

6367254 MOTOROLA SC (XSTRS/R F)

96D 81766 D

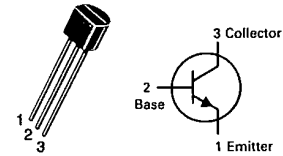
T-29-21

## MAXIMUM RATINGS

| Rating                                                                                 | Symbol         | MPS929      | MPS930A | Unit           |
|----------------------------------------------------------------------------------------|----------------|-------------|---------|----------------|
| Collector-Emitter Voltage                                                              | $V_{CE0}$      | 45          |         | Vdc            |
| Collector-Base Voltage                                                                 | $V_{CBO}$      | 45          | 60      | Vdc            |
| Emitter-Base Voltage                                                                   | $V_{EBO}$      | 5.0         | 6.0     | Vdc            |
| Collector Current — Continuous                                                         | $I_C$          | 100         |         | mA             |
| Total Device Dissipation @ $T_A = 25^\circ\text{C}$<br>Derate above $25^\circ\text{C}$ | $P_D$          | 625<br>5.0  |         | mW<br>mW/°C    |
| Total Device Dissipation @ $T_C = 25^\circ\text{C}$<br>Derate above $25^\circ\text{C}$ | $P_D$          | 1.5<br>12   |         | Watts<br>mW/°C |
| Operating and Storage Junction<br>Temperature Range                                    | $T_J, T_{stg}$ | -55 to +150 |         | °C             |

## THERMAL CHARACTERISTICS

| Characteristic                          | Symbol          | Max  | Unit |
|-----------------------------------------|-----------------|------|------|
| Thermal Resistance, Junction to Case    | $R_{\theta JC}$ | 83.3 | °C/W |
| Thermal Resistance, Junction to Ambient | $R_{\theta JA}$ | 200  | °C/W |

MPS929  
MPS930ACASE 29-04, STYLE 1  
TO-92 (TO-226AA)

## AMPLIFIER TRANSISTOR

NPN SILICON

Refer to MPS3903 for additional 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(1)<br>( $I_C = 10\text{ mA}$ , $I_B = 0$ )            | $V_{(BR)CEO}$ | 45         | —          | Vdc           |
| Collector-Base Breakdown Voltage<br>( $I_C = 10\text{ }\mu\text{A}$ , $I_E = 0$ )         | $V_{(BR)CBO}$ | 45<br>60   | —          | Vdc           |
| Emitter-Base Breakdown Voltage<br>( $I_E = 10\text{ }\mu\text{A}$ , $I_C = 0$ )           | $V_{(BR)EBO}$ | 5.0<br>6.0 | —          | Vdc           |
| Collector Cutoff Current<br>( $V_{CE} = 5.0\text{ Vdc}$ , $I_B = 0$ )                     | $I_{CEO}$     | —          | 2.0        | nA            |
| Collector Cutoff Current<br>( $V_{CB} = 45\text{ Vdc}$ , $I_E = 0$ )                      | $I_{CBO}$     | —          | 10<br>2.0  | nA            |
| Collector Cutoff Current<br>( $V_{CE} = 45\text{ Vdc}$ , $V_{BE} = 0$ )                   | $I_{CES}$     | —          | 10<br>2.0  | nA            |
| ( $V_{CE} = 45\text{ Vdc}$ , $V_{BE} = 0$ , $T_A = 125^\circ\text{C}$ )                   |               | —          | 10<br>2.0  | $\mu\text{A}$ |
| Emitter Cutoff Current<br>( $V_{EB} = 5.0\text{ Vdc}$ , $I_C = 0$ )                       | $I_{EBO}$     | —          | 10<br>2.0  | nA            |
| <b>ON CHARACTERISTICS</b>                                                                 |               |            |            |               |
| DC Current Gain(1)<br>( $I_C = 1.0\text{ }\mu\text{A}$ , $V_{CE} = 5.0\text{ Vdc}$ )      | $h_{FE}$      | 60         | —          | —             |
| ( $I_C = 10\text{ }\mu\text{A}$ , $V_{CE} = 5.0\text{ Vdc}$ )                             |               | 40<br>100  | 120<br>300 |               |
| ( $I_C = 10\text{ }\mu\text{A}$ , $V_{CE} = 5.0\text{ Vdc}$ , $T_A = -55^\circ\text{C}$ ) |               | 10<br>30   | —          |               |
| ( $I_C = 500\text{ }\mu\text{A}$ , $V_{CE} = 5.0\text{ Vdc}$ )                            |               | 60<br>150  | —          |               |
| ( $I_C = 10\text{ mA}$ , $V_{CE} = 5.0\text{ Vdc}$ )                                      |               | —          | 350<br>600 |               |

