

FMBT5401-Q1

List

List.....	1
Package outline.....	2
Features.....	2
Mechanical data.....	2
Maximum ratings	2~3
Rating and characteristic curves.....	4~5
Pinning information.....	6
Marking.....	6
Suggested solder pad layout.....	6
Packing information.....	7
Reel packing.....	8
Suggested thermal profiles for soldering processes.....	8
High reliability test capabilities.....	9

FMBT5401-Q1

High Voltage PNP Transistor

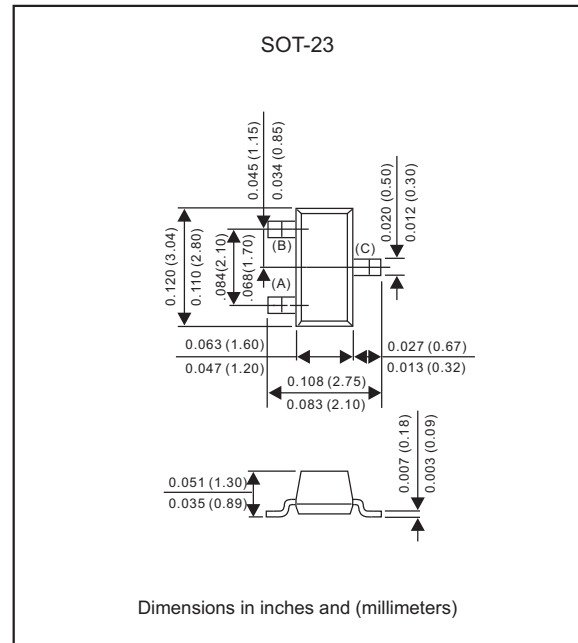
Features

- Lead-free parts for green partner, exceeds environmental standards of MIL-STD-19500 /228
- Qualified to AEC-Q101 standards for high reliability.
- Suffix "-H" dinicates Halogen-free part, ex.FMBT5401-Q1-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



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

PARAMETER	CONDITIONS	Symbol	Value	UNIT
Collector -Base Voltage		V_{CBO}	-160	Vdc
Collector -Emitter Voltage		V_{CEO}	-150	Vdc
Emitter -Base Voltage		V_{EBO}	-5.0	Vdc
Collector Current - Continuous		I_C	-500	mAdc

Thermal Characteristics

Characteristics	CONDITIONS	Symbol	Max	UNIT
Total device dissipation FR-5 board (1)	$T_A = 25^\circ\text{C}$	P_D	225	mW
	Derate above 25°C	P_D	1.8	mW/ $^\circ\text{C}$
Thermal resistance	Junction to ambient	$R_{\theta JA}$	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°C	P_D	2.4	mW/ $^\circ\text{C}$
Thermal resistance	Junction to ambient	$R_{\theta JA}$	417	$^\circ\text{C}/\text{W}$
Operating temperature		T_J	-55 ~ +150	$^\circ\text{C}$
Storage temperature		T_{STG}	-55 ~ +150	

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.

FMBT5401-Q1**Electrical Characteristics** (AT $T_A=25^{\circ}\text{C}$ unless otherwise noted)**OFF characteristics**

PARAMETER	CONDITIONS	Symbol	Min.	Max.	UNIT
Collector-Base Breakdown Voltage	$I_C = -100\mu\text{A}, I_E = 0$	$V_{(BR)CBO}$	-160		Vdc
Collector-Emitter Breakdown Voltage	$I_C = -1.0\text{mA}, I_B = 0$	$V_{(BR)CEO}$	-150		Vdc
Emitter-Base Breakdown Voltage	$I_E = -10\mu\text{A}, I_C = 0$	$V_{(BR)EBO}$	-5.0		Vdc
Collector Cutoff Current	$V_{CB} = -120\text{Vdc}, I_E = 0$ $V_{CB} = -120\text{Vdc}, I_E = 0, T_A = 100^{\circ}\text{C}$	I_{CES}		-50 -50	nAdc uAdc

