

SiC MOSFET Power Module



V_{DS}	1200V
I_D	180A
$R_{DS(on)}$	7.3m Ω

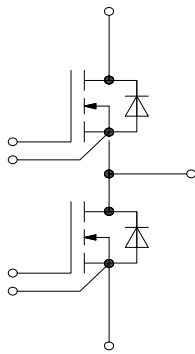
Applications

- 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 Al₂O₃-DBC Insulator (C1)

Circuit



■ MOSFET

Absolute Maximum Ratings ($T_{VJ}=25^{\circ}\text{C}$ Unless Otherwise Specified)

PARAMETER	SYMBOL	CONDITIONS	VALUE	UNIT
Drain-Source Voltage	$V_{DS,max}$	$V_{GS}=0\text{ V}$, $I_{DS}=200\mu\text{A}$	1200	V
Continuous Drain Current	I_D	$V_{GS}=18\text{V}$, $T_C=25^{\circ}\text{C}$	180	A
		$V_{GS}=18\text{V}$, $T_C=80^{\circ}\text{C}$	140	
Pulse Drain Current	$I_{D,pulse}$	Pulse width t_p limited by $T_{VJ,max}$	280	A
Power Dissipation	$P_{D,MOS}$	$T_C=25^{\circ}\text{C}$	430	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	$^{\circ}\text{C}$



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■ MOSFET

Characteristic Values ($T_{VJ}=25^{\circ}\text{C}$ Unless Otherwise Specified)

PARAMETER	SYMBOL	CONDITIONS	VALUE			UNIT
			Min.	Typ.	Max.	
Drain-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS}=0V, I_D=200\mu A$	1200			V
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=40mA$	2.0	2.9	4.0	V
		$V_{DS}=V_{GS}, I_D=40mA, T_{VJ}=175^{\circ}\text{C}$		2.0		
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS}=1200V, V_{GS}=0V$		9.1	200	μA
Gate-Source Leakage Current	I_{GSS}	$V_{DS}=0V, V_{GS}=18V$		4.3	200	nA
Drain-Source On-Resistance	$R_{DS(on)}$	$I_D=140A, V_{GS}=15V$		9.4		m Ω
		$I_D=140A, V_{GS}=18V$		7.3	9	
		$I_D=140A, V_{GS}=15V, T_{VJ}=175^{\circ}\text{C}$		12.7		
		$I_D=140A, V_{GS}=18V, T_{VJ}=175^{\circ}\text{C}$		11.9		
Transconductance	g_{fs}	$V_{DS}=20V, I_D=140A$		137.0		S
		$V_{DS}=20V, I_D=140A, T_{VJ}=175^{\circ}\text{C}$		101.8		
Internal Gate Resistance	$R_{G(int.)}$	$f=1MHz, V_{AC}=25mV$		2.43		Ω
Input Capacitance	C_{iss}	$V_{GS}=0V,$		8.471		nF
Output Capacitance	C_{oss}	$V_{DS}=800V,$		0.488		
Reverse Transfer Capacitance	C_{rss}	$f=100kHz,$ $V_{AC}=25mV$		0.053		
Gate to Source Charge	Q_{GS}	$V_{DD}=800V,$		92		nC
Gate to Drain Charge	Q_{GD}	$V_{GS}=-5/18V,$		200		
Total Gate Charge	Q_G	$I_D=140A$		432		
Turn On Delay Time	$t_{d(on)}$	$V_{DD}=600V,$ $V_{GS}=-5/18V,$ $I_D=140A,$ $R_{G(ext)}=20\Omega$		53		ns
Rise Time	t_r			58		
Turn Off Delay Time	$t_{d(off)}$			485		
Fall Time	t_f			58		
Turn-on Switching Energy, $T_{VJ}=25^{\circ}\text{C}$ $T_{VJ}=150^{\circ}\text{C}$	E_{on}			6.50 5.86		mJ
Turn-off Switching Energy, $T_{VJ}=25^{\circ}\text{C}$ $T_{VJ}=150^{\circ}\text{C}$	E_{off}			7.43 7.71		
MOSFET Thermal Resistance, Junction to Case	R_{thJC}	JESD51-14		0.348		$^{\circ}\text{C/W}$



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■ Body diode

Characteristic Values ($T_{VJ}=25^{\circ}\text{C}$ Unless Otherwise Specified)

