

Product Summary

$V_{(BR)DSS}$	$R_{DS(on)TYP}$	I_D
200V	9.5mΩ@10V	110A



合肥矽普半导体

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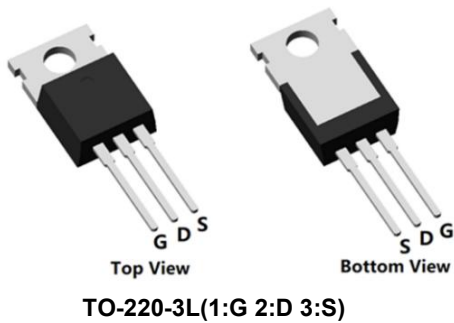
Feature

- Fast Switching
- Low Gate Charge and Rdson
- 175°C Junction Temperature
- **100% UIS TESTED**

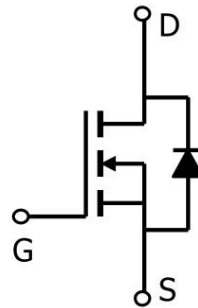
Applications

- Power switching application
- DC-DC Converter
- Power Management

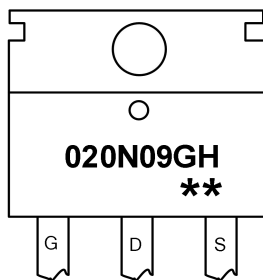
Package



Circuit diagram



Marking



020N09GH : Product code
****** : Week code

Order Information

Device	Package	Unit/Tube
SP020N09GHTQ	TO-220-3L	50

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

Parameter	Symbol	Rating	Unit
Drain-Source Voltage	V _{DS}	200	V
Gate-Source Voltage	V _{GS}	±20	V
Continuous Drain Current (Tc=25°C)	I _D	110	A
Continuous Drain Current (Tc=100°C)	I _D	73	A
Pulsed Drain Current	I _{DM}	440	A
Single Pulse Avalanche Energy ¹	E _{AS}	1296	mJ
Power Dissipation (Tc=25°C)	P _D	270	W
Power Dissipation (Tc=100°C)	P _D	135	W
Thermal Resistance Junction-to-Case	R _{θJC}	0.56	°C/W
Storage Temperature Range	T _{STG}	-55 to 175	°C
Operating Junction Temperature Range	T _J	-55 to 175	°C

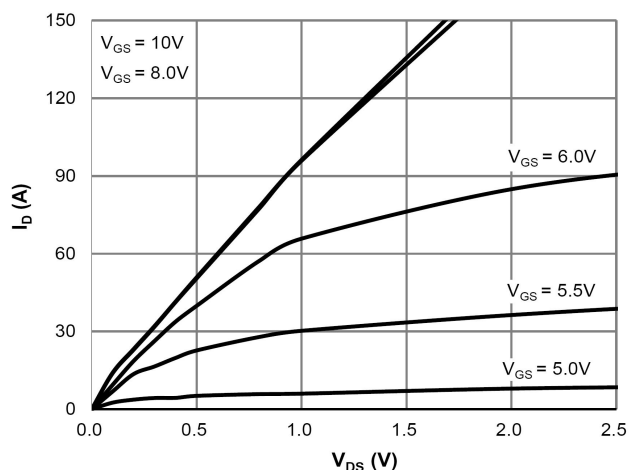
Electrical characteristics (Ta=25°C, unless otherwise noted)

Characteristics	Symbol	Test Condition	Min	Typ	Max	Unit
Static Characteristics						
Drain-Source Breakdown Voltage	BV _{DSS}	ID=250μA , VGS=0V	200	-	-	V
Drain Cut-Off Current	IDSS	VDS=160V , VGS=0V	-	-	1	μA
Gate Leakage Current	IGSS	VGS=±20V , VDS=0V	-	-	±100	nA
Gate Threshold Voltage	VGS(th)	VDS=VGS , ID=250μA	2.9	3.3	3.9	V
Drain-Source ON Resistance	RDS(ON)	VGS=10V , ID=20A	-	9.5	11.5	mΩ
Gate Resistance	RG	f=1MHz	-	7.1	-	Ω
Dynamic Characteristics						
Input Capacitance	Ciss	VDS=100V , VGS=0V , f=1.0MHz	-	4183	-	pF
Output Capacitance	Coss		-	437	-	
Reverse Transfer Capacitance	Crss		-	12	-	
Total Gate Charge	Qg	VDS=100V , VGS=10V , ID=20A	-	62	-	nC
Gate-Source Charge	Qgs		-	16	-	
Gate-Drain Charge	Qgd		-	16	-	
Gate Plateau Voltage	Vplateau		-	5.2	-	V
Switching Characteristics						
Turn-On Delay Time	td(on)	VGS=10V , VDS=100V , ID=20A , RG=6Ω	-	18	-	nS
Rise Time	tr		-	28	-	
Turn-Off Delay Time	td(off)		-	39	-	
Fall Time	tr		-	19	-	
Drain-Source Body Diode Characteristics						
Source-Drain Diode Forward Voltage	VSD	IS=1A , VGS=0V , TJ=25℃	-	-	1.2	V
Maximum Body-Diode Continuous Current	Is		-	-	110	A
Body Diode Reverse Recovery Time	Trr	IS=20A , di/dt=100A/us , TJ=25℃	-	128	-	nS
Body Diode Reverse Recovery Charge	Qrr		-	643	-	nC

