

# Silicon Carbide (SiC) Schottky Diode – EliteSiC, 50 A, 1200 V, D1, Die

## PCFFS50120AF

### Description

Silicon Carbide (SiC) Schottky Diodes use a completely new technology that provides superior switching performance and higher reliability compared to Silicon. No reverse recovery current, temperature dependent switching characteristics, and excellent thermal performance sets Silicon Carbide as the next generation of power semiconductor. System benefits include highest efficiency, faster operation frequency, increased power density, reduced EMI, and reduced system size and cost.

### Features

- Max Junction Temperature 175°C
- Avalanche Rated 441 mJ
- High Surge Current Capacity
- Positive Temperature Coefficient
- Ease of Paralleling
- No Reverse Recovery/No Forward Recovery

### Applications

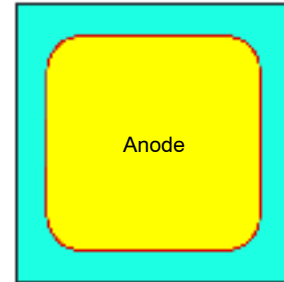
- General Purpose
- SMPS, Solar Inverter, UPS
- Power Switching Circuits

### Die Information

- Wafer Diameter: 6 inch
- Die Size: 4,500 × 4,500 μm (include Scribe Lane)
- Metallization:
  - ◆ Top Ti/TiN/AlCu 4 μm
  - ◆ Back Ti/NiV/Ag
- Die Thickness: Typ. 200 μm
- Bonding Pad Size
  - ◆ Anode 3,920 × 3,920 μm
- Recommended Wire Bond (Note 1)
  - ◆ Anode: 20 mil × 3

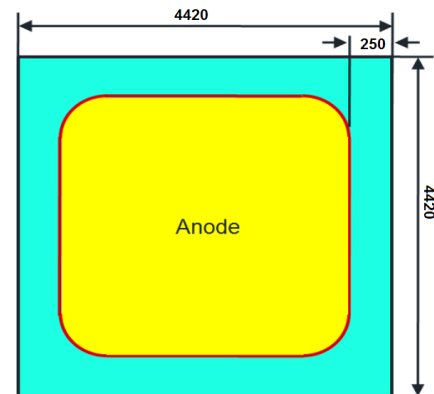
### NOTE:

1. Based on TO-247 package of onsemi.



### DIE LAYOUT

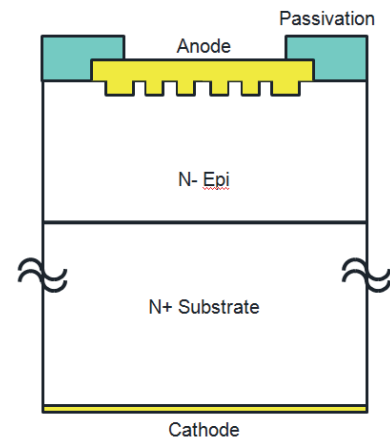
(Dimension: μm, Except Scribe Lane)



### Passivation Information

- Passivation Material: Polyimide (PSPI)
- Passivation Type: Local Passivation
- Passivation Thickness: 90KA

### CROSS SECTION



### ORDERING INFORMATION

| Part Number  | Package | Die Size                                  |
|--------------|---------|-------------------------------------------|
| PCFFS50120AF | N/A     | 4,500 x 4,500 μm<br>(Include Scribe Lane) |

# PCFFS50120AF

## ELECTRICAL CHARACTERISTICS ON WAFER ( $T_C = 25^\circ\text{C}$ unless otherwise noted) (Note 2)

| Symbol | Parameter                | Test Condition                                      | Min  | Typ | Max  | Unit          |
|--------|--------------------------|-----------------------------------------------------|------|-----|------|---------------|
| $V_R$  | Reverse Blocking Voltage | $I_R = 200\ \mu\text{A}$ , $T_C = 25^\circ\text{C}$ | 1200 | –   | –    | V             |
| $V_F$  | Forward Voltage          | $I_F = 50\ \text{A}$ , $T_C = 25^\circ\text{C}$     | 1.20 | –   | 1.75 | V             |
| $I_R$  | Reverse Current          | $V_R = 1200\ \text{V}$ , $T_C = 25^\circ\text{C}$   | –    | –   | 200  | $\mu\text{A}$ |

