



## DESCRIPTION

The MBT3906L is available in SOT-23 Package.

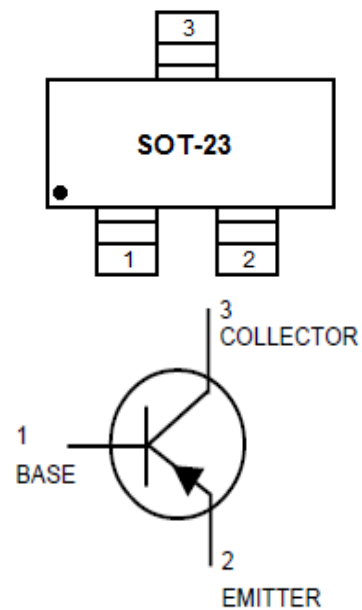
## FEATURES

- Available in SOT-23 Package

## ORDERING INFORMATION

Package Type	Part Number
SOT-23	MBT3906L
Note	SPQ:3,000pcs/Reel
AiT provides all RoHS Compliant Products	

## PIN DESCRIPTION





## ABSOLUTE MAXIMUM RATINGS

$V_{CEO}$ , Collector - Emitter Voltage	-40Vdc
$V_{CBO}$ , Collector - Base Voltage	-40Vdc
$V_{EBO}$ , Emitter - Base Voltage	-5.0Vdc
$I_C$ , Collector Current - Continuous	-200mAdc

Stresses above may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other conditions beyond those indicated in the Electrical Characteristics are not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

## THERMAL CHARACTERISTICS

Parameter	Symbol	Max	Unit
Total Device Dissipation FR-5 Board <sup>NOTE1</sup>			
$T_A = 25^\circ\text{C}$	$P_D$	225	mW
Derate above $25^\circ\text{C}$		1.8	mW/ $^\circ\text{C}$
Total Device Dissipation Alumina Substrate <sup>NOTE2</sup>			
$T_A = 25^\circ\text{C}$	$P_D$	300	mW
Derate above $25^\circ\text{C}$		2.4	mW/ $^\circ\text{C}$
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	417	$^\circ\text{C}/\text{W}$
Junction and Storage Temperature	$T_J, T_{stg}$	-55 to +150	$^\circ\text{C}$

NOTE1: FR-5 = 1.0 x 0.75 x 0.062 in.

NOTE2: Alumina = 0.4 x 0.3 x 0.024 in. 99.5% alumina.



