WILLAS

RoHS COMPLIANT

General Purpose Transistors

MMBT3904TT1

NPN Silicon

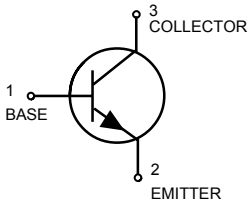
FEATURE

- Simplifies Circuit Design.
- RoHS product for packing code suffix "G"
  Halogen free product for packing code suffix "H"

ORDERING INFORMATION

Device	Marking	Shipping
MMBT3904TT1	MA	3000/Tape&Reel

SOT-523



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

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Total Device Dissipation FR– 4 Board, (1) T_A = 25°C	P_D	200	mW
Derate above 25°C		1.6	mW/°C
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	600	°C/W
Total Device Dissipation FR-4 Board(2), T_A = 25°C	P_D	300	mW
Derate above 25°C		2.4	mW/°C
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	400	°C/W
Junction and Storage Temperature	T_J , T_{stg}	–55 to +150	°C

DEVICE MARKING

MMBT3904TT1 = MA

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

Characteristic	Symbol	Min	Max	Unit
OFF CHARACTERISTICS				
Collector–Emitter Breakdown Voltage(3) (I_C = 1.0 mAdc)	$V_{(BR)CEO}$	40	—	Vdc
Collector–Base Breakdown Voltage (I_C = 10 µAdc)	$V_{(BR)CBO}$	60	—	Vdc
Emitter–Base Breakdown Voltage (I_E = 10 µAdc)	$V_{(BR)EBO}$	6.0	—	Vdc
Base Cutoff Current (V_{CE}= 30 Vdc, V_{EB} = 3.0 Vdc,)	I_{BL}	—	50	nAdc
Collector Cutoff Current (V_{CE} = 30Vdc, V_{BE} = 3.0Vdc)	I_{CEX}	—	50	nAdc

1. FR-4 Minimum Pad.
2. FR-4 1.0 x 1.0 Inch Pad.
3. Pulse Test: Pulse Width ≤300 µs, Duty Cycle ≤2.0%.

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

Characteristic	Symbol	Min	Max	Unit
ON CHARACTERISTICS (3)				
DC Current Gain(1)	h_{FE}			—
(I_C =0.1 mAdc, V_{CE} =1.0 Vdc)		40	—	
(I_C = 1.0 mAdc, V_{CE} = 1.0 Vdc)		70	—	
(I_C = 10 mAdc, V_{CE} = 1.0 Vdc)		100	300	
(I_C = 50mAdc, V_{CE} = 1.0Vdc)		60	—	
(I_C = 100mAdc, V_{CE} =1.0 Vdc)		30	—	
Collector–Emitter Saturation Voltage	$V_{CE(sat)}$			Vdc
(I_C = 10 mAdc, I_B = 1.0 mAdc)(3)		—	0.2	
(I_C = 50 mAdc, I_B = 5.0mAdc)		—	0.3	
Base–Emitter Saturation Voltage(3)	$V_{BE(sat)}$			Vdc
(I_C = 10 mAdc, I_B = 1.0mAdc)		0.65	0.85	
(I_C = 50mAdc, I_B = 5.0mAdc)		—	0.95	
SMALL–SIGNAL CHARACTERISTICS				
Current–Gain — Bandwidth Product (I_C = 10mAdc, V_{CE}= 20Vdc, f = 100MHz)	f_T	200	—	MHz
Output Capacitance (V_{CB} = 5.0Vdc, I_E = 0, f = 1.0 MHz)	C_{obo}	—	4.0	pF
Input Capacitance (V_{BE} = 0.5Vdc, I_C = 0, f = 1.0 MHz)	C_{ibo}	—	8.0	pF
Input Impedancen (V_{CE} = 10Vdc, I_C = 1.0mAdc, f = 1.0 kHz)	h_{ie}	1.0	10	pF
Voltage Feedback Ratio (V_{CE} = 10 Vdc, I_C = 1.0 mAdc, f = 1.0 kHz)	h_{re}	0.5	8.0	X10 $^{-4}$
Small–Signal Current Gain (V_{CE} = 10 Vdc, I_C = 1.0 mAdc, f = 1.0 kHz)	h_{fe}	100	400	—
Output Admittance (V_{CE} = 10 Vdc, I_C = 1.0 mAdc, f = 1.0 kHz)	h_{oe}	1.0	40	θmhos
Noise Figure (V_{CE} = 5.0 Vdc, I_C = 100μAdc, R_S = 1.0 k Ω, f = 1.0 kHz)	NF	—	5.0	dB
SWITCHING CHARACTERISTICS				
Delay Time (V_{CC} = 3.0 Vdc,V_{BE} = 0.5Vdc	t_d	—	35	ns
Rise Time I_C = 10 mAdc, I_{B1} = 1.0mAdc)	t_r	—	35	
Storage Time (V_{CC} = 3.0Vdc,	t_s	—	200	ns
Fall Time I_C = 10 mAdc,I_{B1} = I_{B2} = 1.0mAdc)	t_f	—	50	

