

FMBT4403W**List**

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FMBT4403W

General Purpose PNP Transistors

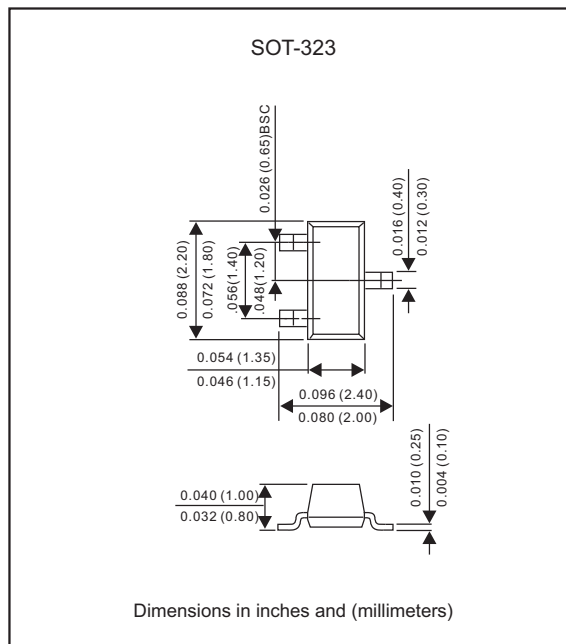
Features

- Epitaxial plana chip construction
- Ideal for medium power application and switching
- Capable of 150mW power dissipation
- Lead-free parts meet RoHS requirements
- Suffix "-H" dinicates Halogen-free part, ex.FMBT4403W-H

Mechanical data

- Epoxy:UL94-V0 rated flame retardant
- Case : Molded plastic, SOT-323
- Terminals : Solder plated, solderable per MIL-STD-750, Method 2026
- Mounting Position : Any
- Weight : Approximated 0.006 gram

Package outline



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

Parameter	Symbol	MIN.	TYP.	MAX.	Unit
Collector-base voltage	V_{CB0}			-40	V
Collector-emitter voltage	V_{CE0}			-40	V
Emitter-base voltage	V_{EB0}			-5.0	V
Collector current-continuous	I_C			-600	mA
Total device dissipation FR-5 board (1) $T_A = 25^{\circ}\text{C}$	P_D			150	mW
Thermal resistance junction to ambient (1)	$R_{\theta JA}$			833	$^{\circ}\text{C/W}$
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.

FMBT4403W

Electrical 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	$V_{CE} = -35\text{V}$, $V_{EB} = -0.4\text{V}$	I_{BEV}			-0.1	μA
Collector cutoff current	$V_{CE} = -35\text{V}$, $V_{EB} = -0.4\text{V}$	I_{CEX}			-0.1	μA

On characteristics

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			
	$I_C = -150\text{mA}$, $V_{CE} = -2.0\text{V}(3)$		100		300	
	$I_C = -500\text{mA}$, $V_{CE} = -2.0\text{V}(3)$		20			
Collector-emitter saturation voltage(3)	$I_C = -150\text{mA}$, $I_B = -15\text{mA}$	$V_{CE(sat)}$			-0.4	V
	$I_C = -500\text{mA}$, $I_B = -50\text{mA}$				-0.75	
Base-emitter saturation voltage(3)	$I_C = -150\text{mA}$, $I_B = -15\text{mA}$	$V_{BE(sat)}$	-0.75		-0.95	V
	$I_C = -500\text{mA}$, $I_B = -50\text{mA}$				-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	$I_C = -20\text{mA}$, $V_{CE} = -10\text{V}$, $f = 100\text{MHz}$	f_T	200			MHz
Collector-base capacitance	$V_{CB} = -10\text{V}$, $I_E = 0$, $f = 1.0\text{MHz}$	C_{cb}			8.5	pF
Emitter-base capacitance	$V_{BE} = -0.5\text{V}$, $I_C = 0$, $f = 1.0\text{MHz}$	C_{eb}			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	k Ω
Voltage feedback ratio	$V_{CE} = -10\text{V}$, $I_C = -1.0\text{mA}$, $f = 1.0\text{KHz}$	h_{re}	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	μmhos

Switching characteristics

Parameter	Conditions	Symbol	MIN.	TYP.	MAX.	Unit
Delay time	$V_{CC} = -30\text{V}$, $V_{EB} = -2.0\text{V}$, $I_C = -150\text{mA}$, $I_{B1} = -15\text{mA}$	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

