Industry's first 1200 V SiC IPM CIPOS™ Maxi IM828-series

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Global trends are driving demand for new power semiconductor solutions

Clean energy

Renewable energy sources like wind and sun are the vital part of new global energy mix

Energy efficiency

Reduction of energy consumed is needed, enabling systems that make the way we live and work greener

Electric mobility

Electrification of mobility is inevitable – in both, private and public transport segment

Silicon Carbide (SiC) can be an answer to these challenges

New requirements & challenges

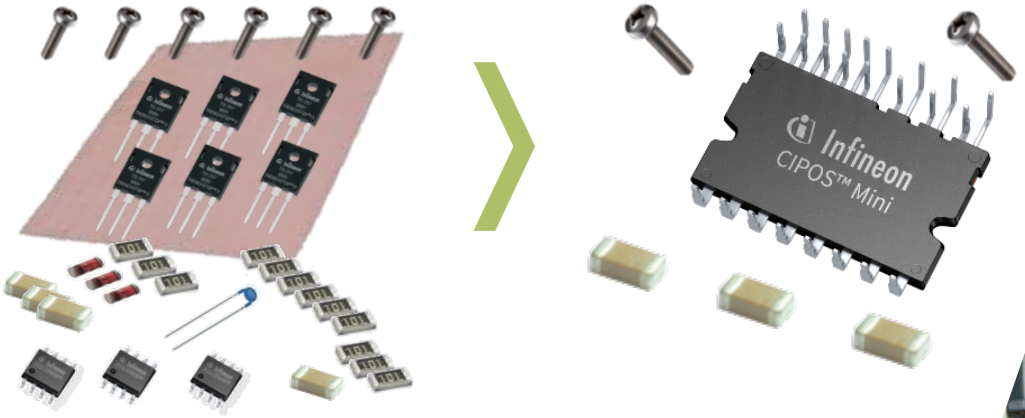
More **energy** from **clean resources**

Get more out of less **energy**

Technical advantages of SiC lead to strong benefits for the system

- Increased performance
- Higher power density
- Reduced system size
- Lower system cost

Functional integration on system level is mainstream – even up to highest power

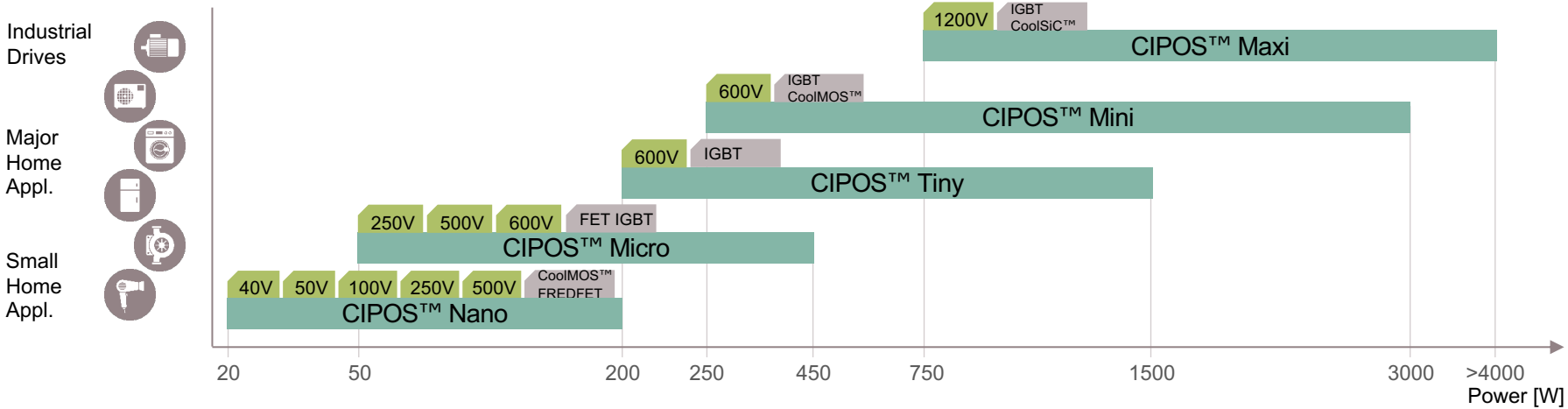


System benefits translate to **customer advantages**

IPMs improve **time to market**, **performance** and **reliability**

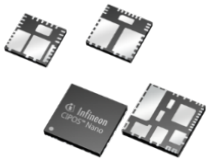
Broad Intelligent Power Module portfolio – serving power ranges from 20 W to 4 kW

