POWER PRODUCTS

Transforming Power with
INDUSTRY-LEADING SILICON CARBIDE EXPERTISE & CAPACITY
Wolfspeed is the foremost manufacturer of silicon carbide MOSFETs, Schottky diodes and power modules that put increased efficiency, higher switching frequency and reduced system size and costs in the hands of designers everywhere.

**AND WE DIDN’T BECOME THE LEADER IN WIDE BANDGAP SEMICONDUCTORS OVERNIGHT.**

Cree, Inc., spent more than 30 years establishing a global brand known for innovation, financial strength and reliable materials sourcing, staffed by the most forward-looking thinkers and doers in any scientific enterprise.

Wolfspeed was born ready, and we’re outpacing the competition in every meaningful performance and cost-benefit parameter to provide RF and Power devices to any industry that needs the fastest, smallest, lightest and most efficient semiconductor products available. Which is all of them.

**6,000,000,000,000+ HOURS IN THE FIELD. AND COUNTING.**

Silicon carbide has powered Wolfspeed’s MOSFETs, Schottky diodes and power modules for more than six trillion hours of end-customer usage worldwide.

**THE WORLD LEADER IN SILICON CARBIDE.**
Meet the Newest Member of Our Family

**Wolfspeed WolfPACK™**

**DELIVERING THE INDUSTRY’S HIGHEST POWER DENSITY IN ITS CLASS FOR UNSURPASSED EFFICIENCY**

Wolfspeed’s latest power modules enable multiple configurations across power levels for electric vehicle fast charging, industrial power, UPS, induction heating and welding, industrial motor drive, power supply, solar and renewable energy and grid infrastructure applications.

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**FEATURES**
- Leading silicon carbide MOSFET technology in an industry standard form factor
- Highest current rated topologies commercially available in class
- Built in NTC
- Press fit connections

**BENEFITS**
- Maximum power density in class
- Ease of layout and assembly
- System scalability and reliability
- End to end support - simulation through reference hardware

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### FEATURES BENEFITS

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Blocking Voltage</th>
<th>( R_{\text{ON,IN}} \text{ at 25°C} )</th>
<th>Configuration</th>
<th>Package</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAB006M12GM3</td>
<td>1200V</td>
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<td>GM3</td>
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<td>6-pack</td>
<td>FM3</td>
</tr>
</tbody>
</table>

*Refer page 13 for the Evaluation kit*
Wolfspeed's latest generation of SiC MOSFETs set the standard for performance, ruggedness and ease of design-in. Extremely fast switching, ultra-low switching losses, stable conduction losses over temperature assure significant improvement of system efficiency, power density and overall BOM cost versus silicon MOSFET and IGBT incumbents.

Leverage Wolfspeed's extensive SiC device portfolio, manufacturing experience, and systems expertise to accelerate your power supply design.

**FEATURED DESIGN TOOLS**

- **BUCK-BOOST EVALUATION BOARD KIT-CRD-3DD12P**
- **22KW HIGH EFFICIENT BI-DIRECTIONAL AFE and DC-DC CONVERTER CRD-22AD12N & CRD-22DD12N**
- **25KW ACTIVE FRONT END (AFE) CRD25AD12N-FMC**

**FEATURES**

- Low $R_{DS(on)}$ over temperature
- Fast, rugged intrinsic body diode
- High Temperature Operation (TJ=175°C)
- Very high speed switching capability
- Wide range of $R_{DS(on)}$

**BENEFITS**

- Lowest possible switching and conduction losses
- Minimizes system heat-sink requirement
- Enables high power density designs
- Easier to drive (+15V gate drive)
- Lowers overall system BOM cost

**SYSTEM SPECS**

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Blocking Voltage</th>
<th>$R_{DS(on)}$ at 25°C</th>
<th>Current Rating at 25°C</th>
<th>Package</th>
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<td>115 A</td>
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</table>
**650V SILICON CARBIDE MOSFETs**

**THE INDUSTRY’S LOWEST ON-STATE RESISTANCE AND SWITCHING LOSSES**

Wolfspeed is proud to offer our 3rd-Generation 650V MOSFETs, enabling smaller, lighter, and highly-efficient power conversion in an even wider range of power systems.

The 650V MOSFET product family is ideal for applications including high performance industrial power supplies, server/telecom power, electric vehicle charging systems, energy storage systems, uninterruptible power supplies, and battery management systems.

