

FMBT2222ADW1

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FMBT2222ADW1

Dual General Purpose Transistor NPN Silicon

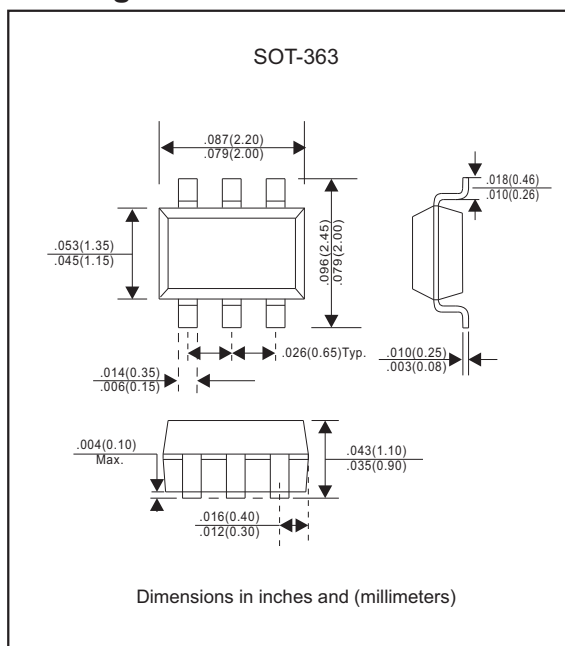
Features

- High collector-emitter breakdown voltage ($BV_{CEO} = 40V @ I_C = 10mA$)
- Small load switch transistor with high gain and low saturation voltage, is designed for general purpose amplifier and switching applications at collector current
- Offer NPN+NPN in one package
- Capable of 150mW power dissipation
- Lead-free parts meet RoHS requirements
- Suffix "-H" indicates Halogen-free part, ex.FMBT2222ADW1-H

Mechanical data

- Epoxy: UL94-V0 rated flame retardant
- Case : Molded plastic, SOT-363
- Terminals : Solder plated, solderable per MIL-STD-750, Method 2026
- Polarity : See Diagram
- Mounting Position : Any
- Weight : Approximated 0.006 gram

Package outline



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

Parameter	Symbol	Value	Unit
Collector-base voltage	V_{CB0}	75	V
Collector-emitter voltage	V_{CE0}	40	V
Emitter-base voltage	V_{EB0}	6.0	V
Collector current - continuous	I_C	600	mA
Total device dissipation(1) $T_A = 25^\circ C$	P_D	150	mW
Thermal resistance Junction to ambient	$R_{\theta JA}$	833	$^\circ C/W$
Operating junction temperature range	T_J	-55 to +150	$^\circ C$
Storage temperature range	T_{STG}	-55 to +150	$^\circ C$

1. Device mounted on FR-4 glass epoxy printed circuit board using the minimum recommended footprint.

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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	$I_C=10\mu\text{A}$, $I_E=0$	$V_{(BR)CBO}$	75			V
Collector-emitter breakdown voltage	$I_C=10\text{mA}$, $I_B=0$	$V_{(BR)CEO}$	40			V
Emitter-base breakdown voltage	$I_E=10\mu\text{A}$, $I_C=0$	$V_{(BR)EBO}$	6.0			V
Base cutoff current	$V_{CE}=60\text{Vdc}$, $V_{EB(off)}=3.0\text{Vdc}$	I_{BL}			20	nA
Collector cutoff current	$V_{CE}=60\text{Vdc}$, $V_{EB(off)}=3.0\text{Vdc}$	I_{CEX}			10	nA
Collector cutoff current	$V_{CB}=60\text{Vdc}$, $I_E=0$ $V_{CB}=60\text{Vdc}$, $I_E=0$, $T_A=125^\circ\text{C}$	I_{CBO}			0.01 10	μA
Emitter cutoff current	$I_C=0$, $V_{EB}=3.0\text{Vdc}$	I_{EBO}			100	nA

