MBT3904DW1T1, MBT3904DW2T1

Dual General Purpose Transistors

The MBT3904DW1T1 and MBT3904DW2T1 devices are a spin-off of our popular SOT-23/SOT-323 three-leaded device. It is designed for general purpose amplifier applications and is housed in the SOT-363 six-leaded surface mount package. By putting two discrete devices in one package, this device is ideal for low-power surface mount applications where board space is at a premium.

Features

- h_{FE}, 100-300
- Low $V_{CE(sat)}$, ≤ 0.4 V
- Simplifies Circuit Design
- Reduces Board Space
- Reduces Component Count
- Available in 8 mm, 7-inch/3,000 Unit Tape and Reel
- Pb-Free Packages are Available

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CEO}	40	Vdc
Collector-Base Voltage	V_{CBO}	60	Vdc
Emitter-Base Voltage	V_{EBO}	6.0	Vdc
Collector Current - Continuous	I_C	200	mAdc
Electrostatic Discharge	ESD	HBM Class 2 MM Class B	

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

THERAML CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Total Package Dissipation (Note 1) T_A = 25°C	P_D	150	mW
Thermal Resistance, Junction-to-Ambient	$R_{\theta JA}$	833	°C/W
Junction and Storage Temperature Range	T_J, T_{stg}	-55 to +150	°C

1. Device mounted on FR4 glass epoxy printed circuit board using the minimum recommended footprint.

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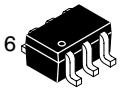
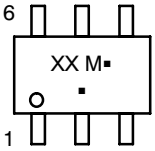
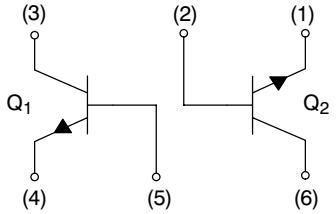
MARKING DIAGRAM



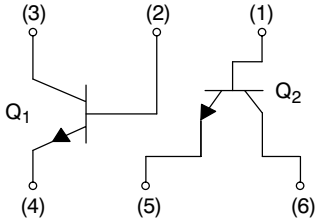
SOT-363/SC-88/ SC70-6 CASE 419B



XX = MA for MBT3904DW1T1
MJ for MBT3904DW2T1
M = Date Code
▪ = Pb-Free Package
(Note: Microdot may be in either location)



MBT3904DW1T1 STYLE 1



MBT3904DW2T1 STYLE 27

ORDERING INFORMATION

Device	Package	Shipping†
MBT3904DW1T1	SOT-363	3000 Units/Reel
MBT3904DW1T1G	SOT-363 (Pb-Free)	3000 Units/Reel
MBT3904DW2T1	SOT-363	3000 Units/Reel
MBT3904DW2T1G	SOT-363 (Pb-Free)	3000 Units/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.

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted)

