

N1M120080PD1

Silicon Carbide Power MOSFET
N-Channel Enhancement Mode

V_{DS}	1200V
$I_D @ 25^{\circ}C$	36A
$R_{DS(ON)}$	80m Ω

Features

- Low On-Resistance
- Low Capacitances
- Low Switching Losses
- Easy to Parallel and Simple to Drive

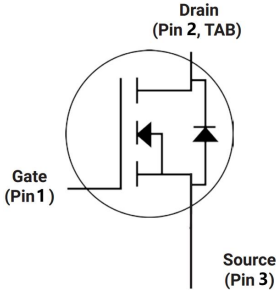
Benefits

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

Applications

- On-Board Charger/PFC
- Solar Inverters
- Booster/DC-DC Converters
- Motor Drives
- Switch Mode Power Supplies

Features



Part Number	Package
N1M120080PD1	TO-247-3

Maximum Ratings (T_C = 25°C unless otherwise specified)

Symbol	Parameter	Value	Unit	Test Conditions	Note
V_{DSmax}	Drain - Source Voltage	1200	V	$V_{GS} = 0\text{ V}$, $I_D = 100\text{ }\mu\text{A}$	
V_{GSmax}	Gate - Source Voltage	-10/+25	V	Absolute maximum values, AC ($f > 1\text{ Hz}$)	
V_{GSop}	Gate - Source Voltage	-5/+20	V	Recommended operational values	
I_D	Continuous Drain Current	36	A	$V_{GS} = 20\text{ V}$, $T_C = 25^{\circ}C$	
		24	A	$V_{GS} = 20\text{ V}$, $T_C = 100^{\circ}C$	
$I_{D(pulse)}$	Pulsed Drain Current	80	A	Pulse width t_p limited by T_{jmax}	
P_D	Power Dissipation	198	W	$T_C=25^{\circ}C, T_J=150\text{ }^{\circ}C$	
T_J, T_{stg}	Operating Junction and Storage Temperature	-55 to + 150	$^{\circ}C$		
T_{Proc}	Maximum Processing Temperature	325	$^{\circ}C$	10 min. maximum	

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	1200			V	$V_{GS}=0V, I_D=100\mu A$	
$V_{GS(th)}$	Gate Threshold Voltage	2	2.7	4	V	$V_{DS}=V_{GS}, I_D=5mA$	Fig. 11
			2.0		V	$V_{DS}=V_{GS}, I_D=5mA, T_J=150^\circ\text{C}$	
I_{DSS}	Zero Gate Voltage Drain Current		0.01	100	μA	$V_{DS}=1200V, V_{GS}=0V$	
I_{GSS}	Gate-Source Leakage Current			250	nA	$V_{GS}=20V, V_{DS}=0V$	
$R_{DS(on)}$	Drain-Source On-State Resistance		80	98	m Ω	$V_{GS}=20V, I_D=20A$	Fig. 4, 5, 6
			131			$V_{GS}=20V, I_D=20A, T_J=150^\circ\text{C}$	
g_{fs}	Transconductance		6.6		S	$V_{DS}=20V, I_{DS}=20A$	Fig. 7
			8.5			$V_{DS}=20V, I_{DS}=20A, T_J=150^\circ\text{C}$	
C_{iss}	Input Capacitance		1337		pF	$V_{GS}=0V, V_{DS}=1000V,$ $f=1MHz, V_{AC}=25mV$	Fig. 17, 18
C_{oss}	Output Capacitance		75				
C_{rss}	Reverse Transfer Capacitance		4.5				
E_{oss}	Coss Stored Energy		21		μJ		Fig. 16
E_{AS}	Avalanche Energy, Single Pluse		780		mJ	$I_D=20A, V_{DD}=50V$	
E_{ON}	Turn-On Switching Energy		284		μJ	$V_{DS}=800V, V_{GS}=-5/20V, I_D=20A,$ $R_{(ext)}=2.5\Omega, L=142\mu H$	Fig. 21
E_{OFF}	Turn Off Switching Energy		24				
$t_{d(on)}$	Turn-On Delay Time		10		ns	$V_{DD}=800V, V_{GS}=-5/20V, I_D=20A,$ $R_{G(ext)}=2.5\Omega, R_L=40\Omega,$	Fig. 22
t_r	Rise Time		7				
$t_{d(off)}$	Turn-Off Delay Time		20				
t_f	Fall Time		5				
$R_{G(int)}$	Internal Gate Resistance		3.1		Ω	$f=1MHz, V_{AC}=25mV$	
Q_{gs}	Gate to Source Charge		15		nC	$V_{DS}=800V, V_{GS}=-5/20V,$ $I_D=20A$	Fig. 12
Q_{gd}	Gate to Drain Charge		10				
Q_g	Total Gate Charge		48				

