

Product Summary

$V_{(BR)DSS}$	$R_{DS(on)TYP}$	I_D
60V	1.7mΩ@10V	200A



合肥矽普半导体

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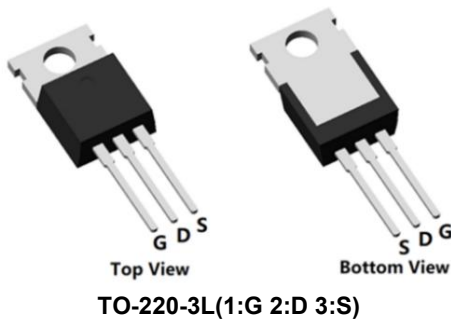
Feature

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

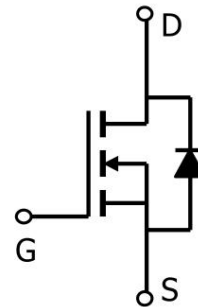
Applications

- Charger
- Battery management
- Power Switching application

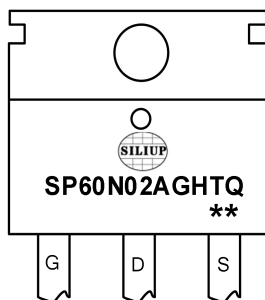
Package



Circuit diagram



Marking



SP60N02AGHTQ :Device Code
** :Week Code

Order Information

Device	Package	Unit/Tube
SP60N02AGHTQ	TO-220-3L	50

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

Parameter		Symbol	Rating	Units
Drain-Source Voltage		V_{DS}	60	V
Gate-Source Voltage		V_{GS}	± 20	V
Continuous Drain Current (Tc=25°C)	Package limit	I_D	200	A
Continuous Drain Current (Tc=25°C)	Silicon limit	I_D	330	A
Continuous Drain Current (Tc=100°C)		I_D	133	A
Pulsed Drain Current		I_{DM}	800	A
Single Pulse Avalanche Energy ¹		E_{AS}	1600	mJ
Power Dissipation (Tc=25°C)		P_D	213	W
Power Dissipation (Tc=100°C)		P_D	85	W
Thermal Resistance Junction-to-Case		$R_{\theta JC}$	0.59	°C/W
Storage Temperature Range		T_{STG}	-55 to 150	°C
Operating Junction Temperature Range		T_J	-55 to 150	°C

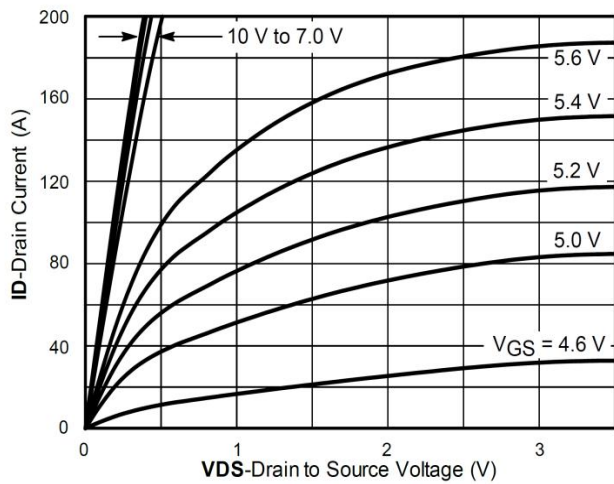
Electrical characteristics (Ta=25°C, unless otherwise noted)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Static Characteristics						
Drain-Source Breakdown Voltage	BV _{DSS}	VGS=0V , ID=250uA	60	-	-	V
Drain-Source Leakage Current	IDSS	VDS=48V , VGS=0V	-	-	1	uA
Gate-Source Leakage Current	IGSS	VGS=±20V , VDS=0V	-	-	±100	nA
Gate Threshold Voltage	VGS(th)	VGS=VDS , ID=250uA	2.4	3.0	3.4	V
Static Drain-Source On-Resistance	RDS(ON)	VGS=10V , ID=30A	-	1.7	2.2	mΩ
Gate Resistance	RG	f=1MHz	-	0.8	-	Ω
Dynamic characteristics						
Input Capacitance	Ciss	VDS=30V , VGS=0V , f=1MHz	-	6430	-	pF
Output Capacitance	Coss		-	2714	-	
Reverse Transfer Capacitance	Crss		-	150	-	
Total Gate Charge	Qg	VDS=30V , VGS=10V , ID=50A	-	91	-	nC
Gate-Source Charge	Qgs		-	30	-	
Gate-Drain Charge	Qgd		-	15	-	
Gate Plateau Voltage	Vplateau		-	4.6	-	V
Switching Characteristics						
Turn-On Delay Time	Td(on)	VDD=30V , VGS=10V , RG=2Ω , ID=50A	-	22	-	nS
Rise Time	Tr		-	54	-	
Turn-Off Delay Time	Td(off)		-	62.8	-	
Fall Time	Tf		-	26.4	-	
Diode Characteristics						
Diode Forward Voltage	VSD	IS=1A , VGS=0V , TJ=25℃	-	-	1.2	V
Maximum Body-Diode Continuous Current	IS		-	-	200	A
Reverse Recovery Time	Trr	IS=50A , di/dt=100A/us , TJ=25℃	-	62	-	nS
Reverse Recovery Charge	Qrr		-	90.8	-	nC