Characteristic	Symbol	Min	Max	Unit
OFF CHARACTERISTICS				
Collector-Emitter Breakdown Voltage (Note 2) (I_C = 1.0 mAdc, I_B = 0)	$V_{(BR)CEO}$	40	-	Vdc
Collector-Base Breakdown Voltage (I_C = 10 μAdc, I_E = 0)	$V_{(BR)CBO}$	60	-	Vdc
Emitter-Base Breakdown Voltage (I_E = 10 μAdc, I_C = 0)	$V_{(BR)EBO}$	6.0	-	Vdc
Base Cutoff Current (V_{CE} = 30 Vdc, V_{EB} = 3.0 Vdc)	I_{BL}	-	50	nAdc
Collector Cutoff Current (V_{CE} = 30 Vdc, V_{EB} = 3.0 Vdc)	I_{CEX}	-	50	nAdc
ON CHARACTERISTICS (Note 2)				
DC Current Gain (I_C = 0.1 mAdc, V_{CE} = 1.0 Vdc) (I_C = 1.0 mAdc, V_{CE} = 1.0 Vdc) (I_C = 10 mAdc, V_{CE} = 1.0 Vdc) (I_C = 50 mAdc, V_{CE} = 1.0 Vdc) (I_C = 100 mAdc, V_{CE} = 1.0 Vdc)	h_{FE}	 40 70 100 60 30	 - - 300 - -	-
Collector-Emitter Saturation Voltage (I_C = 10 mAdc, I_B = 1.0 mAdc) (I_C = 50 mAdc, I_B = 5.0 mAdc)	$V_{CE(sat)}$	 - -	 0.2 0.3	Vdc
Base-Emitter Saturation Voltage (I_C = 10 mAdc, I_B = 1.0 mAdc) (I_C = 50 mAdc, I_B = 5.0 mAdc)	$V_{BE(sat)}$	 0.65 -	 0.85 0.95	Vdc
SMALL-SIGNAL CHARACTERISTICS				
Current-Gain - Bandwidth Product (I_C = 10 mAdc, V_{CE} = 20 Vdc, f = 100 MHz)	f_T	300	-	MHz
Output Capacitance (V_{CB} = 5.0 Vdc, I_E = 0, f = 1.0 MHz)	C_{obo}	-	4.0	pF
Input Capacitance (V_{EB} = 0.5 Vdc, I_C = 0, f = 1.0 MHz)	C_{ibo}	-	8.0	pF
Input Impedance (V_{CE} = 10 Vdc, I_C = 1.0 mAdc, f = 1.0 kHz)	h_{ie}	 1.0 2.0	 10 12	k Ω
Voltage Feedback Ratio (V_{CE} = 10 Vdc, I_C = 1.0 mAdc, f = 1.0 kHz)	h_{re}	 0.5 0.1	 8.0 10	X 10^{-4}
Small-Signal Current Gain (V_{CE} = 10 Vdc, I_C = 1.0 mAdc, f = 1.0 kHz)	h_{fe}	 100 100	 400 400	-
Output Admittance (V_{CE} = 10 Vdc, I_C = 1.0 mAdc, f = 1.0 kHz)	h_{oe}	 1.0 3.0	 40 60	μmhos
Noise Figure (V_{CE} = 5.0 Vdc, I_C = 100 μAdc, R_S = 1.0 k Ω, f = 1.0 kHz)	NF	 - -	 5.0 4.0	dB

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

SWITCHING CHARACTERISTICS

Characteristic		Symbol	Min	Max	Unit
Delay Time	(V_{CC} = 3.0 Vdc, V_{BE} = -0.5 Vdc)	t_d	-	35	ns
Rise Time	(I_C = 10 mAdc, I_{B1} = 1.0 mAdc)	t_r	-	35	
Storage Time	(V_{CC} = 3.0 Vdc, I_C = 10 mAdc)	t_s	-	200	ns
Fall Time	(I_{B1} = I_{B2} = 1.0 mAdc)	t_f	-	50	

