FMBT4401

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FMBT4401

General Purpose Transistors
NPN Silicon

Features

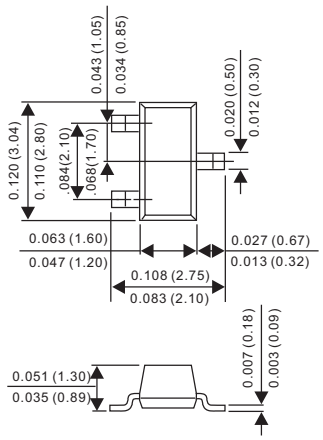
- Epitaxial plana chip construction
- Ideal for medium power application and switching
- Capable of 225mW power dissipation
- Lead-free parts meet RoHS requirements
- Suffix "-H" dinicates Halogen-free part, ex.FMBT4401-H

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
- Weight : Approximated 0.008 gram

Package outline

SOT-23



Dimensions in inches and (millimeters)

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

Parameter	Symbol	Limits	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 - continuous	I_C	600	mA
Collector current -peak	I_{CM}	900	mA

Thermal characteristics

Parameter	Symbol	Limits	Unit
Total device dissipation FR-5 board (Note 1) @ T_A=25°C	P_D	225	mW
Derate above 25°C		1.8	mW/°C
Thermal resistance junction to ambient	$R_{\theta JA}$	556	°C/W
Thermal resistance junction to case	$R_{\theta JC}$	300	°C/W
Operating junction temperature range	T_J	-55 to +150	°C
Storage temperature range	T_{STG}	-55 to +150	°C

Note 1: FR-5 = 1.0 X 0.75 X0.062 in.

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Electrical characteristics (AT T_A=25°C unless otherwise noted)

Off characteristics

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	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}=35V, V_{EB}=0.4V	I_{BEV}			0.1	μA
Collector cutoff current	V_{CE}=35V, V_{EB}=0.4V	I_{CEX}			0.1	μA
Collector cutoff current	V_{CB}=60V, I_E=0	I_{CBO}			100	nA
Emitter-base cut-off current	V_{EB}=5.0V, I_C=0	I_{EBO}			100	nA
Collector-emitter cutoff current	V_{CE}=40V, I_B=0	I_{CEO}			10	μA

On characteristics(2)

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			
	I_C=150mA, V_{CE}=1.0V		100		300	
	I_C=500mA, V_{CE}=2.0V		40			
Collector-emitter saturation voltage	I_C=150mA, I_B=15mA	$V_{CE(sat)}$			0.4	V
	I_C=500mA, I_B=50mA				0.75	
Base-emitter saturation voltage	I_C=150mA, I_B=15mA	$V_{BE(sat)}$	0.75		0.95	V
	I_C=500mA, I_B=50mA				1.20	

2.Pulse test : pulse width ≦300μs, duty cycle ≦2.0%.