ON characteristics

PARAMETER	CONDITIONS	Symbol	Min.	Max.	UNIT
DC Current Gain	$I_C = -1.0\text{mA}, V_{CE} = -5.0\text{Vdc}$ $I_C = -10\text{mA}, V_{CE} = -5.0\text{Vdc}$ $I_C = -50\text{mA}, V_{CE} = -5.0\text{Vdc}$	h_{FE}	50 60 50	240	-
Collector-Emitter Saturation Voltage	$I_C = -10\text{mA}, I_B = -1.0\text{mA}$ $I_C = -50\text{mA}, I_B = -5.0\text{mA}$	$V_{CE(sat)}$		-0.2 -0.5	Vdc
Base-Emitter Saturation Voltage	$I_C = -10\text{mA}, I_B = -1.0\text{mA}$ $I_C = -50\text{mA}, I_B = -5.0\text{mA}$	$V_{BE(sat)}$		-1.0 -1.0	Vdc

Small-Signal characteristics

PARAMETER	CONDITIONS	Symbol	Min.	Max.	UNIT
Current-Gain-Bandwidth Product	$I_C = -10\text{mA}, V_{CE} = -10\text{Vdc}$, $f=100\text{MHz}$	f_T	100	300	MHZ
Output Capacitance	$V_{CB} = -10\text{Vdc}, I_E = 0, f=1.0\text{MHz}$	C_{obo}		6.0	pF
Small Signal Current Gain	$I_C = -1.0\text{mA}, V_{CE} = -10\text{Vdc}$, $f=1.0\text{KHz}$	h_{fe}	40	200	-
Noise Figure	$I_C = -200\mu\text{A}, V_{CE} = -5.0\text{Vdc}$, $R_s=10\Omega, f=1.0\text{KHz}$	NF		8.0	dB

