



DESCRIPTION

These transistors are designed for general purpose amplifier applications. They are housed in the SC-70 which is designed for low power surface mount applications.

The MBT3904W is available in SC-70 package.

ORDERING INFORMATION

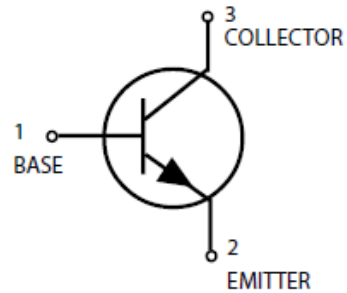
Package Type	Part Number
SC-70	MBT3904W
Note	3,000pcs/ Reel
AiT provides all RoHS Compliant Products	

FEATURES

- ROHS compliance
- Available in SC-70 package

PIN DESCRIPTION

NPN MBT3904W





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 Package Dissipation ^{NOTE1} $T_A = 25^\circ\text{C}$	P_D	150	mW
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	833	$^\circ\text{C}/\text{W}$
Junction and Storage Temperature	T_J, T_{STG}	-55 to +150	$^\circ\text{C}$

NOTE1: Device mounted on FR4 glass epoxy printed circuit board using the minimum recommended footprint



ELECTRICAL CHARACTERISTICS

T_A = 25°C unless otherwise noted

Parameter	Symbol	Conditions	Min	Max	Unit
OFFCHARACTERISTICS					
Collector–Emitter Breakdown Voltage ^{NOTE1}	V _{(BR)CEO}	I _C = 1.0mA _{dc} , I _B = 0	40	-	V _{dc}
Collector–Base Breakdown Voltage	V _{(BR)CBO}	I _C = 10μA _{dc} , I _E = 0	60	-	V _{dc}
Emitter–Base Breakdown Voltage	V _{(BR)EBO}	I _E = 10μA _{dc} , I _C = 0	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}
ONCHARACTERISTICS^{NOTE2}					
DC Current Gain	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}	-	0.2	V _{dc}
		I _C = 50mA _{dc} , I _B = 5.0mA _{dc}	-	0.3	
Base–Emitter Saturation Voltage	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	

NOTE2: Pulse Test: Pulse Width ≤ 300μs; Duty Cycle ≤ 2.0%.



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	300	-	MHz
Output Capacitance	C _{OBO}	V _{CB} = 5.0V _{dc} , I _E = 0, f = 1.0MHz	-	4.0	pF
Input Capacitance	C _{IBO}	V _{EB} = 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	X 10 ⁻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	μΩ
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	ns
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	ns



TYPICAL CHARACTERISTICS

Equivalent Test Circuit

Figure 1. Delay and Rise Time

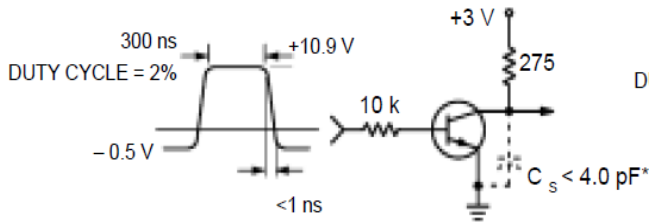
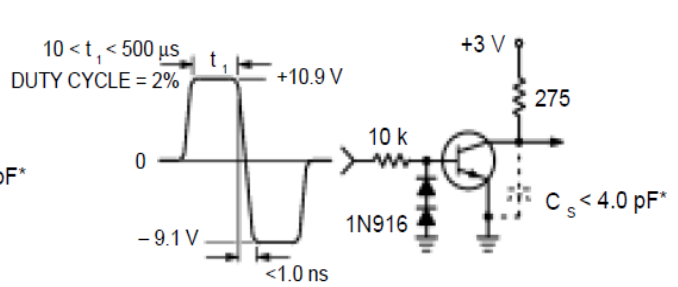


