Change History:

Date	Version	Change Item	Author
2023/9/5	V1.0	First release.	John Ruan

M1P-1200-125B

All Silicon Carbide Power Module

1200V/125A 2-in-1 SiC MOSFET Power Module

Features

- Low $R_{DS(on)}$
- Low surge, low switching loss
- High-speed switching possible
- Silicon Nitride AMB substrate for high reliability
- Halogen Free, RoHS Compliant

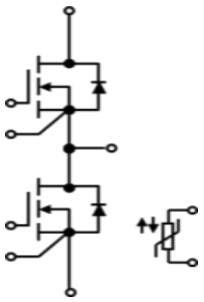
Benefits

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

Applications

- Motor drive
- Electrified vehicle traction inverter
- Photovoltaic, wind power generation
- Induction heating equipment

Equivalent Circuit Schematic



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

Symbol	Parameter	Value	Unit	Test Conditions	Note
V_{DSmax}	Drain - Source Voltage	1200	V		
V_{GSmax}	Gate - Source Voltage	-10/+22	V	Absolute maximum values	
V_{GSop}	Gate - Source Voltage	-6/+18	V	Recommended operational values	
I_D	Continuous Drain Current	125 100 90	A	V_{GS}=18V , T_c=25°C V_{GS}=18V , T_c=75°C V_{GS}=18V , T_c=100°C	
$I_{D,peak}$	Repetitive peak drain current	160	A	Pulsed Drain Current, t_P limited by T_{VJ}max	
T_{VJ}, T_{stg}	Operating Junction and Storage Temperature	-55 to +175	°C		
V_{ISO}	Isolation Test Voltage	3000		AC，50Hz，1 s	

Electrical Characteristics

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions	Note
$V_{(BR)DSS}$	Drain-Source Breakdown Voltage	1200			V	V_{GS}=0V, I_D=100μA	
$V_{GS(th)}$	Gate Threshold Voltage	2.1	3.0	4.2	V	V_{GS}= V_{DS}, I_{DS}=25mA,T_{VJ}=25°C	
I_{DSS}	Zero Gate Voltage Drain Current		10	100	μA	V_{DS}= 1200V, V_{GS}=0V	
I_{GSS}	Gate-Source Leakage Current		20	100	nA	V_{GS}= 18 V, V_{DS}= 0V	
$R_{DS(on)}$	Drain-Source on-state Resistance		14	18	mΩ	V_{GS}= 18 V, I_D=100A, T_{VJ}=25°C	
			19.2		mΩ	V_{GS}= 18 V, I_D=100A, T_{VJ}=125°C	
Ciss	Input Capacitance		5700		pF	V_{GS}=0V, V_{DS}=800 V, f=1MHz, V_{AC}=25 mV	
Coss	Output Capacitance		270				
Crss	Reverse Transfer Capacitance		32				
E_{ON}	Turn-On Switching Energy		1.1		mJ	V_{DS}=800V, V_{GS}=-5/18V, I_D= 100A, $R_{G(ext)}$ = 5Ω, L= 50 μH, di/dt = 4 kA/μs	
E_{OFF}	Turn-Off Switching Energy		0.86				
$t_{d(on)}$	Turn-On Delay Time		38		ns	V_{DS}=800V, V_{GS}=-5/18 V I_D = 100A, $R_{G(ext)}$ = 5 Ω ,	
t_r	Rise Time		16				
$t_{d(off)}$	Turn-Off Delay Time		92				
t_f	Fall Time		26				
Q_{gs}	Gate to Source Charge		133		nC	V_{DS}=800V, V_{GS}=-5/18 VI_D = 75A	
Q_{gd}	Gate to Drain Charge		142				
Q_g	Total Gate Charge		274				

Reverse Diode Characteristics

Symbol	Parameter	Typ.	Max.	Unit	Test Conditions	Note
V_{SD}	Diode Forward Voltage	4.5		V	V_{GS} = -5V, I_{SD} = 50 A, T_{VJ} = 25 °C	
		4.4		V	V_{GS} = -5V, I_{SD} = 50 A, T_{VJ} = 150 °C	
I_S	Continuous Diode Forward Current		100	A	V_{GS} = -5V,T_{VJ} = 25°C	
			80	A	V_{GS} = -5V,T_{VJ} = 150°C	

