GS3M4017K

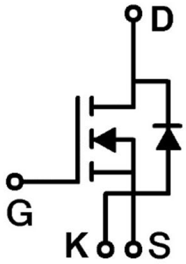
1700 V 40mΩ SiC MOSFET
Silicon Carbide MOSFET
N-Channel Enhancement Mode

V_{DS} = 1700 V
I_D (T_C=25°C) = 70A
R_{Dson} = 32mΩ

Feature

- 1700V/70A
  $R_{DS(ON)}$= 32 mΩ(typ.) @VGS = 20V
- 100% DVDS
- Reliable and Rugged
- Halogen Free and Green Devices Available
  (RoHS Compliant)

TO-247-4L



Single N-Channel MOSFET

Applications

- Solar inverters
- Switch Mode Power Supplies
- High voltage DC/DC converters
- Motor drive

Part Number	Package	Marking
GS3M4017K	TO-247-4L	GS3M4017K

Absolute Maximum Ratings

Symbol	Parameter		Rating	Unit
Common Ratings (Tc=25°C Unless Otherwise Noted)				
V_{DSS}	Drain-Source Voltage		1700	V
V_{GSS}	Gate-Source Voltage		-15/+20	V
$V_{GS(ON)}$	Recommended turn-on Gate-Source Voltage		15 to 20	V
T_J	Junction Temperature Range		-55 to 175	°C
T_{STG}	Storage Temperature Range			°C
I_S	Source Current-Continuous(Body Diode)	Tc=25°C	70	A
Mounted on Large Heat Sink				
I_{DM}	Pulsed Drain Current *	Tc=25°C	150	A
I_D	Continuous Drain Current	Tc=25°C	70	A
		Tc=100°C	50	A
P_D	Maximum Power Dissipation	Tc=25°C	500	W
		Tc=100°C	250	W
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case		0.3	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient **		40	°C/W

Note: * Repetitive rating；pulse width limited by max.junction temperature.
** Surface mounted on 1in2 FR-4 board.

Electrical Characteristics(Tc =25°C Unless Otherwise Noted)

Symbol	Parameter	Test Conditions		HYC400N170			Unit
				Min	Typ.	Max	
Static Characteristics							
BV_{DSS}	Drain-Source Breakdown Voltage	V_{GS}=0V,I_{DS}=100μA		1700	-	-	V
I_{DSS}	Drain-to-Source Leakage Current	V_{DS}=1700V,V_{GS}=0V		-	-	100	μA
			T_J=125°C	-	-	1	mA
I_{GSS}	Gate-Source Leakage Current	V_{GS}=+20V/-15V,V_{DS}=0V		-	-	±250	nA
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS}=V_{GS}, I_{DS}=18mA	T_J=25°C	1.3	2.7	3.9	V
			T_J=175°C	-	1.9	-	V
$R_{DS(ON)}$	Drain-Source On-State Resistance	V_{GS}=20V, I_{DS}=10A	T_J=25°C	-	32	48	mΩ
			T_J=175°C	-	69	104	mΩ
		V_{GS}=18V, I_{DS}=10A	T_J=25°C	-	34	51	mΩ
			T_J=175°C	-	70	105	mΩ
Diode Characteristics							
V_{SD}	Diode Forward Voltage	I_{SD}=10A,V_{GS}=0V		-	2.9	-	V

Electrical Characteristics (Cont.) (Tc =25°C Unless Otherwise Noted)

Symbol	Parameter	Test Conditions	HYC400N170			Unit
			Min	Typ.	Max	
Dynamic Characteristics						
R_G	Gate Resistance	V_{GS}=0V,V_{DS}=0V,F=1MHz	-	0.7	-	Ω
C_{iss}	Input Capacitance	V_{GS}=0V, V_{DS}=1200V, Frequency=1MHz	-	4100	-	pF
C_{oss}	Output Capacitance		-	145	-	
C_{rss}	Reverse Transfer Capacitance		-	32	-	
$t_{d(ON)}$	Turn-on Delay Time	V_{DD}=800V,R_G=5Ω, I_{DS}=10A,V_{GS}=10V	-	28	-	ns
T_r	Turn-on Rise Time		-	28	-	
$t_{d(OFF)}$	Turn-off Delay Time		-	80	-	
T_f	Turn-off Fall Time		-	42	-	
E_{ON}	Turn-on energy		-	760	-	μJ
E_{OFF}	Turn-off energy		-	330	-	
Gate Charge Characteristics						
Q_g	Total Gate Charge(V_{GS}=18V)	V_{DS}=1200V, I_{DS}=10A	-	222	-	nC
Q_{gs}	Gate-Source Charge		-	33.3	-	
Q_{gd}	Gate-Drain Charge		-	105.9	-	
$V_{plateau}$	Gate plateau voltage		-	7.7	-	V