On characteristics

Parameter	Conditions	Symbol	MIN.	TYP.	MAX.	Unit
DC current gain	$I_C=0.1\text{mA}$, $V_{CE}=10\text{V}$	h_{FE}	35			
	$I_C=1.0\text{mA}$, $V_{CE}=10\text{V}$		50			
	$I_C=10\text{mA}$, $V_{CE}=10\text{V}$		75			
	$I_C=10\text{mA}$, $V_{CE}=10\text{V}$, $T_A=-55^\circ\text{C}$		35			
	$I_C=150\text{mA}$, $V_{CE}=10\text{V}$ (Note 2)		100		300	
	$I_C=150\text{mA}$, $V_{CE}=1.0\text{V}$ (Note 2)		50			
	$I_C=500\text{mA}$, $V_{CE}=10\text{V}$ (Note 2)		40			
Collector-emitter saturation voltage(2)	$I_C=150\text{mA}$, $I_B=15\text{mA}$	$V_{CE(sat)}$			0.3	Vdc
	$I_C=500\text{mA}$, $I_B=50\text{mA}$				1.0	
Base-emitter saturation voltage(2)	$I_C=150\text{mA}$, $I_B=15\text{mA}$	$V_{BE(sat)}$	0.60		1.2	Vdc
	$I_C=500\text{mA}$, $I_B=50\text{mA}$				2.0	

2. 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(3)	$I_C=20\text{mA}$, $V_{CE}=20\text{V}$, $f=100\text{MHz}$	f_T	300			MHz
Output capacitance	$V_{CB}=10\text{V}$, $I_E=0$, $f=1.0\text{MHz}$	C_{obo}			8.0	pF
Input capacitance	$V_{EB}=0.5\text{V}$, $I_C=0$, $f=1.0\text{MHz}$	C_{ibo}			25	pF
Input impedance	$V_{CE}=10\text{V}$, $I_C=1.0\text{mA}$, $f=1.0\text{KHz}$	h_{ie}	2.0		8.0	k Ω
	$V_{CE}=10\text{V}$, $I_C=10\text{mA}$, $f=1.0\text{KHz}$		0.25		1.25	
Voltage feedback ratio	$V_{CE}=10\text{V}$, $I_C=1.0\text{mA}$, $f=1.0\text{KHz}$	h_{re}			8.0	$\times 10^{-4}$
	$V_{CE}=10\text{V}$, $I_C=10\text{mA}$, $f=1.0\text{KHz}$				4.0	
Small-signal current gain	$V_{CE}=10\text{V}$, $I_C=1.0\text{mA}$, $f=1.0\text{KHz}$	h_{fe}	50		300	
	$V_{CE}=10\text{V}$, $I_C=10\text{mA}$, $f=1.0\text{KHz}$		75		375	
Output admittance	$V_{CE}=10\text{V}$, $I_C=1.0\text{mA}$, $f=1.0\text{KHz}$	h_{oe}	5.0		35	μmhos
	$V_{CE}=10\text{V}$, $I_C=10\text{mA}$, $f=1.0\text{KHz}$		25		200	
Collector base time constant	$V_{CB}=20\text{V}$, $I_E=20\text{mA}$, $f=31.8\text{MHz}$	r_b , C_c			150	ps
Noise figure	$V_{CE}=10\text{V}$, $I_C=100\mu\text{A}$, $R_s=1.0\text{k}\Omega$, $f=1.0\text{KHz}$	NF			4.0	dB

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

Switching characteristics

Parameter	Conditions	Symbol	MIN.	TYP.	MAX.	Unit
Delay time	$V_{CC}=30\text{V}$, $V_{BE}(\text{off})=-0.5\text{V}$, $I_C=150\text{mA}$, $I_{B1}=15\text{mA}$	t_d			10	ns
Rise time		t_r			25	
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			60	

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Switching time equivalent test circuits

