

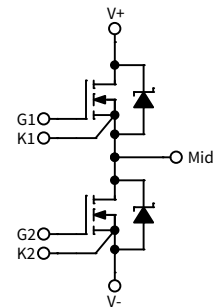
# WAS310M17BM3, WAS310M17BM3T

1700 V, 310 A, Silicon Carbide, Half-Bridge Module

$V_{DS}$	1700 V
$I_{DS}$	310 A

## Technical Features

- Industry Standard 62 mm Footprint
- High Humidity Operation THB-80 (HV-H3TRB)
- 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 Aluminum Nitride Insulator



## Typical Applications

- Induction Heating
- Motor Drives
- Renewables
- Railway Auxiliary & Traction
- EV Fast Charging
- UPS and SMPS

## System Benefits

- 62 mm Form Factor Enables System Retrofit
- Increased System Efficiency, due to Low Switching & Conduction Losses of SiC

## Key Parameters

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions	Note
Drain-Source Voltage	$V_{DS}$			1700	V		
Gate-Source Voltage, Maximum Value	$V_{GS(max)}$	-10		+23		Transient	Note 1 Fig. 33
Gate-Source Voltage, Recommended	$V_{GS(op)}$		-4/+15			Static	
DC Continuous Drain Current	$I_D$		409		A	$V_{GS} = 15 \text{ V}, T_C = 25^\circ\text{C}, T_{VJ} \leq 175^\circ\text{C}$	Notes 2, 3 Fig. 21
			307			$V_{GS} = 15 \text{ V}, T_C = 90^\circ\text{C}, T_{VJ} \leq 175^\circ\text{C}$	
DC Source-Drain Current (Schottky Diode)	$I_{SD(SD)}$		482			$V_{GS} = -4 \text{ V}, T_C = 25^\circ\text{C}, T_{VJ} \leq 175^\circ\text{C}$	
Pulsed Drain-Source Current	$I_{DM}$		620			$t_{pmax}$ limited by $T_{VJmax}$ $V_{GS} = 15 \text{ V}, T_C = 25^\circ\text{C}$	
Power Dissipation	$P_D$		1630		W	$T_C = 25^\circ\text{C}, T_{VJ} \leq 175^\circ\text{C}$	Note 4 Fig. 21
Virtual Junction Temperature	$T_{VJ(op)}$	-40		150	$^\circ\text{C}$	Operation	
				175		Intermittent with Reduced Life	

Note (1): Recommended turn-on gate voltage is 15 V with  $\pm 5\%$  regulation tolerance. Not for use in linear region.

Note (2): Current limit calculated by  $I_{D(max)} = \sqrt{(P_D/R_{DS(typ)})(T_{VJ(max)}I_{D(max)})}$

Note (3): Verified by design

Note (4):  $P_D = (T_{VJ} - T_C)/R_{TH(JC,typ)}$

**MOSFET Characteristics (Per Position) ( $T_{VJ} = 25\text{ }^{\circ}\text{C}$  Unless Otherwise Specified)**

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions	Note
Drain-Source Breakdown Voltage	$V_{(BR)DSS}$	1700				$V_{GS} = 0\text{ V}$ , $T_{VJ} = -40\text{ }^{\circ}\text{C}$	
Gate Threshold Voltage	$V_{GS(th)}$	1.8	2.5	3.6	V	$V_{DS} = V_{GS}$ , $I_D = 102\text{ mA}$	
			2.0			$V_{DS} = V_{GS}$ , $I_D = 102\text{ mA}$ , $T_{VJ} = 175\text{ }^{\circ}\text{C}$	
Zero Gate Voltage Drain Current	$I_{DSS}$		26.4	2560	$\mu\text{A}$	$V_{GS} = 0\text{ V}$ , $V_{DS} = 1700\text{ V}$	
Gate-Source Leakage Current	$I_{GSS}$		4	1000	nA	$V_{GS} = 15\text{ V}$ , $V_{DS} = 0\text{ V}$	
Drain-Source On-State Resistance (Devices Only)	$R_{DS(on)}$		4.3	5.8	m $\Omega$	$V_{GS} = 15\text{ V}$ , $I_D = 310\text{ A}$	Fig. 2 Fig. 3
			8.4			$V_{GS} = 15\text{ V}$ , $I_D = 310\text{ A}$ , $T_{VJ} = 150\text{ }^{\circ}\text{C}$	
			9.8			$V_{GS} = 15\text{ V}$ , $I_D = 310\text{ A}$ , $T_{VJ} = 175\text{ }^{\circ}\text{C}$	
Transconductance	$g_{fs}$		290		S	$V_{DS} = 20\text{ V}$ , $I_D = 310\text{ A}$	Fig. 4
			284			$V_{DS} = 20\text{ V}$ , $I_D = 310\text{ A}$ , $T_{VJ} = 150\text{ }^{\circ}\text{C}$	
Turn-On Switching Energy, $T_{VJ} = 25\text{ }^{\circ}\text{C}$ $T_{VJ} = 125\text{ }^{\circ}\text{C}$ $T_{VJ} = 150\text{ }^{\circ}\text{C}$	$E_{on}$		4.4 4.1 4.0		mJ	$V_{DD} = 900\text{ V}$ , $I_D = 310\text{ A}$ , $V_{GS} = -4\text{ V}/15\text{ V}$ , $R_{G(OFF)} = 1.0\text{ }\Omega$ , $R_{G(ON)} = 1.0\text{ }\Omega$ , $L = 13.6\text{ }\mu\text{H}$	Fig. 11 Fig. 13
Turn-Off Switching Energy, $T_{VJ} = 25\text{ }^{\circ}\text{C}$ $T_{VJ} = 125\text{ }^{\circ}\text{C}$ $T_{VJ} = 150\text{ }^{\circ}\text{C}$	$E_{off}$		7.2 7.4 7.4				
Internal Gate Resistance	$R_{G(int)}$		1.85		$\Omega$	$f = 100\text{ kHz}$	
Input Capacitance	$C_{iss}$		31.5		nF	$V_{GS} = 0\text{ V}$ , $V_{DS} = 1000\text{ V}$ , $V_{AC} = 25\text{ mV}$ , $f = 100\text{ kHz}$	Fig. 9
Output Capacitance	$C_{oss}$		1.8				
Reverse Transfer Capacitance	$C_{rss}$		45		pF		
Gate to Source Charge	$Q_{GS}$		320		nC	$V_{DS} = 1200\text{ V}$ , $V_{GS} = -4\text{ V}/15\text{ V}$ , $I_D = 310\text{ A}$ , Per IEC60747-8-4 pg 21	
Gate to Drain Charge	$Q_{GD}$		280				
Total Gate Charge	$Q_G$		996				
FET Thermal Resistance, Junction to Case	$R_{th\text{ JC}}$		0.092		$^{\circ}\text{C}/\text{W}$		Fig. 17

