MMN02V120X6BS

1200V SiC Module

September 2024 Preliminary RoHS Compliant

PRODUCT FEATURES

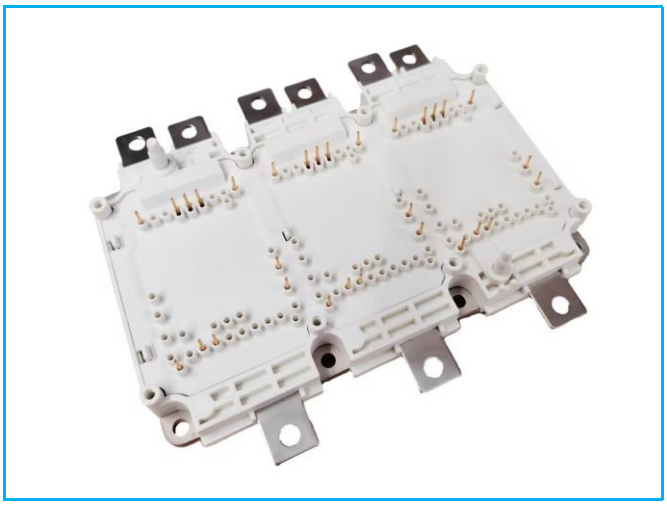
☐ 1200V new semiconductor material-silicon carbide

☐ Optimized for low RDS(on) and high short-circuit ruggedness

☐ Low internal gate resistance for fast switching

☐ Direct-cooled pinfin base plate

☐ High-performance si3n4 ceramic



APPLICATIONS

☐ Automotive Applications

☐ Hybrid Electrical Vehicles (H)EV

☐ Motor Drives

☐ High Frequency Switching Application

MODULE CHARACTERISTICS(T_{vj} *=25°C unless otherwise specified)*

Symbol	Parameter/Test Conditions		Values	Unit
V_{isol}	Isolation test voltage	RMS, f = 50 Hz, t = 5 s	3500	V
CTI	Comparative tracking index		＞200	
T_{stg}	Storage Temperature		-40~125	℃
Torque	baseplate to heatsink	Recommended（M4）	1.8~2.2	Nm
	PCB to frame	Recommended（M3）	0.4~0.6	Nm
Weight			775	g
P_{tot}	Power Dissipation Per Mosfet	T_f=60℃, T_{vjmax}=175℃	974	W

MOSFET

ABSOLUTE MAXIMUM RATINGS(T_{vj} *=25°C unless otherwise specified)*

Symbol	Parameter/Test Conditions		Values	Unit
V_{DSS}	Drain - source voltage		1200	V
I_{DDC}	Continuous DC Drain Current	V_{GS}=18V,T_f=60℃,T_{vj}=175℃	439	A
I_{DRM}	Repetitive Peak Drain Current	tp limited by T_{vjmax}	900	A
V_{GSS}	Gate-source voltage, max.transient voltage	10 hours over lifetime，tp＜20μs	-11/+23	V
V_{GSS}	Gate-source voltage, max.static voltage		-5.5/+20	V
$V_{GS,on}$ $V_{GS,off}$	turn-on gate voltage turn-off gate voltage	Static	15...18 -5…0	V V

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ELECTRICAL CHARACTERISTICS *(T_{vj}=25°C unless otherwise specified)*

Symbol	Parameter/Test Conditions			Min.	Typ.	Max.	Unit
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS}=V_{GS},I_D=60mA,T_{vj}=25℃ (tested after 1ms pulse at V_{GS}=+20 V)			3.9		V
$R_{DS(on)}$	Static drain-source on-state resistance	I_D=400A, V_{GS}=18V, T_{vj}=25℃			2.12		mΩ
		I_D=400A, V_{GS}=18V, T_{vj}=125℃			3.60		
		I_D=400A, V_{GS}=18V, T_{vj}=175℃			4.80		
I_{DSS}	Reverse Bias Drain Current	V_{DS}=1200V, V_{GS}=0V				250	μA
I_{GSS}	Gate-Source Leakage Current	V_{DS}=0V,V_{GS}=20V				200	nA
Q_G	Gate Charge	V_{DS}=800V, V_{GS}=-5/18V			1.1		μC
C_{iss}	Input Capacitance	V_{DS}=800V, V_{GS}=0V, f =100kHz			23.9		nF
C_{oss}	Output Capacitance				7		
C_{rss}	Reverse Transfer Capacitance				0.25		
$R_{G(int)}$	Internal Gate Resistance	f =1MHz			1.8		Ω
$t_{d(on)}$	Turn on Delay Time	V_{DS}=800V,I_D=400A R_G =5Ω V_{GS}=-5/18V di/dt_{on}=9700A/μs dv/dt_{off}=12000V/μs (T_{vj}=175℃)	T_{vj}=25℃		70		ns
			T_{vj}=125℃		56		
			T_{vj}=175℃		49		
t_r	Rise Time		T_{vj}=25℃		123		
			T_{vj}=125℃		97		
			T_{vj}=175℃		95		
$t_{d(off)}$	Turn off Delay Time		T_{vj}=25℃		196		
			T_{vj}=125℃		231		
			T_{vj}=175℃		251		
t_f	Fall Time		T_{vj}=25℃		59		
			T_{vj}=125℃		56		
			T_{vj}=175℃		55		
E_{on}	Turn on Energy		T_{vj}=25℃		13.9		mJ
			T_{vj}=125℃		14.2		
			T_{vj}=175℃		14.9		
E_{off}	Turn off Energy		T_{vj}=25℃		20		
			T_{vj}=125℃		19.7		
			T_{vj}=175℃		19.1		
$R_{th,jf}$	Junction to cooling fluid	per MOSFET, 50% water / 50% ethylenglycol,△V/△t = 8 dm^3 /min, T_f = 60°C			0.118		K /W
T_{vjop}	Operating Temperature			-40		175	℃