FMBT5401-Q1

FIG.1 DC Current Gain

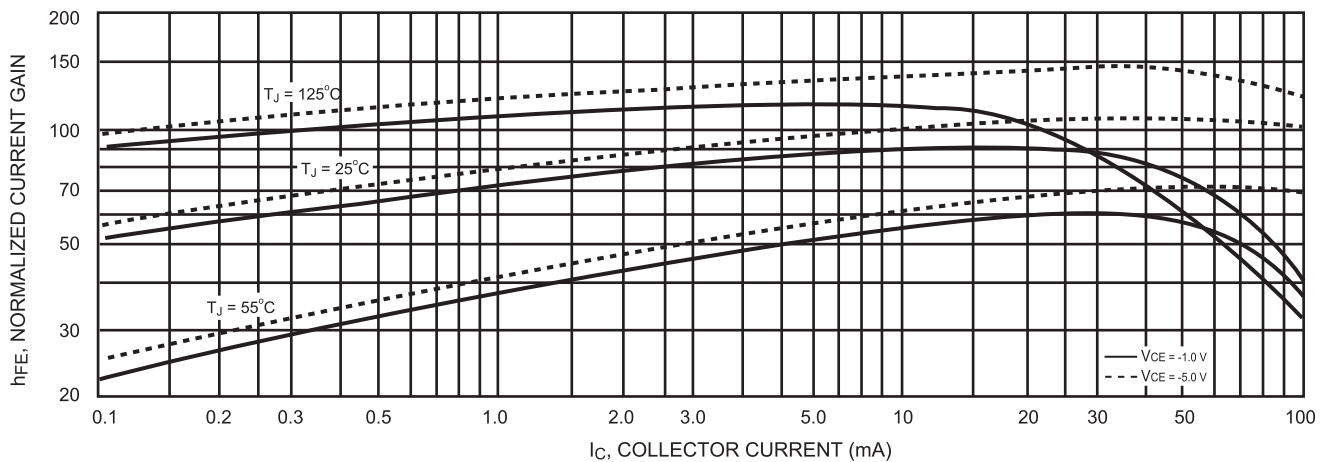


FIG.2 Collector Saturation Region

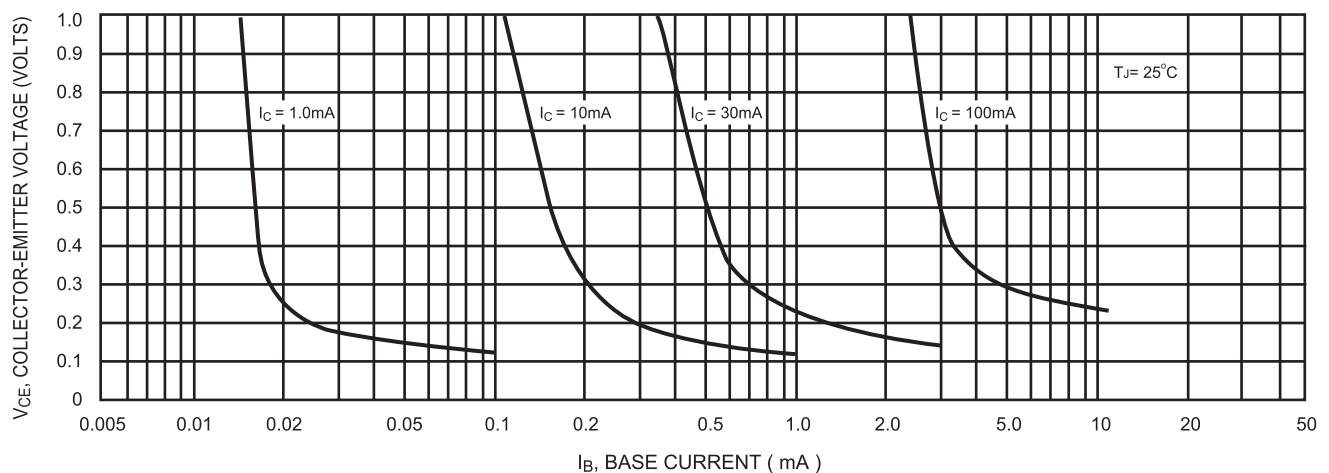


FIG.3 Temperature Coefficients

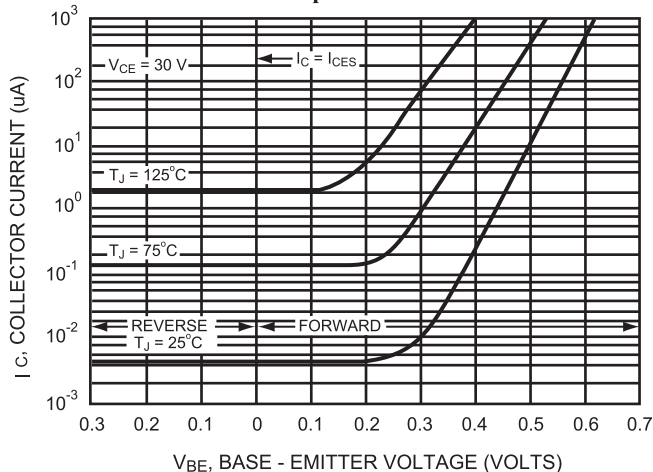
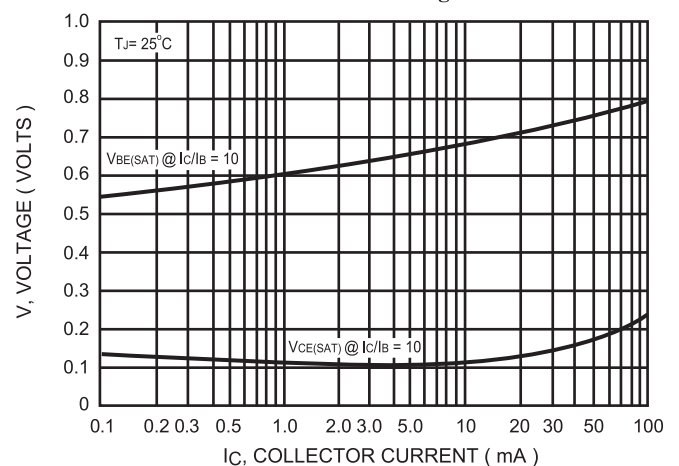


