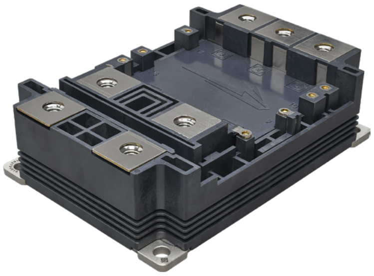
HAB900C33LM4

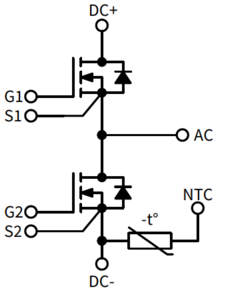
3300 V, 900 A, Silicon Carbide, Half-Bridge Module

V_{DS}	3300 V
$R_{DS(on)}$	2 mΩ

Technical Features

- Fully SiC MOSFET-based for Ultra-Low Loss
- Industry-Compatible Package Footprint
- High Junction Temperature (175 °C) Operation
- Low Stray Inductance (<10 nH)
- Soft Reverse Recovery from Gen 4 Body Diode
- Sintered Die Attach and Copper Die Top System
- Low-Thermal Resistance Copper Baseplate





Typical Applications

- Solar & Wind-Power Infrastructure
- Grid-Scale Energy Storage
- Rail Traction
- Heavy-Duty E-Mobility: Transportation and Mining
- Marine and Aerospace Propulsion

System Benefits

- Increased System Efficiency due to Low Switching & Conduction Losses of SiC
- Improved Power Cycling Capabilities for Increased System Lifetime
- Enhanced Durability and Reduced System Cost
- Enables Two-level Conversion for 2000 V or Greater DC Systems

Maximum Parameters (Verified by Design)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions	Note
Drain-Source Voltage	V_{DS}			3300	V		
Gate-Source Voltage, Maximum Value	$V_{GS(max)}$	-10		23		Transient	Note 1 Fig. 16
Gate-Source Voltage, Recommended	$V_{GS(op)}$		-5/+18			Static	
DC Continuous Drain Current	I_D			1200	A	$V_{GS} = 18$ V, $T_C = 25$ °C, $T_{VJ} \leq 175$ °C	Notes 2, 3, 4 Fig. 11
			908			$V_{GS} = 18$ V, $T_C = 90$ °C, $T_{VJ} \leq 175$ °C	
DC Source-Drain Current (Body Diode)	$I_{SD(BD)}$		876			$V_{GS} = -5$ V, $T_C = 90$ °C, $T_{VJ} \leq 175$ °C	
Pulsed Drain-Source Current	I_{DM}			3600		t_{Pmax} limited by T_{VJmax} $V_{GS} = 18$ V, $T_C = 25$ °C	
Power Dissipation	P_D		7282		W	$T_C = 25$ °C, $T_{VJ} \leq 175$ °C	Note 5 Fig. 12
Virtual Junction Temperature	$T_{VJ(op)}$	-55		175	°C		

Note (1): Recommended turn-on gate voltage is 18 V with ±5 % regulation tolerance
Note (2): Current limit at $T_C = 25$ °C imposed by package
Note (3): Typical current limit calculated by $I_{D(max)} = \sqrt{(P_D/R_{DS(typ)}(T_{VJ(max)},I_{D(max)}))}$
Note (4): Verified by design
Note (5): $P_D = (T_{VJ} - T_C)/R_{TH(JC,typ)}$

