FMOSCPE33N65-H

List

FMOSCPE33N65-H

33A 650V N-Channel Enhancement Mode Silicon Carbide Power MOSFET

Features

- V_{DS} = 650V, I_D = 33A.
- $R_{DS(ON)}$ ≤ 130mΩ, @ V_{GS} = 20V, I_D = 12A.
- Low on-resistance and high current density.
- Low capacitance for high frequency operation.
- Low impedance Kelvin source pin-out.
- Ultra-high avalanche ruggedness.
- Positive temperature coefficient device.
- Lead-free parts meet RoHS requirements.
- Halogen-free (IEC61249-2-21).

Applications

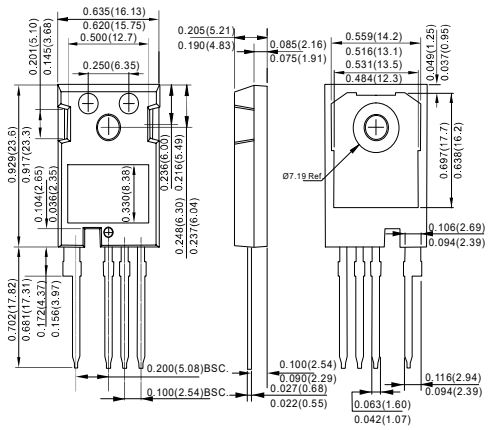
- Solar/ wind renewable energy, and power inverters.
- DC/DC converters, UPS, and PFC.
- Switching mode power supply, EV charging station, and motor drives.

Mechanical data

- Epoxy:UL94-V0 rated flame retardant.
- Case : Molded plastic, TO-247-4L.
- Terminals : Solder plated, solderable per MIL-STD-750, Method 2026.
- Mounting Position : Any.

Package outline

TO-247-4L



Dimensions in inches and (millimeters)

Maximum ratings (At T_C=25°C unless otherwise specified)

Parameter		Symbol	Ratings	Unit
Maximum drain to source voltage	(V_{GS}=0V, I_D=100μA)	V_{DS}	650	V
Recommend Gate-source voltage	Static, recommended DC operating values	$V_{GS(OP)}$	-5 to +20	V
Maximum Gate-source voltage	Transient operating limit (AC f >1Hz, duty cycle <1%)	$V_{GS(Max)}$	-10 to +25	V
Continuous drain current ,@V_{GS}=20V	(T_C=25°C)	I_D	33	A
	(T_C=110°C)		22	
Pulsed drain current, t_{PW} limitation per Fig.15		$I_{D(pulse)}$	62	A
Avalanche energy, single pulse	(V_{DD}=100V, I_D=7A)	E_{AS}	800	mJ
Power dissipation	(T_C=25°C)	P_D	166	W
Mounting torque	(M3 or 6-32 screw)	M_d	1	Nm
Typical thermal resistance, junction to case		$R_{\theta JC}$	0.9 (Typ.)	°C/W
Soldering temperature		T_L	260	°C
Junction temperature		T_J	+175	°C
Storage temperature range		T_{STG}	-55 to +175	°C

