ ) ( $I_C = -100\text{ mAdc}$ , $V_{CE} = -1.0\text{ Vdc}$ )	$H_{FE}$	60 80 100 60 30	– – 300 – –	–
Collector–Emitter Saturation Voltage ( $I_C = -10\text{ mAdc}$ , $I_B = -1.0\text{ mAdc}$ ) ( $I_C = -50\text{ mAdc}$ , $I_B = -5.0\text{ mAdc}$ )	$V_{CE(sat)}$	– –	-0.25 -0.4	Vdc
Base–Emitter Saturation Voltage ( $I_C = -10\text{ mAdc}$ , $I_B = -1.0\text{ mAdc}$ ) ( $I_C = -50\text{ mAdc}$ , $I_B = -5.0\text{ mAdc}$ )	$V_{BE(sat)}$	-0.65 –	-0.85 -0.95	Vdc

## SMALL–SIGNAL CHARACTERISTICS

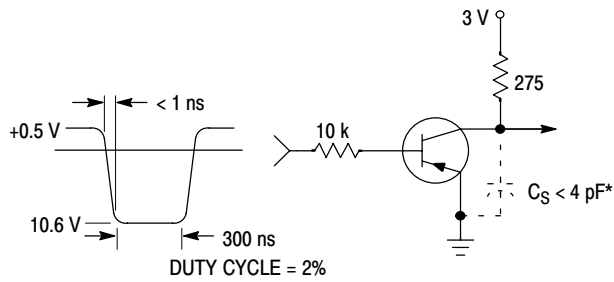
Current–Gain – Bandwidth Product ( $I_C = -10\text{ mAdc}$ , $V_{CE} = -20\text{ Vdc}$ , $f = 100\text{ MHz}$ )	$f_T$	250	–	MHz
Output Capacitance ( $V_{CB} = -5.0\text{ Vdc}$ , $I_E = 0$ , $f = 1.0\text{ MHz}$ )	$C_{obo}$	–	4.5	pF
Input Capacitance ( $V_{EB} = -0.5\text{ Vdc}$ , $I_C = 0$ , $f = 1.0\text{ MHz}$ )	$C_{ibo}$	–	10	pF
Input Impedance ( $I_C = -1.0\text{ mAdc}$ , $V_{CE} = -10\text{ Vdc}$ , $f = 1.0\text{ kHz}$ )	$h_{ie}$	2.0	12	k $\Omega$
Voltage Feedback Ratio ( $I_C = -1.0\text{ mAdc}$ , $V_{CE} = -10\text{ Vdc}$ , $f = 1.0\text{ kHz}$ )	$h_{re}$	0.1	10	$\times 10^{-4}$
Small–Signal Current Gain ( $I_C = -1.0\text{ mAdc}$ , $V_{CE} = -10\text{ Vdc}$ , $f = 1.0\text{ kHz}$ )	$h_{fe}$	100	400	–
Output Admittance ( $I_C = -1.0\text{ mAdc}$ , $V_{CE} = -10\text{ Vdc}$ , $f = 1.0\text{ kHz}$ )	$h_{oe}$	3.0	60	$\mu\text{mhos}$
Noise Figure ( $I_C = -100\text{ }\mu\text{Adc}$ , $V_{CE} = -5.0\text{ Vdc}$ , $R_S = 1.0\text{ k}\Omega$ , $f = 1.0\text{ kHz}$ )	NF	–	4.0	dB