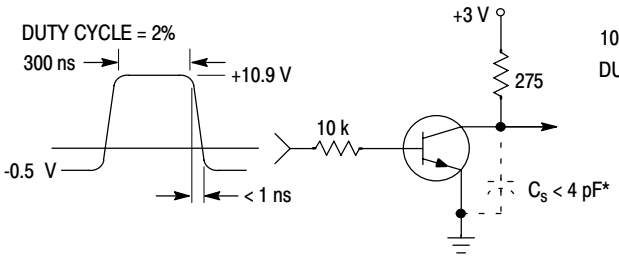


Figure 1. Delay and Rise Time Equivalent Test Circuit

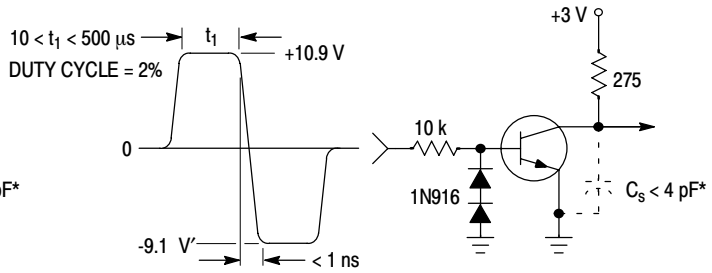


Figure 2. Storage and Fall Time Equivalent Test Circuit

* Total shunt capacitance of test jig and connectors

TYPICAL TRANSIENT CHARACTERISTICS

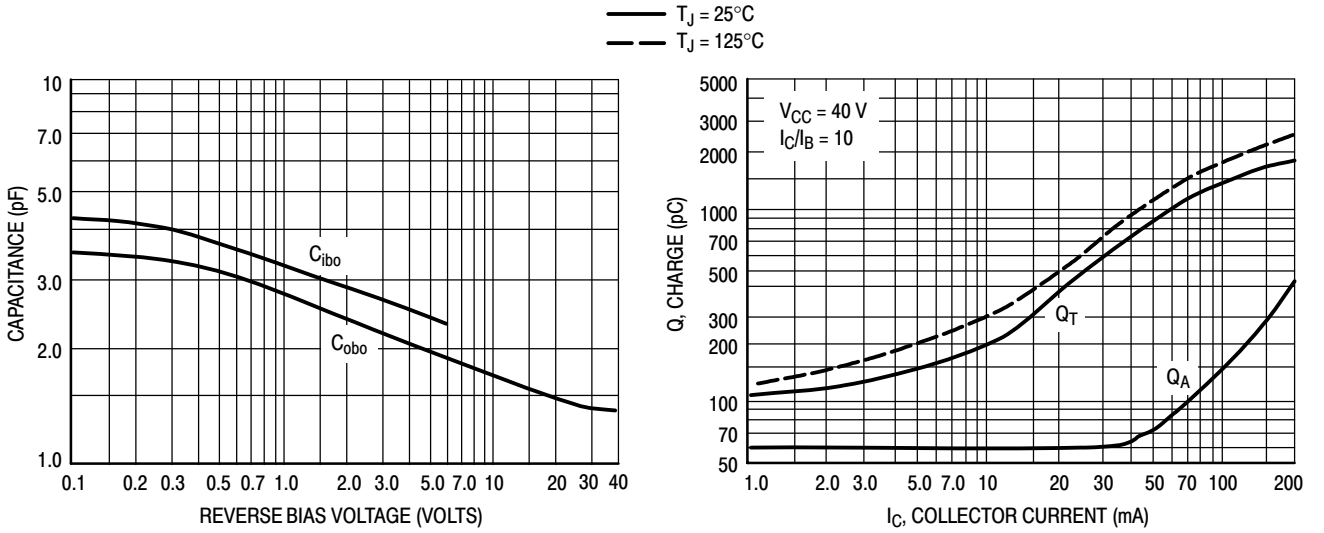


Figure 3. Capacitance

Figure 4. Charge Data

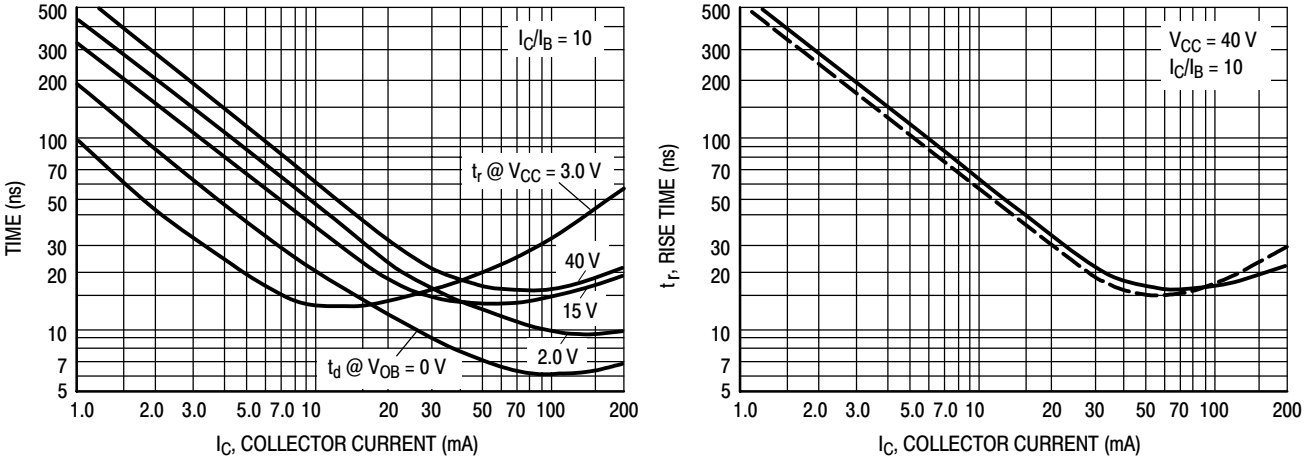