FMOSCPE33N65-H

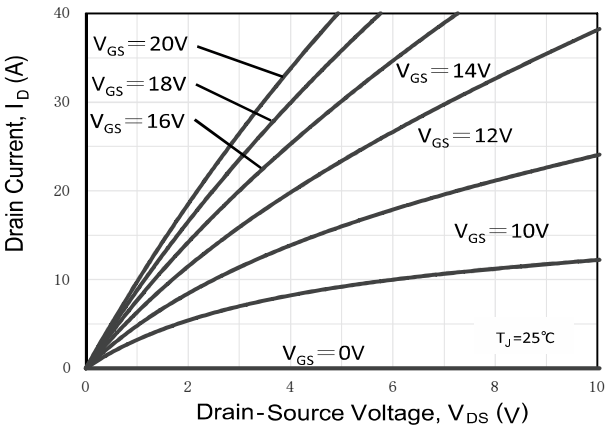
Electrical characteristics (At T_C=25°C unless otherwise specified)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Off characteristics						
Drain-source breakdown voltage	BV_{DSS}	I_D=100μA, V_{GS}=0V	650			V
Drain-source leakage current	I_{DSS}	V_{DS}=650V, V_{GS}=0V		<1	50	μA
		V_{DS}=650V, V_{GS}=0V, T_J=175ºC		5	500	
Gate-source leakage current	I_{GSS}	V_{GS}=20V, V_{DS}=0V			250	nA
On characteristics						
Gate threshold voltage	$V_{GS(TH)}$	V_{DS}=10V, I_{DS}=10mA		2.6		V
Static drain-source on-state resistance	$R_{DS(ON)}$	V_{GS}=20V, I_{DS}=12A		100	130	mΩ
		V_{GS}=20V, I_{DS}=12A, T_J=175ºC		130		
Transconductance	g_{FS}	V_{DS}=15V, I_{DS}=25A		8.5		S
Dynamic parameters						
Input capacitance	C_{iss}	V_{GS}=0V, V_{DS}=400V, f=1.0MHz,V_{AC}=25mV		910		pF
Out capacitance	C_{oss}			105		
Reverse transfer capacitance	C_{rss}			13		
Effective output capacitance, energy related	$C_{o(er)}$	V_{GS}=0V, V_{DS}=0 to 400V		130		
Effective output capacitance, time related	$C_{o(tr)}$	I_D=const. , V_{GS}=0V, V_{DS}=0 to 400V		177		
C_{OSS} Stored energy	E_{OSS}	V_{GS}=0V, V_{DS}=400V, f=1.0MHz,V_{AC}=25mV		10		μJ
Turn-on switching energy	E_{ON}	V_{DS}=400V, V_{GS}=0/+20V, I_D=12A, $R_{G(ext)}$=2.7Ω		29.7		
Turn-off switching energy	E_{OFF}			8.24		
Internal gate resistance	$R_{G(int)}$	f=1.0MHz,V_{AC}=25mV		2		Ω
Gate to source charge	Q_{gs}	V_{DS}=400V, V_{GS}=-5V/+20V, I_D=12A		13.5		nC
Gate to drain charge	Q_{gd}			34		
Total gate charge	Q_g			66		
Gate plateau voltage	V_{pl}			6.75		V
Short- circuit withstand time	t_{sc}	V_{GS}=0/15V , V_{DS}=400V, R_G=100Ω		<18		μs
Turn-on delay time	$t_{d(on)}$	V_{DS}=400V, V_{GS}=-4V/+20V, I_D=10A, R_L=40Ω, $R_{G(ext)}$=8.2Ω		15		ns
Rise time	t_r			17		
Turn-off delay time	$t_{d(off)}$			15		
Fall time	t_f			15		
Built-in SiC diode characteristics						
Diode forward voltage	V_{SD}	I_{SD}=3A, V_{GS}=0V		3.3		V
Diode continuous current	I_S	V_{GS}=0V, T_C=25°C		26.5		A
Peak reverse recovery current	I_{rrm}	V_{GS}=0V, I_{SD}=12A, V_{DS}=400V, di/dt=300A/μs		2.57		A
Reverse recovery time	t_{rr}			54		ns
Reverse recovery charge	Q_{rr}			72		nC

