Ferraz Shawmut | Eldre | Idealec | FTCAP

SOLUTIONS FOR POWER MANAGEMENT

150 kVA – 1.2 KV SiC POWER STACK EVALUATION KIT V2.0

STACK - REFERENCE - DATASHEET - V2.0 (PRELIMINARY)

VISUALLY-PROGRAMMED, CONTROLLED, AND MONITORED BY:

imperix

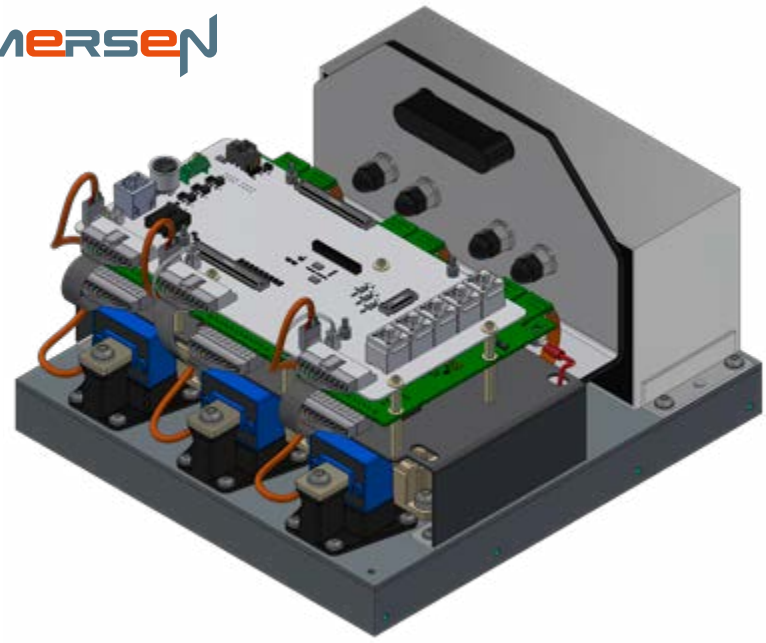
POWERED BY:

MICROCHIP

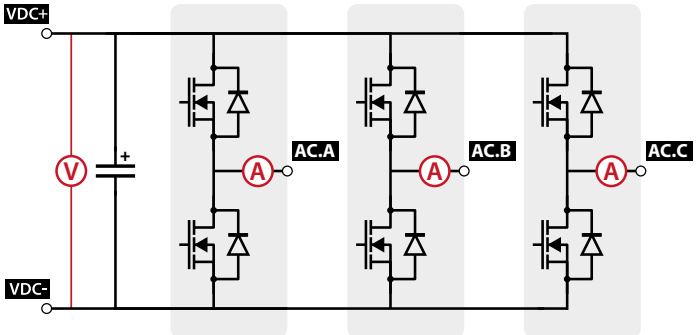
DRIVEN BY:

power integrations

COOLED, CONNECTED, PROTECTED, FILTERED, ASSEMBLED AND TESTED BY:



POWER STACK TOPOLOGY



The Fully Programmable(*) Mersen SiC Power Stack Evaluation Kit enables inverter designers accelerate their product development by relying on a pre-designed, pre-qualified industrial power stack.
Augmented by imperix control and development environment, the Power Stack can easily be programmed and operated, reducing the product development cycle.

FEATURES

- 800 V_{DC} / 200 A_{RMS}
- Up to 130°C Tj
- Peak efficiency > 98%
- Simulink™, PLECS™, or C++ programming
- Microchip® MSCSM120AM042CD3AG SiC MOSFET power modules
- Power Integration 2SP0230T2x0 gate driver series
- Compact water cooled
- Up to 20 kHz switching frequency

BENEFITS

- Ready-to-use
- Optimally designed for versatile use
- Compact footprint
- No external controller or wiring required
- Universal interface board
- Customization service available

