



# PCFFS50120AF

## Silicon Carbide Schottky Diode

### 1200 V, 50 A

#### 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

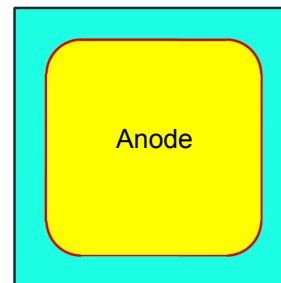
- General Purpose
- SMPS, Solar Inverter, UPS
- Power Switching Circuits

#### 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.

#### Die Information

- Wafer Diameter 6 inch
- Die Size 4,500 x 4,500  $\mu\text{m}$  (include Scribe Lane)
- Metallization
  - Top Ti / TiN / AlCu 4 $\mu\text{m}$
  - Back Ti/ NiV /Ag
- Die Thickness Typ. 200 $\mu\text{m}$
- Bonding Pad Size
  - Anode 3,920 x 3,920  $\mu\text{m}$
- Recommended Wire Bond (Note 1)
  - Anode 20mil x3



#### Electrical Characteristics on Wafer <sup>(Note 2)</sup> $T_C = 25^\circ\text{C}$ unless otherwise noted.

Symbol	Parameter	Test Conditions	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	$\mu\text{A}$

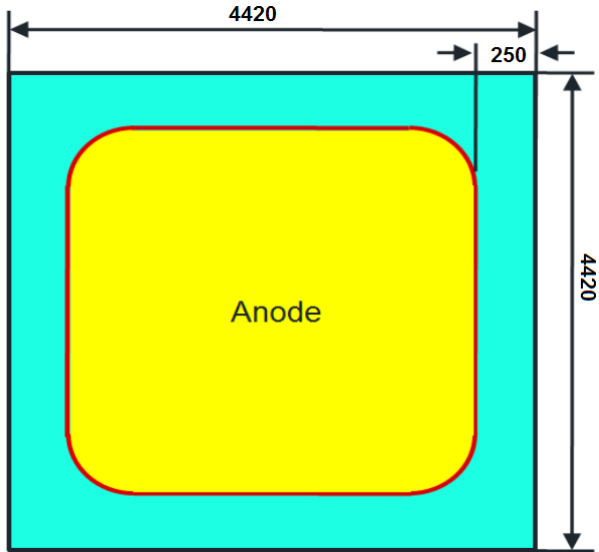
#### Notes:

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

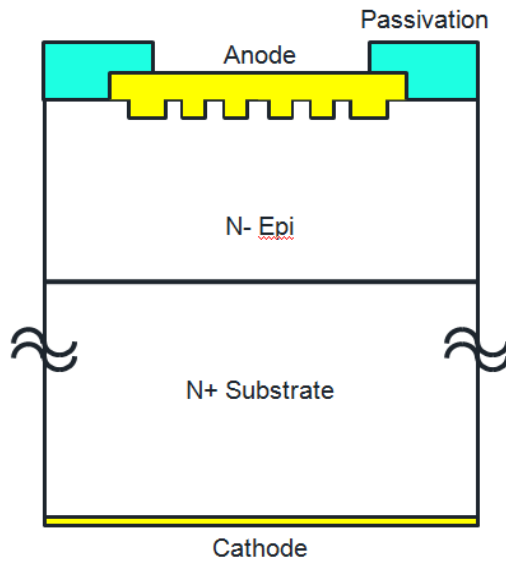
#### For Additional Product Information and Electrical Characteristics on Package

Refer to *FFSH50120A* product datasheet.

