CRD300DA12E-XM3

300 kW High Performance Three Phase Reference Design with Three CAB450M12XM3 1200 V, 450 A SiC Half Bridge Modules + Three CGD12HBXMP Gate Drivers

Technical Features

- Optimized for Cree's All-SiC High-Performance, Low Inductance XM3 Power Module
- Complete Stackup, including: Modules, Cooling, Bussing, Gate Drivers, Voltage / Current Sensors, and Controller
- High-Frequency, Ultra-Fast Switching Operation with Ultra-Low Loss, Low Parasitic Bussing

System Benefits

- Enables Compact, Lightweight Systems
- Increased Power Density
- High Efficiency Operation
- Reduced Thermal Requirements

Package

System Benefits

- High Power Density New Product Development
- High Frequency Converter Applications
- Vehicle Traction Inverters
- Active Front Ends
- Uninterruptible Power Supplies
- Industrial Motor Drives
- Energy Storage
- Grid-Tied Distributed Generation: Solar and Wind
- Smart-Grid / Flexible AC Transmission Systems
- Reduced System Cost

Maximum Ratings (T_C = 25 ˚C unless otherwise specified)

Symbol	Parameter	Value	Unit	Test Conditions
V_{DSmax}	Maximum Drain-Source Voltage	1200	V	
V_{DC}	DC Bus Voltage, Maximum	900		
	DC Bus Voltage, Recommended	800		
I_{DC}	DC Bus Current Ripple, Maximum	300	A	TA = 30 °C at 10 kHz (Set by capacitor rating)

Electrical System Ratings (T_C = 25 ˚C unless otherwise specified)

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
$I_{\Phi(rms)}$	AC Output Phase Current (RMS)		360		A	V_{AC}, out = 480 V_{rms} WEG coolant, 50% blend, 12 L/ min., f_{sw} = 10 kHz, V_{DC} = 800 V, f_{out} = 300 Hz, DPF = 1.0, $T_{coolant}$ = 25 °C, T_a = 25 °C
f_{SW}	Switching Frequency		20	80	kHz	Based on gate drive power
f_{out}	Fundamental Output Frequency			550	Hz	Controller limited
C_{DC}	DC Bus Capacitor Bank Capacity		300		µF	10 kHz
L_{DC}	DC Bus Capacitor Bank ESL		3.5		nH	
R_{DC}	DC Bus Capacitor Bank ESR		0.4		mΩ	10 kHz
L_σ	DC Bus Stray Inductance		1.8		nH	

Environmental Ratings

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
T_a	Ambient Temperature		25	40	°C	Higher ambient temperature possible with power derating.
$T_{coolant}$	Coolant Temperature		25	90		Switching frequency and phase current must be selected as to not exceed $T_{J,Max}$.
T_{stg}	Storage Temperature	-40		85		
	Installation Altitude			2000	m	Without voltage derating

Thermal & Mechanical Characteristics

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
A	Area		812		cm^2	
W	Weight		6.2		kg	
V	Volume		9.3		L	
P	Coolant Operating Pressure			5	bar	
Δp	Pressure Drop		200		mbar	12 L/min, $T_{coolant}$ = 25°C
	Mounting Torque		11.0		N-m	AC & DC Terminals, M10 bolts
		2.0	4.0	5.0		Module Power Terminals M5 Bolts
		2.0	3.0	4.0		Module Baseplate M4 Bolts