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

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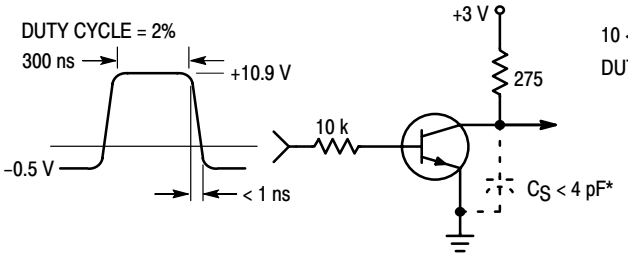

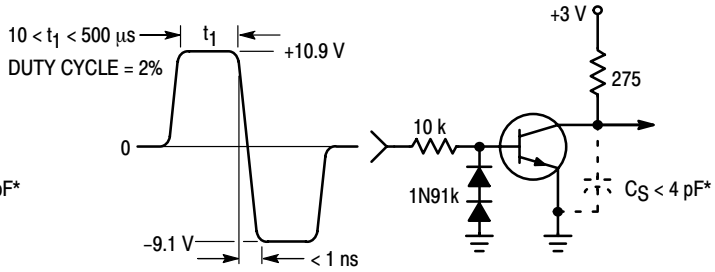

* Total shunt capacitance of test jig and connectors

Figure 1. Delay and Rise Time Equivalent Test Circuit

Figure 2. Storage and Fall Time Equivalent Test Circuit

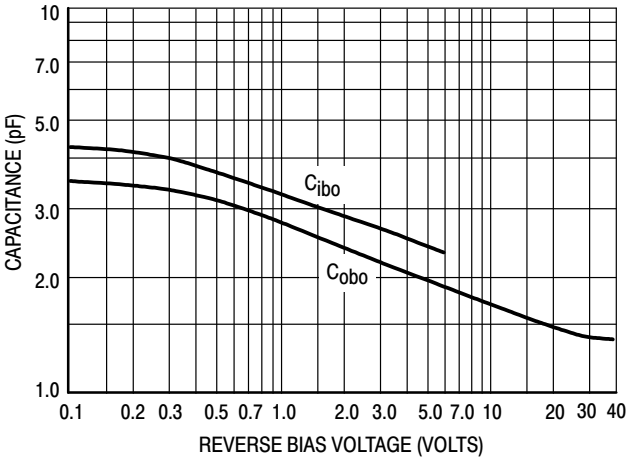

Figure 3. Capacitance

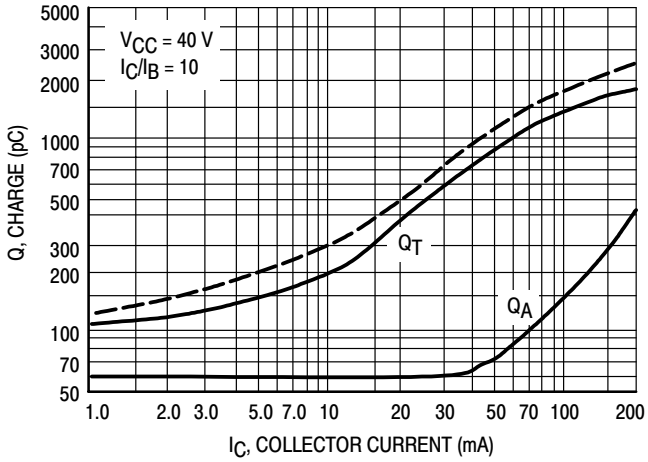

Figure 4. Charge Data

General Purpose Transistors