Note: *Pulse test，pulse width ≤ 300us，duty cycle ≤ 2%

Typical Operating Characteristics

Figure 1: Power Dissipation

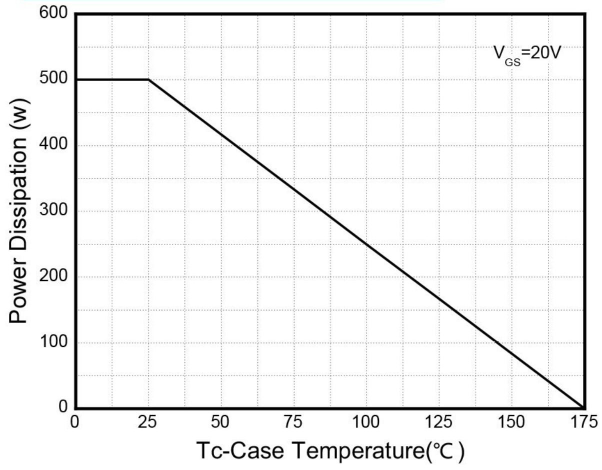


Figure 2: Drain Current

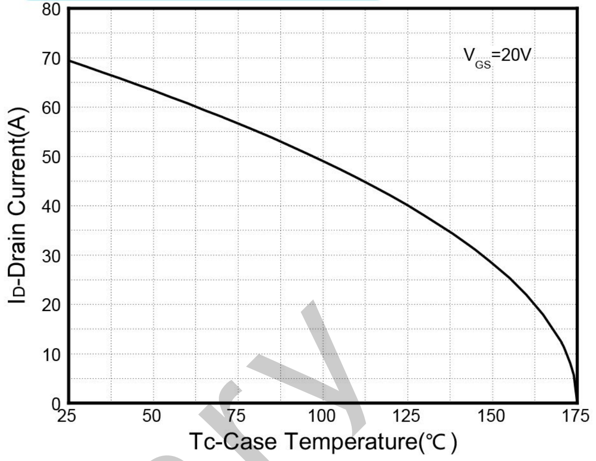


Figure 3: Safe Operation Area

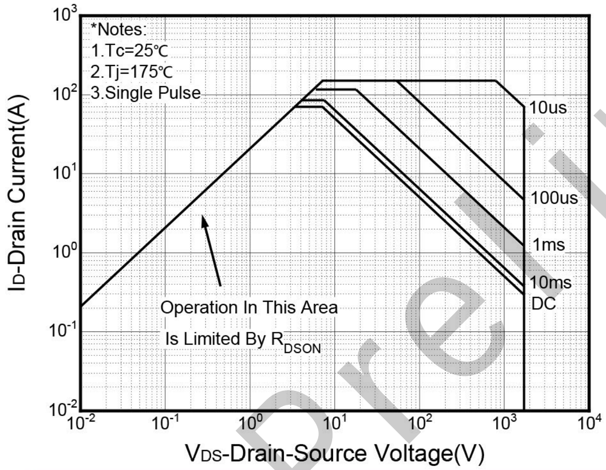


Figure 4: Thermal Transient Impedance

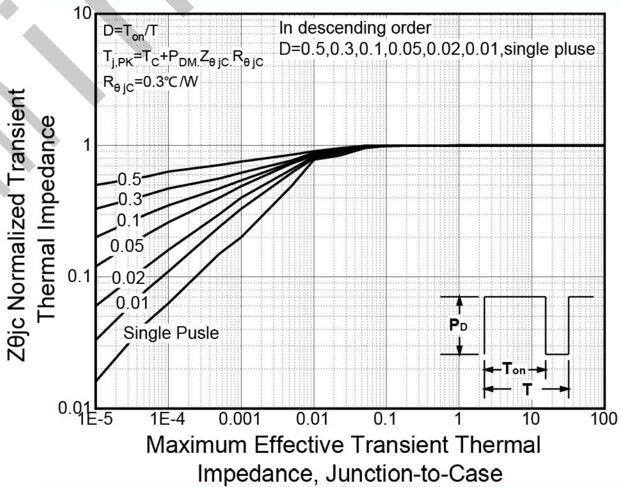


Figure 5: Output Characteristics(Tj=25℃)

