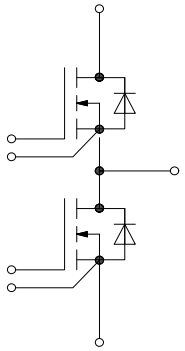
SiC MOSFET Power Module

V_{DS}	1200V
I_D	125A
$R_{DS(on)}$	13.2mΩ

Circuit



Applications

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

Features

·Industry Standard 34mm 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 AlN-AMB Insulator (C1)

■ 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}=200uA	1200	V
Continuous Drain Current	I_D	V_{GS}=18V, T_C=25°C	145	A
		V_{GS}=18V, T_C=80°C	115	
Pulse Drain Current	$I_{D,pulse}$	Pulse width t_p limited by $T_{VJ,max}$	230	A
Power Dissipation	P_{D_MOS}	T_C=25°C	610	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	-8/22	V
Max 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=200uA	1200			V
Gate Threshold Voltage	$V_{GS(th)}$	V_{DS}=V_{GS}, I_D=30mA	2.2	3.3	4.0	V
		V_{DS}=V_{GS}, I_D=30mA, T_{VJ}=175°C		1.9		
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS}=1200V, V_{GS}=0V		5.7	200	uA
Gate-Source Leakage Current	I_{GSS}	V_{DS}=0V, V_{GS}=18V		3.6	200	nA
Drain-Source On-Resistance	$R_{DS(on)}$	I_D=80A, V_{GS}=15V		16.5		mΩ
		I_D=80A, V_{GS}=18V		13.2	18	
		I_D=80A, V_{GS}=15V, T_{VJ}=175°C		25.4		
		I_D=80A, V_{GS}=18V, T_{VJ}=175°C		23.2		
Transconductance	g_{fs}	V_{DS}=20V, I_D=80A		69.9		S
		V_{DS}=20V, I_D=80A, T_{VJ}=175°C		67.2		
Internal Gate Resistance	$R_{G(int.)}$	f=1MHz, V_{AC}=25mV		0.52		Ω
Input Capacitance	C_{iss}	V_{GS}=0V, V_{DS}=800V, f=100kHz, V_{AC}=25mV		9.06		nF
Output Capacitance	C_{oss}			0.40		
Reverse Transfer Capacitance	C_{rss}			27		pF
Gate to Source Charge	Q_{GS}	V_{DD}=800V, V_{GS}=-5/18V, I_D=80A		130		nC
Gate to Drain Charge	Q_{GD}			95		
Total Gate Charge	Q_G			361		
Turn On Delay Time	$t_{d(on)}$	V_{DD}=600V, V_{GS}=-5/18V, I_D=80A, $R_{G(ext)}$=15Ω		37		ns
Rise Time	t_r			45		
Turn Off Delay Time	$t_{d(off)}$			223		
Fall Time	t_f			43		
Turn-on Switching Energy, T_{VJ}=25 °C T_{VJ}=175°C	E_{on}			2.48 1.98		mJ
Turn-off Switching Energy, T_{VJ}=25 °C T_{VJ}=175°C	E_{off}			1.47 1.41		
MOSFET Thermal Resistance, Junction to Case	R_{thJC}	JESD51-14		0.25		°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=40A		4.9		V
		V_{GS}=-5V, I_S=40A, T_{VJ}=175°C		4.4		
Continuous Diode Forward Current	I_S	V_{GS}=-5V, T_C=25°C			70	A
Reverse Recovery Time	t_{rr}	V_{GS}=-5V, I_S=80A, V_R=600V, di/dt=1.78A/ns, T_{VJ}=175°C		33		ns
Reverse Recovery Charge	Q_{rr}			1.86		uC
Peak Reverse Recovery Current	I_{rrm}			95		A
Reverse Recovery Energy, T_{VJ}=25 °C T_{VJ}=175°C	E_{RR}	V_{DD}=600V, I_D=80A V_{GS}=-5V/18V, $R_{G(ext)}$=15Ω		79.7 350.0		uJ

■ Module Characteristics

PARAMETER	SYMBOL	CONDITIONS	VALUE			UNIT
			Min.	Typ.	Max.	
Isolation Breakdown Voltage	V_{isol}	AC, 50Hz (R.M.S), t=1min		3000		V
Stray Inductance	L_{Stray}	Between DC- and DC+, f=10MHz		30		nH
Operating Temperature	T_{Jop}		-40		175	°C
Storage Temperature	T_{stg}		-40		125	°C
Module Electrodes Torque	M_t	Recommended (M5 screw)	2.5		5.0	Nm
Module to Sink Torque	M_s	Recommended (M6 screw)	3.0		5.0	Nm
Weight	W			150		g