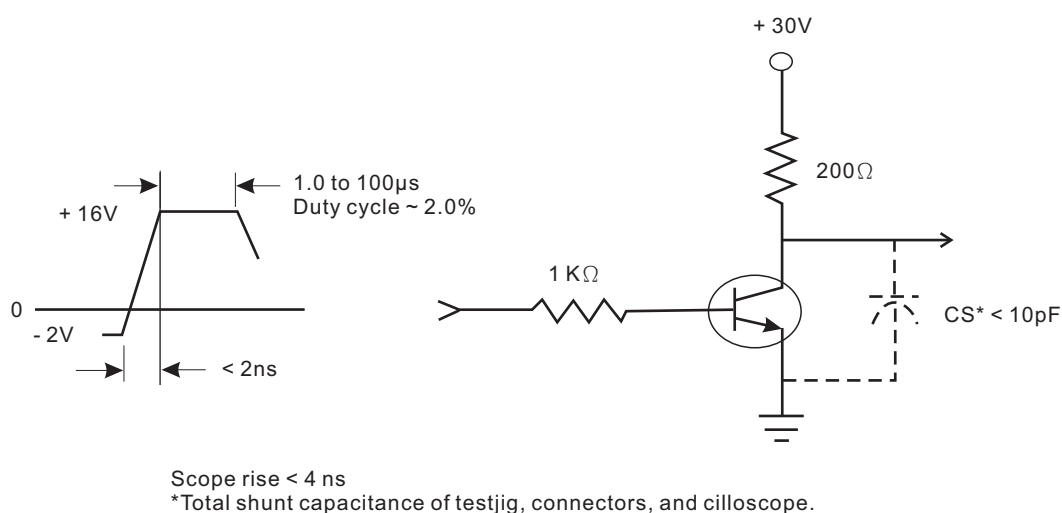


Fig. 1 Delay and rise time equivalent test circuit

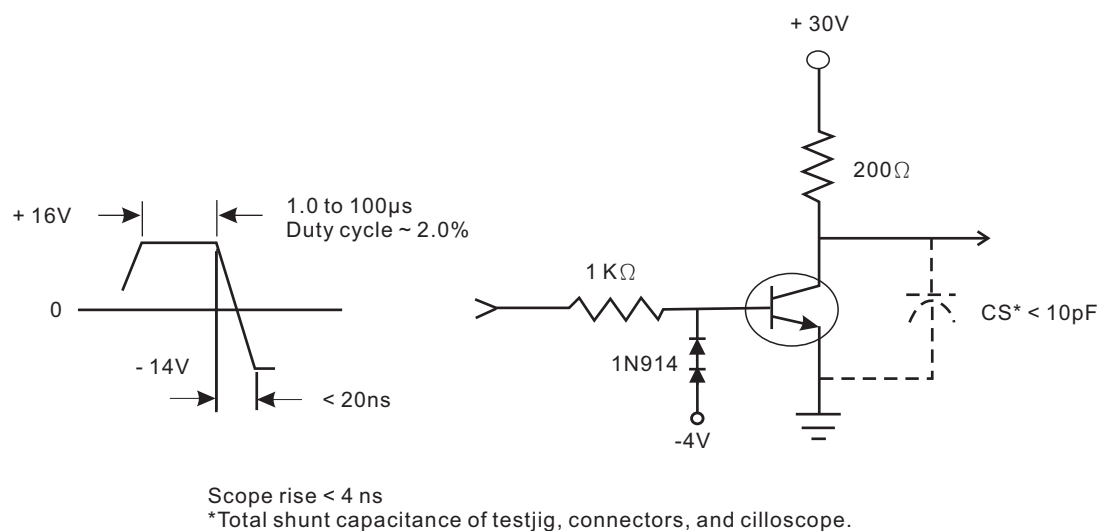


Fig. 2 Storage and fall time equivalent test circuit

Rating and characteristic curves (FMBT2222ADW1)

