

WM3A040065K

N-Channel SiC Power MOSFET

G3 MOSFET Technology

V_{DS}	=	650	V
$R_{DS(on)}$	=	40	m Ω
$I_D@25^{\circ}\text{C}$	=	52	A

Features

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

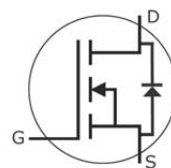
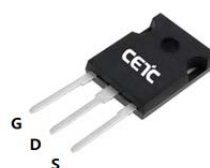
Benefits

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

Applications

- Renewable Energy
- EV Battery Chargers
- High Voltage DC/DC Converters
- Switch Mode Power Supplies

Package



Part Number	Package	Marking
WM3A040065K	TO-247-3	WM3A040065K

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

Symbol	Parameter	Value	Unit	Test Conditions	Note
V_{DSmax}	Drain-Source Voltage	650	V	$V_{GS}=0V, I_D=100\mu A$	
V_{GSmax}	Gate-Source Voltage	-10/+23	V	Absolute maximum values	
V_{GSop}	Gate-Source Voltage	-5/+18	V	Recommended operational values	
I_D	Continuous Drain Current	52	A	$V_{GS}=18V, T_c=25^{\circ}\text{C}$	Fig.19
		37		$V_{GS}=18V, T_c=100^{\circ}\text{C}$	
$I_{D(pulse)}$	Pulsed Drain Current	153	A	Pulse width t_p limited by T_{Jmax}	Fig.22
P_D	Power Dissipation	187.5	W	$T_c=25^{\circ}\text{C}, T_J=175^{\circ}\text{C}$	Fig.20
T_J, T_{STG}	Operating Junction and Storage Temperature	-55 to +175	$^{\circ}\text{C}$		
T_L	Solder Temperature, 1.6mm from case for 10s	260	$^{\circ}\text{C}$		
M_d	Mounting Torque, (M3 or 6-32 screw)	1	Nm		
		8.8	lbf-in		

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

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions	Note
$V_{(BR)DSS}$	Drain-Source Breakdown Voltage	650	/	/	V	$V_{GS}=0V, I_D=1mA$	
$V_{GS(th)}$	Gate Threshold Voltage	2.0	2.9	4.0	V	$V_{DS}=V_{GS}, I_D=7.5mA$	Fig. 11
		/	2.1	/		$V_{DS}=V_{GS}, I_D=7.5mA, T_J=175^{\circ}\text{C}$	
I_{DSS}	Zero Gate Voltage Drain Current	/	1	100	μA	$V_{DS}=650V, V_{GS}=0V$	
I_{GSS+}	Gate-Source Leakage Current	/	10	100	nA	$V_{DS}=0V, V_{GS}=23V$	
I_{GSS-}	Gate-Source Leakage Current	/	10	100	nA	$V_{DS}=0V, V_{GS}=-10V$	
$R_{DS(on)}$	Drain-Source On-State Resistance	/	40	52	m Ω	$V_{GS}=18V, I_D=20A$	Fig. 4,5,6
		/	48	/	m Ω	$V_{GS}=18V, I_D=20A, T_J=175^{\circ}\text{C}$	
g_{fs}	Transconductance	/	22	/	S	$V_{DS}=20V, I_{DS}=20A$	Fig. 7
		/	20	/		$V_{DS}=20V, I_{DS}=20A, T_J=175^{\circ}\text{C}$	
C_{iss}	Input Capacitance	/	1305	/	pF	$V_{GS}=0V$	Fig. 17,18
C_{oss}	Output Capacitance	/	109	/		$V_{DS}=400V$	
C_{rss}	Reverse Transfer Capacitance	/	4.9	/		$f=1MHz$	
E_{oss}	C_{oss} Stored Energy	/	9	/	μJ	$V_{AC}=25mV$	Fig. 16
E_{ON}	Turn-On Switching Energy	/	71	/	uJ	$V_{DS}=400V, V_{GS}=-5V/18V$	
E_{OFF}	Turn-Off Switching Energy	/	69	/		$I_D=20A, R_{G(ext)}=2.5\Omega, L=100\mu H$	
$t_{d(on)}$	Turn-On Delay Time	/	6	/	ns	$V_{DS}=400V, V_{GS}=-5V/18V, I_D=20A$ $R_{G(ext)}=2.5\Omega, R_L=20\Omega$	
t_r	Rise Time	/	8	/			
$t_{d(off)}$	Turn-Off Delay Time	/	15	/			
t_f	Fall Time	/	5	/			
$R_{G(int)}$	Internal Gate Resistance	/	2.0	/	Ω	$f=1MHz, V_{AC}=25mV$	
Q_{GS}	Gate to Source Charge	/	14	/	nC	$V_{DS}=400V$	Fig. 12
Q_{GD}	Gate to Drain Charge	/	12	/		$V_{GS}=-5V/18V$	
Q_G	Total Gate Charge	/	40	/		$I_D=20A$	