■ Typical Performance

Fig1. Output Characteristics for Various Junction Temperatures

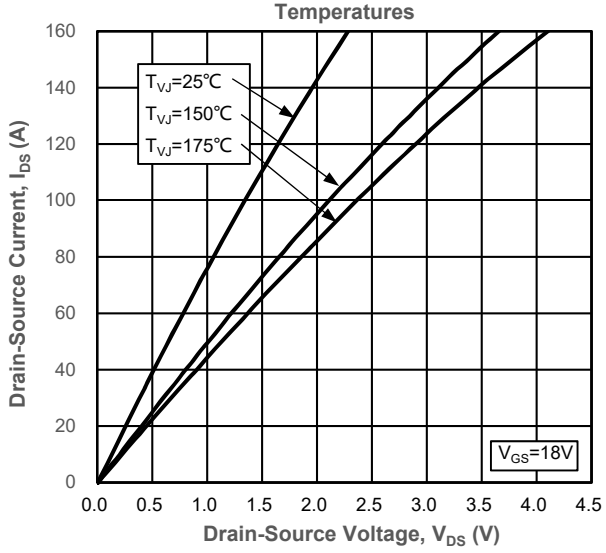


Fig2. Output Characteristics for Various Junction Temperatures

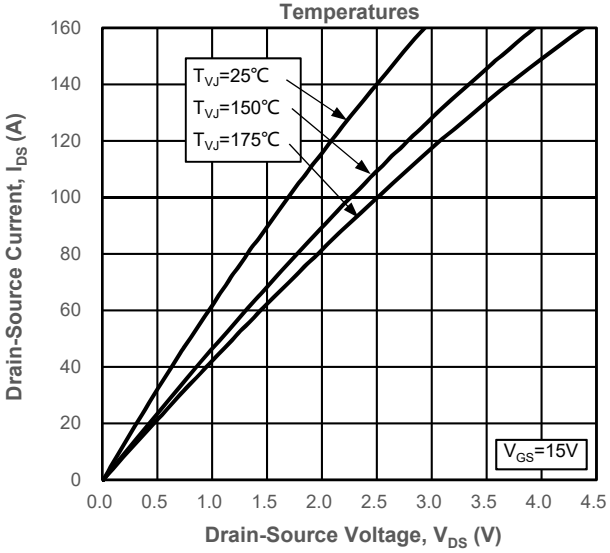


Fig3. Normalized On-State Resistance vs. Drain Current for Various Junction Temperatures

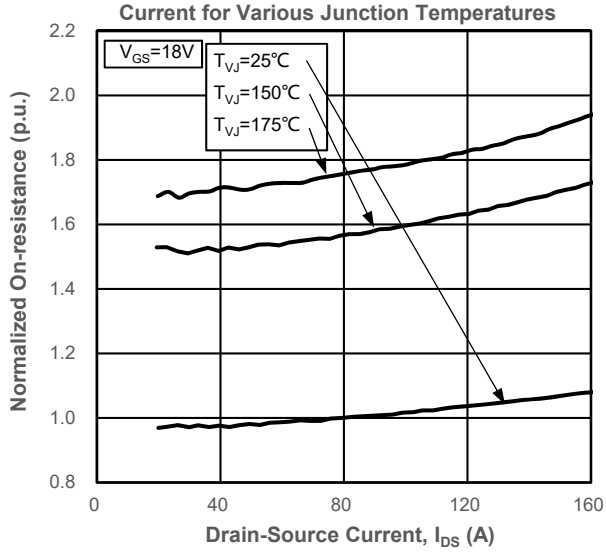


Fig4. Normalized On-State Resistance vs. Drain Current for Various Junction Temperatures

