

## Product Summary

$V_{(BR)DSS}$	$R_{DS(on)TYP}$	$I_D$
120V	1.95mΩ@10V	275A



合肥矽普半导体

Siliup Semiconductor Technology Co., Ltd

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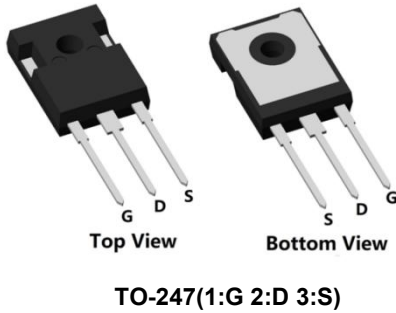
## Feature

- Fast Switching
- Low Gate Charge and Rdson
- Advanced Split Gate Trench Technology
- 100% Single Pulse avalanche energy Test
- **AEC-Q101** quality

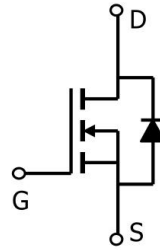
## Applications

- PWM Application
- Hard switched and high frequency circuits
- Power Management

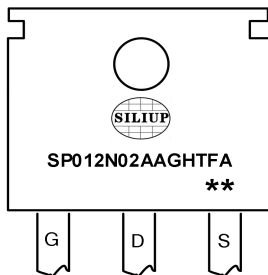
## Package



## Circuit diagram



## Marking



SP012N02AAGHTFA : Product code  
 \*\* : Week code

## Order Information

Device	Package	Unit/Tube
SP012N02AAGHTFA	TO-247	30

**Absolute maximum ratings (Ta=25°C, unless otherwise noted)**

Parameter	Symbol	Rating	Units
Drain-Source Voltage	$V_{DS}$	120	V
Gate-Source Voltage	$V_{GS}$	$\pm 20$	V
Continuous Drain Current (Tc=25°C)	$I_D$	Package Limit	275
Continuous Drain Current (Tc=25°C)		Silicon Limit	345
Continuous Drain Current (Tc=100°C)	$I_D$	193	A
Pulsed Drain Current	$I_{DM}$	1100	A
Single Pulse Avalanche Energy <sup>1</sup>	$E_{AS}$	1210	mJ
Power Dissipation (Tc=25°C)	$P_D$	335	W
Power Dissipation (Tc=100°C)	$P_D$	167.5	W
Thermal Resistance Junction-to-Case	$R_{\theta JC}$	0.45	°C/W
Thermal Resistance Junction-to-Ambient	$R_{\theta JA}$	43	°C/W
Storage Temperature Range	$T_{STG}$	-55 to 175	°C
Operating Junction Temperature Range	$T_J$	-55 to 175	°C

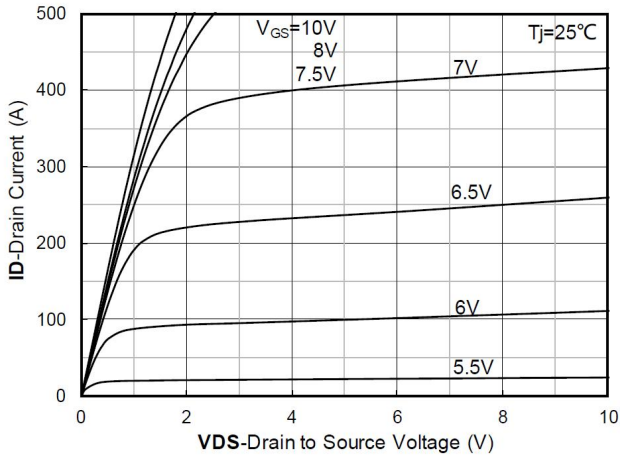
**Electrical characteristics (Ta=25°C, unless otherwise noted)**

