

Product Summary

$V_{(BR)DSS}$	$R_{DS(on)TYP}$	I_D
650V	165mΩ@10V	20A



合肥矽普半导体

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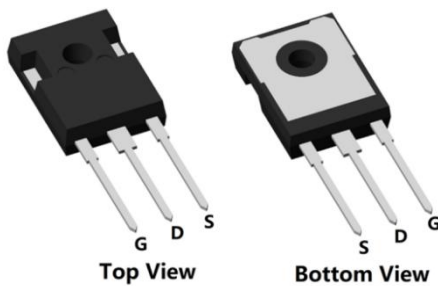
Feature

- Fast Switching
- Low Gate Charge and Rdson
- **100% UIS TESTED**

Applications

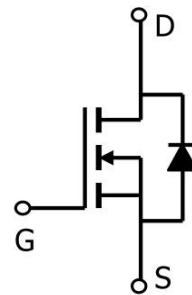
- PWM Application
- Hard switched and high frequency circuits
- Power Management

Package

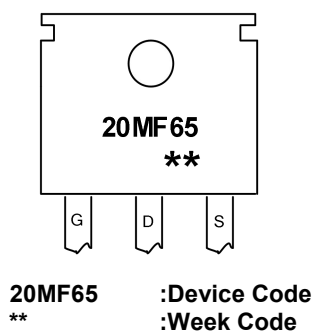


TO-247(1:G 2:D 3:S)

Circuit diagram



Marking



Order Information

Device	Package	Unit/Tube
SP20MF65TF	TO-247	30

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

Parameter	Symbol	Rating	Units
Drain-Source Voltage	V_{DS}	650	V
Gate-Source Voltage	V_{GS}	± 30	V
Continuous Drain Current (Tc=25°C)	I_D	20	A
Continuous Drain Current (Tc=100°C)	I_D	13	A
Pulsed Drain Current	I_{DM}	80	A
Single Pulse Avalanche Energy ¹	E_{AS}	485	mJ
Power Dissipation (Tc=25°C)	P_D	138	W
Power Dissipation (Tc=100°C)	P_D	55.2	W
Thermal Resistance Junction-to-Case	$R_{\theta JC}$	0.91	°C/W
Recovery diode dv/dt	dv/dt	50	V/ns
Storage Temperature Range	T_{STG}	-55 to 150	°C
Operating Junction Temperature Range	T_J	-55 to 150	°C

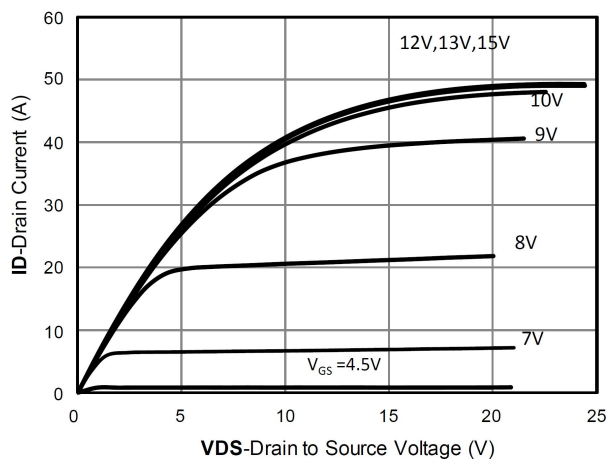