Symbol	Parameter	Typ.	Max.	Unit	Test Conditions	Note
I_{rrm}	Peak reverse recovery current		265	A	V_{GS} = -5V, I_{SD} = 100 A, $V_{R,DS}$=800V, T_{VJ} = 25 °C	
			530	A	V_{GS} = -5V, I_{SD} = 100 A, $V_{R,DS}$=800V, T_{VJ} = 150 °C	
Q_{rr}	Reverse recovery charge		16.6	nC	V_{GS} = -5V, I_{SD} = 100 A, $V_{R,DS}$=800V, T_{VJ} = 25 °C	
			27.2	nC	V_{GS} = -5V, I_{SD} = 100 A, $V_{R,DS}$=800V, T_{VJ} = 150 °C	

NTC Characteristics

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions	Note
R_{25}	Rated Resistance		5.0		kΩ	T_C = 25°C	
ΔR/R	Deviation of R_{100}	-5		5	%	T_C = 100 °C R_{100} = 493 Ω	
P_{25}	Power Dissipation			20	mW	T_C = 25°C	
B-25/50	$R_2 = R_{25} \exp [B_{25/50}(1/T_2 - 1/(298.15\ K))]$		3375		K		
B-25/80	$R_2 = R_{25} \exp [B_{25/80}(1/T_2 - 1/(298.15\ K))]$		3411		K		
B-25/100	$R_2 = R_{25} \exp [B_{25/100}(1/T_2 - 1/(298.15\ K))]$		3433		K		

Package Characteristics

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions	Note
$L_{s,DS}$	Stray inductance of module		9.2		nH	T_C = 25°C	
M_T	Mounting torque for module mounting	1.8	2.0	2.2	Nm	Screw M4 baseplate to heatsink	
W_P	Weight		25		g		
	Internalisolation	basicinsulation(class1, IEC61140)				AIN	

