

# High Voltage Transistor

Lead free product

Halogen-free type

## FEATURE

- We declare that the material of product compliance with RoHS requirements.

## MMBT5401GH



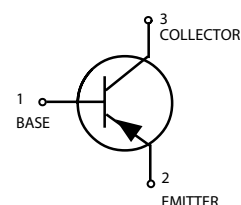
SOT-23

## MAXIMUM RATINGS

| Rating                         | Symbol    | Value | Unit |
|--------------------------------|-----------|-------|------|
| Collector-Emitter Voltage      | $V_{CEO}$ | - 150 | Vdc  |
| Collector-Base Voltage         | $V_{CBO}$ | - 160 | Vdc  |
| Emitter-Base Voltage           | $V_{EBO}$ | - 5.0 | Vdc  |
| Collector Current — Continuous | $I_C$     | - 500 | mAdc |

## THERMAL CHARACTERISTICS

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



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

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

## OFF CHARACTERISTICS

|                                                                                                                                         |               |        |              |                         |
|-----------------------------------------------------------------------------------------------------------------------------------------|---------------|--------|--------------|-------------------------|
| Collector-Emitter Breakdown Voltage<br>( $I_C = -1.0\text{ mAdc}, I_E = 0$ )                                                            | $V_{(BR)CEO}$ | - 150  | —            | Vdc                     |
| Collector-Base Breakdown Voltage<br>( $I_C = -100\text{ }\mu\text{Adc}, I_E = 0$ )                                                      | $V_{(BR)CBO}$ | - 160  | —            | Vdc                     |
| Emitter-Base Breakdown Voltage<br>( $I_E = -10\text{ }\mu\text{Adc}, I_C = 0$ )                                                         | $V_{(BR)EBO}$ | -5.0   | —            | Vdc                     |
| Collector Cutoff Current<br>( $V_{CB} = -120\text{ Vdc}, I_E = 0$ )<br>( $V_{CB} = -120\text{ Vdc}, I_E = 0, T_A = 100^\circ\text{C}$ ) | $I_{CES}$     | —<br>— | - 50<br>- 50 | nAdc<br>$\mu\text{Adc}$ |

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.

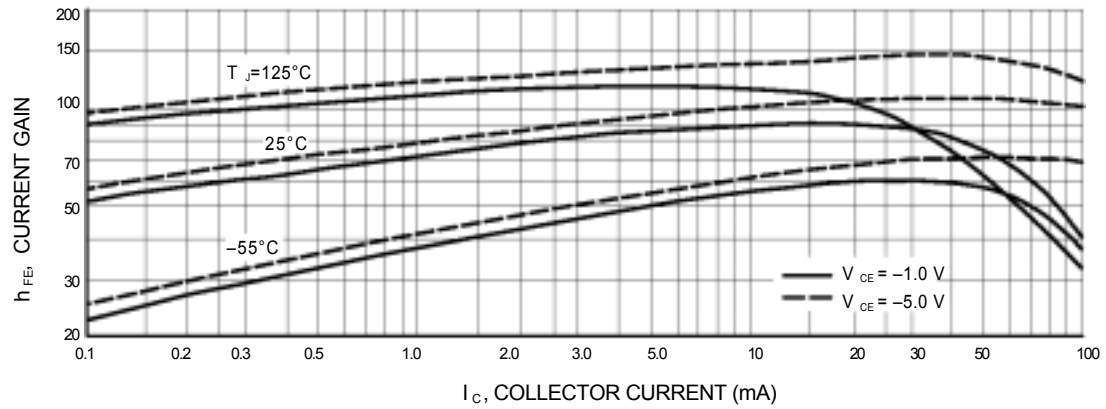
**MMBT5401GH**
**ELECTRICAL CHARACTERISTICS** ( $T_A = 25^\circ\text{C}$  unless otherwise noted) (Continued)

