



DESCRIPTION

The MBT3904T is available in SC-89 Package.

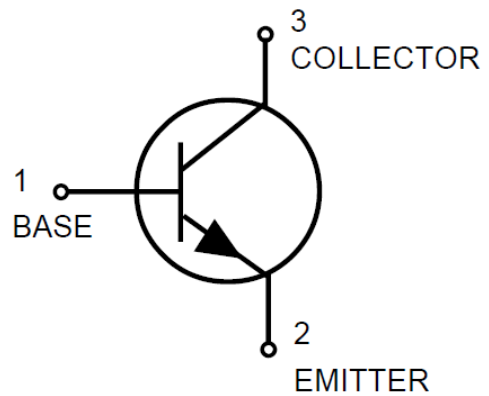
FEATURES

- Simplifies Circuit Design.
- Available in SC-89 Package

ORDERING INFORMATION

Package Type	Part Number
SC-89	MBT3904T
Package	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-4 Board, ^{NOTE1} $T_A = 25^\circ\text{C}$ Derate above 25°C	P_D	200 1.6	mW mW/ $^\circ\text{C}$
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	600	$^\circ\text{C/W}$
Total Device Dissipation FR-4 Board, ^{NOTE2} $T_A = 25^\circ\text{C}$ Derate above 25°C	P_D	300 2.4	mW mW/ $^\circ\text{C}$
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	400	$^\circ\text{C/W}$
Junction and Storage Temperature	T_J, T_{STG}	-55 to +150	$^\circ\text{C}$



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 = 1.0mA _{dc}	40	-	V _{dc}
Collector–Base Breakdown Voltage	V _{(BR)CBO}	I _C = 10μA _{dc}	60	-	V _{dc}
Emitter–Base Breakdown Voltage	V _{(BR)EBO}	I _E = 10μA _{dc}	6.0	-	V _{dc}
Base Cutoff Current	I _{BL}	V _{CE} = 30V _{dc} , V _{EB} = 3.0V _{dc}	-	50	nA _{dc}
Collector Cutoff Current	I _{CEX}	V _{CE} = 30V _{dc} , V _{EB} = 3.0V _{dc}	-	50	nA _{dc}
ON CHARACTERISTICS^{NOTE3}					
DC Current Gain ^{NOTE1}	h _{FE}	I _C = 0.1mA _{dc} , V _{CE} = 1.0V _{dc}	40	-	-
		I _C = 1.0mA _{dc} , V _{CE} = 1.0V _{dc}	70	-	
		I _C = 10mA _{dc} , V _{CE} = 1.0V _{dc}	100	300	
		I _C = 50mA _{dc} , V _{CE} = 1.0V _{dc}	60	-	
		I _C = 100mA _{dc} , V _{CE} = 1.0V _{dc}	30	-	
Collector–Emitter Saturation Voltage	V _{CE(sat)}	I _C = 10mA _{dc} , I _B = 1.0mA _{dc} ^{NOTE3}	-	0.2	V _{dc}
		I _C = 50mA _{dc} , I _B = 5.0mA _{dc}	-	0.3	
Base–Emitter Saturation Voltage ^{NOTE3}	V _{BE(sat)}	I _C = 10mA _{dc} , I _B = 1.0mA _{dc}	0.65	0.85	V _{dc}
		I _C = 50mA _{dc} , I _B = 5.0mA _{dc}	-	0.95	



