

FMNP2305-Q1-H

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FMNP2305-Q1-H

-4.1A -20V P-Channel Enhancement Mode Power MOSFET

Features

- $R_{DS(on)} \leq 45m\Omega$ @ $-V_{GS}=4.5V$, $-I_D=3.5A$
- $R_{DS(on)} \leq 70m\Omega$ @ $-V_{GS}=2.5V$, $-I_D=3.0A$
- $R_{DS(on)} \leq 90m\Omega$ @ $-V_{GS}=1.8V$, $-I_D=2.0A$
- Lead-free parts meet RoHS requirements
- Qualified to AEC-Q101 standards for high reliability
- Halogen-free (IEC61249-2-21)

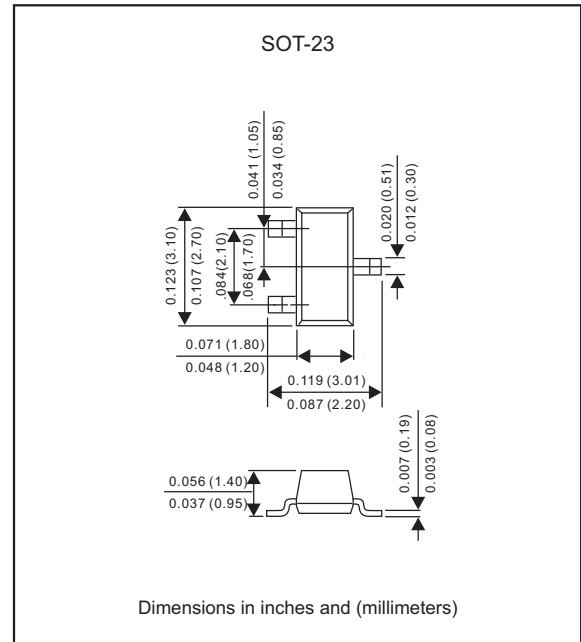
Applications

- Load switch for portable devices
- DC/DC converter

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 $T_A=25^\circ C$ Unless otherwise noted)

Parameter	Symbol	Value	Unit
Drain-source voltage	$-V_{DS}$	20	V
Gate-source voltage	V_{GS}	± 12	V
Continuous drain current	$-I_D$	4.1	A
Pulsed drain current	$-I_{DM}$	16	A
Power dissipation	P_D	0.83	W
Thermal resistance junction to ambient ($t \leq 5s$)	$R_{\theta JA}$	150	$^\circ C/W$
Operating junction temperature range	T_J	-55 to +150	$^\circ C$
Storage temperature range	T_{STG}	-55 to +150	$^\circ C$

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

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Off characteristics						
Drain-source breakdown voltage	$-BV_{\text{DSS}}$	$V_{\text{GS}}=0\text{V}$, $-I_{\text{D}}=250\mu\text{A}$	20	21.5		V
Zero gate voltage drain current	$-I_{\text{DSS}}$	$-V_{\text{DS}}=16\text{V}$, $V_{\text{GS}}=0\text{V}$			1.0	μA
Gate-source leakage current	I_{GSS}	$V_{\text{DS}}=0\text{V}$, $V_{\text{GS}}=\pm 10\text{V}$			± 100	nA

On characteristics

Gate-source threshold voltage	$-V_{\text{GS(th)}}$	$V_{\text{DS}}=V_{\text{GS}}$, $-I_{\text{D}}=250\mu\text{A}$	0.4	0.7	1.0	V
Drain-source on-state resistance (Note 1)	$R_{\text{DS(on)}}$	$-V_{\text{GS}}=4.5\text{V}$, $-I_{\text{D}}=3.5\text{A}$		35	45	m Ω
		$-V_{\text{GS}}=2.5\text{V}$, $-I_{\text{D}}=3.0\text{A}$		38	70	
		$-V_{\text{GS}}=1.8\text{V}$, $-I_{\text{D}}=2.0\text{A}$		50	90	

Dynamic parameters (Note 2)

Input capacitance	C_{iss}	$-V_{\text{DS}}=4\text{V}$, $V_{\text{GS}}=0\text{V}$, $f=1.0\text{MHz}$		740		pF
Output capacitance	C_{oss}			290		
Reverse transfer capacitance	C_{rss}			190		

Switching parameters (Note 2)

