

Product Summary

$V_{(BR)DSS}$	$R_{DS(on)TYP}$	I_D
-60V	5.8mΩ@-10V	-130A
	8.0mΩ@-4.5V	



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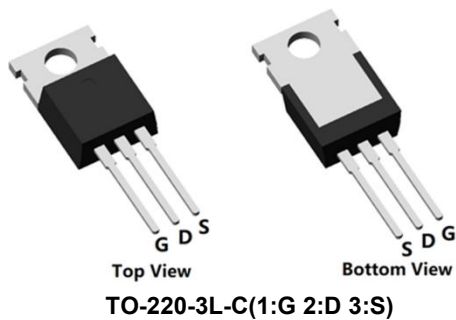
Feature

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

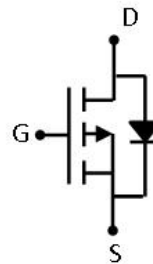
Applications

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

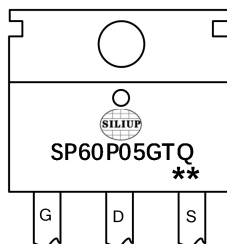
Package



Circuit diagram



Marking



SP60P05GTQ : Product code
** : Week code

Order Information

Device	Package	Unit/Tube
SP60P05GTQ	TO-220-3L	50

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

Parameter	Symbol	Rating	Unit
Drain-Source Voltage	V_{DS}	-60	V
Gate-Source Voltage	V_{GS}	± 20	V
Continuous Drain Current (Tc=25°C)	I_D	-130	A
Continuous Drain Current (Tc=100°C)	I_D	-87	A
Pulse Drain Current Tested	I_{DM}	-520	A
Single pulsed avalanche energy ¹	E_{AS}	1092	mJ
Maximum Power Dissipation (Tc=25°C)	P_D	153	W
Maximum Power Dissipation (Tc=100°C)	P_D	61	W
Thermal Resistance-Junction to Case	$R_{\theta JC}$	0.82	°C/W
Maximum Junction Temperature	T_{STG}	-55 to 150	°C
Storage Temperature Range	T_J	-55 to 150	°C

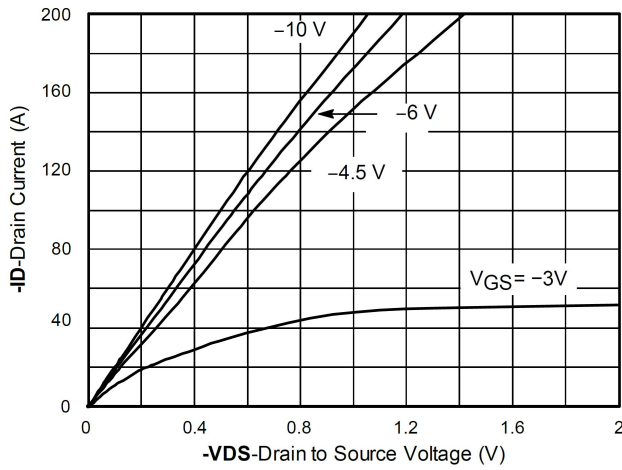
Electrical characteristics (Ta=25°C, unless otherwise noted)

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 , TJ=25℃	-	-	-1	uA
Gate-Source Leakage Current	IGSS	VGS=±20V , VDS=0V	-	-	±100	nA
Gate Threshold Voltage	VGS(th)	VGS=VDS , ID=-250uA	-1.6	-2.0	-2.5	V
Static Drain-Source On-Resistance	RDS(ON)	VGS=-10V , ID=-30A	-	5.8	7.3	mΩ
		VGS=-4.5V , ID=-30A	-	8.0	10.5	
Gate Resistance	RG	VDS=-30V , VGS=0V , f=1MHz	-	2.08	-	Ω
Dynamic characteristics						
Input Capacitance	Ciss	VDS=-30V , VGS=0V , f=1MHz	-	5208	-	pF
Output Capacitance	Coss		-	922	-	
Reverse Transfer Capacitance	Crss		-	84	-	
Total Gate Charge	Qg	VDS=-30V , VGS=-10V , ID=-20A	-	76	-	nC
Gate-Source Charge	Qgs		-	20	-	
Gate-Drain Charge	Qgd		-	14	-	
Gate Plateau Voltage	Vplateau		-	-3.8	-	V
Switching Characteristics						
Turn-On Delay Time	Td(on)	VDD=-30V , VGS=-10V , RG=3Ω , ID=-20A	-	20	-	ns
Rise Time	Tr		-	12	-	
Turn-Off Delay Time	Td(off)		-	42	-	
Fall Time	Tf		-	12	-	
Diode Characteristics						
Diode Forward Voltage	VSD	VGS=0V , IS=-1A , TJ=25℃	-	-	-1.2	V
Diode Continuous Current	IS		-	-	-130	A
Reverse recover time	Trr	IS=-40A , di/dt=200A/us , TJ=25℃	-	72	-	ns
Reverse recovery charge	Qrr		-	88	-	nC

