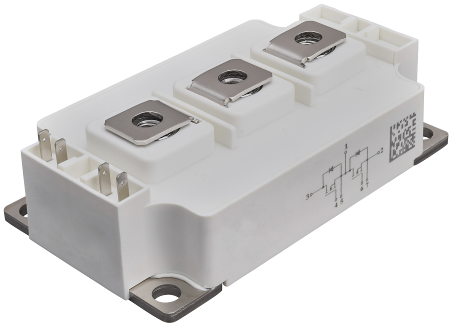
WAS310M17BM3

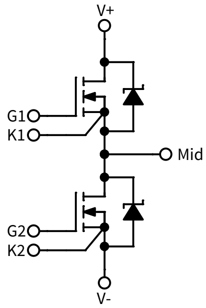
1700 V, 310 A, Silicon Carbide, Half-Bridge Module

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	$V_{GS(max)}$	-8		+19	V	Transient	Note 1 Fig. 33
Gate-Source Voltage, Recommended	$V_{GS(op)}$		-4/+15		V	Static	Note 1 Fig. 33
DC Continuous Drain Current	I_D		409		A	V_{GS} = 15 V, T_C = 25 °C, T_{VJ} ≤ 175 °C	Notes 2, 3 Fig. 21
			307		A	V_{GS} = 15 V, T_C = 90 °C, T_{VJ} ≤ 175 °C	
DC Source-Drain Current (Schottky Diode)	$I_{SD(SD)}$		482		A	V_{GS} = -4 V, T_C = 25 °C, T_{VJ} ≤ 175 °C	
Pulsed Drain-Source Current	I_{DM}		620		A	t_{Pmax} limited by T_{VJmax} V_{GS} = 15 V, T_C = 25 °C	
Power Dissipation	P_D		1630		W	T_C = 25 °C, T_{VJ} ≤ 175 °C	Note 4 Fig. 21
Virtual Junction Temperature	$T_{VJ(op)}$	-40		150	°C	Operation	
				175	°C	Intermittent with Reduced Life	

Note (1): Recommended turn-on gate voltage is 15 V with ±5 % regulation tolerance
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 °C Unless Otherwise Specified)

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

Diode Characteristics (Per Position) (T_{VJ} = 25 °C Unless Otherwise Specified)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions	Note
Diode Forward Voltage	V_F		1.78		V	V_{GS} = -4 V, I_F = 310 A, T_{VJ} = 25 °C	Fig. 7
			2.50		V	V_{GS} = -4 V, I_F = 310 A, T_{VJ} = 150 °C	
Reverse Recovery Time	t_{rr}		27		ns	V_{GS} = -4 V, I_{SD} = 310 A, V_R = 900 V di/dt = 26.5 A/ns, T_{VJ} = 150 °C	Fig. 32
Reverse Recovery Charge	Q_{rr}		4.5		µC		
Peak Reverse Recovery Current	I_{rrm}		281		A		
Reverse Recovery Energy, T_{VJ} = 25 °C T_{VJ} = 125 °C T_{VJ} = 150 °C	E_{rr}		3.5 3.8 3.9		mJ	V_{DS} = 900 V, I_D = 310 A, V_{GS} = -4 V/15 V, $R_{G(ext)}$ = 1.0 Ω, L = 13.6 µH	Fig. 14 Note 5
Diode Thermal Resistance, JCT. to Case	$R_{th\ JC}$		0.086		°C/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)	$R_{3\text{-}1}$		1.31		mΩ	T_C = 25 °C, I_{SD} = 310 A, Note 6
			1.84			T_C = 125 °C, I_{SD} = 310 A, Note 6
Package Resistance, M2 (Low-Side)	$R_{1\text{-}2}$		1.26			T_C = 25 °C, I_{SD} = 310 A, Note 6
			1.77			T_C = 125 °C, I_{SD} = 310 A, Note 6
Stray Inductance	L_{Stray}		11.1		nH	Between DC- and DC+, f = 10 MHz
Case Temperature	T_C	-40		125	°C	
Mounting Torque	M_S	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_{isol}	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 $R_{DS(on)}$ + Switch Position Package Resistance

Typical Performance

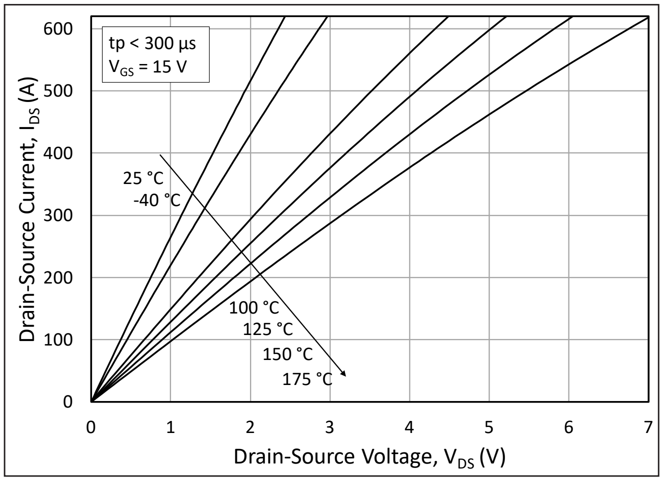


Figure 1. Output Characteristics for Various Junction Temperatures

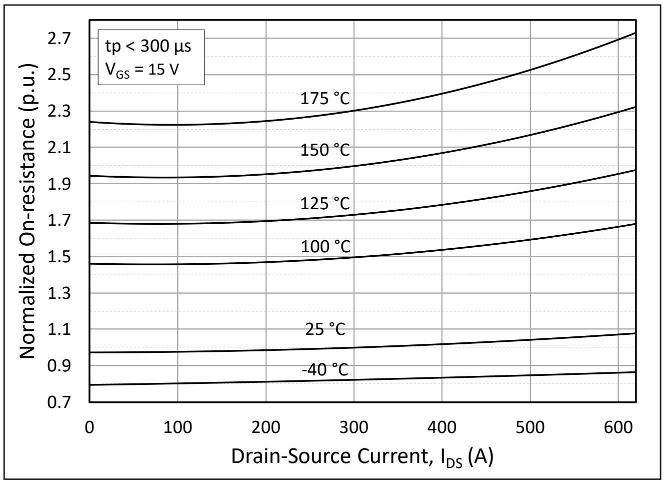


Figure 2. Normalized On-State Resistance vs. Drain Current for Various Junction Temperatures

