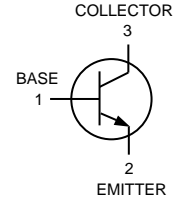
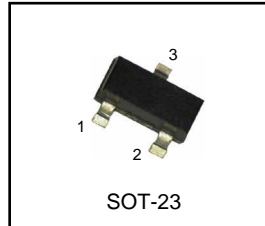


General Purpose Transistor

NPN Silicon

MMBT2222A



MAXIMUM RATINGS

| Rating | Symbol | Value | Unit |
|------------------------------|------------------|-------|-----------------|
| Collector-Emitter Voltage | V _{CEO} | 40 | V _{dc} |
| Collector-Base Voltage | V _{CBO} | 75 | V _{dc} |
| Emitter-Base Voltage | V _{EBO} | 6.0 | V _{dc} |
| Collector Current-Continuous | I _C | 600 | mAdc |

THERMAL CHARACTERISTICS

| Characteristic | Symbol | Max. | Unit |
|--|----------------------------------|-------------|---------------|
| Total Device Dissipation FR-5 Board ⁽¹⁾ T _A =25°C Derate above 25°C | P _D | 225 1.8 | mW mW / °C |
| Thermal Resistance Junction to Ambient | R _{θJA} | 556 | °C / W |
| Total Device Dissipation Alumina Substrate, ⁽²⁾ T _A =25°C Derate above 25°C | P _D | 300 2.4 | mW mW / °C |
| Thermal Resistance Junction to Ambient | R _{θJA} | 417 | °C / W |
| Junction and Storage Temperature | T _J ,T _{STG} | -55 to +150 | °C |

DEVICE MARKING

MMBT2222A=1P

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

| Characteristic | Symbol | Min. | Max. | Unit |
|----------------|--------|------|------|------|
|----------------|--------|------|------|------|

OFF CHARACTERISTICS

| | | | | |
|---|----------------------|--------|------------|-----------------|
| Collector-Emitter Breakdowe Voltage (I _C =10mAdc, I _B =0) | V _{(BR)CEO} | 40 | - | V _{dc} |
| Collector-Emitter Breakdowe Voltage (I _C =10uAdc, I _E =0) | V _{(BR)CBO} | 75 | - | V _{dc} |
| Emitter - Base Breakdowe Voltage (I _E =10 uAdc, I _C =0) | V _{(BR)EBO} | 6.0 | - | V _{dc} |
| Collector Cutoff Current (V _{CE} =60 Vdc, V _{EB} (off)=3.0 Vdc) | I _{CEX} | - | 10 | nAdc |
| Collector Cutoff Current (V _{CB} =60 Vdc, I _E =0) (V _{CB} =60 Vdc, I _E =0, T _A =125°C) | I _{CBO} | - - | 0.01 10 | uAdc |
| Emitter Cutoff Current (V _{EB} =3.0 Vdc, I _C =0) | I _{EBO} | - | 100 | nAdc |
| Base Cutoff Current (V _{CE} =60 V, V _{EB} (off)=3.0 Vdc) | I _{BL} | - | 20 | nAdc |

(1) FR-5=1.0 x 0.75 x 0.062in.

(2) Alumina=0.4 x 0.3 x 0.024in. 99.5% alumina.

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

| Characteristic | Symbol | Min. | Max. | Unit |
|---|---------------|---|-----------------------------------|------|
| ON CHARACTERISTICS⁽³⁾ | | | | |
| DC Current Gain ($I_C=0.1\text{ mAdc}$, $V_{CE}=10\text{ Vdc}$) ($I_C=1.0\text{ mAdc}$, $V_{CE}=10\text{ Vdc}$) ($I_C=10\text{ mAdc}$, $V_{CE}=10\text{ Vdc}$) ($I_C=10\text{ mAdc}$, $V_{CE}=10\text{ Vdc}$, $T_A=-55^{\circ}\text{C}$) ($I_C=150\text{ mAdc}$, $V_{CE}=10\text{ Vdc}$) ⁽³⁾ ($I_C=150\text{ mAdc}$, $V_{CE}=1.0\text{ Vdc}$) ⁽³⁾ ($I_C=500\text{ mAdc}$, $V_{CE}=10\text{ Vdc}$) ⁽³⁾ | HFE | 35 50 75 35 100 50 40 | - - - - 300 - - | - |
| Collector-Emitter Saturation Voltage ⁽³⁾ ($I_C=150\text{ mAdc}$, $I_B=15\text{ mAdc}$) ($I_C=500\text{ mAdc}$, $I_B=50\text{ mAdc}$) | $V_{CE(sat)}$ | - - | 0.3 1.0 | Vdc |
| Base-Emitter Saturation Voltage ⁽³⁾ ($I_C=150\text{ mAdc}$, $I_B=15\text{ mAdc}$) ($I_C=500\text{ mAdc}$, $I_B=50\text{ mAdc}$) | $V_{BE(sat)}$ | 0.6 - | 1.2 2.0 | Vdc |