## ELECTRICAL CHARACTERISTICS

Parameter	Symbol	Conditions	Min	Max	Unit
<b>OFF CHARACTERISTICS</b>					
Collector-Emitter Breakdown Voltage <sup>NOTE3</sup>	$V_{(BR)CEO}$	$I_C = -1.0\text{mA}$ , $I_B = 0$	-40	-	Vdc
Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	$I_C = -10\mu\text{A}$ , $I_E = 0$	-40	-	Vdc
Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	$I_E = -10\mu\text{A}$ , $I_C = 0$	-5.0	-	Vdc
Base Cutoff Current	$I_{BL}$	$V_{CE} = -30\text{Vdc}$ , $V_{EB} = -3.0\text{Vdc}$	-	-50	nAdc
Collector Cutoff Current	$I_{CEX}$	$V_{CE} = -30\text{Vdc}$ , $V_{EB} = -3.0\text{Vdc}$	-	-50	nAdc
<b>ON CHARACTERISTICS</b> <sup>NOTE2</sup>					
DC Current Gain <sup>NOTE1</sup>	$h_{FE}$	$I_C = -0.1\text{mA}$ , $V_{CE} = -1.0\text{Vdc}$	60	-	-
		$I_C = -1.0\text{mA}$ , $V_{CE} = -1.0\text{Vdc}$	80	-	-
		$I_C = -10\text{mA}$ , $V_{CE} = -1.0\text{Vdc}$	100	300	-
		$I_C = -50\text{mA}$ , $V_{CE} = -1.0\text{Vdc}$	60	-	-
		$I_C = -100\text{mA}$ , $V_{CE} = -1.0\text{Vdc}$	30	-	-
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$I_C = -10\text{mA}$ , $I_B = -1.0\text{mA}$ <sup>NOTE3</sup>	-	-0.25	Vdc
		$I_C = -50\text{mA}$ , $I_B = -5.0\text{mA}$	-	-0.4	
Base-Emitter Saturation Voltage <sup>NOTE3</sup>	$V_{BE(sat)}$	$I_C = -10\text{mA}$ , $I_B = -1.0\text{mA}$	-0.65	-0.85	Vdc
		$I_C = -50\text{mA}$ , $I_B = -5.0\text{mA}$	-	-0.95	
<b>SMALL-SIGNAL CHARACTERISTICS</b>					
Current-Gain-Bandwidth Product	$f_T$	$I_C = -10\text{mA}$ , $V_{CE} = -20\text{Vdc}$ , $f = 100\text{MHz}$	250	-	MHz
Output Capacitance	$C_{obo}$	$V_{CB} = -5.0\text{Vdc}$ , $I_E = 0$ , $f = 1.0\text{MHz}$	-	4.5	pF
Input Capacitance	$C_{ibo}$	$V_{BE} = -0.5\text{Vdc}$ , $I_C = 0$ , $f = 1.0\text{MHz}$	-	10	pF
Input Impedance	$h_{ie}$	$V_{CE} = -10\text{Vdc}$ , $I_C = -1.0\text{mA}$ , $f = 1.0\text{kHz}$	2.0	12	k $\Omega$
Voltage Feedback Ratio	$h_{re}$	$V_{CE} = -10\text{Vdc}$ , $I_C = -1.0\text{mA}$ , $f = 1.0\text{kHz}$	0.1	10	$\times 10^{-4}$
Small-Signal Current Gain	$h_{fe}$	$V_{CE} = -10\text{Vdc}$ , $I_C = -1.0\text{mA}$ , $f = 1.0\text{kHz}$	100	400	-
Output Admittance	$h_{oe}$	$V_{CE} = -10\text{Vdc}$ , $I_C = -1.0\text{mA}$ , $f = 1.0\text{kHz}$	3.0	60	$\mu\text{mhos}$
Noise Figure	$N_F$	$V_{CE} = -5.0\text{Vdc}$ , $I_C = -100\mu\text{A}$ , $R_S = 1.0\text{k}\Omega$ , $f = 1.0\text{kHz}$	-	4.0	dB
<b>SWITCHING CHARACTERISTICS</b>					
Delay Time	$t_d$	$V_{CC} = -3.0\text{Vdc}$ , $V_{BE} = 0.5\text{Vdc}$	-	35	ns
Rise Time	$t_r$	$I_C = -10\text{mA}$ , $I_{B1} = -1.0\text{mA}$	-	35	
Storage Time	$t_s$	$V_{CC} = -3.0\text{Vdc}$ , $I_C = -10\text{mA}$ ,	-	225	ns
Fall Time	$t_f$	$I_{B1} = I_{B2} = -1.0\text{mA}$	-	75	

NOTE1: FR-5 = 1.0 x 0.75 x 0.062 in.

NOTE2: Alumina = 0.4 x 0.3 x 0.024 in. 99.5% alumina.

NOTE3: Pulse Width <300 $\mu$ s; Duty Cycle <2.0%.