**Diode Characteristics (Per Position) ( $T_{VJ} = 25\text{ }^{\circ}\text{C}$  Unless Otherwise Specified)**

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions	Note
Diode Forward Voltage	$V_F$		1.78		V	$V_{GS} = -4\text{ V}$ , $I_F = 310\text{ A}$ , $T_{VJ} = 25\text{ }^{\circ}\text{C}$	Fig. 7
			2.50			$V_{GS} = -4\text{ V}$ , $I_F = 310\text{ A}$ , $T_{VJ} = 150\text{ }^{\circ}\text{C}$	
Reverse Recovery Time	$t_{rr}$		27		ns	$V_{GS} = -4\text{ V}$ , $I_{SD} = 310\text{ A}$ , $V_R = 900\text{ V}$ $di/dt = 26.5\text{ A/ns}$ , $T_{VJ} = 150\text{ }^{\circ}\text{C}$	Fig. 32
Reverse Recovery Charge	$Q_{rr}$		4.5		$\mu\text{C}$		
Peak Reverse Recovery Current	$I_{rrm}$		281		A		
Reverse Recovery Energy, $T_{VJ} = 25\text{ }^{\circ}\text{C}$ $T_{VJ} = 125\text{ }^{\circ}\text{C}$ $T_{VJ} = 150\text{ }^{\circ}\text{C}$	$E_{rr}$		3.5 3.8 3.9		mJ	$V_{DS} = 900\text{ V}$ , $I_D = 310\text{ A}$ , $V_{GS} = -4\text{ V}/15\text{ V}$ , $R_{G(ext)} = 1.0\text{ }\Omega$ , $L = 13.6\text{ }\mu\text{H}$	Fig. 14 Note 5
Diode Thermal Resistance, JCT. to Case	$R_{th\text{ JC}}$		0.086		$^{\circ}\text{C}/\text{W}$		Fig. 18

Note (5): SiC Schottky diodes do not have reverse recovery energy but still contribute capacitive energy



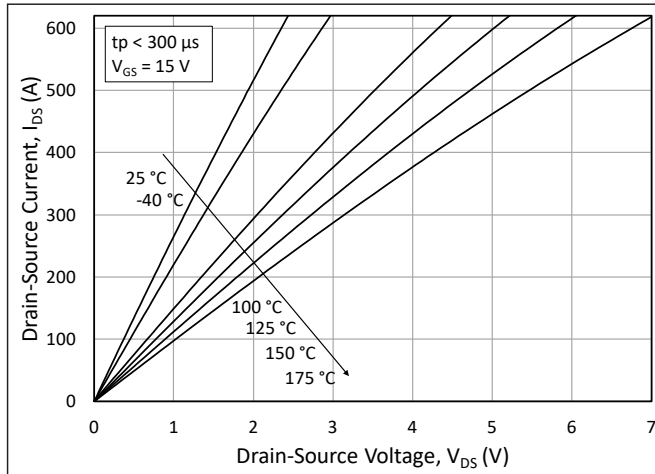
Module Physical Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Package Resistance, M1 (High-Side)	R <sub>3-1</sub>		1.31		mΩ	T <sub>C</sub> = 25 °C, I <sub>SD</sub> = 310 A, Note 6
			1.84			T <sub>C</sub> = 125 °C, I <sub>SD</sub> = 310 A, Note 6
Package Resistance, M2 (Low-Side)	R <sub>1-2</sub>		1.26			T <sub>C</sub> = 25 °C, I <sub>SD</sub> = 310 A, Note 6
			1.77			T <sub>C</sub> = 125 °C, I <sub>SD</sub> = 310 A, Note 6
Stray Inductance	L <sub>Stray</sub>		11.1		nH	Between DC- and DC+, f = 10 MHz
Case Temperature	T <sub>C</sub>	-40		125	°C	
Mounting Torque	M <sub>S</sub>	4	5	5.5	N-m	Baseplate, M6-1.0 Bolts
		4	5	5.5		Power Terminals, M6-1.0 Bolts
Weight	W		300		g	
Case Isolation Voltage	V <sub>isol</sub>	5			kV	AC, 50 Hz, 1 minute
Clearance Distance		9			mm	Terminal to Terminal
		30				Terminal to Baseplate
Creepage Distance		30				Terminal to Terminal
		40				Terminal to Baseplate

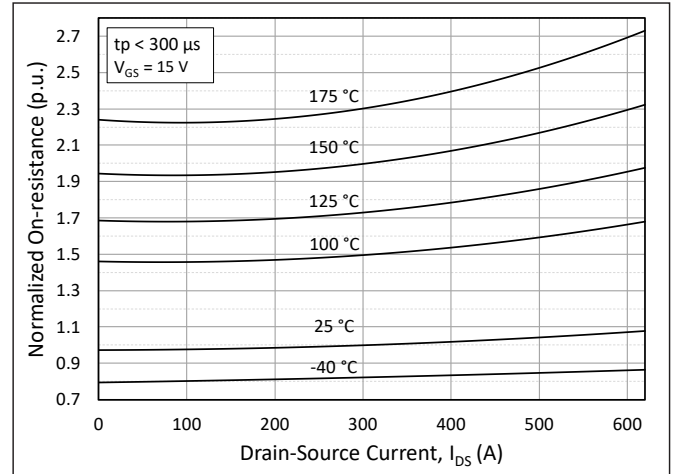
Note (6): Total Effective Resistance (Per Switch Position) = MOSFET R<sub>DS(on)</sub> + Switch Position Package Resistance



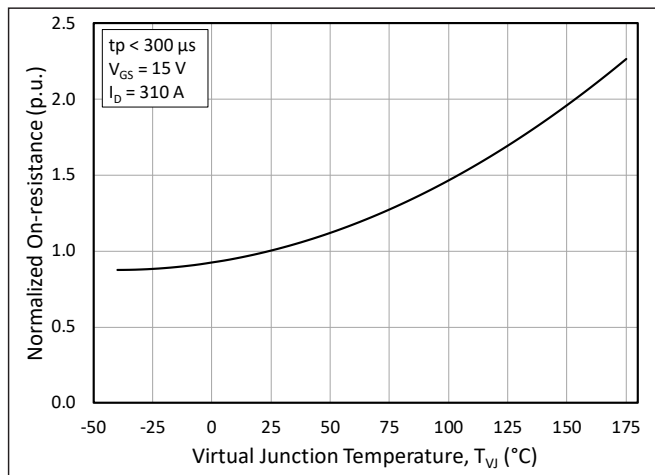
## Typical Performance



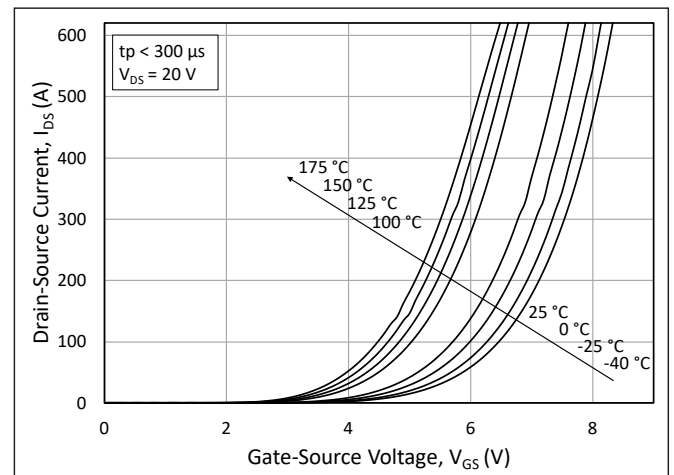
**Figure 1.** Output Characteristics for Various Junction Temperatures



