

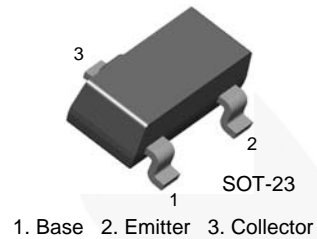


November 2014

# MMBT2369A NPN Switching Transistor

## Description

This device is designed for high speed saturated switching at collector currents of 10 mA to 100 mA. Sourced from process 21.



## Ordering Information

| Part Number | Marking | Package   | Packing Method |
|-------------|---------|-----------|----------------|
| MMBT2369A   | 1S      | SOT-23 3L | Tape and Reel  |

## Absolute Maximum Ratings<sup>(1),(2)</sup>

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only. Values are at  $T_A = 25^\circ\text{C}$  unless otherwise noted.

| Symbol         | Parameter  | Value       | Unit             |
|----------------|--|-------------|------------------|
| $V_{CEO}$      | Collector-Emitter Voltage                        | 15          | V                |
| $V_{CBO}$      | Collector-Base Voltage                           | 40          | V                |
| $V_{EBO}$      | Emitter-Base Voltage                             | 4.5         | V                |
| $I_C$          | Collector Current - Continuous                   | 200         | mA               |
| $T_J, T_{STG}$ | Operating and Storage Junction Temperature Range | -55 to +150 | $^\circ\text{C}$ |

### Notes:

1. These ratings are based on a maximum junction temperature of  $150^\circ\text{C}$ .
2. These are steady-state limits. Fairchild Semiconductor should be consulted on applications involving pulsed or low-duty-cycle operations.

**Thermal Characteristics<sup>(3)</sup>**

Values are at  $T_A = 25^\circ\text{C}$  unless otherwise noted.

| Symbol    | Parameter                               | Value | Unit                      |
|-----------|---|-------|---------------------------|
| $P_D$     | Total Device Dissipation                | 225   | mW                        |
|           | Derate Above $25^\circ\text{C}$         | 1.8   | mW/ $^\circ\text{C}$      |
| $R_{qJA}$ | Thermal Resistance, Junction-to-Ambient | 556   | $^\circ\text{C}/\text{W}$ |

**Note:**

3. Device is mounted on FR-4 PCB 1.6 inch X 1.6 inch X 0.06 inch.

**Electrical Characteristics**

Values are at  $T_A = 25^\circ\text{C}$  unless otherwise noted.

