

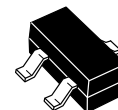
The RF Line NPN Silicon High-Frequency Transistor

Designed for low noise, wide dynamic range front-end amplifiers and low-noise VCO's. Available in a surface-mountable plastic package. This Motorola small-signal plastic transistor offers superior quality and performance at low cost.

- High Gain-Bandwidth Product
 $f_T = 7.0 \text{ GHz (Typ) @ 30 mA}$
- Low Noise Figure
 $NF = 1.7 \text{ dB (Typ) @ 500 MHz}$
- High Gain
 $G_{NF} = 17 \text{ dB (Typ) @ 10 mA/500 MHz}$
- State-of-the-Art Technology
Fine Line Geometry
Ion-Implanted Arsenic Emitters
Gold Top Metallization and Wires
Silicon Nitride Passivation
- Available in tape and reel packaging options:
T1 suffix = 3,000 units per reel

MMBR911LT1

$I_C = 60 \text{ mA}$
**LOW NOISE
HIGH-FREQUENCY
TRANSISTOR
NPN SILICON**



**CASE 318-08, STYLE 6
SOT-23
LOW PROFILE**

MAXIMUM RATINGS

| Rating | Symbol | Value | Unit |
|--|--------------|-------------|-------------|
| Collector-Emitter Voltage | V_{CEO} | 12 | Vdc |
| Collector-Base Voltage | V_{CBO} | 20 | Vdc |
| Emitter-Base Voltage | V_{EBO} | 2.0 | Vdc |
| Collector Current — Continuous | I_C | 60 | mA |
| Power Dissipation @ $T_{case} = 75^\circ\text{C}$ (1) Derate linearly above $T_{case} = 75^\circ\text{C}$ | $P_{D(max)}$ | 333 4.44 | mW mW/°C |
| Storage Temperature | T_{stg} | -55 to +150 | °C |
| Maximum Junction Temperature | T_{Jmax} | 150 | °C |

THERMAL CHARACTERISTICS

| Rating | Symbol | Value | Unit |
|--------------------------------------|-----------------|-------|------|
| Thermal Resistance, Junction to Case | $R_{\theta JC}$ | 225 | °C/W |

DEVICE MARKING

MMBR911LT1 = 7P

NOTE:

1. Case temperature measured on collector lead immediately adjacent to body of package.

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

| Characteristic | Symbol | Min | Typ | Max | Unit |
|--|---------------|-----|-----|-----|------|
| OFF CHARACTERISTICS | | | | | |
| Collector–Emitter Breakdown Voltage ($I_C = 1.0\text{ mA}$, $I_B = 0$) | $V_{(BR)CEO}$ | 12 | — | — | Vdc |
| Collector–Base Breakdown Voltage ($I_C = 0.1\text{ mA}$, $I_E = 0$) | $V_{(BR)CBO}$ | 20 | — | — | Vdc |
| Emitter–Base Breakdown Voltage ($I_E = 0.1\text{ mA}$, $I_C = 0$) | $V_{(BR)EBO}$ | 2.0 | — | — | Vdc |
| Collector Cutoff Current ($V_{CB} = 15\text{ Vdc}$, $I_E = 0$) | I_{CBO} | — | — | 50 | nAdc |

ON CHARACTERISTICS

| | | | | | |
|--|----------|----|---|-----|---|
| DC Current Gain ($I_C = 30\text{ mAdc}$, $V_{CE} = 10\text{ Vdc}$) | h_{FE} | 30 | — | 200 | — |
|--|----------|----|---|-----|---|

DYNAMIC CHARACTERISTICS

| | | | | | |
|--|----------|---|-----|-----|-----|
| Collector–Base Capacitance ($V_{CB} = 10\text{ Vdc}$, $I_E = 0$, $f = 1.0\text{ MHz}$) | C_{cb} | — | — | 1.0 | pF |
| Current Gain–Bandwidth Product ($V_{CE} = 10\text{ Vdc}$, $I_C = 30\text{ mAdc}$, $f = 1.0\text{ GHz}$) | f_T | — | 6.0 | — | GHz |