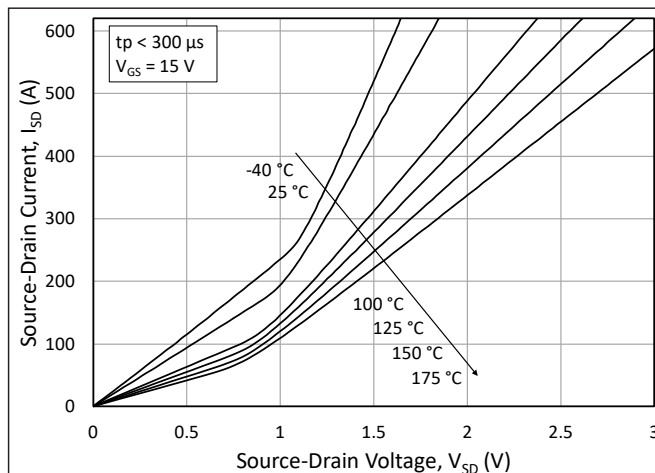
**Figure 2.** Normalized On-State Resistance vs. Drain Current for Various Junction Temperatures



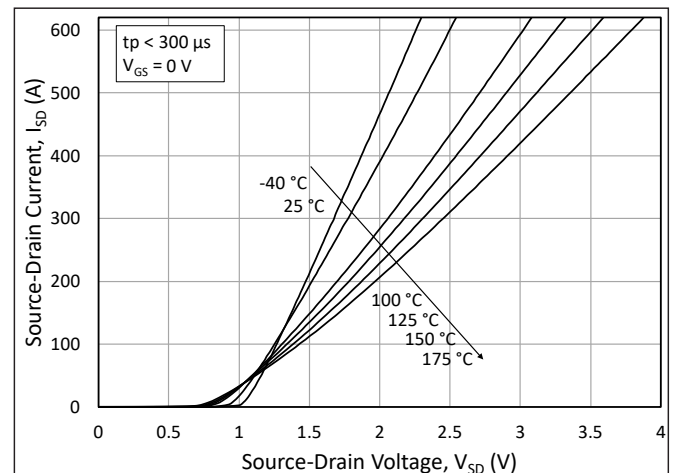
**Figure 3.** Normalized On-State Resistance vs. Junction Temperature



**Figure 4.** Transfer Characteristic for Various Junction Temperatures

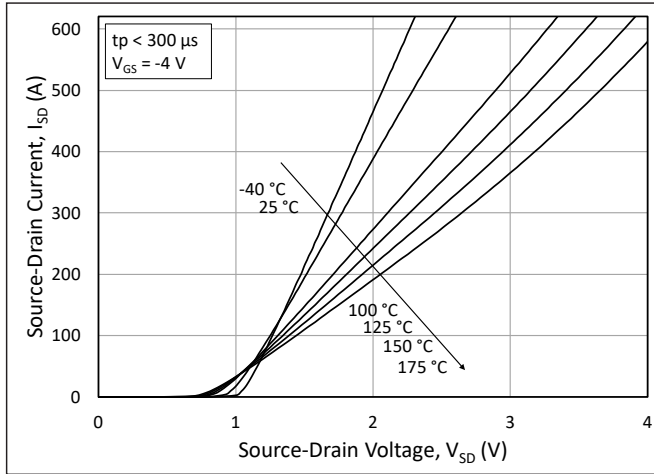


**Figure 5.** 3<sup>rd</sup> Quadrant Characteristic vs. Junction Temperatures at  $V_{GS} = 15$  V

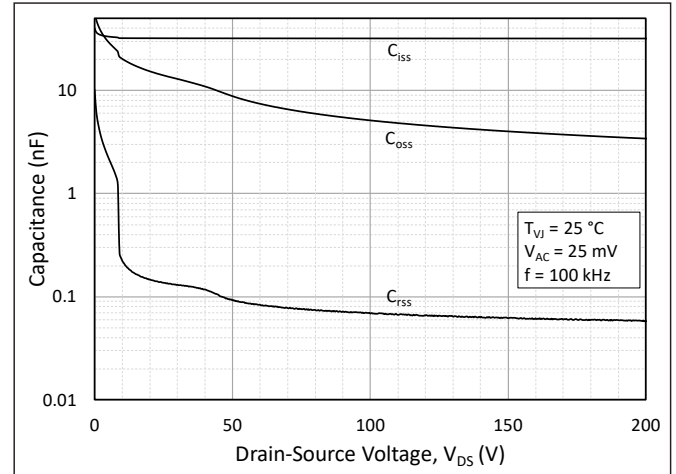


**Figure 6.** 3<sup>rd</sup> Quadrant Characteristic vs. Junction Temperatures at  $V_{GS} = 0$  V (Diode)

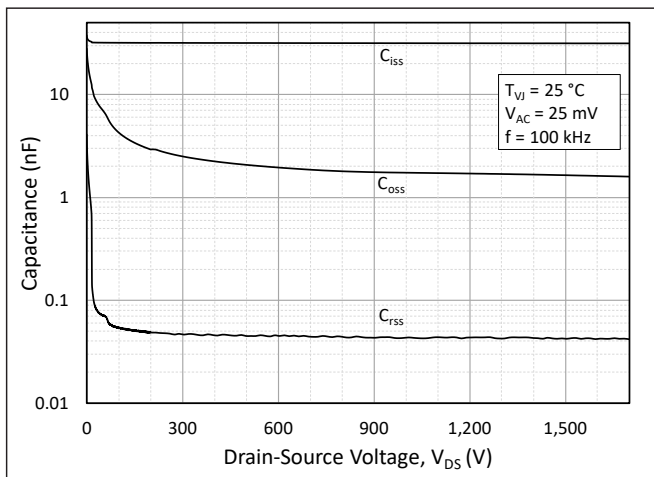
## Typical Performance



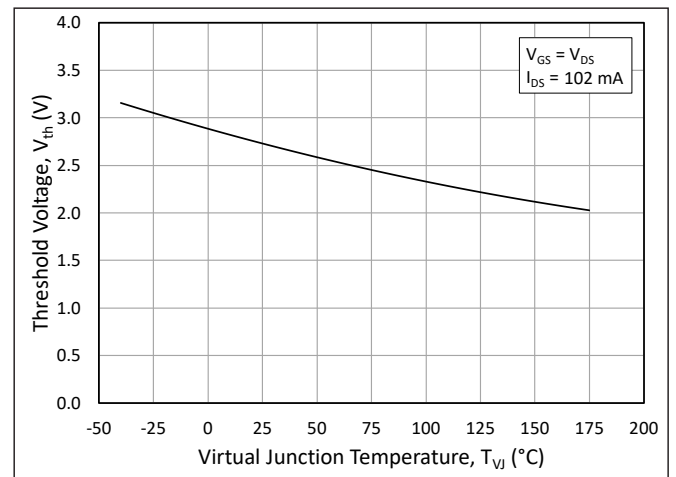
**Figure 7.** 3<sup>rd</sup> Quadrant Characteristic vs. Junction Temperatures at  $V_{GS} = -4$  V (Diode)



