

Product Summary

$V_{(BR)DSS}$	$R_{DS(on)TYP}$	I_D
60V	3.7mΩ@10V	140A
	4.6mΩ@4.5V	



合肥矽普半导体

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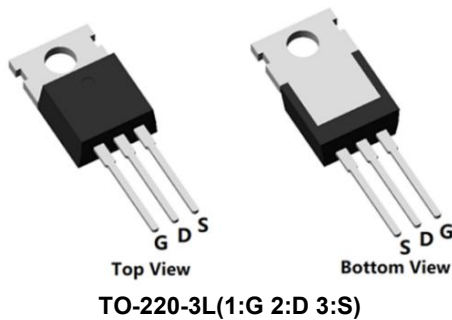
Feature

- Fast Switching
- Low Gate Charge and Rdson
- Advanced Split Gate Trench Technology
- **100% UIS TESTED**

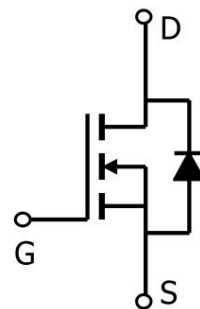
Applications

- Power switching application
- Hard switched and high frequency circuits
- Uninterruptible power supply

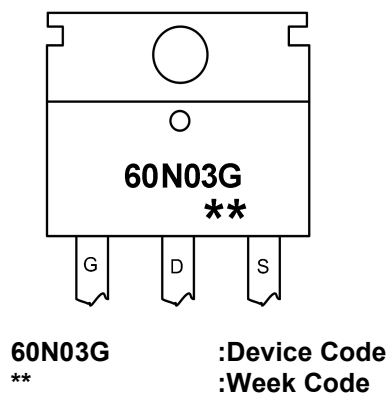
Package



Circuit diagram



Marking



Order Information

Device	Package	Unit/Tube
SP60N03GTQ	TO-220-3L	50

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

Parameter	Symbol	Rating	Unit
Drain-Source Voltage	V_{DSS}	60	V
Gate-Source Voltage	V_{GSS}	± 20	V
Continuous Drain Current (Tc=25°C)	I_D	140	A
Continuous Drain Current (Tc=100°C)	I_D	93	A
Pulse Drain Current Tested	I_{DM}	560	A
Single Pulse Avalanche Energy ¹	E_{AS}	552	mJ
Power Dissipation (Tc=25°C)	P_D	145	W
Power Dissipation (Tc=100°C)	P_D	58	W
Thermal Resistance Junction-to-Case	$R_{\theta JC}$	0.86	°C/W
Maximum Junction Temperature	T_J	-55 to 150	°C
Storage Temperature Range	T_{STG}	-55 to 150	°C

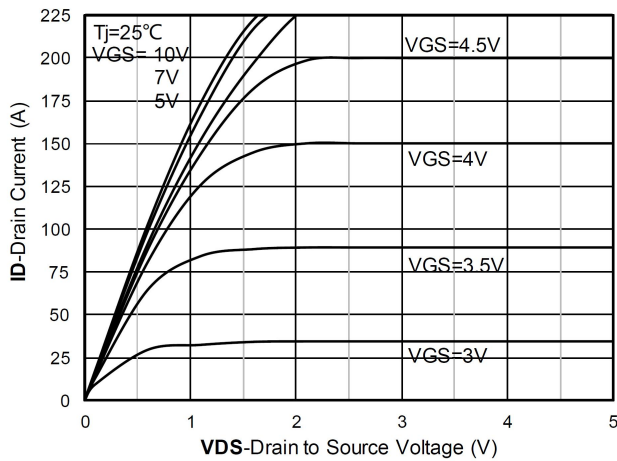
Electrical characteristics (Ta=25°C, unless otherwise noted)

