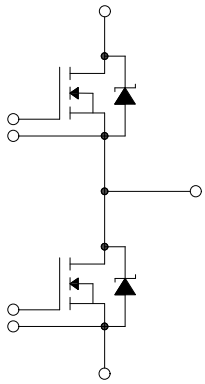
SiC MOSFET Power Module

V_{DS}	1200V
I_D	400A
$R_{DS(on)}$	3.3mΩ

Circuit



Applications

- Induction Heating
- Motor Drives
- Solar and Wind Inverters
- UPS and SMPS
- Traction

Features

- Industry Standard 62mm Footprint
- Ultra Low Loss, High-Frequency Operation
- Zero Reverse Recovery from Diodes
- Zero Turn-off Tail Current from MOSFET
- Normally-off, Fail-safe Device Operation
- Copper Baseplate and Si_3N_4-AMB Insulator (C2A)

■ MOSFET

Absolute Maximum Ratings (T_{VJ}=25°C Unless Otherwise Specified)

PARAMETER	SYMBOL	CONDITIONS	VALUE	UNIT
Drain-Source Voltage	$V_{DS,max}$	V_{GS}=0 V, I_{DS}=400uA	1200	V
Continuous Drain Current	I_D	V_{GS}=18V, T_C=25°C	400	A
		V_{GS}=18V, T_C=80°C	315	
Pulse Drain Current	$I_{D,pulse}$	Pulse width t_p limited by $T_{VJ,max}$	630	A
Power Dissipation	P_{D_MOS}	T_C=25°C	1120	W
Recommend Gate Source Voltage	$V_{GS,op}$	Static, recommended DC operating values	-5/18	V
Maximum Gate Source Voltage	$V_{GS,max}$	Absolute maximum values	-10/22	V
Maximum Junction Temperature	$T_{VJ,max}$		175	°C

■ MOSFET

Characteristic Values (T_{VJ}=25°C Unless Otherwise Specified)

PARAMETER	SYMBOL	CONDITIONS	VALUE			UNIT
			Min.	Typ.	Max.	
Drain-Source Breakdown Voltage	$V_{(BR)DSS}$	V_{GS}=0V, I_D=400uA	1200			V
Gate Threshold Voltage	$V_{GS(th)}$	V_{DS}=V_{GS}, I_D=80mA	2.0	2.7	4.0	V
		V_{DS}=V_{GS}, I_D=80mA, T_{VJ}=175°C		2.0		
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS}=1200V, V_{GS}=0V		23	400	uA
Gate-Source Leakage Current	I_{GSS}	V_{DS}=0V, V_{GS}=18V		1	400	nA
Drain-Source On-Resistance	$R_{DS(on)}$	I_D=300A, V_{GS}=15V		4.1	6	mΩ
		I_D=300A, V_{GS}=18V		3.3	5	
		I_D=300A, V_{GS}=15V, T_{VJ}=175°C		5.6		
		I_D=300A, V_{GS}=18V, T_{VJ}=175°C		5.3		
Transconductance	g_{fs}	V_{DS}=20V, I_D=300A		247.1		S
		V_{DS}=20V, I_D=300A, T_{VJ}=175°C		239.3		
Internal Gate Resistance	$R_{G(int.)}$	f=1MHz, V_{AC}=25mV		4.98		Ω
Input Capacitance	C_{iss}	V_{GS}=0V, V_{DS}=800V, f=100kHz, V_{AC}=25mV		16.86		nF
Output Capacitance	C_{oss}			2.03		
Reverse Transfer Capacitance	C_{rss}			0.11		
Gate to Source Charge	Q_{GS}	V_{DD}=800V, V_{GS}=-5/18V, I_D=300A		184		nC
Gate to Drain Charge	Q_{GD}			400		
Total Gate Charge	Q_G			864		
Turn On Delay Time	$t_{d(on)}$	V_{DD}=600V, V_{GS}=-5/18V, I_D=300A, $R_{G(ext)}$=5.1Ω		96		ns
Rise Time	t_r			60		
Turn Off Delay Time	$t_{d(off)}$			448		
Fall Time	t_f			72		
Turn-on Switching Energy, T_{VJ}=25 °C T_{VJ}=150°C	E_{on}			9.99 8.34		mJ
Turn-off Switching Energy, T_{VJ}=25 °C T_{VJ}=150°C	E_{off}			16.31 16.74		
MOSFET Thermal Resistance, Junction to Case	R_{thJC}	JESD51-14		0.134		°C/W

■ Body diode

Characteristic Values (T_{VJ}=25°C Unless Otherwise Specified)