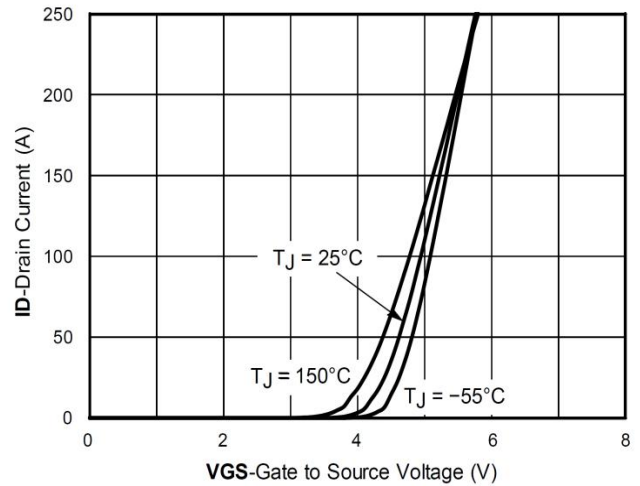
Note:

- The test condition is $V_{DD}=30V$, $V_{GS}=10V$, $L=0.5mH$, $R_G=25\Omega$;

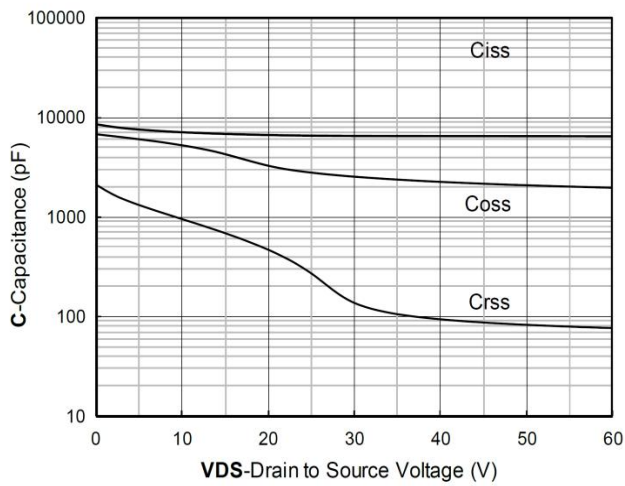
Typical Characteristics



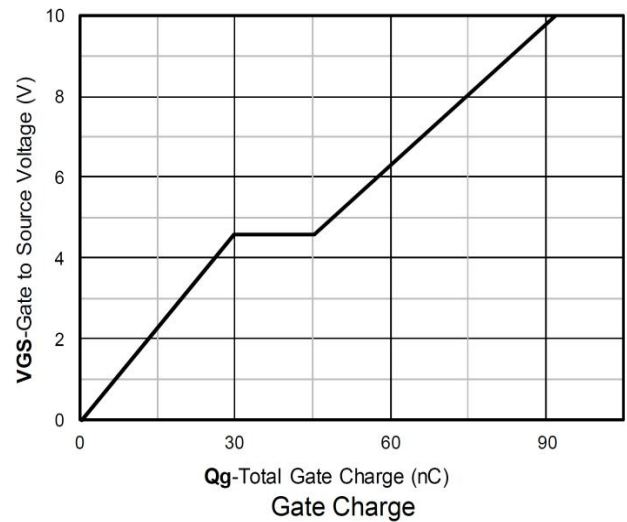
