T·29-/5

MMBT2907
MMBT2907A

CASE 318-02/03, STYLE 6
SOT-23 (TO-236AA/AB)

GENERAL PURPOSE TRANSISTOR

PNP SILICON

Refer to MPS2907 for graphs.

MAXIMUM RATINGS

Rating	Symbol	MPS2907	MPS2907A	Unit
Collector-Emitter Voltage	V_{CEO}	40	60	Vdc
Collector-Base Voltage	V_{CBO}	60		Vdc
Emitter-Base Voltage	V_{EBO}	5.0		Vdc
Collector Current — Continuous	I_C	600		mAdc

THERMAL CHARACTERISTICS
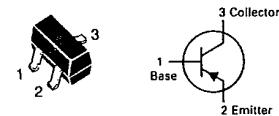
Characteristic	Symbol	Max	Unit
Total Device Dissipation FR-5 Board,* $T_A = 25°C$	P_D	225	mW
Derate above 25°C		1.8	mW/°C
Thermal Resistance Junction to Ambient	$R_{\theta JA}$	556	°C/mW
Total Device Dissipation Alumina Substrate,** $T_A = 25°C$	P_D	300	mW
Derate above 25°C		2.4	mW/°C
Thermal Resistance Junction to Ambient	$R_{\theta JA}$	417	°C/mW
Junction and Storage Temperature	T_J, T_{stg}	150	°C

*FR-5 = 1.0 x 0.75 x 0.62 in.
**Alumina = 0.4 x 0.3 x 0.024 in. 99.5% alumina.

DEVICE MARKING

MMBT2907 = 2B; MMBT2907A = 2F

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

Characteristic		Symbol	Min	Max	Unit
OFF CHARACTERISTICS					
Collector-Emitter Breakdown Voltage(1) (I_C = 10 mAdc, I_B = 0) MMBT2907 MMBT2907A		$V_{(BR)CEO}$	40 60	— —	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)		$V_{(BR)EBO}$	5.0	—	Vdc
Collector Cutoff Current (V_{CE} = 30 Vdc, $V_{BE(off)}$ = 0.5 Vdc)		I_{CEX}	—	50	nAdc
Collector Cutoff Current (V_{CB} = 50 Vdc, I_E = 0) MMBT2907 MMBT2907A		I_{CBO}	— —	0.020 0.010	μAdc
(V_{CB} = 50 Vdc, I_E = 0, T_A = 125°C) MMBT2907 MMBT2907A			— —	20 10	
Base Current (V_{CE} = 30 Vdc, $V_{BE(off)}$ = 0.5 Vdc)		I_B	—	50	nAdc
ON CHARACTERISTICS					
DC Current Gain (I_C = 0.1 mAdc, V_{CE} = 10 Vdc) MMBT2907 MMBT2907A		h_{FE}	35 75	— —	—
(I_C = 1.0 mAdc, V_{CE} = 10 Vdc) MMBT2907 MMBT2907A			50 100	— —	
(I_C = 10 mAdc, V_{CE} = 10 Vdc) MMBT2907 MMBT2907A			75 100	— —	
(I_C = 150 mAdc, V_{CE} = 10 Vdc)(1) MMBT2907, MMBT2907A			100	300	
(I_C = 500 mAdc, V_{CE} = 10 Vdc)(1) MMBT2907 MMBT2907A			30 50	— —	
Collector-Emitter Saturation Voltage(1) (I_C = 150 mAdc, I_B = 15 mAdc) (I_C = 500 mAdc, I_B = 50 mAdc)		$V_{CE(sat)}$	— —	0.4 1.6	Vdc
Base-Emitter Saturation Voltage(1) (I_C = 150 mAdc, I_B = 15 mAdc) (I_C = 500 mAdc, I_B = 50 mAdc)		$V_{BE(sat)}$	— —	1.3 2.6	Vdc

