

6367254 MOTOROLA SC (XSTRS/R F)

96D 81990 D

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CEO}	40	Vdc
Collector-Base Voltage	V_{CBO}	50	Vdc
Emitter-Base Voltage	V_{EBO}	5.0	Vdc
Collector Current — Continuous	I_C	100	mAdc

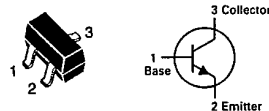
THERMAL CHARACTERISTICS

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	$^\circ\text{C}/\text{mW}$
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

MMBC1623L3 = L3; MMBC1623L4 = L4; MMBC1623L5 = L5;
MMBC1623L6 = L6; MMBC1623L7 = L7T-29-15
MMBC1623L3,4,5,6,7CASE 318-02/03, STYLE 6
SOT-23 (TO-236AA/AB)

AMPLIFIER TRANSISTOR

NPN SILICON

Refer to MPS3904 for graphs.

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

Characteristic	Symbol	Min	Max	Unit
OFF CHARACTERISTICS				
Collector Cutoff Current ($V_{CB} = 40\text{ Vdc}, I_E = 0$)	I_{CBO}	—	100	nAdc
Emitter Cutoff Current ($V_{EB} = 5.0\text{ Vdc}, I_C = 0$)	I_{EBO}	—	100	nAdc
ON CHARACTERISTICS				
DC Current Gain ($I_C = 1.0\text{ mAdc}, V_{CE} = 6.0\text{ Vdc}$)	MMBC1623L3 MMBC1623L4 MMBC1623L5 MMBC1623L6 MMBC1623L7	h_{FE}	60 90 135 200 300	120 180 270 400 600
Collector-Emitter Saturation Voltage ($I_C = 100\text{ mAdc}, I_B = 10\text{ mAdc}$)	$V_{CE(sat)}$	—	0.3	Vdc
Base-Emitter Saturation Voltage ($I_C = 100\text{ mA}, I_B = 10\text{ mAdc}$)	$V_{BE(sat)}$	—	1.0	Vdc
Base-Emitter On Voltage ($I_C = 1.0\text{ mAdc}, V_{CE} = 6.0\text{ Vdc}$)	$V_{BE(on)}$.60	0.7	Vdc
SMALL-SIGNAL CHARACTERISTICS				
Current-Gain — Bandwidth Product ($V_{CE} = 6.0\text{ Vdc}, I_E = 10\text{ mAdc}, f = 100\text{ MHz}$)	f_T	200	—	MHz

6367254 MOTOROLA SC (XSTRS/R F)

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T-29-15

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector-Emitter Voltage	V _{CEO}	130	Vdc
Collector-Base Voltage	V _{CBO}	150	Vdc
Emitter-Base Voltage	V _{EBO}	5.0	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

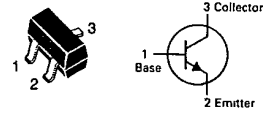
MMBC1653N2 = N2; MMBC1653N3 = N3; MMBC1653N4 = N4

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

Characteristic	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS					
Collector Cutoff Current (V _{CB} = 100 Vdc, I _E = 0)	I _{CBO}	—	—	0.1	μAdc
Emitter Cutoff Current (V _{EB} = 5.0 Vdc, I _C = 0)	I _{EBO}	—	—	0.1	μAdc
ON CHARACTERISTICS					
DC Current Gain (V _{CE} = 3.0 Vdc, I _C = 15 mAdc)	h _{FE}				
		50	—	130	
		100	—	220	
		150	—	330	
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)}	—	—	1.0	Vdc
SMALL-SIGNAL CHARACTERISTICS					
Current-Gain — Bandwidth Product (V _{CE} = 10 Vdc, I _F = 10 mAdc, f = 100 MHz)	f _T	—	150	—	MHz
Output Capacitance (V _{CB} = 10 Vdc, I _E = 0, f = 1.0 MHz)	C _{obo}	—	4.5	—	pF

MMBC1653N2,3,4

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



HIGH VOLTAGE TRANSISTOR

NPN SILICON

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6367254 MOTOROLA SC (XSTRS/R F)

96D 81992 D

T-29-15

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector-Emitter Voltage	V _{CEO}	160	V _{dc}
Collector-Base Voltage	V _{CBO}	180	V _{dc}
Emitter-Base Voltage	V _{EBO}	5.0	V _{dc}
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

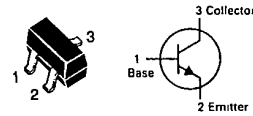
*FR-5 = 1.0 x 0.75 x 0.62 in.