Output Characteristics



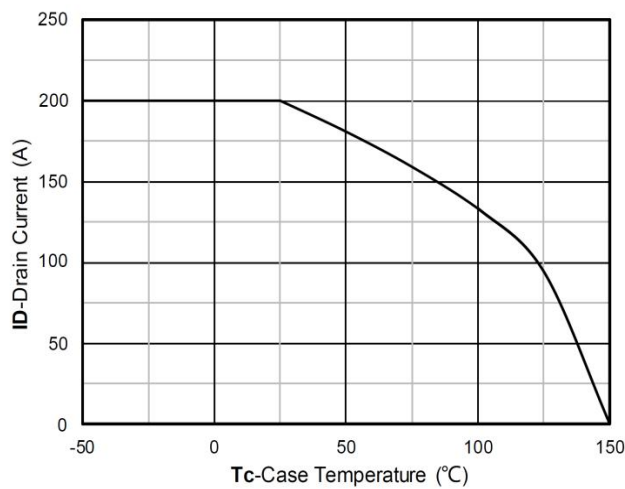
Transfer Characteristics



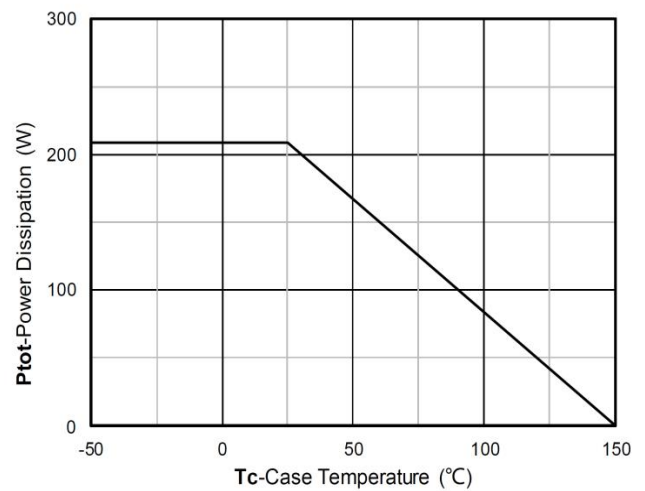
Capacitance Characteristics



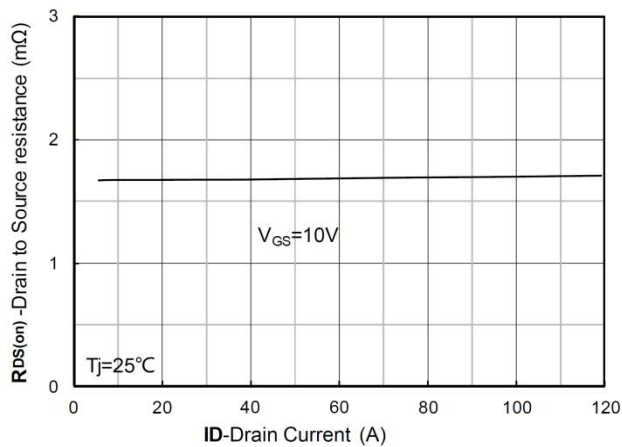
Gate Charge



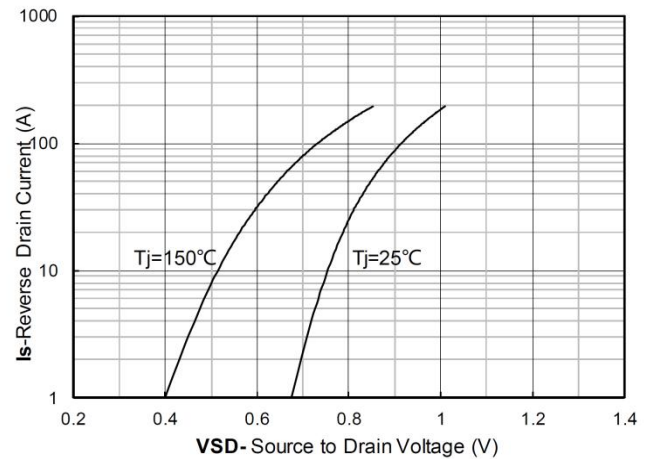