Figure 2. Storage and Fall Time



*Total shunt capacitance of test jig and connectors

————— T_J=25°C
- - - - - T_J=125°C

Figure 3. Capacitance

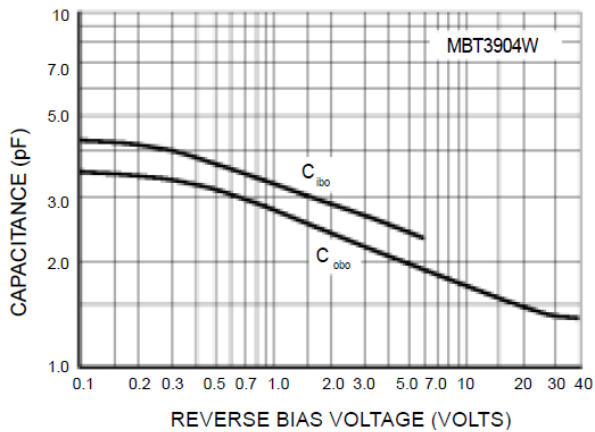


Figure 4. Charge Data

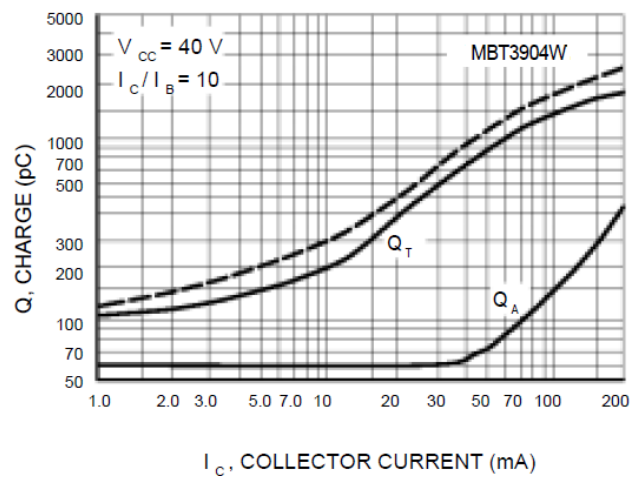


Figure 5. Turn-On Time

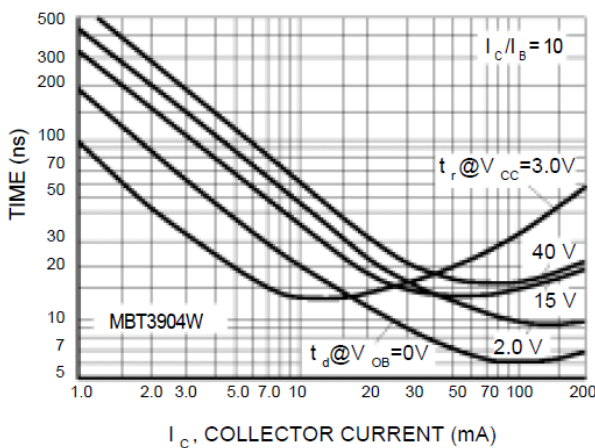


Figure 6. Rise Time

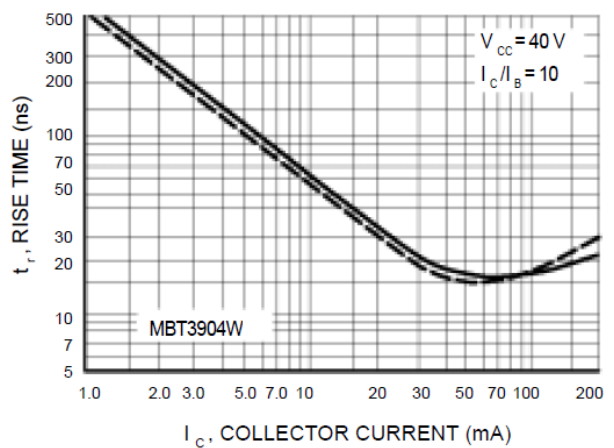