Reverse Diode Characteristics

Symbol	Parameter	Typ.	Max.	Unit	Test conditions	Note
V_{SD}	Diode Forward Voltage	4.0		V	$V_{GS}=-5V, I_{SD}=10A$	Fig. 8,9,10
		3.5		V	$V_{GS}=-5V, I_{SD}=10A, T_J=150^\circ\text{C}$	
I_S	Continuous Diode Forward Current		36	A	$T_C=25^\circ\text{C}$	Note 2
t_{rr}	Reverse Recover time	32		ns	$V_{GS}=-5V, I_{SD}=20A, V_R=800V,$ $dif/dt=1950A/us$	Note 1
Q_{rr}	Reverse Recovery Charge	108		nC		
I_{rrm}	Peak Reverse Recovery Current	6		A		

Note (1): When using SiC Body Diode the maximum recommended $V_{GS} = -5V$

Thermal Characteristics

Symbol	Parameter	Typ.	Max.	Unit	Test conditions	Note
$R_{\theta JC}$	Thermal Resistance from Junction to Case	0.63		$^\circ\text{C/W}$		
$R_{\theta JA}$	Thermal Resistance From Junction to Ambient		40			

Typical Performance

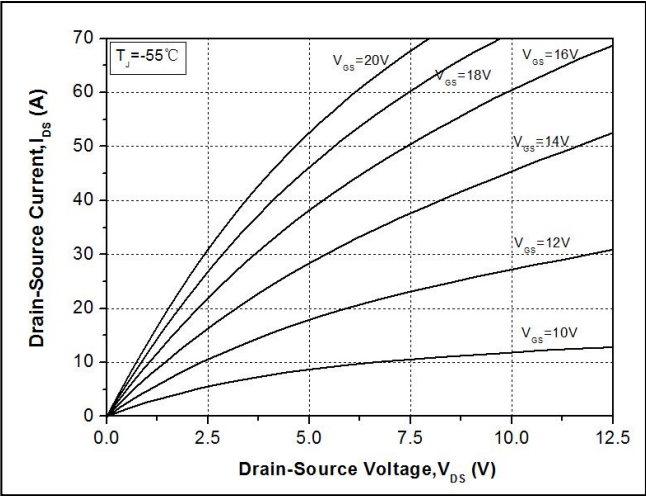


Figure 1. Output Characteristics $T_J = -55\text{ }^{\circ}\text{C}$

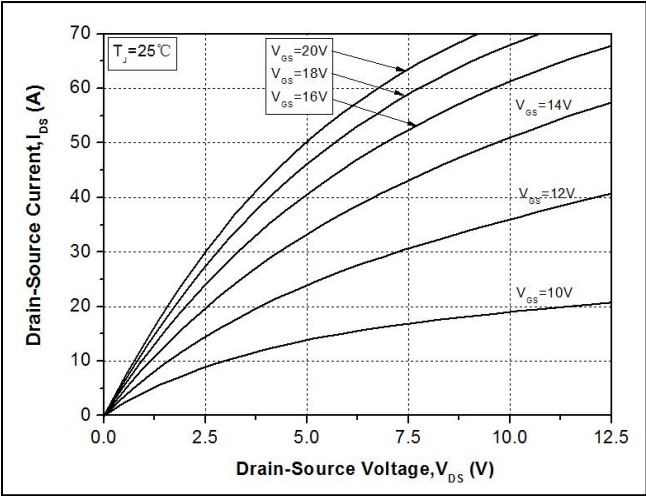


Figure 2. Output Characteristics $T_J = 25\text{ }^{\circ}\text{C}$

