

晁元國際半導體股份有限公司
MaxPower SiC Semiconductor Co., Ltd.

Change History:

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

M1P-1200-300B

All Silicon Carbide Power Module

1200V/300A 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

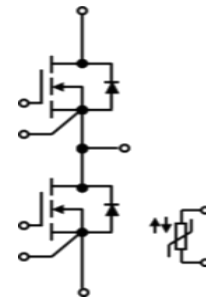
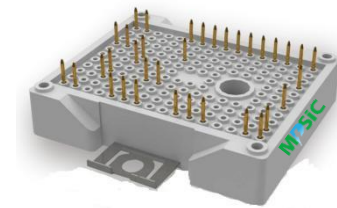
Benefits

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

Symbol	Parameter	Value	Unit	Test Conditions	Note
V_{DSmax}	Drain - Source Voltage	1200	V		
V_{GSmax}	Gate - Source Voltage	-8/+25	V	Absolute maximum values	
V_{GSop}	Gate - Source Voltage	-5/+20	V	Recommended operational values	
I_D	Continuous Drain Current	300 250	A	$V_{GS}=18\text{V}$, $T_{VJ}=25^\circ\text{C}$ $V_{GS}=18\text{V}$, $T_{VJ}=175^\circ\text{C}$	
$I_{D,peak}$	Repetitive peak drain current	900	A	Pulsed Drain Current, t_p limited by T_{VJ} max	
T_{VJ} , T_{stg}	Operating Junction and Storage Temperature	-55 to +175	$^\circ\text{C}$		
V_{ISO}	Isolation Test Voltage	3000		AC, 50Hz, 1 s	

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Electrical Characteristics

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions	Note
$V_{(BR)DSS}$	Drain-Source Breakdown Voltage	1200			V	$V_{GS}=0V, I_D=100\mu A$	
$V_{GS(th)}$	Gate Threshold Voltage	2.0	2.50	4.0	V	$V_{GS}=V_{DS}, I_{DS}=100mA, T_{VJ}=25^{\circ}C$	
			1.80			$V_{GS}=V_{DS}, I_{DS}=100mA, T_{VJ}=150^{\circ}C$	
I_{DSS}	Zero Gate Voltage Drain Current		32	300	μA	$V_{DS}=1200V, V_{GS}=0V$	
I_{GSS}	Gate-Source Leakage Current		80	480	nA	$V_{GS}=18V, V_{DS}=0V$	
$R_{DS(on)}$	Drain-Source on-state Resistance		4.75	6.1	m Ω	$V_{GS}=18V, I_D=250A, T_{VJ}=25^{\circ}C$	
			7.55		m Ω	$V_{GS}=18V, I_D=250A, T_{VJ}=150^{\circ}C$	
Ciss	Input Capacitance		16.8		nF	$V_{GS}=0V, V_{DS}=800V, f=1MHz, V_{AC}=25mV$	
Coss	Output Capacitance		1.15				
Crss	Reverse Transfer Capacitance		0.16				
E_{ON}	Turn-On Switching Energy		12.2		mJ	$V_{DS}=800V, V_{GS}=-5/18V, I_D=250A, R_{G(ext)}=5\Omega, L=50\mu H, di/dt=4kA/\mu s$	
E_{OFF}	Turn-Off Switching Energy		10.8				
$t_{d(on)}$	Turn-On Delay Time		62		ns	$V_{DS}=800V, V_{GS}=-5/18V, I_D=250A, R_{G(ext)}=5\Omega,$	
t_r	Rise Time		57				
$t_{d(off)}$	Turn-Off Delay Time		208				
t_f	Fall Time		49				
Q_{gs}	Gate to Source Charge		240		nC	$V_{DS}=800V, V_{GS}=-5/18V, I_D=250A$	
Q_{gd}	Gate to Drain Charge		320				
Q_g	Total Gate Charge		1030				