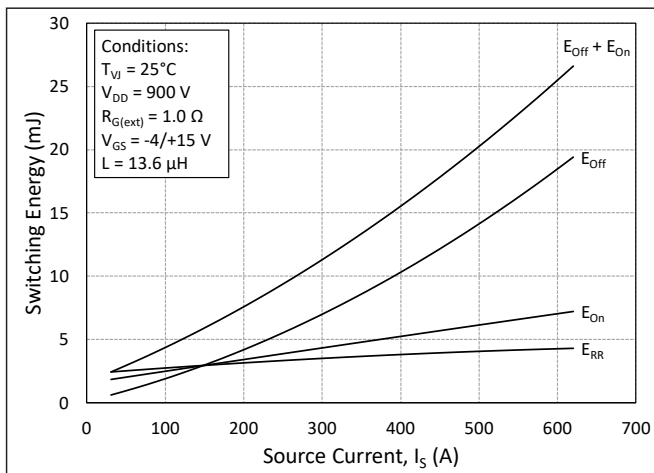
**Figure 8.** Typical Capacitances vs. Drain to Source Voltage (0 - 200 V)



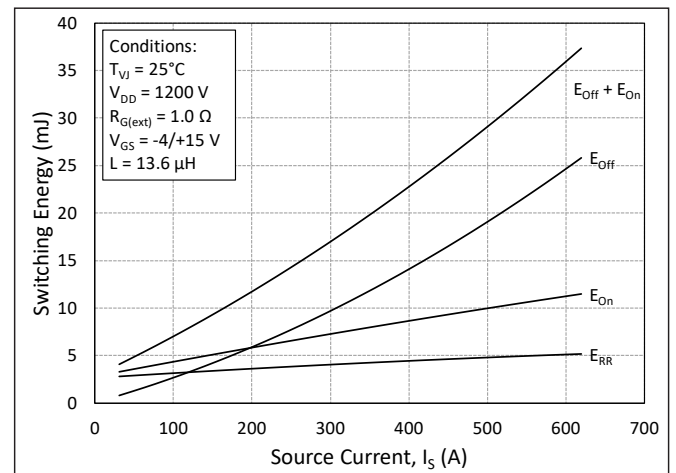
**Figure 9.** Typical Capacitances vs. Drain to Source Voltage (0 - 1700 V)



**Figure 10.** Threshold Voltage vs. Junction Temperature



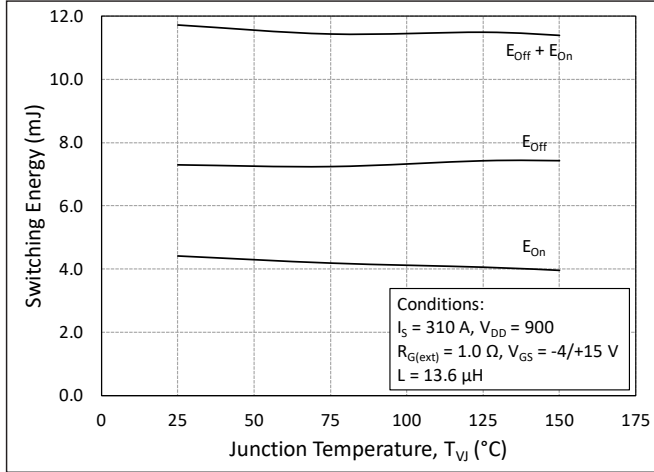
**Figure 11.** Switching Energy vs. Drain Current ( $V_{DD} = 900$  V)



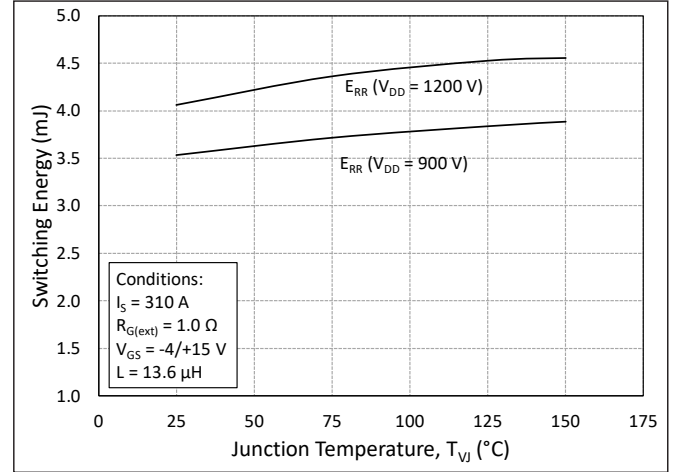
**Figure 12.** Switching Energy vs. Drain Current ( $V_{DD} = 1200$  V)



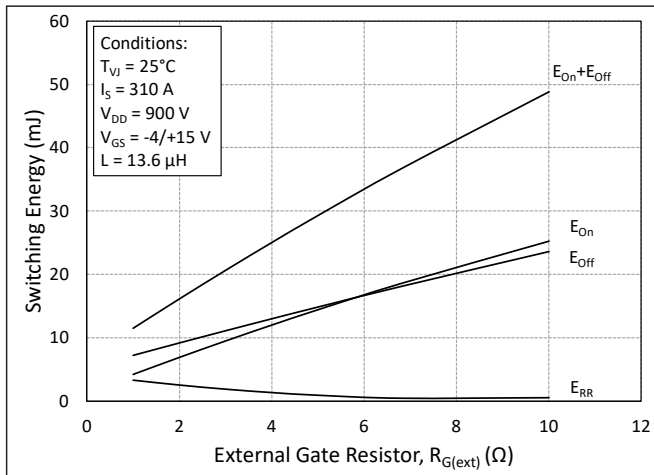
## Typical Performance



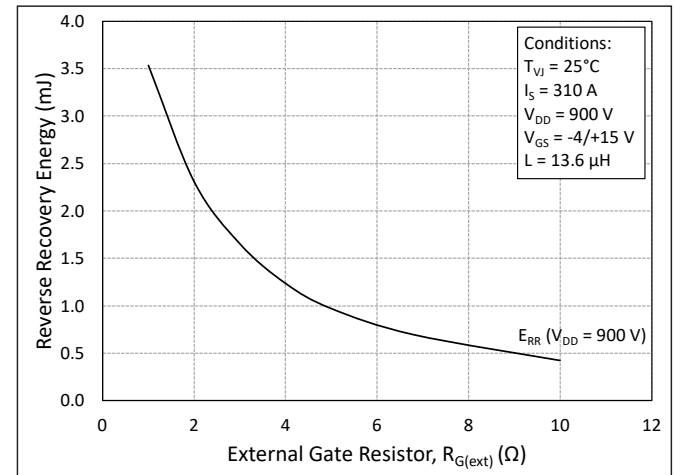
**Figure 13.** MOSFET Switching Energy vs. Junction Temperature