Fig. 3 DC Current Gain

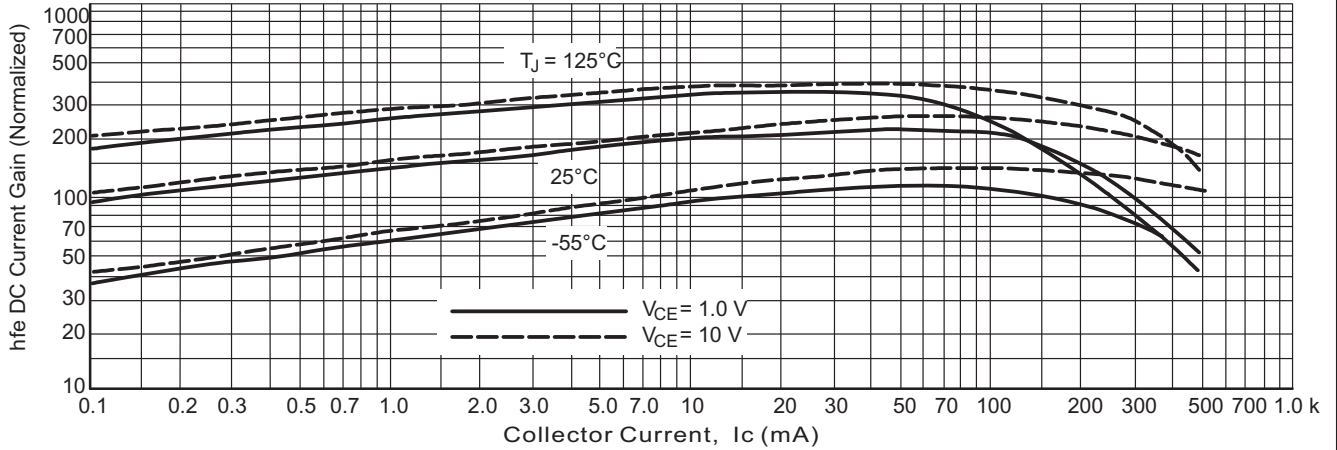


Fig. 4 Collect Saturation Region

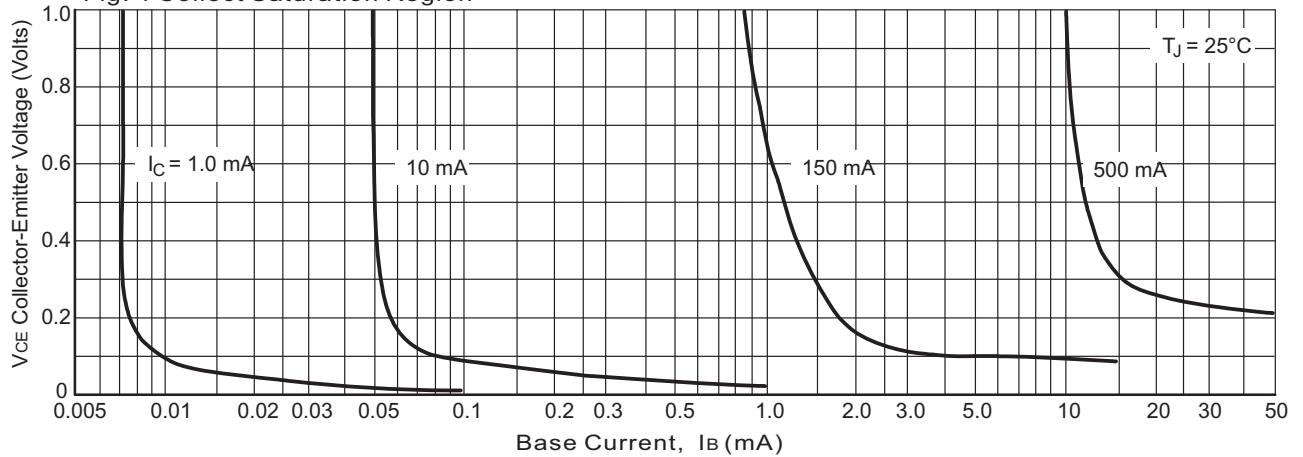


Fig. 5 Turn-On Time vs Collector Current

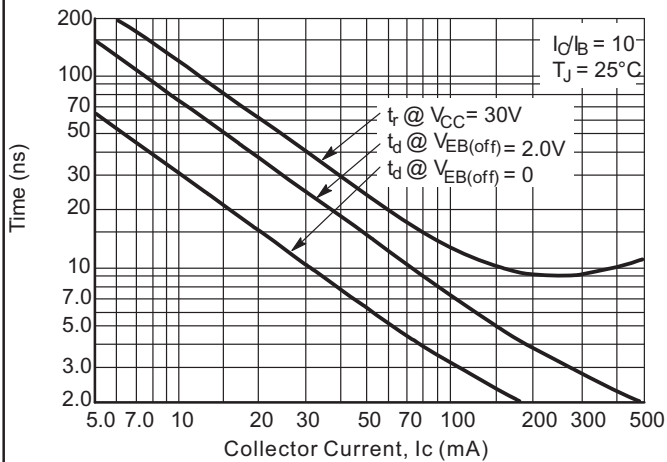
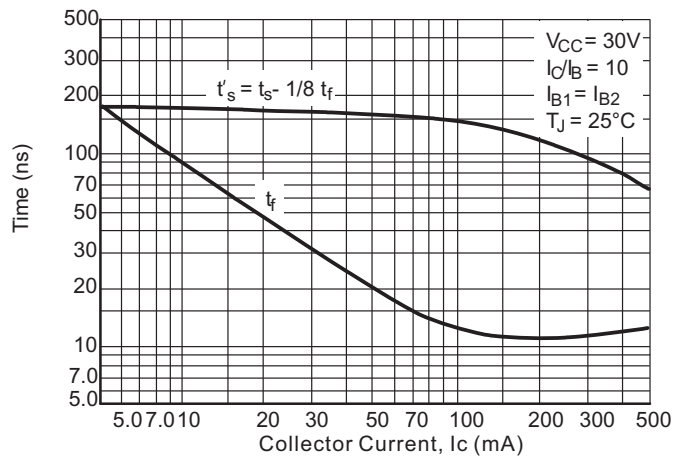