Reverse Diode Characteristics

Symbol	Parameter	Typ.	Max.	Unit	Test Conditions	Note
V_{SD}	Diode Forward Voltage	3.9	/	V	$V_{GS}=-5V, I_{SD}=10A, T_J=25^{\circ}\text{C}$	Fig. 8,9,10
		3.6	/		$V_{GS}=-5V, I_{SD}=10A, T_J=175^{\circ}\text{C}$	
I_S	Continuous Diode Forward Current	/	51	A	$T_C=25^{\circ}\text{C}$	
t_{rr}	Reverse Recover Time	13	/	ns	$V_R=400V, I_{SD}=10A$	
Q_{rr}	Reverse Recovery Charge	98	/	nC		
I_{rrm}	Peak Reverse Recovery Current	5	/	A		

Thermal Characteristics

Symbol	Parameter	Typ.	Max.	Unit	Test Conditions	Note
$R_{\theta JC}$	Thermal Resistance from Junction to Case	0.9	/	$^{\circ}\text{C/W}$		Fig. 21
$R_{\theta JA}$	Thermal Resistance from Junction to Ambient	/	40			

Typical Performance

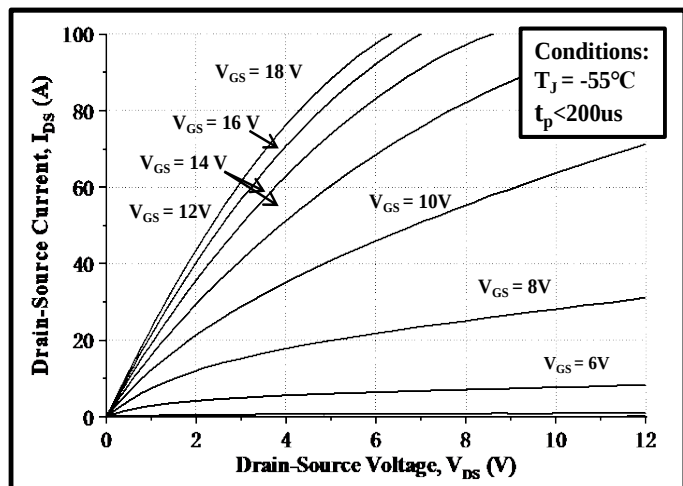


Figure 1. Output Characteristics $T_j = -55^\circ\text{C}$

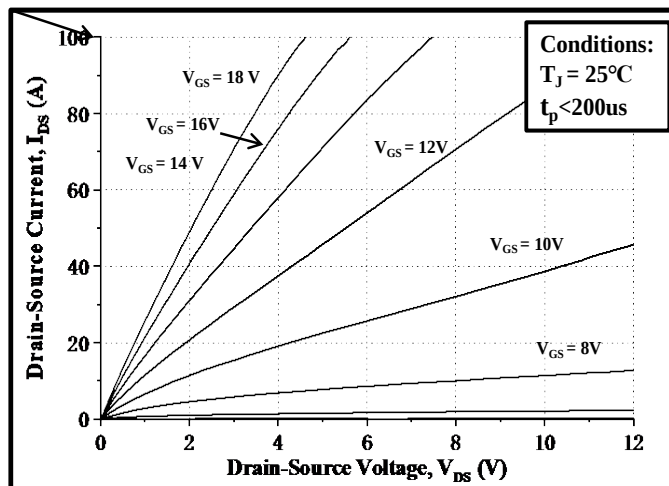


Figure 2. Output Characteristics $T_j = 25^\circ\text{C}$

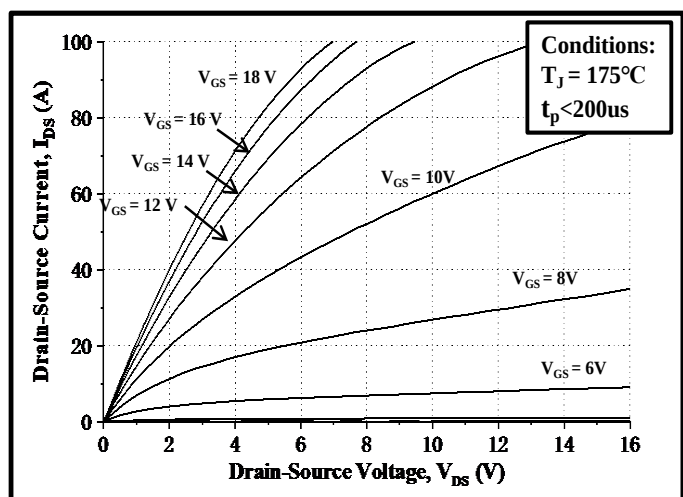


Figure 3. Output Characteristics $T_j = 175^\circ\text{C}$