**FEATURED DESIGN TOOLS**

- **2.2kW High Efficiency**
  (80+ Titanium) Bridgeless Totem-Pole PFC
  CRD-02AD065N

- **6.6kW High Frequency**
  DC-DC Converter
  CRD-066000D065N

- **6.6kW High Power Density Bi-Directional EV On-Board Charger**
  CRD-06600FF065N

- **Buck-Boost Evaluation Kit for Wolfspeed 650V SiC MOSFETs**
  KIT-CRD-3DD065P

**FEATURES**
- Low $R_{DS(ON)}$ over Temperature
- Low Device Capacitances
- Kelvin Source Pin
- High Temperature Operation ($T_J = 175^\circ\text{C}$)
- Fast Diode with ultra low reverse recovery

**BENEFITS**
- Improves System Efficiency with lower conduction losses
- Enables high switching frequency operation
- Improves System Level Power Density
- Reduces System Size, Weight, and Cooling Requirements
- Enables new hard switching topologies (Totem-Pole PFC)

**APPLICATIONS**
- Industrial Power Supplies
- Server/Telecom
- EV-Charging Systems
- Energy Storage Systems (ESS)
- Uninterruptible Power Supplies (UPS)
- Battery Management Systems (BMS)

**SYSTEM SPECS**

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Blocking Voltage</th>
<th>$R_{DS(ON)}$ at 25°C</th>
<th>Current Rating at 25°C</th>
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<td>650 V</td>
<td>120 mΩ</td>
<td>21 A</td>
<td>TO-263-7</td>
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</table>
AUTOMOTIVE SiC PRODUCTS

Wolfspeed continues to lead in silicon carbide with our E-Series line of SiC MOSFETs and Schottky diodes. The portfolio is fully automotive qualified and PPAP capable, and adds superior resistance to humidity to our already rugged technology, enabling the lowest switching losses and highest figures of merit in the most demanding applications. These devices are optimized for use in EV battery chargers and high-voltage DC/DC converters, and are featured in Wolfspeed’s 6.6kW bi-directional on-board charger reference design.

FEATURES
Automotive qualified (AEC-Q101) and PPAP capable
Low MOSFET $R_{DS(on)}$ and Schottky Diode $V_f$ over temperature
Fast intrinsic diode with low reverse recovery ($Q_{rr}$)
Low forward voltage in diodes ($V_f$)

BENEFITS
High-voltage, high-temperature, and high-humidity resistance
Improves system efficiency with lower conduction losses
Enables high switching frequency operation
Enables high-reliability operation

APPLICATIONS
Drivetrain traction inverters
Onboard EV battery chargers
PV inverters
High voltage DC/DC converters

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Blocking Voltage</th>
<th>Current Rating at 25°C</th>
<th>Package</th>
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<th>Current Rating at 25°C</th>
<th>Package</th>
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<td>900 V</td>
<td>120 mΩ</td>
<td>22 A</td>
<td>TO-247-3</td>
</tr>
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</table>
900V SILICON CARBIDE MOSFETs

WOLFSPEED SILICON CARBIDE SOLUTIONS FOR FAST SWITCHING POWER DEVICES

Wolfspeed’s 900V SiC MOSFETs offer low inductance in low inductance discrete packages with wide creepage and clearance distance between drain and source (~8mm). These MOSFETs take advantage of the high-frequency capability of the latest technology chips while providing extra electrical isolation suitable for high pollution environments. The separate Kelvin source pin reduces inductance, which reduces switching losses by as much as 30%. Designers can reduce component-count by moving from silicon-based, three-level topologies to simpler two-level topologies made possible by the improved switching performance.

FEATURED DESIGN TOOLS

Evaluation Board for 900V SiC C3M™ MOSFET in a 7-pin D2PAK (TO-263-7L) Kit-CRD-8FF90P

FEATURES

- Low R\(_{\text{DS(on)}}\) over Temperature
- Low-impedance package
- Fast intrinsic diode with low reverse recovery (Qrr)
- Kelvin source pin

BENEFITS

- Improves system efficiency with lower conduction losses
- Enables high switching frequency operation
- Reduces system size, weight, and cooling requirements
- Enables new hard switching topologies (Totem-Pole PFC)

APPLICATIONS

- Motor Drive
- EV Charging Systems
- Uninterruptible Power Supply (UPS)
- Battery management systems
- Fast EV-Charging Systems
- Welding

### FEATURES

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Blocking Voltage</th>
<th>R(_{\text{DS(on)}}) at 25°C</th>
<th>Current Rating at 25°C</th>
<th>Package</th>
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<td>900 V</td>
<td>65 mΩ</td>
<td>36 A</td>
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<td>C3M0120090D</td>
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<td>900 V</td>
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<td>11.5 A</td>
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</table>
1000V SILICON CARBIDE MOSFETs

WOLFSPEED SILICON CARBIDE SOLUTIONS FOR FAST SWITCHING POWER DEVICES

The 1000V SiC MOSFETs address many power design challenges by providing a unique device with low on-resistance, very low output capacitance, and low source inductance for a perfect blend of low switching losses and low conduction losses.