T_A = 25°C, unless otherwise noted

Parameter	Symbol	Conditions	Min	Max	Unit
SMALL-SIGNAL CHARACTERISTICS					
Current-Gain — Bandwidth Product	f _T	I _C = 10mA _{dc} , V _{CE} = 20V _{dc} , f = 100MHz	200	-	MHz
Output Capacitance	C _{obo}	V _{CB} = 5.0V _{dc} , I _E = 0, f = 1.0MHz	-	4.0	pF
Input Capacitance	C _{ibo}	V _{BE} = 0.5V _{dc} , I _C = 0, f = 1.0MHz	-	8.0	pF
Input Impedance	h _{ie}	V _{CE} = 10V _{dc} , I _C = 1.0mA _{dc} , f = 1.0kHz	1.0	10	kΩ
Voltage Feedback Ratio	h _{re}	V _{CE} = 10V _{dc} , I _C = 1.0mA _{dc} , f = 1.0kHz	0.5	8.0	X10 ⁻⁴
Small-Signal Current Gain	h _{fe}	V _{CE} = 10V _{dc} , I _C = 1.0mA _{dc} , f = 1.0kHz	100	400	-
Output Admittance	h _{oe}	V _{CE} = 10V _{dc} , I _C = 1.0mA _{dc} , f = 1.0kHz	1.0	40	mhos
Noise Figure	NF	V _{CE} = 5.0V _{dc} , I _C = 100μA _{dc} , R _S = 1.0kΩ, f = 1.0kHz	-	5.0	dB
SWITCHING CHARACTERISTICS					
Delay Time	t _d	V _{CC} = 3.0V _{dc} , V _{BE} = 0.5V _{dc}	-	35	ns
Rise Time	t _r	I _C = 10mA _{dc} , I _{B1} = 1.0mA _{dc}	-	35	
Storage Time	t _s	V _{CC} = 3.0V _{dc} , I _C = 10mA _{dc} ,	-	200	ns
Fall Time	t _f	I _{B1} = I _{B2} = 1.0mA _{dc}	-	50	

NOTE1: FR-4 Minimum Pad.

NOTE2: FR-4 1.0 x 1.0 Inch Pad.

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

TYPICAL CHARACTERISTICS

Equivalent Test Circuit

Figure 1. Delay and Rise Time

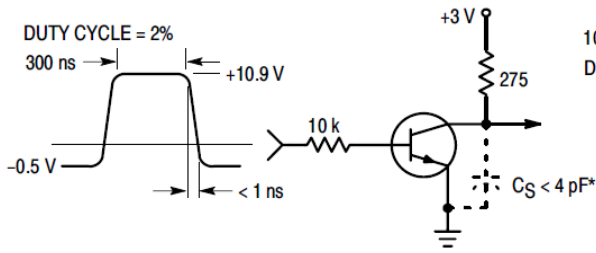
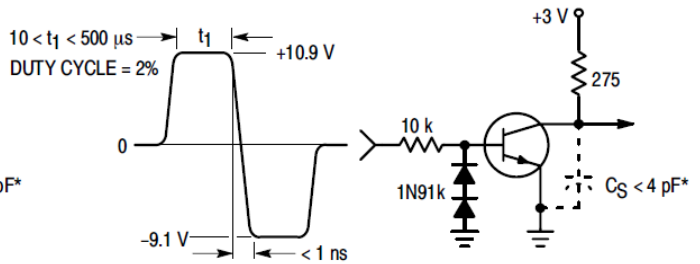


