

WMH004M230E1SA

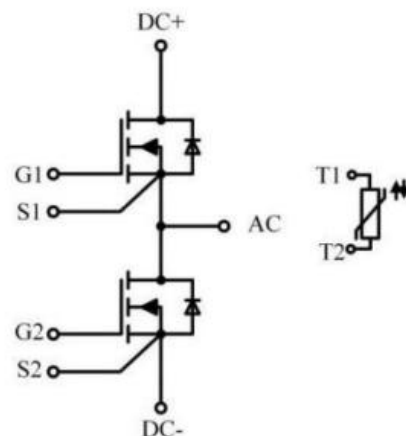
SiC Power Module

V_{DS}	=	2300	V
$R_{DS(on)}$	=	3.3	m Ω
$I_D(T_C=65^{\circ}C)$	=	450	A

Features

- Low $R_{DS(on)}$
- Low inductance module structure
- Temperature-Independent Switching
- Easy to Parallel and Simple to Drive
- Higher System Efficiency
- High Temperature Operation
- Integrated NTC sensor
- Si_3N_4 ceramic substrate with low thermal resistance
- Increased System Switching Frequency

Package

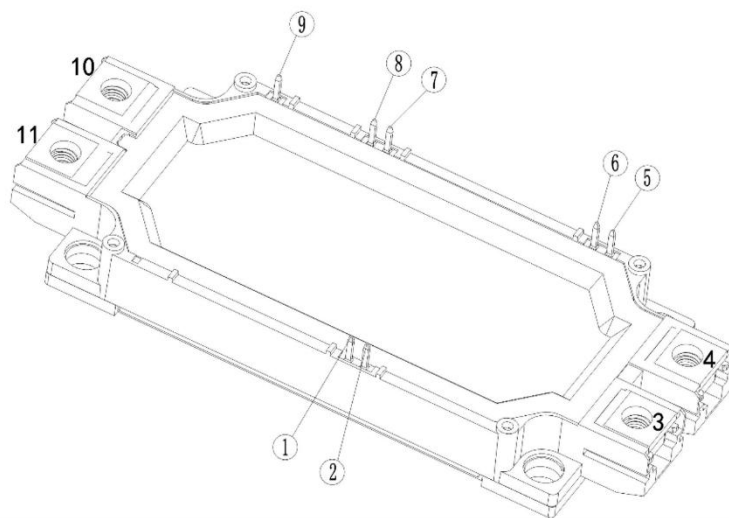
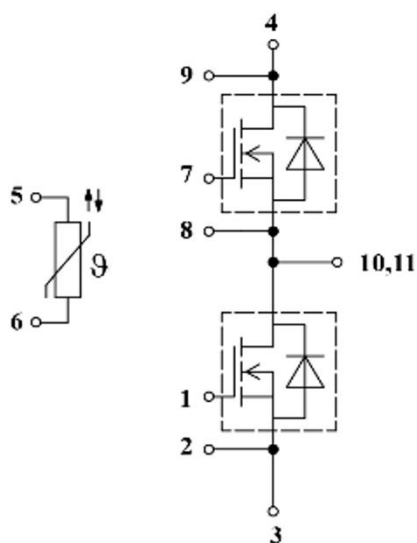


Applications

- Automotive applications
- Wind turbines
- Motor drives

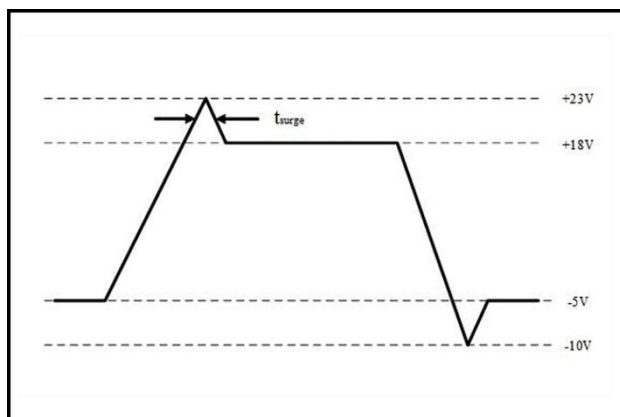
Part Number	Package
WMH004M230E1SA	ED3

Circuit Diagram

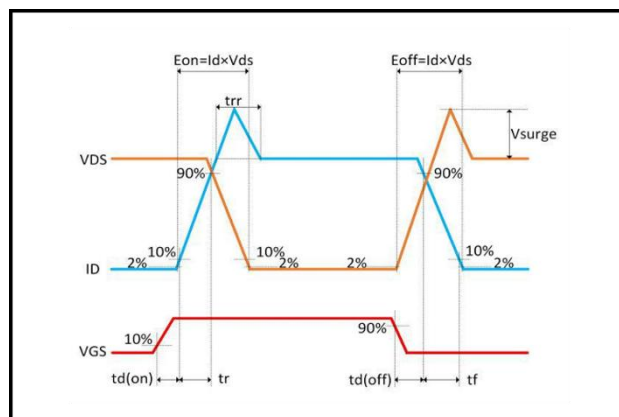


Absolute Maximum Ratings ($T_{vj}=25^{\circ}\text{C}$ unless otherwise specified)

