

6367254 MOTOROLA SC (XSTRS/R F)

96D 82031 D

T-29-15

## MAXIMUM RATINGS

| Rating                         | Symbol    | Value | Unit |
|--------------------------------|-----------|-------|------|
| Collector-Emitter Voltage      | $V_{CEO}$ | 45    | Vdc  |
| Collector-Base Voltage         | $V_{CBO}$ | 45    | Vdc  |
| Emitter-Base Voltage           | $V_{EBO}$ | 5.0   | Vdc  |
| Collector Current — Continuous | $I_C$     | 30    | mAdc |

## THERMAL CHARACTERISTICS

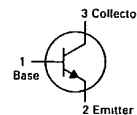
| Characteristic                                                                                               | Symbol          | Max | Unit                |
|--------------------------------------------------------------------------------------------------------------|-----------------|-----|---------------------|
| Total Device Dissipation FR-5 Board,*<br>$T_A = 25^\circ\text{C}$<br>Derate above $25^\circ\text{C}$         | $P_D$           | 225 | mW                  |
| Thermal Resistance Junction to Ambient                                                                       | $R_{\theta JA}$ | 556 | $^\circ\text{C/mW}$ |
| Total Device Dissipation<br>Alumina Substrate,** $T_A = 25^\circ\text{C}$<br>Derate above $25^\circ\text{C}$ | $P_D$           | 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 =  $1.0 \times 0.75 \times 0.62$  in.\*\*Alumina =  $0.4 \times 0.3 \times 0.024$  in. 99.5% alumina.

## DEVICE MARKING

MMBT930 = 1X

## MMBT930

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

## GENERAL PURPOSE TRANSISTOR

NPN SILICON

Refer to MPS3904 for graphs.

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

| Characteristic                                                                                                                                           | Symbol        | Min             | Max             | Unit |
|----------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|-----------------|-----------------|------|
| <b>OFF CHARACTERISTICS</b>                                                                                                                               |               |                 |                 |      |
| Collector-Emitter Breakdown Voltage<br>( $I_C = 10$ mAdc, $I_B = 0$ )                                                                                    | $V_{(BR)CEO}$ | 45              | —               | Vdc  |
| Collector-Base Breakdown Voltage<br>( $I_C = 10$ $\mu$ Adc, $I_E = 0$ )                                                                                  | $V_{(BR)CBO}$ | 45              | —               | Vdc  |
| Emitter-Base Breakdown Voltage<br>( $I_E = 10$ $\mu$ Adc, $I_C = 0$ )                                                                                    | $V_{(BR)EBO}$ | 5.0             | —               | Vdc  |
| Collector Cutoff Current<br>( $V_{CE} = 5.0$ Vdc, $I_B = 0$ )                                                                                            | $I_{CEO}$     | —               | 10              | nAdc |
| Collector Cutoff Current<br>( $V_{CB} = 45$ Vdc, $I_E = 0$ )                                                                                             | $I_{CBO}$     | —               | 10              | nAdc |
| Collector Cutoff Current<br>( $V_{CE} = 45$ Vdc, $V_{BE} = 0$ )                                                                                          | $I_{CES}$     | —               | 10              | nAdc |
| Emitter Cutoff Current<br>( $V_{EB} = 5.0$ Vdc, $I_C = 0$ )                                                                                              | $I_{EBO}$     | —               | 10              | nAdc |
| <b>ON CHARACTERISTICS</b>                                                                                                                                |               |                 |                 |      |
| DC Current Gain<br>( $I_C = 10$ $\mu$ Adc, $V_{CE} = 5.0$ Vdc)<br>( $I_C = 500$ $\mu$ Adc, $V_{CE} = 5.0$ Vdc)<br>( $I_C = 10$ mAdc, $V_{CE} = 5.0$ Vdc) | $h_{FE}$      | 100<br>150<br>— | 300<br>—<br>600 | —    |
| Collector-Emitter Saturation Voltage<br>( $I_C = 10$ mAdc, $I_B = 0.5$ mAdc)                                                                             | $V_{CE(sat)}$ | —               | 1.0             | Vdc  |
| Base-Emitter Saturation Voltage<br>( $I_C = 10$ mAdc, $I_B = 0.5$ mAdc)                                                                                  | $V_{BE(sat)}$ | 0.6             | 1.0             | Vdc  |
| <b>SMALL-SIGNAL CHARACTERISTICS</b>                                                                                                                      |               |                 |                 |      |
| Current-Gain — Bandwidth Product<br>( $I_C = 500$ $\mu$ Adc, $V_{CE} = 5.0$ Vdc, $f = 30$ MHz)                                                           | $f_T$         | 30              | —               | MHz  |
| Output Capacitance<br>( $V_{CB} = 5.0$ Vdc, $I_E = 0$ , $f = 1.0$ MHz)                                                                                   | $C_{obo}$     | —               | 8.0             | pF   |
| Noise Figure<br>( $I_C = 10$ $\mu$ Adc, $V_{CE} = 5.0$ Vdc, $R_S = 10$ k $\Omega$ ,<br>$f = 10$ Hz to 15.7 kHz)                                          | NF            | —               | 3.0             | dB   |