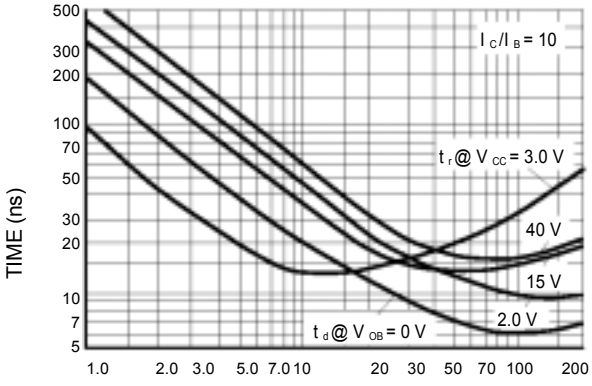

Figure 5. Turn–On Time

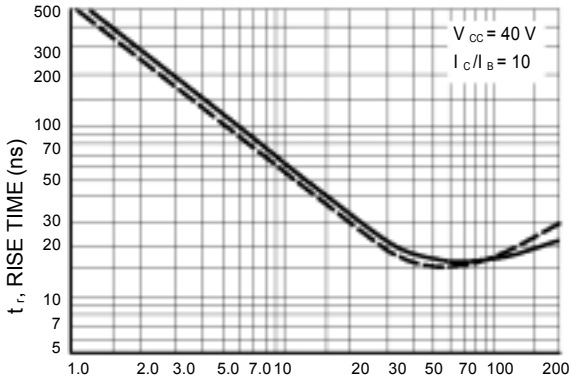

Figure 6. Rise Time

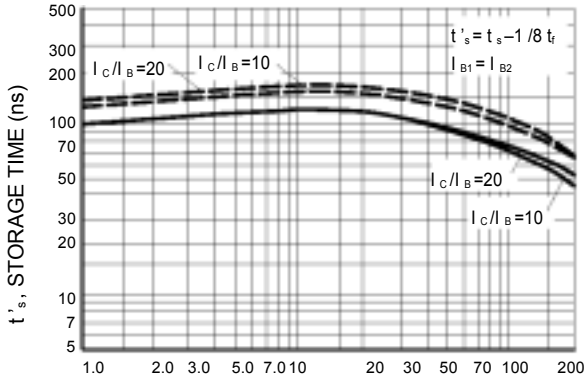

Figure 7. Storage Time

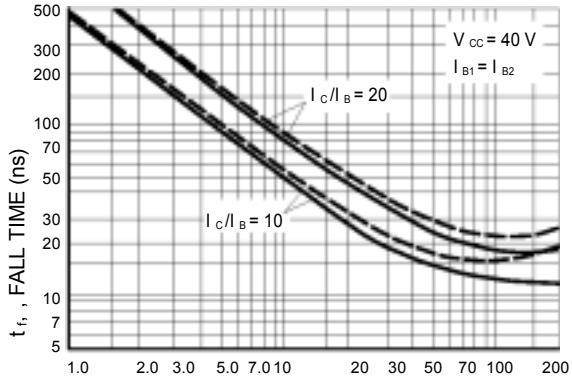

Figure 8. Fall Time

TYPICAL AUDIO SMALL–SIGNAL CHARACTERISTICS

NOISE FIGURE VARIATIONS

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

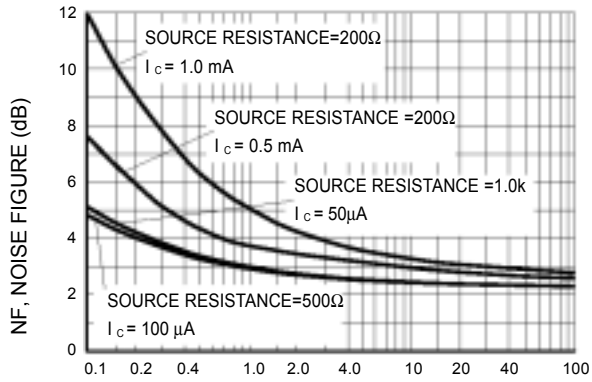

Figure 9.

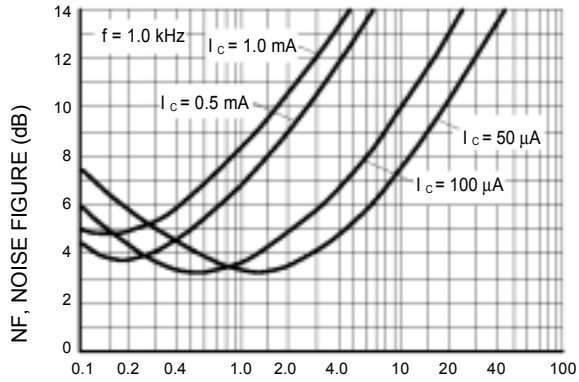

Figure 10.