Current dissipation



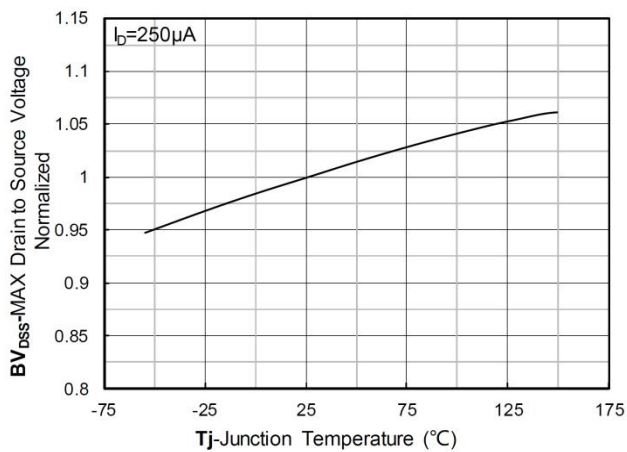
Power dissipation



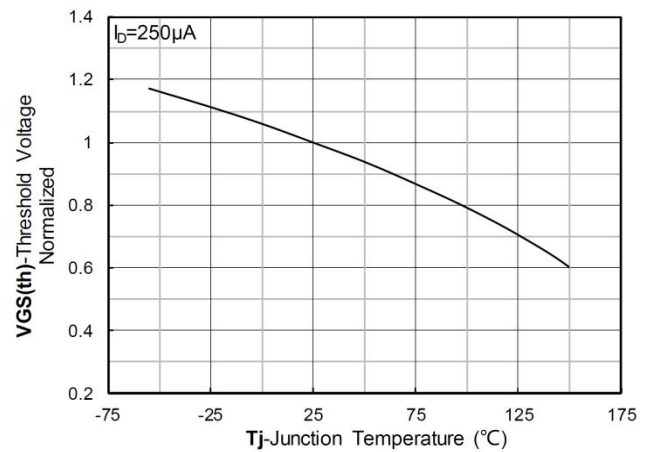
$R_{DS(on)}$ vs. Drain Current



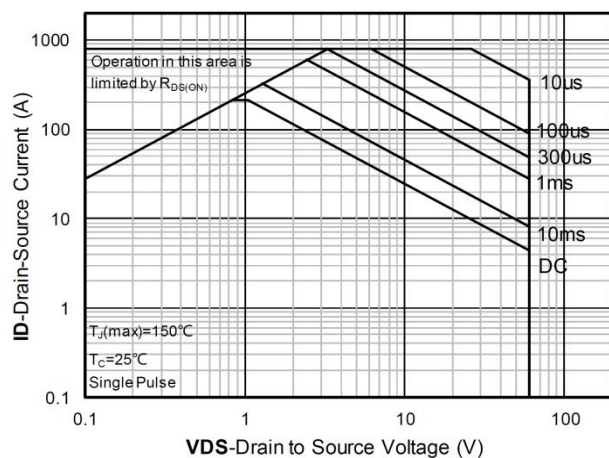
Forward characteristics of reverse diode