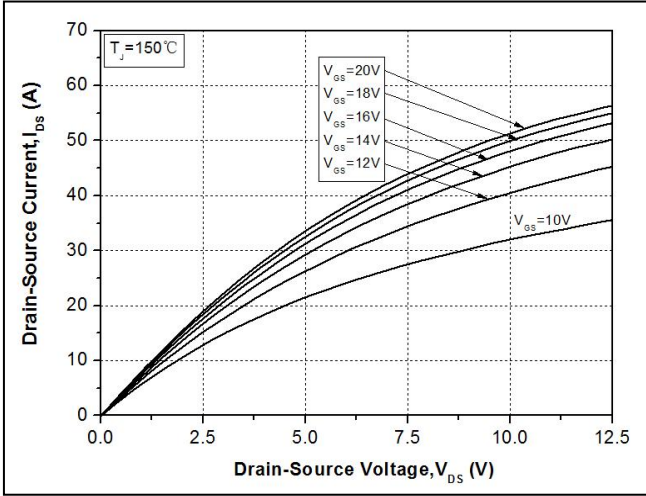


Figure 3. Output Characteristics $T_J = 150\text{ }^{\circ}\text{C}$

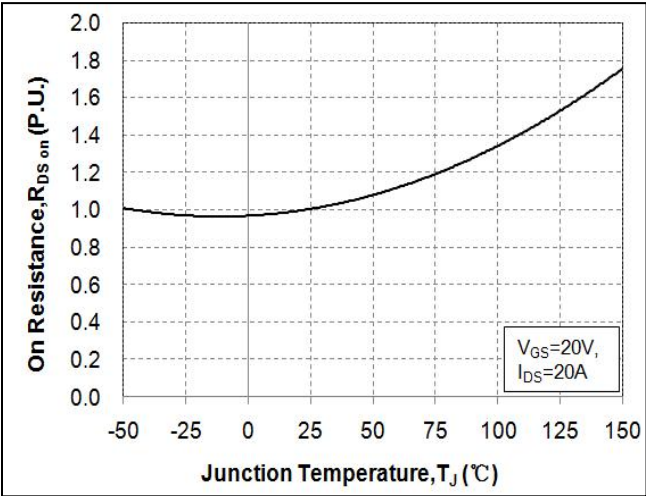


Figure 4. Normalized On-Resistance vs. Temperature

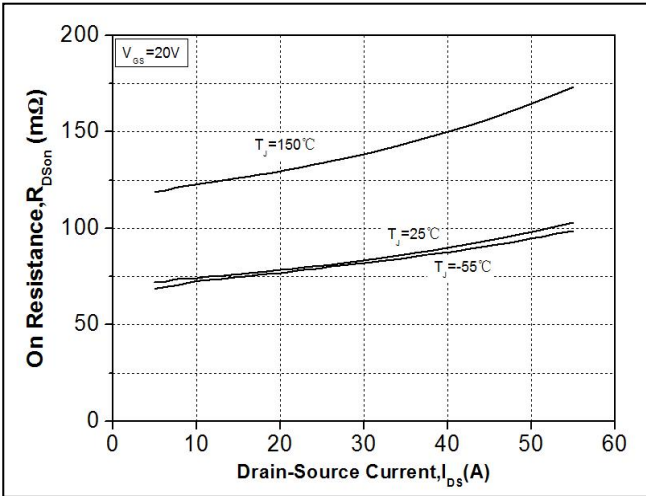


Figure 5. On-Resistance vs. Drain Current for Various Temperatures

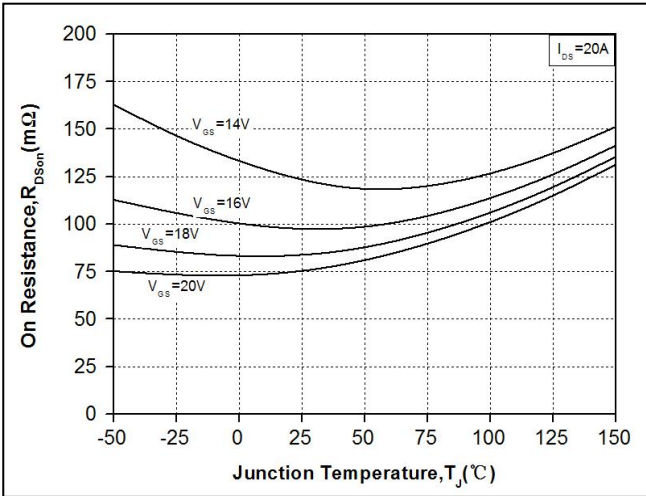


Figure 6. On-Resistance vs. Temperature for Various Gate Voltages

Typical Performance

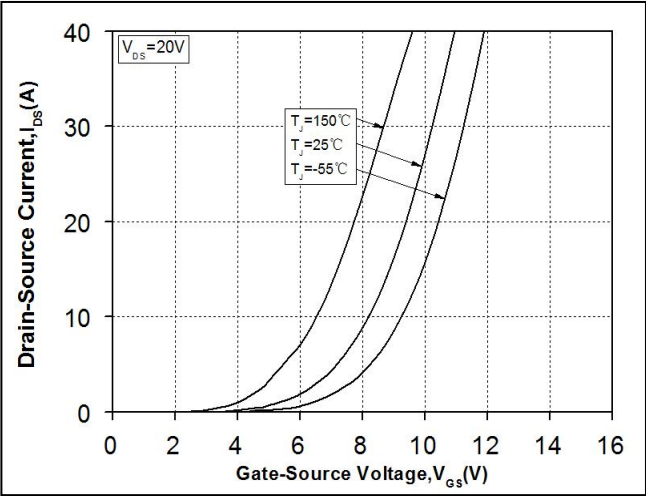


