

6367254 MOTOROLA SC (XSTRS/R F)

96D 82047 D

T-29-15

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CEO}	50	Vdc
Collector-Base Voltage	V_{CBO}	50	Vdc
Emitter-Base Voltage	V_{EBO}	3.0	Vdc
Collector Current — Continuous	I_C	50	mA dc

THERMAL CHARACTERISTICS

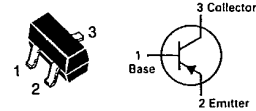
Characteristic	Symbol	Max	Unit
Total Device Dissipation FR-5 Board,* $T_A = 25^\circ\text{C}$ Derate above 25°C	P_D	225	mW
		1.8	mW/ $^\circ\text{C}$
Thermal Resistance Junction to Ambient	$R_{\theta JA}$	556	$^\circ\text{C}/\text{mW}$
Total Device Dissipation Alumina Substrate,** $T_A = 25^\circ\text{C}$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

*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

MMBT5086 = 2P; MMBT5087 = 2Q

MMBT5086
MMBT5087CASE 318-02/03, STYLE 6
SOT-23 (TO-236AA/AB)

LOW NOISE TRANSISTOR

PNP SILICON

Refer to 2N5086 for graphs.

ELECTRICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$ unless otherwise noted.)

Characteristic	Symbol	Min	Max	Unit
OFF CHARACTERISTICS				
Collector-Emitter Breakdown Voltage ($I_C = 1.0 \text{ mA dc}, I_E = 0$)	$V_{(BR)CEO}$	50	—	Vdc
Collector-Base Breakdown Voltage ($I_C = 100 \mu\text{A dc}, I_E = 0$)	$V_{(BR)CBO}$	50	—	Vdc
Collector Cutoff Current ($V_{CB} = 10 \text{ Vdc}, I_E = 0$) ($V_{CB} = 35 \text{ Vdc}, I_E = 0$)	I_{CBO}	— —	10 50	nA dc
ON CHARACTERISTICS				
DC Current Gain ($I_C = 100 \mu\text{A dc}, V_{CE} = 5.0 \text{ Vdc}$)	h_{FE}	150 250	500 800	—
($I_C = 1.0 \text{ mA dc}, V_{CE} = 5.0 \text{ Vdc}$)		150 250	— —	
($I_C = 10 \text{ mA dc}, V_{CE} = 5.0 \text{ Vdc}$)		150 250	— —	
Collector-Emitter Saturation Voltage ($I_C = 10 \text{ mA dc}, I_B = 1.0 \text{ mA dc}$)	$V_{CE(sat)}$	—	0.3	Vdc
Base-Emitter Saturation Voltage ($I_C = 10 \text{ mA dc}, I_B = 1.0 \text{ mA dc}$)	$V_{BE(sat)}$	—	0.85	Vdc
SMALL-SIGNAL CHARACTERISTICS				
Current-Gain — Bandwidth Product ($I_C = 500 \mu\text{A dc}, V_{CE} = 5.0 \text{ Vdc}, f = 20 \text{ MHz}$)	f_T	40	—	MHz
Output Capacitance ($V_{CB} = 5.0 \text{ Vdc}, I_E = 0, f = 100 \text{ kHz}$)	C_{obo}	—	4.0	pF
Small-Signal Current Gain ($I_C = 1.0 \text{ mA dc}, V_{CE} = 5.0 \text{ Vdc}, f = 1.0 \text{ kHz}$) ($I_C = 1.0 \text{ mA dc}, V_{CE} = 5.0 \text{ Vdc}, f = 1.0 \text{ kHz}$)	h_{fe}	150 250	600 900	—
Noise Figure ($I_C = 20 \text{ mA dc}, V_{CE} = 5.0 \text{ Vdc}, R_S = 10 \text{ k}\Omega$, $f = 10 \text{ Hz to } 15.7 \text{ kHz}$)	NF	— —	3.0 2.0	dB
($I_C = 100 \mu\text{A dc}, V_{CE} = 5.0 \text{ Vdc}$, $R_S = 3.0 \text{ k}\Omega, f = 1.0 \text{ kHz}$)		— —	3.0 2.0	