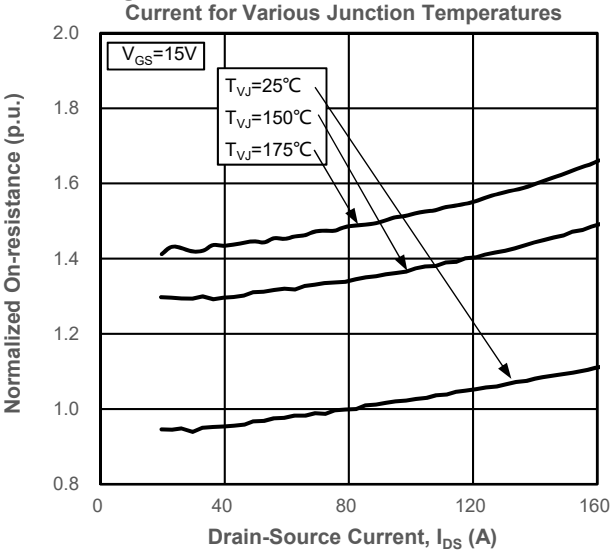


Fig5. Transfer Characteristic for Various Junction Temperatures

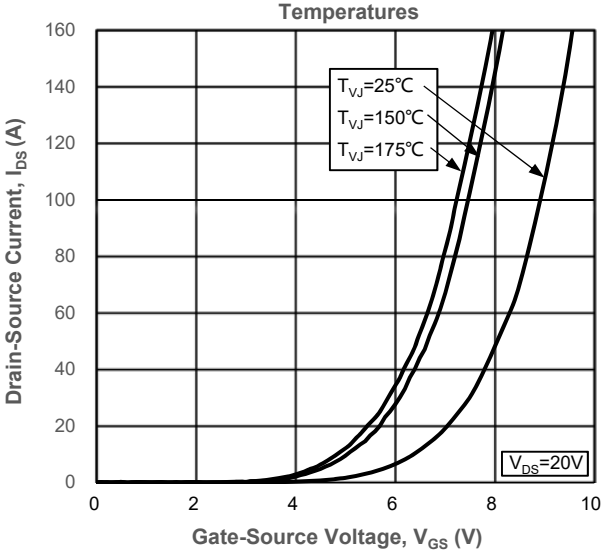


Fig6. 3rd Quadrant Characteristic vs. Junction Temperatures at V_{GS} = 18V

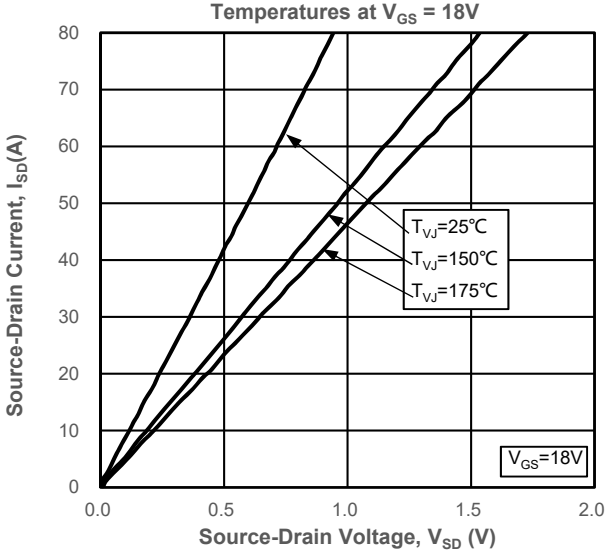


Fig7. 3rd Quadrant Characteristic vs. Junction Temperatures at V_{GS}=0V

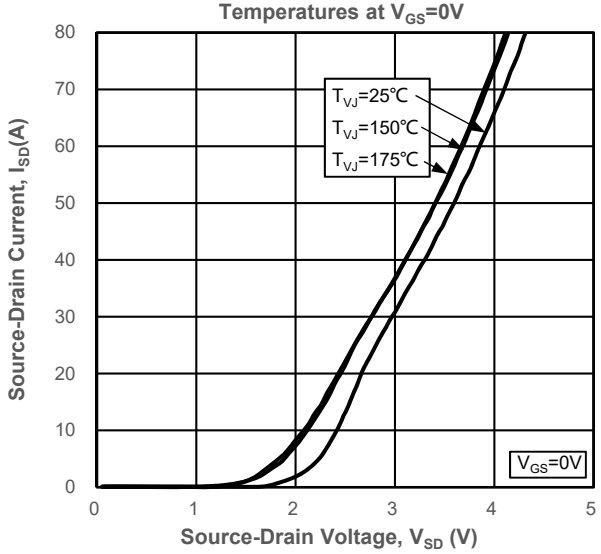


Fig8. 3rd Quadrant Characteristic vs. Junction Temperatures at V_{GS}=-5V

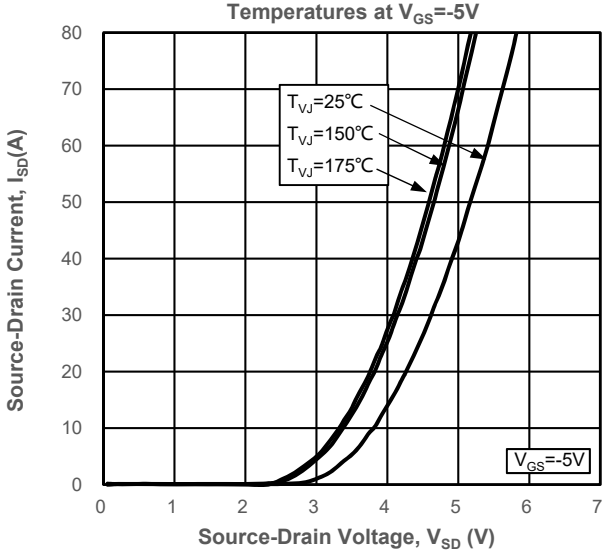


Fig9. Typical Capacitances vs. Drain to Source Voltage (0-200V)