| Characteristic                                        | Symbol        | Min | Max   | Unit |
|-------------------------------------------------------|---------------|-----|-------|------|
| <b>ON CHARACTERISTICS (2)</b>                         |               |     |       |      |
| DC Current Gain                                       | $h_{FE}$      |     |       | —    |
| ( $I_C = -1.0\text{mA}$ , $V_{CE} = -5.0\text{Vdc}$ ) |               | 50  | —     |      |
| ( $I_C = -10\text{mA}$ , $V_{CE} = -5.0\text{Vdc}$ )  |               | 60  | 240   |      |
| ( $I_C = -50\text{mA}$ , $V_{CE} = -5.0\text{Vdc}$ )  |               | 50  | —     |      |
| Collector–Emitter Saturation Voltage                  | $V_{CE(sat)}$ |     |       | Vdc  |
| ( $I_C = -10\text{mA}$ , $I_B = -1.0\text{mA}$ )      |               | —   | – 0.2 |      |
| ( $I_C = -50\text{mA}$ , $I_B = -5.0\text{mA}$ )      |               | —   | – 0.5 |      |
| Base–Emitter Saturation Voltage                       | $V_{BE(sat)}$ |     |       | Vdc  |
| ( $I_C = -10\text{mA}$ , $I_B = -1.0\text{mA}$ )      |               | —   | – 1.0 |      |
| ( $I_C = -50\text{mA}$ , $I_B = -5.0\text{mA}$ )      |               | —   | – 1.0 |      |

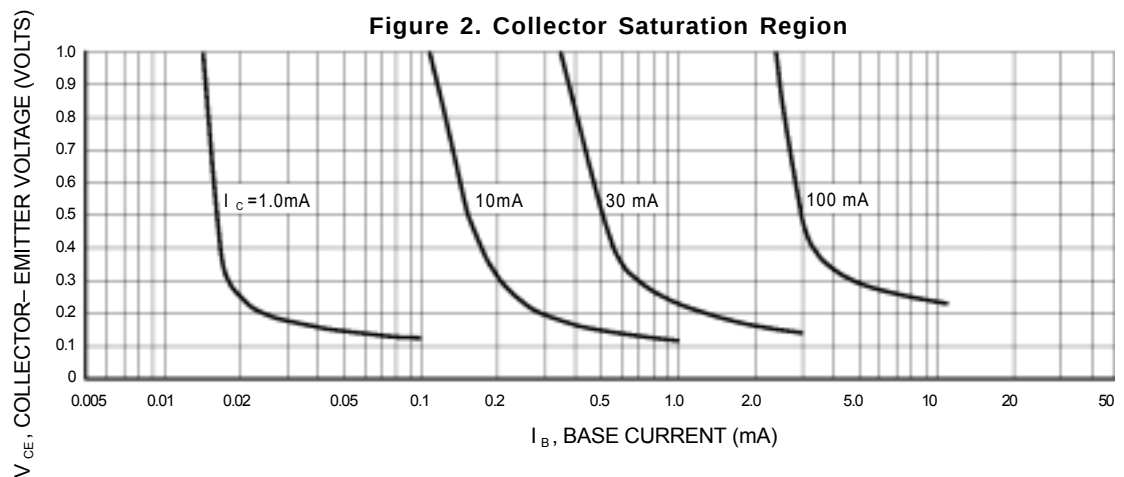
**SMALL–SIGNAL CHARACTERISTICS**

|                                                                                                  |           |     |     |     |
|--------------------------------------------------------------------------------------------------|-----------|-----|-----|-----|
| Current–Gain — Bandwidth Product                                                                 | $f_T$     |     |     | MHz |
| ( $I_C = -10\text{mA}$ , $V_{CE} = -10\text{Vdc}$ , $f = 100\text{MHz}$ )                        |           | 100 | 300 |     |
| Output Capacitance                                                                               | $C_{obo}$ |     |     | pF  |
| ( $V_{CB} = -10\text{Vdc}$ , $I_E = 0$ , $f = 1.0\text{MHz}$ )                                   |           | —   | 6.0 |     |
| Small–Signal Current Gain                                                                        | $h_{fe}$  |     |     | —   |
| ( $I_C = -1.0\text{mA}$ , $V_{CE} = -10\text{Vdc}$ , $f = 1.0\text{kHz}$ )                       |           | 40  | 200 |     |
| Noise Figure                                                                                     | NF        |     |     | dB  |
| ( $I_C = -200\mu\text{A}$ , $V_{CE} = -5.0\text{Vdc}$ , $R_s = 10\Omega$ , $f = 1.0\text{kHz}$ ) |           | —   | 8.0 |     |