MOTOROLA SMALL-SIGNAL SEMICONDUCTORS

6367254 MOTOROLA SC (XSTRS/R F)

96D 82048 D

MAXIMUM RATINGS

Rating	Symbol	Value		Unit
		MMBT5088	MMBT5089	
Collector-Emitter Voltage	V _{CEO}	30	25	Vdc
Collector-Base Voltage	V _{CBO}	35	30	Vdc
Emitter-Base Voltage	V _{EBO}	4.5		Vdc
Collector Current — Continuous	I _C	50		mAdc

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Total Device Dissipation FR-5 Board,* T _A = 25°C Derate above 25°C	P _D	225	mW
Thermal Resistance Junction to Ambient	R _{θJA}	556	°C/mW
Total Device Dissipation Alumina Substrate,** T _A = 25°C Derate above 25°C	P _D	300	mW
Thermal Resistance Junction to Ambient	R _{θJA}	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

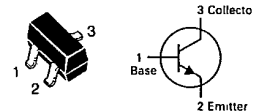
MMBT5088 = 1Q; MMBT5089 = 1R

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

Characteristic	Symbol	Min	Max	Unit
OFF CHARACTERISTICS				
Collector-Emitter Breakdown Voltage (I _C = 1.0 mAdc, I _B = 0)	V _{(BR)CEO}	30 25	—	Vdc
Collector-Base Breakdown Voltage (I _C = 100 μAdc, I _E = 0)	V _{(BR)CBO}	35 30	—	Vdc
Collector Cutoff Current (V _{CB} = 20 Vdc, I _E = 0) (V _{CB} = 15 Vdc, I _E = 0)	I _{CBO}	— —	50 50	nAdc
Emitter Cutoff Current (V _{EB(off)} = 3.0 Vdc, I _C = 0) (V _{EB(off)} = 4.5 Vdc, I _C = 0)	I _{EBO}	— —	50 100	nAdc
ON CHARACTERISTICS				
DC Current Gain (I _C = 100 μAdc, V _{CE} = 5.0 Vdc)	h _{FE}	300 400	900 1200	—
(I _C = 1.0 mAdc, V _{CE} = 5.0 Vdc)		350 450	— —	
(I _C = 10 mAdc, V _{CE} = 5.0 Vdc)		300 400	— —	
Collector-Emitter Saturation Voltage (I _C = 10 mAdc, I _B = 1.0 mAdc)	V _{CE(sat)}	—	0.5	Vdc
Base-Emitter Saturation Voltage (I _C = 10 mAdc, I _B = 1.0 mAdc)	V _{BE(sat)}	—	0.8	Vdc
SMALL SIGNAL CHARACTERISTICS				
Current-Gain — Bandwidth Product (I _C = 500 μAdc, V _{CE} = 5.0 Vdc, f = 20 MHz)	f _T	50	—	MHz
Collector-Base Capacitance (V _{CB} = 5.0 Vdc, I _E = 0, f = 100 kHz emitter guarded)	C _{cb}	—	4.0	pF
Emitter-Base Capacitance (V _{BE} = 0.5 Vdc, I _C = 0, f = 100 kHz collector guarded)	C _{eb}	—	10	pF
Small Signal Current Gain (I _C = 1.0 mAdc, V _{CE} = 5.0 Vdc, f = 1.0 kHz)	h _{fe}	350 450	1400 1800	—
Noise Figure (I _C = 100 μAdc, V _{CE} = 5.0 Vdc, R _S = 10 kΩ, f = 10 Hz to 15.7 Hz)	NF	— —	3.0 2.0	dB

MMBT5088
MMBT5089

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



LOW NOISE TRANSISTOR

NPN SILICON

Refer to MPSA18 for graphs.

MOTOROLA SMALL-SIGNAL SEMICONDUCTORS

6367254 MOTOROLA SC (XSTRS/R F)

96D 82049 D

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CEO}	150	Vdc
Collector-Base Voltage	V_{CBO}	160	Vdc
Emitter-Base Voltage	V_{EBO}	5.0	Vdc
Collector Current — Continuous	I_C	500	mA _{dc}

THERMAL CHARACTERISTICS

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

*FR-5 = 1.0 x 0.75 x 0.62 in.

**Alumina = 0.4 x 0.3 x 0.024 in. 99.5% alumina.

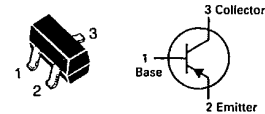
DEVICE MARKING

MMBT5401 = 2L

ELECTRICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$ unless otherwise noted.)

