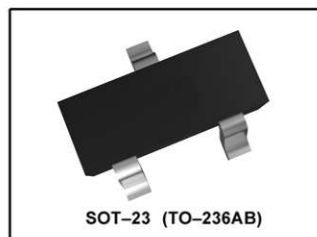
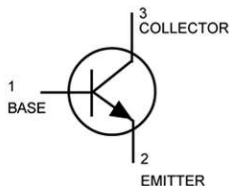


NPN Silicon



● MAXIMUM RATINGS

| Rating | Symbol | 2222 | 2222A | Unit |
|--------------------------------|-----------|------|-------|------|
| Collector–Emitter Voltage | V_{CEO} | 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 | 600 | mAdc |

● THERMAL CHARACTERISTICS

| Characteristic | Symbol | Max | Unit |
|---|-----------------|-------------|---------------------------|
| Total Device Dissipation FR– 5 Board, (1) $T_A = 25^\circ\text{C}$ | P_D | 225 | mW |
| Derate above 25°C | | 1.8 | mW/ $^\circ\text{C}$ |
| Thermal Resistance, Junction to Ambient | $R_{\theta JA}$ | 556 | $^\circ\text{C}/\text{W}$ |
| Total Device Dissipation Alumina Substrate, (2) $T_A = 25^\circ\text{C}$ | P_D | 300 | mW |
| Derate above 25°C | | 2.4 | mW/ $^\circ\text{C}$ |
| Thermal Resistance, Junction to Ambient | $R_{\theta JA}$ | 417 | $^\circ\text{C}/\text{W}$ |
| Junction and Storage Temperature | T_J, T_{stg} | -55 to +150 | $^\circ\text{C}$ |

● DEVICE MARKING

MMBT2222LT1 = M1B; MMBT2222ALT1 = 1P;

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

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

OFF CHARACTERISTICS

| | | | | | |
|---|-----------------------|---------------|------------|------|-----------------|
| Collector–Emitter Breakdown Voltage ($I_C = 10\text{ mAdc}, I_E = 0$) | MMBT2222 MMBT2222A | $V_{(BR)CEO}$ | 30 40 | — | Vdc |
| Collector–Base Breakdown Voltage ($I_C = 10\text{ }\mu\text{Adc}, I_E = 0$) | MMBT2222 MMBT2222A | $V_{(BR)CBO}$ | 60 75 | — | Vdc |
| Emitter–Base Breakdown Voltage ($I_E = 10\text{ }\mu\text{Adc}, I_C = 0$) | MMBT2222 MMBT2222A | $V_{(BR)EBO}$ | 5.0 6.0 | — | Vdc |
| Collector Cutoff Current ($V_{CE} = 60\text{ Vdc}, I_{E(off)} = 3.0\text{ Vdc}$) | MMBT2222A | I_{CEX} | — | 10 | nAdc |
| Collector Cutoff Current ($V_{CB} = 50\text{ Vdc}, I_E = 0$) | MMBT2222 | I_{CBO} | — | 0.01 | μAdc |
| ($V_{CB} = 60\text{ Vdc}, I_E = 0$) | MMBT2222A | | — | 0.01 | |
| ($V_{CB} = 50\text{ Vdc}, I_E = 0, T_A = 125^\circ\text{C}$) | MMBT2222 | | — | 10 | |
| ($V_{CB} = 60\text{ Vdc}, I_E = 0, T_A = 125^\circ\text{C}$) | MMBT2222A | | — | 10 | |
| Emitter Cutoff Current ($V_{EB} = 3.0\text{ Vdc}, I_C = 0$) | MMBT2222A | I_{EBO} | — | 100 | nAdc |
| Base Cutoff Current ($V_{CE} = 60\text{ Vdc}, V_{E(off)} = 3.0\text{ Vdc}$) | MMBT2222A | I_{BL} | — | 20 | nAdc |