APPLICATIONS

- E-Mobility
- DC smart grid
- Industrial
- Renewable energies

(*) Fully Programmable only for the SiC-EVAL-KIT-150 V2.0 set (power stack + Imperix Control Board) configuration

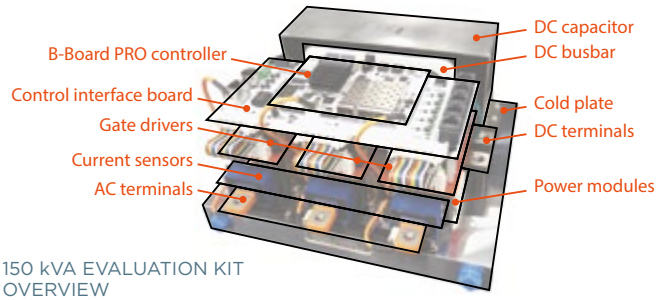
150 kVA 3-PHASE SiC
POWER STACK REFERENCE DESIGN

STACK FEATURES

The power stack is designed as a bi-directional DC-AC 3-phase topology delivering up to 150kVA. It includes three Microchip 1.2kV SiC MOSFET half-bridge modules, digital gate drivers, current sensors, a DC link capacitor and a low-inductance DC link bus bar. Thermal management of the evaluation kit is achieved by means of water cooling.

Key components	
Power modules	Microchip® 1.2kV MSCSM120AM042CD3AG
Gate drivers	Power Integration 2SP0230T2x0
DC capacitor	Mersen 760 µF, 1100 V
Cooling device	Mersen vacuum-brazed Aluminum cold plate
Current sensors	LEM HAS Series
Interface board	Mersen ITFB-02
Control board	imperix B-Board PRO (1GHz dual core, FPGA)

Mersen 150 kVA SiC evaluation kit includes imperix B-Board PRO controller by default, but can be ordered without it, in the eventuality customer is using its own control system.



150 kVA EVALUATION KIT OVERVIEW

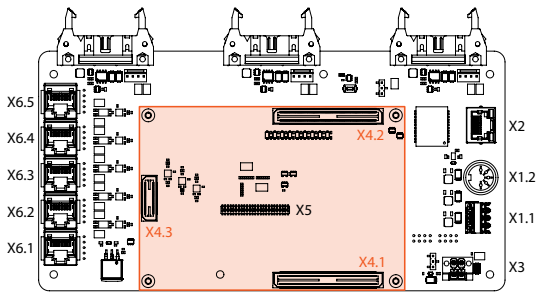
Interface board. This centralization board groups together the three gate driver's I/O signals, including PWM control and fault detection. It allows controlling the converter in many ways, using either:

Imperix programming workflow, using B-Board PRO controller

A 3rd party generic digital controller

A home-made proprietary control system

ITFB-01 connectors layout and description	
X1.n	Auxiliary power supply, screw terminal and 5-pin DIN socket
X2	Ethernet (for B-Board PRO programming /monitoring)
X3	External interlock (only for B-Board PRO)
X4.n	Interface to imperix B-Board PRO controller
X5	Generic 3rd party controller header
X6.n	External sensor interfaces (w/ sensor power supply)



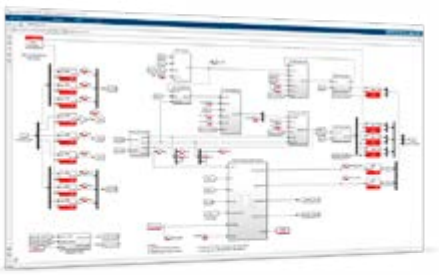
ITFB-01 INTERFACE BOARD OVERVIEW

IMPERIX B-BOARD PRO CONTROLLER

B-Board PRO is imperix's industrial programmable high performance control module, based on AMD Xilinx Zynq. It is ideally suited for demanding power electronic applications and advanced converter control techniques, which require powerful computational capabilities and complete software/firmware flexibility.