Characteristic	Symbol	Min	Max	Unit
OFF CHARACTERISTICS				
Collector-Emitter Breakdown Voltage ($I_C = 1.0 \text{ mA}_{dc}, I_B = 0$)	$V_{(BR)CEO}$	150	—	Vdc
Collector-Base Breakdown Voltage ($I_C = 100 \mu\text{A}_{dc}, I_E = 0$)	$V_{(BR)CBO}$	160	—	Vdc
Emitter-Base Breakdown Voltage ($I_E = 10 \mu\text{A}_{dc}, I_C = 0$)	$V_{(BR)EBO}$	5.0	—	Vdc
Collector Cutoff Current ($V_{CB} = 100 \text{ Vdc}, I_E = 0$) ($V_{CB} = 100 \text{ Vdc}, I_E = 0, T_A = 150^\circ\text{C}$)	I_{CBO}	—	50 50	nA _{dc} μA_{dc}
ON CHARACTERISTICS				
DC Current Gain ($I_C = 1.0 \text{ mA}_{dc}, V_{CE} = 5.0 \text{ Vdc}$) ($I_C = 10 \text{ mA}_{dc}, V_{CE} = 5.0 \text{ Vdc}$) ($I_C = 50 \text{ mA}_{dc}, V_{CE} = 5.0 \text{ Vdc}$)	h_{FE}	50 60 50	— 240 —	—
Collector-Emitter Saturation Voltage ($I_C = 10 \text{ mA}_{dc}, I_B = 1.0 \text{ mA}_{dc}$) ($I_C = 50 \text{ mA}_{dc}, I_B = 5.0 \text{ mA}_{dc}$)	$V_{CE(sat)}$	— —	0.20 0.5	Vdc
Base-Emitter Saturation Voltage ($I_C = 10 \text{ mA}_{dc}, I_B = 1.0 \text{ mA}_{dc}$) ($I_C = 50 \text{ mA}_{dc}, I_B = 5.0 \text{ mA}_{dc}$)	$V_{BE(sat)}$	— —	1.0 1.0	Vdc
SMALL-SIGNAL CHARACTERISTICS				
Current-Gain — Bandwidth Product ($I_C = 10 \text{ mA}_{dc}, V_{CE} = 10 \text{ Vdc}, f = 100 \text{ MHz}$)	f_T	100	300	MHz
Output Capacitance ($V_{CB} = 10 \text{ Vdc}, I_E = 0, f = 1.0 \text{ MHz}$)	C_{obo}	—	6.0	pF
Small Signal Current Gain ($I_C = 1.0 \text{ mA}_{dc}, V_{CE} = 10 \text{ Vdc}, f = 1.0 \text{ kHz}$)	h_{fe}	40	200	—
Noise Figure ($I_C = 200 \mu\text{A}_{dc}, V_{CE} = 5.0 \text{ Vdc}, R_S = 10 \text{ ohms}$, $f = 10 \text{ Hz to } 15.7 \text{ kHz}$)	NF	—	8.0	dB

MMBT5401

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

HIGH VOLTAGE TRANSISTOR

PNP SILICON

Refer to 2N5401 for graphs.

6367254 MOTOROLA SC (XSTRS/R F)

96D 82050 D

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CEO}	140	Vdc
Collector-Base Voltage	V_{CBO}	160	Vdc
Emitter-Base Voltage	V_{EBO}	6.0	Vdc
Collector Current — Continuous	I_C	600	mAdc

THERMAL CHARACTERISTICS

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

*FR-5 = 1.0 x 0.75 x 0.62 in.

**Alumina = 0.4 x 0.3 x 0.024 in. 99.5% alumina.

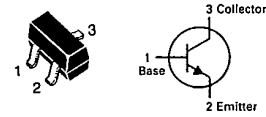
DEVICE MARKING

MMBT5550 = 1F; MMBT5551 = G1

T-29-15

MMBT5550
MMBT5551

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



HIGH VOLTAGE TRANSISTOR

NPN SILICON

Refer to 2N5550 for graphs.

ELECTRICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$ unless otherwise noted.)