Characteristics	Symbol	Test Condition	Min	Typ	Max	Unit
Static Characteristics						
Drain-Source Breakdown Voltage	BV _{DSS}	VGS=0V, ID=250uA	60	-	-	V
Zero Gate Voltage Drain Current	I _{DSS}	VDS=48V , VGS=0V	-	-	1	uA
Gate Leakage Current	I _{GSS}	VGS=±20V , VDS=0V	-	-	±100	nA
Gate Threshold Voltage	V _{GS(th)}	VDS=VGS , ID=250uA	1	1.7	2.5	V
Drain-Source On-state Resistance	R _{DS(ON)}	VGS=10V , ID=20A	-	3.7	4.7	mΩ
		VGS=4.5V , ID=10A	-	4.6	6.2	
Gate Resistance	R _G	f=1MHz	-	0.8	-	Ω
Dynamic Characteristics						
Input Capacitance	C _{iss}	VGS=0V , VDS=30V , f=1MHz	-	4250	-	pF
Output Capacitance	C _{oss}		-	975	-	
Reverse Transfer Capacitance	C _{rss}		-	31	-	
Total Gate Charge	Q _g	VDS=30V , VGS=10V , ID=20A	-	42	-	nC
Gate-Source Charge	Q _{gs}		-	12	-	
Gate-Drain Charge	Q _{gd}		-	10	-	
Gate Plateau Voltage	V _{plateau}		-	3.7	-	
Switching Characteristics						
Turn-On Delay Time	t _{d(on)}	VDD=30V , ID=20A , VGS=10V , RG=3Ω	-	16	-	nS
Rise Time	t _r		-	114	-	
Turn-Off Delay Time	t _{d(off)}		-	47.5	-	
Fall Time	t _f		-	136.5	-	
Drain-Source Body Diode Characteristics						
Source-Drain Diode Forward Voltage	V _{SD}	VGS=0V , IS=1A , TJ=25℃	-	-	1.2	V
Maximum Body-Diode Continuous Current	I _s		-	-	140	A
Reverse Recovery Time	T _{rr}	IS=50A , di/dt=100A/μs , TJ=25℃	-	35	-	nS
Reverse Recovery Charge	Q _{rr}		-	30	-	nC

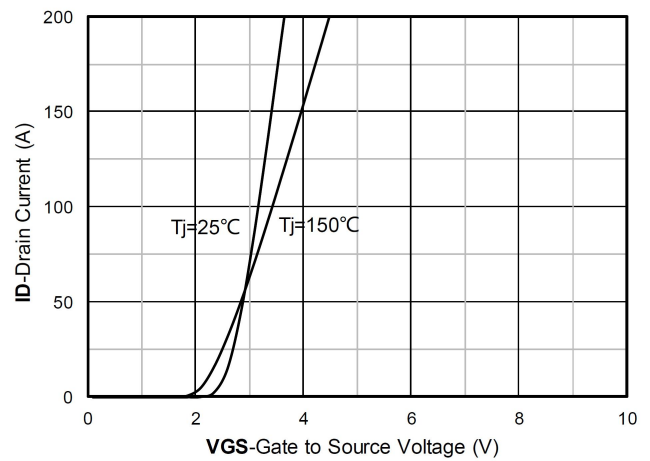
Note :