**TYPICAL CHARACTERISTICS**

Figure 1. Delay and Rise Time Equivalent Test Circuit

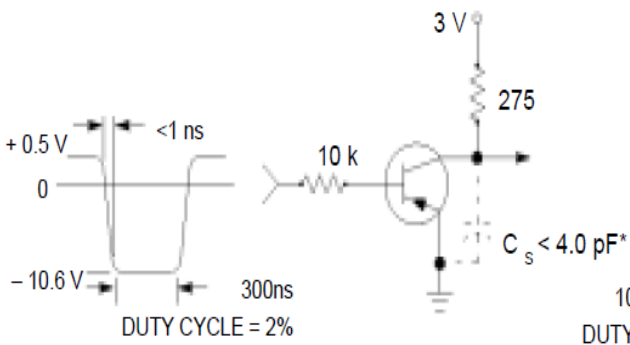
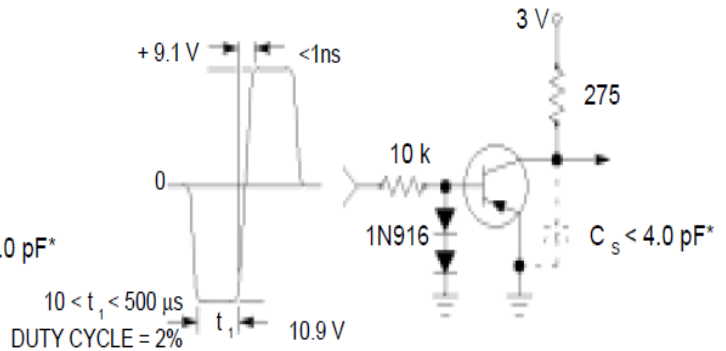