PARAMETER	SYMBOL	CONDITIONS	VALUE			UNIT
			Min.	Typ.	Max.	
Inverse Diode Forward Voltage	V_{SD}	V_{GS}=-5V, I_S=300A		1.51		V
		V_{GS}=-5V, I_S=300A, T_{VJ}=175°C		2.2		
Continuous Diode Forward Current	I_S	V_{GS}=-5V, T_C=25°C			430	A
Reverse Recovery Time	t_{rr}	V_{GS}=-5V, I_S=300A, V_R=600V, di/dt=4.63A/ns, T_{VJ}=150°C		46		ns
Reverse Recovery Charge	Q_{rr}			3.87		uC
Peak Reverse Recovery Current	I_{rrm}			142.6		A
Reverse Recovery Energy, T_{VJ}=25 °C T_{VJ}=150°C	E_{RR}	V_{DD}=600V, I_D=300A V_{GS}=-5V/18V, $R_{G(ext)}$=5.1Ω		0.83 1.01		mJ

■ Module Characteristics

PARAMETER	SYMBOL	CONDITIONS	VALUE			UNIT
			Min.	Typ.	Max.	
Isolation Breakdown Voltage	V_{isol}	AC, 50Hz (R.M.S), t=1minute		4000		V
Stray Inductance	L_{Stray}	Between DC- and DC+, f=10MHz		12		nH
Operating Junction Temperature	$T_{VJ,op}$		-40		175	°C
Storage Temperature	T_{stg}		-40		150	°C
Module Electrodes Torque	M_t	Recommended (M6)	3.0		5.0	Nm
Module to Sink Torque	M_s	Recommended (M6)	3.0		5.0	Nm
Weight	W			315		g

■ Typical Performance

Fig1. Output Characteristics for Various Junction Temperatures

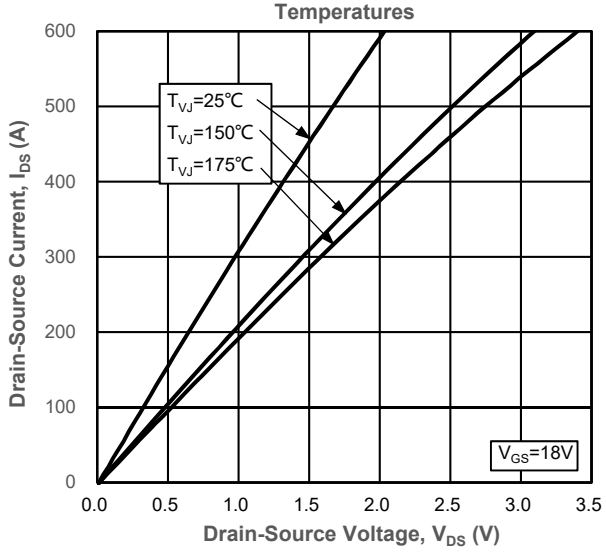


Fig2. Output Characteristics for Various Junction Temperatures

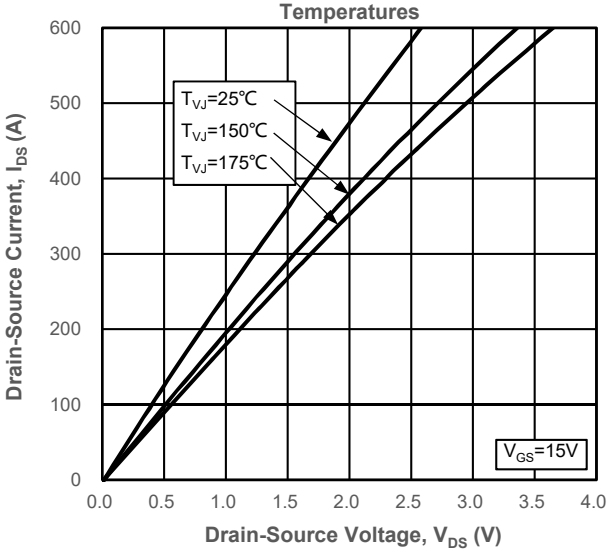


Fig3. Normalized On-State Resistance vs. Drain Current for Various Junction Temperatures

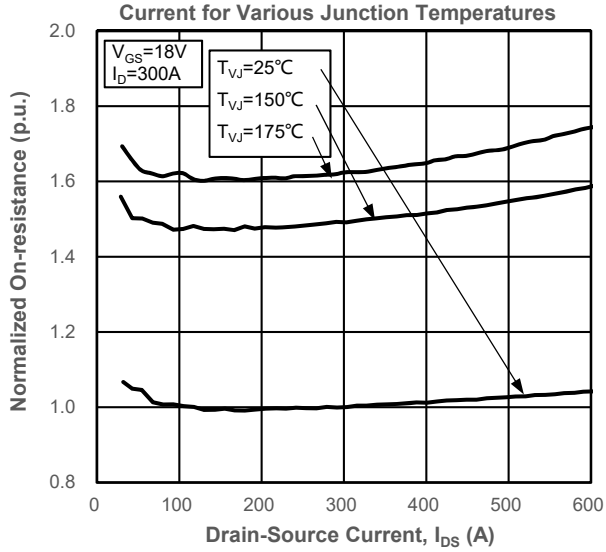


Fig4. Normalized On-State Resistance vs. Drain Current for Various Junction Temperatures