6367254 MOTOROLA SC (XSTRS/R F)

96D 82032 D

T 29-15

## MAXIMUM RATINGS

| Rating                         | Symbol    | MMBT2222 | MMBT2222A | Unit |
|--------------------------------|-----------|----------|-----------|------|
| Collector-Emitter Voltage      | $V_{CE0}$ | 30       | 40        | Vdc  |
| Collector-Base Voltage         | $V_{CBO}$ | 60       | 75        | Vdc  |
| Emitter-Base Voltage           | $V_{EBO}$ | 5.0      | 6.0       | Vdc  |
| Collector Current — Continuous | $I_C$     | 600      |           | mAdc |

## THERMAL CHARACTERISTICS

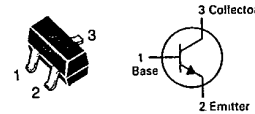
| Characteristic                                                                                               | Symbol          | Max | Unit                       |
|--------------------------------------------------------------------------------------------------------------|-----------------|-----|----------------------------|
| Total Device Dissipation FR-5 Board,*<br>$T_A = 25^\circ\text{C}$<br>Derate above $25^\circ\text{C}$         | $P_D$           | 225 | mW                         |
| Thermal Resistance Junction to Ambient                                                                       | $R_{\theta JA}$ | 556 | $^\circ\text{C}/\text{mW}$ |
| Total Device Dissipation<br>Alumina Substrate,** $T_A = 25^\circ\text{C}$<br>Derate above $25^\circ\text{C}$ | $P_D$           | 300 | mW                         |
| Thermal Resistance Junction to Ambient                                                                       | $R_{\theta JA}$ | 2.4 | $^\circ\text{C}/\text{mW}$ |
| 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

MMBT2222 = 1B; MMBT2222A = 1P

MMBT2222  
MMBT2222ACASE 318-02/03, STYLE 6  
SOT-23 (TO-236AA/AB)

## TRANSISTOR

NPN SILICON

Refer to MPS2222 for graphs.