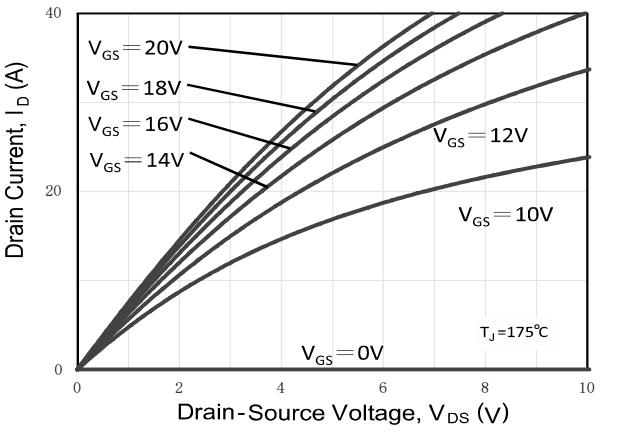
FMOSCPE33N65-H

Rating and characteristic curves

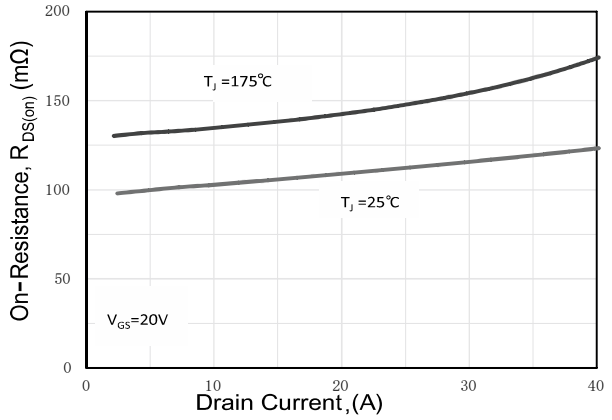
Forward output characteristics at T_J=25°C



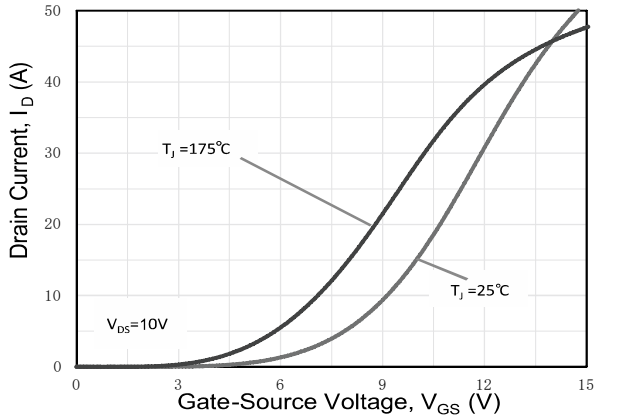
Forward output characteristics at T_J=175°C