**Die Layout** (Dimension:  $\mu\text{m}$ , except Scribe Lane)



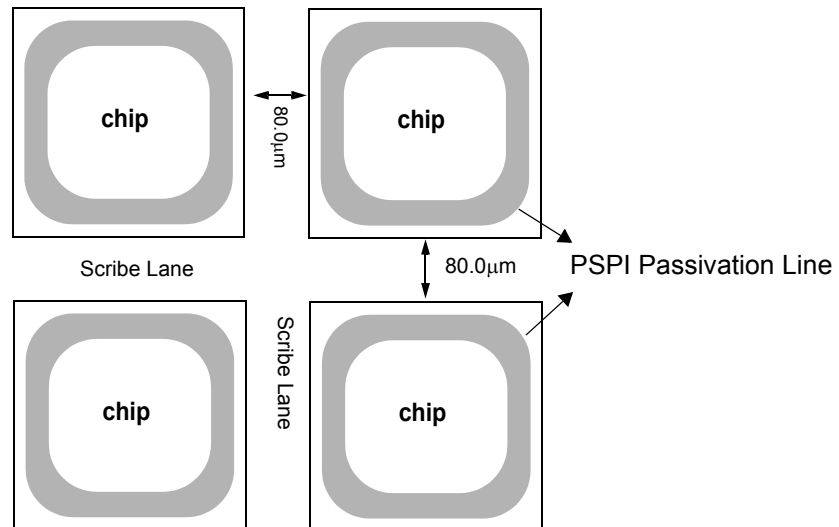
**Cross Section**



**Passivation Information**

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

**The Configuration of chips** (Based on 6 inch wafer)



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# FFSH50120A

## Silicon Carbide Schottky Diode

### 1200 V, 50 A

#### Features

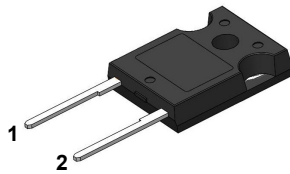
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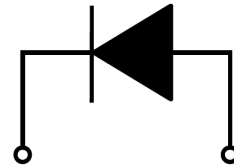
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TO-247-2L



1. Cathode

2. Anode

#### Absolute Maximum Ratings $T_C = 25\text{ °C}$ unless otherwise noted.

Symbol	Parameter	FFSH50120A	Unit	
$V_{RRM}$	Peak Repetitive Reverse Voltage	1200	V	
$E_{AS}$	Single Pulse Avalanche Energy (Note 1)	441	mJ	
$I_F$	Continuous Rectified Forward Current @ $T_C < 155\text{ °C}$	50	A	
	Continuous Rectified Forward Current @ $T_C < 135\text{ °C}$	77	A	
$I_{F, Max}$	Non-Repetitive Peak Forward Surge Current	$T_C = 25\text{ °C}$ , 10 $\mu$ s	1700	A
		$T_C = 150\text{ °C}$ , 10 $\mu$ s	1600	A
$I_{F, SM}$	Non-Repetitive Forward Surge Current	Half-Sine Pulse, $t_p = 8.3\text{ ms}$	280	A
$I_{F, RM}$	Repetitive Forward Surge Current	Half-Sine Pulse, $t_p = 8.3\text{ ms}$	75	A
$P_{tot}$	Power Dissipation	$T_C = 25\text{ °C}$	736	W
		$T_C = 150\text{ °C}$	147	W
$T_J, T_{STG}$	Operating and Storage Temperature Range	-55 to +175	°C	
	TO247 Mounting Torque, M3 Screw	60	Ncm	

#### Thermal Characteristic

Symbol	Parameter	Rating	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case, Max	0.17	°C/W

**Package Marking and Ordering Information**

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
FFSH50120A	FFSH50120A	TO-247-2L	Tube	N/A	N/A	30 units

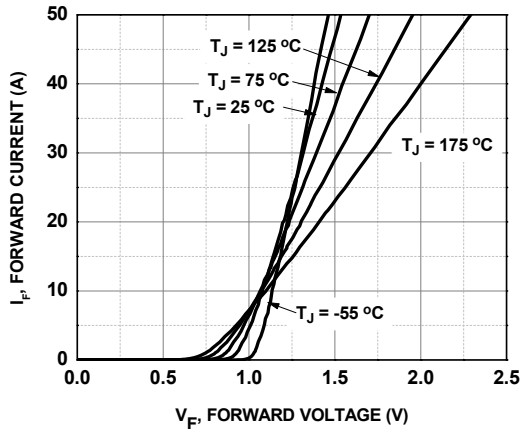
**Electrical Characteristics**  $T_C = 25\text{ }^\circ\text{C}$  unless otherwise noted.