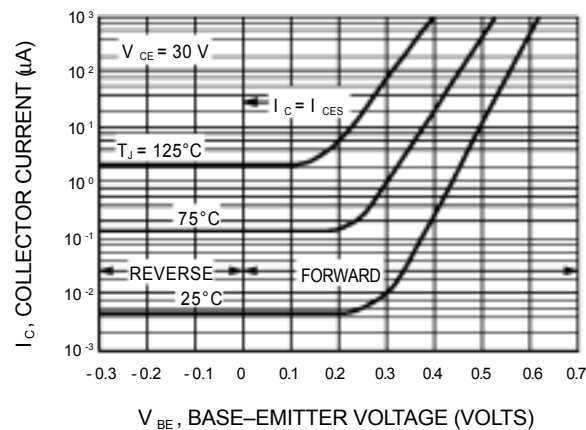
**Figure 1. DC Current Gain**



**Figure 2. Collector Saturation Region**

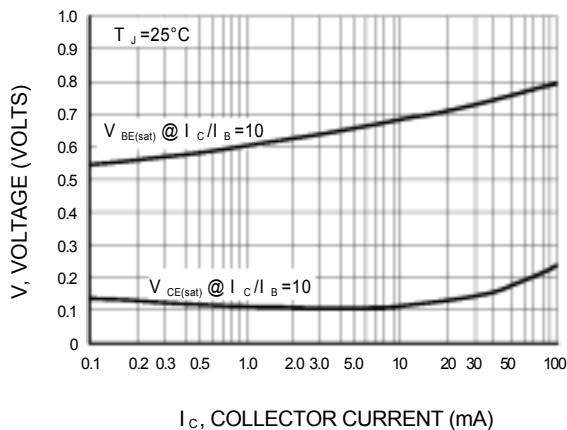


**Figure 3. Collector Cut-Off Region**

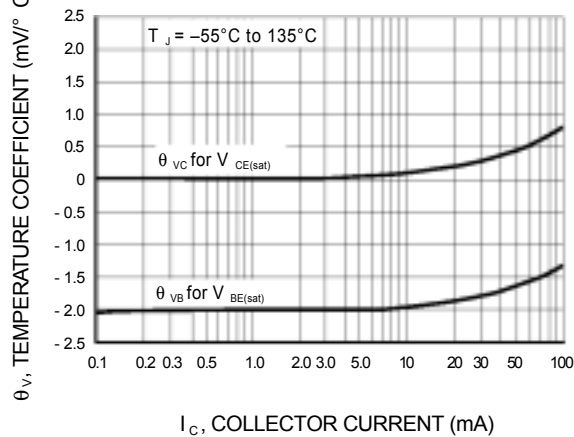


## MMBT5401GH

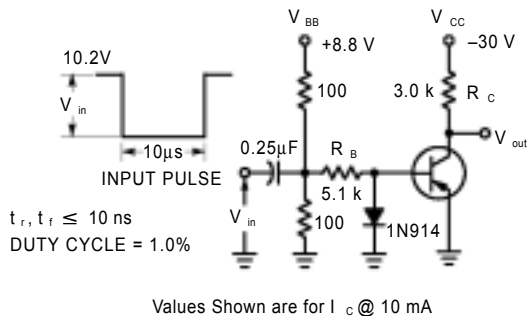
**Figure 4. "On" Voltages**



**Figure 5. Temperature Coefficients**

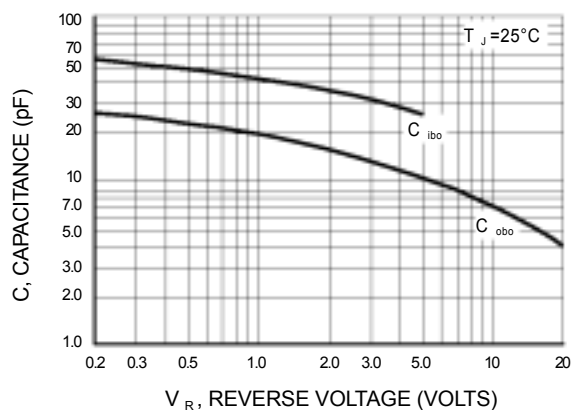


**Figure 6. Switching Time Test Circuit**

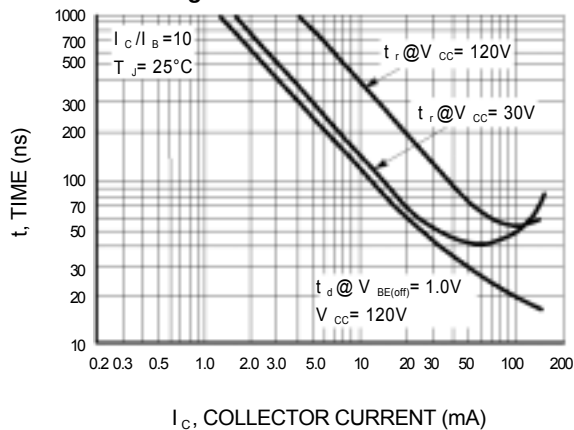


Values Shown are for  $I_C @ 10\text{ mA}$