Figure 7. Transfer Characteristics for Various Junction Temperatures

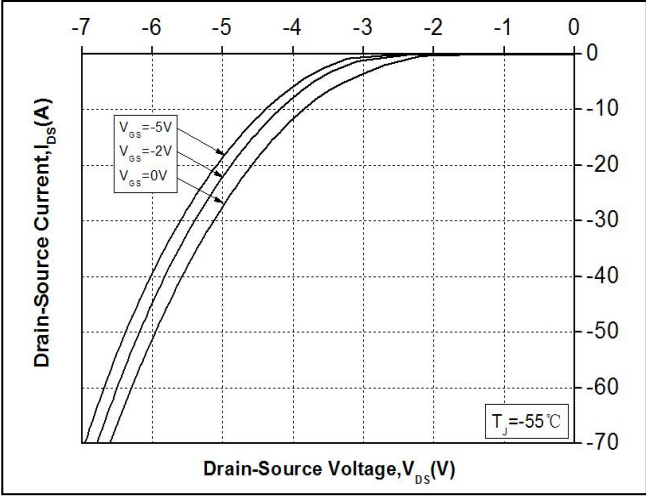


Figure 8. Body Diode Characteristics at -55 °C

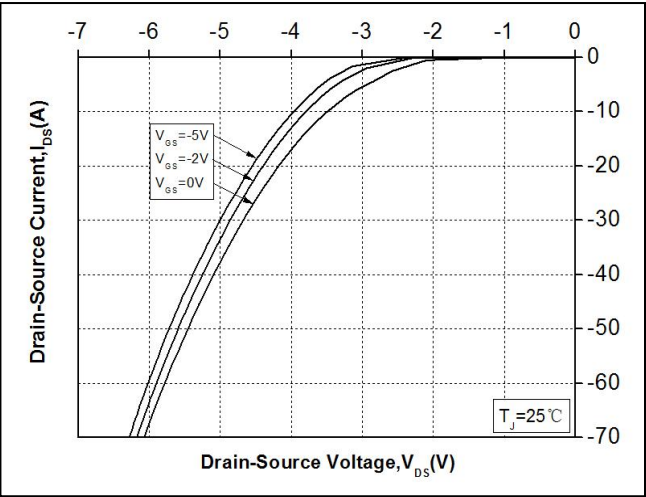


Figure 9. Body Diode Characteristics at 25 °C

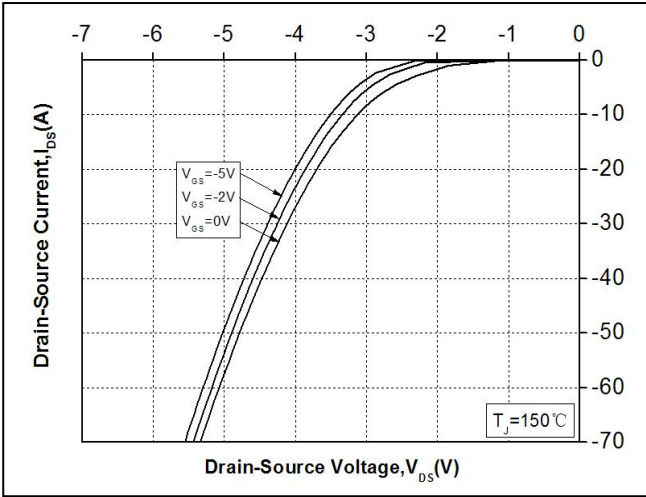


Figure 10. Body Diode Characteristics at 150 °C

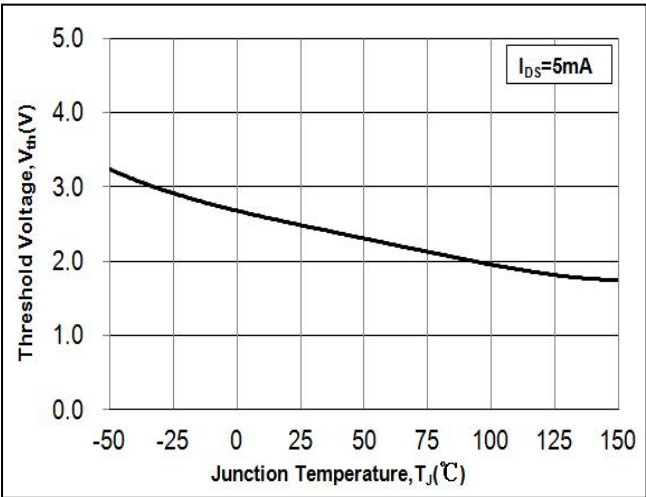


Figure 11. Threshold Voltage vs. Temperature

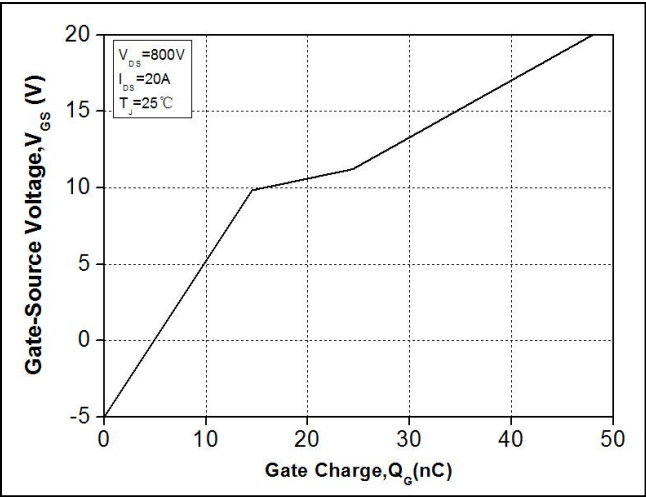


Figure 12. Gate Charge Characteristics