| Symbol        | Parameter   | Conditions   | Min. | Max. | Unit          |
|---------------|---|--|------|------|---------------|
| $BV_{CEO}$    | Collector-Emitter Breakdown Voltage <sup>(4)</sup>  | $I_C = 10\text{ mA}, I_B = 0$  | 15   |      | V             |
| $BV_{CES}$    | Collector-Emitter Breakdown Voltage                 | $I_C = 10\ \mu\text{A}, V_{BE} = 0$  | 40   |      | V             |
| $BV_{CBO}$    | Collector-Base Breakdown Voltage                    | $I_C = 10\ \mu\text{A}, I_E = 0$   | 40   |      | V             |
| $BV_{EBO}$    | Emitter-Base Breakdown Voltage                      | $I_E = 10\ \mu\text{A}, I_C = 0$   | 4.5  |      | V             |
| $I_{CBO}$     | Collector Cut-Off Current                           | $V_{CB} = 20\text{ V}, I_E = 0$  |      | 0.4  | $\mu\text{A}$ |
|               |   | $V_{CB} = 20\text{ V}, I_E = 0, T_A = 125^\circ\text{C}$   |      | 30   |               |
| $h_{FE}$      | DC Current Gain <sup>(4)</sup>                      | $I_C = 10\text{ mA}, V_{CE} = 1.0\text{ V}$  | 40   | 120  |               |
|               |   | $I_C = 10\text{ mA}, V_{CE} = 0.35\text{ V}, T_A = -55^\circ\text{C}$                            | 20   |      |               |
|               |   | $I_C = 100\text{ mA}, V_{CE} = 1.0\text{ V}$   | 20   |      |               |
| $V_{CE(sat)}$ | Collector-Emitter Saturation Voltage <sup>(4)</sup> | $I_C = 10\text{ mA}, I_B = 1.0\text{ mA}$  |      | 0.20 | V             |
|               |   | $I_C = 10\text{ mA}, I_B = 1.0\text{ mA}, T_A = 125^\circ\text{C}$                               |      | 0.30 |               |
|               |   | $I_C = 30\text{ mA}, I_B = 3.0\text{ mA}$  |      | 0.25 |               |
|               |   | $I_C = 100\text{ mA}, I_B = 10\text{ mA}$  |      | 0.50 |               |
| $V_{BE(sat)}$ | Base-Emitter Saturation Voltage                     | $I_C = 10\text{ mA}, I_B = 1.0\text{ mA}$  | 0.70 | 0.85 | V             |
|               |   | $I_C = 10\text{ mA}, I_B = 1.0\text{ mA}, T_A = -55^\circ\text{C}$                               |      | 1.02 |               |
|               |   | $I_C = 10\text{ mA}, I_B = 1.0\text{ mA}, T_A = 125^\circ\text{C}$                               | 0.59 |      |               |
|               |   | $I_C = 30\text{ mA}, I_B = 3.0\text{ mA}$  |      | 1.15 |               |
|               |   | $I_C = 100\text{ mA}, I_B = 10\text{ mA}$  |      | 1.60 |               |
| $C_{obo}$     | Output Capacitance                                  | $V_{CB} = 5.0\text{ V}, I_E = 0, f = 1.0\text{ MHz}$   |      | 4.0  | pF            |
| $C_{ibo}$     | Input Capacitance                                   | $V_{EB} = 0.5\text{ V}, I_C = 0, f = 1.0\text{ MHz}$   |      | 5.0  | pF            |
| $h_{fe}$      | Small-Signal Current Gain                           | $I_C = 10\text{ mA}, V_{CE} = 10\text{ V}$<br>$R_G = 2.0\text{ k}\Omega, f = 100\text{ MHz}$     | 5.0  |      |               |
| $t_s$         | Storage Time  | $I_{B1} = I_{B2} = I_C = 10\text{ mA}$   |      | 13   | ns            |
| $t_{on}$      | Turn-On Time  | $V_{CC} = 3.0\text{ V}, I_C = 10\text{ mA},$<br>$I_{B1} = 3.0\text{ mA}$                         |      | 12   | ns            |
| $t_{off}$     | Turn-Off Time                                       | $V_{CC} = 3.0\text{ V}, I_C = 10\text{ mA},$<br>$I_{B1} = 3.0\text{ mA}, I_{B2} = 1.5\text{ mA}$ |      | 18   | ns            |