SMALL-SIGNAL CHARACTERISTIC

| | | | | |
|--|--------|-------------|-------------|------------------|
| Current-Gain-Bandwidth Product ⁽⁴⁾ ($I_C=20\text{ mAdc}$, $V_{CE}=20\text{ Vdc}$, $f=100\text{ MHz}$) | fT | 300 | - | MHZ |
| Output Capacitance ($V_{CB}=10\text{ Vdc}$, $I_E=0$, $f=1.0\text{ MHz}$) | Cobo | - | 8.0 | pF |
| Input Capacitance ($V_{EB}=0.5\text{ Vdc}$, $I_C=0$, $f=1.0\text{ MHz}$) | Cibo | - | 25 | pF |
| Input Impedance ($V_{CE}=10\text{ Vdc}$, $I_C=1.0\text{ mAdc}$, $f=1.0\text{ kHz}$) ($V_{CE}=10\text{ Vdc}$, $I_C=10\text{ mAdc}$, $f=1.0\text{ kHz}$) | hie | 2.0 0.25 | 8.0 1.25 | k ohms |
| Voltage Feedback Ratio ($V_{CE}=10\text{ Vdc}$, $I_C=1.0\text{ mAdc}$, $f=1.0\text{ kHz}$) ($V_{CE}=10\text{ Vdc}$, $I_C=10\text{ mAdc}$, $f=1.0\text{ kHz}$) | hre | - - | 8.0 4.0 | $\times 10^{-4}$ |
| Small-Signal Current Gain ($V_{CE}=10\text{ Vdc}$, $I_C=1.0\text{ mAdc}$, $f=1.0\text{ kHz}$) ($V_{CE}=10\text{ Vdc}$, $I_C=10\text{ mAdc}$, $f=1.0\text{ kHz}$) | hfe | 50 75 | 300 375 | - |
| Output Admittance ($V_{CE}=10\text{ Vdc}$, $I_C=1.0\text{ mAdc}$, $f=1.0\text{ kHz}$) ($V_{CE}=10\text{ Vdc}$, $I_C=10\text{ mAdc}$, $f=1.0\text{ kHz}$) | hoe | 5.0 25 | 35 200 | u mhos |
| Collector Base Time Constant ($V_{CB}=10\text{ Vdc}$, $I_C=100\text{ uAdc}$, $R_s = 1.0\text{ k ohms}$, $f=1.0\text{ kHz}$) | rb, Cc | - | 150 | ps |
| Noise Figure ($V_{CE}=10\text{ Vdc}$, $I_C=100\text{ uAdc}$, $R_s=1.0\text{ k ohm}$, $f=1.0\text{ kHz}$) | NF | - | 4.0 | dB |

SWITCHING CHARACTERISTICS

| | | | | | |
|--------------|--|----|---|-----|----|
| Delay Time | ($V_{CC}=30\text{ Vdc}$, $V_{BE}(\text{off}) = -0.5\text{ Vdc}$, $I_C=150\text{ mAdc}$, $I_{B1} = 15\text{ mAdc}$) | td | - | 10 | nS |
| Rise Time | | tr | - | 25 | |
| Storage Time | ($V_{CC}=30\text{ Vdc}$, $I_C = 150\text{ mAdc}$, $I_{B1} = I_{B2} = 15\text{ mAdc}$) | ts | - | 225 | nS |
| Fall Time | | tf | - | 60 | |

(3) Pulse Test : Pulse Width $\leq 300\text{ uS}$, Duty Cycle $\leq 2.0\%$.

(2) fT is defined as the frequency at which hfe extrapolates to unity.