Figure 7. Storage Time

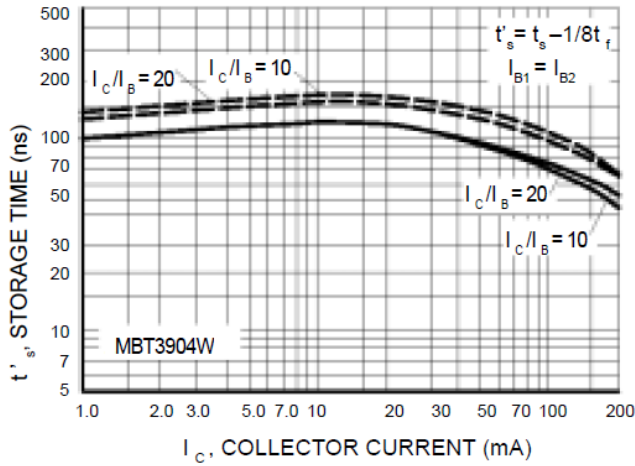
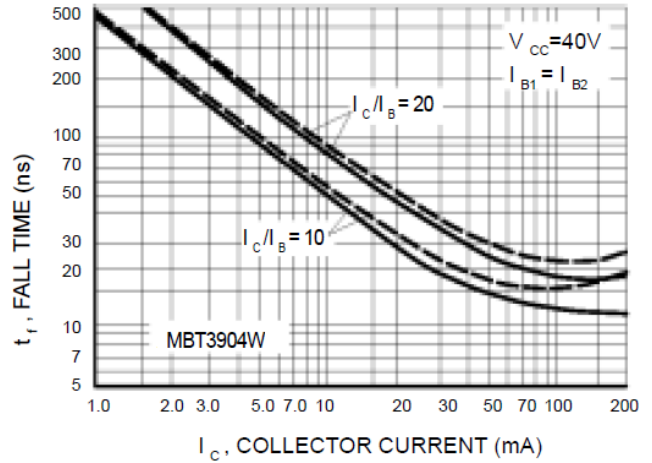


Figure 8. Fall Time



TYPICAL AUDIO SMALL-SIGNAL CHARACTERISTICS NOISE FIGURE VARIATIONS

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

Figure 9. Noise Figure

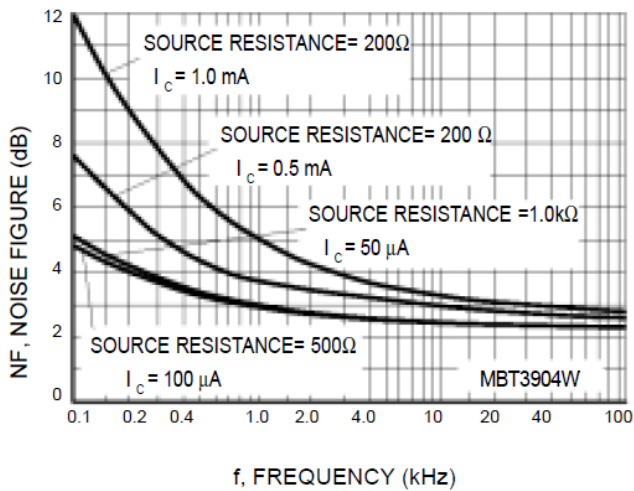
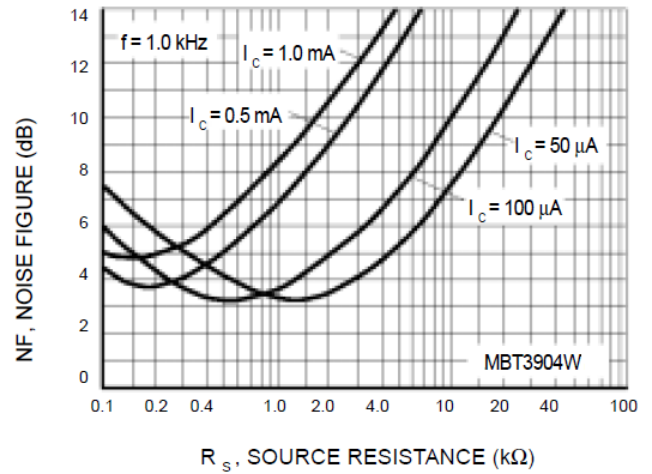