2. Tested 100% on wafer.

### The Configuration of Chips (Based on 6" Wafer)

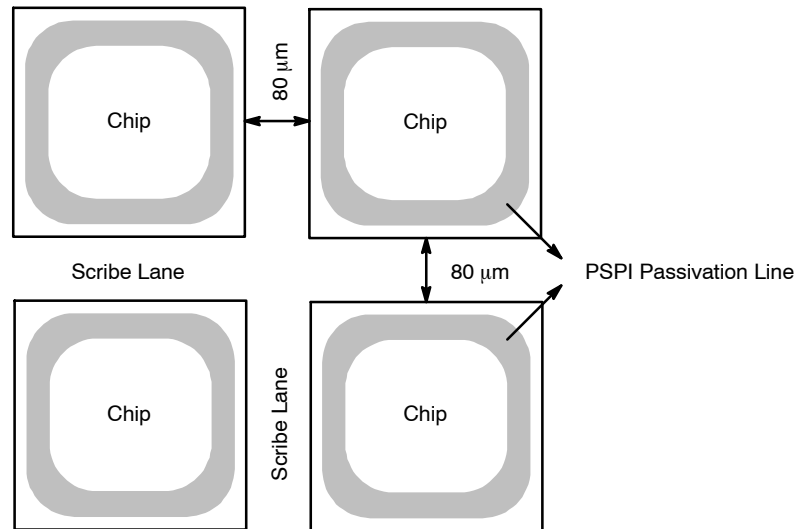


Figure 1. Saw-on-film Frame Packing Based on Tested Wafer

# PCFFS50120AF

## ABSOLUTE MAXIMUM RATINGS (T<sub>C</sub> = 25°C unless otherwise noted)

| Symbol                            | Parameter                                                     | FFSH50120A                               | Unit |
|-----------------------------------|---------------------------------------------------------------|------------------------------------------|------|
| V <sub>RRM</sub>                  | Peak Repetitive Reverse Voltage                               | 1200                                     | V    |
| E <sub>AS</sub>                   | Single Pulse Avalanche Energy (Note 3)                        | 441                                      | mJ   |
| I <sub>F</sub>                    | Continuous Rectified Forward Current @ T <sub>C</sub> < 155°C | 50                                       | A    |
|                                   | Continuous Rectified Forward Current @ T <sub>C</sub> < 135°C | 77                                       |      |
| I <sub>F, Max</sub>               | Non-Repetitive Peak Forward Surge Current                     | T <sub>C</sub> = 25°C, 10 μs             | A    |
|                                   |                                                               | T <sub>C</sub> = 150°C, 10 μs            | A    |
| I <sub>F, SM</sub>                | Non-Repetitive Forward Surge Current                          | Half-Sine Pulse, t <sub>p</sub> = 8.3 ms | A    |
| I <sub>F, RM</sub>                | Repetitive Forward Surge Current                              | Half-Sine Pulse, t <sub>p</sub> = 8.3 ms | A    |
| P <sub>tot</sub>                  | Power Dissipation                                             | T <sub>C</sub> = 25°C                    | W    |
|                                   |                                                               | T <sub>C</sub> = 150°C                   | W    |
| T <sub>J</sub> , T <sub>STG</sub> | Operating and Storage Temperature Range                       | -55 to +175                              | °C   |
|                                   | TO247 Mounting Torque, M3 Screw                               | 60                                       | Ncm  |

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

3. E<sub>AS</sub> of 441 mJ is based on starting T<sub>J</sub> = 25°C, L = 0.5 mH, I<sub>AS</sub> = 42 A, V = 50 V.

## THERMAL CHARACTERISTICS

| Symbol           | Parameter                                 | Value | Unit |
|------------------|-------------------------------------------|-------|------|
| R <sub>θJC</sub> | Thermal Resistance, Junction to Case, Max | 0.17  | °C/W |