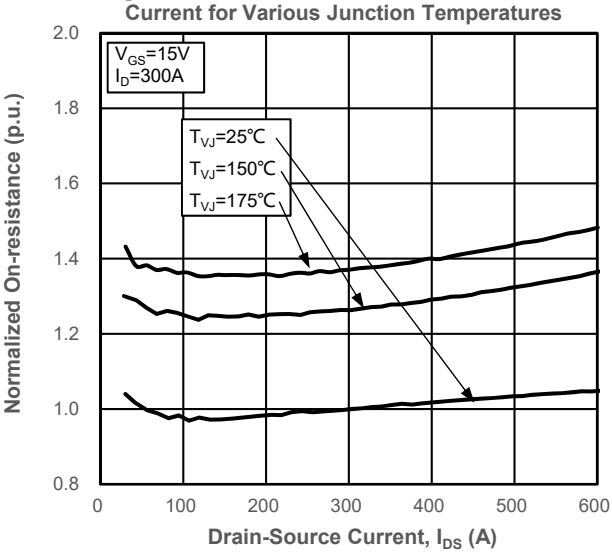


Fig5. Transfer Characteristic for Various Junction Temperatures

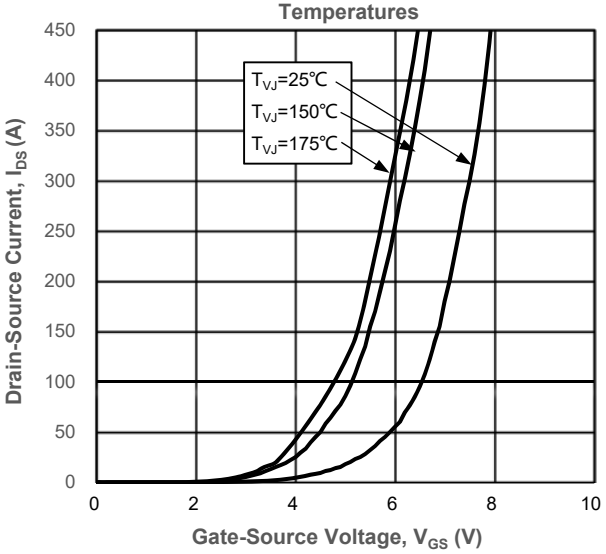


Fig6. 3rd Quadrant Characteristic vs. Junction Temperatures at V_{GS} = 18V

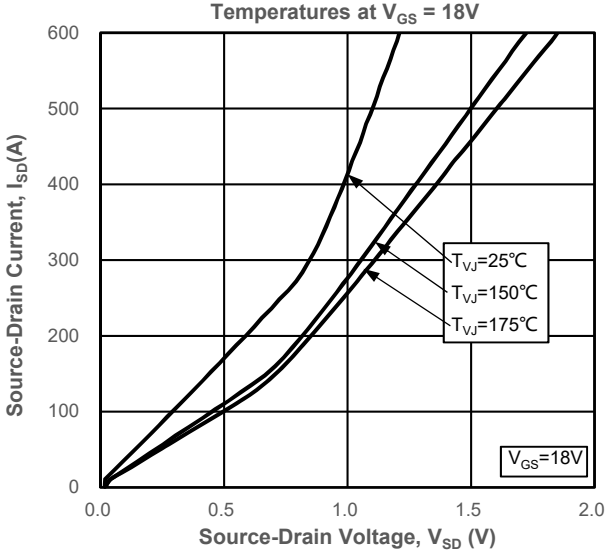


Fig7. 3rd Quadrant Characteristic vs. Junction Temperatures at V_{GS}=0V

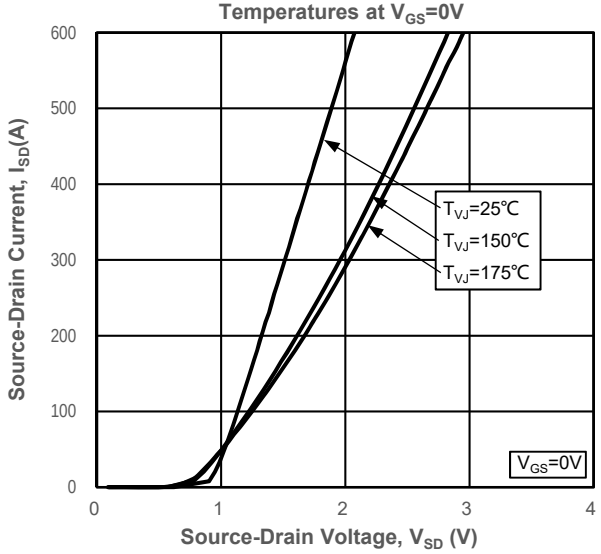


Fig8. 3rd Quadrant Characteristic vs. Junction Temperatures at V_{GS}=-5V

