FMBT2222 / FMBT2222A

List

List..... 1

Package outline..... 2

Features..... 2

Mechanical data..... 2

Maximum ratings 2

Electrical Characteristics..... 3~4

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

FMBT2222 / FMBT2222A

General Purpose Transistor
NPN Silicon

Features

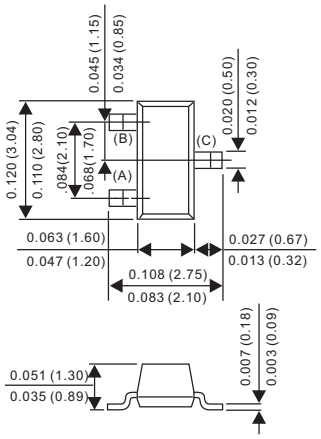
- High collector-emitterbreakdien voltage. (BV_{CEO} = 40V@I_C=10mA)
- Small load switch transistor with high gain and low stauration voltage, is designed for general purpose amflifier and switching applications at collector current.
- Capable of 225mW power dissipation.
- Lead-free parts for green partner, exceeds environmental standards of MIL-STD-19500 /228
- Suffix "-H" indicates Halogen-free part, ex.FMBT2222-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	CONDITIONS	Symbol	FMBT2222	FMBT2222A	UNIT
Collector-Base voltage		V_{CBO}	60	75	V
Collector-Emitter voltage		V_{CEO}	30	40	V
Emitter-Base voltage		V_{EBO}	5.0	6.0	V
Collector current		I_C	600		mA
Total device dissipation FR-5 board (1)	T_A = 25°C	P_D	225		mW
	Derate above 25°C		1.8		mW/°C
Thermal resistance(1)	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		2.4		mW/°C
Thermal resistance(2)	Junction to ambient	$R_{\theta JA}$	417		°C/W
Operating junction temperature range		T_J	-55 ~ +150		°C
Storage temperature range		T_{STG}	-55 ~ +150		°C

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.

FMBT2222 / FMBT2222A

ELECTRICAL CHARACTERISTICS (TA = 25°C unless otherwise noted)

Characteristics		Symbol	Min	Max	Unit
OFF CHARACTERISTICS					
Collector-Emitter Breakdown Voltage (I_C=10 mAdc.I_B=0)	FMBT2222 FMBT2222A	$V_{(BR)CEO}$	30 40	- -	Vdc
Collector-Base Breakdown Voltage (I_C=10 μAdc.I_E=0)	FMBT2222 FMBT2222A	$V_{(BR)CBO}$	60 75	- -	Vdc
Emitter-Base Breakdown Voltage (I_E=10 μAdc.I_C=0)	FMBT2222 FMBT2222A	$V_{(BR)EBO}$	5.0 6.0	- -	Vdc
Collector Cutoff Current (V_{CE}=60 Vdc,$V_{EB\ (0ff)}$=3.0 Vdc)	FMBT2222A	I_{CEX}	-	10	nAdc
Collector Cutoff Current (V_{CB}=50 Vdc,I_E=0) (V_{CB}=60Vdc, I_E=0) (V_{CB}=50Vdc, I_E=0, T_A=125°C) (V_{CB}=60Vdc, I_E=0, T_A=125°C)	 FMBT2222 FMBT2222A FMBT2222 FMBT2222A	I_{CBO}	- - - -	0.01 0.01 10 10	uAdc
Emitter Cutoff Current (V_{EB}=3.0 Vdc,I_C=0)	FMBT2222A	I_{EBO}	-	100	nAdc
Base Cutoff Current (V_{CE}=60Vdc, $V_{EB(off)}$=3.0Vdc)	FMBT2222A	I_{BL}	-	20	nAdc

ELECTRICAL CHARACTERISTICS (T A = 25°C unless otherwise noted) (Continued)