Characteristics	Symbol	Test Condition	Min	Typ	Max	Unit
<b>Static Characteristics</b>						
Drain-Source Breakdown Voltage	$BV_{DSS}$	$I_D=250\mu A, V_{GS}=0V$	120	135	-	V
Drain Cut-Off Current	$I_{DSS}$	$V_{DS}=120V, V_{GS}=0V$	-	-	1	$\mu A$
Gate Leakage Current	$I_{GSS}$	$V_{GS}=\pm 20V, V_{DS}=0V$	-	-	$\pm 100$	nA
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=250\mu A$	2.6	3.0	3.4	V
Drain-Source ON Resistance	$R_{DS(ON)}$	$V_{GS}=10V, I_D=50A$	-	1.95	2.75	m $\Omega$
Gate Resistance	$R_G$	$V_{DS}=60V, V_{GS}=0V, f=1MHz$	-	6.2	-	$\Omega$
<b>Dynamic Characteristics</b>						
Input Capacitance	$C_{iss}$	$V_{DS}=60V, V_{GS}=0V, f=1.0MHz$	-	14120	-	pF
Output Capacitance	$C_{oss}$		-	1260	-	
Reverse Transfer Capacitance	$C_{rss}$		-	84	-	
Total Gate Charge	$Q_g$	$V_{DS}=60V, V_{GS}=10V, I_D=100A$	-	236	-	nC
Gate-Source Charge	$Q_{gs}$		-	66	-	
Gate-Drain Charge	$Q_{gd}$		-	62	-	
Gate Plateau Voltage	$V_{plateau}$		-	5	-	
<b>Switching Characteristics</b>						
Turn-On Delay Time	$t_{d(on)}$	$V_{DS}=60V, V_{GS}=10V, I_D=100A, R_G=1.6\Omega$	-	38	-	nS
Rise Time	$t_r$		-	30	-	
Turn-Off Delay Time	$t_{d(off)}$		-	86	-	
Fall Time	$t_f$		-	32	-	
<b>Drain-Source Body Diode Characteristics</b>						
Source-Drain Diode Forward Voltage	$V_{SD}$	$I_S=1A, V_{GS}=0V, T_J=25^\circ C$	-	-	1.2	V
Maximum Body-Diode Continuous Current	$I_S$		-	-	275	A
Reverse Recovery Time	$T_{rr}$	$I_S=100A, di/dt=100A/us, T_J=25^\circ C$	-	122	-	nS
Reverse Recovery Charge	$Q_{rr}$		-	312	-	nC