Typical Performance

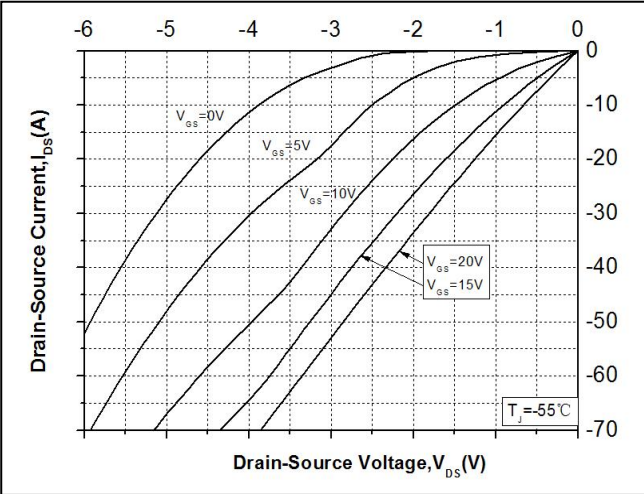


Figure 13. 3rd Quadrant Characteristics at -55 °C

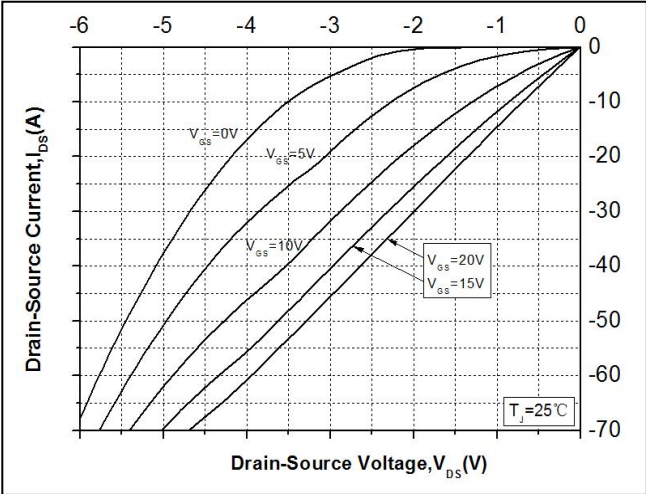


Figure 14. 3rd Quadrant Characteristics at 25 °C

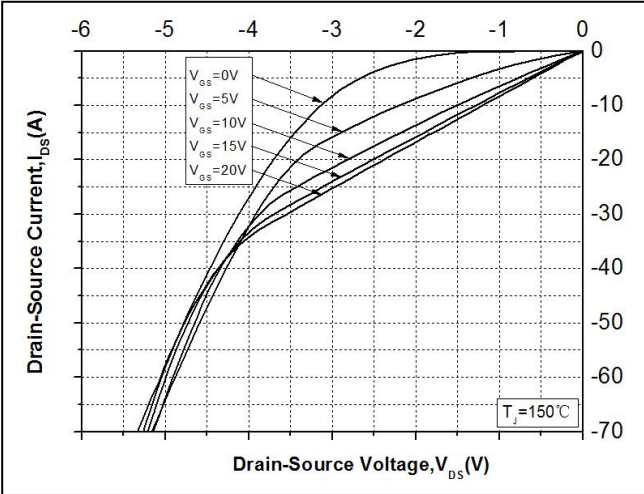


Figure 15. 3rd Quadrant Characteristics at 150 °C

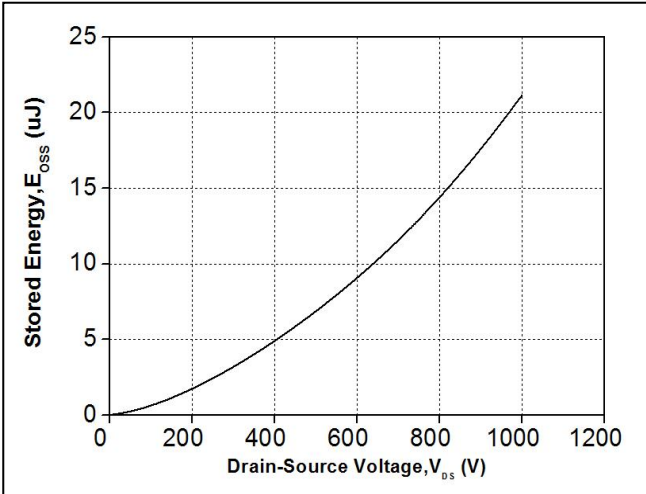


Figure 16. Output Capacitor Stored Energy

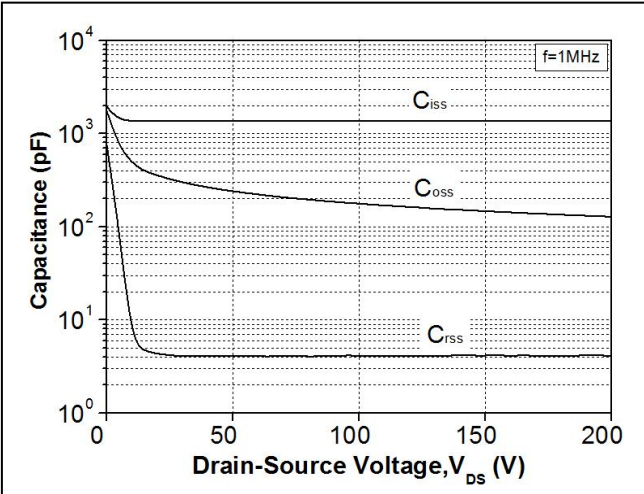


Figure 17. Capacitances vs. Drain-Source Voltage (0 - 200V)