Electrical Characteristic Curve

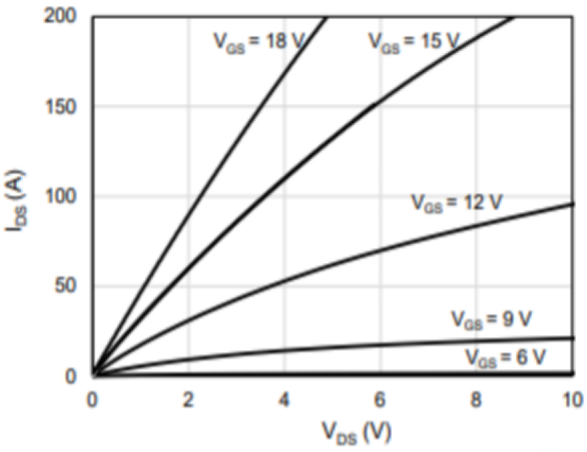


Figure 1: Output Characteristics T_J = -40℃

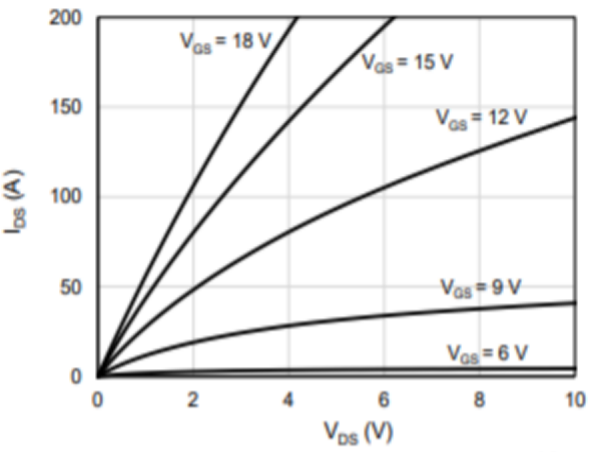


Figure 2: Output Characteristics T_J = 25℃

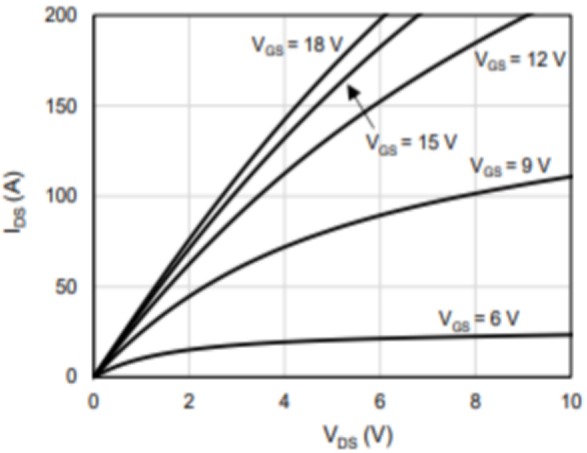


Figure 3: Output Characteristics T_J = 175℃

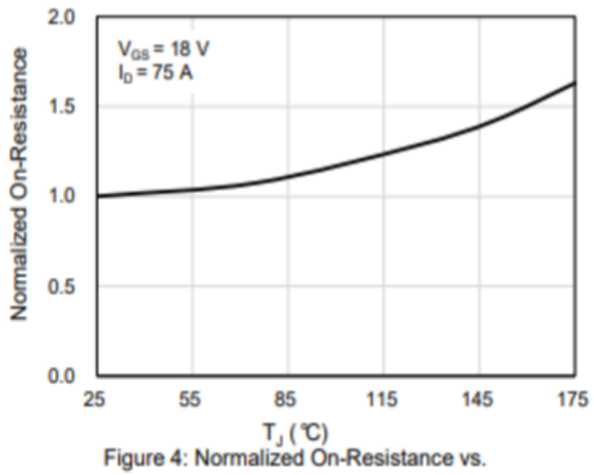


Figure 4: Normalized On-Resistance vs. Temperature

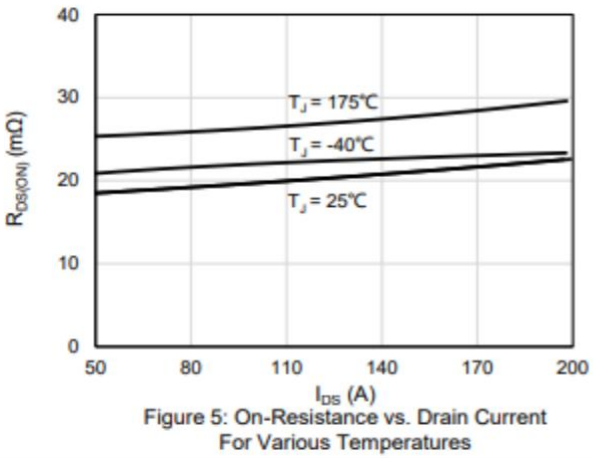


Figure 5: On-Resistance vs. Drain Current For Various Temperatures

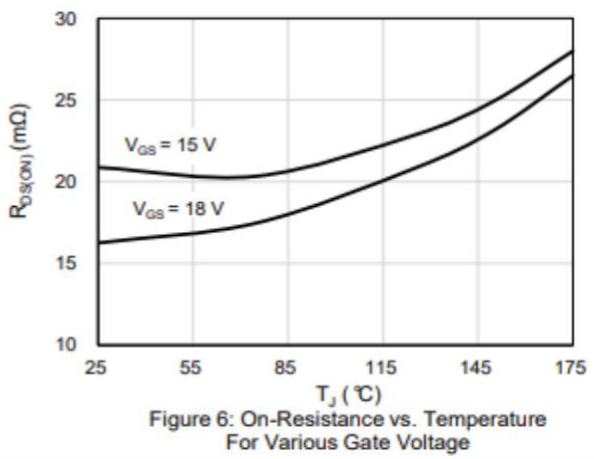