Main Applications

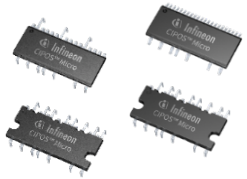


Intelligent Power Module Portfolio

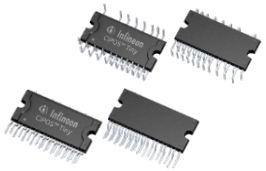
CIPOS™ Nano



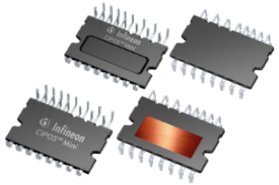
POS™ Micro



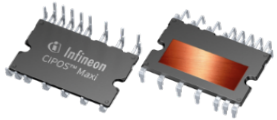
CIPOS™ Tiny



CIPOS™ Mini



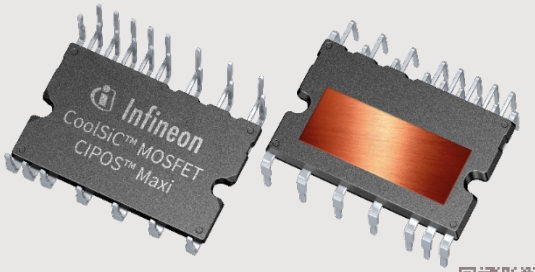
CIPOS™ Maxi



Industry's first 1200 V full SiC IPM: IM828-series at a glance

Products

DIP 36x23D package



Dimension [mm]	36 x 22.7 x 3.1 mm³ with 24 pins
Configuration	3-phase inverter with open emitters
Voltage Rating	1200 V
Rds(on)	55 mΩ (I_D=20 A, Vin=5 V, T_J < 25°C)
I_D DC drain current	20 A (T_C = 80°C, T_J < 150°C)

Key Features

- Fully isolated Dual In-Line molded module with **1200 V CoolSiC™ MOSFET**
- **Power capability over 8 kW**
- Improved heat dissipation
- Rugged 1200 V SOI gate driver technology (6ED)
- Integrated bootstrap functionality
- Over current shutdown
- Independent temperature thermistor
- Under-voltage lockout at all channels
- Low side pins accessible for all phase current monitoring

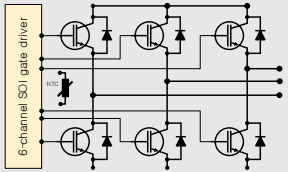
Application

- Commercial air conditioners
  - Active filter (PFC)/compressor
- Industrial motor drives
- Pumps

Product Line

Part No.	Package	Rds(on)	Voltage Rating	Ver.
IM828-XCC	DIP 36x23D	55 mΩ	1200 V	CoolSiC™ MOSFET

Topology:
3 phase inverter



Value Proposition

- Offer very low loss by using the advanced CooSiC™ MOSFET technology
- High power density and high efficiency
- High output power in one small package
- Provide wide switching speed range
- Minimize system size and reduce system costs
- Fast time to market

IM828-XCC vs. reference A: Thermal performance comparison

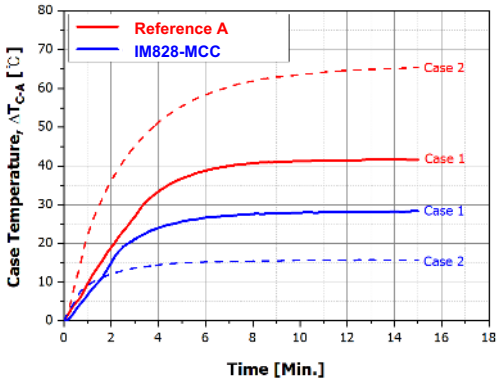
IM828-MCC shows superior thermal performance compared to Reference A