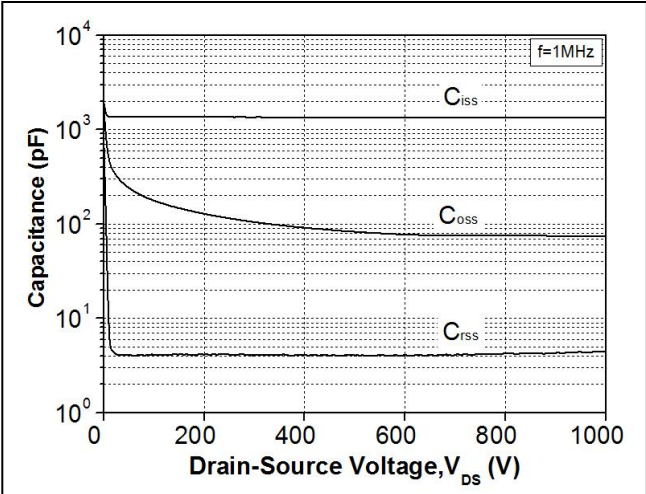


Figure 18. Capacitances vs. Drain-Source Voltage (0 - 1000V)

Typical Performance

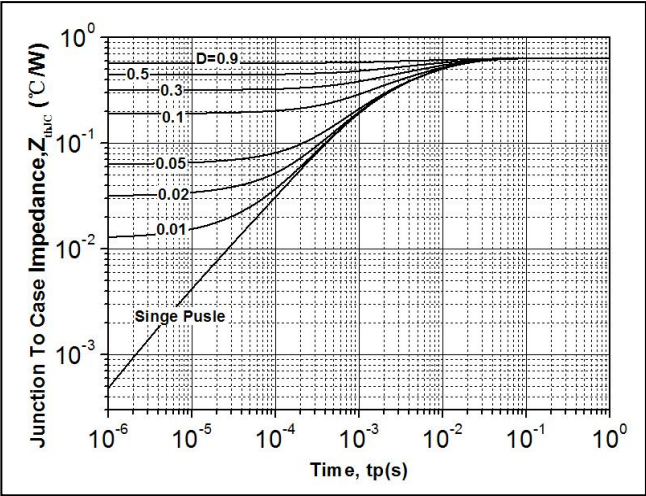


Figure 19. Transient Thermal Impedance (Junction - Case)