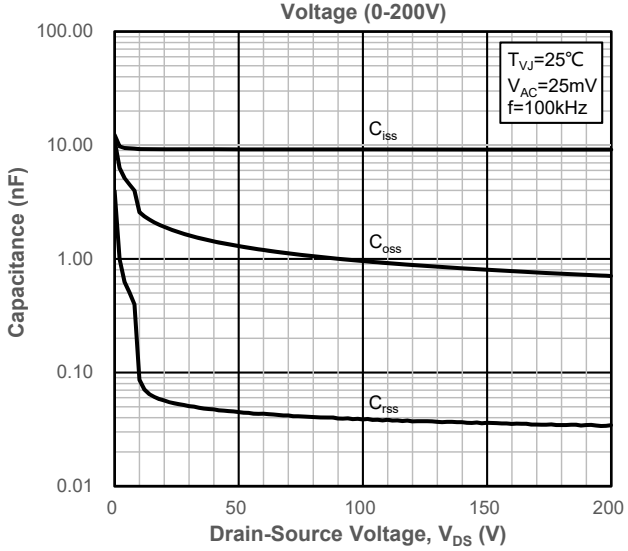


Fig10. Typical Capacitances vs. Drain to Source Voltage (0-1200V)

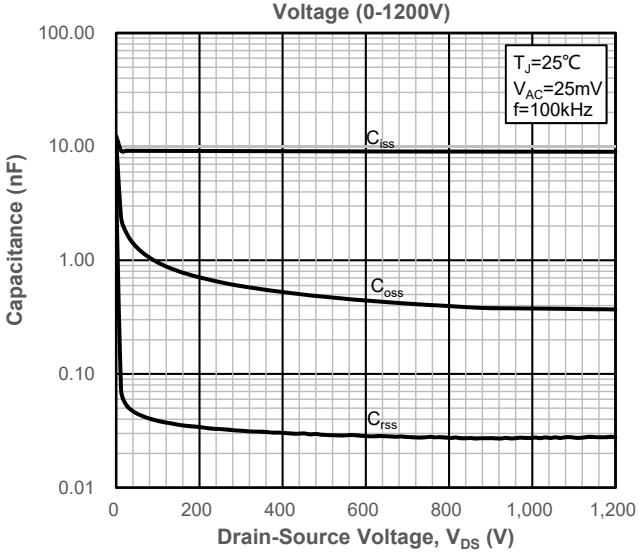


Fig11. Dynamic Input Characteristics

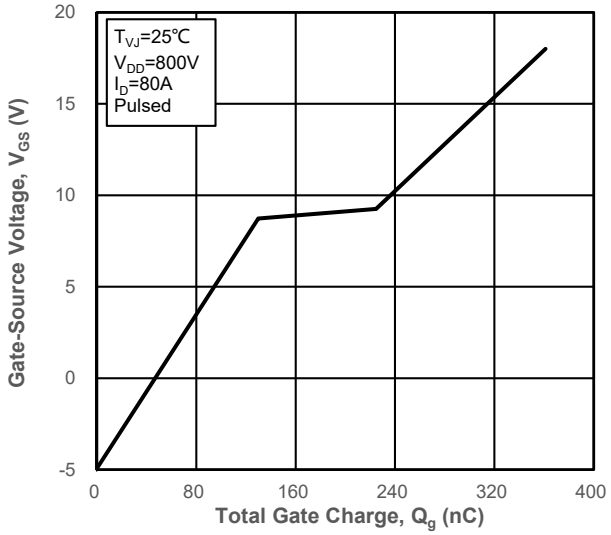


Fig12. Switching Energy vs. Drain Current (V_{DD}=600 V)

