

FMAEN138E-H

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FMAEN138E-H

0.23A 50V N-Channel General Small Signal MOSFET ESD Protection

Features

- $V_{DS}=20V$, $I_D=0.75A$.
- $R_{DS(ON)} \leq 1800m\Omega$, @ $V_{GS}=10V$, $I_D=0.45A$.
- $R_{DS(ON)} \leq 2000m\Omega$, @ $V_{GS}=4.5V$, $I_D=0.25A$.
- $R_{DS(ON)} \leq 6000m\Omega$, @ $V_{GS}=2.5V$, $I_D=0.01A$.
- $R_{DS(ON)} \leq 15000m\Omega$, @ $V_{GS}=1.8V$, $I_D=0.01A$.
- Low Thermal Resistance and low gate charge.
- Fast Switching Speed.
- ESD protected: 2.0KV(HBM).
- Lead-free parts meet RoHS requirements.
- Halogen-free (IEC61249-2-21).

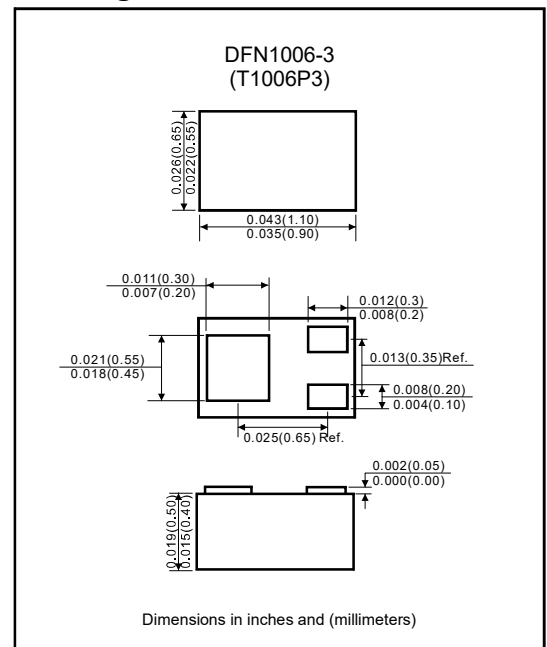
Applications

- Load Switch for Portable Devices, DC/DC converters.
- Voltage controlled small signal switch.

Mechanical data

- Epoxy: UL94-V0 rated flame retardant.
- Case : Molded plastic, DFN1006-3 (T1006P3).
- Weight : Approximated 1.0mg.

Package outline



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

Parameter	Symbol	Ratings	Unit
Drain-source voltage	V_{DS}	50	V
Gate-source voltage	V_{GS}	± 20	V
Continuous drain current	I_D	0.23	A
Pulse drain current tested (Note 1)	I_{DM}	0.9	A
Power dissipation	P_D	0.32	W
Thermal resistance form junction to ambient (Note2)	$R_{\theta JA}$	455	$^{\circ}C/W$
Thermal resistance form junction to case	$R_{\theta JC}$	285	$^{\circ}C/W$
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 $T_J=25^{\circ}\text{C}$ unless otherwise specified)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Off characteristics						
Drain-source breakdown voltage	BV_{DSS}	$I_D=250\mu\text{A}$, $V_{GS}=0\text{V}$	50			V
Drain-source leakage current	I_{DSS}	$V_{DS}=30\text{V}$, $V_{GS}=0\text{V}$			1	μA
Gate-source leakage current	I_{GSS}	$V_{GS}=\pm 20\text{V}$, $V_{DS}=0\text{V}$			± 5	nA

