



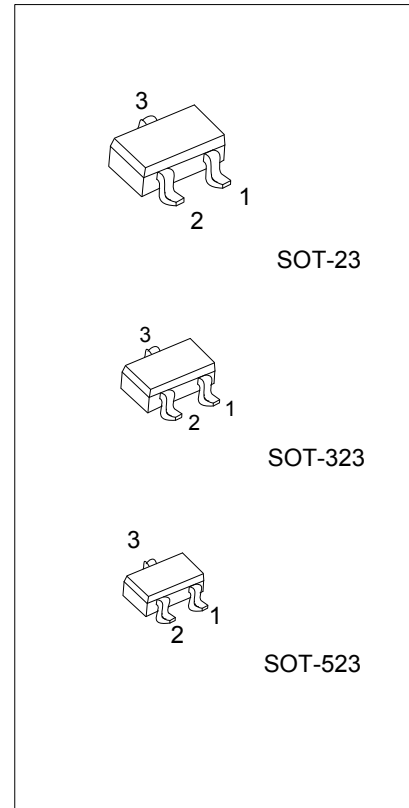
## MMBT2222A

## NPN SILICON TRANSISTOR

### NPN GENERAL PURPOSE AMPLIFIER

#### FEATURES

\* This device is for use as a medium power amplifier and switch requiring collector currents up to 600mA.

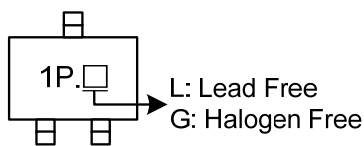


#### ORDERING INFORMATION

| Ordering Number  |                  | Package | Pin Assignment |   |   | Packing   |
|------------------|------------------|---------|----------------|---|---|-----------|
| Lead Free        | Halogen Free     |         | 1              | 2 | 3 |           |
| MMBT2222AL-AE3-R | MMBT2222AG-AE3-R | SOT-23  | E              | B | C | Tape Reel |
| MMBT2222AL-AL3-R | MMBT2222AG-AL3-R | SOT-323 | E              | B | C | Tape Reel |
| MMBT2222AL-AN3-R | MMBT2222AG-AN3-R | SOT-523 | E              | B | C | Tape Reel |

|  |   |
|--|---|
| <p>MMBT2222AL-AE3-R</p> <p>(1) Packing Type<br/>(2) Package Type<br/>(3) Lead Free</p> | <p>(1) R: Tape Reel<br/>(2) AE3: SOT-23, AL3: SOT-323, AN3: SOT-523<br/>(3) G: Halogen Free, L: Lead Free</p> |
|--|---|

#### MARKING



# MMBT2222A

## NPN SILICON TRANSISTOR

### ■ ABSOLUTE MAXIMUM RATINGS (Ta=25°C, unless otherwise specified.)

| PARAMETER                 |         | SYMBOL    | RATINGS    | UNIT |
|---------------------------|---------|-----------|------------|------|
| Collector-Base Voltage    |         | $V_{CBO}$ | 75         | V    |
| Collector-Emitter Voltage |         | $V_{CEO}$ | 40         | V    |
| Emitter-Base Voltage      |         | $V_{EBO}$ | 6          | V    |
| Collector Current         |         | $I_C$     | 600        | mA   |
| Collector Dissipation     | SOT-23  | $P_C$     | 350        | mW   |
|                           | SOT-323 |           | 200        |      |
|                           | SOT-523 |           | 150        |      |
| Junction Temperature      |         | $T_J$     | +150       | °C   |
| Storage Temperature       |         | $T_{STG}$ | -55 ~ +150 | °C   |

Note: Absolute maximum ratings are those values beyond which the device could be permanently damaged.  
Absolute maximum ratings are stress ratings only and functional device operation is not implied.