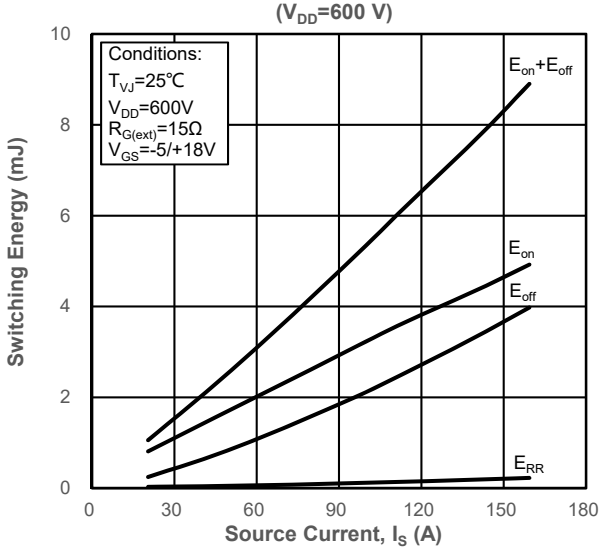


Fig13. Switching Energy vs. Drain Current (V_{DD}=800 V)

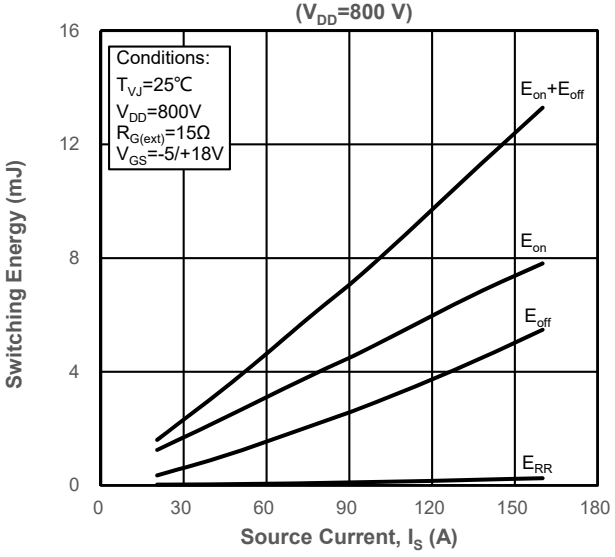


Fig14. MOSFET Switching Energy vs. External Gate Resistance

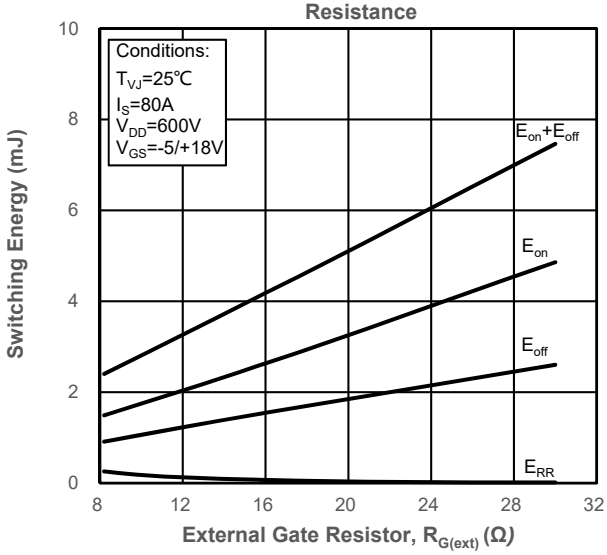


Fig15. Reverse Recovery Energy vs. External Gate Resistance

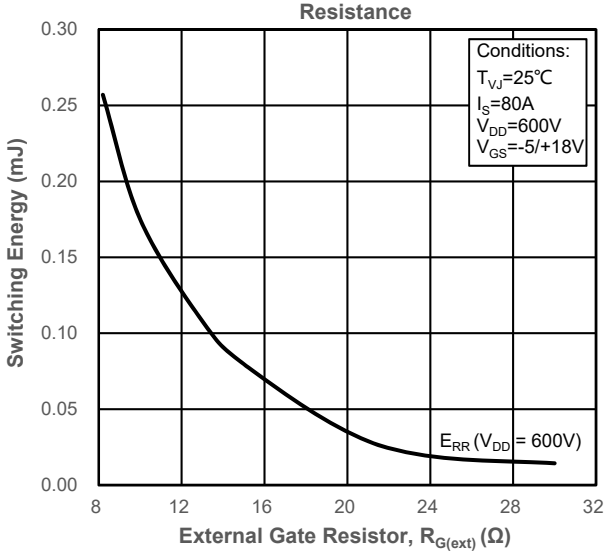


Fig16. MOSFET Junction to Case Transient Thermal Impedance, $Z_{th\ JC}$ (°C/W)

