

FMBT3946DW-Q1

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FMBT3946DW-Q1

Dual Transistor (NPN + PNP)

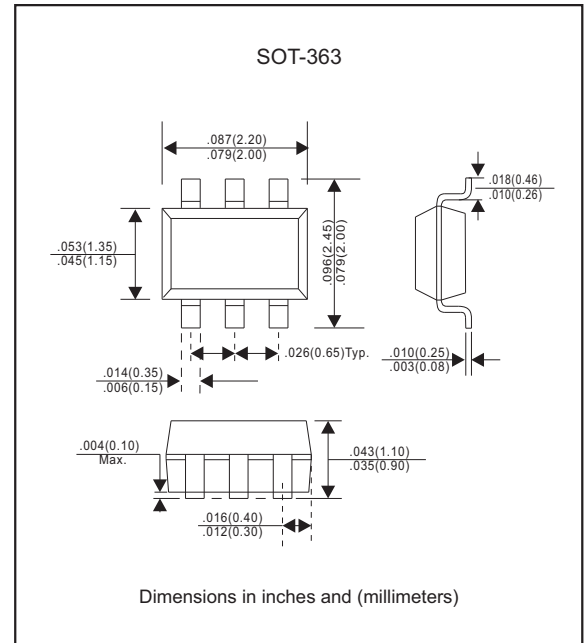
Features

- Complementary pair.
One 3904-Type NPN.
One 3906-Type PNP.
- Epitaxial planar die.
- Ideal for low power amplification and switching.
- Qualified to AEC-Q101 standards for high reliability.
- Lead-free parts for green partner, exceeds environmental standards of MIL-STD-19500 /228.
- Suffix "-H" indicates Halogen-free part, ex.FMBT3946DW-Q1-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



NPN 3904 Maximum ratings (At $T_A=25^{\circ}\text{C}$ unless otherwise noted)

Parameter	Symbol	Value	Unit
Collector to base voltage	V_{CBO}	60	V
Collector to Emitter Voltage	V_{CEO}	40	V
Emitter to base voltage	V_{EBO}	5	V
Collector current	I_C	200	mA
Total power dissipation	P_D	200	mW
Junction temperature	T_J	+150	$^{\circ}\text{C}$
Storage temperature range	T_{STG}	-55 ~ +150	$^{\circ}\text{C}$

PNP 3906 Maximum ratings (At $T_A=25^{\circ}\text{C}$ unless otherwise noted)

Parameter	Symbol	Value	Unit
Collector to base voltage	$-V_{CBO}$	40	V
Collector to Emitter Voltage	$-V_{CEO}$	40	V
Emitter to base voltage	$-V_{EBO}$	-5	V
Collector current	$-I_C$	200	mA
Total power dissipation	P_C	200	mW
Junction temperature	T_J	+150	$^{\circ}\text{C}$
Storage temperature	T_{STG}	-55 ~ +150	$^{\circ}\text{C}$

FMBT3946DW-Q1**NPN 3904 Electrical characteristics** (At $T_A=25^\circ\text{C}$ unless otherwise noted)