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

| Characteristic                                                                                                                                                                                                                                                                                                                                                                                                                                              | Symbol        | Min                                           | Max                                    | Unit            |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|-----------------------------------------------|----------------------------------------|-----------------|
| <b>OFF CHARACTERISTICS</b>                                                                                                                                                                                                                                                                                                                                                                                                                                  |               |                                               |                                        |                 |
| Collector-Emitter Breakdown Voltage<br>( $I_C = 10\text{ mA}$ , $I_B = 0$ )                                                                                                                                                                                                                                                                                                                                                                                 | $V_{(BR)CEO}$ | 30<br>40                                      | —<br>—                                 | Vdc             |
| Collector-Base Breakdown Voltage<br>( $I_C = 10\text{ }\mu\text{A}$ , $I_E = 0$ )                                                                                                                                                                                                                                                                                                                                                                           | $V_{(BR)CBO}$ | 60<br>75                                      | —<br>—                                 | Vdc             |
| Emitter-Base Breakdown Voltage<br>( $I_E = 10\text{ }\mu\text{A}$ , $I_C = 0$ )                                                                                                                                                                                                                                                                                                                                                                             | $V_{(BR)EBO}$ | 5.0<br>6.0                                    | —<br>—                                 | Vdc             |
| Collector Cutoff Current<br>( $V_{CE} = 60\text{ Vdc}$ , $V_{EB(off)} = 3.0\text{ Vdc}$ )                                                                                                                                                                                                                                                                                                                                                                   | $I_{CEX}$     | —                                             | 10                                     | nAdc            |
| Collector Cutoff Current<br>( $V_{CB} = 50\text{ Vdc}$ , $I_E = 0$ )<br>( $V_{CB} = 60\text{ Vdc}$ , $I_E = 0$ )<br>( $V_{CB} = 50\text{ Vdc}$ , $I_E = 0$ , $T_A = 125^\circ\text{C}$ )<br>( $V_{CB} = 50\text{ Vdc}$ , $I_E = 0$ , $T_A = 125^\circ\text{C}$ )                                                                                                                                                                                            | $I_{CBO}$     | —<br>—<br>—<br>—                              | 0.01<br>0.01<br>10<br>10               | $\mu\text{Adc}$ |
| Emitter Cutoff Current<br>( $V_{EB} = 3.0\text{ Vdc}$ , $I_C = 0$ )                                                                                                                                                                                                                                                                                                                                                                                         | $I_{EBO}$     | —                                             | 10                                     | nAdc            |
| Base Cutoff Current<br>( $V_{CE} = 60\text{ Vdc}$ , $V_{EB(off)} = 3.0\text{ Vdc}$ )                                                                                                                                                                                                                                                                                                                                                                        | $I_{BL}$      | —                                             | 20                                     | nAdc            |
| <b>ON CHARACTERISTICS</b>                                                                                                                                                                                                                                                                                                                                                                                                                                   |               |                                               |                                        |                 |
| DC Current Gain<br>( $I_C = 0.1\text{ mA}$ , $V_{CE} = 10\text{ Vdc}$ )<br>( $I_C = 1.0\text{ mA}$ , $V_{CE} = 10\text{ Vdc}$ )<br>( $I_C = 10\text{ mA}$ , $V_{CE} = 10\text{ Vdc}$ )<br>( $I_C = 10\text{ mA}$ , $V_{CE} = 10\text{ Vdc}$ , $T_A = -55^\circ\text{C}$ )<br>( $I_C = 150\text{ mA}$ , $V_{CE} = 10\text{ Vdc}$ )(1)<br>( $I_C = 150\text{ mA}$ , $V_{CE} = 1.0\text{ Vdc}$ )(1)<br>( $I_C = 500\text{ mA}$ , $V_{CE} = 10\text{ Vdc}$ )(1) | $h_{FE}$      | 35<br>50<br>75<br>35<br>100<br>50<br>30<br>40 | —<br>—<br>—<br>—<br>300<br>—<br>—<br>— | —               |
| Collector-Emitter Saturation Voltage(1)<br>( $I_C = 150\text{ mA}$ , $I_B = 15\text{ mA}$ )<br><br>( $I_C = 500\text{ mA}$ , $I_B = 50\text{ mA}$ )                                                                                                                                                                                                                                                                                                         | $V_{CE(sat)}$ | —<br>—<br>—                                   | 0.4<br>0.3<br>1.6<br>1.0               | Vdc             |

MOTOROLA SMALL-SIGNAL SEMICONDUCTORS

6367254 MOTOROLA SC (XSTRS/R F)

96D 82033 D

MMBT2222,A

T-29-15

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

| Characteristic                                                                             | Symbol        | Min | Max | Unit |
|--------------------------------------------------------------------------------------------|---------------|-----|-----|------|
| Base-Emitter Saturation Voltage(1)<br>( $I_C = 150\text{ mAdc}$ , $I_B = 15\text{ mAdc}$ ) | $V_{BE(sat)}$ | —   | 1.3 | Vdc  |
| MMBT2222                                                                                   |               | 0.6 | 1.2 |      |
| ( $I_C = 500\text{ mAdc}$ , $I_B = 50\text{ mAdc}$ )                                       | MMBT2222      | —   | 2.6 |      |
| MMBT2222A                                                                                  |               | —   | 2.0 |      |

