

FMHN2N7002E-H

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FMHN2N7002E-H

0.3A 60V N-Channel Small Signal MOSFET With ESD Protection

Features

- $V_{DS}=60V, I_D=0.3A$.
- $R_{DS(on)} < 2.1\Omega @ V_{GS}=10V, I_D=0.3A$.
- $R_{DS(on)} < 2.4\Omega @ V_{GS}=4.5V, I_D=0.2A$.
- Excellent $R_{DS(on)}$ and low gate charge.
- ESD protected up to 2KV.
- Lead-free parts meet RoHS requirements.
- Halogen-free (IEC61249-2-21).

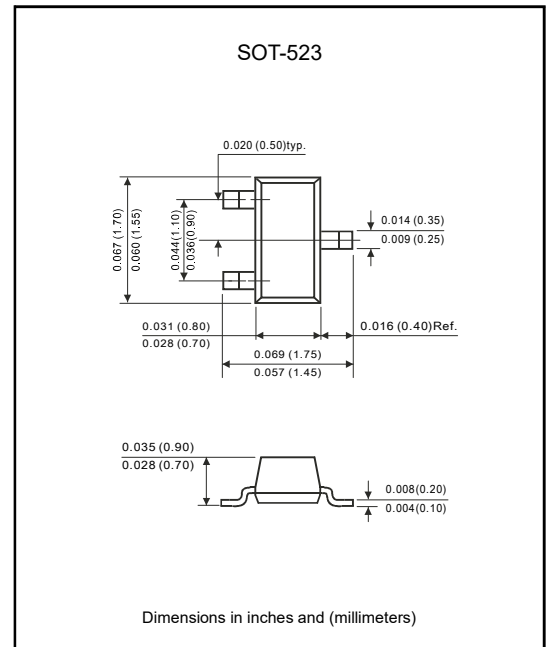
Applications

- Load Switch.
- PWM Application.
- Power Management.

Mechanical data

- Epoxy: UL94-V0 rated flame retardant.
- Case : Molded plastic, SOT-523.
- Terminals : Solder plated, solderable per MIL-STD-750, Method 2026.
- Weight : Approximated 1.5mg.

Package outline



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

Parameter	Symbol	Ratings	Units
Drain-source voltage	V_{DS}	60	V
Gate-source voltage	V_{GS}	± 20	V
Continuous drain current	I_D	$T_A=25^\circ\text{C}$ 0.3	A
		$T_A=100^\circ\text{C}$ 0.18	
Pulsed drain current (Note 1)	I_{DM}	1.2	A
Power dissipation ($T_A=25^\circ\text{C}$)	P_D	0.17	W
Thermal resistance form junction to ambient (Note 2)	$R_{\theta JA}$	735	$^\circ\text{C/W}$
Operating junction temperature range	T_J	-55 to +150	$^\circ\text{C}$
Storage temperature range	T_{STG}	-55 to +150	$^\circ\text{C}$

Note : 1. Repetitive Rating: Pulse Width Limited by Maximum Junction Temperature.

2. $R_{\theta JA}$ is measured with the device mounted on a 1inch² pad of 2oz copper FR4 PCB.

3. Pulse Test: Pulse Width $\leq 300\mu\text{s}$, Duty Cycles $\leq 0.5\%$.

FMHN2N7002E-H**Electrical characteristics** (At $T_A=25^\circ\text{C}$ unless otherwise noted)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Off characteristics						
Drain-source breakdown voltage	BV_{DSS}	$I_D=250\mu\text{A}$, $V_{GS}=0\text{V}$	60			V
Drain-source leakage current	I_{DSS}	$V_{DS}=60\text{V}$, $V_{GS}=0\text{V}$			1	μA
Gate-source leakage current	I_{GSS}	$V_{GS}=\pm 20\text{V}$, $V_{DS}=0\text{V}$			± 10	μA

On characteristics

Gate threshold voltage	$V_{GS(TH)}$	$V_{DS}=V_{GS}$, $I_D=250\mu\text{A}$	1.0	1.6	2.0	V
Static drain-source on-state resistance (Note 3)	$R_{DS(ON)}$	$V_{GS}=10\text{V}$, $I_D=0.3\text{A}$		1.5	2.1	Ω
		$V_{GS}=4.5\text{V}$, $I_D=0.2\text{A}$		2.0	2.4	

