# MMBT2222A

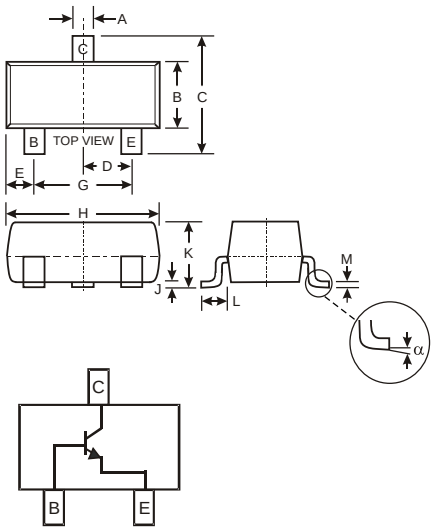
## NPN SMALL SIGNAL SURFACE MOUNT TRANSISTOR

## Features

- Epitaxial Planar Die Construction
- Complementary PNP Type Available (MMBT2907A)
- Ideal for Medium Power Amplification and Switching
- **Lead Free/RoHS Compliant (Note 2)**

## Mechanical Data

- Case: SOT-23
- Case Material: Molded Plastic. UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020C
- Terminals: Solderable per MIL-STD-202, Method 208
- Lead Free Plating (Matte Tin Finish annealed over Alloy 42 leadframe).
- Terminal Connections: See Diagram
- Marking (See Page 2): K1P
- Ordering & Date Code Information: See Page 4
- Weight: 0.008 grams (approximate)




| SOT-23 | | |
|---|---|---|
| **Dim** | **Min** | **Max** |
| **A** | 0.37 | 0.51 |
| **B** | 1.20 | 1.40 |
| **C** | 2.30 | 2.50 |
| **D** | 0.89 | 1.03 |
| **E** | 0.45 | 0.60 |
| **G** | 1.78 | 2.05 |
| **H** | 2.80 | 3.00 |
| **J** | 0.013 | 0.10 |
| **K** | 0.903 | 1.10 |
| **L** | 0.45 | 0.61 |
| **M** | 0.085 | 0.180 |
| α | 0° | 8° |
| **All Dimensions in mm** | | |

## Maximum Ratings @ $T_A$ = 25°C unless otherwise specified

| Characteristic | Symbol | MMBT2222A | Unit |
|---|---|---|---|
| Collector-Base Voltage | $V_{CBO}$ | 75 | V |
| Collector-Emitter Voltage | $V_{CEO}$ | 40 | V |
| Emitter-Base Voltage | $V_{EBO}$ | 6.0 | V |
| Collector Current - Continuous | $I_C$ | 600 | mA |
| Peak Collector Current | $I_{CM}$ | 800 | mA |
| Power Dissipation (Note 1) | $P_d$ | 300 | mW |
| Thermal Resistance, Junction to Ambient (Note 1) | $R_{\theta JA}$ | 417 | °C/W |
| Operating and Storage and Temperature Range | $T_j$, $T_{STG}$ | -55 to +150 | °C |

Notes: 1. Device mounted on FR-4 PCB, 1 inch x 0.85 inch x 0.062 inch; pad layout as shown on Diodes Inc. suggested pad layout document AP02001, which can be found on our website at http://www.diodes.com/datasheets/ap02001.pdf.
2. No purposefully added lead.


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## Electrical Characteristics @ $T_A$ = 25°C unless otherwise specified

