

# Silicon Carbide (SiC) Schottky Diode – EliteSiC, 40 A, 1200 V, D1, Die

## PCFFS40120AF

### 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 420 mJ
- High Surge Current Capacity
- Positive Temperature Coefficient
- Ease of Paralleling
- No Reverse Recovery/No Forward Recovery

### Applications

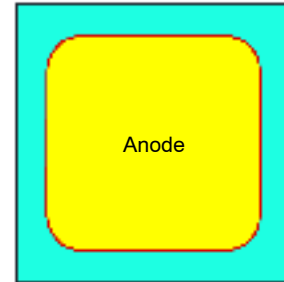
- General Purpose
- SMPS, Solar Inverter, UPS
- Power Switching Circuits

### Die Information

- Wafer Diameter: 6 inch
- Die Size: 4,200 × 4,200 μm (include Scribe Lane)
- Metallization:
  - ◆ Top Ti/TiN/AlCu 4 μm
  - ◆ Back Ti/NiV/Ag
- Die Thickness: Typ. 200 μm
- Bonding Pad Size
  - ◆ Anode 3,620 × 3,620 μm
- Recommended Wire Bond (Note 1)
  - ◆ Anode: 20 mil × 3

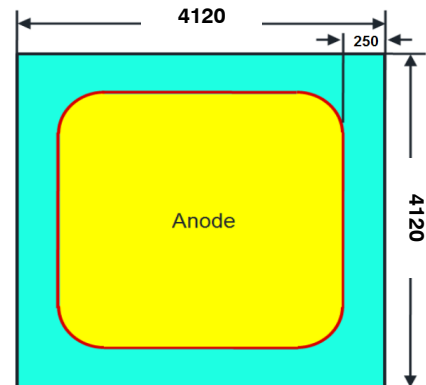
### NOTE:

1. Based on TO-247 package of onsemi.



### DIE LAYOUT

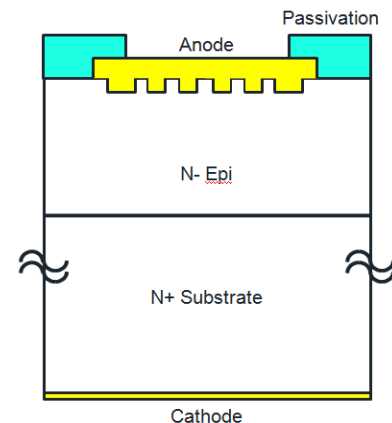
(Dimension: μm, Except Scribe Lane)



### Passivation Information

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

### CROSS SECTION



### ORDERING INFORMATION

Part Number	Package	Die Size
PCFFS40120AF	N/A	4,200 x 4,200 μm (Include Scribe Lane)

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## 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	$I_F = 40\ \text{A}$ , $T_C = 25^\circ\text{C}$	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)

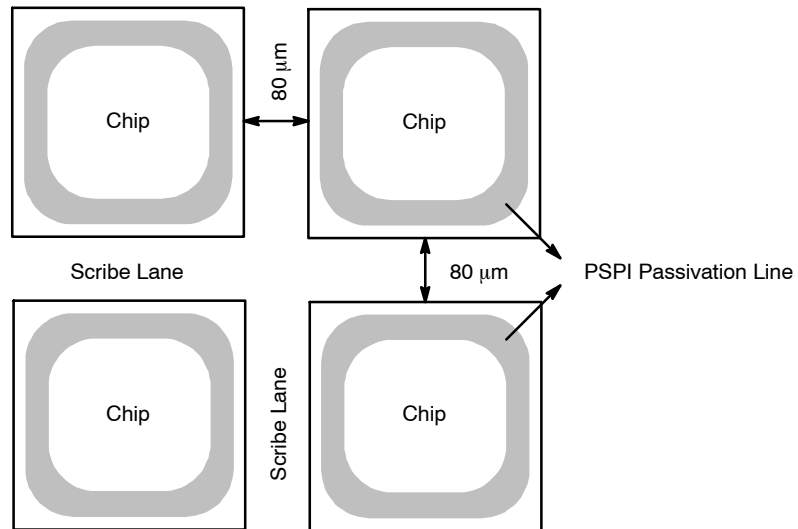


Figure 1. Saw-on-film Frame Packing Based on Tested Wafer

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

Symbol	Parameter	Value	Unit
V <sub>RRM</sub>	Peak Repetitive Reverse Voltage	1200	V
E <sub>AS</sub>	Single Pulse Avalanche Energy (Note 3)	420	mJ
I <sub>F</sub>	Continuous Rectified Forward Current @ T <sub>C</sub> < 155°C	40	A
	Continuous Rectified Forward Current @ T <sub>C</sub> < 135°C	61	
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 420 mJ is based on starting T<sub>J</sub> = 25°C, L = 0.5 mH, I<sub>AS</sub> = 41 A, V = 50 V.