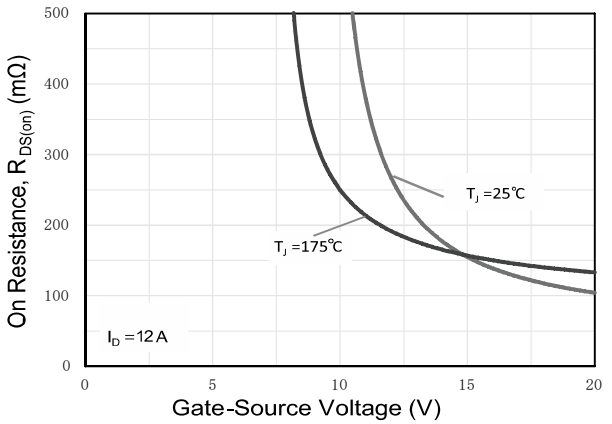
On-resistance vs. Drain current



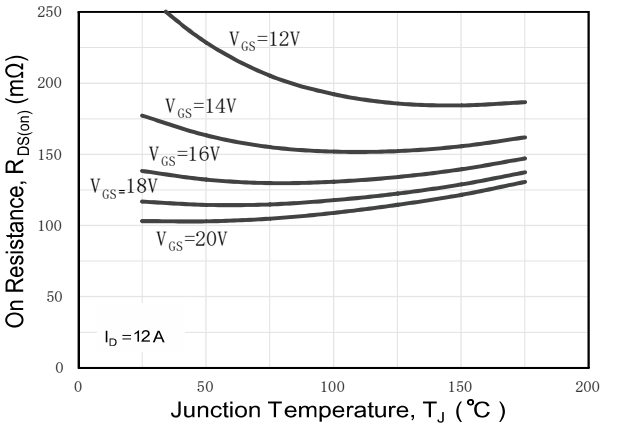
Transfer characteristics



On-resistance vs. Gate voltage



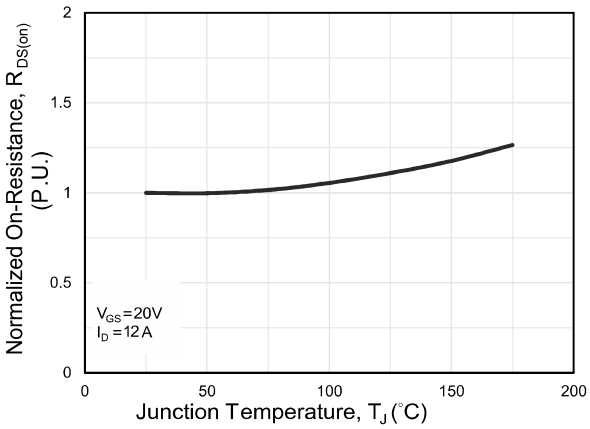
On-resistance vs. Junction temperature



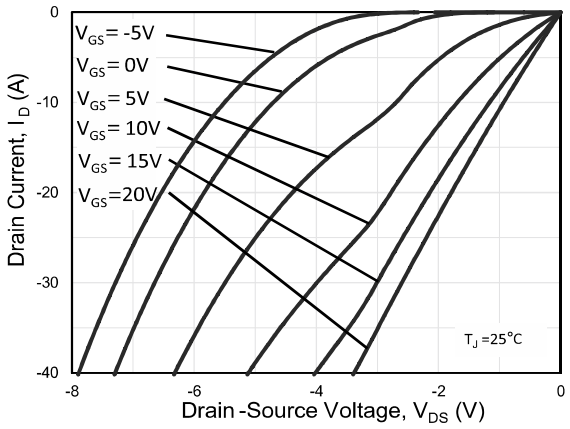
FMOSCPE33N65-H

Rating and characteristic curves

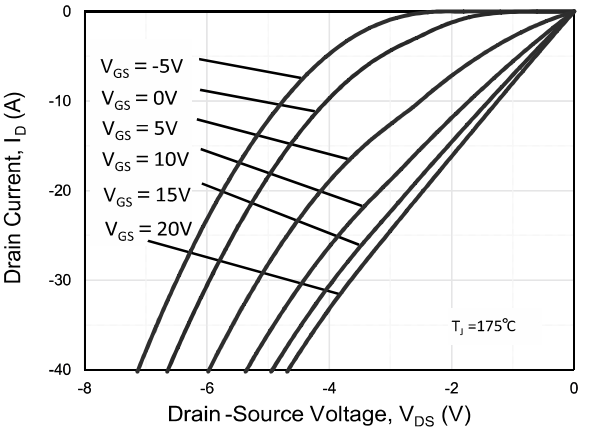
Normalized on-resistance vs. Junction temperature



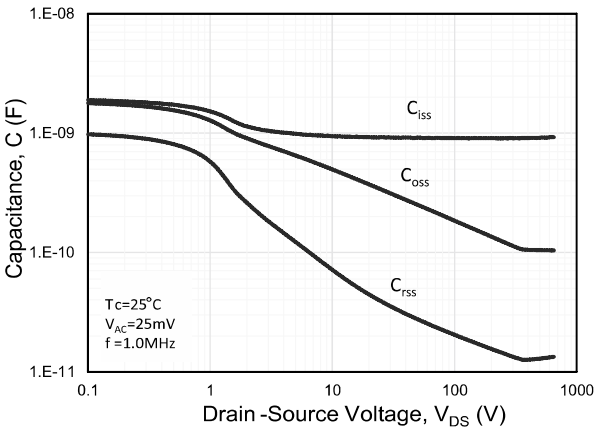
Reverse output characteristics at T_J=25°C