1. The test condition is VDD=30V, VGS=10V, L=0.5mH, RG=25Ω;

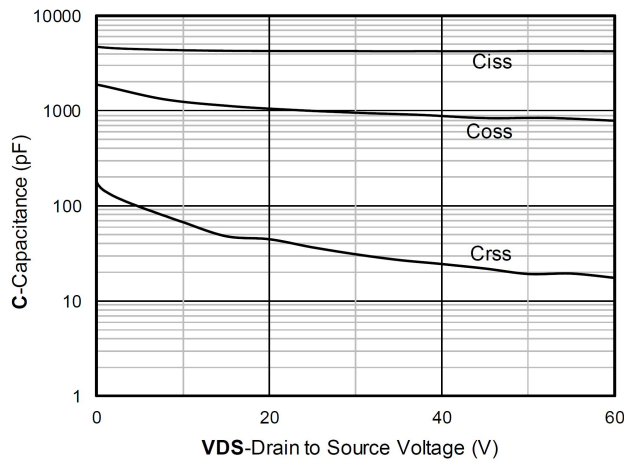
Typical Characteristics



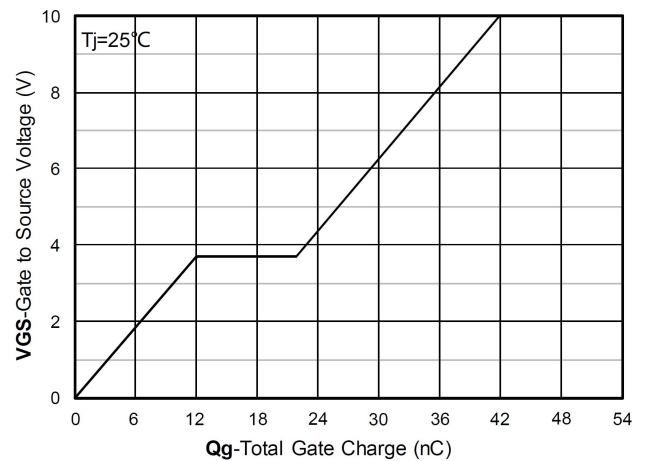
Output Characteristics



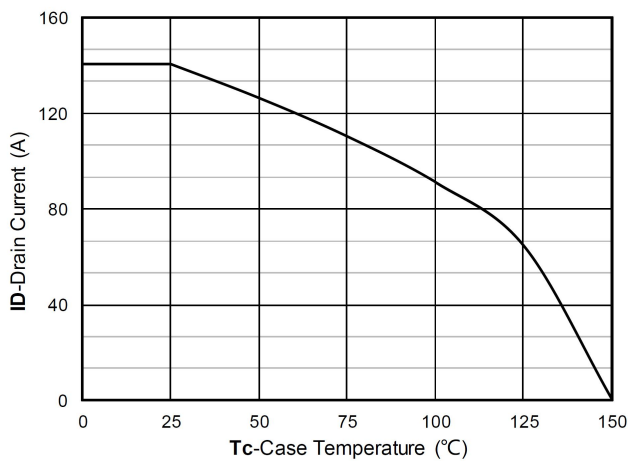
Transfer Characteristics



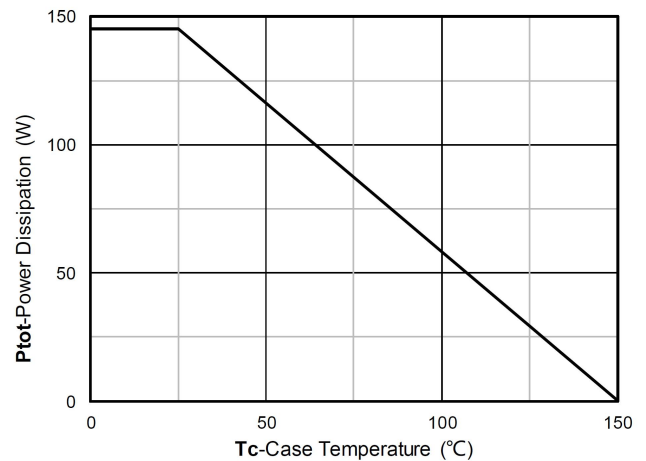
Capacitance Characteristics



