

FMOSTHAC240N04-Q1-H

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FMOSTHAC240N04-Q1-H

240A 40V N-Channel Trench
Enhancement Mode Power MOSFET

Features

- $V_{DS} = 40V$, $I_D = 240A$.
- $R_{DS(ON)} \leq 1.35 m\Omega$, @ $V_{GS} = 10V$, $I_D = 20A$.
- $R_{DS(ON)} \leq 1.85 m\Omega$, @ $V_{GS} = 4.5V$, $I_D = 20A$.
- Excellent gate charge x on-resistance product (FOM.).
- Very low on-resistance.
- 100% UIS and ΔV_{DS} tested.
- Qualified to AEC-Q101 standards for high reliability.
- Lead-free parts meet RoHS requirements.
- Halogen-free (IEC61249-2-21).

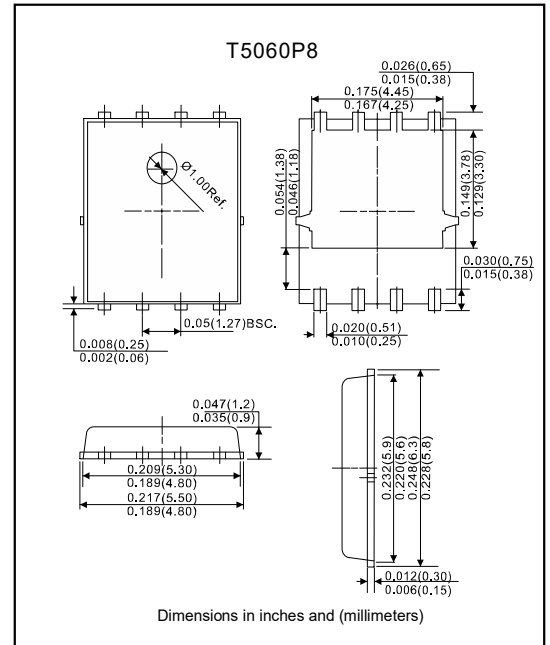
Application

- Automotive application.
- DC/DC converter.
- Ideal for high-frequency switching and synchronous rectification.

Mechanical data

- Epoxy: UL94-V0 rated flame retardant.
- Case : Molded plastic, T5060P8 (DFN5060-8) .
- Mounting Position : Any.

Package outline

Maximum ratings (At $T_c = 25^\circ C$ unless otherwise noted)

Parameter	Symbol	Ratings	Unit
Drain-source voltage	V_{DS}	40	V
Gate-source voltage	V_{GS}	± 20	V
Continuous drain current (Note1) (Silicon limited)	I_D	240	A
(Silicon limited) (100°C)		170	
Continuous drain current (Package limited)		150	
Pulsed drain current tested	I_{DM}	600	A
Single pulse avalanche energy (Note 2)	E_{AS}	1500	mJ
Derating factor	-	1.1	W/°C
Power dissipation	P_D	160	W
Thermal resistance Junction to case	$R_{\theta JC}$	0.93	°C/W
Operating Junction temperature	T_J	+175	°C
Storage temperature range	T_{STG}	-55 to +175	°C

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

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Off characteristics						
Drain-source breakdown voltage	BV_{DS}	$I_D=250\mu\text{A}$, $V_{GS}=0\text{V}$	40			V
Drain-source leakage current	I_{DSS}	$V_{DS}=40\text{V}$, $V_{GS}=0\text{V}$			1	μA
Gate-source leakage current	I_{GSS}	$V_{GS}=\pm 20\text{V}$, $V_{DS}=0\text{V}$			± 100	nA

On characteristics

Gate threshold voltage	$V_{GS(TH)}$	$V_{GS}=V_{DS}$, $I_D=250\mu\text{A}$	1.0	1.5	2.2	V
Static drain-source on-resistance	$R_{DS(ON)}$	$V_{GS}=10\text{V}$, $I_D=20\text{A}$		1.09	1.35	m Ω
		$V_{GS}=4.5\text{V}$, $I_D=20\text{A}$		1.50	1.85	
Forward trans conductance	g_{FS}	$V_{DS}=5\text{V}$, $I_D=20\text{A}$		80		S

