DESCRIPTION

The MBT3904L is available in SOT-23 Package.

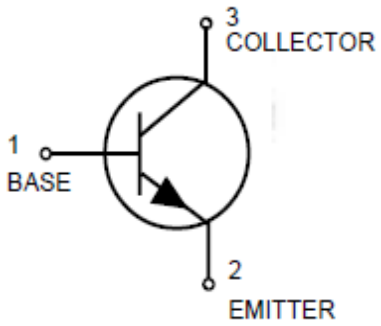
FEATURES

- Available in SOT-23 Package.

ORDERING INFORMATION

Package Type	Part Number
SOT-23	MBT3904L
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	60Vdc
V_{EBO}, Emitter-Base Voltage	6.0Vdc
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 NOTE1			
T_A = 25°C	P_D	225	mW
Derate above 25°C		1.8	mW/°C
Thermal Resistance Junction to Ambient	$R_{\theta JA}$	556	°C/W
Total Device Dissipation Alumina Substrate NOTE2			
T_A = 25°C	P_D	300	mW
Derate above 25°C		2.4	mW/°C
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	417	°C/W
Junction and Storage Temperature	T_J , T_{stg}	-55 to +150	°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

T_A = 25°C unless otherwise noted

Parameter	Symbol	Conditions	Min	Max	Unit
OFF CHARACTERISTICS					
Collector-Emitter Breakdown Voltage NOTE3	$V_{(BR)CEO}$	I_C = 1.0mAdc	40	-	Vdc
Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	I_C = 10μAdc	60	-	Vdc
Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	I_E = 10μAdc	6.0	-	Vdc
Base Cutoff Current	I_{BL}	V_{CE} = 30Vdc, V_{EB} = 3.0Vdc	-	50	nAdc
Collector Cutoff Current	I_{CEX}	V_{CE} = 30Vdc, V_{EB} = 3.0Vdc	-	50	nAdc
ON CHARACTERISTICS NOTE3					
DC Current Gain NOTE1	h_{FE}	I_C = 0.1mAdc, V_{CE} = 1.0Vdc	40	-	-
		I_C = 1.0mAdc, V_{CE} = 1.0Vdc	70	-	-
		I_C = 10mAdc, V_{CE} = 1.0Vdc	100	300	-
		I_C = 50mAdc, V_{CE} = 1.0Vdc	60	-	-
		I_C = 100mAdc, V_{CE} =1.0Vdc	30	-	-
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	I_C = 10mAdc, I_B = 1.0mAdc NOTE3	-	0.2	Vdc
		I_C = 50mAdc, I_B = 5.0mAdc	-	0.3	
Base-Emitter Saturation Voltage NOTE3	$V_{BE(sat)}$	I_C = 10mAdc, I_B = 1.0mAdc	0.65	0.85	Vdc
		I_C = 50mAdc, I_B = 5.0mAdc	-	0.95	
SMALL–SIGNAL CHARACTERISTICS					
Current-Gain-Bandwidth Product	f_T	I_C = 10mAdc, V_{CE} = 20Vdc, f = 100MHz	300	-	MHz
Output Capacitance	C_{obo}	V_{CB} = 5.0Vdc, I_E = 0, f = 1.0MHz	-	4.0	pF
Input Capacitance	C_{ibo}	V_{BE} = 0.5Vdc, I_C = 0, f = 1.0MHz	-	8.0	pF
Input Impedance	h_{ie}	V_{CE} = 10Vdc, I_C = 1.0mAdc, f = 1.0 kHz	1.0	10	kΩ
Voltage Feedback Ratio	h_{re}	V_{CE} = 10Vdc, I_C = 1.0mAdc, f = 1.0kHz	0.5	8.0	$x10^{-4}$
Small-Signal Current Gain	h_{fe}	V_{CE} = 10Vdc, I_C = 1.0mAdc, f = 1.0kHz	100	400	-
Output Admittance	h_{oe}	V_{CE} = 10Vdc, I_C = 1.0mAdc, f = 1.0kHz	1.0	40	μmhos
Noise Figure	NF	V_{CE} = 5.0Vdc, I_C = 100μAdc, R_S = 1.0kΩ, f = 1.0kHz	-	5.0	dB
SWITCHING CHARACTERISTICS					
Delay Time	t_d	V_{CC} = 3.0Vdc,V_{BE} = -0.5Vdc	-	35	ns
Rise Time	t_r	I_C = 10mAdc, I_{B1} = 1.0mAdc	-	35	
Storage Time	t_s	V_{CC} = 3.0Vdc, I_C = 10mAdc,	-	200	ns
Fall Time	t_f	I_{B1} = I_{B2} = 1.0mAdc	-	50	