On characteristics

Gate threshold voltage	$V_{GS(TH)}$	$V_{DS}=V_{GS}$, $I_D=250\mu\text{A}$	0.8	1.0	1.5	V
Static drain-source on-resistance	$R_{DS(ON)}$	$V_{GS}=10\text{V}$, $I_D=0.45\text{A}$		1200	1800	m Ω
		$V_{GS}=4.5\text{V}$, $I_D=0.25\text{A}$		1400	2000	
		$V_{GS}=2.5\text{V}$, $I_D=0.01\text{A}$		2000	6000	
		$V_{GS}=1.8\text{V}$, $I_D=0.01\text{A}$		4000	15000	
Forward transconductance	g_{FS}	$V_{DS}=15\text{V}$, $I_D=0.1\text{A}$		0.5		S

Dynamic Parameters

Input capacitance	C_{iss}	$V_{GS}=0\text{V}$, $V_{DS}=15\text{V}$, $f=1.0\text{MHz}$		23		pF
Output capacitance	C_{oss}			12		
Reverse transfer capacitance	C_{rss}			5		

Switching parameters

Total gate charge	Q_g	$V_{GS}=10\text{V}$, $V_{DS}=30\text{V}$, $I_D=0.1\text{A}$		1.6		nC
Gate to source charge	Q_{gs}			0.4		
Gate to Drain charge	Q_{gd}			0.45		
Turn-on delay time	$t_{d(on)}$	$V_{DS}=5.0\text{V}$, $V_{GS}=5.0\text{V}$, $I_D=10\text{mA}$, $R_L=500\Omega$ $R_G=10\Omega$		8.6		ns
Rise time	t_r			4.0		
Turn-off delay time	$t_{d(off)}$			23.8		
Fall time	t_f			14.2		