## SMALL-SIGNAL CHARACTERISTICS

|                                                                                                                                                                                            |                        |           |             |             |                  |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|-----------|-------------|-------------|------------------|
| Current-Gain — Bandwidth Product(2)<br>( $I_C = 20\text{ mAdc}$ , $V_{CE} = 20\text{ Vdc}$ , $f = 100\text{ MHz}$ )                                                                        | MMBT2222<br>MMBT2222A  | $f_T$     | 250<br>300  | —           | MHz              |
| Output Capacitance<br>( $V_{CB} = 10\text{ Vdc}$ , $I_E = 0$ , $f = 1.0\text{ MHz}$ )                                                                                                      |                        | $C_{obo}$ | —           | 8.0         | pF               |
| Input Capacitance<br>( $V_{EB} = 0.5\text{ Vdc}$ , $I_C = 0$ , $f = 1.0\text{ MHz}$ )                                                                                                      | MMBT2222<br>MMBT2222A  | $C_{ibo}$ | —           | 30<br>25    | pF               |
| Input Impedance<br>( $I_C = 1.0\text{ mAdc}$ , $V_{CE} = 10\text{ Vdc}$ , $f = 1.0\text{ kHz}$ )<br>( $I_C = 10\text{ mAdc}$ , $V_{CE} = 10\text{ Vdc}$ , $f = 1.0\text{ kHz}$ )           | MMBT2222A<br>MMBT2222A | $h_{ie}$  | 2.0<br>0.25 | 8.0<br>1.25 | k $\Omega$       |
| Voltage Feedback Ratio<br>( $I_C = 1.0\text{ mAdc}$ , $V_{CE} = 10\text{ Vdc}$ , $f = 1.0\text{ kHz}$ )<br>( $I_C = 10\text{ mAdc}$ , $V_{CE} = 10\text{ Vdc}$ , $f = 1.0\text{ kHz}$ )    | MMBT2222A<br>MMBT2222A | $h_{re}$  | —           | 8.0<br>4.0  | $\times 10^{-4}$ |
| Small-Signal Current Gain<br>( $I_C = 1.0\text{ mAdc}$ , $V_{CE} = 10\text{ Vdc}$ , $f = 1.0\text{ kHz}$ )<br>( $I_C = 10\text{ mAdc}$ , $V_{CE} = 10\text{ Vdc}$ , $f = 1.0\text{ kHz}$ ) | MMBT2222A<br>MMBT2222A | $h_{fe}$  | 50<br>75    | 300<br>375  | —                |
| Output Admittance<br>( $I_C = 1.0\text{ mAdc}$ , $V_{CE} = 10\text{ Vdc}$ , $f = 1.0\text{ kHz}$ )<br>( $I_C = 10\text{ mAdc}$ , $V_{CE} = 10\text{ Vdc}$ , $f = 1.0\text{ kHz}$ )         | MMBT2222A<br>MMBT2222A | $h_{oe}$  | 5.0<br>25   | 35<br>200   | $\mu\text{mhos}$ |
| Collector Base Time Constant<br>( $I_E = 20\text{ mAdc}$ , $V_{CB} = 20\text{ Vdc}$ , $f = 31.8\text{ MHz}$ )                                                                              | MMBT2222A              | $r_b'C_c$ | —           | 150         | ps               |
| Noise Figure<br>( $I_C = 100\text{ }\mu\text{A}$ , $V_{CE} = 10\text{ Vdc}$ , $R_S = 1.0\text{ k}\Omega$ , $f = 1.0\text{ kHz}$ )                                                          | MMBT2222A              | NF        | 4.0         | 4.0         | dB               |