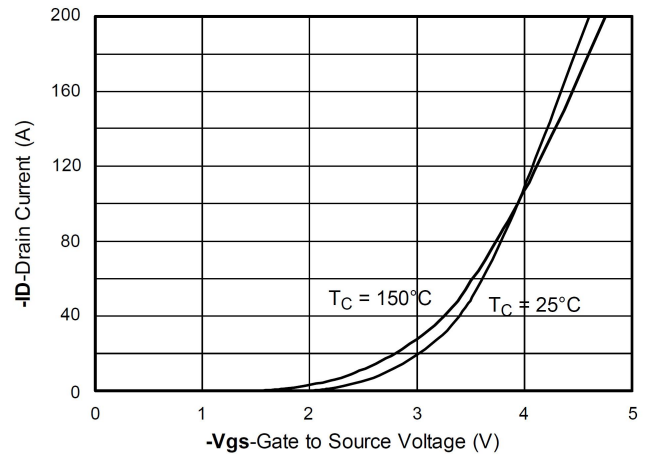
Note:

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

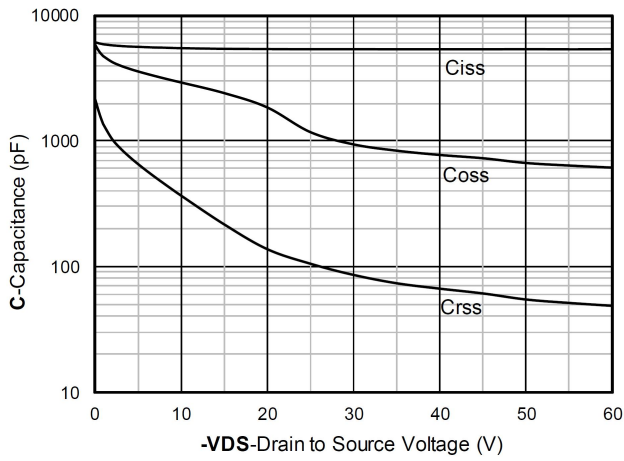
Typical Characteristics



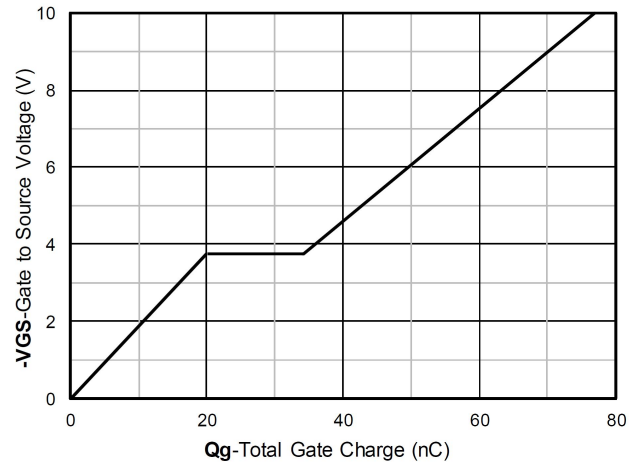
Output Characteristics



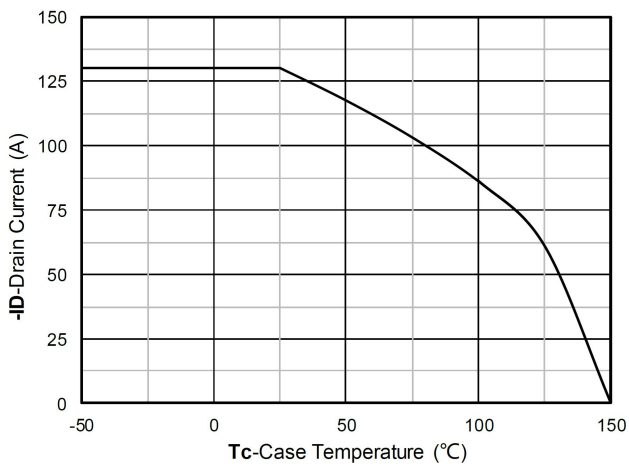
Transfer Characteristics



