

**SOT-23 BIPOLAR TRANSISTORS  
TRANSISTOR(PNP)**

**FEATURES**

- \* Power dissipation  
P<sub>CM</sub>: 0.3 W(T<sub>amb</sub>=25°C)
- \* Collector current  
I<sub>CM</sub>: -0.6 A
- \* Collector-base voltage  
V<sub>(BR)CBO</sub>: -40 V
- \* Operating and storage junction temperature range  
T<sub>J</sub>, T<sub>stg</sub>: -55°C to +150°C

**MECHANICAL DATA**

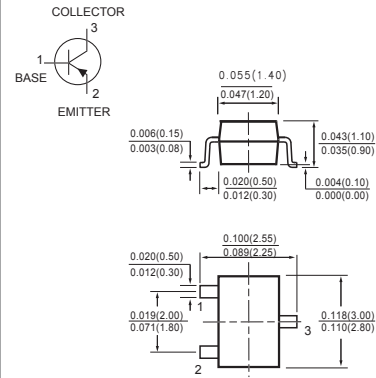
- \* Case: Molded plastic
- \* Epoxy: UL 94V-O rate flame retardant
- \* Lead: MIL-STD-202E method 208C guaranteed
- \* Mounting position: Any
- \* Weight: 0.008 gram

**MAXIMUM RATINGS AND ELECTRICAL CHARACTERISTICS**

Ratings at 25°C ambient temperature unless otherwise specified.  
Single phase, half wave, 60 Hz, resistive or inductive load.  
For capacitive load, derate current by 20%.



**SOT-23**



**MAXIMUM RATINGS** ( @ T<sub>A</sub> = 25°C unless otherwise noted)

| RATINGS  | SYMBOL           | VALUE       | UNITS |
|--|------------------|-------------|-------|
| Max. Steady State Power Dissipation <sup>(1)</sup> @T <sub>A</sub> =25°C Derate above 25°C | P <sub>D</sub>   | 300         | mW    |
| Max. Operating Temperature Range   | T <sub>J</sub>   | 150         | °C    |
| Storage Temperature Range  | T <sub>STG</sub> | -55 to +150 | °C    |

**ELECTRICAL CHARACTERISTICS** ( @ T<sub>A</sub> = 25°C unless otherwise noted)

| CHARACTERISTICS                        | SYMBOL           | MIN. | TYP. | MAX. | UNITS |
|--|------------------|------|------|------|-------|
| Thermal Resistance Junction to Ambient | R <sub>θJA</sub> | -    | -    | 417  | °C/W  |

Notes :1. Alumina=0.4\*0.3\*0.024in,99.5% alumina  
2. "Fully ROHS Compliant", "100% Sn plating (Pb-free)".

**ELECTRICAL CHARACTERISTICS** (@TA=25°C unless otherwise noted)

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

**OFF CHARACTERISTICS**

|   |               |      |      |                 |
|---|---------------|------|------|-----------------|
| Collector-Emitter Breakdown Voltage(1) ( $I_C = -1.0 \text{ mAdc}$ , $I_B = 0$ )      | $V_{(BR)CEO}$ | -40  | -    | Vdc             |
| Collector-Base Breakdown Voltage ( $I_C = -0.1 \text{ mAdc}$ , $I_E = 0$ )            | $V_{(BR)CBO}$ | -40  | -    | Vdc             |
| Emitter-Base Breakdown Voltage ( $I_E = -0.1 \text{ mAdc}$ , $I_C = 0$ )              | $V_{(BR)EBO}$ | -5.0 | -    | Vdc             |
| Base Cutoff Current ( $V_{CE} = -35 \text{ Vdc}$ , $V_{BE(off)} = -0.4 \text{ Vdc}$ ) | $I_{BEV}$     | -    | -0.1 | $\mu\text{Adc}$ |
| Collector Cutoff Current ( $V_{CE} = -35 \text{ Vdc}$ , $V_{EB} = -0.4 \text{ Vdc}$ ) | $I_{CEX}$     | -    | -0.1 | $\mu\text{Adc}$ |