FIG.4 " On " Voltages



FMBT5401-Q1

FIG.5 Temperature Coefficients

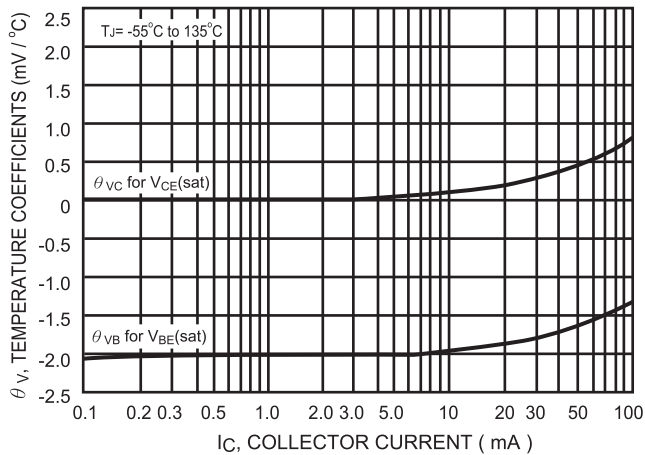


FIG.6 Switching Time Test Circuit

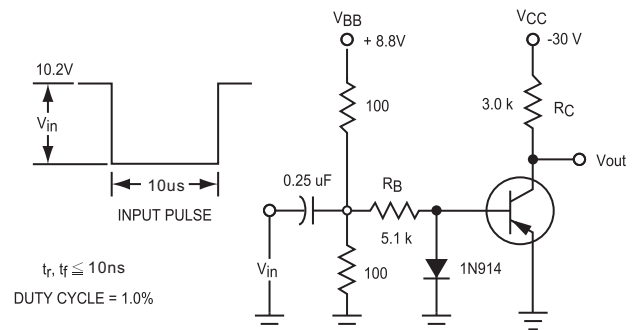
VALUES SHOWN ARE FOR I_C @ 10 mA

FIG.7 Capacitances

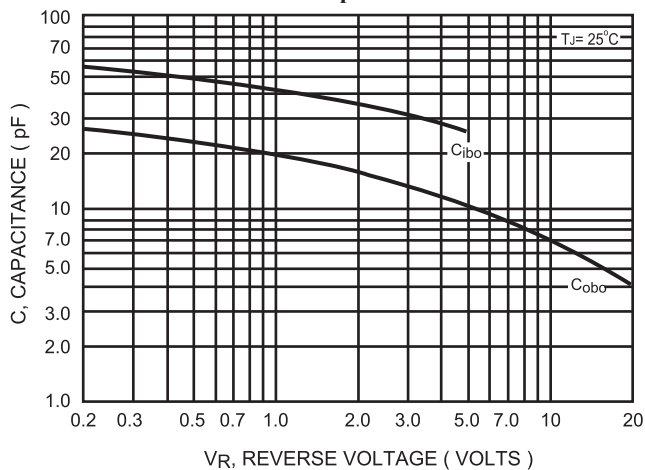


FIG.8 Turn - On Time

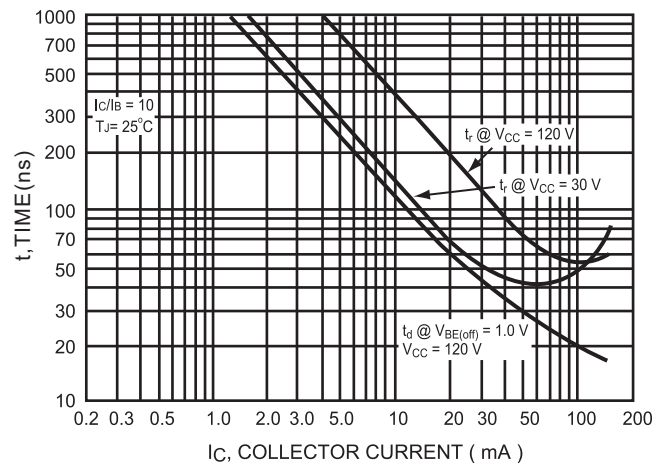
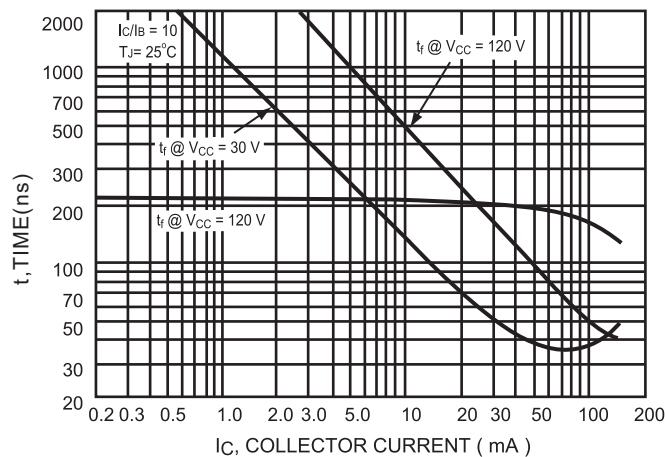
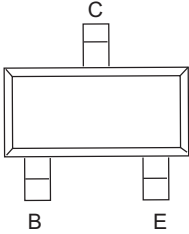
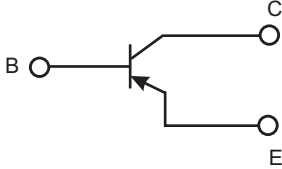