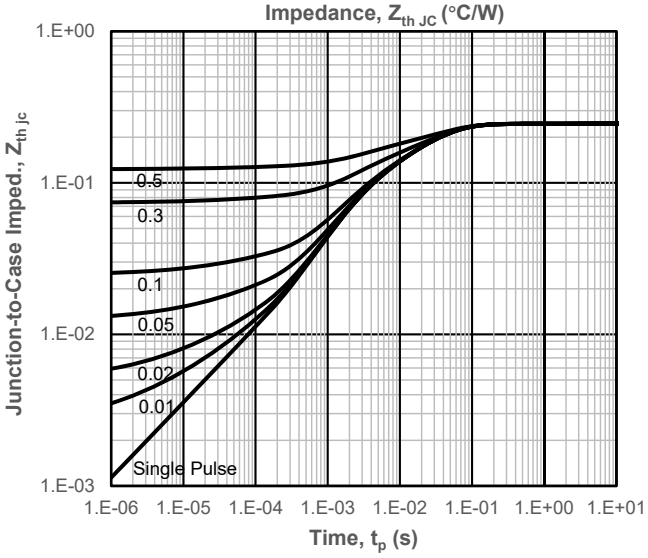


Fig17. Forward Bias Safe Operating Area (FBSOA)

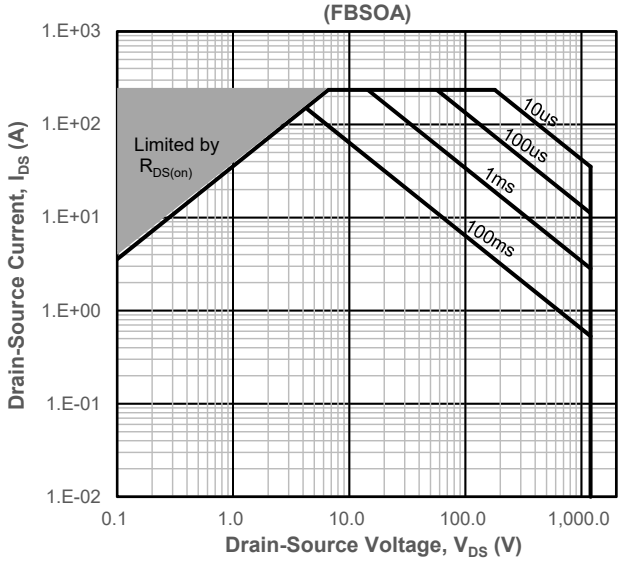


Fig18. Continuous Drain Current Derating vs. Case Temperature

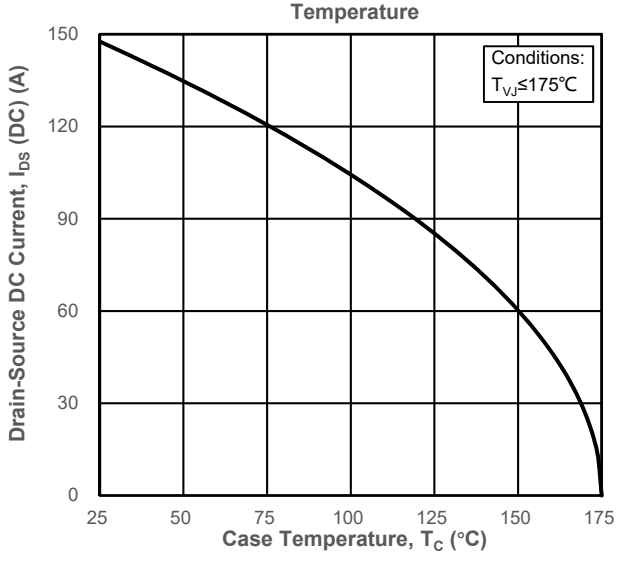


Fig19. Maximum Power Dissipation Derating vs. Case Temperature

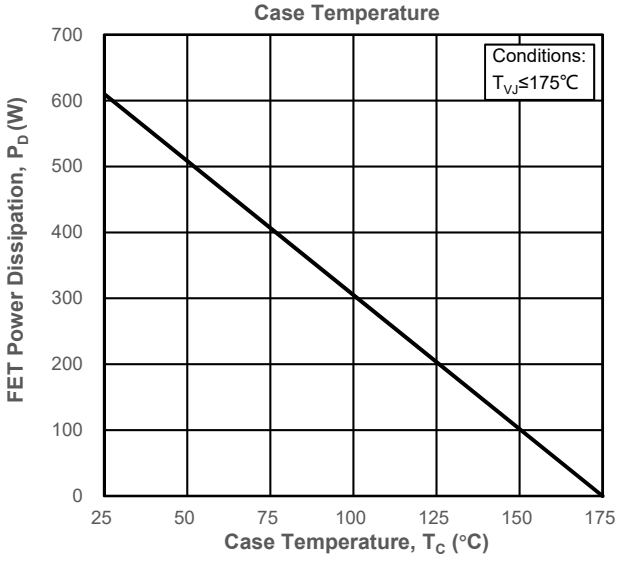