Figure 2. Storage and Fall Time Equivalent Test Circuit



\*Total shunt capacitance of test jig and connectors

Figure 3. Capacitance

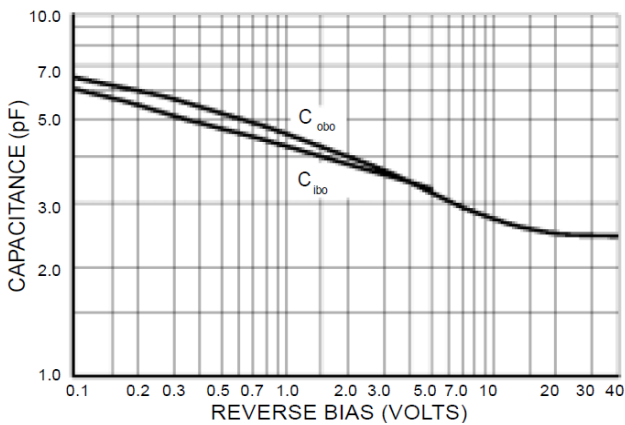


Figure 4. Charge Data

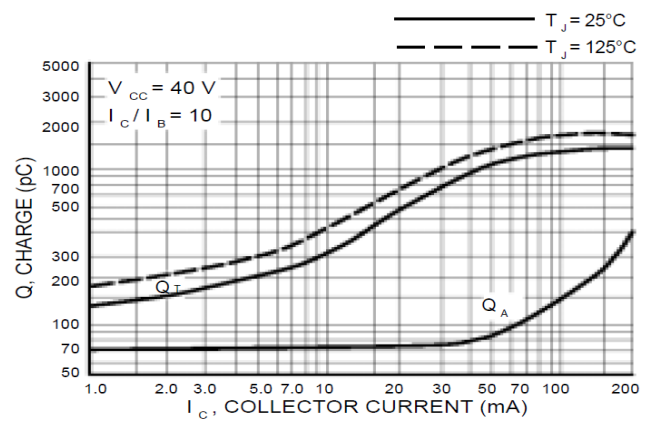


Figure 5. Turn-On Time

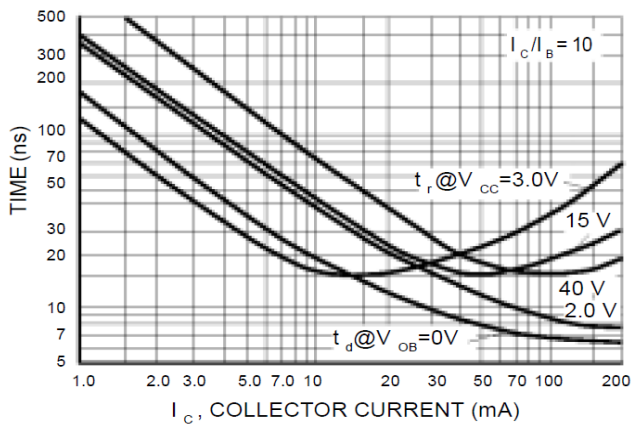
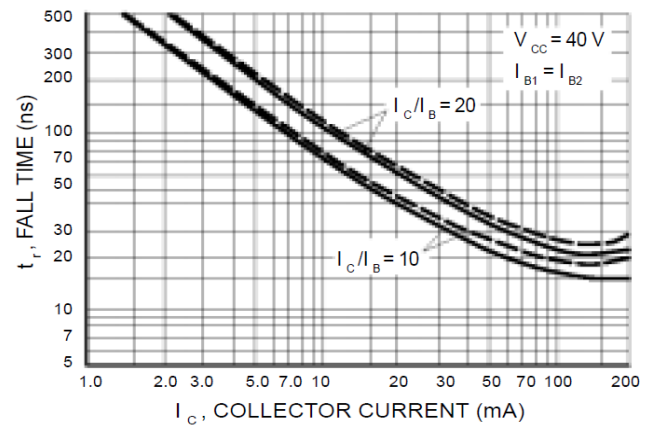


Figure 6. Fall Time





**TYPICAL AUDIO SMALL-SIGNAL CHARACTERISTICS NOISE FIGURE VARIATIONS**

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

Figure 7. Noise Figure

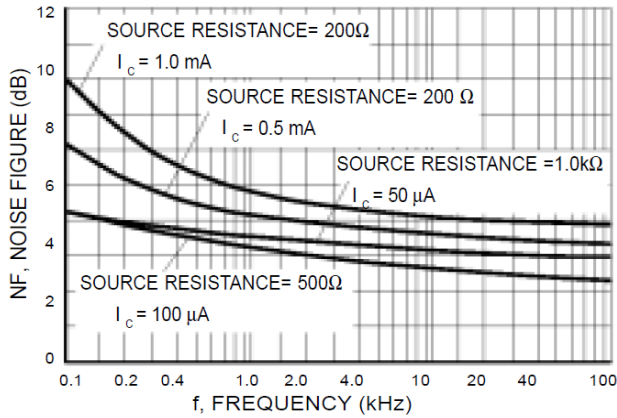
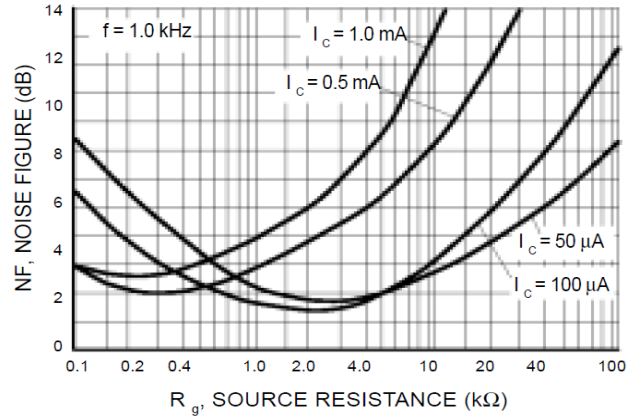