Total gate charge	Q_{g}	$-V_{\text{DS}}=4\text{V}$, $-V_{\text{GS}}=2.5\text{V}$, $-I_{\text{D}}=4.1\text{A}$		4.5	9.0	nC
Gate-source charge	Q_{gs}			1.2		
Gate-drain charge	Q_{gd}			1.6		
Turn-on delay time	$t_{\text{d(on)}}$	$-V_{\text{DS}}=4.0\text{V}$, $R_{\text{L}}=1.2\Omega$, $-I_{\text{D}}=3.3\text{A}$, $-V_{\text{GEN}}=4.5\text{V}$, $R_{\text{G}}=1\Omega$		13	20	ns
Rise time	t_{r}			35	53	
Turn-off delay time	$t_{\text{d(off)}}$			32	48	
Fall time	t_{f}			10	20	

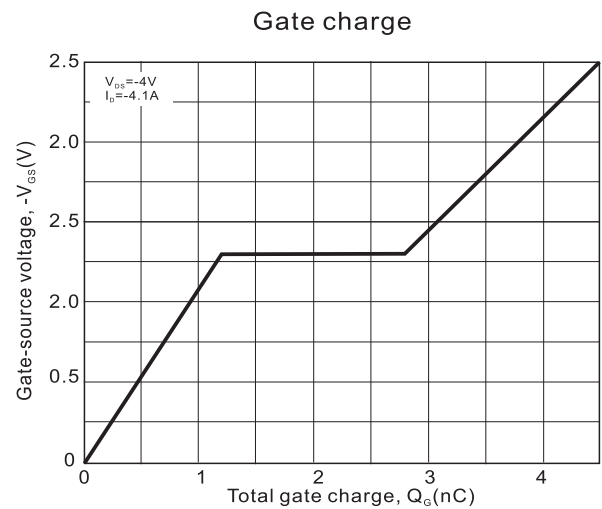
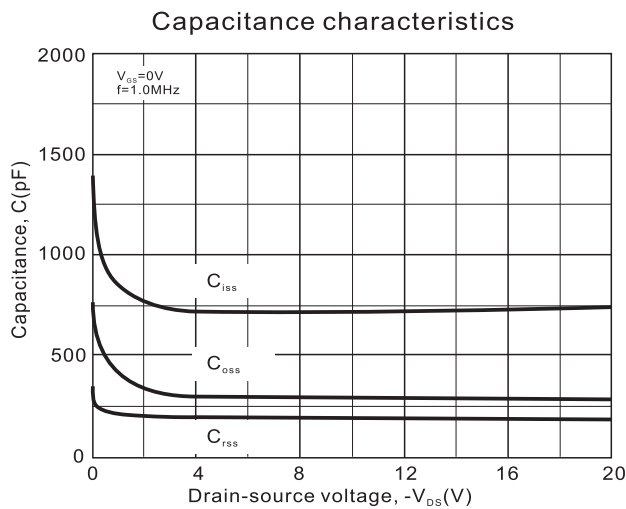
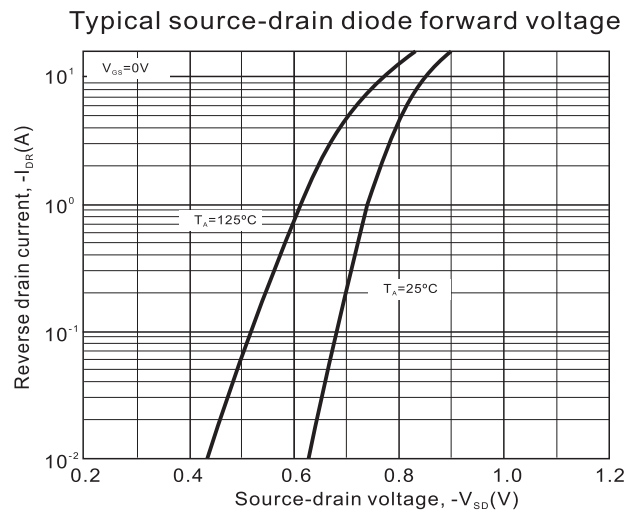
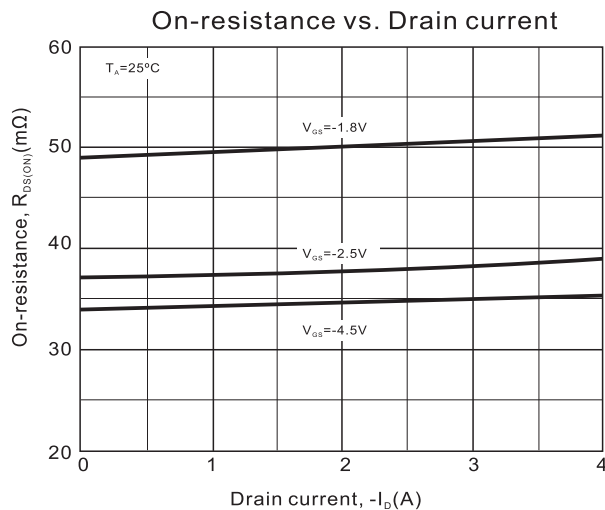
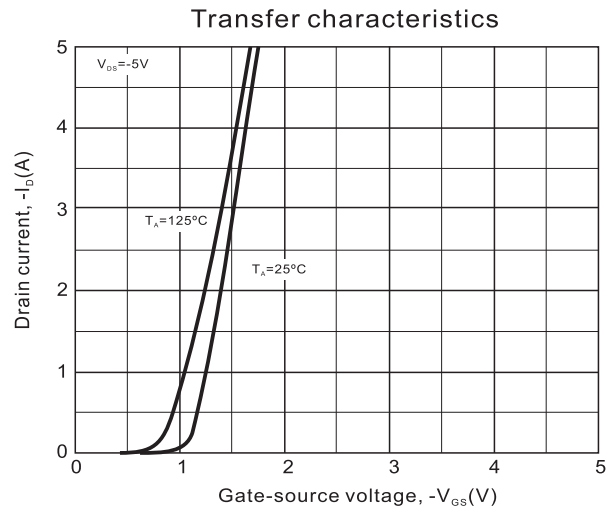
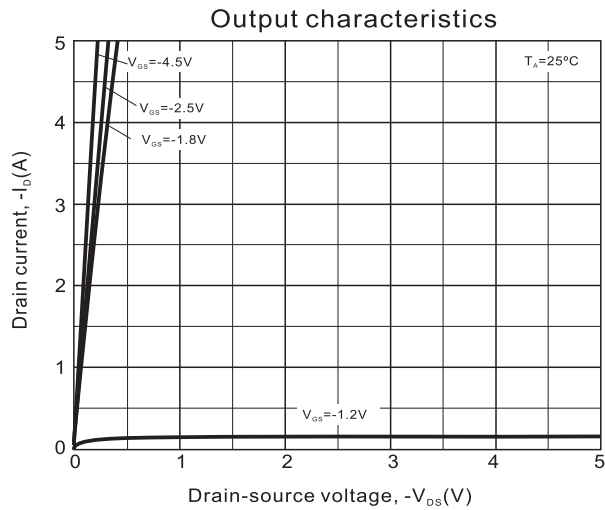
Source-drain diode ratings and characteristics