MOTOROLA SMALL-SIGNAL SEMICONDUCTORS

6367254 MOTOROLA SC (XSTRS/R F)

96D 81767

D

MPS929, MPS930A

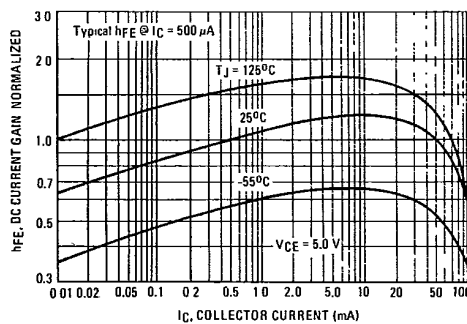
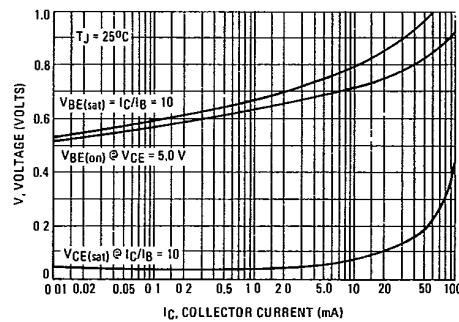
T-29-21

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

| Characteristic                                                                                  |                   | Symbol        | Min        | Max        | Unit |
|-------------------------------------------------------------------------------------------------|-------------------|---------------|------------|------------|------|
| Collector-Emitter Saturation Voltage(1)<br>( $I_C = 10\text{ mAdc}$ , $I_B = 0.5\text{ mAdc}$ ) | MPS929<br>MPS930A | $V_{CE(sat)}$ | —          | 1.0<br>0.5 | Vdc  |
| Base-Emitter Saturation Voltage(1)<br>( $I_C = 10\text{ mAdc}$ , $I_B = 0.5\text{ mAdc}$ )      | MPS929<br>MPS930A | $V_{BE(sat)}$ | 0.6<br>0.7 | 1.0<br>0.9 | Vdc  |

**SMALL-SIGNAL CHARACTERISTICS**

|                                                                                                                                                      |                   |           |           |            |                  |
|------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|-----------|-----------|------------|------------------|
| Current-Gain — Bandwidth Product<br>( $I_C = 500\text{ }\mu\text{Adc}$ , $V_{CE} = 5.0\text{ Vdc}$ , $f = 30\text{ MHz}$ )                           | MPS929<br>MPS930A | $f_T$     | 30<br>45  | —          | MHz              |
| Output Capacitance<br>( $V_{CB} = 5.0\text{ Vdc}$ , $I_E = 0$ , $f = 1.0\text{ MHz}$ )                                                               | MPS929<br>MPS930A | $C_{obo}$ | —         | 8.0<br>6.0 | pF               |
| Input Impedance<br>( $I_E = 1.0\text{ mAdc}$ , $V_{CB} = 5.0\text{ Vdc}$ , $f = 1.0\text{ kHz}$ )                                                    |                   | $h_{ib}$  | 25        | 32         | Ohms             |
| Voltage Feedback Ratio<br>( $I_E = 1.0\text{ mAdc}$ , $V_{CB} = 5.0\text{ Vdc}$ , $f = 1.0\text{ kHz}$ )                                             |                   | $h_{rb}$  | —         | 600        | $\times 10^{-6}$ |
| Small-Signal Current Gain<br>( $I_C = 1.0\text{ mAdc}$ , $V_{CE} = 5.0\text{ Vdc}$ , $f = 1.0\text{ kHz}$ )                                          | MPS929<br>MPS930A | $h_{fe}$  | 60<br>150 | 350<br>600 | —                |
| Output Admittance<br>( $I_E = 1.0\text{ mAdc}$ , $V_{CB} = 5.0\text{ Vdc}$ , $f = 1.0\text{ kHz}$ )                                                  |                   | $h_{ob}$  | —         | 1.0        | $\mu\text{mho}$  |
| Noise Figure<br>( $I_C = 10\text{ }\mu\text{Adc}$ , $V_{CE} = 5.0\text{ Vdc}$ ,<br>$R_S = 10\text{ kohms}$ , $f = 10\text{ Hz to }15.7\text{ kHz}$ ) | MPS929<br>MPS930A | NF        | —         | 4.0<br>3.0 | dB               |