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

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions	Note
Drain-Source Breakdown Voltage	$V_{(BR)DSS}$	3300			V	V_{GS} = 0 V, T_{VJ} = -55 °C	
Gate Threshold Voltage	$V_{GS(th)}$	2.6	3.5	4.4		V_{DS} = V_{GS}, I_D = 530 mA	
			2.6			V_{DS} = V_{GS}, I_D = 530 mA, T_{VJ} = 175 °C	
Zero Gate Voltage Drain Current	I_{DSS}		20	400	µA	V_{GS} = 0 V, V_{DS} = 3300 V	
Gate-Source Leakage Current	I_{GSS}		200	5000	nA	V_{GS} = 18 V, V_{DS} = 0 V	
Drain-Source On-State Resistance (Devices Only)	$R_{DS(on)}$		2.0	2.6	mΩ	V_{GS} = 18 V, I_D = 900 A	Fig. 2 Fig. 3
			5.0			V_{GS} = 18 V, I_D = 900 A, T_{VJ} = 175 °C	
Transconductance	g_{fs}		617		S	V_{DS} = 20 V, I_{DS} = 900 A	Fig. 4
			619			V_{DS} = 20 V, I_{DS} = 900 A, T_{VJ} = 175 °C	
Internal Gate Resistance	$R_{G(int)}$		0.5		Ω	f = 100 kHz	
Input Capacitance	C_{iss}		159.9		nF	V_{GS} = 0 V, V_{DS} = 1800 V, V_{AC} = 25 mV, f = 100 kHz	Fig. 9
Output Capacitance	C_{oss}		2.4				
Reverse Transfer Capacitance	C_{rss}		6.7		pF		
FET Thermal Resistance, Junction to Heatsink	$R_{th\ JHS}$		0.021		°C/W		

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

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions	Note
Body Diode Forward Voltage	V_{SD}		5.7		V	V_{GS} = -5 V, I_{SD} = 900 A	Fig. 7
			4.7			V_{GS} = -5 V, I_{SD} = 900 A, T_{VJ} = 175 °C	

Module Physical Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Package Resistance	R_{pkg}		0.19		mΩ	T_C = 25 °C, Note 6
Stray Inductance	L_{Stray}		9.5		nH	Between DC+ and DC-, f = 10 MHz
Storage Temperature	T_{Stg}	-55		150	°C	
Weight	W		745		g	
Mounting Torque	M_S	3.5	4.5	5.5	N-m	Baseplate, M6 bolts
		8	12	16		Power Terminals, M8 bolts
		0.5	0.7	1.3		Auxiliary Terminals, M3 bolts
Case Isolation Voltage	V_{isol}	6			kV	AC, 50 Hz, 1 min
Comparative Tracking Index	CTI	600				
Clearance Distance			11		mm	Terminal to Terminal
			33			Terminal to Baseplate
Creepage Distance			23			Terminal to Terminal
			45			Terminal to Baseplate

Note (6): Total Effective Resistance (Per Switch Position) = MOSFET $R_{DS(on)}$ + Switch Position Package Resistance

Temperature Sensor (NTC) Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test Conditions
Resistance at 25 °C	R_{25}		4700		Ω	T_{NTC} = 25 °C
Tolerance of R_{25}			±1		%	
Beta Value for 25 °C to 85 °C	$B_{25/80}$		3435		K	
Beta Value for 0 °C to 100 °C	$B_{0/100}$		3399		K	
Tolerance of $B_{25/85}$			±1		%	
Maximum Power Dissipation	P_{25}		50		mW	T_{NTC} = 25°C

Steinhart & Hart Coefficients for NTC Resistance & NTC Temperature Computation (T in K)

$$\ln\left(\frac{R}{R_{25}}\right) = A + \frac{B}{T} + \frac{C}{T^2} + \frac{D}{T^3}$$

A	B	C	D
-1.289E+01	4.245E+03	-8.749E+04	-9.588E+06

$$\frac{1}{T} = A_1 + B_1 \ln\left(\frac{R}{R_{25}}\right) + C_1 \ln^2\left(\frac{R}{R_{25}}\right) + D_1 \ln^3\left(\frac{R}{R_{25}}\right)$$