**ON CHARACTERISTICS (1)**

|  |               |                              |                         |     |
|--|---------------|------------------------------|-------------------------|-----|
| DC Current Gain ( $I_C = -0.1 \text{ mAdc}$ , $V_{CE} = -1.0 \text{ Vdc}$ )<br>( $I_C = -1.0 \text{ mAdc}$ , $V_{CE} = -1.0 \text{ Vdc}$ )<br>( $I_C = -10 \text{ mAdc}$ , $V_{CE} = -1.0 \text{ Vdc}$ )<br>( $I_C = -150 \text{ mAdc}$ , $V_{CE} = -2.0 \text{ Vdc}$ )<br>( $I_C = -500 \text{ mAdc}$ , $V_{CE} = -2.0 \text{ Vdc}$ ) | $h_{FE}$      | 30<br>60<br>100<br>100<br>20 | -<br>-<br>-<br>300<br>- | -   |
| Collector-Emitter Saturation Voltage (1) ( $I_C = -150 \text{ mAdc}$ , $I_B = -15 \text{ mAdc}$ )<br>( $I_C = -500 \text{ mAdc}$ , $I_B = -50 \text{ mAdc}$ )  | $V_{CE(sat)}$ | -<br>-                       | -0.4<br>-0.75           | Vdc |
| Base-Emitter Saturation Voltage (1) ( $I_C = -150 \text{ mAdc}$ , $I_B = -15 \text{ mAdc}$ )<br>( $I_C = -500 \text{ mAdc}$ , $I_B = -50 \text{ mAdc}$ )   | $V_{BE(sat)}$ | -0.75<br>-                   | -0.95<br>-1.3           | Vdc |

**SMALL-SIGNAL CHARACTERISTICS**

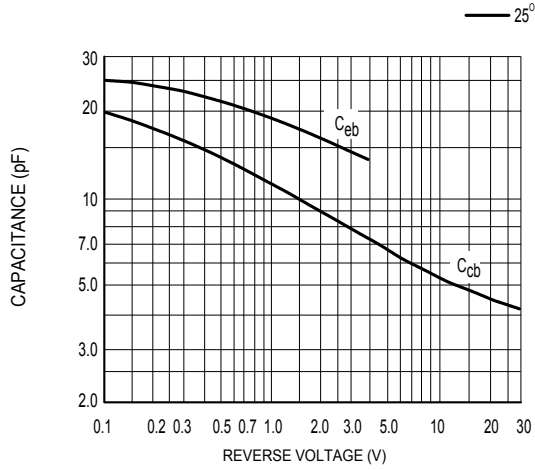
|  |          |     |     |                  |
|--|----------|-----|-----|------------------|
| Current-Gain-Bandwidth Product ( $I_C = -20 \text{ mAdc}$ , $V_{CE} = -10 \text{ Vdc}$ , $f = 100 \text{ MHz}$ ) | $f_T$    | 200 | -   | MHz              |
| Output Capacitance ( $V_{CB} = -10 \text{ Vdc}$ , $I_E = 0$ , $f = 1.0 \text{ MHz}$ )                            | $C_{cb}$ | -   | 8.5 | pF               |
| Input Capacitance ( $V_{EB} = -0.5 \text{ Vdc}$ , $I_C = 0$ , $f = 1.0 \text{ MHz}$ )                            | $C_{eb}$ | -   | 30  | pF               |
| Input Impedance ( $V_{CE} = -10 \text{ Vdc}$ , $I_C = -1.0 \text{ mAdc}$ , $f = 1.0 \text{ kHz}$ )               | $h_{ie}$ | 1.5 | 15  | kohms            |
| Voltage Feedback Ratio ( $V_{CE} = -10 \text{ Vdc}$ , $I_C = -1.0 \text{ mAdc}$ , $f = 1.0 \text{ kHz}$ )        | $h_{re}$ | 0.1 | 8.0 | $\times 10^{-4}$ |
| Small-Signal Current Gain ( $V_{CE} = -10 \text{ Vdc}$ , $I_C = -1.0 \text{ mAdc}$ , $f = 1.0 \text{ kHz}$ )     | $h_{fe}$ | 60  | 500 | -                |
| Output Admittance ( $V_{CE} = -10 \text{ Vdc}$ , $I_C = -1.0 \text{ mAdc}$ , $f = 1.0 \text{ kHz}$ )             | $h_{oe}$ | 1.0 | 100 | $\mu\text{mhos}$ |