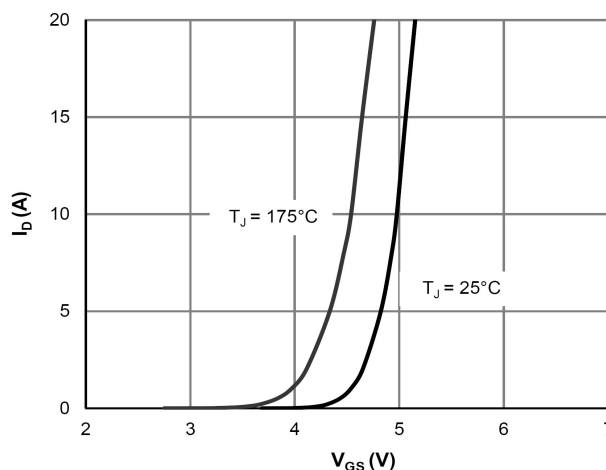
Note:

1. The test condition is VDD=50V, VGS=10V, L=0.5mH, RG=25Ω;

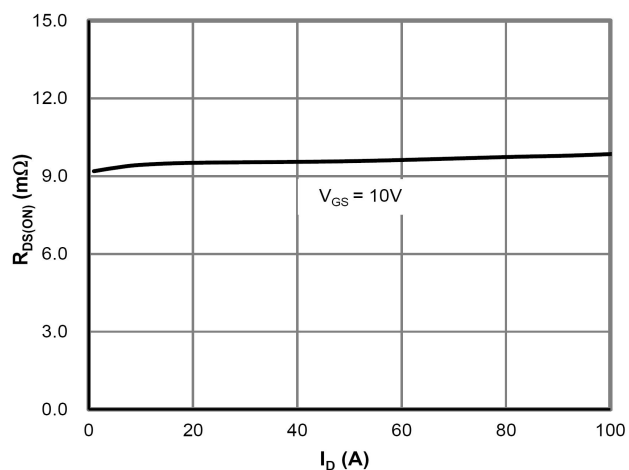
Typical Characteristics



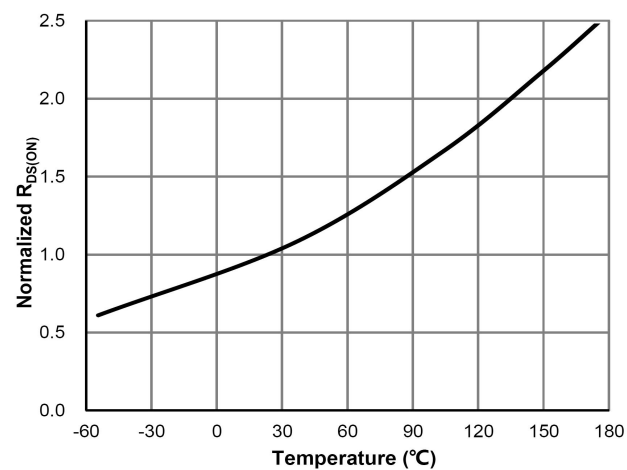
Saturation Characteristics



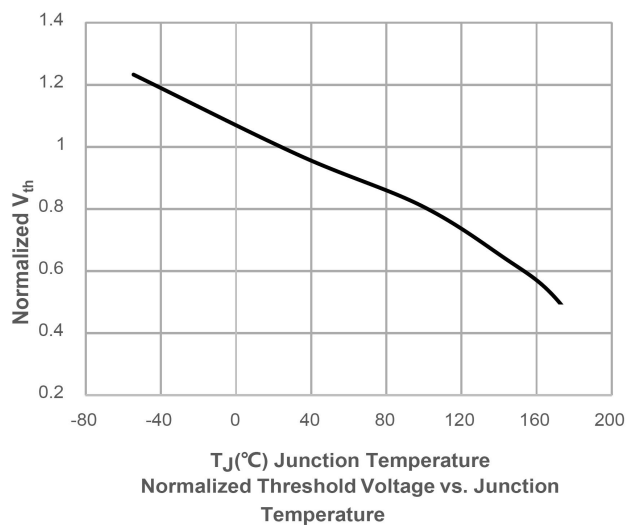