A_1	B_1	C_1	D_1
3.354E-03	3.001E-04	5.085E-06	2.188E-07

Typical Performance

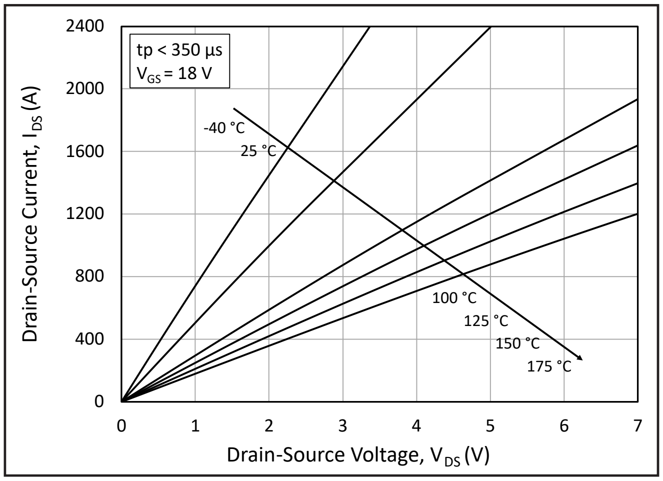


Figure 1. Output Characteristics for Various Junction Temperatures

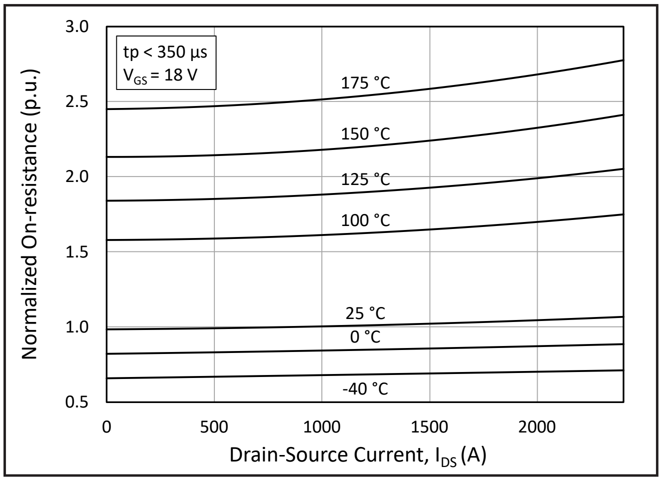


Figure 2. Normalized On-State Resistance vs. Drain Current for Various Junction Temperatures