1. FR–5 = $1.0 \times 0.75 \times 0.062\text{ in.}$

2. Alumina = $0.4 \times 0.3 \times 0.024\text{ in.}$ 99.5% alumina.



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

| Characteristic | Symbol | Min | Max | Unit | |
|--|----------------------|----------------|-----|-----------------|---|
| DC CHARACTERISTICS | | | | | |
| DC Current Gain (I _C = 0.1 mA _{dc} , V _{CE} = 10 V _{dc}) | h _{FE} | 35 | — | — | |
| (I _C = 1.0 mA _{dc} , V _{CE} = 10 V _{dc}) | | 50 | — | — | |
| (I _C = 10 mA _{dc} , V _{CE} = 10 V _{dc}) | | 75 | — | — | |
| (I _C = 10 mA _{dc} , V _{CE} = 10 V _{dc} , T _A = -55°C) | | MMBT2222A only | 35 | — | — |
| (I _C = 150 mA _{dc} , V _{CE} = 10 V _{dc}) (3) | | 100 | 300 | — | |
| (I _C = 150 mA _{dc} , V _{CE} = 1.0 V _{dc}) (3) | | 50 | — | — | |
| (I _C = 500 mA _{dc} , V _{CE} = 10 V _{dc}) (3) | MMBT2222 | 30 | — | — | |
| | MMBT2222A | 40 | — | — | |
| Collector–Emitter Saturation Voltage(3) (I _C = 150 mA _{dc} , I _B = 15 mA _{dc}) | V _{CE(sat)} | — | 0.4 | V _{dc} | |
| | | MMBT2222 | — | 0.3 | |
| (I _C = 500mA _{dc} , I _B = 50 mA _{dc}) | | MMBT2222 | — | 1.6 | |
| | | MMBT2222A | — | 1.0 | |
| Base–Emitter Saturation Voltage (I _C = 150 mA _{dc} , I _B = 15 mA _{dc}) | V _{BE(sat)} | — | 1.3 | V _{dc} | |
| | | MMBT2222 | 0.6 | 1.2 | |
| (I _C = 500 mA _{dc} , I _B = 50 mA _{dc}) | | MMBT2222 | — | 2.6 | |
| | | MMBT2222A | — | 2.0 | |

SMALL–SIGNAL CHARACTERISTICS

| | | | | | |
|--|-----------|---------------------------------|------|------|--------------------|
| Current–Gain — Bandwidth Product(4) (I _C = 20mA _{dc} , V _{CE} = 20V _{dc} , f = 100MHz) | MMBT2222 | f _T | 250 | — | MHz |
| | MMBT2222A | | 300 | — | |
| Output Capacitance(V _{CB} = 10 V _{dc} , I _E = 0, f = 1.0 MHz) | | C _{obo} | — | 8.0 | pF |
| Input Capacitance (V _{EB} = 0.5 V _{dc} , I _C = 0, f = 1.0 MHz) | MMBT2222 | C _{ibo} | — | 30 | pF |
| | MMBT2222A | | — | 25 | |
| Input Impedance(V _{CE} = 10 V _{dc} , I _C = 1.0 mA _{dc} , f = 1.0 kHz) | MMBT2222A | h _{ie} | 2.0 | 8.0 | kΩ |
| (V _{CE} = 10 V _{dc} , I _C = 10 mA _{dc} , f = 1.0 kHz) | MMBT2222A | | 0.25 | 1.25 | |
| Voltage Feedback Ratio(V _{CE} = 10 V _{dc} , I _C = 1.0 mA _{dc} , f = 1.0 kHz) | MMBT2222A | h _{re} | — | 8.0 | X 10 ⁻⁴ |
| (V _{CE} = 10 V _{dc} , I _C = 10 mA _{dc} , f = 1.0 kHz) | MMBT2222A | | — | 4.0 | |
| Small–Signal Current Gain(V _{CE} = 10 V _{dc} , I _C = 1.0 mA _{dc} , f = 1.0 kHz) | MMBT2222A | h _{fe} | 50 | 300 | — |
| (V _{CE} = 10 V _{dc} , I _C = 10 mA _{dc} , f = 1.0 kHz) | MMBT2222A | | 75 | 375 | |
| Output Admittance(V _{CE} = 10 V _{dc} , I _C = 1.0 mA _{dc} , f = 1.0 kHz) | MMBT2222A | h _{oe} | 5.0 | 35 | μmhos |
| (V _{CE} = 10 V _{dc} , I _C = 10 mA _{dc} , f = 1.0 kHz) | MMBT2222A | | 25 | 200 | |
| Current Base Time Constant (V _{CB} = 20 V _{dc} , I _E = 20 mA _{dc} , f = 31.8 MHz) | MMBT2222A | r _b , C _c | — | 150 | ps |
| Noise Figure(V _{CE} = 10 V _{dc} , I _C = 10 mA _{dc} , R _S = 1.0 kΩ, f = 1.0 kHz) | MMBT2222A | NF | — | 4.0 | dB |

● SWITCHING CHARACTERISTICS

| | | | | | |
|--------------|--|----------------|---|-----|----|
| Delay Time | (V _{CC} = 30 V _{dc} , V _{EB(off)} = -0.5 V _{dc} I _C = 150 mA _{dc} , I _{B1} = 15 mA _{dc}) | t _d | — | 10 | ns |
| Rise Time | | t _r | — | 25 | |
| Storage Time | (V _{CC} = 30 V _{dc} , I _C = 150 mA _{dc} I _{B1} = I _{B2} = 15 mA _{dc}) | t _s | — | 225 | ns |
| Fall Time | | t _f | — | 60 | |

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

4. f_T is defined as the frequency at which |h_{ie}| extrapolates to unity.