h PARAMETERS

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

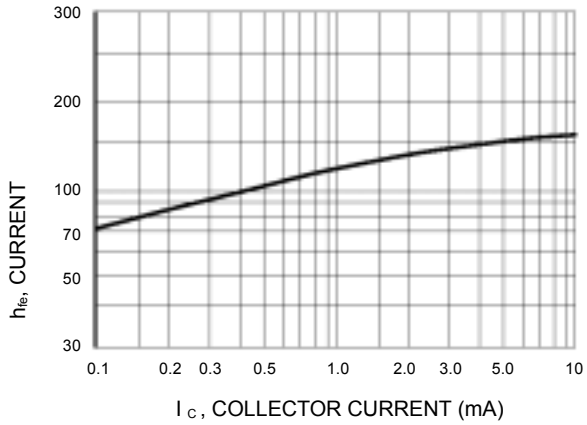

Figure 11. Current Gain

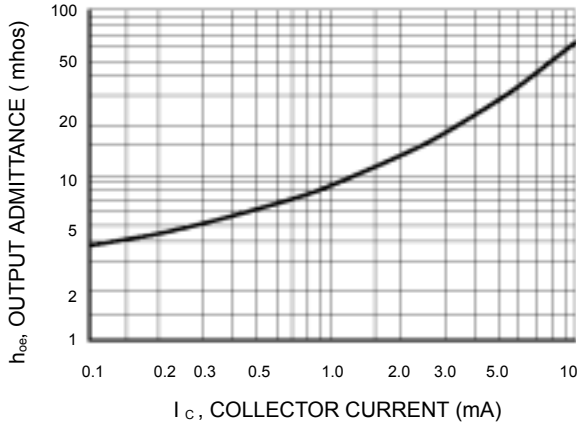

Figure 12. Output Admittance