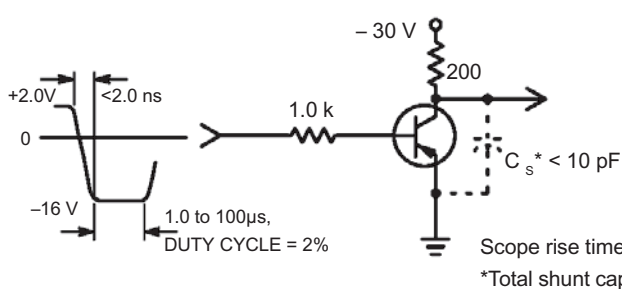


Figure 1. T turn-On Time

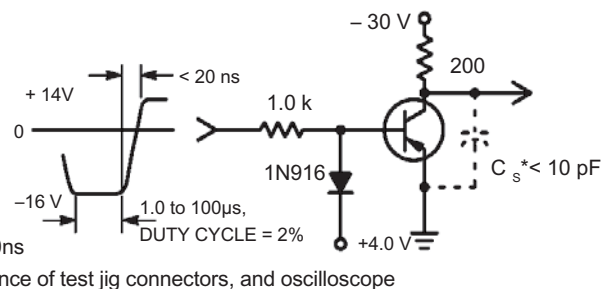


Figure 2. T turn-Off Time

TYPICAL TRANSIENT CHARACTERISTICS

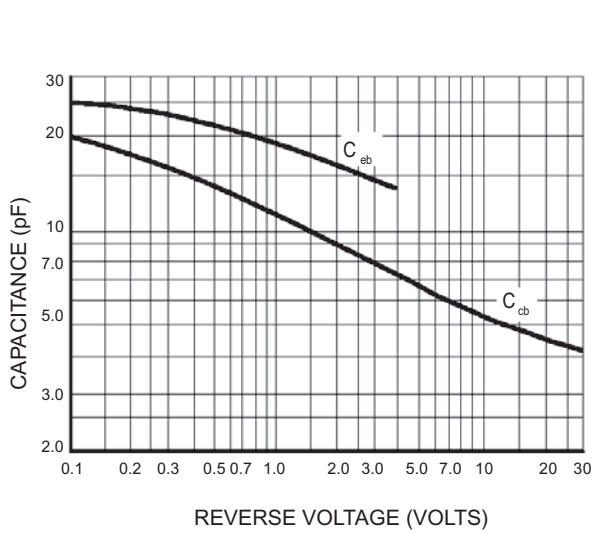


Figure 3. Capacitance

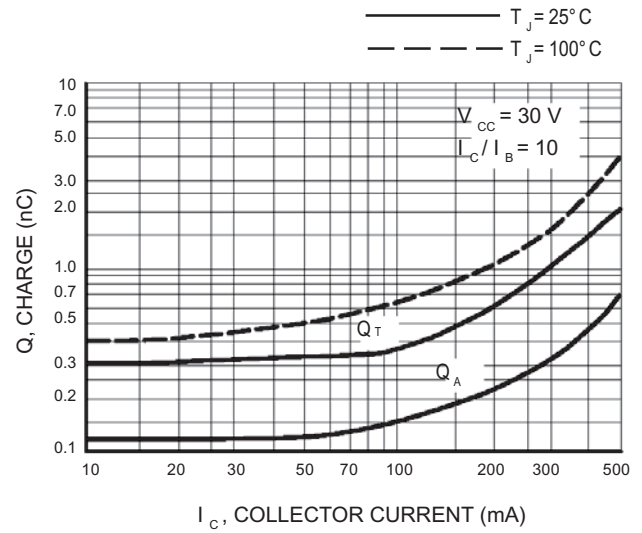


Figure 4. Charge Data

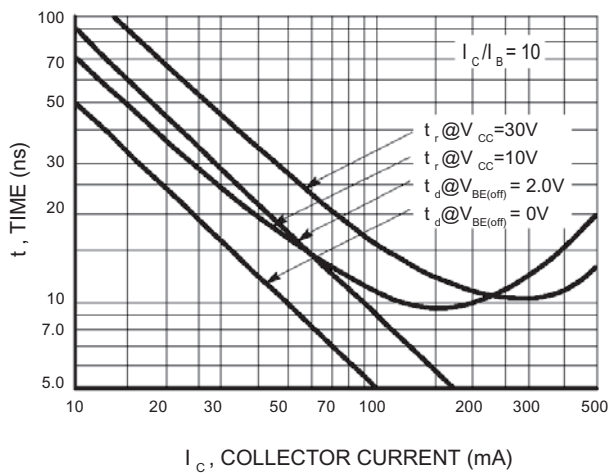


Figure 5. Turn-On Time

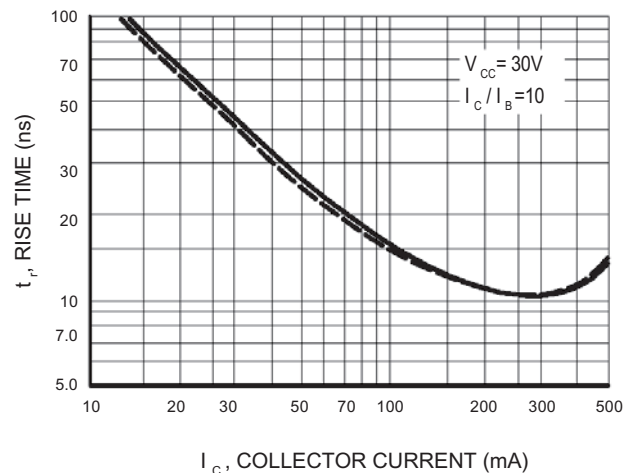


Figure 6. Rise Time

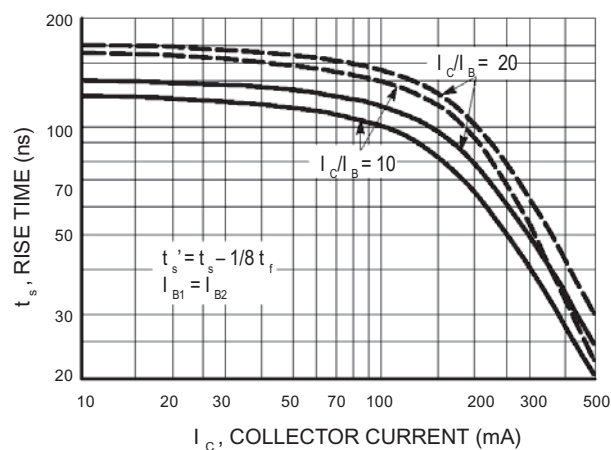


Figure 7. Storage Time

SMALL-SIGNAL CHARACTERISTICS

NOISE FIGURE