SWITCHING TIME EQUIVALENT TEST CIRCUITS

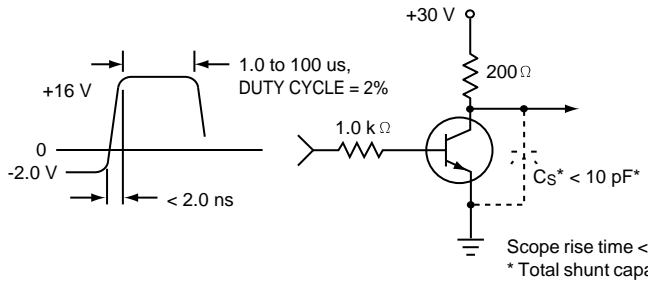


Figure 1. Turn-On Time

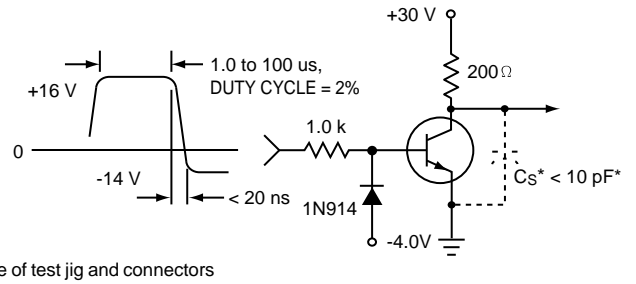


Figure 2. Turn-Off Time

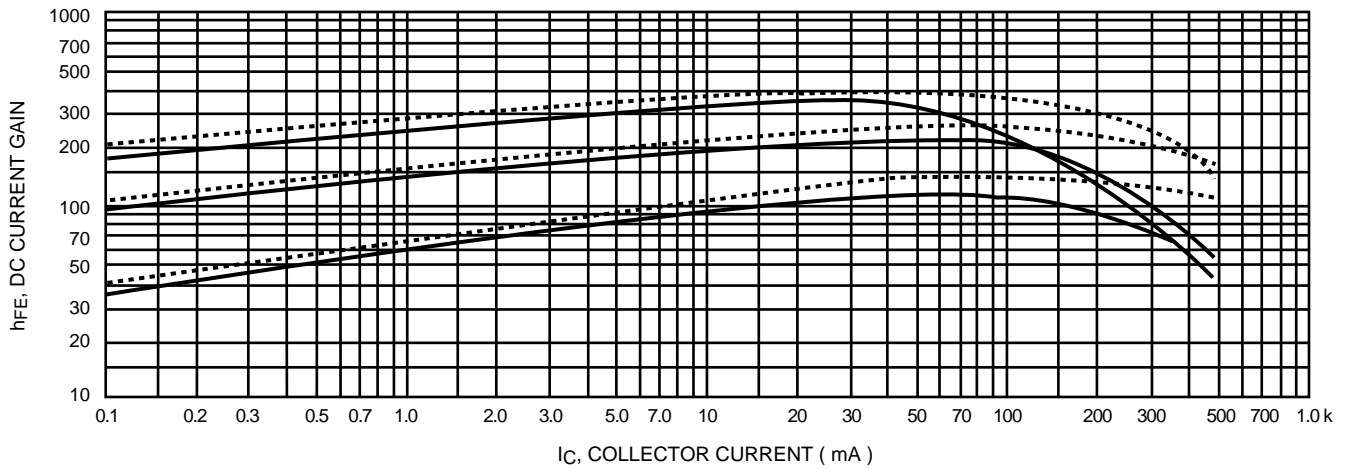


Figure 3. DC Current Gain

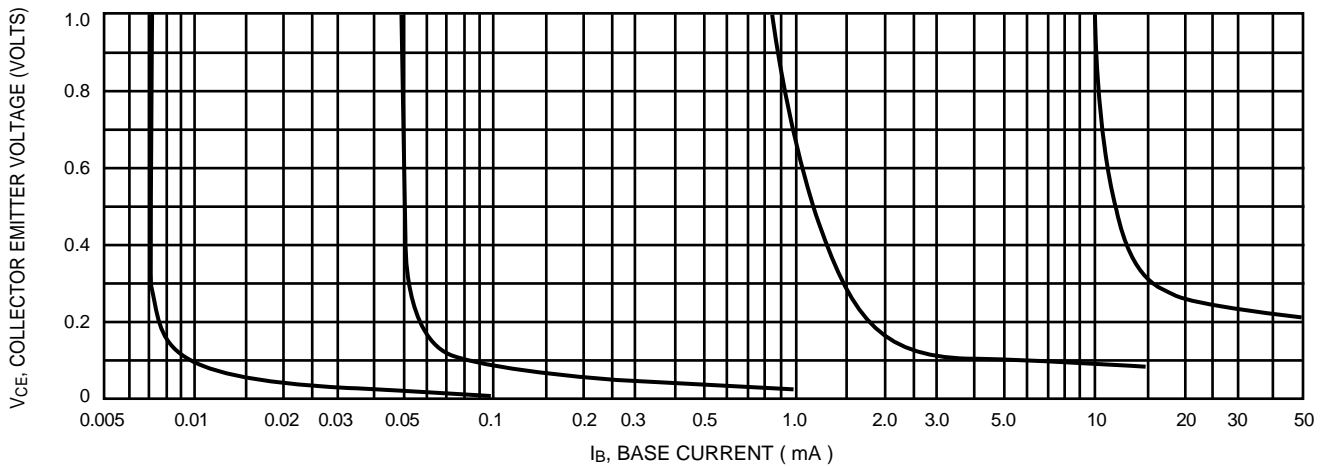


