

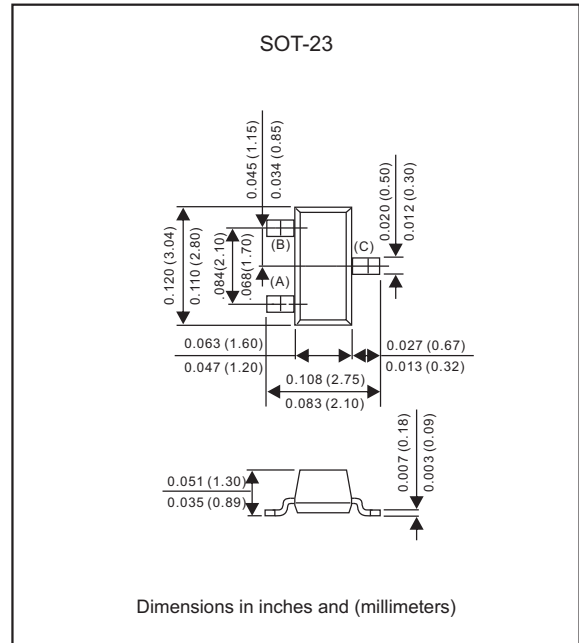
### Features

- Epitaxial plana chip construction
- Ideal for medium power application and switching
- Capable of 225mW power dissipation.
- Lead-free parts for green partner, exceeds environmental standards of MIL-STD-19500 /228
- Suffix "-H" indicates Halogen-free part, ex.MMBT4403-H.

### Mechanical data

- Epoxy:UL94-V0 rated flame retardant
- Case : Molded plastic, SOT-23
- Terminals : Solder plated, solderable per MIL-STD-750, Method 2026
- Mounting Position : Any

### Package outline



### Maximum ratings (AT $T_A=25^\circ\text{C}$ unless otherwise noted)

PARAMETER	CONDITIONS	Symbol	MIN.	TYP.	MAX.	UNIT
Collector-Base voltage		$V_{CBO}$			-40	V
Collector-Emitter voltage		$V_{CEO}$			-40	V
Emitter-Base voltage		$V_{EBO}$			-5.0	V
Collector current		$I_C$			-600	mA
Total device dissipation FR-5 board (1)	$T_A = 25^\circ\text{C}$	$P_D$			225	mW
	Derate above $25^\circ\text{C}$	$P_D$			1.8	mW/ $^\circ\text{C}$
Thermal resistance(1)	Junction to ambient	$R_{BJA}$			556	$^\circ\text{C}/\text{W}$
Total device dissipation alumina substrate(2)	$T_A = 25^\circ\text{C}$	$P_D$			300	mW
	Derate above $25^\circ\text{C}$	$P_D$			2.4	mW/ $^\circ\text{C}$
Thermal resistance(2)	Junction to ambient	$R_{BJA}$			417	$^\circ\text{C}/\text{W}$
Operating junction temperature range		$T_J$	-55		+150	$^\circ\text{C}$
Storage temperature range		$T_{STG}$	-55		+150	$^\circ\text{C}$

1.FR-5 = 1.0 X 0.75 X 0.062 in.

2.Alumina = 0.4 X 0.3 X 0.024 in. 99.5% alumina.

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

#### Off characteristics

PARAMETER	CONDITIONS	Symbol	MIN.	TYP.	MAX.	UNIT
Collector-Base breakdown voltage	$I_C = -0.1\text{mA}, I_E = 0$	$V_{(BR)CBO}$	-40			V
Collector-Emitter breakdown voltage(3)	$I_C = -1.0\text{mA}, I_B = 0$	$V_{(BR)CEO}$	-40			V
Emitter-Base breakdown voltage	$I_E = -0.1\text{mA}, I_C = 0$	$V_{(BR)EBO}$	-5.0			V
Base cutoff current	$V_{CE} = -35\text{Vdc}, V_{EB} = -0.4\text{Vdc}$	$I_{BL}$			-0.1	$\mu\text{A}$
Collector cutoff current	$V_{CE} = -35\text{Vdc}, V_{EB} = -0.4\text{Vdc}$	$I_{CEX}$			-0.1	