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_F$	Forward Voltage	$I_F = 50\text{ A}, T_C = 25\text{ }^\circ\text{C}$	-	1.45	1.75	V
		$I_F = 50\text{ A}, T_C = 125\text{ }^\circ\text{C}$	-	1.7	2	
		$I_F = 50\text{ A}, T_C = 175\text{ }^\circ\text{C}$	-	2	2.4	
$I_R$	Reverse Current	$V_R = 1200\text{ V}, T_C = 25\text{ }^\circ\text{C}$	-	-	200	$\mu\text{A}$
		$V_R = 1200\text{ V}, T_C = 125\text{ }^\circ\text{C}$	-	-	300	
		$V_R = 1200\text{ V}, T_C = 175\text{ }^\circ\text{C}$	-	-	400	
$Q_C$	Total Capacitive Charge	$V = 800\text{ V}$	-	252	-	nC
C	Total Capacitance	$V_R = 1\text{ V}, f = 100\text{ kHz}$	-	2560	-	pF
		$V_R = 400\text{ V}, f = 100\text{ kHz}$	-	234	-	
		$V_R = 800\text{ V}, f = 100\text{ kHz}$	-	190	-	

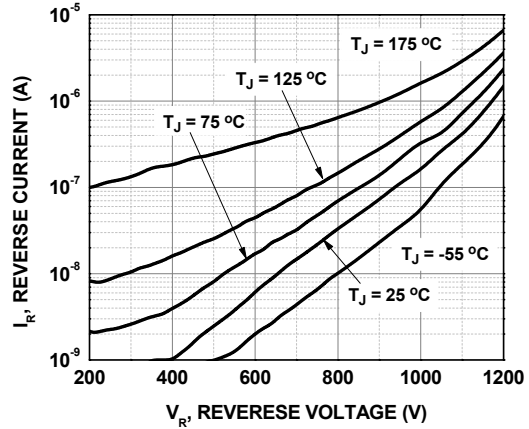
**Notes:**  
 1:  $E_{AS}$  of 441 mJ is based on starting  $T_J = 25\text{ }^\circ\text{C}$ ,  $L = 0.5\text{ mH}$ ,  $I_{AS} = 42\text{ A}$ ,  $V = 50\text{ V}$ .