Wolfspeed’s 1000V SiC MOSFETs are optimized for fast switching devices such as electric-vehicle charging systems, industrial power supplies, and renewable energy systems.

FEATURED DESIGN TOOLS

FEATURES
- Low $R_{D(ON)}$ over Temperature
- High-speed switching with low output capacitance
- Fast intrinsic diode with low reverse recovery (Qrr)
- Kelvin source pin

BENEFITS
- Enables a reduction in overall system cost
- Improves system efficiency while decreasing system-size
- Enables hard switching topologies
- Enables high switching frequency operation

APPLICATIONS
- Industrial Power Supplies
- Renewable energy systems
- EV-Charging Systems
- Fast electric vehicle charging systems
- Onboard electric vehicle charging

<table>
<thead>
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<th>Blocking Voltage</th>
<th>$R_{D(ON)}$ at 25°C</th>
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<th>Package</th>
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<td>TO-263-7</td>
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<tr>
<td>C3M0065100K</td>
<td>1000 V</td>
<td>65 mΩ</td>
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<td>1000 V</td>
<td>65 mΩ</td>
<td>35 A</td>
<td>TO-263-7</td>
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</table>

SILICON CARBIDE MOSFETs
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FEATURED DESIGN TOOLS

FEATURES
- Low $R_{D(ON)}$ over Temperature
- High-speed switching with low output capacitance
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- Kelvin source pin

BENEFITS
- Enables a reduction in overall system cost
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APPLICATIONS
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- Renewable energy systems
- EV-Charging Systems
- Fast electric vehicle charging systems
- Onboard electric vehicle charging

<table>
<thead>
<tr>
<th>Part Number</th>
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<td>C3M0120100K</td>
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<td>65 mΩ</td>
<td>35 A</td>
<td>TO-247-4</td>
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<tr>
<td>C3M0065100J</td>
<td>1000 V</td>
<td>65 mΩ</td>
<td>35 A</td>
<td>TO-263-7</td>
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</table>
SILICON CARBIDE MOSFETs

Wolfspeed’s 1700V SiC MOSFETs enable smaller and more efficient power conversion systems. Compared to silicon-based solutions, Wolfspeed silicon carbide technology enables increased system power density, higher switching frequencies, smaller designs, cooler components, reduced size of components like inductors, capacitors, filters & transformers, and overall cost benefits.

FEATURED DESIGN TOOLS

FEATURES
- High blocking voltage with low $R_{DS(on)}$
- High speed switching with low capacitances
- Fast intrinsic diode with low reverse recovery (Qrr)
- Low parasitic inductance
- ~8mm creepage and clearance distance

BENEFITS
- Higher system efficiency
- Increased system switching frequency
- Enables hard-switching topologies
- Separate Kelvin source pin lowers source inductance and provides up to 30% lower switching losses
- Robust isolation with wide creepage and clearance distance between drain and source

APPLICATIONS
- Auxiliary power supplies
- Switch mode power supplies
- Power inverters
- 1500V solar inverters
- High voltage DC-DC converters
- Motor drives
- Pulsed power applications

WIDE INPUT VOLTAGE RANGE (300 VDC – 1200 VDC) 15W FLYBACK AUXILIARY POWER SUPPLY BOARD CRD-15DD17P

FEATURED DESIGN TOOLS

**SYSTEM SPECS**

WIDE INPUT VOLTAGE RANGE (300 VDC – 1200 VDC) 15W FLYBACK AUXILIARY POWER SUPPLY BOARD CRD-15DD17P

<table>
<thead>
<tr>
<th>Part Number</th>
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Wolfspeed’s 6th generation SiC Schottky diode family offers the lowest forward voltage drop ($V_f = 1.27 \text{ V} @25^\circ\text{C}$), which significantly reduces conduction losses. This reduction enables extremely high system level efficiency and power density in the most demanding power conversion applications, such as Power Factor Correction (PFC) and High Voltage DC/DC Converters.

**FEATURES**
- Low $V_f = 1.27 \text{ V} @25^\circ\text{C}$
- Positive Temperature Co-efficient
- Zero Reverse Recovery
- Robust MPS Technology
- Low Figure of Merit ($Q_c \times V_f$)
- Wide range of $T_J$ (-55°C to 175°C)
- Standard TO-220 package

**BENEFITS**
- Improved System Level Efficiency
- High Surge Current Capability
- High Frequency Operation
- Direct Drop in Replacement of C3D
- Easy Parallel Operation
- Reduced Heat Sink Requirements

**APPLICATIONS**
- Server/Telecom
- Uninterruptible Power Supplies (UPS)
- Medical
- Consumer Electronics
- Industrial Power Supplies
- Solar Energy Systems

---

### SYSTEM SPECS

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### E-Series

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EXPERIENCE THE BENEFITS OF SiC IN YOUR AUTOMOTIVE OR SOLAR APPLICATION

Wolfspeed’s E-Series diodes are specifically designed to be robust and reliable in the harshest environments. As a result, the E-Series diodes are the industry’s first 1200V SiC diodes to be automotive qualified and high-humidity/high-voltage/high-temperature tested. The E-Series family of diodes are ideal for on-board and off-board automotive charger applications and solar power inversion.