Figure 10. Noise Figure





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

Figure 11. Current Gain

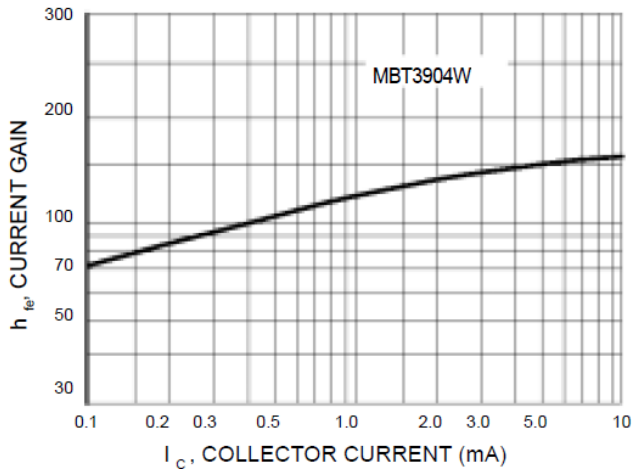


Figure 12. Output Admittance

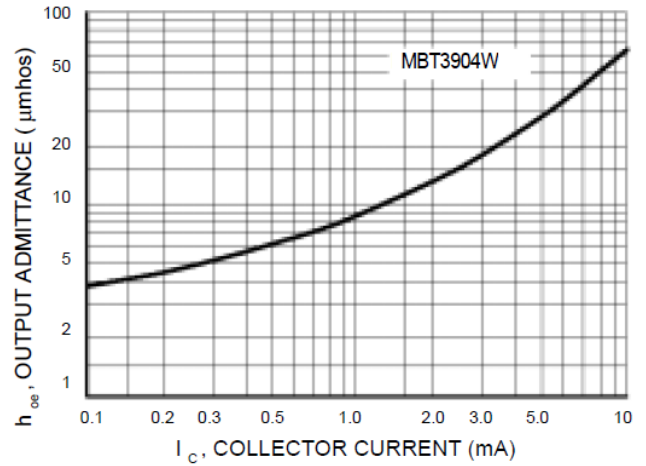


Figure 13. Input Impedance

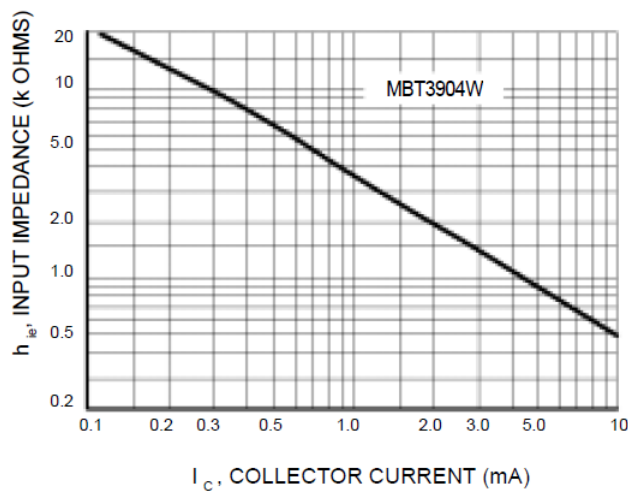
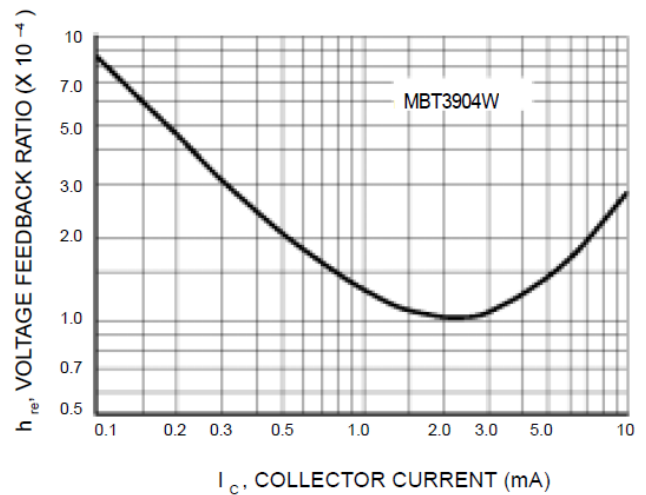