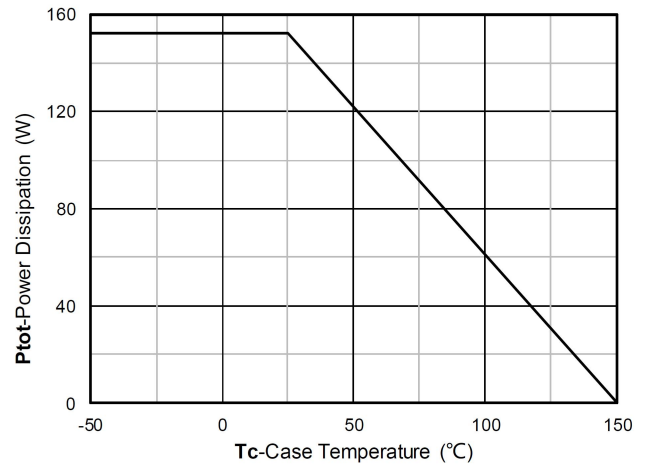
Capacitance Characteristics



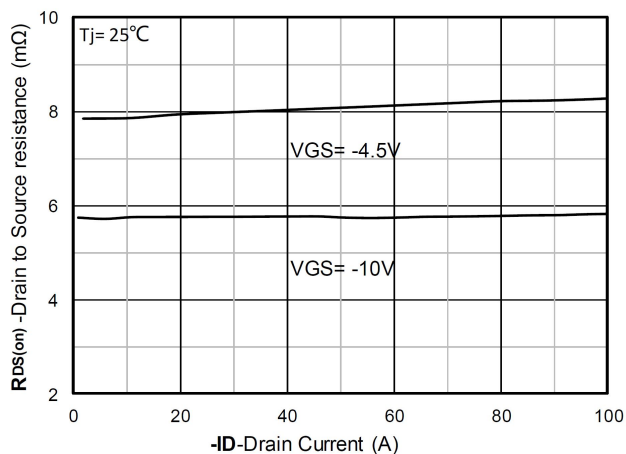
Gate Charge



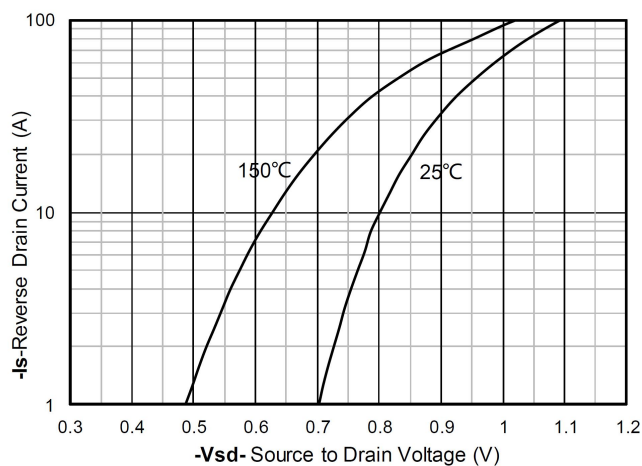
Current dissipation



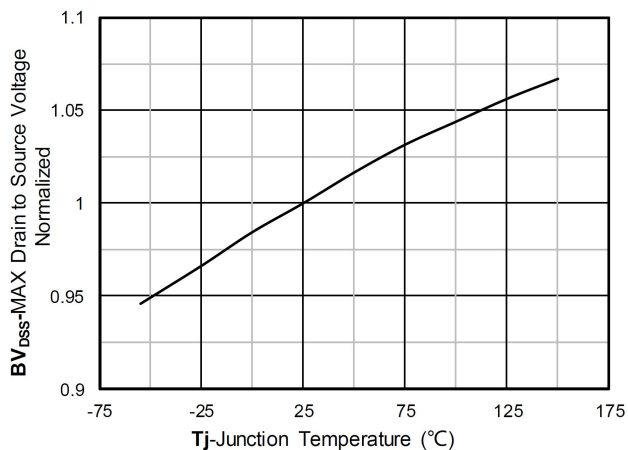
Power dissipation



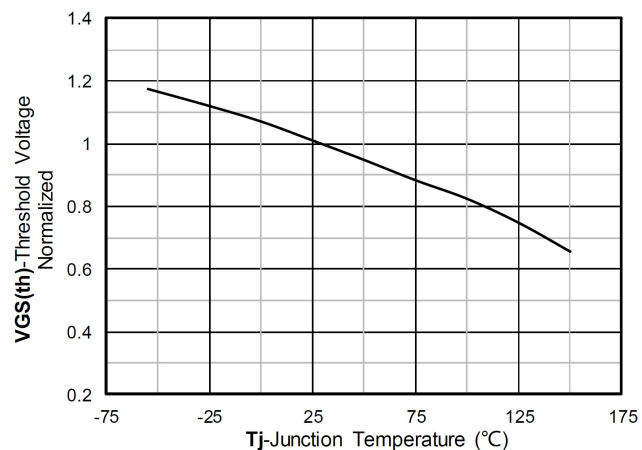