Figure 2. Storage and Fall Time



* Total shunt capacitance of test jig and connectors

Figure 3. Capacitance

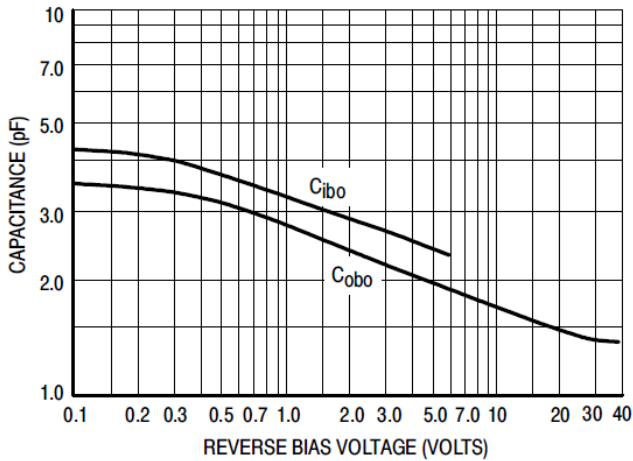


Figure 4. Charge Data

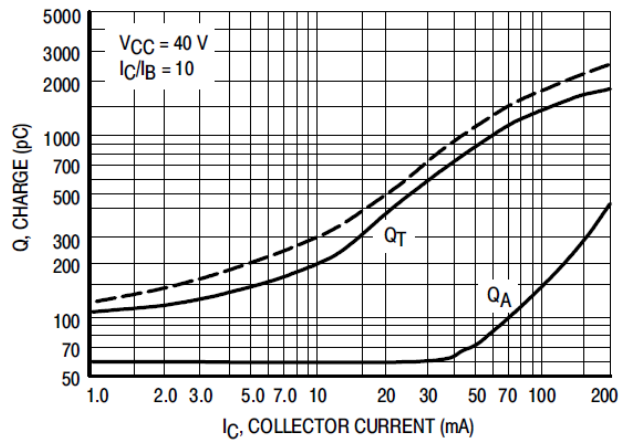


Figure 5. Turn-On Time

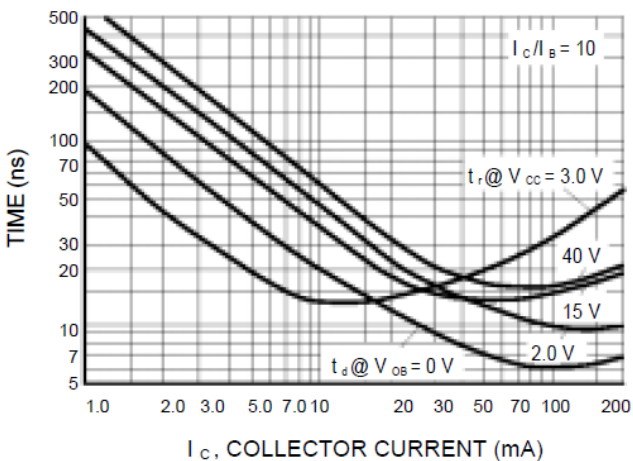


Figure 6. Rise Time

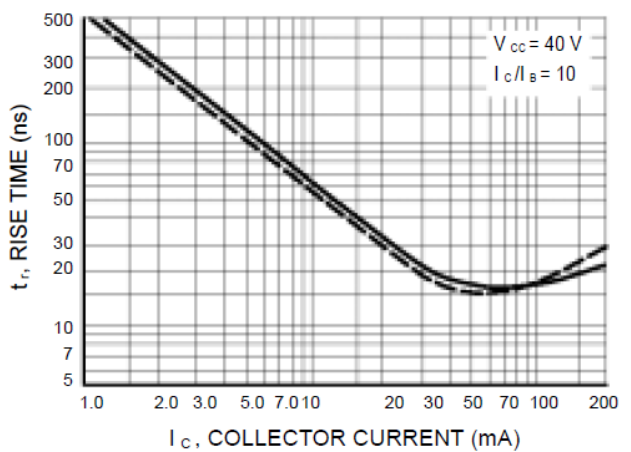


Figure 7. Storage Time

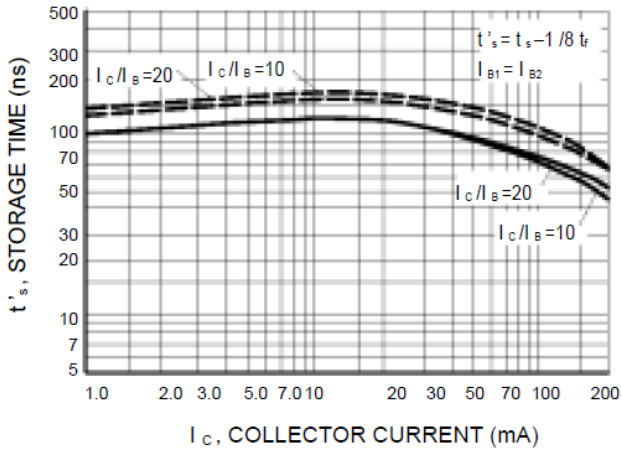
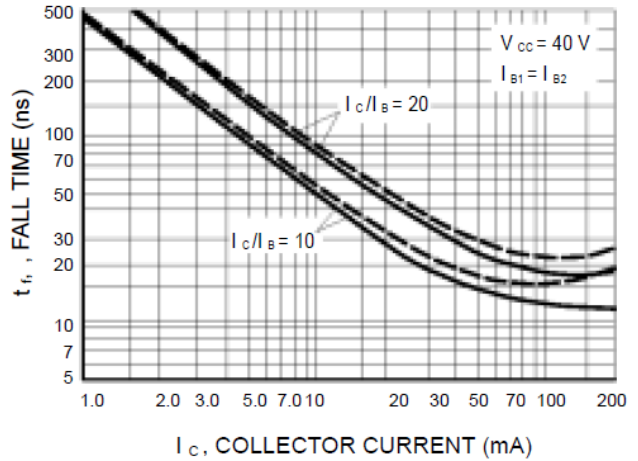