**Note:**

4. Pulse test: Pulse width  $\leq 300\ \mu\text{s}$ , duty cycle  $\leq 2\%$

Typical Performance Characteristics

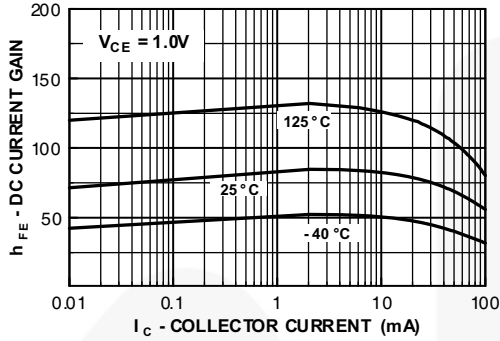


Figure 1. DC Current Gain vs. Collector Current

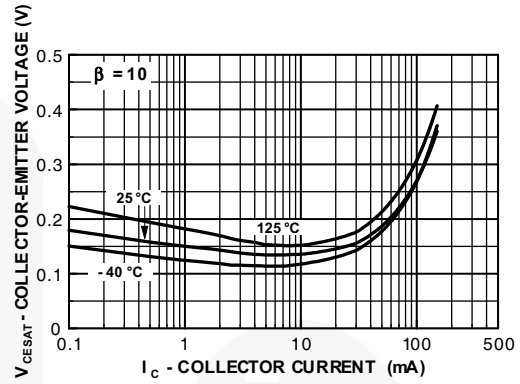


Figure 2. Collector-Emitter Saturation Voltage vs. Collector Current

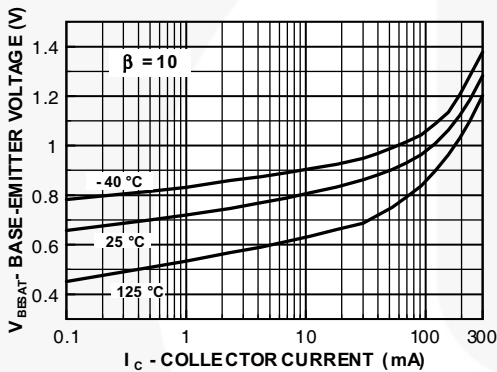


Figure 3. Base-Emitter Saturation Voltage vs. Collector Current

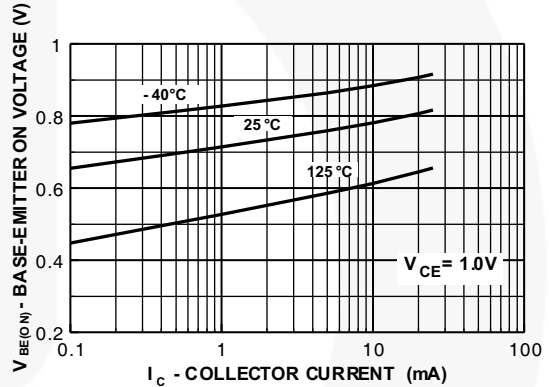


Figure 4. Base-Emitter On Voltage vs. Collector Current

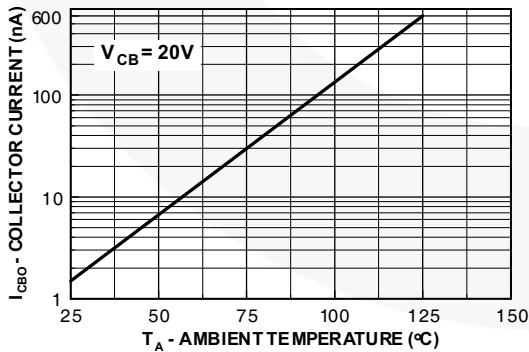


Figure 5. Collector Cut-Off Current vs. Ambient Temperature

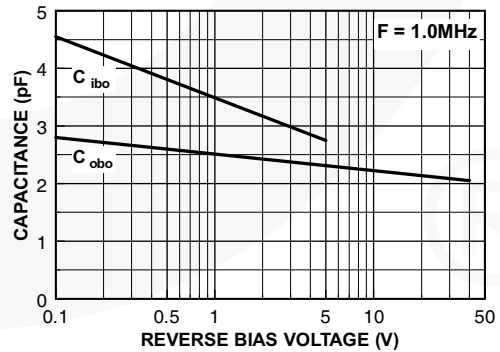


Figure 6. Output Capacitance vs. Reverse Bias Voltage

Typical Performance Characteristics (Continued)

