# MMBT2222ATT1

**Preferred Device**

# General Purpose Transistor

## NPN Silicon

These transistors are designed for general purpose amplifier applications. They are housed in the SOT−416/SC−75 package which is designed for low power surface mount applications.

**MAXIMUM RATINGS** ($T_A$ = 25°C)

| Rating | Symbol | Max | Unit |
|---|---|---|---|
| Collector−Emitter Voltage | $V_{CEO}$ | 40 | Vdc |
| Collector−Base Voltage | $V_{CBO}$ | 75 | 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 (Note 1) $T_A$ = 25°C | $P_D$ | 150 | mW |
| Thermal Resistance, Junction−to−Ambient | $R_{\theta JA}$ | 833 | °C/W |
| Operating and Storage Junction Temperature Range | $T_J$, $T_{stg}$ | −55 to +150 | °C |

Maximum ratings are those values beyond which device damage can occur. Maximum ratings applied to the device are individual stress limit values (not normal operating conditions) and are not valid simultaneously. If these limits are exceeded, device functional operation is not implied, damage may occur and reliability may be affected.

1. Device mounted on FR4 glass epoxy printed circuit board using the minimum recommended footprint.

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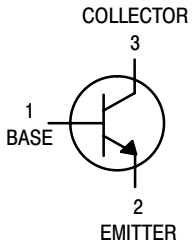
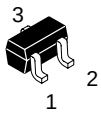
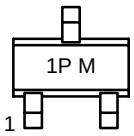



**CASE 463**
**SOT−416/SC−75**
**STYLE 1**

**MARKING DIAGRAM**




1P = Specific Device Code
M = Date Code

**ORDERING INFORMATION**

| Device | Package | Shipping† |
|---|---|---|
| MMBT2222ATT1 | SOT−416 | 3000 / Tape & Reel |

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specification Brochure, BRD8011/D.

**Preferred** devices are recommended choices for future use and best overall value.

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

| Characteristic | Symbol | Min | Max | Unit |
|---|---|---|---|---|
| **OFF CHARACTERISTICS** | | | | |
| Collector−Emitter Breakdown Voltage(1) ($I_C$ = 1.0 mAdc, $I_B$ = 0) | $V_{(BR)CEO}$ | 40 | — | Vdc |
| Collector−Base Breakdown Voltage ($I_C$ = 10 μAdc, $I_E$ = 0) | $V_{(BR)CBO}$ | 75 | — | Vdc |
| Emitter−Base Breakdown Voltage ($I_E$ = 10 μAdc, $I_C$ = 0) | $V_{(BR)EBO}$ | 6.0 | — | Vdc |
| Base Cutoff Current ($V_{CE}$ = 60 Vdc, $V_{EB}$ = 3.0 Vdc) | $I_{BL}$ | — | 20 | nAdc |
| Collector Cutoff Current ($V_{CE}$ = 60 Vdc, $V_{EB}$ = 3.0 Vdc) | $I_{CEX}$ | — | 10 | nAdc |
| **ON CHARACTERISTICS** (Note 2) | | | | |
| DC Current Gain | $H_{FE}$ | | | — |
| ($I_C$ = 0.1 mAdc, $V_{CE}$ = 10 Vdc) | | 35 | — | |
| ($I_C$ = 1.0 mAdc, $V_{CE}$ = 10 Vdc) | | 50 | — | |
| ($I_C$ = 10 mAdc, $V_{CE}$ = 10 Vdc) | | 75 | — | |
| ($I_C$ = 150 mAdc, $V_{CE}$ = 10 Vdc) | | 100 | — | |
| ($I_C$ = 500 mAdc, $V_{CE}$ = 10 Vdc) | | 40 | — | |
| Collector−Emitter Saturation Voltage | $V_{CE(sat)}$ | | | Vdc |
| ($I_C$ = 150 mAdc, $I_B$ = 15 mAdc) | | — | 0.3 | |
| ($I_C$ = 500 mAdc, $I_B$ = 50 mAdc) | | — | 1.0 | |
| Base−Emitter Saturation Voltage | $V_{BE(sat)}$ | | | Vdc |
| ($I_C$ = 150 mAdc, $I_B$ = 15 mAdc) | | 0.6 | 1.2 | |
| ($I_C$ = 500 mAdc, $I_B$ = 50 mAdc) | | — | 2.0 | |
| **SMALL−SIGNAL CHARACTERISTICS** | | | | |
| Current−Gain — Bandwidth Product ($I_C$ = 20 mAdc, $V_{CE}$ = 20 Vdc, f = 100 MHz) | $f_T$ | 300 | — | MHz |
| Output Capacitance ($V_{CB}$ = 10 Vdc, $I_E$ = 0, f = 1.0 MHz) | $C_{obo}$ | — | 8.0 | pF |
| Input Capacitance ($V_{EB}$ = 0.5 Vdc, $I_C$ = 0, f = 1.0 MHz) | $C_{ibo}$ | — | 30 | pF |
| Input Impedance ($V_{CE}$ = 10 Vdc, $I_C$ = 10 mAdc, f = 1.0 kHz) | $h_{ie}$ | 0.25 | 1.25 | k ohms |
| Voltage Feedback Ratio ($V_{CE}$ = 10 Vdc, $I_C$ = 10 mAdc, f = 1.0 kHz) | $h_{re}$ | — | 4.0 | X $10^{-4}$ |
| Small−Signal Current Gain ($V_{CE}$ = 10 Vdc, $I_C$ = 10 mAdc, f = 1.0 kHz) | $h_{fe}$ | 75 | 375 | — |
| Output Admittance ($V_{CE}$ = 10 Vdc, $I_C$ = 10 mAdc, f = 1.0 kHz) | $h_{oe}$ | 25 | 200 | μmhos |
| Noise Figure ($V_{CE}$ = 10 Vdc, $I_C$ = 100 μAdc, $R_S$ = 1.0 k ohms, f = 1.0 kHz) | NF | — | 4.0 | dB |
| **SWITCHING CHARACTERISTICS** | | | | |
| Delay Time ($V_{CC}$ = 3.0 Vdc, $V_{BE}$ = −0.5 Vdc, $I_C$ = 150 mAdc, $I_{B1}$ = 15 mAdc) | $t_d$ | — | 10 | ns |
| Rise Time | $t_r$ | — | 25 | |
| Storage Time ($V_{CC}$ = 30 Vdc, $I_C$ = 150 mAdc, $I_{B1}$ = $I_{B2}$ = 15 mAdc) | $t_s$ | — | 225 | ns |
| Fall Time | $t_f$ | — | 60 | |

2. Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2.0%.

## SWITCHING TIME EQUIVALENT TEST CIRCUITS

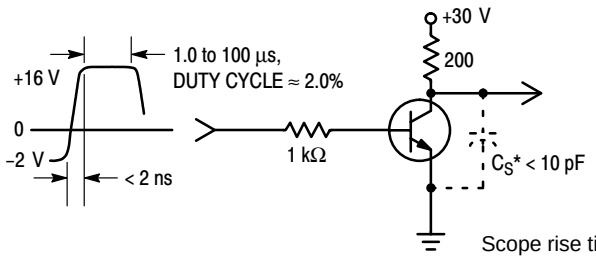
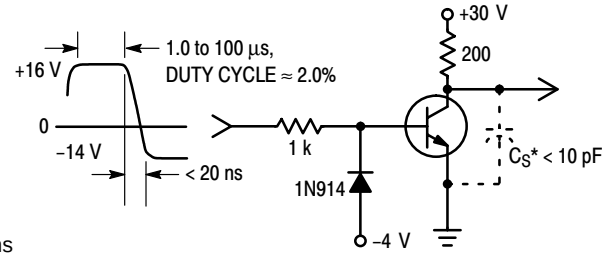



**Figure 1. Turn−On Time**




Scope rise time < 4 ns
*Total shunt capacitance of test jig, connectors, and oscilloscope.