Figure 6: On-Resistance vs. Temperature For Various Gate Voltage

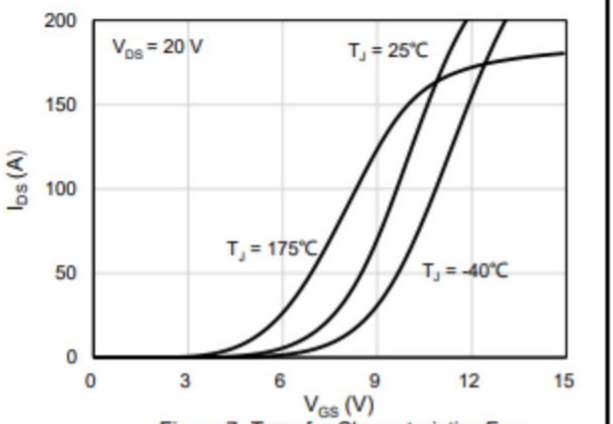


Figure 7: Transfer Characteristics For Various Junction Temparature

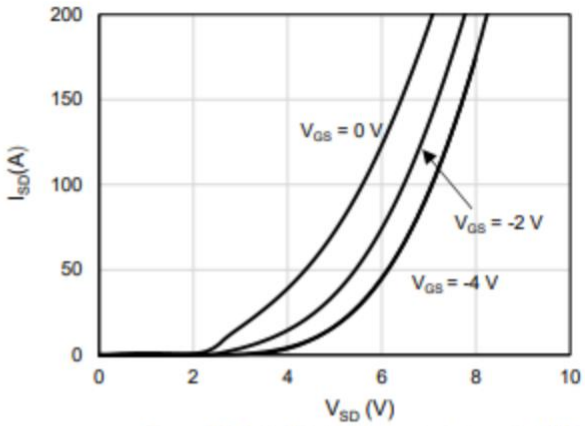


Figure 8: Body Diode Characteristics at -40℃

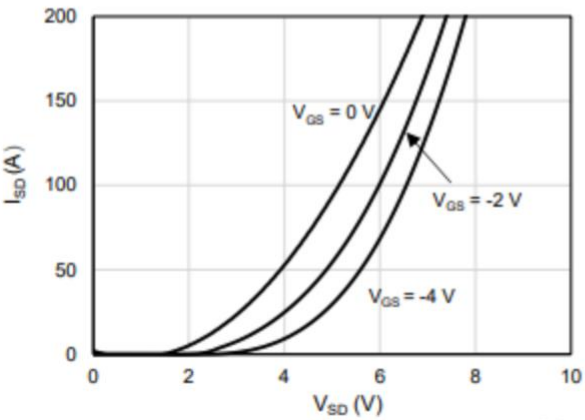


Figure 9: Body Diode Characteristics at 25℃

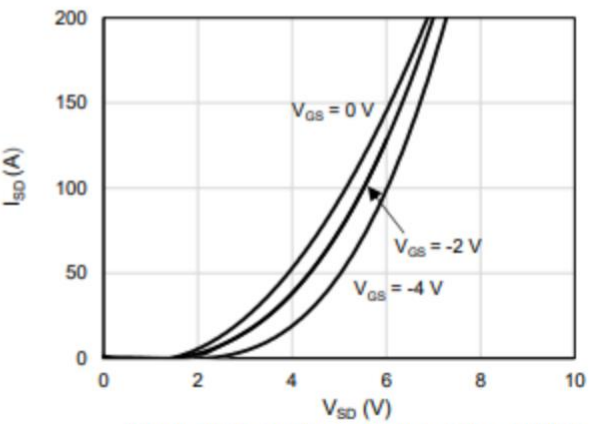


Figure 10: Body Diode Characteristics at 175℃

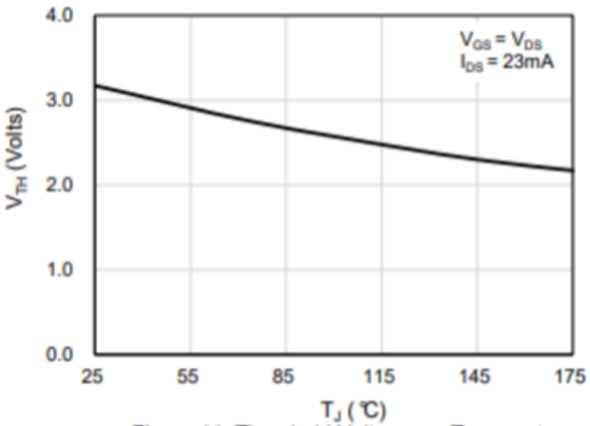


Figure 11: Threshold Voltage vs. Temperature