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

Bandwidth = 1.0 Hz

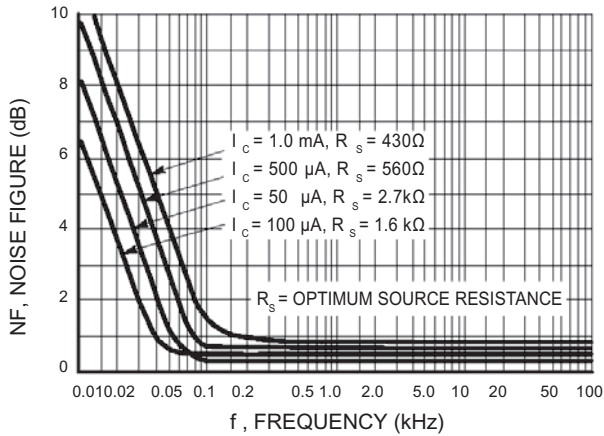


Figure 8. Frequency Effects

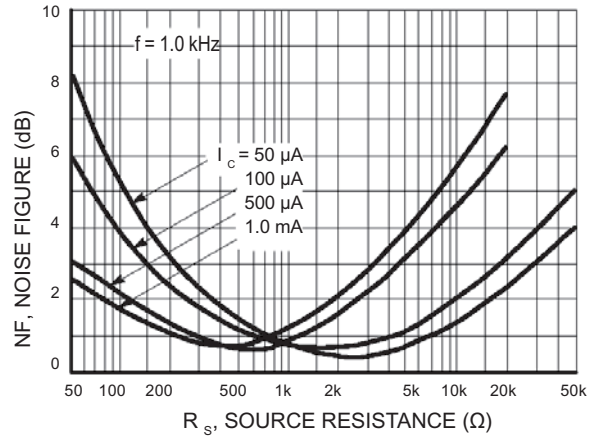


Figure 9. Source Resistance Effects

h PARAMETERS

($V_{CE} = -10 \text{ Vdc}$, $f = 1.0 \text{ kHz}$, $T_A = 25^\circ \text{C}$)

This group of graphs illustrates the relationship between h_{fe} 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 FMBT4403W lines, and the same units were used to develop the correspondingly numbered curves on each graph.