## SWITCHING CHARACTERISTICS MMBT2222A only

|              |                                                                                                          |       |   |     |    |
|--------------|----------------------------------------------------------------------------------------------------------|-------|---|-----|----|
| Delay Time   | (VCC = 30 Vdc, $V_{BE(off)} = 0.5\text{ Vdc}$ ,<br>$I_C = 150\text{ mAdc}$ , $I_{B1} = 15\text{ mAdc}$ ) | $t_d$ | — | 10  | ns |
| Rise Time    |                                                                                                          | $t_r$ | — | 25  | ns |
| Storage Time | (VCC = 30 Vdc, $I_C = 150\text{ mAdc}$ ,<br>$I_{B1} = I_{B2} = 15\text{ mAdc}$ )                         | $t_s$ | — | 225 | ns |
| Fall Time    |                                                                                                          | $t_f$ | — | 60  | ns |

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

6367254 MOTOROLA SC (XSTRS/R F)

96D 82034 D

T-35-09

## MAXIMUM RATINGS

| Rating                         | Symbol    | Value | Unit |
|--------------------------------|-----------|-------|------|
| Collector-Emitter Voltage      | $V_{CEO}$ | 15    | Vdc  |
| Collector-Emitter Voltage      | $V_{CES}$ | 40    | Vdc  |
| Collector-Base Voltage         | $V_{CBO}$ | 40    | Vdc  |
| Emitter-Base Voltage           | $V_{EBO}$ | 4.5   | Vdc  |
| Collector Current — Continuous | $I_C$     | 500   | mAdc |

## THERMAL CHARACTERISTICS

| Characteristic                                                            | Symbol          | Max | Unit                       |
|---------------------------------------------------------------------------|-----------------|-----|----------------------------|
| Total Device Dissipation FR-5 Board,*<br>$T_A = 25^\circ\text{C}$         | $P_D$           | 225 | mW                         |
| Derate above $25^\circ\text{C}$                                           |                 | 1.8 | mW/ $^\circ\text{C}$       |
| Thermal Resistance Junction to Ambient                                    | $R_{\theta JA}$ | 556 | $^\circ\text{C}/\text{mW}$ |
| Total Device Dissipation<br>Alumina Substrate,** $T_A = 25^\circ\text{C}$ | $P_D$           | 300 | mW                         |
| Derate above $25^\circ\text{C}$                                           |                 | 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 | $^\circ\text{C}$           |

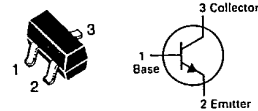
\*FR-5 = 1.0 x 0.75 x 0.62 in.

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

## DEVICE MARKING

MMBT2369 = 1J

## MMBT2369

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

## SWITCHING TRANSISTOR

NPN SILICON

Refer to MPS2369 for graphs.