Dynamic parameters

Input capacitance	C_{iss}	$V_{GS}=0\text{V}$, $V_{DS}=20\text{V}$, $f=1.0\text{MHz}$		5200		pF
Out capacitance	C_{oss}			1700		
Reverse transfer capacitance	C_{rss}			85		
Gate resistance	R_g	$V_{GS}=0\text{V}$, $V_{DS}=0\text{V}$, $f=1.0\text{MHz}$		2		Ω

Switching parameters (Note1)

Total gate charge	Q_g	$V_{GS}=10\text{V}$, $V_{DS}=20\text{V}$, $I_D=20\text{A}$		91		nC
Gate to source charge	Q_{gs}			13		
Gate to drain charge	Q_{gd}			16		
Turn-on delay time	$t_{d(on)}$	$V_{DD}=20\text{V}$, $V_{GS}=10\text{V}$, $R_g=1.6\Omega$, $I_D=20\text{A}$		12		ns
Rise time	t_r			6.5		
Turn-off delay time	$t_{d(off)}$			49		
Fall time	t_f			8		

Source-drain diode ratings and characteristics

Diode forward voltage	V_{SD}	$I_S=20\text{A}$, $V_{GS}=0\text{V}$			1.2	V
Diode forward current	I_S				240	A
Body diode reverse recovery time	t_{rr}	$I_F=I_S$, $T_J=25^\circ\text{C}$, $di/dt=100\text{A}/\mu\text{s}$			30	nS
Body diode reverse recovery charge	Q_{rr}				110	nC

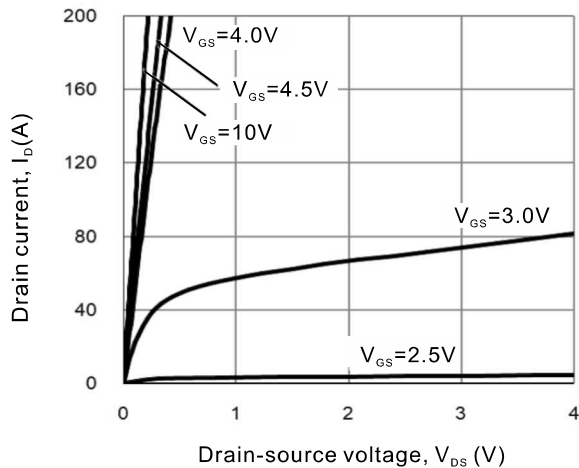
Note : 1. Defined by design. not subject to production test.

2. E_{AS} condition: $T_J=25^\circ\text{C}$, $V_{DD}=20\text{V}$, $V_G=10\text{V}$, $L=0.5\text{mH}$, $R_g=25\Omega$ 3. These curves are based on the junction-case thermal impedance which is measured with the device mounted to a large heatsink, assuming a maximum junction temperature of $T_{J(Max)}=175^\circ\text{C}$. The SOA curve provides a single pulse rating.

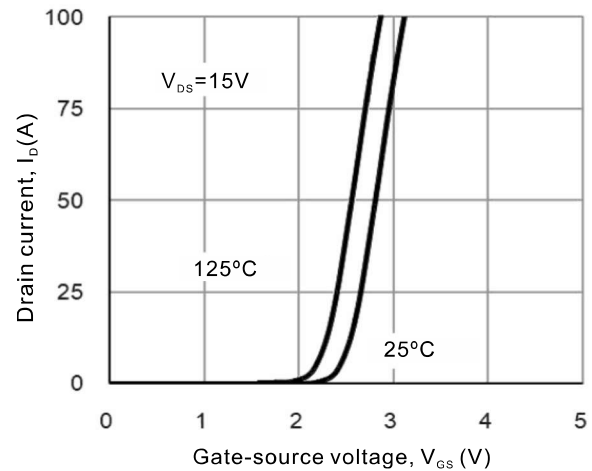
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Rating and characteristic curves