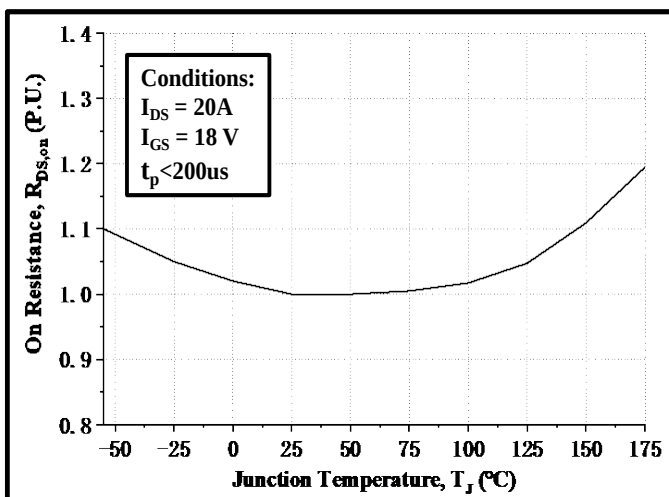


Figure 4. Normalized On-Resistance vs. Temperature

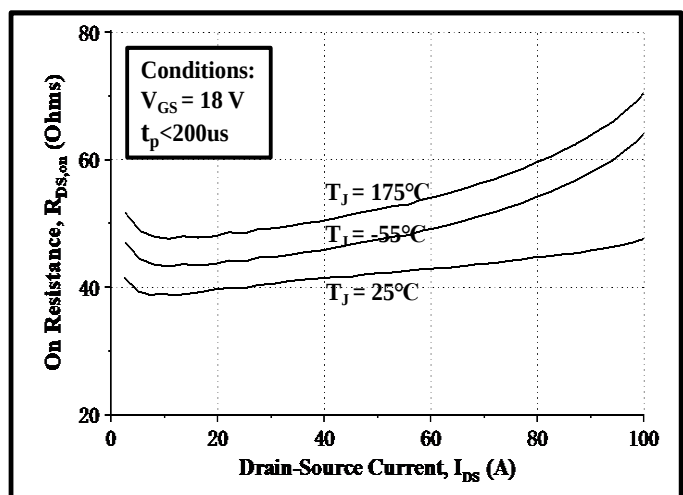


Figure 5. On-Resistance vs. Drain Current
For Various Temperatures

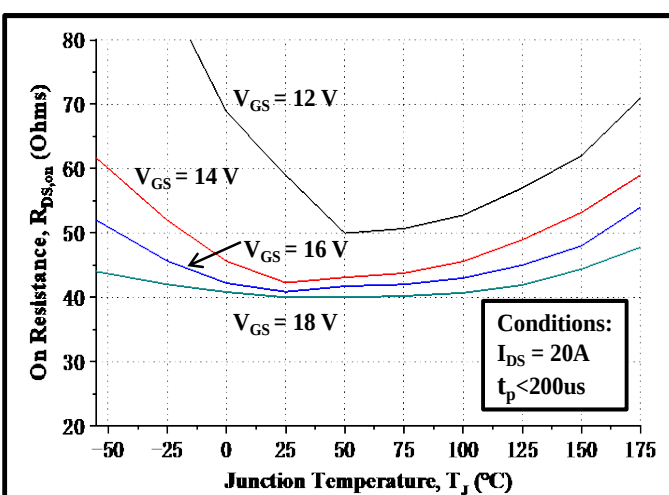


Figure 6. On-Resistance vs. Temperature
For Various Gate Voltage

Typical Performance

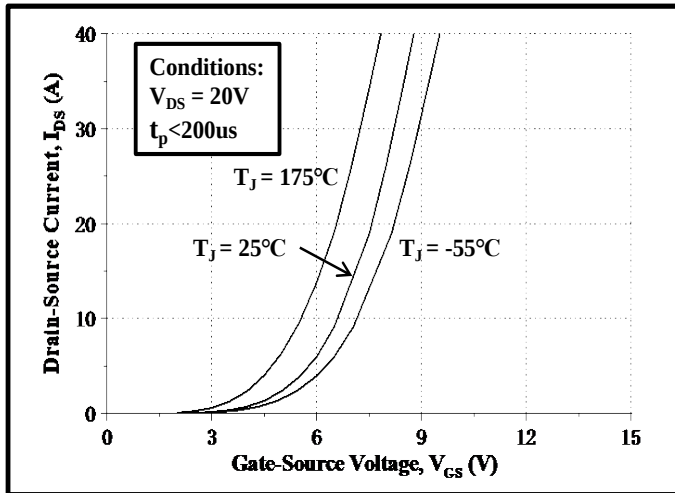


Figure 7. Transfer Characteristic for Various Junction Temperatures

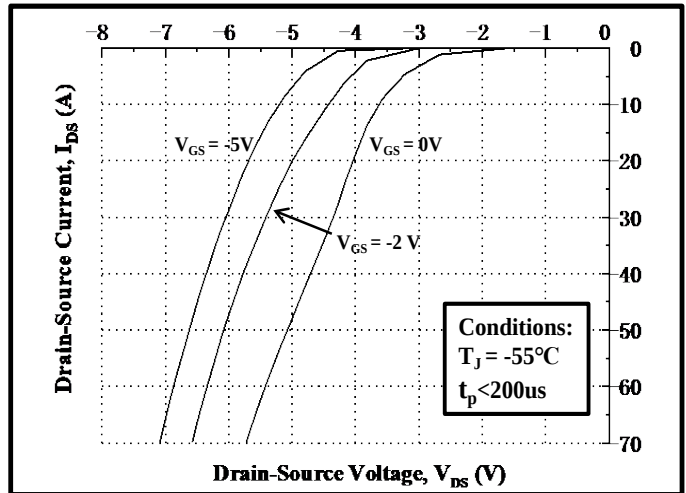