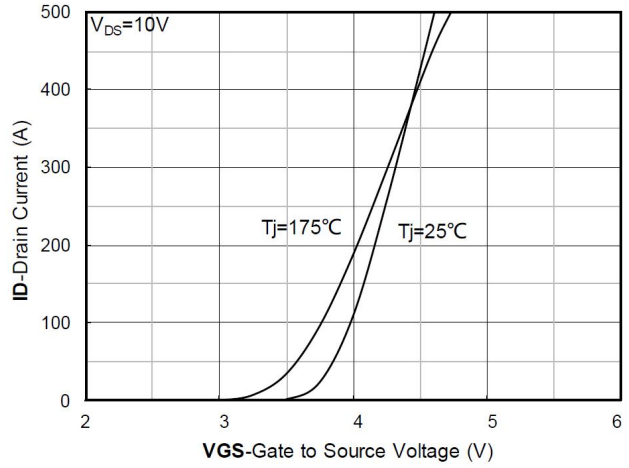
**Note :**

- The test condition is  $V_{DD}=75V, V_{GS}=10V, L=0.5mH, R_G=25\Omega$

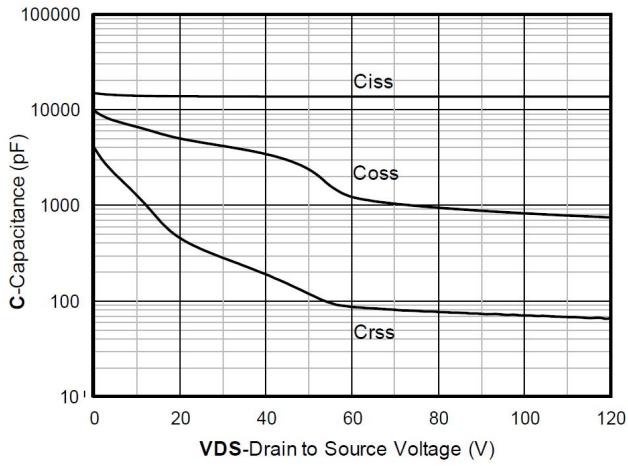
### Typical Characteristics



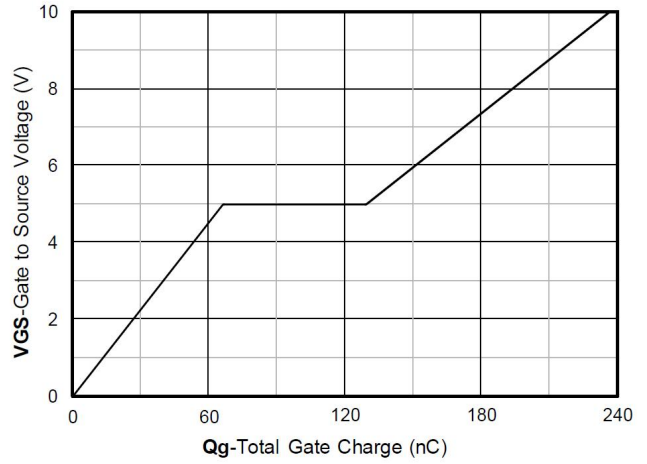
Output Characteristics



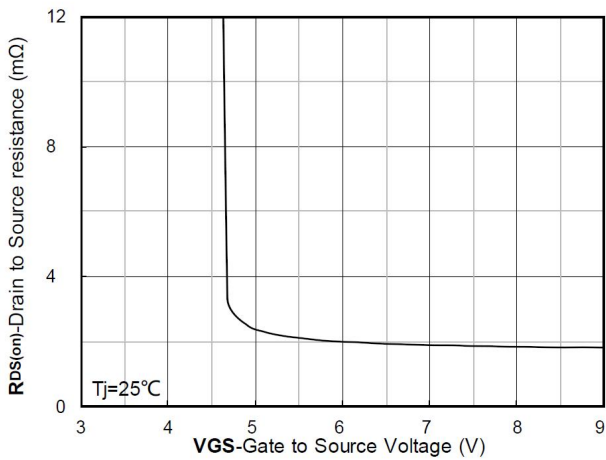
Transfer Characteristics



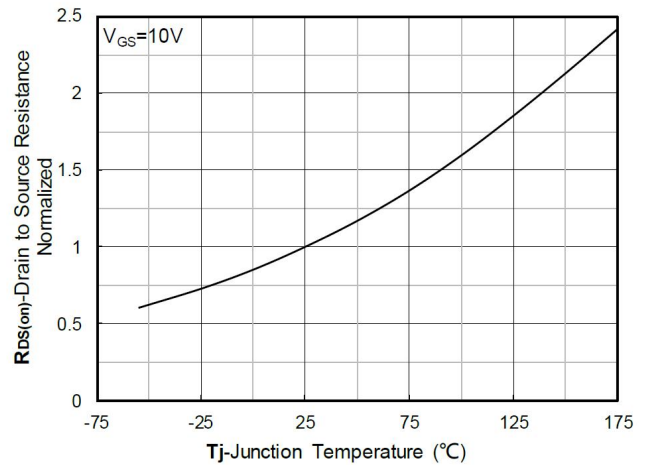
Capacitance Characteristics



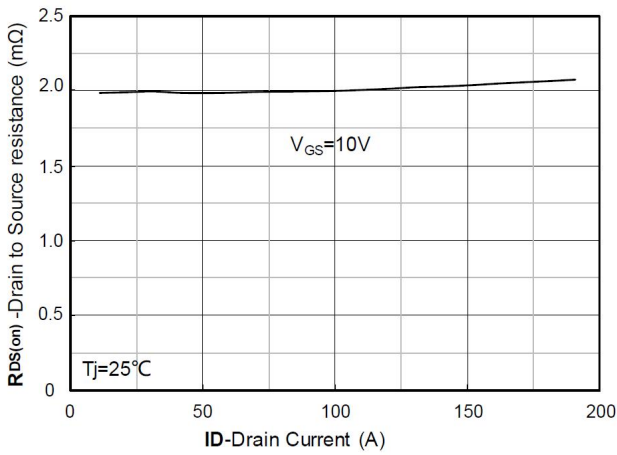
Gate Charge



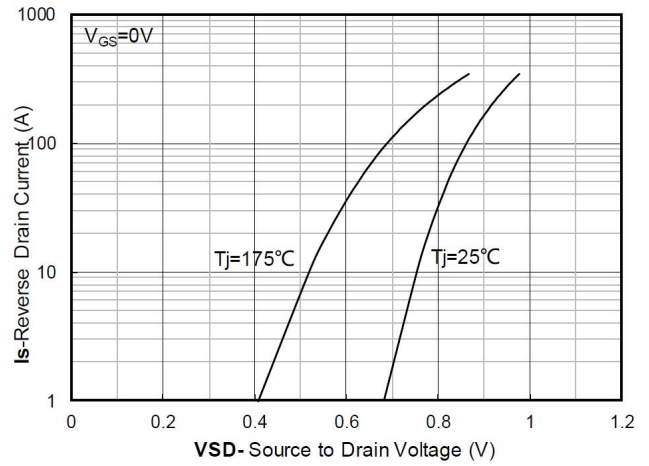
On-Resistance vs. Gate to Source Voltage