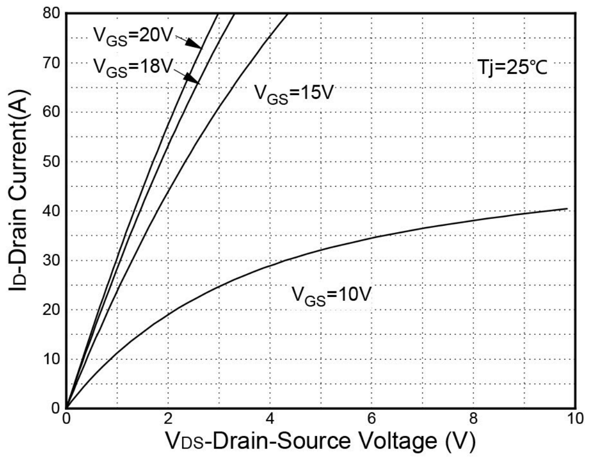


Figure 6: Output Characteristics(Tj=175℃)

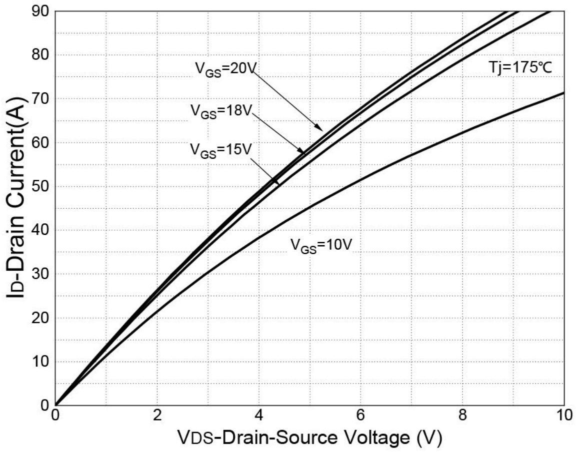


Figure 7: Drain-Source On Resistance

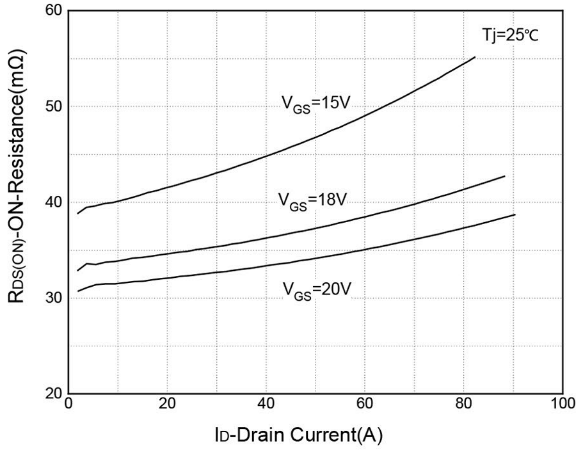


Figure 8: Transfer Characteristics

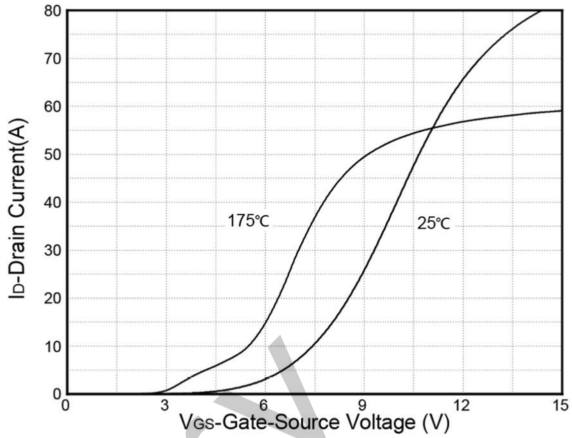


Figure 9: On-Resistance vs. Temperature