Dynamic parameters

Input capacitance	C_{iss}	$V_{DS}=25\text{V}$, $V_{GS}=0\text{V}$, $f=1.0\text{MHz}$		20		pF
Output capacitance	C_{oss}			5		
Reverse transfer capacitance	C_{rss}			2		
Gate resistance	R_g	$V_{DS}=0\text{V}$, $V_{GS}=0\text{V}$, $f=1.0\text{MHz}$		72		Ω
Forward transconductance	g_{FS}	$V_{DS}=5.0\text{V}$, $I_D=200\text{mA}$		450		mS

Switching parameters

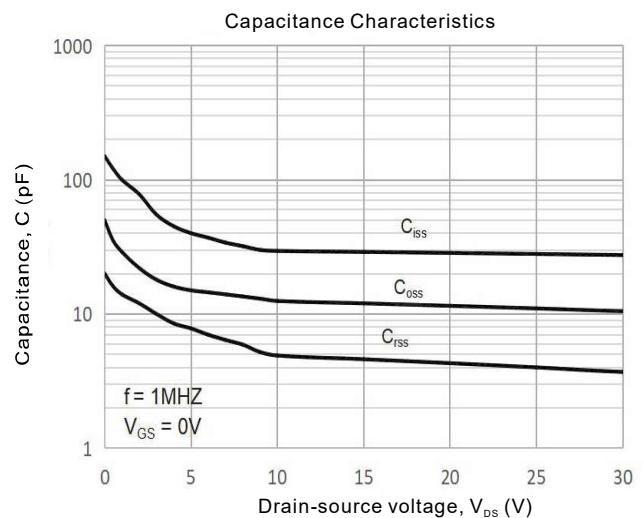
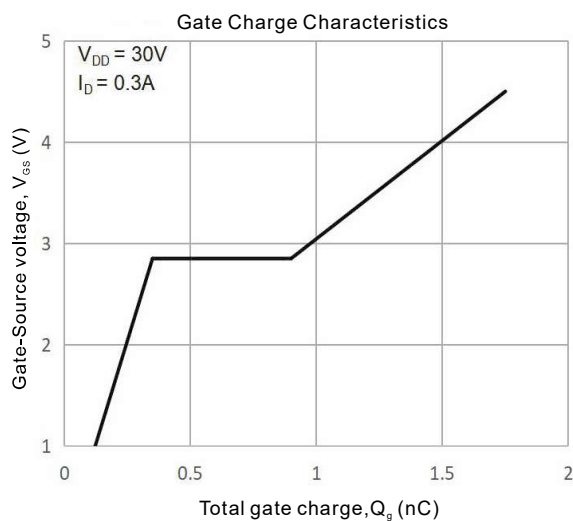
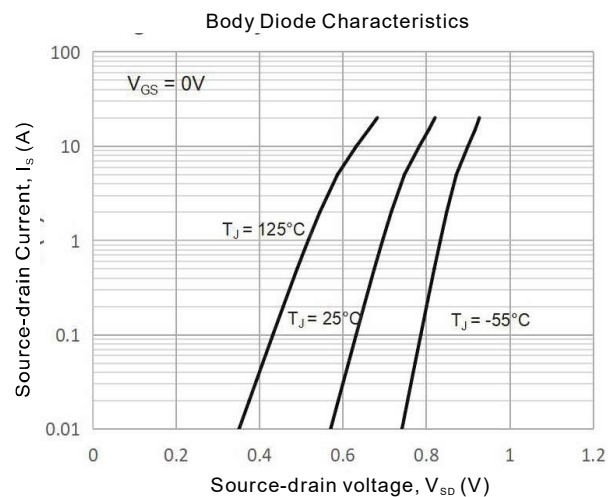