Characteristics		Symbol	Min	Max	Unit
ON CHARACTERISTICS					
DC Current Gain		h_{FE}			-
(I_C=0.1 mAdc, V_{CE}=10 Vdc)			35	-	
(I_C=1.0 mAdc, V_{CE}=10 Vdc)			50	-	
(I_C=10 mAdc, V_{CE}=10 Vdc)			75	-	
(I_C=10 mAdc, V_{CE}=10 Vdc, TA=-55°C)	FMBT2222A ONLY		35	-	
(I_C=150 mAdc, V_{CE}=10 Vdc) (3)			100	300	
(I_C=150 mAdc, V_{CE}=1.0Vdc) (3)			50	-	
(I_C=500 mAdc, V_{CE}=10 Vdc) (3)	FMBT2222 FMBT2222A		30 40	- -	
Collector-Emitter Saturation Voltage (3) (I_C=150 mAdc, I_B=15mAdc)	FMBT2222 FMBT2222A	$V_{CE(sat)}$	- -	0.4 0.3	Vdc
(I_C=500 mAdc, I_B=50mAdc)	FMBT2222 FMBT2222A		- -	1.6 1.0	
Base-Emitter Saturation Voltage (3) (I_C=150 mAdc, I_B=15mAdc)	FMBT2222 FMBT2222A	$V_{BE(sat)}$	- 0.6	1.3 1.2	Vdc
(I_C=500 mAdc, I_B=50mAdc)	FMBT2222 FMBT2222A		- -	2.6 2.0	

FMBT2222 / FMBT2222A

ELECTRICAL CHARACTERISTICS (T A = 25°C unless otherwise noted) (Continued)

Characteristics		Symbol	Min	Max	Unit
SMALL–SIGNAL CHARACTERISTICS					
Current-Gain-Bandwidth Product (4) (I_C=20 mAdc, V_{CE}=20 Vdc, f=100MHz)	FMBT2222 FMBT2222A	f_T	250 300	- -	MHz
Output Capacitance (V_{CB}=10 Vdc, I_E=0, f=1.0MHz)	FMBT2222 FMBT2222A	C_{obo}	-	8.0	pF
Input Capacitance (V_{EB}=0.5 Vdc, I_C=0, f=1.0MHz)	FMBT2222 FMBT2222A	C_{ibo}	- -	30 25	pF
Input Impedance (I_C=1.0 mAdc, V_{CE}=10 Vdc, f=1.0 kHz) (I_C=10 mAdc, V_{CE}=10 Vdc, f=1.0 kHz)	FMBT2222A FMBT2222A	h_{ie}	2.0 0.25	8.0 1.25	κΩ
Voltage Feeback Radio (I_C=1.0 mAdc, V_{CE}=10 Vdc, f=1.0 kHz) (I_C=10 mAdc, V_{CE}=10 Vdc, f=1.0 kHz)	FMBT2222A FMBT2222A	h_{re}	- -	8.0 4.0	x 10^{-4}
Small-Signal Current Gain (I_C=1.0 mAdc, V_{CE}=10Vdc, f=1.0 kHz) (I_C=10 mAdc, V_{CE}=10Vdc, f=1.0 kHz)	FMBT2222A FMBT2222A	h_{fe}	50 75	300 375	-
Output Admittance (I_C=1.0 mAdc, V_{CE}=10Vdc, f=-1.0kHz) (I_C=10 mAdc, V_{CE}=10Vdc, f=-1.0kHz)	FMBT2222A FMBT2222A	h_{oe}	5.0 25	35 200	μmhos
Collector Base Time Constant (I_E=20 mAdc, V_{CB}=20 Vdc, f=31.8 MHz)	FMBT2222A	rb, C_c	-	150	ps
Noise Figure (I_C=100 A dc, V_{CE}=10Vdc, R_S=1.0kW, f=1.0kHz)	FMBT2222A	NF	-	4.0	dB

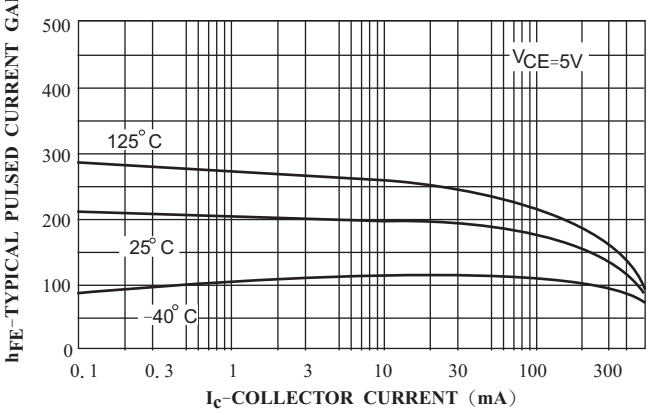
SWITCHING CHARACTERISTICS(FMBT2222A only)