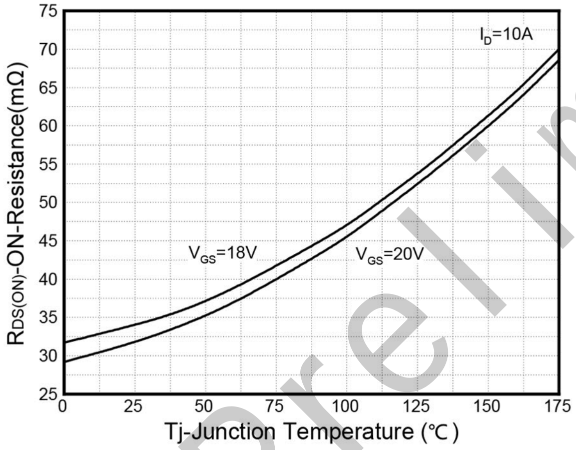


Figure 10: Source-Drain Diode Forward

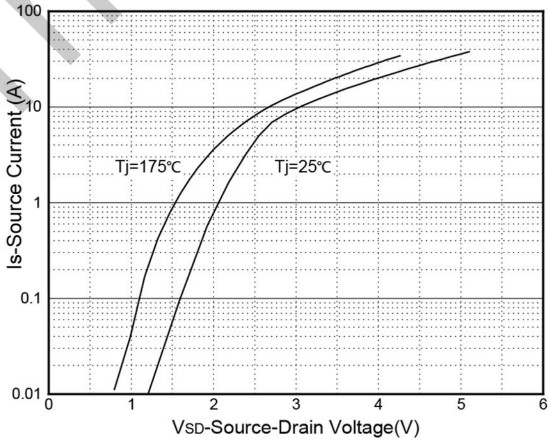


Figure 11: Capacitance Characteristics

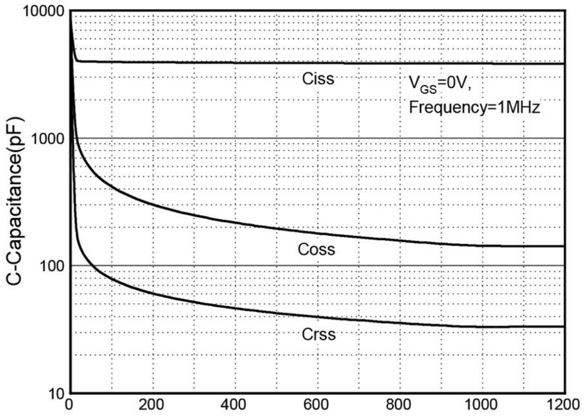


Figure 12: Gate Charge Characteristics

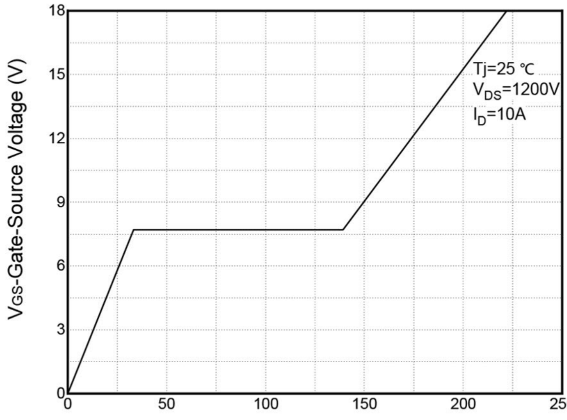