RDS(on) VS Drain Current



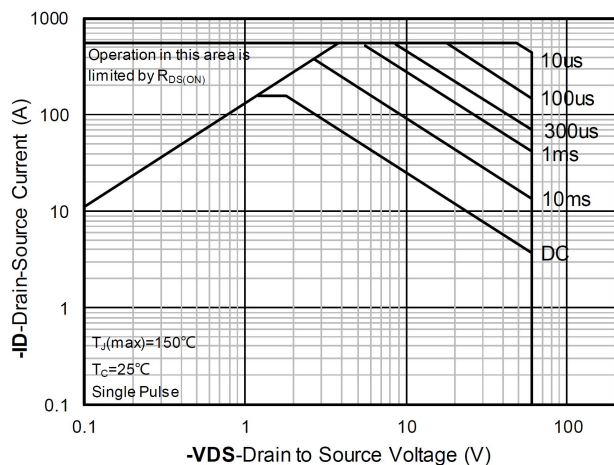
Forward characteristics of reverse diode



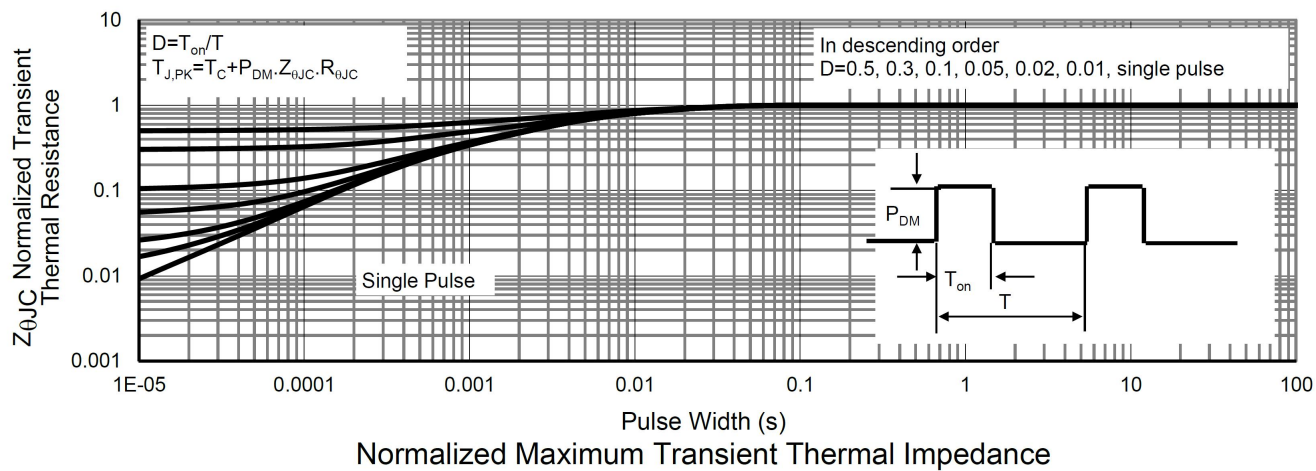
Normalized breakdown voltage



Normalized Threshold voltage

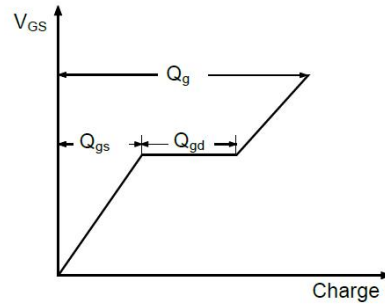
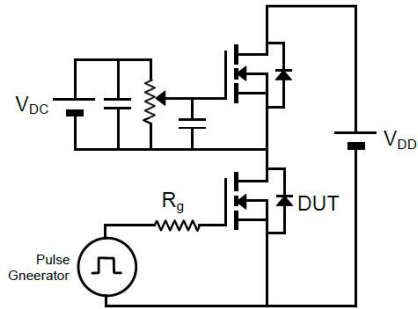