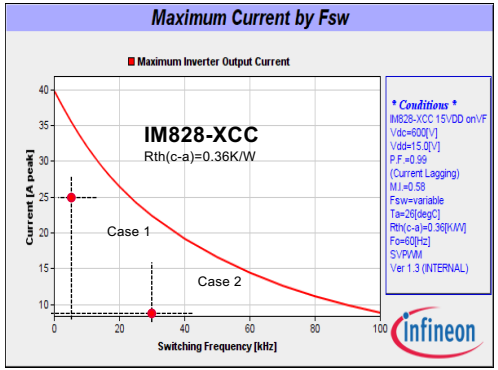
Test conditions	DUT	Measured value			Simulated data	
		Ta [°C]	Tc [°C]	Tca [°C]	Tj max. [°C]	Loss(INV)
Case 1 (5 kHz, 25 Apeak, MI=0.58)	**IM828-XCC**	**26.1**	**54.4**	**28.3**	**83.0**	**77.92**
	Reference A	**26.6**	**68.2**	**41.6**	**84.1**	**132.14**
Case 2 (30 kHz, 7 Apeak, MI=0.64)	**IM828-XCC**	**25.9**	**41.6**	**15.7**	**58.6**	**44.02**
	Reference A	**26.5**	**92.0**	**65.5**	**99.7**	**168.91**

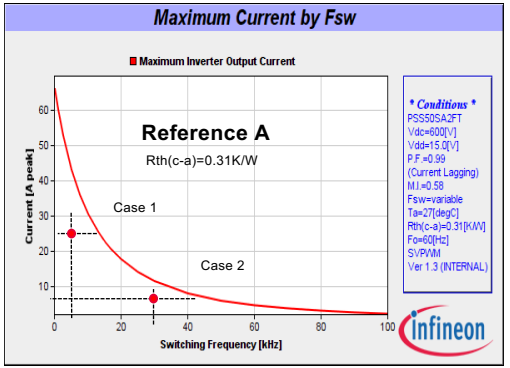
Comments

Reference A is 1200 V 50 A IPM based on Si-IGBT technology

V_{DC}=600 V, V_{DD}=15 V, R_{shunt}=10 mΩ, F_O=60 Hz, PF=0.99, T_{dead}=0.5 µs (SiC-MOSFET) / 3 µs (Si-IGBT)







IM828-XCC SiC IPM gives an excellent value to fit for various applications

Key Features

3 phase inverter topology with smallest compact molded package, up to 8 kW power rating

Embedded single 1200 V SOI gate driver technology

- Built-in bootstrap
- Over current shutdown
- Under-voltage lockout
- All of 6 switches turn off during protection
- Enable pin
- Excellent thermal performance with DCB substrate
- Independent thermistor

Key Benefits

- Minimized PCB size
- Easy PCB footprint design
- Less peripheral components
- Wide switching speed range
- Maintain stability against transient
- Lower switching losses
- Monitoring system thermal status

Value

Reduced system costs

Fast time to market

Wide range of application

High efficiency

High power density

High output power

To fit for…

Servo

- Compact system design
- Dynamic and heavy load
- High power disspation requirement
- High efficiency requirement
- High switching frequency