## SWITCHING CHARACTERISTICS

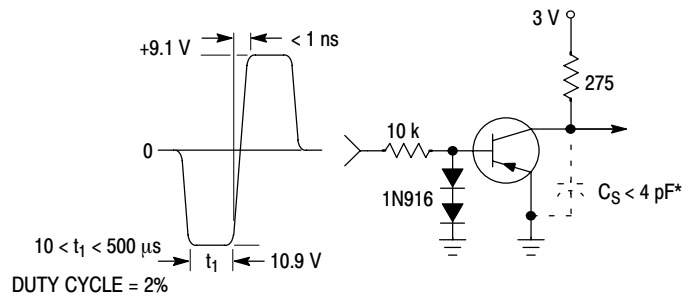
Delay Time	$(V_{CC} = -3.0\text{ Vdc}$ , $V_{BE} = 0.5\text{ Vdc}$ , $I_C = -10\text{ mAdc}$ , $I_{B1} = -1.0\text{ mAdc}$ )	$t_d$	–	35	ns
Rise Time		$t_r$	–	35	
Storage Time	$(V_{CC} = -3.0\text{ Vdc}$ , $I_C = -10\text{ mAdc}$ , $I_{B1} = I_{B2} = -1.0\text{ mAdc}$ )	$t_s$	–	225	ns
Fall Time		$t_f$	–	75	

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

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

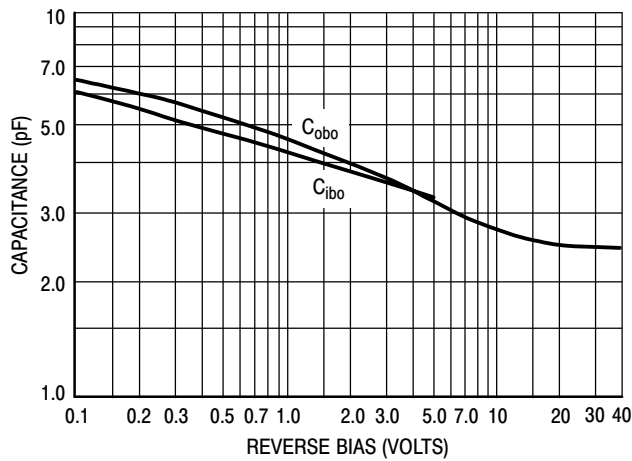


**Figure 2. Storage and Fall Time  
Equivalent Test Circuit**

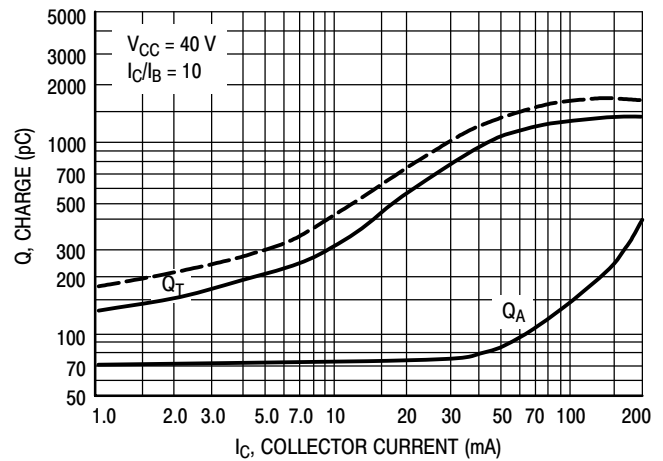
\* Total shunt capacitance of test jig and connectors

## TYPICAL TRANSIENT CHARACTERISTICS

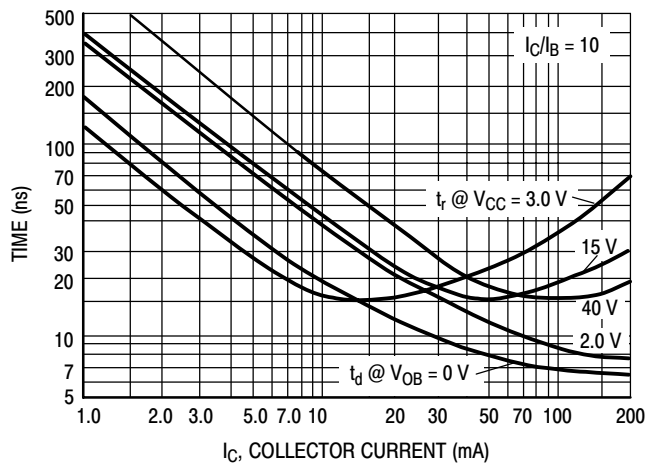
—  $T_J = 25^\circ\text{C}$   
 - -  $T_J = 125^\circ\text{C}$