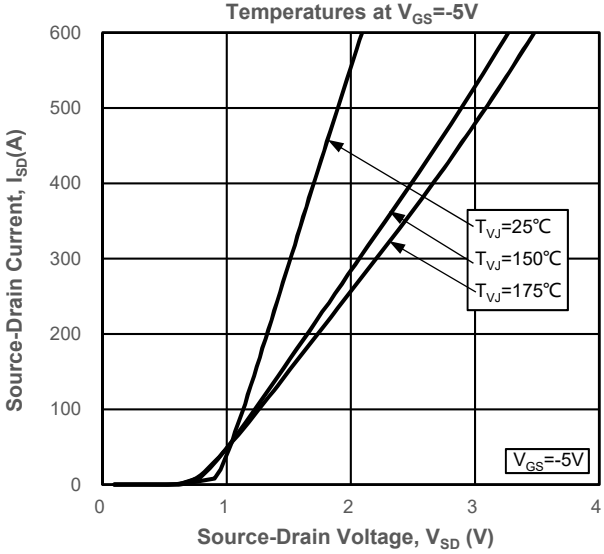


Fig9. Typical Capacitances vs. Drain to Source Voltage (0-200V)

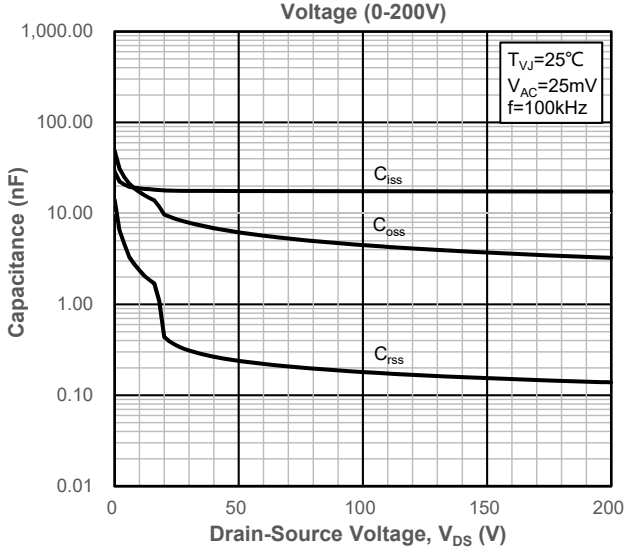


Fig10. Typical Capacitances vs. Drain to Source Voltage (0-1200V)

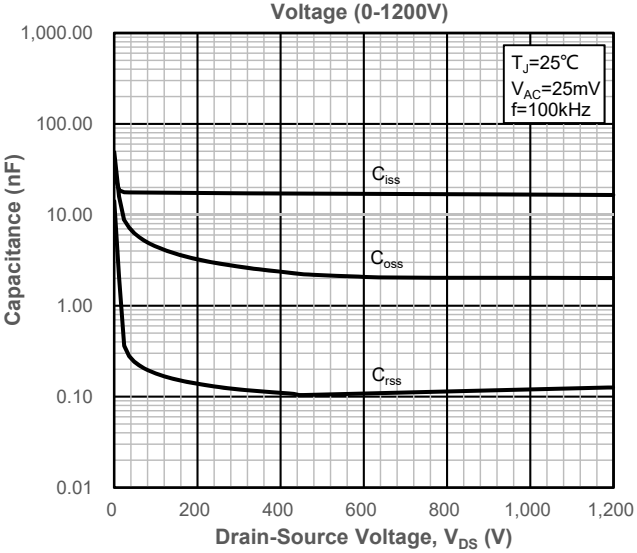


Fig11. Switching Energy vs. Drain Current (V_{DD}=600 V)

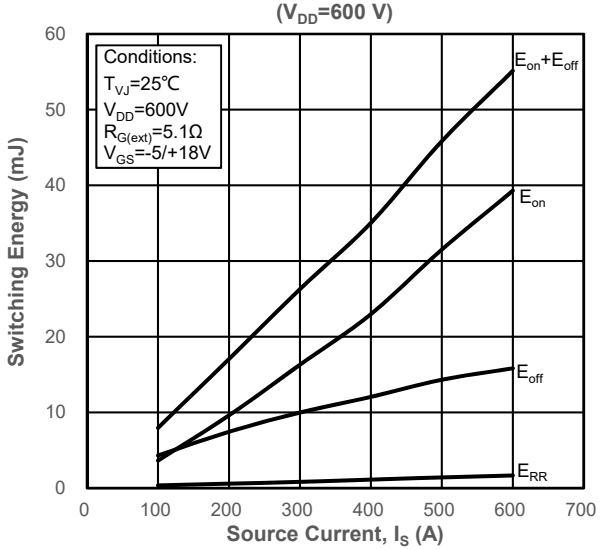


Fig12. Switching Energy vs. Drain Current (V_{DD}=800 V)