**SWITCHING CHARACTERISTICS**

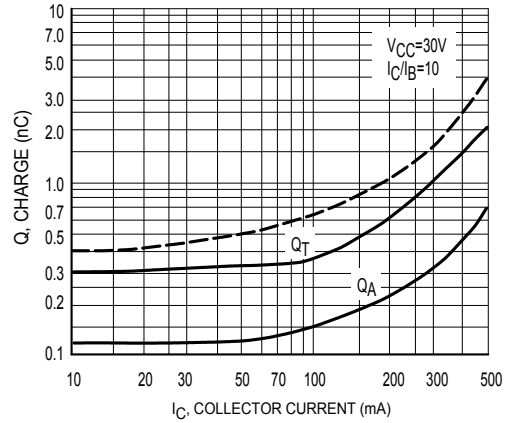
|              |   |       |   |     |    |
|--------------|---|-------|---|-----|----|
| Delay Time   | $(V_{CC} = -30 \text{ Vdc}$ , $V_{EB} = -2.0 \text{ Vdc}$ , $I_C = -150 \text{ mAdc}$ , $I_{B1} = -15 \text{ mAdc}$ ) | $t_d$ | - | 15  | ns |
| Rise Time    |   | $t_r$ | - | 20  |    |
| Storage Time | $(V_{CC} = -30 \text{ Vdc}$ , $I_C = -150 \text{ mAdc}$ , $I_{B1} = I_{B2} = -15 \text{ mAdc}$ )                      | $t_s$ | - | 225 | ns |
| Fall Time    |   | $t_f$ | - | 30  |    |

Note : Pulse Test: Pulse Width $\leq$ 300ms,Duty Cycle $\leq$ 2.0%

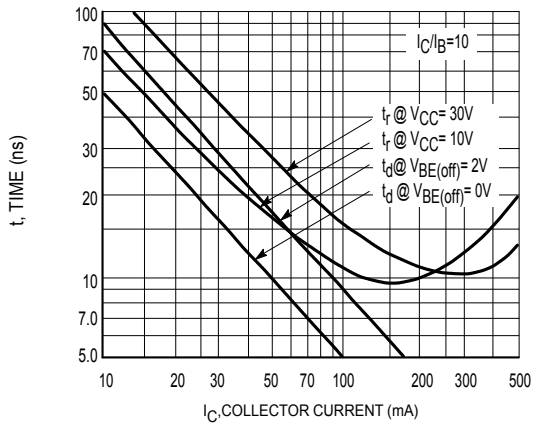
## RATING AND CHARACTERISTICS CURVES ( MMBT4403 )