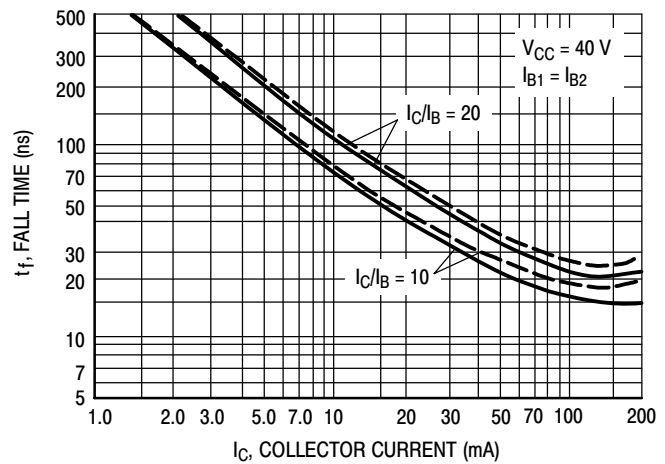
**Figure 3. Capacitance**



**Figure 4. Charge Data**



**Figure 5. Turn-On Time**



**Figure 6. 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)

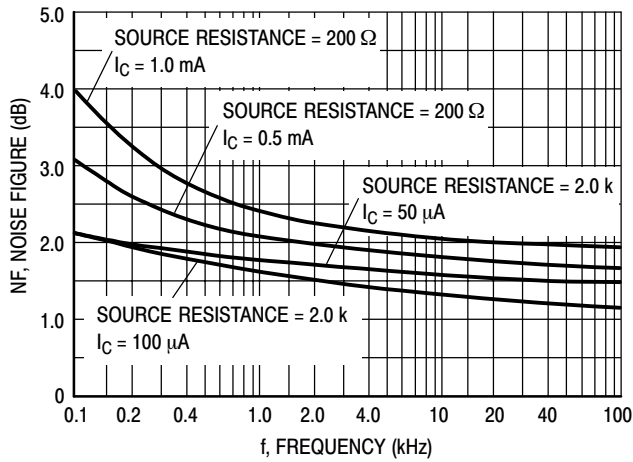


Figure 7.

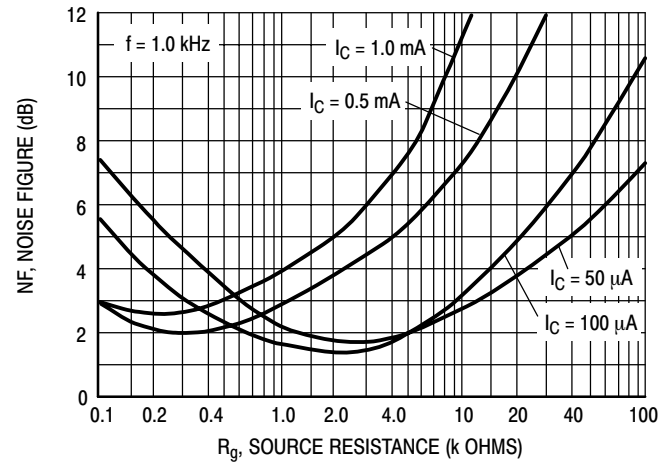


Figure 8.