Delay Time	(V_{CC}=30 Vdc, V_{BE}=(off)=-0.5Vdc,	t_d	-	10	ns
Rise Time	I_C=150 mAdc, I_{B1}=15 mAdc)	t_r	-	25	
Storage Time	(V_{CC}=30 Vdc, I_C=150 mAdc,	t_s	-	225	ns
Fall Time	I_{B1}=I_{B2}=15 mAdc)	t_f	-	60	

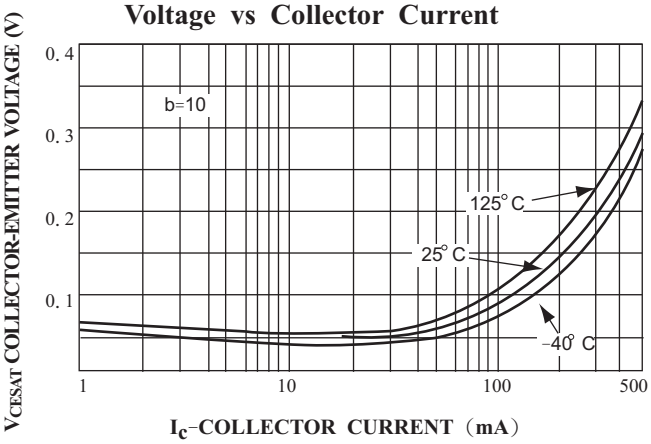
3.Pulse Test:Pulse Width 300 μs, Duty Cycle≤2.0%.
4.f_T is defined as the frequency at which Ihfe extrapolates to unity.

Rating and characteristic curves (FMBT2222 / FMBT2222A)

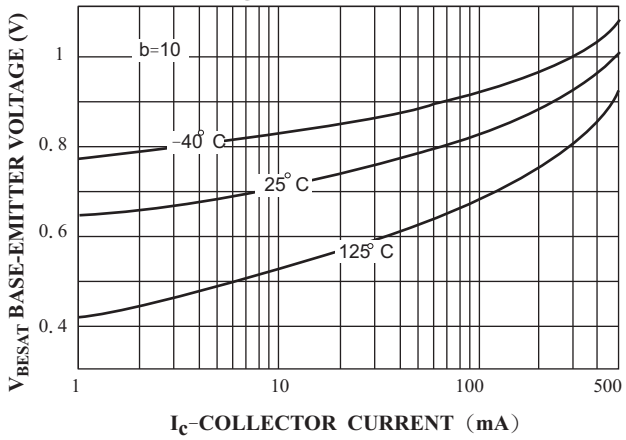
Typical Pulsed Current Gain vs Collector Current



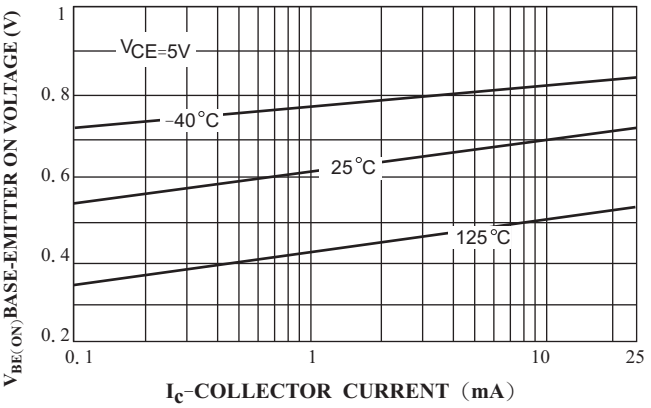
Collector– Emitter Saturation Voltage vs Collector Current



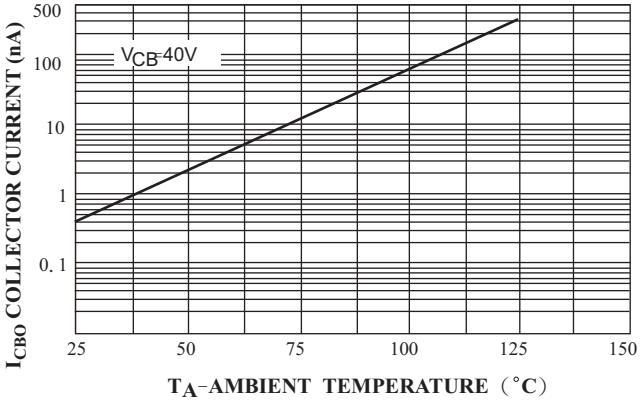
Base–Emitter Saturation Voltage vs Collector Current