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MMBT2907,A

T·29-15

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

Characteristic	Symbol	Min	Max	Unit
SMALL-SIGNAL CHARACTERISTICS				
Current-Gain — Bandwidth Product(1),(2) (I_C = 50 mAdc, V_{CE} = 20 Vdc, f = 100 MHz)	f_T	200	—	MHz
Output Capacitance (V_{CB} = 10 Vdc, I_E = 0, f = 1.0 MHz)	C_{obo}	—	8.0	pF
Input Capacitance (V_{BE} = 2.0 Vdc, I_C = 0, f = 1.0 MHz)	C_{ibo}	—	30	pF
SWITCHING CHARACTERISTICS				
Turn-On Time	t_{on}	—	45	ns
Delay Time	t_d	—	10	ns
Rise Time	t_r	—	40	ns
Turn-Off Time	t_{off}	—	100	ns
Storage Time	t_s	—	80	ns
Fall Time	t_f	—	30	ns

Turn-On Time / Delay Time / Rise Time: (V_{CC} = 30 Vdc, I_C = 150 mAdc, I_{B1} = 15 mAdc)

Turn-Off Time / Storage Time / Fall Time: (V_{CC} = 6.0 Vdc, I_C = 150 mAdc, I_{B1} = I_{B2} = 15 mAdc)

(1) Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2.0%.
(2) f_T is defined as the frequency at which $|h_{fe}|$ extrapolates to unity.

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6367254 MOTOROLA SC (XSTRS/R F)   96D 82038   D

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CEO}	12	Vdc
Collector-Base Voltage	V_{CBO}	12	Vdc
Emitter-Base Voltage	V_{EBO}	4.0	Vdc
Collector Current — Continuous	I_C	80	mAdc

THERMAL CHARACTERISTICS
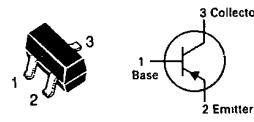
Characteristic	Symbol	Max	Unit
Total Device Dissipation FR-5 Board,* $T_A = 25°C$	P_D	225	mW
Derate above 25°C		1.8	mW/°C
Thermal Resistance Junction to Ambient	$R_{\theta JA}$	556	°C/mW
Total Device Dissipation Alumina Substrate,** $T_A = 25°C$	P_D	300	mW
Derate above 25°C		2.4	mW/°C
Thermal Resistance Junction to Ambient	$R_{\theta JA}$	417	°C/mW
Junction and Storage Temperature	T_J, T_{stg}	150	°C

*FR-5 = 1.0 x 0.75 x 0.62 in.
**Alumina = 0.4 x 0.3 x 0.024 in. 99.5% alumina.

DEVICE MARKING

MMBT3640 = 2J

MMBT3640

CASE 318-02/03, STYLE 6
SOT-23 (TO-236AA/AB)

3 Collector
1 Base
2 Emitter

SWITCHING TRANSISTOR

PNP SILICON

Refer to MPS3640 for graphs.