Fig20. Timing vs. Source Current

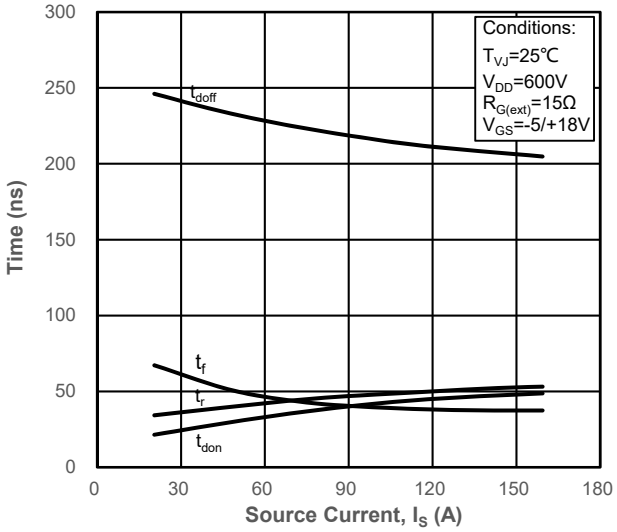


Fig21. dv/dt and di/dt vs. Source Current

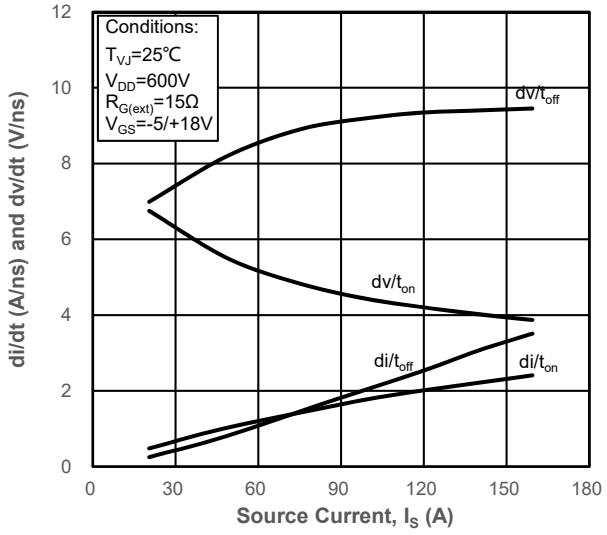


Fig22. Timing vs. External Gate Resistance

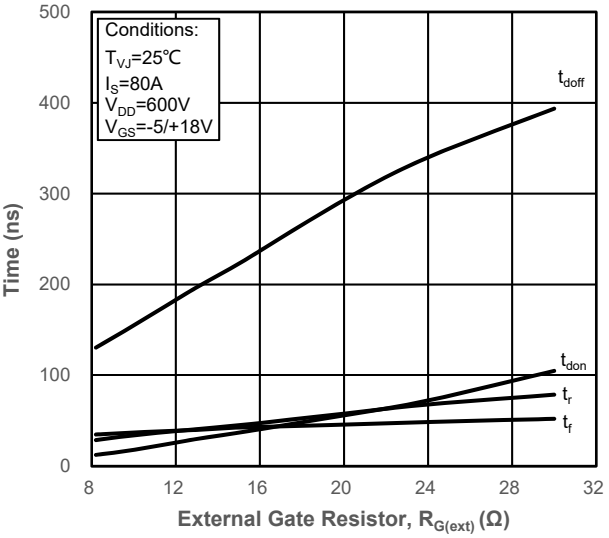
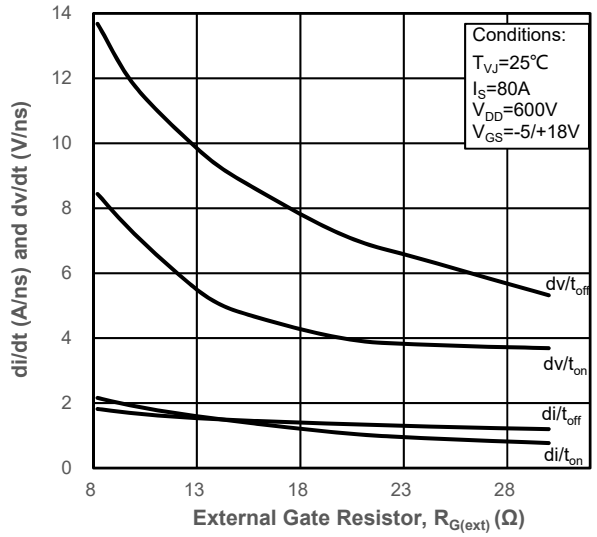
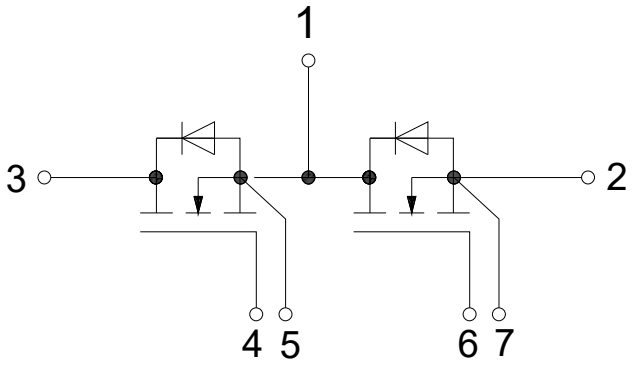