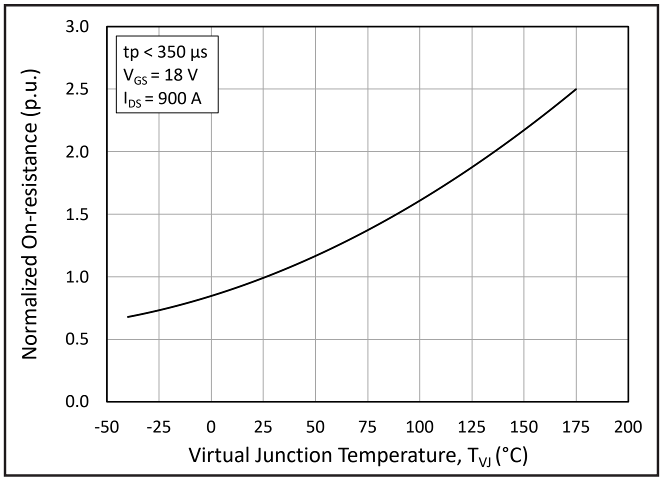


Figure 3. Normalized On-State Resistance vs. Junction Temperature

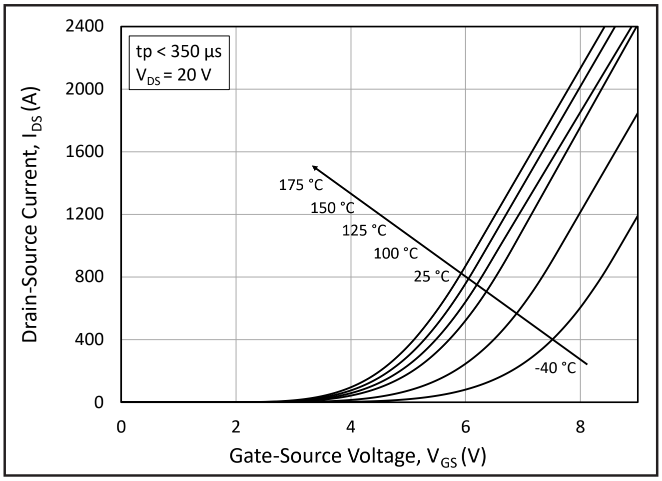


Figure 4. Transfer Characteristic for Various Junction Temperatures

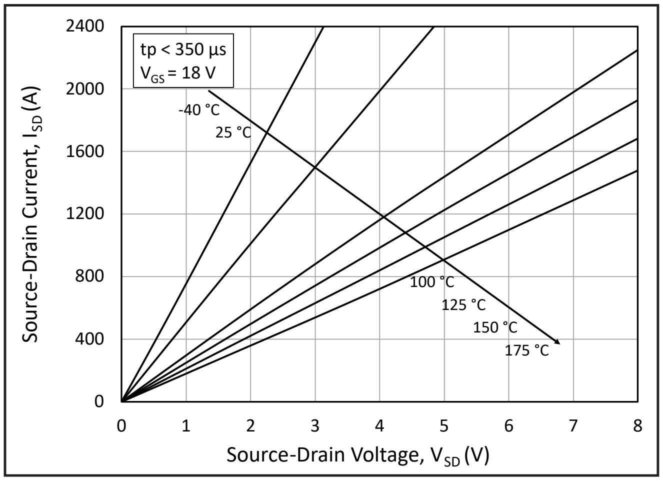


Figure 5. 3rd Quadrant Characteristic vs. Junction Temperatures at $V_{GS} = 18$ V

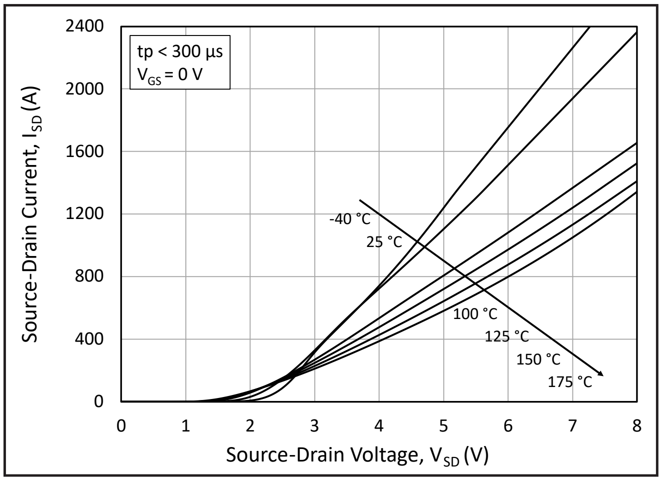


Figure 6. 3rd Quadrant Characteristic vs. Junction Temperatures at $V_{GS} = 0$ V (Body Diode)

Typical Performance

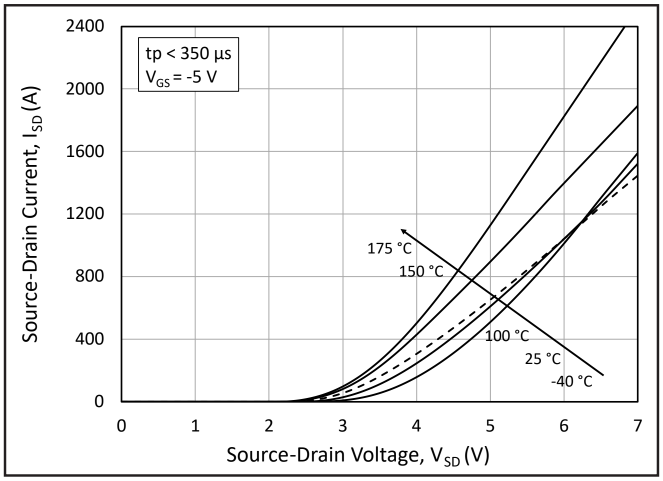


Figure 7. 3rd Quadrant Characteristic vs. Junction Temperatures at V_{GS} = -5 V (Body Diode)