Body DIODE

ABSOLUTE MAXIMUM RATINGS(T_{vj} *=25°C unless otherwise specified)*

Symbol	Parameter/Test Conditions		Values	Unit
I_{SD}	DC Body Diode Forward Current	V_{GS}=-5V,T_F=60℃,T_{vj}=175℃	205	A

ELECTRICAL CHARACTERISTICS *(T_{vj} =25°C unless otherwise specified)*

Symbol	Parameter/Test Conditions			Min.	Typ.	Max.	Unit
V_{SD}	Diode Forward Voltage	I_{SD}=400A , V_{GS}=-5V, T_{vj} =25℃			4.05		V
		I_{SD}=400A , V_{GS}=-5V, T_{vj}=125℃			3.9		
		I_{SD}=400A , V_{GS}=-5V, T_{vj}=175℃			3.7		
I_{rrm}	Peak reverse recovery current	V_{DS}=800V, V_{GS}=-5V, I_{SD}=400A, -di/dt=11kA/μs	T_{vj}=25℃		150		A
			T_{vj}=125℃		270		
			T_{vj}=175℃		377		
Q_{rr}	Reverse recovery charge		T_{vj}=25℃		3		μC
			T_{vj}=125℃		7.9		
			T_{vj}=175℃		12.6		
E_{rec}	Reverse recovery energy		T_{vj}=25℃		0.88		mJ
			T_{vj}=125℃		3.05		
			T_{vj}=175℃		5.5		

NTC CHARACTERISTICS *(T_F =25°C unless otherwise specified)*

Symbol	Parameter/Test Conditions		Min.	Typ.	Max.	Unit
R_{25}	Resistance	T_{NTC} =25℃		5		kΩ
$B_{25/50}$	$R_2 = R_{25}$ exp [$B_{25/50}$(1/T_2 - 1/(298.15 K))]			3375		K
△R/R	T_{NTC}=100℃， R_{100}=493Ω		-5		5	%