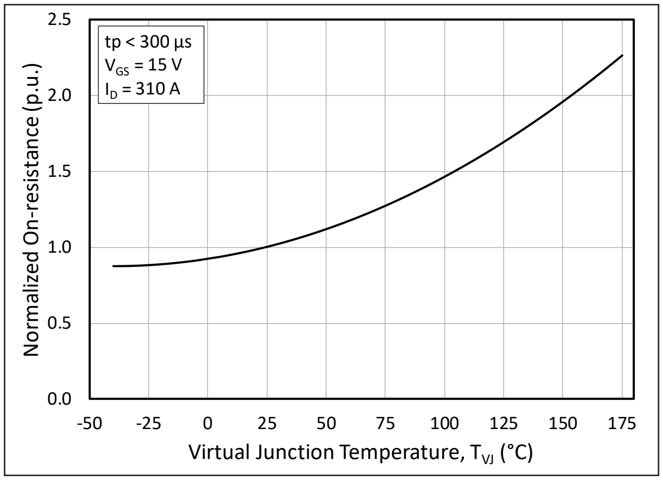


Figure 3. Normalized On-State Resistance vs. Junction Temperature

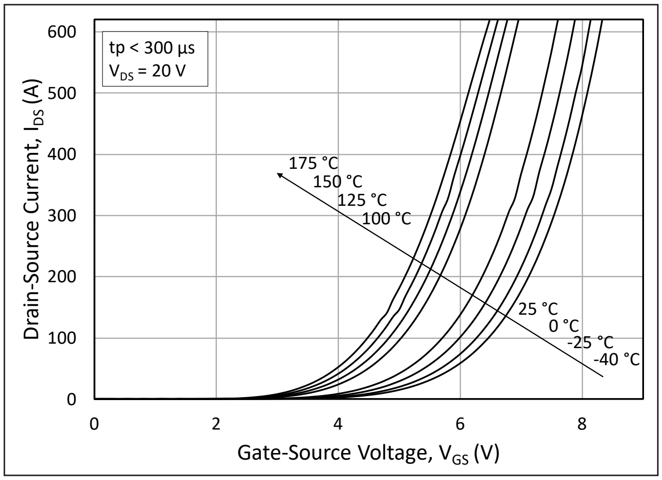


Figure 4. Transfer Characteristic for Various Junction Temperatures

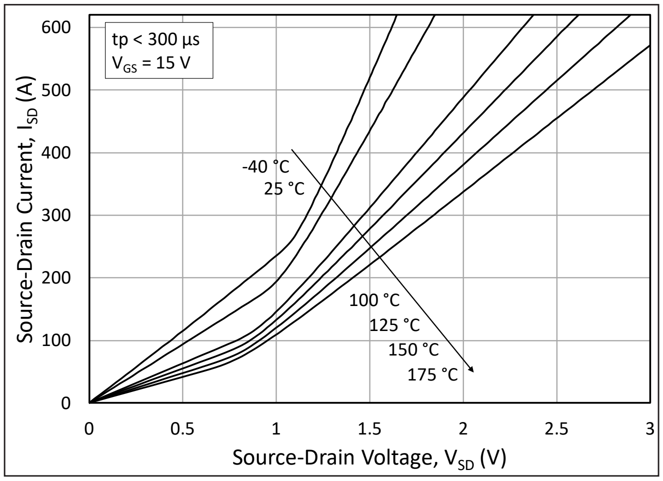


Figure 5. 3rd Quadrant Characteristic vs. Junction Temperatures at V_{GS} = 15 V

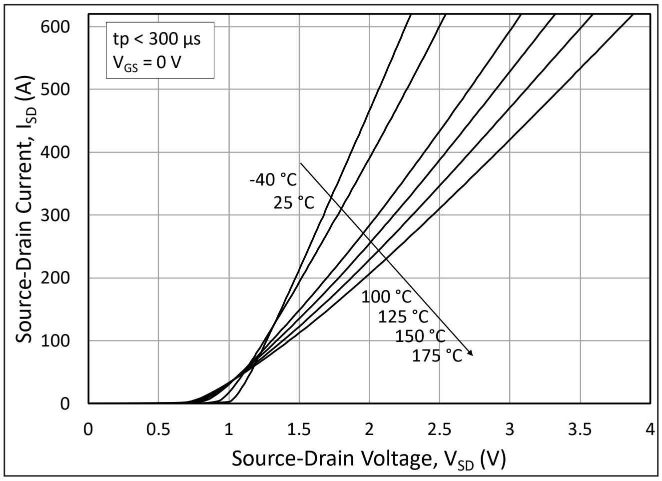


Figure 6. 3rd Quadrant Characteristic vs. Junction Temperatures at V_{GS} = 0 V (Diode)

Typical Performance

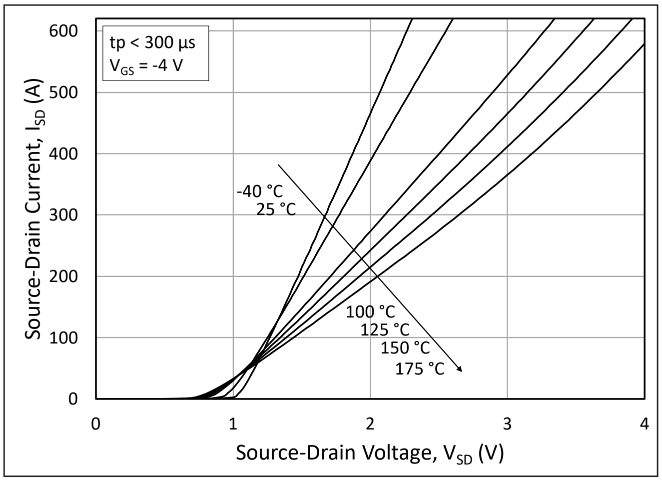


Figure 7. 3rd Quadrant Characteristic vs. Junction Temperatures at V_{GS} = -4 V (Diode)