Figure 8. Body Diode Characteristic at $-55^\circ C$

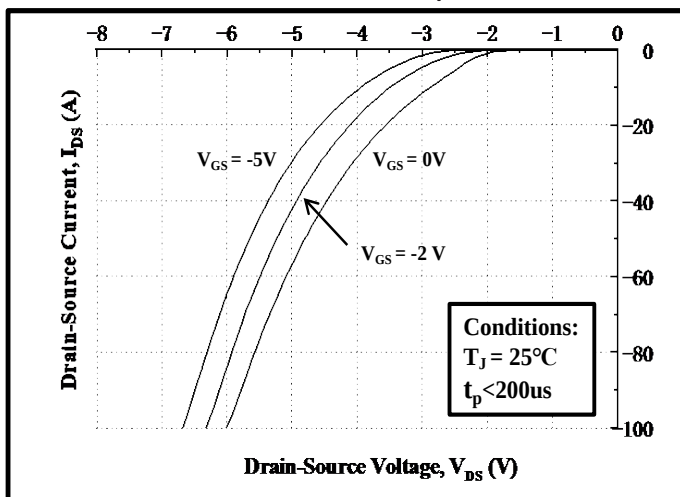


Figure 9. Body Diode Characteristic at $25^\circ C$

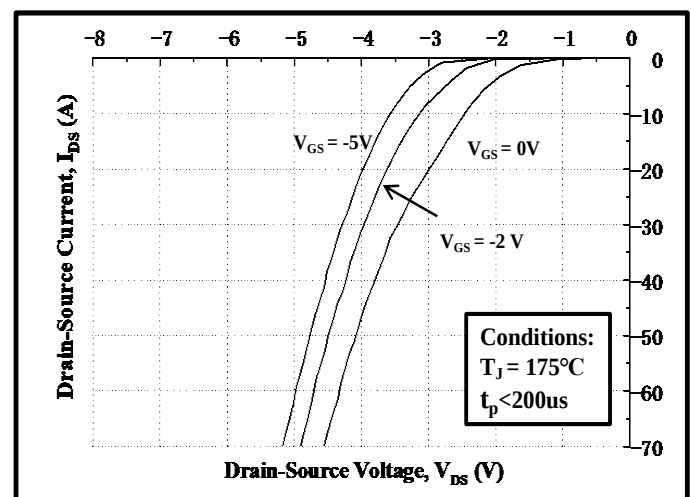


Figure 10. Body Diode Characteristic at $175^\circ C$

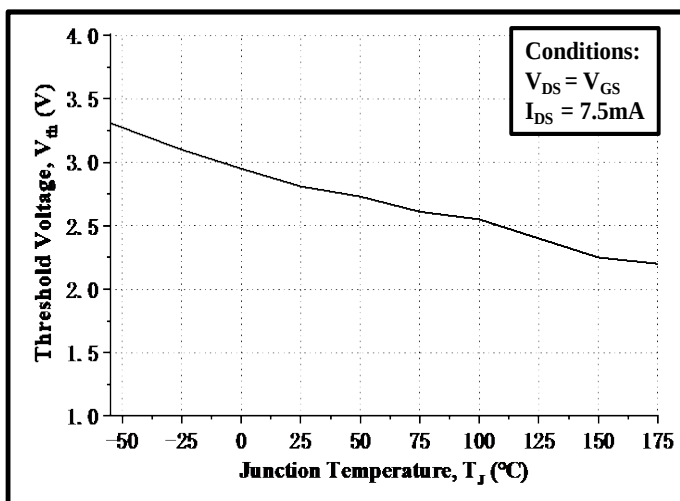


Figure 11. Threshold Voltage vs. Temperature

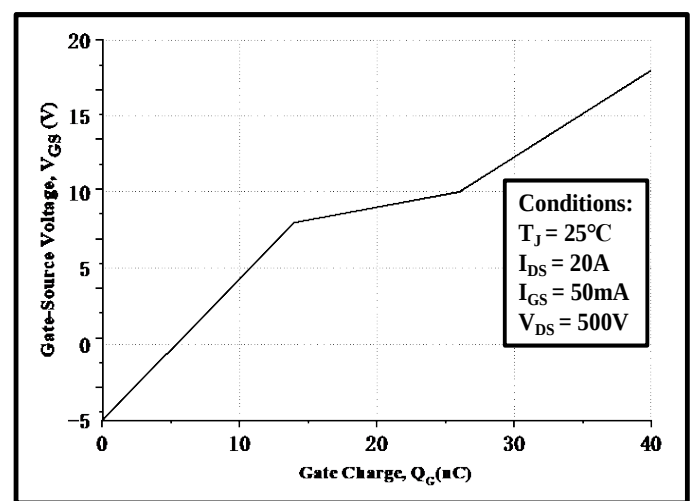


Figure 12. Gate Charge Characteristics

Typical Performance

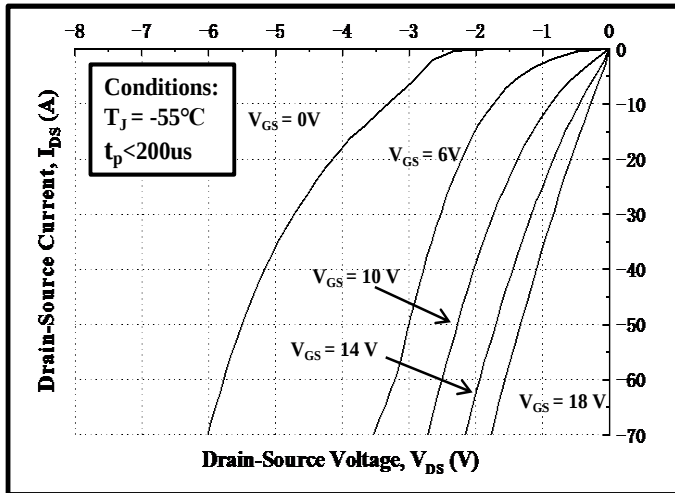