Figure 8. Fall Time



TYPICAL AUDIO SMALL-SIGNAL CHARACTERISTICS NOISE FIGURE VARIATIONS

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

Figure 9. Noise Figure

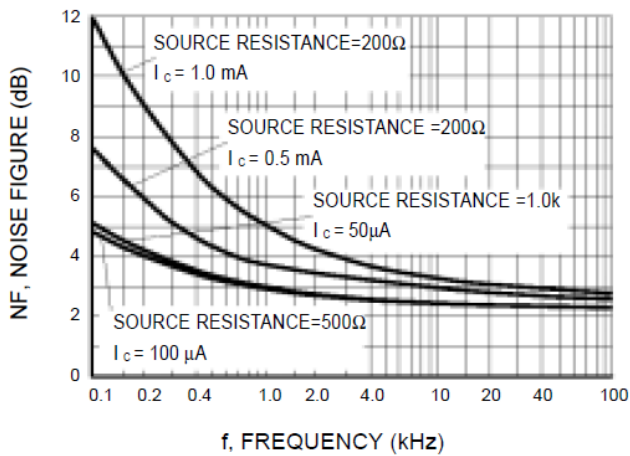
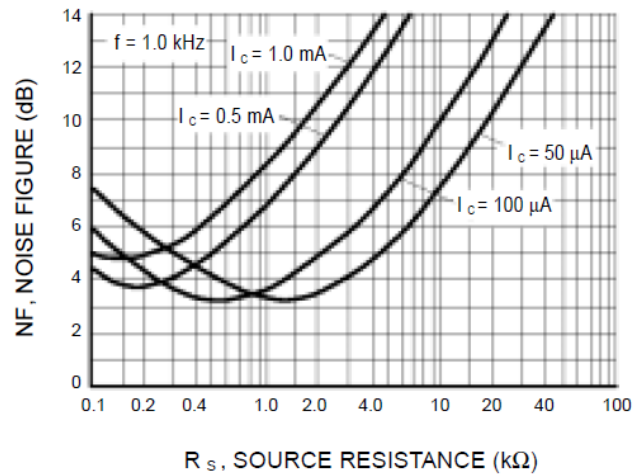