Electrical characteristics (Ta=25°C, unless otherwise noted)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Static Characteristics						
Drain-Source Breakdown Voltage	B _V DSS	ID=250μA , VGS=0V	650	-	-	V
Drain-Source Leakage Current	I _D SS	VDS=520V , VGS=0V	-	-	1	uA
Gate-Source Leakage Current	I _G SS	VGS=±30V , VDS=0V	-	-	±100	nA
Gate Threshold Voltage	V _{GS} (th)	VDS=VGS , ID=250μA	3	4	5	V
Static Drain-Source On-Resistance	R _{DS} (ON)	VGS=10V , ID=10A	-	165	190	mΩ
Gate Resistance	R _G	f=1MHz	-	13	-	Ω
Dynamic characteristics						
Input Capacitance	C _{iss}	VDS=100V , VGS=0V , f=1MHz	-	1100	-	pF
Output Capacitance	C _{oss}		-	65	-	
Reverse Transfer Capacitance	C _{rss}		-	0.8	-	
Total Gate Charge	Q _g	VDS=480V , VGS=10V , ID=10A	-	36	-	nC
Gate-Source Charge	Q _{gs}		-	10	-	
Gate-Drain Charge	Q _{gd}		-	20	-	
Gate Plateau Voltage	V _{plateau}		-	7.7	-	V
Switching Characteristics						
Turn-On Delay Time	T _d (on)	VDD=400V , VGS=10V , RG=2Ω, ID=10A	-	46	-	nS
Rise Time	T _r		-	61	-	
Turn-Off Delay Time	T _d (off)		-	120	-	
Fall Time	T _f		-	34	-	
Diode Characteristics						
Diode Forward Voltage	V _{SD}	VGS=0V , IS=1A , TJ=25℃	-	-	1.2	V
Maximum Body-Diode Continuous Current	I _S		-	-	20	A
Reverse recover time	T _{rr}	IS=10A , di/dt=100A/us , TJ=25℃	-	95	-	nS
Reverse recovery charge	Q _{rr}		-	0.32	-	uC