Symbol	Parameter	Value	Unit	Test Conditions
V_{DSmax}	Drain-Source Voltage	2300	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	600	A	$V_{GS}=18V$, $T_F=25^{\circ}\text{C}$, $T_J \leq 150^{\circ}\text{C}$
		450		$V_{GS}=18V$, $T_F=65^{\circ}\text{C}$, $T_J \leq 150^{\circ}\text{C}$
$I_{D(pulse)}$	Pulsed Drain Current	1200	A	Pulse width t_p limited by T_{Jmax}
T_{vj} , T_{STG}	Operating Junction and Storage Temperature	-55 to +175	$^{\circ}\text{C}$	



Example of acceptable V_{GS} waveform



Wavelength for switching test

Module ($T_{vj}=25^{\circ}\text{C}$ unless otherwise specified)

Parameter	Symbol	Conditions	Value			Unit
			Min.	Typ.	Max.	
Isolation test voltage	V_{isol}	All terminals to baseplate AC 60Hz 1min	3500	/	/	V_{rms}
Stray inductance	L_s	Terminal P to terminal N	/	11	/	nH
Creepage distance	/	Terminal to heat sink	14.5	/	/	mm
		Terminal to terminal	13.0	/	/	
Clearance distance	/	Terminal to heat sink	12.5	/	/	mm
		Terminal to terminal	10.0	/	/	
Module flatness	/	Heatsink side	0	/	300	μm
Mounting torque	/	Mounting to heatsink with M6 screw	5.5	6	6.5	$\text{N} \cdot \text{m}$
Thermal resistance	R_{thJC}	Junction-to-Case Thermal Resistance for MOSFET	/	0.08	0.12	$^{\circ}\text{C}/\text{W}$

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

Symbol	Parameter	Value			Unit	Test Conditions
		Min.	Typ.	Max.		
V _{(BR)DSS}	Drain-Source Breakdown Voltage	2300	/	/	V	V _{GS} =0V, I _D =100uA
V _{GS(th)}	Gate Threshold Voltage	2.0	2.9	4.0	V	V _{DS} =V _{GS} , I _D =120mA
		/	2.1	/		V _{DS} =V _{GS} , I _D =120mA, T _J =175℃
I _{DSS}	Zero Gate Voltage Drain Current	/	/	80	μA	V _{DS} =2300V, V _{GS} =0V
I _{GSS+}	Gate-Source Leakage Current	/	/	100	nA	V _{DS} =0V, V _{GS} =23V
I _{GSS-}	Gate-Source Leakage Current	/	/	100	nA	V _{DS} =0V, V _{GS} =-10V
R _{DS(on)}	Drain-Source On Resistance	/	3.3	4.7	mΩ	V _{GS} =18V, I _D =480A
		/	7.5	/	mΩ	V _{GS} =18V, I _D =480A, T _J =175℃
C _{iss}	Input Capacitance	/	37.8	/	nF	V _{GS} =0V
C _{oss}	Output Capacitance	/	0.84	/		V _{DS} =1000V
C _{rss}	Reverse Transfer Capacitance	/	0.09	/		f=1MHz
R _{G(int)}	Internal Gate Resistance	/	0.37	/	Ω	V _{AC} =25mV
Q _{GS}	Gate to Source Charge	/	360	/	nC	V _{DS} =1000V
Q _{GD}	Gate to Drain Charge	/	372	/		V _{GS} =-5V/18V
Q _G	Total Gate Charge	/	1680	/		I _D =480A

Body Diode Characteristics($T_{vj} = 25^{\circ}\text{C}$ unless otherwise specified)