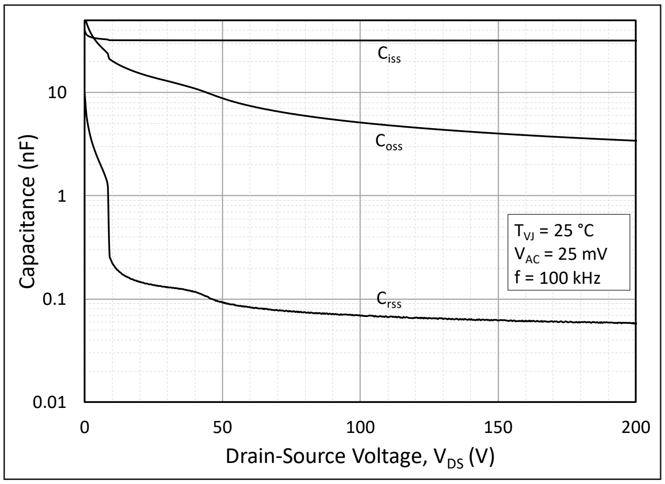


Figure 8. Typical Capacitances vs. Drain to Source Voltage (0 - 200 V)

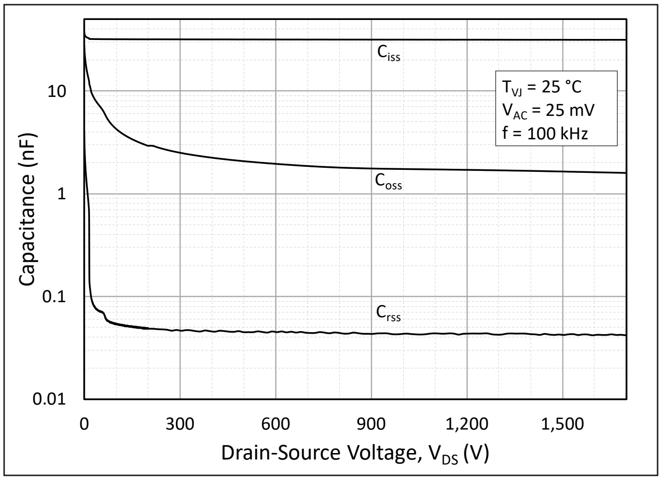


Figure 9. Typical Capacitances vs. Drain to Source Voltage (0 - 1700 V)

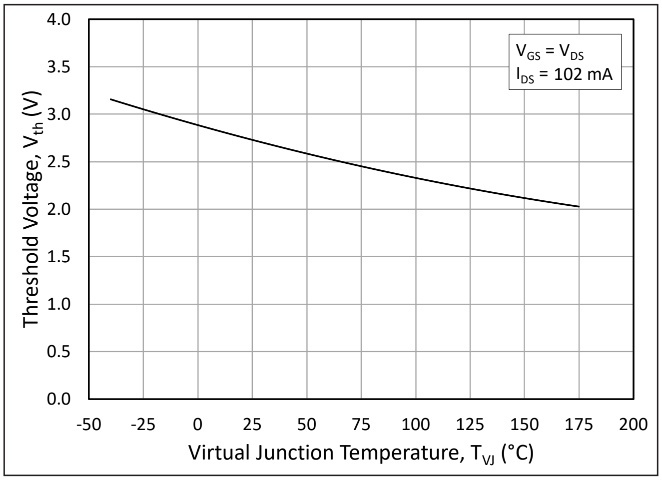


Figure 10. Threshold Voltage vs. Junction Temperature

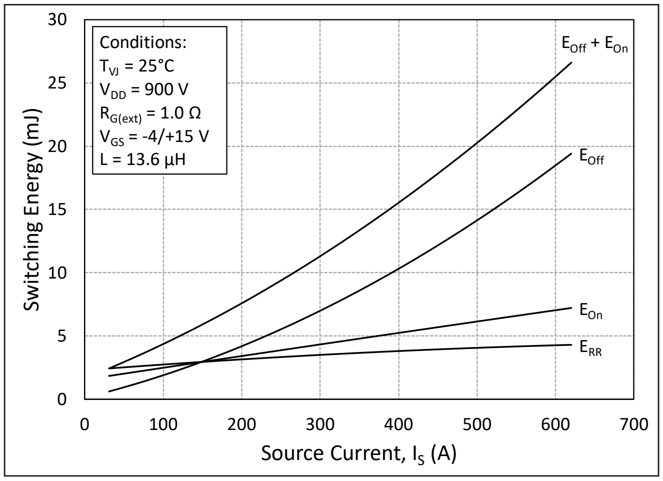


Figure 11. Switching Energy vs. Drain Current (V_{DD} = 900 V)

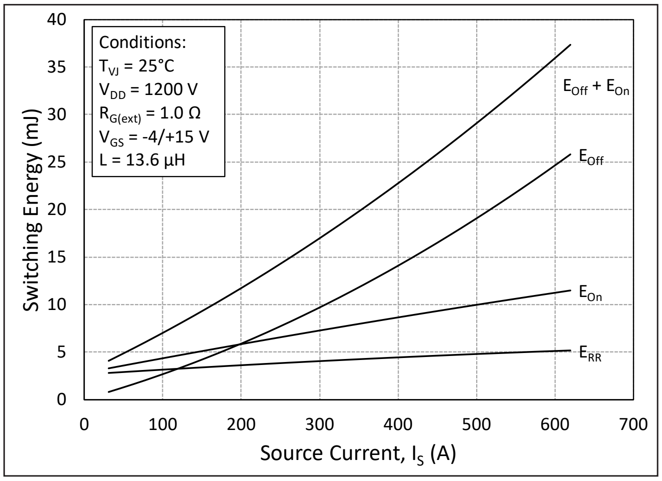


Figure 12. Switching Energy vs. Drain Current (V_{DD} = 1200 V)