### ■ THERMAL DATA

| PARAMETER           |         | SYMBOL        | RATINGS | UNIT |
|---------------------|---------|---------------|---------|------|
| Junction to Ambient | SOT-23  | $\theta_{JA}$ | 357     | °C/W |
|                     | SOT-323 |               | 625     |      |
|                     | SOT-523 |               | 833     |      |

# MMBT2222A

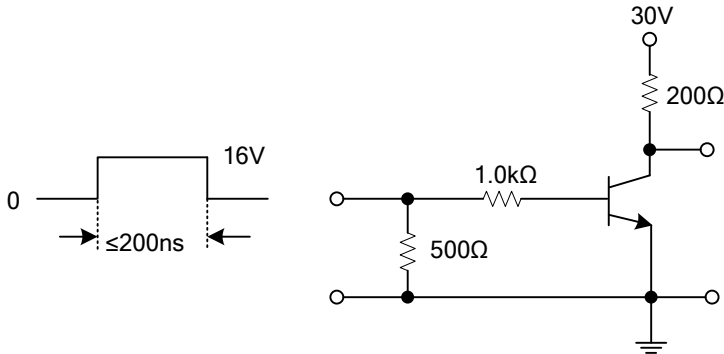
## NPN SILICON TRANSISTOR

■ ELECTRICAL CHARACTERISTICS (Ta=25°C, unless otherwise specified.)

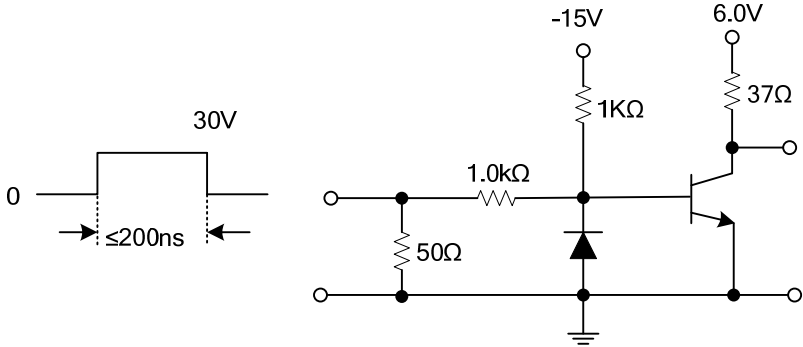
| PARAMETER  | SYMBOL        | TEST CONDITIONS                                      | MIN | TYP | MAX  | UNIT     |
|--|---------------|--|-----|-----|------|----------|
| <b>OFF CHARACTERISTICS</b>                                 |               |  |     |     |      |          |
| Collector-Base Breakdown Voltage                           | $BV_{CBO}$    | $I_C=10\mu A, I_E=0$                                 | 75  |     |      | V        |
| Collector-Emitter Breakdown Voltage                        | $BV_{CEO}$    | $I_C=10mA, I_B=0$                                    | 40  |     |      | V        |
| Emitter-Base Breakdown Voltage                             | $BV_{EBO}$    | $I_E=10\mu A, I_C=0$                                 | 6   |     |      | V        |
| Collector Cutoff Current                                   | $I_{CBO}$     | $V_{CB}=60V, I_E=0$                                  |     |     | 0.01 | $\mu A$  |
|  |               | $V_{CB}=60V, I_E=0, T_a=150^\circ C$                 |     |     | 10   | $\mu A$  |
| Emitter Cutoff Current                                     | $I_{EBO}$     | $V_{EB}=3.0V, I_C=0$                                 |     |     | 10   | nA       |
| Base Cutoff Current  | $I_{BL}$      | $V_{CE}=60V, V_{EB(OFF)}=3.0V$                       |     |     | 20   | nA       |
| Collector Cutoff Current                                   | $I_{CEO}$     | $V_{CE}=60V, V_{EB(OFF)}=3.0V$                       |     |     | 10   | nA       |
| <b>ON CHARACTERISTICS</b>                                  |               |  |     |     |      |          |
| DC Current Gain  | $h_{FE}$      | $I_C=0.1mA, V_{CE}=10V$                              | 35  |     |      |          |
|  |               | $I_C=1.0mA, V_{CE}=10V$                              | 50  |     |      |          |
|  |               | $I_C=10mA, V_{CE}=10V$                               | 75  |     |      |          |