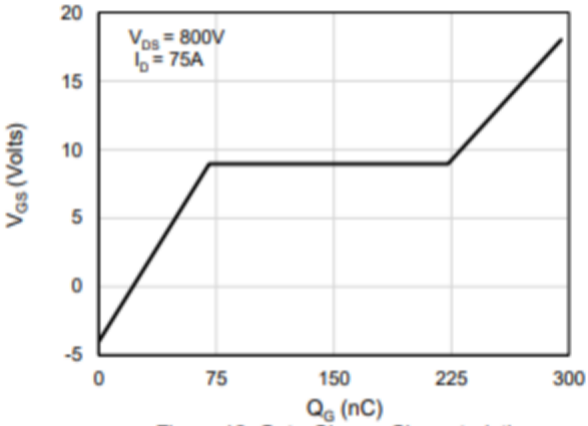


Figure 12: Gate-Charge Characteristics

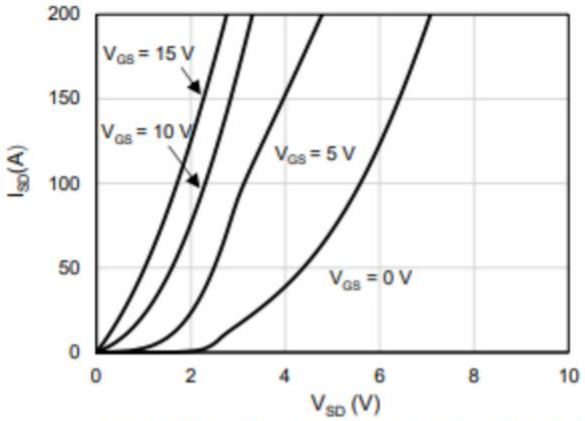


Figure 13: 3rd Quadrant Characteristics at -40℃

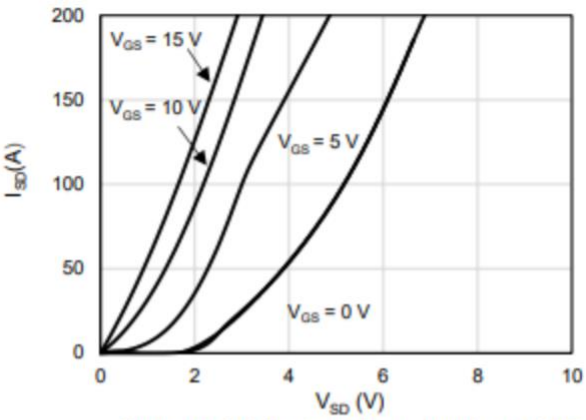


Figure 14: 3rd Quadrant Characteristics at 25℃

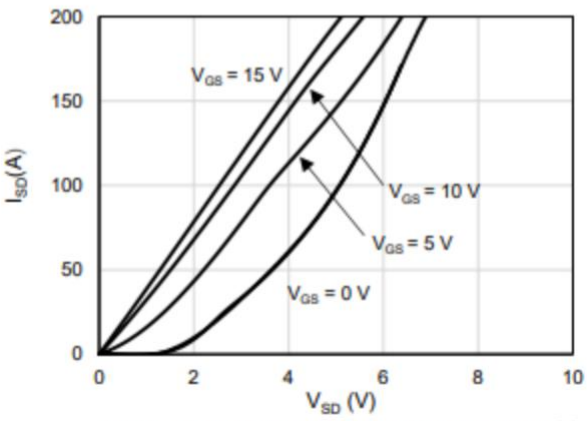


Figure 15: 3rd Quadrant Characteristics at 175℃

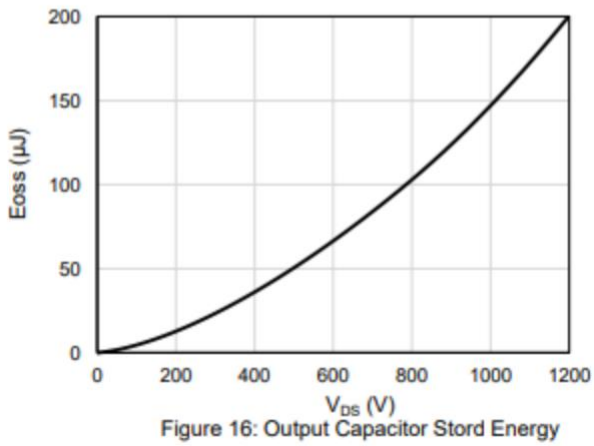


Figure 16: Output Capacitor Stord Energy

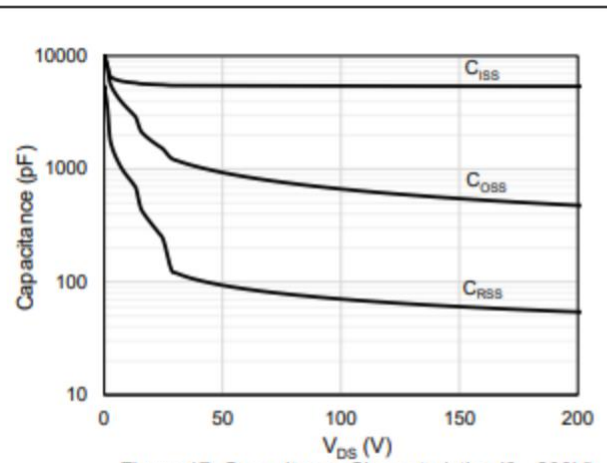


Figure 17: Capacitance Characteristics (0 - 200V)