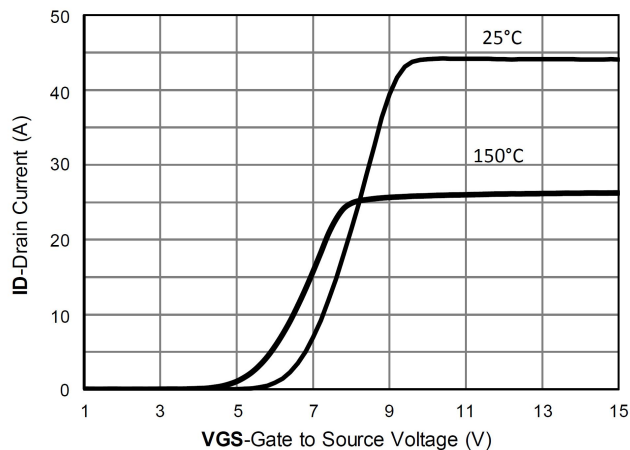
Note :

1. The test condition is $V_{DD}=100V$, $V_{GS}=10V$, $L=10mH$, $R_G=25\Omega$;

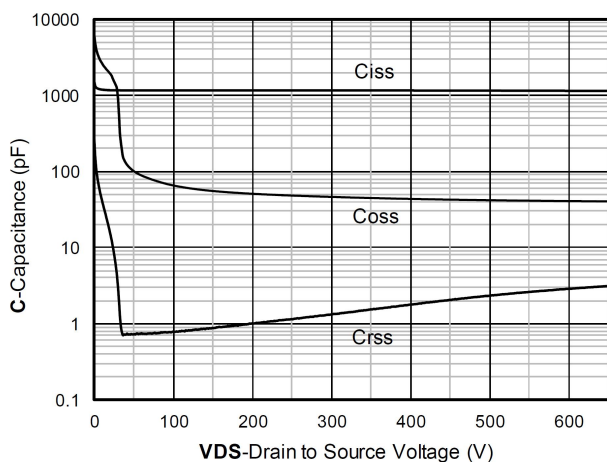
Typical Characteristics



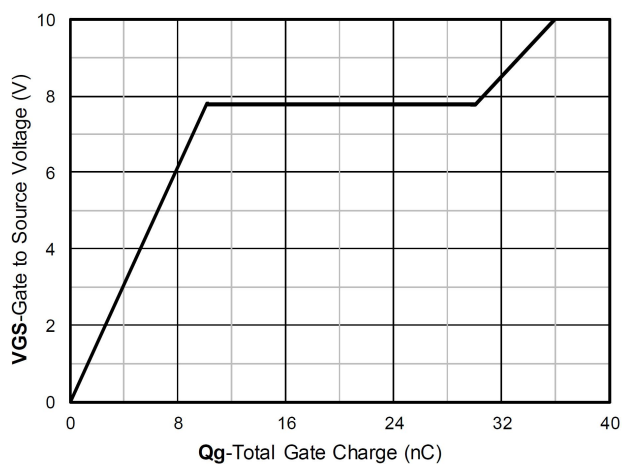
Output Characteristics; typical values



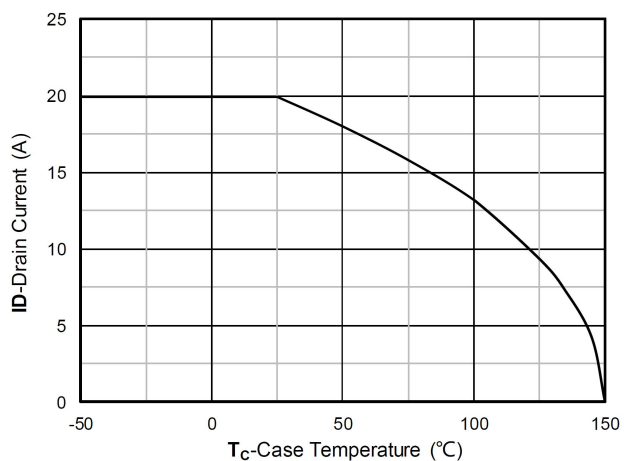
Transfer Characteristics; typical values



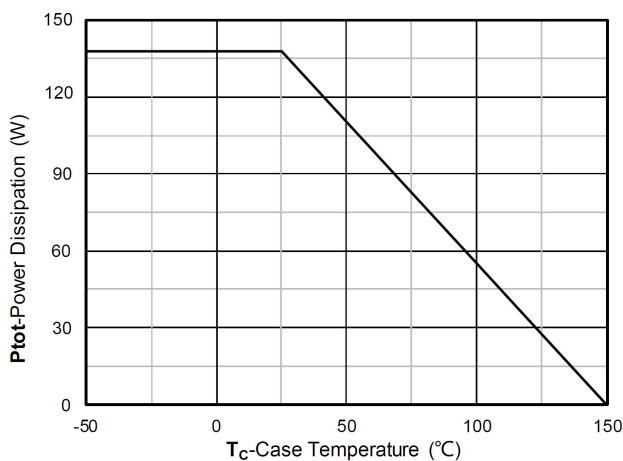
Capacitance Characteristics; typical values



