

FMUN2211-Q1 Thru FMUN2241-Q1

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FMUN2211-Q1 Thru FMUN2241-Q1

NPN Silicon Epitaxial Planar
Digital Transistors

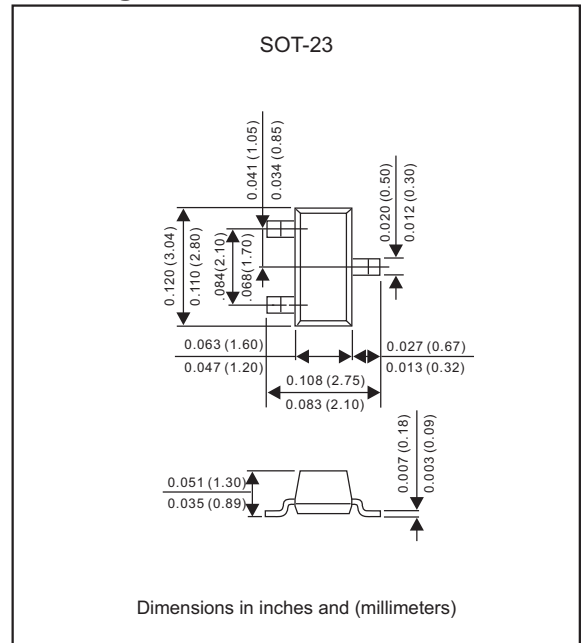
Features

- For switching and interface circuit and drive circuit applications
- Lead-free parts meet RoHS requirements
- Qualified to AEC-Q101 standards for high reliability
- Suffix "-H" indicates Halogen free parts, ex. FMUN2211-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	Symbol	Value	Unit
Collector-base voltage	V_{CBO}	50	V
Collector-emitter voltage	V_{CEO}	50	V
Collector current	I_C	100	mA
Total power dissipation	P_{tot}	200	mW
Operating junction temperature range	T_J	-55 to +150	$^{\circ}\text{C}$
Storage temperature range	T_{STG}	-55 to +150	$^{\circ}\text{C}$

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

Parameter	Conditions	Device	Symbol	Min.	Typ.	Max.	Unit
Collector-base cutoff current	$V_{CB}=50\text{V}$		I_{CBO}			100	nA
Collector-emitter cutoff current	$V_{CE}=50\text{V}$		I_{CEO}			500	nA
Collector-base breakdown voltage	$I_C=10\mu\text{A}$		$V_{(BR)CBO}$	50			V
Collector-emitter breakdown voltage	$I_C=2\text{mA}$		$V_{(BR)CEO}$	50			V
Output voltage (on)	$V_{CC}=5\text{V}, V_B=2.5\text{V}, R_L=1\text{k}\Omega$		V_{OL}			0.2	V
	$V_{CC}=5\text{V}, V_B=3.5\text{V}, R_L=1\text{k}\Omega$	FMUN2213-Q1				0.2	
	$V_{CC}=5\text{V}, V_B=5\text{V}, R_L=1\text{k}\Omega$	FMUN2241-Q1				0.2	
Output voltage (off)	$V_{CC}=5\text{V}, V_B=0.5\text{V}, R_L=1\text{k}\Omega$		V_{OH}	4.9			V
	$V_{CC}=5\text{V}, V_B=0.05\text{V}, R_L=1\text{k}\Omega$	FMUN2230-Q1		4.9			
	$V_{CC}=5\text{V}, V_B=0.25\text{V}, R_L=1\text{k}\Omega$	FMUN2215-Q1		4.9			
		FMUN2216-Q1					
		FMUN2233-Q1					
		FMUN2238-Q1					
DC current gain	$V_{CE}=10\text{V}, I_C=5\text{mA}$	FMUN2211-Q1	h_{FE}	35			
		FMUN2212-Q1		60			
		FMUN2213-Q1		80			
		FMUN2214-Q1		80			
		FMUN2215-Q1		160			
		FMUN2216-Q1		160			
		FMUN2230-Q1		3			
		FMUN2231-Q1		8			
		FMUN2232-Q1		15			
		FMUN2233-Q1		80			
		FMUN2234-Q1		80			
		FMUN2235-Q1		80			
		FMUN2238-Q1		160			
		FMUN2241-Q1		160			

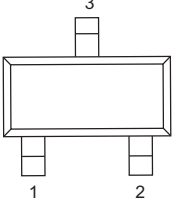
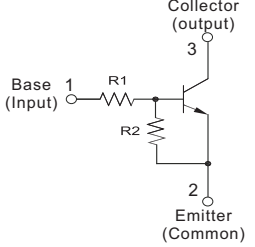
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Electrical characteristics (At $T_A=25^\circ\text{C}$ unless otherwise noted)