## ELECTRICAL CHARACTERISTICS (T<sub>J</sub> = 25°C unless otherwise noted)

| Symbol         | Parameter               | Test Condition                                  | Min | Typ  | Max  | Unit |
|----------------|-------------------------|-------------------------------------------------|-----|------|------|------|
| V <sub>F</sub> | Forward Voltage         | I <sub>F</sub> = 50 A, T <sub>C</sub> = 25°C    | –   | 1.45 | 1.75 | V    |
|                |                         | I <sub>F</sub> = 50 A, T <sub>C</sub> = 125°C   | –   | 1.7  | 2.0  |      |
|                |                         | I <sub>F</sub> = 50 A, T <sub>C</sub> = 175°C   | –   | 2    | 2.4  |      |
| I <sub>R</sub> | Reverse Current         | V <sub>R</sub> = 1200 V, T <sub>C</sub> = 25°C  | –   | –    | 200  | μA   |
|                |                         | V <sub>R</sub> = 1200 V, T <sub>C</sub> = 125°C | –   | –    | 300  |      |
|                |                         | V <sub>R</sub> = 1200 V, T <sub>C</sub> = 175°C | –   | –    | 400  |      |
| Q <sub>C</sub> | Total Capacitive Charge | V = 800 V                                       | –   | 252  | –    | nC   |
| C              | Total Capacitance       | V <sub>R</sub> = 1 V, f = 100 kHz               | –   | 2560 | –    | pF   |
|                |                         | V <sub>R</sub> = 400 V, f = 100 kHz             | –   | 234  | –    |      |
|                |                         | V <sub>R</sub> = 800 V, f = 100 kHz             | –   | 190  | –    |      |