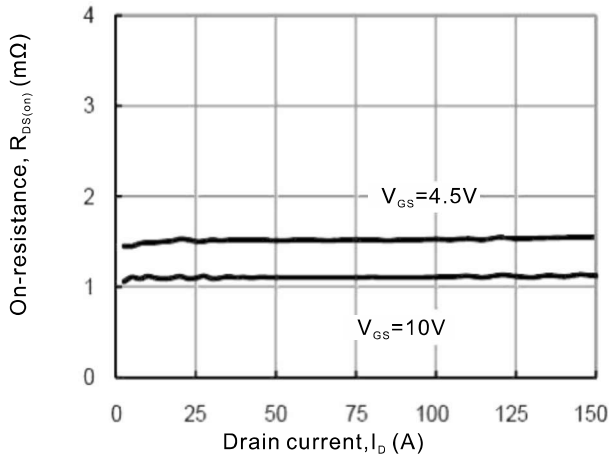
Output characteristics



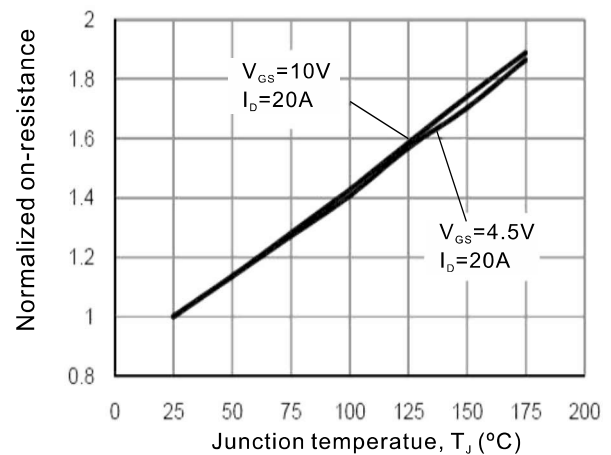
Transfer characteristics



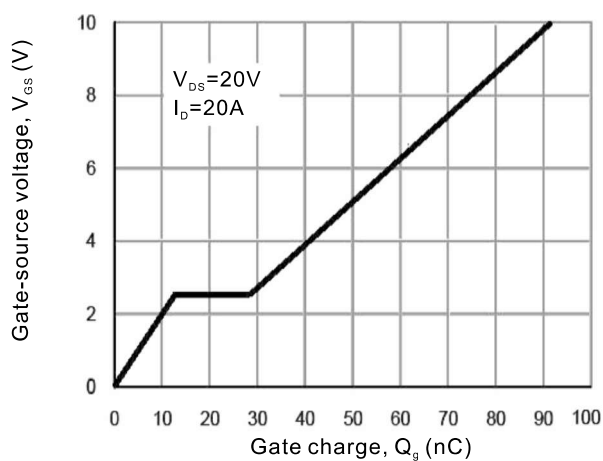