Figure 8. Noise Figure



**h PARAMETERS ( $V_{CE} = 10V_{dc}$ ,  $f = 1.0 kHz$ ,  $T_A = 25^\circ C$ )**

Figure 9. Current Gain

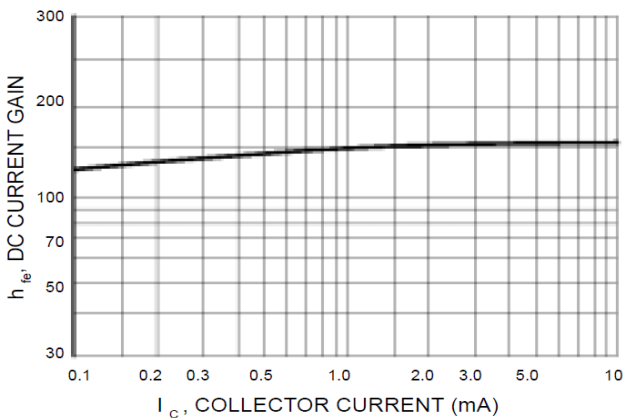


Figure 10. Output Admittance

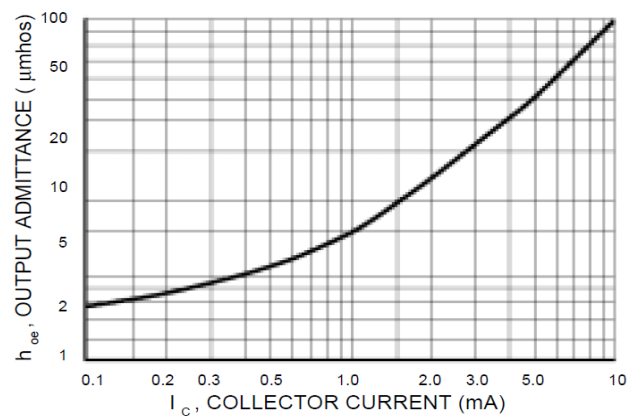


Figure 11. Input Impedance

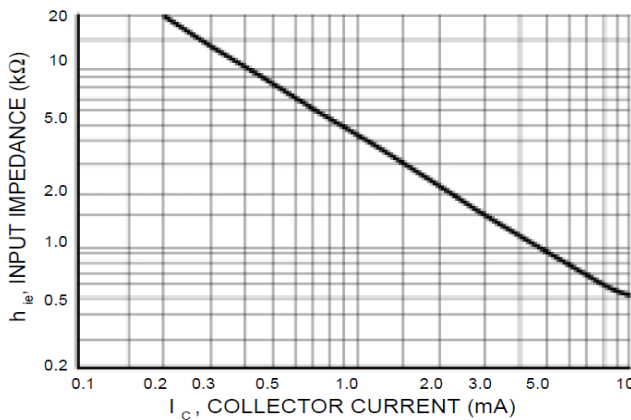
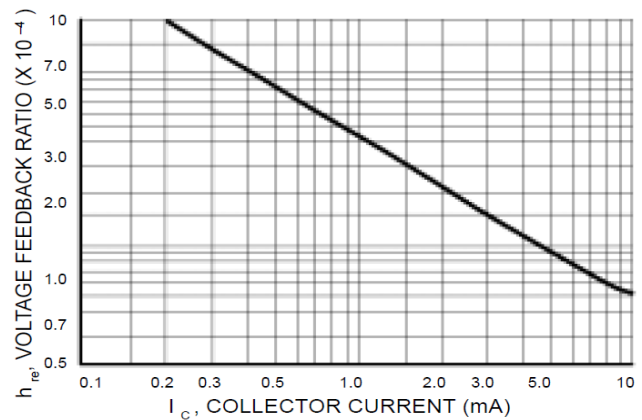