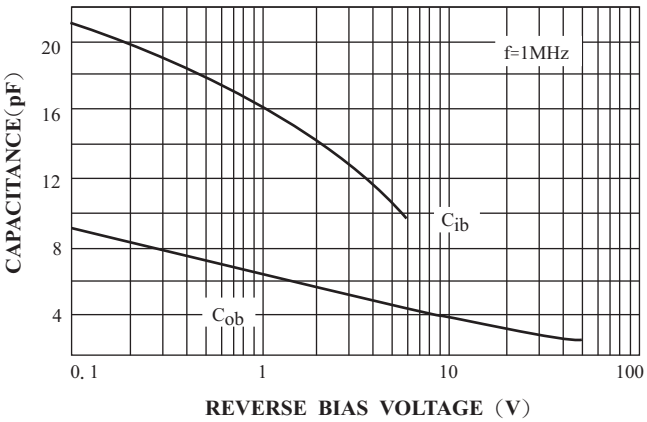
Base–Emitter ON Voltage vs Collector Current



C0llector–Cutoff Current vs Ambient Temperature

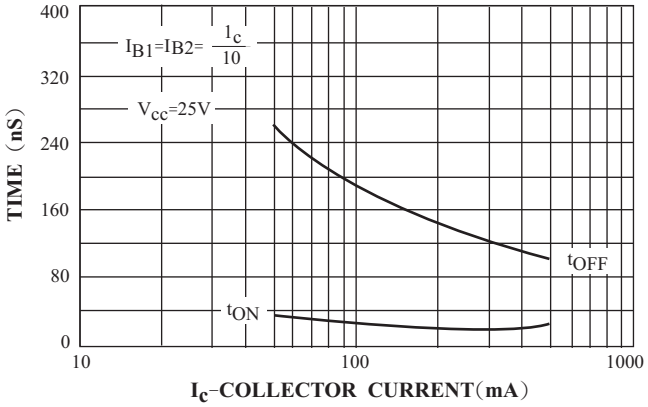


Emitter Transition and Output Capacitance vs Reverse Bias Voltage

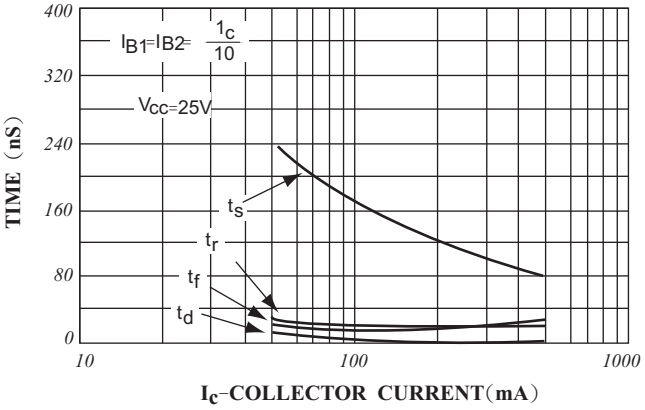


Rating and characteristic curves (FMBT2222 / FMBT2222A)

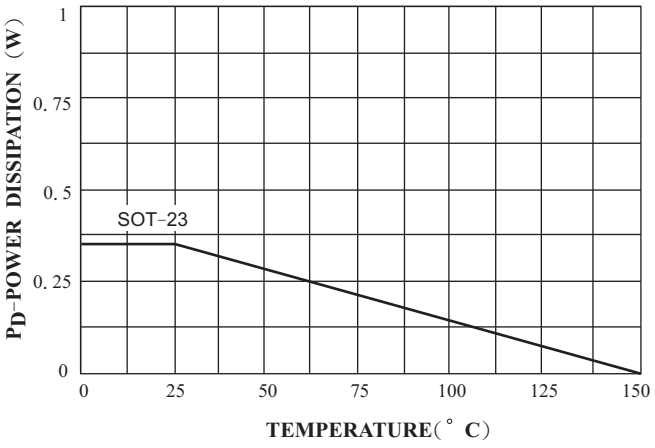
Turn On and Turn Off Times vs Collector Current