Transfer Characteristics



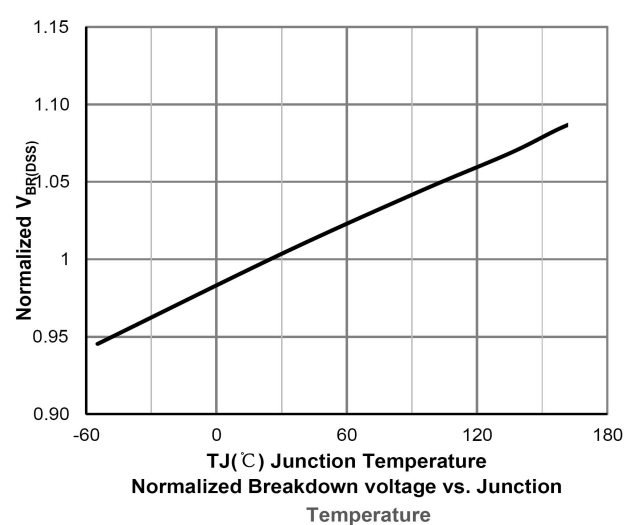
$R_{DS(ON)}$ vs. Drain Current



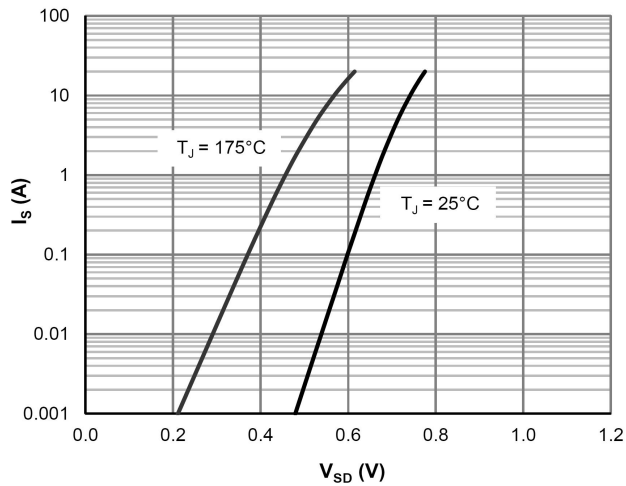
$R_{DS(ON)}$ vs. Junction Temperature



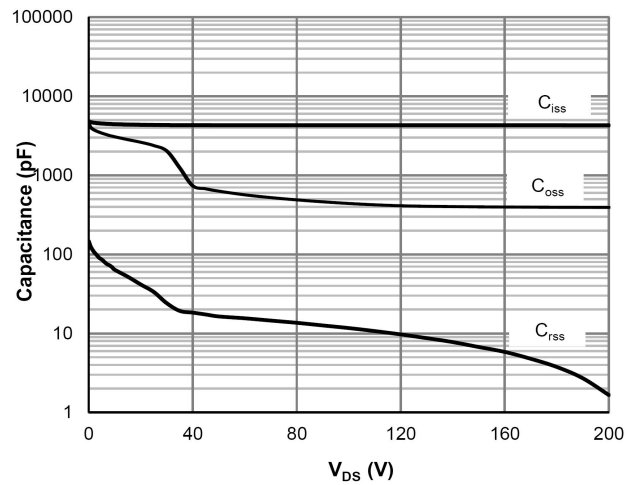
Normalized Threshold Voltage vs. Junction Temperature