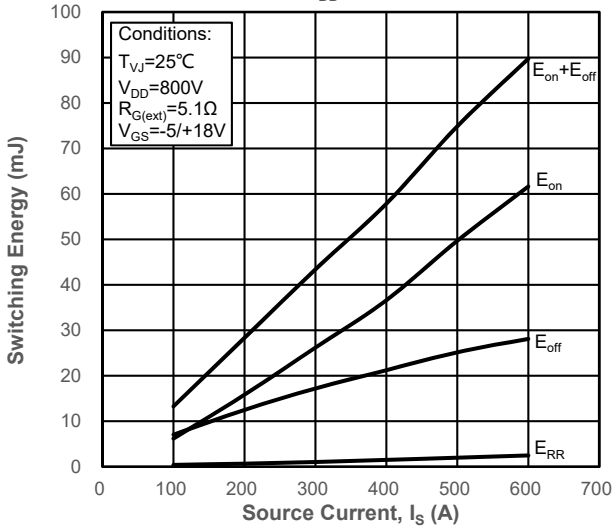


Fig13. MOSFET Switching Energy vs. External Gate Resistance

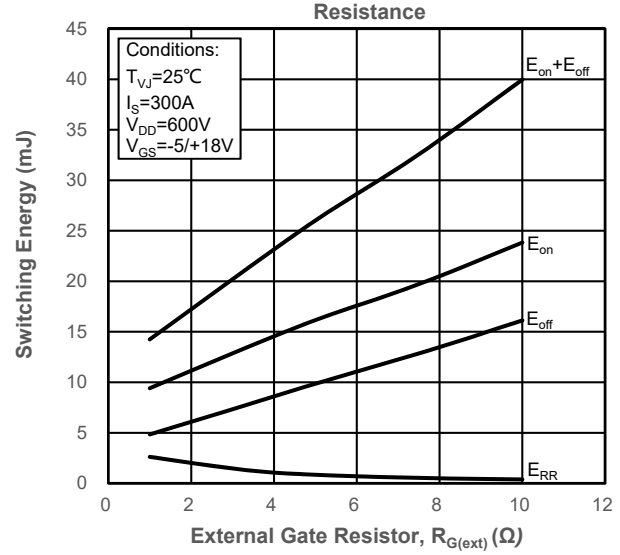


Fig14. Reverse Recovery Energy vs. External Gate Resistance

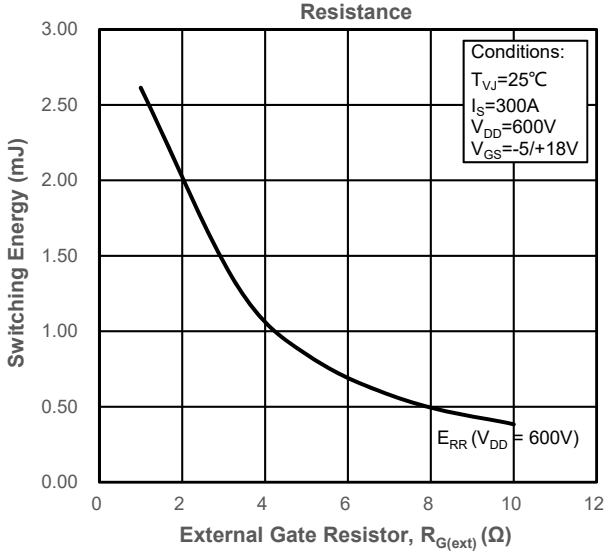


Fig15. MOSFET Junction to Case Transient Thermal Impedance, $Z_{th\ JC}$ (°C/W)

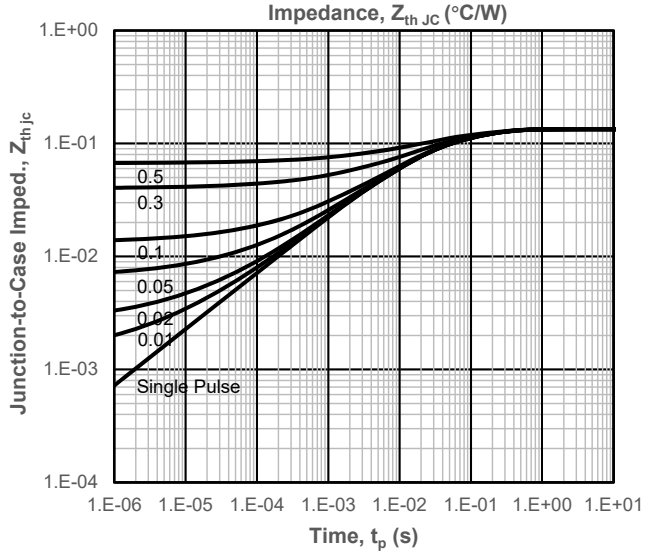


Fig16. Diode Junction to Case Transient Thermal Impedance, $Z_{th\ JC}$ (°C/W)