Fig. 6 Turn-Off Time vs Collector Current



Rating and characteristic curves (FMBT2222ADW1)

Fig. 7 Frequency Effects

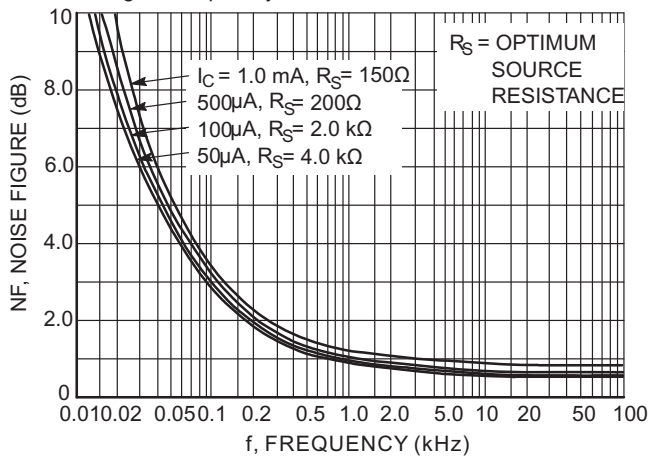


Fig. 8 Source Resistance Effects

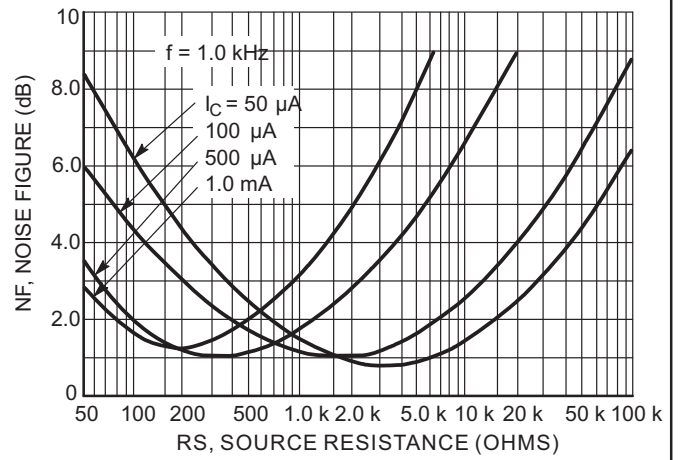


Fig. 9 Capacitances

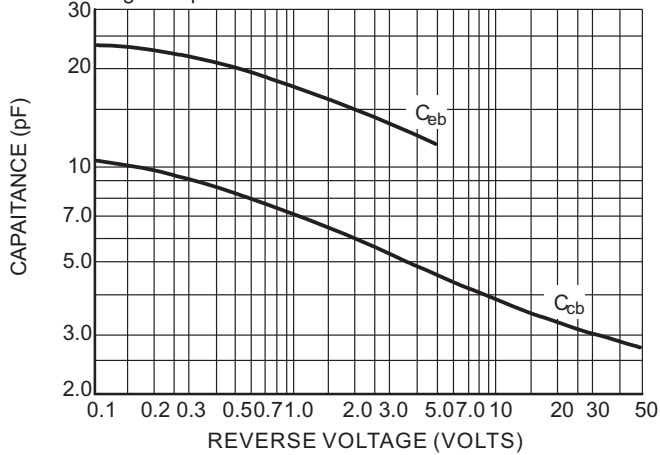


Fig. 10 Current-Gain Bandwidth Product