| Characteristic (Note 3) | Symbol | Min | Max | Unit | Test Condition |
|---|---|---|---|---|---|
| **OFF CHARACTERISTICS** | | | | | |
| Collector-Base Breakdown Voltage | $V_{(BR)CBO}$ | 75 | ¾ | V | $I_C$ = 10µA, $I_E$ = 0 |
| Collector-Emitter Breakdown Voltage | $V_{(BR)CEO}$ | 40 | ¾ | V | $I_C$ = 10mA, $I_B$ = 0 |
| Emitter-Base Breakdown Voltage | $V_{(BR)EBO}$ | 6.0 | ¾ | V | $I_E$ = 10µA, $I_C$ = 0 |
| Collector Cutoff Current | $I_{CBO}$ | ¾ | 10 | nA<br>µA | $V_{CB}$ = 60V, $I_E$ = 0<br>$V_{CB}$ = 60V, $I_E$ = 0, $T_A$ = 150°C |
| Collector Cutoff Current | $I_{CEX}$ | ¾ | 10 | nA | $V_{CE}$ = 60V, $V_{EB(OFF)}$ = 3.0V |
| Emitter Cutoff Current | $I_{EBO}$ | ¾ | 10 | nA | $V_{EB}$ = 3.0V, $I_C$ = 0 |
| Base Cutoff Current | $I_{BL}$ | ¾ | 20 | nA | $V_{CE}$ = 60V, $V_{EB(OFF)}$ = 3.0V |
| **ON CHARACTERISTICS** | | | | | |
| DC Current Gain | $h_{FE}$ | 35<br>50<br>75<br>100<br>40<br>50<br>35 | ¾<br>¾<br>¾<br>300<br>¾<br>¾<br>¾ | ¾ | $I_C$ = 100µA, $V_{CE}$ = 10V<br>$I_C$ = 1.0mA, $V_{CE}$ = 10V<br>$I_C$ = 10mA, $V_{CE}$ = 10V<br>$I_C$ = 150mA, $V_{CE}$ = 10V<br>$I_C$ = 500mA, $V_{CE}$ = 10V<br>$I_C$ = 10mA, $V_{CE}$ = 10V, $T_A$ = -55°C<br>$I_C$ = 150mA, $V_{CE}$ = 1.0V |
| Collector-Emitter Saturation Voltage | $V_{CE(SAT)}$ | ¾ | 0.3<br>1.0 | V | $I_C$ = 150mA, $I_B$ = 15mA<br>$I_C$ = 500mA, $I_B$ = 50mA |
| Base-Emitter Saturation Voltage | $V_{BE(SAT)}$ | 0.6<br>¾ | 1.2<br>2.0 | V | $I_C$ = 150mA, $I_B$ = 15mA<br>$I_C$ = 500mA, $I_B$ = 50mA |
| **SMALL SIGNAL CHARACTERISTICS** | | | | | |
| Output Capacitance | $C_{obo}$ | ¾ | 8 | pF | $V_{CB}$ = 10V, f = 1.0MHz, $I_E$ = 0 |
| Input Capacitance | $C_{ibo}$ | — | 25 | pF | $V_{EB}$ = 0.5V, f = 1.0MHz, $I_C$ = 0 |
| Current Gain-Bandwidth Product | $f_T$ | 300 | ¾ | MHz | $V_{CE}$ = 20V, $I_C$ = 20mA, f = 100MHz |
| Noise Figure | NF | ¾ | 4.0 | dB | $V_{CE}$ = 10V, $I_C$ = 100µA, $R_S$ = 1.0kΩ, f = 1.0kHz |
| **SWITCHING CHARACTERISTICS** | | | | | |
| Delay Time | $t_d$ | ¾ | 10 | ns | $V_{CC}$ = 30V, $I_C$ = 150mA, $V_{BE(off)}$ = - 0.5V, $I_{B1}$ = 15mA |
| Rise Time | $t_r$ | ¾ | 25 | ns | |
| Storage Time | $t_s$ | ¾ | 225 | ns | $V_{CC}$ = 30V, $I_C$ = 150mA, $I_{B1}$ = $I_{B2}$ = 15mA |
| Fall Time | $t_f$ | ¾ | 60 | ns | |

Note: 3. Short duration test pulse used to minimize self-heating effect.