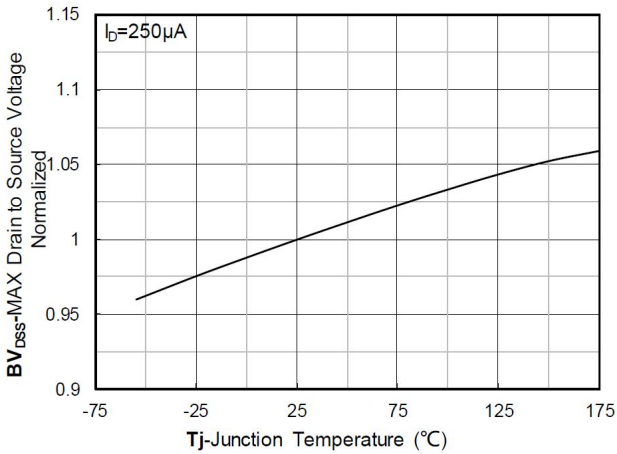
Normalized On-Resistance



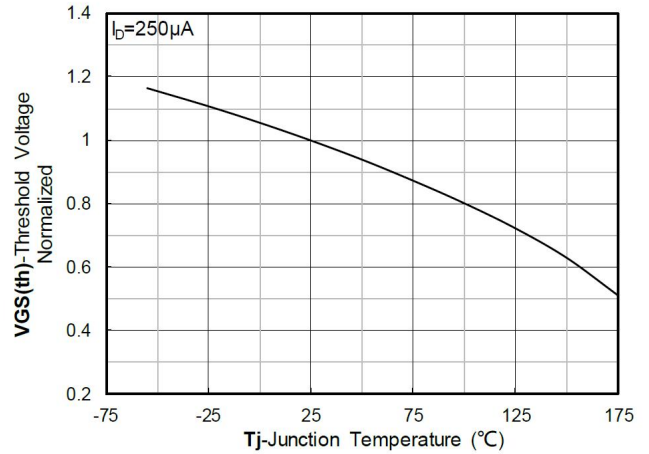
RDS(on) vs. Drain Current



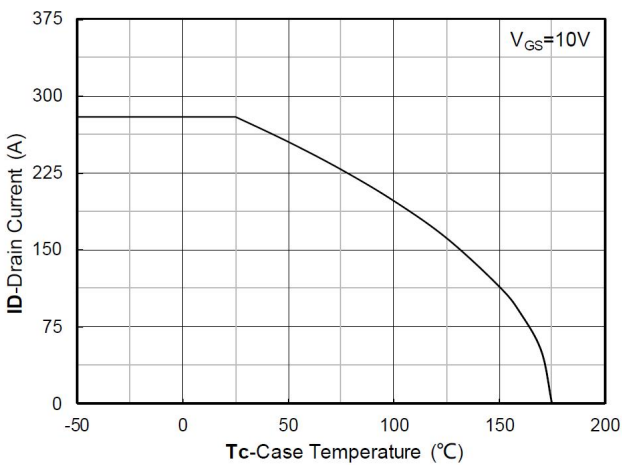
Forward characteristics of reverse diode