**Figure 2. Turn−Off Time**

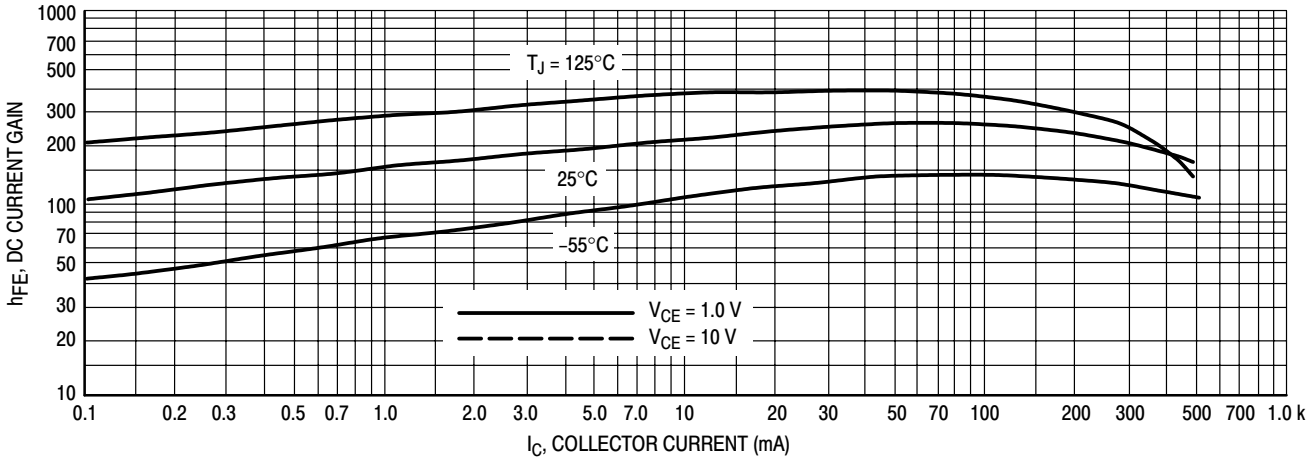



**Figure 3. DC Current Gain**

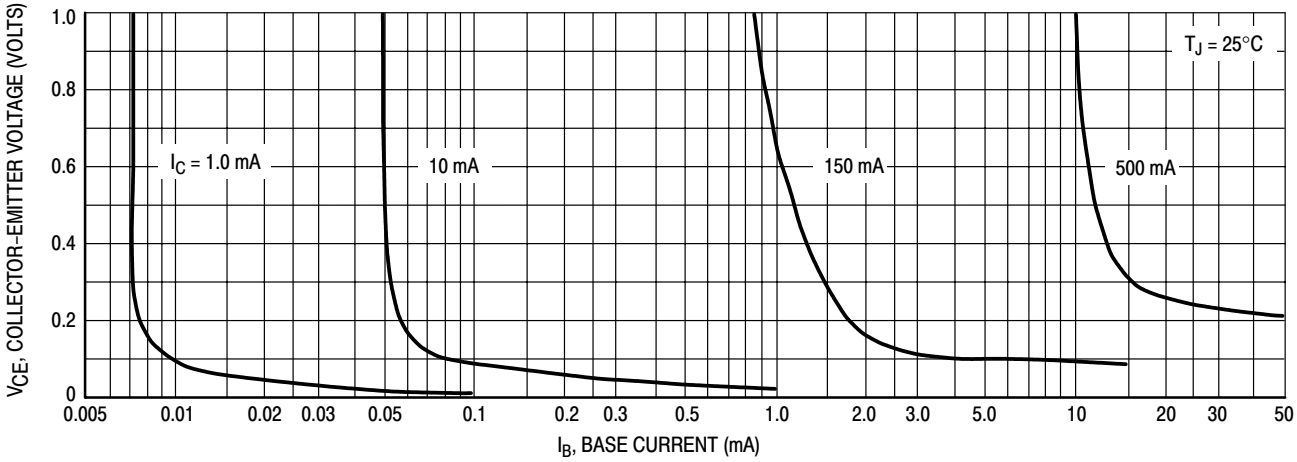



**Figure 4. Collector Saturation Region**

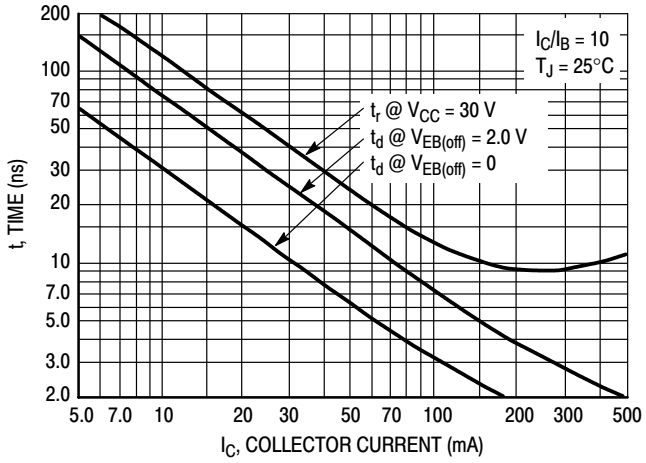



**Figure 5. Turn−On Time**

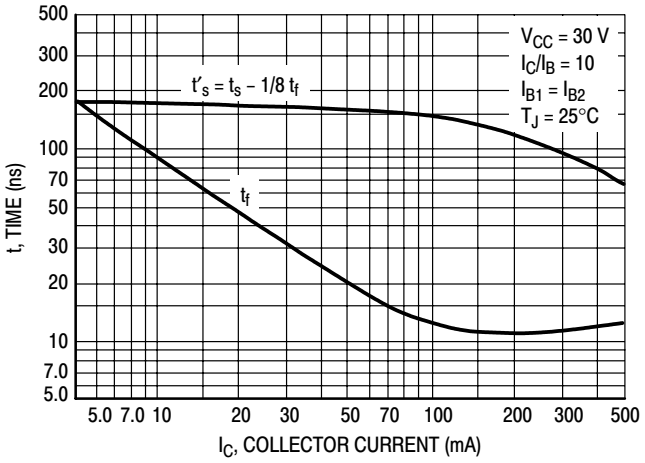



**Figure 6. Turn−Off Time**

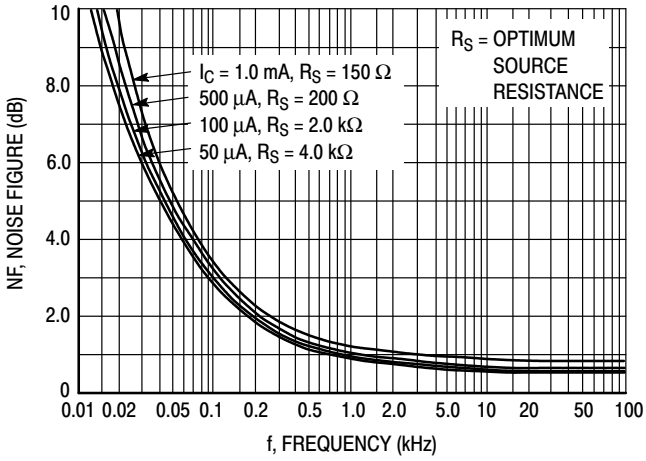



**Figure 7. Frequency Effects**

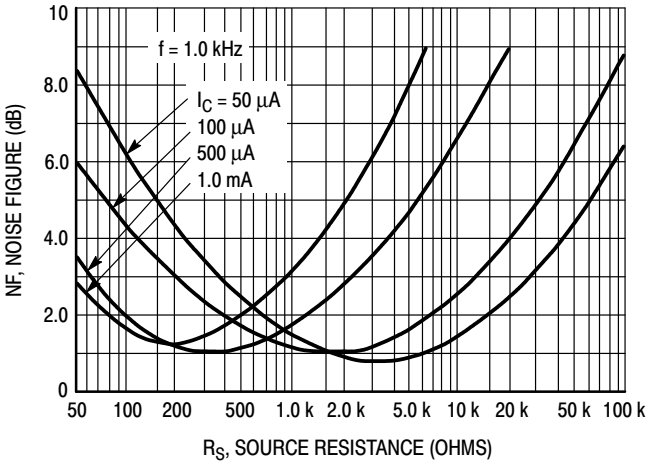



**Figure 8. Source Resistance Effects**

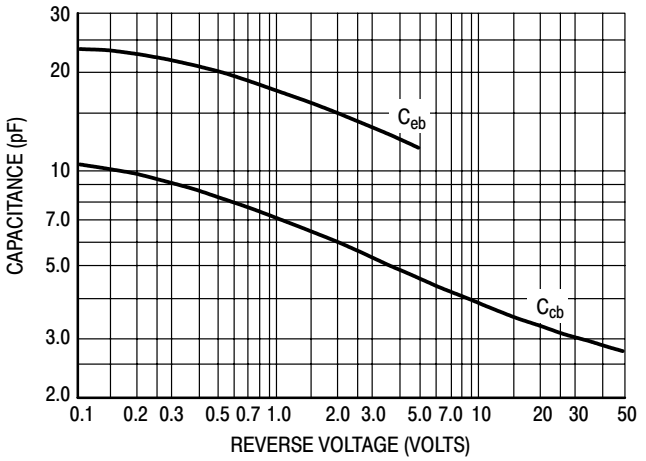