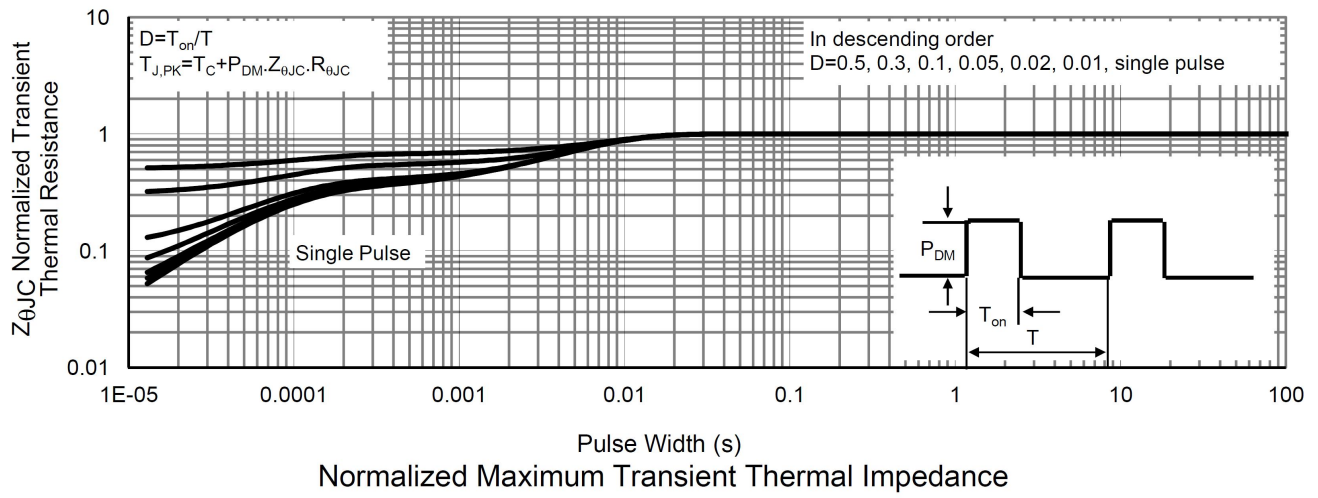
Normalized breakdown voltage



Normalized Threshold voltage

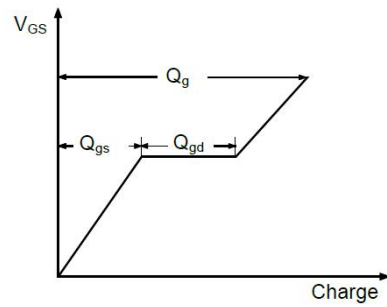
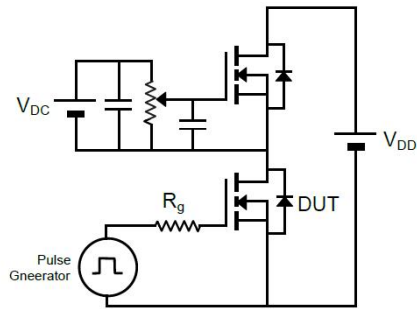


Safe Operation Area

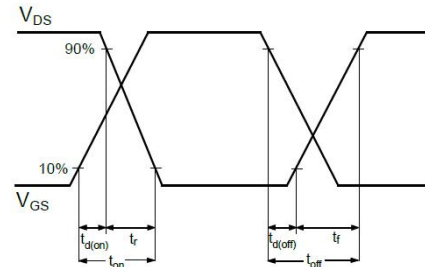
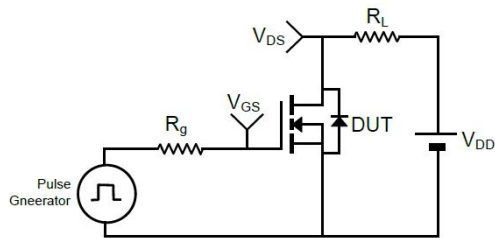