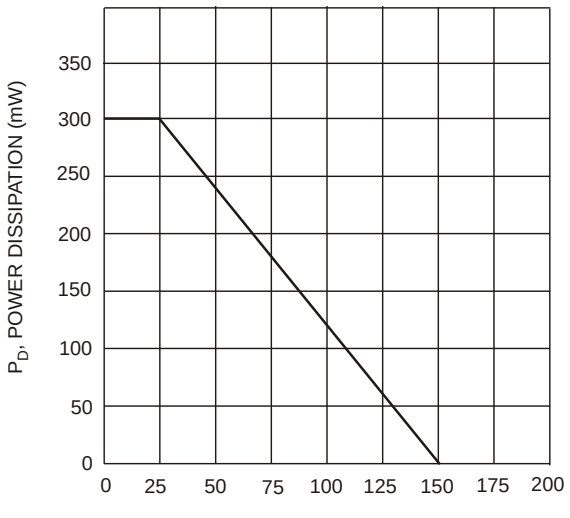



Fig. 1, Max Power Dissipation vs Ambient Temperature

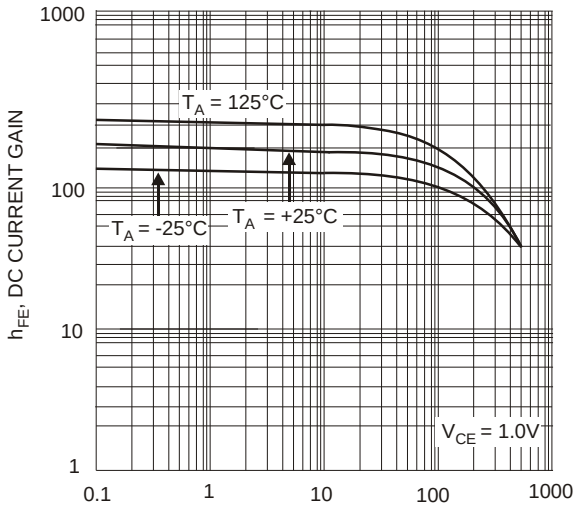



Fig. 2, Typical DC Current Gain vs Collector Current

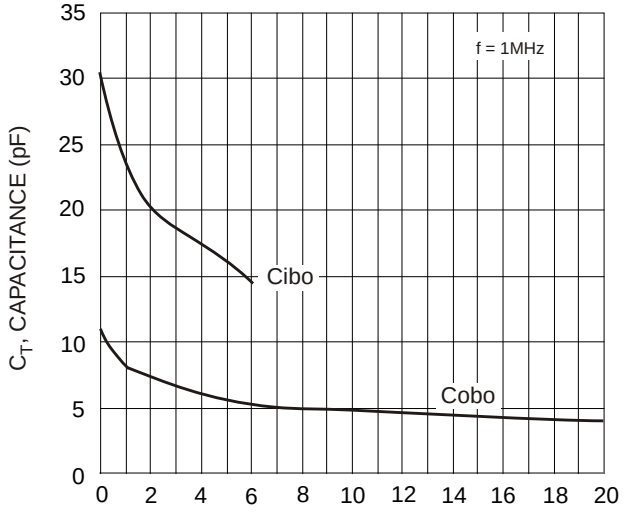



Fig. 3, Typical Capacitance Characteristics

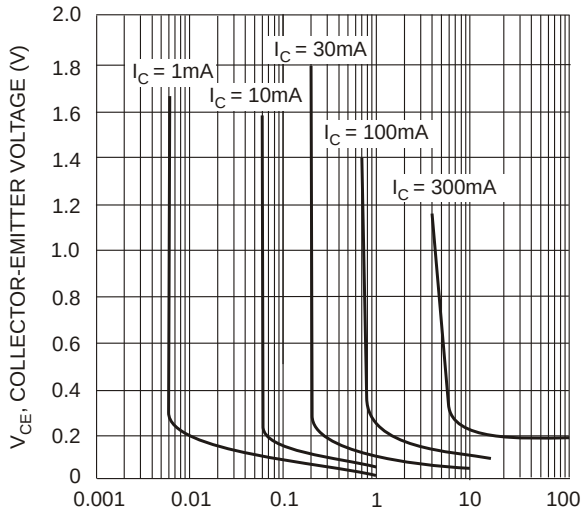



Fig. 4, Typical Collector Saturation Region

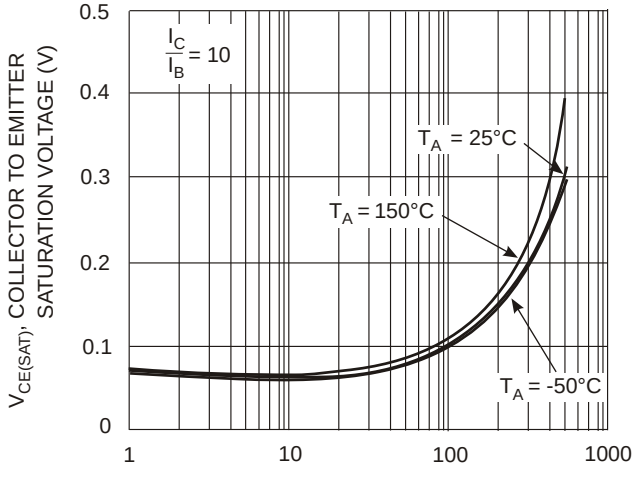



Fig. 5, Collector-Emitter Saturation Voltage vs. Collector Current

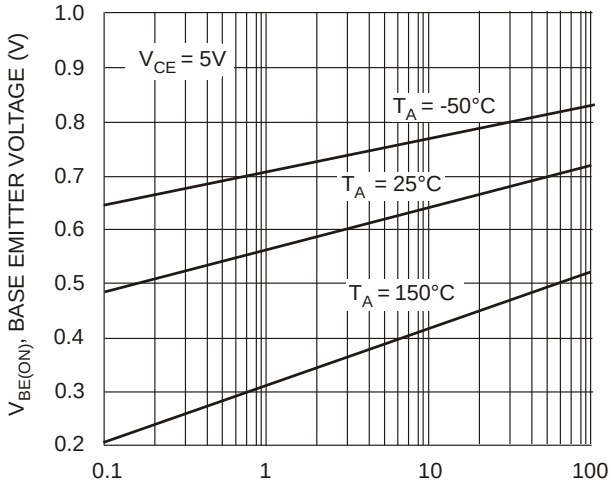



Fig. 6, Base-Emitter Voltage vs. Collector Current

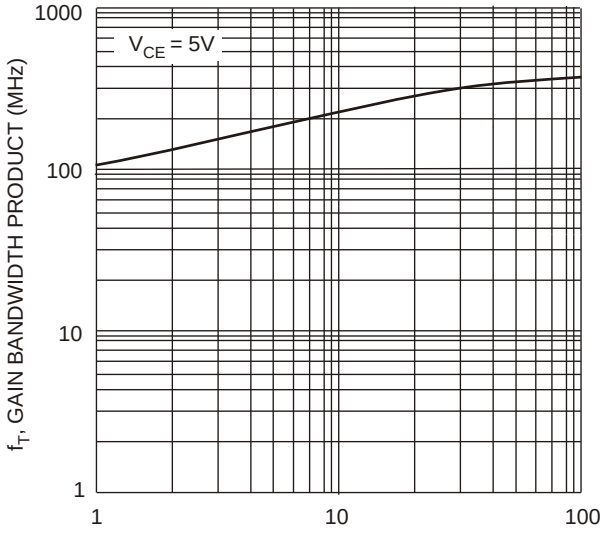


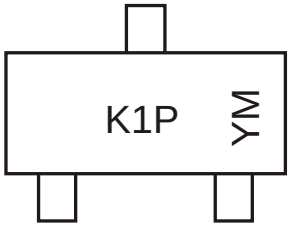
Fig. 7 Gain Bandwidth Product vs. Collector Current

## Ordering Information (Note 4)

| Device | Packaging | Shipping |
|---|---|---|
| MMBT2222A-7-F | SOT-23 | 3000/Tape & Reel |

Note: 4. For Packaging Details, go to our website at http://www.diodes.com/datasheets/ap02007.pdf.

## Marking Information




K1P = Product Type Marking Code
YM = Date Code Marking
Y = Year ex: N = 2002
M = Month ex: 9 = September

Date Code Key

| Year | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Code | J | K | L | M | N | P | R | S | T | U | V | W |

| Month | Jan | Feb | March | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Code | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | O | N | D |

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