Source-drain diode ratings and characteristics

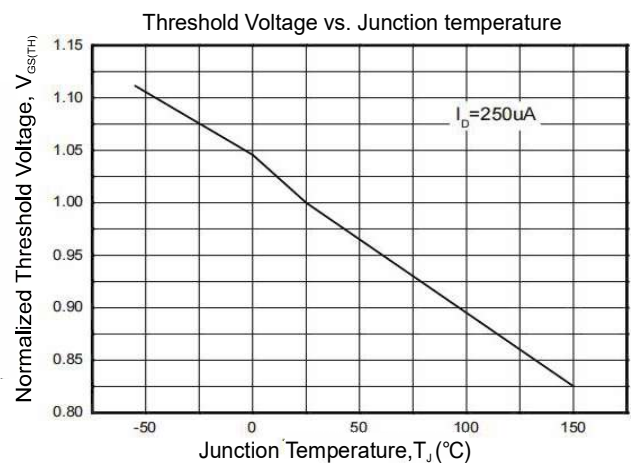
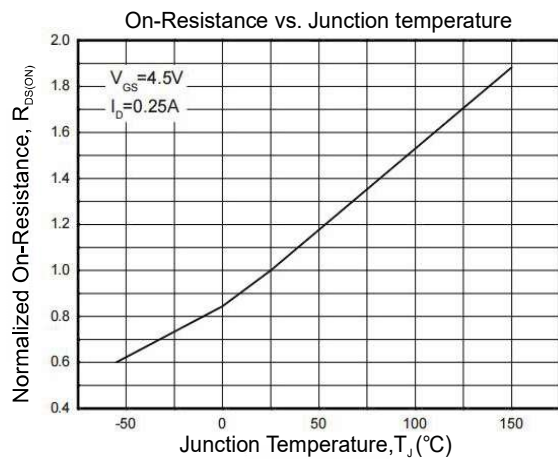
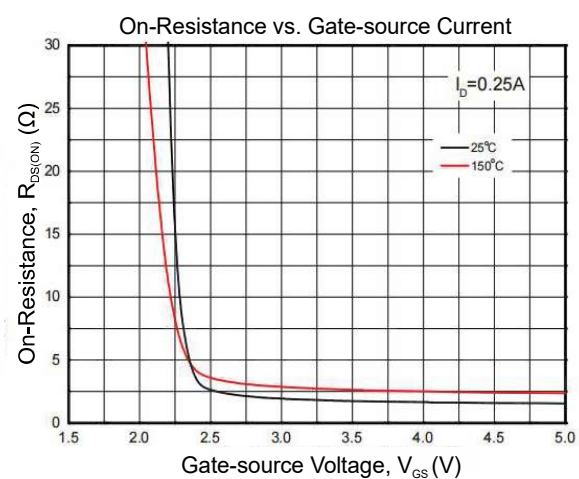
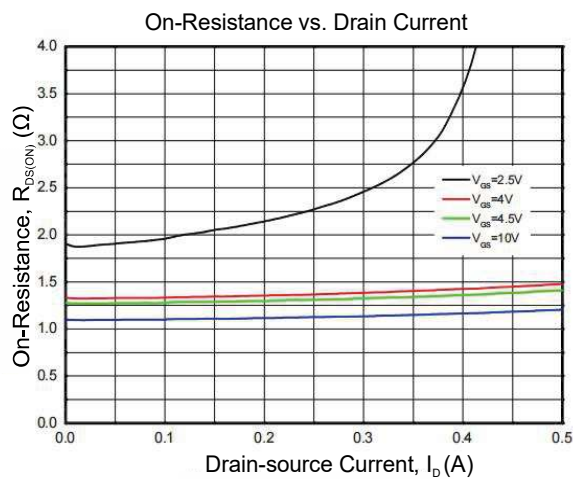
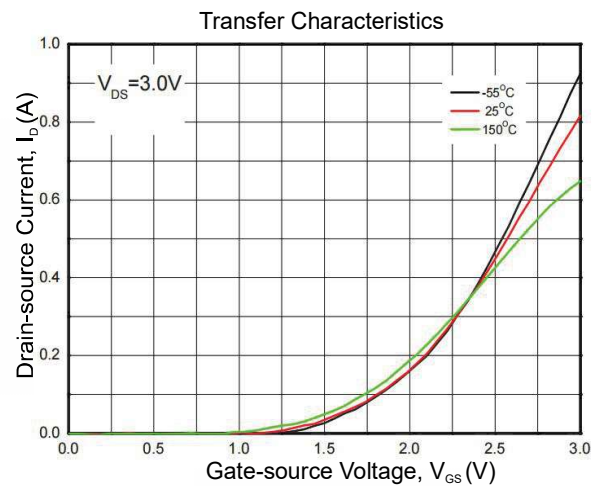
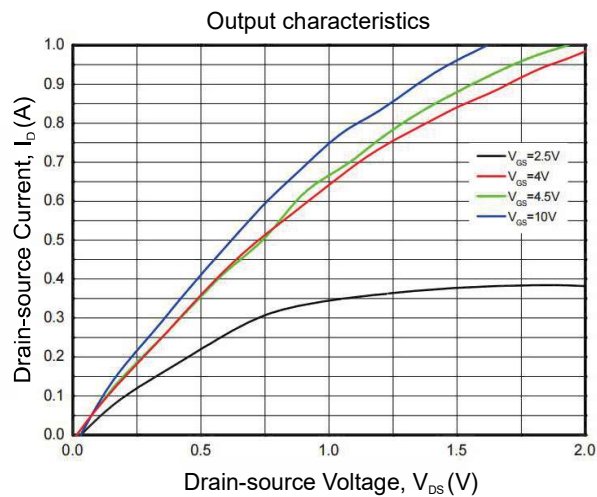
Drain - source diode forward voltage	V_{SD}	$V_{GS}=0\text{V}$, $I_S=1\text{A}$		0.8	1.5	V
Diode continuous current	I_S	Integral reverse P-N junction diode in the MOSFET			0.36	A
Reverse recovery time	t_{rr}	$I_F=10\text{A}$, $di/dt=100\text{A}/\mu\text{s}$		20		ns
Reverse recovery charge	Q_{rr}			10.7		μC

Note: 1. Pulse width $\leq 100\mu\text{s}$, duty cycle $\leq 1\%$, limited by T_J max.