Characteristic	Symbol	Min	Max	Unit
OFF CHARACTERISTICS				
Collector-Emitter Breakdown Voltage(2) ($I_C = 1.0 \text{ mAdc}, I_B = 0$)	$V_{(BR)CEO}$	140 160	—	Vdc
Collector-Base Breakdown Voltage ($I_C = 100 \mu\text{Adc}, I_E = 0$)	$V_{(BR)CBO}$	160 180	—	Vdc
Emitter-Base Breakdown Voltage ($I_E = 10 \mu\text{Adc}, I_C = 0$)	$V_{(BR)EBO}$	6.0	—	Vdc
Collector Cutoff Current ($V_{CB} = 100 \text{ Vdc}, I_E = 0$) ($V_{CB} = 120 \text{ Vdc}, I_E = 0$) ($V_{CB} = 100 \text{ Vdc}, I_E = 0, T_A = 100^\circ\text{C}$) ($V_{CB} = 120 \text{ Vdc}, I_E = 0, T_A = 100^\circ\text{C}$)	I_{CBO}	— — — —	100 50 100 50	nAdc μAdc
Emitter Cutoff Current ($V_{EB} = 4.0 \text{ Vdc}, I_C = 0$)	I_{EBO}	—	50	nAdc
ON CHARACTERISTICS(2)				
DC Current Gain ($I_C = 1.0 \text{ mAdc}, V_{CE} = 5.0 \text{ Vdc}$)	h_{FE}	60 80	— —	—
($I_C = 10 \text{ mAdc}, V_{CE} = 5.0 \text{ Vdc}$)		60 80	250 250	
($I_C = 50 \text{ mAdc}, V_{CE} = 5.0 \text{ Vdc}$)		20 30	— —	
Collector-Emitter Saturation Voltage ($I_C = 10 \text{ mAdc}, I_B = 1.0 \text{ mAdc}$)	$V_{CE(sat)}$	—	0.15	Vdc
($I_C = 50 \text{ mAdc}, I_B = 5.0 \text{ mAdc}$)		—	0.25 0.20	
Base-Emitter Saturation Voltage ($I_C = 10 \text{ mAdc}, I_B = 1.0 \text{ mAdc}$)	$V_{BE(sat)}$	—	1.0	Vdc
($I_C = 50 \text{ mAdc}, I_B = 5.0 \text{ mAdc}$)		—	1.2 1.0	

(2) Pulse Test; Pulse Width = 300 μs , Duty Cycle = 2.0%.

6367254 MOTOROLA SC (XSTRS/R F)

96D 82051 D
T-29-29

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CE0}	40	Vdc
Collector-Base Voltage	V_{CBO}	40	Vdc
Emitter-Base Voltage	V_{EBO}	12	Vdc
Collector Current — Continuous	I_C	500	mA dc

THERMAL CHARACTERISTICS

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

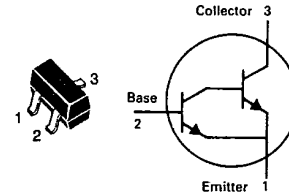
*FR-5 = 1.0 x 0.75 x 0.62 in.

**Alumina = 0.4 x 0.3 x 0.024 in. 99.5% alumina.

DEVICE MARKING

MMBT6427 = 1V

MMBT6427

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

DARLINGTON TRANSISTOR

NPN SILICON

Refer to 2N6426 for graphs.

ELECTRICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$ unless otherwise noted.)