Architecture. The control board hosts a 1 GHz dual-core processor, with one core dedicated to the real-time control tasks, and the other one responsible for the system supervision and data logging. This guarantees exemplary performance, ranging up to 250 kHz control rates. In addition, a dedicated user-programmable FPGA area is provided, with straightforward integration with the processor side.

Simulink and PLECS integration. The controller can be programmed using C/C++ code, or directly from simulation software, such as Simulink and PLECS. Thanks to imperix fully automated code generation toolchain, just one single click is all it needs to fully program the device. The provided blocksets also embed simulation models so that the system can be accurately simulated and tuned before run-time is generated.



Remote monitoring. Benefit from a fully-instrumented converter along with imperix Cockpit remote monitoring software to quickly commission, tune, and thouroughly test your inverter design. *https://imperix.com/software/cockpit/*

Knowledge base. Rely on imperix's extensive documentation base to bootstrap your development (more info). Start from getting-started guides, technical notes, and ready-to-use example files, such as:
Three-phase voltage source inverter (AN002)
Single-phase PV inverter with FAE (AN003)
Multi-converter system for micro-grid (AN008)

Licensing. The stack is delivered with a 6-month complimentary[1] license for imperix ACG SDK, which includes[2] imperix blocksets for Simulink and PLECS.
1) For license extension (R&D and production) ask sales@imperix.com
2)Prerequisites and software compatibility on https://imperix.com/downloads/

150 kVA 3-PHASE SiC
FULLY PROGRAMMABLE POWER STACK REFERENCE DESIGN

TECHNICAL SPECIFICATIONS

Electrical - Power		Min	Typ.	Max	Unit
Vo	Three Phase Output Voltage, VDC > 700V		480		VRMS
Io	Flow: 4 l/min, Coolant: 50% Water/50% Glycol, Tcoolant = 70°C , VDC = 700V, fsw = 15kHz		200		
VDC	DC Bus Voltage / DC Supply Voltage		700	800 [1]	
fsw	Switching frequency, PWM type	10	15	20	A_{RMS}
Cdc	DC Link Capacitor, 760 µF, 1100 V	0.65	0.7	0.75	kHz
Viso	Power Terminals to chassis, DC, 1 min		3000	4000	mF
Electrical - Sensing		**Min**	**Typ.**	**Max**	**Unit**
Current sensor – measuring range	Bandwidth (-3dB) = 50kHz	-500		500	A
Current sensor – nominal sensitivity	Including analog circuitry on interface board		10		mV/A
Voltage sensor – measuring range	Bandwidth (-3dB) = 2kHz	50		1650	V
Voltage sensor – nominal sensitivity	PWM-type, 31.5kHz		0.06		%/V
Temperature sensor – measuring range		25		125	°C
Temperature sensor – nominal sensitivity	PWM-type, 31.5kHz		1		%/°C
Electrical - Auxiliary power supply (X1.x)		**Min**	**Typ.**	**Max**	**Unit**
Supply currents	For 5V ±10% supply			5	A
	For 15V ±10% supply			2	A
	For -15V ±10% supply			0.8	A
Electrical - External sensor interfaces (X6.x)		**Min**	**Typ.**	**Max**	**Unit**
Analog input voltage range	Differential pair, bandwidth (-3dB) = 1MHz	-5		5	V
Supply voltages	For supplying external sensor		+15/-15		V
Supply currents	Per channel, at ±15V		100	140	mA
Cooling and Environment		**Min**	**Typ.**	**Max**	**Unit**
Tsto	Storage Temperature	-40		+40	°C
Tair*	Ambient air temperature	-40		65	°C
T coolant	Coolant inlet temperature, derate > 70°C	-40		105	°C
IP	Enclosure Ingress Protection		IP00		
dp	Pressure Drop, nominal flow 4 ltr/min		29		mbar
P	Power dissipated to liquid coolant		2400	3000	W
Humidity	No condensation, Pollution Degree 2	5		85	%
Mechanical		**Min**	**Typ.**	**Max**	**Unit**
Dimensions	178x277x256		-		mm
Weight	Average value		18		kg

Note[1]: Maximum DC voltage depends on operating conditions (fsw, Io, Vo..) and gate driver parameters or possible customization (software and/or hardware)

DISCLAIMER AND IMPORTANT NOTES: Silicon Carbide (SiC) Evaluation Kit 150kVA

Note: This SiC evaluation kit is a high voltage and high temperature power electronic device that is meant to serve as an evaluation tool preferably in a lab setting for users to conduct experiment on SiC stack performance.