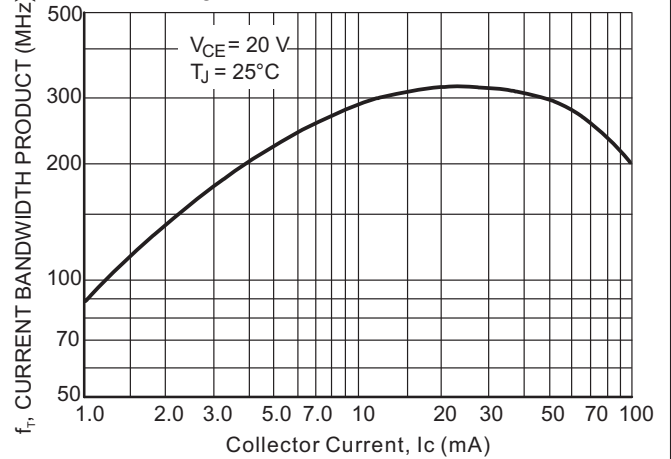


Fig. 11 Collector Emitter Saturation Voltage vs. Collector Current

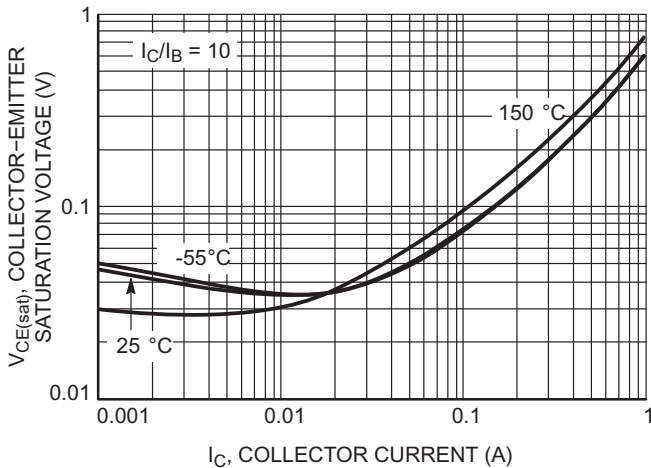
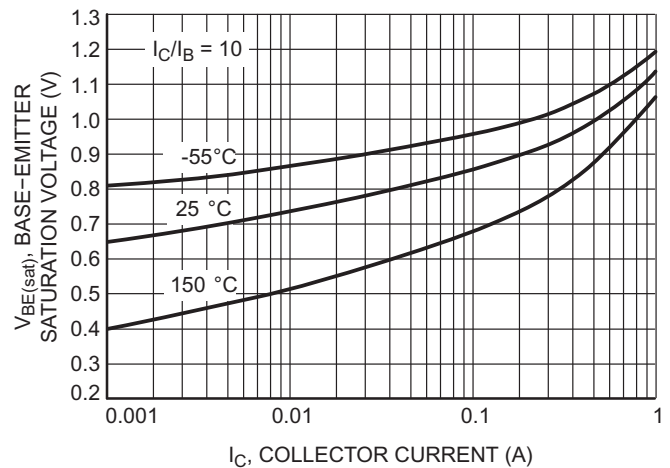


Fig. 12 Base Emitter Saturation Voltage vs. Collector Current



Rating and characteristic curves (FMBT2222ADW1)