Figure 14. Voltage Feedback Ratio





TYPICAL STATIC CHARACTERISTICS

Figure 15. DC Current Gain

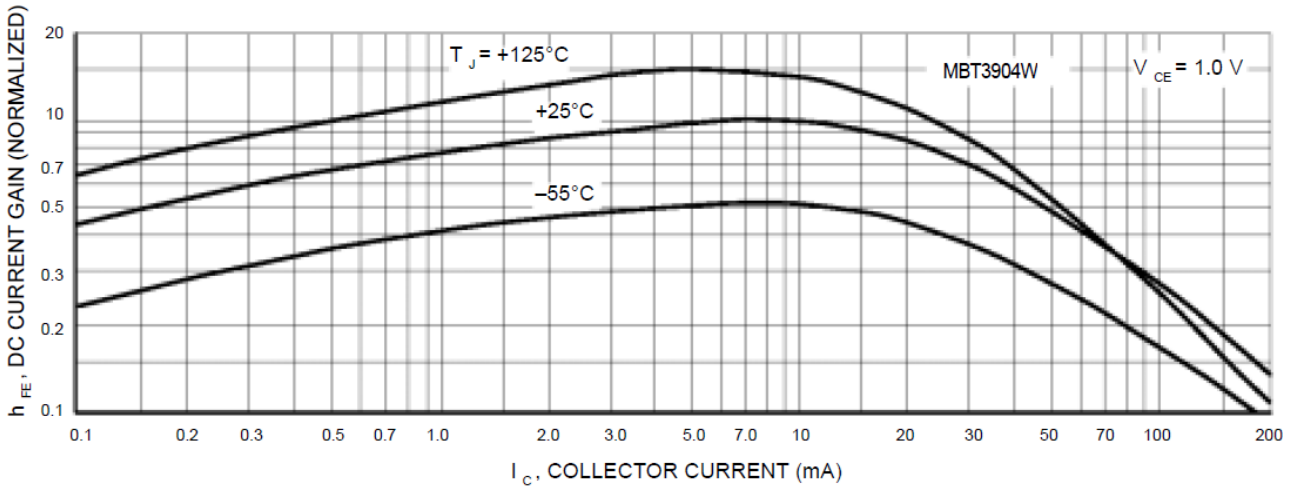


Figure 16. Collector Saturation Region

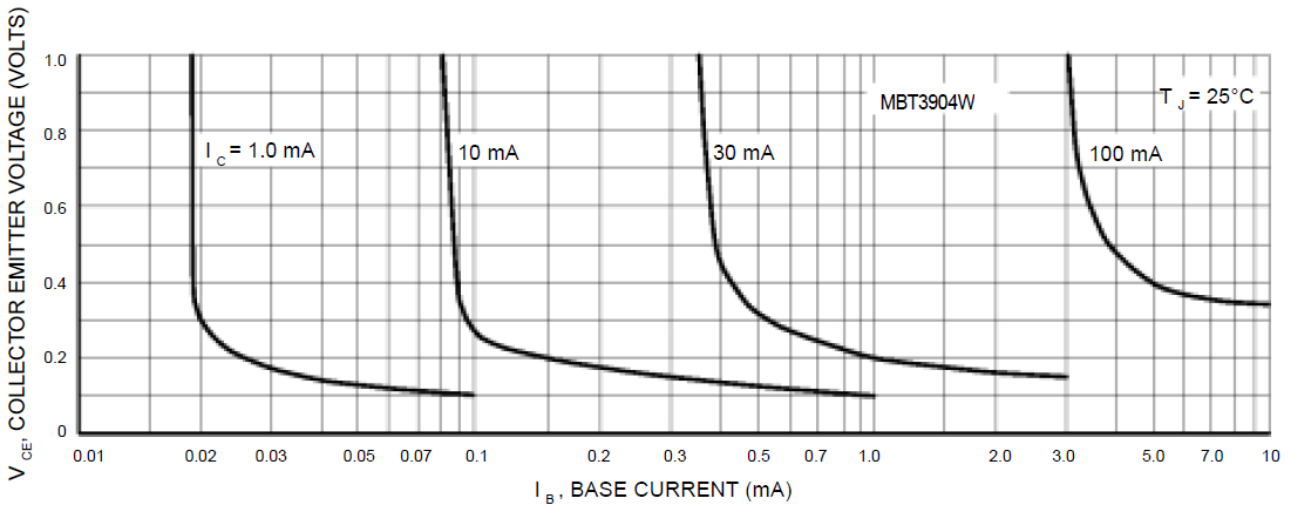


Figure 17. "ON" Voltages

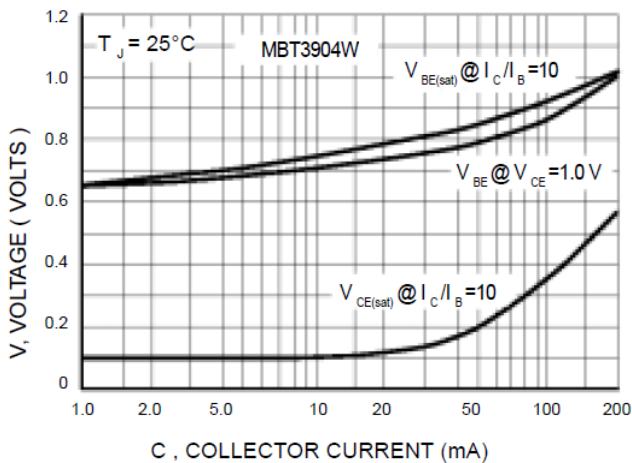
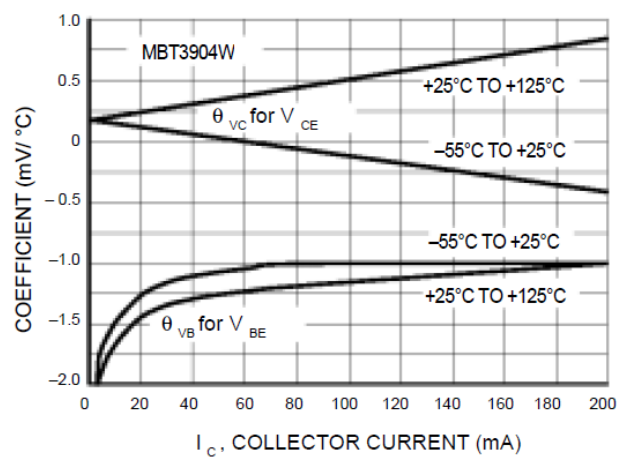


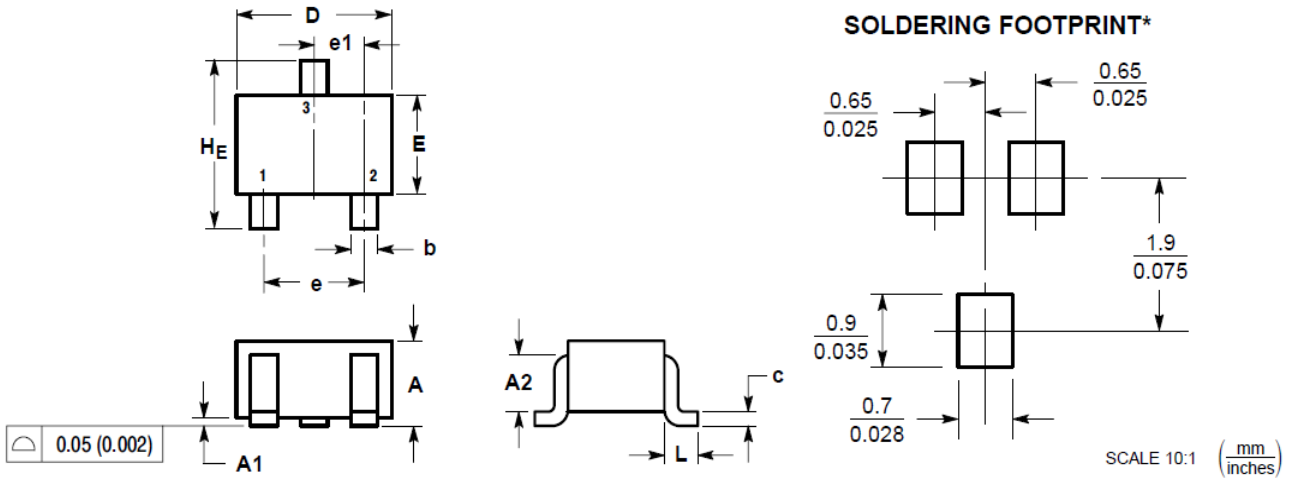
Figure 18. Temperature Coefficients





PACKAGE INFORMATION

Dimension in SC-70 Package (Unit: mm)



DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	0.80	1.00	0.032	0.040
A1	0.00	0.10	0.000	0.004
A2	0.7 REF		0.028 REF	
b	0.30	0.40	0.012	0.016
c	0.10	0.25	0.004	0.010
D	1.80	2.20	0.071	0.087
E	1.15	1.35	0.045	0.053
e	1.20	1.40	0.047	0.055
e1	0.65 BSC		0.026 BSC	
L	0.425 REF		0.017 REF	
HE	2.00	2.40	0.079	0.095



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