#### On characteristics(3)

PARAMETER	CONDITIONS	Symbol	MIN.	TYP.	MAX.	UNIT
DC current gain	$I_C = -0.1\text{mA}, V_{CE} = -1.0\text{V}$	$h_{FE}$	30			-
	$I_C = -1.0\text{mA}, V_{CE} = -1.0\text{V}$		60			
	$I_C = -10\text{mA}, V_{CE} = -1.0\text{V}$		100		300	
	$I_C = -150\text{mA}, V_{CE} = -1.0\text{V}$		100			
	$I_C = -500\text{mA}, V_{CE} = -2.0\text{V}$		20			
Collector-Emitter saturation voltage(3)	$I_C = 150\text{mA}, I_B = 15\text{mA}$	$V_{CE(sat)}$			-0.4	Vdc
	$I_C = 500\text{mA}, I_B = 50\text{mA}$				-0.75	
Base-Emitter saturation voltage(3)	$I_C = 150\text{mA}, I_B = 15\text{mA}$	$V_{BE(sat)}$	0.75		-0.95	Vdc
	$I_C = 500\text{mA}, I_B = 50\text{mA}$				-1.30	

3. Pulse test : pulse width  $\leq 300\mu\text{s}$ , duty cycle  $\leq 2.0\%$ .

#### Small-signal characteristics

PARAMETER	CONDITIONS	Symbol	MIN.	TYP.	MAX.	UNIT
Current-gain-bandwidth product(4)	$I_C = -20\text{mA}, V_{CE} = -10\text{V}, f = 100\text{MHz}$	$f_T$	200			MHz
Output capacitance	$V_{CB} = -10\text{V}, I_E = 0, f = 1.0\text{MHz}$	$C_{obo}$			8.5	pF
Input capacitance	$V_{EB} = -0.5\text{V}, I_C = 0, f = 1.0\text{MHz}$	$C_{ibo}$			30	pF
Input impedance	$V_{CE} = -10\text{V}, I_C = -1.0\text{mA}, f = 1.0\text{KHz}$	$h_{ie}$	1.5		15	kohms
Voltage feedback ratio	$V_{CE} = -10\text{V}, I_C = 1.0\text{mA}, f = 1.0\text{KHz}$	$h_{fe}$	0.1		8.0	$\times 10^{-4}$
Small-signal current gain	$V_{CE} = -10\text{V}, I_C = -1.0\text{mA}, f = 1.0\text{KHz}$	$h_{fe}$	60		500	-
Output admittance	$V_{CE} = -10\text{V}, I_C = -1.0\text{mA}, f = 1.0\text{KHz}$	$h_{oe}$	1.0		100	$\mu\text{mhos}$

4.  $f_T$  is defined as the frequency at which  $h_{fe}$  extrapolates to unity.

#### Switching characteristics

PARAMETER	CONDITIONS	Symbol	MIN.	TYP.	MAX.	UNIT
Delay time	$V_{CC} = -30\text{V}, V_{BE} = -2.0\text{Vdc}, I_C = -150\text{mA}, I_{B1} = -15\text{mA}$	$t_d$			15	ns
Rise time		$t_r$			20	
Storage time	$V_{CC} = -30\text{V}, I_C = -150\text{mA}, I_{B1} = I_{B2} = -15\text{mA}$	$t_s$			225	
Fall time		$t_f$			30	