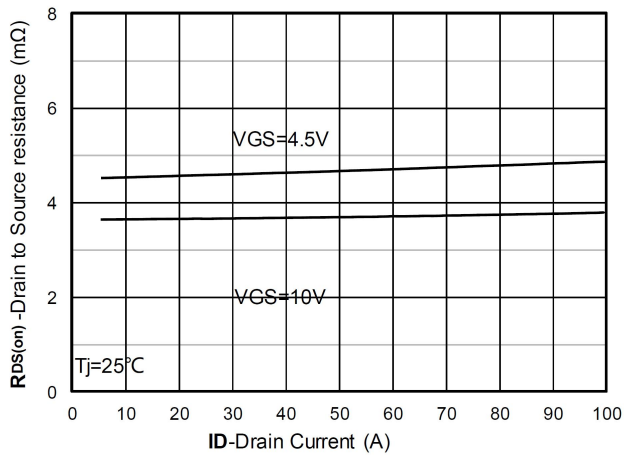
Gate Charge



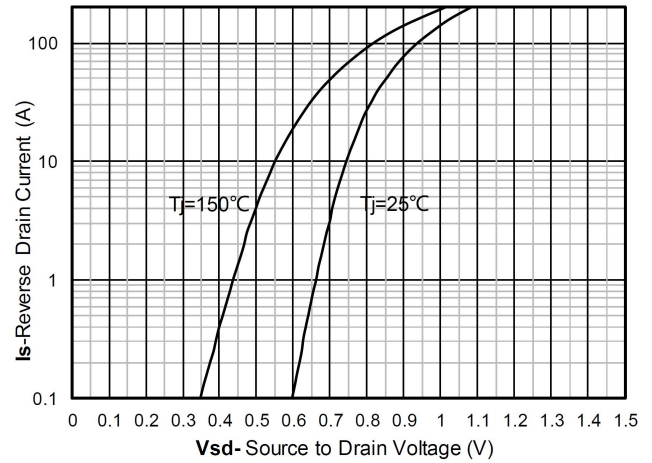
Current dissipation



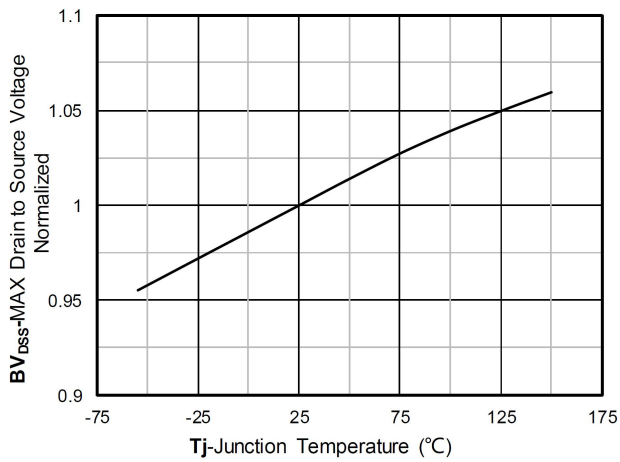
Power dissipation



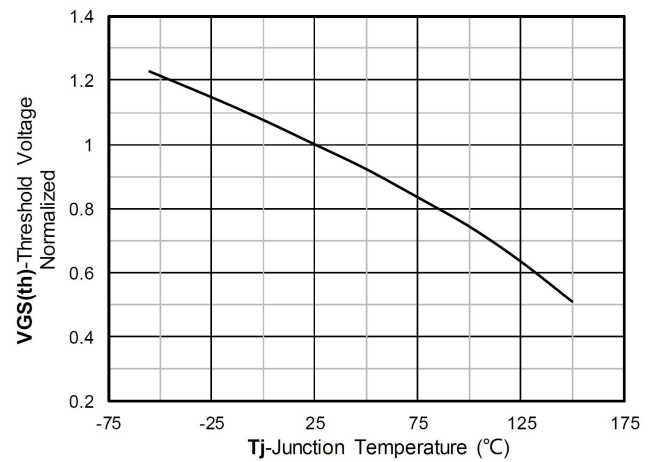
RDS(on) VS Drain Current



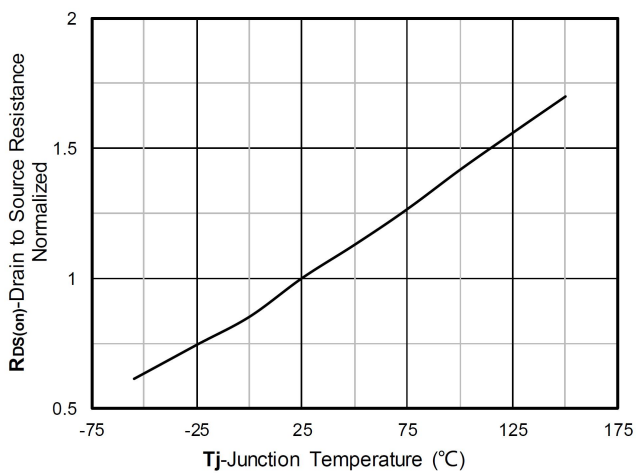
Forward characteristics of reverse diode