Symbol	Parameter	Value			Unit	Test Conditions
		Min.	Typ.	Max.		
V_{SD}	Diode Forward Voltage	/	5.54	/	V	$V_{GS} = -5\text{V}, I_{SD} = 450\text{A}, T_J = 25^{\circ}\text{C}$
		/	4.80	/		$V_{GS} = -5\text{V}, I_{SD} = 450\text{A}, T_J = 125^{\circ}\text{C}$
		/	4.68	/		$V_{GS} = -5\text{V}, I_{SD} = 450\text{A}, T_J = 150^{\circ}\text{C}$
		/	4.58	/		$V_{GS} = -5\text{V}, I_{SD} = 450\text{A}, T_J = 175^{\circ}\text{C}$
I_S	Continuous Diode Forward Current	/	380	/	A	$T_F = 25^{\circ}\text{C}$
I_{SM}	Pulsed Diode Forward Current		920		A	Pulse width t_p limited by T_{Jmax}

NTC Characteristics($T_{vj} = 25^{\circ}\text{C}$ unless otherwise specified)

Symbol	Parameter	Value	Unit	Test Conditions
T_{NTC}	NTC operating temperature range	$-40 \sim +180$	$^{\circ}\text{C}$	
R_{25}	NTC R_{25} -value	$5 \pm 3\%$	$\text{k}\Omega$	$T_{NTC} = 25 \pm 1^{\circ}\text{C}$
$B_{25/80}$	B-value	$3411 \pm 1\%$	K	

