

HSCM0020065K

N-Channel Silicon Carbide Power MOSFET

Features

- High Blocking Voltage with Low On-Resistance
- High Speed Switching with Low Capacitances
- Easy to Parallel and Simple to Drive

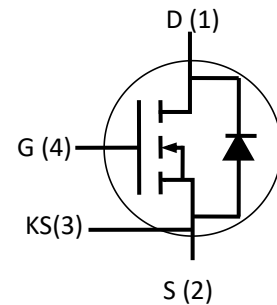
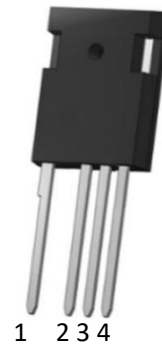
Benefits

- Higher System Efficiency
- Reduced Cooling Requirements
- Increased Power Density
- Increased System Switching Frequency

Applications

- Solar Inverters
- Switch Mode Power Supplies
- High Voltage DC/DC Converters
- Battery Chargers
- Motor Drives

TO-247-4L



Maximum Ratings ($T_c=25^\circ\text{C}$ unless otherwise specified)

Symbol	Parameter	Value	Unit	Test Conditions
V_{DSmax}	Drain-Source Voltage	650	V	$V_{GS}=0V, I_D=100\mu A$
V_{GSmax}	Gate-Source Voltage	-8/+22	V	Absolute maximum values
V_{GSop}	Gate-Source Voltage	-4/+18	V	Recommended operational values
I_D	Continuous Drain Current	92	A	$V_{GS}=18V, T_c=25^\circ\text{C}$
		64		$V_{GS}=18V, T_c=100^\circ\text{C}$
$I_{D(pulse)}$	Pulsed Drain Current	257	A	Pulse width t_p limited by T_{Jmax}
P_D	Power Dissipation	312	W	$T_c=25^\circ\text{C}, T_J=175^\circ\text{C}$
T_J, T_{STG}	Operating Junction and Storage Temperature	-55 to +175	$^\circ\text{C}$	

Electrical Characteristics ($T_c=25^{\circ}\text{C}$ unless otherwise specified)

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
$V_{(BR)DSS}$	Drain-Source Breakdown Voltage	650	/	/	V	$V_{GS}=0V, I_D=100\mu A$
$V_{GS(th)}$	Gate Threshold Voltage	2.0	2.6	4.0	V	$V_{DS}=V_{GS}, I_D=15mA$
		/	1.8	/		$V_{DS}=V_{GS}, I_D=15mA, T_J=175^{\circ}\text{C}$
I_{DSS}	Zero Gate Voltage Drain Current	/	1	100	μA	$V_{DS}=650V, V_{GS}=0V$
I_{GSS+}	Gate-Source Leakage Current	/	10	250	nA	$V_{DS}=0V, V_{GS}=22V$
I_{GSS-}	Gate-Source Leakage Current	/	10	250	nA	$V_{DS}=0V, V_{GS}=-8V$
$R_{DS(on)}$	Drain-Source On-State Resistance	/	20	30	m Ω	$V_{GS}=18V, I_D=50A$
		/	28	/		$V_{GS}=18V, I_D=50A, T_J=175^{\circ}\text{C}$
g_{fs}	Transconductance	/	35	/	S	$V_{DS}=20V, I_D=50A$
		/	31.6	/		$V_{DS}=20V, I_D=50A, T_J=175^{\circ}\text{C}$
C_{iss}	Input Capacitance	/	3180	/	pF	$V_{GS}=0V$
C_{oss}	Output Capacitance	/	281	/		$V_{DS}=650V$
C_{rss}	Reverse Transfer Capacitance	/	33	/		$f=1MHz$
E_{oss}	C_{oss} Stored Energy	/	41	/	μJ	$V_{AC}=25mV$
E_{on}	Turn-On Switching Energy	/	121	/	μJ	$V_{DS}=400V, V_{GS}=-4V/18V, I_D=40A$
E_{off}	Turn-Off Switching Energy	/	53	/		$R_{G(ext)}=2.5\Omega, L=59\mu H, T_J=175^{\circ}\text{C}$
$t_{d(on)}$	Turn-On Delay Time	/	12	/	ns	$V_{DS}=400V, V_{GS}=-4V/18V, I_D=40A$ $R_{G(ext)}=2.5\Omega$, Timing relative to VDS Inductive load
t_r	Rise Time	/	18	/		
$t_{d(off)}$	Turn-Off Delay Time	/	25	/		
t_f	Fall Time	/	8	/		
$R_{G(int)}$	Internal Gate Resistance	/	3.2	/	Ω	$f=1MHz, V_{AC}=25mV$
Q_{GS}	Gate to Source Charge	/	49	/	nC	$V_{DS}=400V$
Q_{GD}	Gate to Drain Charge	/	31	/		$V_{GS}=-4V/18V$
Q_G	Total Gate Charge	/	187	/		$I_D=40A$