Fig23. dv/dt and di/dt vs. External Gate Resistance

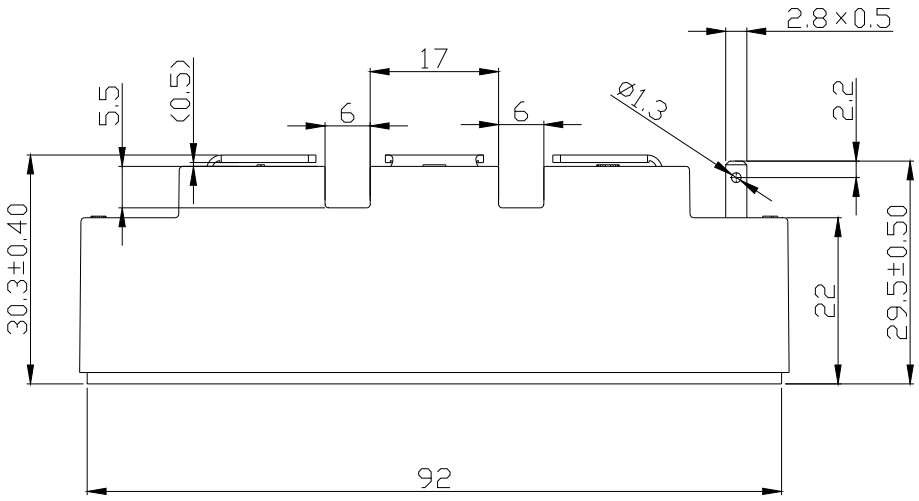


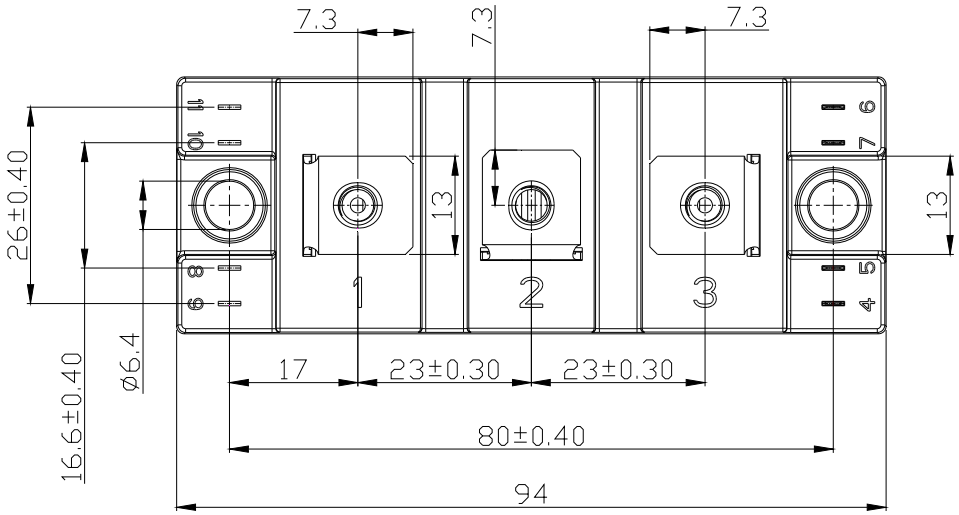
■ Schematic and Pin Out



■ Package Dimensions (mm)

Dimensions in Millimeters





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