|  |               | $I_C=10mA, V_{CE}=10V, T_a=-55^\circ C$              | 35  |     |      |          |
|  |               | $I_C=150mA, V_{CE}=10V$ (Note)                       | 100 |     | 300  |          |
|  |               | $I_C=150mA, V_{CE}=1.0V$ (Note)                      | 50  |     |      |          |
| Collector-Emitter Saturation Voltage(Note)                 | $V_{CE(SAT)}$ | $I_C=150mA, I_B=15mA$                                |     |     | 0.3  | V        |
|  |               | $I_C=500mA, I_B=50mA$                                |     |     | 1.0  | V        |
| Base-Emitter Saturation Voltage(Note)                      | $V_{BE(SAT)}$ | $I_C=150mA, I_B=15mA$                                | 0.6 |     | 1.2  | V        |
|  |               | $I_C=500mA, I_B=50mA$                                |     |     | 2.0  | V        |
| <b>SMALL SIGNAL CHARACTERISTICS</b>                        |               |  |     |     |      |          |
| Real Part of Common-Emitter High Frequency Input Impedance | $Re(h_{je})$  | $I_C=20mA, V_{CB}=20V, f=300MHz$                     |     |     | 60   | $\Omega$ |
| Transition Frequency                                       | $f_T$         | $I_C=20mA, V_{CE}=20V, f=100MHz$                     | 300 |     |      | MHz      |
| Output Capacitance   | $C_{obo}$     | $V_{CB}=10V, I_E=0, f=100kHz$                        |     |     | 8.0  | pF       |
| Input Capacitance  | $C_{ibo}$     | $V_{EB}=0.5V, I_C=0, f=100kHz$                       |     |     | 25   | pF       |
| Collector Base Time Constant                               | $\tau_{b'c}$  | $I_C=20mA, V_{CB}=20V, f=31.8MHz$                    |     |     | 150  | pS       |
| Noise Figure   | NF            | $I_C=100\mu A, V_{CE}=10V, R_s=1.0k\Omega, f=1.0kHz$ |     |     | 4.0  | dB       |
| <b>SWITCHING CHARACTERISTICS</b>                           |               |  |     |     |      |          |
| Delay Time   | $t_D$         | $V_{CC}=30V, V_{BE(OFF)}=0.5V,$                      |     |     | 10   | ns       |
| Rise Time  | $t_R$         | $I_C=150mA, I_{B1}=15mA$                             |     |     | 25   | ns       |
| Storage Time   | $t_S$         | $V_{CC}=30V, I_C=150mA$                              |     |     | 225  | ns       |
| Fall Time  | $t_F$         | $I_{B1}=I_{B2}=15mA$                                 |     |     | 60   | ns       |