Typical Performance

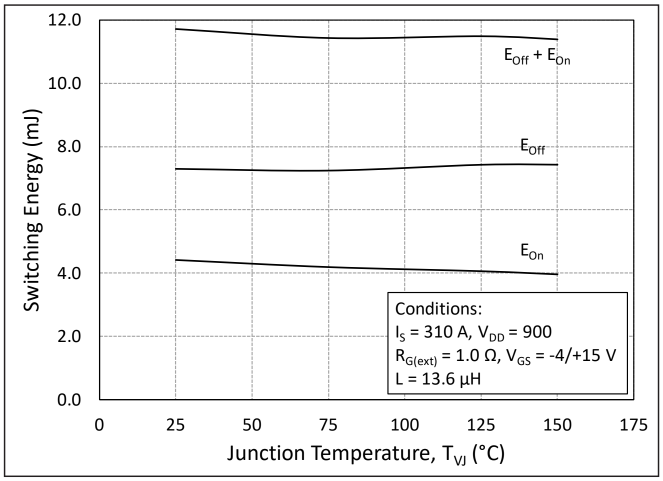


Figure 13. MOSFET Switching Energy vs. Junction Temperature

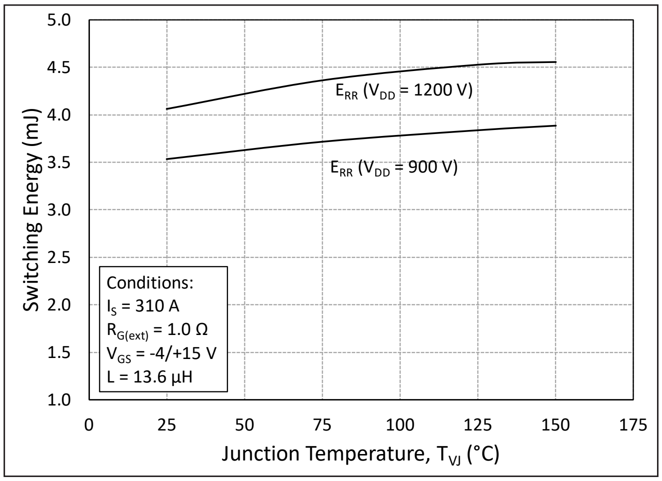


Figure 14. Reverse Recovery Energy vs. Junction Temperature

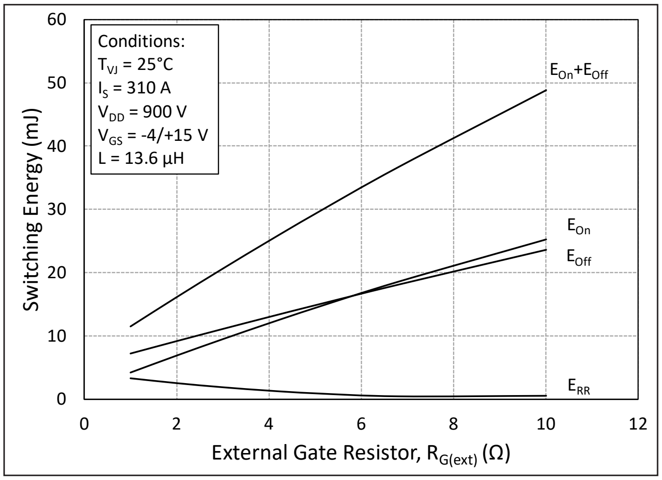


Figure 15. MOSFET Switching Energy vs. External Gate Resistance

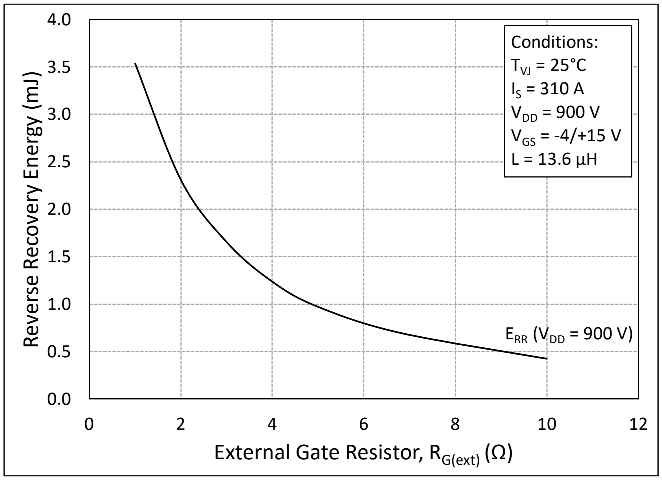


Figure 16. Reverse Recovery Energy vs. External Gate Resistance

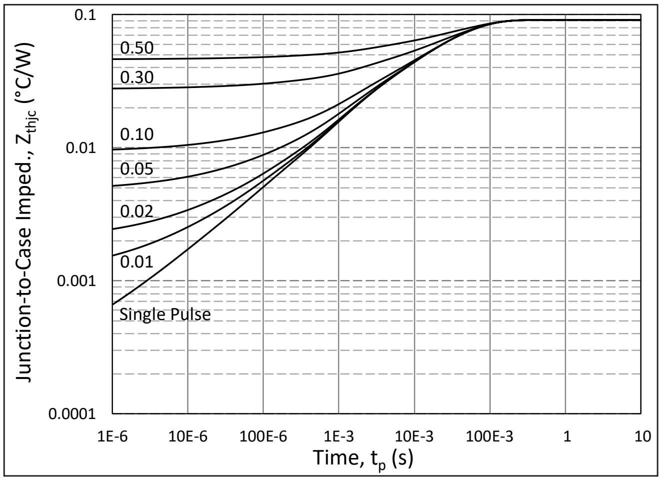


Figure 17. MOSFET Junction to Case Transient Thermal Impedance, $Z_{th,jc}$ (°C/W)

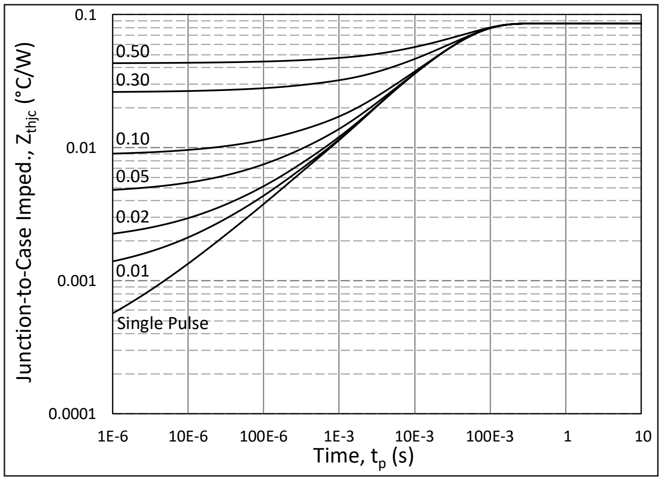


Figure 18. Diode Junction to Case Transient Thermal Impedance, $Z_{th,jc}$ (°C/W)