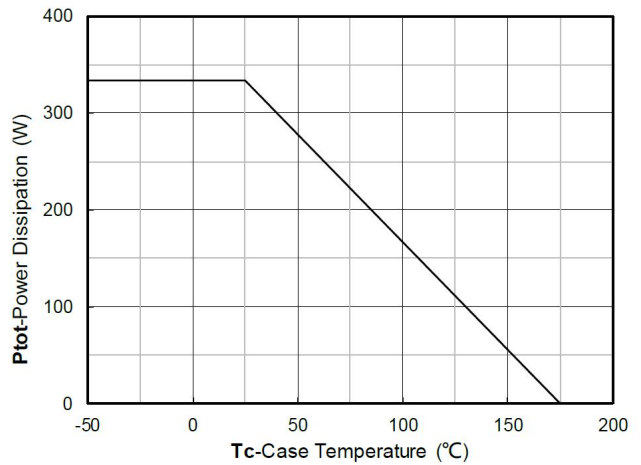
Normalized breakdown voltage



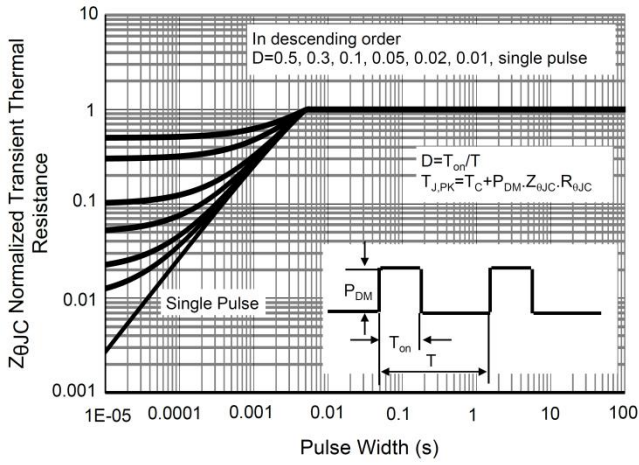
Normalized Threshold voltage



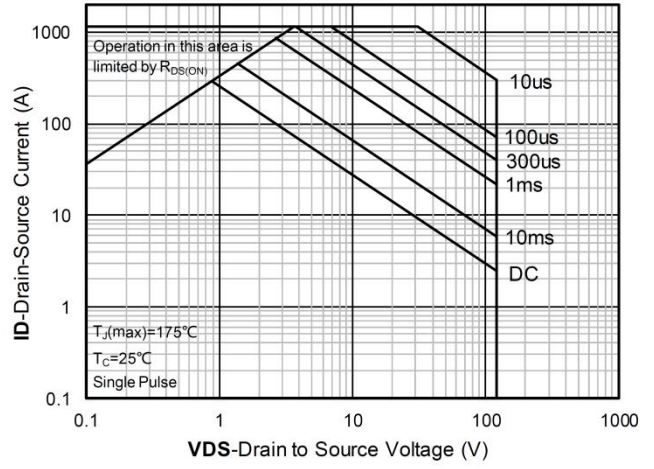