FUNCTIONAL TESTS

| | | | | | | |
|--|----------------------|----------|---|-----|---|----|
| Gain @ Noise Figure ($I_C = 10\text{ mAdc}$, $V_{CE} = 10\text{ Vdc}$) | $f = 0.5\text{ GHz}$ | G_{NF} | — | 17 | — | dB |
| | $f = 1.0\text{ GHz}$ | | — | 11 | — | |
| Noise Figure ($I_C = 10\text{ mAdc}$, $V_{CE} = 10\text{ Vdc}$) | $f = 0.5\text{ GHz}$ | NF | — | 2.0 | — | dB |
| | $f = 1.0\text{ GHz}$ | | — | 2.9 | — | |

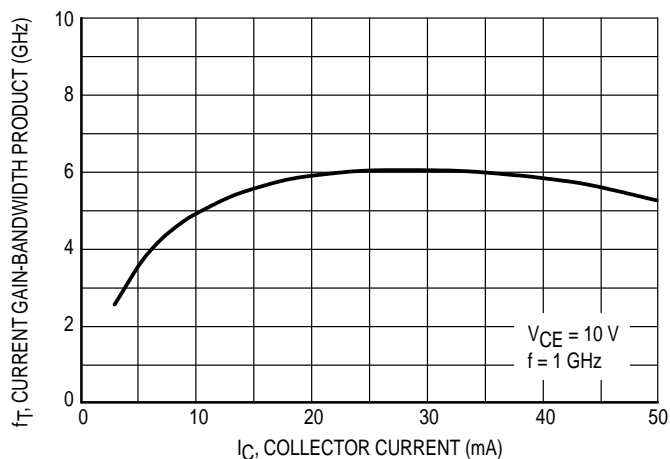