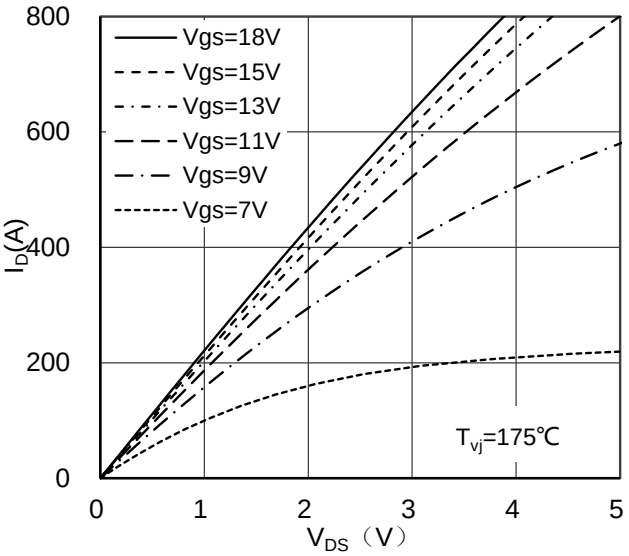


Figure 1. Typical Output Characteristics

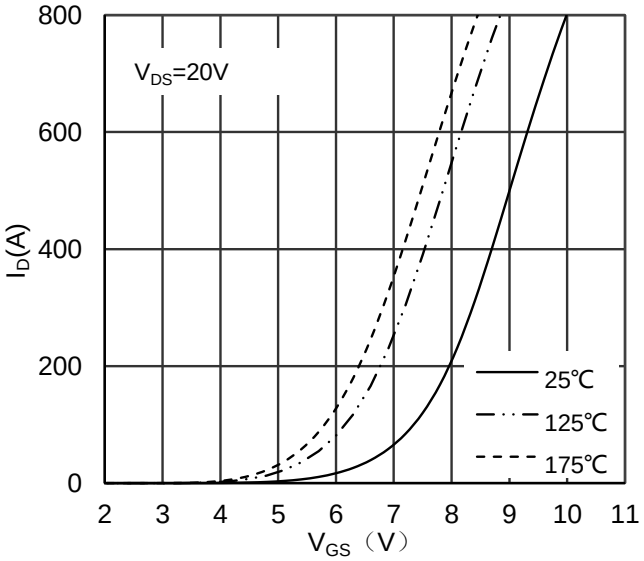


Figure 2. Typical Transfer characteristics

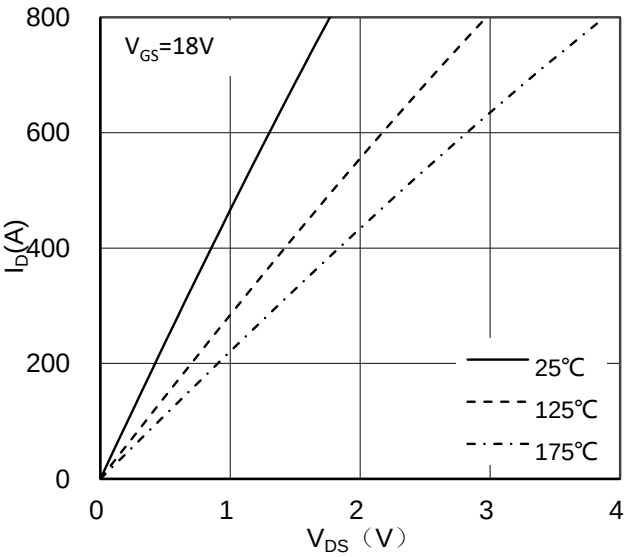


Figure 3. Typical Output Characteristics

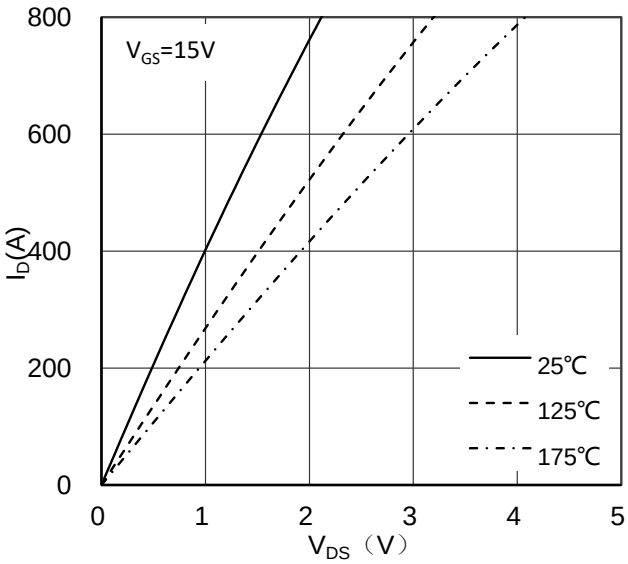


Figure 4. Typical Output Characteristics