Test Circuit

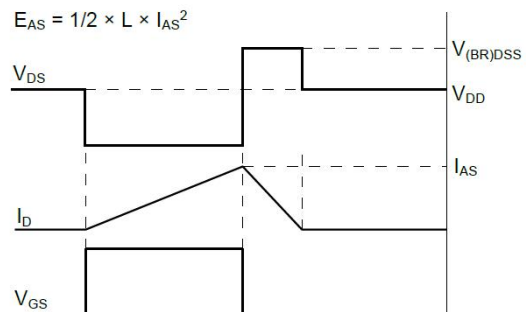
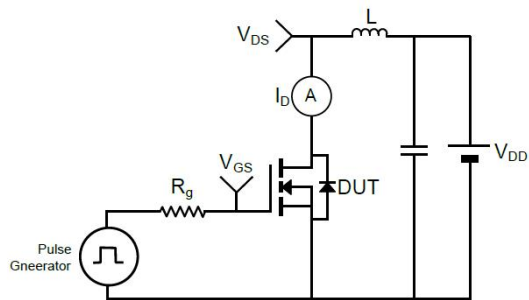
Gate Charge



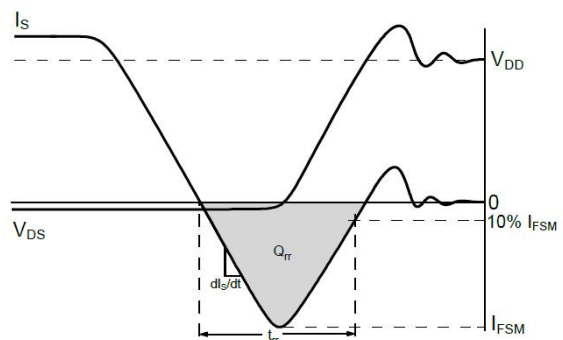
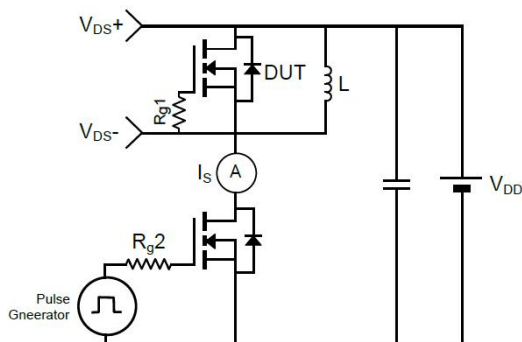
Resistive Load Switching Time