Reverse Diode Characteristics

Symbol	Parameter	Typ.	Max.	Unit	Test Conditions	Note
V_{SD}	Diode Forward Voltage	3.7		V	$V_{GS}=-5V, I_{SD}=250A, T_{VJ}=25^{\circ}C$	
		3.4		V	$V_{GS}=-5V, I_{SD}=250A, T_{VJ}=150^{\circ}C$	
I_S	Continuous Diode Forward Current		300	A	$V_{GS}=-5V, T_{VJ}=25^{\circ}C$	
			160	A	$V_{GS}=-5V, T_{VJ}=150^{\circ}C$	

Symbol	Parameter	Typ.	Max.	Unit	Test Conditions	Note
I_{rrm}	Peak reverse recovery current		170	A	$V_{GS}=-5V, I_{SD}=250A, V_{R,DS}=800V, T_{VJ}=25^{\circ}C$	
			325	A	$V_{GS}=-5V, I_{SD}=250A, V_{R,DS}=800V, T_{VJ}=150^{\circ}C$	
Q_{rr}	Reverse recovery charge		11.6	nC	$V_{GS}=-5V, I_{SD}=250A, V_{R,DS}=800V, T_{VJ}=25^{\circ}C$	
			19.5	nC	$V_{GS}=-5V, I_{SD}=250A, V_{R,DS}=800V, T_{VJ}=150^{\circ}C$	

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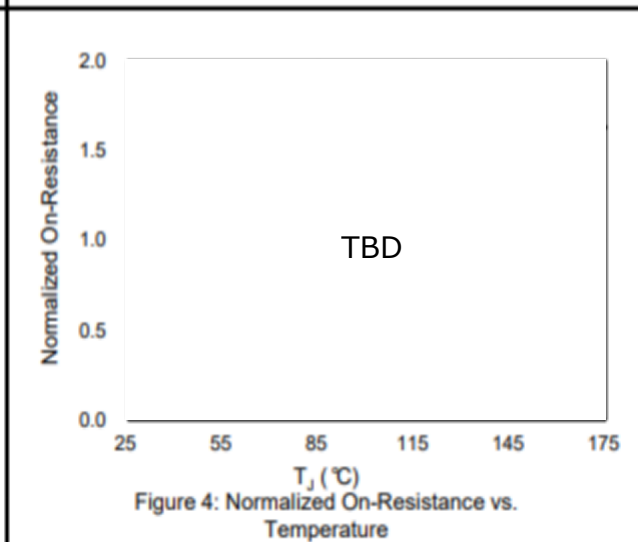
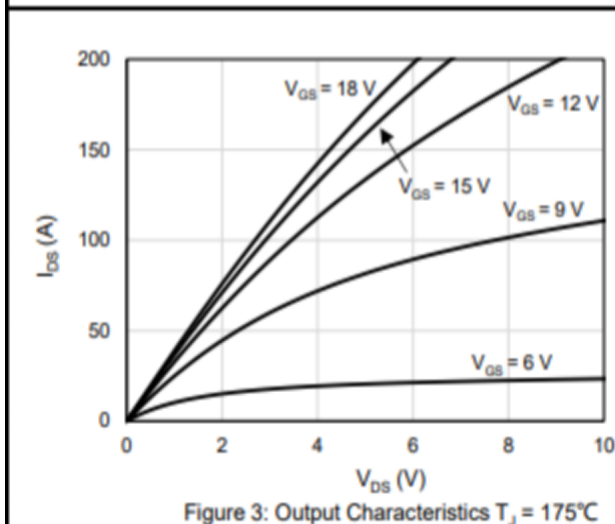
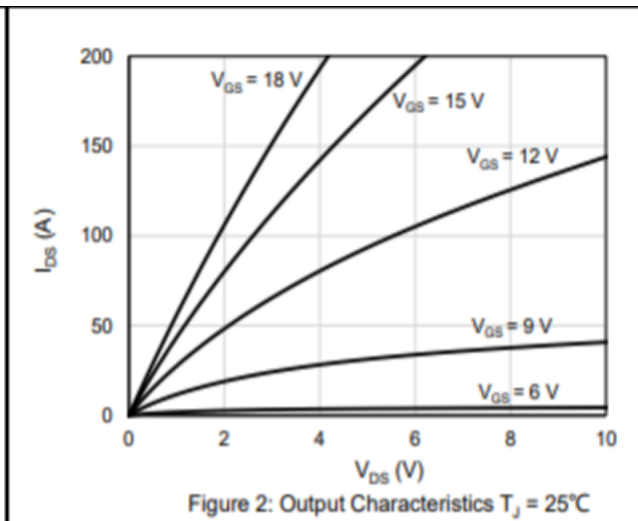
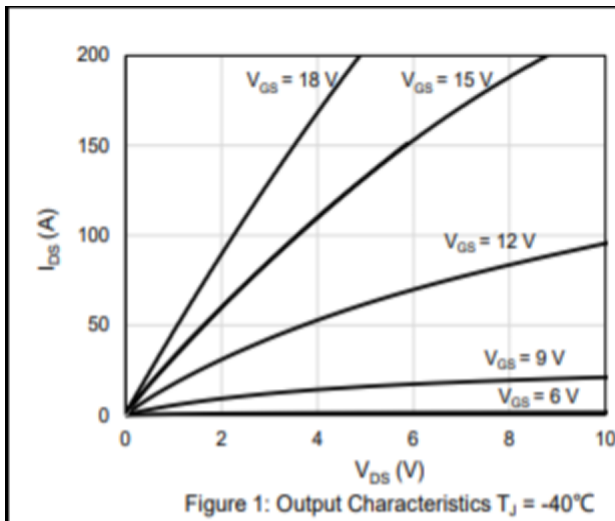
NTC Characteristics