Characteristic	Symbol	Min	Max	Unit
OFF CHARACTERISTICS				
Collector-Emitter Breakdown Voltage ($I_C = 10\text{ mA dc}, I_B = 0$)	$V_{(BR)CEO}$	40	—	Vdc
Collector-Base Breakdown Voltage ($I_C = 100\text{ }\mu\text{A dc}, I_E = 0$)	$V_{(BR)CBO}$	40	—	Vdc
Emitter-Base Breakdown Voltage ($I_C = 10\text{ }\mu\text{A dc}, I_C = 0$)	$V_{(BR)EBO}$	12	—	Vdc
Collector Cutoff Current ($V_{CE} = 25\text{ Vdc}, I_B = 0$)	I_{CEO}	—	1.0	$\mu\text{A dc}$
Collector Cutoff Current ($V_{CB} = 30\text{ Vdc}, I_E = 0$)	I_{CBO}	—	50	nA dc
Emitter Cutoff Current ($V_{BE} = 10\text{ Vdc}, I_C = 0$)	I_{EBO}	—	50	nA dc
ON CHARACTERISTICS				
DC Current Gain ($I_C = 10\text{ mA dc}, V_{CE} = 5.0\text{ Vdc}$) ($I_C = 100\text{ mA dc}, V_{CE} = 5.0\text{ Vdc}$) ($I_C = 500\text{ mA dc}, V_{CE} = 5.0\text{ Vdc}$)	h_{FE}	10,000 20,000 14,000	100,000 200,000 140,000	—
Collector-Emitter Saturation Voltage ($I_C = 50\text{ mA dc}, I_B = 0.5\text{ mA dc}$) ($I_C = 500\text{ mA dc}, I_B = 0.5\text{ mA dc}$)	$V_{CE(sat)}$	— —	1.2 1.5	Vdc
Base-Emitter Saturation Voltage ($I_C = 500\text{ mA dc}, I_B = 0.5\text{ mA dc}$)	$V_{BE(sat)}$	—	2.0	Vdc
Base-Emitter On Voltage ($I_C = 50\text{ mA dc}, V_{CE} = 5.0\text{ Vdc}$)	$V_{BE(on)}$	—	1.75	Vdc
SMALL-SIGNAL CHARACTERISTICS				
Output Capacitance ($V_{CB} = 10\text{ Vdc}, I_E = 0, f = 1.0\text{ MHz}$)	C_{obo}	—	7.0	pF
Input Capacitance ($V_{BE} = 0.5, I_C = 0, f = 1.0\text{ MHz}$)	C_{ibo}	—	15	pF
Current Gain — High Frequency ($I_C = 10\text{ mA dc}, V_{CE} = 5.0\text{ Vdc}, f = 100\text{ MHz}$)	$ h_{fe} $	1.3	—	Vdc
Noise Figure ($I_C = 1.0\text{ mA dc}, V_{CE} = 5.0\text{ Vdc}, R_S = 100\text{ k}\Omega$, $f = 1.0\text{ kHz to }15.7\text{ kHz}$)	NF	—	10	dB

MOTOROLA SMALL-SIGNAL SEMICONDUCTORS

6367254 MOTOROLA SC (XSTRS/R F)

96D 82052 D

T-29-15

MAXIMUM RATINGS

Rating	Symbol	Value		Unit
		MMBT6428	MMBT6429	
Collector-Emitter Voltage	V_{CEO}	50	45	Vdc
Collector-Base Voltage	V_{CBO}	60	55	Vdc
Emitter-Base Voltage	V_{EBO}	6.0		Vdc
Collector Current — Continuous	I_C	200		mAdc

THERMAL CHARACTERISTICS

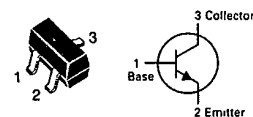
Characteristic	Symbol	Max	Unit
Total Device Dissipation FR-5 Board,* $T_A = 25^\circ\text{C}$ Derate above 25°C	P_D	225	mW
Thermal Resistance Junction to Ambient	$R_{\theta JA}$	556	$^\circ\text{C/mW}$
Total Device Dissipation Alumina Substrate,** $T_A = 25^\circ\text{C}$ Derate above 25°C	P_D	300	mW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

*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

MMBT6428 = 1K; MMBT6429 = 1L

MMBT6428
MMBT6429CASE 318-02/03, STYLE 6
SOT-23 (TO-236AA/AB)

AMPLIFIER TRANSISTOR

NPN SILICON

Refer to MPSA18 for graphs.

ELECTRICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$ unless otherwise noted.)