Figure 1. Current Gain–Bandwidth versus Collector Current @ 1.0 GHz

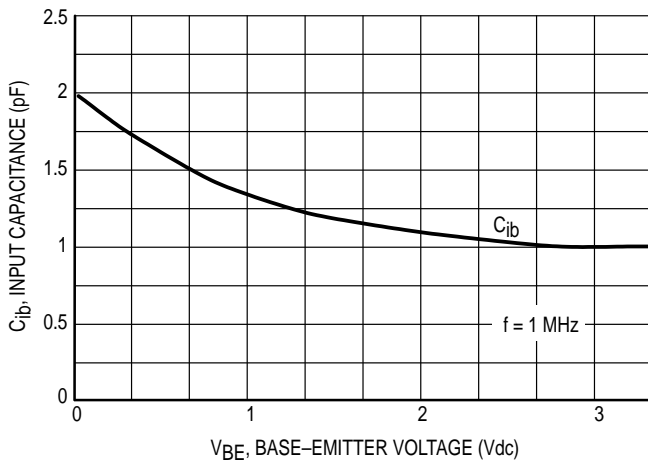


Figure 2. Input Capacitance versus Base-Emitter Voltage

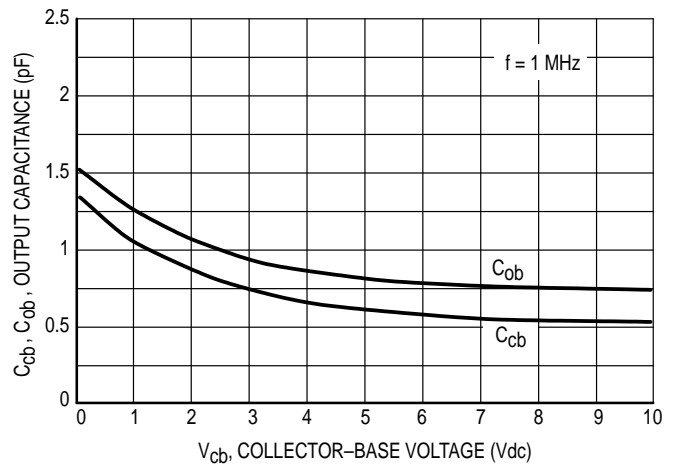


Figure 3. Output Capacitances versus Collector-Base Voltage

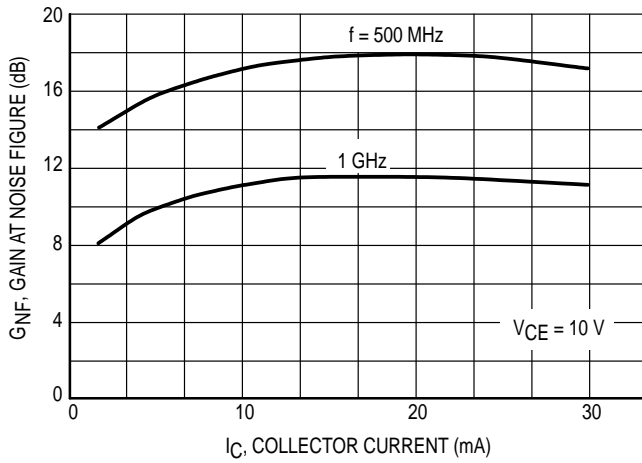


Figure 4. Gain at Noise Figure versus Collector Current

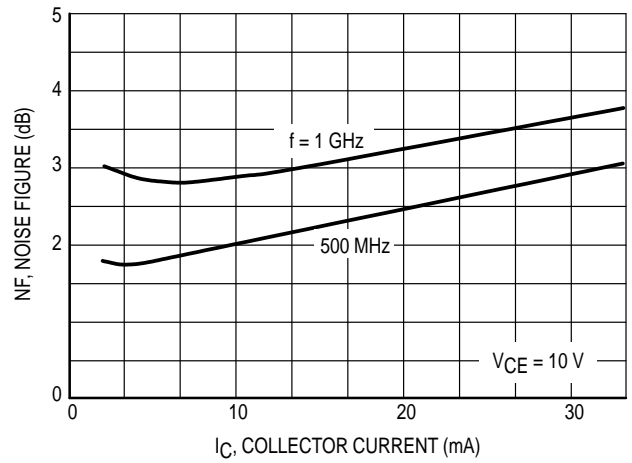


Figure 5. Noise Figure versus Collector Current

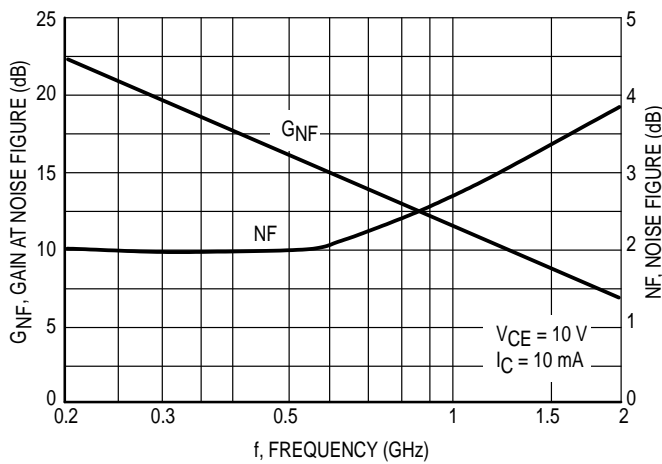


