FMBT4401W

List

List..... 1

Package outline..... 2

Features..... 2

Mechanical data..... 2

Maximum ratings 2.3

Switching time equivalent test circuits..... 4

Rating and characteristic curves..... 5, 6

Pinning information.....7

Marking..... 7

Suggested solder pad layout..... 7

Packing information.....8

Reel packing..... 9

Suggested thermal profiles for soldering processes.....9

High reliability test capabilities..... 10

FMBT4401W

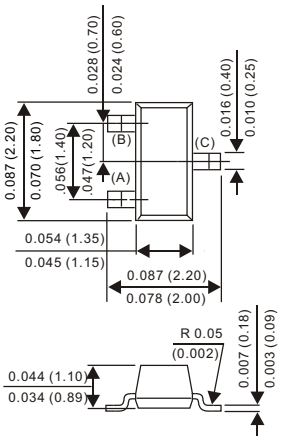
600mA Silicon NPN Epitaxial Planar Transistor

Features

- Epitaxial plana chip construction
- Ideal for medium power application and switching
- As complementary type, the NPN transistor FMBT4403W is recommended.
- Capable of 150mW power dissipation.
- Suffix "-H" indicates Halogen-free part, ex. FMBT4401W-H.
- Lead-free parts for green partner, exceeds environmental standards of MIL-STD-19500/228

Package outline

SOT-323



Dimensions in inches and (millimeters)

Mechanical data

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

Maximum ratings (AT T_A=25°C unless otherwise noted)

PARAMETER	CONDITIONS	Symbol	MIN.	TYP.	MAX.	UNIT
Collector-Base voltage		V_{CBO}			60	V
Collector-Emitter voltage		V_{CEO}			40	V
Emitter-Base voltage		V_{EBO}			6.0	V
Collector current		I_C			600	mA
Total device dissipation FR-5 board (1)	T_A = 25°C	P_D			150	mW
	Derate above 25°C	P_D			1.8	mW/°C
Thermal resistance	Junction to ambient	$R_{\theta JA}$			556	°C/W
Total device dissipation alumina substrate(2)	T_A = 25°C	P_D			300	mW
	Derate above 25°C	P_D			2.4	mW/°C
Thermal resistance	Junction to ambient	$R_{\theta JA}$			417	°C/W
Storage temperature		T_J	-55		+150	°C
Operating temperature		T_{STG}	-65		+175	

1.FR-5 = 1.0 X 0.75 X0.062 in.
2.Alumina = 0.4 X 0.3 X 0.024 in. 99.5% alumina.

FMBT4401W

Characteristics (AT T_A=25°C unless otherwise noted)

Off characteristivs

PARAMETER	CONDITIONS	Symbol	MIN.	TYP.	MAX.	UNIT
Collector-Base breakdown voltage	I_c = 0.1mA, I_E = 0	$V_{(BR)CBO}$	60			V
Collector-Emitter breakdown voltage(3)	I_c = 1.0mA, I_B = 0	$V_{(BR)CEO}$	40			V
Emitter-Base breakdown voltage	I_E = 0.1mA, I_C = 0	$V_{(BR)EBO}$	6.0			V
Base cutoff current	V_{CE} = 35Vdc, V_{EB} = 0.4 Vdc	I_{BL}			0.1	μA
Collector cutoff current	V_{CE} = 35Vdc, V_{EB} = 0.4Vdc	I_{CEX}			0.1	

On characteristivs(3)

PARAMETER	CONDITIONS	Symbol	MIN.	TYP.	MAX.	UNIT
DC current gain	I_c = 0.1mA, V_{CE} = 1.0V	H_{FE}	20			-
	I_c = 1.0mA, V_{CE} = 1.0V		40			
	I_c = 10mA, V_{CE} = 1.0V		80		300	
	I_c = 150mA, V_{CE} = 1.0V		100			
	I_c = 500mA, V_{CE} = 2.0V		40			
Collector-Emitter saturation voltage(3)	I_c = 150mA, I_B = 15mA	$V_{CE(sat)}$			0.4	Vdc
	I_c = 500mA, I_B = 50mA				0.75	
Base-Emitter saturation voltage(3)	I_c = 150mA, I_B = 15mA	$V_{BE(sat)}$	0.75		0.95	Vdc
	I_c = 500mA, I_B = 50mA				1.20	

3.Pulse test : pukse width ≤ 300uS, duty cycle ≤ 2.0%.