Body diode voltage	$-V_{\text{SD}}$	$-I_{\text{S}}=3.3\text{A}$		0.9	1.2	V
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Notes 1: Pulse test: pulse width $\leq 300\mu\text{s}$, duty cycle $\leq 2\%$.

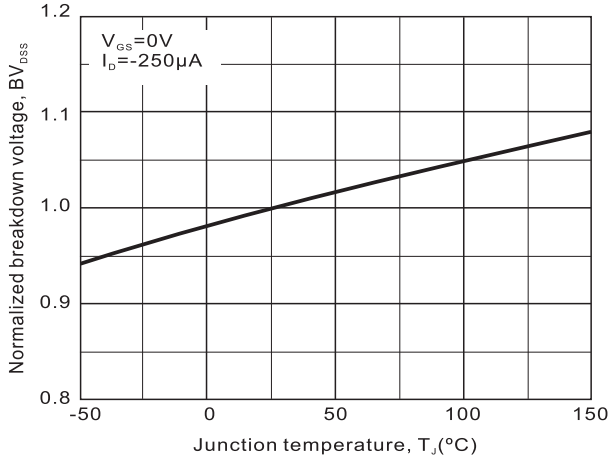
2: Guaranteed by design, not subject to production testing.

Rating and characteristic curves

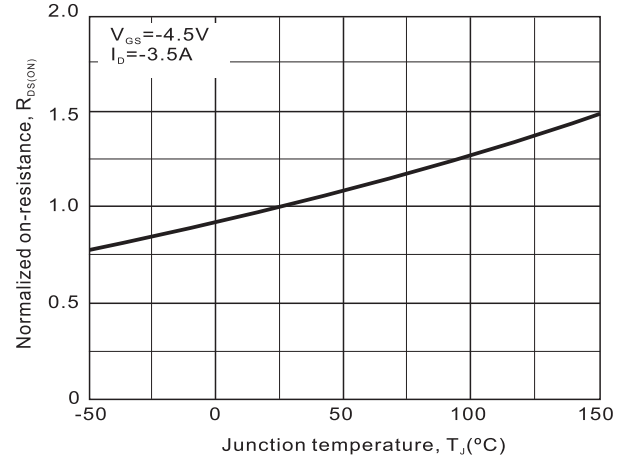


Rating and characteristic curves

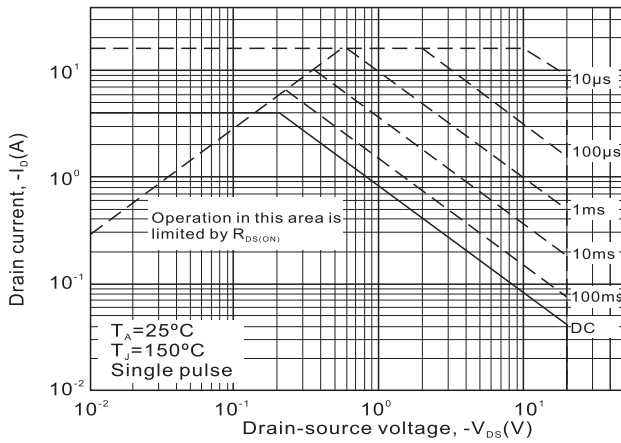
Normalized breakdown voltage vs. Temperature



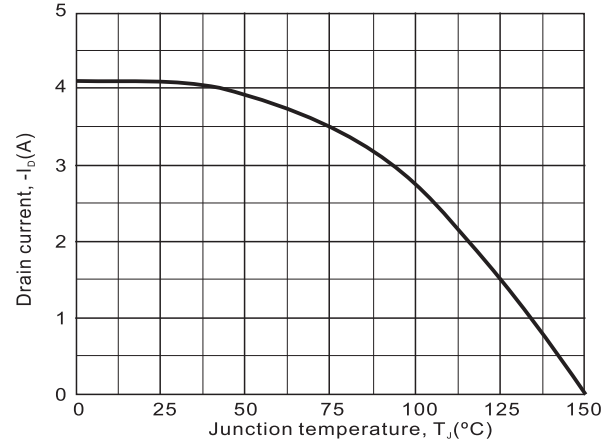
Normalized on-resistance vs. Temperature