On-resistance vs. Drain current



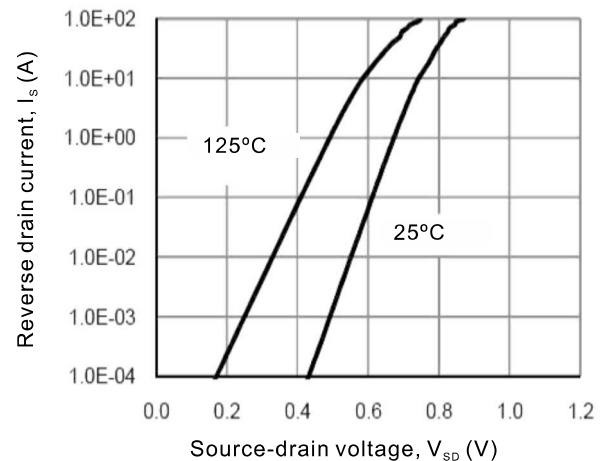
On-resistance vs. Junction temperature



Gate charge

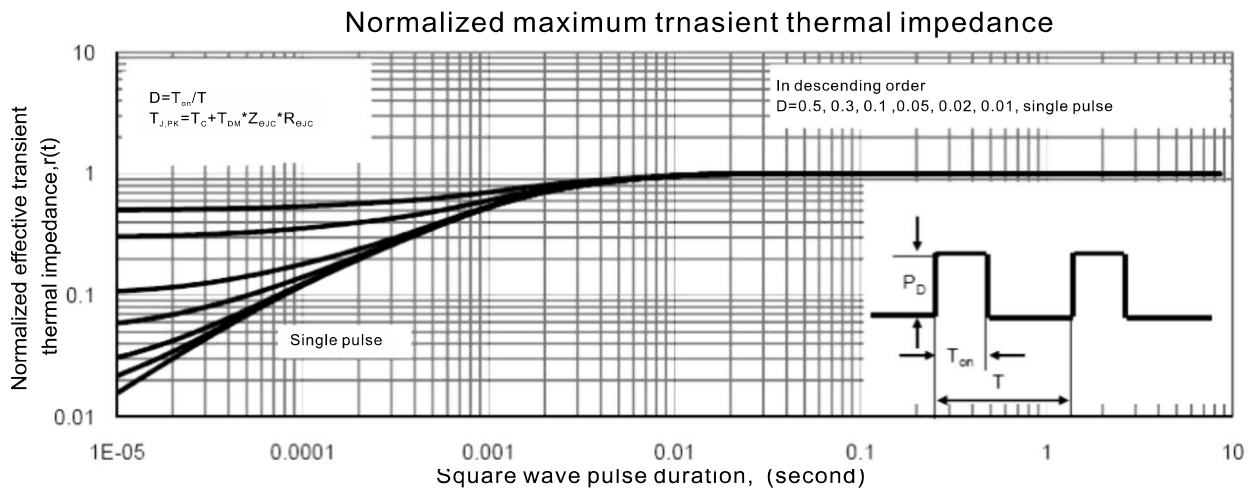