### Switching time equivalent test circuits

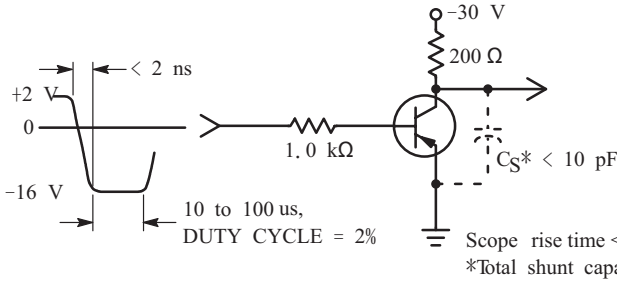


Figure 1. Turn-On Time

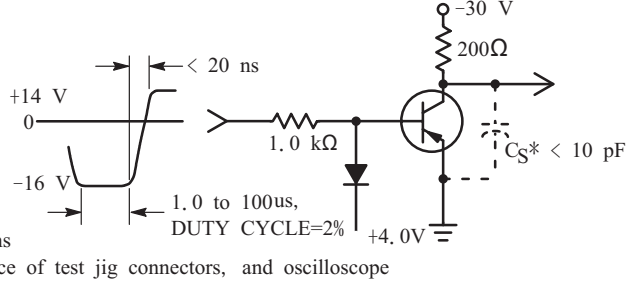


Figure 2. Turn-Off Time

### TRANSIENT CHARACTERISTICS

— 25°C    - - - 125°C

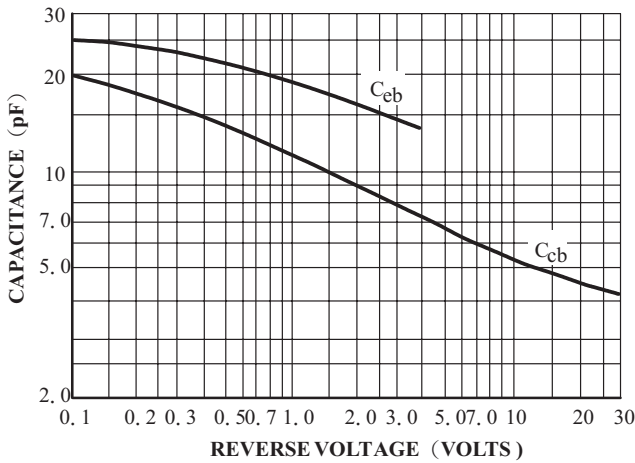


Figure 3. Capacitances

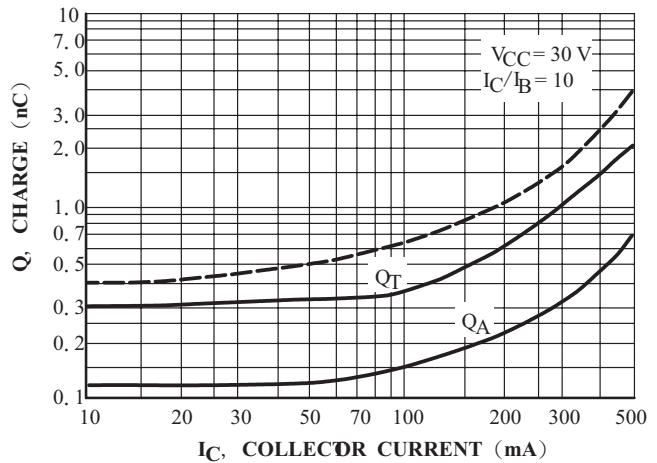


Figure 4. Charge Data

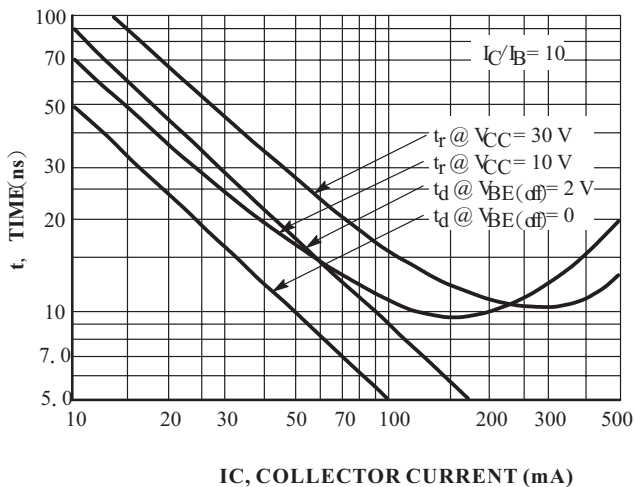


Figure 5. Turn-On Time

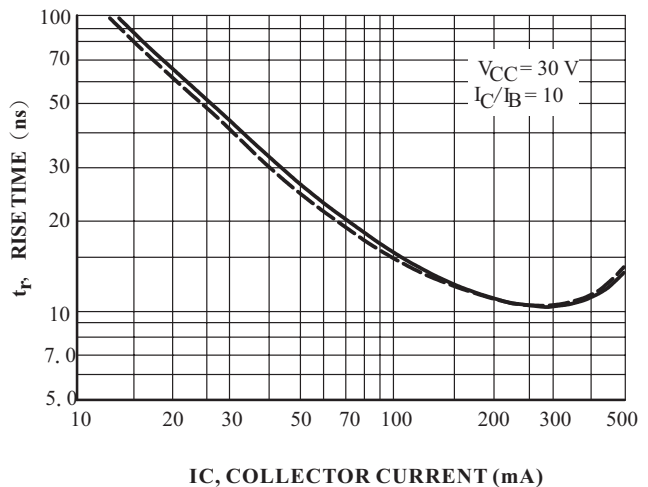


Figure 6. Rise Time

### Rating and characteristic curves

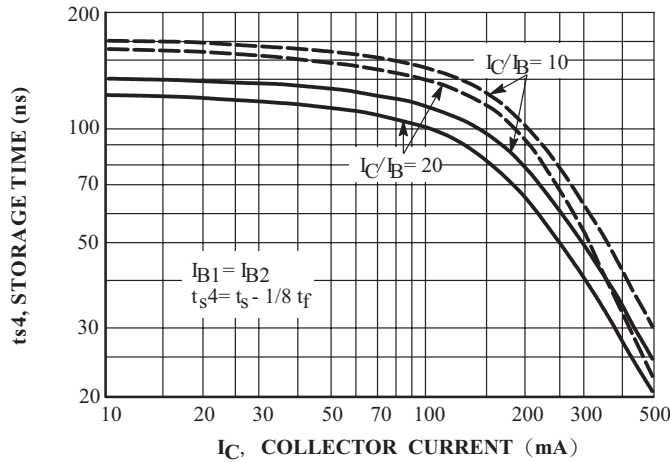


Figure 7. Storage Time

#### h P PARAMETERS

VCE = ±10 Vdc, f = 1.0 kHz, TA = 25°C

This group of graphs illustrates the relationship between hfe and other h parameters for this series of transistors. To

obtain these curves, a high±gain and a low±gain unit were selected from the FMBT4403 lines, and the same units were used to develop the correspondingly±numbered curves on each graph.