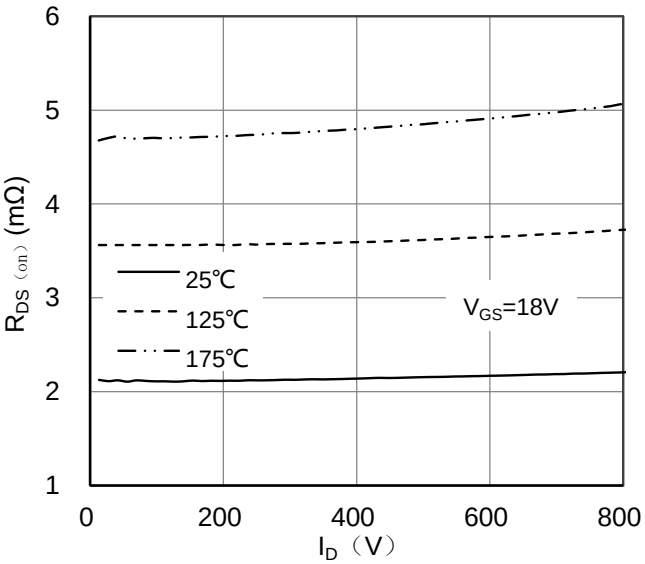


Figure 5. Typical Drain source on-resistance

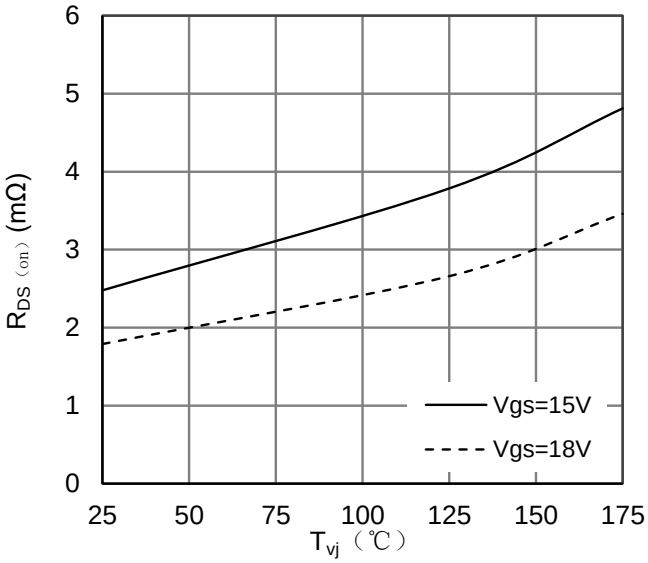


Figure 6. Typical Drain source on-resistance

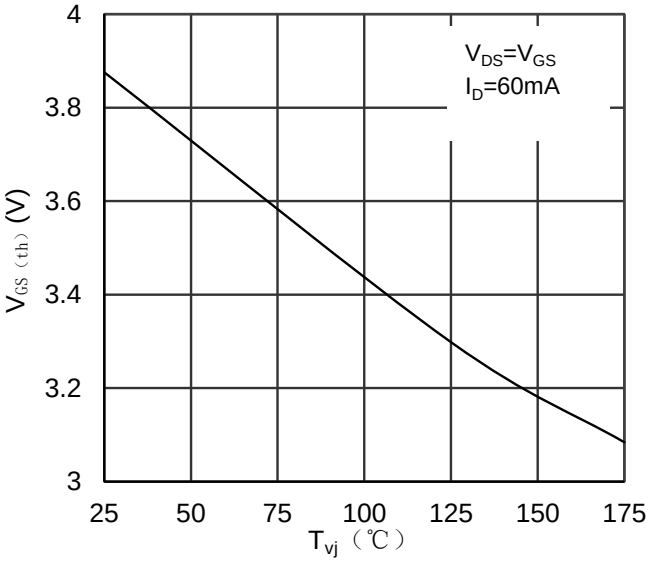


Figure 7. Typical Gate-source threshold voltage

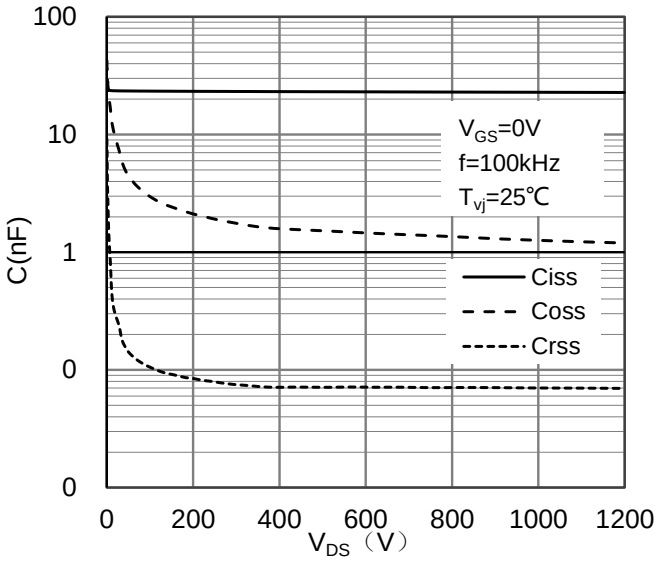


Figure 8. Typical capacitance