Figure 13: Gate Threshold Voltage

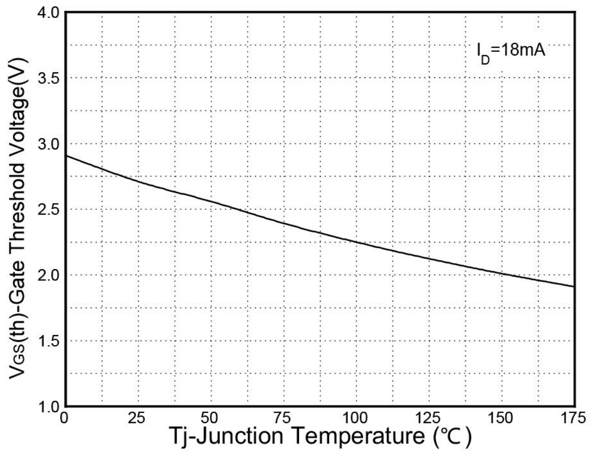


Figure 14: Drain-Source Breakdown

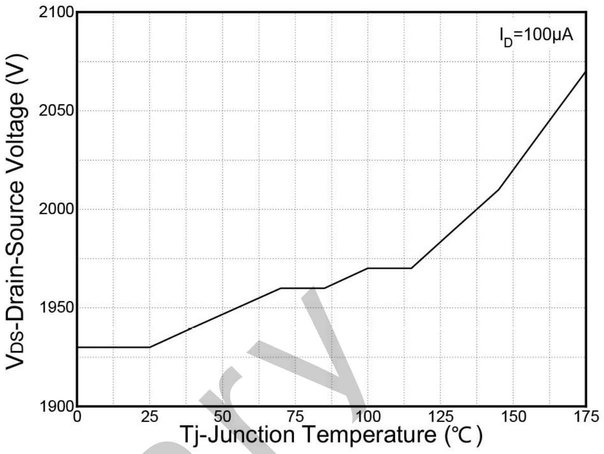


Figure 15: Rdson vs. Gate Voltage

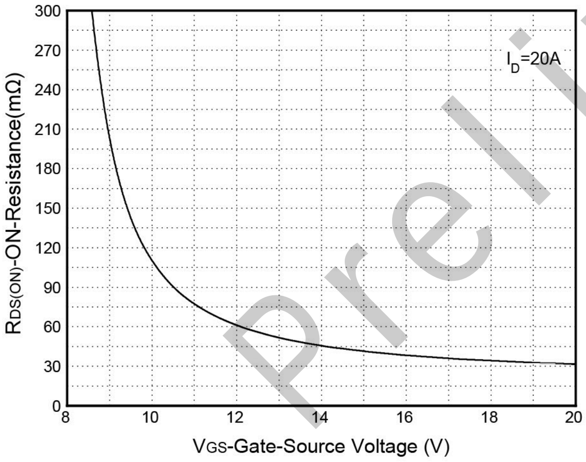
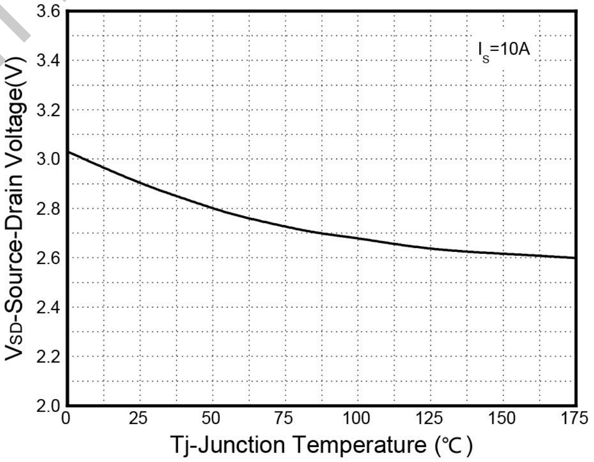
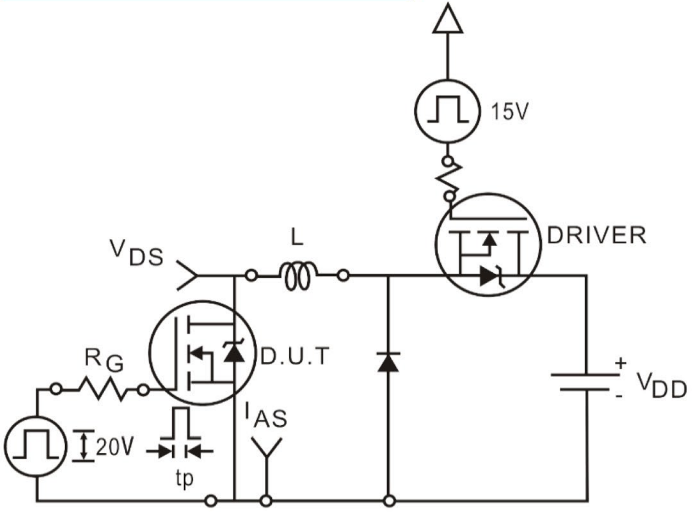