Reverse Diode Characteristics

Symbol	Parameter	Typ.	Max.	Unit	Test Conditions
V_{SD}	Diode Forward Voltage	4.2	/	V	$V_{GS}=-4V, I_{SD}=25A$
		3.9	/		$V_{GS}=-4V, I_{SD}=25A, T_J=175^{\circ}\text{C}$
I_S	Continuous Diode Forward Current	/	92	A	$T_c=25^{\circ}\text{C}$
t_{rr}	Reverse Recover Time	26	/	ns	$V_R=400V, I_{SD}=40A$
Q_{rr}	Reverse Recovery Charge	58	/	nC	
I_{rrm}	Peak Reverse Recovery Current	3.4	/	A	

Thermal Characteristics

Symbol	Parameter	Typ	Unit	Test Conditions
$R_{\theta JC}$	Thermal Resistance from Junction to Case	0.48	$^{\circ}\text{C}/\text{W}$	
$R_{\theta JA}$	Thermal Resistance From Junction to Ambient	40		

Typical Performance

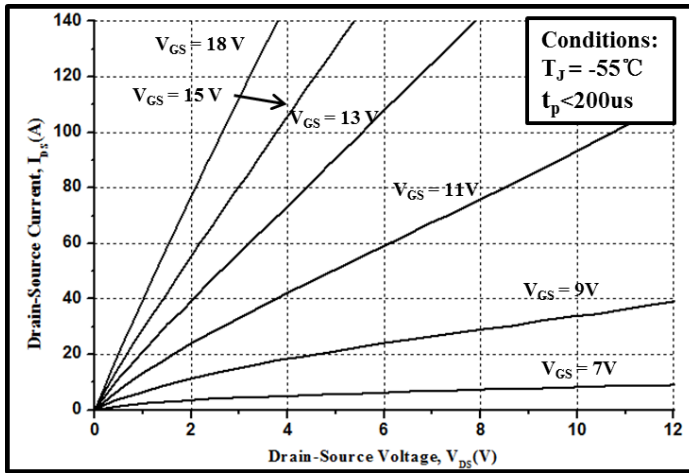


Figure 1. Output Characteristics $T_j = -55^\circ\text{C}$

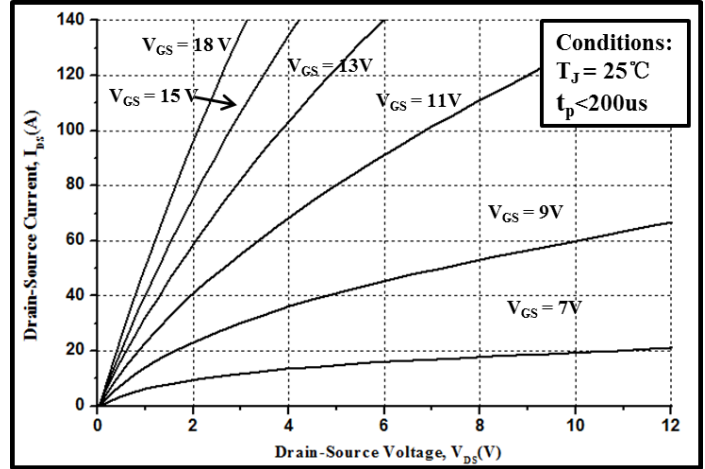


Figure 2. Output Characteristics $T_j = 25^\circ\text{C}$

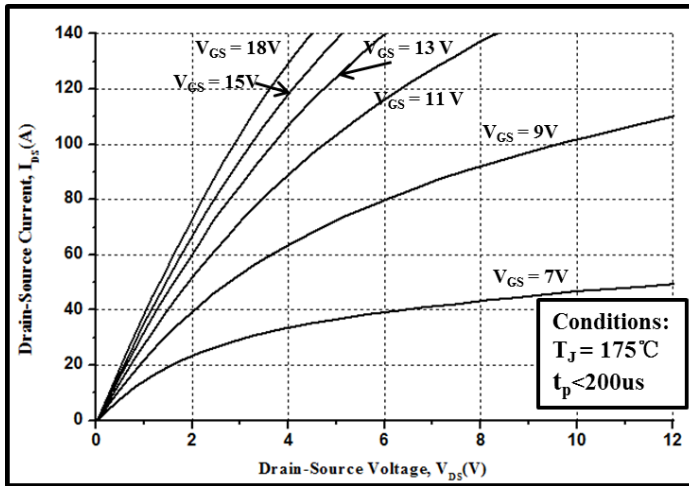