PFC (Active filter) for pump or HVAC

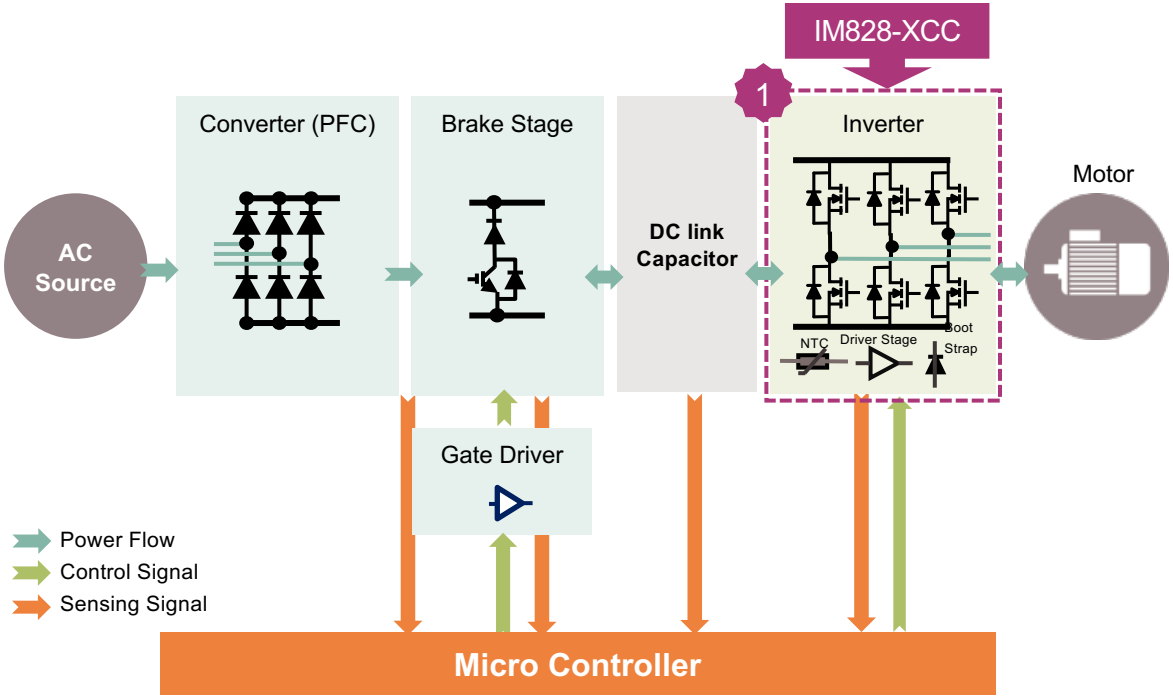
- Require harmonic current suppression capability
- Compact system design
- Minimize size and weight
- Improve system stable capability
- High power factor requirement
- High efficiency requirement
- High switching frequency requirement

CAC compressor

- Compact system design
- System simplify and easy design
- High power rating requirement

IM828-XCC in compact package with high output power and low heat dissipation for servo drive applications

Advanced servo drive topology with SiC IPM technology



Comments

Miniaturization of servo drive

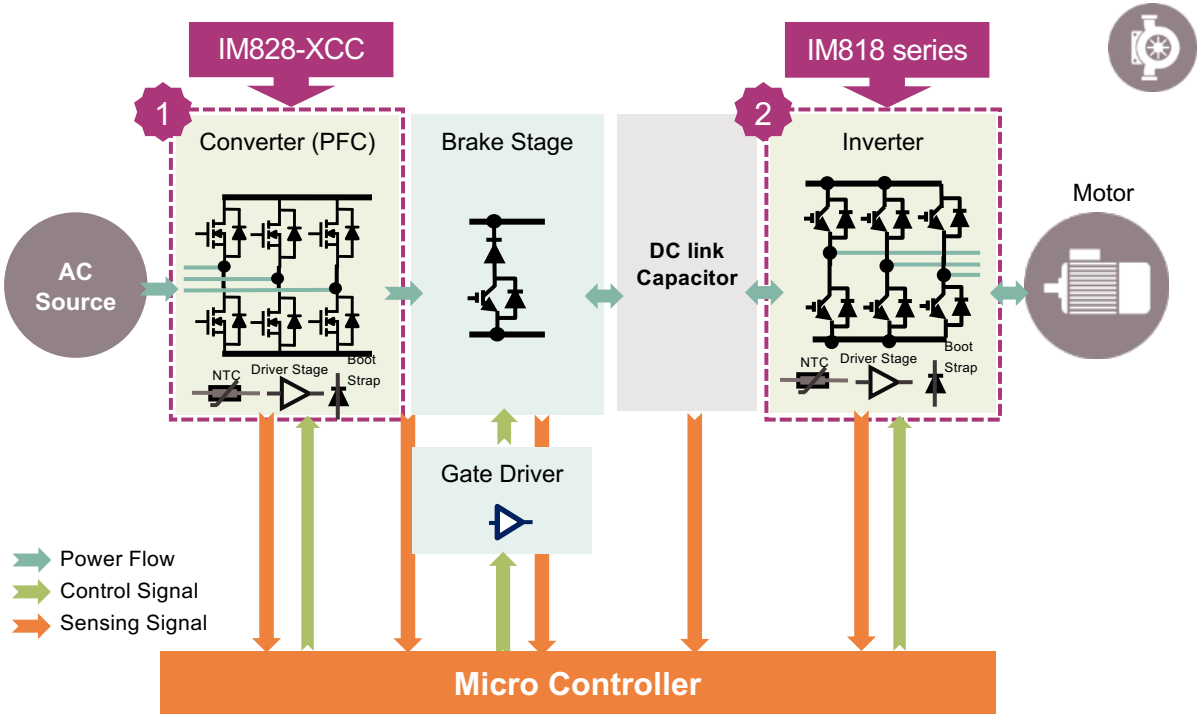
- High power requirement for dynamic load condition
- High power density and good thermal performance requirement based on the compact mechanical structure with heavy load
- High efficiency and high switching frequency requirement