Parameter	Conditions	Device	Symbol	Min.	Typ.	Max.	Unit
Emitter-base cutoff current	$V_{EB}=6\text{V}$	FMUN2211-Q1	I_{EBO}			0.5	mA
		FMUN2212-Q1				0.2	
		FMUN2213-Q1				0.1	
		FMUN2214-Q1				0.2	
		FMUN2215-Q1				0.9	
		FMUN2216-Q1				1.9	
		FMUN2230-Q1				4.3	
		FMUN2231-Q1				2.3	
		FMUN2232-Q1				1.5	
		FMUN2233-Q1				0.18	
		FMUN2234-Q1				0.13	
		FMUN2235-Q1				0.2	
		FMUN2238-Q1				4	
		FMUN2241-Q1				0.1	
Collector-emitter saturation voltage	$I_C=10\text{mA}$, $I_B=0.3\text{mA}$		$V_{(CE)sat}$			0.25	V
	$I_C=10\text{mA}$, $I_B=5\text{mA}$	FMUN2230-Q1				0.25	
		FMUN2231-Q1				0.25	
	$I_C=10\text{mA}$, $I_B=1\text{mA}$	FMUN2215-Q1				0.25	
		FMUN2216-Q1				0.25	
		FMUN2232-Q1				0.25	
		FMUN2233-Q1				0.25	
		FMUN2234-Q1				0.25	
		FMUN2235-Q1				0.25	
		FMUN2238-Q1				0.25	

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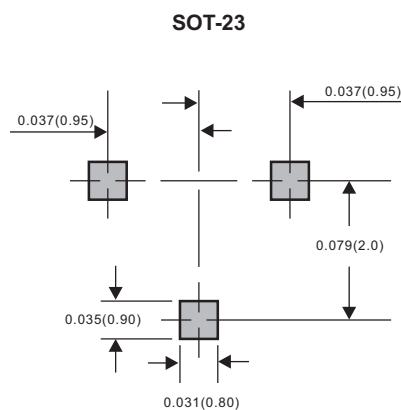
Pinning information

Pin	Simplified outline	Symbol
Pin1 Base Pin2 Emitter Pin3 Collector		

Marking and resistor values

Device	Marking	Input resistor R_1 (k Ω)			R_2 (k Ω)	Resistor ratio R_1 / R_2		
		Min	Normal	Max		Min	Normal	Max
FMUN2211-Q1	A8A	7	10	13	10	0.8	1.0	1.2
FMUN2212-Q1	A8B	15.4	22	28.6	22	0.8	1.0	1.2
FMUN2213-Q1	A8C	32.9	47	61.1	47	0.8	1.0	1.2
FMUN2214-Q1	A8D	7	10	13	47	0.17	0.21	0.25
FMUN2215-Q1	A8E	7	10	13	∞	-	-	-
FMUN2216-Q1	A8F	3.3	4.7	6.1	∞	-	-	-
FMUN2230-Q1	A8G	0.7	1.0	1.3	1.0	0.8	1.0	1.2
FMUN2231-Q1	A8H	1.5	2.2	2.9	2.2	0.8	1.0	1.2
FMUN2232-Q1	A8J	3.3	4.7	6.1	4.7	0.8	1.0	1.2
FMUN2233-Q1	A8K	3.3	4.7	6.1	47	0.055	0.1	0.185
FMUN2234-Q1	A8L	15.4	22	28.6	47	0.38	0.47	0.56
FMUN2235-Q1	A8M	1.54	2.2	2.86	47	0.038	0.047	0.056
FMUN2238-Q1	A8R	1.54	2.2	2.86	∞	-	-	-
FMUN2241-Q1	A8U	70	100	130	∞	-	-	-