Figure 3. Output Characteristics $T_j = 175^\circ\text{C}$

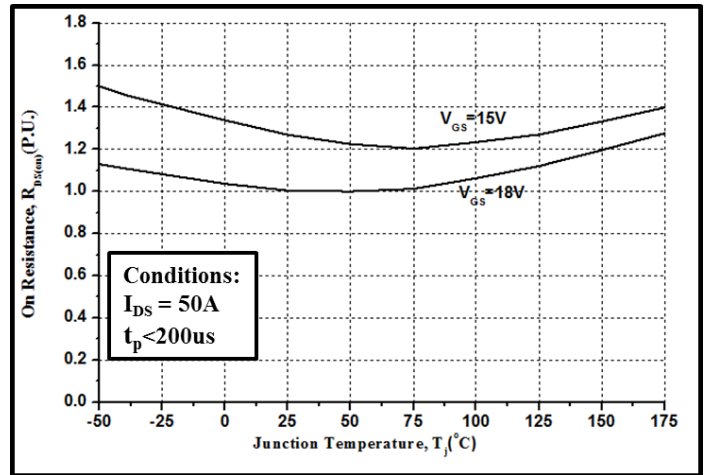


Figure 4. Normalized On-Resistance vs. Temperature

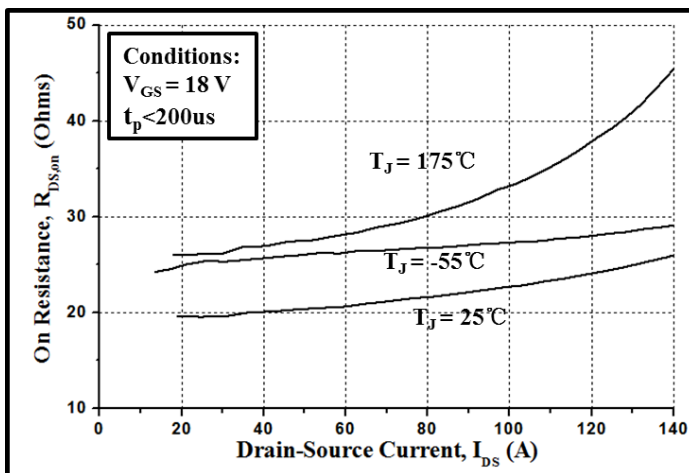


Figure 5. On-Resistance vs. Drain Current
For Various Temperatures

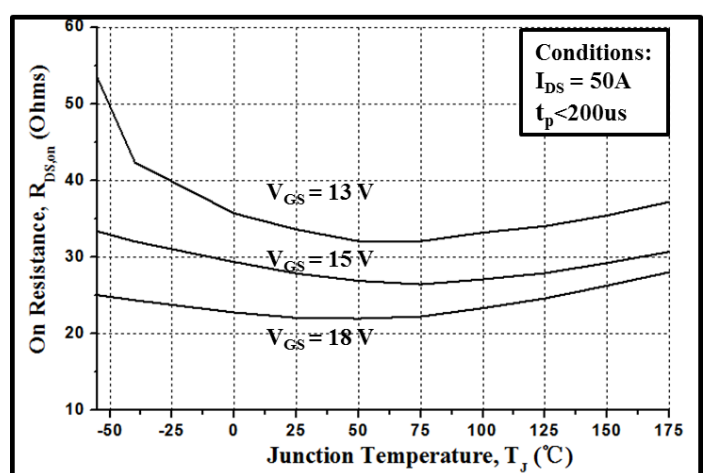


Figure 6. On-Resistance vs. Temperature
For Various Gate Voltage

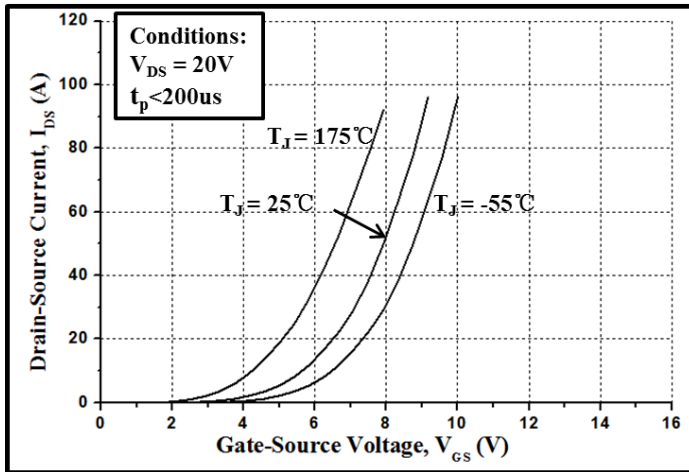


Figure 7. Transfer Characteristic for Various Junction Temperatures