Typical Performance

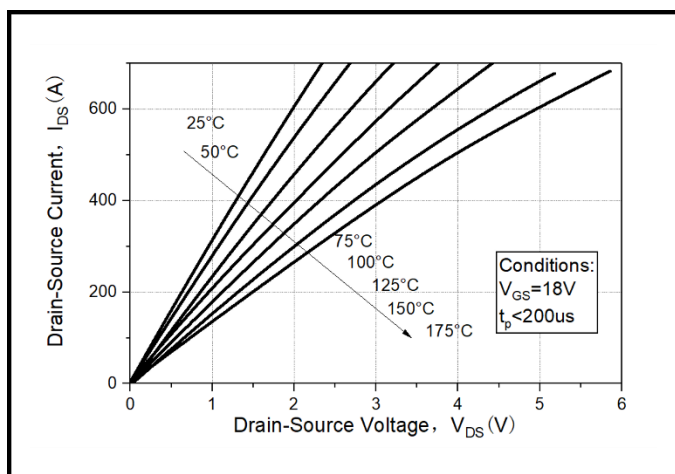


Figure 1. Output Characteristics for Various Junction Temperature

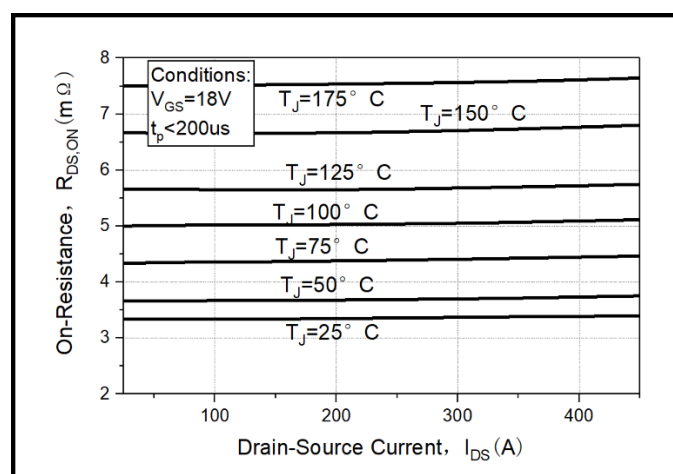


Figure 2. On-Resistance vs. Drain Current for Various Junction Temperature

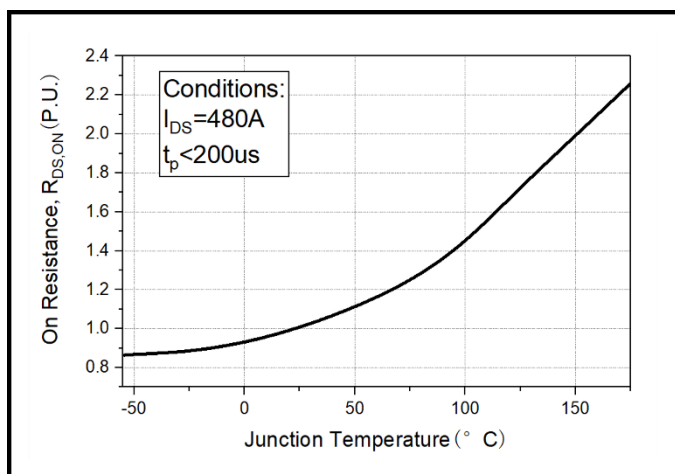


Figure 3. Normalized On-Resistance vs. Junction Temperature

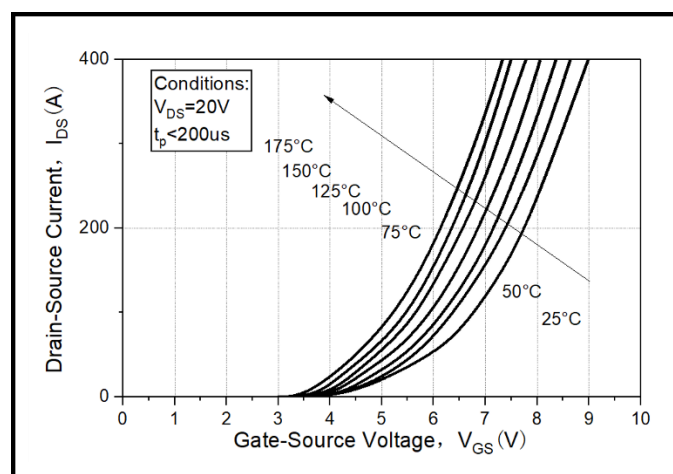


Figure 4. Transfer Characteristic for Various Junction Temperature

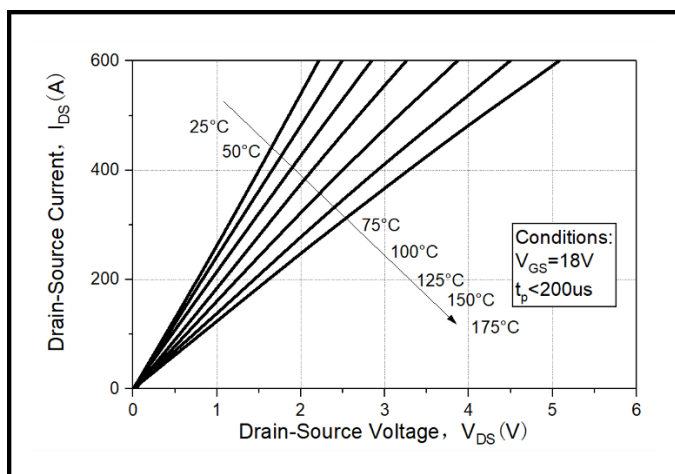


Figure 5. 3rd Quadrant Characteristic vs. Junction Temperature at $V_{GS}=18V$

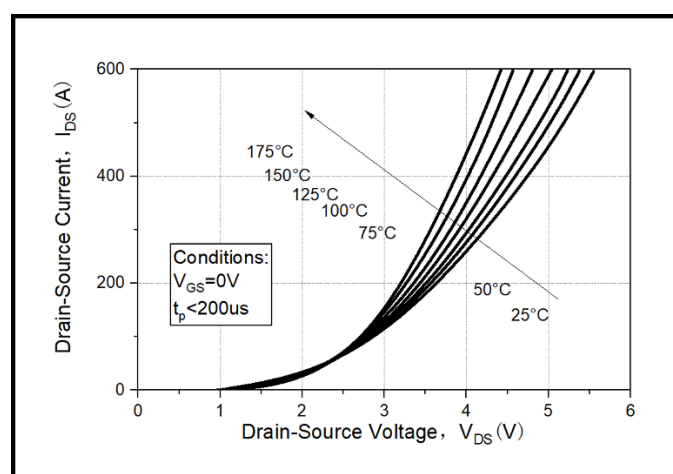


Figure 6. 3rd Quadrant Characteristic vs. Junction Temperature at $V_{GS}=0V$ (Diode)

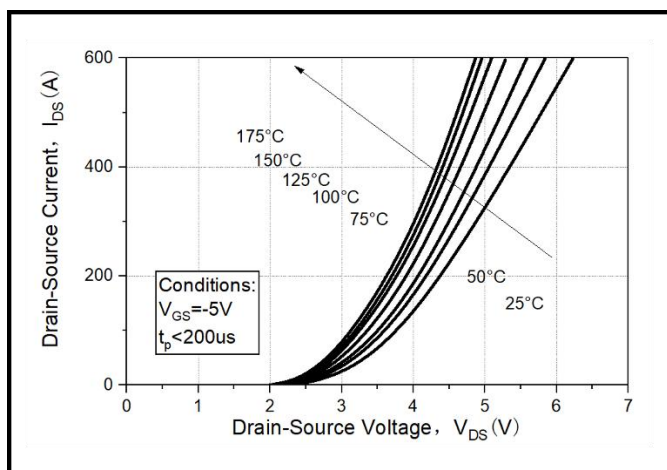


Figure 7. 3rd Quadrant Characteristic vs. Junction Temperature at $V_{GS}=-5V$ (Diode)