Small-signal characteristivs

PARAMETER	CONDITIONS	Symbol	MIN.	TYP.	MAX.	UNIT
Current-gain-bandwidth product(4)	I_C = 20mA, V_{CE} = 10V, f = 100MHz	f_T	250			MHz
Output capacitance	V_{CB} = 5.0V, I_E = 0, f= 1.0MHz	C_{obo}			6.5	pF
Input capacitance	V_{EB} = 0.5V, I_C = 0, f= 1.0MHz	C_{ibo}			30	pF
Input impedance	V_{CE} = 10mA, I_C = 1.0mA, f= 1.0KHz	h_{ie}	1.0		15	k Ω
Voltage feeback radio	V_{CE} = 10V, I_C = 1.0mA, f= 1.0KHz	h_{re}	0.1		8.0	X 10^{-4}
Small-signal current gain	V_{CE} = 10V, I_C = 1.0mA, f= 1.0KHz	h_{fe}	40		500	-
Output admittance	V_{CE} = 10V, I_C = 1.0mA, f= 1.0KHz	h_{oe}	1.0		30	μmhos

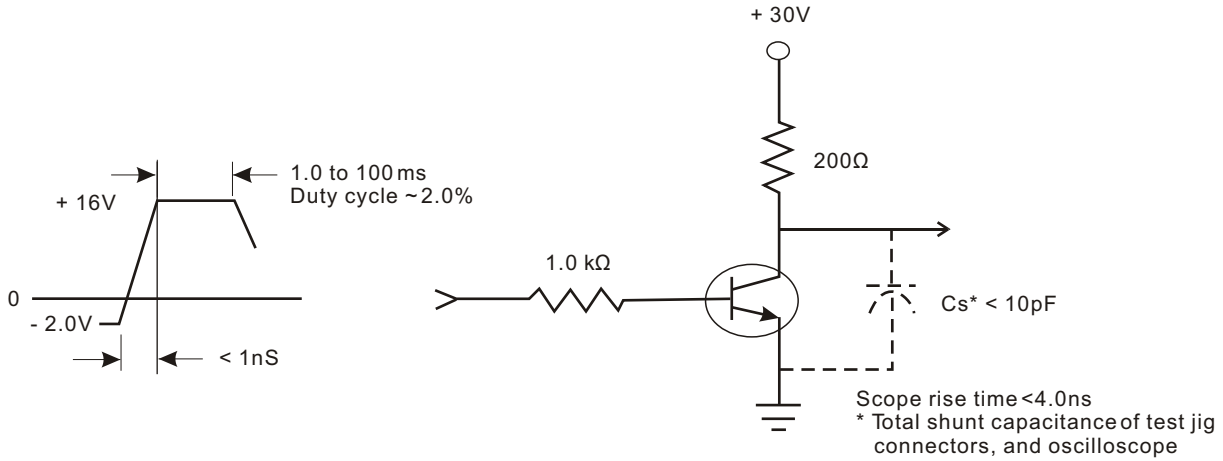
4.f_T is defined as the frequency at which h_{fe} extrapolates to unity.