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

NOTE3: Pulse Test: Pulse Width ≤300 μs, Duty Cycle ≤2.0%.

TYPICAL CHARACTERISTICS

Figure 1. Delay and Rise Time Equivalent Test Circuit

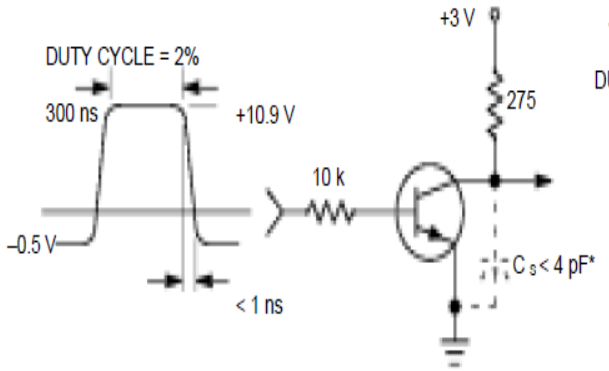
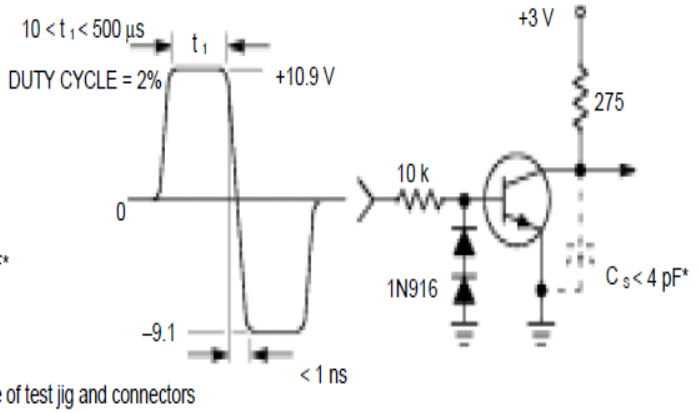