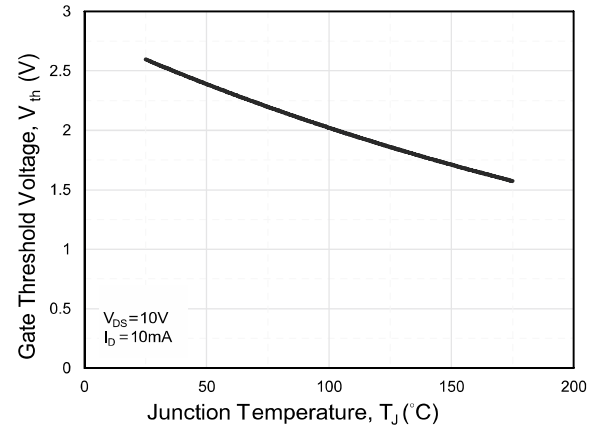
Reverse output characteristics at T_J=175°C



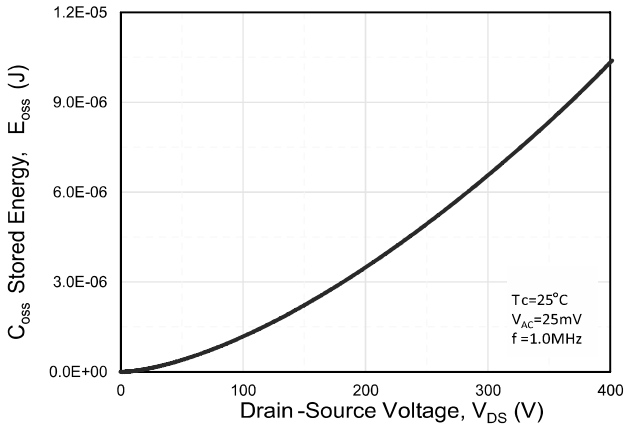
Capacitances vs. Drain-source voltage



Threshold voltage vs. Junction temperature



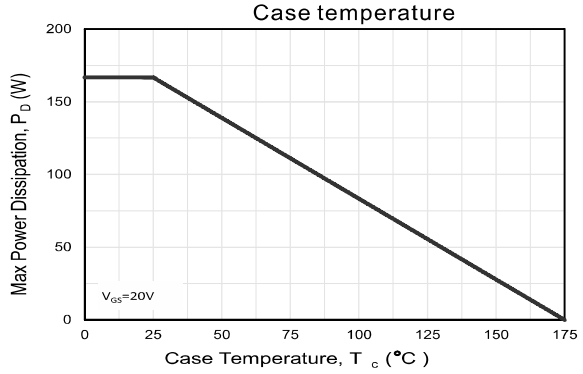
Output capacitor stored energy



FMOSCPE33N65-H

Rating and characteristic curves

Maximum power dissipation de-rating vs. Case temperature