PARAMETER	SYMBOL	CONDITIONS	VALUE			UNIT
			Min.	Typ.	Max.	
Inverse Diode Forward Voltage	V_{SD}	$V_{GS}=-5\text{V}$, $I_S=140\text{A}$		5.3		V
		$V_{GS}=-5\text{V}$, $I_S=140\text{A}$, $T_{VJ}=175^{\circ}\text{C}$		4.7		
Continuous Diode Forward Current	I_S	$V_{GS}=-5\text{V}$, $T_C=25^{\circ}\text{C}$			100	A
Reverse Recovery Time	t_{rr}	$V_{GS}=-5\text{V}$, $I_S=140\text{A}$, $V_R=600\text{V}$, $di/dt=2.27\text{A/ns}$, $T_{VJ}=150^{\circ}\text{C}$		47		ns
Reverse Recovery Charge	Q_{rr}			3.2		uC
Peak Reverse Recovery Current	I_{rrm}			115		A
Reverse Recovery Energy, $T_{VJ}=25^{\circ}\text{C}$ $T_{VJ}=150^{\circ}\text{C}$	E_{RR}	$V_{DD}=600\text{V}$, $I_D=140\text{A}$ $V_{GS}=-5\text{V}/18\text{V}$, $R_{G(ext)}=20\Omega$		0.27 0.64		mJ

■ Module Characteristics

PARAMETER	SYMBOL	CONDITIONS	VALUE			UNIT
			Min.	Typ.	Max.	
Isolation Breakdown Voltage	V_{isol}	AC, 50Hz (R.M.S), $t=1\text{minute}$	2500			V
Stray Inductance	L_{Stray}	Between DC- and DC+, $f=10\text{MHz}$		30		nH
Operating Junction Temperature	$T_{VJ,op}$		-40		175	$^{\circ}\text{C}$
Storage Temperature	T_{stg}		-40		150	$^{\circ}\text{C}$
Module Electrodes Torque	M_t	Recommended (M5)	2.5		5.0	Nm
Module to Sink Torque	M_s	Recommended (M6)	3.0		5.0	Nm
Weight	W			150		g



■ Typical Performance

Fig1. Output Characteristics for Various Junction Temperatures

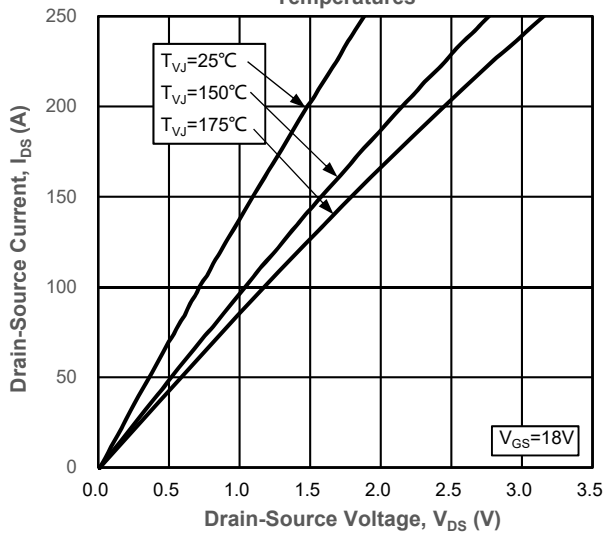


Fig2. Output Characteristics for Various Junction Temperatures

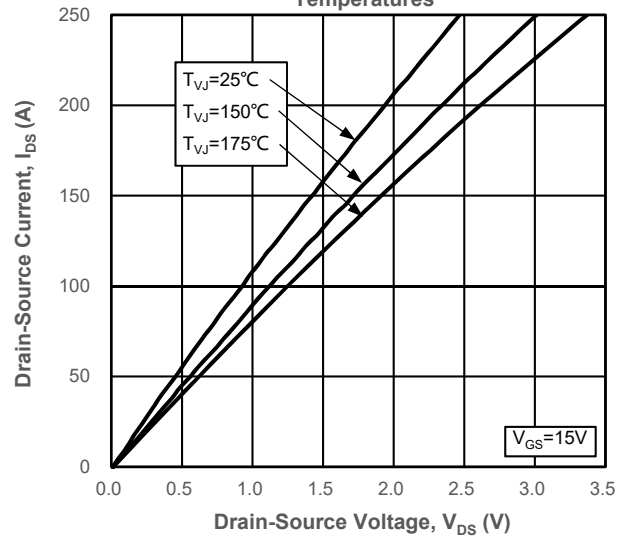


Fig3. Normalized On-State Resistance vs. Drain Current for Various Junction Temperatures