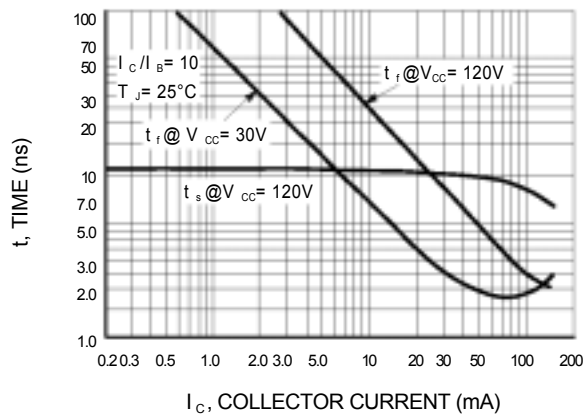
**Figure 7. Capacitances**



**Figure 8. Turn-On Time**



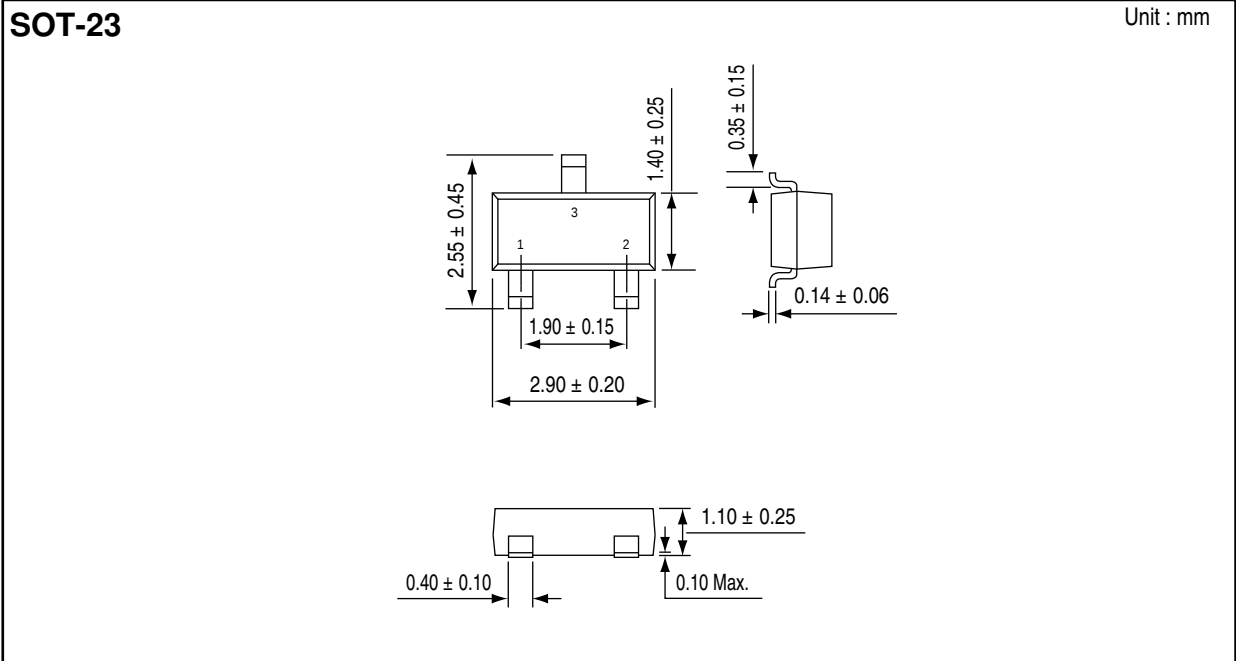
**Figure 9. Turn-Off Time**



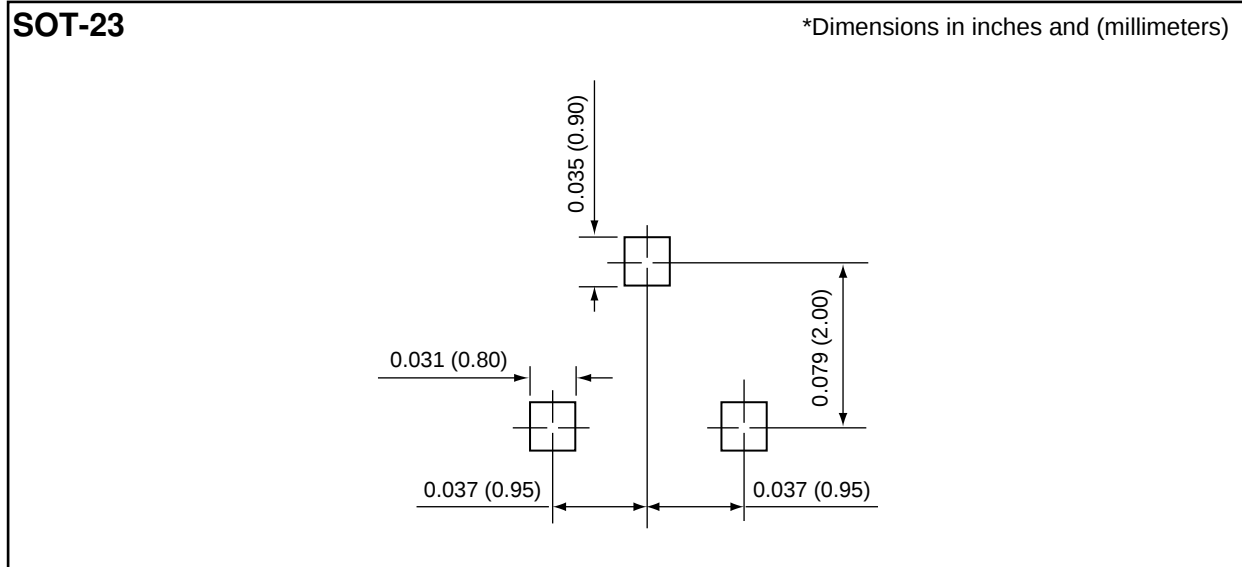
## DEVICE MARKING AND ORDERING INFORMATION

| Device     | Marking | Reel | Reel (pcs) | Carton (pcs)      | Packaging |
|------------|---------|------|------------|-------------------|-----------|
| MMBT5401GH | RK      | 7"   | 3,000      | 60,000<br>120,000 | SOT-23    |