## h PARAMETERS

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

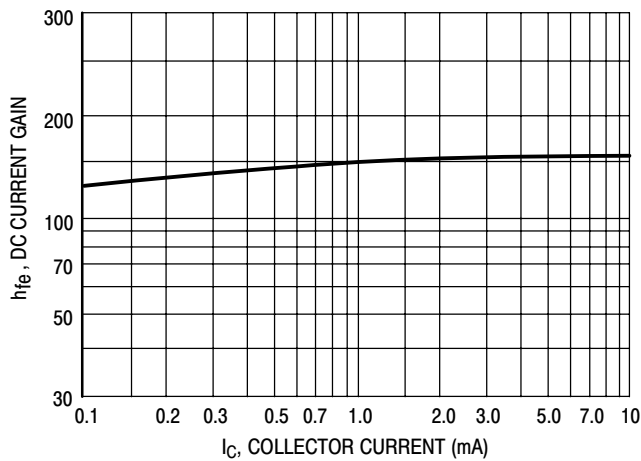


Figure 9. Current Gain

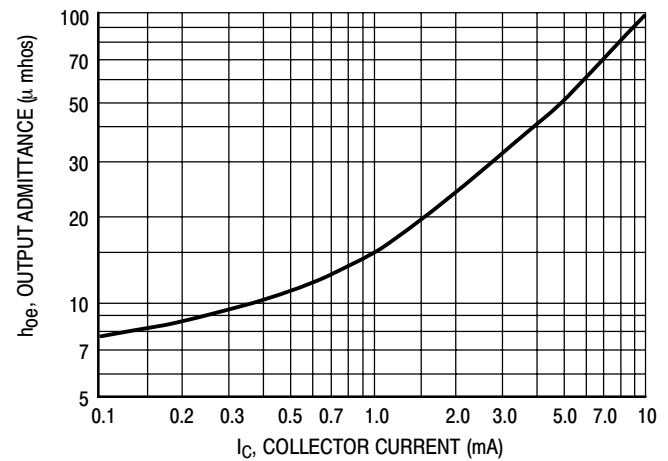


Figure 10. Output Admittance

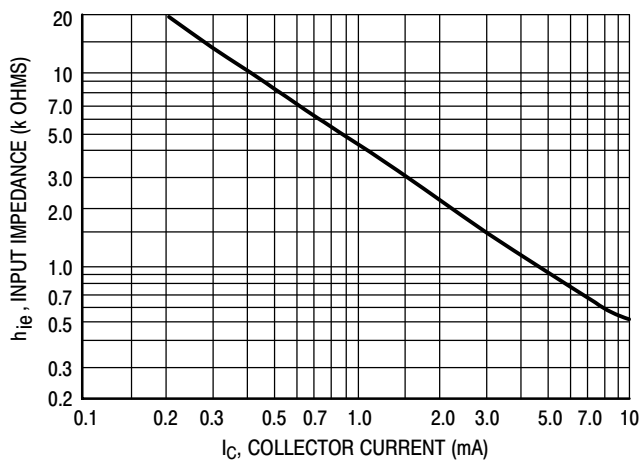


Figure 11. Input Impedance

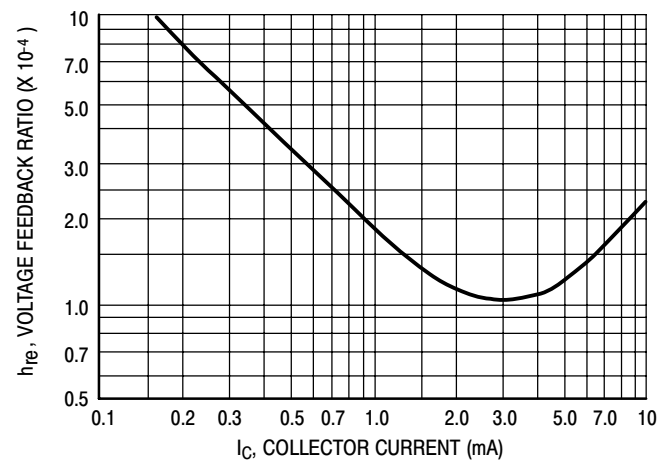


Figure 12. Voltage Feedback Ratio

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## TYPICAL STATIC CHARACTERISTICS