CIPOS™ Maxi offers the highest power density compact solution with SiC IPM

- High power rating with excellent protection functions
- Small and compact design with good thermal performance
- High efficiency and wide range for switching frequency
- Highest power density of system

IM828-XCC with excellent performance for high frequency and low heat dissipation for PFC applications

Advanced motor drive topology for fan/pump with dual IPM solution



Comments

PFC will be the trend in fan and pump applications

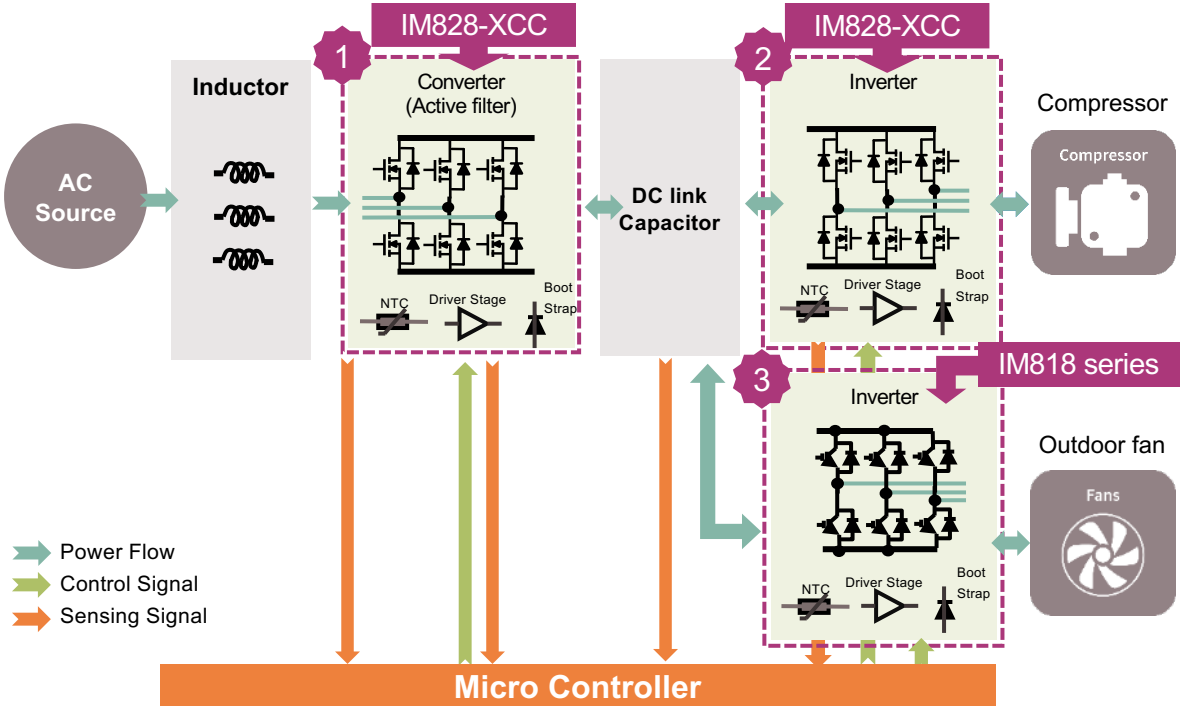
- Harmonic current suppression requirement
  - Regulatory requirement be strict
- Minimized losses and cost
  - The generation of the power and the capital equipment involved in the process