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

| Characteristic                                                                                                                                                                                                          | Symbol        | Min            | Typ         | Max           | Unit          |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|----------------|-------------|---------------|---------------|
| <b>OFF CHARACTERISTICS</b>                                                                                                                                                                                              |               |                |             |               |               |
| Collector-Emitter Breakdown Voltage(1)<br>( $I_C = 10 \text{ mAdc}, I_B = 0$ )                                                                                                                                          | $V_{(BR)CEO}$ | 15             | —           | —             | Vdc           |
| Collector-Emitter Breakdown Voltage<br>( $I_C = 10 \mu\text{A}, V_{BE} = 0$ )                                                                                                                                           | $V_{(BR)CES}$ | 40             | —           | —             | Vdc           |
| Collector-Base Breakdown Voltage<br>( $I_C = 10 \mu\text{A}, I_E = 0$ )                                                                                                                                                 | $V_{(BR)CBO}$ | 40             | —           | —             | Vdc           |
| Emitter-Base Breakdown Voltage<br>( $I_E = 10 \mu\text{A}, I_C = 0$ )                                                                                                                                                   | $V_{(BR)EBO}$ | 4.5            | —           | —             | Vdc           |
| Collector Cutoff Current<br>( $V_{CB} = 20 \text{ Vdc}, I_E = 0$ )<br>( $V_{CB} = 20 \text{ Vdc}, I_E = 0, T_A = 125^\circ\text{C}$ )                                                                                   | $I_{CBO}$     | —              | —           | 0.4<br>30     | $\mu\text{A}$ |
| <b>ON CHARACTERISTICS</b>                                                                                                                                                                                               |               |                |             |               |               |
| DC Current Gain(1)<br>( $I_C = 10 \text{ mAdc}, V_{CE} = 1.0 \text{ Vdc}$ )<br>( $I_C = 10 \text{ mAdc}, V_{CE} = 1.0 \text{ Vdc}, T_A = -55^\circ\text{C}$ )<br>( $I_C = 100 \text{ mAdc}, V_{CE} = 2.0 \text{ Vdc}$ ) | $h_{FE}$      | 40<br>20<br>20 | —<br>—<br>— | 120<br>—<br>— | —             |
| Collector-Emitter Saturation Voltage(1)<br>( $I_C = 10 \text{ mAdc}, I_B = 1.0 \text{ mAdc}$ )                                                                                                                          | $V_{CE(sat)}$ | —              | —           | 0.25          | Vdc           |
| Base-Emitter Saturation Voltage(1)<br>( $I_C = 10 \text{ mAdc}, I_B = 1.0 \text{ mAdc}$ )                                                                                                                               | $V_{BE(sat)}$ | 0.70           | —           | 0.85          | Vdc           |
| <b>SMALL-SIGNAL CHARACTERISTICS</b>                                                                                                                                                                                     |               |                |             |               |               |
| Output Capacitance<br>( $V_{CB} = 5.0 \text{ Vdc}, I_E = 0, f = 1.0 \text{ MHz}$ )                                                                                                                                      | $C_{obo}$     | —              | —           | 4.0           | pF            |
| Small Signal Current Gain<br>( $I_C = 10 \text{ mAdc}, V_{CE} = 10 \text{ Vdc}, f = 100 \text{ MHz}$ )                                                                                                                  | $h_{fe}$      | 5.0            | —           | —             | —             |
| <b>SWITCHING CHARACTERISTICS</b>                                                                                                                                                                                        |               |                |             |               |               |
| Storage Time<br>( $I_{B1} = I_{B2} = I_C = 10 \text{ mAdc}$ )                                                                                                                                                           | $t_s$         | —              | 5.0         | 13            | ns            |
| Turn-On Time<br>( $V_{CC} = 3.0 \text{ Vdc}, I_C = 10 \text{ mAdc}, I_{B1} = 3.0 \text{ mAdc}$ )                                                                                                                        | $t_{on}$      | —              | 8.0         | 12            | ns            |
| Turn-Off Time<br>( $V_{CC} = 3.0 \text{ Vdc}, I_C = 10 \text{ mAdc}, I_{B1} = 3.0 \text{ mAdc}, I_{B2} = 1.5 \text{ mAdc}$ )                                                                                            | $t_{off}$     | —              | 10          | 18            | ns            |

(1) Pulse Test: Pulse Width  $\leq 300 \mu\text{s}$ , Duty Cycle  $\leq 2.0\%$ .

MOTOROLA SMALL-SIGNAL SEMICONDUCTORS

6367254 MOTOROLA SC (XSTRS/R F)

96D 82035 D  
T-29-15

## MAXIMUM RATINGS

| Rating                         | Symbol    | Value | Unit             |
|--------------------------------|-----------|-------|------------------|
| Collector-Emitter Voltage      | $V_{CEO}$ | 60    | Vdc              |
| Collector-Base Voltage         | $V_{CBO}$ | 60    | Vdc              |
| Emitter-Base Voltage           | $V_{EBO}$ | 6.0   | Vdc              |
| Collector Current — Continuous | $I_C$     | 50    | mA <sub>dc</sub> |

## THERMAL CHARACTERISTICS

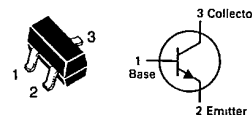
| Characteristic                                                                                               | Symbol          | Max | Unit                       |
|--------------------------------------------------------------------------------------------------------------|-----------------|-----|----------------------------|
| Total Device Dissipation FR-5 Board,*<br>$T_A = 25^\circ\text{C}$<br>Derate above $25^\circ\text{C}$         | $P_D$           | 225 | mW                         |
| Thermal Resistance Junction to Ambient                                                                       | $R_{\theta JA}$ | 556 | $^\circ\text{C}/\text{mW}$ |
| Total Device Dissipation<br>Alumina Substrate,** $T_A = 25^\circ\text{C}$<br>Derate above $25^\circ\text{C}$ | $P_D$           | 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 =  $1.0 \times 0.75 \times 0.62$  in.\*\*Alumina =  $0.4 \times 0.3 \times 0.024$  in. 99.5% alumina.