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

Characteristic	Symbol	Min	Max	Unit
OFF CHARACTERISTICS				
Collector-Emitter Breakdown Voltage ($I_C = 100 \mu Adc, V_{BE} = 0$)	$V_{(BR)CES}$	12	—	Vdc
Collector-Emitter Sustaining Voltage(1) ($I_C = 10$ mAdc, $I_B = 0$)	$V_{CEO(sus)}$	12	—	Vdc
Collector-Base Breakdown Voltage ($I_C = 100 \mu Adc, I_E = 0$)	$V_{(BR)CBO}$	12	—	Vdc
Emitter-Base Breakdown Voltage ($I_E = 100 \mu Adc, I_C = 0$)	$V_{(BR)EBO}$	4.0	—	Vdc
Collector Cutoff Current ($V_{CE} = 6.0$ Vdc, $V_{BE} = 0$)	I_{CES}	—	0.01	μAdc
($V_{CE} = 6.0$ Vdc, $V_{BE} = 0, T_A = 65°C$)		—	1.0	
Base Current ($V_{CE} = 6.0$ Vdc, $V_{BE} = 0$)	I_B	—	10	nAdc
ON CHARACTERISTICS(1)				
DC Current Gain ($I_C = 10$ mAdc, $V_{CE} = 0.3$ Vdc)	h_{FE}	30	120	—
($I_C = 50$ mAdc, $V_{CE} = 1.0$ Vdc)		20	—	
Collector-Emitter Saturation Voltage ($I_C = 10$ mAdc, $I_B = 1.0$ mAdc)	$V_{CE(sat)}$	—	0.2	Vdc
($I_C = 50$ mAdc, $I_B = 5.0$ mAdc)		—	0.6	
($I_C = 10$ mAdc, $I_B = 1.0$ mAdc, $T_A = 65°C$)		—	0.25	
Base-Emitter Saturation Voltage ($I_C = 10$ mAdc, $I_B = 0.5$ mAdc)	$V_{BE(sat)}$	0.75	0.95	Vdc
($I_C = 10$ mAdc, $I_B = 1.0$ mAdc)		0.8	1.0	
($I_C = 50$ mAdc, $I_B = 5.0$ mAdc)		—	1.5	
SMALL SIGNAL CHARACTERISTICS				
Current-Gain — Bandwidth Product ($I_C = 10$ mAdc, $V_{CE} = 5.0$ Vdc, $f = 100$ MHz)	f_T	500	—	MHz
Output Capacitance ($V_{CB} = = 5.0$ Vdc, $I_E = 0, f = 1.0$ MHz)	C_{obo}	—	3.5	pF
Input Capacitance ($V_{BE} = 0.5$ Vdc, $I_C = 0, f = 1.0$ MHz)	C_{ibo}	—	3.5	pF
SWITCHING CHARACTERISTICS				
Delay Time ($V_{CC} = 6.0$ Vdc, $I_C = 50$ mAdc, $V_{BE(off)} = 1.9$ Vdc, $I_{B1} = 5.0$ mAdc)	t_d	—	10	ns
Rise Time	t_r	—	30	ns
Storage Time ($V_{CC} = 6.0$ Vdc, $I_C = 50$ mAdc, $I_{B1} = I_{B2} = 5.0$ mAdc)	t_s	—	20	ns
Fall Time	t_f	—	12	ns
Turn-On Time	t_{on}			ns
($V_{CC} = 6.0$ Vdc, $I_C = 50$ mAdc, $V_{BE(off)} = 1.9$ Vdc, $I_{B1} = 5.0$ mAdc)		—	25	
($V_{CC} = 1.5$ Vdc, $I_C = 10$ mAdc, $I_{B1} = 0.5$ mAdc)		—	60	
Turn-Off Time	t_{off}			ns
($V_{CC} = 6.0$ Vdc, $I_C = 50$ mAdc, $V_{BE(off)} = 1.9$ V, $I_{B1} = I_{B2} = 5.0$ mAdc)		—	35	
($V_{CC} = 1.5$ Vdc, $I_C = 10$ mAdc, $I_{B1} = I_{B2} = 0.5$ mAdc)		—	75	

(1) Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2.0%.

MOTOROLA SMALL-SIGNAL SEMICONDUCTORS

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
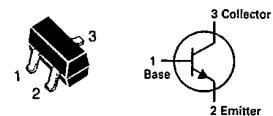
Characteristic	Symbol	Max	Unit
Total Device Dissipation FR-5 Board,* T_A = 25°C	P_D	225	mW
Derate above 25°C		1.8	mW/°C
Thermal Resistance Junction to Ambient	$R_{\theta JA}$	556	°C/mW
Total Device Dissipation Alumina Substrate,** T_A = 25°C	P_D	300	mW
Derate above 25°C		2.4	mW/°C
Thermal Resistance Junction to Ambient	$R_{\theta JA}$	417	°C/mW
Junction and Storage Temperature	T_J, T_{stg}	150	°C

*FR-5 = 1.0 x 0.75 x 0.62 in.
**Alumina = 0.4 x 0.3 x 0.024 in. 99.5% alumina.

DEVICE MARKING

MMBT3903 = 1Y; MMBT3904 = 1A

MMBT3903
MMBT3904

CASE 318-03, STYLE 6
SOT-23 (TO-236AA/AB)

GENERAL PURPOSE TRANSISTOR

NPN SILICON

Refer to 2N3903 for graphs.