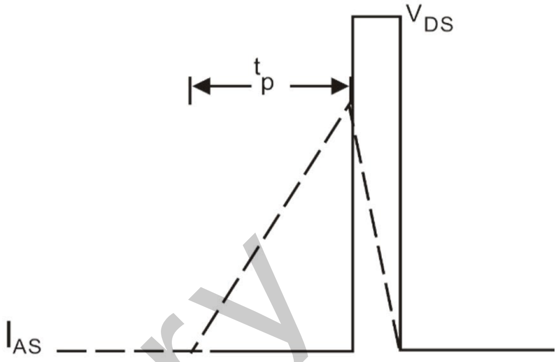
Figure 16: Diode Voltage vs. Temperature



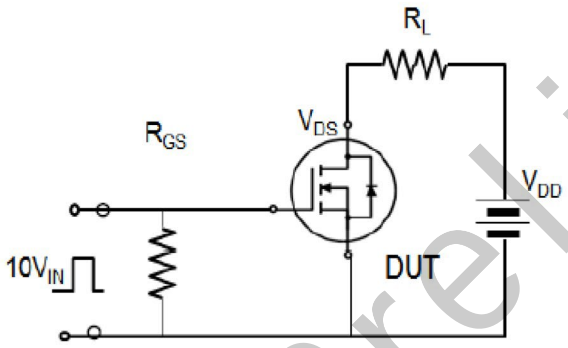
Avalanche Test Circuit

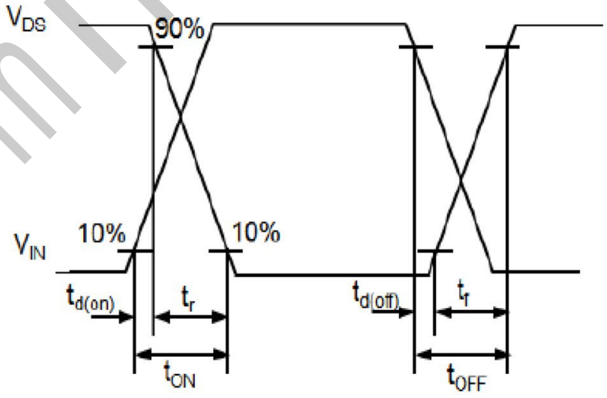


$$E_{AS} = \frac{1}{2} L I_{AS}^2$$

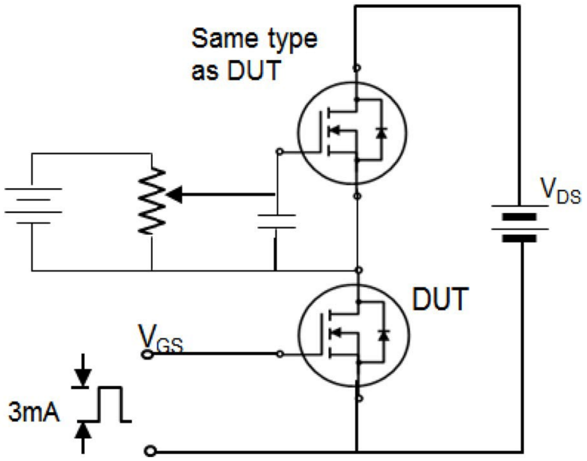


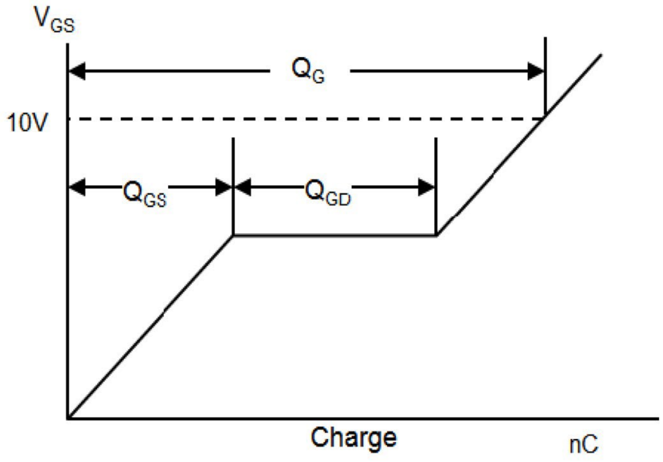
Switching Time Test Circuit





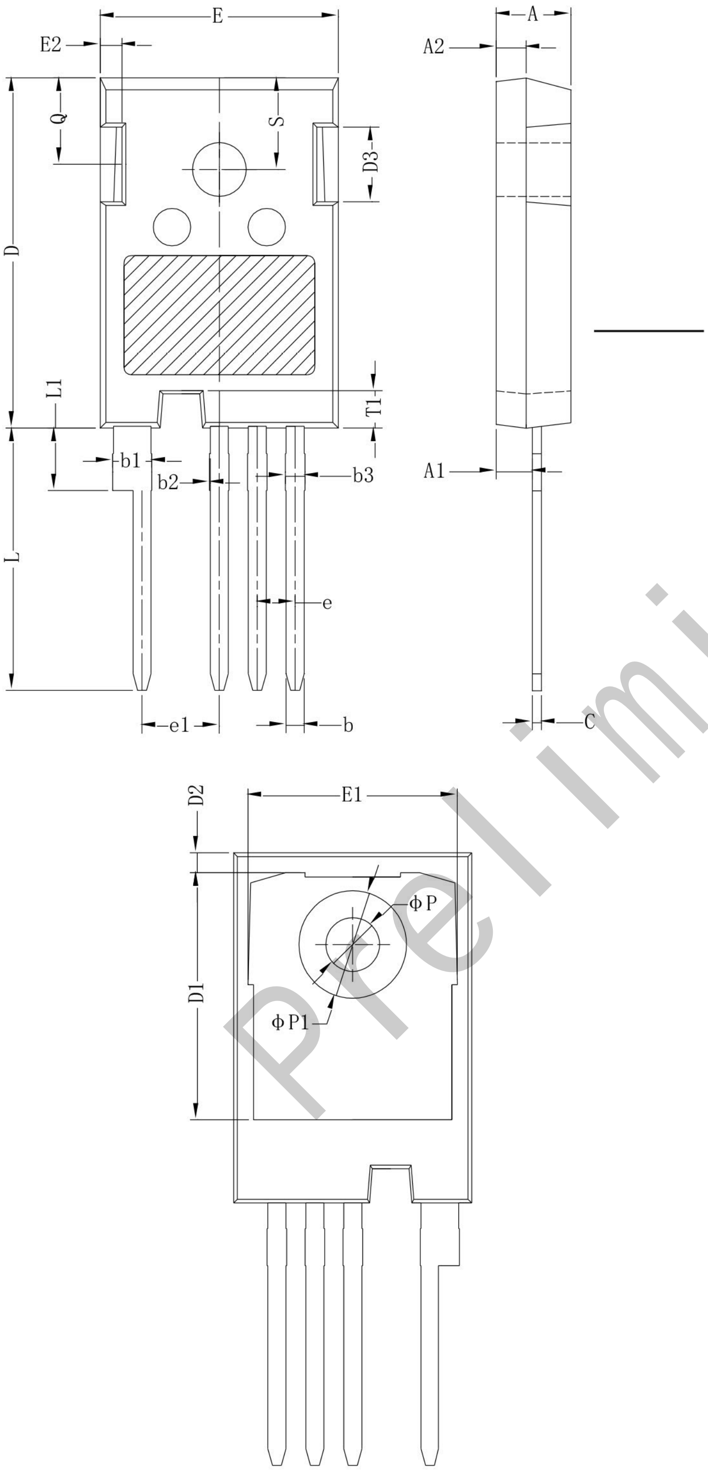
Gate Charge Test Circuit





Package Information

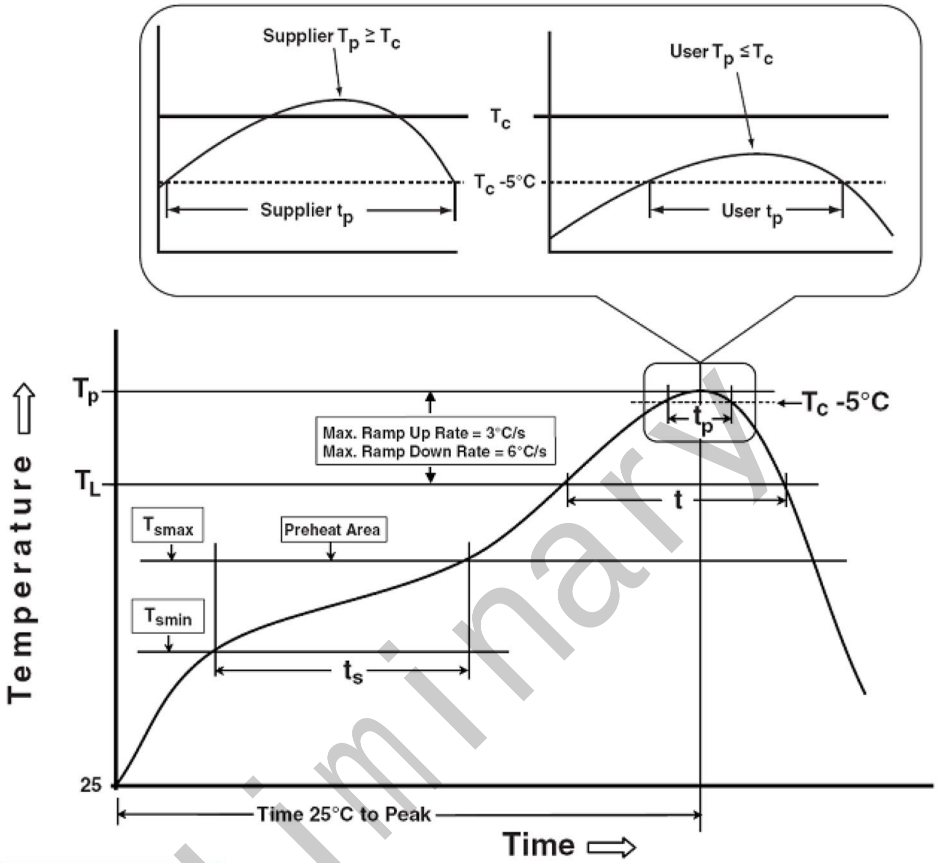
TO-247-4L



COMMON DIMENSIONS

SYMBOL	mm		
	MIN	NOM	MAX
A	4.80	5.00	5.20
A1	2.21	2.41	2.61
A2	1.80	2.00	2.20
b	1.06	1.21	1.36
b1	2.33	2.63	2.93
b2	-	0.05	-
b3	1.07	1.30	1.60
c	0.51	0.61	0.75
D	23.30	23.45	23.60
D1	16.25	16.55	16.85
D2	1.03	1.33	1.63