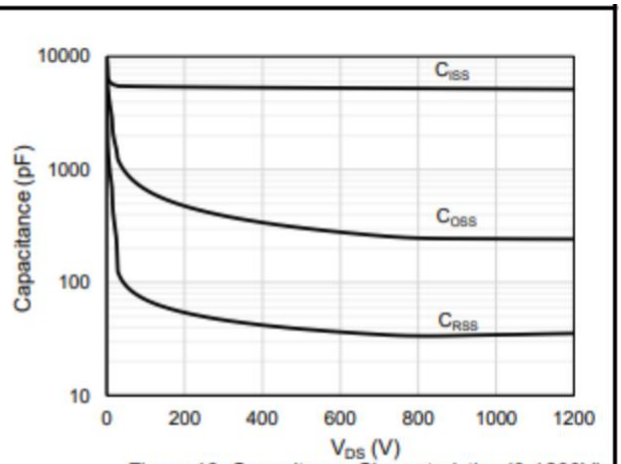


Figure 18: Capacitance Characteristics (0-1200V)

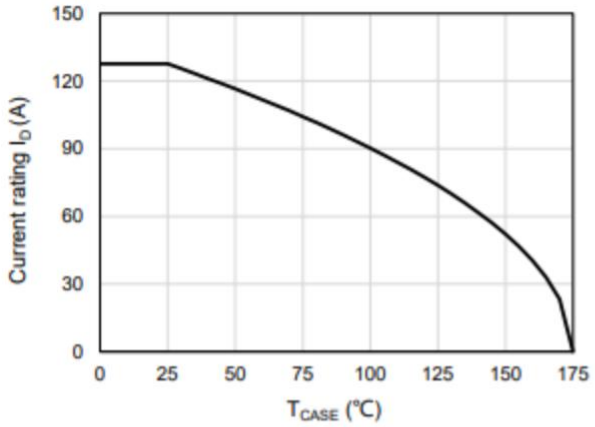


Figure 19: Current De-rating

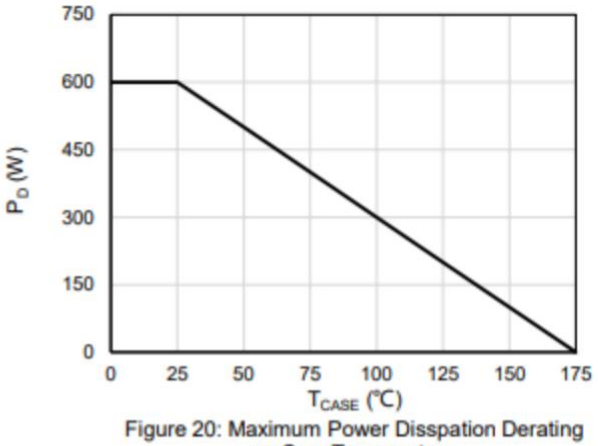


Figure 20: Maximum Power Disspation Derating vs CaseTemperature

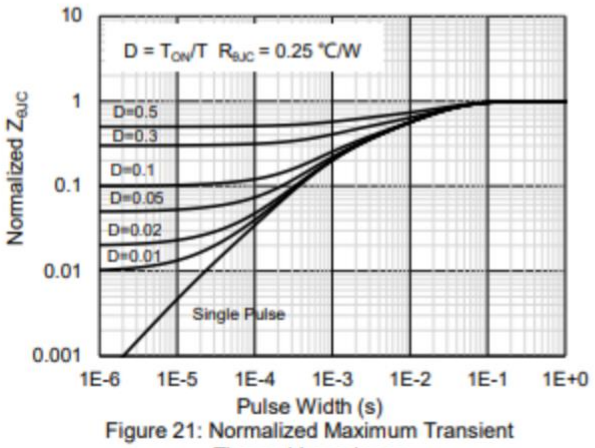


Figure 21: Normalized Maximum Transient Thermal Impedance