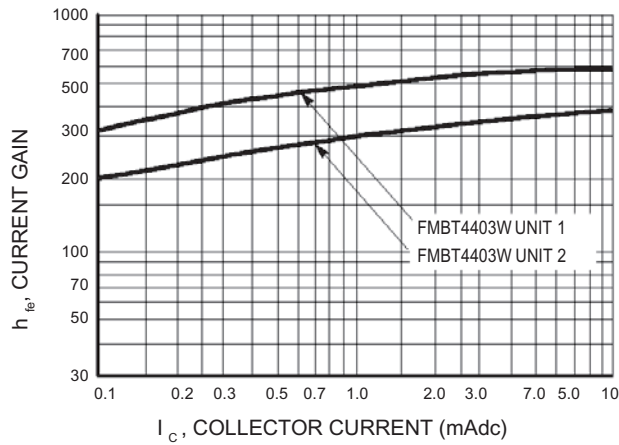


Figure 10. Current Gain

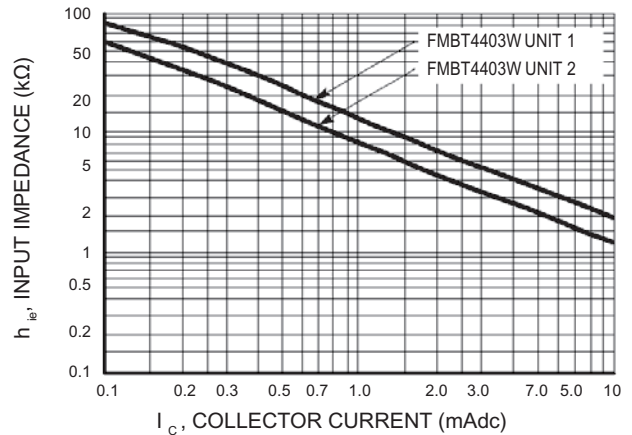


Figure 11. Input Impedance

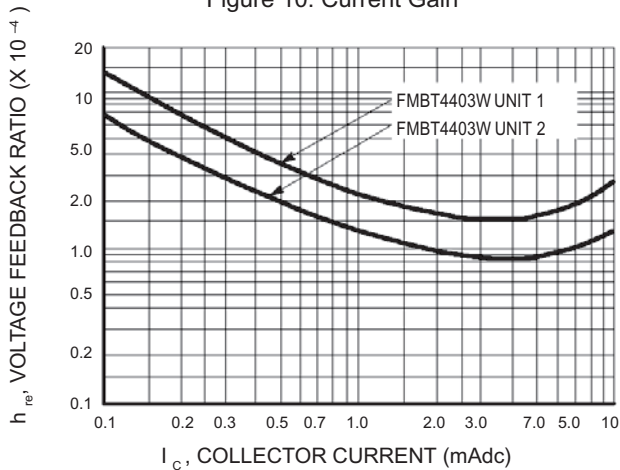


Figure 12. Voltage Feedback Ratio