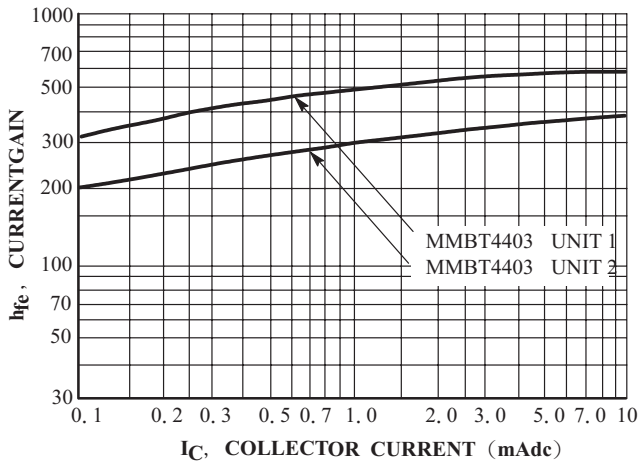


Figure 10. Current Gain

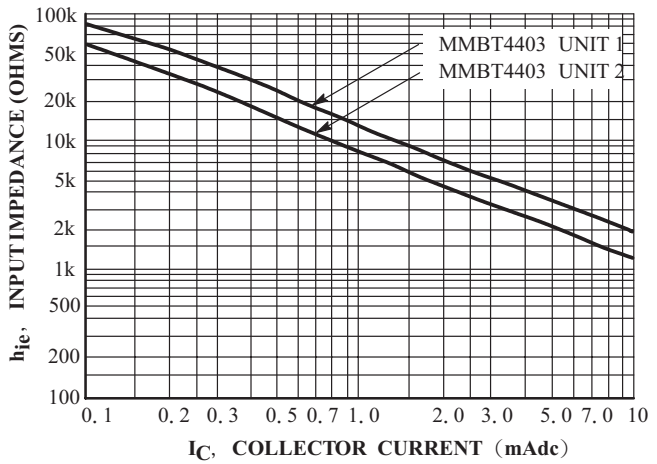


Figure 11. Input Impedance

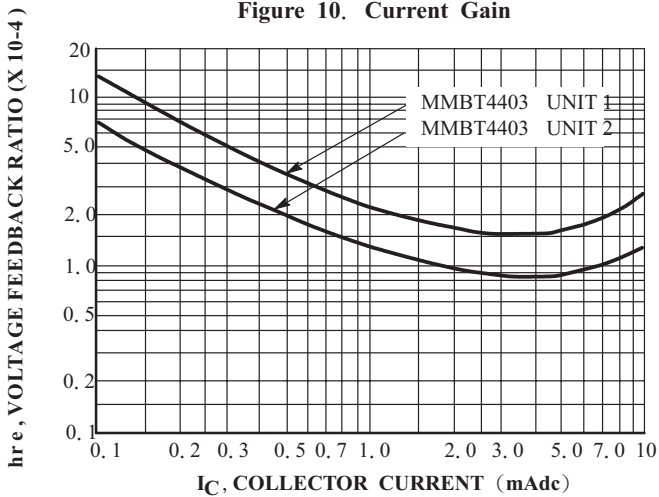


Figure 12. Voltage Feedback Ratio

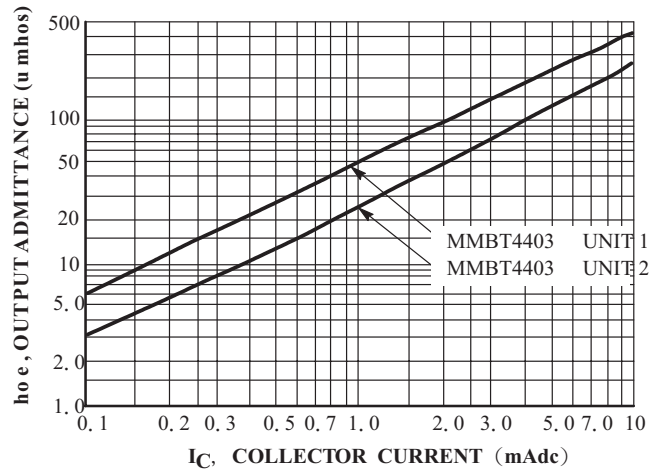


Figure 13. Output Admittance