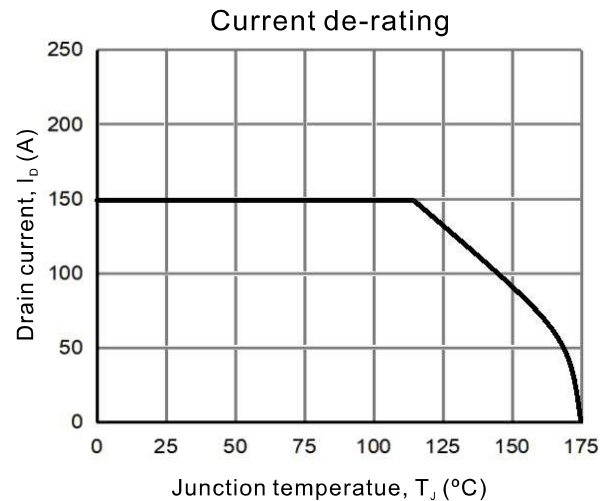
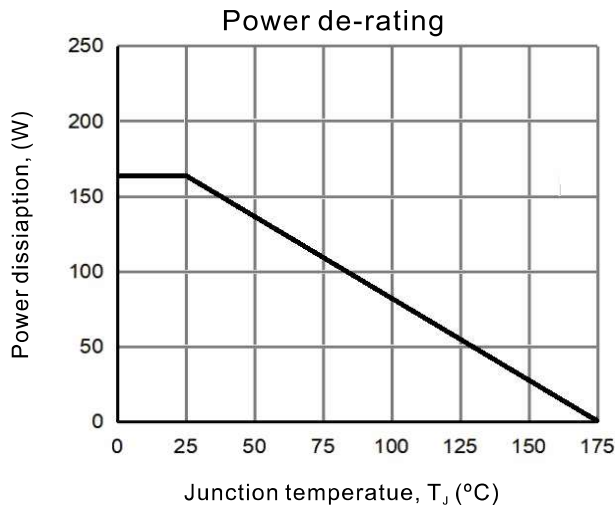
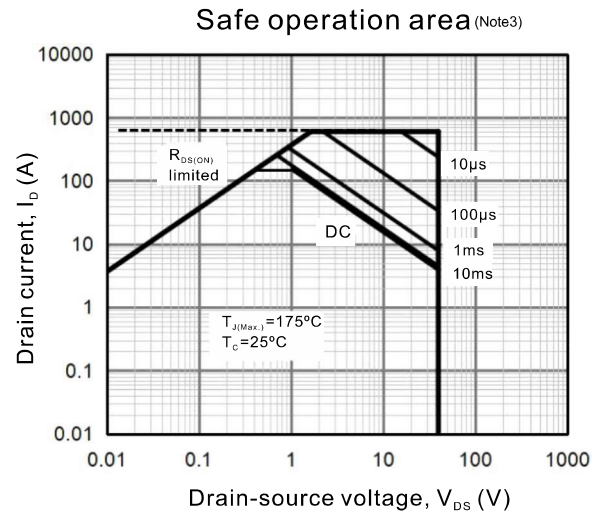
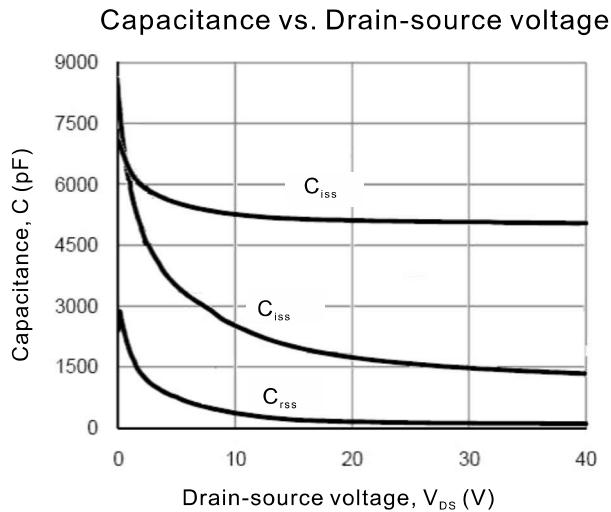