It is important to note that the kit should be handled and operated by qualified technicians or engineers. As this kit is a fragile device, when not in use it should be stored in an area with ambient storage temperature ranging from -40 to +40 degree Celsius. Also, special care should be given during transportation to avoid damaging the electronics and use of electrostatic discharge (ESD) bags is highly recommended.

It is important to note that this kit is not designed to meet any safety or industrial standards and is not meant to be used as a production qualified device.

CAUTION

Please ensure that appropriate safety procedures are followed when operating this board, as any of the following can occur if you handle or use this board without following proper safety precautions: death; serious injury; electrocution; electrical shock; electrical burns; severe heat burns.

IMPORTANT NOTES

Purposes and Use

Mersen (on behalf of itself and its affiliates, "Mersen") reserves the right to make changes to the evaluation kit without prior notice. This kit should not be used as production item or be used as all or part of a finished product. This kit should be handled and operated by qualified technical engineers.

NO WARRANTY

Mersen SiC Stack Evaluation Kit (hereinafter referred to as the "Equipment") is provided on an "AS IS" basis, and therefore there is no warranty of any kind whatsoever, whether express or implied, statutory, or otherwise, including but not limited to any warranty of merchantability, non-infringement, satisfactory quality, accuracy, or fitness for a particular purpose. Mersen does not guarantee that the Equipment will properly operate.

LIMITATION OF LIABILITY

Mersen shall be not liable to the Buyer and any third party for any damages of any kind in connection with the use of the Equipment including but not limited to indirect or consequential damages such as loss of profits, loss of data, loss of production, loss of revenue and business interruption losses, arising out of or relating to the supply of the Equipment.

Mersen shall not be held liable for any and all damages arising from or in connection with the misuse of the Equipment by Buyer, its employees, customers or others. To the fullest extent permitted by the applicable law, the total cumulative liability of Mersen and its agents or employees, arising from or in connection with the supply of the Equipment from any cause whatsoever whether based on contract, tort, strict liability, any warranty or otherwise, shall, in no event and under no circumstances, exceed the total payments made by Buyer pursuant to the supply of the Equipment, and effectively received by Mersen at the time of Buyer's claim.

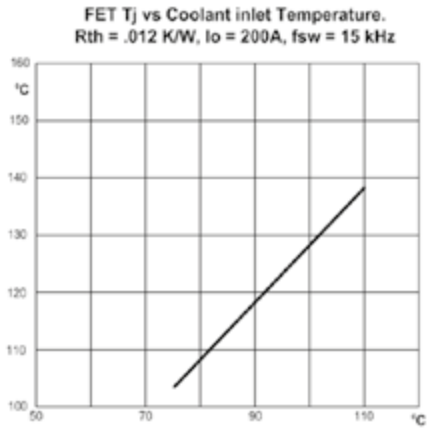
INDEMNIFICATION

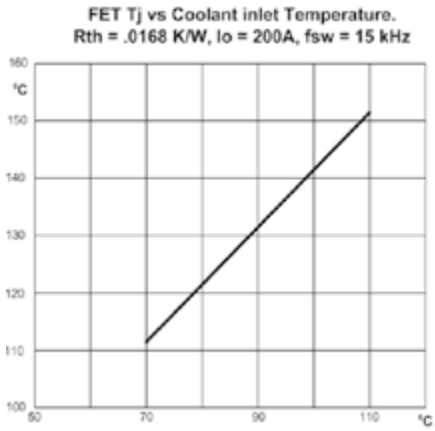
The Equipment is not serially manufactured product and is in course of development. It can be used for evaluation of power conversion process using SiC power modules in the laboratories only. In this result and to the extent permitted by applicable law, the liability of Mersen with respect to product safety, product liability, technical performance, reliability, shelf life or non-infringement of intellectual property rights of third parties is expressly excluded.