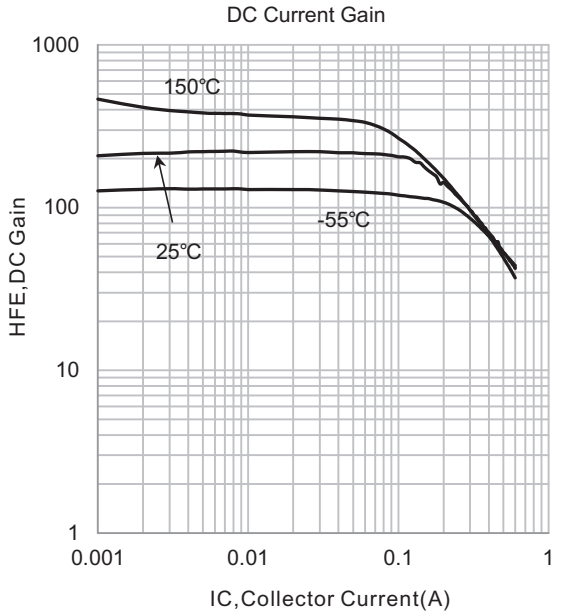
Small-signal characteristics

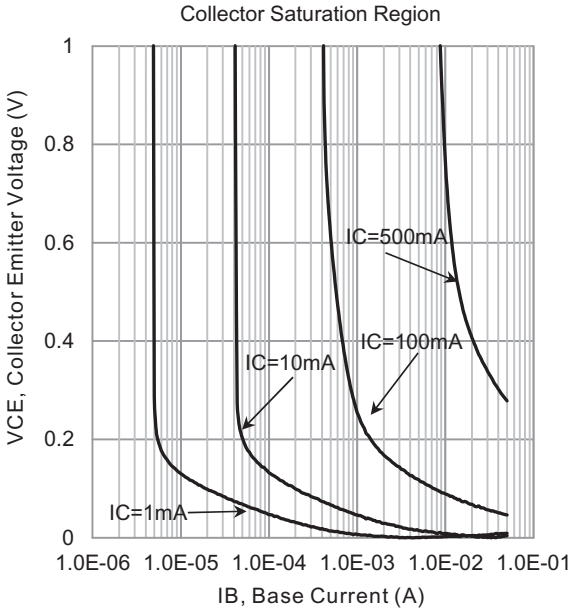
Parameter	Conditions	Symbol	MIN.	TYP.	MAX.	Unit
Current-gain-bandwidth product	I_C=20mA, V_{CE}= 20V, f=100MHz	f_T	250			MHz
Output capacitance	V_{CB}=5.0V, I_E=0, f=1.0MHz	C_{obo}			6.5	pF
Input capacitance	V_{EB}=0.5V, I_C=0, f=1.0MHz	C_{ibo}			30	pF

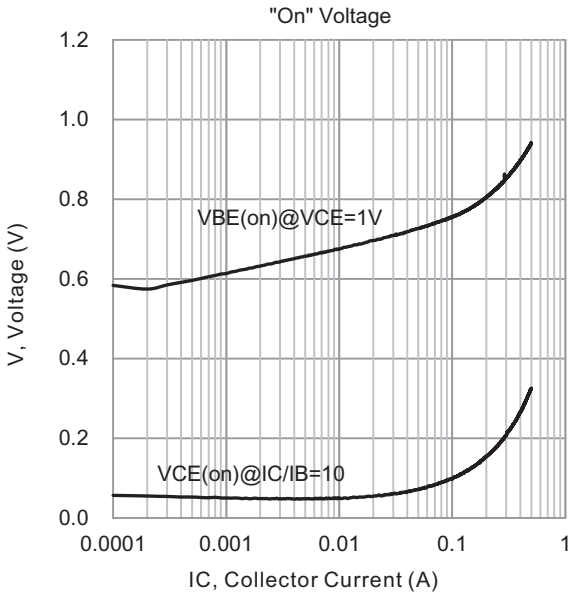
Switching characteristics

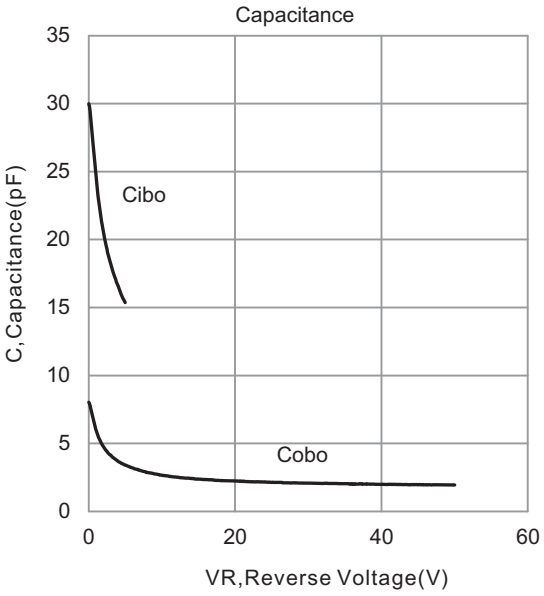
Parameter	Conditions	Symbol	MIN.	TYP.	MAX.	Unit
Delay time	V_{CC}=30V, V_{BE}=2.0V, I_C=150mA, I_{B1}=15mA	t_d			15	ns
Rise time		t_r			20	
Storage time	V_{CC}=30V, I_C=150mA, I_{B1}=I_{B2}=15mA	t_s			225	
Fall time		t_f			30	

Rating and characteristic curves (FMBT4401)