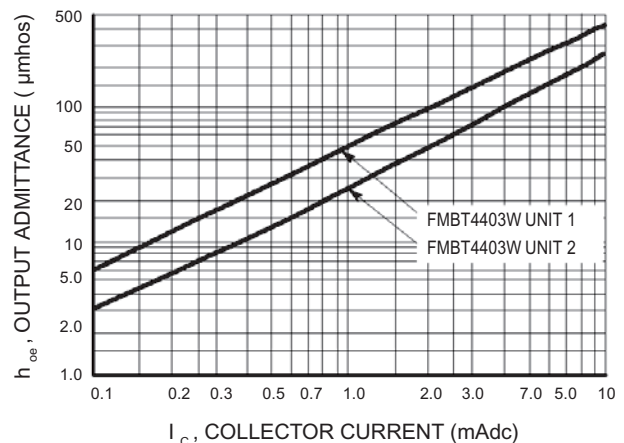


Figure 13. Output Admittance

STATIC CHARACTERISTICS

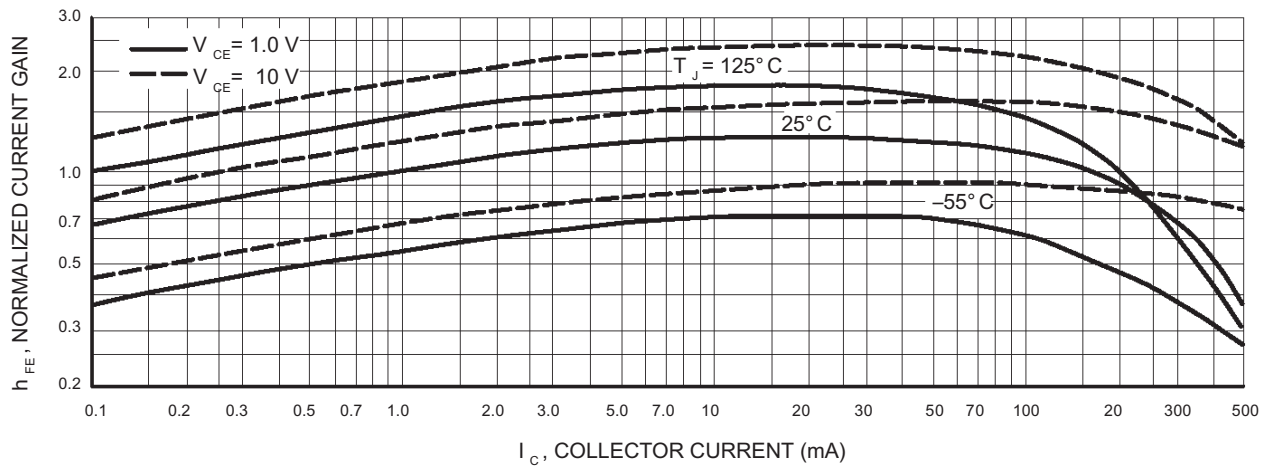


Figure 14. DC Current Gain

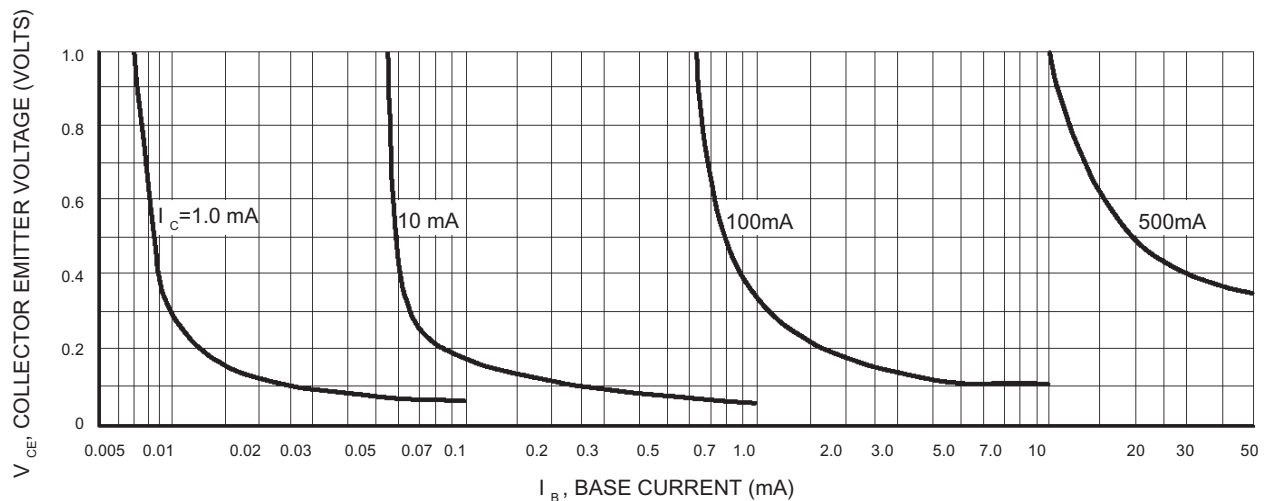