**Typical Characteristics**  $T_J = 25\text{ }^\circ\text{C}$  unless otherwise noted.

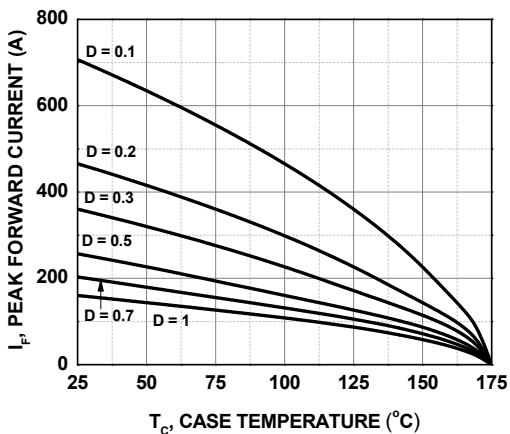
**Figure 1. Forward Characteristics**



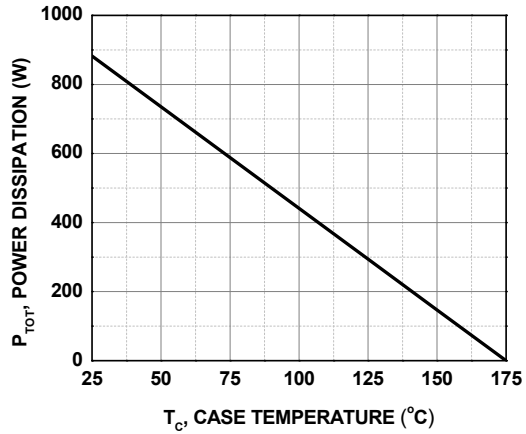
**Figure 2. Reverse Characteristics**



**Figure 3. Current Derating**

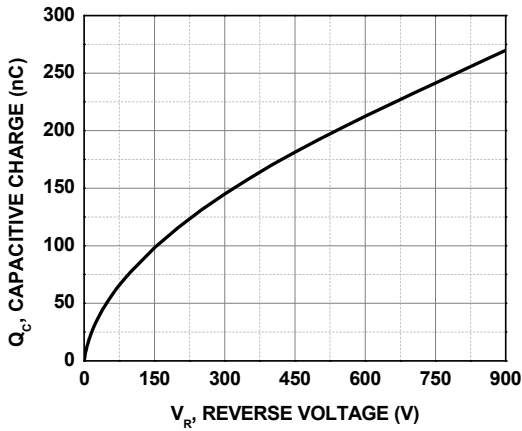


**Figure 4. Power Derating**

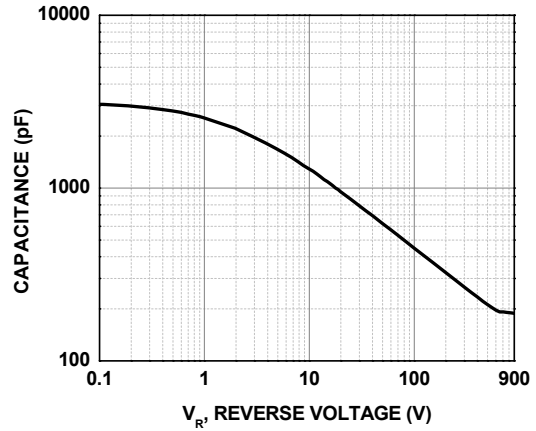


**Typical Characteristics**  $T_J = 25\text{ }^\circ\text{C}$  unless otherwise noted.

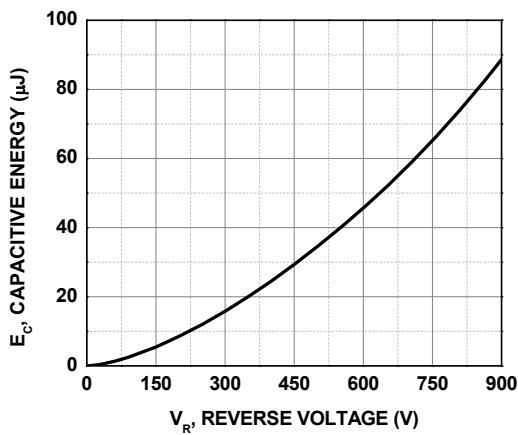
**Figure 5. Capacitive Charge vs. Reverse Voltage**



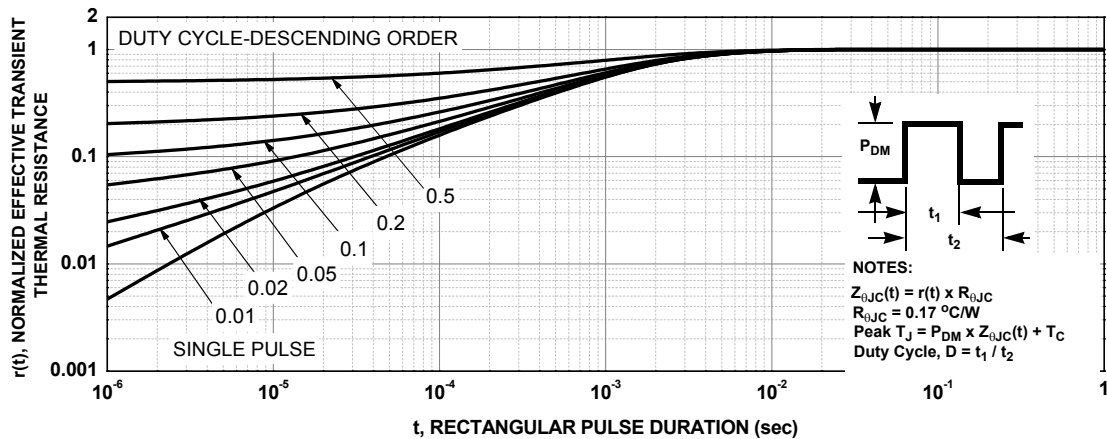
**Figure 6. Capacitive vs. Reverse Voltage**



**Figure 7. Capacitance Stored Energy**



**Figure 8. Junction-to-Case Transient Thermal Response Curve**



## Test Circuit and Waveforms

Figure 9. Unclamped Inductive Switching Test Circuit & Waveform

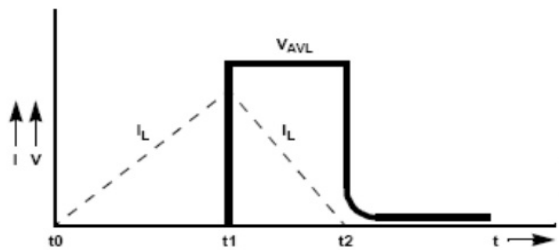
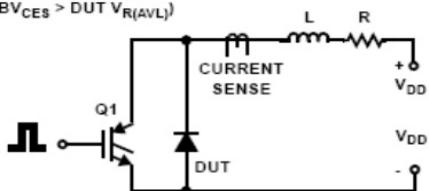
$L = 0.5\text{mH}$