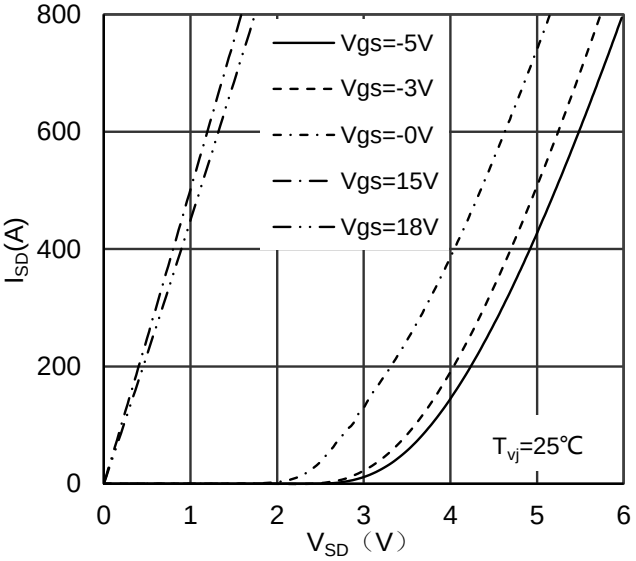


Figure 9. Typical Body Diode Forward

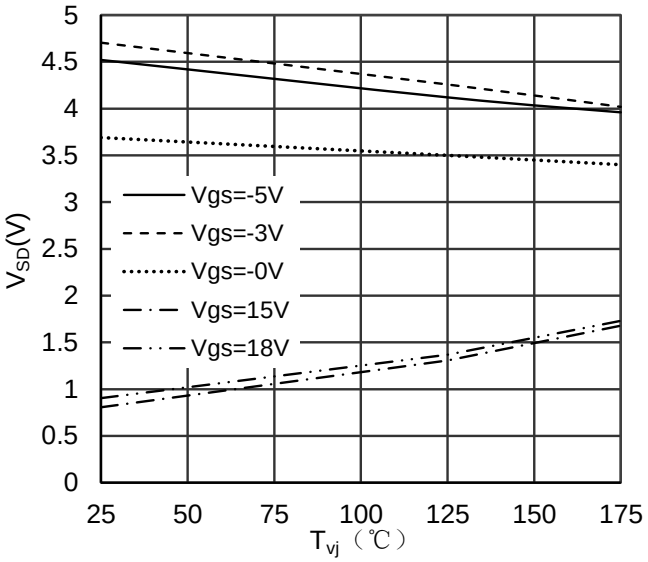


Figure 10. Typical Body Diode Forward Voltage

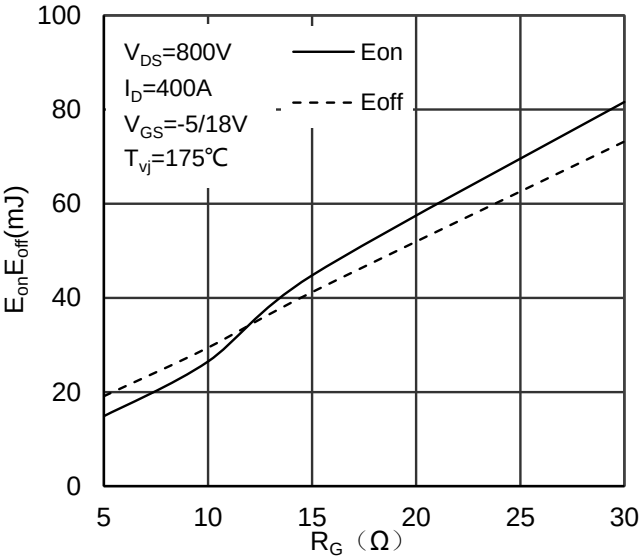


Figure 11. Typical Switching Energy

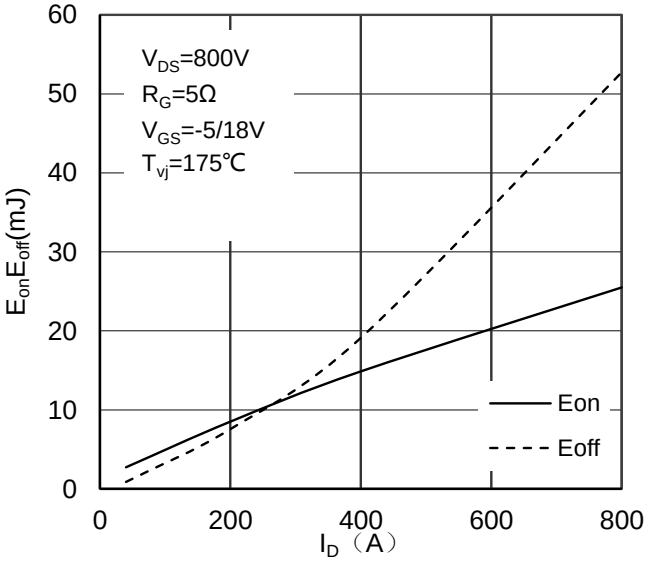


Figure 12. Typical Switching Energy

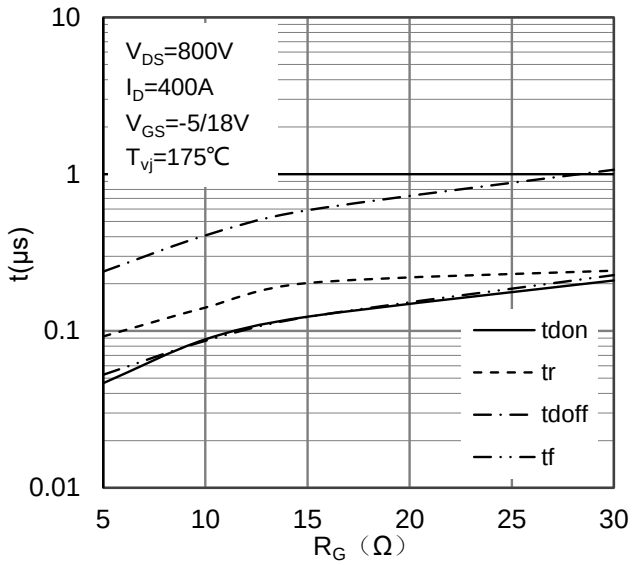