(1) Pulse Test: Pulse Width  $\leq 300\text{ }\mu\text{s}$ , Duty Cycle  $\leq 2.0\%$ .**TYPICAL CHARACTERISTICS****FIGURE 1 — DC CURRENT GAIN****FIGURE 2 — "ON" VOLTAGES**

6367254 MOTOROLA SC (XSTRS/R F)

96D 81768 D

MPS929, MPS930A

T-29-21

FIGURE 3 - COLLECTOR SATURATION REGION

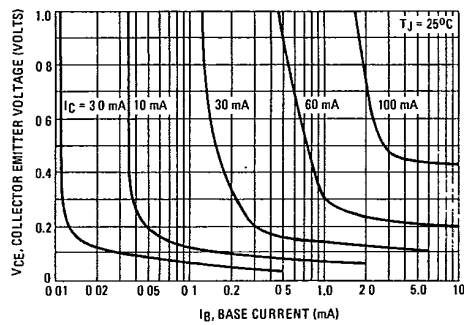


FIGURE 4 - TEMPERATURE COEFFICIENTS

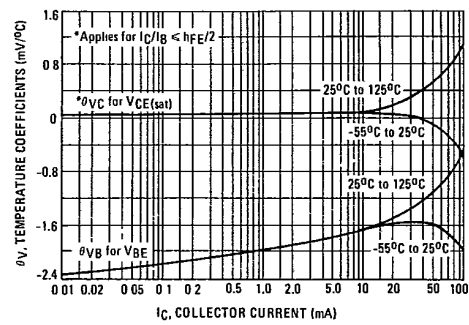


FIGURE 5 - CURRENT-GAIN - BANDWIDTH PRODUCT

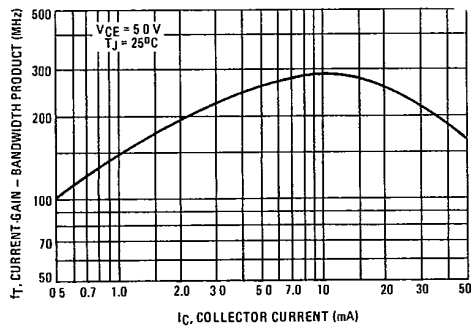
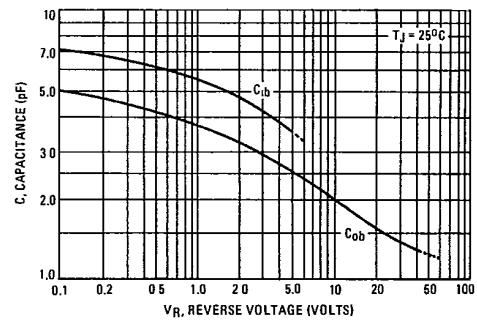