Current dissipation



Power dissipation

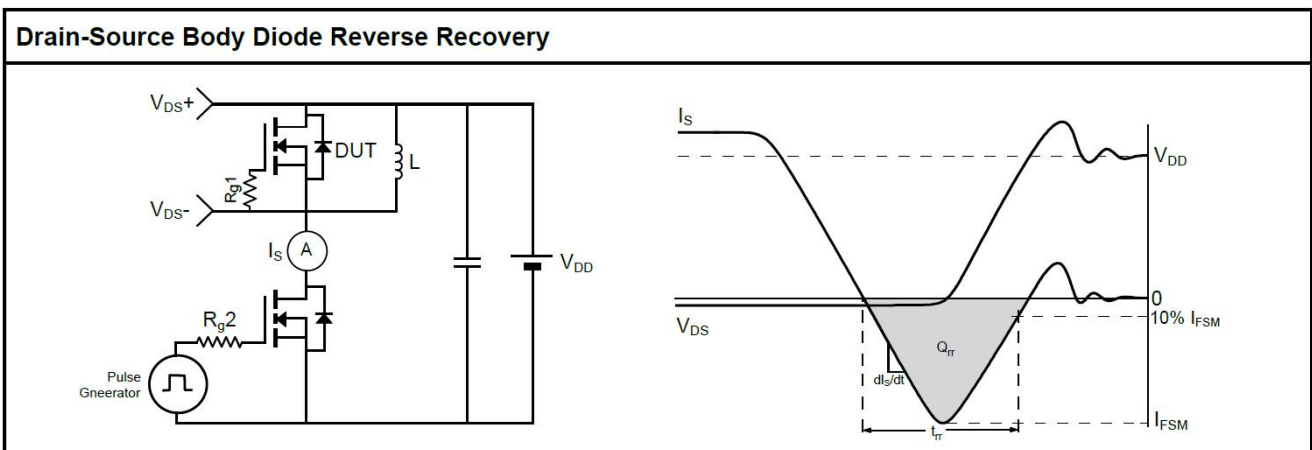
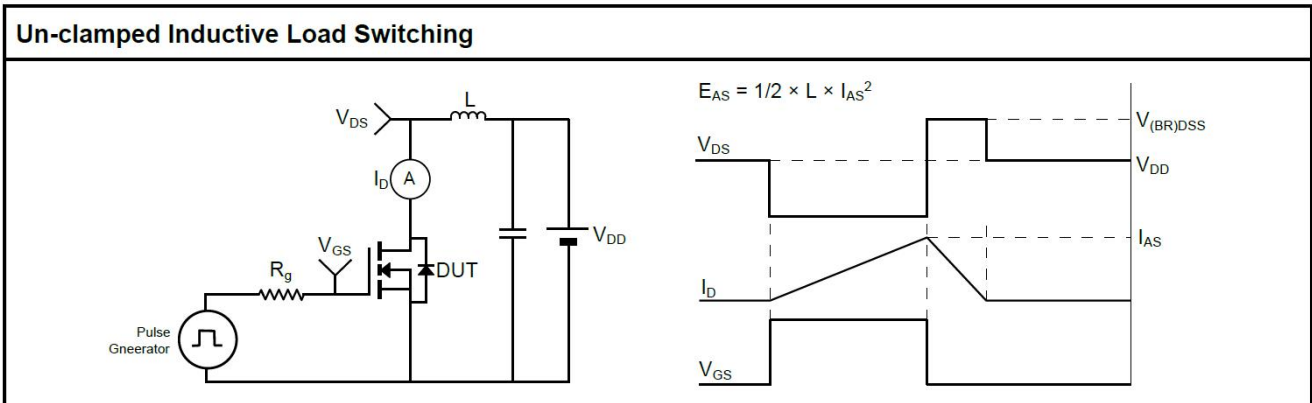
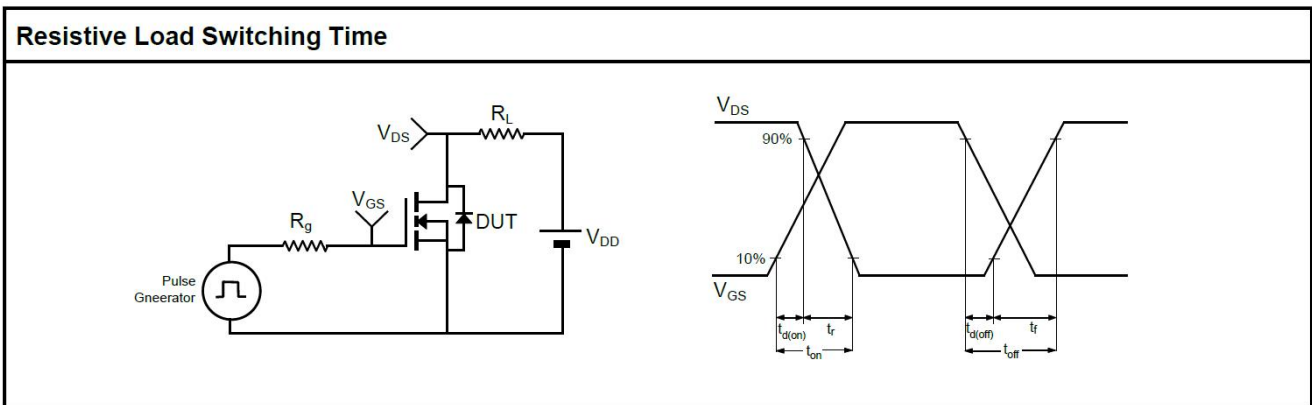
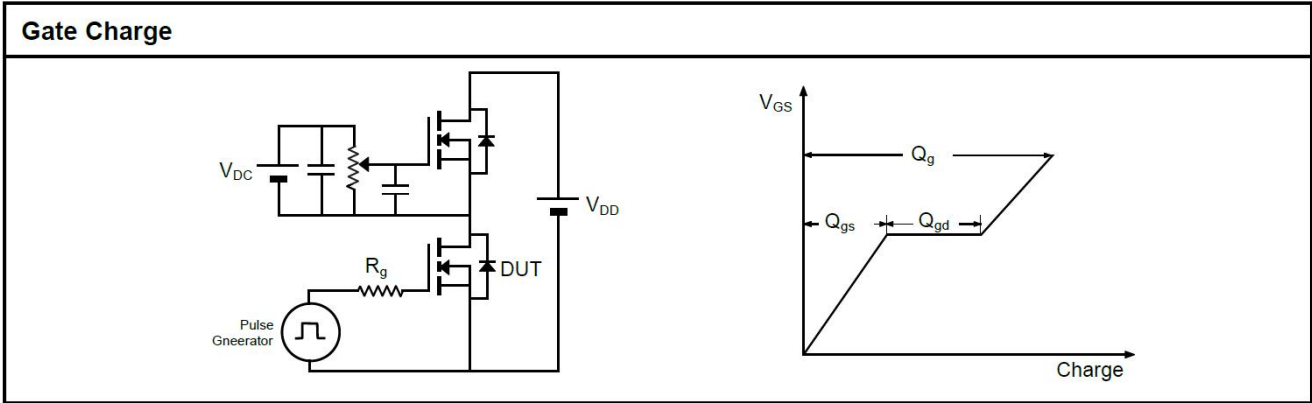