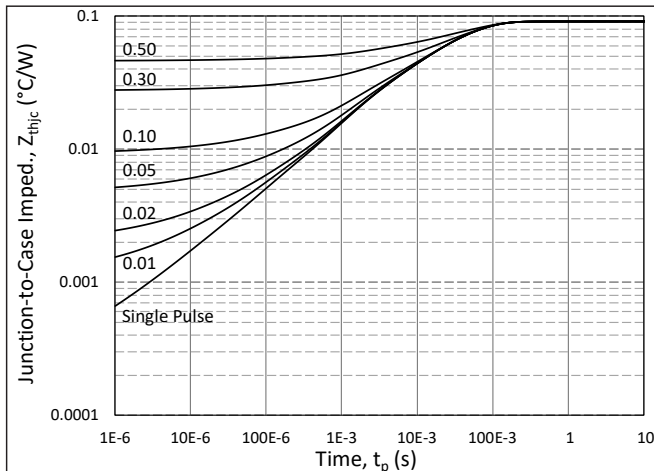
**Figure 14.** Reverse Recovery Energy vs. Junction Temperature



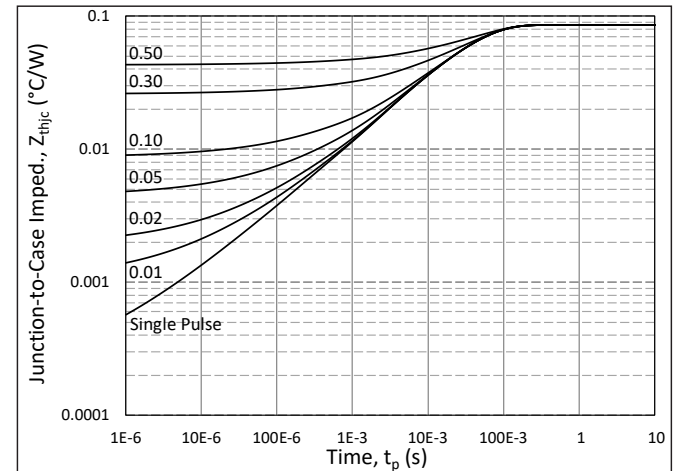
**Figure 15.** MOSFET Switching Energy vs. External Gate Resistance



**Figure 16.** Reverse Recovery Energy vs. External Gate Resistance

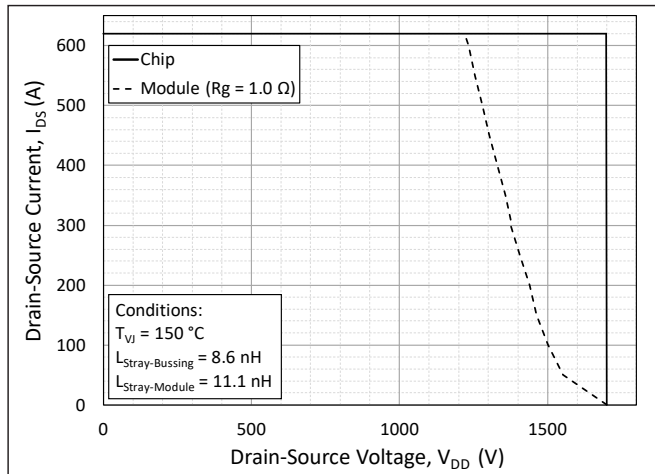


**Figure 17.** MOSFET Junction to Case Transient Thermal Impedance,  $Z_{thjc}$  (°C/W)

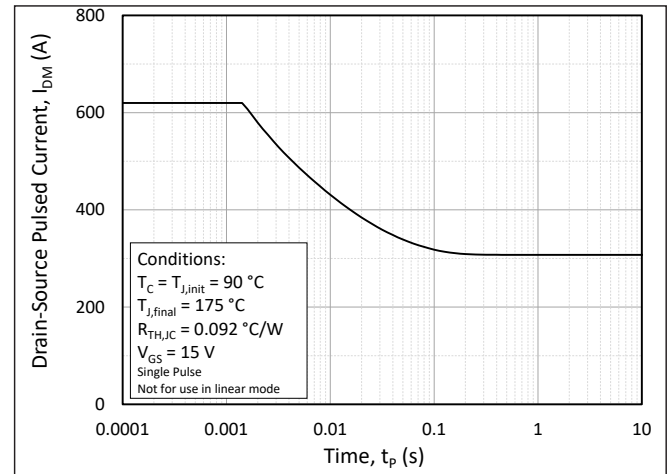


**Figure 18.** Diode Junction to Case Transient Thermal Impedance,  $Z_{thjc}$  (°C/W)

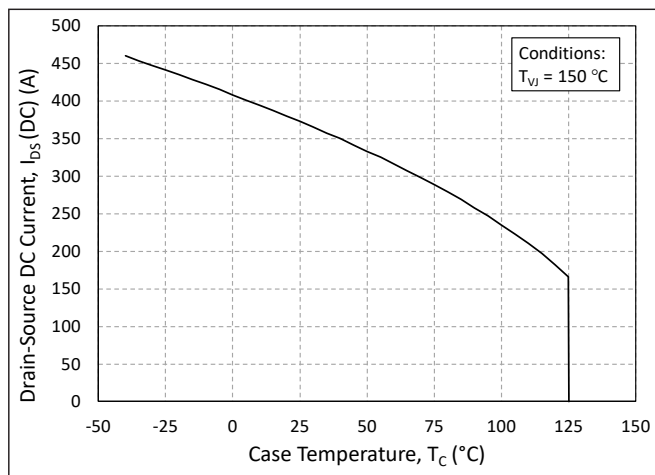
## Typical Performance



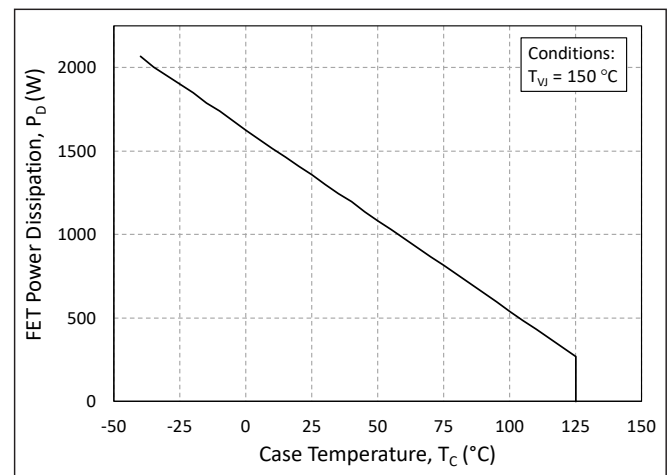
**Figure 19.** Switching Safe Operating Area