FEATURED DESIGN TOOLS

60kW INTERLEAVED BOOST CONVERTER
CRD-60DD12N

DIODE FAMILY

FEATUR ES

- 1200-Volt Schottky Rectifier
- Zero Forward and Reverse Recovery
- High-Frequency Operation
- Temperature-Independent Switching Behavior
- Extremely Fast Switching
- Positive temperature coefficient on $V_f$

BENEFITS

- Reduces system size, weight, and cooling requirements
- Increased power density
- Improved system efficiency at high switching frequencies
- Parallel mode operation possible

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## MODULES

**WOLFSPEED IS SERIOUS ABOUT POWER MODULES** - PROVIDING THE MOST EXTENSIVE LINEUP OF MODULES TO DATE, SERVING INDUSTRIAL, HARSH ENVIRONMENT, AND MOBILITY MARKETS.

Wolfspeed’s vertical integration (from SiC material to packaging) enables us to provide leading SiC technology throughout the supply chain. Our power modules are designed to meet each customer’s system design requirements with a package that offers best-in-class SiC performance. We offer two distinct product categories to serve different customer value propositions: Industry-Standard Footprints and Optimized Footprints.

### FEATURED FOOTPRINTS

*Refer to page 2 for product line up

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*DC Current at Tc = 90 °C. ; **Not recommended for any new customer designs.

Curious about these parts? Reach out to your local Cree Sales representative for information about sampling and availability.
Wolfspeed’s latest power modules enable multiple configurations across power levels for electric vehicle fast charging, industrial power, UPS, induction heating and welding, industrial motor drive, power supply, solar and renewable energy and grid infrastructure applications.

**Dynamic Characterization Evaluation Tool Optimized for the Wolfspeed WolfPACK Half-Bridge Module Platform**

Wolfspeed’s KIT-CRD-CIL12N-FMA is a dynamic characterization tool that can be used to evaluate and optimize switching performance of Wolfspeed’s WolfPACK SiC half-bridge power modules. A clamped inductive load (CIL) test circuit with current measurement provides a high speed, low inductance test fixture for double pulse testing. This test fixture in conjunction with a choice of gate driver boards options allows measurement of: Timing (TDelay-On, TDelay-Off, TRise, TFall), Overshoot (VDS-Max, ID-Max), Speed (di/dt, dv/dt) Switching Loss (EON, EOFF, ERR).

**Evaluation Tool Matrix**

<table>
<thead>
<tr>
<th>Wolfspeed WolfPACK™</th>
<th>Dynamic Characterization Evaluation Tool</th>
<th>Differential Transceiver Evaluation Tool</th>
<th>Silicon Labs® Gate Driver Board</th>
<th>Analog Devices® Gate Driver Board</th>
<th>Wolfspeed Gate Driver Board (Design Only)</th>
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**CAS-BM2** | **CAB-BM3** | **CAS-BM3** | **WAB-BM3**
---|---|---|---
Robust, Reliable Wolfspeed SiC Performance? | ✓ | ✓ | ✓ | ✓
Latest Gen3 MOSFET Technology? | ✓ | ✓ | ✓ | ✓
Materials Optimized for Industrial Operating Conditions? | ✓ | ✓ | ✓ | ✓
Devices Optimized for Humidity Robustness? | ✓ | ✓ | ✓ | ✓
Reduced SiC Device Area (includes only MOSFETs)? | ✓ | ✓ | ✓ | ✓
Minimization of Switching Losses? | ✓ | ✓ | | ✓
Materials Optimized for Sustained High Junction Temperature Operation? | | | | ✓
Commercial Part Numbers
*Not Yet Commercial, Planned Products Only with Limited Samples
CAS120M12BM2
CAS300M12BM2
CAS300M17BM2
CAB530M12BM3
CAB530M12BM3*
CAB175M12BM3*
CAS530M12BM3*
CAS350M12BM3*
CAS175M12BM3*
WAB400M12BM3
WAB300M12BM3