Figure 15. Collector Saturation Region

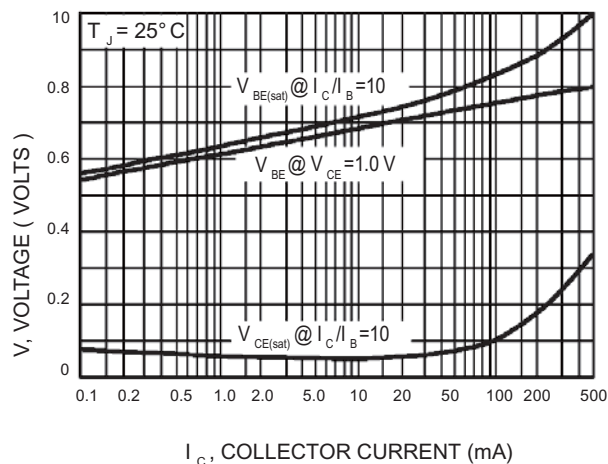


Figure 16. "On" Voltages

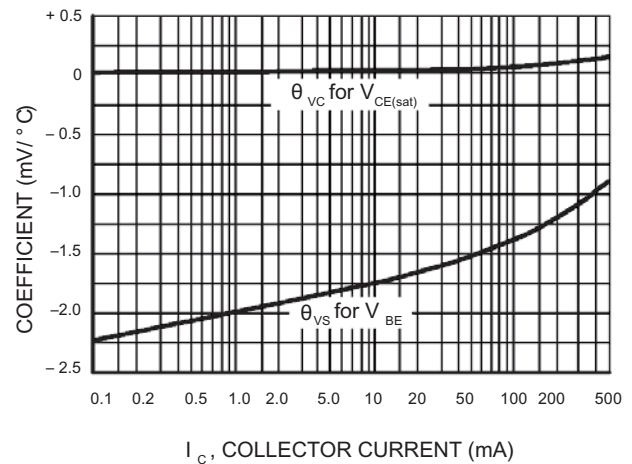
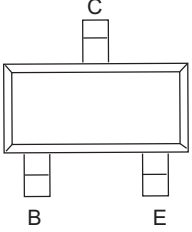
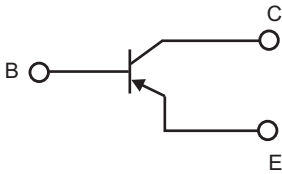


