Silicon Carbide (SiC) Schottky Diode – EliteSiC, 50 A, 650 V, D1, Die

PCFFS5065AF

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

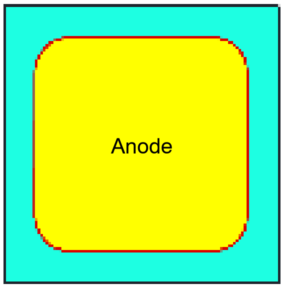
Applications

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

Die Information

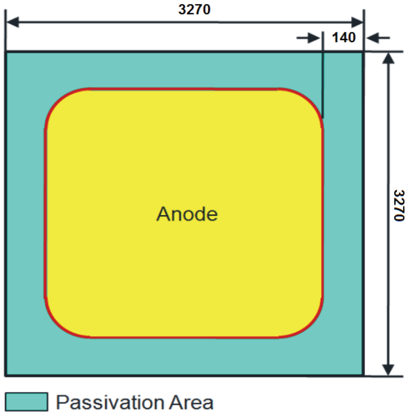
- Wafer Diameter: 6 inch
- Die Size: 3,350 × 3,350 μm (include Scribe Lane)
- Metallization:
  - Top 40KA 0.5%AlCu
  - Back 0.5K Ti + 3K Ni/V + 1.5K Ag
- Die Thickness: Typ. 200 μm
- Bonding Pad Size
  - Anode 2,990 × 2,990 μm
- Recommended Wire Bond (Note 1)
  - Anode: 20 mil × 2

NOTE:
1. Based on TO−247 package of **onsemi**.



DIE LAYOUT

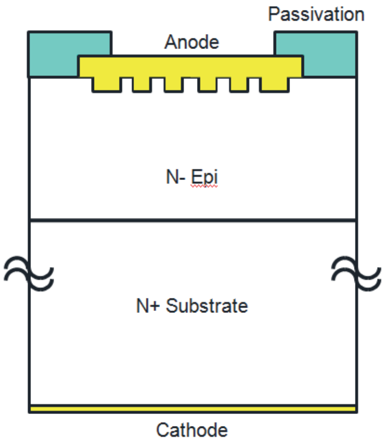
(Dimension: μm, Except Scribe Lane)



Passivation Information

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

CROSS SECTION



ORDERING INFORMATION

Part Number	Package	Die Size
PCFFS5065AF	N/A	3,350 x 3,350 μm (Include Scribe Lane)

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ELECTRICAL CHARACTERISTICS ON WAFER (T_C = 25°C unless otherwise noted) (Note 2)

Symbol	Parameter	Test Condition	Min	Typ	Max	Unit
V_R	Reverse Blocking Voltage	I_R = 200 μA, T_C = 25°C	650	–	–	V
V_F	Forward Voltage	I_F = 50 A, T_C = 25°C	1.20	–	1.75	V
I_R	Reverse Current	V_R = 650 V, T_C = 25°C	–	–	200	μA

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.

2. Tested 100% on wafer.

The Configuration of Chips (Based on 6″ Wafer)

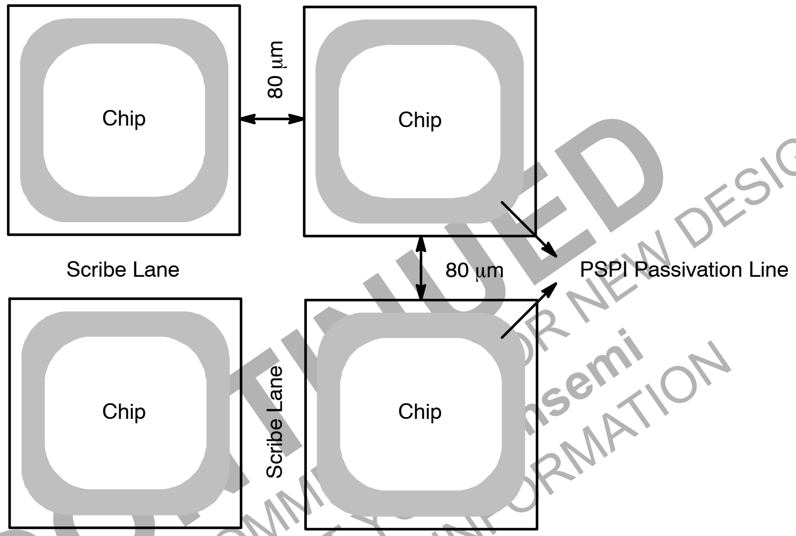

Figure 1. Saw-on-film Frame Packing Based on Tested Wafer

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ABSOLUTE MAXIMUM RATINGS (T_C = 25°C unless otherwise noted)