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

DEVICE MARKING

MMBC1654N5 = N5; MMBC1654N6 = N6; MMBC1654N7 = N7

MMBC1654N5,6,7

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

HIGH VOLTAGE TRANSISTOR

NPN SILICON

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

Characteristic	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS					
Collector Cutoff Current (V _{CB} = 100 V, I _E = 0)	I _{CBO}	—	—	0.1	μAdc
Emitter Cutoff Current (V _{EB} = 6.0 V _{dc} , I _C = 0)	I _{EBO}	—	—	0.1	μAdc
ON CHARACTERISTICS					
DC Current Gain (V _{CE} = 3.0 V, I _C = 15 mAdc)	h _{FE}				—
	MMBC1654N5	50	—	130	
	MMBC1654N6	100	—	220	
	MMBC1654N7	150	—	330	
Collector-Emitter Saturation Voltage (I _C = 10 mAdc, I _B = 1.0 mAdc)	V _{CE(sat)}	—	—	0.5	V _{dc}
Base-Emitter Saturation Voltage (I _C = 10 mAdc, I _B = 1.0 mAdc)	V _{BE(sat)}	—	—	1.0	V _{dc}
SMALL-SIGNAL CHARACTERISTICS					
Current-Gain — Bandwidth Product (V _{CE} = 10 V _{dc} , I _F = 10 mAdc, f = 100 MHz)	f _T	—	150	—	MHz
Output Capacitance (V _{CB} = 10 V _{dc} , I _E = 0, f = 1.0 MHz)	C _{obo}	—	4.5	—	pF

6367254 MOTOROLA SC (XSTRS/R F)

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T-31-25

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Drain-Source Voltage	V _{DS}	30	Vdc
Drain-Gate Voltage	V _{DG}	30	Vdc
Gate-Source Voltage	V _{GS}	30	Vdc
Gate Current	I _G	10	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.

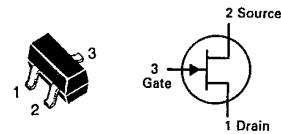
**Alumina = 0.4 x 0.3 x 0.024 in. 99.5% alumina.

DEVICE MARKING

MMBF4416 = 6A

MMBF4416

CASE 318-02/03, STYLE 10
SOT-23 (TO-236AA/AB)



JFET
VHF/UHF AMPLIFIER TRANSISTOR
N-CHANNEL

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

Characteristic	Symbol	Min	Max	Unit
OFF CHARACTERISTICS				
Gate-Source Breakdown Voltage (I _G = 1.0 μAdc, V _{DS} = 0)	V _{(BR)GSS}	30	—	Vdc
Gate Reverse Current (V _{GS} = 20 Vdc, V _{DS} = 0) (V _{GS} = 20 Vdc, V _{DS} = 0, T _A = 150°C)	I _{GSS}	—	1.0 200	nAdc nAdc
Gate Source Cutoff Voltage (I _D = 1.0 nAdc, V _{DS} = 15 Vdc)	V _{GS(off)}	—	6.0	Vdc
Gate Source Voltage (I _D = 0.5 mAdc, V _{DS} = 15 Vdc)	V _{GS}	1.0	5.5	Vdc
ON CHARACTERISTICS				
Zero-Gate-Voltage Drain (V _{GS} = 15 Vdc, V _{GS} = 0)	I _{DSS}	5.0	15	mAdc
Gate-Source Forward Voltage (I _G = 1.0 mAdc, V _{DS} = 0)	V _{GS(f)}	—	1.0	Vdc
SMALL-SIGNAL CHARACTERISTICS				
Forward Transfer Admittance (V _{DS} = 15 Vdc, V _{GS} = 0, f = 1.0 kHz)	Y _{fs}	4500	7500	μmhos
Output Admittance (V _{DS} = 15 Vdc, V _{GS} = 0, f = 1.0 kHz)	Y _{os}	—	50	μmhos
Input Capacitance (V _{DS} = 15 Vdc, V _{GS} = 0, f = 1.0 MHz)	C _{iss}	—	4.0	pF
Reverse Transfer Capacitance (V _{DS} = 15 Vdc, V _{GS} = 0, f = 1.0 MHz)	C _{rss}	—	0.8	pF
Output Capacitance (V _{DS} = 15 Vdc, V _{GS} = 0, f = 1.0 MHz)	C _{oss}	—	2.0	pF
FUNCTIONAL CHARACTERISTICS				
Noise Figure (V _{DS} = 15 Vdc, I _D = 5.0 mAdc, R _g = 1000 Ω, f = 100 MHz) (V _{DS} = 15 Vdc, I _D = 5.0 mAdc, R _g = 1000 Ω, f = 400 MHz)	NF	—	2.0 4.0	dB
Common Source Power Gain (V _{DS} = 15 Vdc, I _D = 5.0 mAdc, f = 100 MHz) (V _{DS} = 15 Vdc, I _D = 5.0 mAdc, f = 400 MHz)	G _{ps}	18 10	—	dB

6367254 MOTOROLA SC (XSTRS/R F)

96D 82005 D

T-35-25

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Drain-Source Voltage	V _{DS}	30	Vdc
Drain-Gate Voltage	V _{DG}	30	Vdc
Reverse Gate-Source Voltage	V _{GS(r)}	30	Vdc
Forward Gate Current	I _{G(f)}	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.