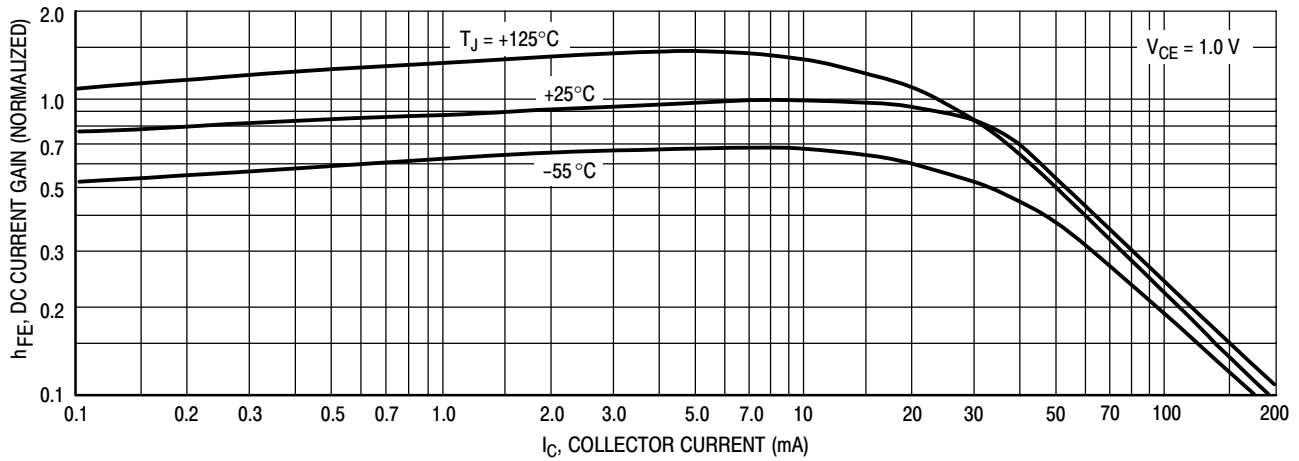


Figure 13. DC Current Gain

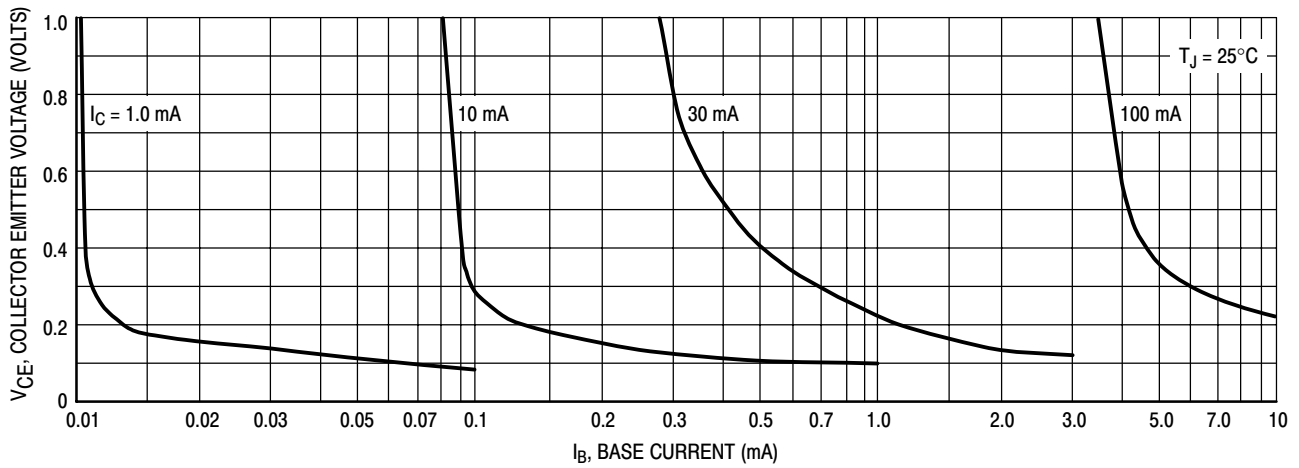


Figure 14. Collector Saturation Region

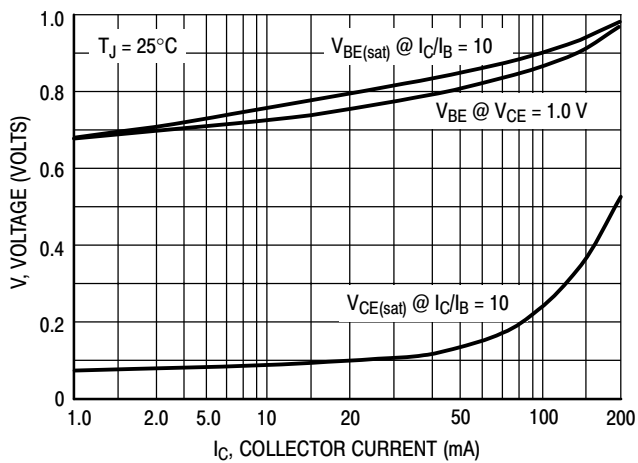


Figure 15. "ON" Voltages

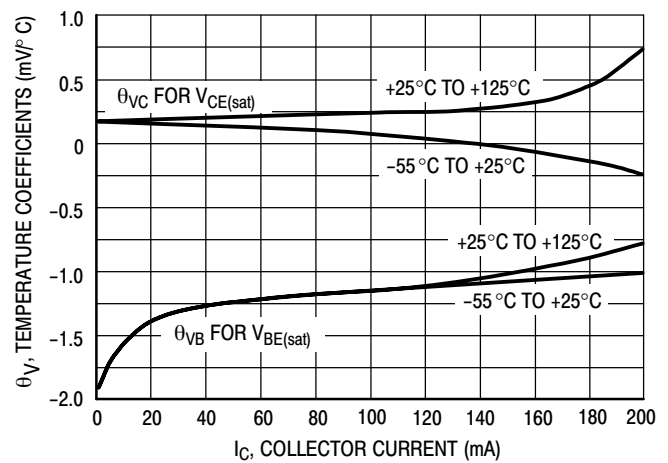
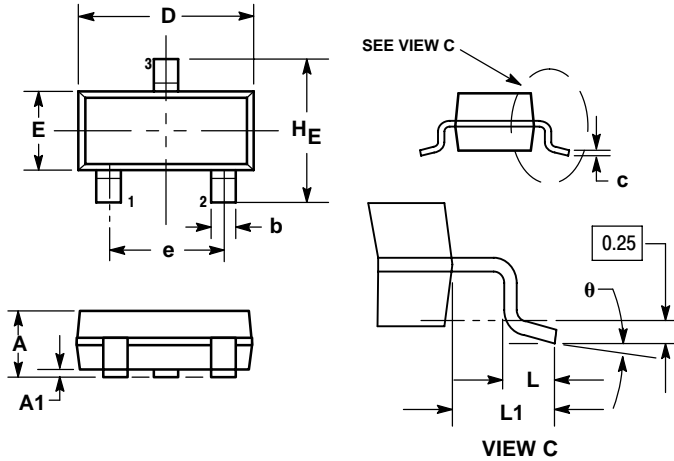


Figure 16. Temperature Coefficients

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## PACKAGE DIMENSIONS

### SOT-23 (TO-236) CASE 318-08 ISSUE AN



#### NOTES:

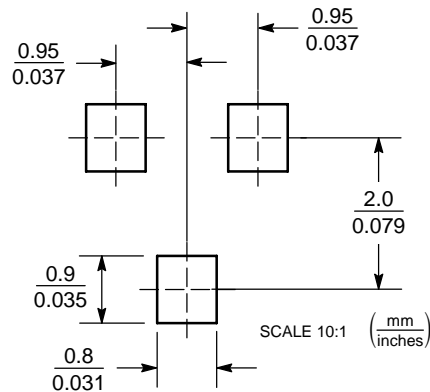
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.
4. 318-01 THRU -07 AND -09 OBSOLETE, NEW STANDARD 318-08.

DIM	MILLIMETERS			INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	0.89	1.00	1.11	0.035	0.040	0.044
A1	0.01	0.06	0.10	0.001	0.002	0.004
b	0.37	0.44	0.50	0.015	0.018	0.020
c	0.09	0.13	0.18	0.003	0.005	0.007
D	2.80	2.90	3.04	0.110	0.114	0.120
E	1.20	1.30	1.40	0.047	0.051	0.055
e	1.78	1.90	2.04	0.070	0.075	0.081
L	0.10	0.20	0.30	0.004	0.008	0.012
L1	0.35	0.54	0.69	0.014	0.021	0.029
H_E	2.10	2.40	2.64	0.083	0.094	0.104


#### STYLE 6:

1. BASE
2. EMITTER
3. 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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