Fig.13 Base Emitter Voltage vs. Collector Current

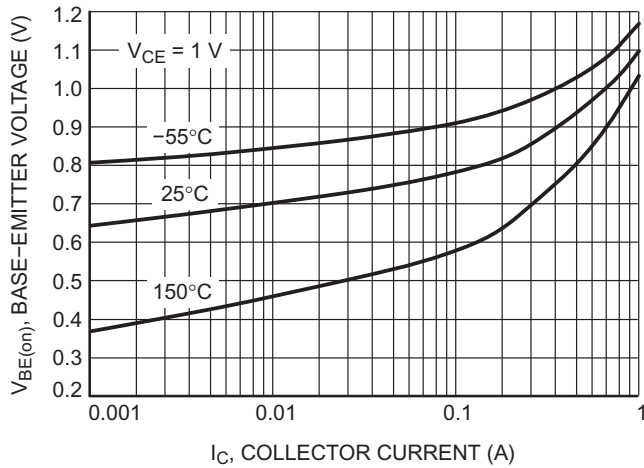


Fig.14 Temperature Coefficients

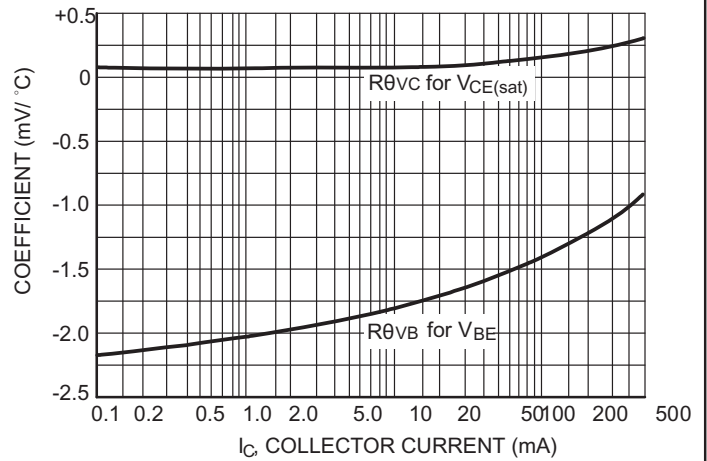
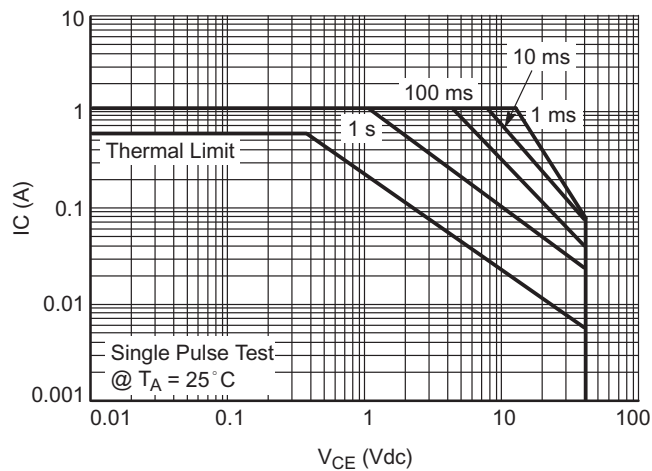
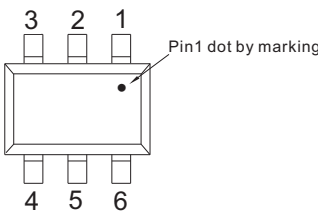
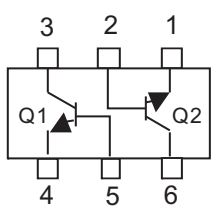


Fig.15 Safe Operating Area



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Pinning information

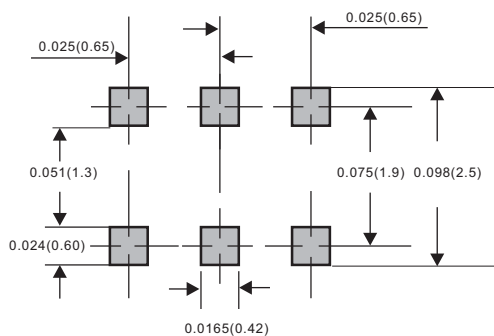
Pin	Simplified outline	Symbol
FMBT2222ADW1		