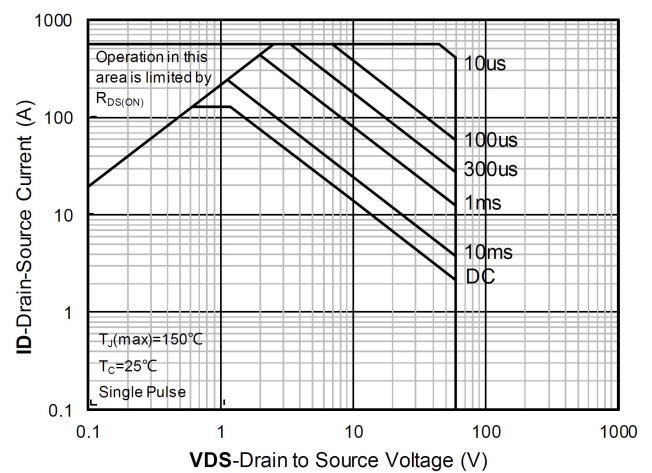
Normalized breakdown voltage



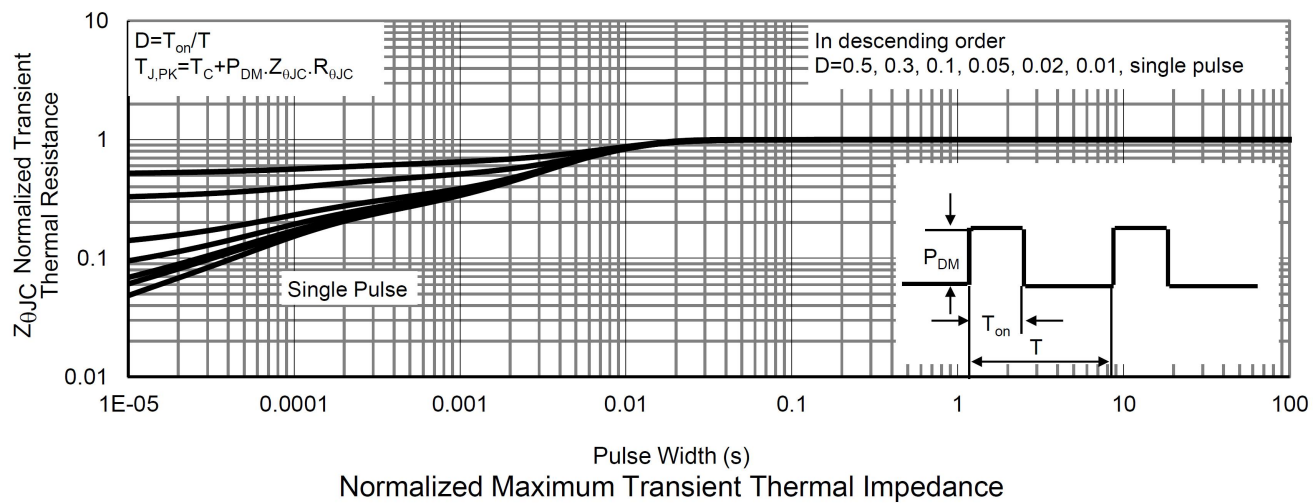
Normalized Threshold voltage



Normalized On-Resistance

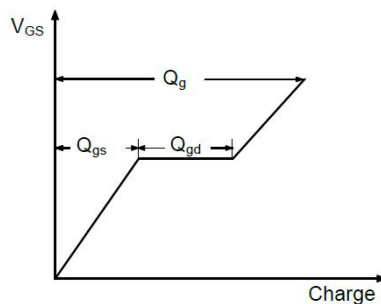
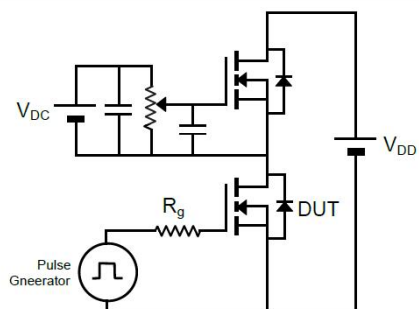


Safe Operation Area

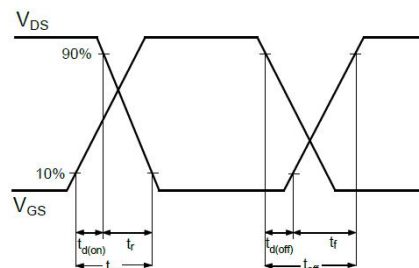
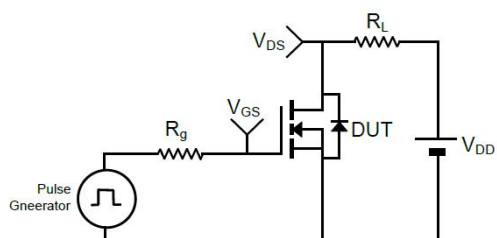