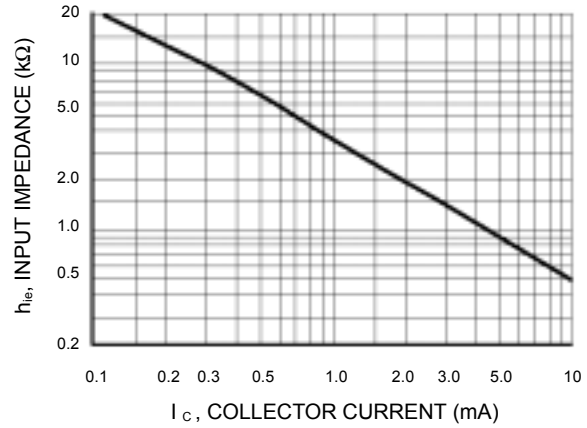

Figure 13. Input Impedance

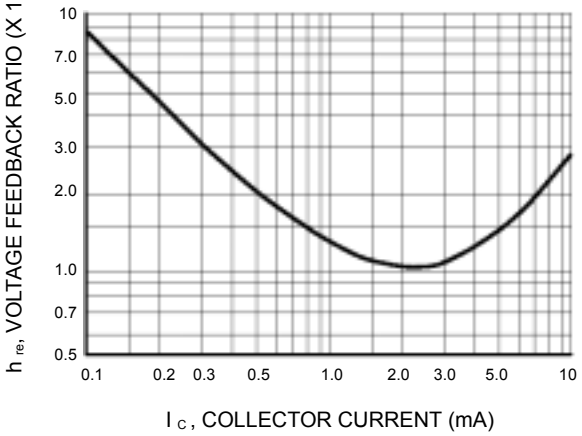

Figure 14. Voltage Feedback Ratio

TYPICAL STATIC CHARACTERISTICS

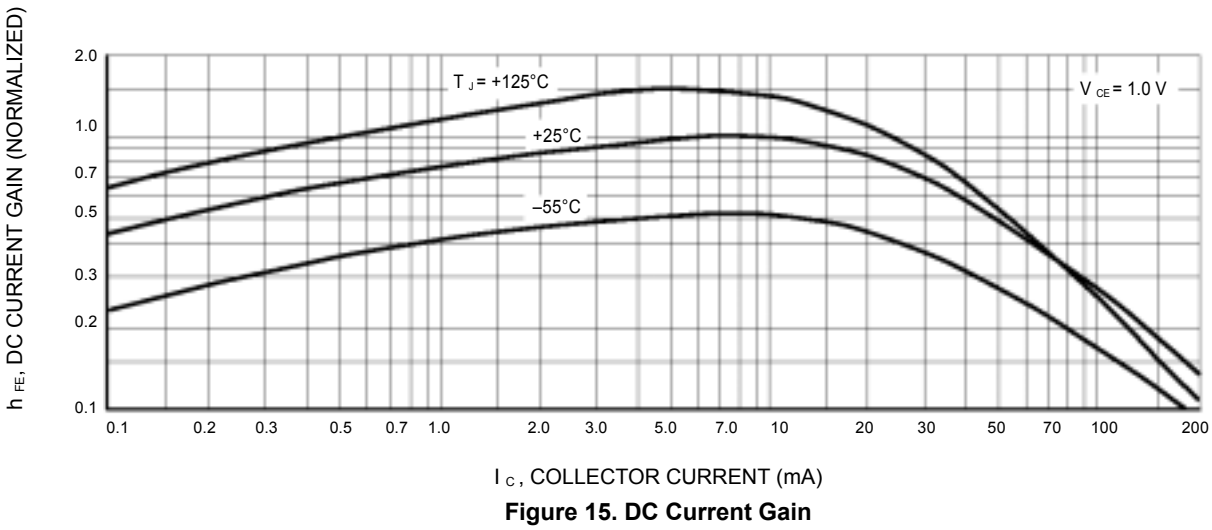