Figure 5. Turn-On Time

Figure 6. Rise Time

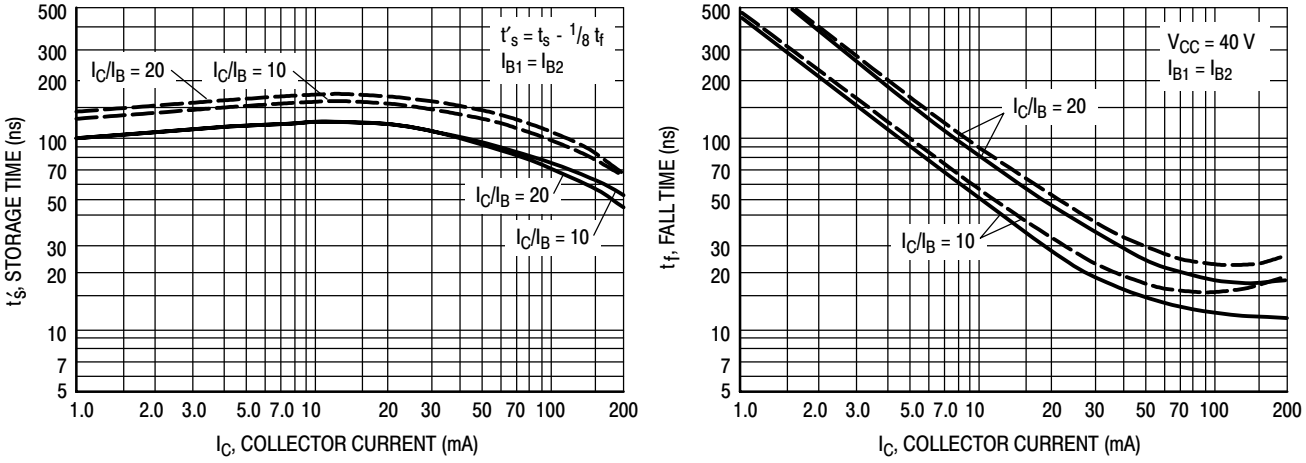


Figure 7. Storage Time

Figure 8. Fall Time

TYPICAL AUDIO SMALL-SIGNAL CHARACTERISTICS
NOISE FIGURE VARIATIONS

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

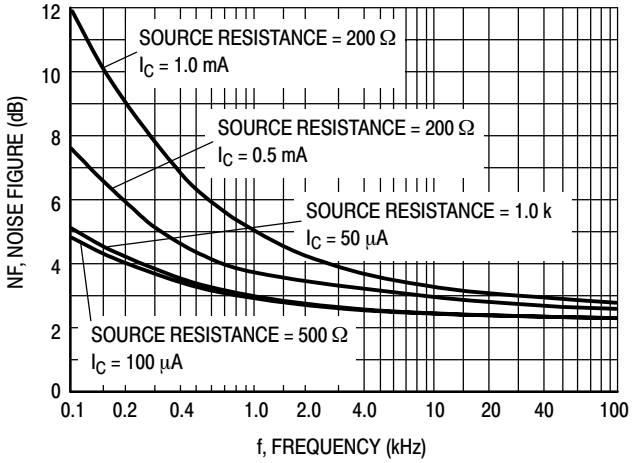


Figure 9. Noise Figure

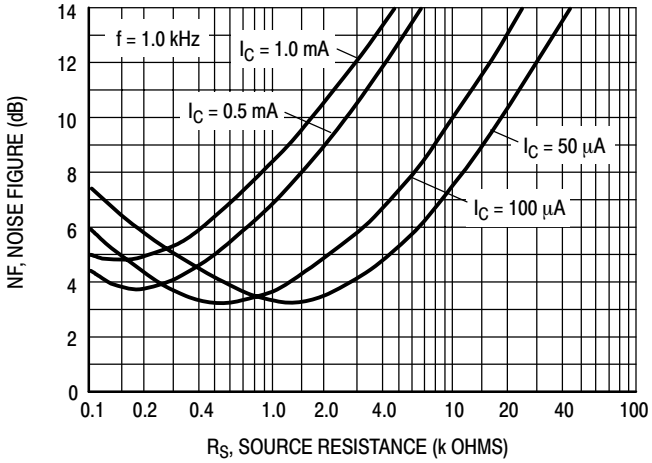


Figure 10. Noise Figure

h PARAMETERS