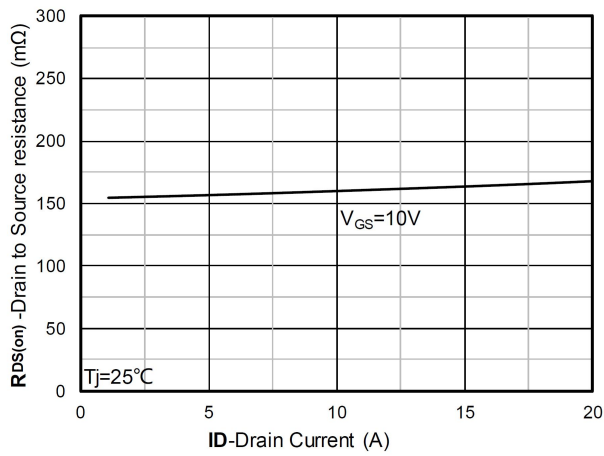
Gate Charge; typical values



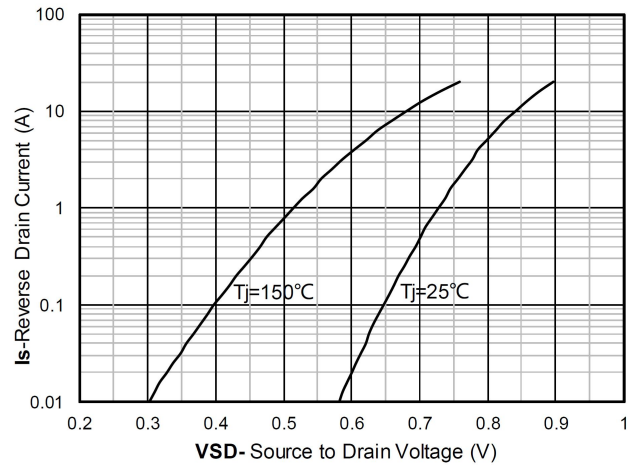
Current dissipation



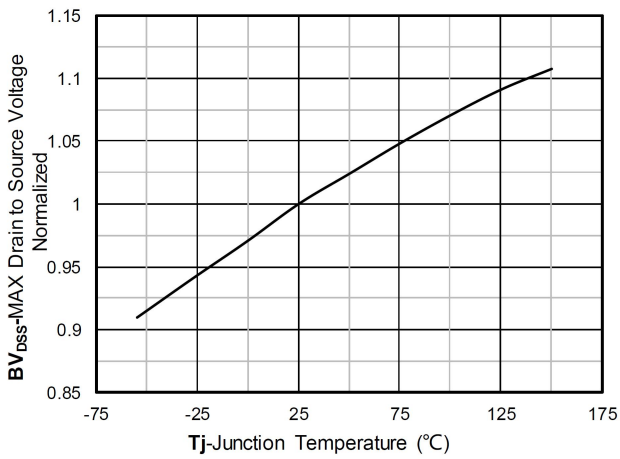
Power dissipation



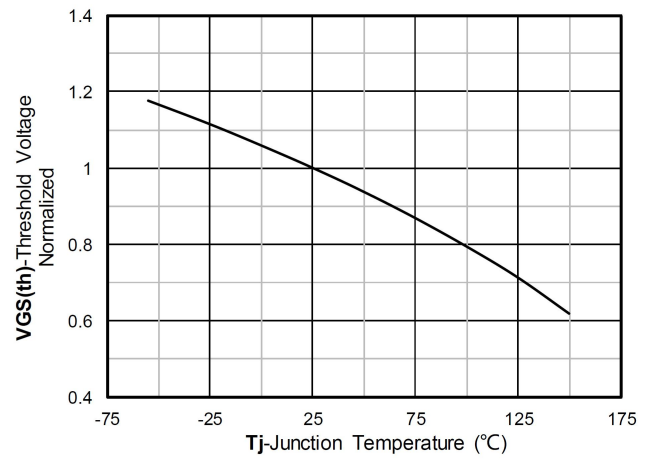
$R_{DS(on)}$ vs. Drain Current



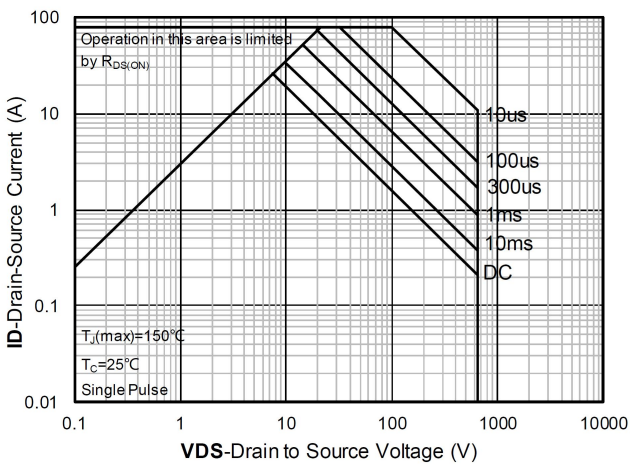
Forward characteristics of reverse diode