SWITCHING TIME EQUIVALENT TEST CIRCUITS

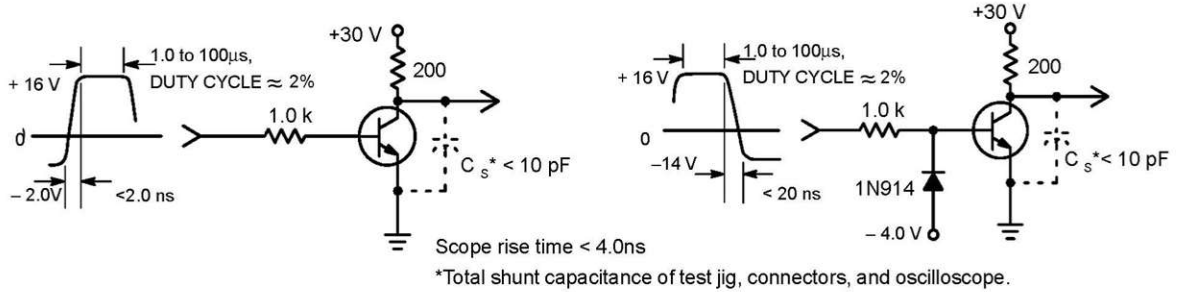


Figure 1. Turn-On Time

Figure 2. Turn-Off Time

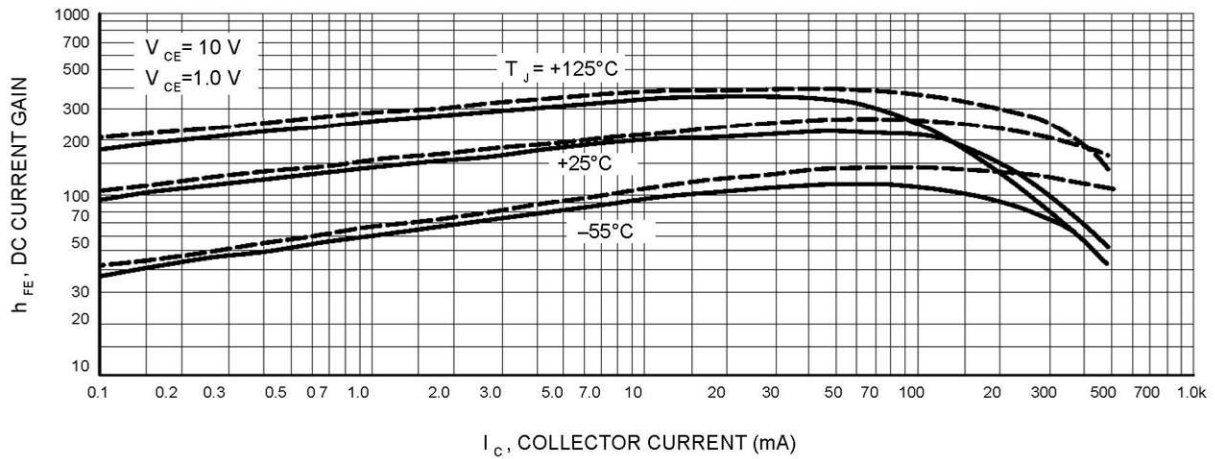


Figure 3. DC Current Gain

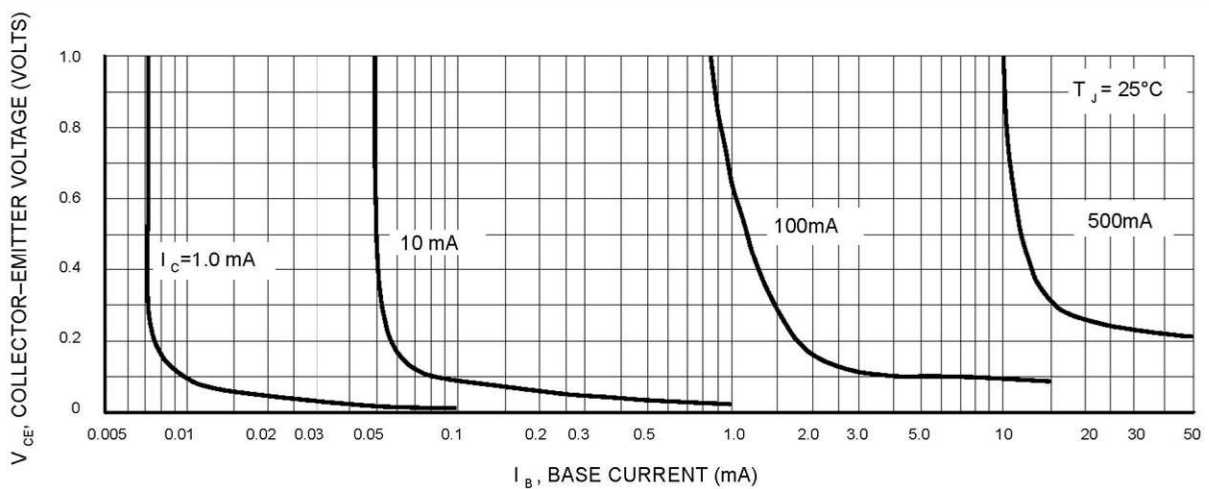


Figure 4. Collector Saturation Region