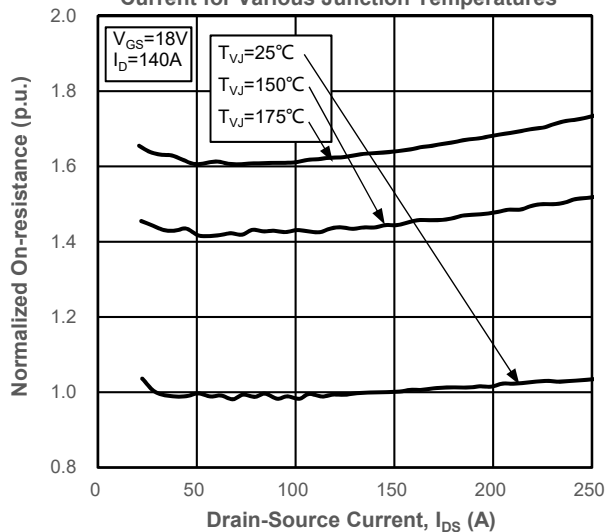


Fig4. Normalized On-State Resistance vs. Drain Current for Various Junction Temperatures

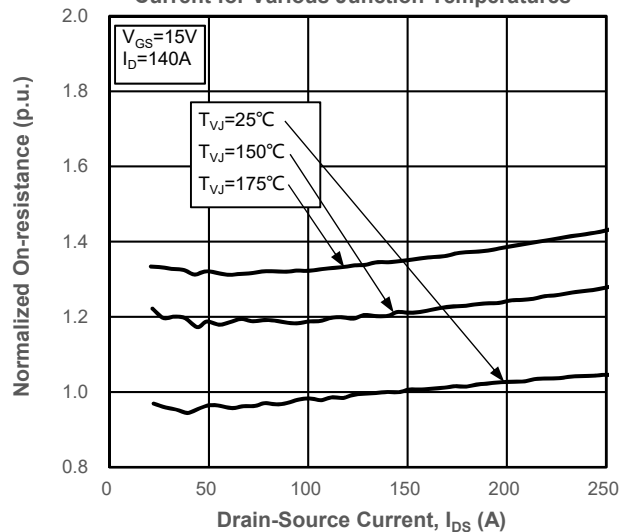


Fig5. Transfer Characteristic for Various Junction Temperatures

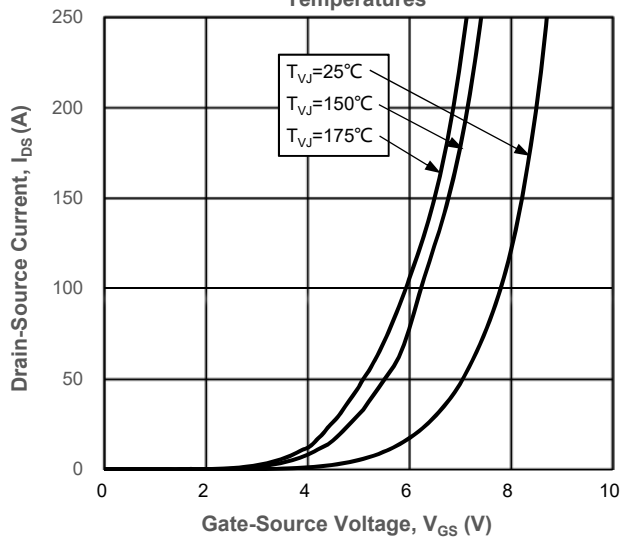
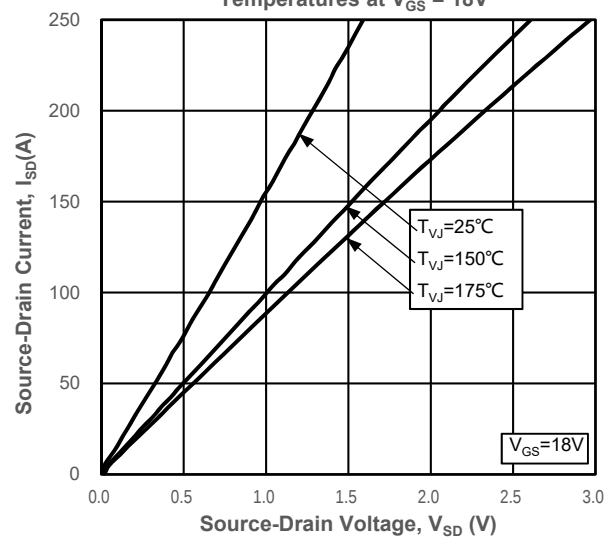