Figure 2. Storage and Fall Time Equivalent Test Circuit



* Total shunt capacitance of test jig and connectors

Figure 3. Capacitance

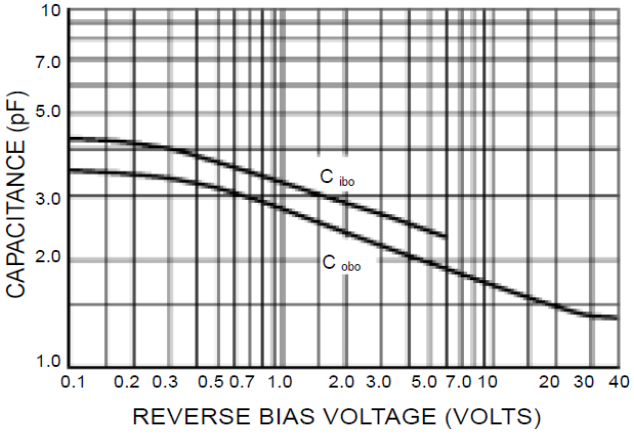


Figure 4. Charge Data

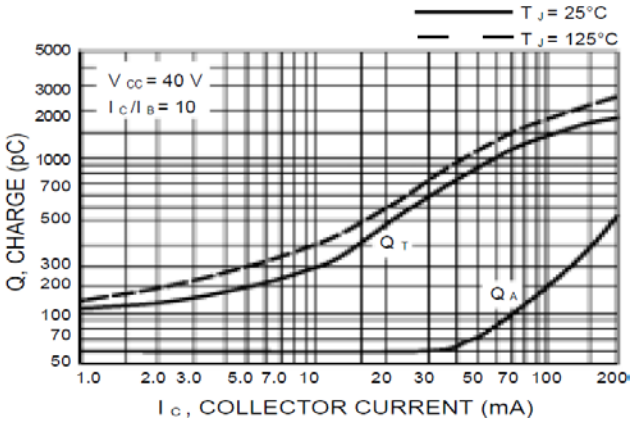


Figure 5. Turn–On Time

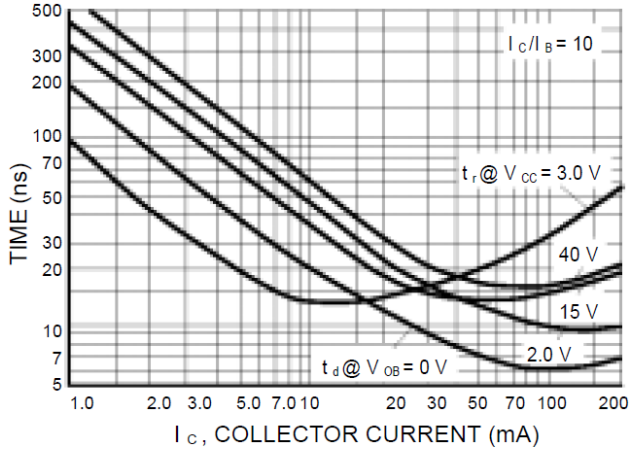


Figure 6. Rise Time

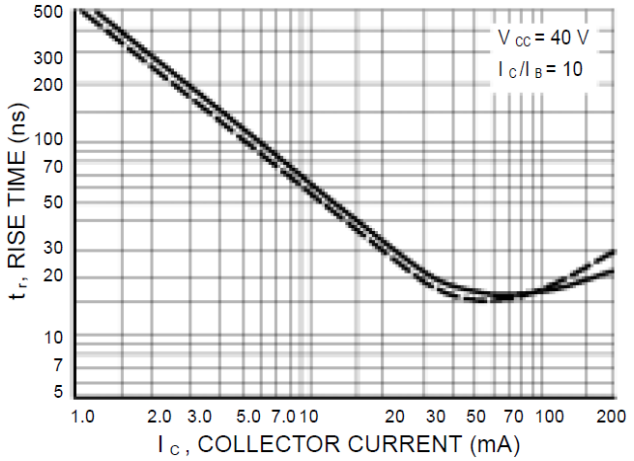


Figure 7. Storage Time

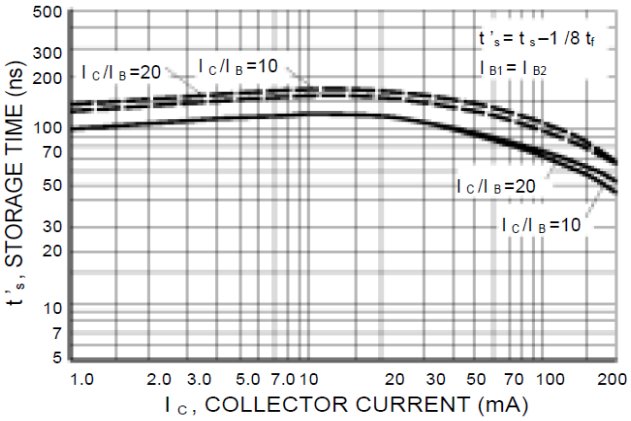
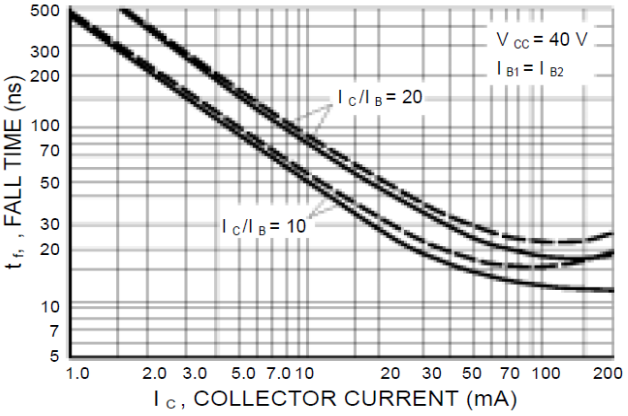