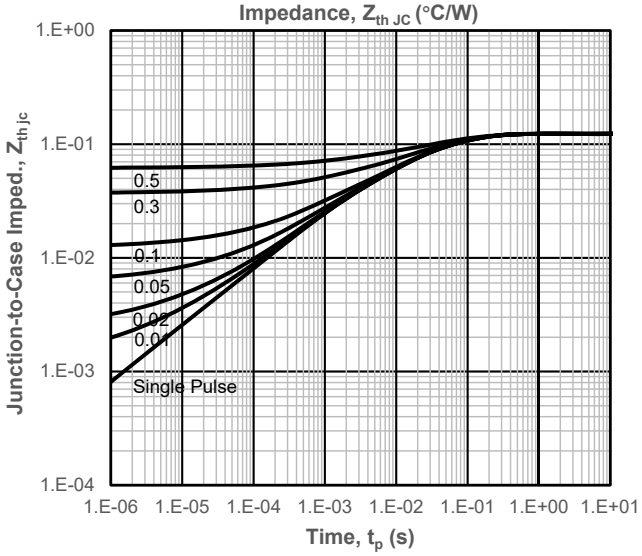


Fig17. Forward Bias Safe Operating Area (FBSOA)

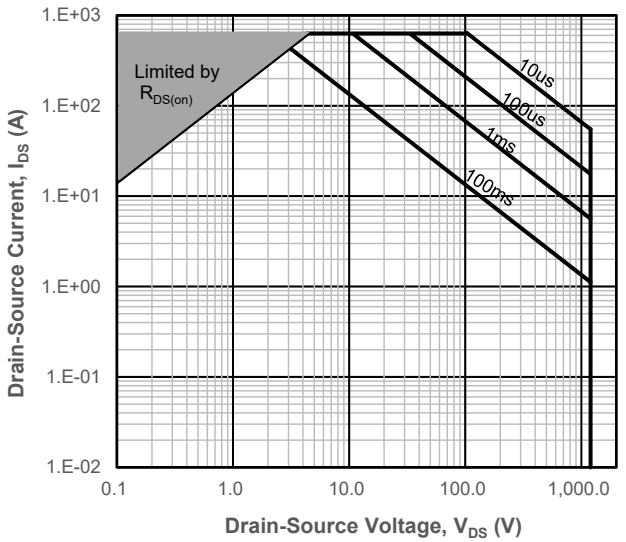


Fig18. Continuous Drain Current Derating vs. Case Temperature

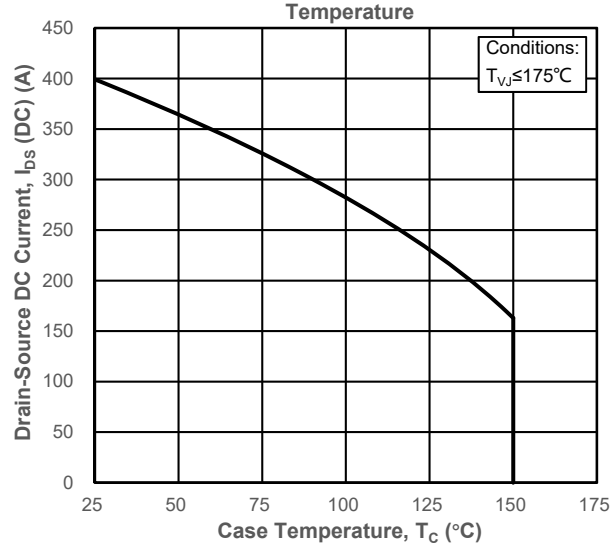


Fig19. Maximum Power Dissipation Derating vs. Case Temperature

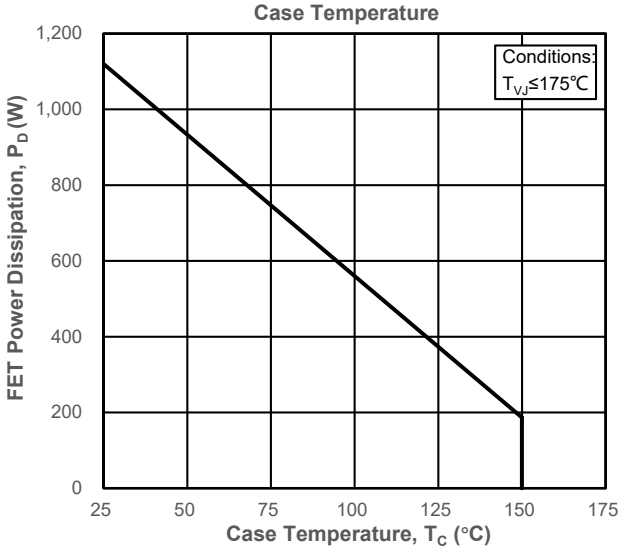