Switching characteristivs

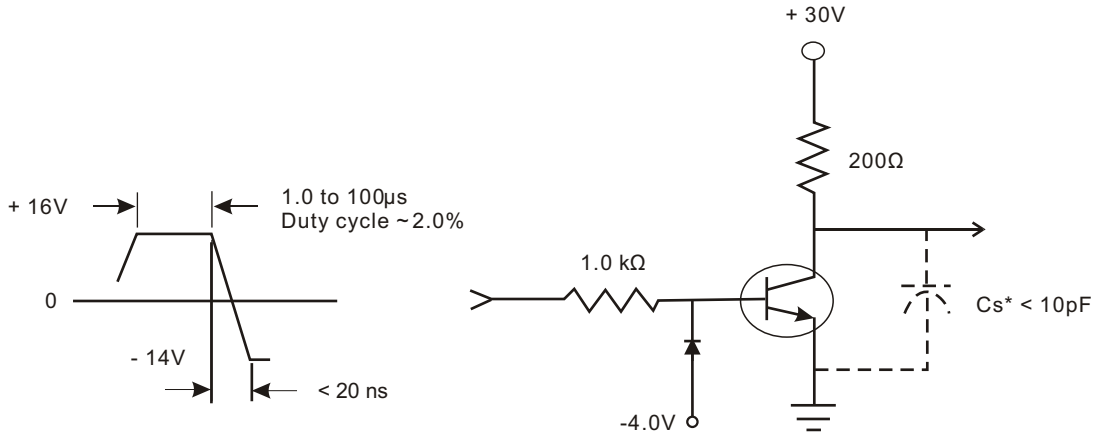
PARAMETER	CONDITIONS	Symbol	MIN.	TYP.	MAX.	UNIT
Delay time	V_{CC} = 30V, V_{BE} = 2.0V_{dc}, I_C = 150mA, I_{B1} = 15mA	td			15	nS
Rise time		tr			20	
Storage time	V_{CC} = 30V, I_C =150mA, I_{B1} = I_{B2} = 15mA	ts			225	
Fall time		tf			30	

FMBT4401W

Switching time equivalent test circuits



Delay and rise time equivalent test circuit



Storage and fall time equivalent test circuit

Rating and characteristic curves (FMBT4401W)