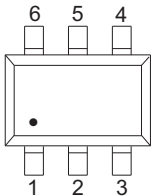
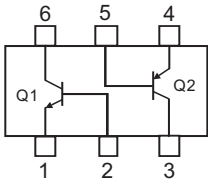
Parameter	Conditions	Symbol	Min.	Typ.	Max.	Unit
Collector-base breakdown voltage	$I_C = 10\mu\text{A}, I_E=0$	$V_{(BR)CBO}$	60			V
Collector-emitter breakdown voltage	$I_C = 1\text{mA}, I_B=0$	$V_{(BR)CEO}$	40			V
Emitter-base breakdown voltage	$I_E = 10\mu\text{A}, I_C=0$	$V_{(BR)EBO}$	5			V
Collector-base cut-off current	$V_{CB} = 30\text{V}, I_E=0$	I_{CBO}			50	nA
Collector-emitter cut-off current	$V_{CE} = 30\text{V}, I_B=0$	I_{CEO}			500	nA
Emitter-base cut off current	$V_{EB} = 5\text{V}, I_C=0$	I_{EBO}			50	nA
Collector-emitter saturation voltage	$I_C = 10\text{mA}, I_B = 1\text{mA}$	$V_{CE(sat)}$			0.2	V
	$I_C = 50\text{mA}, I_B = 5\text{mA}$				0.3	
Base-emitter saturation voltage	$I_C = 10\text{mA}, I_B = 1\text{mA}$	$V_{BE(sat)}$	0.65		0.85	V
	$I_C = 50\text{mA}, I_B = 5\text{mA}$				0.95	
DC current gain	$V_{CE}=1\text{V}, I_C=0.1\text{mA}$	h_{FE1}	40			
	$V_{CE}=1\text{V}, I_C=1\text{mA}$	h_{FE2}	70			
	$V_{CE}=1\text{V}, I_C=10\text{mA}$	h_{FE3}	100		300	
	$V_{CE}=1\text{V}, I_C=50\text{mA}$	h_{FE4}	60			
	$V_{CE}=1\text{V}, I_C=100\text{mA}$	h_{FE5}	30			
Transition Frequency	$V_{CE}=20\text{V}, I_C=20\text{mA}, f=100\text{MHz}$	f_T	300			MHZ
Collector output capacitance	$V_{CB}=5\text{V}, I_E=0, f=1\text{MHz}$	C_{ob}			4	pF
Delay time	$V_{CC}=3\text{V}, V_{BE}=0.5\text{V}, I_C=10\text{mA}, I_{B1}=I_{B2}=1\text{mA}$	t_d			35	ns
Rise time		t_r			35	
Storage time		t_s			200	
Fall time		t_f			50	
Noise figure	$V_{CE}=5\text{V}, I_C=0.25\text{mA}, f=10\text{Hz to } 15.7\text{KHz}, R_s=1\text{K}\Omega$	NF			5	dB

PNP 3906 Electrical characteristics (At $T_A=25^\circ\text{C}$ unless otherwise noted)

Parameter	Conditions	Symbol	Min.	Typ.	Max.	Unit
Collector-base breakdown voltage	$-I_C=10\mu\text{A}, I_E=0$	$-V_{(BR)CBO}$	40			V
Collector-emitter breakdown voltage	$-I_C=1\text{mA}, I_B=0$	$-V_{(BR)CEO}$	40			V
Emitter-base breakdown voltage	$-I_E=10\mu\text{A}, I_C=0$	$-V_{(BR)EBO}$	5			V
Collector cut-off current	$-V_{CB}=30\text{V}, I_E=0$	$-I_{CBO}$			50	nA
Emitter cut-off current	$-V_{EB}=5\text{V}, I_C=0$	$-I_{EBO}$			50	nA
DC current gain	$-V_{CE}=1\text{V}, -I_C=0.1\text{mA}$	h_{FE1}	60			
	$-V_{CE}=1\text{V}, -I_C=1\text{mA}$	h_{FE2}	80			
	$-V_{CE}=1\text{V}, -I_C=10\text{mA}$	h_{FE3}	100		300	
	$-V_{CE}=1\text{V}, -I_C=50\text{mA}$	h_{FE4}	60			
	$-V_{CE}=1\text{V}, -I_C=100\text{mA}$	h_{FE5}	30			
Collector-emitter saturation voltage	$-I_C=10\text{mA}, -I_B=1\text{mA}$	$-V_{CE(sat)}$			0.25	V
	$-I_C=50\text{mA}, -I_B=5\text{mA}$				0.4	
Base-emitter saturation voltage	$-I_C=10\text{mA}, -I_B=1\text{mA}$	$-V_{BE(sat)}$	0.65		0.85	V
	$-I_C=50\text{mA}, -I_B=5\text{mA}$				0.95	
Transition frequency	$-V_{CE}=20\text{V}, -I_C=10\text{mA}, f=100\text{MHz}$	f_T	250			MHZ
Collector output capacitance	$-V_{CB}=5\text{V}, I_E=0, f=1\text{MHz}$	C_{ob}			4.5	pF
Delay time	$-V_{CC}=3\text{V}, -V_{BE}=0.5\text{V}, -I_C=10\text{mA}, -I_{B1}=-I_{B2}=1\text{mA}$	t_d			35	ns
Rise time		t_r			35	
Storage time		t_s			225	
Fall time		t_f			75	
Noise figure	$-V_{CE}=5\text{V}, I_C=0.1\text{mA}, f=1\text{KHz}, R_s=1\text{K}\Omega$	NF			4	dB