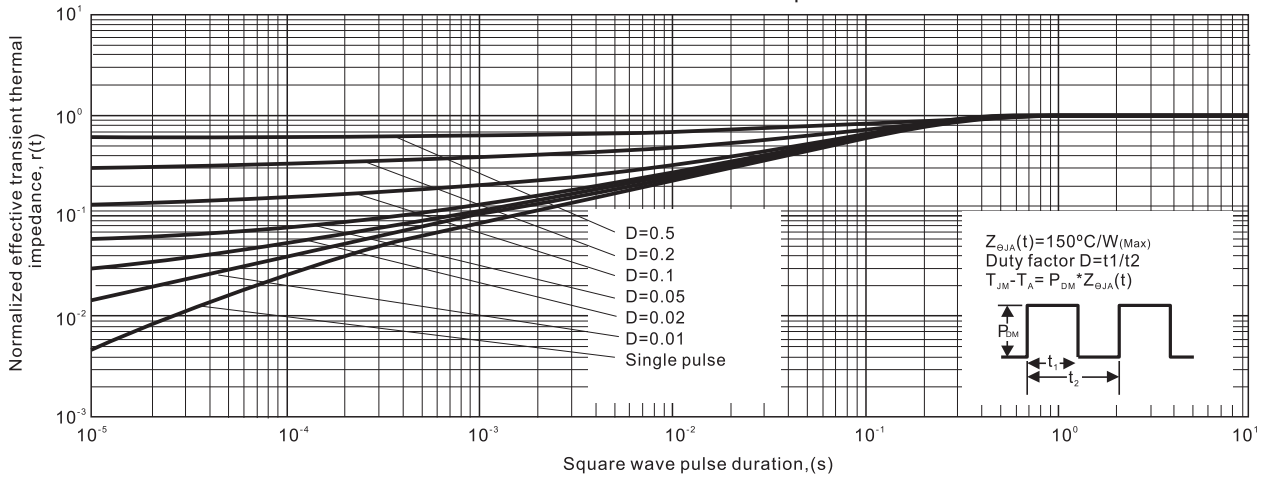
Safe operation area



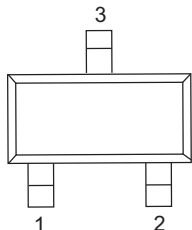
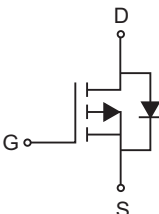
Drain current vs. Case temperature



Normalized thermal transient impedance

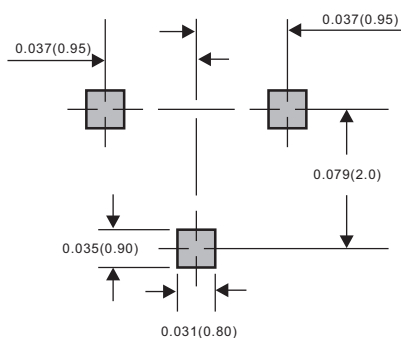


FMNP2305-Q1-H**Pinning information**

Pin	Simplified outline	Symbol
Pin 1 Gate Pin 2 Source Pin 3 Drain		

Marking

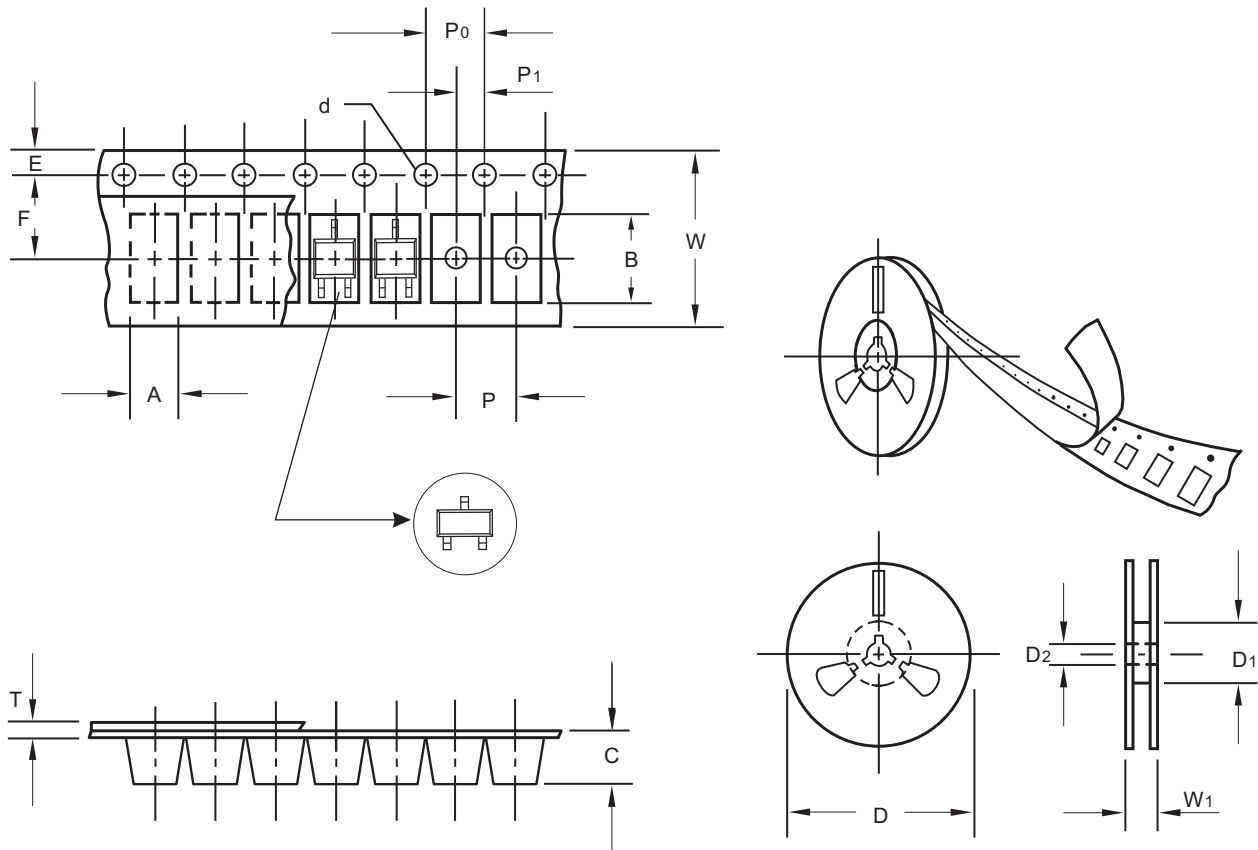
Type Number	Marking code
FMNP2305-Q1-H	2305