**MODULE PLATFORM**

**WOLFSPEED’S 62MM HALF-BRIDGE SiC MODULES SUPPORT RAPID SYSTEM DEVELOPMENT**

**PLATFORM BENEFITS:**
- Second and Third Generation MOSFET Technology Available
- Industry-Standard 62mm Footprint
- Fast Time-to-Market with Existing 62mm Compatible Designs
- Low Inductance (10-11 nH) Design
- Expanded Portfolio Offering Solutions to Meet Demands of Industrial & Harsh Environment Operating Conditions

**MODULE SIZE:**
106 x 62 x 30 (mm)

**TOPOLOGY:**
Half-Bridge

**TARGETED APPLICATIONS:**
Industrial Automation & Testing, Railway & Traction, EV Charging Infrastructure, Power Supplies (UPS), Renewable-Energy Systems & Grid-Tied Inverters

**SUPPORTING GATE DRIVER:**
CGD1200HB2P-BM2, -BM3

**SUPPORTING EVALUATION KIT:**
KIT-CRD-CIL12N-BM

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**SUPPORTING GATE DRIVER:**
CGD1200HB2P-BM2, -BM3

**SUPPORTING EVALUATION KIT:**
KIT-CRD-CIL12N-BM
WOLFSPEED’S XM3 HALF-BRIDGE SiC MODULES ARE DESIGNED FOR POWER DENSITY

PLATFORM BENEFITS:
- Implements Third Generation MOSFET Technology (Frequency and Conduction Optimized Configurations Available)
- High Power Density Footprint
- High Temperature (175 °C) Operation
- Low Inductance (6.7 nH) Design
- Offset Terminal Layout Simplifies Bus Bar Design
- Integrated Temperature Sensing
- Dedicated Drain-Kelvin Pin
- Silicon Nitride Insulator and Copper Baseplate

TARGETED APPLICATIONS:
- Motor and Traction Drives, UPS, EV Chargers, Industrial Automation and Testing, Power Supplies

SUPPORTING GATE DRIVER:
- CGD12HBXMP

SUPPORTING EVALUATION KIT:
- KIT-CRD-CIL12N-XM3

SUPPORTING REFERENCE DESIGNS:
- CRD---DA12E-XM3 Inverters

MODULE SIZE: TOPOLOGY:
- 80 x 53 x 19 (mm) Half-Bridge

Module Gate Driver Boards

<table>
<thead>
<tr>
<th>SKU</th>
<th>Package</th>
<th>Designed By</th>
<th>Working Voltage</th>
<th>Gate Driver</th>
<th>Output Channels</th>
</tr>
</thead>
<tbody>
<tr>
<td>CGD1700HB2M-UNA</td>
<td>FM3, GM3</td>
<td>Wolfspeed</td>
<td>1200 V</td>
<td>Texas Instruments UCC21710</td>
<td>2</td>
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<tr>
<td>EVAL-ADUM4146WHB1Z</td>
<td>FM3, GM3</td>
<td>Partner</td>
<td>1200 V</td>
<td>Analog Devices AduM4146</td>
<td>2</td>
</tr>
<tr>
<td>Si823H-AxWA-KIT</td>
<td>FM3, GM3</td>
<td>Partner</td>
<td>1200 V</td>
<td>Silicon Labs Si823Hx</td>
<td>2</td>
</tr>
<tr>
<td>CGD1700HB3P-HM3</td>
<td>HM High Performance 62 mm</td>
<td>Wolfspeed</td>
<td>1500 V</td>
<td>IXDD614YY</td>
<td>2</td>
</tr>
<tr>
<td>CGD15HB62LP</td>
<td>HM High Performance 62 mm</td>
<td>Wolfspeed</td>
<td>1500 V</td>
<td>IXDD614YY</td>
<td>2</td>
</tr>
<tr>
<td>CGD1200HB2P-BM3</td>
<td>Standard 62mm (BMx)</td>
<td>Wolfspeed</td>
<td>1000 V</td>
<td>Analog Devices AduM4135</td>
<td>2</td>
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<tr>
<td>CGD1200HB2P-BM2</td>
<td>Standard 62mm (BMx)</td>
<td>Wolfspeed</td>
<td>1000 V</td>
<td>Analog Devices AduM4135</td>
<td>2</td>
</tr>
<tr>
<td>CGD12HBXMP</td>
<td>XM3</td>
<td>Wolfspeed</td>
<td>1000 V</td>
<td>Analog Devices AduM4135</td>
<td>2</td>
</tr>
<tr>
<td>CGD15FB45P1</td>
<td>45mm</td>
<td>Wolfspeed</td>
<td>1200 V</td>
<td>NA</td>
<td>6</td>
</tr>
</tbody>
</table>
START MODELING FOR YOUR DESIGN WITH SpeedFIT™

WELCOME TO SpeedFit 2.0

Welcome to SpeedFit 2.0, the industry’s most comprehensive system-level circuit simulator for silicon carbide power applications.