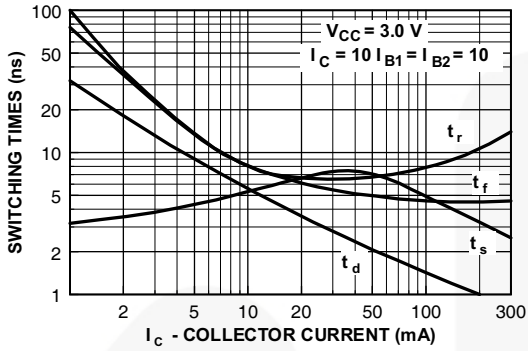


Figure 7. Switching Times vs. Collector Current

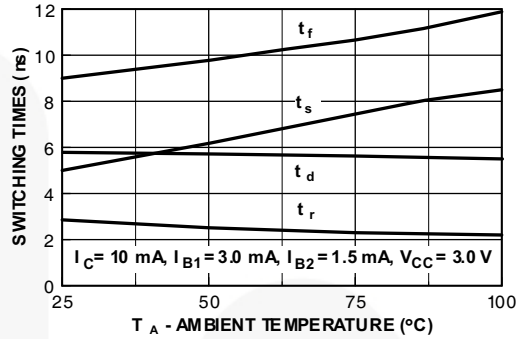


Figure 8. Switching Times vs. Ambient Temperature

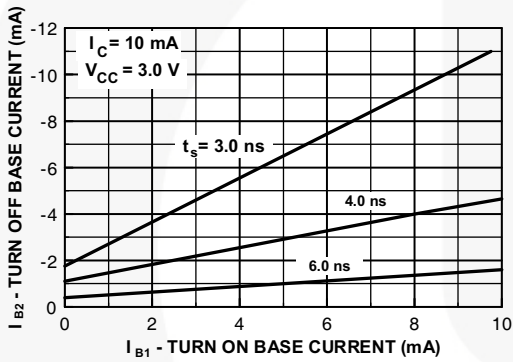


Figure 9. Storage Time vs. Turn-On and Turn-Off Base Currents

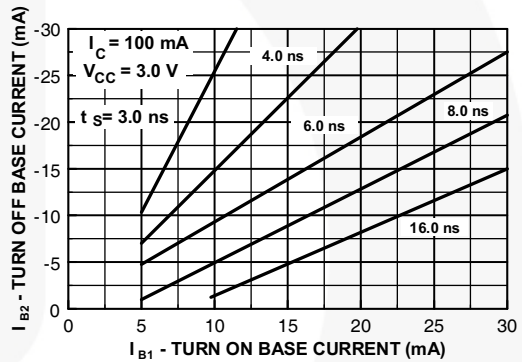


Figure 10. Storage Time vs. Turn-On and Turn-Off Base Currents

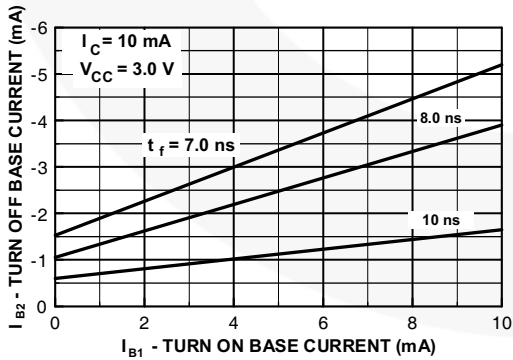


Figure 11. Fall Time vs. Turn-On and Turn-Off Base Currents

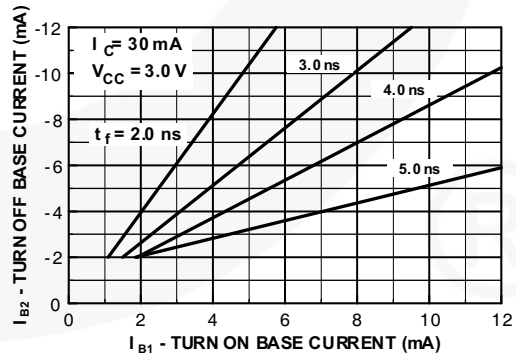


Figure 12. Fall Time vs. Turn-On and Turn-Off Base Currents

Typical Performance Characteristics (Continued)