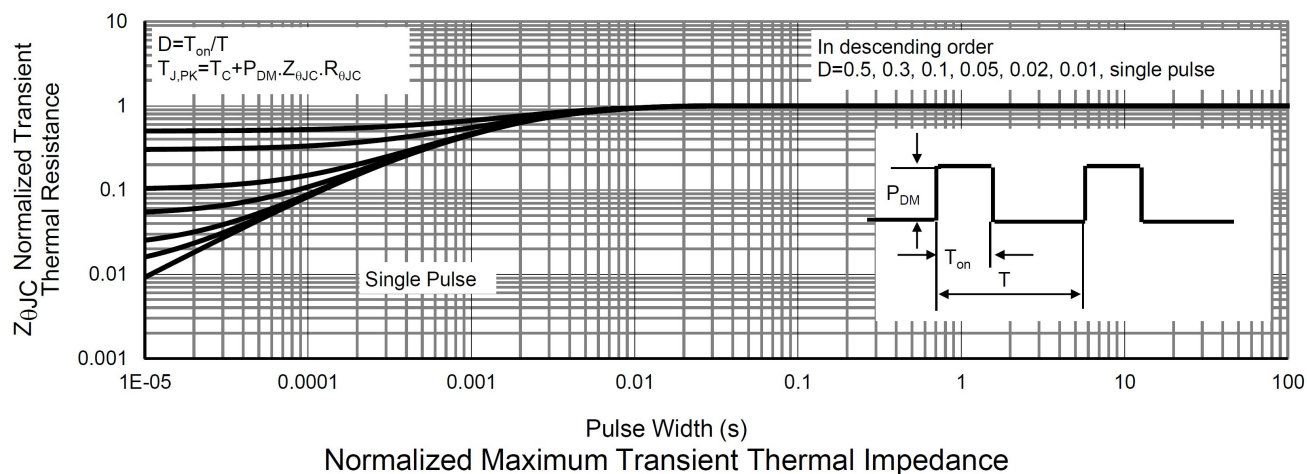
Normalized breakdown voltage



Normalized Threshold voltage

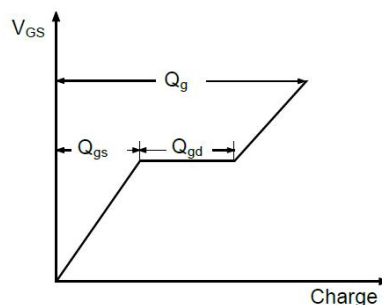
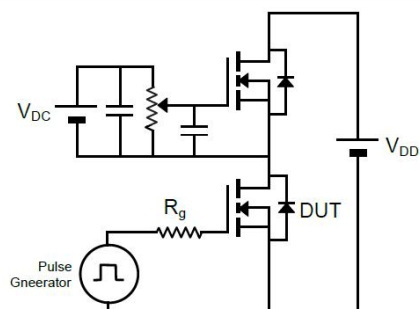


Safe Operation Area

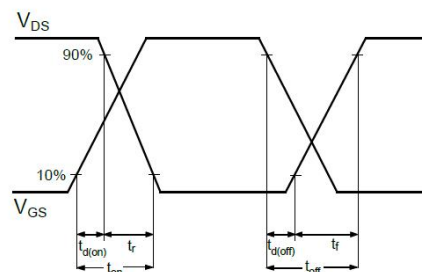
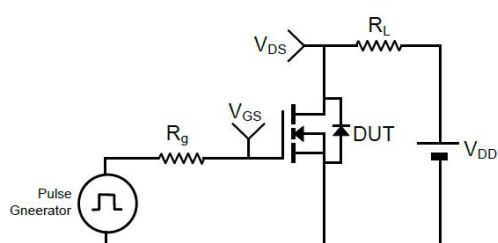


Test Circuit

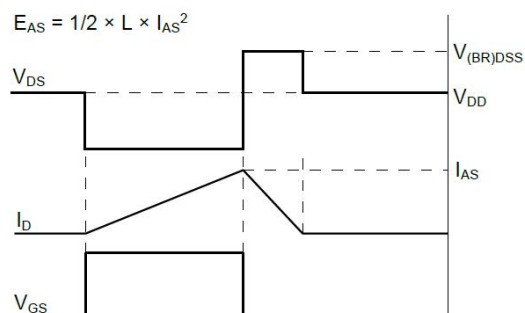
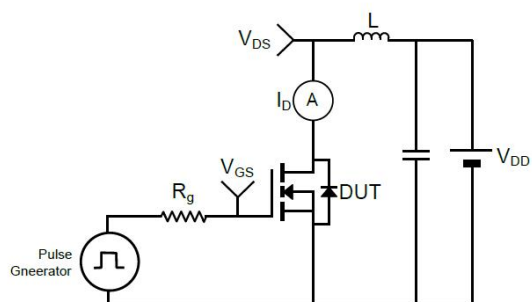
Gate Charge