D3	4.70	5.00	5.30
E	15.74	15.94	16.14
E1	13.72	14.02	14.32
T1	2.35	2.50	2.65
e	2.54 BSC		
E1	5.08 BSC		
Q	5.49	5.79	6.09
S	5.83	6.13	6.43
L	17.27	17.57	17.87
L1	3.99	4.19	4.39
ΦP	3.40	3.60	3.80
ΦP1	7.19 REF		
S	6.15BSC		

Classification Profile



Classification Reflow Profiles

Profile Feature	Sn-Pb Eutectic Assembly	Pb-Free Assembly
Preheat & Soak		
Temperature min (T_{smin}) Temperature max (T_{smax}) Time (Tsmin to Tsmax) (t_s)	100 °C 150 °C 60-120 seconds	150 °C 200 °C 60-120 seconds
Average ramp-up rate ($T_{smax}$to T_P)	3 °C/second max.	3°C/second max.
Liquidous temperature (T_L) Time at liquidous (t_L)	183 °C 60-150 seconds	217 °C 60-150 seconds
Peak package body Temperature (T_p)*	See Classification Temp in table 1	SeeClassification Tempin 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 (Tc)

Package Thickness	Volume mm³ <350	Volume mm³ ⩾350
＜2.5 mm	235 °C	220 °C
≥2.5 mm	220 °C	220 °C

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

Package Thickness	Volume mm³ <350	Volume mm³ 350-2000	Volume mm³ ⩾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

Reliability Test Program

Test item	Method	Description
SOLDERABILITY	JESD-22, B102	5 Sec, 245°C
HTRB	JESD-22, A108	168/500/1000 Hrs, Bias @ 150°C
HTGB	JESD-22, A108	168/500/1000 Hrs, V_{gs}100% @ 150°C
PCT	JESD-22, A102	96 Hrs, 100%RH, 2atm, 121°C
TCT	JESD-22, A104	250/500 Cycles, -55°C~150°C

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