TRANSIENT CHARACTERISTICS

25°C
105°C

Fig.1- Capacitances

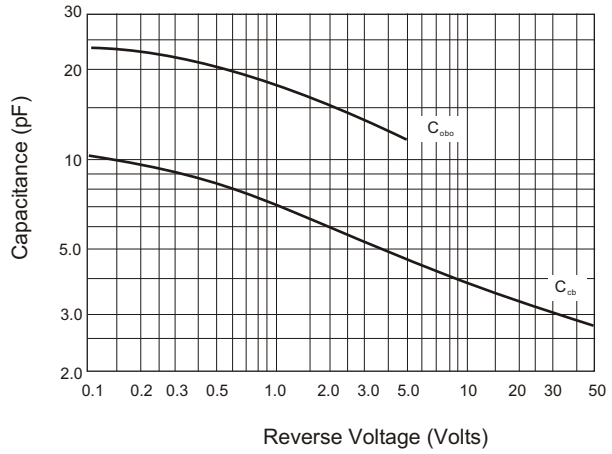


Fig. 2-Charge Data

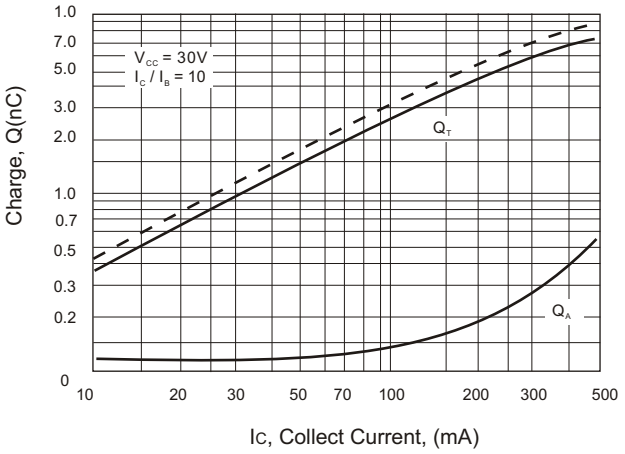


FIG.3- Turn-On Time

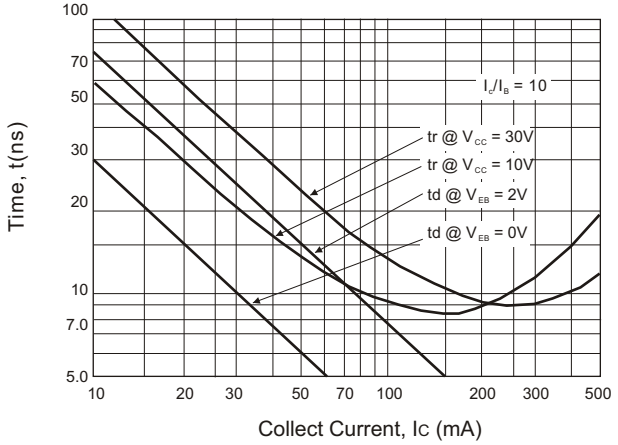


Fig. 4-Rise Time

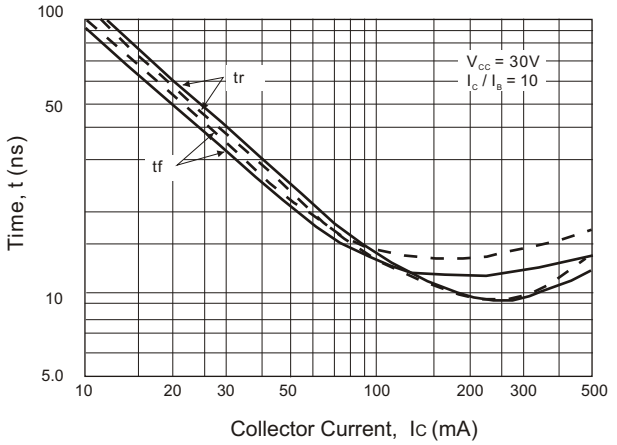


Fig. 5.-Storage T time

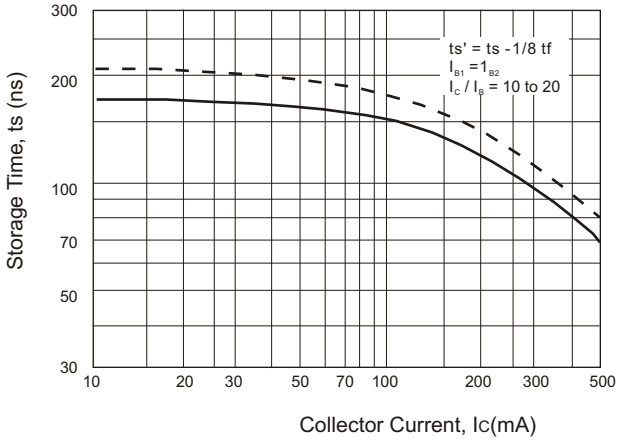
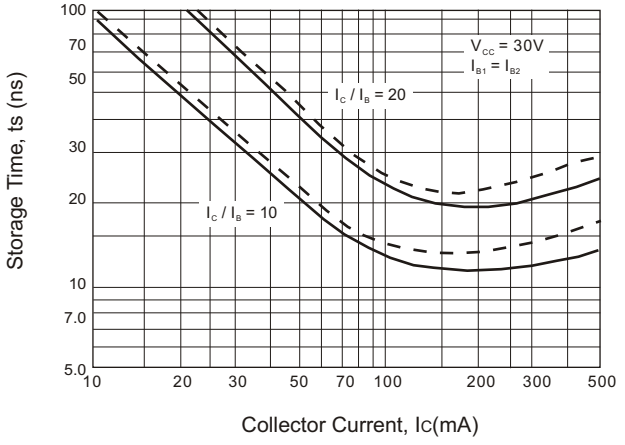


Fig. 6- Fall Time



Rating and characteristic curves (FMBT4401W)