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

**TYPICAL CHARACTERISTICS**  
( $T_J = 25^\circ\text{C}$  UNLESS OTHERWISE NOTED)

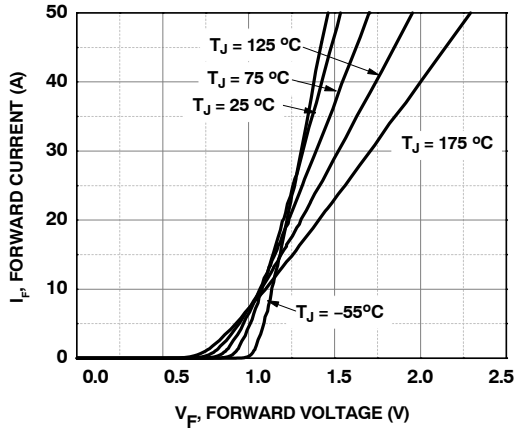


Figure 2. Forward Characteristics

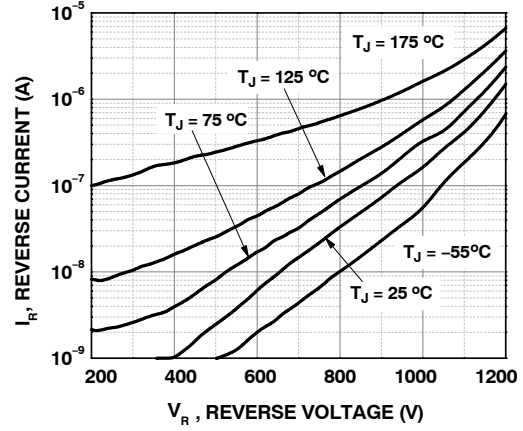


Figure 3. Reverse Characteristics

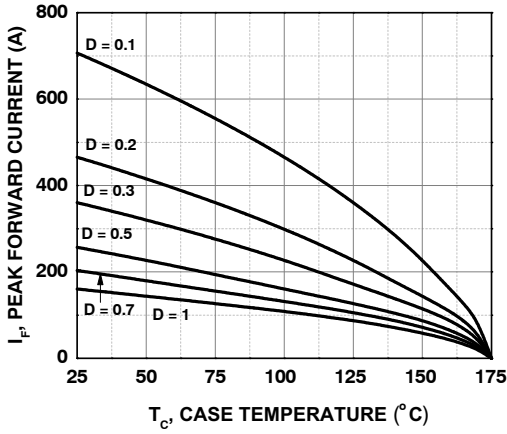


Figure 4. Current Derating

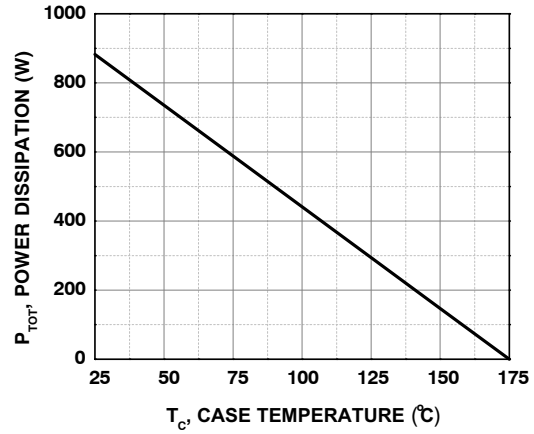


Figure 5. Power Derating

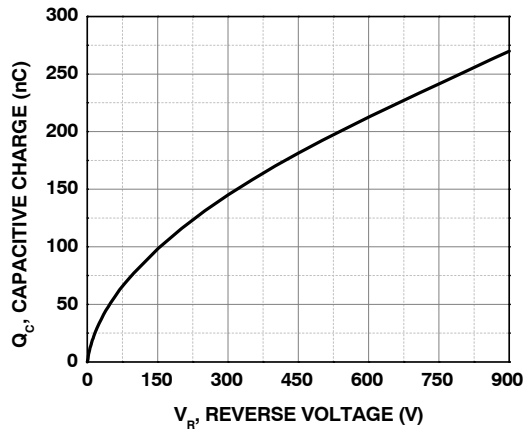


Figure 6. Capacitive Charge vs. Reverse Voltage

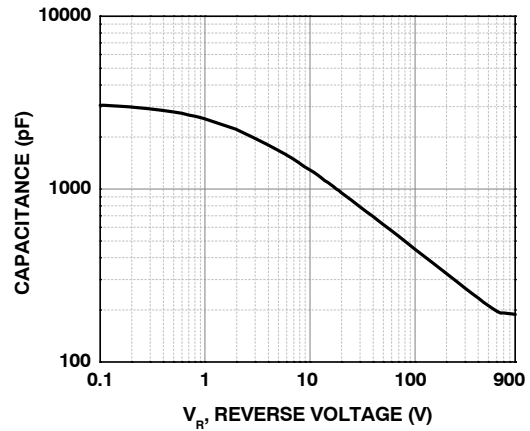


Figure 7. Capacitive vs. Reverse Voltage

# TYPICAL CHARACTERISTICS

( $T_J = 25^{\circ}\text{C}$  UNLESS OTHERWISE NOTED)