FIG.9 Turn - Off Time



FMBT5401-Q1

Pinning information

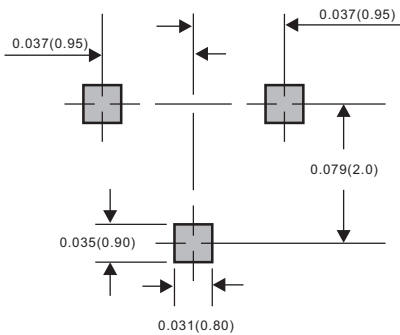
Pin	Simplified outline	Symbol
PinB Base PinC Collector PinE Emitter		

Marking

Type number	Marking code
FMBT5401-Q1	2L

Suggested solder pad layout

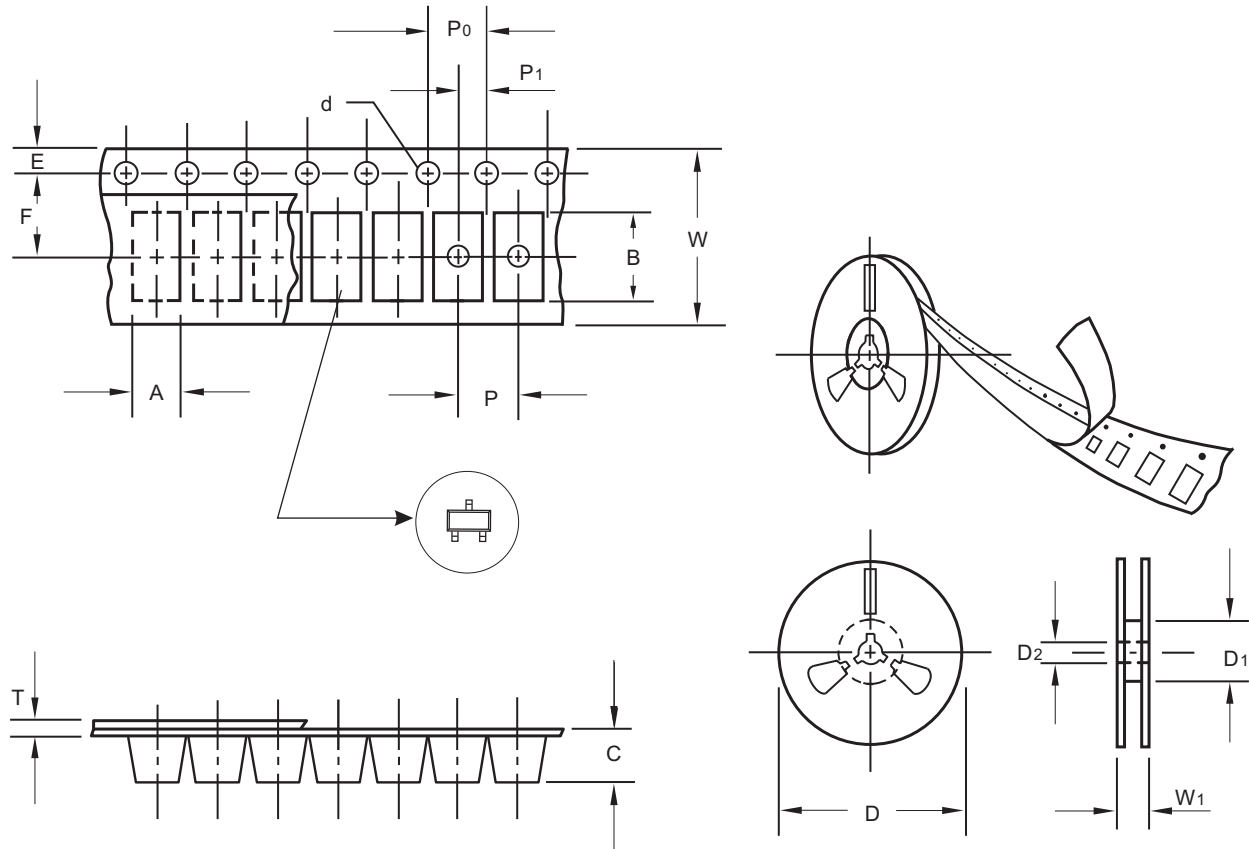
SOT-23



Dimensions in inches and (millimeters)