Figure 6. Gain at Noise Figure and Noise Figure versus Frequency

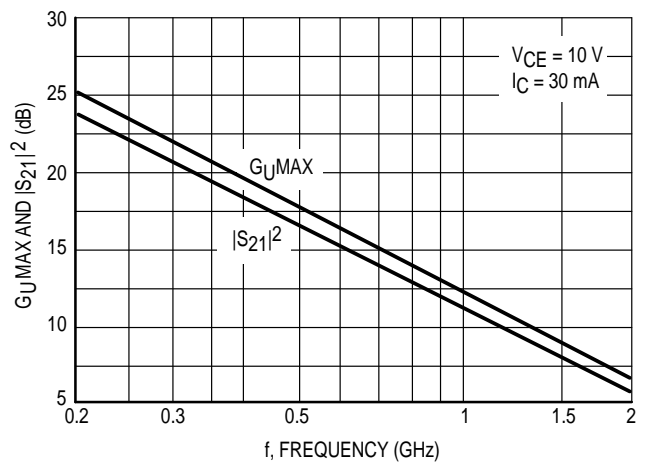


Figure 7. Maximum Unilateral Gain and Insertion Gain versus Frequency

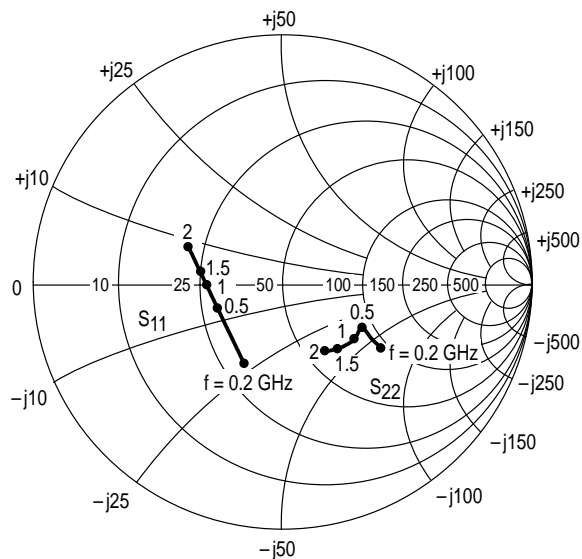


Figure 8. Input and Output Reflection Coefficients versus Frequency
VCE = 10 V, IC = 30 mA

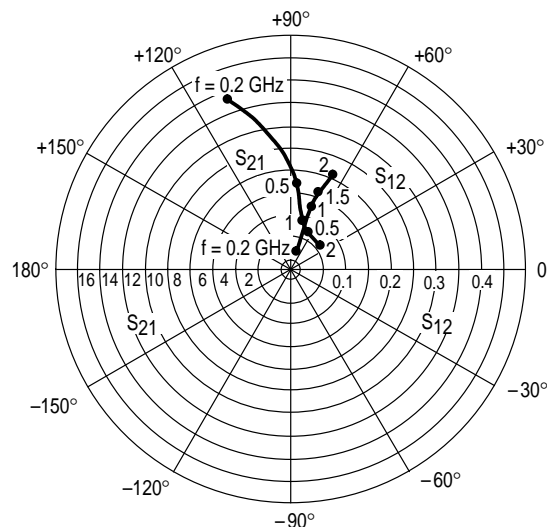
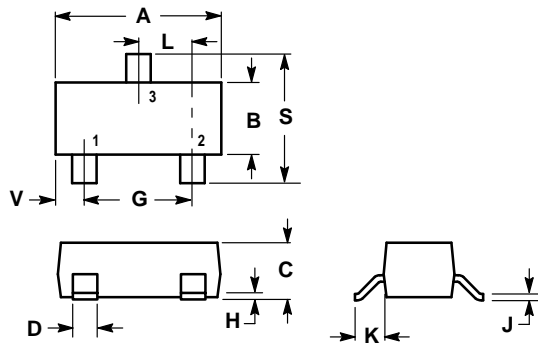


Figure 9. Forward and Reverse Transmission Coefficients versus Frequency
VCE = 10 V, IC = 30 mA