Figure 15. DC Current Gain

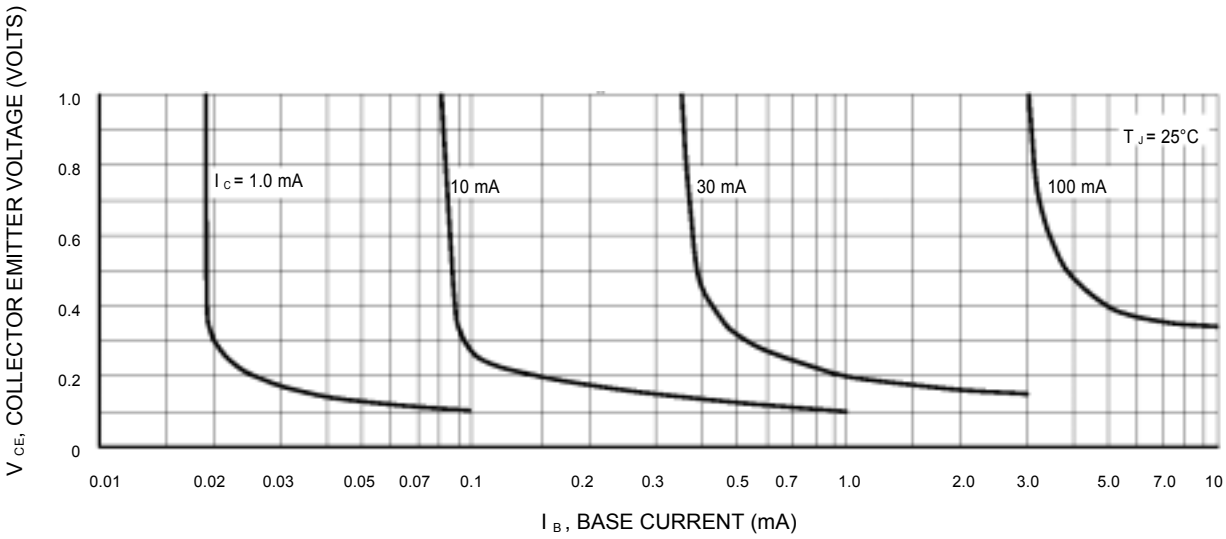

Figure 16. Collector Saturation Region

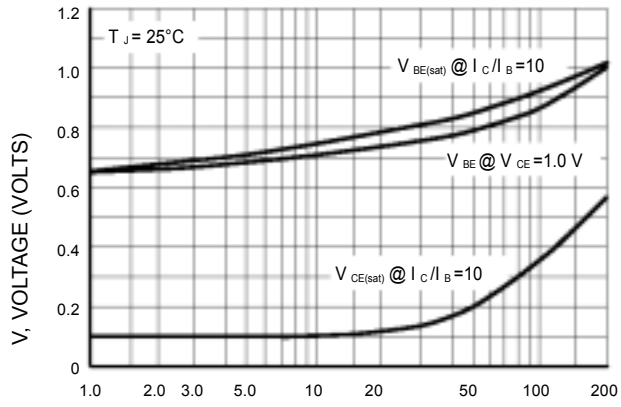

Figure 17. "ON" Voltages