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

Characteristic		Symbol	Min	Max	Unit
OFF CHARACTERISTICS					
Collector-Emitter Breakdown Voltage(1) (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					
DC Current Gain(1)		h_{FE}			—
(I_C = 0.1 mAdc, V_{CE} = 1.0 Vdc)	MMBT3903		20	—	
	MMBT3904		40	—	
(I_C = 1.0 mAdc, V_{CE} = 1.0 Vdc)	MMBT3903		35	—	
	MMBT3904		70	—	
(I_C = 10 mAdc, V_{CE} = 1.0 Vdc)	MMBT3903		50	150	
	MMBT3904		100	300	
(I_C = 50 mAdc, V_{CE} = 1.0 Vdc)	MMBT3903		30	—	
	MMBT3904		60	—	
(I_C = 100 mAdc, V_{CE} = 1.0 Vdc)	MMBT3903		15	—	
	MMBT3904		30	—	
Collector-Emitter Saturation Voltage(1)		$V_{CE(sat)}$			Vdc
(I_C = 10 mAdc, I_B = 1.0 mAdc)			—	0.2	
(I_C = 50 mAdc, I_B = 5.0 mAdc)			—	0.3	
Base-Emitter Saturation Voltage(1)		$V_{BE(sat)}$			Vdc
(I_C = 10 mAdc, I_B = 1.0 mAdc)			0.65	0.85	
(I_C = 50 mAdc, I_B = 5.0 mAdc)			—	0.95	
SMALL-SIGNAL CHARACTERISTICS					
Current-Gain — Bandwidth Product		f_T			MHz
(I_C = 10 mAdc, V_{CE} = 20 Vdc, f = 100 MHz)	MMBT3903		250	—	
	MMBT3904		300	—	

MOTOROLA SMALL-SIGNAL SEMICONDUCTORS

T·29-15

MMBT3903, MMBT3904

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

Characteristic		Symbol	Min	Max	Unit
Output Capacitance (V_{CB} = 5.0 Vdc, I_E = 0, f = 1.0 MHz)		C_{obo}	—	4.0	pF
Input Capacitance (V_{BE} = 0.5 Vdc, I_C = 0, f = 1.0 MHz)		C_{ibo}	—	8.0	pF
Input Impedance (I_C = 1.0 mAdc, V_{CE} = 10 Vdc, f = 1.0 kHz)	MMBT3903 MMBT3904	h_{ie}	1.0 1.0	8.0 10	k ohms
Voltage Feedback Ratio (I_C = 1.0 mAdc, V_{CE} = 10 Vdc, f = 1.0 kHz)	MMBT3903 MMBT3904	h_{re}	0.1 0.5	5.0 8.0	X 10⁻⁴
Small-Signal Current Gain (I_C = 1.0 mAdc, V_{CE} = 10 Vdc, f = 1.0 kHz)	MMBT3903 MMBT3904	h_{fe}	50 100	200 400	—
Output Admittance (I_C = 1.0 mAdc, V_{CE} = 10 Vdc, f = 1.0 kHz)		h_{oe}	1.0	40	μmhos
Noise Figure (I_C = 100 μAdc, V_{CE} = 5.0 Vdc, R_S = 1.0 k ohms, f = 10 Hz to 15.7 kHz)	MMBT3903 MMBT3904	NF	— —	6.0 5.0	dB

SWITCHING CHARACTERISTICS

			Symbol	Min	Max	Unit
Delay Time	(V_{CC} = 3.0 Vdc, V_{BE} = 0.5 Vdc, I_C = 10 mAdc, I_{B1} = 1.0 mAdc)		t_d	—	35	ns
Rise Time			t_r	—	35	ns
Storage Time	(V_{CC} = 3.0 Vdc, I_C = 10 mAdc, I_{B1} = I_{B2} = 1.0 mAdc)	MMBT3903 MMBT3904	t_s	— —	175 200	ns
Fall Time			t_f	—	50	ns

(1) Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2.0%.