## THERMAL CHARACTERISTICS

Symbol	Parameter	Value	Unit
R <sub>θJC</sub>	Thermal Resistance, Junction to Case, Max	0.22	°C/W

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

Symbol	Parameter	Test Condition	Min	Typ	Max	Unit
V <sub>F</sub>	Forward Voltage	I <sub>F</sub> = 40 A, T <sub>C</sub> = 25°C	–	1.45	1.75	V
		I <sub>F</sub> = 40 A, T <sub>C</sub> = 125°C	–	1.7	2.0	
		I <sub>F</sub> = 40 A, T <sub>C</sub> = 175°C	–	2.0	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	–	220	–	nC
C	Total Capacitance	V <sub>R</sub> = 1 V, f = 100 kHz	–	2250	–	pF
		V <sub>R</sub> = 400 V, f = 100 kHz	–	204	–	
		V <sub>R</sub> = 800 V, f = 100 kHz	–	169	–	

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

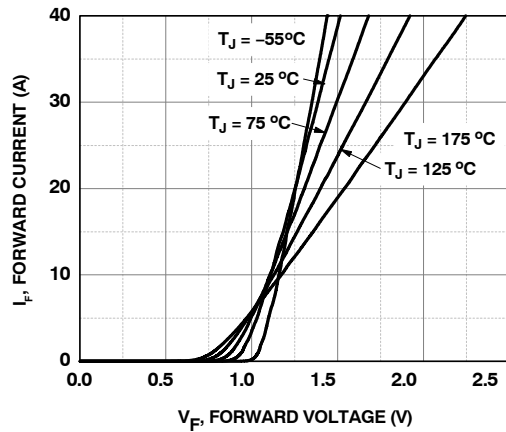
(T<sub>J</sub> = 25°C UNLESS OTHERWISE NOTED)