Figure 4. Collector Saturation Region

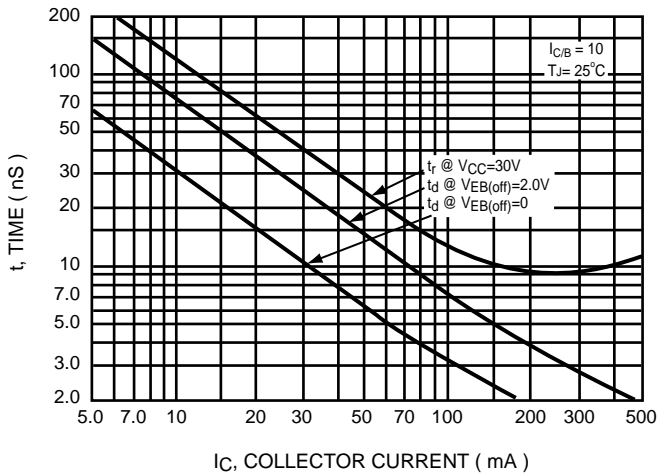


Figure 5. Turn - On Time

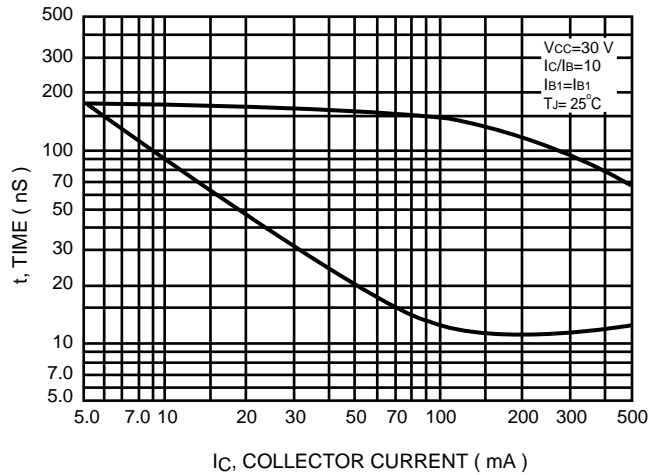


Figure 6. Turn - Off Time

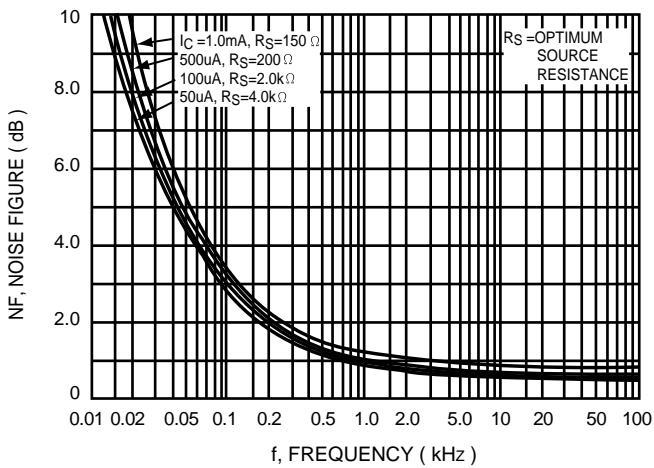


Figure 7. Frequency Effects

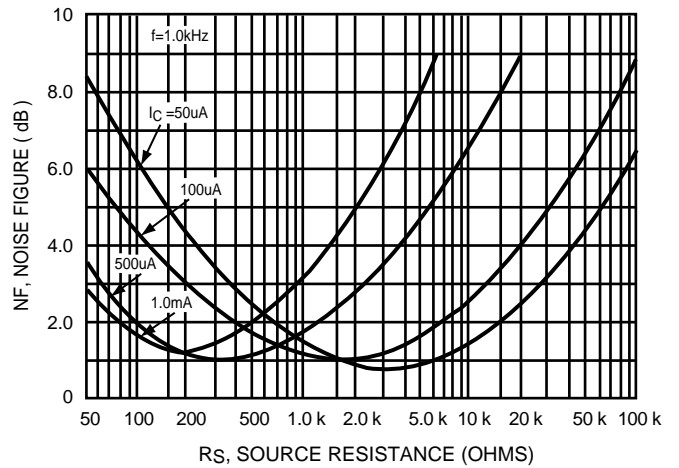


Figure 8. Source Resistance Effects