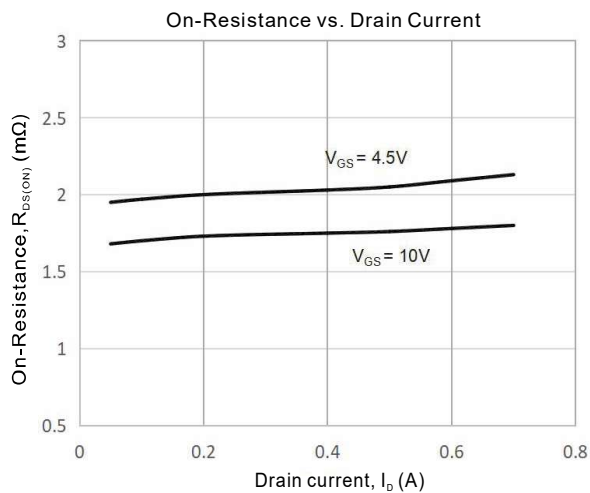
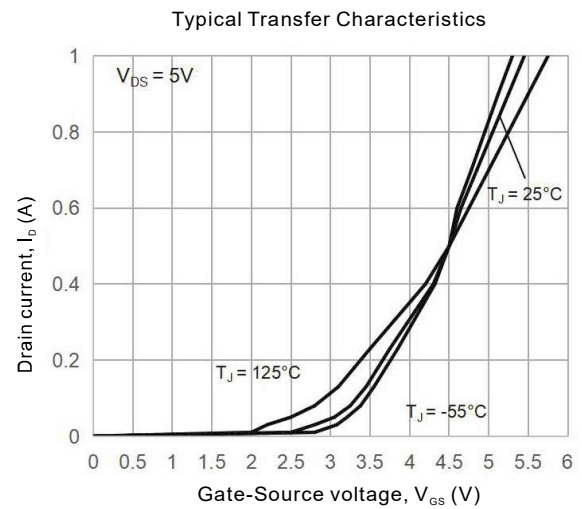
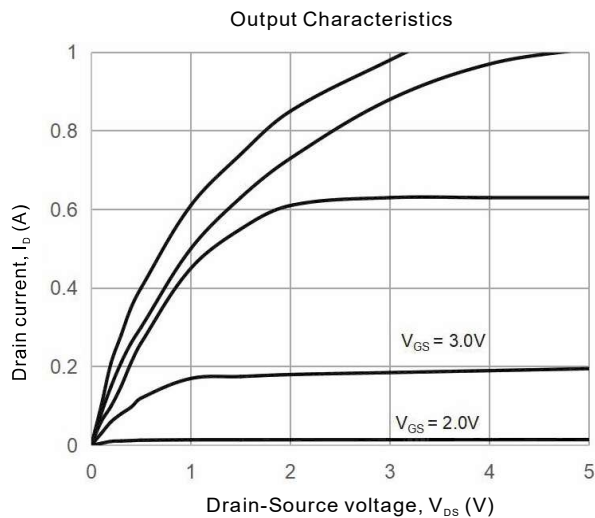
Total gate charge	Q_g	$V_{GS}=0$ to 4.5V , $V_{DS}=10\text{V}$, $I_D=0.3\text{A}$		1.7		nC
Gate to source charge	Q_{gs}			0.3		
Gate to drain charge	Q_{gd}			0.6		
Turn-on delay time	$t_{d(on)}$	$V_{GS}=10\text{V}$, $V_{DS}=10\text{V}$, $I_D=0.2\text{A}$, $R_{GEN}=10\Omega$		2		ns
Turn-on rise time	t_r			15		
Turn-off delay time	$t_{d(off)}$			7		
Turn-off fall time	t_f			20		