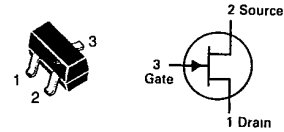
**Alumina = 0.4 x 0.3 x 0.024 in. 99.5% alumina.

DEVICE MARKING

MMBF4860 = 6F

MMBF4860

CASE 318-02/03, STYLE 10
SOT-23 (TO-236AA/AB)



**JFET
SWITCHING TRANSISTOR**
N-CHANNEL

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

Characteristic	Symbol	Min	Max	Unit
OFF CHARACTERISTICS				
Gate-Source Breakdown Voltage (I _G = 1.0 μAdc, V _{DS} = 0)	V(BR)GSS	30	—	Vdc
Gate Reverse Current (V _{GS} = 15 Vdc, V _{DS} = 0) (V _{GS} = 15 Vdc, V _{DS} = 0, T _A = 150°C)	I _{GSS}	—	0.5 2.0	nAdc μAdc
Gate Source Cutoff Voltage (V _{DS} = 15 Vdc, I _D = 0.5 nAdc)	V _{GS(off)}	2.0	6.0	Vdc
ON CHARACTERISTICS				
Zero-Gate-Voltage Drain(1) (V _{DS} = 15 Vdc, V _{GS} = 0)	I _{DSS}	20	100	mAdc
Drain Cutoff Current (V _{DS} = 15 Vdc, V _{GS} = 10 Vdc) (V _{DS} = 15 Vdc, V _{GS} = 10 Vdc, T _A = 150°C)	I _{D(off)}	—	0.25 0.5	nAdc μAdc
Drain-Source On-Voltage (I _D = 10 mAdc, V _{GS} = 0)	V _{DS(on)}	—	0.5	Vdc
Static Drain-Source On Resistance (V _{GS} = 0, I _D = 0, f = 1.0 kHz)	r _{DS(on)}	—	40	Ohms
Input Capacitance (V _{DS} = 0, V _{GS} = 10 Vdc, f = 1.0 MHz)	C _{iss}	—	18	pF
Reverse Transfer Capacitance (V _{DS} = 0, V _{GS} = 10 Vdc, f = 1.0 MHz)	C _{rss}	—	8.0	pF
SWITCHING CHARACTERISTICS				
Delay Time (V _{DD} = 10 Vdc, I _{D(on)} = 20 mAdc) (V _{G(on)} = 0, V _{GS(off)} = 10 Vdc)	t _d	—	6.0	ns
Rise Time (V _{DD} = 10 Vdc, I _{D(on)} = 10 mAdc) (V _{GS(on)} = 0, V _{GS(off)} = 6.0 Vdc) (Figure 1)	t _r	—	4.0	ns
Turn-Off Time (V _{DD} = 10 Vdc, I _{D(on)} = 5.0 mAdc) (V _{GS(on)} = 0, V _{GS(off)} = 4.0 Vdc) (Figure 1)	t _{off}	—	50	ns

(1) Pulse Test: Pulse Width = 100 ms, Duty Cycle ≤ 10%.

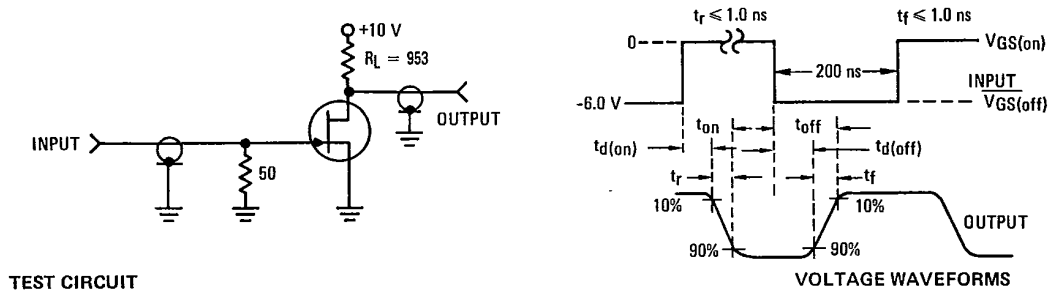
6367254 MOTOROLA SC (XSTRS/R F)

96D 82006 D

MMBF4860

T-35-25

FIGURE 1 — SWITCHING TIMES TEST CIRCUIT



TEST CIRCUIT

VOLTAGE WAVEFORMS

- NOTES: 1. The input waveforms are supplied by a generator with the following characteristics:
 $Z_{out} = 50$ ohms, Duty Cycle $\approx 2.0\%$
 2. Waveforms are monitored on an oscilloscope with the following characteristics:
 $t_r \leq 0.75$ ns, $R_{in} \geq 1.0$ megohm, $C_{in} \leq 2.5$ pF.