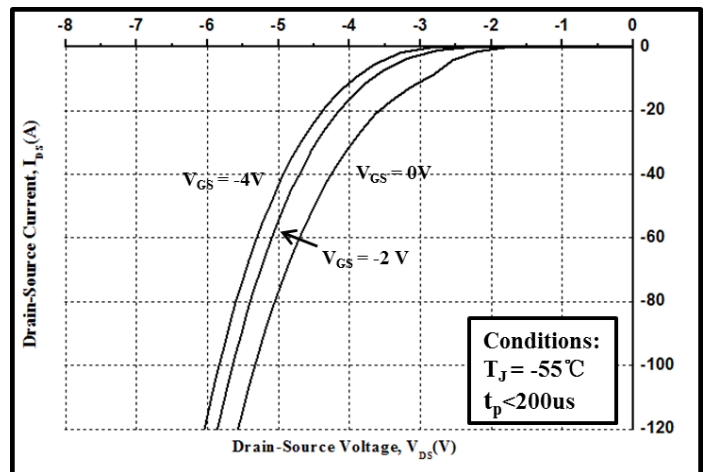


Figure 8. Body Diode Characteristic at $-55^\circ C$

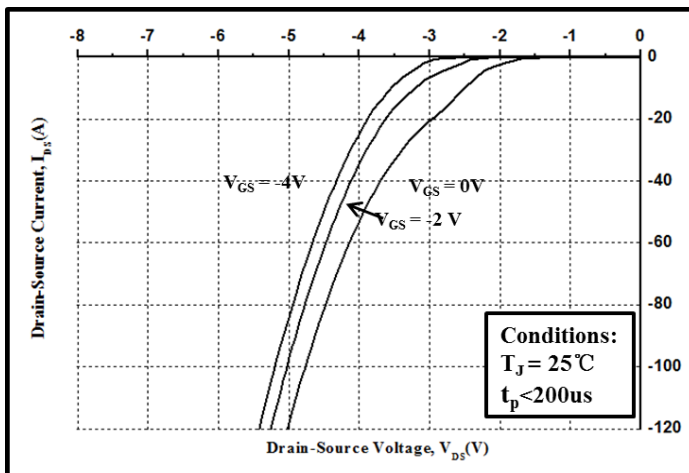


Figure 9. Body Diode Characteristic at $25^\circ C$

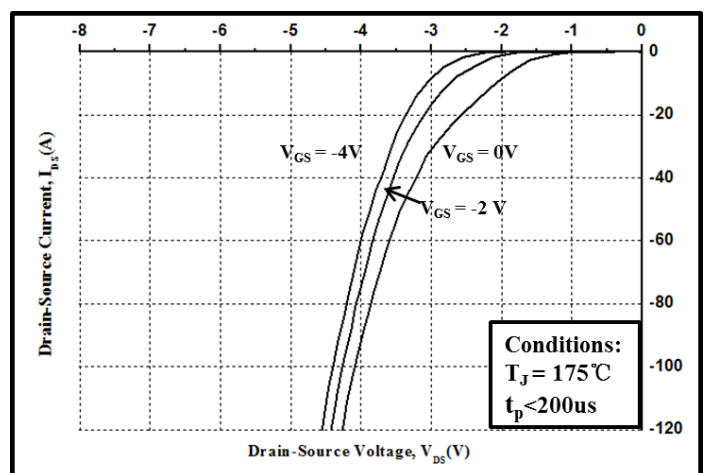


Figure 10. Body Diode Characteristic at $175^\circ C$

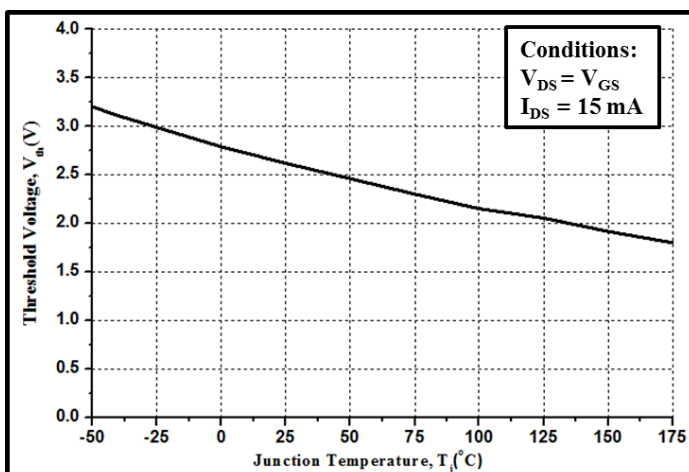


Figure 11. Threshold Voltage vs. Temperature

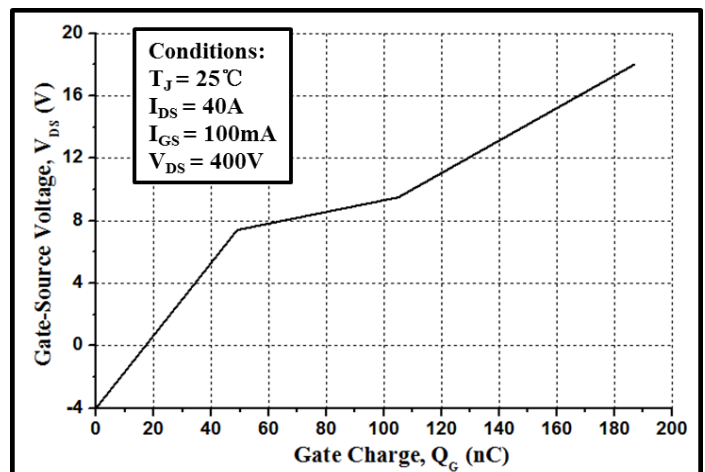


Figure 12. Gate Charge Characteristics