Input Connector Information

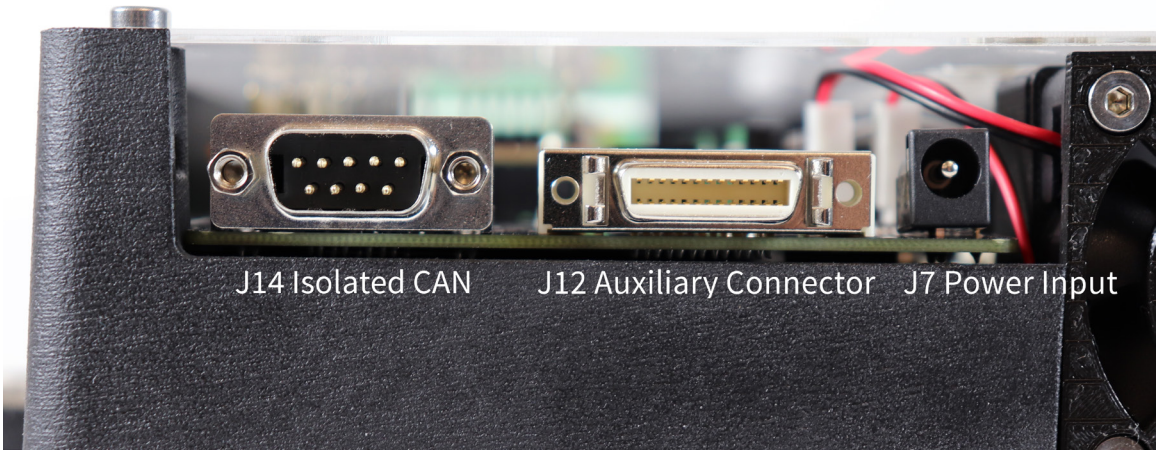
Pin Number	Parameter	Description
1	V_{DC}	Power supply input pin (+12 V Nominal Input)
2	Common	Common
3	HS-P (*)	Positive line of 5 V differential high-side PWM signal pair. Terminated Into 120 Ω.
4	HS-N (*)	Negative line of 5 V differential high-side PWM signal pair. Terminated into 120 Ω.
5	LS-P (*)	Positive line of 5 V differential low-side PWM signal pair. Terminated into 120 Ω.
6	LS-N (*)	Negative line of 5 V differential low-side PWM signal pair. Terminated into 120 Ω.
7	$\overline{\text{FAULT- P}}$ (*)	Positive line of 5 V differential fault condition signal pair. Drive strength 20 mA. A low state on FAULT indicates when a de-saturation fault has occurred. The presence of a fault precludes the gate drive output from going high.
8	$\overline{\text{FAULT- N}}$ (*)	Negative line of 5 V differential fault condition signal pair. Drive strength 20 mA.
9	RTD-P (*)	Positive line of 5 V temperature dependent resistor output signal pair. Drive strength 20 mA. Temperature measurement is encoded via frequency.
10	RTD-N (*)	Negative line of 5 V temperature dependent resistor output signal pair. Drive strength 20mA. Temperature measurement is encoded via frequency.
11	$\overline{\text{PS-Dis}}$	Pull down to disable power supply. Pull up or leave floating to enable. Gate and source are connected with 10 kΩ when disabled.
12	Common	Common
13	PWM-EN	Pull down to disable PWM input logic. Pull up or leave floating to enable. Gate driver output will be held low through turn-off gate resistor if power supplies are enabled.
14	Common	Common
15	Reset	When a fault exists, bring this pin high to clear the fault.
16	Common	Common

*** Inputs 3 - 10 are differential pairs.**

Performance References

- For information on the integrated modules, please reference the CAB450M12XM3 datasheet.
- For information on the integrated gate drivers, please reference the CGD12HBXMP datasheet.
- For higher ambient temperatures, the DC-Link voltage and DC-Link current must be de-rated according to the DC-Link capacitor ratings. Please reference the Fisher & Tausche 1100 V / 100 µF CX100µ1100d51KF6 datasheet.
- The included cold plate is a Wieland MicroCool® CP3012-XM3. In order to calculate the thermal resistance (°C/W) and pressure drop (bar) versus flow rate (liters/min.), please refer to the CP3012-XM3 datasheet documentation provided by the supplier.
- The included current sensor board uses the LEM LF 510-S, please refer to its datasheet for more detailed information.

Controller Connections



Controller input power supply input utilizes a CUI, PJ-102AH barrel jack connector.

Pin Number	Name	Type	Description
Center	+12V	PWR	+12V Input Power
Sleeve	Ground	-	Controller Ground

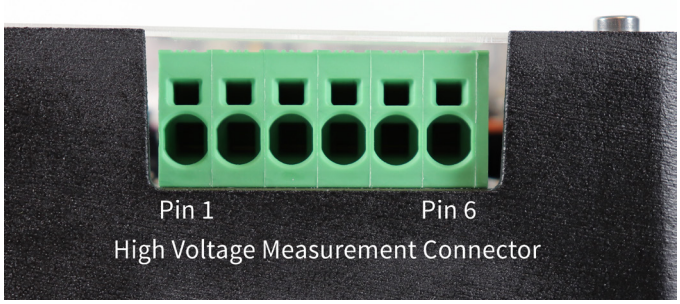
Isolated CAN port utilizes a NorComp, 182-009-113R181 male DE-9 connector.

Pin Number	Name	Type	Description
1	NC	-	NO CONNECT
2	CANA-L	I/O	Isolated CAN Port A Low
3	GND-1	-	Isolated Ground
4	NC	-	NO CONNECT
5	GND-1	-	Isolated Ground
6	NC	-	NO CONNECT
7	CANA-H	I/O	Isolated CAN Port A High
8	NC	-	NO CONNECT
9	+5V-ISO	PWR	Isolated +5V Power Supply Output

Auxiliary controller connector utilizes 3M, 10226-55G3PC connector.