Figure 8. Fall Time



TYPICAL AUDIO SMALL–SIGNAL CHARACTERISTICS NOISE FIGURE VARIATIONS

(V_{CE} = 5.0Vdc, T_A = 25°C, Bandwidth = 1.0Hz)

Figure 9.

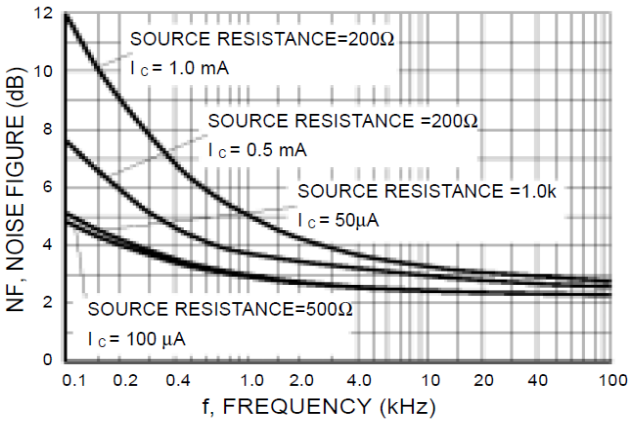
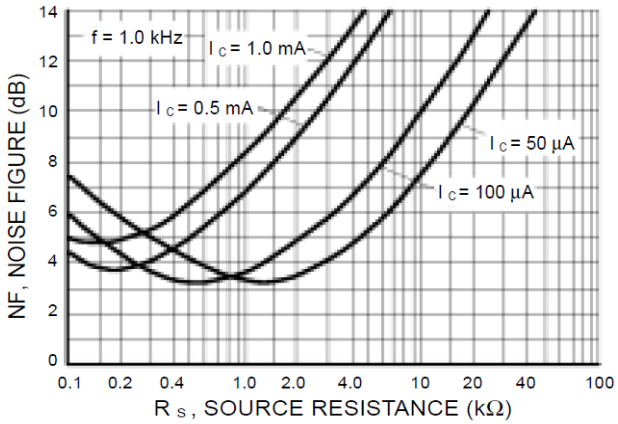


Figure 10.



h PARAMETERS (V_{CE} = 10Vdc, f = 1.0kHz, T_A = 25°C)