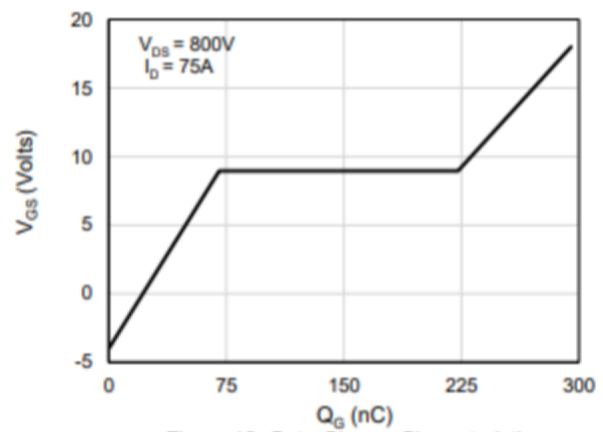
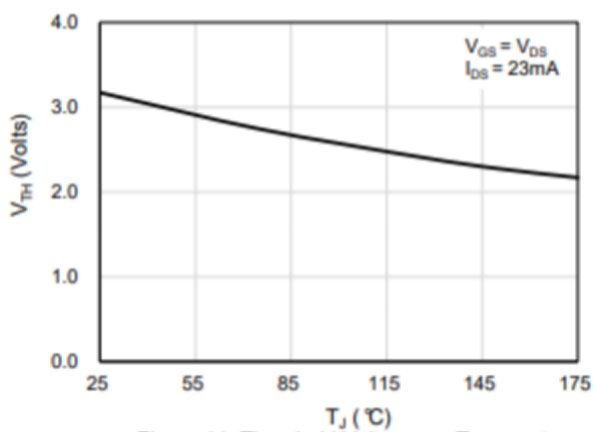
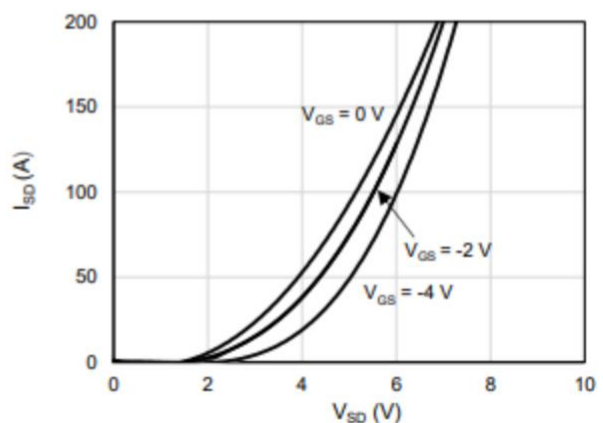
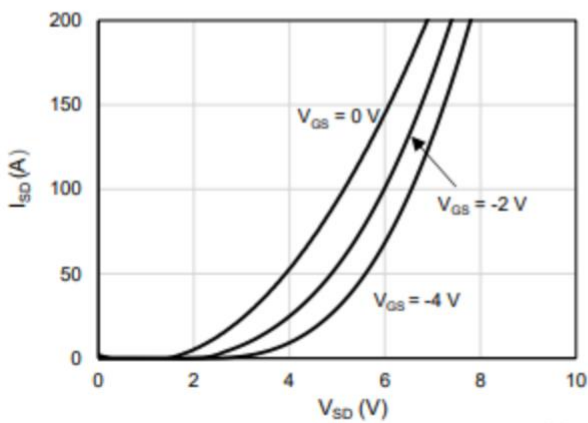
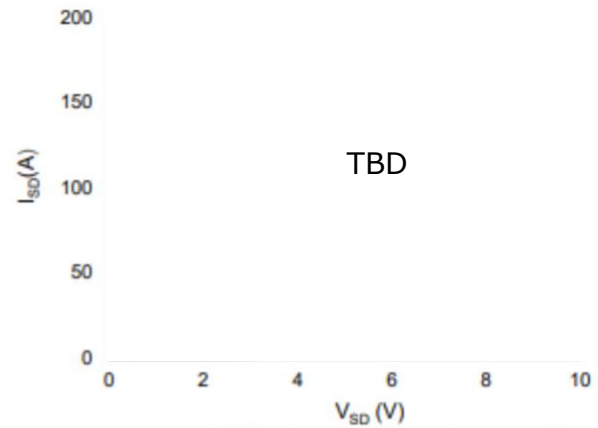
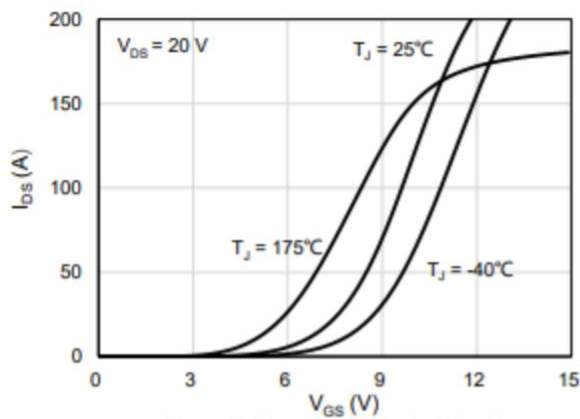
Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions	Note
R ₂₅	Rated Resistance		5.0		kΩ	T _C = 25°C	
ΔR/R	Deviation of R ₁₀₀	-5		5	%	T _C = 100 °C R ₁₀₀ = 493 Ω	
P ₂₅	Power Dissipation			20	mW	T _C = 25°C	
B-25/50	$R_2 = R_{25} \exp [B_{25/50}(1/T_2 - 1/(298.15 \text{ K}))]$		3375		K		
B-25/80	$R_2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