Characteristic	Symbol	Min	Max	Unit
OFF CHARACTERISTICS				
Collector-Emitter Breakdown Voltage ($I_C = 1.0$ mAdc, $I_B = 0$) ($I_C = 1.0$ mAdc, $I_B = 0$)	$V_{(BR)CEO}$	50 45	— —	Vdc
Collector-Base Breakdown Voltage ($I_C = 0.1$ mAdc, $I_E = 0$) ($I_C = 0.1$ mAdc, $I_E = 0$)	$V_{(BR)CBO}$	60 55	— —	Vdc
Collector Cutoff Current ($V_{CE} = 30$ Vdc)	I_{CEO}	—	0.1	μA dc
Collector Cutoff Current ($V_{CB} = 30$ Vdc, $I_E = 0$)	I_{CBO}	—	0.01	μA dc
Emitter Cutoff Current ($V_{EB} = 5.0$ Vdc, $I_C = 0$)	I_{EBO}	—	0.01	μA dc
ON CHARACTERISTICS				
DC Current Gain ($I_C = 0.01$ mAdc, $V_{CE} = 5.0$ Vdc)	h_{FE}	250 500	— —	—
($I_C = 0.1$ mAdc, $V_{CE} = 5.0$ Vdc)		250 500	650 1250	
($I_C = 1.0$ mAdc, $V_{CE} = 5.0$ Vdc)		250 500	— —	
($I_C = 10$ mAdc, $V_{CE} = 5.0$ Vdc)		250 500	— —	
Collector-Emitter Saturation Voltage ($I_C = 10$ mAdc, $I_B = 0.5$ mAdc) ($I_C = 100$ mAdc, $I_B = 5.0$ mAdc)	$V_{CE(sat)}$	— —	0.2 0.6	Vdc
Base-Emitter On Voltage ($I_C = 1.0$ mAdc, $V_{CE} = 5.0$ Vdc)	$V_{BE(on)}$	0.56	0.66	Vdc
SMALL-SIGNAL CHARACTERISTICS				
Current-Gain — Bandwidth Product ($I_C = 1.0$ mAdc, $V_{CE} = 5.0$ Vdc, $f = 100$ MHz)	f_T	100	700	MHz
Output Capacitance ($V_{CB} = 10$ Vdc, $I_E = 0$, $f = 1.0$ MHz)	C_{obo}	—	3.0	pF
Input Capacitance ($V_{EB} = 0.5$ Vdc, $I_C = 0$, $f = 1.0$ MHz)	C_{ibo}	—	8.0	pF

MOTOROLA SMALL-SIGNAL SEMICONDUCTORS

6367254 MOTOROLA SC (XSTRS/R F)

96D 82053 D

T-29-15

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CEO}	350	Vdc
Collector-Base Voltage	V_{CBO}	350	Vdc
Emitter-Base Voltage	V_{EBO}	5.0	Vdc
Base Current	I_B	250	mA
Collector Current — Continuous	I_C	500	mA

THERMAL CHARACTERISTICS

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

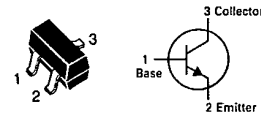
*FR-5 = 1.0 x 0.75 x 0.62 in.

**Alumina = 0.4 x 0.3 x 0.024 in. 99.5% alumina.

DEVICE MARKING

MMBT6517 = 1Z

MMBT6517

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

HIGH VOLTAGE TRANSISTOR

NPN SILICON

Refer to 2N6517 for graphs.

ELECTRICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$ unless otherwise noted.)

Characteristic	Symbol	Min	Max	Unit
OFF CHARACTERISTICS				
Collector-Emitter Breakdown Voltage ($I_C = 1.0\text{ mA}$)	$V_{(BR)CEO}$	350	—	Vdc
Collector-Base Breakdown Voltage ($I_C = 100\text{ }\mu\text{A}$)	$V_{(BR)CBO}$	350	—	Vdc
Emitter-Base Breakdown Voltage ($I_E = 10\text{ }\mu\text{A}$)	$V_{(BR)EBO}$	6.0	—	Vdc
Collector Cutoff Current ($V_{CB} = 250\text{ V}$)	I_{CBO}	—	50	nA
Emitter Cutoff Current ($V_{EB} = 5.0\text{ V}$)	I_{EBO}	—	50	nA
ON CHARACTERISTICS				
DC Current Gain ($I_C = 1.0\text{ mA}, V_{CE} = 10\text{ V}$) ($I_C = 10\text{ mA}, V_{CE} = 10\text{ V}$) ($I_C = 30\text{ mA}, V_{CE} = 10\text{ V}$) ($I_C = 50\text{ mA}, V_{CE} = 10\text{ V}$) ($I_C = 100\text{ mA}, V_{CE} = 10\text{ V}$)	h_{FE}	20 30 30 20 15	— — 200 200 —	—
Collector-Emitter Saturation Voltage ($I_C = 10\text{ mA}, I_B = 1.0\text{ mA}$) ($I_C = 20\text{ mA}, I_B = 2.0\text{ mA}$) ($I_C = 30\text{ mA}, I_B = 3.0\text{ mA}$) ($I_C = 50\text{ mA}, I_B = 5.0\text{ mA}$)	$V_{CE(sat)}$	— — — —	0.30 0.35 0.50 1.0	Vdc
Base-Emitter Saturation Voltage ($I_C = 10\text{ mA}, I_B = 1.0\text{ mA}$) ($I_C = 20\text{ mA}, I_B = 2.0\text{ mA}$) ($I_C = 30\text{ mA}, I_B = 3.0\text{ mA}$)	$V_{BE(sat)}$	— — —	0.75 0.85 0.90	Vdc
Base-Emitter On Voltage ($I_C = 100\text{ mA}, V_{CE} = 10\text{ V}$)	$V_{BE(on)}$	—	2.0	Vdc
SMALL-SIGNAL CHARACTERISTICS				
Current-Gain — Bandwidth Product ($I_C = 10\text{ mA}, V_{CE} = 20\text{ V}, f = 20\text{ MHz}$)	f_T	40	200	MHz
Collector-Base Capacitance ($V_{CB} = 20\text{ V}, f = 1.0\text{ MHz}$)	C_{cb}	—	6.0	pF
Emitter-Base Capacitance ($V_{EB} = 0.5\text{ V}, f = 1.0\text{ MHz}$)	C_{eb}	—	80	pF