Test Circuit

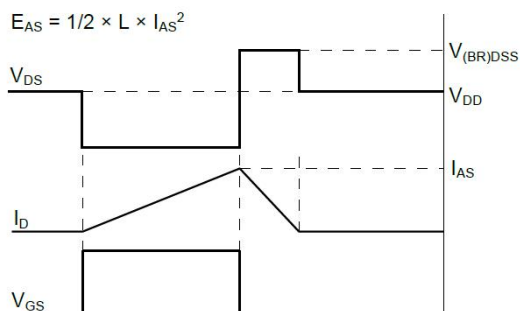
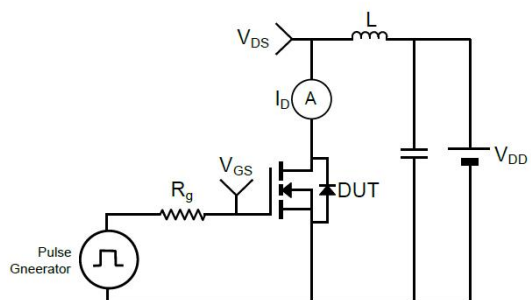
Gate Charge



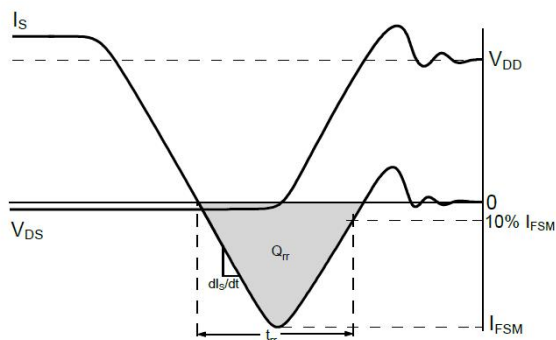
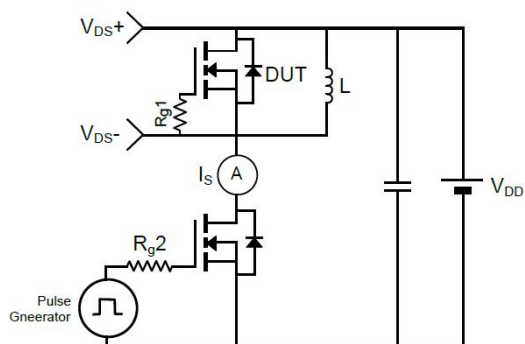
Resistive Load Switching Time

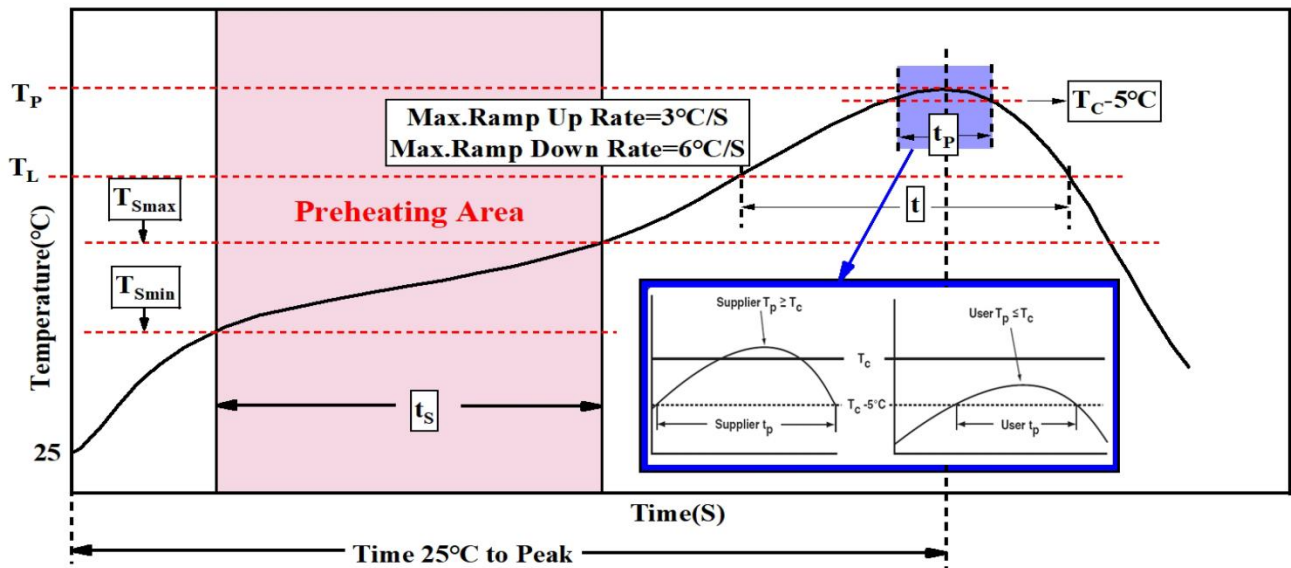


Un-clamped Inductive Load Switching



Drain-Source Body Diode Reverse Recovery



Temperature Profile for IR Reflow Soldering(Pb-Free)