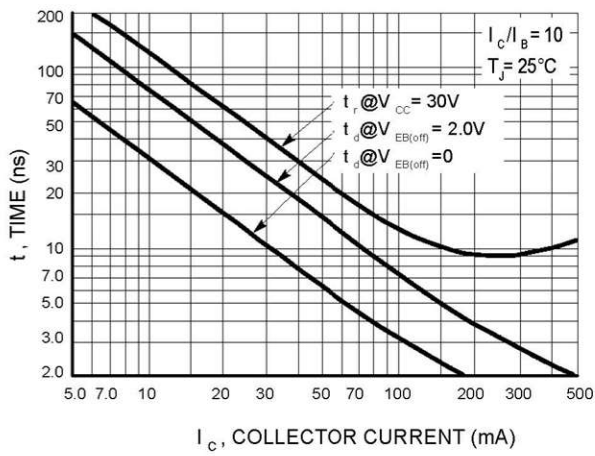


Figure 5. Turn-On Time

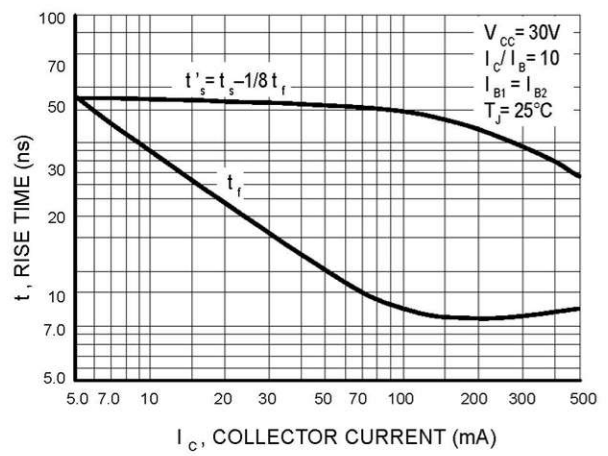


Figure 6. Turn - Off Time

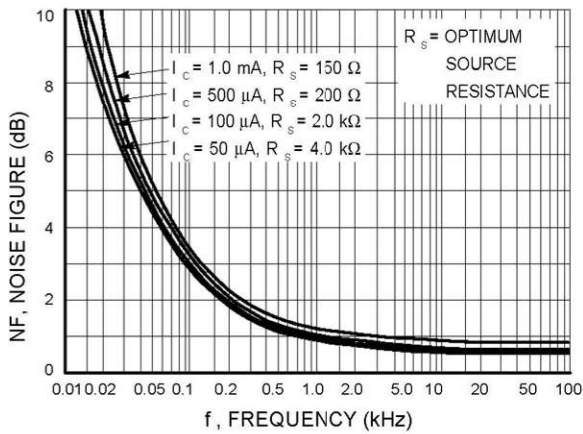


Figure 7. Frequency Effects

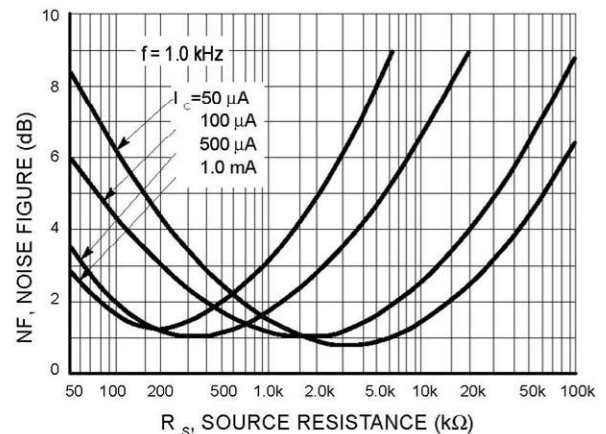


Figure 8. Source Resistance Effects