Figure 13. Typical Switching Times

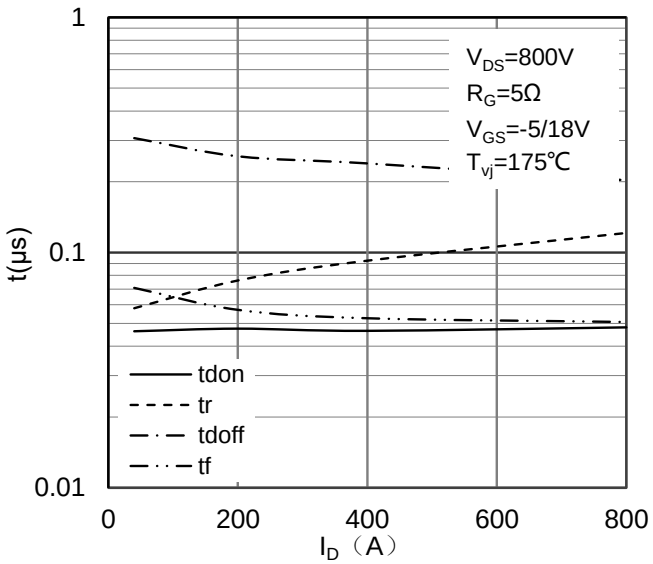


Figure 14. Typical Switching Times

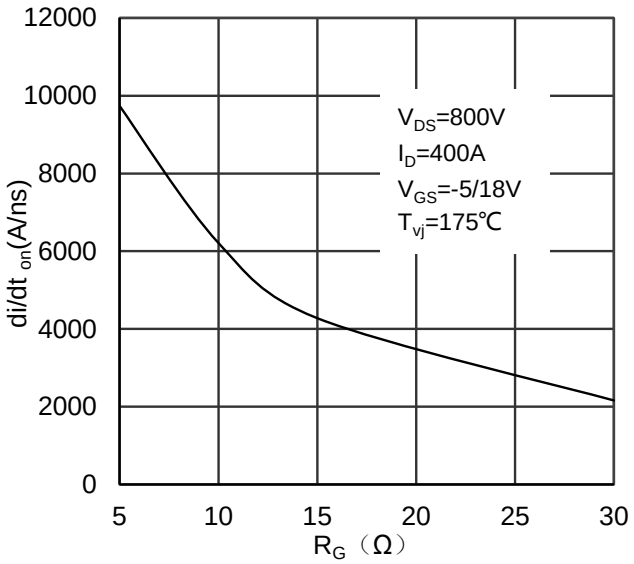


Figure 15.Typical Current slope

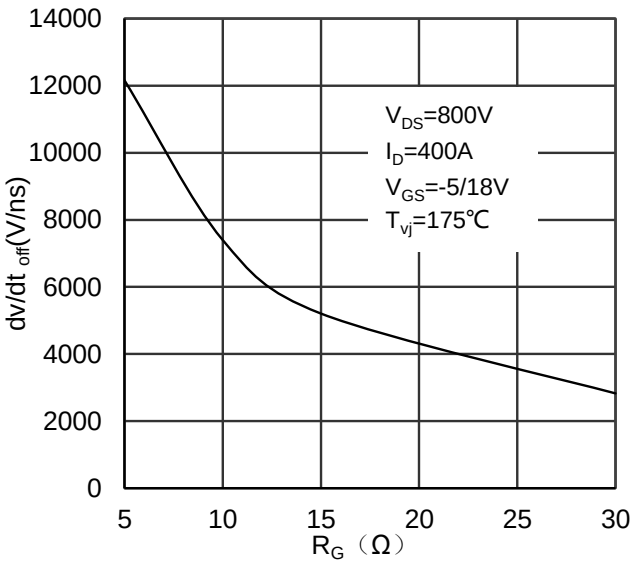


Figure 16.Typical Voltage slope

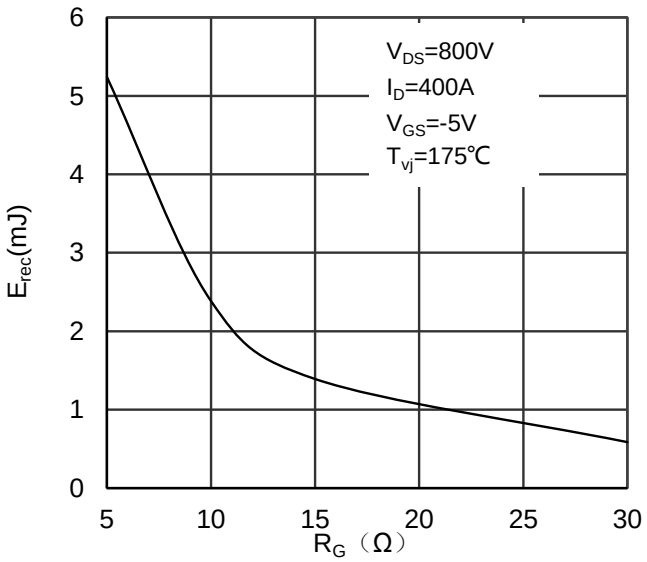


Figure 17. Typical Switching Energy