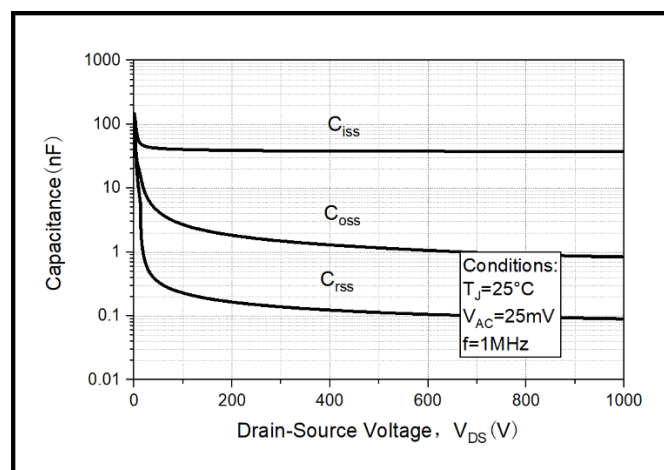


Figure 8. Typical Capacitances vs. Drain to Source (0~1000V)

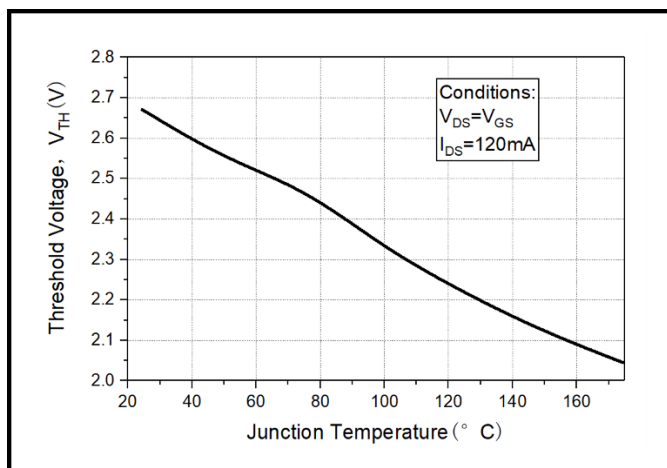


Figure 9. Threshold Voltage vs. Temperature

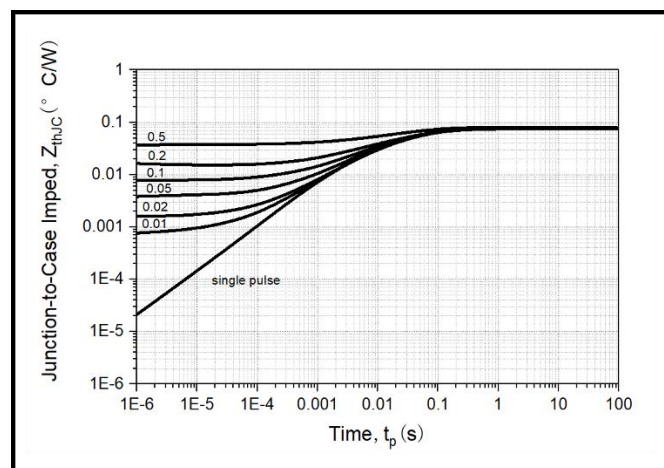


Figure 10. MOSFET Junction to Case Thermal Impedance, Z_{thJC}

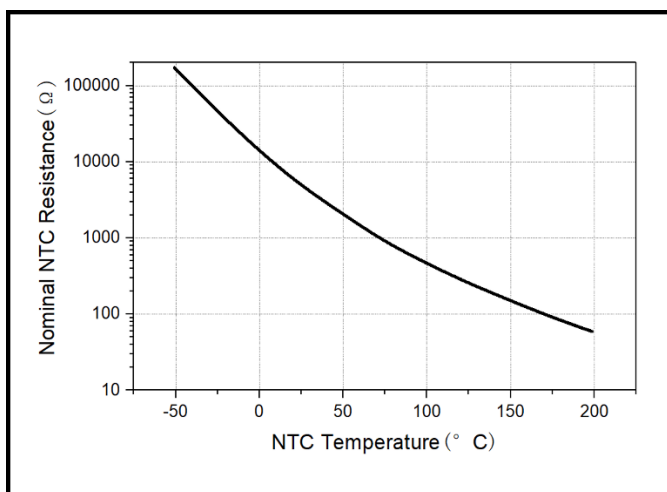


Figure 11. Nominal NTC Resistance vs. NTC Temperature

Package outlines

unit: mm