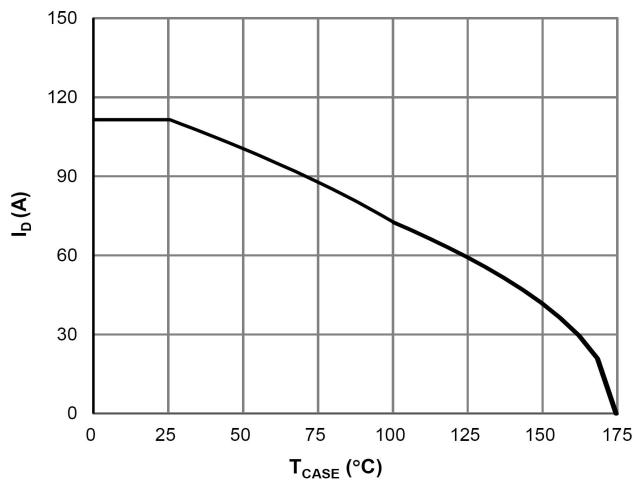
Normalized Breakdown voltage vs. Junction Temperature



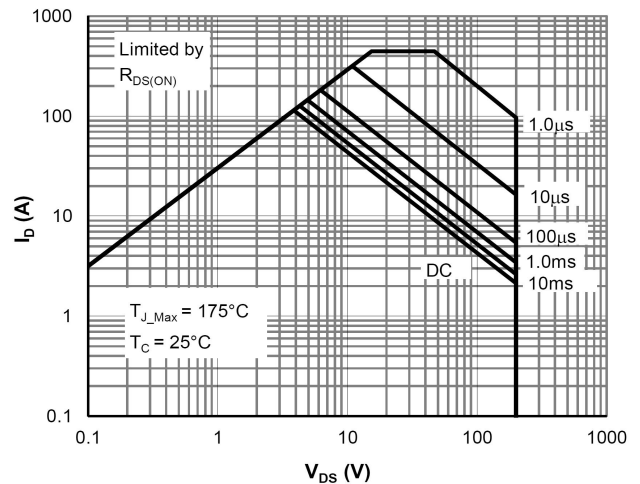
Body-Diode Characteristics



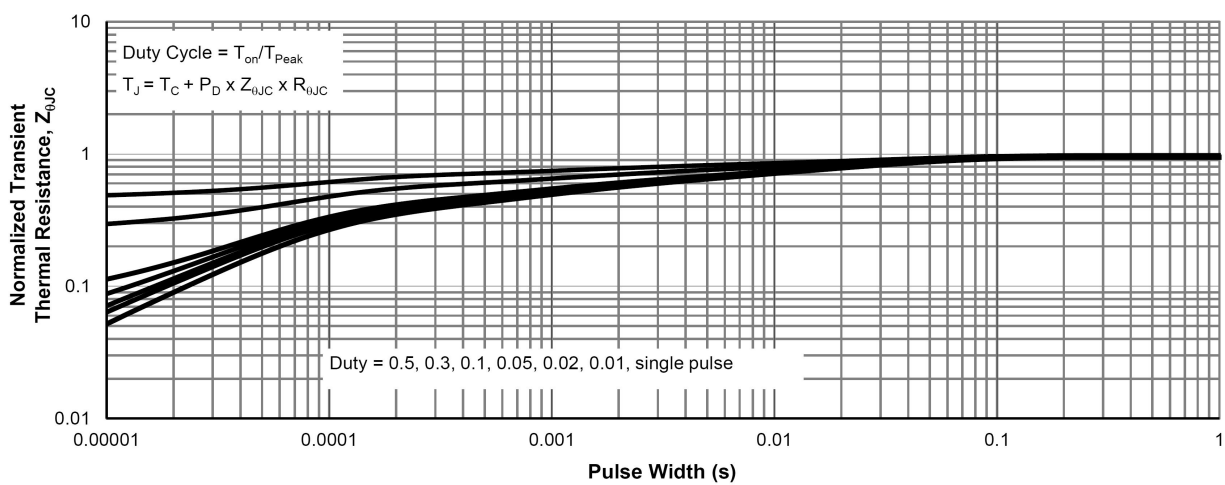
Capacitance Characteristics



Current De-rating



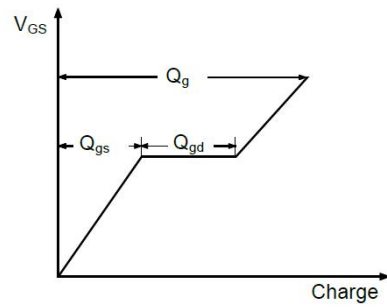
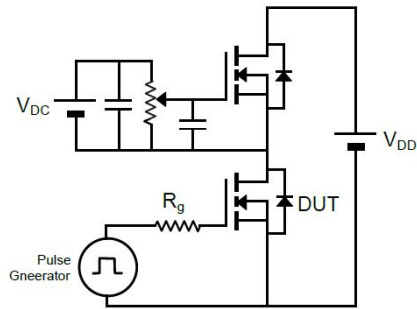
Maximum Safe Operating Area