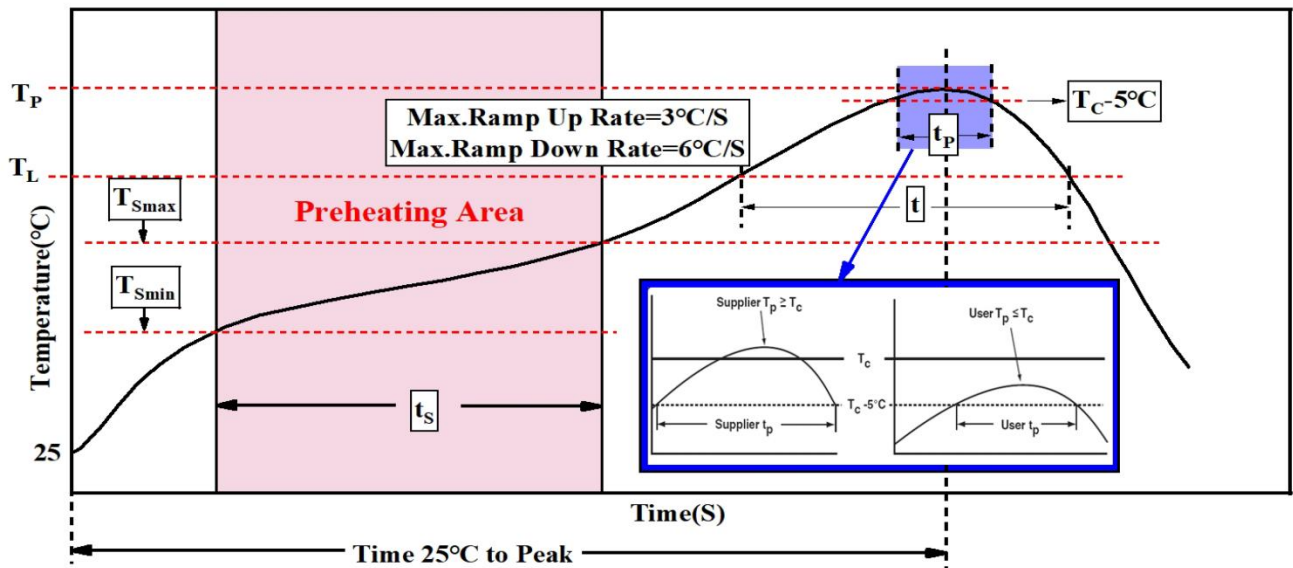
Un-clamped Inductive Load Switching



Drain-Source Body Diode Reverse Recovery



Temperature Profile for IR Reflow Soldering



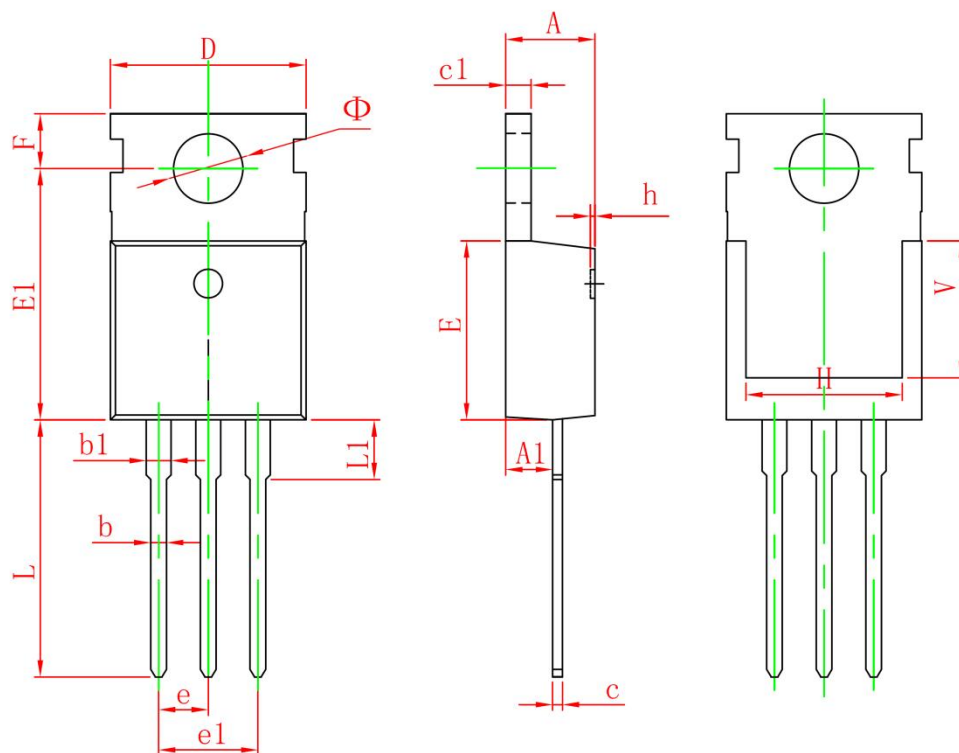
Profile Feature	Sn-Pb Eutectic Assembly	Pb-Free Assembly
Preheat & Soak		
Temperature min (T_{Smin})	100°C	150°C
Temperature max (T_{Smax})	150°C	200°C
Time (T_{Smin} to T_{Smax}) (t_s)	60-120 seconds	60-120 seconds
Average ramp-up rate (T_{Smax} to T_P)	3 °C/second max.	3°C/second max.
Liquidous temperature (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