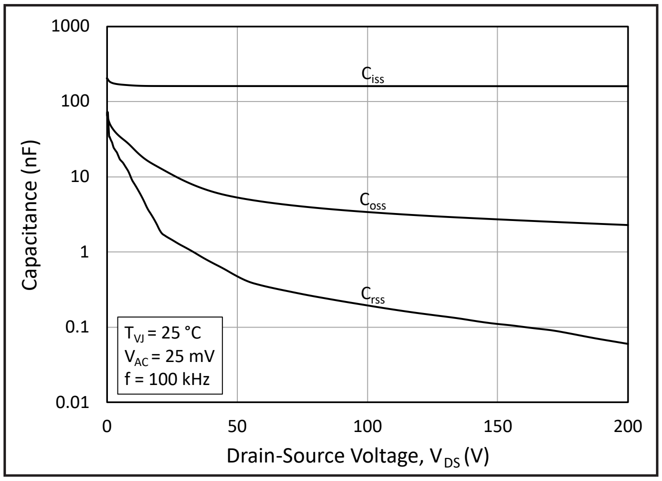


Figure 8. Typical Capacitances vs. Drain to Source Voltage (0 - 200 V)

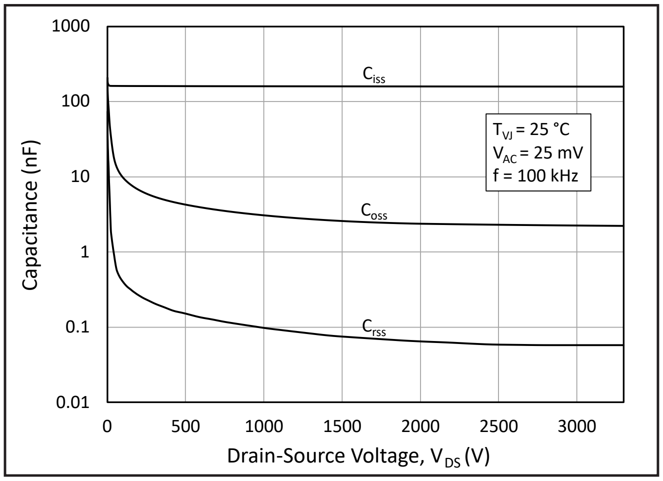


Figure 9. Typical Capacitances vs. Drain to Source Voltage (0 - 3300V)