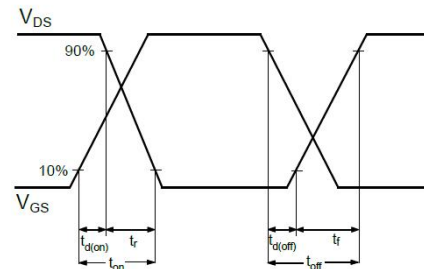
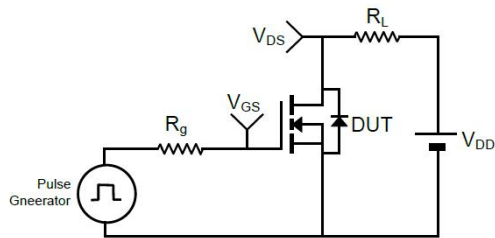
Normalized Maximum Transient Thermal Impedance

Test Circuit

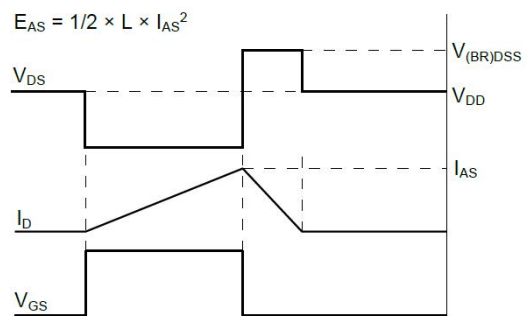
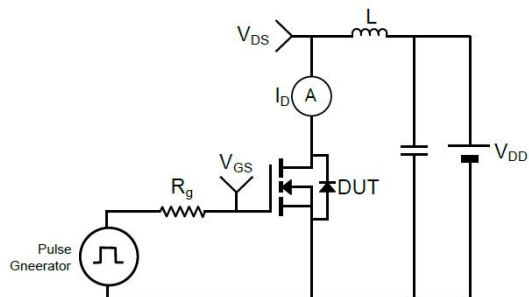
Gate Charge



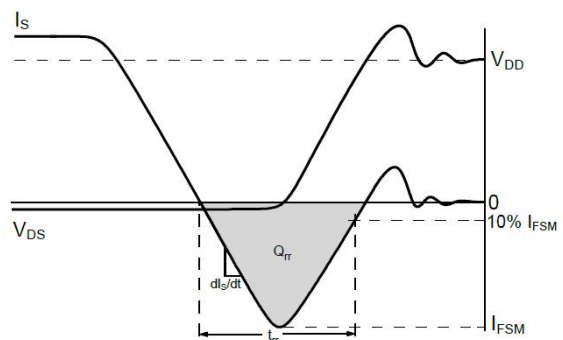
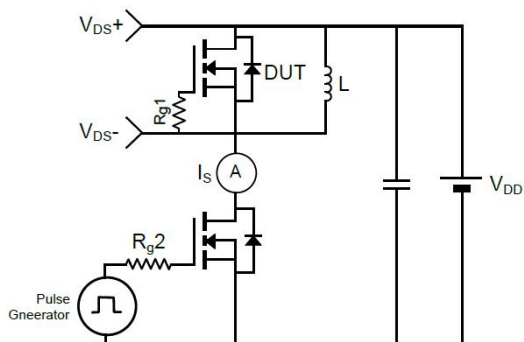
Resistive Load Switching Time