MOTOROLA SMALL-SIGNAL SEMICONDUCTORS

6367254 MOTOROLA SC (XSTRS/R F)

96D 82054 D

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector-Emitter Voltage	V _{CEO}	350	V _{dc}
Collector-Base Voltage	V _{CBO}	350	V _{dc}
Emitter-Base Voltage	V _{EBO}	5.0	V _{dc}
Base Current	I _B	250	mA
Collector Current — Continuous	I _C	500	mA _{dc}

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 _{θJA}	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 _{θJA}	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.

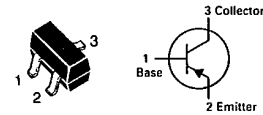
DEVICE MARKING

MMBT6520 = 2Z

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

Characteristic	Symbol	Min	Max	Unit
OFF CHARACTERISTICS				
Collector-Emitter Breakdown Voltage (I _C = 1.0 mA)	V _{(BR)CEO}	350	—	V _{dc}
Collector-Base Breakdown Voltage (I _C = 100 μA)	V _{(BR)CBO}	350	—	V _{dc}
Emitter-Base Breakdown Voltage (I _E = 10 μA)	V _{(BR)EBO}	5.0	—	V _{dc}
Collector Cutoff Current (V _{CB} = 250 V)	I _{CBO}	—	50	nA
Emitter Cutoff Current (V _{EB} = 4.0 V)	I _{EBO}	—	50	nA
ON CHARACTERISTICS				
DC Current Gain (I _C = 1.0 mA, V _{CE} = 10 V) (I _C = 10 mA, V _{CE} = 10 V) (I _C = 30 mA, V _{CE} = 10 V) (I _C = 50 mA, V _{CE} = 10 V) (I _C = 100 mA, V _{CE} = 10 V)	h _{FE}	20 30 30 20 15	— — 200 200 —	—
Collector-Emitter Saturation Voltage (I _C = 10 mA, I _B = 1.0 mA) (I _C = 20 mA, I _B = 2.0 mA) (I _C = 30 mA, I _B = 3.0 mA) (I _C = 50 mA, I _B = 5.0 mA)	V _{CE(sat)}	— — — —	0.30 0.35 0.50 1.0	V _{dc}
Base-Emitter Saturation Voltage (I _C = 10 mA, I _B = 1.0 mA) (I _C = 20 mA, I _B = 2.0 mA) (I _C = 30 mA, I _B = 3.0 mA)	V _{BE(sat)}	— — —	0.75 0.85 0.90	V _{dc}
Base-Emitter On Voltage (I _C = 100 mA, V _{CE} = 10 V)	V _{BE(on)}			V _{dc}
SMALL-SIGNAL CHARACTERISTICS				
Current-Gain — Bandwidth Product (I _C = 10 mA, V _{CE} = 20 V, f = 20 MHz)	f _T	40	200	MHz
Collector-Base Capacitance (V _{CB} = 20 V, f = 1.0 MHz)	C _{cb}	—	6.0	pF
Emitter-Base Capacitance (V _{EB} = 0.5 V, f = 1.0 MHz)	C _{eb}	—	100	pF

MMBT6520

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

HIGH VOLTAGE TRANSISTOR

PNP SILICON

Refer to 2N6520 for graphs.