Source-drain diode ratings and characteristics

Body diode forward drop voltage	V_{SD}	$I_S=0.3\text{A}$, $V_{GS}=0\text{V}$			1.2	V
Source-drain continuous current	I_S	Integral reverse P-N junction diode in the MOSFET			0.3	A
Source-drain pulse current	I_{SM}				1.2	
Reverse recovery time	t_{rr}	$I_F=0.3\text{A}$, $di/dt=100\text{A}/\mu\text{s}$, $T_J=25^\circ\text{C}$		10		ns
Reverse recovery charge	Q_{rr}			2.9		nC

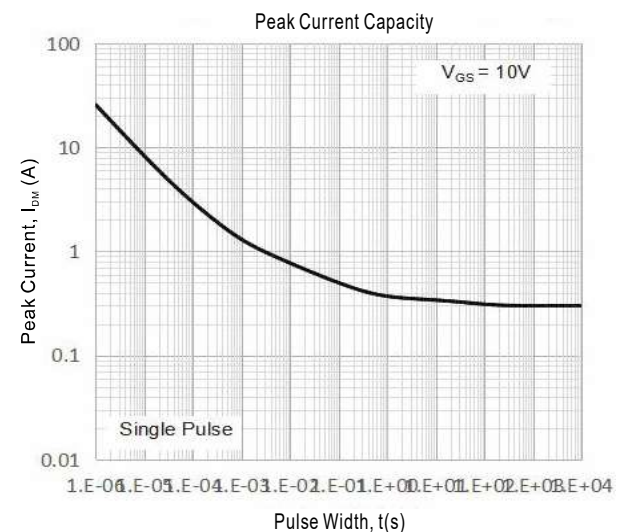
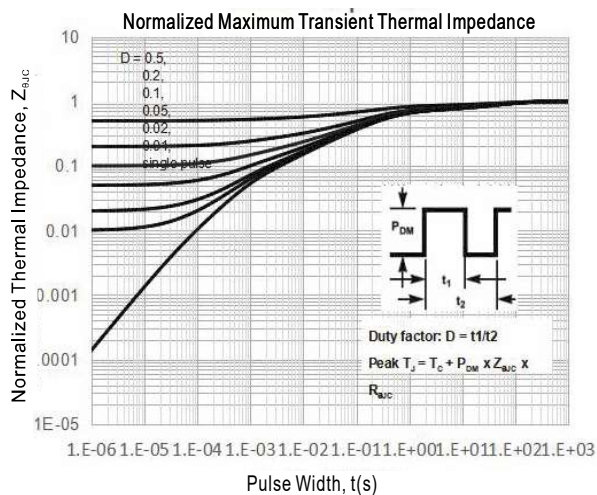
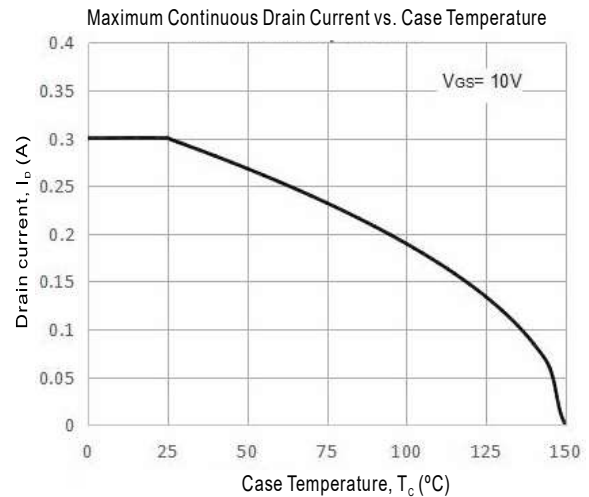
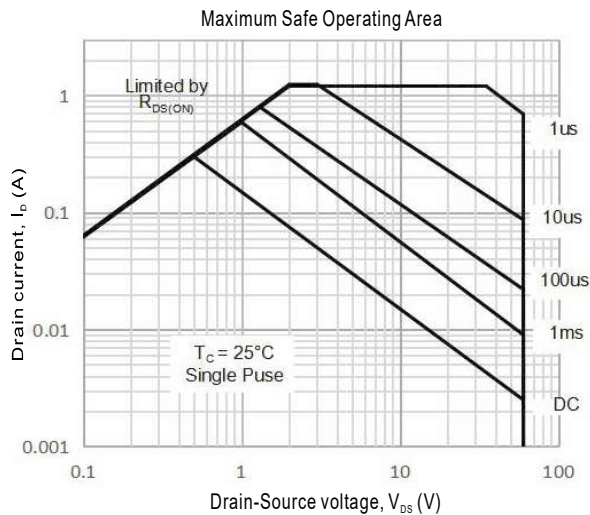
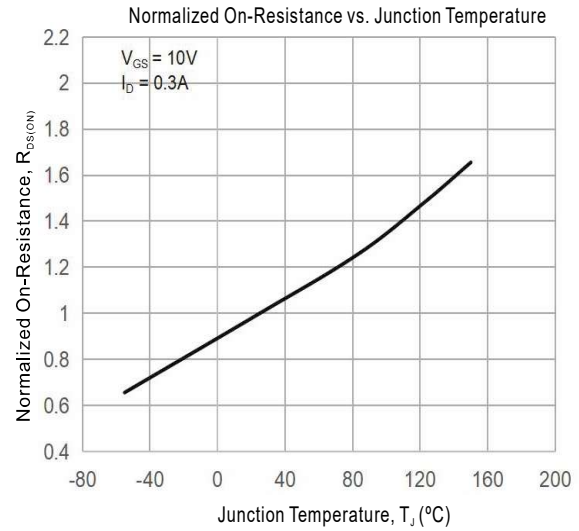
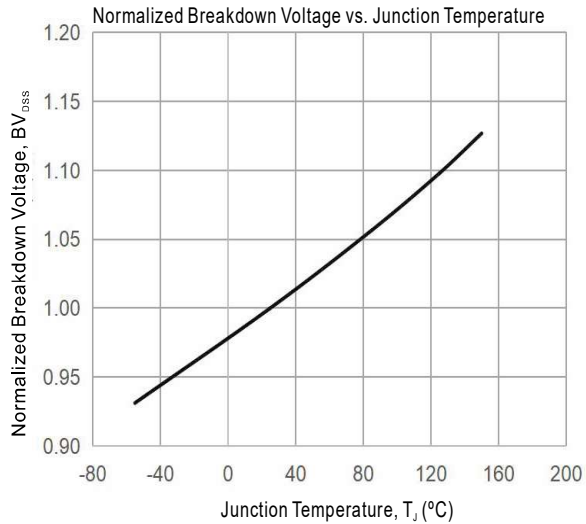
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Rating and characteristic curves