Typical Performance

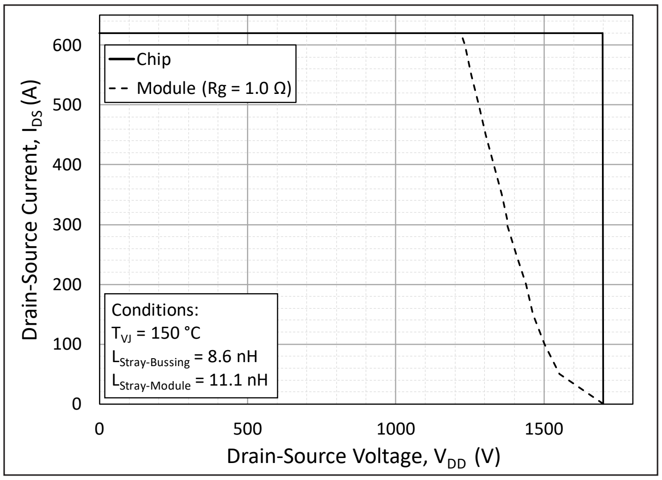


Figure 19. Switching Safe Operating Area

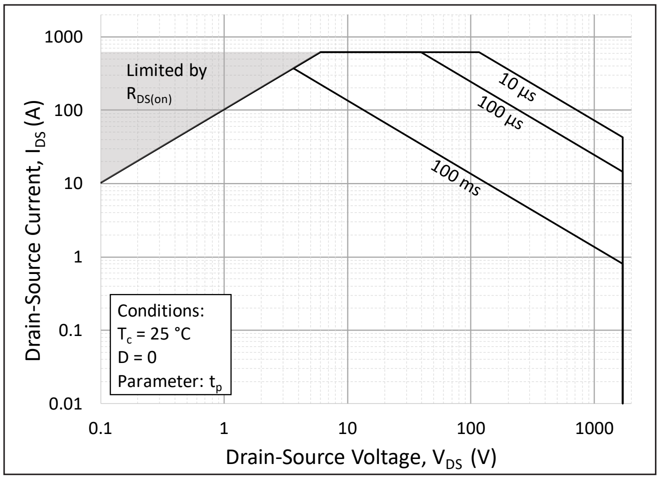


Figure 20. Forward Bias Safe Operating Area (FBSOA)

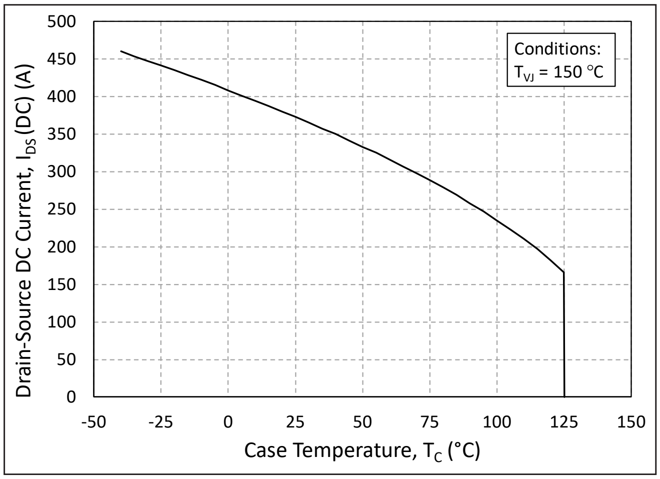


Figure 21. Continuous Drain Current Derating vs. Case Temperature

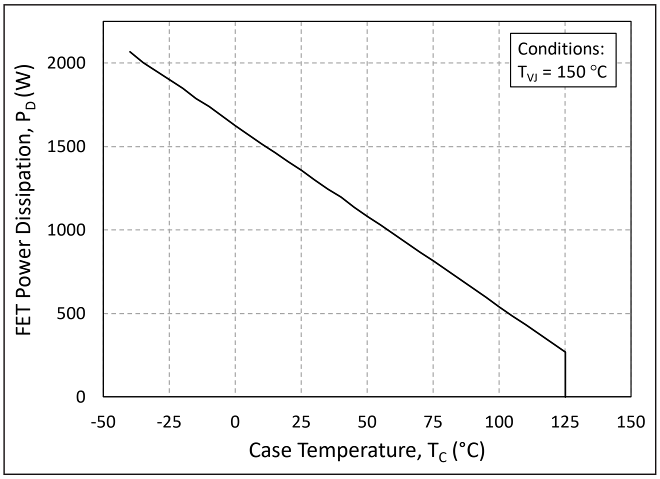


Figure 22. Maximum Power Dissipation Derating vs. Case Temperature

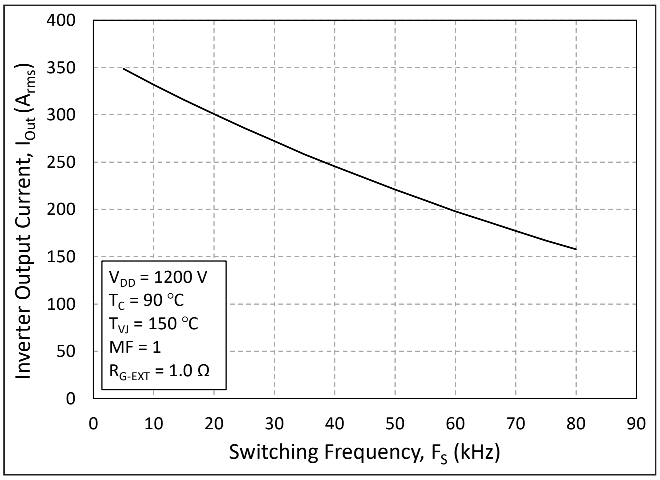


Figure 23. Typical Output Current Capability vs. Switching Frequency (Inverter Application)