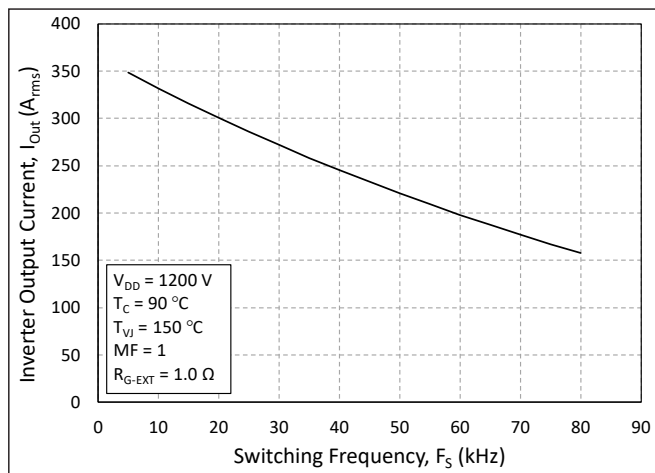
**Figure 20.** Pulsed Current Safe Operating Area



**Figure 21.** Continuous Drain Current Derating vs. Case Temperature

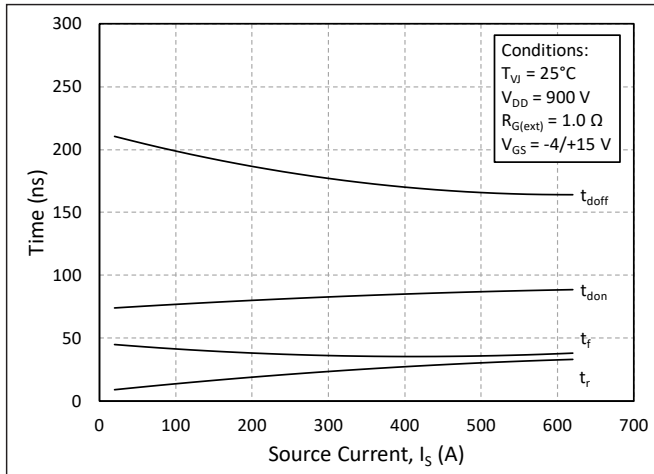


**Figure 22.** Maximum Power Dissipation Derating vs. Case Temperature

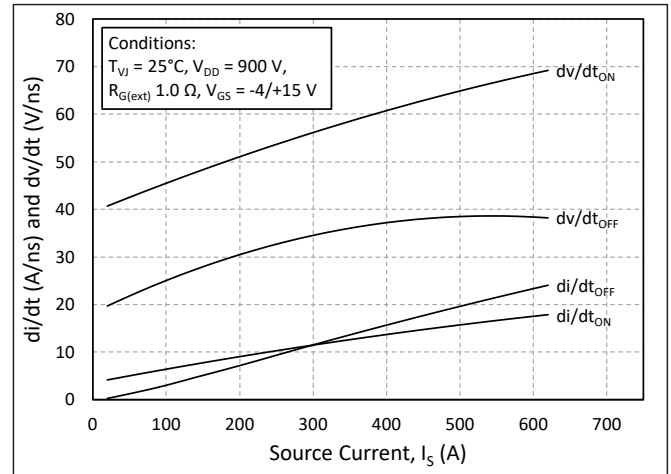


**Figure 23.** Typical Output Current Capability vs. Switching Frequency (Inverter Application)

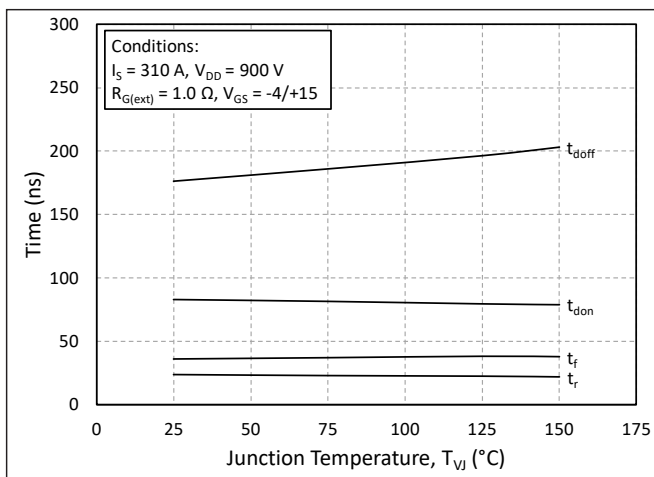
## Timing Characteristics



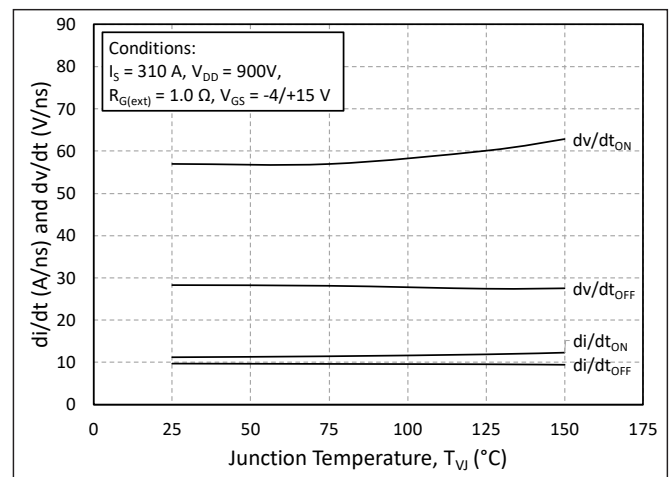
**Figure 24.** Timing vs. Source Current