Normalized Maximum Transient Thermal Impedance

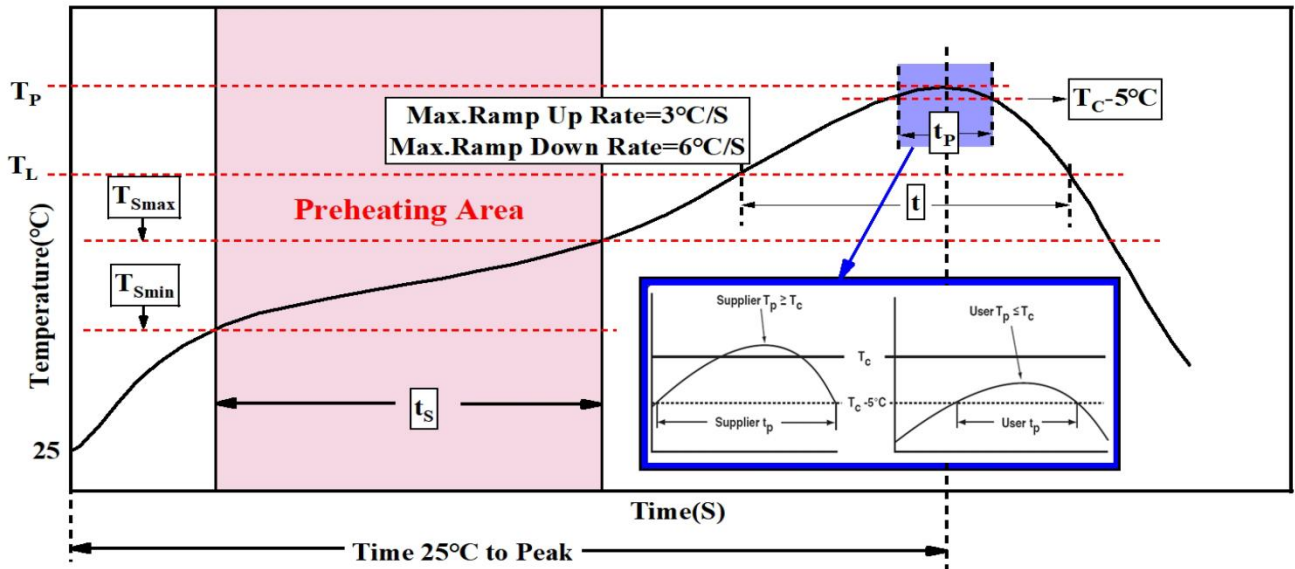


Safe Operation Area

## Test Circuit



### Temperature Profile for IR Reflow Soldering



Profile Feature	Sn-Pb Eutectic Assembly	Pb-Free Assembly
<b>Preheat &amp; Soak</b>		
Temperature min (T <sub>Smin</sub> )	100°C	150°C
Temperature max (T <sub>Smax</sub> )	150°C	200°C
Time (T <sub>Smin</sub> to T <sub>Smax</sub> ) (t <sub>S</sub> )	60-120 seconds	60-120 seconds
Average ramp-up rate (T <sub>Smax</sub> to T <sub>P</sub> )	3 °C/second max.	3°C/second max.
Liquidous temperature (T <sub>L</sub> )	183 °C	217°C
Time at liquidous (t <sub>L</sub> )	60-150 seconds	60-150 seconds
Peak package body Temperature e (T <sub>P</sub> )*	See Classification Temp in table 1	See Classification Temp in table 2
Time (t <sub>p</sub> )** within 5°C of the specified classification temperature (T <sub>c</sub> )	20** seconds	30** seconds
Average ramp-down rate (T <sub>P</sub> to T <sub>Smax</sub> )	6 °C/second max.	6 °C/second max.
Time 25°C to peak temperature	6 minutes max.	8 minutes max.
* Tolerance for peak profile Temperature (T <sub>P</sub> ) is defined as a supplier minimum and a user maximum. ** Tolerance for time at peak profile temperature (t <sub>p</sub> ) is defined as a supplier minimum and a user maximum		