Accelerate the design process with simulation results you can trust. SpeedFit 2.0 quickly calculates losses and estimates junction temperature for power devices based on lab data for common topologies ranging from simple buck and boost converters to a fully bi-directional totem pole PFC with resonant DC/DC converter.

USING SpeedFIT 2.0, YOU CAN QUICKLY DETERMINE:

- The right product for an application
- Comparative performance for different devices
- How the performance with varies Rg
- How many devices need to be paralleled

KICKSTART YOUR DESIGN

Choose your Application

Converter Type
(AC-DC, DC-DC, DC-AC)

No. of AC phases
(1, 3)

Input Design Specifications

- Input voltage
- Output voltage
- Rated output power \( P_o \)
- AC frequency \( F_{ac} \)
- Switching frequency \( F_{sw} \)
- Deadtime

Select Circuit Type

- Buck-boost converter
- LLC resonant converter
- Phase shift full bridge converter etc.

Input Design Specifications

- Select the device from recommended products list
- Number of devices to be paralleled

Input Thermal Management Specs

- Cooling System
- Thermal interface resistance \( R_{th,ci} \)
- Heatsink temperature \( T_h \)
- Thermal resistance \( R_{th,ha} \)
- Heatsink time constant \( t_{ha} \)
- Additional heat source on heatsink \( P_{add} \)
- Ambient temperature \( T_{amb} \)

Simulate

- Comparative performance for different devices
- Choose the right product for your application

EXPLORE SPEEDFIT 2.0 AT WOLFSPEED.COM/SPEEDFIT
EVALUATION KITS

Wolfspeed understands that system designers want to perform characterization in their own labs when working with a new product. To help reduce design resource investment and enable fast characterization of our products, Wolfspeed offers a wide array of Evaluation Kits to help you better understand the capability of our silicon carbide discrete and module packages.

Wolfspeed partners with component manufacturers to provide our customers with access to the widest selection of and the latest system components. Our Partner Evaluation Kits are developed and supported by our partners in collaboration with Wolfspeed.

<table>
<thead>
<tr>
<th>Name*</th>
<th>Topology</th>
<th>Package</th>
<th>SKU</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evaluation Board for 650V SiC C3™ MOSFET in a 7-pin D2PAK (TO-263-7L)</td>
<td>Dynamic Characterization</td>
<td>TO-263-7</td>
<td>KIT-CRD-8FF65P</td>
</tr>
<tr>
<td>Evaluation Board for 900V SiC C3™ MOSFET in a 7-pin D2PAK (TO-263-7L)</td>
<td>Dynamic Characterization</td>
<td>TO-263-7</td>
<td>KIT-CRD-8FF90P</td>
</tr>
<tr>
<td>Evaluation Tool for the XM3 Module Platform</td>
<td>AC to DC, Dynamic Characterization</td>
<td>XM3</td>
<td>KIT-CRD-CIL12N-XM3</td>
</tr>
<tr>
<td>Dynamic Characterization Evaluation Tool Optimized for the 62mm (BM) Module Platform</td>
<td>Dynamic Characterization</td>
<td>BM2, BM3 (62mm)</td>
<td>KIT-CRD-CIL12N-BM</td>
</tr>
<tr>
<td>Buck-Boost Evaluation Kit for Wolfspeed 650 V SiC MOSFETs</td>
<td>DC to DC, Dynamic Characterization</td>
<td>TO-247-3, TO-247-4</td>
<td>KIT-CRD-3DD065P</td>
</tr>
<tr>
<td>Buck Boost Evaluation Board</td>
<td>DC to DC, Dynamic Characterization</td>
<td>TO-247-3, TO-247-4</td>
<td>KIT-CRD-3DD12P</td>
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</tbody>
</table>

*All of these Evaluation kits are designed by Wolfspeed

TO LEARN MORE, VISIT US AT WOLFSPEED.COM/POWER
Wolfspeed offers time-saving Reference Designs for some of the most in-demand silicon carbide devices in power systems – Inverters, power converters, chargers and many more. These Reference Designs come complete with application notes, user guides and design files to allow designers to create rugged and reliable systems with best-in-class power density, performance and efficiency. Wolfspeed partners with experts in system integration to offer a wider selection of applications and power topologies built with the latest components. Our Partner reference Designs are developed and supported by our partners in collaboration with Wolfspeed. Hardware Design Files, System and Mechanical Design Files, Firmware are available with these reference designs.