Source-drain diode forward



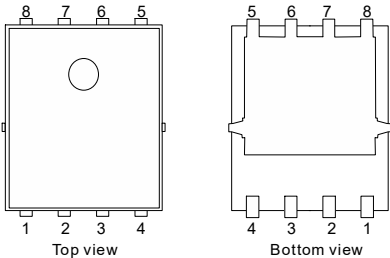
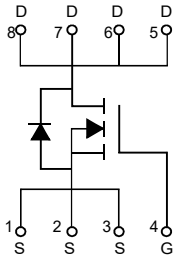
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Rating and characteristic curves



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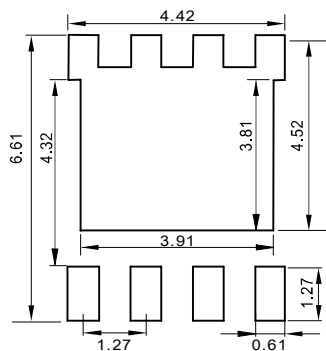
Pinning information

Pin	Simplified outline	Symbol
Pin 1, 2, 3 Source Pin 4 Gate Pin 5, 6, 7, 8 Drain		

Marking

Type number	Marking code
FMOSTHAC240N04-Q1-H	AP40T15GU

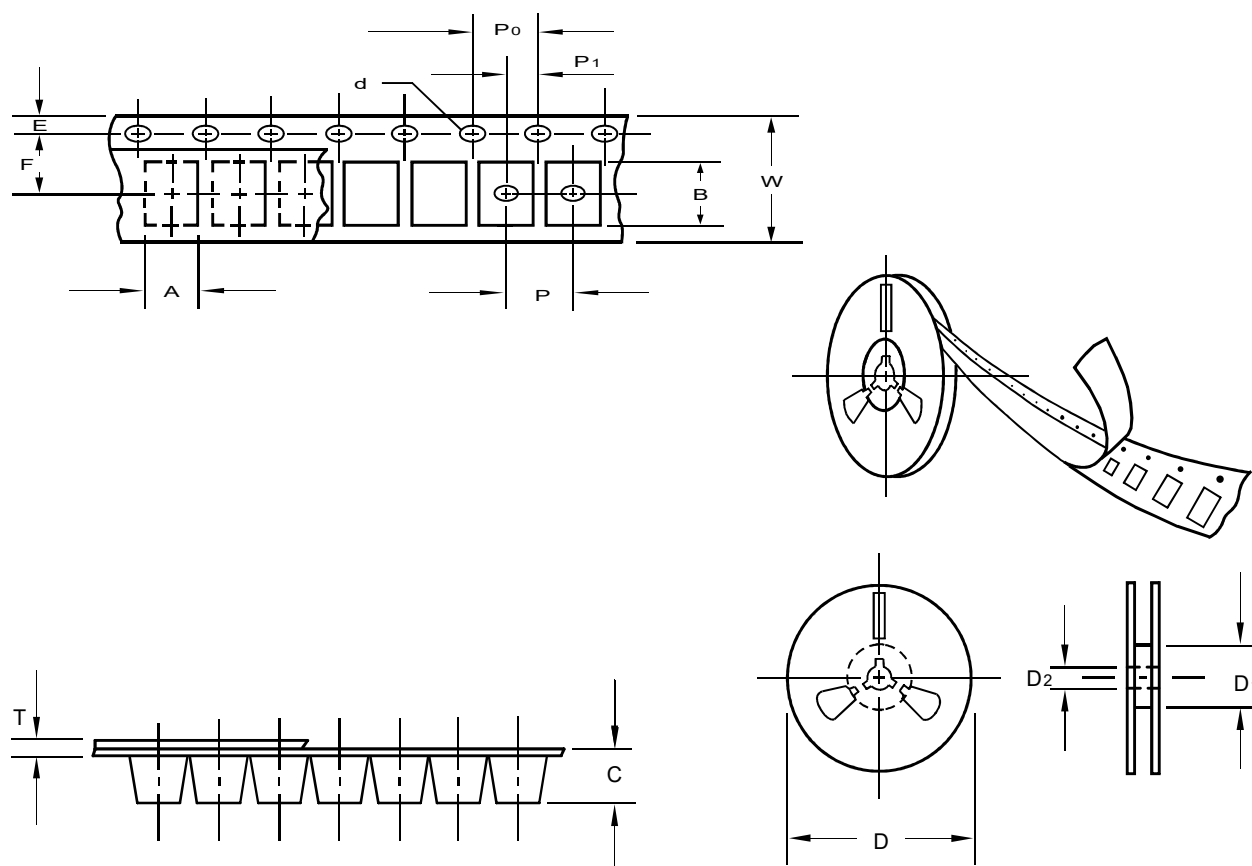
Suggested solder pad layout



Note:
1. Controlling dimension: in millimeters.
2. General tolerance: $\pm 0.05\text{mm}$
3. The pad layout is for reference purposes only.

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Packing information



unit:mm

Item	Symbol	Tolerance	T5060P8
Carrier width	A	0.1	6.40
Carrier length	B	0.1	5.40
Carrier depth	C	0.1	1.20
Sprocket hole	d	0.1	1.55
13" Reel outside diameter	D	2.0	330.00
13" Reel inner diameter	D ₁	min	99.50
7" Reel outside diameter	D	2.0	-
7" Reel inner diameter	D ₁	min	-
Sprocket hole position	E	0.1	1.75
Punch hole position	F	0.1	5.50
Punch hole pitch	P	0.1	8.00
Sprocket pitch	P ₀	0.1	4.00
Embossment center	P ₁	0.1	2.00
Overall tape thickness	T	0.1	0.25
Tape width	W	0.3	12.0