Figure 11. Current Gain

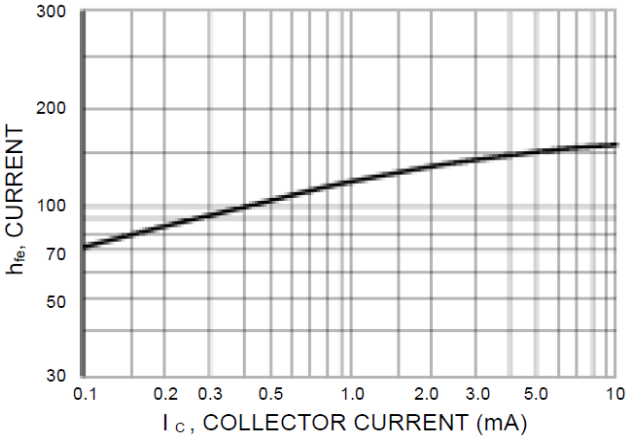


Figure 12. Output Admittance

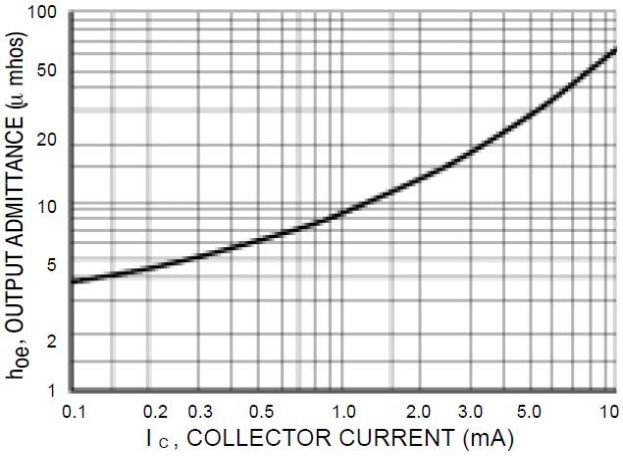


Figure 13. Input Impedance

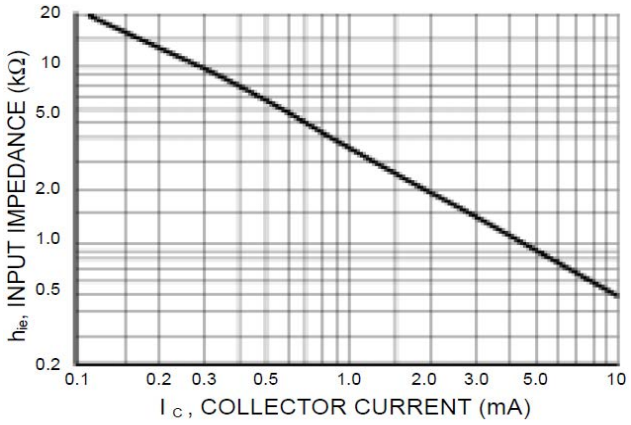


Figure 14. Voltage Feedback Ratio

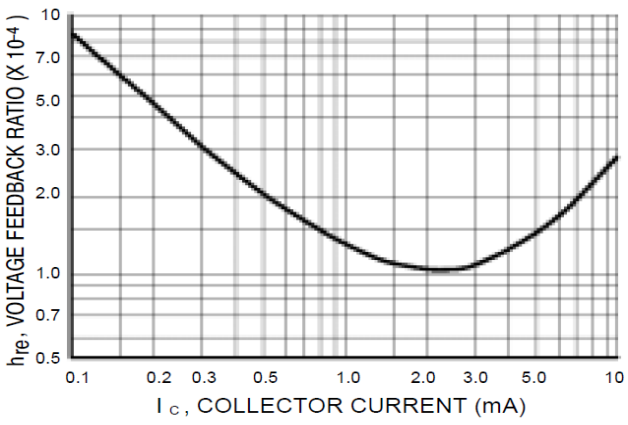


Figure 15. DC Current Gain

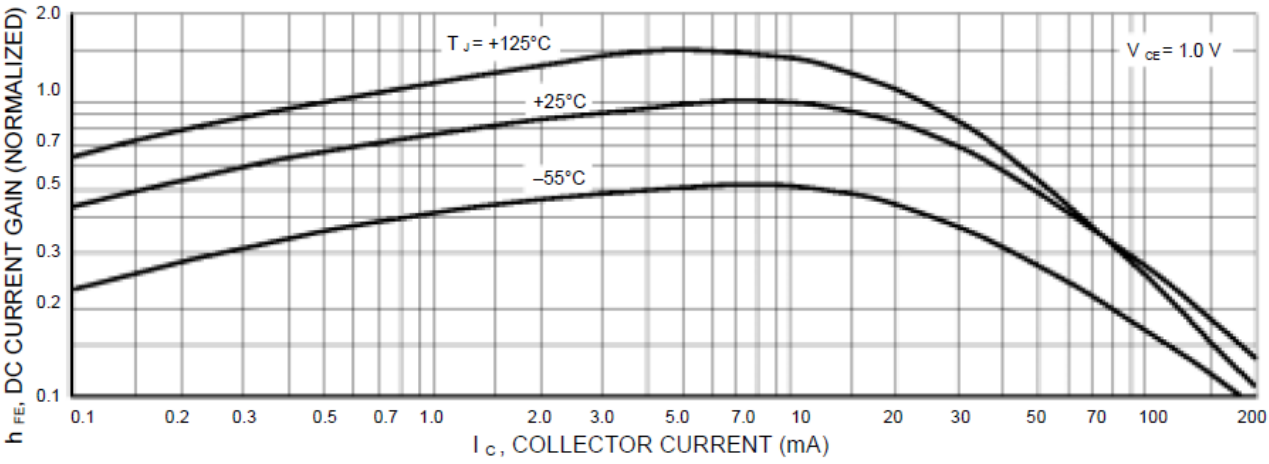