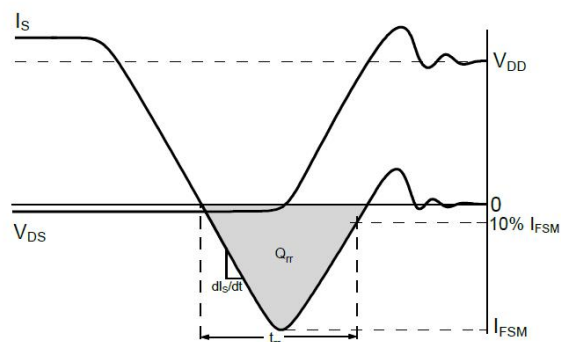
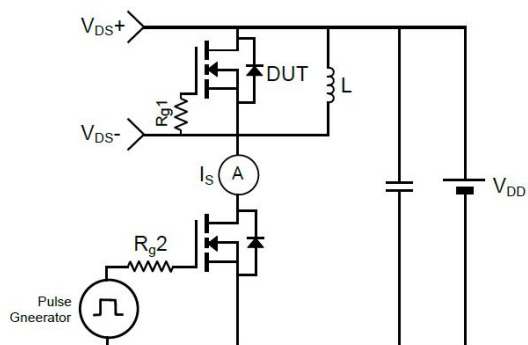
Resistive Load Switching Time



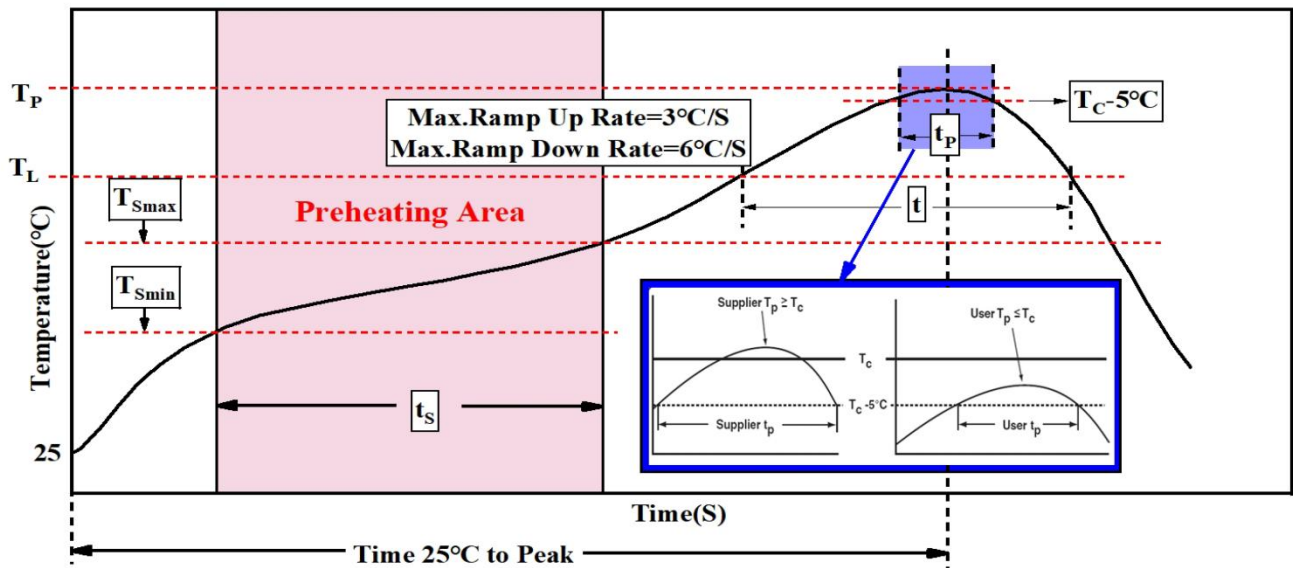
Un-clamped Inductive Load Switching



Drain-Source Body Diode Reverse Recovery



Temperature Profile for IR Reflow Soldering(Pb-Free)