STATIC CHARACTERISTICS

Fig.7- DC Current Gain

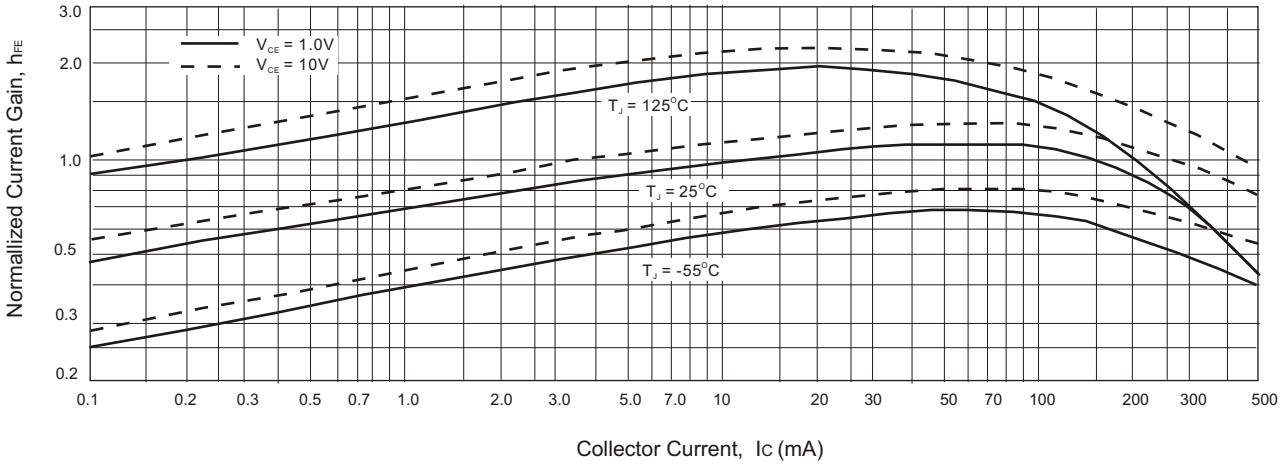


FIG.8- Collector Saturation Region

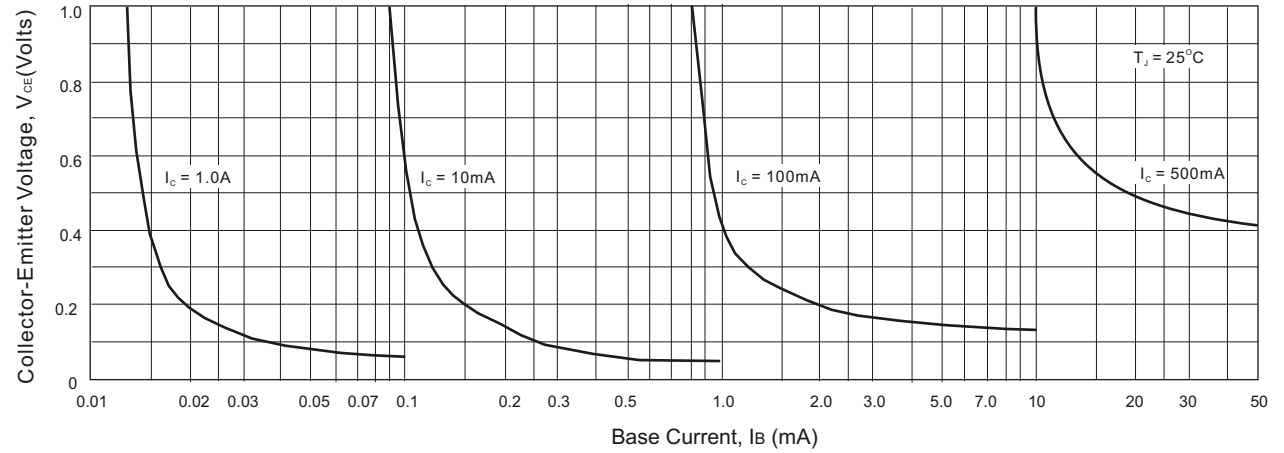


Fig. 9.-"On" Voltage

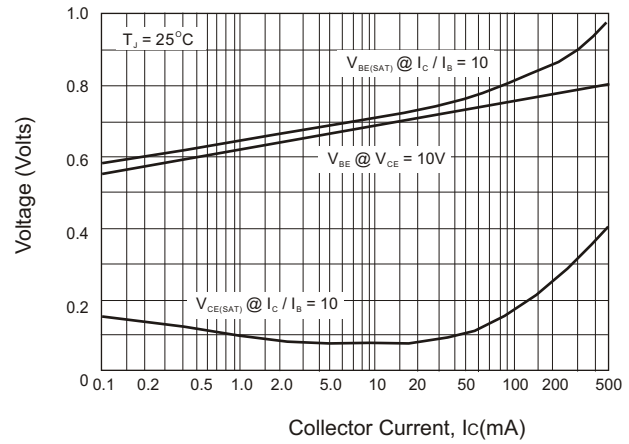
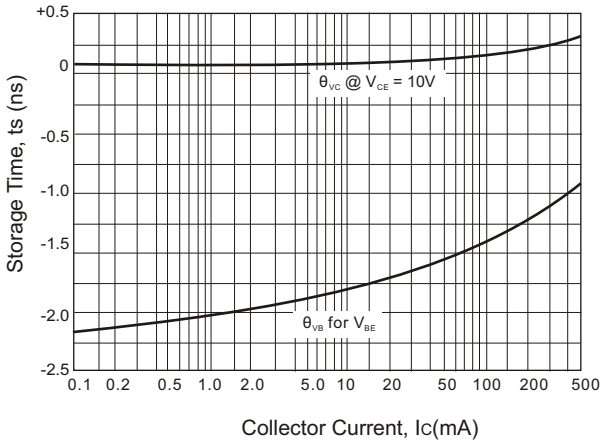
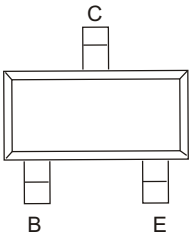
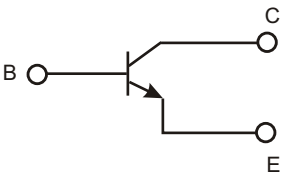


Fig. 10- Temperature Coefficients



FMBT4401W

Pinning information

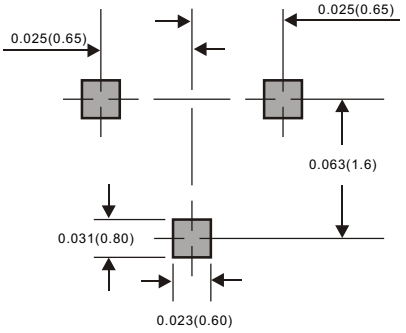
Pin	Simplified outline	Symbol
PinB Base PinC Collector PinE Emitter		