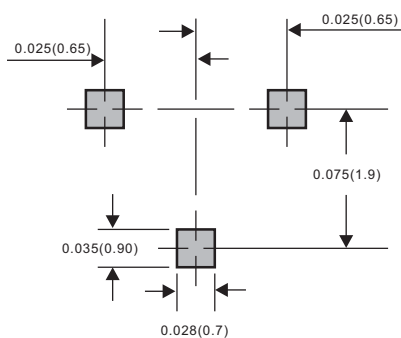
Figure 17. Temperature Coefficients

FMBT4403W**Pinning information**

Pin	Simplified outline	Symbol
PinB Base PinC Collector PinE Emitter		

Marking

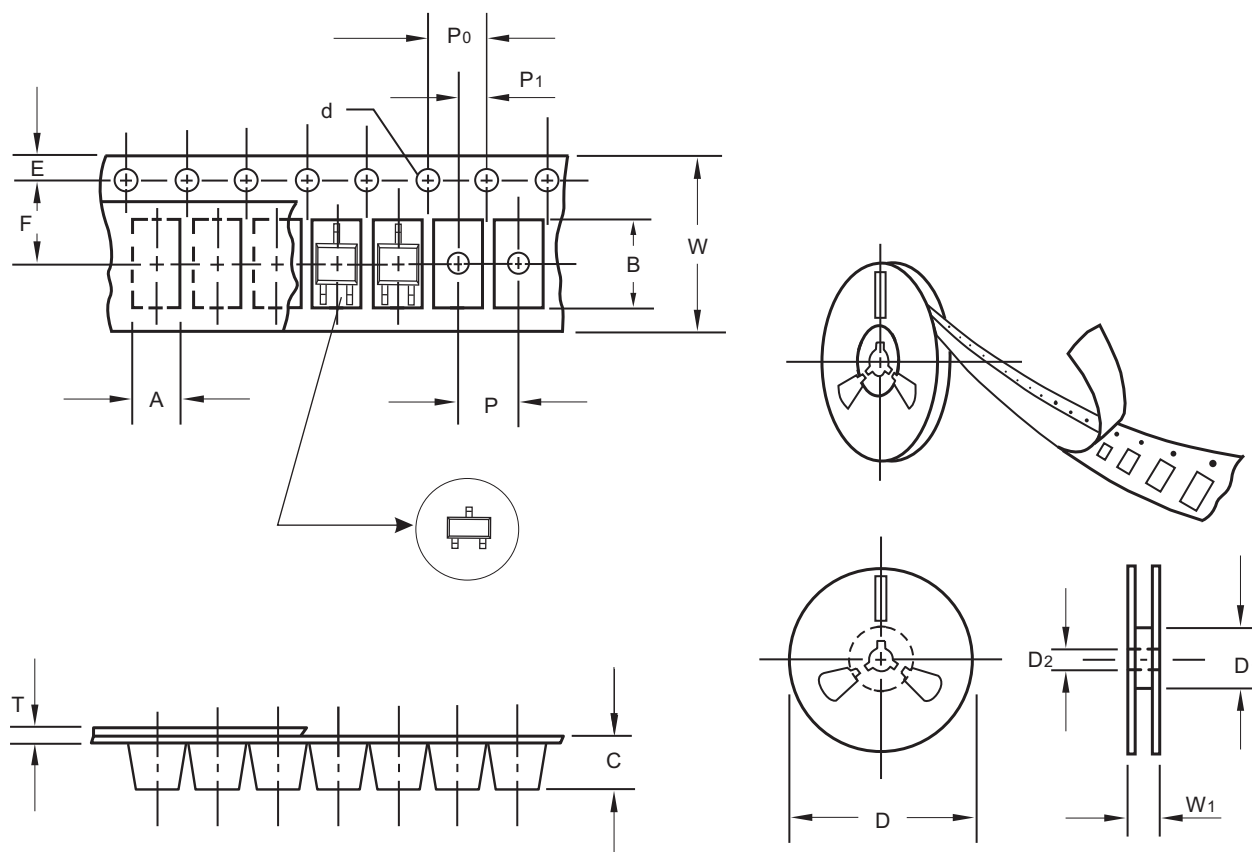
Type number	Marking code
FMBT4403W	2T

Suggested solder pad layout**SOT-323**

Dimensions in inches and (millimeters)

FMBT4403W

Packing information



unit:mm

Item	Symbol	Tolerance	SOT-323
Carrier width	A	0.1	2.25
Carrier length	B	0.1	2.55
Carrier depth	C	0.1	1.19
Sprocket hole	d	0.1	1.50
13" Reel outside diameter	D	2.0	-
13" Reel inner diameter	D1	min	-
7" Reel outside diameter	D	2.0	178.00
7" Reel inner diameter	D1	min	54.40
Feed hole diameter	D2	0.5	13.00
Sprocket hole position	E	0.1	1.75
Punch hole position	F	0.1	3.50
Punch hole pitch	P	0.1	4.00
Sprocket hole pitch	P0	0.1	4.00
Embossment center	P1	0.1	2.00
Overall tape thickness	T	0.1	0.23
Tape width	W	0.3	8.00
Reel width	W1	1.0	11.40