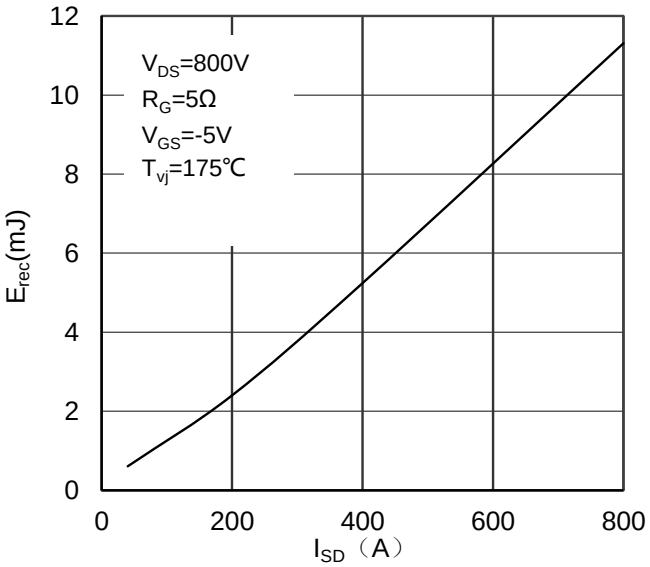


Figure 18. Typical Switching Energy

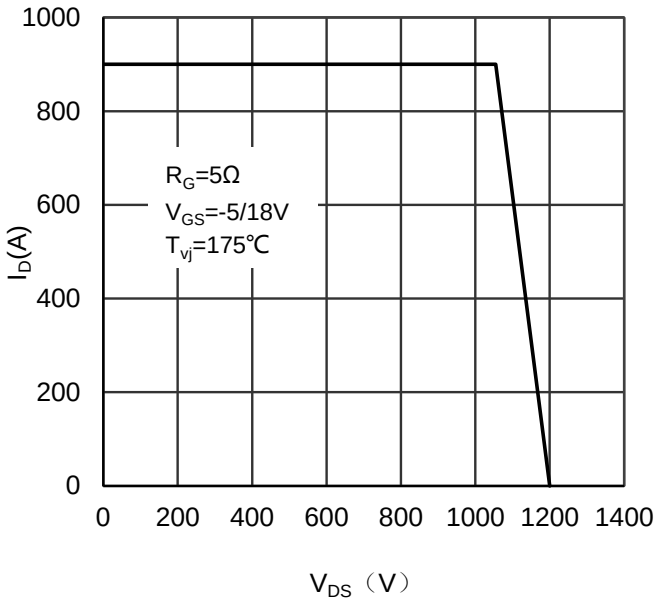


Figure 19. Reverse Bias Safe Operating Area

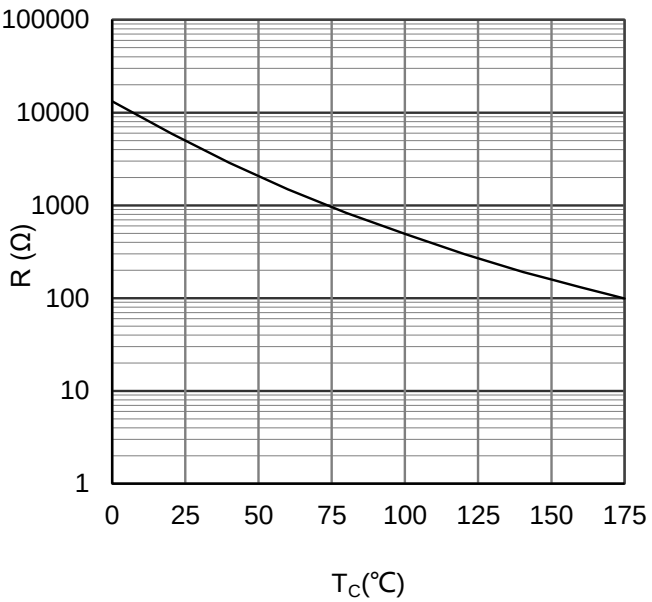


Figure 20. NTC Characteristics

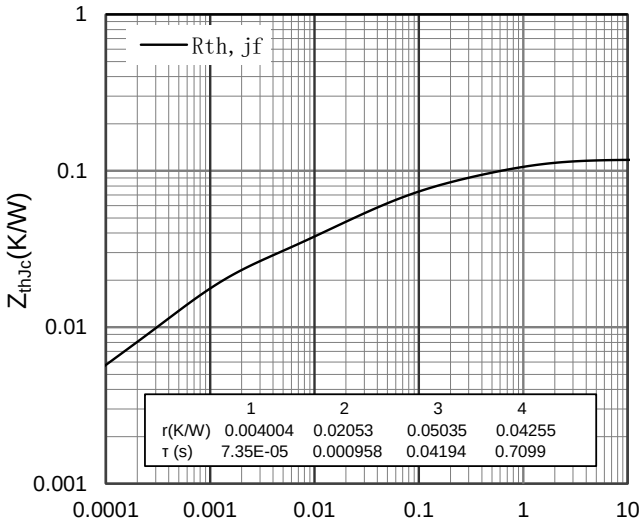


Figure 21. Transient Thermal Impedance (Typical)