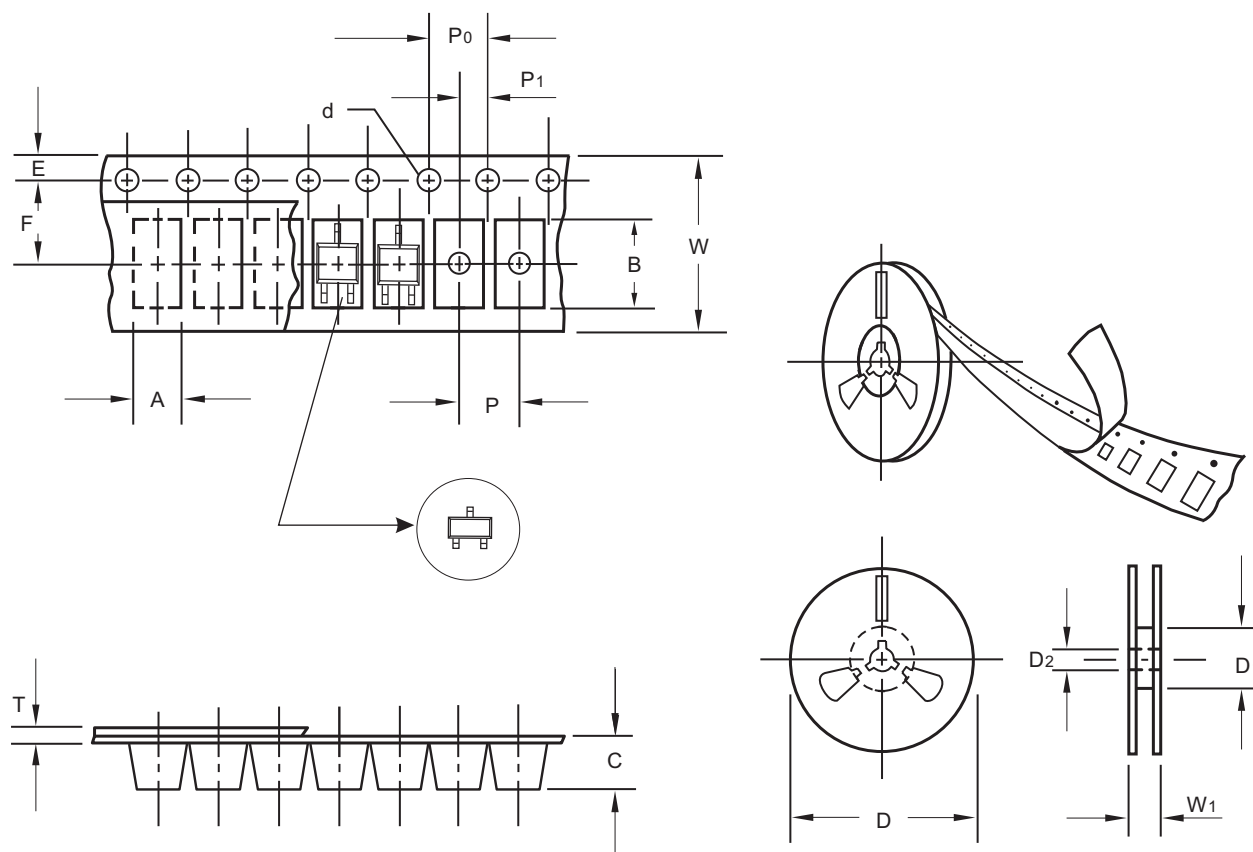
Suggested solder pad layout



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	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.

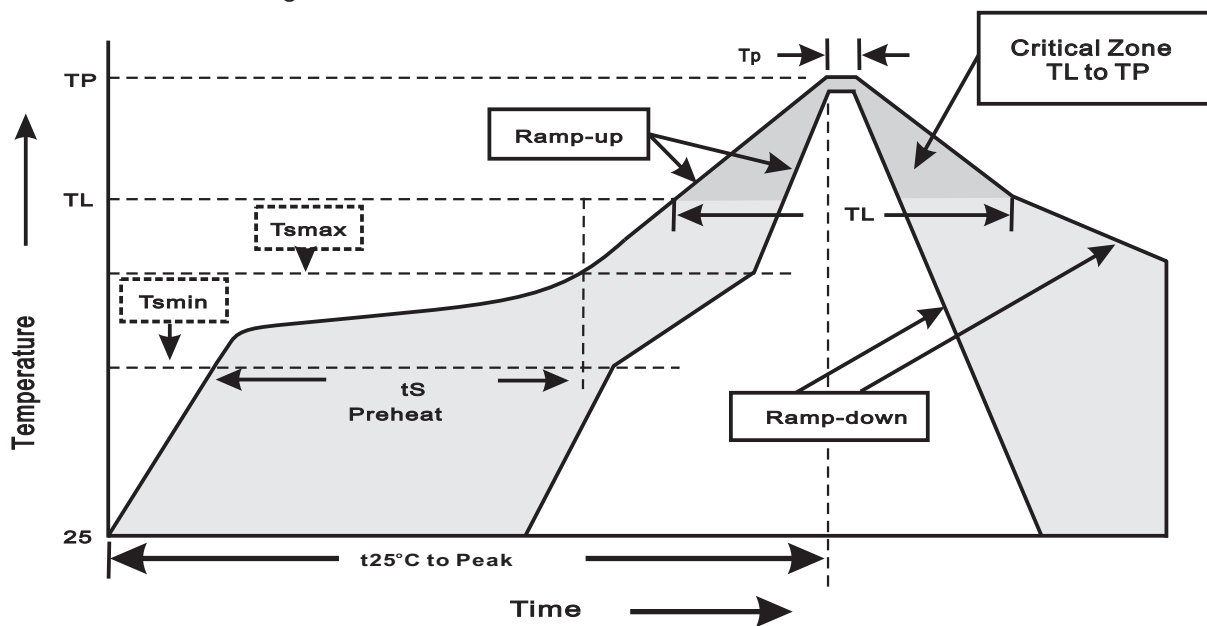
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Reel packing

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

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

FMUN2211-Q1 Thru FMUN2241-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°C, $\Delta T_j \geq 100^\circ\text{C}$ on/off=2min Test Duration:1000hrs	MIL-STD-750E METHOD 1037
3. High Temperature Reverse Bias	$V_{CE}=100\%B_{V_{CE0}}$ ($T_{JMAX}=150^\circ\text{C}$) Test Duration: 1000hrs	JESD22-A108
4. High Temperature Storage Life	Ta=150°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, $V_{CE}=80\%B_{V_{CE0}}$ Test Duration:1000hrs	JESD22-A101