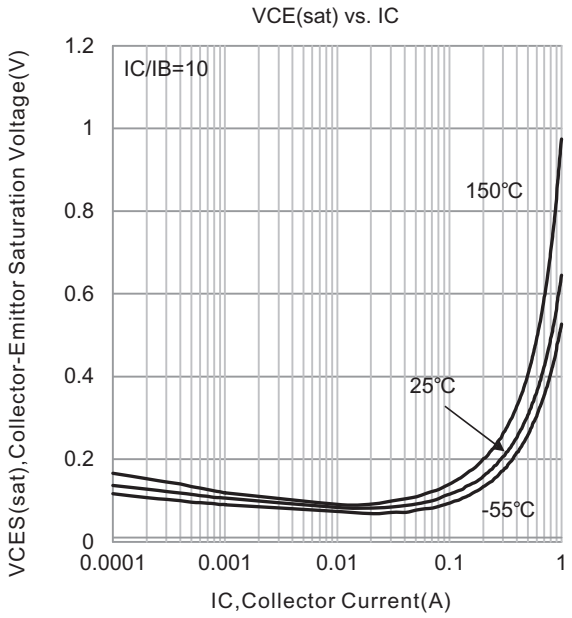


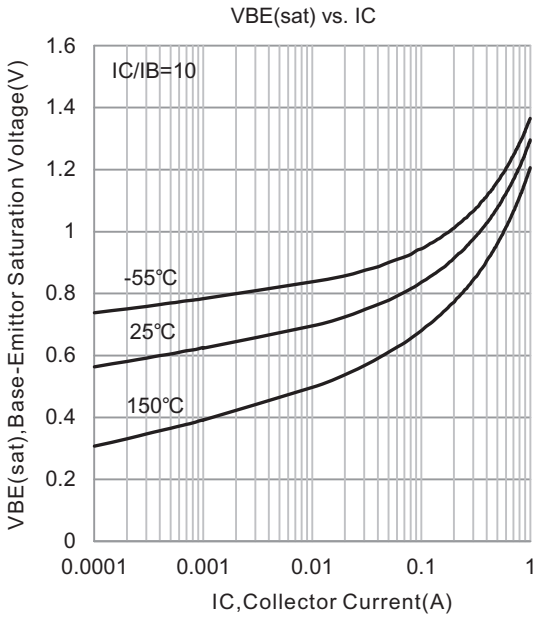


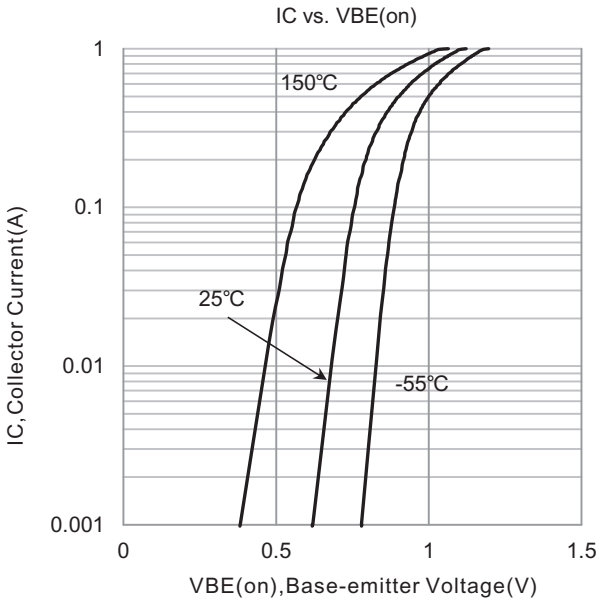


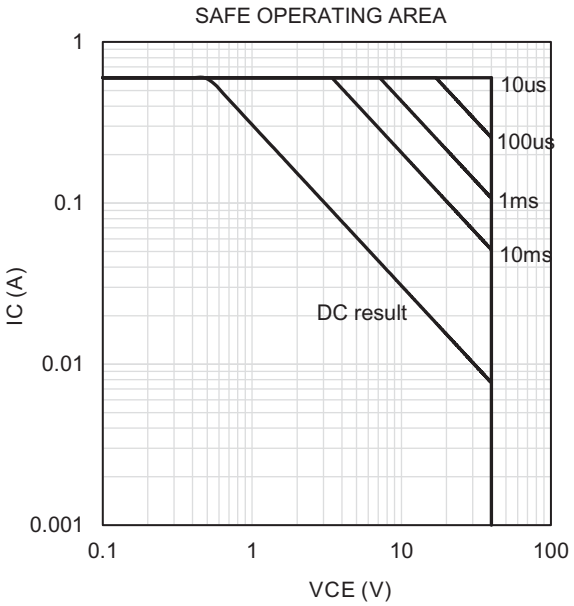


Rating and characteristic curves (FMBT4401)