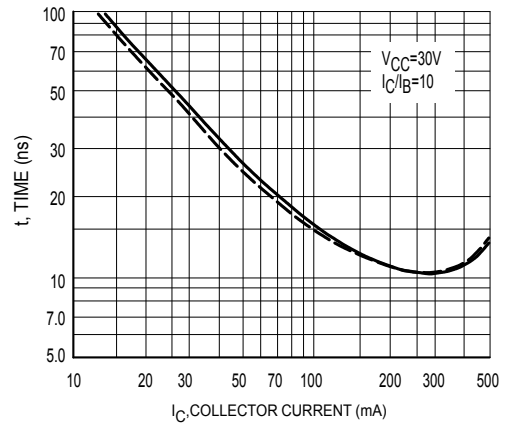
**Figure 1. Capacitances**



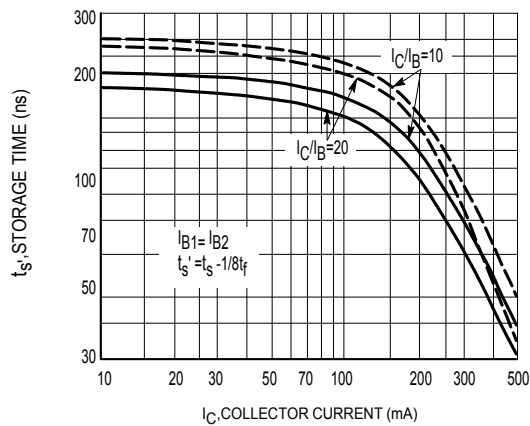
**Figure 2. Charge Data**



**Figure 3. Turn-On Time**



**Figure 4. Rise Times**



**Figure 5. Storage Time**

# RATING AND CHARACTERISTICS CURVES ( MMBT4403 )

$V_{CE} = -10V_{dc}$ ,  $T_A = 25^{\circ}C$

Bandwidth = 1.0Hz

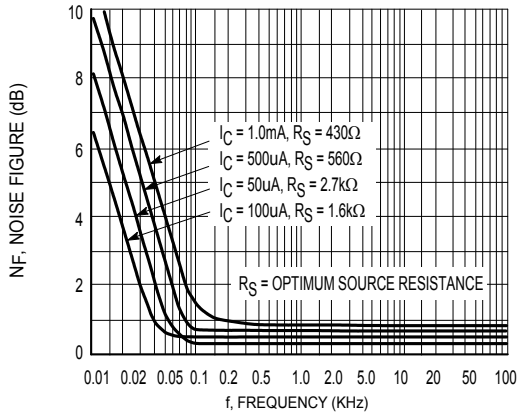


Figure 6. Frequency Effects

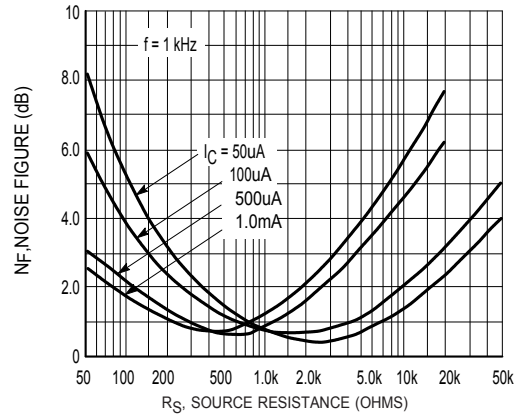


Figure 7. Source Resistance Effects

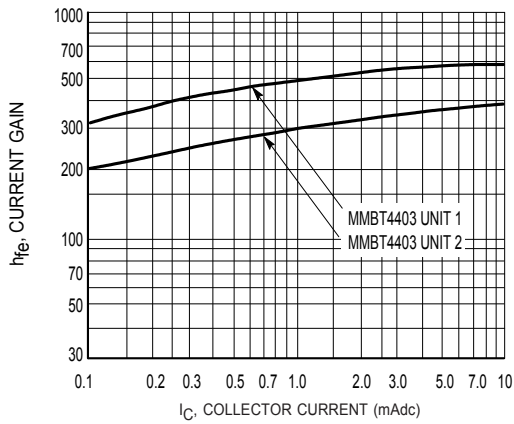


Figure 8. Current Gain

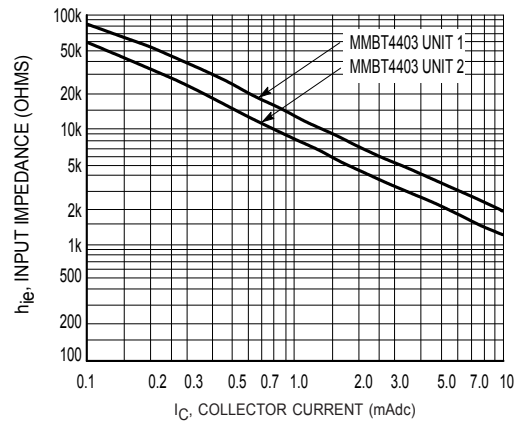