Fig6. 3rd Quadrant Characteristic vs. Junction Temperatures at $V_{GS} = 18V$





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

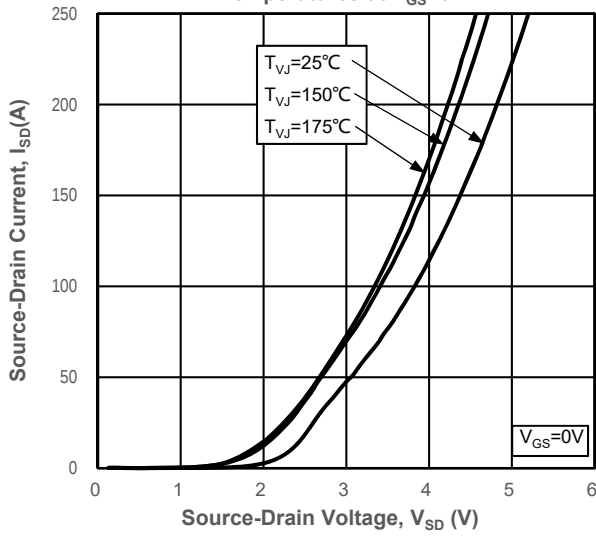


Fig8. 3rd Quadrant Characteristic vs. Junction Temperatures at $V_{GS} = -5V$

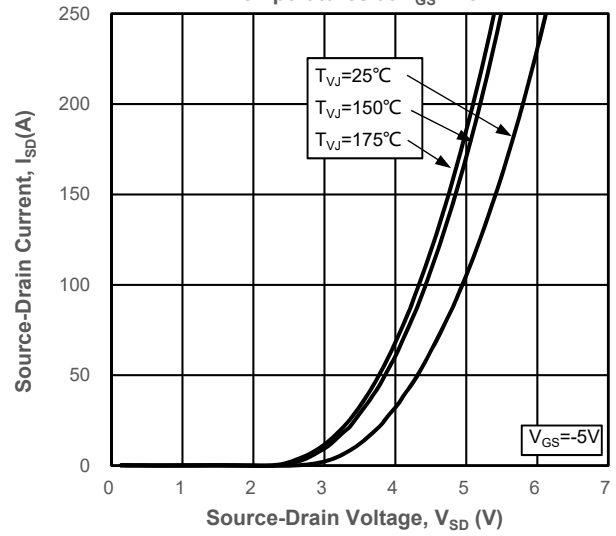


Fig9. Typical Capacitances vs. Drain to Source Voltage (0-200V)

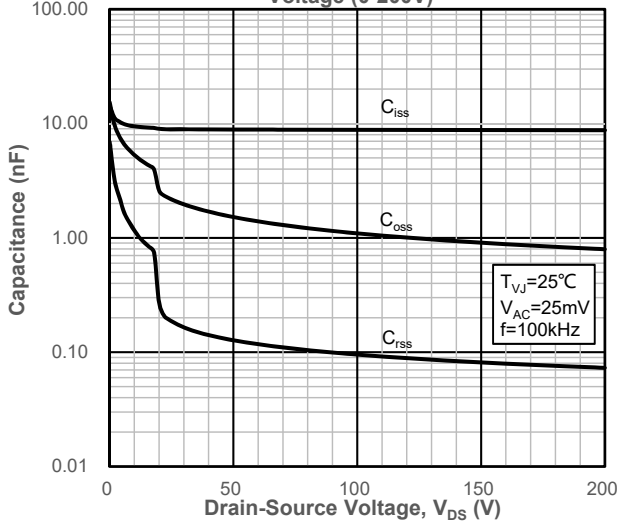


Fig10. Typical Capacitances vs. Drain to Source Voltage (0-1200V)

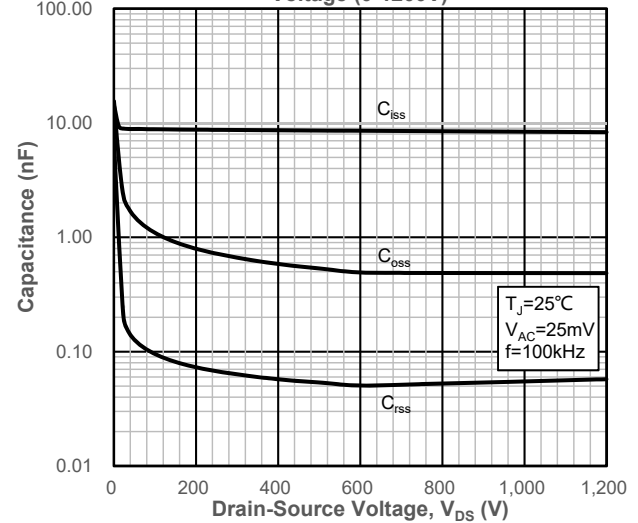


Fig11. Switching Energy vs. Drain Current ($V_{DD}=600V$)

