

# FFS50120AF-DIE

## Silicon Carbide Schottky Diode

1200 V, 50 A

### 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

### ELECTRICAL CHARACTERISTICS ON WAFER (T<sub>C</sub> = 25°C unless otherwise noted) (Note 2)

Symbol	Parameter	Test Condition	Min	Typ	Max	Unit
V <sub>R</sub>	Reverse Blocking Voltage	I <sub>R</sub> = 200 μA, T <sub>C</sub> = 25°C	1200	–	–	V
V <sub>F</sub>	Forward Voltage	I <sub>F</sub> = 50 A, T <sub>C</sub> = 25°C	1.20	–	1.75	V
I <sub>R</sub>	Reverse Current	V <sub>R</sub> = 1200 V, T <sub>C</sub> = 25°C	–	–	200	μA

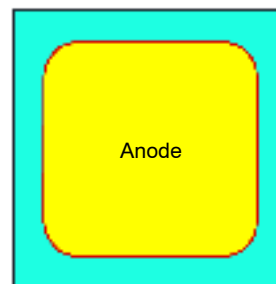
### NOTES:

1. Based on TO-247 package of ON Semiconductor.
2. Tested 100% on wafer.



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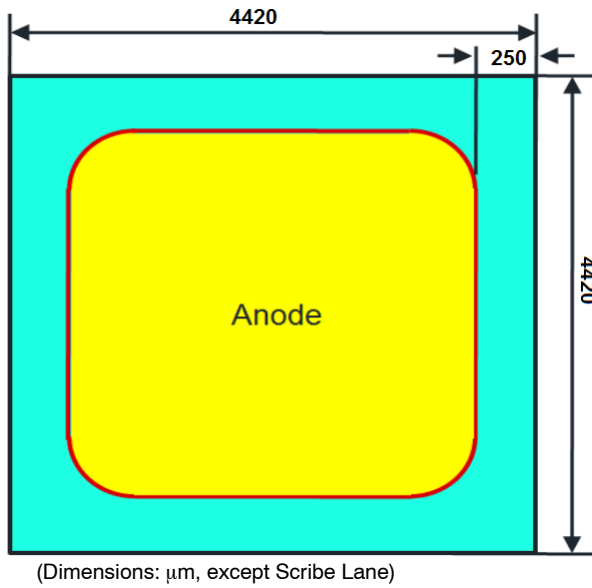


### ORDERING INFORMATION

See detailed ordering and shipping information on page 3 of this data sheet.