## Rating and characteristic curves

### STATIC CHARACTERISTICS

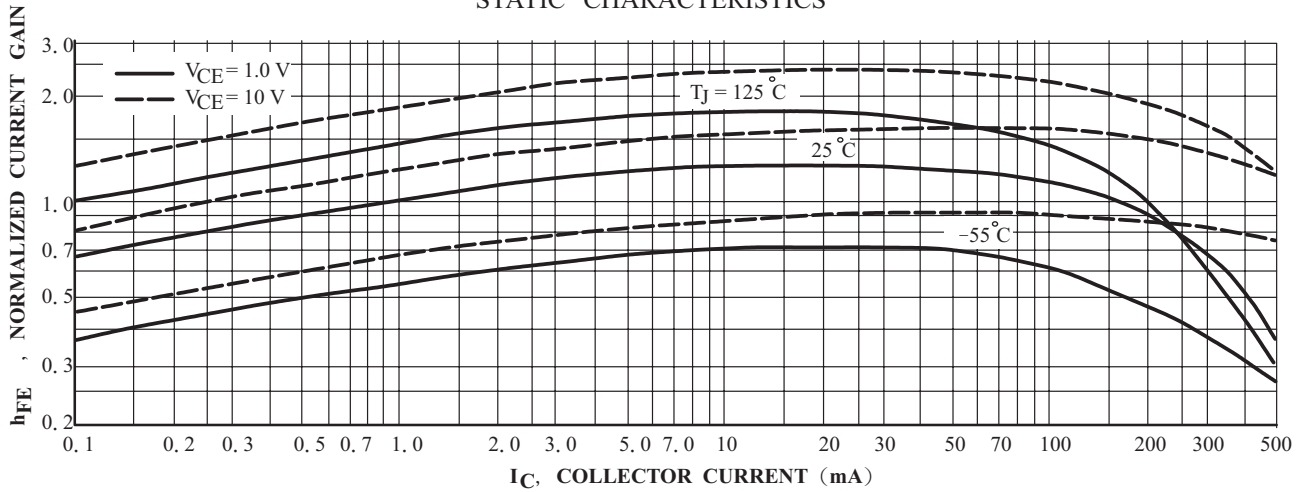


Figure 14. DC Current Gain

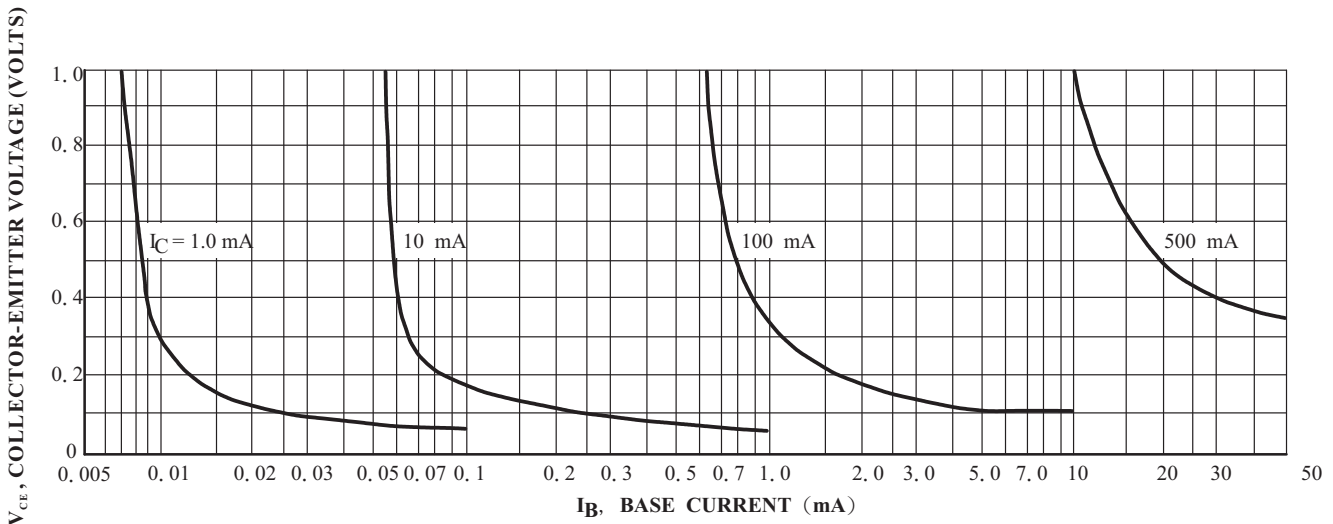


Figure 15. Collector Saturation Region

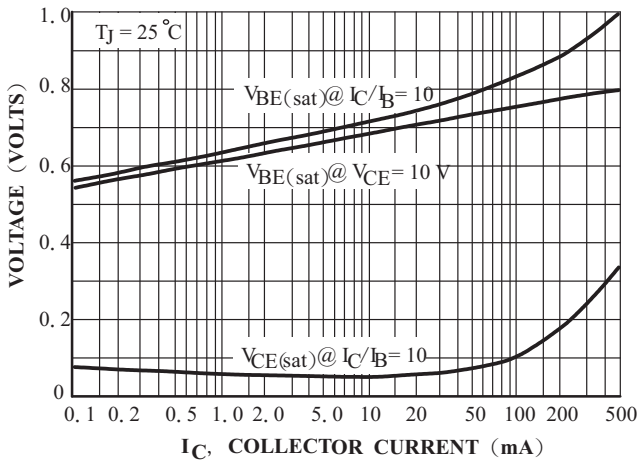


Figure 16. "On" Voltages

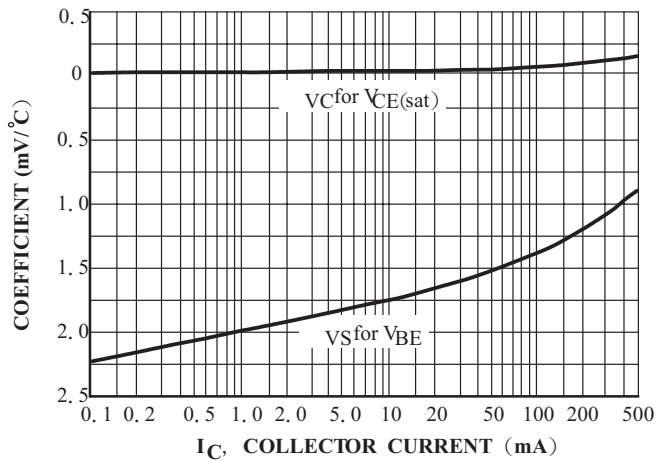
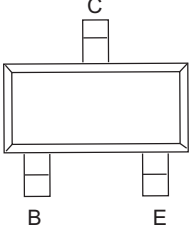
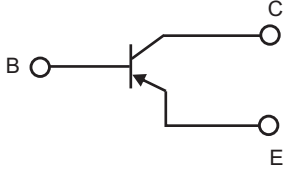


Figure 17. Temperature Coefficients

### Pinning information

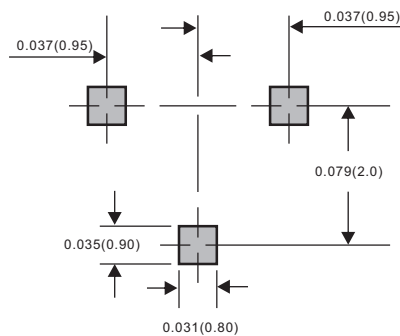
Pin	Simplified outline	Symbol
PinB Base PinC Collector PinE Emitter		

### Marking

Type number	Marking code
MMBT4403	2T

### Suggested solder pad layout

#### SOT-23



Dimensions in inches and (millimeters)