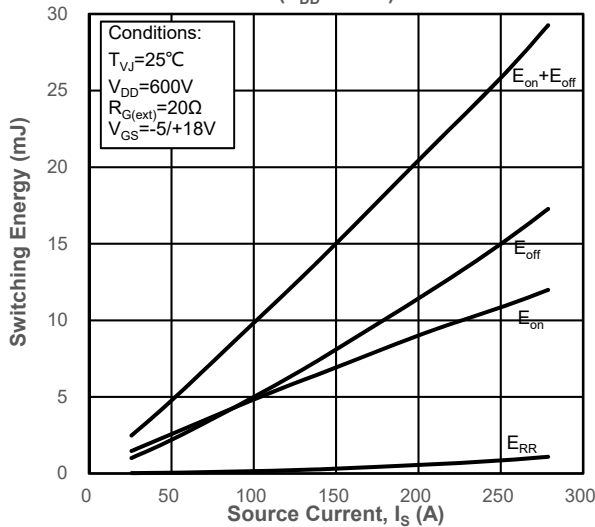
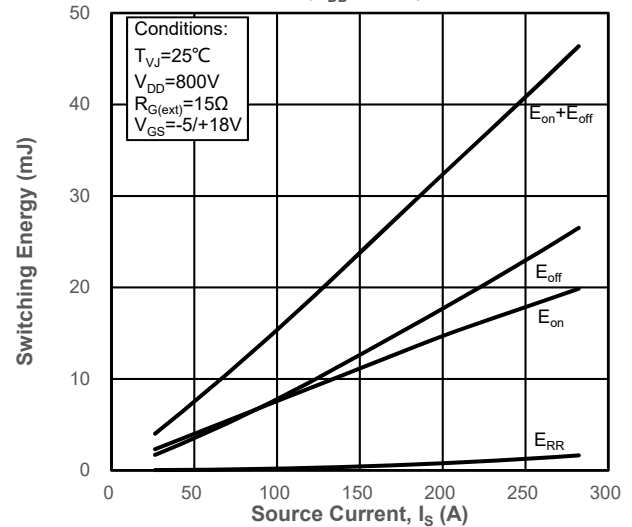


Fig12. Switching Energy vs. Drain Current ($V_{DD}=800V$)





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Fig13. MOSFET Switching Energy vs. External Gate Resistance

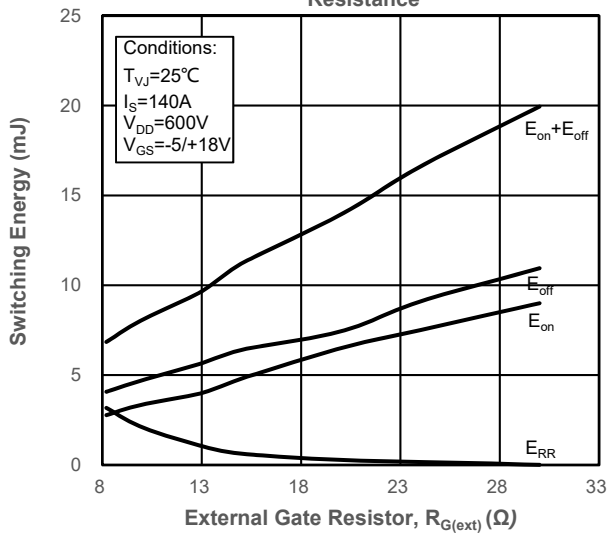


Fig14. Reverse Recovery Energy vs. External Gate Resistance

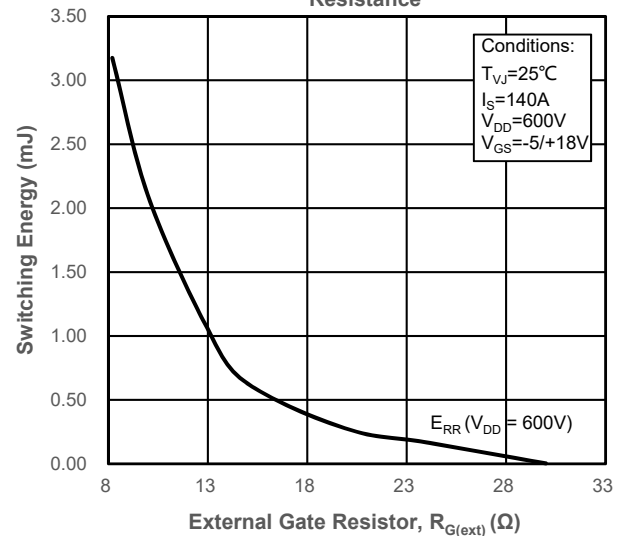


Fig15. MOSFET Junction to Case Transient Thermal Impedance, Z_{thJC} ($^{\circ}\text{C/W}$)