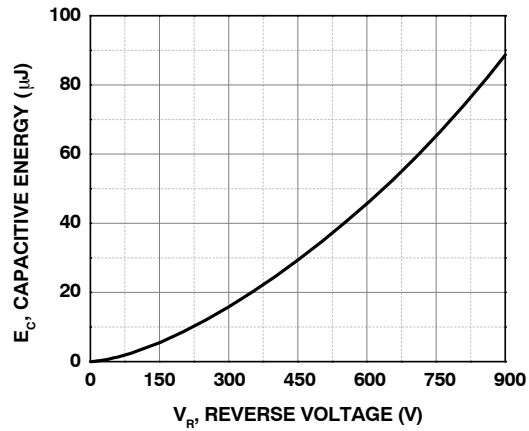


Figure 8. Capacitance Stored Energy

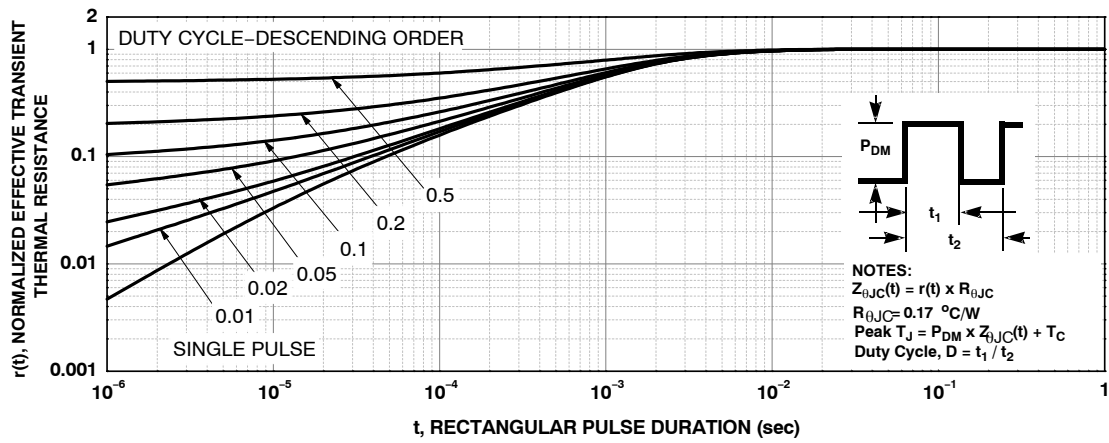


Figure 9. Junction-to-Case Transient Thermal Response Curve

TEST CIRCUIT AND WAVEFORMS

$L = 0.5 \text{ mH}$   
 $R < 0.1 \Omega$   
 $V_{DD} = 50 \text{ V}$   
 $E_{AVL} = 1/2 L I_L^2 [V_{R(AVL)} / (V_{R(AVL)} - V_{DD})]$   
 $Q1 = \text{IGBT (} BV_{CES} > \text{DUT } V_{R(AVL)} \text{)}$

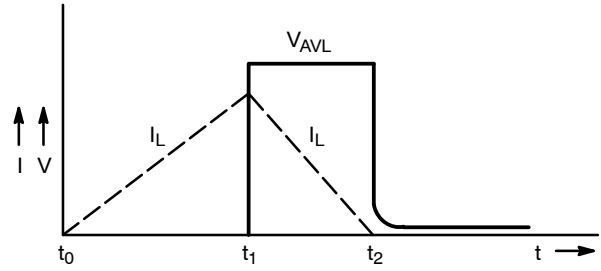
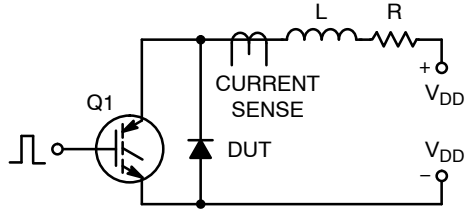


Figure 10. Unclamped Inductive Switching Test Circuit & Waveform

**onsemi**, **Onsemi**, and other names, marks, and brands are registered and/or common law trademarks of Semiconductor Components Industries, LLC dba "**onsemi**" or its affiliates and/or subsidiaries in the United States and/or other countries. **onsemi** owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of **onsemi**'s product/patent coverage may be accessed at [www.onsemi.com/site/pdf/Patent-Marking.pdf](http://www.onsemi.com/site/pdf/Patent-Marking.pdf). **onsemi** reserves the right to make changes at any time to any products or information herein, without notice. The information herein is provided "as-is" and **onsemi** makes no warranty, representation or guarantee regarding the accuracy of the information, product features, availability, functionality, or suitability of its products for any particular purpose, nor does **onsemi** assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using **onsemi** products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by **onsemi**. "Typical" parameters which may be provided in **onsemi** data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. **onsemi** does not convey any license under any of its intellectual property rights nor the rights of others. **onsemi** products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use **onsemi** products for any such unintended or unauthorized application, Buyer shall indemnify and hold **onsemi** and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that **onsemi** was negligent regarding the design or manufacture of the part. **onsemi** is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

## ADDITIONAL INFORMATION

### TECHNICAL PUBLICATIONS:

Technical Library: [www.onsemi.com/design/resources/technical-documentation](http://www.onsemi.com/design/resources/technical-documentation)  
onsemi Website: [www.onsemi.com](http://www.onsemi.com)

### ONLINE SUPPORT: [www.onsemi.com/support](http://www.onsemi.com/support)

For additional information, please contact your local Sales Representative at  
[www.onsemi.com/support/sales](http://www.onsemi.com/support/sales)