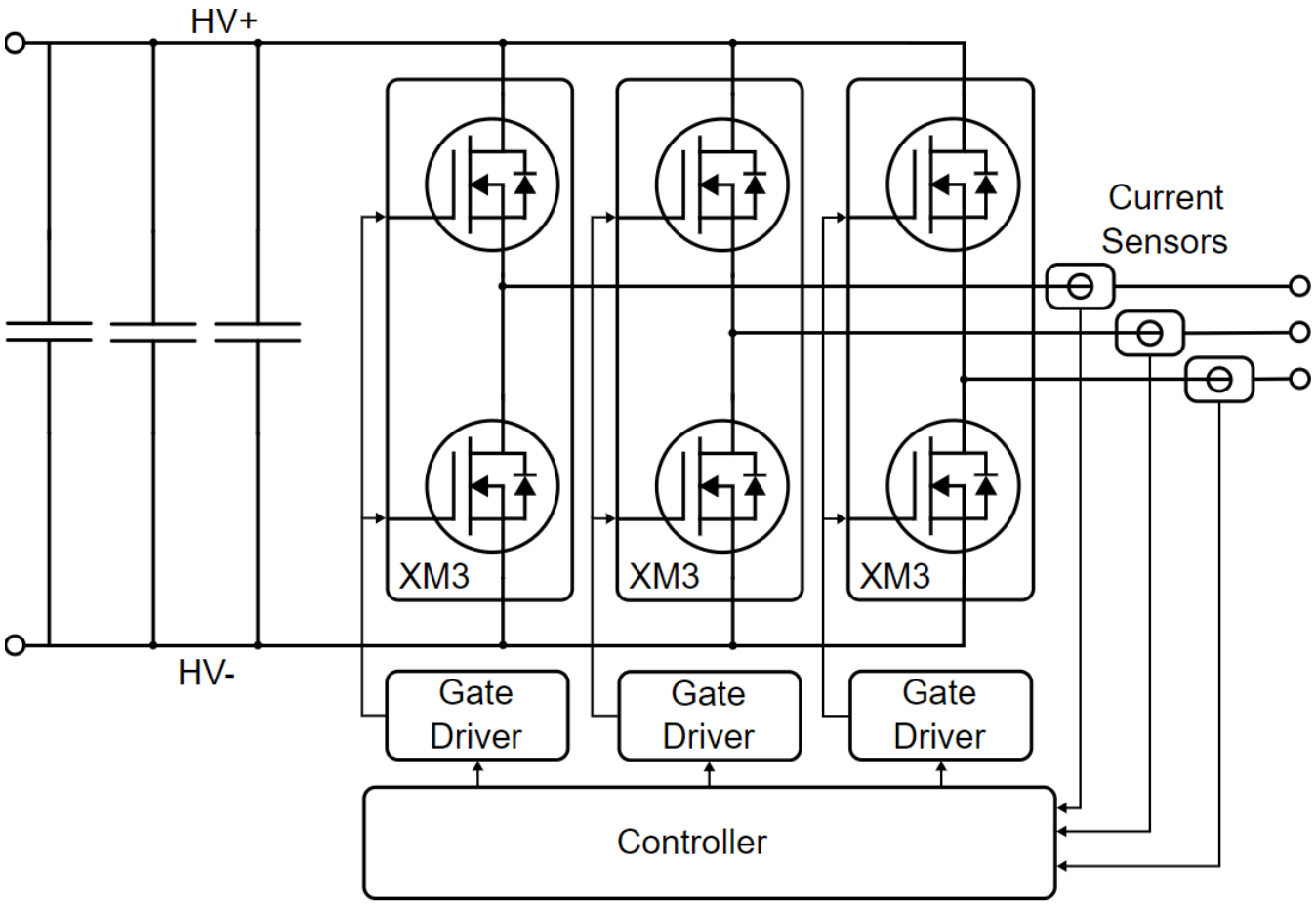
Pin Number	Name	Type	Description
1	CANBL	I/O	Non-isolated CAN port B Low
2	CANBH	I/O	Non-isolated CAN port B High
3	GND	-	Controller Ground
4	GND	-	Controller Ground
5	GND	-	Controller Ground
6	IEXT-m	I	External Current Sensor Signal
7	-15V	PWR	External Current Sensor Power -15V
8	+15V	PWR	External Current Sensor Power +15V
9	GND	-	Controller Ground
10	+3V3	PWR	+3.3V Power Supply Output
11	GND	-	Controller Ground
12	+5V	PWR	+5V Power Supply Output
13	GND	PWR	Controller Ground
14	QEA_A	I	Quadrature Encoder Port A Input A
15	GND	-	Controller Ground
16	QEA_B	I	Quadrature Encoder Port A Input B
17	GND	-	Controller Ground
18	QEA_I	I	Quadrature Encoder Port A Input I
19	GND	-	Controller Ground
20	+5V	PWR	+5V Power Supply Output
21	GND	-	Controller Ground

The voltage sensor input utilizes a Phoenix Contact, 1719231 connector.