2. Surface mounted on FR4 Board using 1 square inch pad size, 1oz copper.

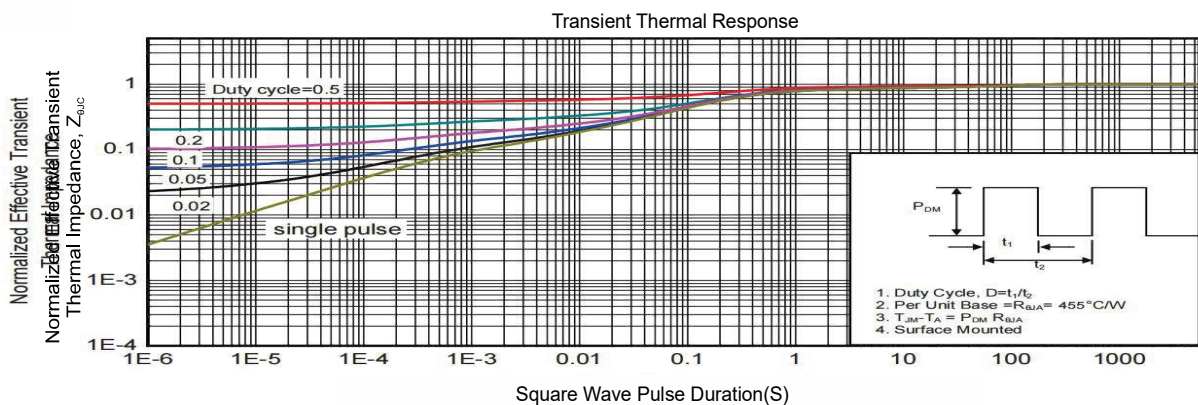
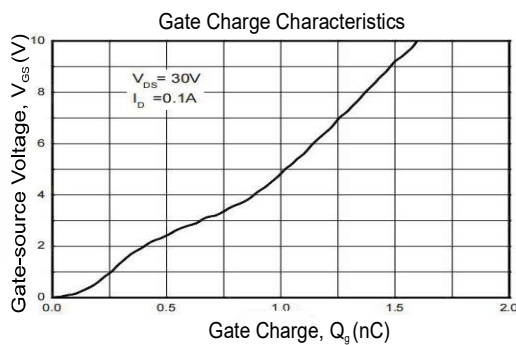
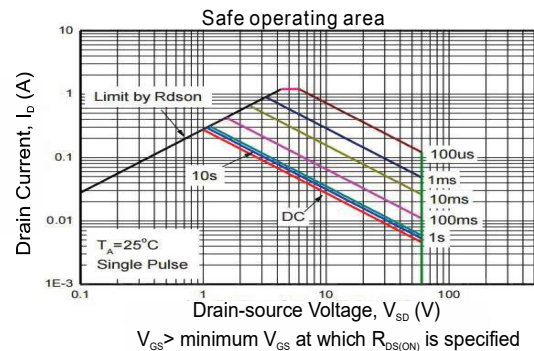
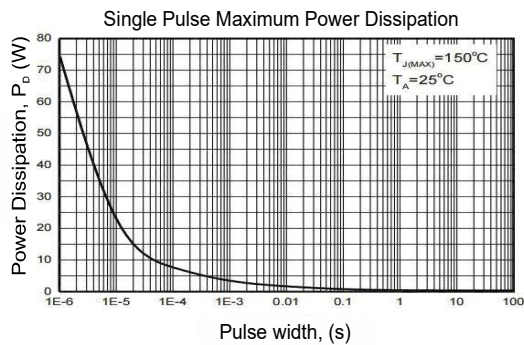
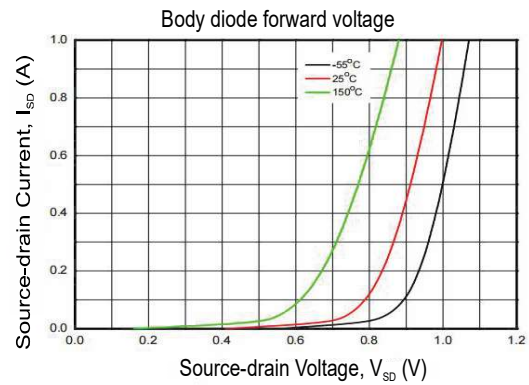
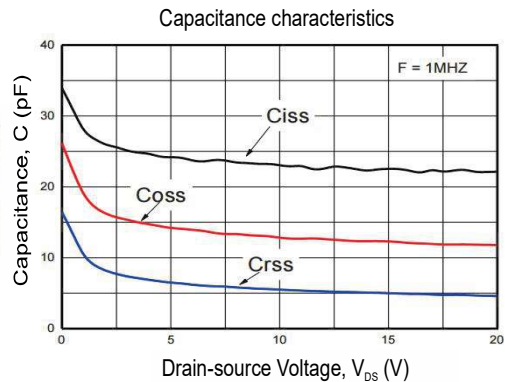
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Rating and characteristic curves