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

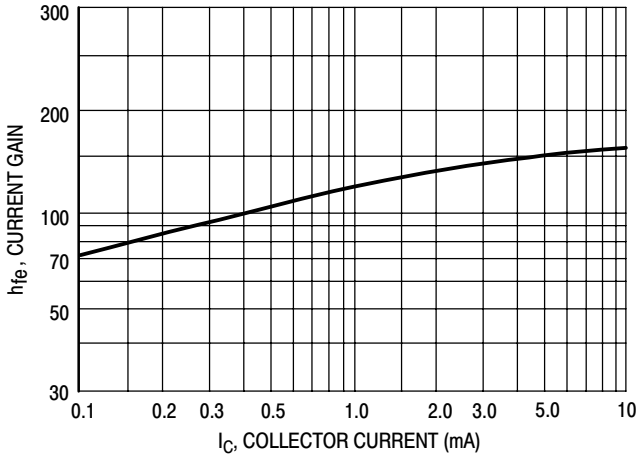


Figure 11. Current Gain

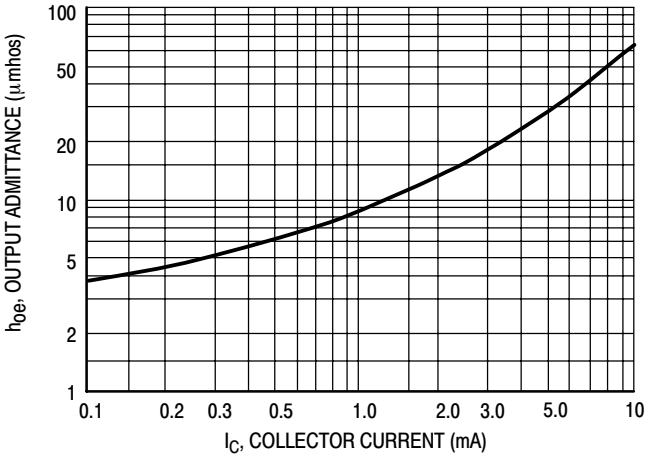


Figure 12. Output Admittance

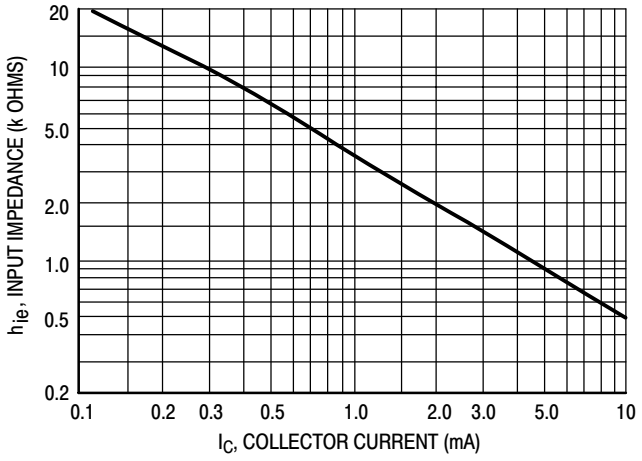


Figure 13. Input Impedance

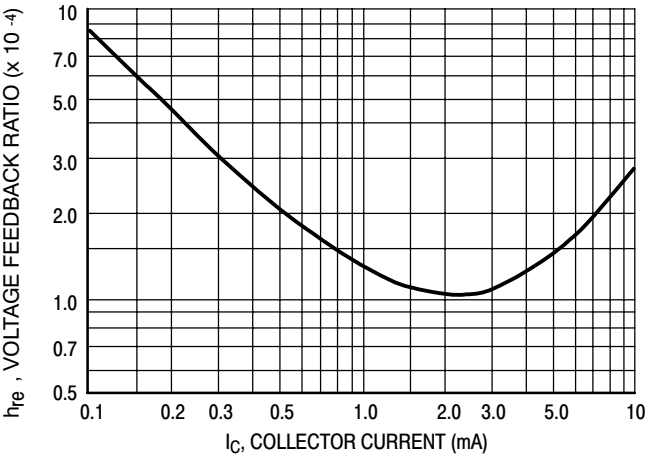


Figure 14. Voltage Feedback Ratio

TYPICAL STATIC CHARACTERISTICS

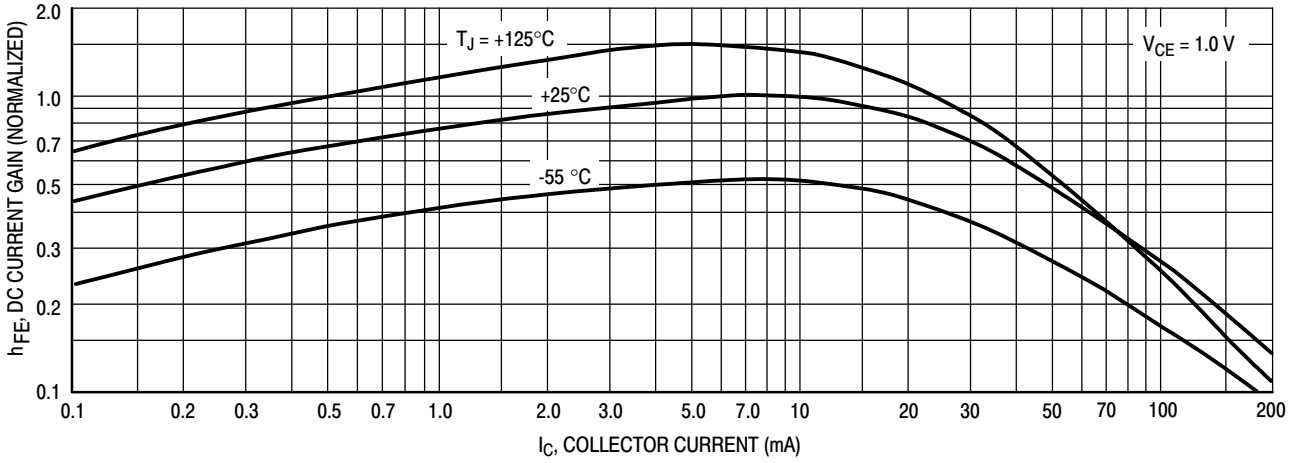


Figure 15. DC Current Gain