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

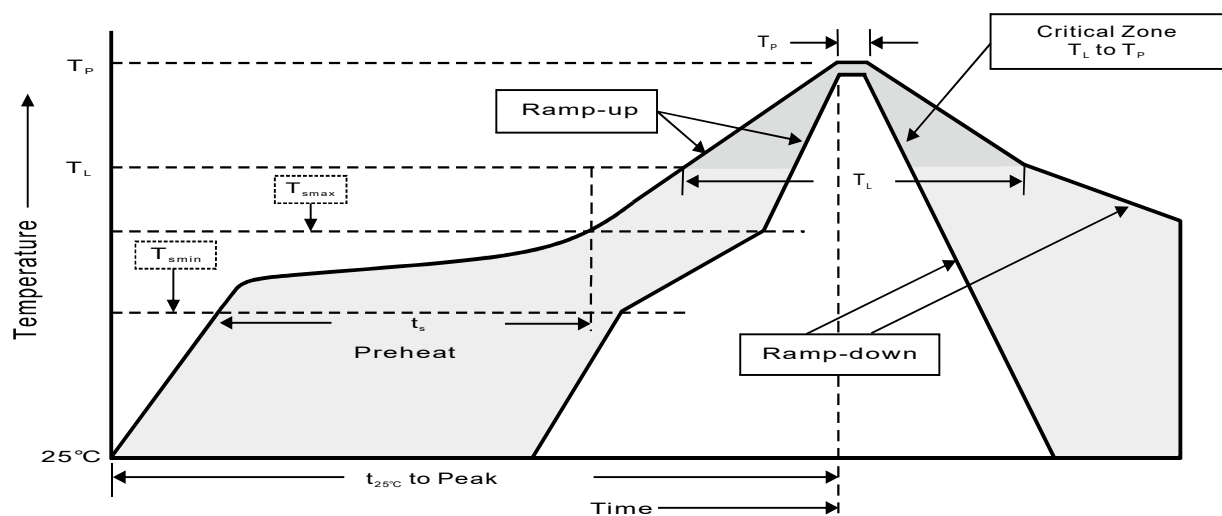
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Reel packing

Device	Outline	Device Package	Reel Size
FMOSTHAC240N04-Q1-H	Taping	T5060P8	13 inch

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_{min}) - Temperature Max (T_{max}) - Time (Min to Max) (t_s)	150°C 200°C 60 ~ 120 sec
T_{smax} to T_L - Ramp-up rate	< 3 °C/sec
Time maintained above : - Temperature (T_L) - Time (T_L)	217°C 60 ~ 260 sec
Peak temperature (T_P)	255 °C -0/+5°C
Time with 5°C of actual peak temperature (T_P)	10 ~30 sec
Ramp-down rate	< 6 °C/sec
Time 25°C to peak temperature	< 6 minutes

FMOSTHAC240N04-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	$V_{DS}=V_{DS}^{*}80\%$ ($T_J=T_J \text{ max.}$) Test Duration:1000hrs	JESD22-A108
3. High Temperature Storage Life	$T_a=150^{\circ}\text{C}$ Test Duration:1000hrs	JESD22 A-103
4. Temperature Cycle	-55°C (15min) to 150°C (15min) Test Cycles:1000cycles	JESD22 A-104
5. Autoclave	$P=2\text{atm}$ $T_a=121^{\circ}\text{C}$ RH=100% Test Duration:96hrs	JESD22 A-102
6. Solderability	$245\pm 5^{\circ}\text{C}$ for 5sec	J-STD-002
7. Moisture Resistance	$T_a=85^{\circ}\text{C}$ /85% Relative humidity Test Duration:1000hrs	MIL-STD-750E METHOD 1021.2
8. Resistance To Solder Heat	$260\pm 5^{\circ}\text{C}$ for 10sec	JESD22 B-106
9. High Temperature High Humidity Reverse Bias	$T_a=85^{\circ}\text{C}$, 85%RH, $V_{DS}=80\%$ rated V_{DS} Test Duration: 1000hrs	JESD22-A101