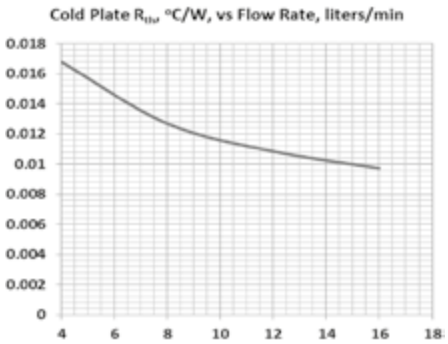
For additional information please contact dominique.tournier@mersen.com

150 kVA 3-PHASE SiC
FULLY PROGRAMMABLE POWER STACK REFERENCE DESIGN

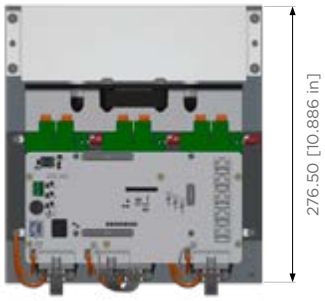
COOLING PERFORMANCE

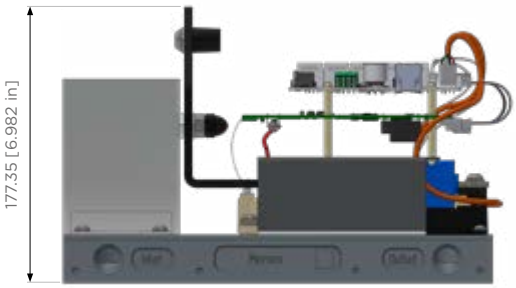


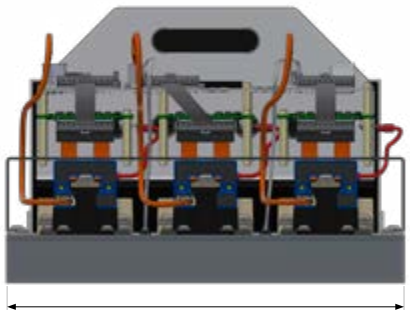




DIMENSIONS







ORDERING

Product Code	Scope of delivery	Available options
SiC-EVAL-KIT-150 V2.0 set	Base stack Interface board w/ pre-fitted imperix B-Board PRO controller imperix ACG SDK, CPP SDK 6-month complimentary license	Auxiliary power supply (AEH45UM32) Voltage sensors (set of 3) imperix ACG/CPP SDK permanent license Imperix Current and Voltage sensors
SIC-EVAL-KIT-150 V2.0 basic	Base stack (w/o B-Board PRO controller) Interface board w/ cable for external controller	Auxiliary power supply (AEH45UM32)

POSSIBLE CUSTOMIZATION AND ADAPTATION (UPON REQUEST)

- Overall dimensions and form-factor of the mechanical frame
- Bracket and hardware for integration
- SiC MOSFET module model and type
- 1700V SiC module
- Air-cooling (instead or liquid-cooled)
- Increase of Fsw, Inom or Vdc
- Integration of output filter inductors
- Test and qualification
- Purchase of individual stand-alone components only (no assembly service)

TARGETED CUSTOMERS

- Inverter / Stack design-house and R&D lab with limited or no production capability.
- OEM / stack and inverter manufacturers: specialists and generalists
- System Integrators

CONTACT

Dominique TOURNIER, PhD, Senior Application Engineer, Power Stacks Solutions
Email: dominique.tournier@mersen.com

More information at:
https://www.mersen.com/en/products/power-stack-design-manufacturing-testing-evaluation-kits

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