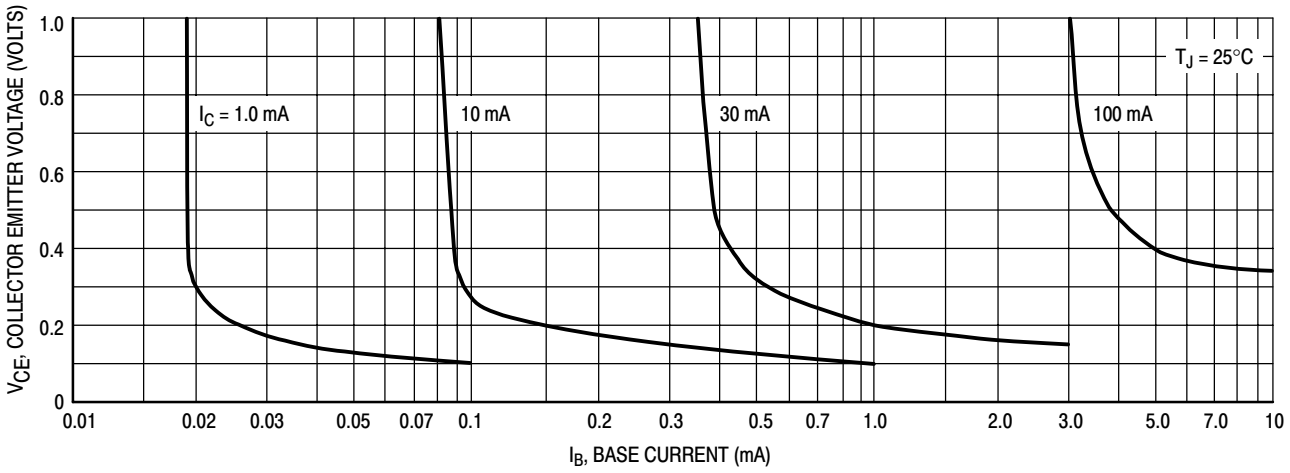


Figure 16. Collector Saturation Region

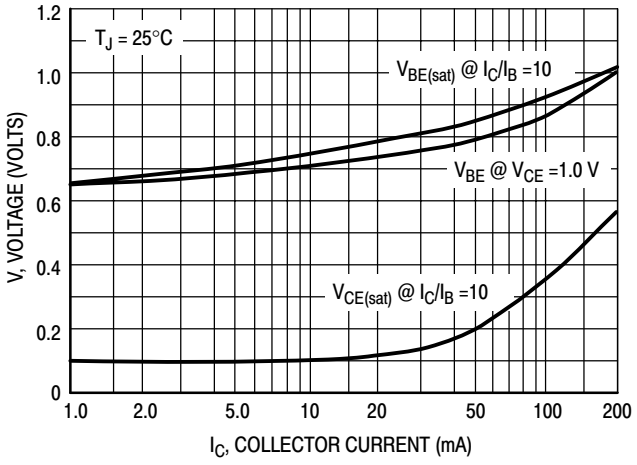


Figure 17. "ON" Voltages

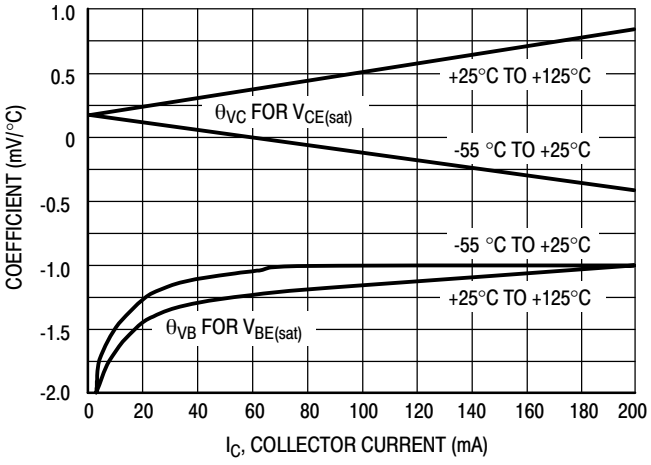
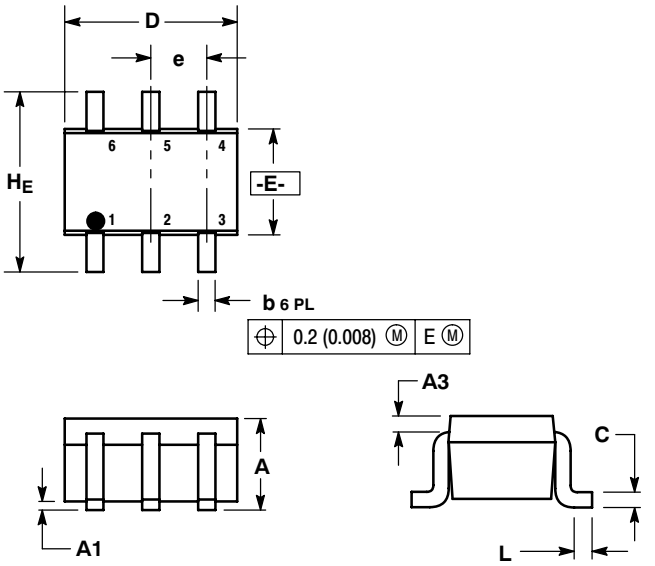


Figure 18. Temperature Coefficients

PACKAGE DIMENSIONS

SOT-363/SC-88/SC70-6
CASE 419B-02
ISSUE W



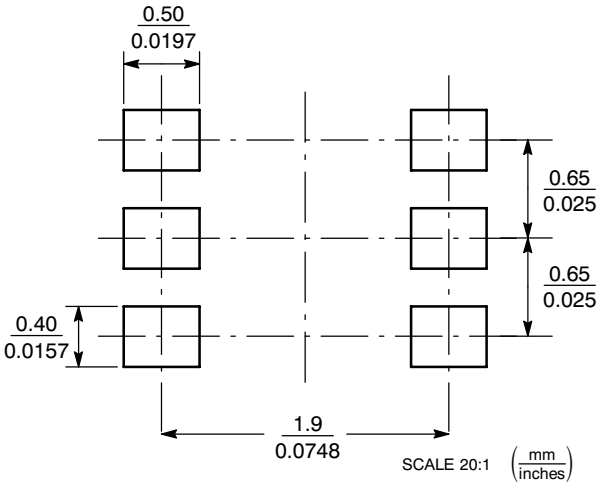
NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. 419B-01 OBSOLETE, NEW STANDARD 419B-02.

	MILLIMETERS			INCHES		
DIM	MIN	NOM	MAX	MIN	NOM	MAX
A	0.80	0.95	1.10	0.031	0.037	0.043
A1	0.00	0.05	0.10	0.000	0.002	0.004
A3		0.20 REF			0.008 REF	
b	0.10	0.21	0.30	0.004	0.008	0.012
C	0.10	0.14	0.25	0.004	0.005	0.010
D	1.80	2.00	2.20	0.070	0.078	0.086
E	1.15	1.25	1.35	0.045	0.049	0.053
e		0.65 BSC			0.026 BSC	
L	0.10	0.20	0.30	0.004	0.008	0.012
H_E	2.00	2.10	2.20	0.078	0.082	0.086

STYLE 1:
PIN 1. EMITTER 2
2. BASE 2
3. COLLECTOR 1
4. EMITTER 1
5. BASE 1
6. COLLECTOR 2

STYLE 27:
PIN 1. BASE 2
2. BASE 1
3. COLLECTOR 1
4. EMITTER 1
5. EMITTER 2
6. COLLECTOR 2

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.

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:
Literature Distribution Center for ON Semiconductor
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