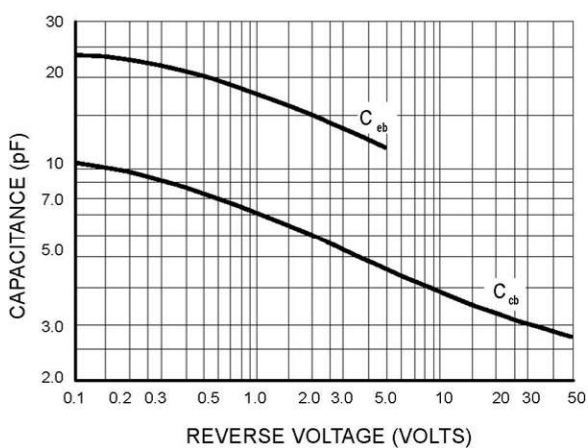


Figure 9. Capacitance

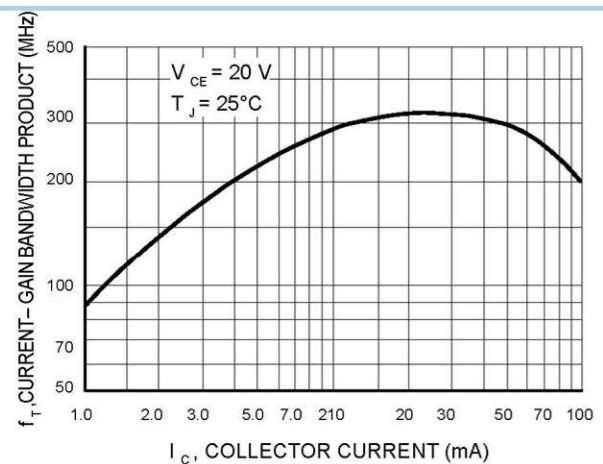


Figure 10. Current-Gain Bandwidth Product



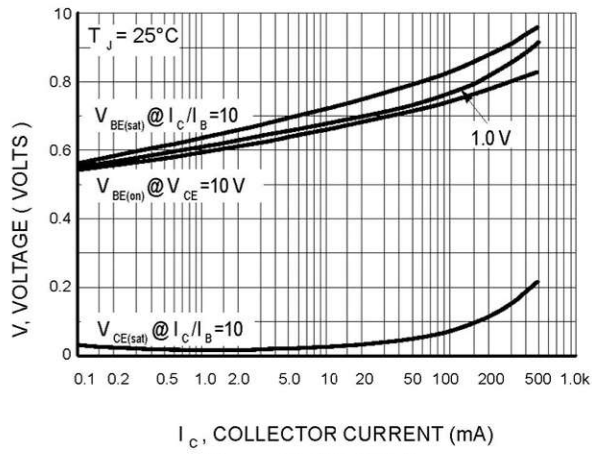


Figure 11. "On" Voltages

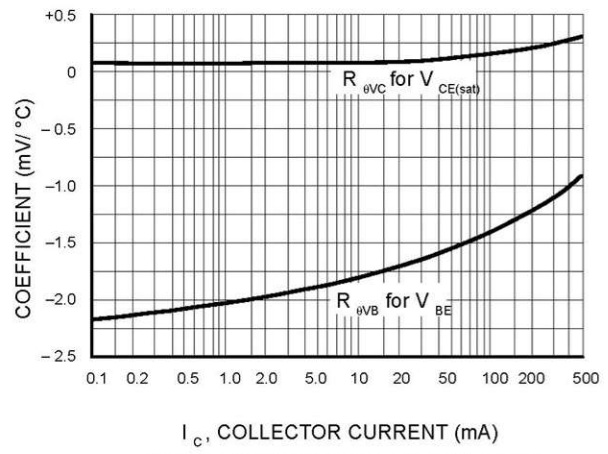


Figure 12. Temperature Coefficients