Figure 12. Voltage Feedback Ratio





### TYPICAL STATIC CHARACTERISTICS

Figure 13. DC Current Gain

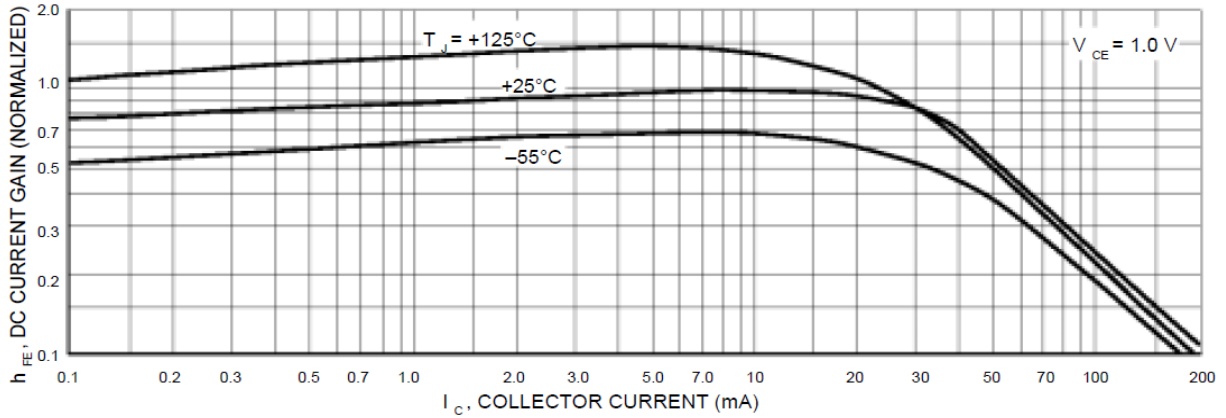


Figure 14. Collector Saturation Region

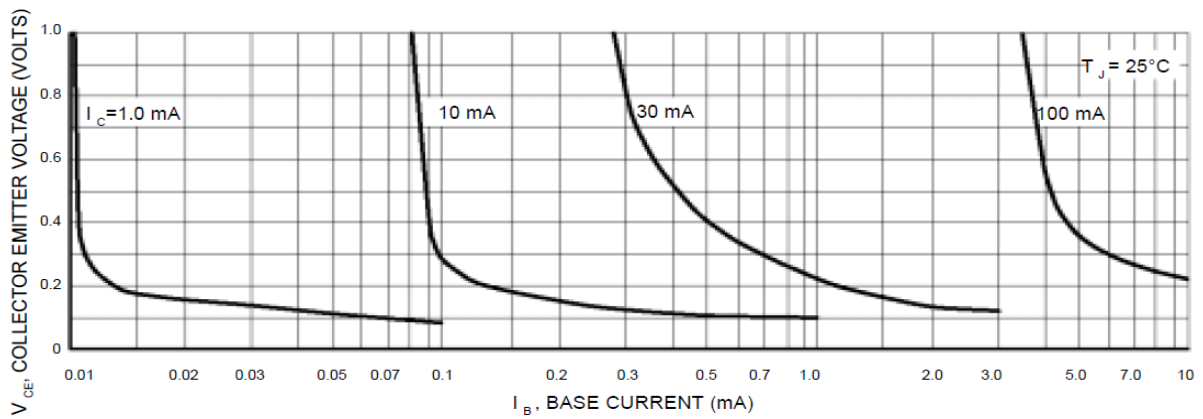


Figure 15. "ON" Voltages

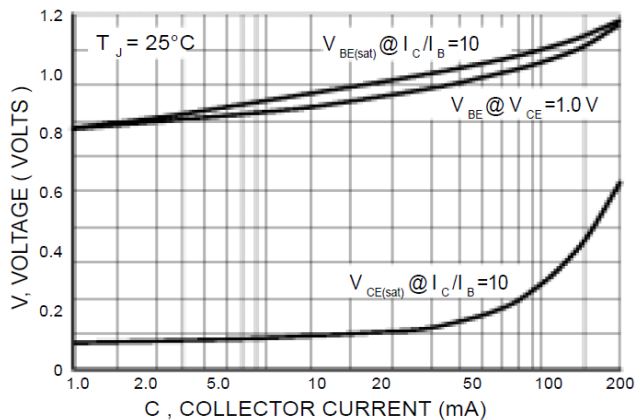
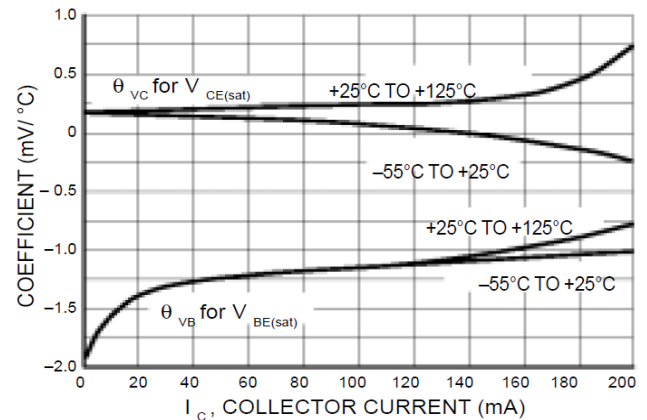