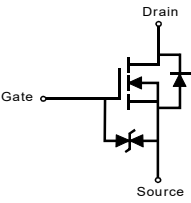
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Rating and characteristic curves



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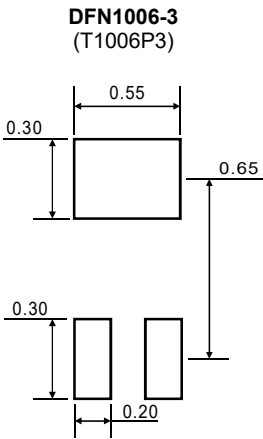
Pinning information

Pin	Simplified outline	Symbol
Pin 1 Source Pin 2 Gate Pin 3 Drain	SSK Top view 1 2 3 Bottom view	

Marking

Type number	Marking code
FMAEN138E-H	SSK

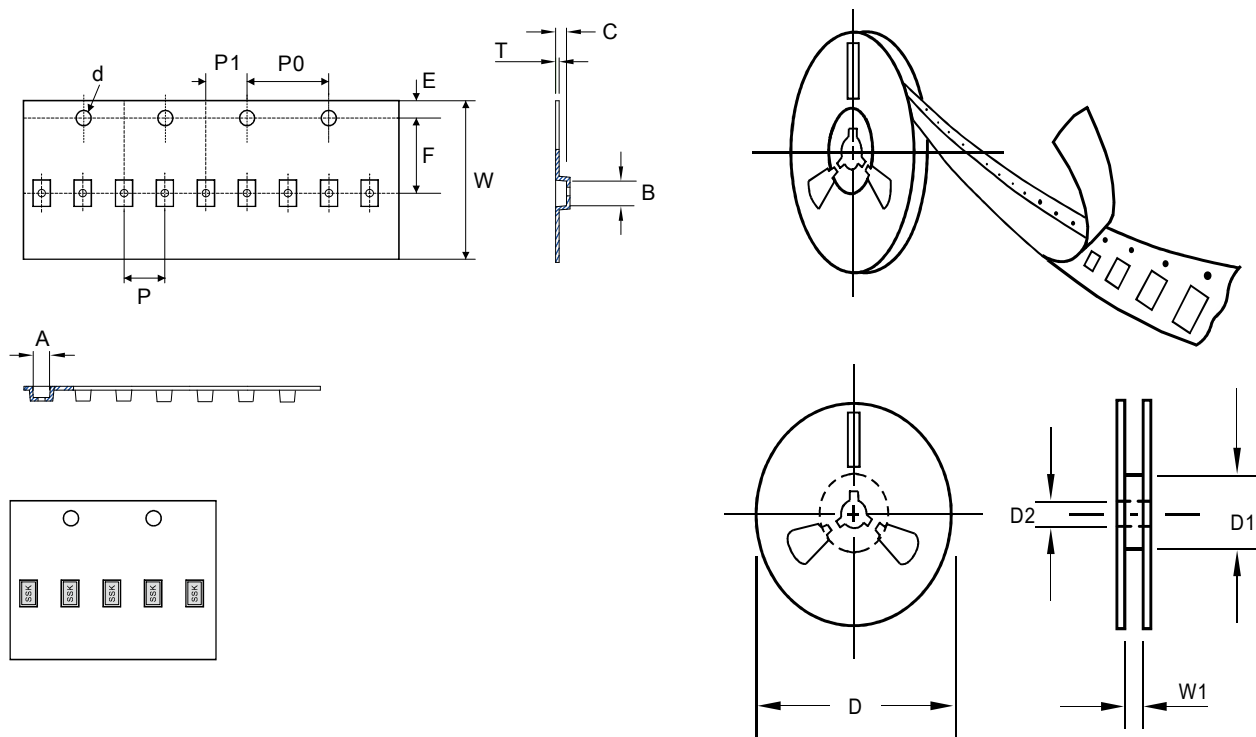
Suggested solder pad layout



Dimensions in inches and (millimeters)

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Packing information



Unit : mm

Item	Symbol	Tolerance	DFN1006-3