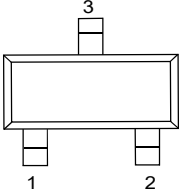
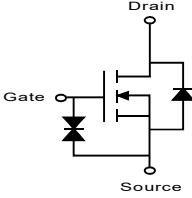
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Rating and characteristic curves



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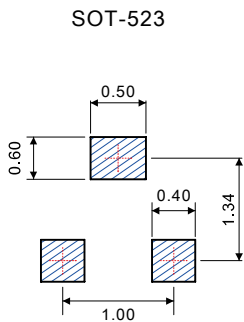
Pinning information

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

Marking

Type number	Marking code
FMHN2N7002E-H	K72

Suggested solder pad layout

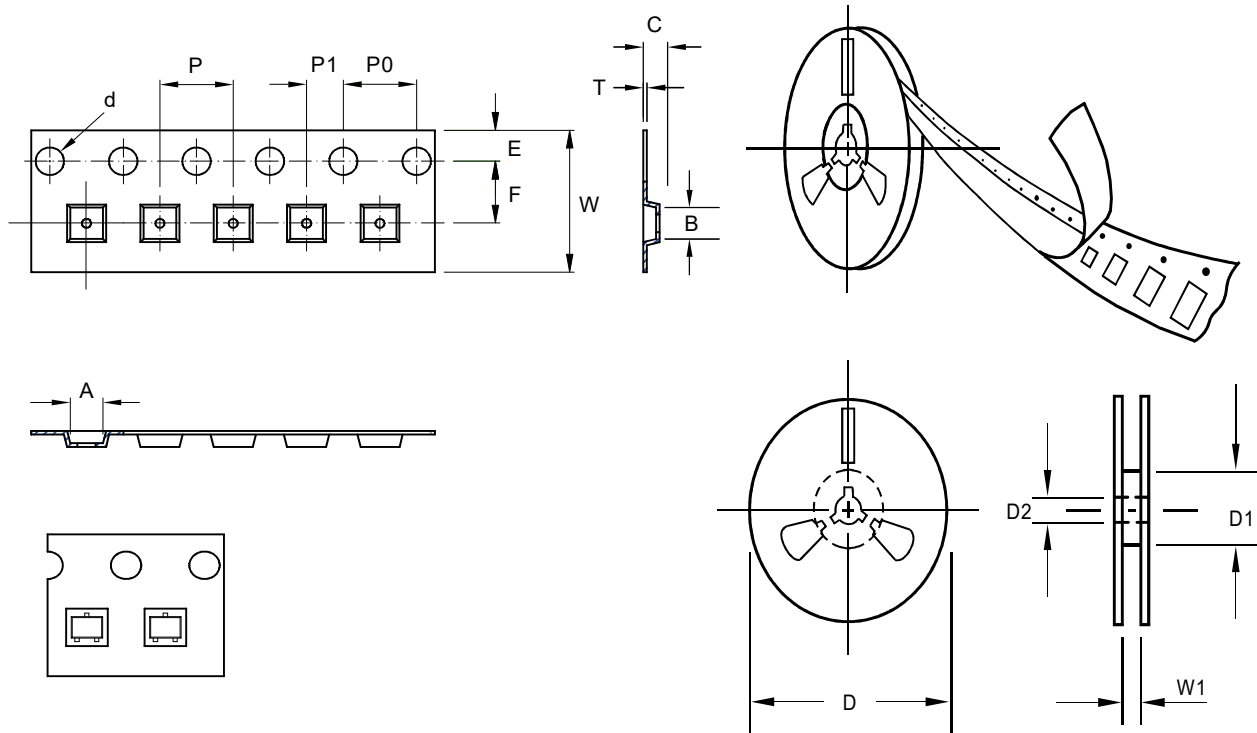


Note :

- 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	SOT-523
Carrier width	A	± 0.1	1.85
Carrier length	B	± 0.1	1.85
Carrier depth	C	± 0.1	1.00
Sprocket hole	d	± 0.1	1.50
7" Reel outside diameter	D	± 1.0	178.00
7" Reel inner diameter	D1	± 0.5	54.40
Feed hole diameter	D2	± 0.3	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
Over all tape thickness	T	± 0.1	0.23
Tape width	W	± 0.2	8.00
Reel width	W1	± 0.2	11.4

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

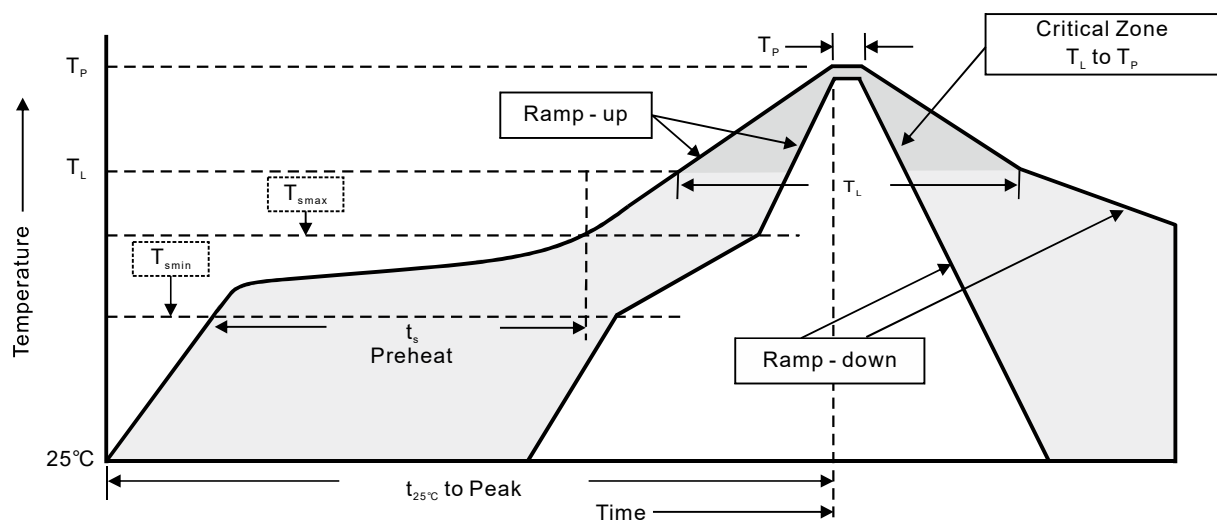
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Reel packing

Package	Units (pcs)			Dimension (Unit : mm)		
	Reel	Inner Box	Outer Box	Reel DIA,	Inner Box	Outer Box
SOT-523	3,000	30,000	180,000	178 (7")	180 x 120 x 180	390 x 385 x 205

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 ~ 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