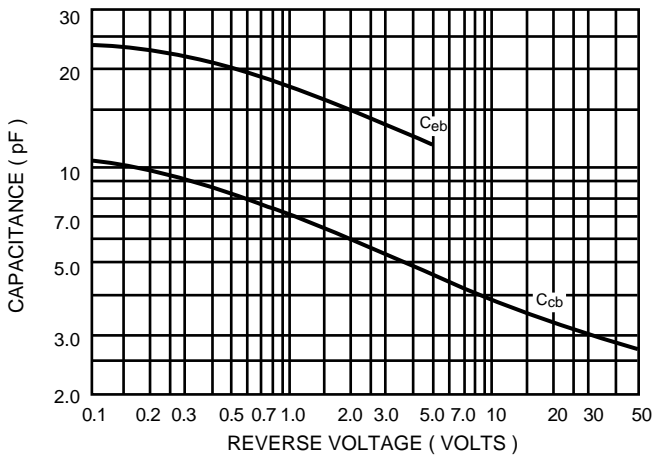


Figure 9. Capacitances

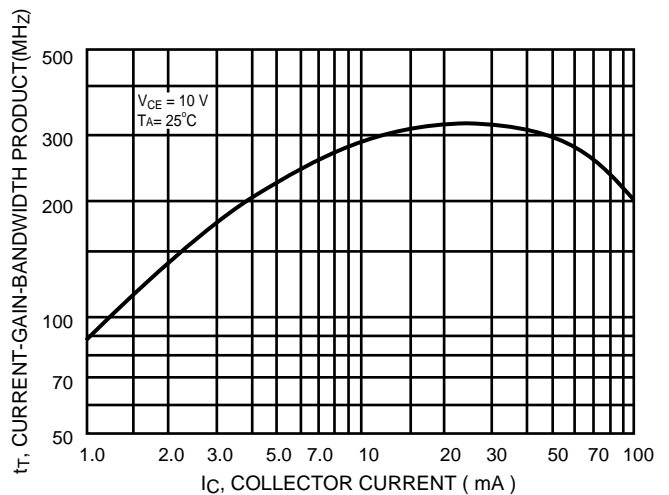


Figure 10. Current-Gain Bandwidth Product

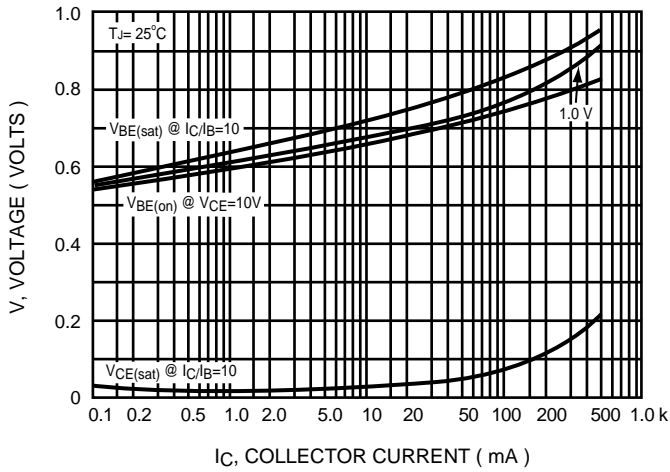


Figure 11. " On " Voltage

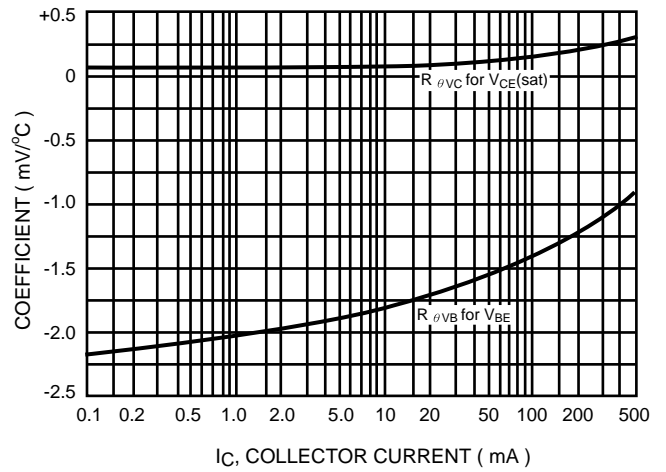


Figure 12. Temperature Coefficients