Timing Characteristics

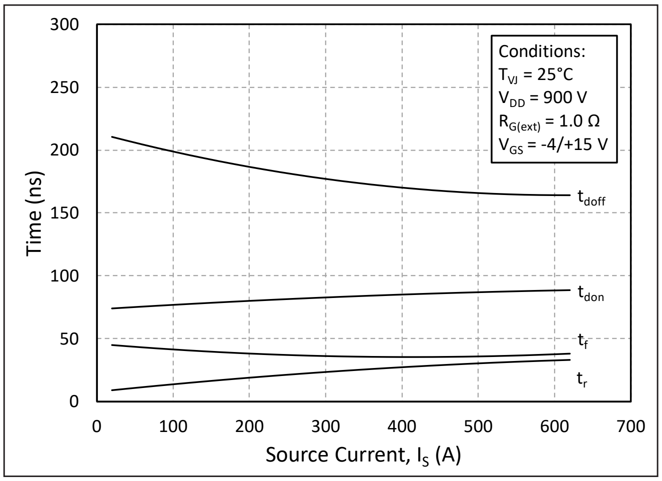


Figure 24. Timing vs. Source Current

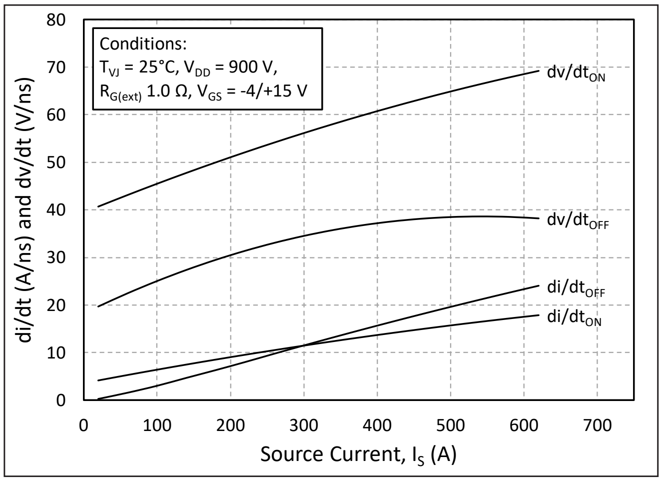


Figure 25. dv/dt and di/dt vs. Source Current

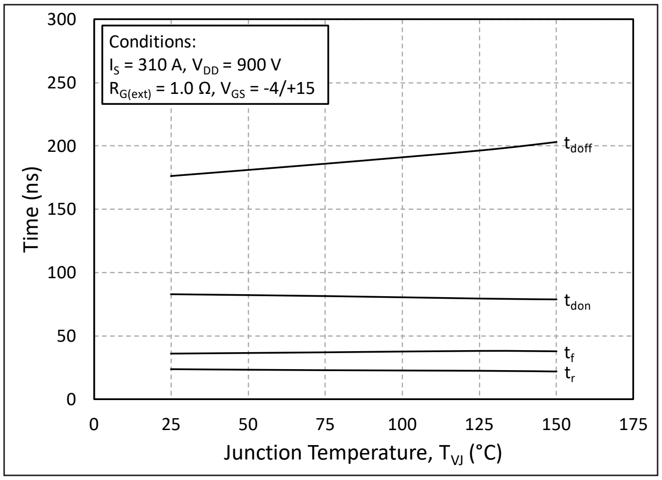


Figure 26. Timing vs. Junction Temperature

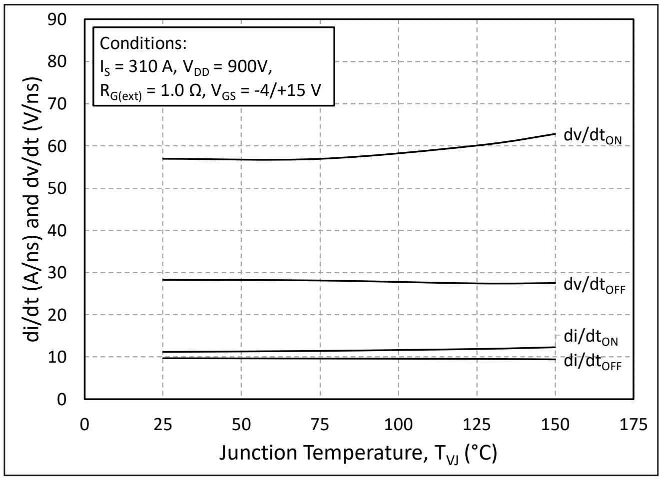


Figure 27. dv/dt and di/dt vs. Junction Temperature

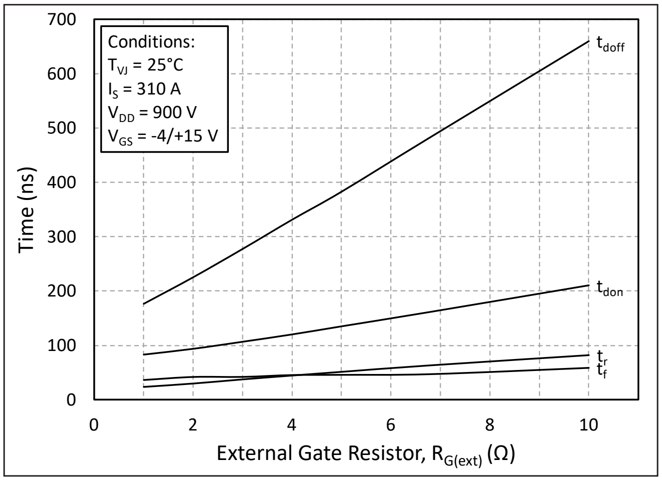


Figure 28. Timing vs. External Gate Resistance