Figure 2. Forward Characteristics

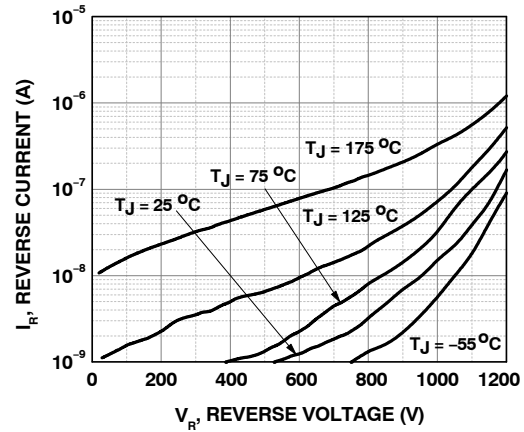


Figure 3. Reverse Characteristics

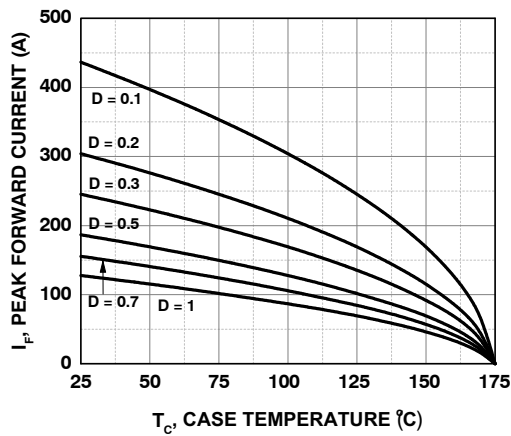


Figure 4. Current Derating

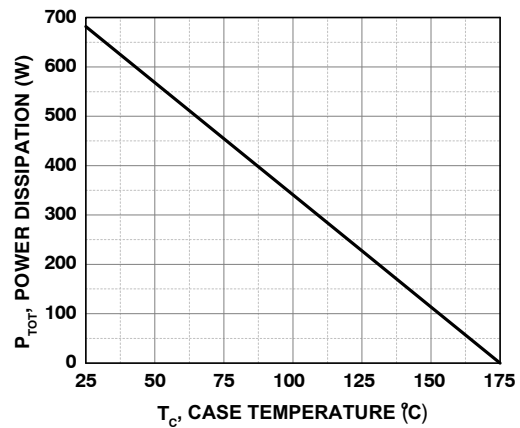


Figure 5. Power Derating

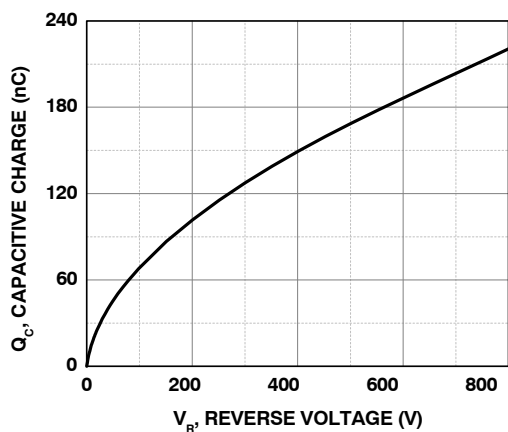


Figure 6. Capacitive Charge vs. Reverse Voltage

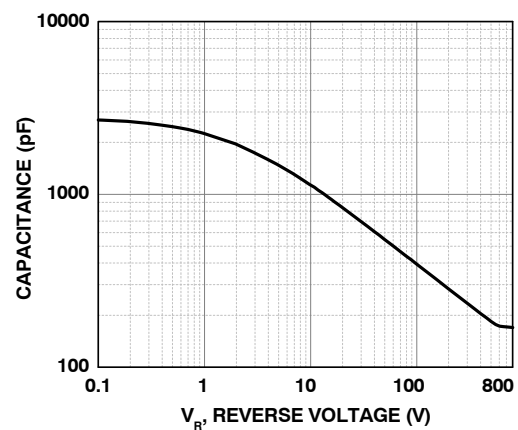


Figure 7. Capacitance vs. Reverse Voltage

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

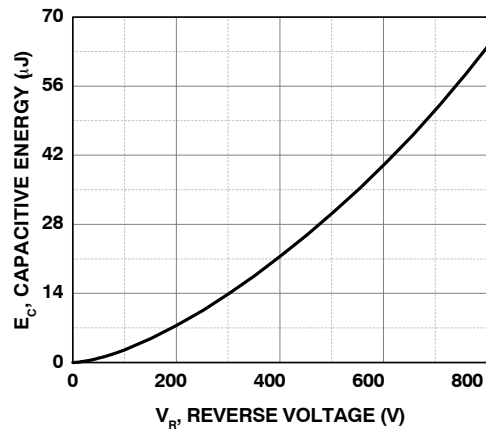


Figure 8. Capacitance Stored Energy

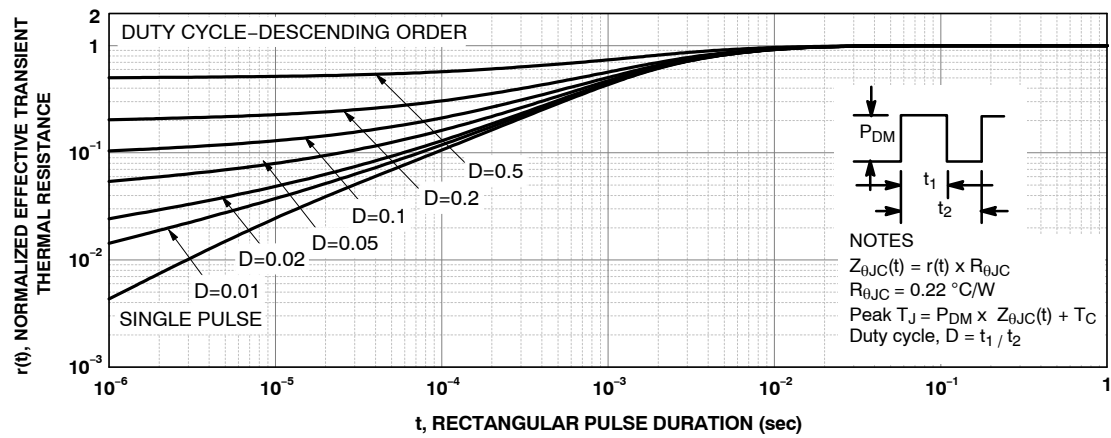


Figure 9. Junction-to-Case Transient Thermal Response Curve

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## TEST CIRCUIT AND WAVEFORMS

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

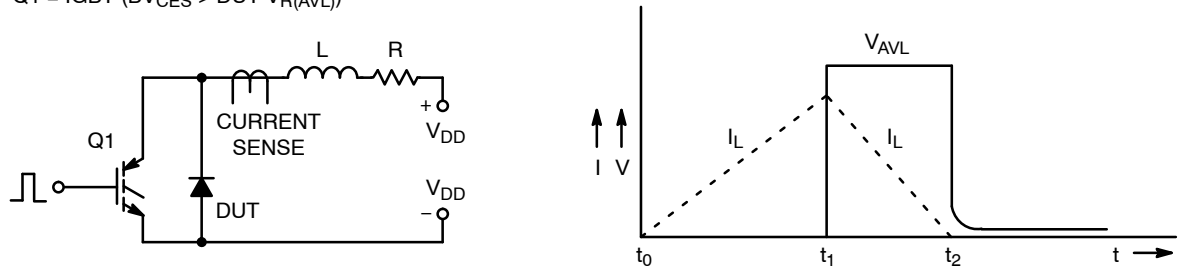


Figure 10. Unclamped Inductive Switching Test Circuit & Waveform

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