Marking

Type number	Marking code
FMBT4401W	2X

Suggested solder pad layout

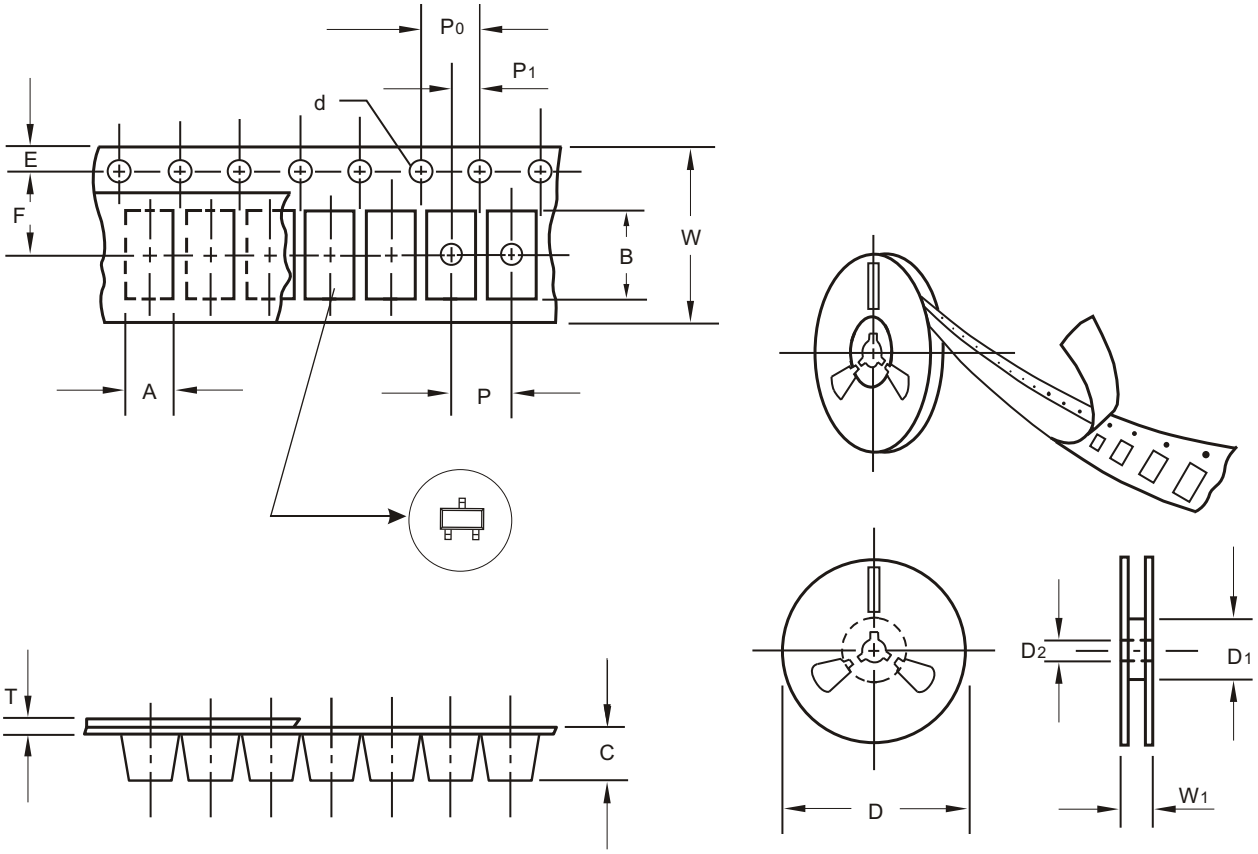
SOT-323



Dimensions in inches and (millimeters)

FMBT4401W

Packing information



unit:mm

Item	Symbol	Tolerance	SOT-323
Carrier width	A	0.1	1.47
Carrier length	B	0.1	2.95
Carrier depth	C	0.1	1.15
Sprocket hole	d	0.1	1.50
13" Reel outside diameter	D	2.0	-
13" Reel inner diameter	D_1	min	-
7" Reel outside diameter	D	2.0	178.00
7" Reel inner diameter	D_1	min	62.00
Feed hole diameter	D_2	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	P_0	0.1	4.00
Embossment center	P_1	0.1	2.00
Overall tape thickness	T	0.1	0.23
Tape width	W	0.3	8.00
Reel width	W_1	1.0	11.40

Note:Devices are packed in accor dance with EIA standar RS-481-A and specifications listed above.