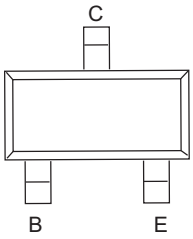
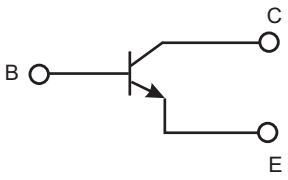






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Pinning information

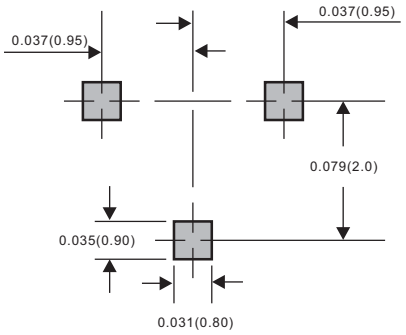
Pin	Simplified outline	Symbol
PinB Base PinC Collector PinE Emitter		

Marking

Type number	Marking code
FMBT4401	2X

Suggested solder pad layout

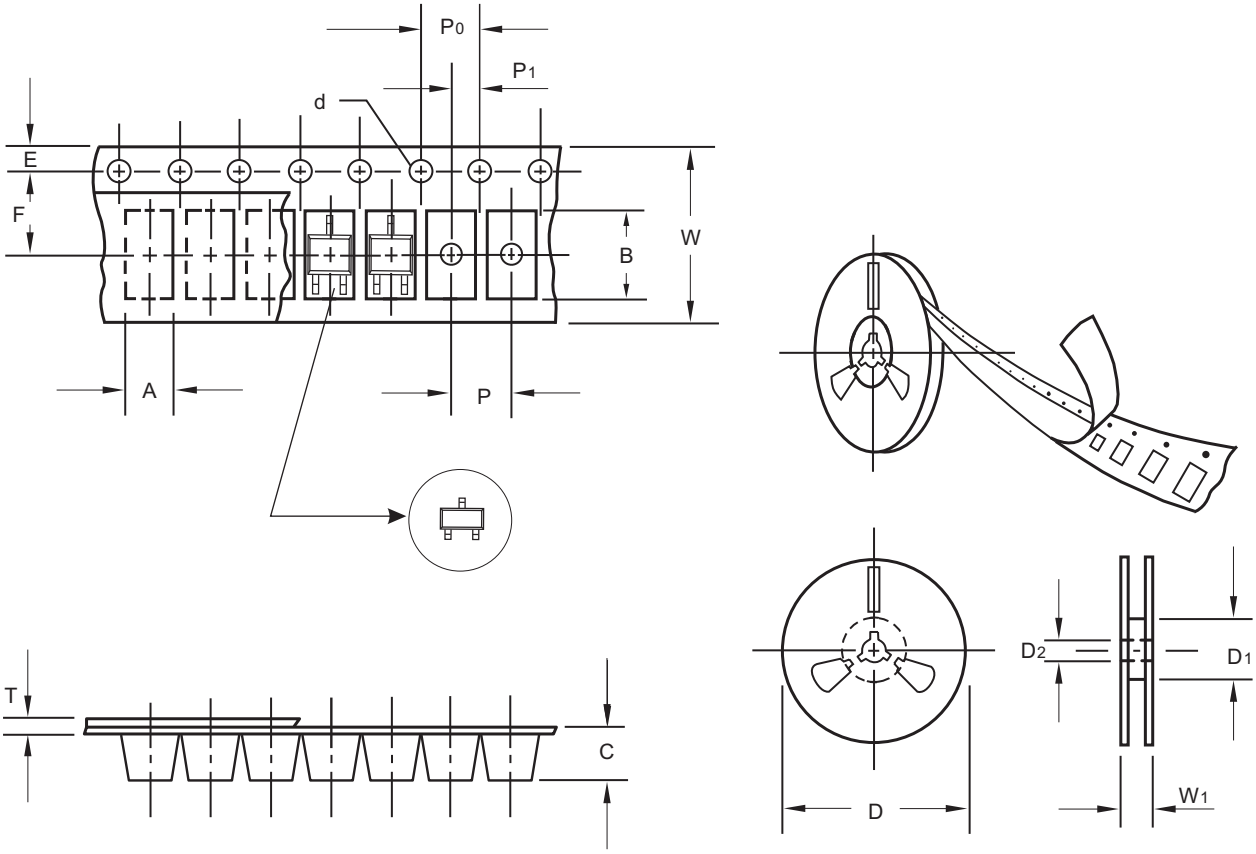
SOT-23



Dimensions in inches and (millimeters)