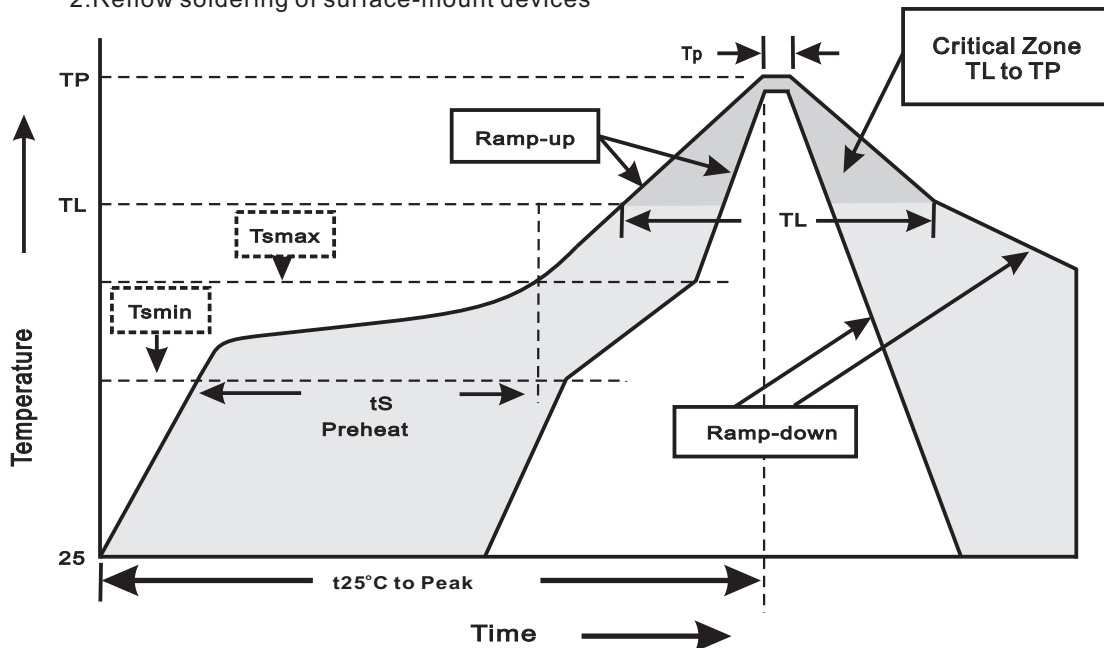
Note: Devices are packed in accordance with EIA standard RS-481-A and specifications listed above.

FMBT4403W**Reel packing**

PACKAGE	REEL SIZE	REEL (pcs)	COMPONENT SPACING (m/m)	BOX (pcs)	INNER BOX (m/m)	REEL DIA, (m/m)	CARTON SIZE (m/m)	CARTON (pcs)	APPROX. GROSS WEIGHT (kg)
SOT-323	7"	3,000	4.0	30,000	183*123*183	178	382*257*387	240,000	9.5

Suggested thermal profiles for soldering processes

- 1.Storage environment: Temperature=5°C~40°C Humidity=55%±25%
- 2.Reflow soldering of surface-mount devices

**3.Reflow soldering**

Profile Feature	Soldering Condition
Average ramp-up rate(T_L to T_P)	$<3^{\circ}\text{C}/\text{sec}$
Preheat -Temperature Min(T_{smin}) -Temperature Max(T_{smax}) -Time(min to max)(t_s)	150°C 200°C $60\sim 120\text{sec}$
T_{smax} to T_L -Ramp-upRate	$<3^{\circ}\text{C}/\text{sec}$
Time maintained above: -Temperature(T_L) -Time(t_L)	217°C $60\sim 260\text{sec}$
Peak Temperature(T_P)	$255^{\circ}\text{C}-0/+5^{\circ}\text{C}$
Time within 5°C of actual Peak Temperature(t_P)	$10\sim 30\text{sec}$
Ramp-down Rate	$<6^{\circ}\text{C}/\text{sec}$
Time 25°C to Peak Temperature	$<6\text{minutes}$

FMBT4403W

High reliability test capabilities

Item Test	Conditions
1. Steady State Operating Life	$P_D=150\text{mW}$ Test Duration:1000hrs
2. High Temperature Reverse Bias	$T_J=150^\circ\text{C}$, $V_{CE}=80\%$ related volage, 1000hrs
3. Temperature Cycle	$-55^\circ\text{C}(15\text{min})$ to $150^\circ\text{C}(15\text{min})$ Air to Air Transition Time<20sec Test Cycles: 1000cycle
4. Autoclave	$P=2\text{atm}$ $T_a=121^\circ\text{C}$ $RH=100\%$ Test Duration: 96hrs
5. High Temperature Storage Life	$T_a=150^\circ\text{C}$ Test Duration: 1000hrs
6. Solderability	245°C , 5sec
7. High Temperature High Humidity Reverse Bias	$T_a=85^\circ\text{C}$, 85%RH, $V_{CE}=80\%$ related volage, 1000hrs
8. Resistance to Soldering Heat	260°C , 10sec