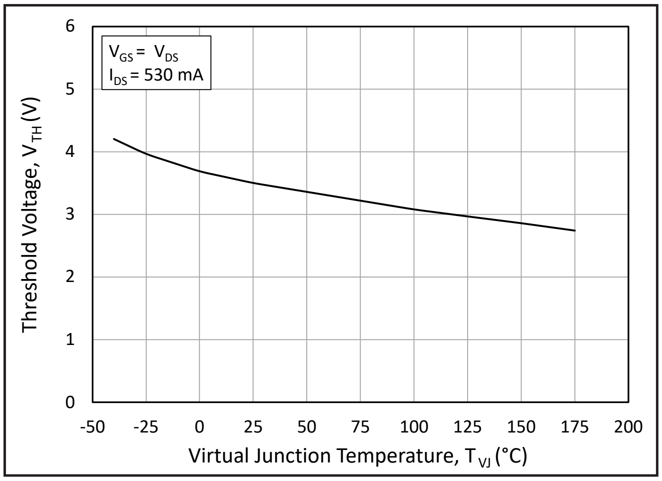


Figure 10. Threshold Voltage vs. Junction Temperature

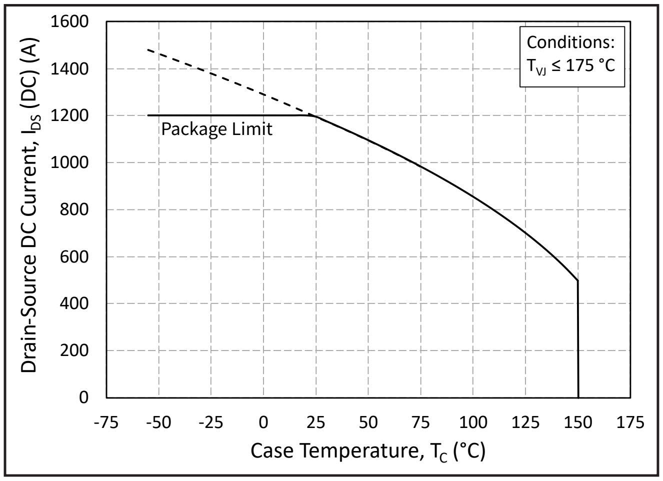


Figure 11. Continuous Drain Current Derating vs. Case Temperature

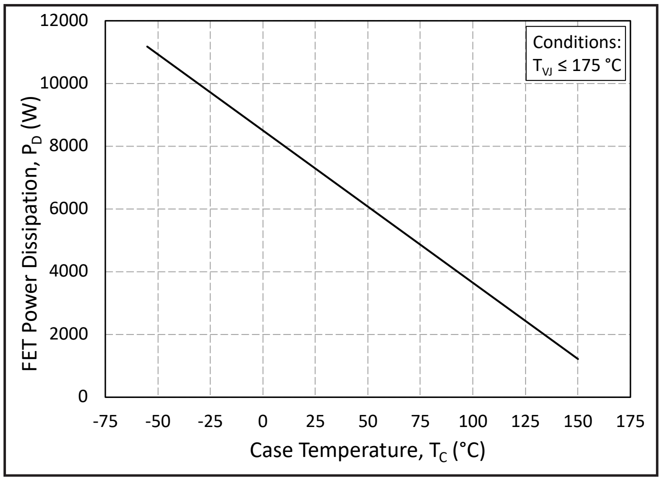


Figure 12. Maximum Power Dissipation Derating vs. Case Temperature

Definitions

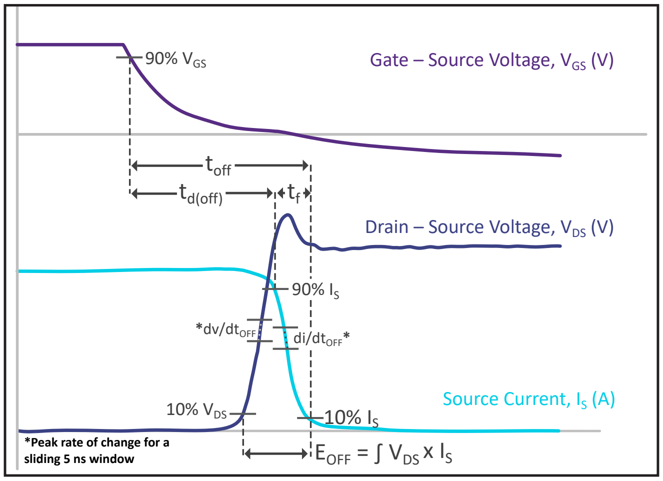