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Packing information



unit:mm

Item	Symbol	Tolerance	SOT-23
Carrier width	A	0.1	3.15
Carrier length	B	0.1	2.77
Carrier depth	C	0.1	1.22
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	55.00
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	12.0

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

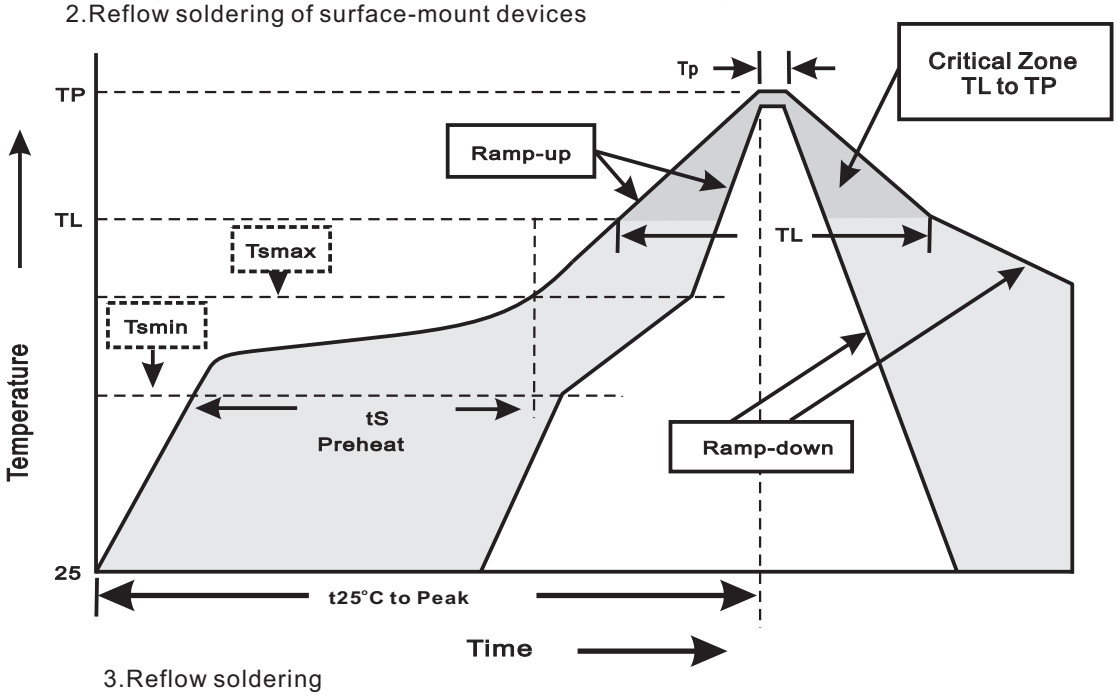
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Reel packing

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-23	7"	3,000	4.0	30,000	183*123*183	178	382*257*387	240,000	11.6

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°C/sec
Preheat -Temperature Min(Tsmin) -Temperature Max(Tsmax) -Time(min to max)(t_s)	 150°C 200°C 60~120sec
Tsmax to T_L -Ramp-upRate	 <3°C/sec
Time maintained above: -Temperature(T_L) -Time(t_L)	 217°C 60~260sec
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

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High reliability test capabilities

Item Test	Conditions
1. Steady State Operating Life	P_D=225mW Test Duration:1000hrs
2. High Temperature Reverse Bias	Tj=150℃, V_{CE}=80% related volage, 1000hrs
3. Temperature Cycle	-55℃(15min) to 150℃(15min)Air to Air Transition Time<20sec Test Cycles:1000cycle
4. Autoclave	P=2atm Ta=121℃ RH=100% Test Duration:96hrs
5. High Temperature Storage Life	Ta=150℃ Test Duration:1000hrs
6. Solderability	245℃,5sec
7. High Temperature High Humidity Reverse Bias	Ta=85℃, 85%RH, V_{CE}=80% related volage, 1000hrs
8. Resistance to Soldering Heat	260℃,10sec