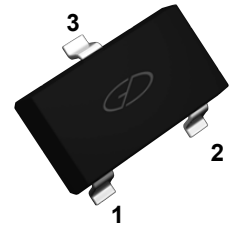


**Features**

- Switching transistor
- Ultra-small surface mount package
- Plastic-Encapsulate transistor



**SOT-23**

1. BASE
2. EMITTER
3. COLLECTOR

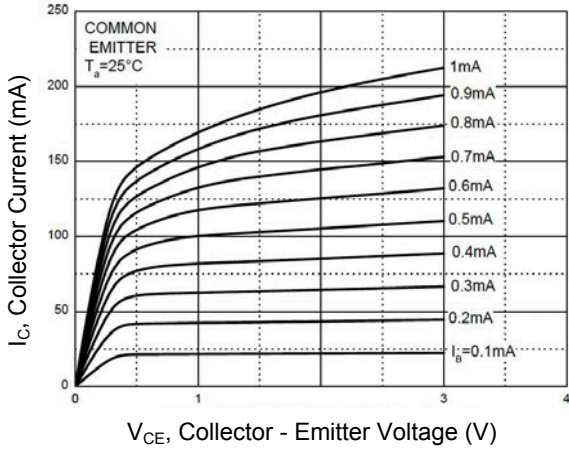
**Absolute Maximum Ratings** ( $T_A=25^{\circ}\text{C}$  unless otherwise noted)

| Parameter   | Symbol          | Max.        | Unit                        |
|---|-----------------|-------------|-----------------------------|
| Collector-Base Voltage                              | $V_{CB0}$       | 60          | V                           |
| Collector-Emitter Voltage                           | $V_{CE0}$       | 40          | V                           |
| Emitter-Base Voltage                                | $V_{EB0}$       | 6           | V                           |
| Collector Current-Continuous                        | $I_C$           | 600         | mA                          |
| Collector Power Dissipation                         | $P_C$           | 300         | mW                          |
| Typical Thermal Resistance from Junction to Ambient | $R_{\theta JA}$ | 417         | $^{\circ}\text{C}/\text{W}$ |
| Operating Junction Temperature Range                | $T_J$           | -55 To +150 | $^{\circ}\text{C}$          |
| Storage Temperature Range                           | $T_{STG}$       | -55 To +150 | $^{\circ}\text{C}$          |

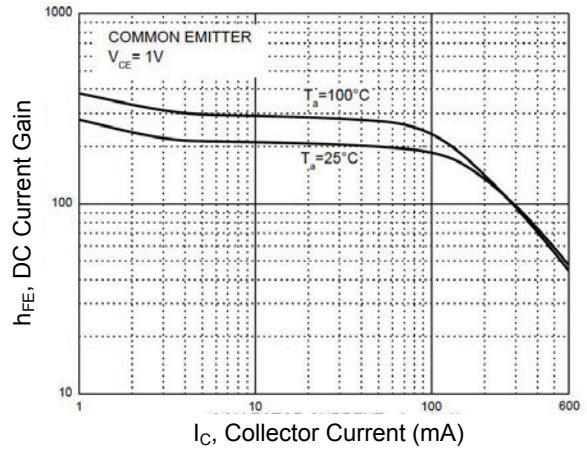
**Electrical Characteristics** ( $T_A=25^\circ\text{C}$  unless otherwise noted)