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		

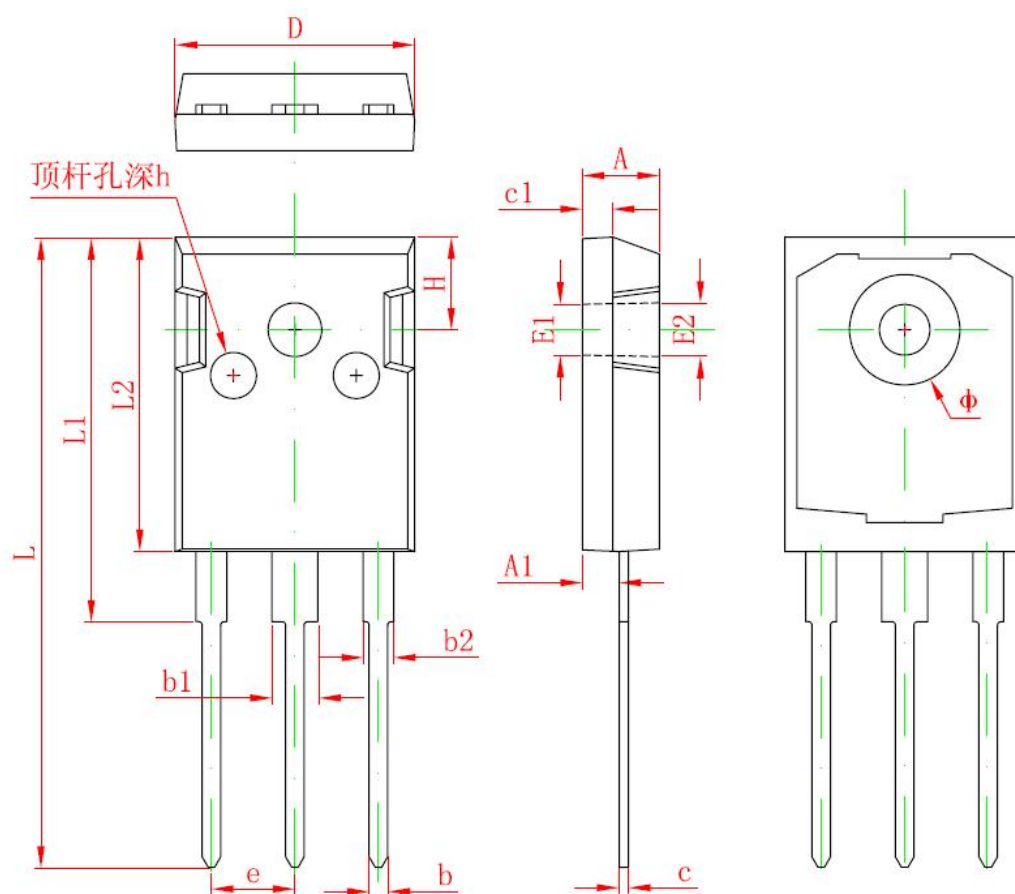
Table 1. SnPb Eutectic Process – Classification Temperatures (T_c)

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-247 Package Information



Symbol	Dimensions In Millimeters	
	Min.	Max.
A	4.700	5.300
A1	2.100	2.600
b	1.000	1.400
b1	2.800	3.200
b2	1.800	2.200
c	0.500	0.700
c1	1.900	2.500
D	15.450	16.200
E1	3.500 REF.	
E2	3.600 REF.	
L	40.400	41.600
L1	24.750	25.750
L2	20.300	21.300
Φ	7.100	7.300
e	5.450 TYP.	
H	5.980 REF.	
h	0.000	0.300