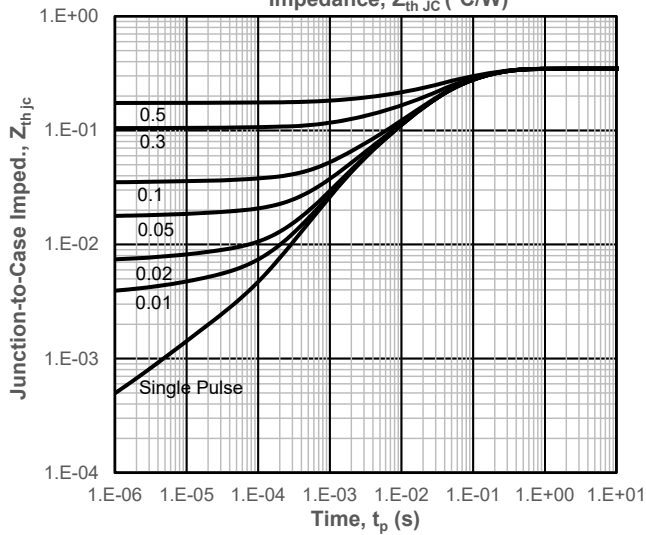


Fig16. Forward Bias Safe Operating Area (FBSOA)

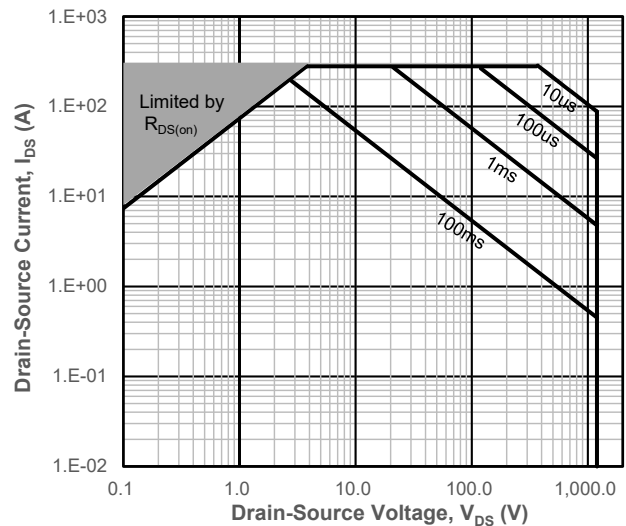


Fig17. Continuous Drain Current Derating vs. Case Temperature

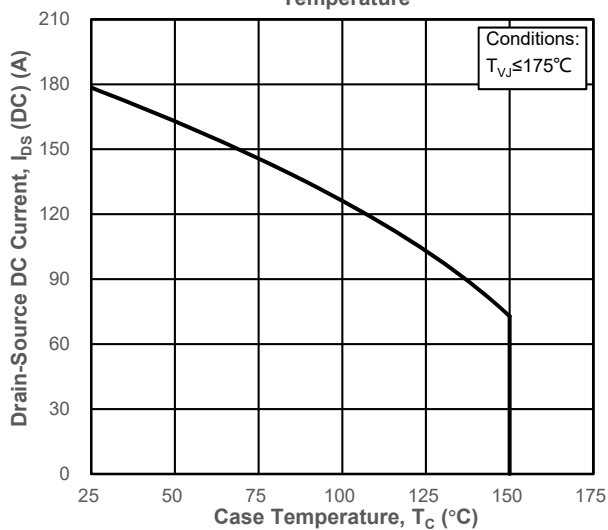
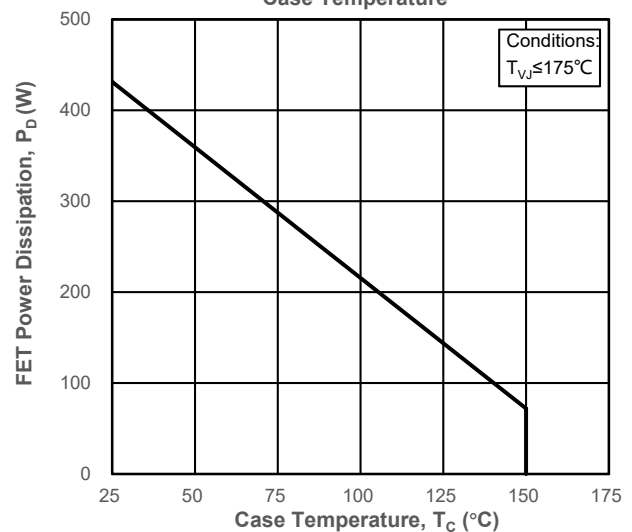


Fig18. Maximum Power Dissipation Derating vs. Case Temperature





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Fig19. Timing vs. Source Current