Fig20. Timing vs. Source Current

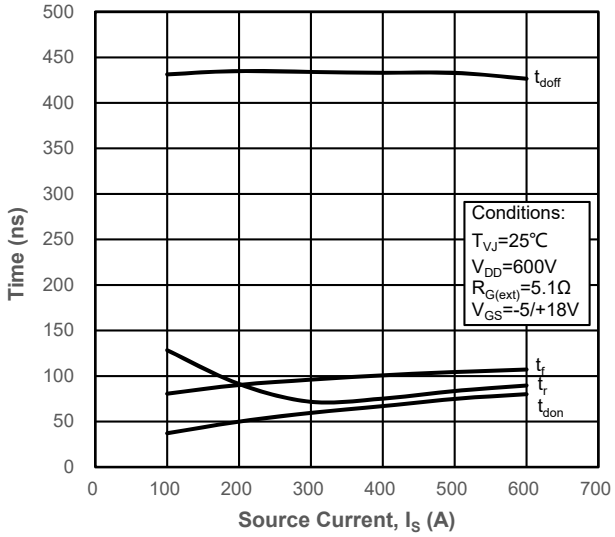


Fig21. dv/dt and di/dt vs. Source Current

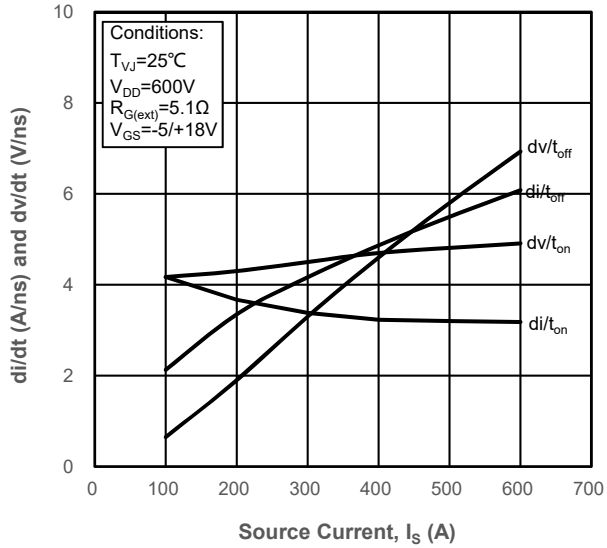


Fig22. Timing vs. External Gate Resistance

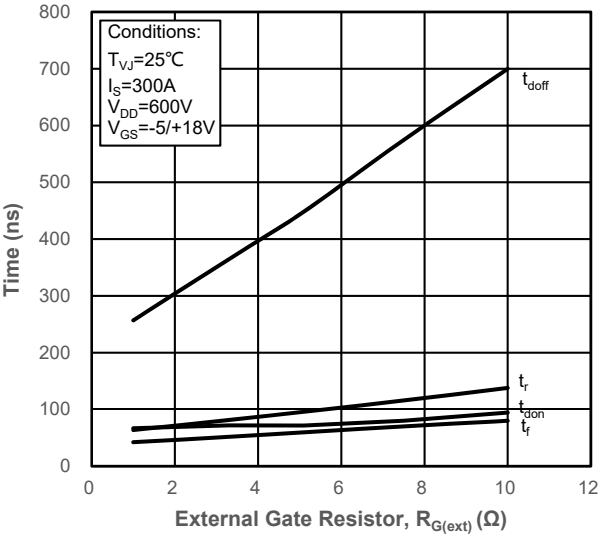
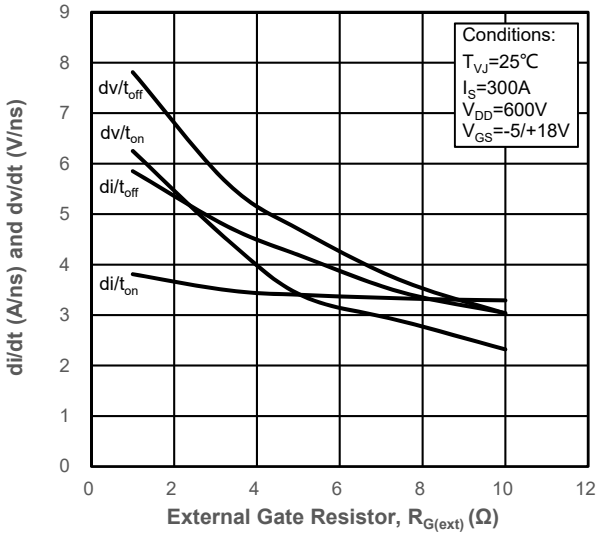
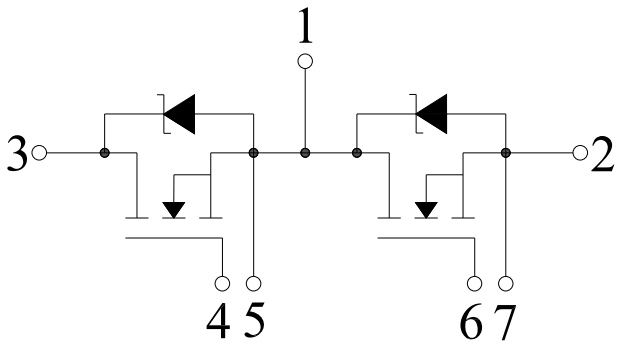