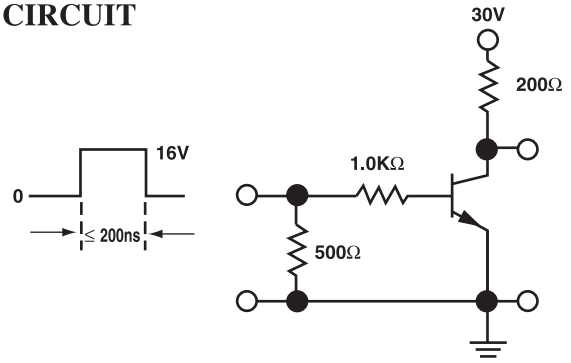
Switching Times vs Collector Current



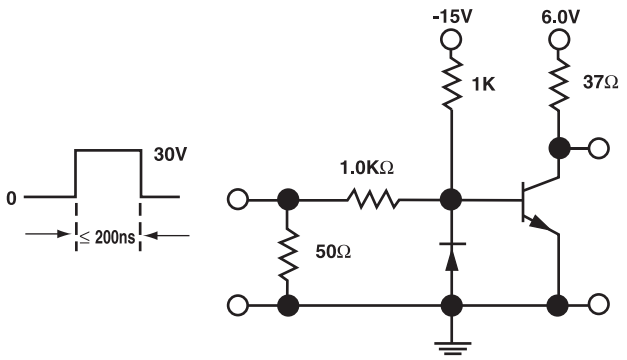
Power Dissipation vs Ambient Temperature



TEST CIRCUIT



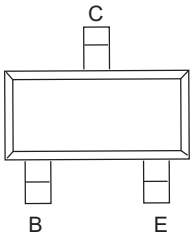
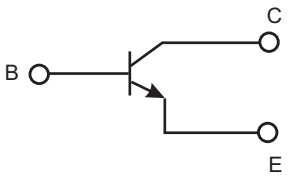
FIGURT 1: Saturated Turn-On Switching Time



FIGURT 2: Saturated Turn-Off Switching Time

FMBT2222 / FMBT2222A

Pinning information

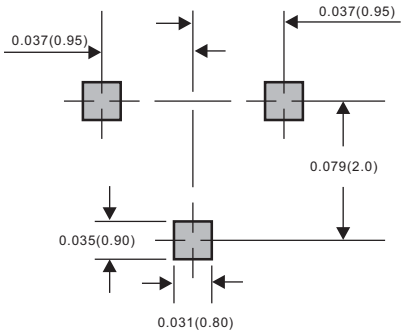
Pin	Simplified outline	Symbol
PinB Base PinC Collector PinE Emitter		