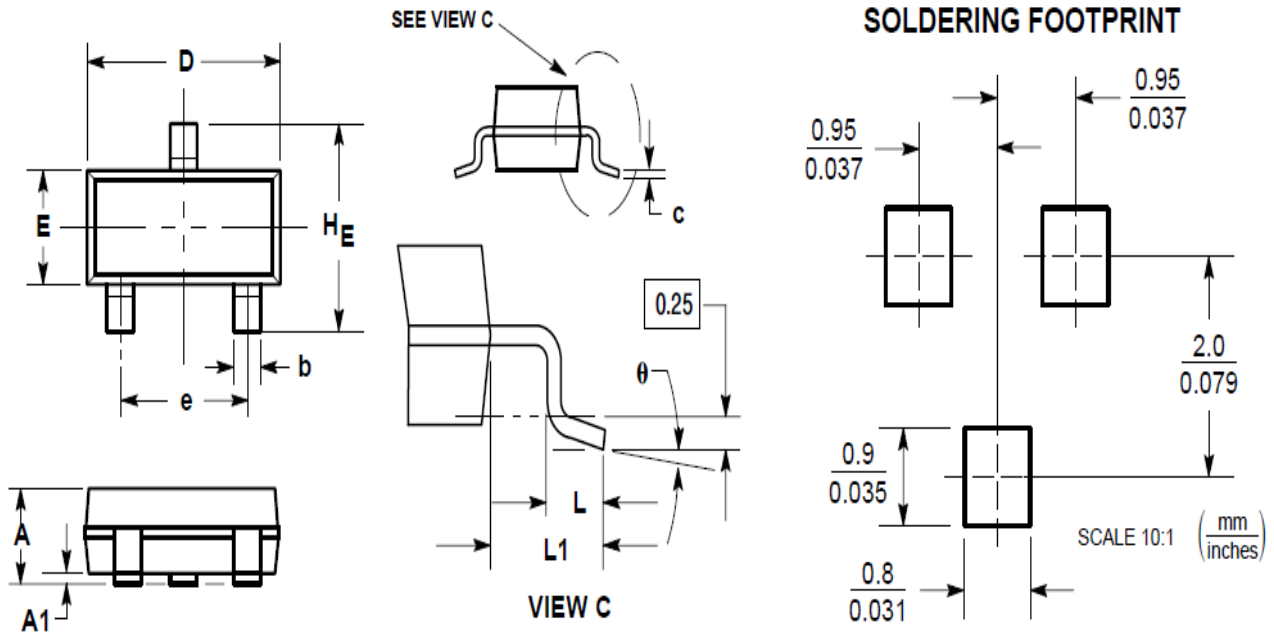
Figure 16. Temperature Coefficients





**PACKAGE INFORMATION**

Dimension in SOT-23 Package (Unit: mm)



DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.035	0.044	0.89	1.11
A1	0.001	0.004	0.01	0.10
b	0.015	0.020	0.37	0.50
c	0.003	0.007	0.09	0.18
D	0.110	0.120	2.80	3.04
E	0.047	0.055	1.20	1.40
e	0.070	0.081	1.78	2.04
L	0.004	0.012	0.10	0.30
L1	0.014	0.029	0.35	0.69
HE	0.083	0.104	2.10	2.64



## IMPORTANT NOTICE

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