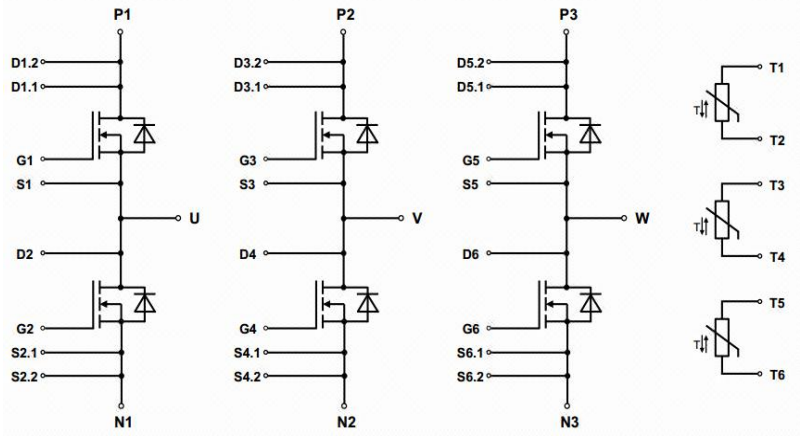
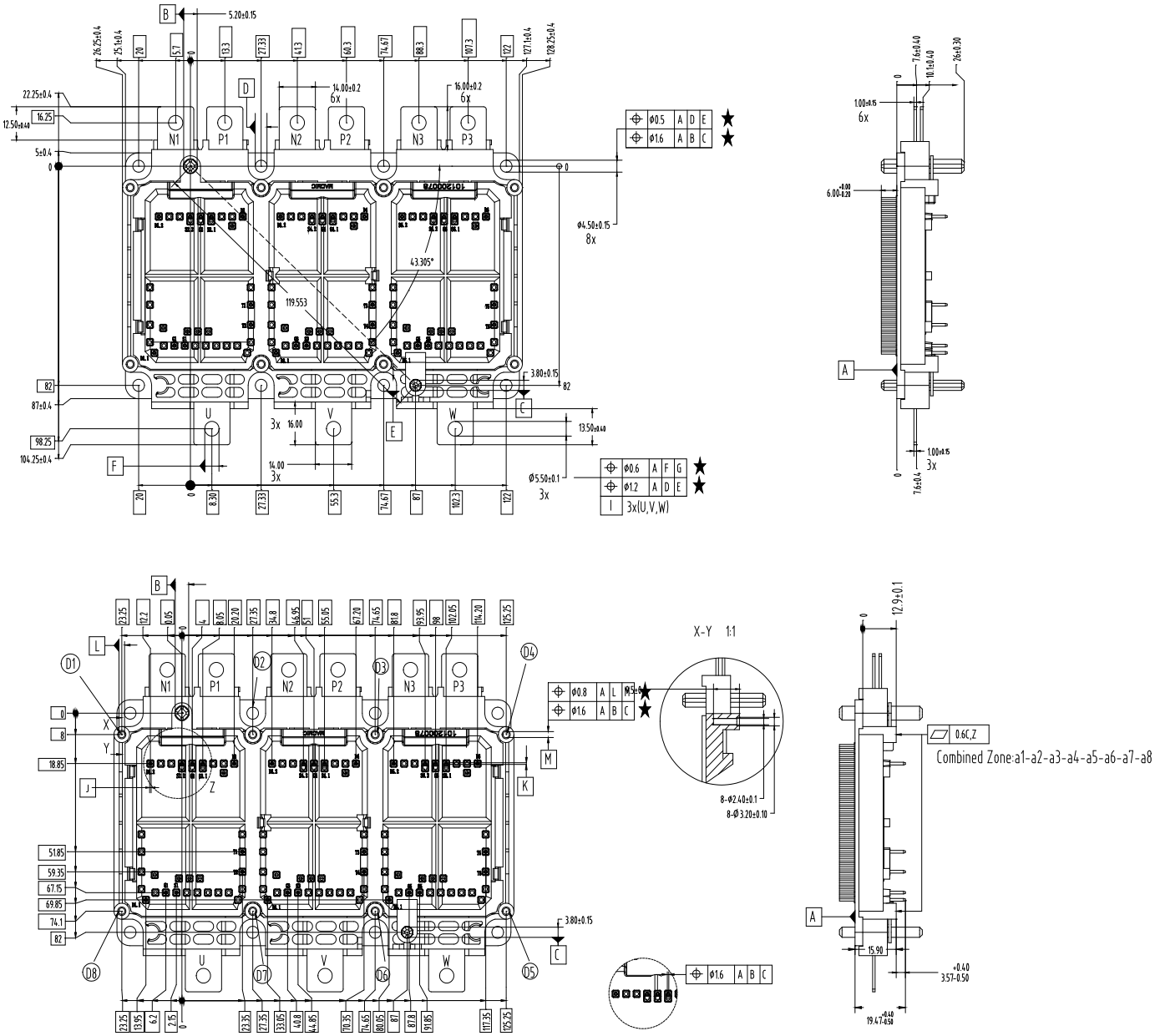


Figure 21. Circuit Diagram



Dimensions in (mm)

Figure 22. Package Outline