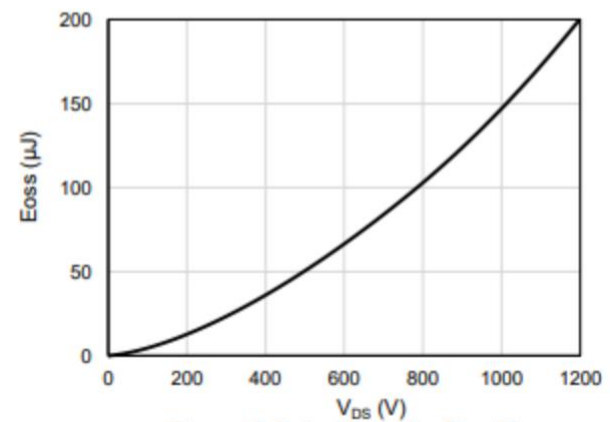
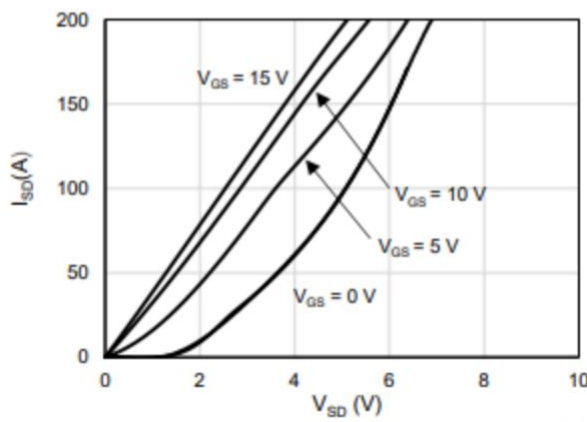
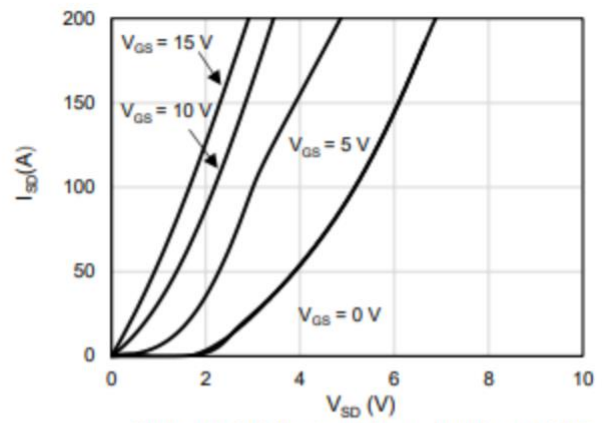
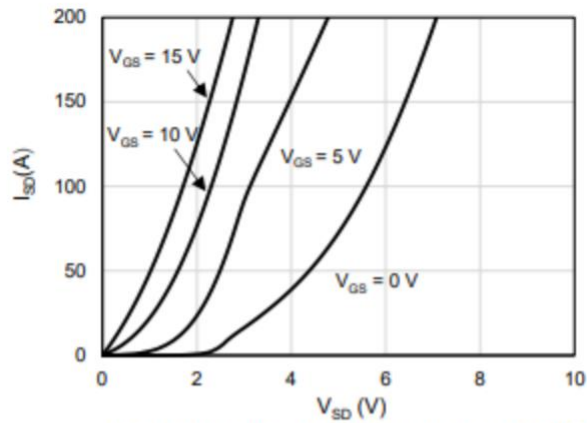
Package Characteristics

