MMBT3904

Small Signal Transistors (NPN)

SOT-23

Top View

.122 (3.1)
.118 (3.0)

.016 (0.4)

3

.056 (1.43)
.052 (1.33)

1   2

.037(0.95) .037(0.95)

max. .004 (0.1)

.007 (0.175)
.005 (0.125)

.045 (1.15)
.037 (0.95)

.016 (0.4)   .016 (0.4)

.102 (2.6)
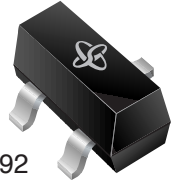.094 (2.4)

Dimensions in inches and (millimeters)
Pin configuration
1 = Base, 2 = Emitter, 3 = Collector.

FEATURES

♦ NPN Silicon Epitaxial Planar Transistor for switching and amplifier applications.

♦ As complementary type, the PNP transistor MMBT3906 is recommended.

♦ This transistor is also available in the TO-92 case with the type designation 2N3904.

MECHANICAL DATA

Case: SOT-23 Plastic Package
Weight: approx. 0.008g
Marking code: 1AM

MAXIMUM RATINGS AND ELECTRICAL CHARACTERISTICS

Ratings at 25°C ambient temperature unless otherwise specified

	SYMBOL	VALUE	UNIT
Collector-Base Voltage	V_{CBO}	60	V
Collector-Emitter Voltage	V_{CEO}	40	V
Emitter-Base Voltage	V_{EBO}	6.0	V
Collector Current	I_C	200	mA
Power Dissipation at T_A = 25 °C	P_{tot}	225[1] 300[2]	mW
Thermal Resistance Junction to Substrate Backside	$R_{\theta SB}$	320[1]	°C/W
Thermal Resistance Junction to Ambient Air	$R_{\theta JA}$	450[1]	°C/W
Junction Temperature	T_j	150	°C
Storage Temperature Range	T_S	−65 to +150	°C

NOTES:
(1) Device on fiberglass substrate, see layout.
(2) Device on alumina substrate.

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ELECTRICAL CHARACTERISTICS

Ratings at 25°C ambient temperature unless otherwise specified

	SYMBOL	MIN.	MAX.	UNIT
Collector-Base Breakdown Voltage at I_C = 10 μA, I_E = 0	$V_{(BR)CBO}$	60	–	V
Collector-Emitter Breakdown Voltage at I_C = 1 mA, I_B = 0	$V_{(BR)CEO}$	40	–	V
Emitter-Base Breakdown Voltage at I_E = 10 μA, I_C = 0	$V_{(BR)EBO}$	6.0	–	V
Collector Saturation Voltage at I_C = 10 mA, I_B = 1 mA at I_C = 50 mA, I_B = 5 mA	V_{CEsat} V_{CEsat}	– –	0.2 0.3	V V
Base Saturation Voltage at I_C = 10 mA, I_B = 1 mA at I_C = 50 mA, I_B = 5 mA	V_{BEsat} V_{BEsat}	– –	0.85 0.95	V V
Collector-Emitter Cutoff Current V_{EB} = 3 V, V_{CE} = 30 V	I_{CEV}	–	50	nA
Emitter-Base Cutoff Current V_{EB} = 3 V, V_{CE} = 30 V	I_{EBV}	–	50	nA
DC Current Gain at V_{CE} = 1 V, I_C = 0.1 mA at V_{CE} = 1 V, I_C = 1 mA at V_{CE} = 1 V, I_C = 10 mA at V_{CE} = 1 V, I_C = 50 mA at V_{CE} = 1 V, I_C = 100 mA	h_{FE} h_{FE} h_{FE} h_{FE} h_{FE}	40 70 100 60 30	– – 300 – –	– – – – –
Input Impedance at V_{CE} = 10 V, I_C = 1 mA, f = 1 kHz	h_{ie}	1	10	kΩ
Gain-Bandwidth Product at V_{CE} = 20 V, I_C = 10 mA, f = 100 MHz	f_T	300	–	MHz
Collector-Base Capacitance at V_{CB} = 5 V, f = 100 kHz	C_{CBO}	–	4	pF
Emitter-Base Capacitance at V_{EB} = 0.5 V, f = 100 kHz	C_{EBO}	–	8	pF

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ELECTRICAL CHARACTERISTICS

Ratings at 25°C ambient temperature unless otherwise specified

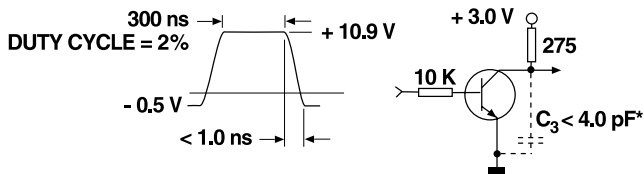|	SYMBOL	MIN.	MAX.	UNIT
Voltage Feedback Ratio V_{CE} = 10 V, I_C = 1 mA, f = 1 kHz	h_{re}	$0.5 \cdot 10^{-4}$	$8 \cdot 10^{-4}$	–
Small Signal Current Gain at V_{CE} = 10 V, I_C = 1 mA, f = 1 kHz	h_{fe}	100	400	–
Output Admittance at V_{CE} = 1 V, I_C = 1 mA, f = 1 kHz	h_{oe}	1	40	μS
Noise Figure at V_{CE} = 5 V, I_C = 100 μA, R_G = 1 kΩ, f = 10 … 15000 Hz	NF	–	5	dB
Delay Time (see Fig. 1) at I_{B1} = 1 mA, I_C = 10 mA	t_d	–	35	ns
Rise Time (see Fig. 1) at I_{B1} = 1 mA, I_C = 10 mA	t_r	–	35	ns
Storage Time (see Fig. 2) at $-I_{B1}$ = I_{B2} = 1 mA, I_C = 10 mA	t_s	–	200	ns
Fall Time (see Fig. 2) at $-I_{B1}$ = I_{B2} = 1 mA, I_C = 10 mA	t_f	–	50	ns

Fig. 1: Test circuit for delay and rise time
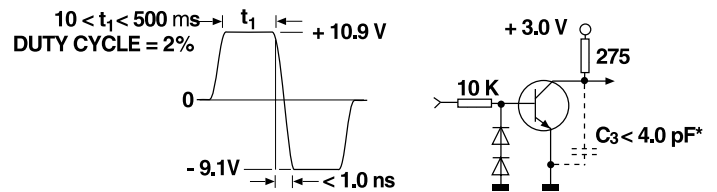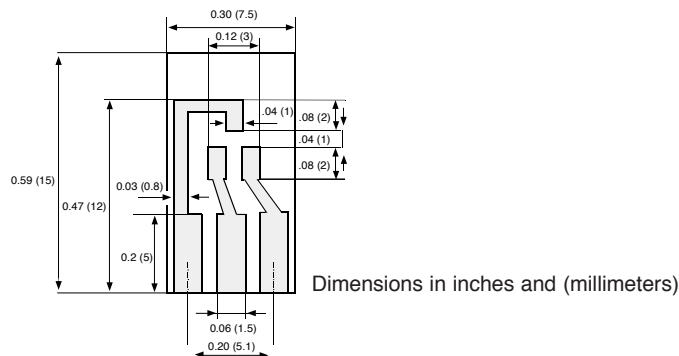* total shunt capacitance of test jig and connectors

Fig. 2: Test circuit for storage and fall time
* total shunt capacitance of test jig and connectors

Dimensions in inches and (millimeters)

Layout for R_{thJA} test
Thickness: Fiberglass 0.059 in (1.5 mm)
Copper leads 0.012 in (0.3 mm)

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