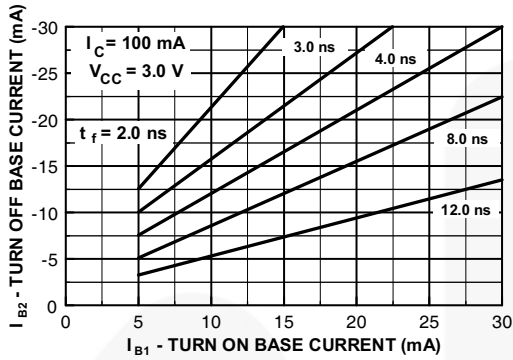


Figure 13. Fall Time vs. Turn-On and Turn-Off Base Currents

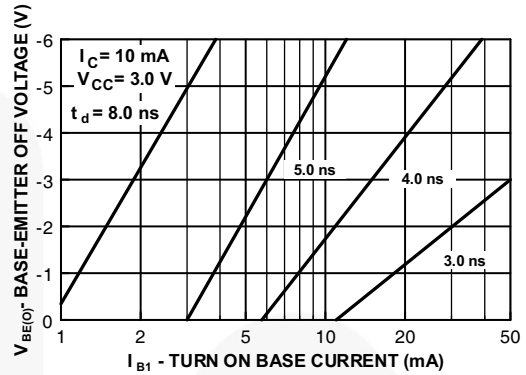


Figure 14. Delay Time vs. Base-Emitter Off Voltage and Turn-On Base Current

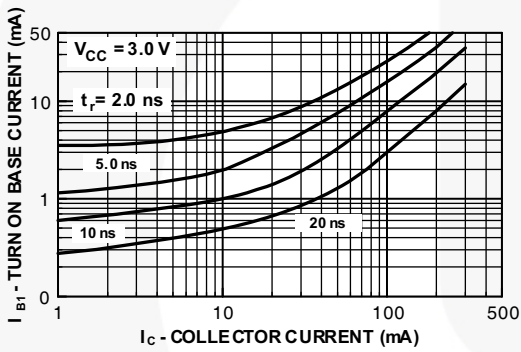


Figure 15. Rise Time vs. Turn-On Base Current and Collector Current

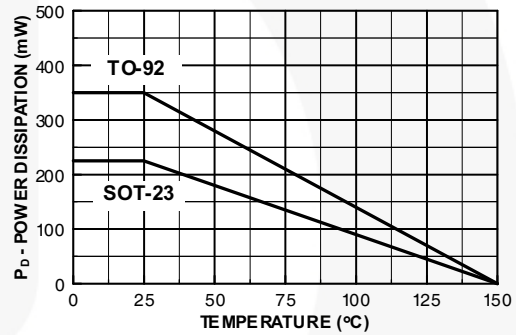
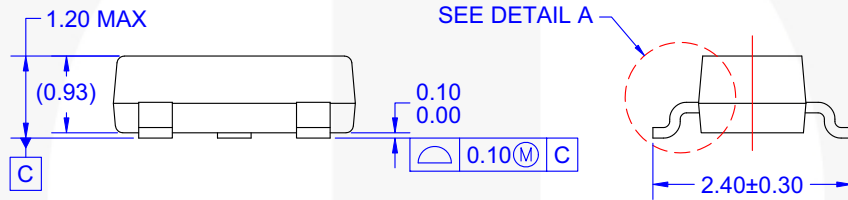
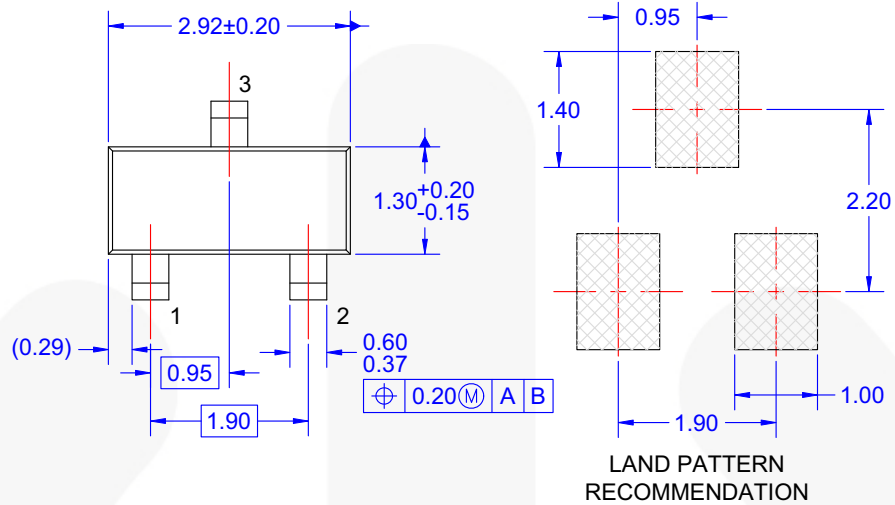


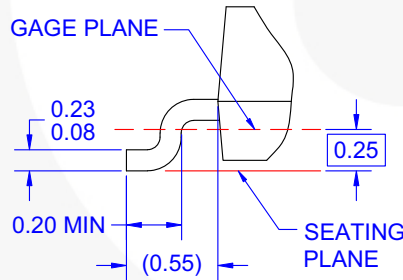
Figure 16. Power Dissipation vs. Ambient Temperature

Physical Dimensions



NOTES: UNLESS OTHERWISE SPECIFIED

- A) REFERENCE JEDEC REGISTRATION TO-236, VARIATION AB, ISSUE H.
- B) ALL DIMENSIONS ARE IN MILLIMETERS.
- C) DIMENSIONS ARE INCLUSIVE OF BURRS, MOLD FLASH AND TIE BAR EXTRUSIONS.
- D) DIMENSIONING AND TOLERANCING PER ASME Y14.5M - 1994.
- E) DRAWING FILE NAME: MA03DREV10








**DETAIL A**  
SCALE: 2X

**Figure 17. 3-LEAD, SOT23, JEDEC TO-236, LOW PROFILE**



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