Figure 13. 3rd Quadrant Characteristic at -55°C

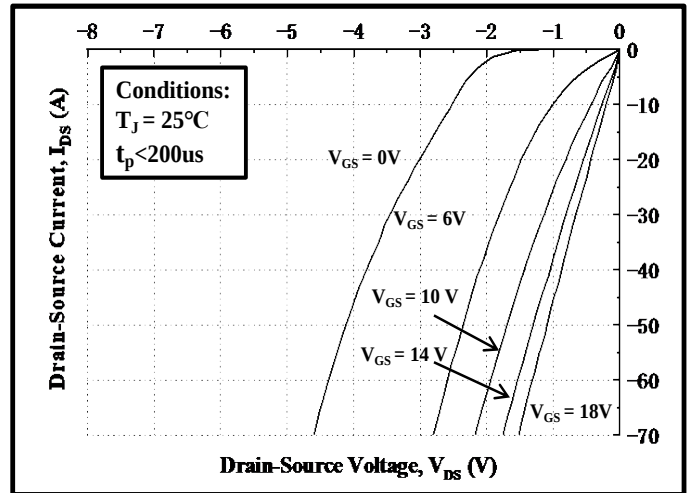


Figure 14. 3rd Quadrant Characteristic at 25°C

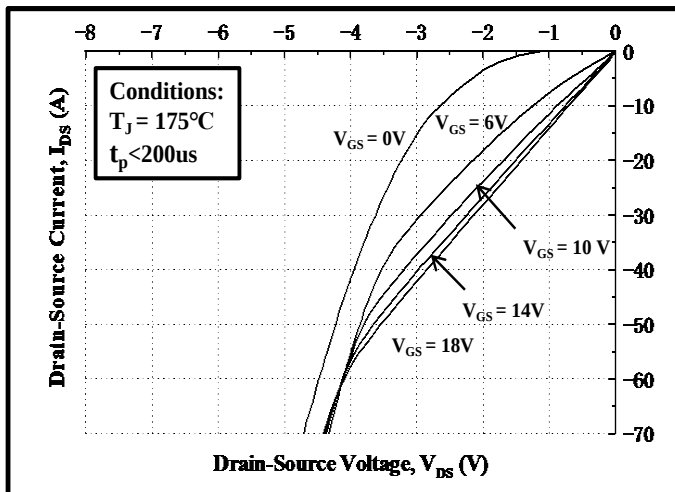


Figure 15. 3rd Quadrant Characteristic at 175°C

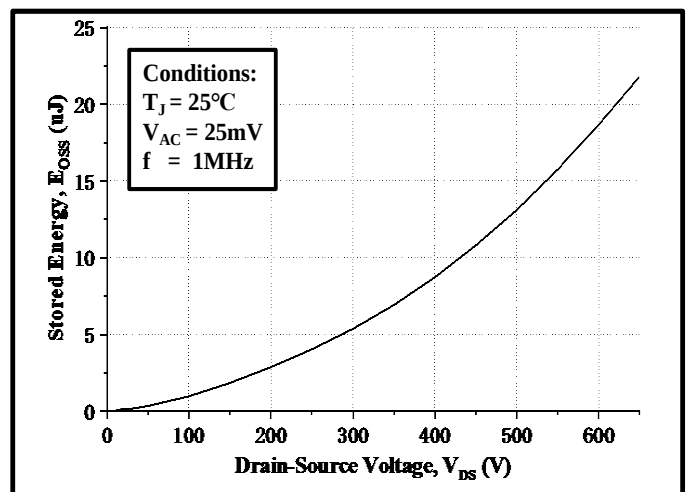


Figure 16. Output Capacitor Stored Energy

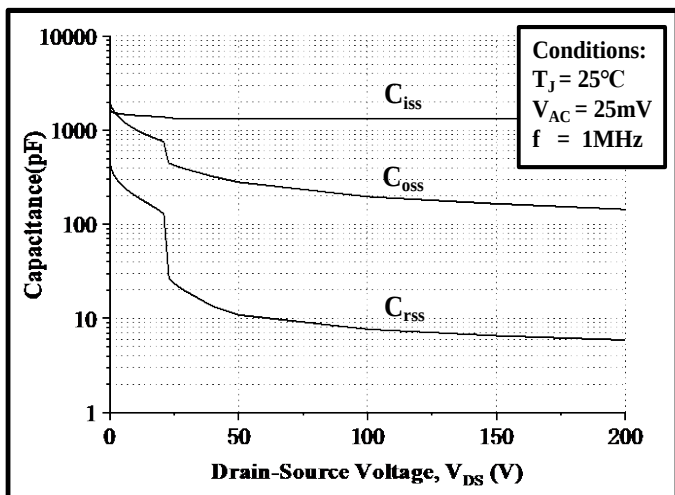


Figure 17. Capacitances vs. Drain-Source Voltage (0 - 200V)

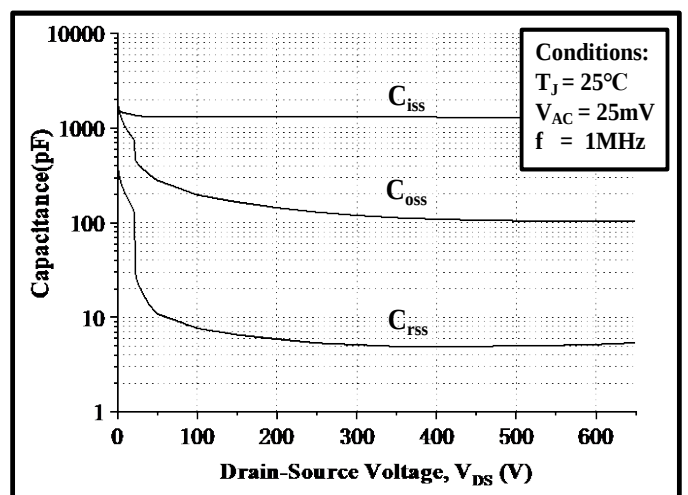


Figure 18. Capacitances vs. Drain-Source Voltage (0 - 650V)