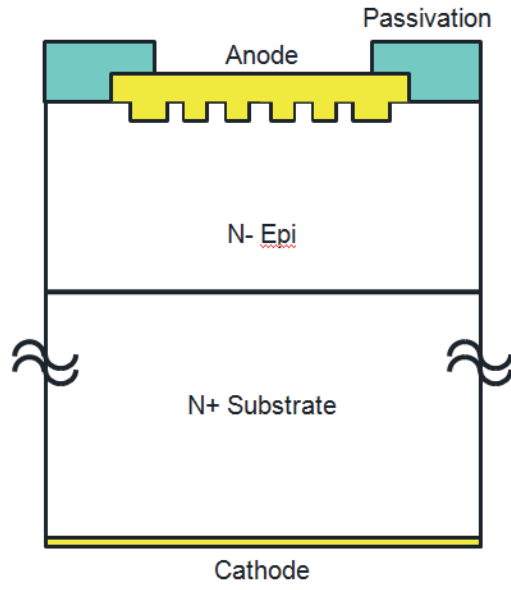
# FFS50120AF-DIE

**Die Layout**



**Figure 1. Die Layout**

**Cross Section**

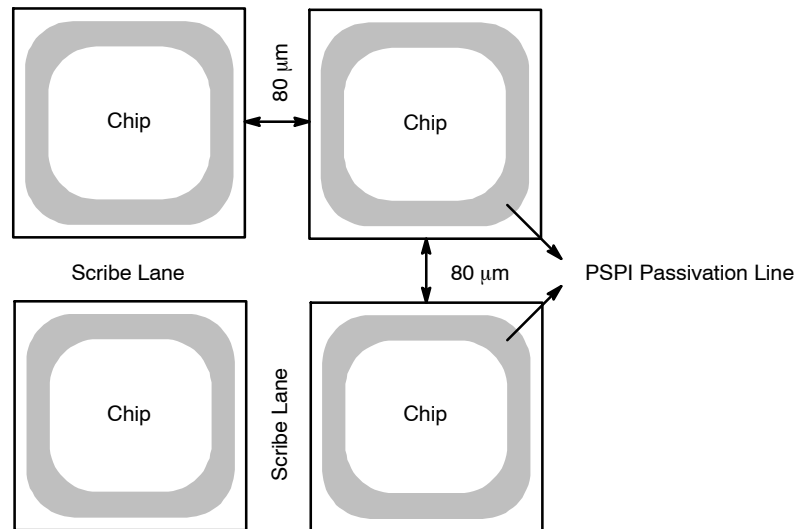


**Figure 2. Cross Section**

**Passivation Information**

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

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



**Figure 3. Saw-on-film Frame Packing Based on Tested Wafer**

# FFS50120AF-DIE

## 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	1700	A
		T <sub>C</sub> = 150°C, 10 μs	1600	A
I <sub>F, SM</sub>	Non-Repetitive Forward Surge Current	Half-Sine Pulse, t <sub>p</sub> = 8.3 ms	280	A
I <sub>F, RM</sub>	Repetitive Forward Surge Current	Half-Sine Pulse, t <sub>p</sub> = 8.3 ms	75	A
P <sub>tot</sub>	Power Dissipation	T <sub>C</sub> = 25°C	736	W
		T <sub>C</sub> = 150°C	147	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.

## ORDERING INFORMATION

Part Number	Top Marking	Package	Packing Method	Quantity
FFSH50120A	FFSH50120A	TO-247-2L	Tube	30 units

# FFS50120AF-DIE

## TYPICAL CHARACTERISTICS

( $T_J = 25^\circ\text{C}$  unless otherwise noted)