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
7" Reel outside diameter	D	2.0	178.00
7" Reel inner diameter	D1	min	54.40
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	0.05	2.00
Overall tape thickness	T	0.02	0.20
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.

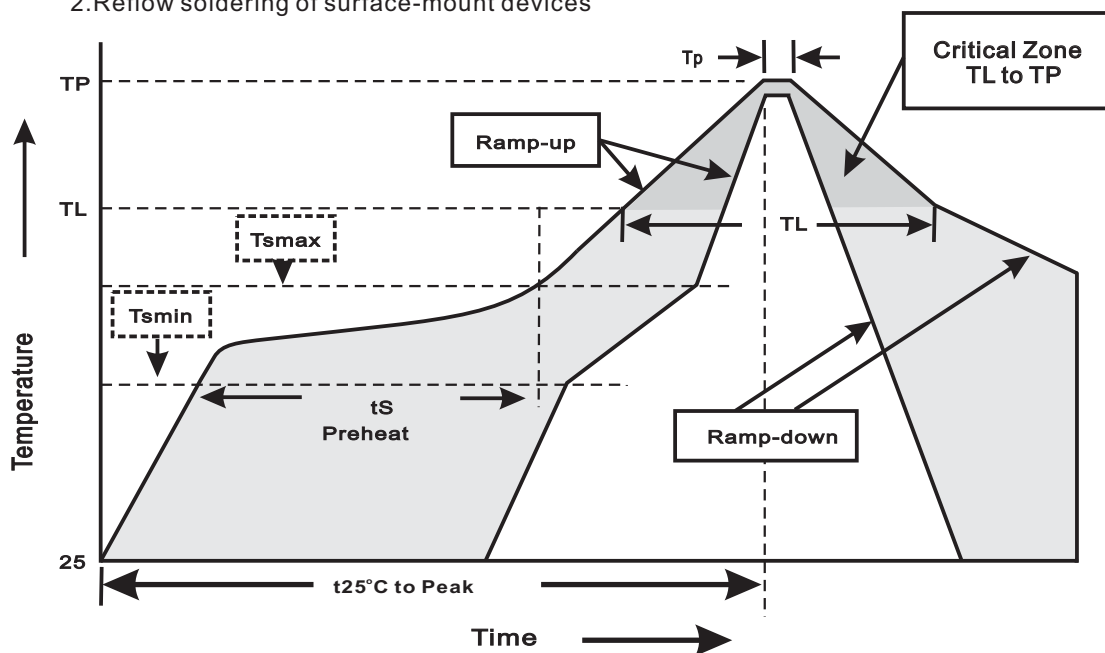
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Reel packing

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)	APPROX. GROSS WEIGHT (kg)
SOT-23	7"	3,000	4.0	30,000	183*123*183	178	382*257*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(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

FMNP2305-Q1-H**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. High Temperature Reverse Bias	$V_{DS}=V_{DS} \times 100\%$ ($T_J=T_{JMAX}$) Test Duration: 1000 hrs	JESD22-A108
3. High Temperature Storage Life	Ta=150°C Test Duration: 1000 hrs	JESD22 A-103
4. Temperature Cycle	-55°C(15min) to 150°C(15min) Test Cycles: 1000 cycles	JESD22 A-104
5. Autoclave	P=2atm Ta=121°C RH=100% Test Duration: 96 hrs	JESD22 A-102
6. Solderability	245±5°C for 5 sec	J-STD-002
7. Moisture Resistance	Ta=85°C/85% Relative humidity Test Duration: 1000 hrs	MIL-STD-750E METHOD 1021.2
8. Resistance To Solder Heat	260±5°C for 10 sec	JESD22 B-106
9. High Temperature High Humidity Reverse Bias	Ta=85°C/85%RH, $V_{DS}=80\%$ rated V_{DS} Test Duration: 1000 hrs	JESD22-A101