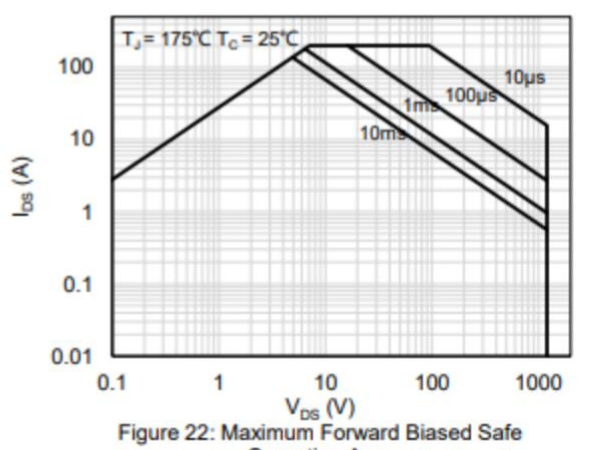


Figure 22: Maximum Forward Biased Safe Operating Area

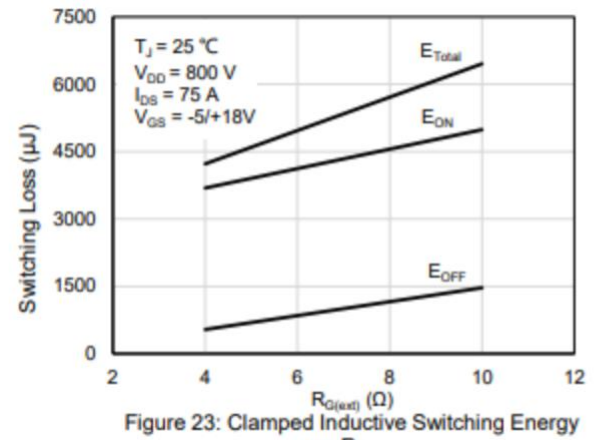


Figure 23: Clamped Inductive Switching Energy vs. $R_{G(ext)}$

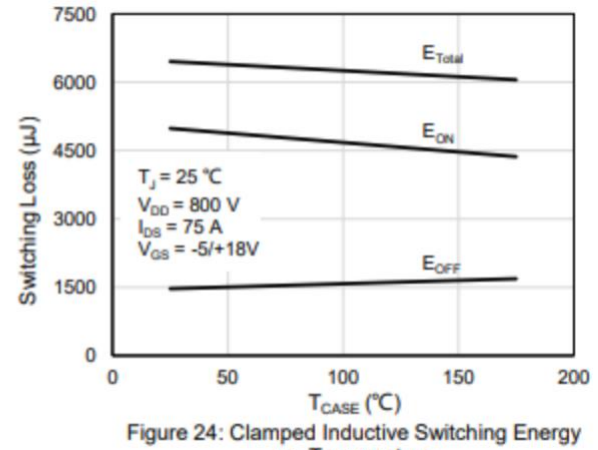
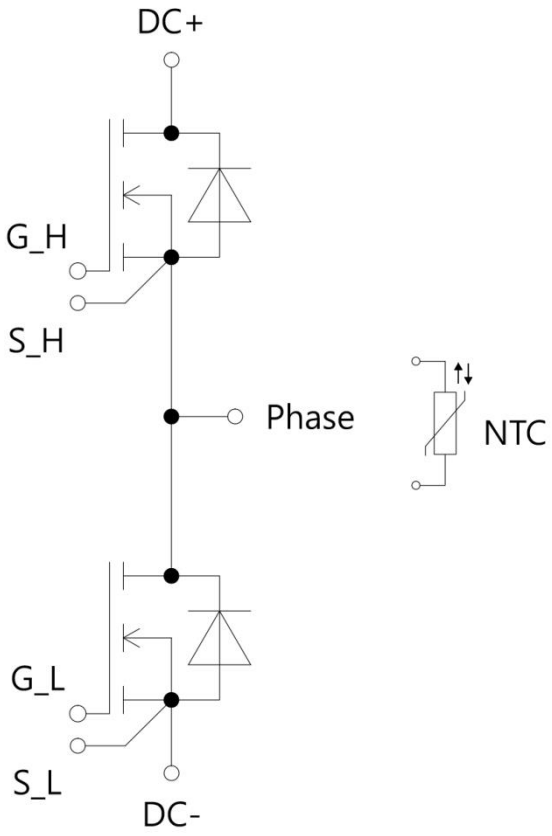


Figure 24: Clamped Inductive Switching Energy vs. Temperature

Circuit Schematic



Package Dimension