| Parameter                            | Symbol        | Conditions  | Min. | Max. | Unit          |
|--------------------------------------|---------------|---|------|------|---------------|
| Collector-Base Breakdown Voltage     | $V_{(BR)CBO}$ | $I_C=100\mu\text{A}$ , $I_E=0$  | 60   | -    | V             |
| Collector-Emitter Breakdown Voltage  | $V_{(BR)CEO}$ | $I_C=1\text{mA}$ , $I_B=0$  | 40   | -    | V             |
| Emitter-Base Breakdown Voltage       | $V_{(BR)EBO}$ | $I_E=100\mu\text{A}$ , $I_C=0$  | 6    | -    | V             |
| Collector Cut-off Current            | $I_{CBO}$     | $V_{CB}=50\text{V}$ , $I_E=0$   | -    | 0.1  | $\mu\text{A}$ |
| Collector Cut-off Current            | $I_{CEX}$     | $V_{CE}=35\text{V}$ , $V_{EB}=0.4\text{V}$  | -    | 0.1  | $\mu\text{A}$ |
| Emitter Cut-off Current              | $I_{EBO}$     | $V_{EB}=5\text{V}$ , $I_C=0$  | -    | 0.1  | $\mu\text{A}$ |
| DC Current Gain                      | $h_{FE}^1$    | $V_{CE}=1\text{V}$ , $I_C=0.1\text{mA}$   | 20   | -    | -             |
|                                      | $h_{FE}^2$    | $V_{CE}=1\text{V}$ , $I_C=1\text{mA}$   | 40   | -    | -             |
|                                      | $h_{FE}^3$    | $V_{CE}=1\text{V}$ , $I_C=10\text{mA}$  | 80   | -    | -             |
|                                      | $h_{FE}^4$    | $V_{CE}=1\text{V}$ , $I_C=150\text{mA}$   | 100  | 300  | -             |
|                                      | $h_{FE}^5$    | $V_{CE}=2\text{V}$ , $I_C=500\text{mA}$   | 40   | -    | -             |
| Collector-Emitter Saturation Voltage | $V_{CE(sat)}$ | $I_C=150\text{mA}$ , $I_B=15\text{mA}$  | -    | 0.4  | V             |
|                                      |               | $I_C=500\text{mA}$ , $I_B=50\text{mA}$  | -    | 0.75 | V             |
| Base-Emitter Saturation Voltage      | $V_{BE(sat)}$ | $I_C=150\text{mA}$ , $I_B=15\text{mA}$  | -    | 0.95 | V             |
|                                      |               | $I_C=500\text{mA}$ , $I_B=50\text{mA}$  | -    | 1.2  | V             |
| Transition Frequency                 | $f_T$         | $V_{CE}=10\text{V}$ , $I_C=20\text{mA}$ ,<br>$F=100\text{MHz}$                                | 250  | -    | MHz           |
| Delay Time                           | $t_d$         | $V_{CC}=30\text{V}$ , $V_{BE(off)}=-2\text{V}$ ,<br>$I_C=150\text{mA}$ , $I_{B1}=15\text{mA}$ | -    | 15   | nS            |
| Rise Time                            | $t_r$         | $I_C=150\text{mA}$ , $I_{B1}=15\text{mA}$   | -    | 20   | nS            |
| Storage Time                         | $t_s$         | $V_{CC}=30\text{V}$ , $I_C=150\text{mA}$ ,<br>$I_{B1}=I_{B2}=15\text{mA}$                     | -    | 225  | nS            |
| Fall Time                            | $t_f$         | $I_{B1}=I_{B2}=15\text{mA}$   | -    | 60   | nS            |

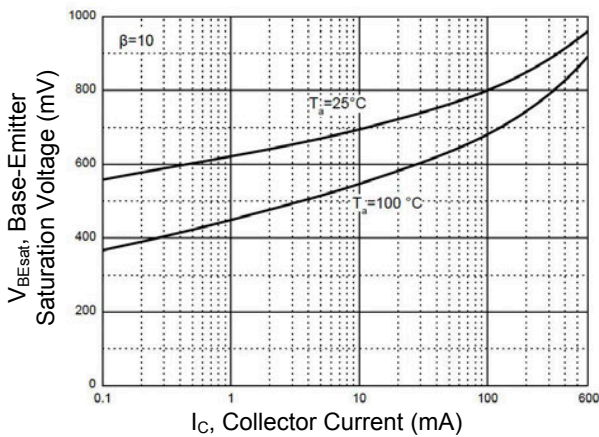
**Ratings and Characteristics Curves** ( $T_A=25^\circ\text{C}$  unless otherwise noted)