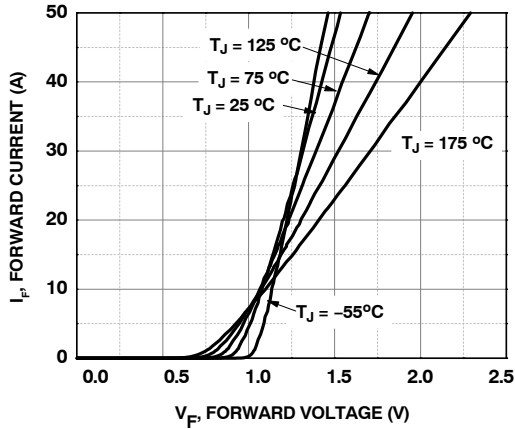


Figure 4. Forward Characteristics

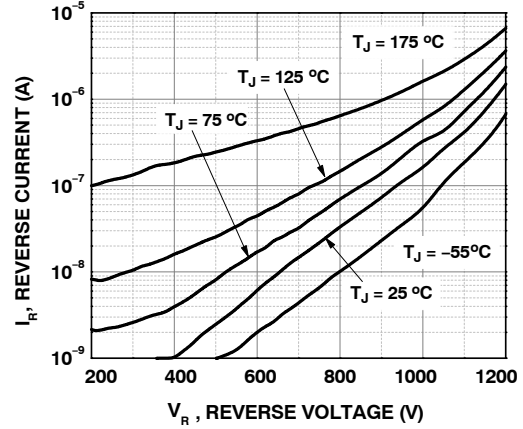


Figure 5. Reverse Characteristics

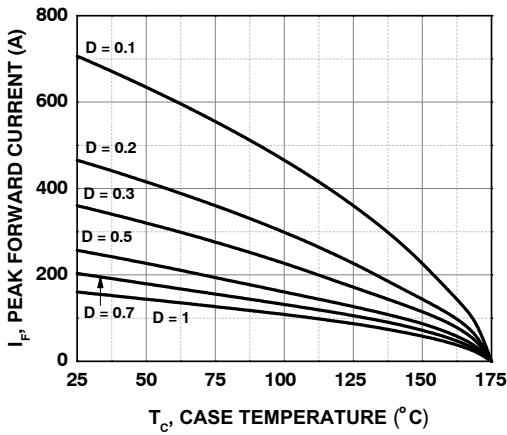


Figure 6. Current Derating

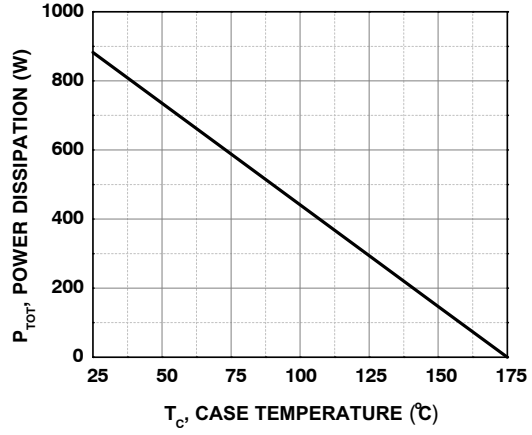


Figure 7. Power Derating

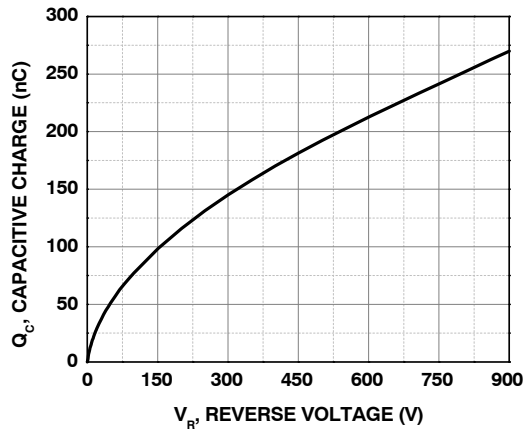


Figure 8. Capacitive Charge vs. Reverse Voltage

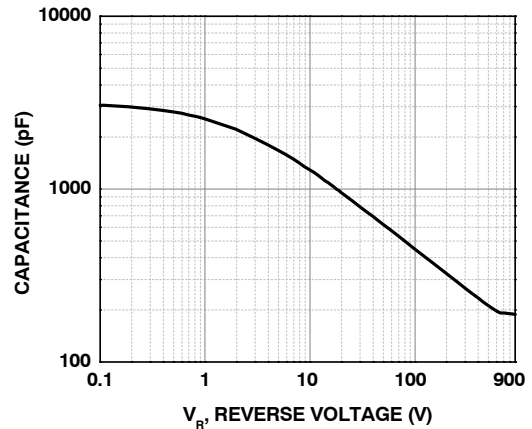


Figure 9. Capacitive vs. Reverse Voltage

# FFS50120AF-DIE

## TYPICAL CHARACTERISTICS

( $T_J = 25^\circ\text{C}$  unless otherwise noted)

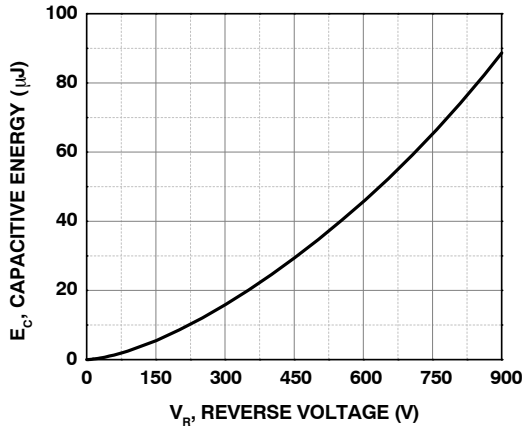


Figure 10. Capacitance Stored Energy

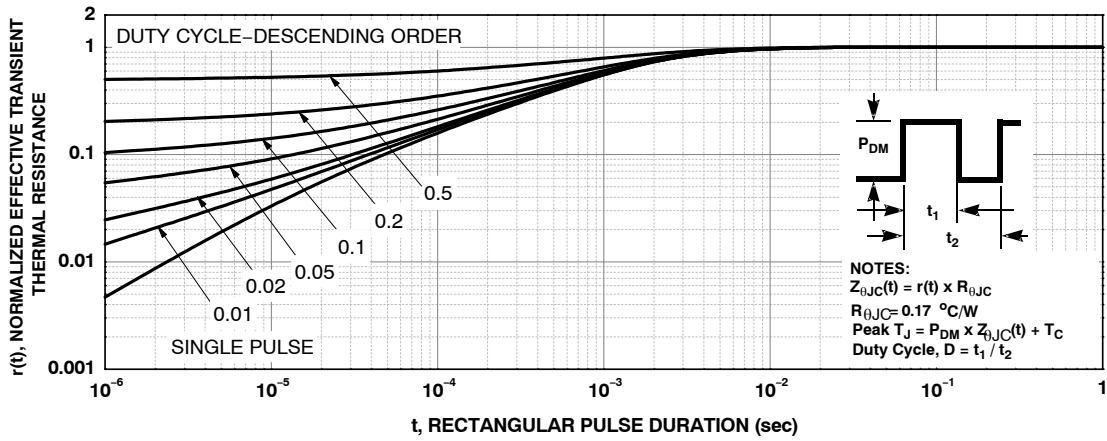


Figure 11. Junction-to-Case Transient Thermal Response Curve

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## TEST CIRCUIT AND WAVEFORMS

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

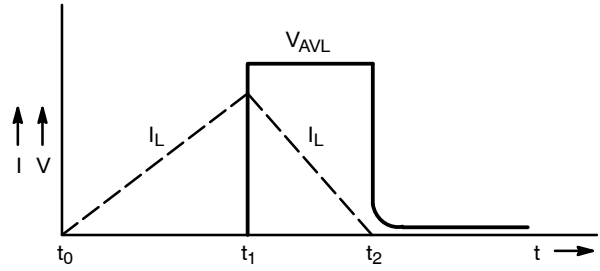
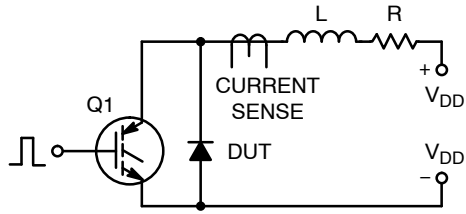


Figure 12. Unclamped Inductive Switching Test Circuit & Waveform

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