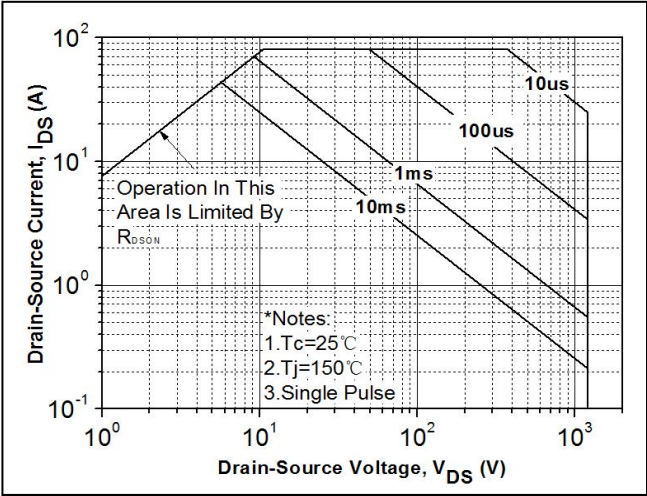


Figure 20. Safe Operating Area

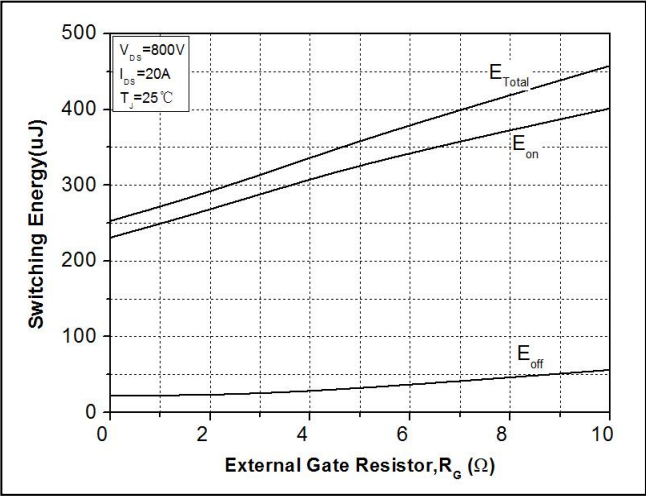


Figure 21. Clamped Inductive Switching Energy vs. $R_{G(ext)}$

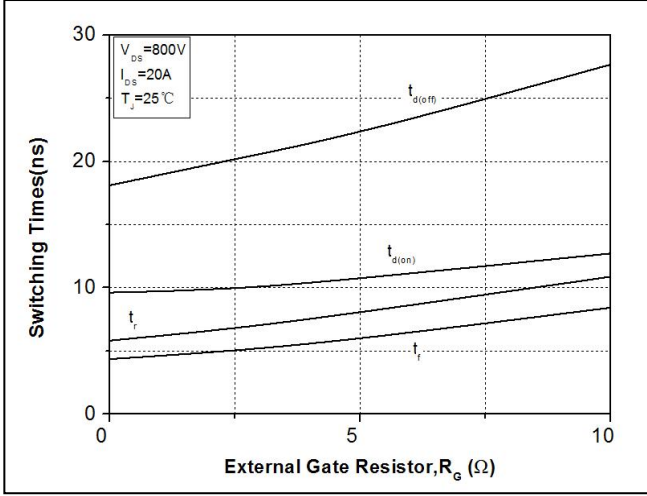
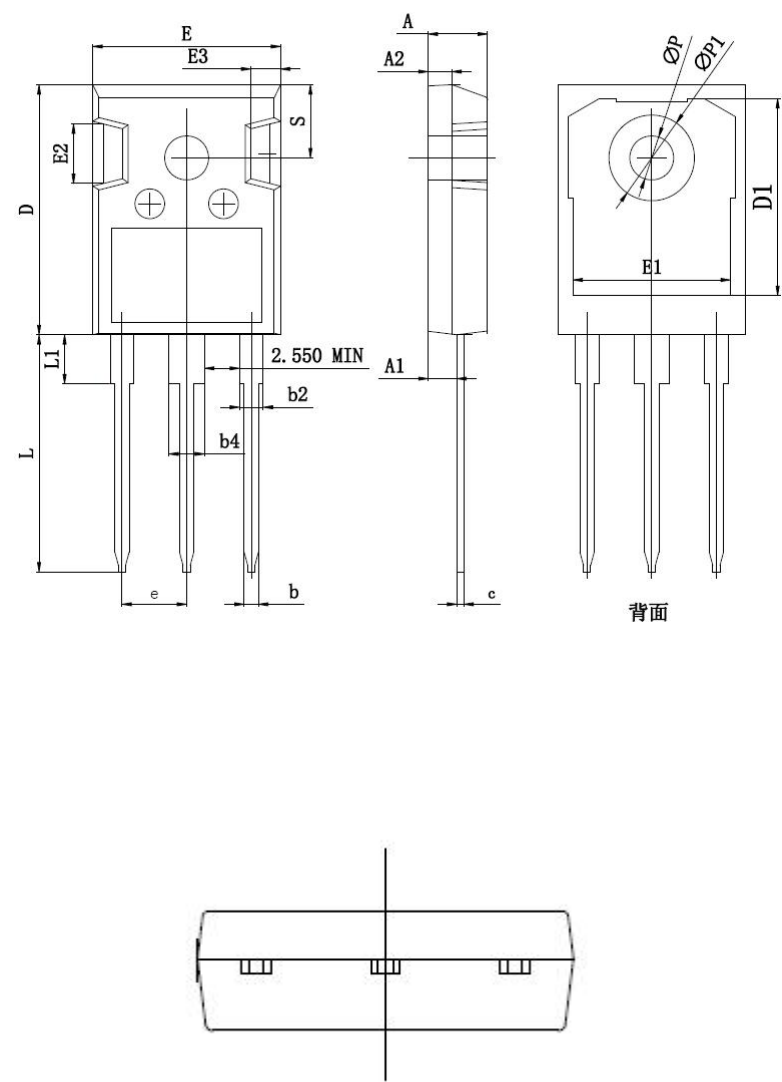


Figure 22. Switching Times vs. $R_{G(ext)}$

Package Dimensions



	mm		
	MIN	NOM	MAX
A	4.800	5.000	5.200
A1	2.210	2.410	2.590
A2	1.850	2.000	2.150
b	1.110	1.210	1.360
b2	1.910	2.010	2.210
b4	2.910	3.010	3.210
c	0.510	0.610	0.750
D	20.800	21.000	21.300
D1	16.250	16.550	16.860
E	15.500	15.800	16.100
E1	13.000	13.300	13.600
E2	4.800	5.000	5.200
E3	2.300	2.500	2.700
e	5.440BSC		
L	19.820	19.920	20.220
L1	/	/	4.300
φP	3.400	3.600	3.800
φP1	/	/	7.300
S	6.150BSC		