Figure 10. Noise Figure





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

Figure 11. Current Gain

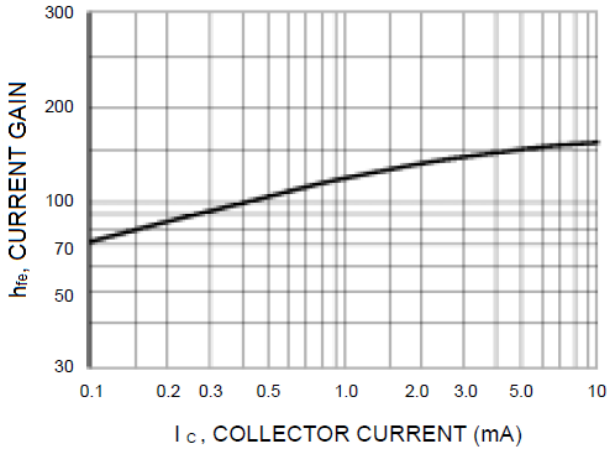


Figure 12. Output Admittance

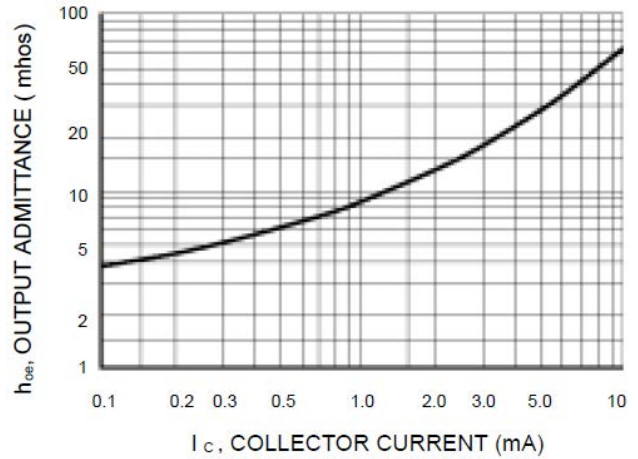


Figure 13. Input Impedance

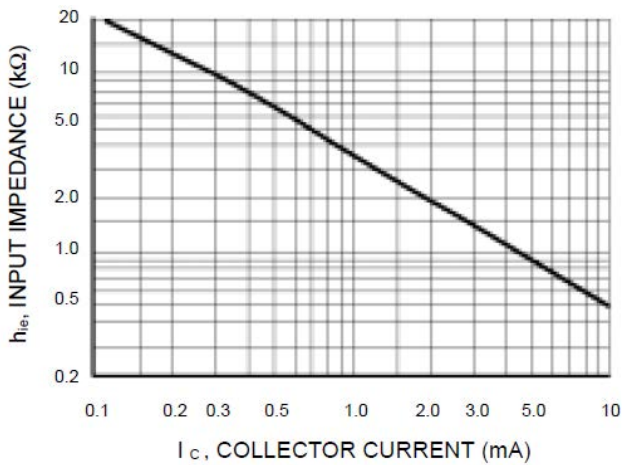
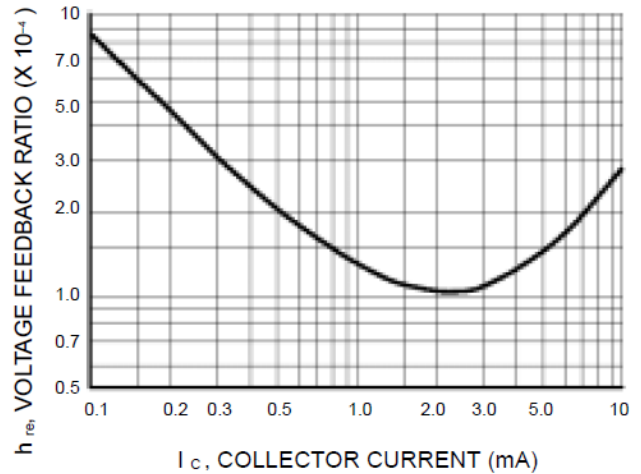