| VCE (Volts) | IC (mA) | f (MHz) | S11 | | S21 | | S12 | | S22 | |
|-------------|---------|---------|------|-------|-------|------|------|------|------|-----|
| | | | S11 | ∠φ | S21 | ∠φ | S12 | ∠φ | S22 | ∠φ |
| 10 | 2.0 | 200 | 0.82 | -45 | 4.14 | 145 | 0.06 | 66 | 0.88 | -16 |
| | | 500 | 0.60 | -96 | 3.23 | 112 | 0.09 | 49 | 0.71 | -27 |
| | | 1000 | 0.47 | -149 | 2.16 | 85 | 0.11 | 49 | 0.62 | -34 |
| | | 1500 | 0.46 | -179 | 1.59 | 71 | 0.13 | 55 | 0.58 | -43 |
| | | 2000 | 0.47 | 162 | 1.35 | 57 | 0.16 | 62 | 0.56 | -51 |
| | 5.0 | 200 | 0.66 | -63 | 8.63 | 134 | 0.05 | 64 | 0.75 | -25 |
| | | 500 | 0.43 | -117 | 5.29 | 100 | 0.07 | 58 | 0.55 | -31 |
| | | 1000 | 0.37 | -163 | 3.05 | 82 | 0.11 | 63 | 0.48 | -36 |
| | | 1500 | 0.38 | 176 | 2.17 | 70 | 0.15 | 65 | 0.45 | -44 |
| | | 2000 | 0.40 | 160 | 1.81 | 57 | 0.19 | 65 | 0.43 | -51 |
| | 10 | 200 | 0.49 | -83 | 12.70 | 124 | 0.04 | 65 | 0.62 | -30 |
| | | 500 | 0.33 | -134 | 6.42 | 94 | 0.07 | 66 | 0.44 | -32 |
| | | 1000 | 0.32 | -171 | 3.53 | 80 | 0.12 | 70 | 0.41 | -36 |
| | | 1500 | 0.35 | 173 | 2.46 | 69 | 0.16 | 69 | 0.38 | -45 |
| | | 2000 | 0.37 | 159 | 2.04 | 58 | 0.20 | 66 | 0.35 | -52 |
| | 20 | 200 | 0.36 | -103 | 15.25 | 114 | 0.03 | 69 | 0.52 | -32 |
| | | 500 | 0.28 | -149 | 6.95 | 90 | 0.06 | 72 | 0.39 | -30 |
| | | 1000 | 0.29 | -176 | 3.73 | 78 | 0.12 | 73 | 0.37 | -35 |
| | | 1500 | 0.33 | 172 | 2.60 | 68 | 0.17 | 71 | 0.34 | -43 |
| | | 2000 | 0.36 | 158 | 2.14 | 58 | 0.21 | 67 | 0.32 | -52 |
| 30 | 200 | 0.32 | -114 | 15.64 | 109 | 0.03 | 71 | 0.48 | -29 | |
| | 500 | 0.27 | -156 | 6.92 | 88 | 0.06 | 73 | 0.38 | -27 | |
| | 1000 | 0.29 | -178 | 3.71 | 78 | 0.12 | 74 | 0.37 | -33 | |
| | 1500 | 0.34 | 170 | 2.58 | 68 | 0.16 | 72 | 0.34 | -44 | |
| | 2000 | 0.37 | 156 | 2.13 | 57 | 0.21 | 68 | 0.32 | -51 | |

Table 1. Common Emitter S-Parameters

PACKAGE DIMENSIONS



NOTES:


1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.

| DIM | INCHES | | MILLIMETERS | |
|-----|--------|--------|-------------|-------|
| | MIN | MAX | MIN | MAX |
| A | 0.1102 | 0.1197 | 2.80 | 3.04 |
| B | 0.0472 | 0.0551 | 1.20 | 1.40 |
| C | 0.0350 | 0.0440 | 0.89 | 1.11 |
| D | 0.0150 | 0.0200 | 0.37 | 0.50 |
| G | 0.0701 | 0.0807 | 1.78 | 2.04 |
| H | 0.0005 | 0.0040 | 0.013 | 0.100 |
| J | 0.0034 | 0.0070 | 0.085 | 0.177 |
| K | 0.0140 | 0.0285 | 0.35 | 0.69 |
| L | 0.0350 | 0.0401 | 0.89 | 1.02 |
| S | 0.0830 | 0.1039 | 2.10 | 2.64 |
| V | 0.0177 | 0.0236 | 0.45 | 0.60 |

STYLE 6:

- PIN 1. BASE
2. EMITTER
3. COLLECTOR

**CASE 318-08
ISSUE AF**

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