Carrier width	A	±0.1	0.65
Carrier length	B	±0.1	1.10
Carrier depth	C	±0.1	0.60
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	2.00
Sprocket hole pitch	P0	±0.1	4.00
Embossment center	P1	±0.1	2.00
Over all tape thickness	T	±0.1	0.17
Tape width	W	±0.2	8.00
Reel width	W1	±0.2	12.30

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

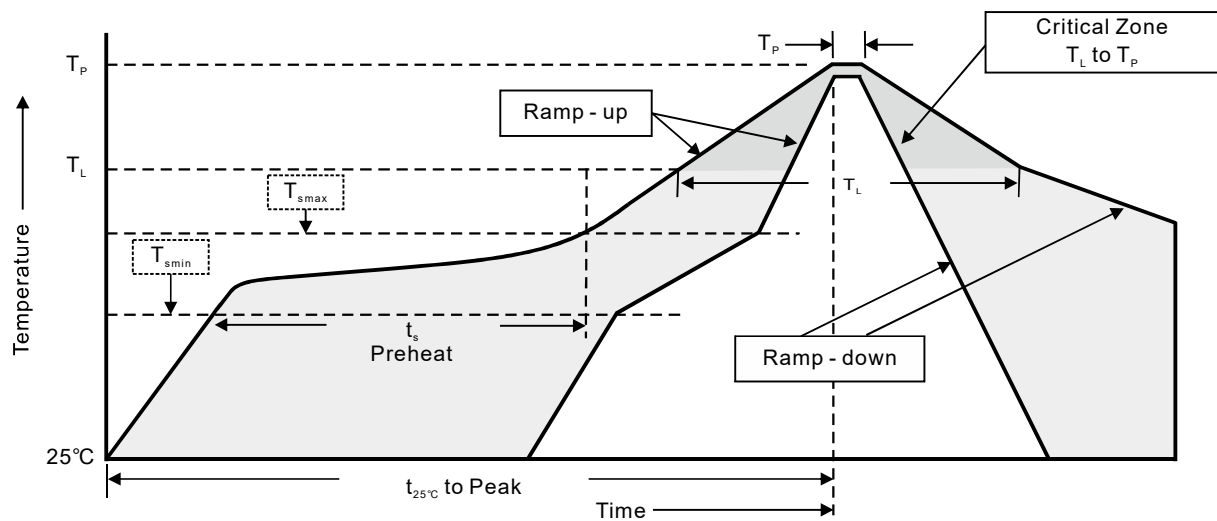
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Reel packing

Package	Units (pcs)			Dimension (Unit : mm ³)		
	Reel	Inner Box	Outer Box	Reel DIA,	Inner Box	Outer Box
T1006P3	10,000	100,000	600,000	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