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Pinning information

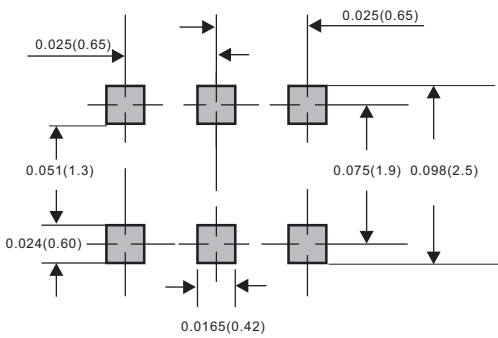
Pin	Simplified outline	Symbol
FMBT3946DW-Q1		

Marking

Type number	Marking code
FMBT3946DW-Q1	K46

Suggested solder pad layout

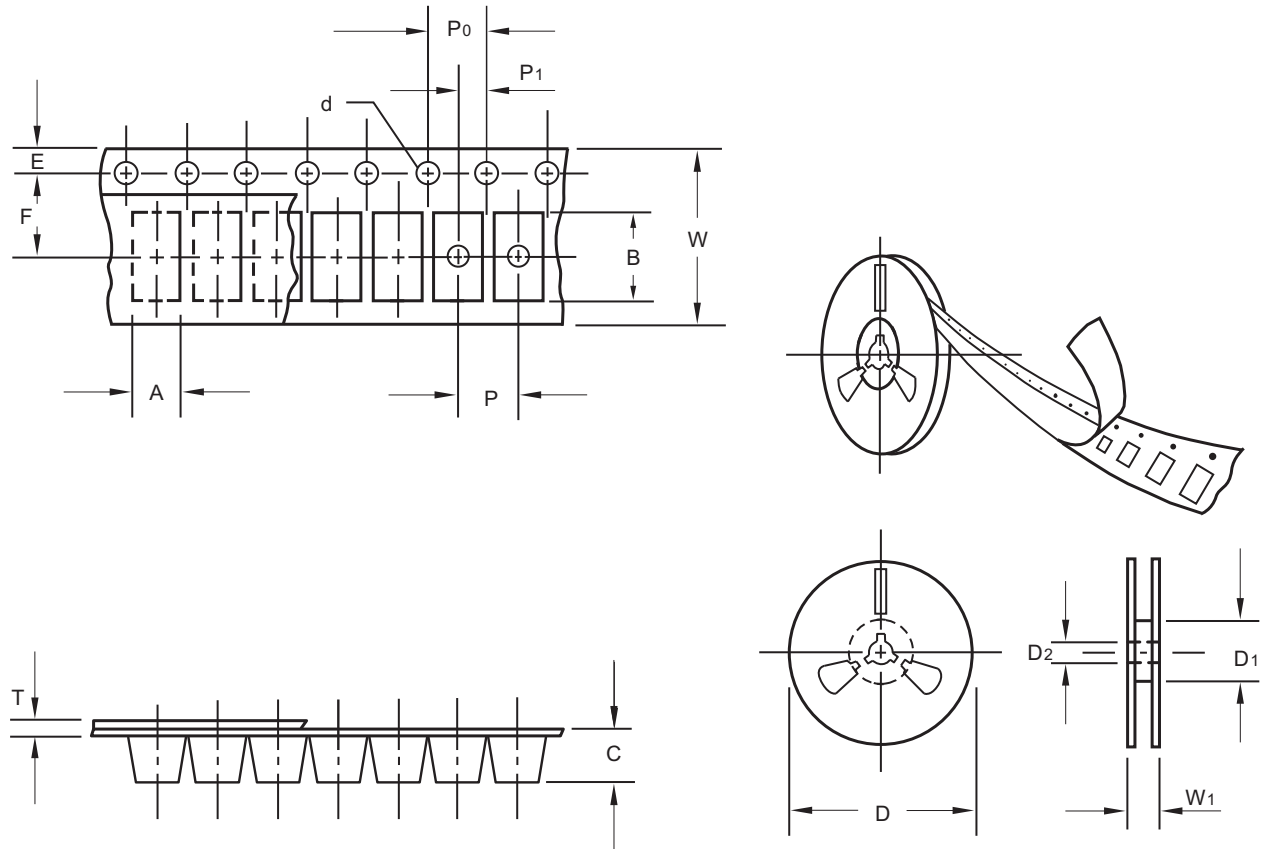
SOT-363



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.