Drain current de-rating vs. Case temperature

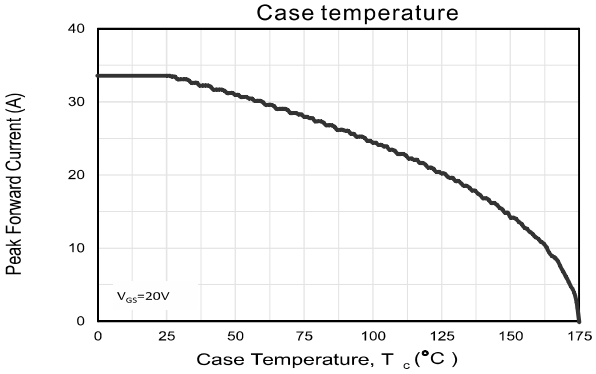
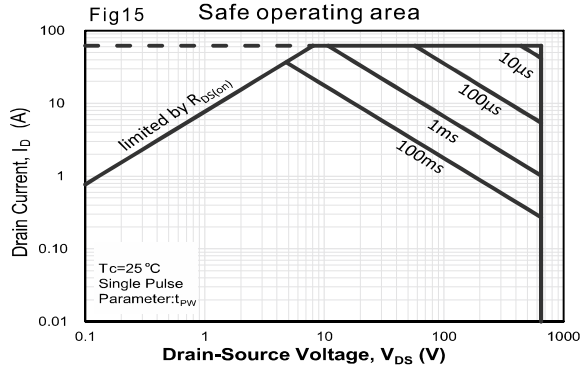
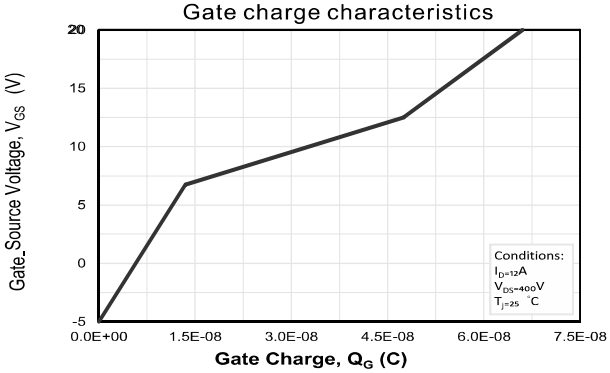


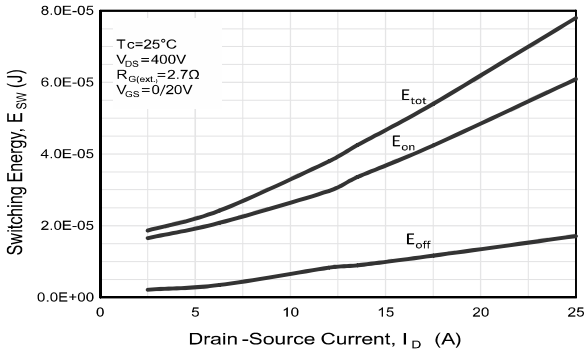
Fig15 Safe operating area



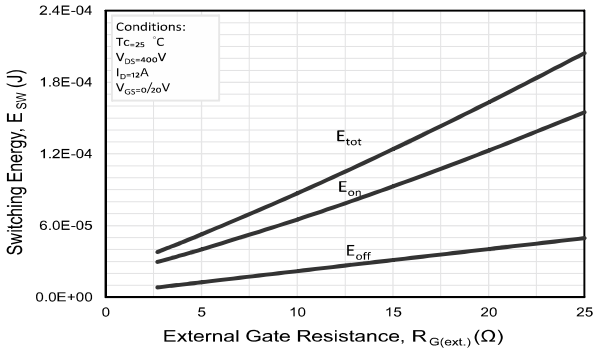
Gate charge characteristics



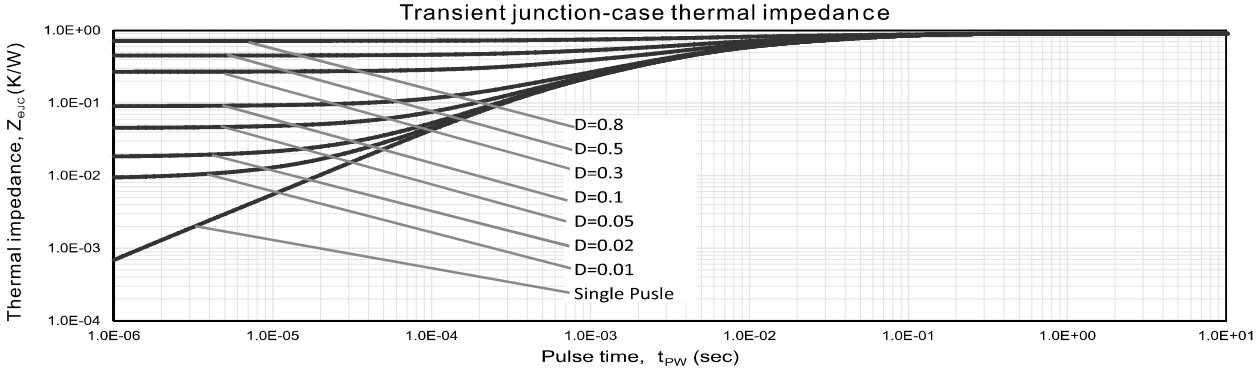
Clamped inductive switching energy vs. Drain current