Figure 14. Voltage Feedback Ratio





TYPICAL STATIC CHARACTERISTICS

Figure 15. DC Current Gain

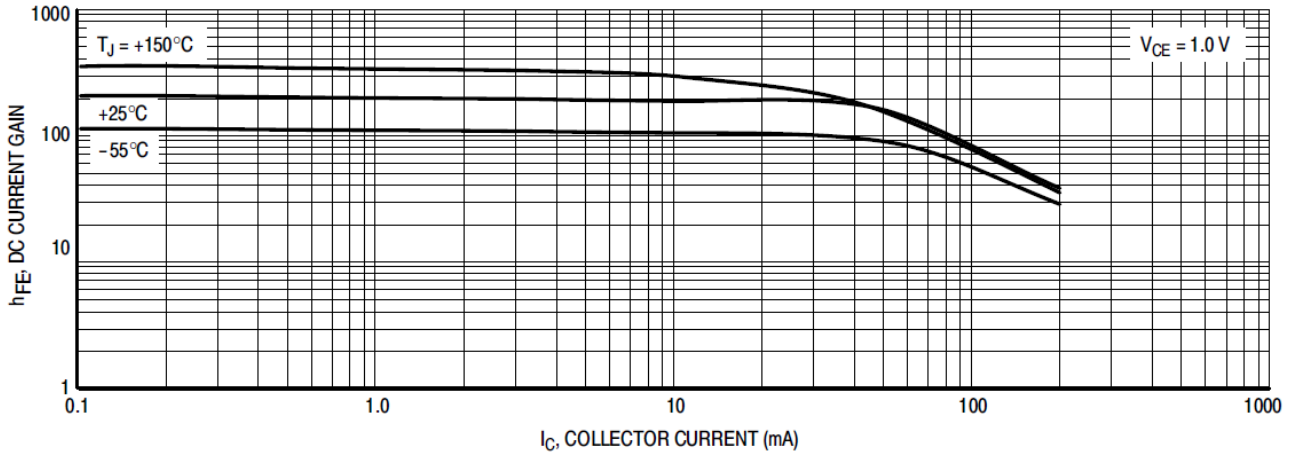


Figure 16. Collector Saturation Region

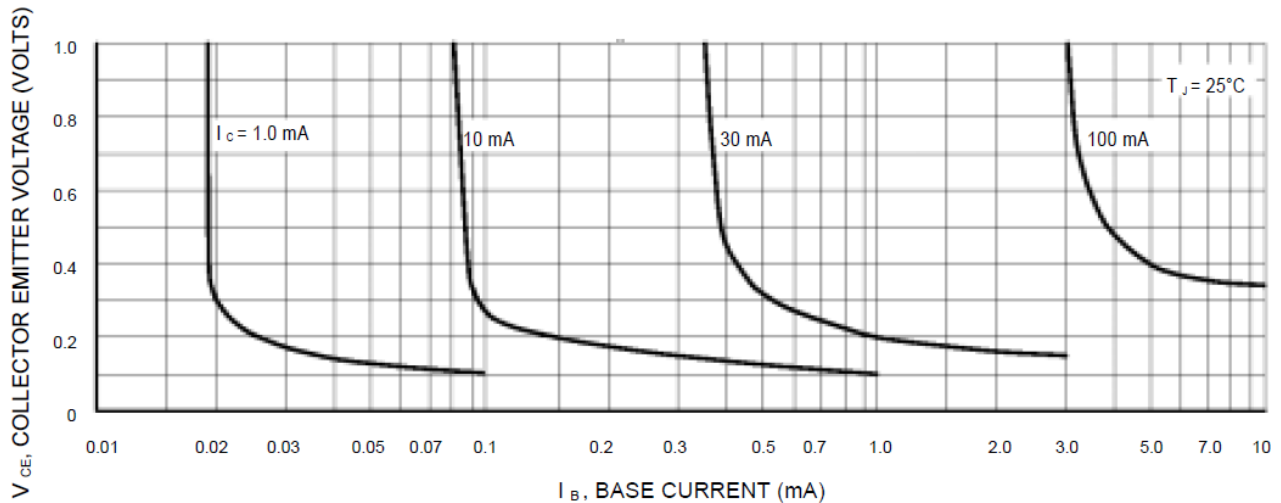


Figure 17. "ON" Voltages

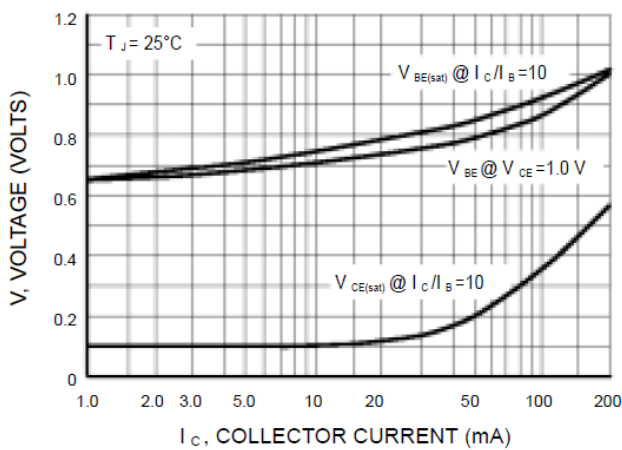
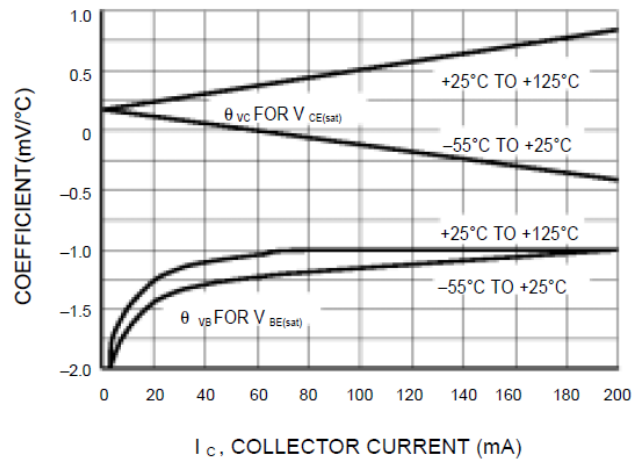