## DEVICE MARKING

MMBT2484 = 1U

## MMBT2484

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

## LOW NOISE TRANSISTOR

NPN SILICON

Refer to MPSA18 for graphs.

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

| Characteristic                                                                                                                 | Symbol        | Min      | Max      | Unit                                      |
|--------------------------------------------------------------------------------------------------------------------------------|---------------|----------|----------|-------------------------------------------|
| <b>OFF CHARACTERISTICS</b>                                                                                                     |               |          |          |                                           |
| Collector-Emitter Breakdown Voltage<br>( $I_C = 10$ mA <sub>dc</sub> , $I_B = 0$ )                                             | $V_{(BR)CEO}$ | 60       | —        | Vdc                                       |
| Collector-Base Breakdown Voltage<br>( $I_C = 10$ $\mu$ A <sub>dc</sub> , $I_E = 0$ )                                           | $V_{(BR)CBO}$ | 60       | —        | Vdc                                       |
| Emitter-Base Breakdown Voltage<br>( $I_E = 10$ $\mu$ A <sub>dc</sub> , $I_C = 0$ )                                             | $V_{(BR)EBO}$ | 5.0      | —        | Vdc                                       |
| Collector Cutoff Current<br>( $V_{CB} = 45$ Vdc, $I_E = 0$ )<br>( $V_{CB} = 45$ Vdc, $I_E = 0$ , $T_A = 150^\circ\text{C}$ )   | $I_{CBO}$     | —        | 10<br>10 | nA <sub>dc</sub><br>$\mu$ A <sub>dc</sub> |
| Emitter Cutoff Current<br>( $V_{BE} = 5.0$ Vdc, $I_C = 0$ )                                                                    | $I_{EBO}$     | —        | 10       | nA <sub>dc</sub>                          |
| <b>ON CHARACTERISTICS</b>                                                                                                      |               |          |          |                                           |
| DC Current Gain<br>( $I_C = 1.0$ mA <sub>dc</sub> , $V_{CE} = 5.0$ Vdc)<br>( $I_C = 10$ mA <sub>dc</sub> , $V_{CE} = 5.0$ Vdc) | $h_{FE}$      | 250<br>— | —<br>800 | —                                         |
| Collector-Emitter Saturation Voltage<br>( $I_C = 1.0$ mA <sub>dc</sub> , $I_B = 0.1$ mA <sub>dc</sub> )                        | $V_{CE(sat)}$ | —        | 0.35     | Vdc                                       |
| Base-Emitter On Voltage<br>( $I_C = 1.0$ mA <sub>dc</sub> , $V_{CE} = 5.0$ Vdc)                                                | $V_{BE(on)}$  | —        | 0.95     | Vdc                                       |
| <b>SMALL-SIGNAL CHARACTERISTICS</b>                                                                                            |               |          |          |                                           |
| Output Capacitance<br>( $V_{CB} = 5.0$ Vdc, $I_E = 0$ , $f = 1$ MHz)                                                           | $C_{obo}$     | —        | 6.0      | pF                                        |
| Input Capacitance<br>( $V_{BE} = 0.5$ Vdc, $I_C = 0$ , $f = 1$ MHz)                                                            | $C_{ibo}$     | —        | 6.0      | pF                                        |
| Noise Figure<br>( $I_C = 10$ $\mu$ A <sub>dc</sub> , $V_{CE} = 5.0$ Vdc, $R_S = 10$ k $\Omega$ , $f = 1.0$ kHz, BW = 200 Hz)   | NF            | —        | 3.0      | dB                                        |