CIPOS™ Maxi offers a smaller compact solution with dual IPM: ①+②

- Wide range for switching frequency to fit for PFC requirement
- High efficiency and high power rating
- Highest power density of system
- Small and compact design
- Easy assembly with pin compatible package

High Power and High Performance IM828-XCC with Wide Speed Range for HVAC Application

Revolutionary HVAC topology with complete IPM Soution



Comments

Miniaturized high performance HVAC

- Require harmonic current suppression capability
  - IEC/EU 61000-3-2 standard requirement
- Require high performance and stable capability
- Minimized system cost such as size and weight

CIPOS™ Maxi offers complete IPM revolutionary solution: ①+②+③

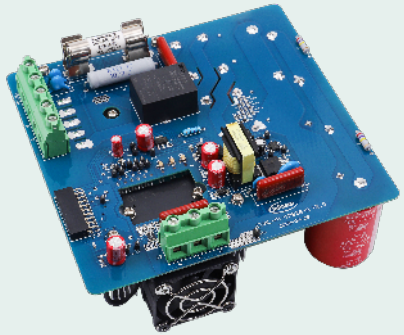
- Excellent high frequency capability to achieve high power factor for suppress harmonic current to meet standard
- High output power can be generated at low frequency to drive compressor
- High efficency and highest power density to privode system stable capability
- Compact system design to reduce 70% inductor core size/PCB size and 75% weight for saving huge space

EVAL-M1-IM828-A MADK evaluation board: IM828-XCC SiC IPM performance for 8 kW motor drive

Specifications

- Input voltage 380~480 V_{AC}
- **Default 8 kW motor power output**
- Output current 15 A_{rms}/ 19 A_{rms} (low speed)
- On board EMI filter
- Single shunt current sensing configured by default
- Auxiliary power supply with 15 V, 3.3 V
- Over-current protection
- Over-temperature protection
- Sensing of DC-link voltage
- Thermistor output
- Fault diagnostic output
- Measurement test-points compatible to standard oscilloscope probes
- PCB is 150 mm × 140 mm and has two layers with 70 µm copper each
- RoHS complaint