Figure 13. Turn-off Transient Definitions

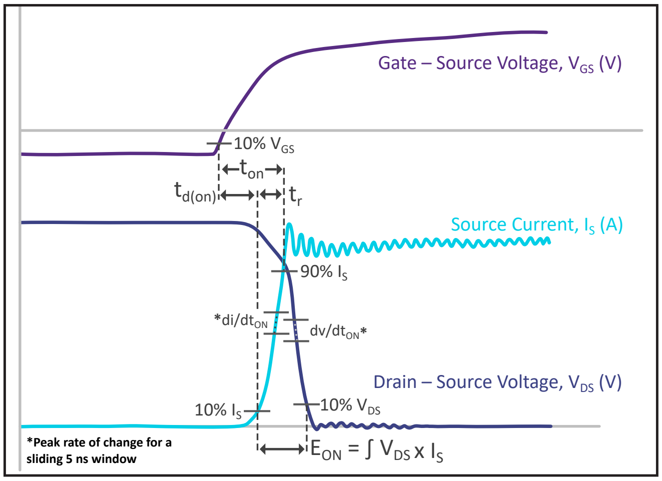


Figure 14. Turn-on Transient Definitions

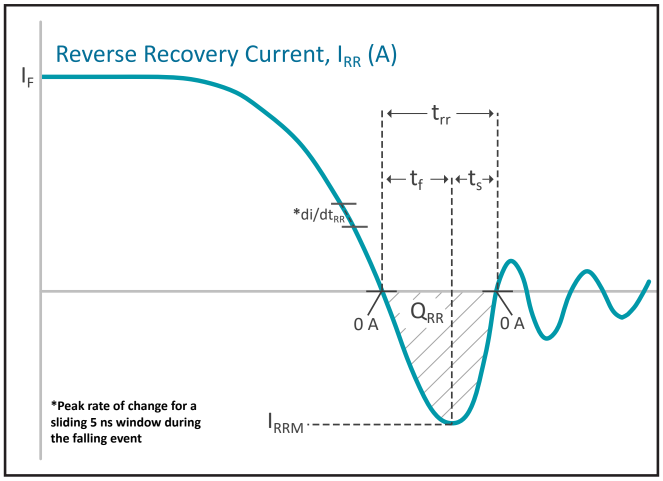


Figure 15. Reverse Recovery Definitions

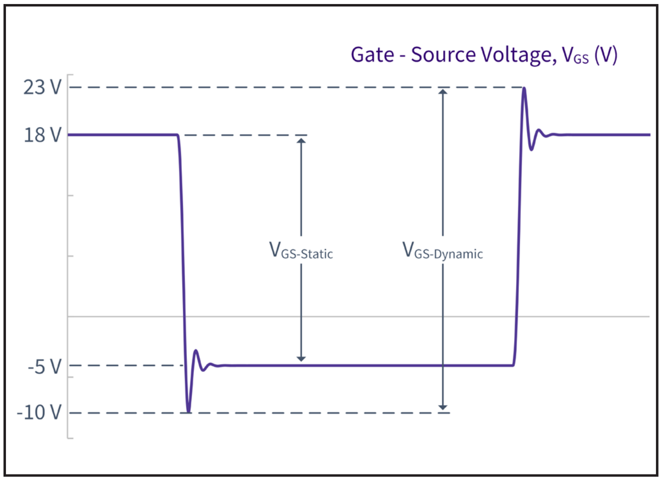
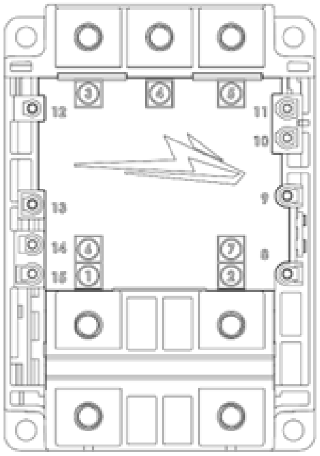
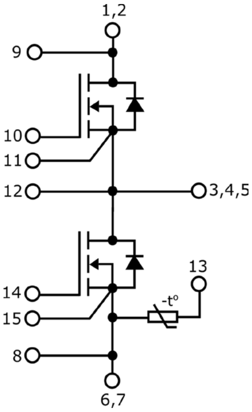
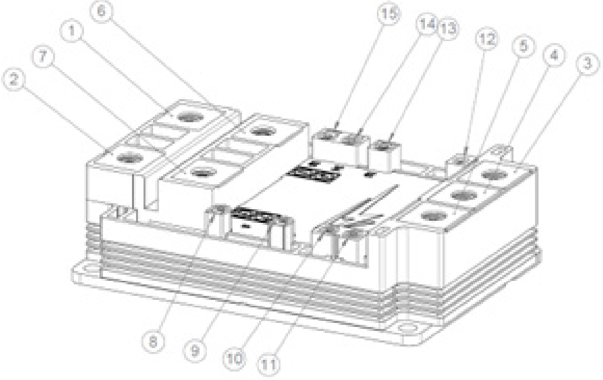