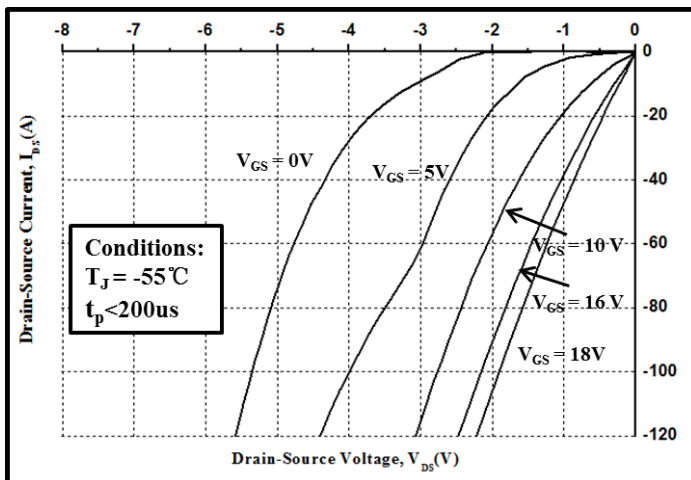


Figure 13. 3rd Quadrant Characteristic at -55°C

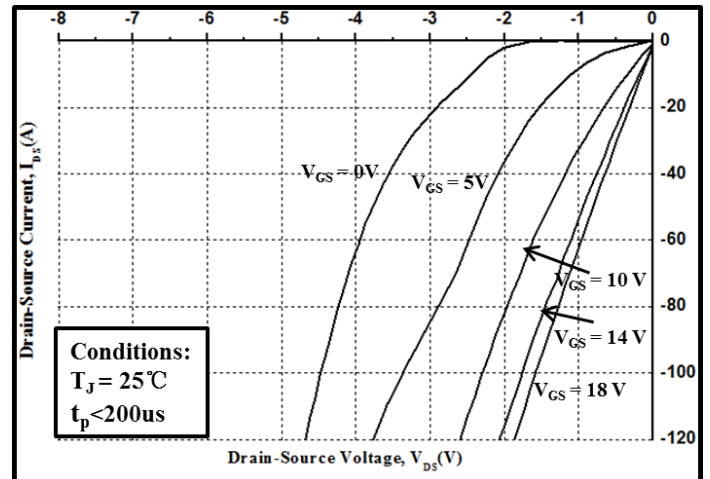


Figure 14. 3rd Quadrant Characteristic at 25°C

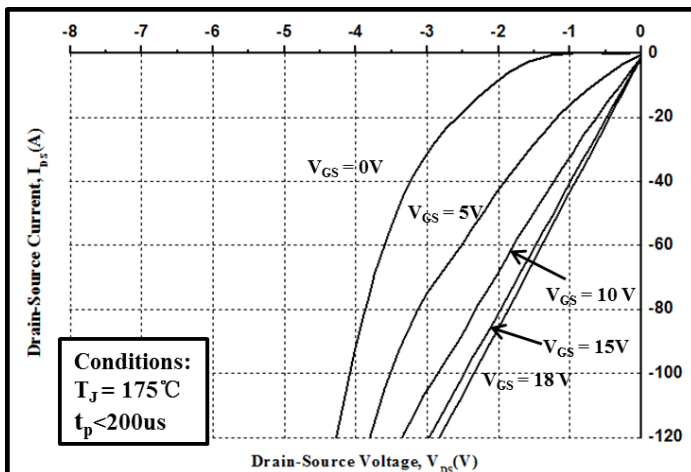


Figure 15. 3rd Quadrant Characteristic at 175 °C

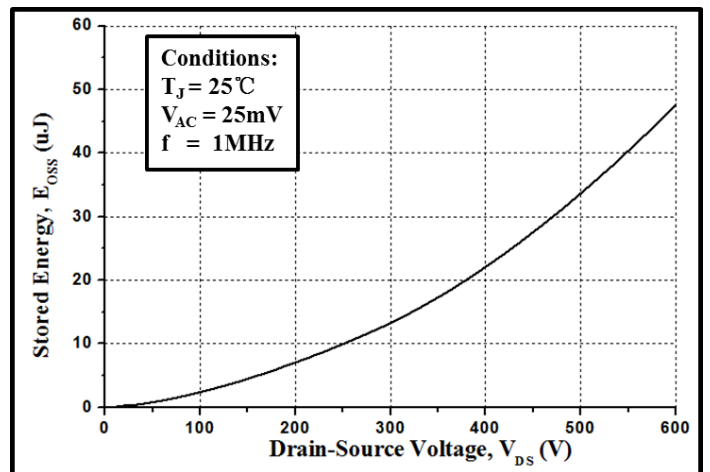


Figure 16. Output Capacitor Stored Energy

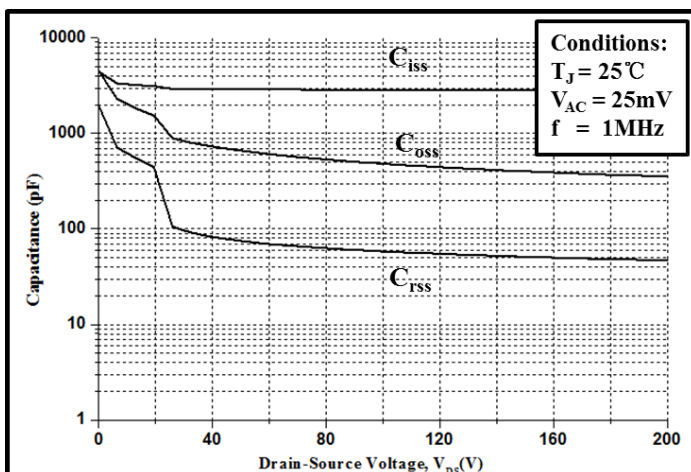


Figure 17. Capacitances vs. Drain-Source Voltage (0 - 200V)