Safe Operation Area

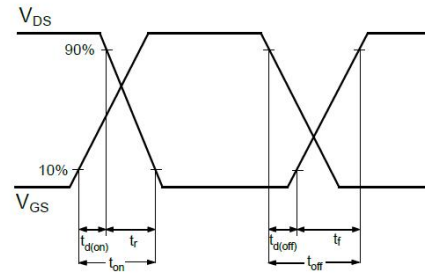
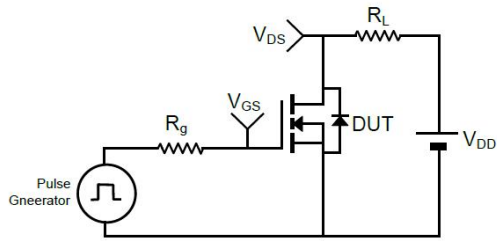


Test Circuit

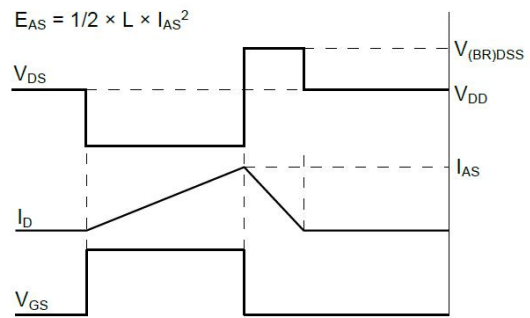
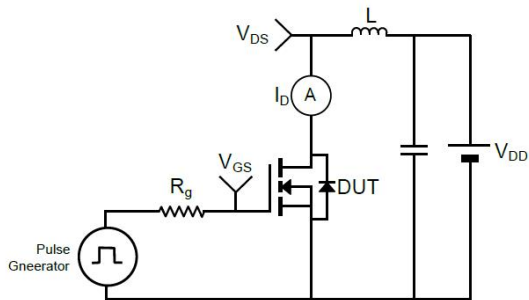
Gate Charge



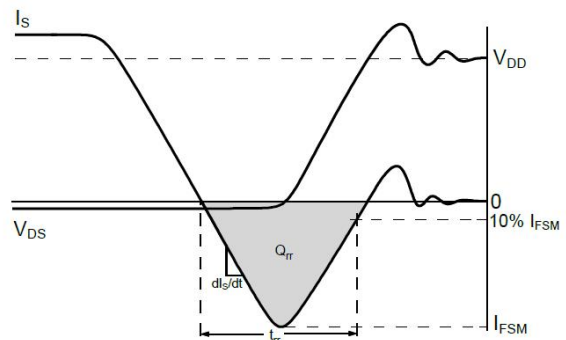
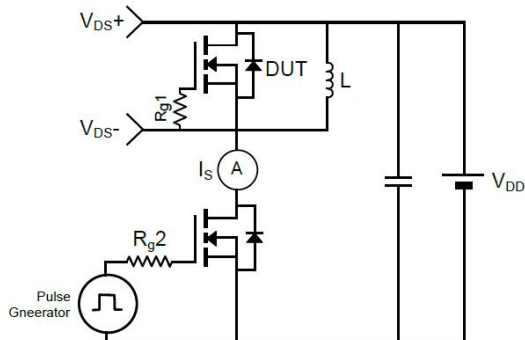
Resistive Load Switching Time