## PACKAGE DIMENSIONS



## SOLDERING FOOTPRINT

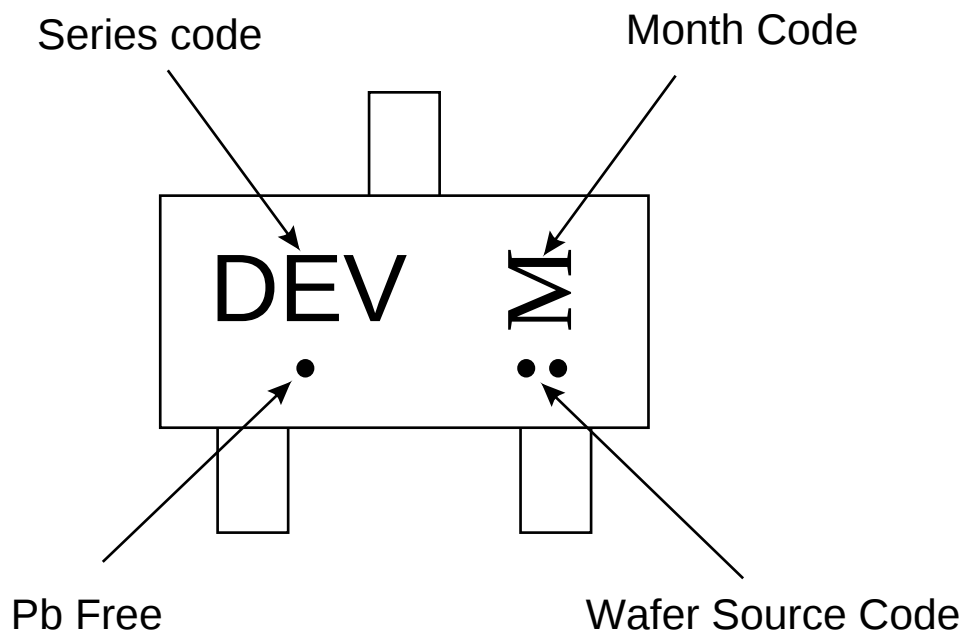


## MARKING DIAGRAM

**SOT-23**

**DEV = Series Code**

**M = Month Code**



### Month Code :

ODD YEARS (2009/1/3)

EVEN YEARS (2010/1/3)

|     |   |
|-----|---|
| Jan | 1 |
| Feb | 2 |
| Mar | 3 |
| Apr | 4 |
| May | 5 |
| Jun | 6 |
| Jul | 7 |
| Aug | 8 |
| Sep | 9 |
| Oct | T |
| Nov | V |
| Dec | C |

|     |   |
|-----|---|
| Jan | E |
| Feb | F |
| Mar | H |
| Apr | J |
| May | K |
| Jun | L |
| Jul | N |
| Aug | P |
| Sep | U |
| Oct | X |
| Nov | Y |
| Dec | Z |