Profile Feature	Sn-Pb Eutectic Assembly	Pb-Free Assembly
Preheat & Soak		
Temperature min (T_{Smin})	100°C	150°C
Temperature max (T_{Smax})	150°C	200°C
Time (T_{Smin} to T_{Smax}) (t_s)	60-120 seconds	60-120 seconds
Average ramp-up rate (T_{Smax} to T_P)	3 °C/second max.	3°C/second max.
Liquidous temperature (T_L)	183 °C	217°C
Time at liquidous (t_L)	60-150 seconds	60-150 seconds
Peak package body Temperature e (T_P)*	See Classification Temp in table 1	See Classification Temp in table 2
Time (t_p)** within 5°C of the specified classification temperature (T_C)	20** seconds	30** seconds
Average ramp-down rate (T_P to T_{Smax})	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_P) is defined as a supplier minimum and a user maximum. ** Tolerance for time at peak profile temperature (t_p) is defined as a supplier minimum and a user maximum		

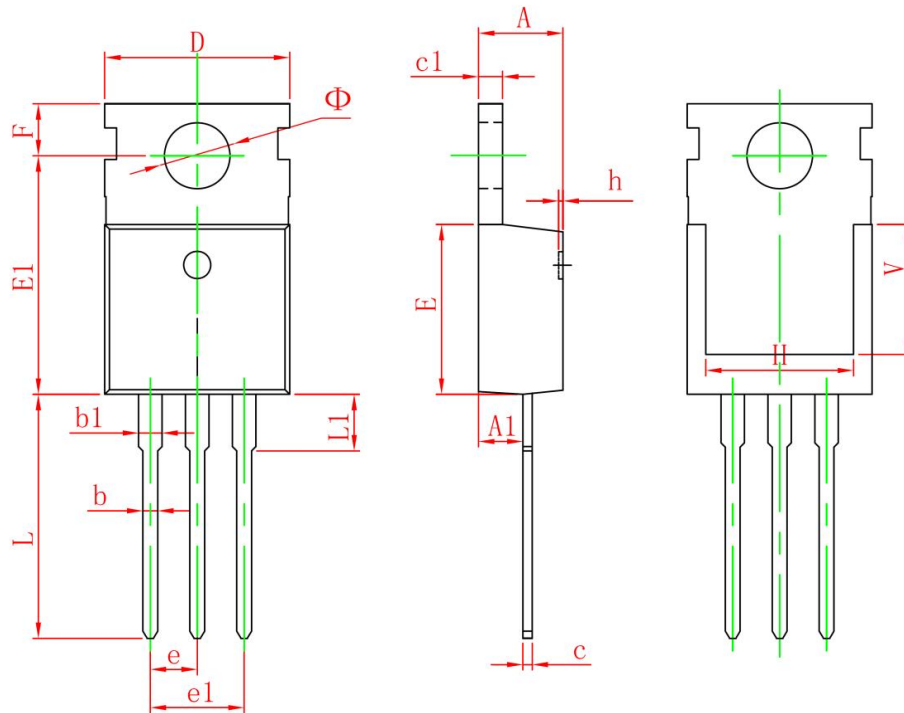
Table 1. SnPb Eutectic Process – Classification Temperatures (T_C)

Package Thickness	Volume mm^3 <350	Volume mm^3 ≥ 350
<2.5 mm	235 °C	220 °C
≥ 2.5 mm	220 °C	220 °C

Table 2. Pb-free Process – Classification Temperatures (T_C)

Package Thickness	Volume mm^3 <350	Volume mm^3 350-2000	Volume mm^3 >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-220-3L Package Information



Symbol	Dimensions In Millimeters	
	Min.	Max.
A	4.300	4.700
A1	2.200	2.500
b	0.700	0.900
b1	1.100	1.400
c	0.300	0.700
c1	1.200	1.400
D	9.800	10.200
E	9.000	9.400
E1	12.700	13.500
e	2.490	2.590
e1	4.980	5.180
F	2.650	2.950
H	7.600	8.400
h	0.000	0.300
L	12.700	13.500
L1	2.850	3.250
V	6.900 REF.	
Φ	3.400	3.800