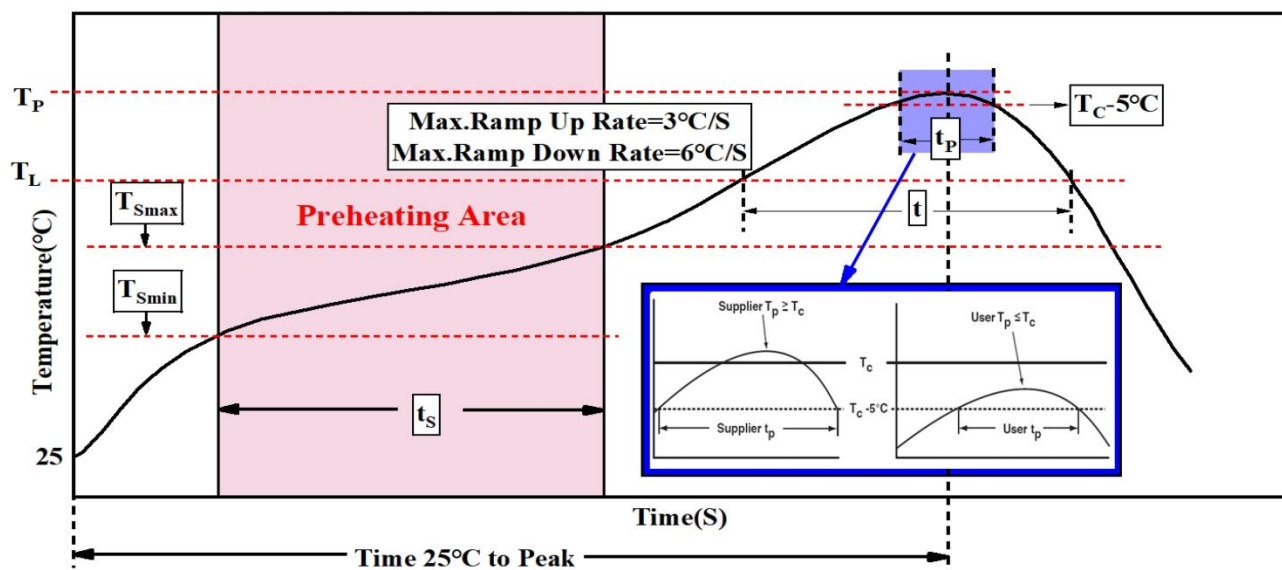
Un-clamped Inductive Load Switching



Drain-Source Body Diode Reverse Recovery



Temperature Profile for IR Reflow Soldering



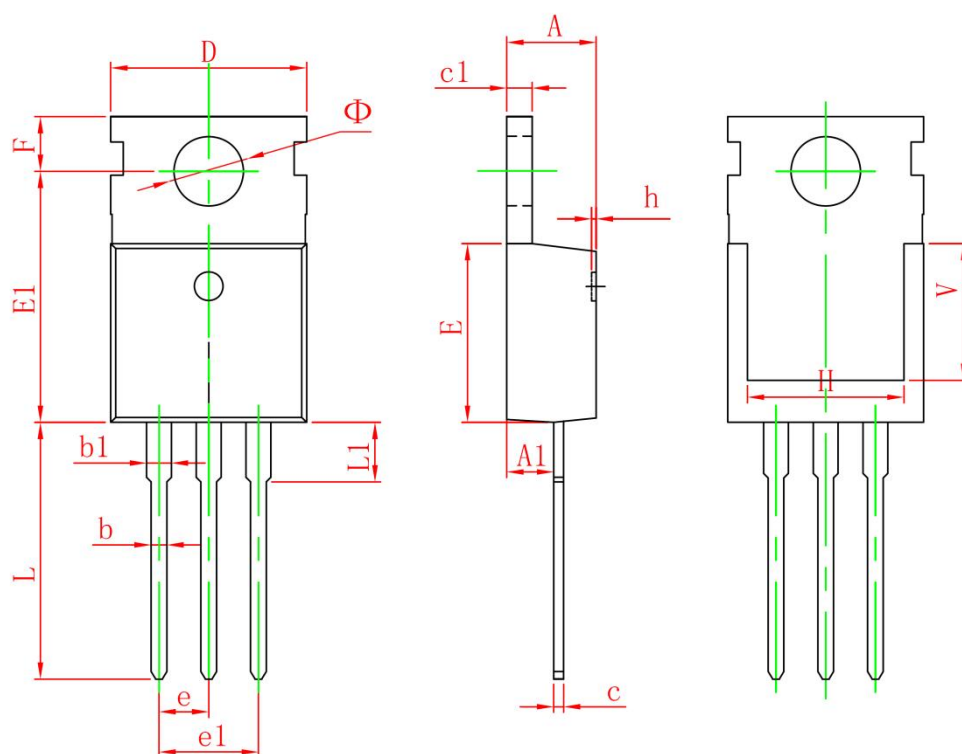
Profile Feature	Sn-Pb Eutectic Assembly	Pb-Free Assembly
Preheat & Soak		
Temperature min (T_{Smin})	100°C	150°C
Temperature max (T_{Smax})	150°C	200°C
Time (T_{Smin} to T_{Smax}) (t_s)	60-120 seconds	60-120 seconds
Average ramp-up rate (T_{Smax} to T_P)	3 °C/second max.	3°C/second max.
Liquidous temperature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