FIGURE 6 - CAPACITANCES



6367254 MOTOROLA SC (XSTRS/R F)

96D 81779

D  
T-29-21

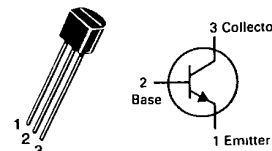
2

## MAXIMUM RATINGS

| Rating                                                                                 | Symbol         | Value       | Unit                          |
|----------------------------------------------------------------------------------------|----------------|-------------|-------------------------------|
| Collector-Emitter Voltage                                                              | $V_{CEO}$      | 25          | Vdc                           |
| Collector-Base Voltage                                                                 | $V_{CBO}$      | 25          | Vdc                           |
| Emitter-Base Voltage                                                                   | $V_{EBO}$      | 5           | Vdc                           |
| Collector Current — Continuous                                                         | $I_C$          | 100         | mA dc                         |
| Total Device Dissipation @ $T_A = 25^\circ\text{C}$<br>Derate above $25^\circ\text{C}$ | $P_D$          | 625<br>5.0  | mW<br>mW/ $^\circ\text{C}$    |
| Total Device Dissipation @ $T_C = 25^\circ\text{C}$<br>Derate above $25^\circ\text{C}$ | $P_D$          | 1.5<br>12   | Watts<br>mW/ $^\circ\text{C}$ |
| Operating and Storage Junction<br>Temperature Range                                    | $T_J, T_{stg}$ | -55 to +150 | $^\circ\text{C}$              |

## THERMAL CHARACTERISTICS

| Characteristic                          | Symbol          | Max | Unit               |
|-----------------------------------------|-----------------|-----|--------------------|
| Thermal Resistance, Junction to Ambient | $R_{\theta JA}$ | 200 | $^\circ\text{C/W}$ |

MPS3390, MPS3391,  
MPS3396  
thru MPS3398CASE 29-04, STYLE 1  
TO-92 (TO-226AA)GENERAL PURPOSE  
TRANSISTOR

NPN SILICON

Refer to 2N3903 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>( $I_C = 1.0 \text{ mA dc}, I_B = 0$ )                        | $V_{(BR)CEO}$ | 25                           | —                                 | V             |
| Collector Cutoff Current<br>( $V_{CB} = 18 \text{ Vdc}, I_E = 0$ )                                   | $I_{CBO}$     | —                            | 0.1                               | $\mu\text{A}$ |
| Emitter Cutoff Current<br>( $V_{EB} = 5.0 \text{ Vdc}, I_C = 0$ )                                    | $I_{EBO}$     | —                            | 0.1                               | $\mu\text{A}$ |
| <b>ON CHARACTERISTICS</b>                                                                            |               |                              |                                   |               |
| DC Current Gain<br>( $V_{CE} = 4.5 \text{ Vdc}, I_C = 2.0 \text{ mA dc}$ )                           | $h_{FE}$      | 400<br>250<br>90<br>55<br>55 | 800<br>500<br>500<br>500<br>800   | —             |
| <b>SMALL-SIGNAL CHARACTERISTICS</b>                                                                  |               |                              |                                   |               |
| Output Capacitance<br>( $V_{CB} = 10 \text{ V}, I_E = 0, f = 1.0 \text{ MHz}$ )                      | $C_{obo}$     | —                            | 10                                | pF            |
| Small-Signal Current Gain<br>( $V_{CE} = 4.5 \text{ V}, I_C = 2.0 \text{ mA}, f = 1.0 \text{ kHz}$ ) | $h_{fe}$      | 400<br>250<br>90<br>55<br>55 | 1250<br>800<br>800<br>800<br>1250 | —             |