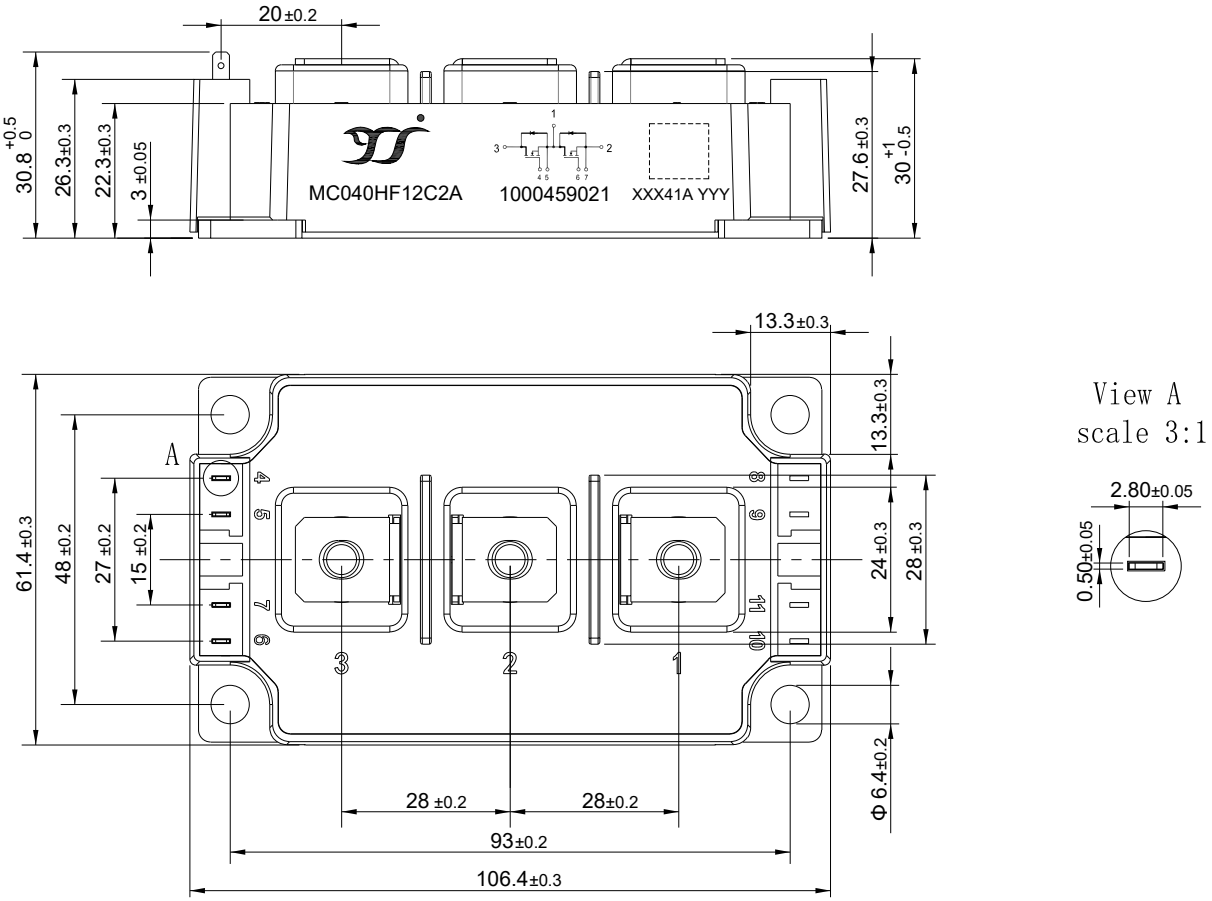
Fig23. dv/dt and di/dt vs. External Gate Resistance



■ Schematic and Pin Out



■ Package Dimensions (mm)



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