Figure 9. Input Impedance

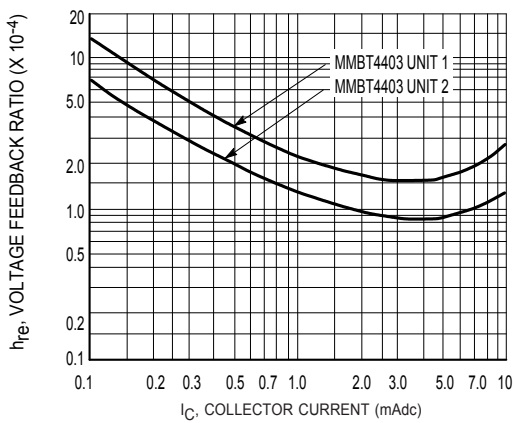


Figure 10. Voltage Feedback Ratio

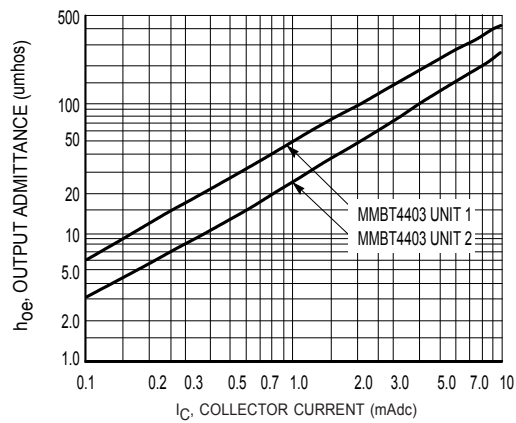


Figure 11. Temperature Coefficients

## RATING AND CHARACTERISTICS CURVES ( MMBT4403 )

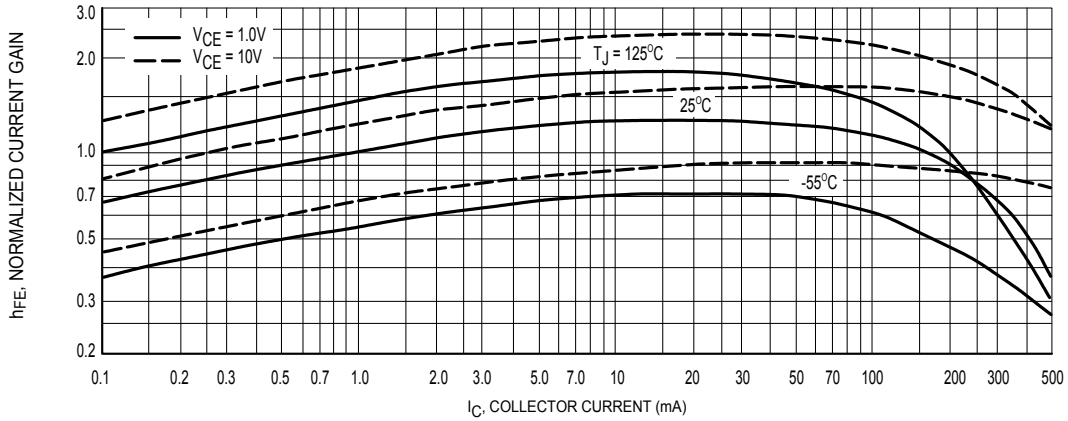


Figure 12. DC Current Gain

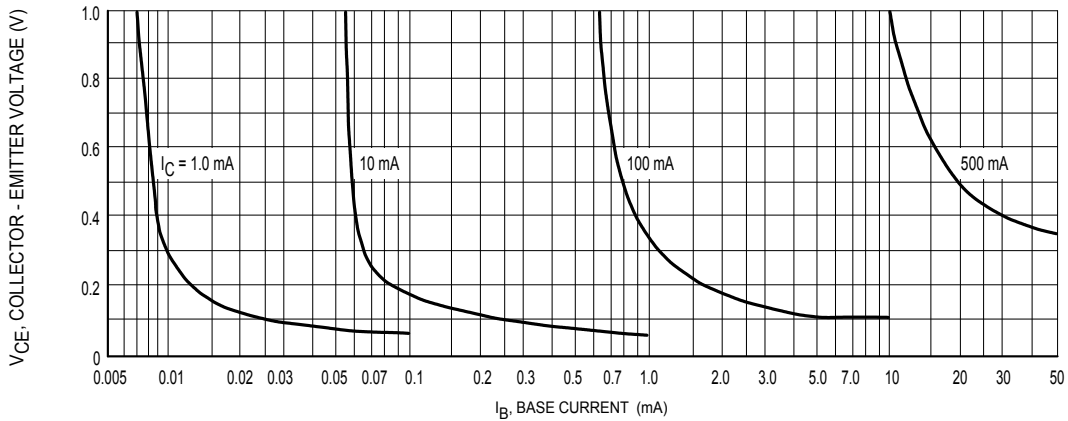


Figure 13. Collector Saturation Region

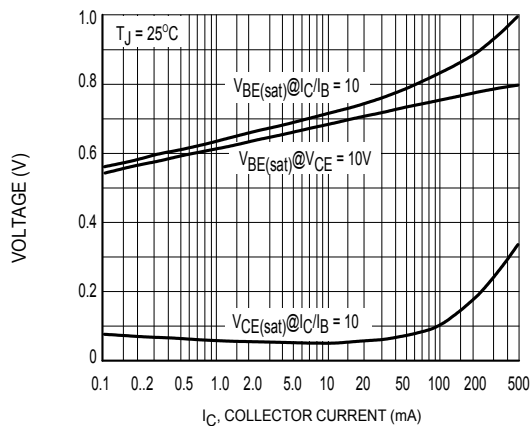


Figure 14. "ON" Voltages

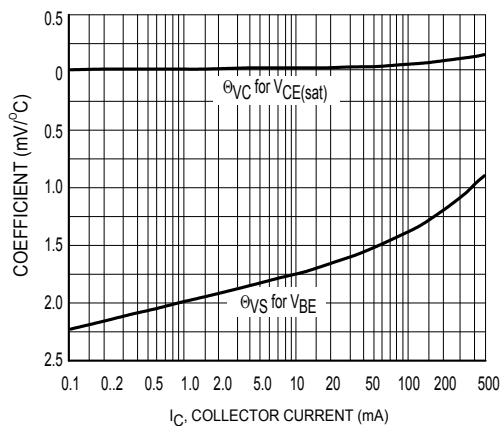


Figure 15. Temperature Coefficients

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