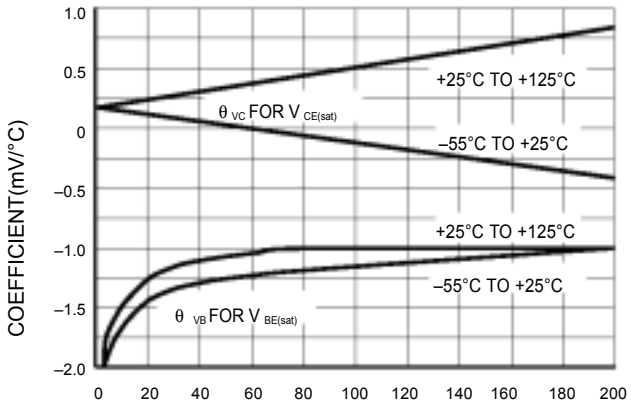

Figure 18. Temperature Coefficients

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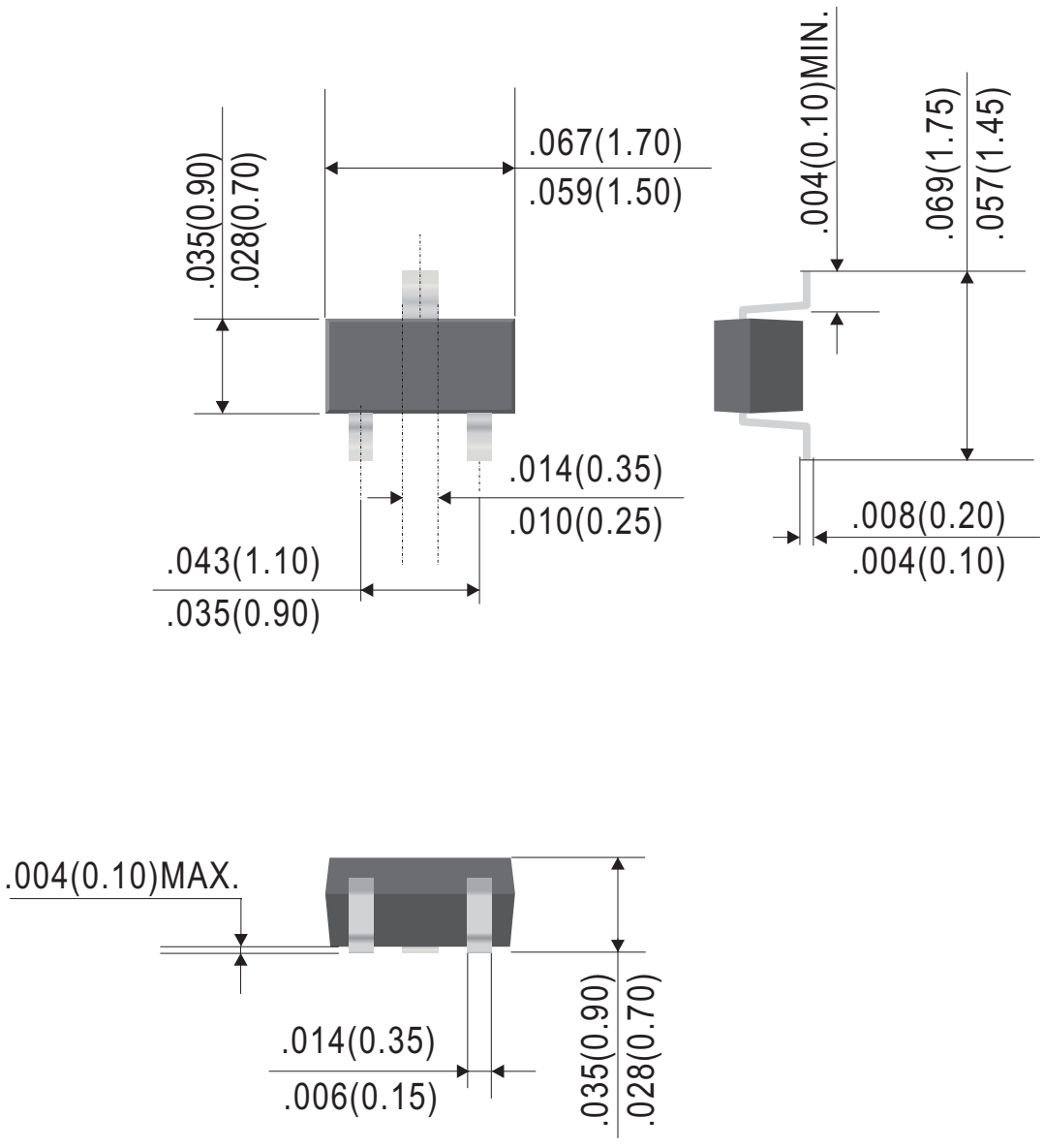

Dimensions in inches and (millimeters)