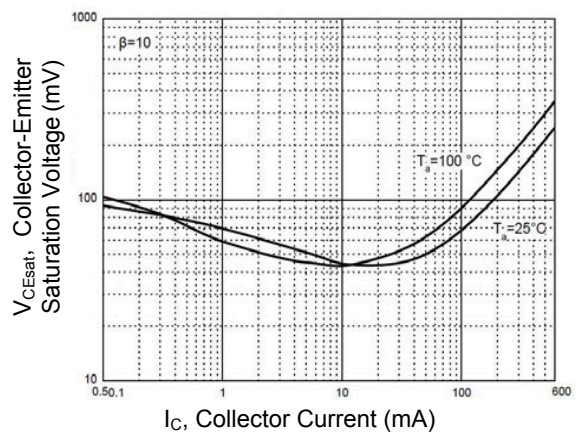
**Figure 1. Static Characteristics**



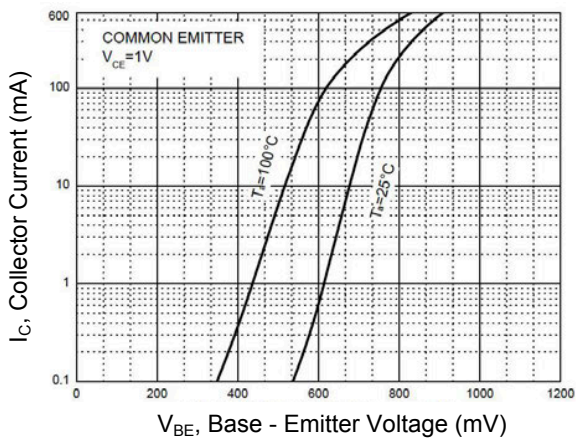
**Figure 2. DC Current Gain vs. Collector Current**



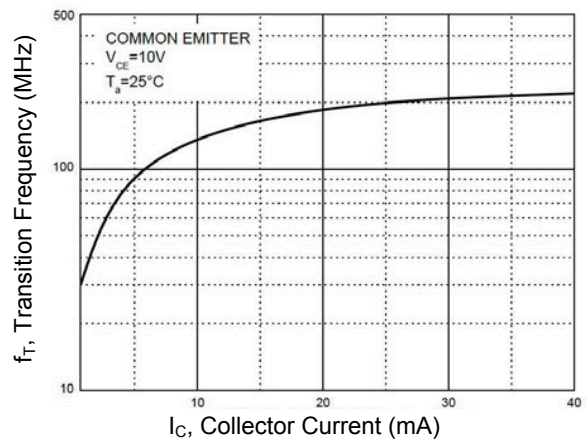
**Figure 3. Base - Emitter Saturation Voltage vs. Collector Current**