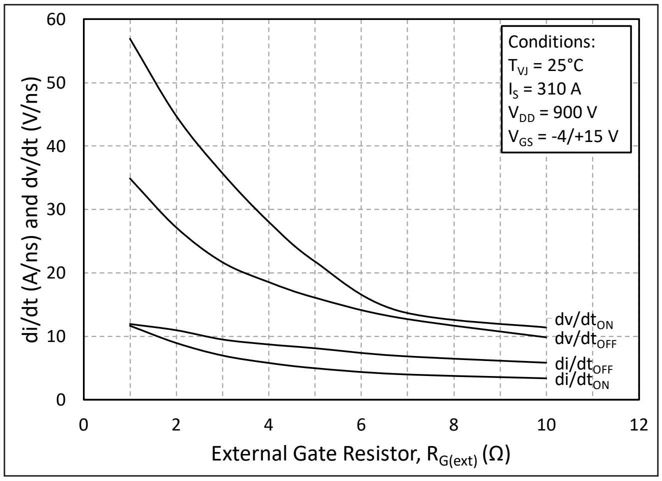


Figure 29. dv/dt and di/dt vs. External Gate Resistance

Definitions

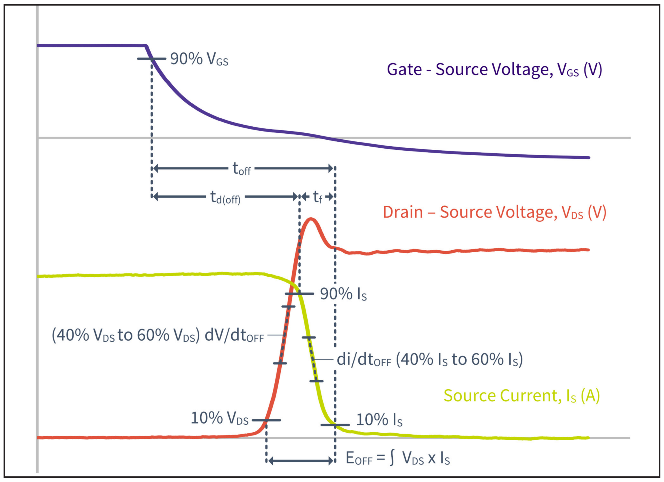


Figure 30. Turn-Off Transient Definitions

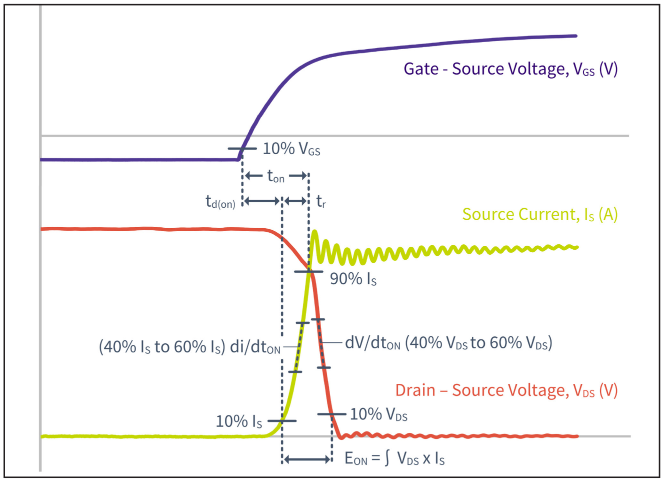


Figure 31. Turn-On Transient Definitions

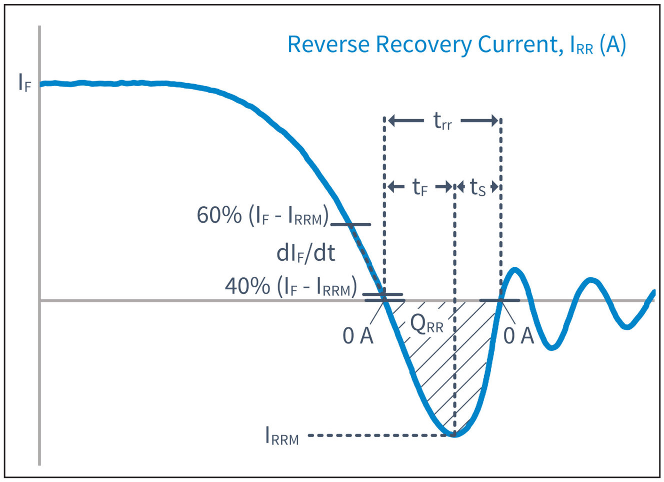


Figure 32. Reverse Recovery Definitions

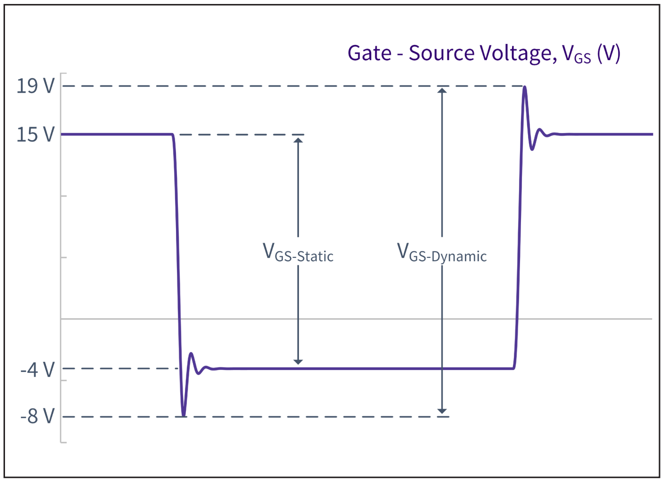
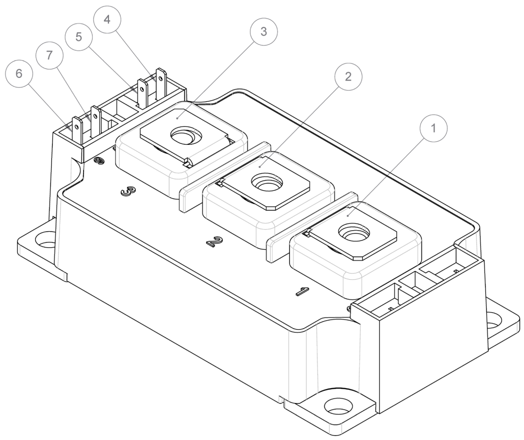
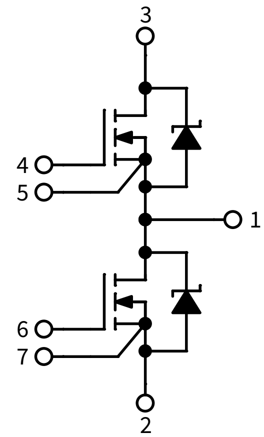