Note: Pulse test: Pulse Width  $\leq 300\mu s$ , Duty Cycle  $\leq 2.0\%$

■ TEST CIRCUITS

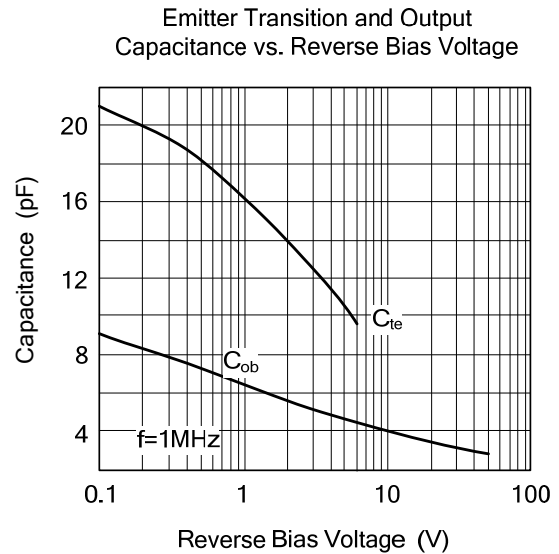
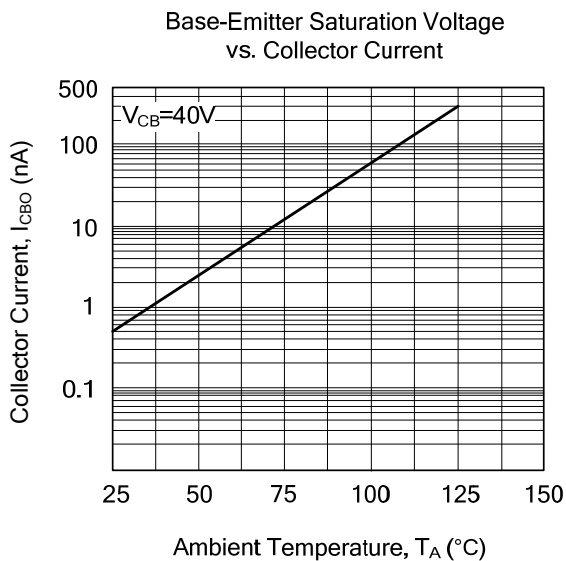
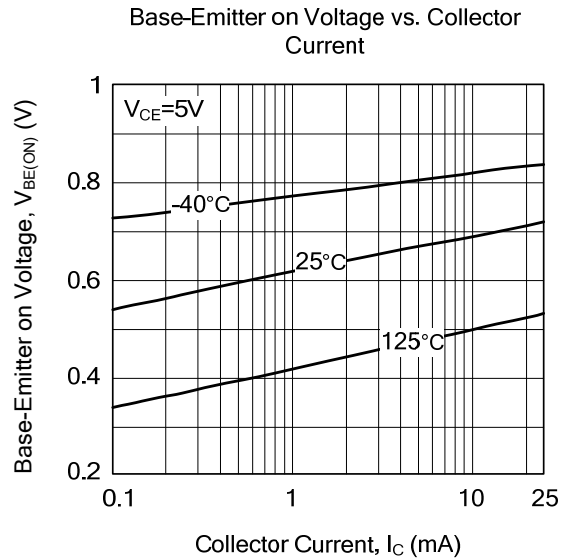
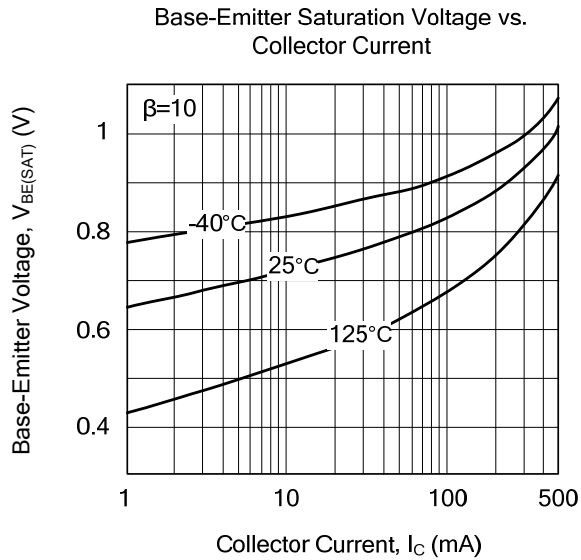
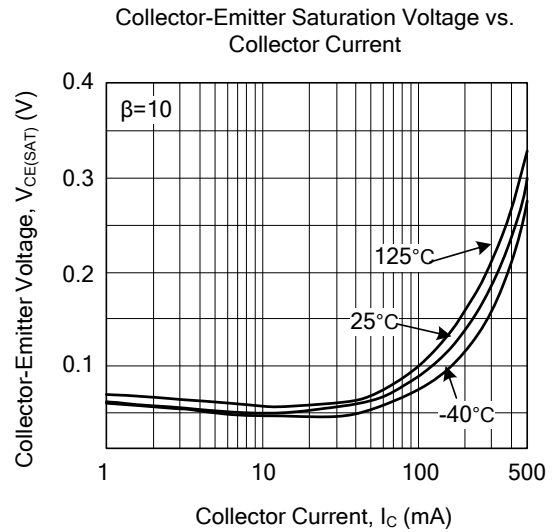
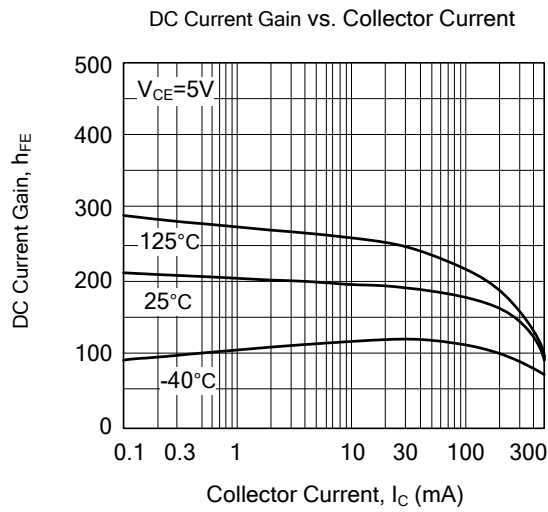