### 600 kW XM3 High Performance Dual Three-Phase Inverter

**Topology:**
AC to DC

**Package:**
XM3

CRD600DA12E-XM3

- Optimized for Wolfspeed’s All-SiC, Low Inductance, Conduction Optimized XM3 Power Module
- Complete Stackup, including: Modules, Cooling, Bussing, Gate Drivers, Voltage / Current Sensors, and Controller

**Specifications:**
- DC Bus voltage: 800 V nominal, 900 V maximum
- Switching frequency: 80 kHz maximum
- DC Link capacitance: 600 µF
- Double-sided liquid cold plate
- CAN interface
- Single Bridge Operation
- 360 Arms output current
- Parallel Bridge Operation
- 720 Arms output current

### 25kW SiC Active Front End (AFE)

**Topology:**
AC to DC

**Package:**
FM3

CRD25AD12N-FMC

This reference design demonstrates the application of Wolfspeed’s WolfPACK™ power modules to create a bidirectional high power density Active Front End (AFE) that can be applied to electric vehicle (EV) fast charging, industrial motor drives, power supplies and renewable energy applications.

**Specifications:**
- Three Phase input voltage between 400 and 480 VAC
- Output Voltage of 800V DC/ 900V Max
- Output Power: 25 kW with 480 VAC input and 20 kW with 400 VAC input
- Switching frequency of 100KHz
- Controller board design and firmware example
- Auxiliary Circuitry Included for Safe Operation: Pre Charge Soft Start, Contactors, Fuses and EMI/EMC Filter
- Complete Stackup Including: Modules, Heatsink, Magnetics, Power PCBs, Gate Drivers, Voltage / Current Sensors, and Controller
22kW Bi-directional High Efficiency Active Front End (AFE) Converter

**Topology:**
AC to DC

**Package:**
TO-247-4
CRD-22AD12N

This reference design demonstrates the application of Wolfspeed’s 1200V C3M™ SiC MOSFETs to create a 22kW three phase bidirectional active front end (AFE) converter for electric vehicle (EV) on-board charger (OBC), off-board fast charging, and other industrial applications such as energy storage systems and three phase PFC power supplies.

**Specifications:**
- Switching Frequency: 45kHz
- Toolied heatsink to simulate cooling plate
- CAN interface

**PFC Mode**
- Max current: 32A
- Three Phase Input Voltage: 305Vrms → 450Vrms line-line 50/60Hz
- Output DC Voltage: 650V → 900V, Max power 22kW
- Single Phase Input Voltage: 180Vrms → 264Wms 50/60Hz
- Output DC Voltage: 380V → 900V, Max power 6.6kW

**Inverter Mode**
- DC Input Voltage: 350V → 760V DC
- Max current: 20A
- AC Output Voltage: 230Vrms 50Hz single phase
- Max power: 6.6kW

22kW Bi-directional High Efficiency DC/DC Converter

**Topology:**
DC to DC

**Package:**
TO-247-4
CRD-22DD12N

The design accomplishes peak efficiencies of 98.5% in both charging and discharging mode power densities of 8kW/L. This reference design is offered as a comprehensive design package which can be used as a starting point for new SiC designs.

**Specifications:**
- Full bridge CLLC resonant converter operating at 135-250kHz
- Toolied heatsink to simulate cooling plate
- CAN interface

**Charging Mode**
- Input Voltage: 380V-900V DC
- Output Voltage: 480V-800V DC Nominal. System capable of 200V-800V DC
- At Vin=650V-900V DC , Output Power: 22kW , Output current: 36A
- At Vin=380V-900V DC , Output Power: 6.6kW , Output current: 26.4A

**Discharging Mode**
- Input Voltage: 300V-800V DC
- Output Voltage: 360V-750V DC Nominal
- Output Power: 6.6kW, Output current: 19A

6.6 kW High Frequency DC-DC Converter

**Topology:**
DC to DC

**Package:**
TO-247-3
CRD-06600DD065N

**Specifications:**
- Input Voltage: 380VDC → 420VDC
- Output Voltage 400VDC
- Max current: 16.5A
- Output Power: 6.6kW
- Switching Frequency: 500kHz – 1 MHz
- Closed loop control for regulated output
- Optional external PWM inputs for open loop testing
6.6 kW High Power Density Bi-Directional EV On-Board Charger

**Topology:**
AC to DC, DC to AC  
**Package:**
TO-247-3  
CRD-06600FF065N

This reference design is offered as a comprehensive design package which can be used as a starting point for new SiC designs. The design accomplishes: Peak efficiencies of 96.5% and power densities of 53W/in^3 or 3KW/L.