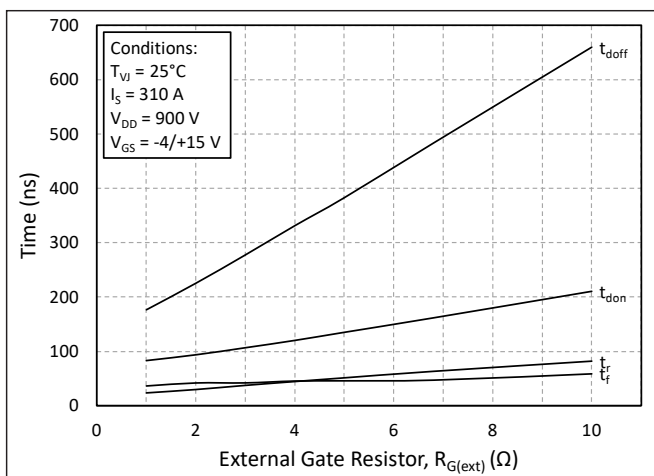
**Figure 25.** dv/dt and di/dt vs. Source Current



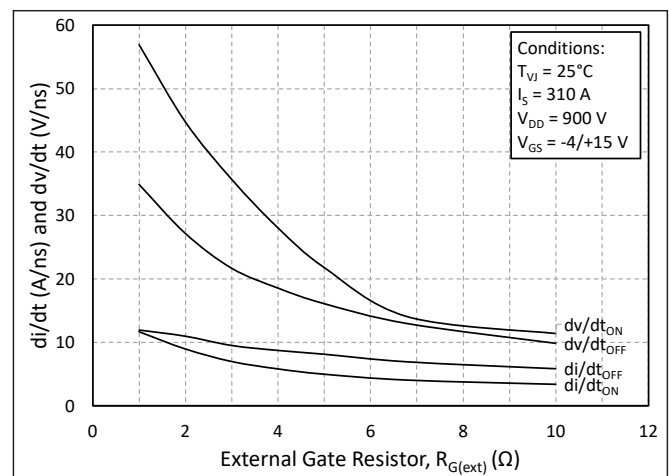
**Figure 26.** Timing vs. Junction Temperature



**Figure 27.** dv/dt and di/dt vs. Junction Temperature



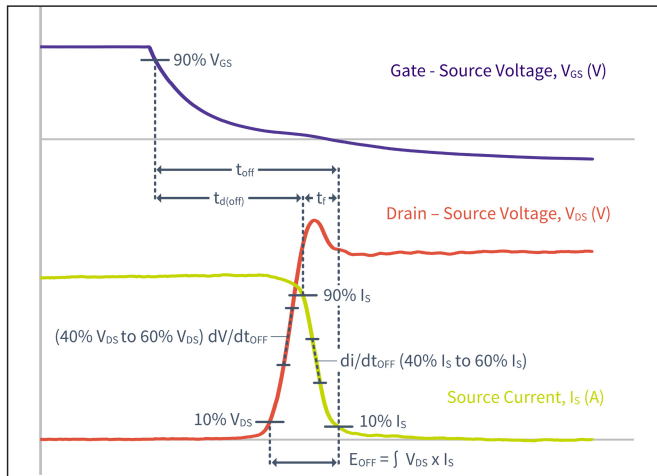
**Figure 28.** Timing vs. External Gate Resistance



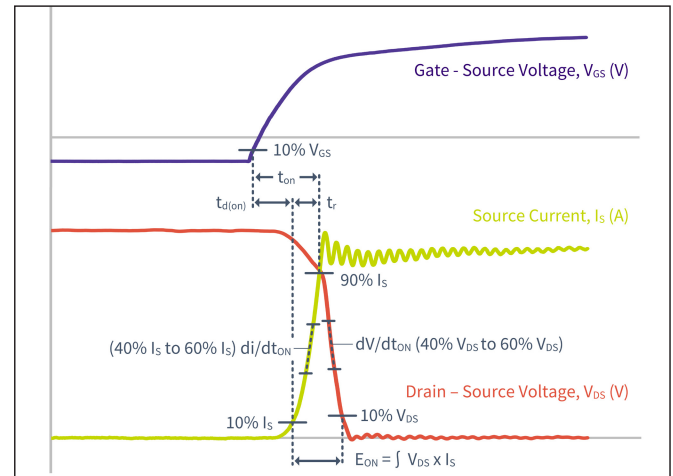
**Figure 29.** dv/dt and di/dt vs. External Gate Resistance



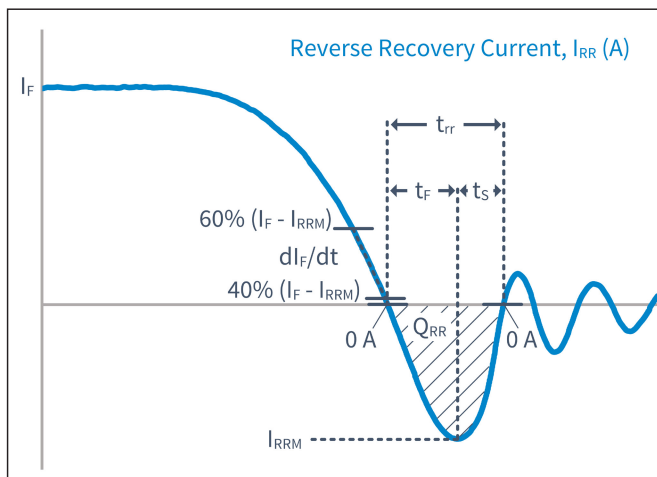
## Definitions



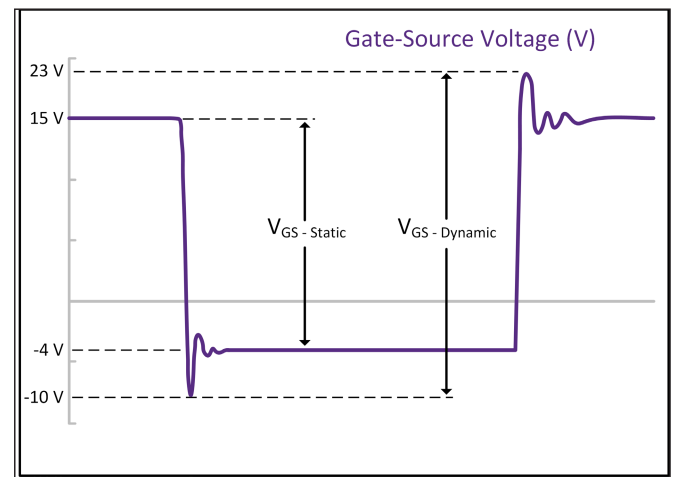
**Figure 30.** Turn-Off Transient Definitions