Power Board Picture

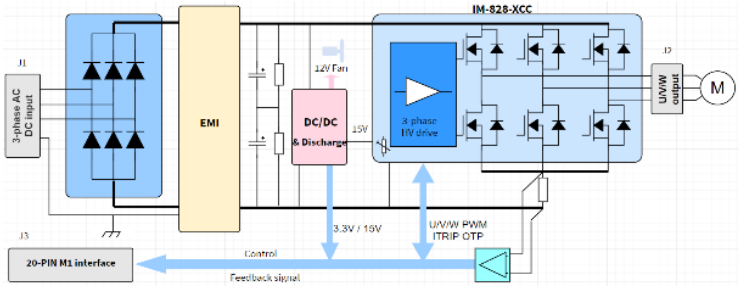


Control Board Picture

EVAL-M1-101T

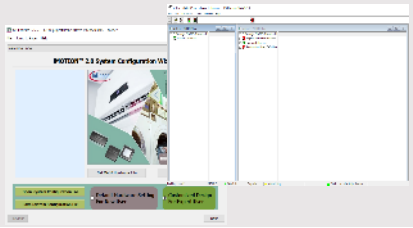
OPN: EVALM1101TTOBO1

Power Board Diagram

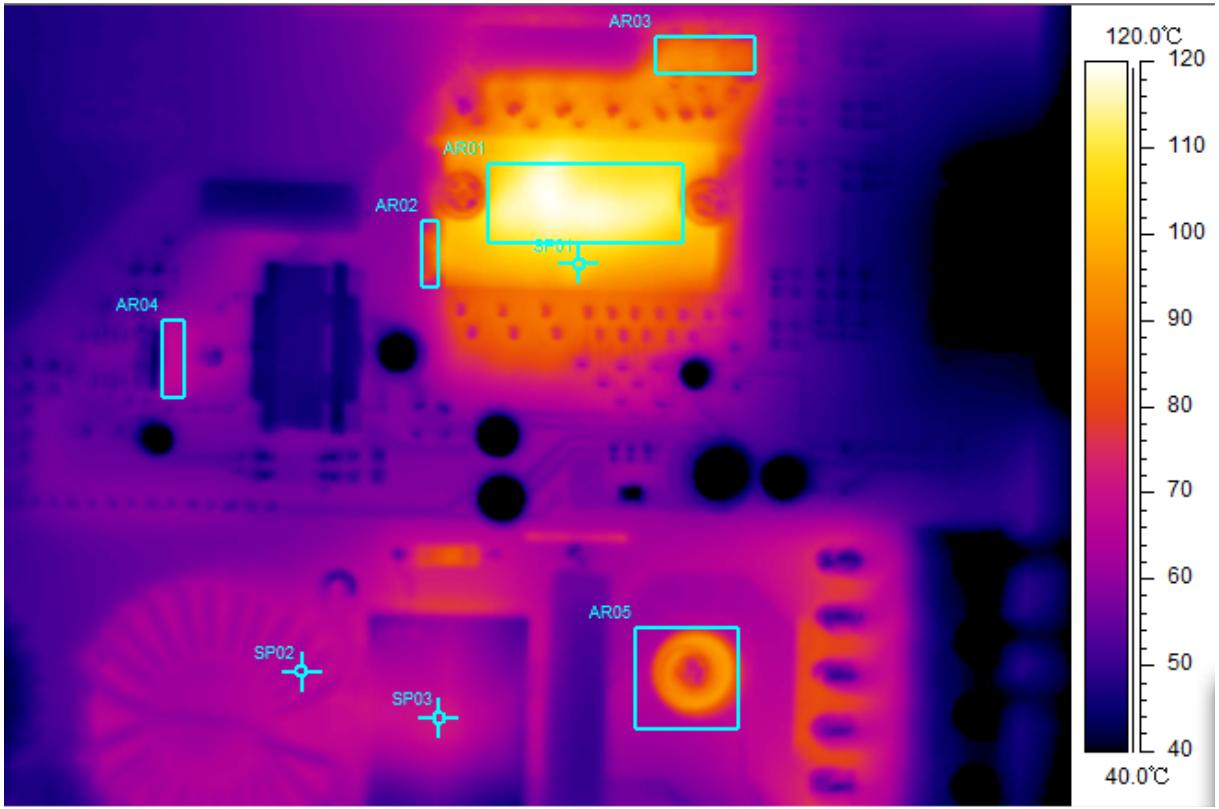


Tool and Software

MCEWizard and MCEDesigner :
http://www.infineon.com/imotion- software



Thermal image of evaluation board: Output power 8.9 kW



Operating conditions:
550 V AC input,
11.5 A RMS output current

IM828 SiC IPM: next level of performance

- Infineon has a long and successful history with SiC diodes and power switches
- SiC represents a strong technology option for applications needing higher performance and efficiency
- IM828 full SiC intelligent power module is the latest and greatest addition to the portfolio of Infineon's CoolSiC products:
  - High power density and low losses enable system cost savings
  - High switching frequency enables high performance for systems requiring high load dynamics
  - High switching frequency enables significant system cost reductions in active filter applications
- Full industrial qualification, high reliability and robustness

Part of your life. Part of tomorrow.