**Figure 4. Collector - Emitter Saturation Voltage vs. Collector Current**

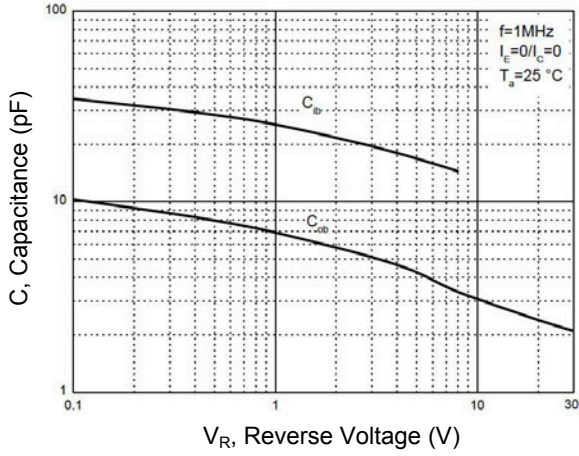


**Figure 5. Collector Current vs. Base - Emitter Voltage**

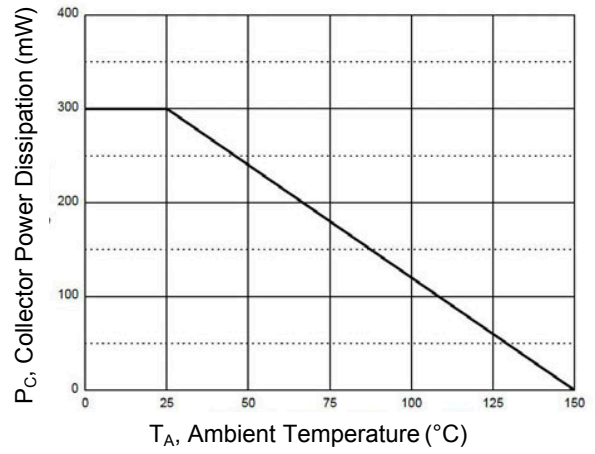


**Figure 6. Transition Frequency vs. Collector Current**

**Ratings and Characteristics Curves** ( $T_A=25^\circ\text{C}$  unless otherwise noted)

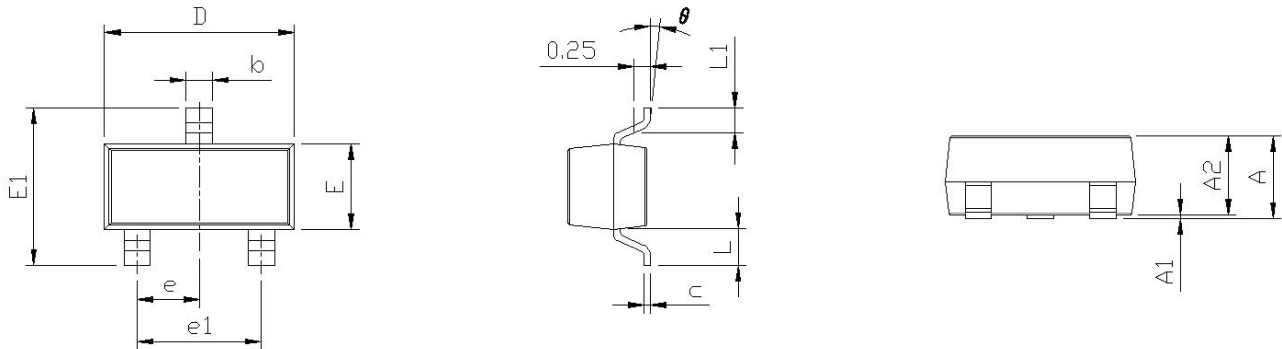


**Figure 7. Capacitance Characteristics**



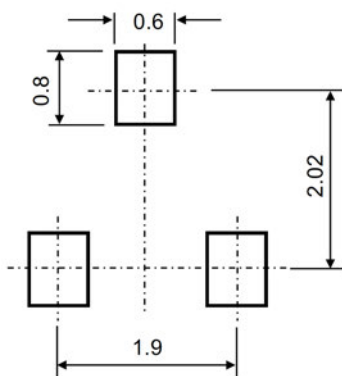
**Figure 8. Power Dissipation vs Ambient Temperature**

**Package Outline Dimensions (SOT-23)**



| Symbol | Dimensions In Millimeters |       | Dimensions In Inches |       |
|--------|---------------------------|-------|----------------------|-------|
|        | Min                       | Max   | Min                  | Max   |
| A      | 0.900                     | 1.150 | 0.035                | 0.045 |
| A1     | 0.000                     | 0.100 | 0.000                | 0.004 |
| A2     | 0.900                     | 1.050 | 0.035                | 0.041 |
| b      | 0.300                     | 0.500 | 0.012                | 0.020 |
| c      | 0.080                     | 0.150 | 0.003                | 0.006 |
| D      | 2.800                     | 3.000 | 0.110                | 0.118 |
| E      | 1.200                     | 1.400 | 0.047                | 0.055 |
| E1     | 2.250                     | 2.550 | 0.089                | 0.100 |
| e      | 0.950 TYP                 |       | 0.037 TYP            |       |
| e1     | 1.800                     | 2.000 | 0.071                | 0.079 |
| L      | 0.550 REF                 |       | 0.022 REF            |       |
| L1     | 0.300                     | 0.500 | 0.012                | 0.020 |
| θ      | 0°                        | 8°    | 0°                   | 8°    |

**Suggested Pad Layout**



Note:  
 1. Controlling dimension: in millimeters.  
 2. General tolerance:  $\pm 0.05\text{mm}$ .  
 3. The pad layout is for reference purposes only.

**Ordering Information**

| Device   | Package | Marking | Quantity        | HSF Status     |
|----------|---------|---------|-----------------|----------------|
| MMBT4401 | SOT-23  | 2X      | 3,000pcs / Reel | RoHS Compliant |