Figure 16. Collector Saturation Region

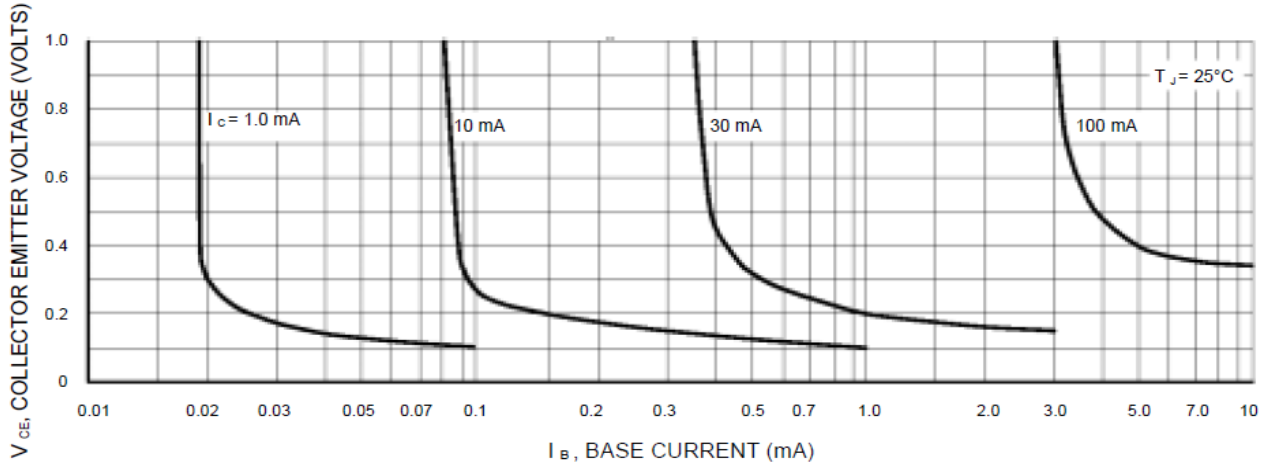


Figure 17. “ON” Voltages

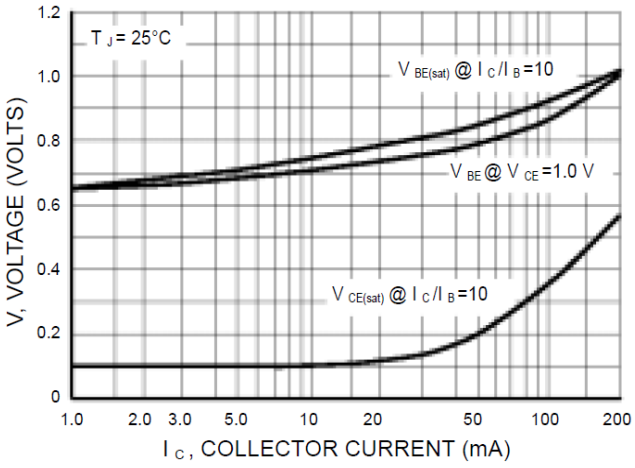
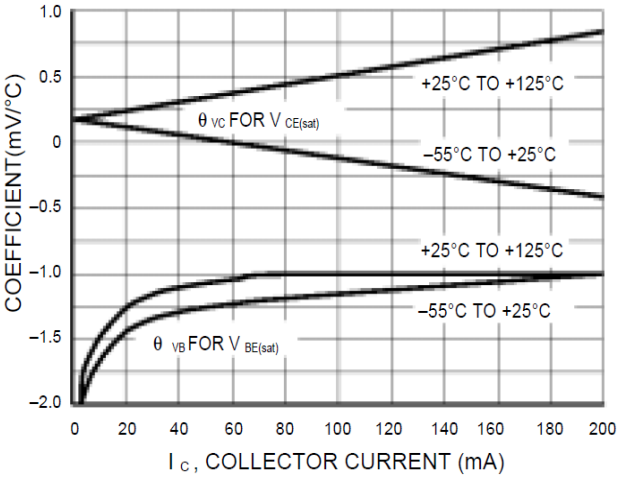
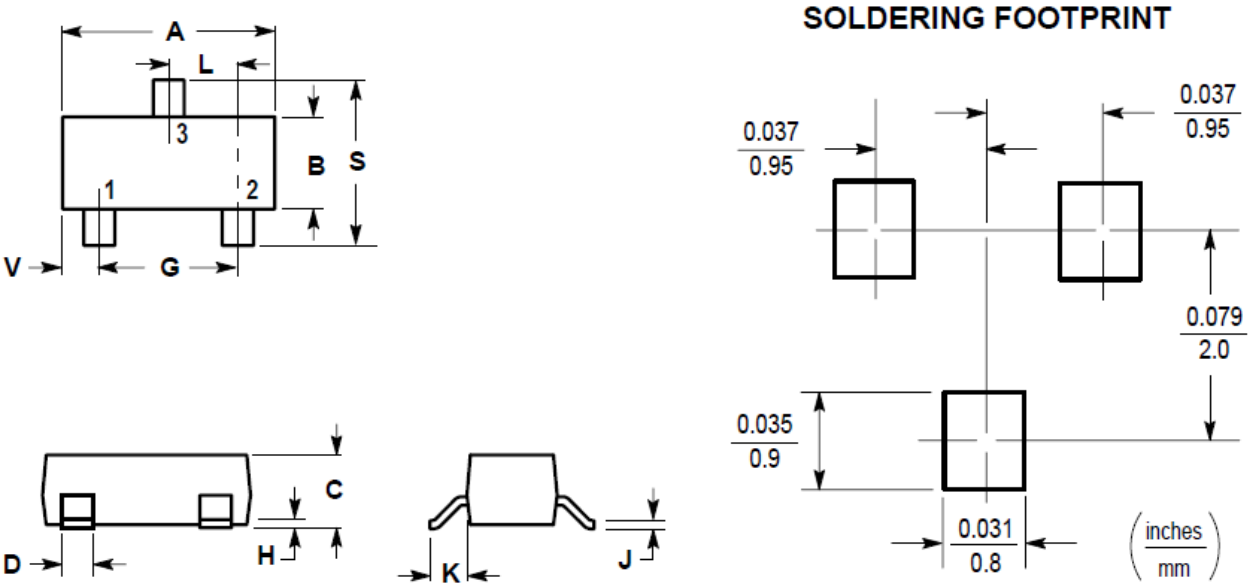


Figure 18. Temperature Coefficients



PACKAGE INFORMATION

Dimension in SOT-23 Package (Unit: mm)



DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.1102	0.1197	2.80	3.04
B	0.0472	0.0551	1.20	1.40
C	0.0350	0.0440	0.89	1.11
D	0.0150	0.0200	0.37	0.50
G	0.0701	0.0807	1.78	2.04
H	0.0005	0.0040	0.013	0.100
J	0.0034	0.0070	0.085	0.177
K	0.0140	0.0285	0.35	0.69
L	0.0350	0.0401	0.89	1.02
S	0.0830	0.1039	2.10	2.64
V	0.0177	0.0236	0.45	0.60

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