$R < 0.1\Omega$

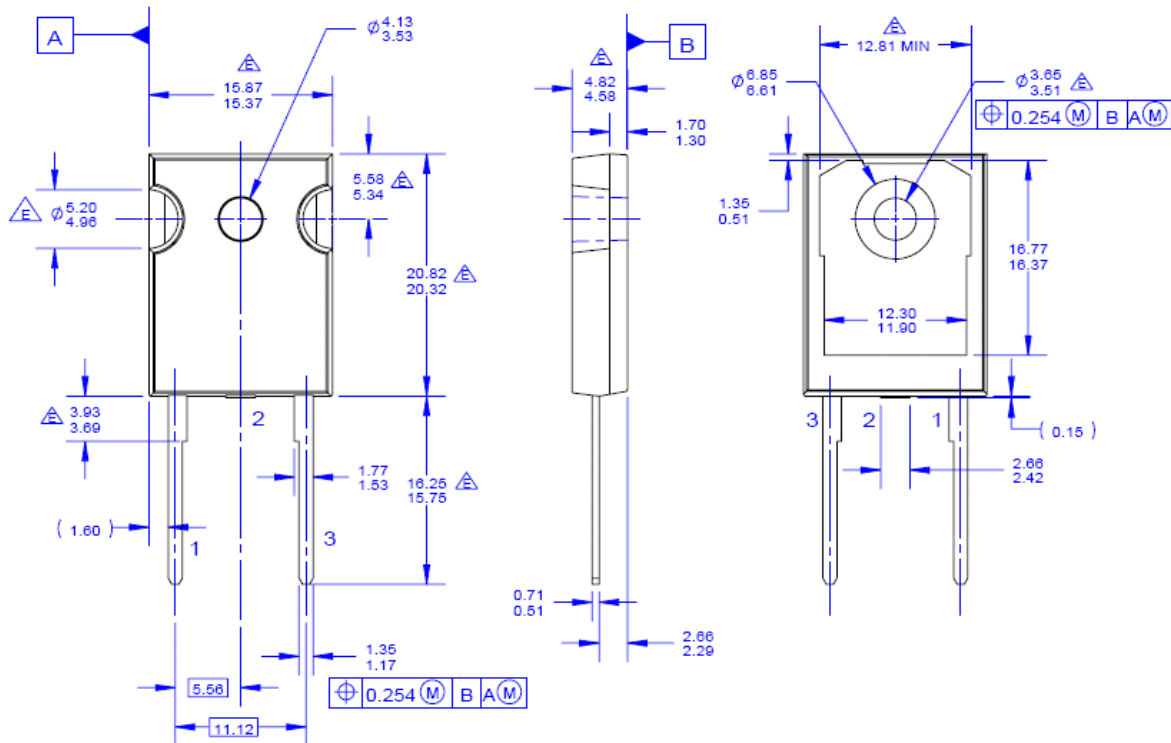
$V_{DD} = 50\text{V}$

$E_{AVL} = 1/2LI^2 [V_{R(AVL)}/(V_{R(AVL)} - V_{DD})]$

$Q1 = \text{IGBT (}BV_{CES} > \text{DUT } V_{R(AVL)})$



## Mechanical Dimensions



NOTES: UNLESS OTHERWISE SPECIFIED.

- A. PACKAGE REFERENCE: JEDEC TO-247, ISSUE E, VARIATION AB, DATED JUNE, 2004.
- B. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.
- C. ALL DIMENSIONS ARE IN MILLIMETERS.
- D. DRAWING CONFORMS TO ASME Y14.5 - 2009.
- E. DOES NOT COMPLY JEDEC STANDARD VALUE.
- F. DRAWING FILENAME: MKT-TO247B02\_REV04.
- G. FAIRCHILD SEMICONDUCTOR.

Figure 10. TO-247, Molded, 2LD, Jedec Option AB

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