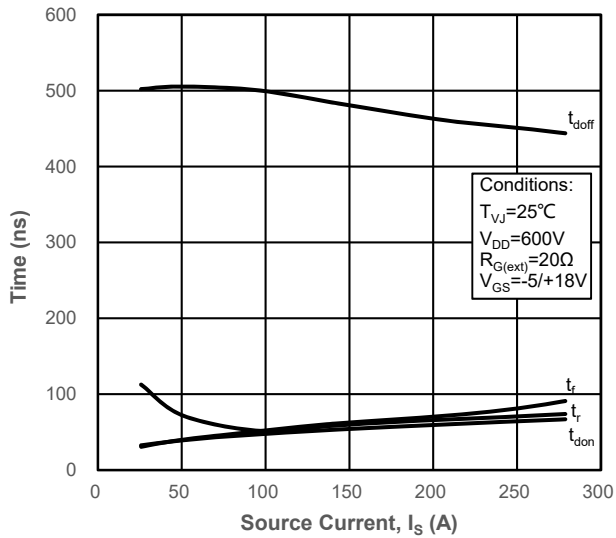


Fig20. dv/dt and di/dt vs. Source Current

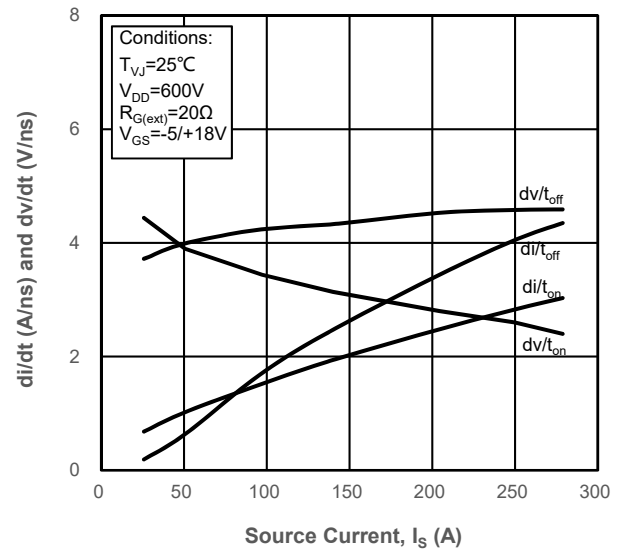


Fig21. Timing vs. External Gate Resistance

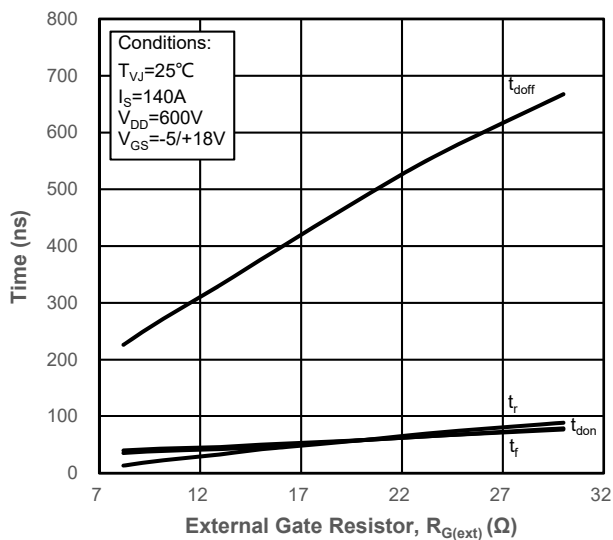
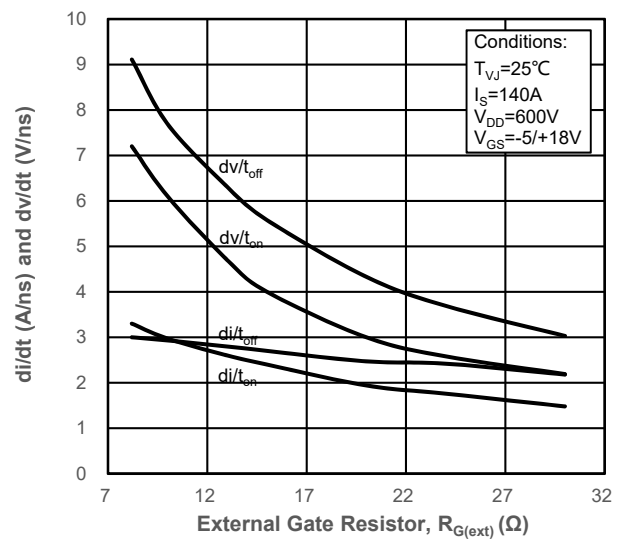