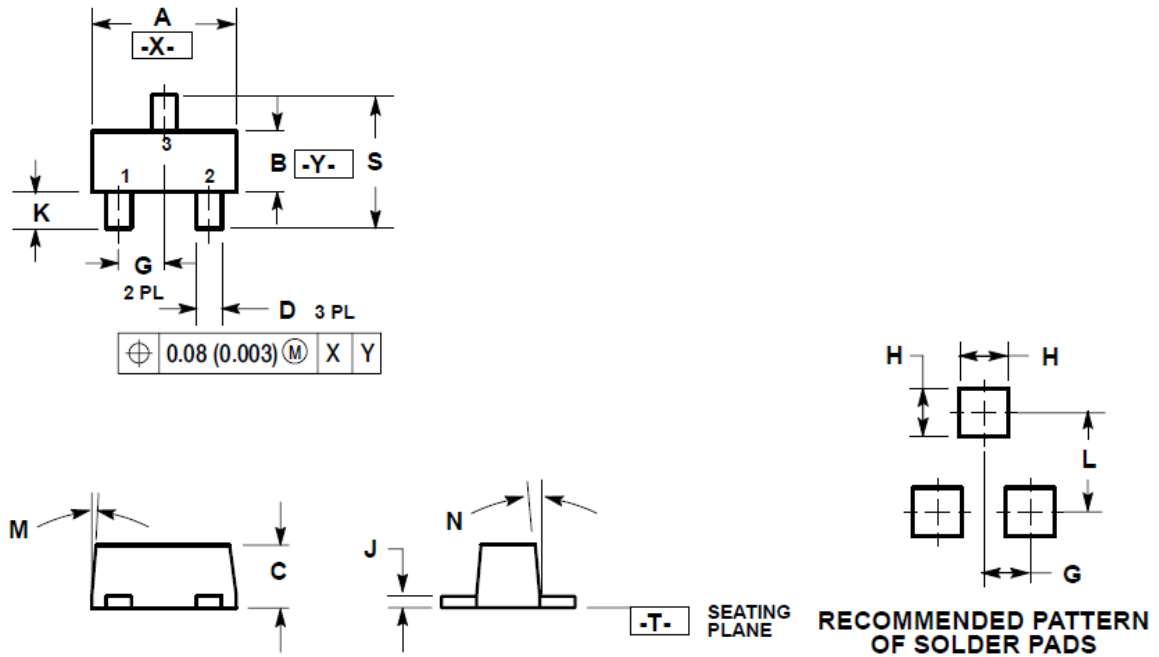
Figure 18. Temperature Coefficients





PACKAGE INFORMATION

Dimension in SC-89 Package (Unit: mm)



DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	1.50	1.70	0.059	0.067
B	0.75	0.95	0.030	0.040
C	0.60	0.80	0.024	0.031
D	0.23	0.33	0.009	0.013
G	0.50 BSC		0.020 BSC	
H	0.53 REF		0.021 REF	
J	0.10	0.20	0.004	0.008
K	0.30	0.50	0.012	0.020
L	1.10 REF		0.043 REF	
M	-	10°	-	10°
N	-	10°	-	10°
S	1.50	1.70	0.059	0.067



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