FMBT5401-Q1

Packing information



unit:mm

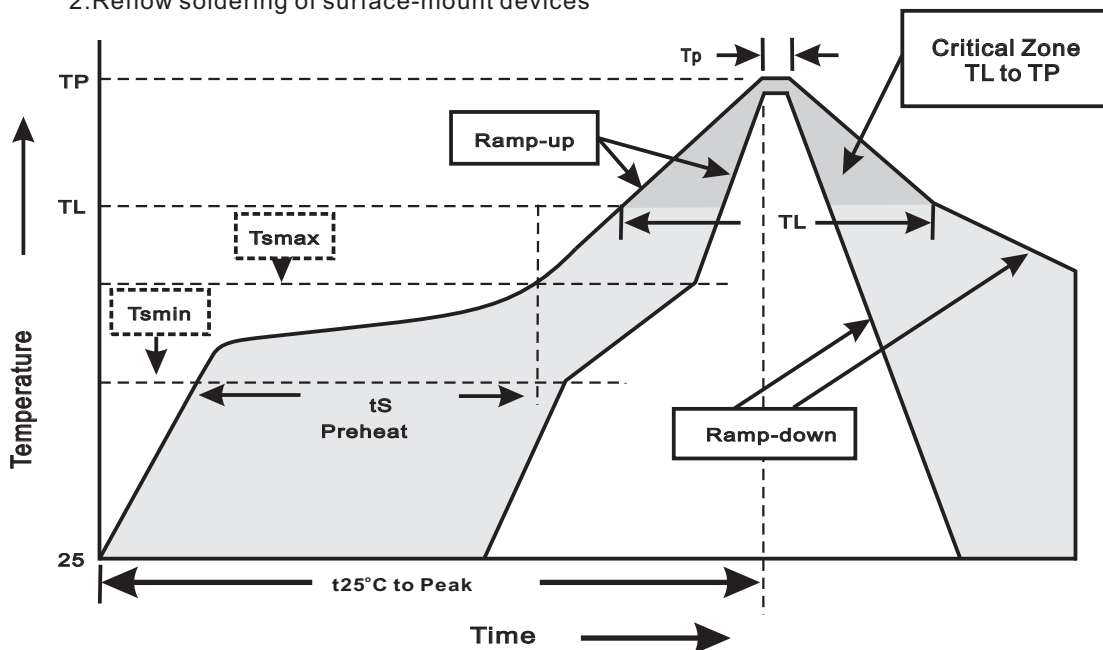
Item	Symbol	Tolerance	SOT-23
Carrier width	A	0.1	3.15
Carrier length	B	0.1	2.77
Carrier depth	C	0.1	1.22
Sprocket hole	d	0.1	1.50
13" Reel outside diameter	D	2.0	-
13" Reel inner diameter	D1	min	-
7" Reel outside diameter	D	2.0	178.00
7" Reel inner diameter	D1	min	55.00
Feed hole diameter	D2	0.5	13.00
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	12.0

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

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*183*123	178	382*262*387	240,000	11.6

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



Profile Feature	Soldering Condition
Average ramp-up rate(T_L to T_P)	$<3^{\circ}\text{C}/\text{sec}$
Preheat -Temperature Min(T_{min}) -Temperature Max(T_{max}) -Time(min to max)(t_s)	150°C 200°C $60\sim 120\text{sec}$
T_{max} 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	$<6\text{minutes}$

FMBT5401-Q1**High reliability test capabilities**

Item Test	Conditions	Reference
1. MSL Preconditioning	24hr bake@125°C+168hrs@85°C /85%RH+3xIR@260°C+1flux immersion+alcohol+DI H2O rinse	JESD22-A113
2. Intermittent Operating Life	Ta=25?, ΔTj≥100? On/Off=2min Test Duration:1000hrs	MIL-STD-750E METHOD 1037
3. High Temperature Reverse Bias	VCE=80%BVCEO (Tj=150°C)Test Duration:1000hrs	JESD22-A108
4. High Temperature Storage Life	Ta=125°C Test Duration: 1000hrs	JESD22 A-103
5. Temperature Cycle	-55°C (15min) to 150°C (15min)Test Cycles: 1000cycles	JESD22 A-104
6. Autoclave	P=2atm Ta=121°C RH=100% Test Duration:96hrs	JESD22 A-102
7. Solderability	245±5°C for 5sec	J-STD-002
8. Moisture Resistance	Ta=85°C/85% Relative humidity Test Duration:1000hrs	MIL-STD-750E METHOD 1021.2
9. Resistance To Solder Heat	260±5°C for 10sec	JESD22 B-106
10. High Temperature High Humidity Reverse Bias	Ta=85°C, 85%RH, VCE=80%BVCEO Test Duration:1000hrs	JESD22-A101