**Figure 9. Capacitances**

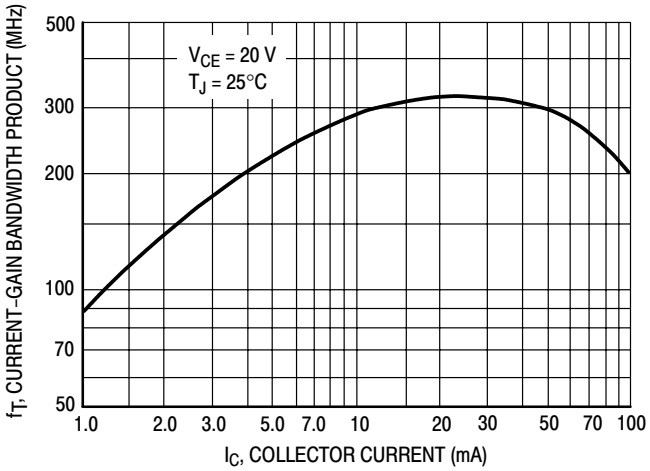



**Figure 10. Current−Gain Bandwidth Product**

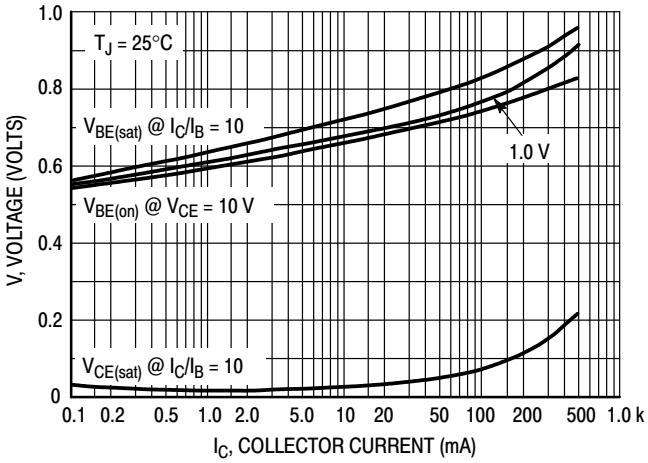



**Figure 11. “On” Voltages**

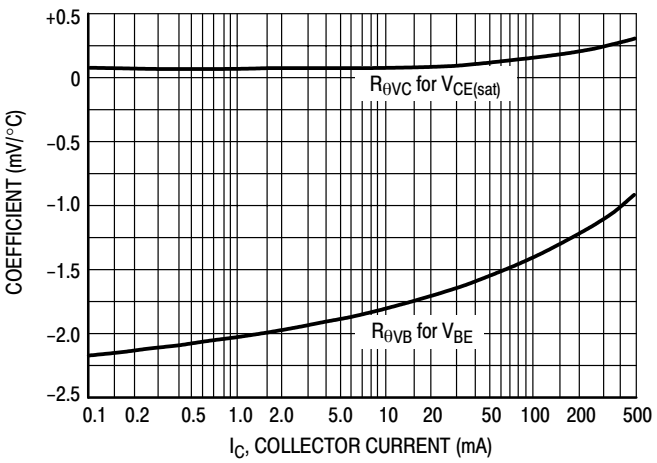
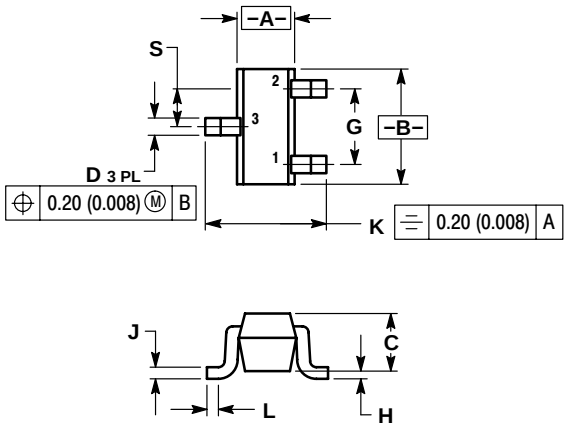



**Figure 12. Temperature Coefficients**

# MMBT2222ATT1

## PACKAGE DIMENSIONS

**SC−75/SOT−416**
CASE 463−01
ISSUE C




NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.

| | MILLIMETERS | | INCHES | |
|---|---|---|---|---|
| DIM | MIN | MAX | MIN | MAX |
| A | 0.70 | 0.90 | 0.028 | 0.035 |
| B | 1.40 | 1.80 | 0.055 | 0.071 |
| C | 0.60 | 0.90 | 0.024 | 0.035 |
| D | 0.15 | 0.30 | 0.006 | 0.012 |
| G | 1.00 BSC | | 0.039 BSC | |
| H | −−− | 0.10 | −−− | 0.004 |
| J | 0.10 | 0.25 | 0.004 | 0.010 |
| K | 1.45 | 1.75 | 0.057 | 0.069 |
| L | 0.10 | 0.20 | 0.004 | 0.008 |
| S | 0.50 BSC | | 0.020 BSC | |

STYLE 1:
PIN 1. BASE
2. EMITTER
3. COLLECTOR



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**MMBT2222ATT1/D**