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions	Note
L _{s,DS}	Stray inductance of module		8.5		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		32		g		
	Internal isolation	Basic insulation(class1, IEC61140)				Si3N4	

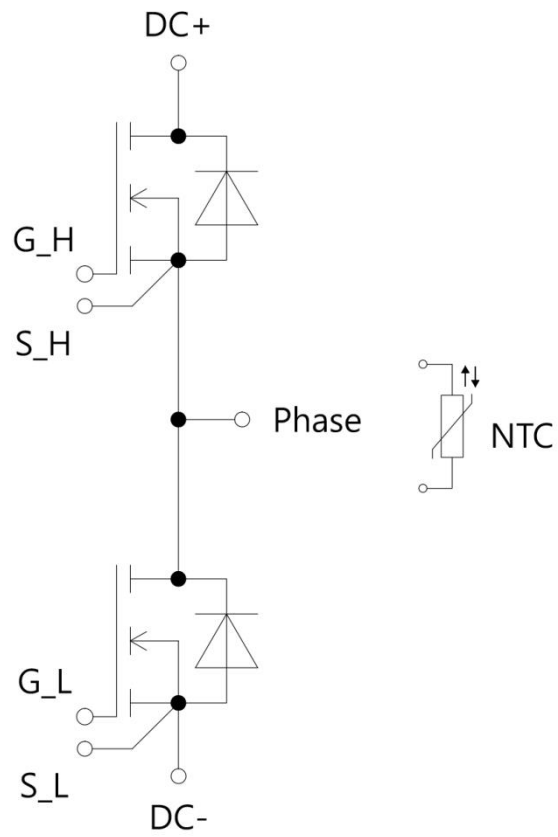
Electrical Characteristic Curve







Circuit Schematic



Package Dimension