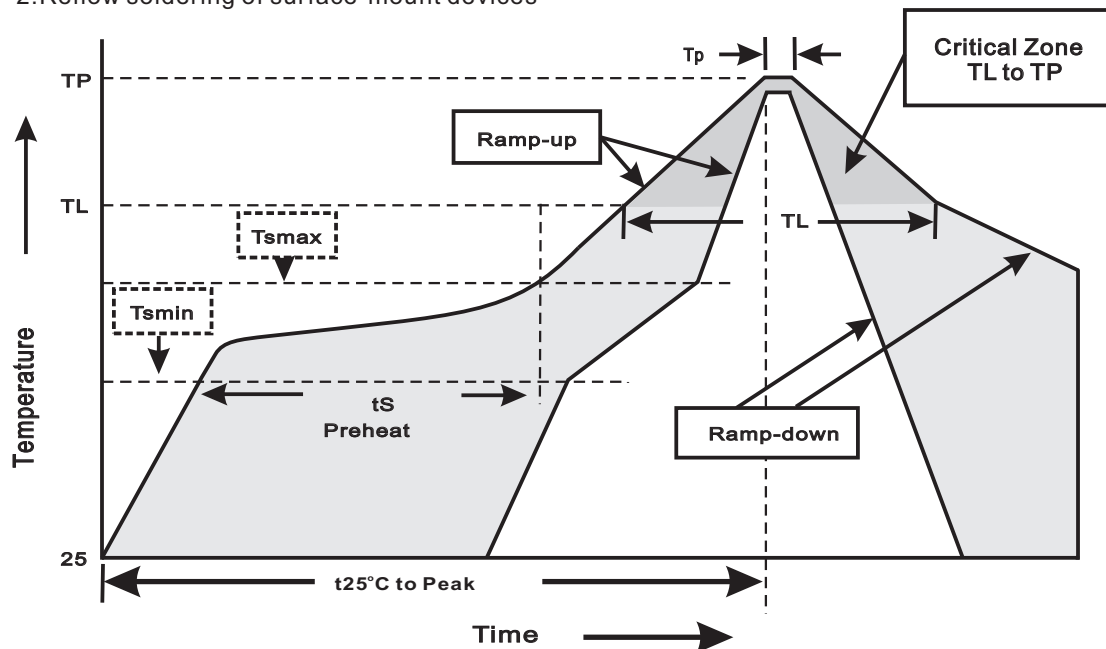
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Reel packing

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 _{5min}) -Temperature Max(T _{5max}) -Time(min to max)(t _S)	150°C 200°C 60~120sec
T _{5max} 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

FMBT3946DW-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