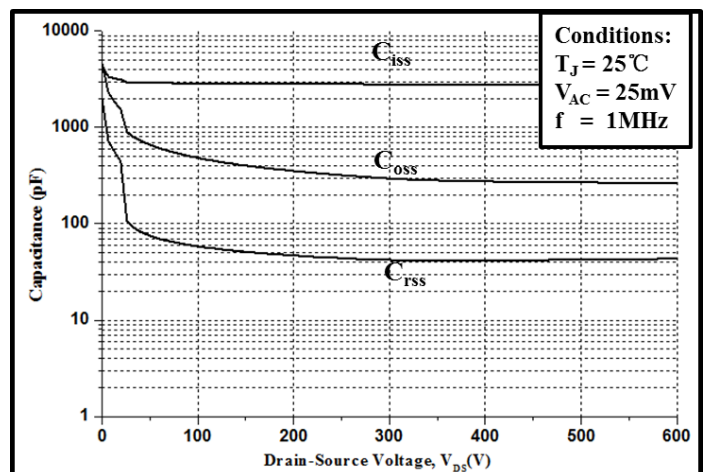


Figure 18. Capacitances vs. Drain-Source Voltage (0 - 1000V)

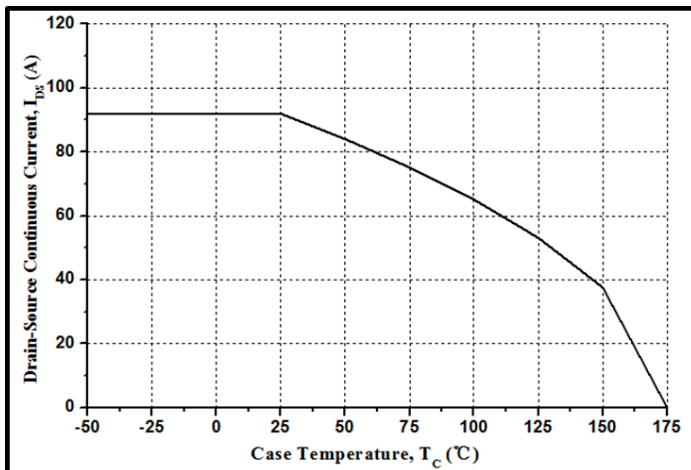


Figure 19. Continuous Drain Current Derating vs. Case Temperature

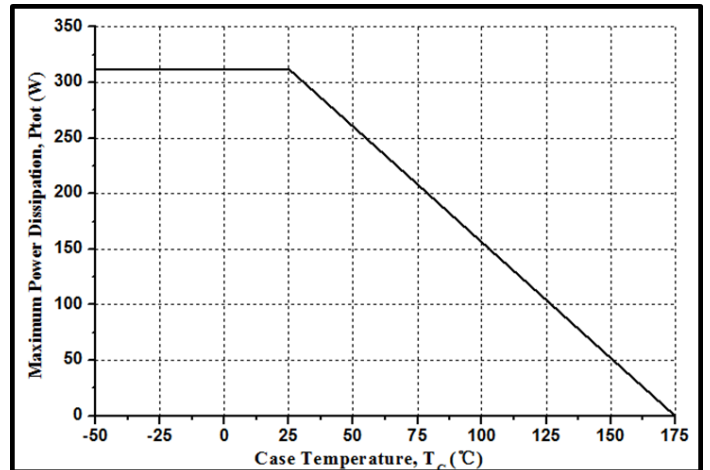


Figure 20. Maximum Power Dissipation Derating vs. Case Temperature

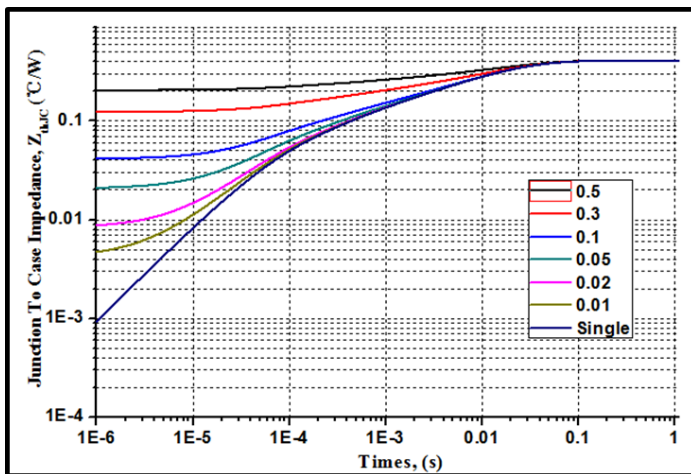


Figure 21. Transient Thermal Impedance (Junction - Case)