Figure 16. V_{GS} Transient Definitions

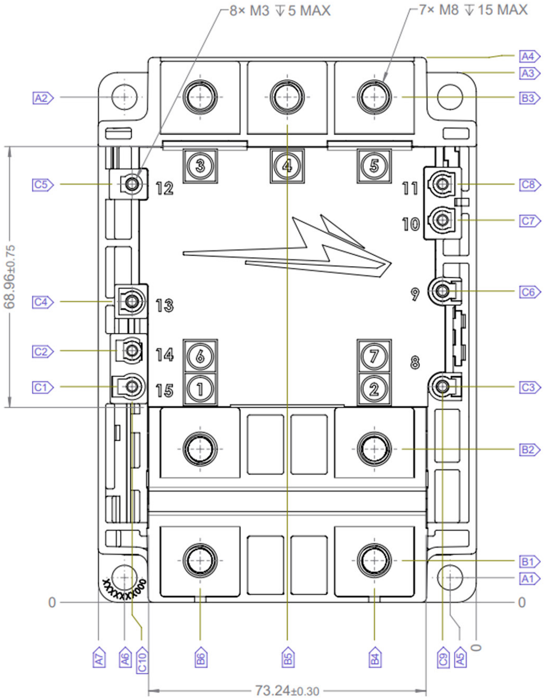
Schematic and Pin Out

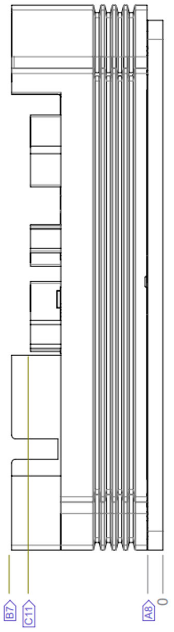






Package Dimensions (mm)





DIMENSION TABLE		
SYMBOL	DIMENSION	TOLERANCE
A1	2× 6.5	±1.0
A2	2× 133.5	±1.0
A3	140	±0.75
A4	144	±0.5
A5	2× 6.9	±0.75
A6	2× 92.9	±0.75
A7	99.8	±0.5
A8	4	±0.3
B1	2× 11	±0.5
B2	2× 40.5	±0.5
B3	3× 133.5	±0.5
B4	3× 26.9	±0.5
B5	49.9	±0.5
B6	3× 72.9	±0.5
B7	40	±0.75
C1	57	±0.4
C2	66.5	±0.4
C3	57	±0.6
C4	79.5	±0.4
C5	110.5	±0.4
C6	82.3	±0.5
C7	101	±0.4
C8	110.5	±0.4
C9	4× 8.9	±0.6
C10	4× 90.9	±0.6
C11	35	±0.75

Supporting Links & Tools

Evaluation Tools & Support

- LTspice and PLECS Models
- SpeedFit® Design Simulator
- Technical Support Forum

Dual-Channel Gate Driver Board

- CGD12HB00D: Differential Transceiver Daughter Board Companion Tool for Differential Gate Drivers
- CGD1700HB2M-UNA: Wolfspeed Gate Driver Board
- EVAL-ADUM4146WHB1Z: Analog Devices® Gate Driver Board
- UCC21710QDWEVM-054: Texas Instruments® Gate Driver Board

Application Notes

- PRD-08407: LM Module Platform Mounting Guide
- PRD-04814: Design Options for Wolfspeed® Silicon Carbide MOSFET Gate Bias Power Supplies
- PRD-09301: Gate Driver Design for SiC Power Modules
- PRD-06379: Environmental Considerations for Power Electronics Systems
- PRD-07845: Power Module Baseplate Capacitance and Electromagnetic Compatibility
- PRD-07933: Wolfspeed Power Module Thermal Interface Material Application User Guide
- PRD-08376: Thermal Characterization Methods and Applications
- PRD-08710: Measuring Stray Inductance in Power Electronics Systems
- PRD-08911: Considerations for Current Balancing in Paralleled SiC Power Modules
- PRD-09035: Power Module RC Thermal Models User Guide

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