Typical Performance

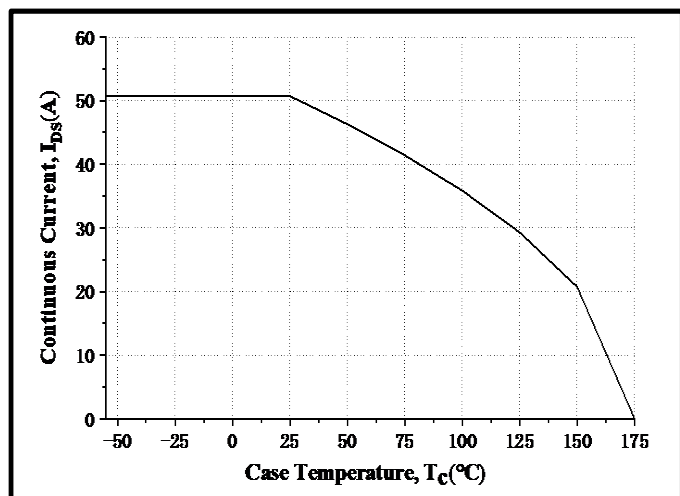


Figure 19. Continuous Drain Current Derating vs. Case Temperature

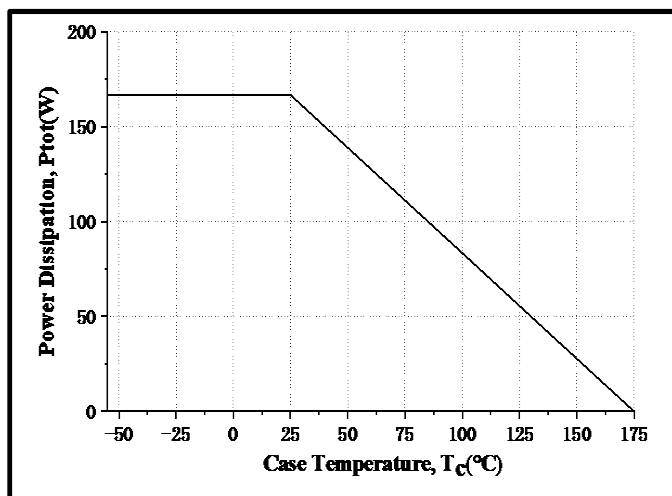


Figure 20. Maximum Power Dissipation Derating vs. Case Temperature

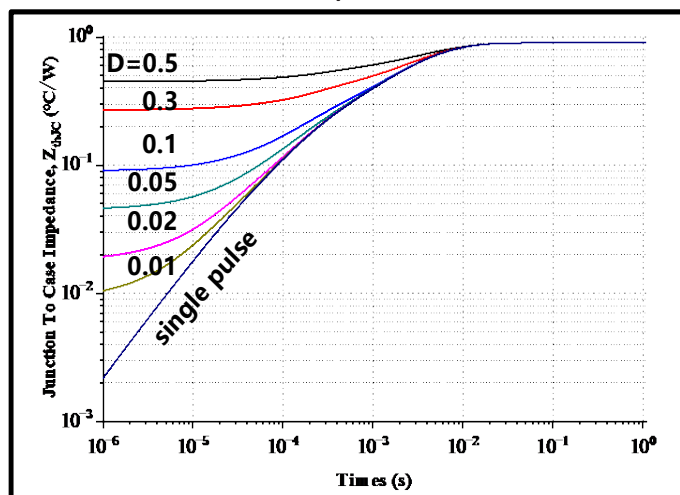


Figure 21. Transient Thermal Impedance (Junction - Case)