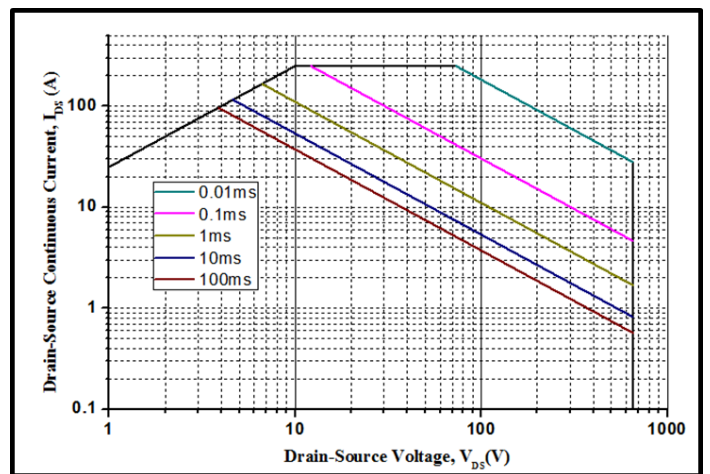
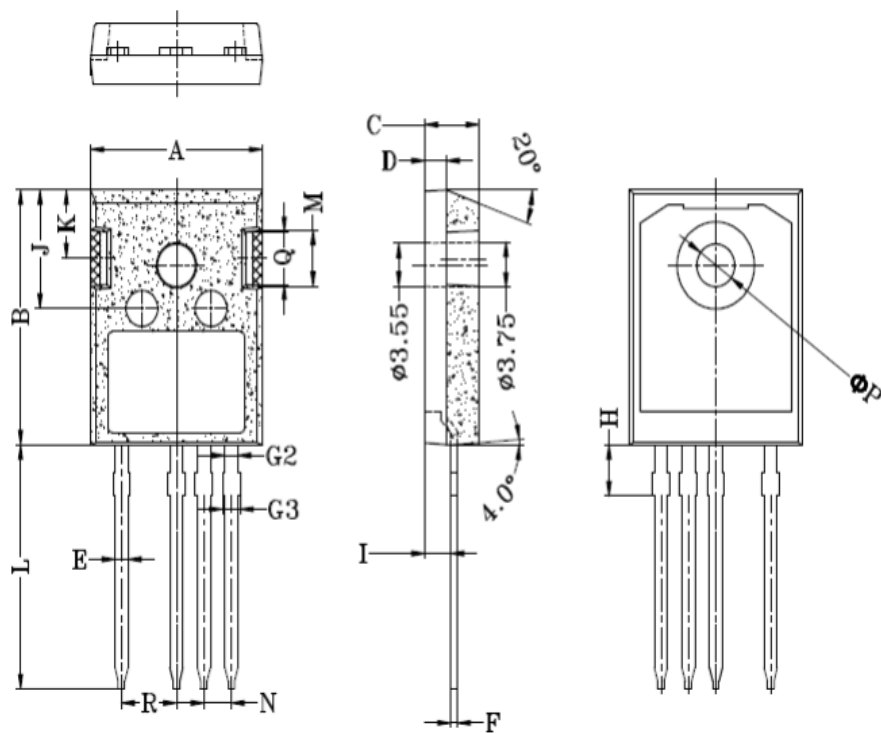


Figure 22. Safe Operating Area

Package Dimensions: TO-247-4L



Symbol	unit(mm)	
	MIN	MAX
A	15.80	16.00
B	20.90	21.10
C	4.90	5.10
D	1.90	2.10
E	1.10	1.30
F	0.50	0.70
G2	1.10	1.30
G3	1.18	1.38
H	4.18	4.38
I	2.30	2.50
J	9.65	9.85
K	5.54	5.74
L	19.80	20.20
M	4.50	4.70
N	2.34	2.74
Φ P	3.40	3.60
Q	4.232	4.432
R	4.88	5.28