**Figure 31.** Turn-On Transient Definitions



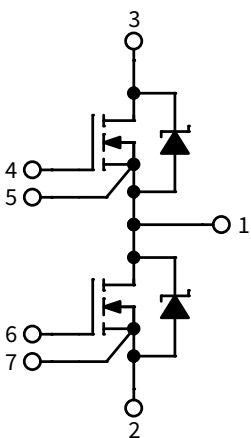
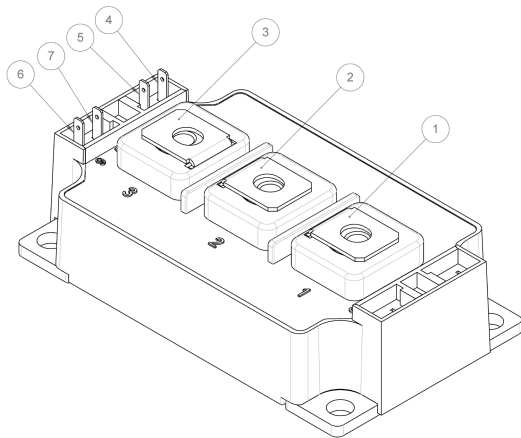
**Figure 32.** Reverse Recovery Definitions



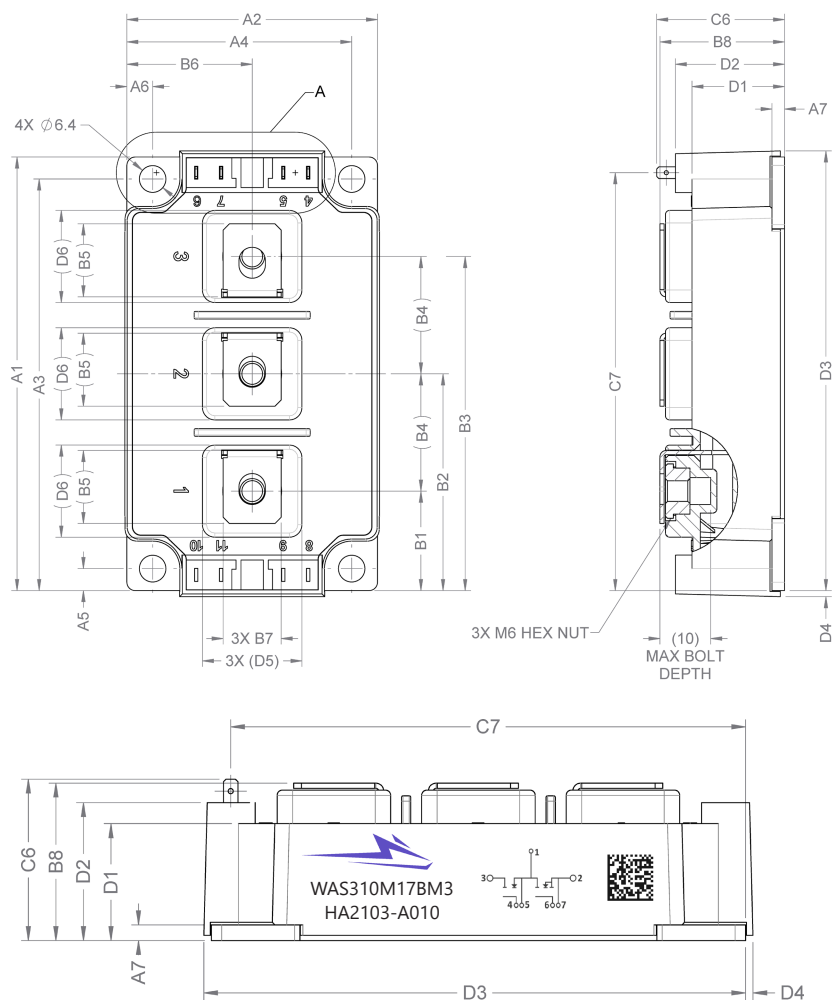
**Figure 33.**  $V_{GS}$  Transient Definitions



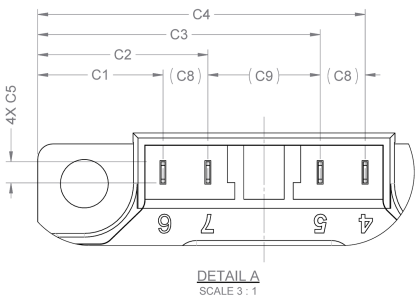
Schematic and Pin Out



Package Dimension (mm)



DIMENSION TABLE		
SYMBOL	DIMENSION	TOLERANCE
A1	103.5	±0.30
A2	60.44	±0.30
A3	98.25	±0.30
A4	54.22	±0.30
A5	5.25	±0.30
A6	6.22	±0.30
A7	3	±0.30
B1	23.75	±0.40
B2	51.75	±0.40
B3	79.75	±0.40
B4	(28)	REF.
B5	(17.43)	REF.
B6	30.23	±0.40
B7	(14)	REF.
B8	30.03	±0.40
C1	16.73	±0.40
C2	22.73	±0.40
C3	37.73	±0.40
C4	43.73	±0.40
C5	2.8	±0.40
C6	30.8	±0.50
C7	99.75	±0.40
C8	(6)	REF.
C9	(15)	REF.
D1	22.3	±0.30
D2	26.3	±0.30
D3	104.95	±0.30
D4	1.45	±0.40
D5	(24)	REF.
D6	(22)	REF.





## Product Ordering Code

Part Number	Description
WAS310M17BM3	Without Pre-Applied Phase Change Thermal Interface Material
WAS310M17BM3T	With Pre-Applied Phase Change Thermal Interface Material

## Supporting Links & Tools

### Simulation Tools & Support

- [All LTSpice Models](#)
- [All PLECS Models](#)
- [SpeedFit 2.0 Design Simulator™](#)
- [Technical Support Forum](#)

### Compatible Evaluation Hardware

- [CGD1200HB2P-BM3: Dual Channel Differential Isolated Half Bridge Gate Driver Board](#)
- [KIT-CRD-CIL12N-BM: Dynamic Performance Evaluation Board for the BM2 and BM3 Module](#)
- [CGD1700HB2P-BM3: Evaluation Gate Driver Tool Optimized for the 1700 V BM3 Power Modules](#)
- [KIT-CRD-CIL17N-BM: Dynamic Characterization Evaluation Tool Optimized for 1700 V BM Power Modules](#)
- [CGD12HB00D: Differential Transceiver Daughter Board Companion Tool for Differential Gate Drivers](#)

### Application Notes

- [PRD-07933: Wolfspeed Power Module Thermal Interface Material Application User Guide](#)
- [PRD-06379: Environmental Considerations for Power Electronics](#)
- [PRD-08710: Measuring Stray Inductance in Power Electronic Systems](#)
- [PRD-07845: Power Module Baseplate Capacitance and Electromagnetic Compatibility](#)
- [PRD-08376: Thermal Characterization Methods and Applications](#)
- [PRD-06933: Capacitance Ratio and Parasitic Turn-On](#)



## Notes & Disclaimers

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REACH substances of high concern (SVHCs) information is available for this product. Since the European Chemical Agency (ECHA) has published notice of their intent to frequently revise the SVHC listing for the foreseeable future, please contact your Wolfsppeed representative to ensure you get the most up-to-date REACH SVHC Declaration. REACH banned substance information (REACH Article 67) is also available upon request.

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