Saturated Turn-On Switching Time

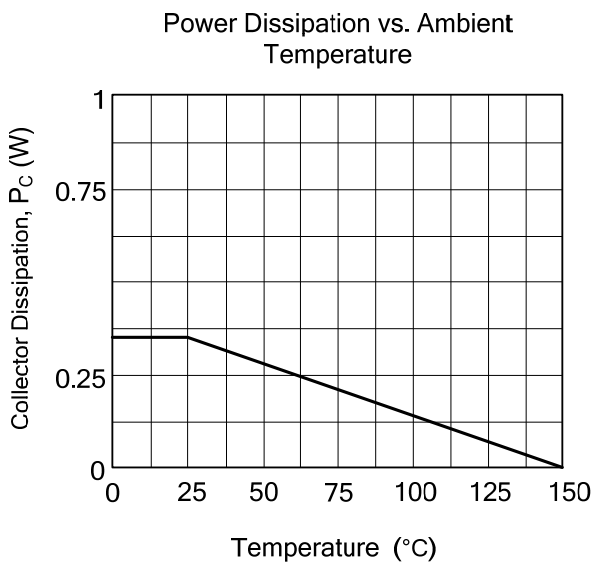
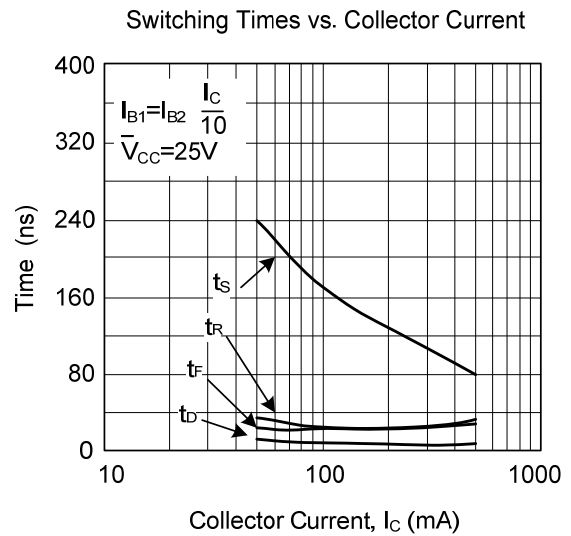
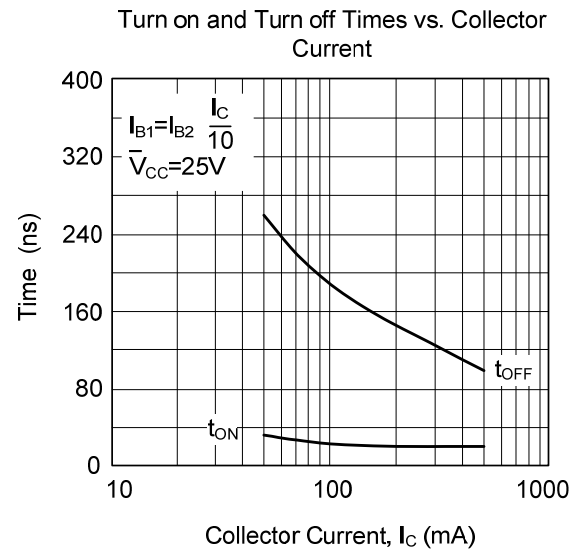


Saturated Turn-Off Switching Time

### TYPICAL CHARACTERISTICS



■ TYPICAL CHARACTERISTICS(Cont.)



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