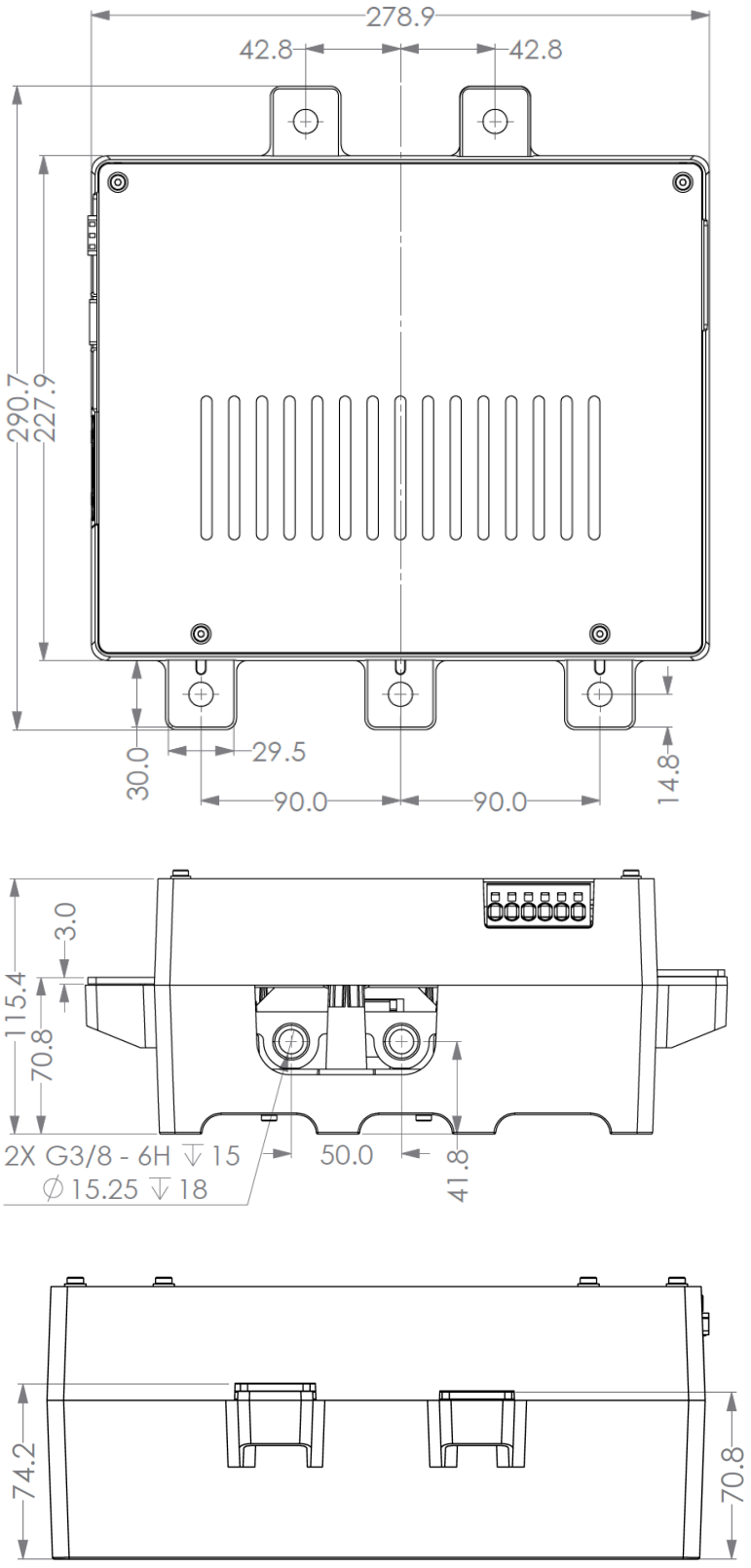
Pin Number	Name	Type	Description
1	VA-P	I	Positive High-Voltage Measurement Input Phase A
2	VA-M	I	Negative High-Voltage Measurement Input Phase A
3	VB-P	I	Positive High-Voltage Measurement Input Phase B
4	VB-M	I	Negative High-Voltage Measurement Input Phase B
5	VC-P	I	Positive High-Voltage Measurement Input Phase C
6	VC-M	I	Negative High-Voltage Measurement Input Phase C

Performance References



Full circuit schematics provided upon delivery of the reference design.

Package Dimensions



Supporting Links & Tools

- CAB450M12XM2: 1200 V, 450 A SiC Half-Bridge Module
- CGD12HB00D: Differential Transceiver Board for CGD12HBXMP
- CRD300DA12E-XM3: 300 kW Inverter Kit for Conduction-Optimized XM3 (CPWR-AN26)
- KIT-CRD-CIL12N-XM3: Dynamic Performance Evaluation Board for the XM3 Module (CPWR-AN27)
- CPWR-AN28: Module Mounting Application Note

Notes

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