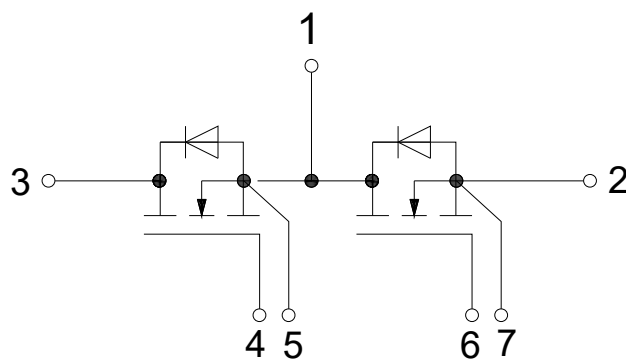
Fig22. dv/dt and di/dt vs. External Gate Resistance





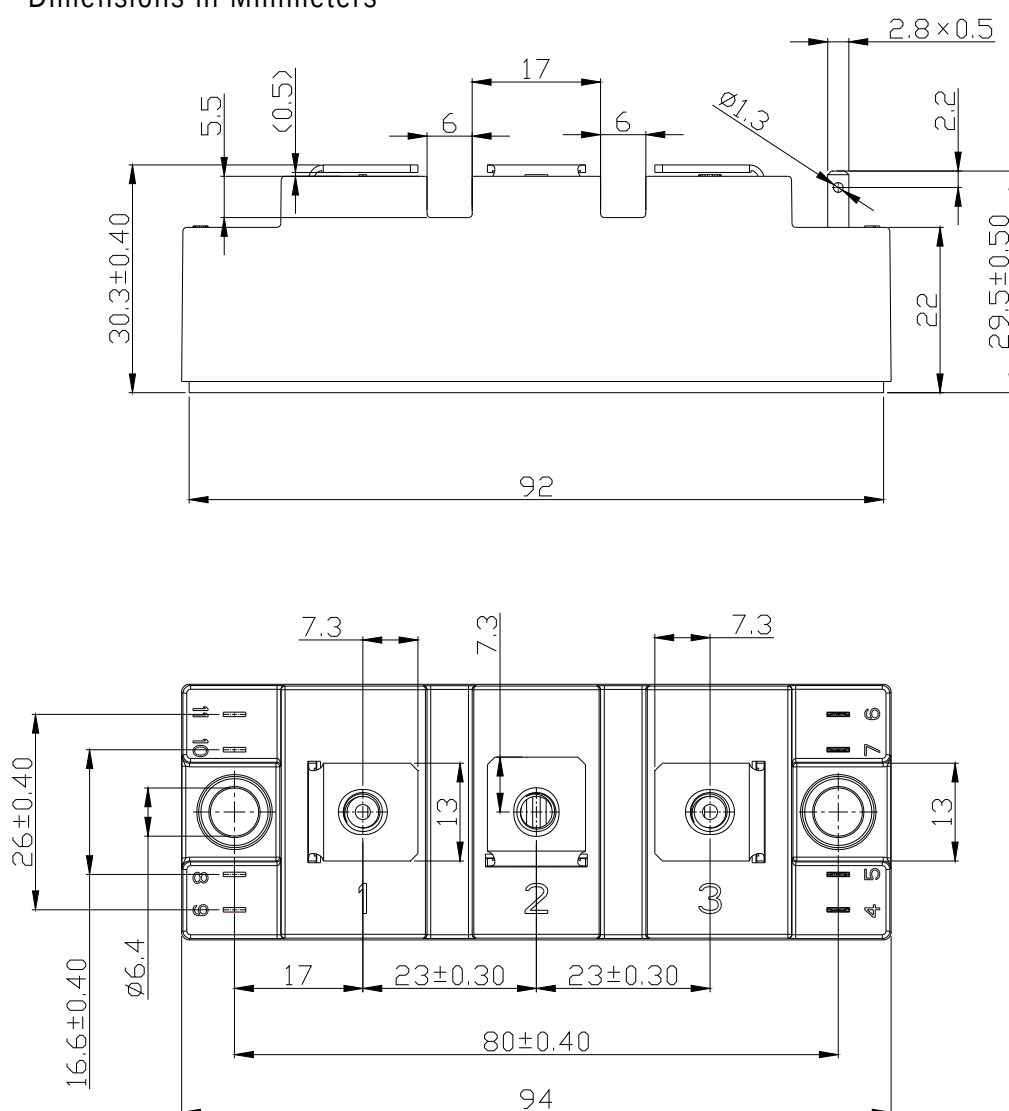
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■ Schematic and Pin Out



■ Package Dimensions (mm)

Dimensions in Millimeters





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