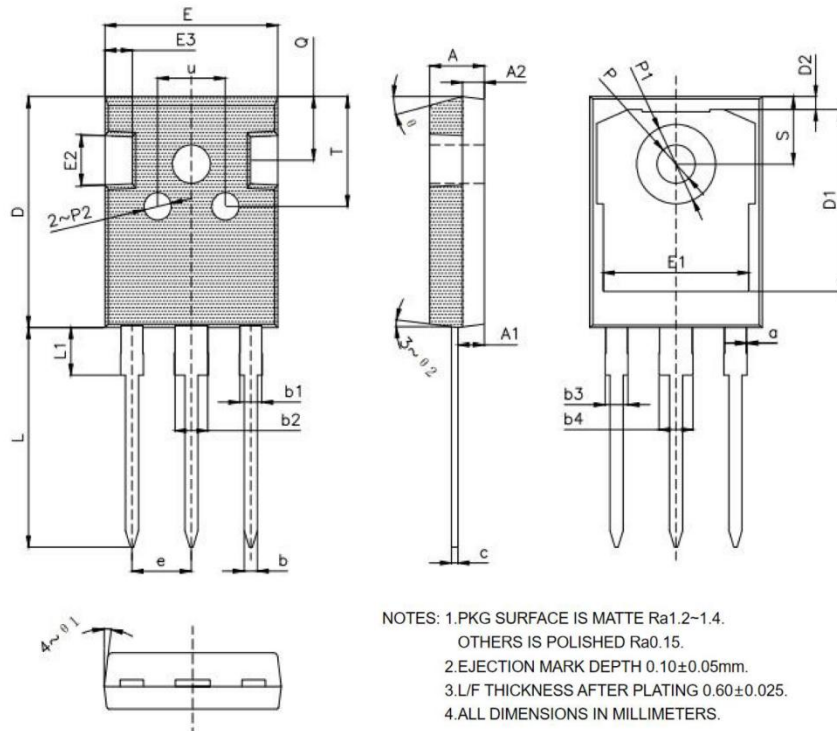
Table 1. SnPb Eutectic Process – Classification Temperatures (T<sub>c</sub>)

Package Thickness	Volume mm <sup>3</sup> <350	Volume mm <sup>3</sup> ≥350
<2.5 mm	235 °C	220 °C
≥2.5 mm	220 °C	220 °C

Table 2. Pb-free Process – Classification Temperatures (T<sub>c</sub>)

Package Thickness	Volume mm <sup>3</sup> <350	Volume mm <sup>3</sup> 350-2000	Volume mm <sup>3</sup> >2000
<1.6 mm	260 °C	260 °C	260 °C
1.6 mm – 2.5 mm	260 °C	250 °C	245 °C
≥2.5 mm	250 °C	245 °C	245 °C

## TO-247 Package Information



NOTES: 1.PKG SURFACE IS MATTE Ra1.2-1.4.  
 OTHERS IS POLISHED Ra0.15.  
 2.EJECTION MARK DEPTH  $0.10 \pm 0.05$ mm.  
 3.L/F THICKNESS AFTER PLATING  $0.60 \pm 0.025$ .  
 4.ALL DIMENSIONS IN MILLIMETERS.

Symbol	Dimensions In Millimeters	
	Min.	Max.
A	4.900	5.100
A1	2.310	2.510
A2	1.900	2.100
a	0.000	0.150
b	1.160	1.260
b1	1.960	2.040
b2	2.960	3.040
b3	2.000	2.200
b4	3.000	3.200
c	0.550	0.650
D	20.900	21.200
D1	16.350	16.750
D2	1.070	1.270
E	15.700	15.900
E1	13.100	13.500
E2	4.400	4.600
E3	2.400	2.600
e	5.436 BSC.	
L	19.720	20.120
L1	-	4.300
P	3.400	3.600
P1	7.100	7.300
P2	2.400	2.600
Q	5.600	6.000
S	6.050	6.250
T	9.800	10.200
U	6.000	6.400
$\theta$	13°	17°
$\theta_1$	5°	9°
$\theta_2$	5°	9°