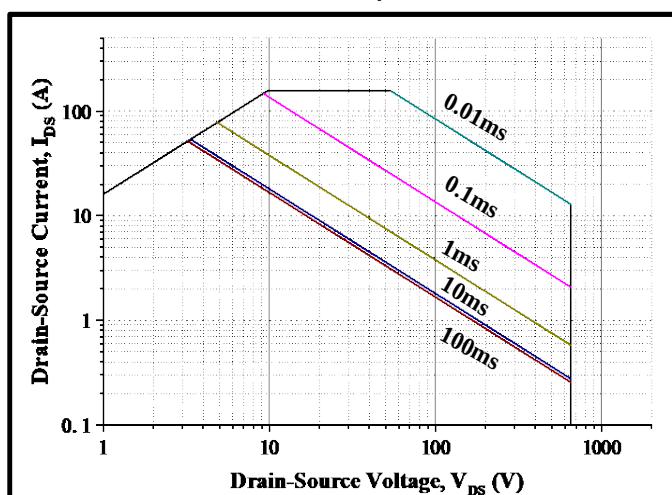


Figure 22. Safe Operating Area

Test Circuit Schematic

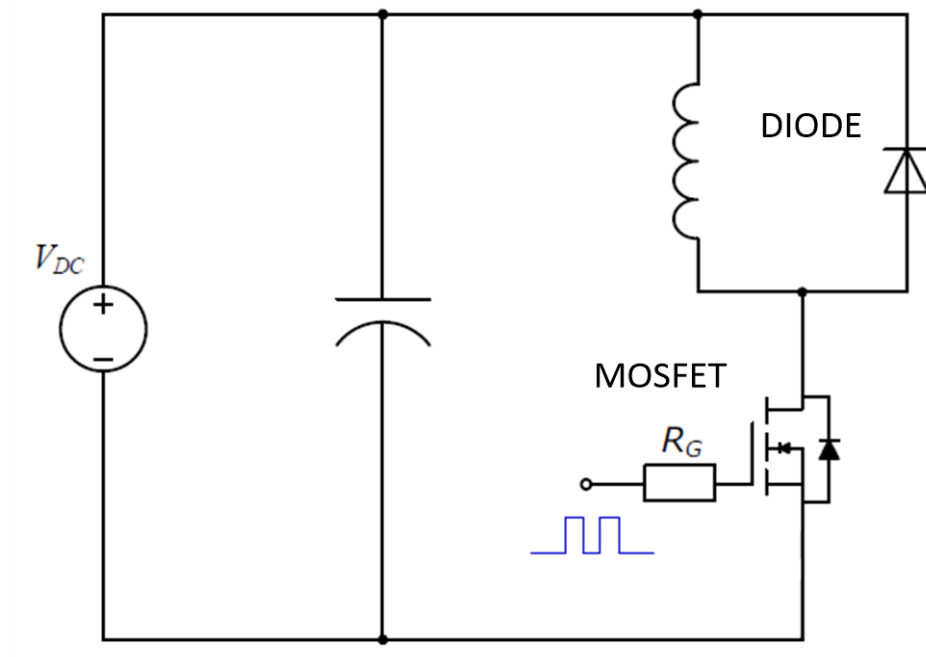
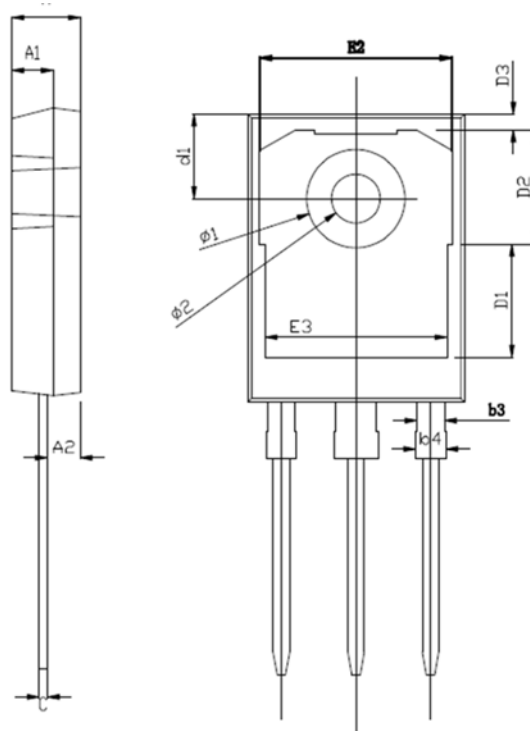
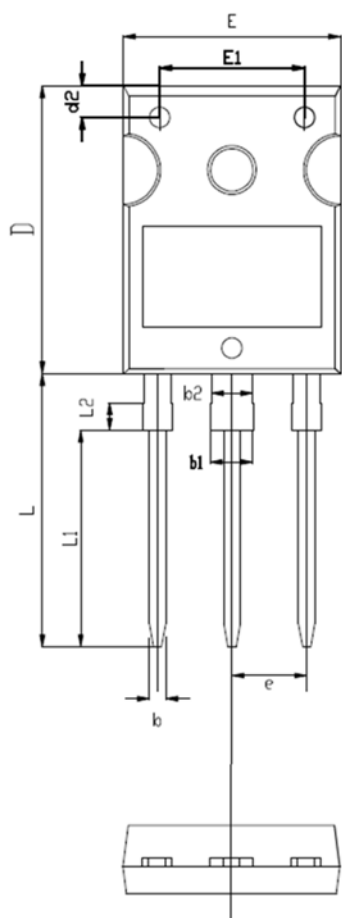


Figure 23. Clamped Inductive Switching
Waveform Test Circuit

Package Dimensions



RECOMMENDED LAND PATTERN



UNIT: mm

	MIN	NOM	MAX
A	4.80	5.00	5.20
A1	2.80	3.00	3.20
A2	2.26	2.41	2.56
b	1.10	1.20	1.30
b1	2.90	-	3.20
b2	2.90	3.00	3.10
b3	1.90	2.00	2.10
b4	2.00	-	2.20
c	0.50	0.60	0.70
D	20.80	21.00	21.20
D1		8.23	
D2		8.32	
D3		1.17	
d1	6.00	6.15	6.30
d2	2.20	2.30	2.40
E	15.60	15.80	16.00
E1		10.50	
E2		14.02	
E3		13.50	
e	5.34	5.44	5.54
L	19.72	19.92	20.12
L1		15.79	
L2		1.98	
Ø1	7.10	7.19	7.30
Ø2	3.50	3.60	3.70

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