FMBT4401W

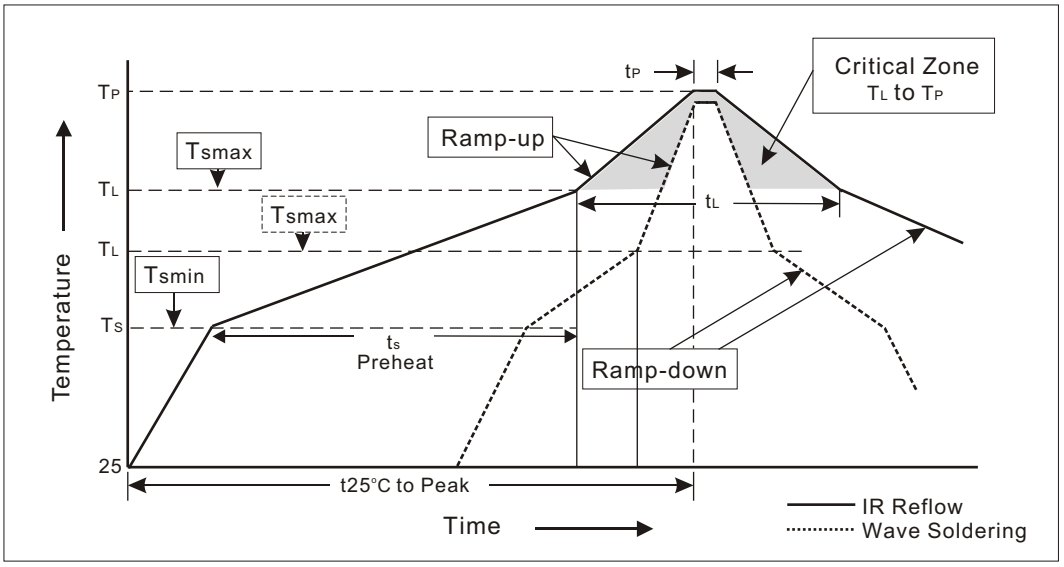
Reel packing

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"	3000	4.0	15,000	183*124*185	178	390*270*400	240,000	9.4

Suggested thermal profiles for soldering processes

1.Storage environment: Temperature=10°C~35°C Humidity=65%±15%

2.Reflow soldering of surface-mount devices



3.Flow (wave)soldering (solder dipping)

Profile Feature	Soldering Condition
Average ramp-up rate(T_L to T_P)	<3°C/sec
Preheat -Temperature Min(Tsmin) -Temperature Max(Tsmax) -Time(min to max)(t_s)	 100°C 150°C 60~120sec
Tsmax to T_L -Ramp-upRate	 <3°C/sec
Time maintained above: -Temperature(T_L) -Time(t_L)	 183°C 60~150sec
Peak Temperature(T_P)	255°C-0/+5°C
Time within 5°C of actual Peak Temperature(t_P)	10~30sec
Ramp-down Rate	<6°C/sec
Time 25°C to Peak Temperature	<6minutes

FMBT4401W

High reliability test capabilities

Item Test	Conditions	Reference
1. Solder Resistance	at 260±5°C for 10±2sec. immerse body into solder 1/16"±1/32"	MIL-STD-750D METHOD-2031
2. Solderability	at 245±5°C for 5 sec.	MIL-STD-202F METHOD-208
3. High Temperature Reverse Bias	V_{CB}=0.8 X V_{CBO}, V_{BE} open at T_A=150°C for 168 hrs.	MIL-STD-883
4. Operation Life Test	Continuous operation at max rated T_A=25°C, P_C=$P_{C(max)}$ for 500hrs.	MIL-STD-883
5. Pressure Cooker	15P_{SIG} at T_A=121°C for 4 hrs.	MIL-STD-750D METHOD-1051
6. Temperature Cycling	-55°C to +125°C dwelled for 30 min. and transferred for 5min. total 10 cycles.	MIL-STD-750D METHOD-1056
7. Thermal Shock	0°C for 5 min. rise to 100°C for 5 min. total 10 cycles.	MIL-STD-750D METHOD-4066-2
8. Humidity	at T_A=65°C, RH=98% for 1000hrs.	MIL-STD-750D METHOD-1038
9. High Temperature Storage Life	at 175°C for 1000 hrs.	MIL-STD-750D METHOD-1031
10. Solvent Resistance	Dip into Freon at 25°C for 1 min.	MIL-STD-202F METHOD-215