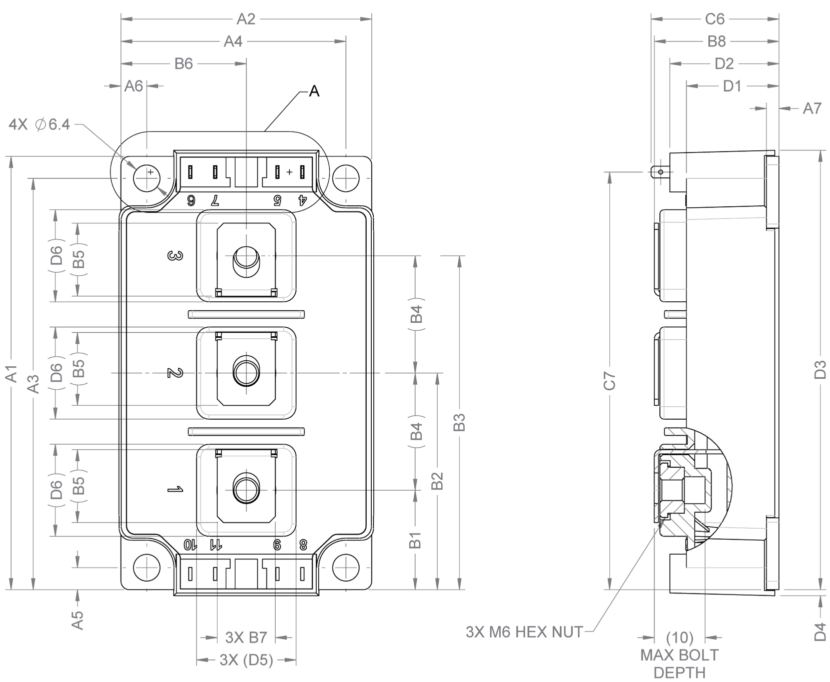
Figure 33. V_{GS} Transient Definitions

Schematic and Pin Out

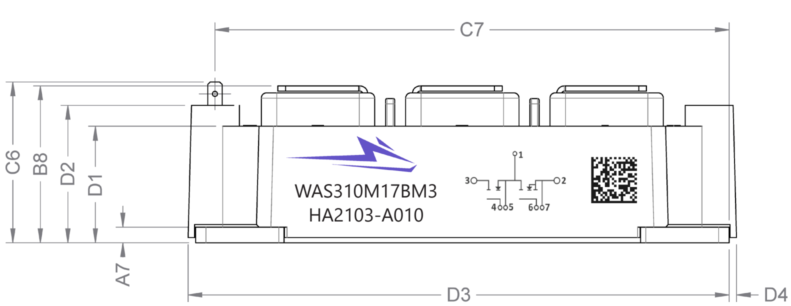


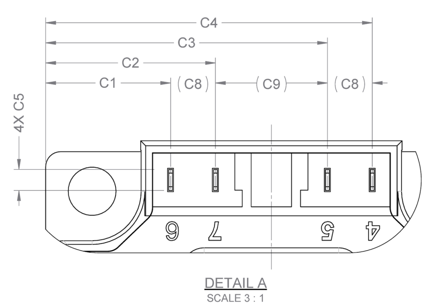


Package Dimension (mm)



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.





Supporting Links & Tools

Simulation Tools & Support

- PLECS Models
- LTSpice Models
- SpeedFit 2.0 Design Simulator™
- Technical Support Forum

Compatable Evaluation Hardware

- 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

WOLFSPEED PROVIDES TECHNICAL AND RELIABILITY DATA, DESIGN RESOURCES, APPLICATION OR OTHER DESIGN ADVICE, WEB TOOLS, AND OTHER RESOURCES "AS IS" AND WITH ALL FAULTS, AND DISCLAIMS ALL WARRANTIES, EXPRESS AND IMPLIED, WITH RESPECT THERETO, INCLUDING WITHOUT LIMITATION ANY IMPLIED WARRANTIES OF MERCHANTABILITY, SUITABILITY, FITNESS FOR A PARTICULAR PURPOSE, OR NON-INFRINGEMENT OF THIRD-PARTY INTELLECTUAL PROPERTY RIGHTS.

This document and the information contained herein are subject to change without notice. Any such change shall be evidenced by the publication of an updated version of this document by Wolfspeed. No communication from any employee or agent of Wolfspeed or any third party shall effect an amendment or modification of this document. No responsibility is assumed by Wolfspeed for any infringement of patents or other rights of third parties which may result from use of the information contained herein. No license is granted by implication or otherwise under any patent or patent rights of Wolfspeed.

The information contained in this document (excluding examples, as well as figures or values that are labeled as "typical") constitutes Wolfspeed's sole published specifications for the subject product. "Typical" parameters are the average values expected by Wolfspeed in large quantities and are provided for informational purposes only. Any examples provided herein have not been produced under conditions intended to replicate any specific end use. Product performance can and does vary due to a number of factors.

This product has not been designed or tested for use in, and is not intended for use in, any application in which failure of the product would reasonably be expected to cause death, personal injury, or property damage. For purposes of (but without limiting) the foregoing, this product is not designed, intended, or authorized for use as a critical component in equipment implanted into the human body, life-support machines, cardiac defibrillators, and similar emergency medical equipment; air traffic control systems; or equipment used in the planning, construction, maintenance, or operation of nuclear facilities. Notwithstanding any application-specific information, guidance, assistance, or support that Wolfspeed may provide, the buyer of this product is solely responsible for determining the suitability of this product for the buyer's purposes, including without limitation (1) selecting the appropriate Wolfspeed products for the buyer's application, (2) designing, validating, and testing the buyer's application, and (3) ensuring the buyer's application meets applicable standards and any other legal, regulatory, and safety-related requirements.

RoHS Compliance

The levels of RoHS restricted materials in this product are below the maximum concentration values (also referred to as the threshold limits) permitted for such substances, or are used in an exempted application, in accordance with EU Directive 2011/65/EC (RoHS2), as implemented January 2, 2013. RoHS Declarations for this product can be obtained from your Wolfspeed representative or from the Product Documentation sections of www.wolfspeed.com.

REACh Compliance

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 Wolfspeed 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.

Contact info:
4600 Silicon Drive
Durham, NC 27703 USA
Tel: +1.919.313.5300
www.wolfspeed.com/power

© 2024 Wolfspeed, Inc. All rights reserved. Wolfspeed® and the Wolfstreak logo are registered trademarks and the Wolfspeed logo is a trademark of Wolfspeed, Inc.
The information in this document is subject to change without notice.