Marking

Type number	Marking code
FMBT2222ADW1	XX,K1P

Suggested solder pad layout

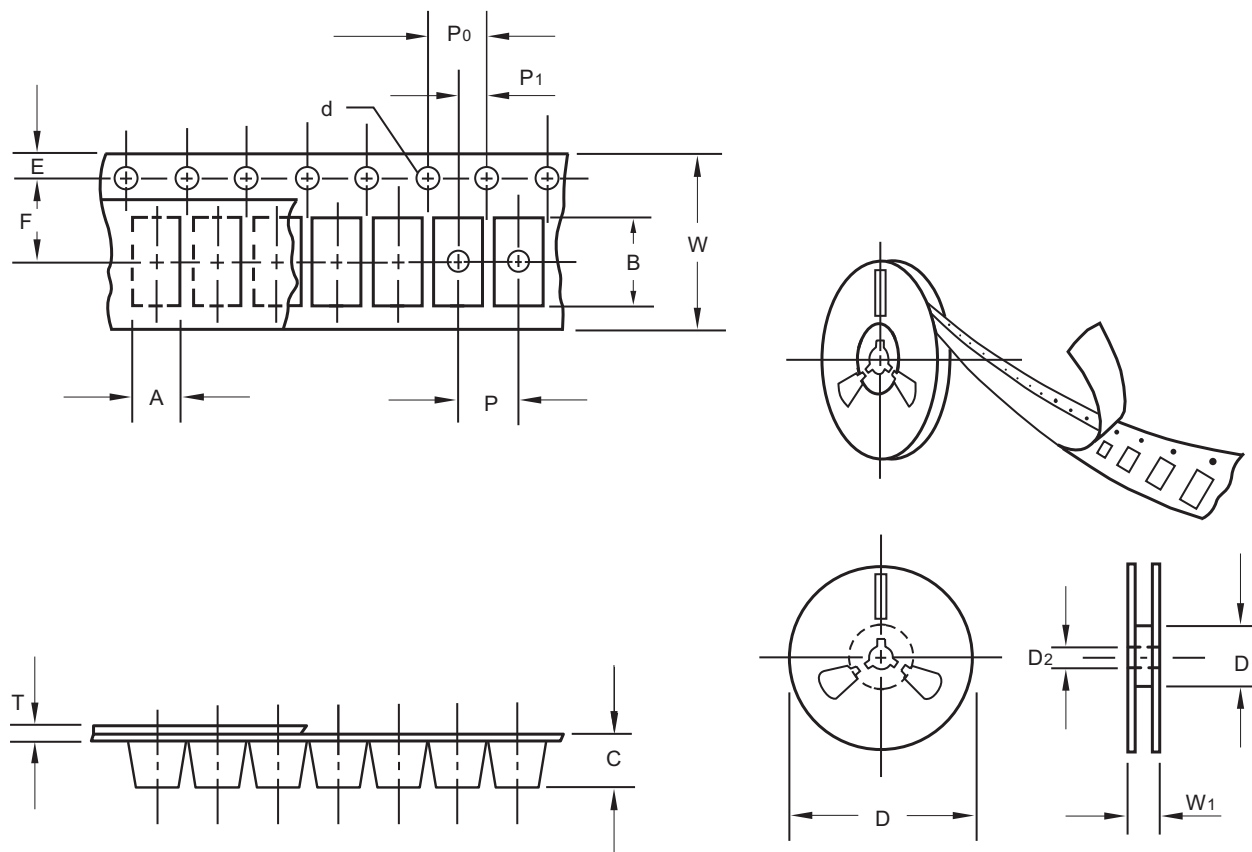
SOT-363



Dimensions in inches and (millimeters)

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Packing information



unit:mm

Item	Symbol	Tolerance	SOT-363
Carrier width	A	0.1	2.36
Carrier length	B	0.1	2.40
Carrier depth	C	0.1	1.20
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	62.00
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	11.40

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

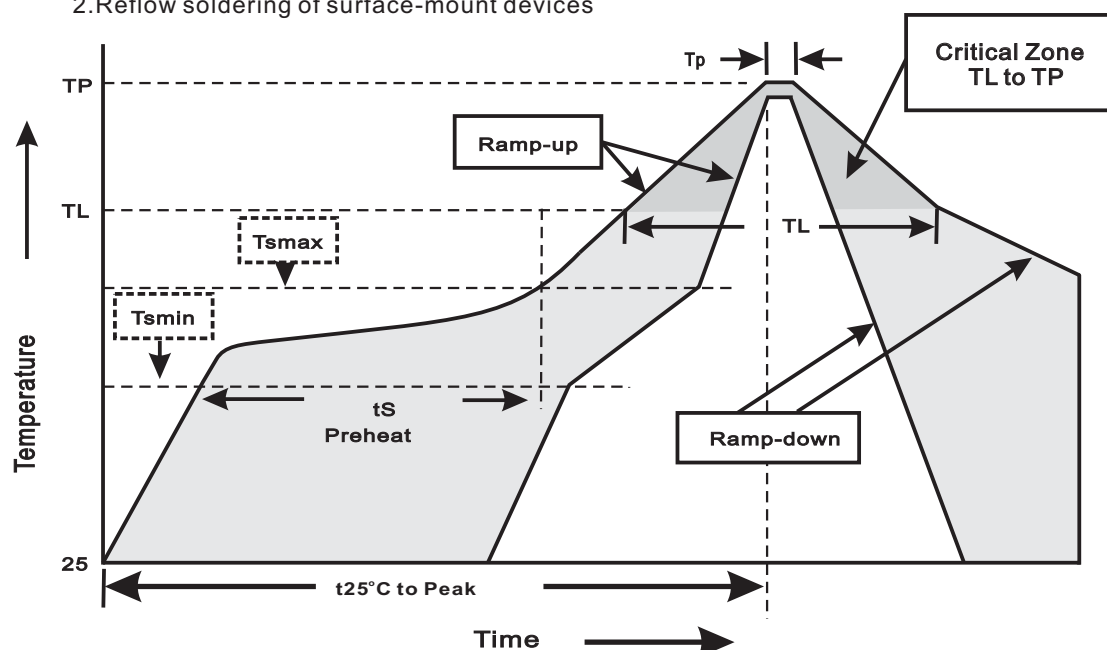
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Reel packing

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-363	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°C/sec
Preheat -Temperature Min(T _{smin}) -Temperature Max(T _{smax}) -Time(min to max)(t _s)	150°C 200°C 60~120sec
T _{smax} 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	$P_D=150\text{mW}$ 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	$P=2\text{atm}$ $T_a=121^\circ\text{C}$ $\text{RH}=100\%$ 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