Marking

Type number	Marking code
FMBT2222	M1B
FMBT2222A	1P

Suggested solder pad layout

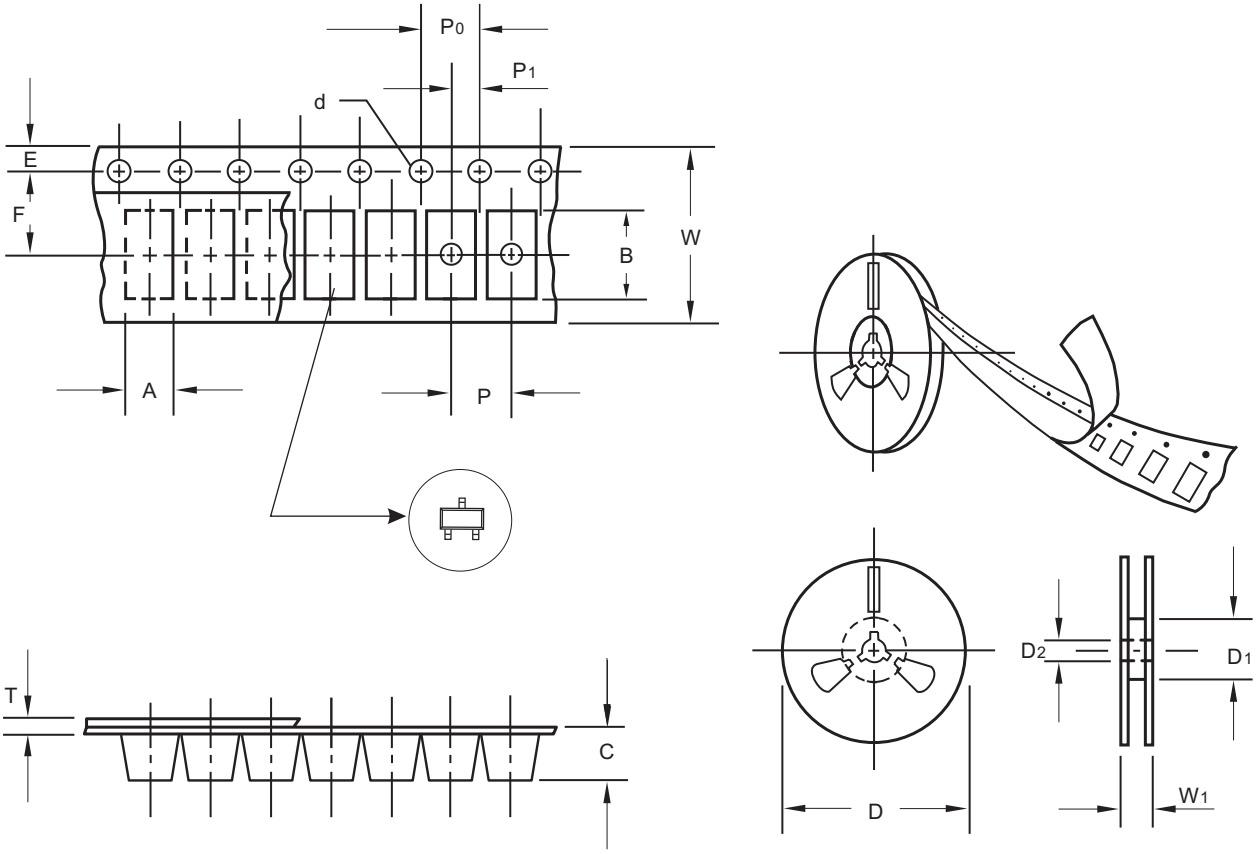
SOT-23



Dimensions in inches and (millimeters)

FMBT2222 / FMBT2222A

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.

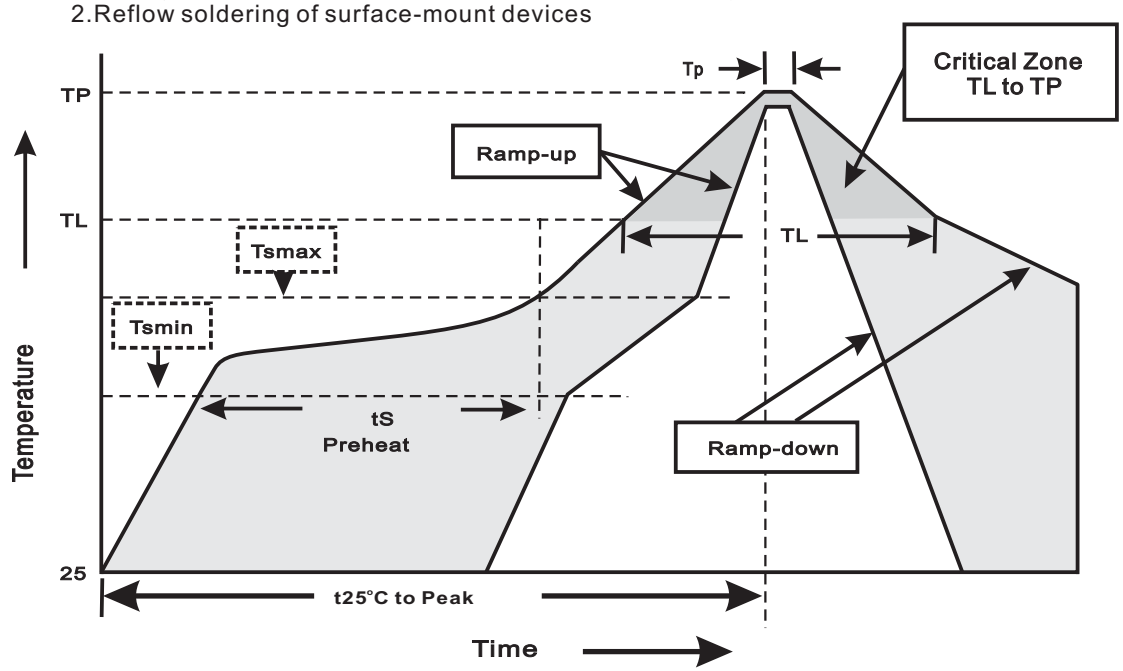
FMBT2222 / FMBT2222A

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"	3000	4.0	30,000	183*183*123	178	383*262*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