6367254 MOTOROLA SC (XSTRS/R F)

96D 81807 D

T-21-21

2

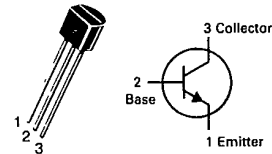
## MAXIMUM RATINGS

| Rating                                                                                 | Symbol         | Value       | Unit           |
|----------------------------------------------------------------------------------------|----------------|-------------|----------------|
| Collector-Emitter Voltage                                                              | $V_{CEO}$      | 25          | Vdc            |
| Collector-Base Voltage                                                                 | $V_{CBO}$      | 25          | Vdc            |
| Emitter-Base Voltage                                                                   | $V_{EBO}$      | 5.0         | Vdc            |
| Collector Current — Continuous                                                         | $I_C$          | 100         | mA dc          |
| Total Device Dissipation @ $T_A = 25^\circ\text{C}$<br>Derate above $25^\circ\text{C}$ | $P_D$          | 625<br>5.0  | mW<br>mW/°C    |
| Total Device Dissipation @ $T_C = 25^\circ\text{C}$<br>Derate above $25^\circ\text{C}$ | $P_D$          | 1.5<br>12   | Watts<br>mW/°C |
| Operating and Storage Junction<br>Temperature Range                                    | $T_J, T_{stg}$ | -55 to +150 | °C             |

## THERMAL CHARACTERISTICS

| Characteristic                          | Symbol          | Max  | Unit |
|-----------------------------------------|-----------------|------|------|
| Thermal Resistance, Junction to Case    | $R_{\theta JC}$ | 83.3 | °C/W |
| Thermal Resistance, Junction to Ambient | $R_{\theta JA}$ | 200  | °C/W |

## MPS5172

CASE 29-04, STYLE 1  
TO-92 (TO-226AA)

## AMPLIFIER TRANSISTOR

NPN SILICON

Refer to MPS3903 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<br>( $I_C = 10 \text{ mA dc}, I_B = 0$ )                                                          | $V_{(BR)CEO}$ | 25  | —    | —         | Vdc                       |
| Collector Cutoff Current<br>( $V_{CB} = 25 \text{ Vdc}, I_E = 0$ )<br>( $V_{CB} = 25 \text{ Vdc}, I_E = 0, T_A = 100^\circ\text{C}$ ) | $I_{CBO}$     | —   | —    | 100<br>10 | nA dc<br>$\mu\text{A dc}$ |
| Collector Cutoff Current<br>( $V_{CE} = 25 \text{ Vdc}, V_{BE} = 0$ )                                                                 | $I_{CES}$     | —   | —    | 100       | nA dc                     |
| Emitter Cutoff Current<br>( $V_{BE} = 5.0 \text{ Vdc}, I_C = 0$ )                                                                     | $I_{EBO}$     | —   | —    | 100       | nA dc                     |
| <b>ON CHARACTERISTICS</b>                                                                                                             |               |     |      |           |                           |
| DC Current Gain(1)<br>( $I_C = 10 \text{ mA dc}, V_{CE} = 10 \text{ Vdc}$ )                                                           | $h_{FE}$      | 100 | —    | 500       | —                         |
| Collector-Emitter Saturation Voltage<br>( $I_C = 10 \text{ mA dc}, I_B = 1.0 \text{ mA dc}$ )                                         | $V_{CE(sat)}$ | —   | —    | 0.25      | Vdc                       |
| Base-Emitter Saturation Voltage<br>( $I_C = 10 \text{ mA dc}, I_B = 1.0 \text{ mA dc}$ )                                              | $V_{BE(sat)}$ | —   | 0.75 | —         | Vdc                       |
| Base-Emitter On Voltage<br>( $I_C = 10 \text{ mA dc}, V_{CE} = 10 \text{ Vdc}$ )                                                      | $V_{BE(on)}$  | 0.5 | —    | 1.2       | Vdc                       |
| <b>SMALL SIGNAL CHARACTERISTICS</b>                                                                                                   |               |     |      |           |                           |
| Current-Gain — Bandwidth Product<br>( $I_C = 2.0 \text{ mA dc}, V_{CE} = 5.0 \text{ Vdc}$ )                                           | $f_T$         | —   | 120  | —         | MHz                       |
| Collector-Base Capacitance<br>( $V_{CB} = 0, I_E = 0, f = 1.0 \text{ MHz}$ )                                                          | $C_{cb}$      | 1.6 | —    | 10        | pF                        |
| Small Signal Current Gain<br>( $I_C = 10 \text{ mA dc}, V_{CE} = 10 \text{ Vdc}, f = 1.0 \text{ kHz}$ )                               | $h_{fe}$      | 100 | —    | 750       | —                         |

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