**Specifications:**
- Universal single phase input voltage between 90V and 265V  
- Output Voltage of 250V-450V DC  
- 18A Output Current in charging mode  
- Front End AC/DC PFC using CCM Totem-Pole Bi-Directional Topology operating at 67Khz  
- Bi-Directional DC/DC CLLC resonant converter operating at 148-300KHz  
- Constant Current, Constant Voltage or Constant Power Mode  
- Unique integrated heatsink design removes heat from MOSFET’s, transformer and inductors  
- CAN Interface

300kW, 250kW & 200kW XM3 Three-Phase Inverter

**Topology:**
AC to DC, DC to DC, DC to AC  
**Package:**
XM3  
CRD200DA12E-XM3  
CRD250DA12E-XM3  
CRD300DA12E-XM3

Highly efficient and low cost solution of 2.2 kW bridgeless totem-pole PFC topology based on Cree’s latest (C3M™) 650 V 60 mΩ SiC MOSFETs. Comfortably achieve Titanium standard by having > 98.5% efficiency while THD < 4% under all load conditions.

**Specifications:**
- Parameters Values Note  
- Input voltage range, 47-63Hz 180-264V (rms)  
- Output voltage 385V nominal +/- 5%  
- Output power  
- 2,200 W At 230V AC  
- 1,500 W (limited by thermal) At 180V AC  
- Input power factor >.98  
- Input THD at full load <5% (of fundamental)  
- Switching frequency 64kHz  
- Efficiency at 50% load >98.5%  
- Max ambient operating temperature 50 °C  
- Cooling Forced air, 15x40mm Fan  
- Topology Totem pole Diode as LF switch  
- Power devices package TO-247-3, TO-247-4, TO-263-7

2.2 kW High Efficiency (80+ Titanium) Bridgeless Totem-Pole PFC with SiC MOSFET

**Topology:**
AC to DC  
**Package:**
TO-247-3, TO-247-4, TO-263-7  
CRD-02AD065N

Highly efficient and low cost solution of 2.2 kW bridgeless totem-pole PFC topology based on Cree’s latest (C3M™) 650 V 60 mΩ SiC MOSFETs. Comfortably achieve Titanium standard by having > 98.5% efficiency while THD < 4% under all load conditions.

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- 1,500 W (limited by thermal) At 180V AC  
- Input power factor >.98  
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- Switching frequency 64kHz  
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- Max ambient operating temperature 50 °C  
- Cooling Forced air, 15x40mm Fan  
- Topology Totem pole Diode as LF switch  
- Power devices package TO-247-3, TO-247-4, TO-263-7
60 kW Interleaved Boost Converter

**Topology:**
DC to DC

**Package:**
TO-247-4

**Specifications:**
- Demonstration of new 1200 V, 75 mΩ C3M™ SiC MOSFET and its parallel operation in a 60 kW Interleaved Boost Converter
- CRD-60DD12N

---

Wide Input Voltage Range (300 VDC – 1200 VDC) 15W Flyback Auxiliary Power Supply Board

**Topology:**
AC to DC, DC to DC

**Package:**
TO-263-7

**Specifications:**
- Demonstration of the efficient operation of Cree’s 1700 V, 1Ω SiC MOSFET with an availability of high blocking voltage and high creepage distance (~7mm)
- CRD-15DD17P

---

6.6 kW Bi-Directional EV On-Board Charger

**Topology:**
AC to DC, DC to AC

**Package:**
TO-247-4

**Specifications:**
- Demonstration of 1000 V, 65 mΩ C3M™ SiC MOSFET in a 6.6 kW Bi-Directional EV On-Board Charger
- CRD-06600FF10N

---

20 kW full bridge LLC resonant converter using 1kV SiC MOSFET

**Topology:**
DC to DC

**Package:**
TO-247-4

**Specifications:**
- Input Voltage: 650 – 750 VDC
- Output Voltage: 300 – 550 VDC
- Switching Frequency: 150-400 kHz
- Continuous Output Power: 20kW
- Pk. Efficiency: >98.4%
- Power Density: 60W Cu/in
As a vertically integrated company, Wolfspeed owns all steps in the silicon carbide production process, allowing us to push the technology forward quickly.

Wolfspeed invented the silicon carbide MOSFET, and has the world's largest install base of SiC devices. With a best-in-class failure-in-time (FIT) rate, Wolfspeed’s is consistently in the single digits at 5-per-billion device hours, illustrating the industry-leading reliability and performance of the company’s SiC devices.

**ACCESS TO WORLD-LEADING UNPACKAGED MOSFETs AND DIODES RANGING FROM 650V TO 1700V**

TO LEARN MORE ABOUT WOLFSPEED SiC BARE DIE MOSFETs AND DIODES, GO TO WOLFSPEED.COM/BAREDIE
NOBODY KNOWS SiC POWER DEVICES LIKE WOLFSPEED.
WE’RE GLAD TO SHARE WHAT WE KNOW, AND WE LOVE TALKING ABOUT THIS STUFF. VISIT WOLFSPEED.COM TO CONNECT WITH THE SiC EXPERTS.