Clamped inductive switching energy vs. External gate resistor($R_{G(ext.)}$)

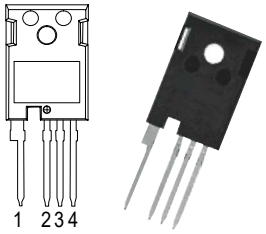
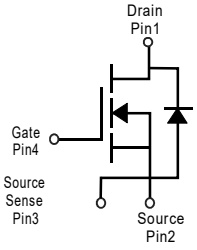


Transient junction-case thermal impedance



FMOSCPE33N65-H

Pinning information

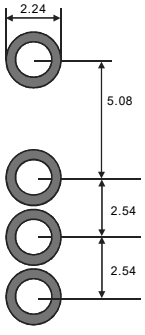
Pin	Simplified outline	Symbol
Pin 1 Drain Pin 2 Source Pin 3 Source sense Pin 4 Gate		

Marking

Type number	Marking code
FMOSCPE33N65-H	CPE33N65

Suggested solder pad layout

TO-247-4L



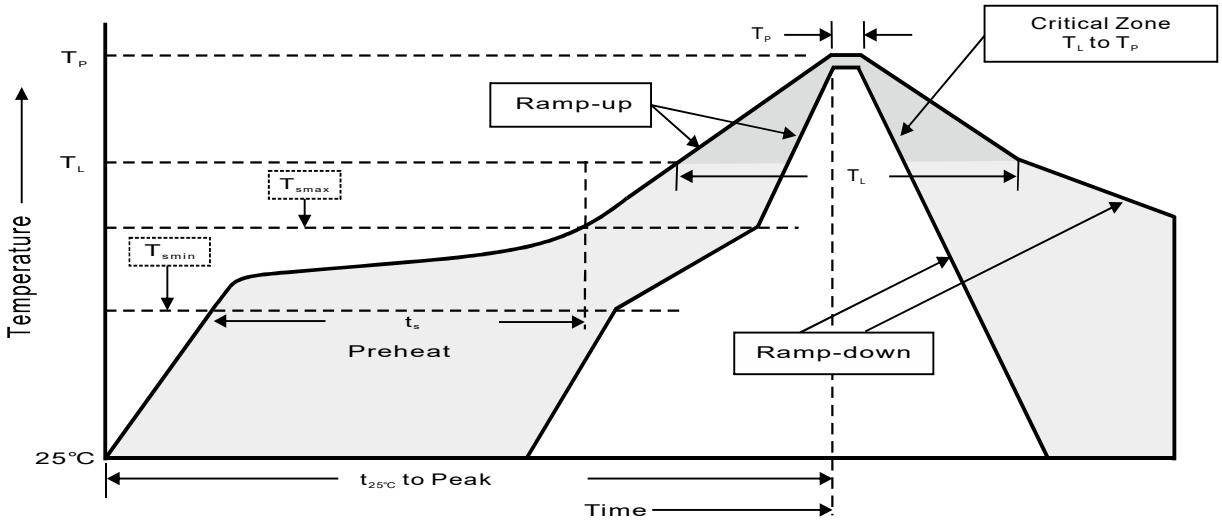
Dimensions in millimeters

FMOSCPE33N65-H

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