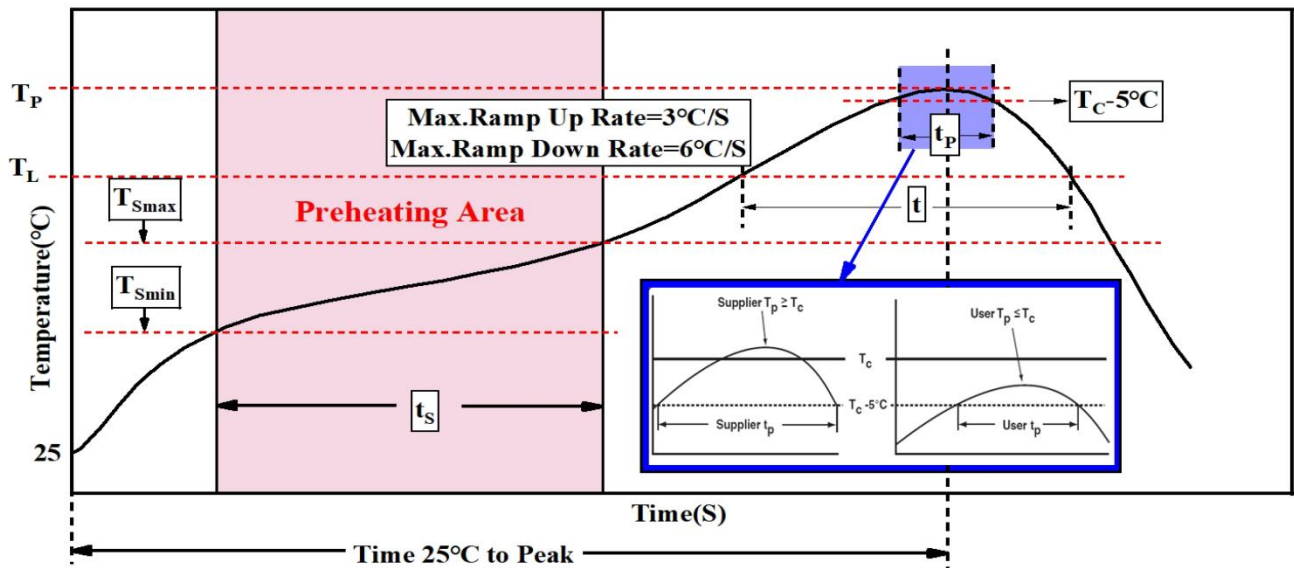
Un-clamped Inductive Load Switching



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 _{min})	100°C	150°C
Temperature max (T _{max})	150°C	200°C
Time (T _{min} to T _{max}) (t _s)	60-120 seconds	60-120 seconds
Average ramp-up rate (T _{max} 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 _{max})	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)

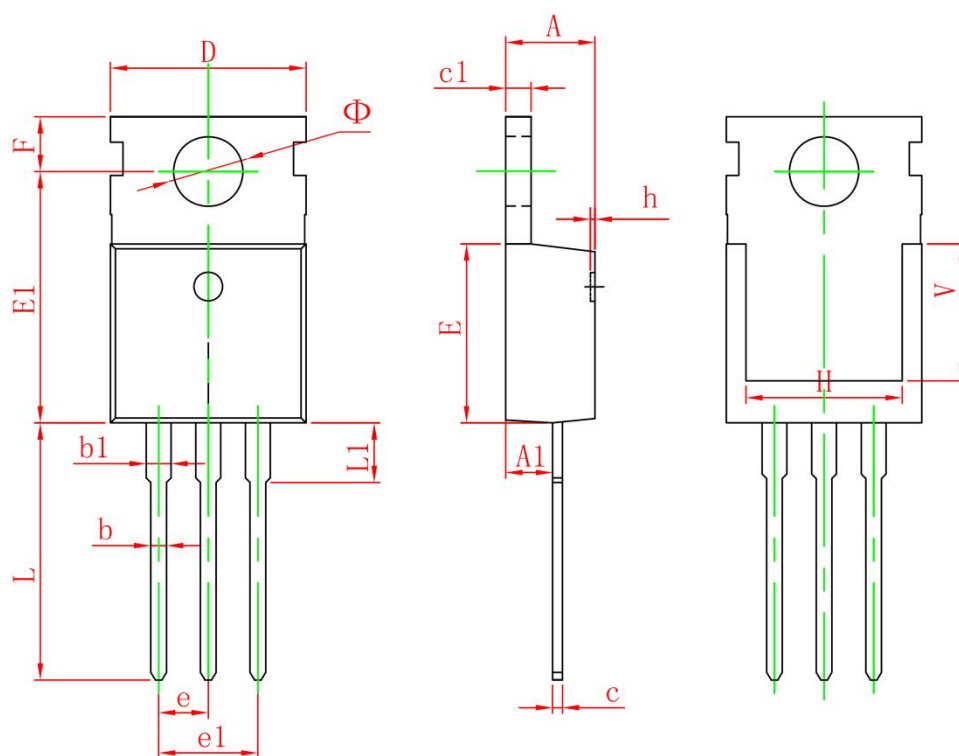
Package Thickness	Volume mm ³ <350	Volume mm ³ ≥350
<2.5 mm	235 °C	220 °C
≥2.5 mm	220 °C	220 °C

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