Symbol	Parameter		FFSH4065A	Unit
V_{RRM}	Peak Repetitive Reverse Voltage		650	V
E_{AS}	Single Pulse Avalanche Energy (Note 3)		240	mJ
I_F	Continuous Rectified Forward Current @ T_C < 144°C		50	A
	Continuous Rectified Forward Current @ T_C < 135°C		60	
$I_{F,\ Max}$	Non-Repetitive Peak Forward Surge Current	T_C = 25°C, 10 μs	1350	A
		T_C = 150°C, 10 μs	1250	A
$I_{F,SM}$	Non-Repetitive Forward Surge Current	Half-Sine Pulse, t_p = 8.3 ms	230	A
$I_{F,RM}$	Repetitive Forward Surge Current	Half-Sine Pulse, t_p = 8.3 ms	95	A
Ptot	Power Dissipation	T_C = 25°C	429	W
		T_C = 150°C	72	W
T_J, T_{STG}	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_{AS} of 240 mJ is based on starting T_J = 25°C, L = 0.5 mH, I_{AS} = 31 A, V = 50 V.

THERMAL CHARACTERISTICS

Symbol	Parameter	Value	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case, Max (Note 4)	0.35	°C/W

4. Pulse: Test Pulse width = 300 μs, Duty Cycle = 2%

ELECTRICAL CHARACTERISTICS (T_J = 25°C unless otherwise noted)

Symbol	Parameter	Test Condition	Min	Typ	Max	Unit
V_F	Forward Voltage	I_F = 50 A, T_C = 25°C	–	1.51	1.75	V
		I_F = 50 A, T_C = 125°C	–	1.67	2.0	
		I_F = 50 A, T_C = 175°C	–	1.82	2.4	
I_R	Reverse Current	V_R = 650 V, T_C = 25°C	–	–	200	μA
		V_R = 650 V, T_C = 125°C	–	–	400	
		V_R = 650 V, T_C = 175°C	–	–	600	
Q_C	Total Capacitive Charge	V = 400 V	–	147	–	nC
C	Total Capacitance	V_R = 1 V, f = 100 kHz	–	2530	–	pF
		V_R = 200 V, f = 100 kHz	–	271	–	
		V_R = 400 V, f = 100 kHz	–	211	–	

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TYPICAL CHARACTERISTICS

(T_J = 25°C unless otherwise noted)

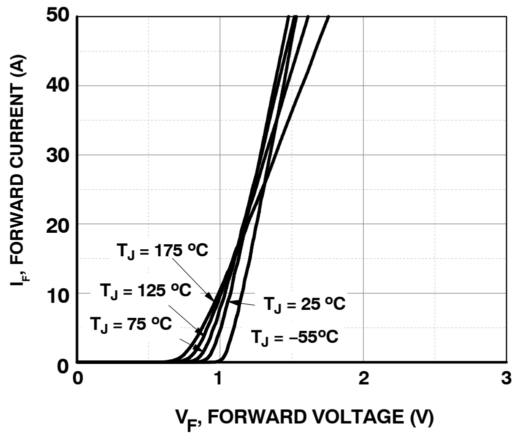

Figure 2. Forward Characteristics

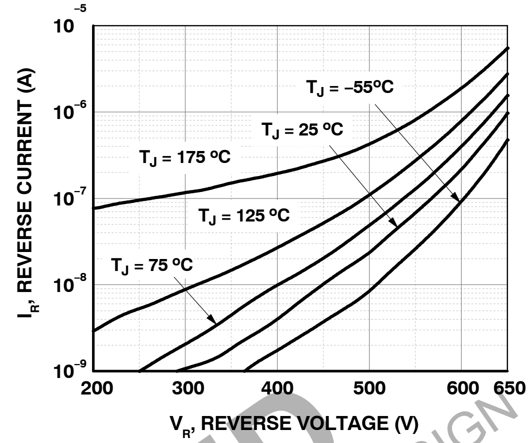

Figure 3. Reverse Characteristics

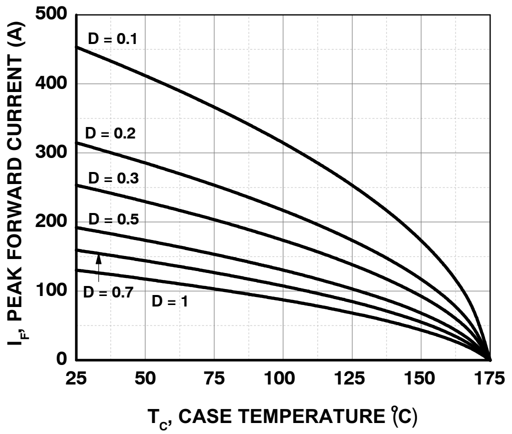

Figure 4. Current Derating

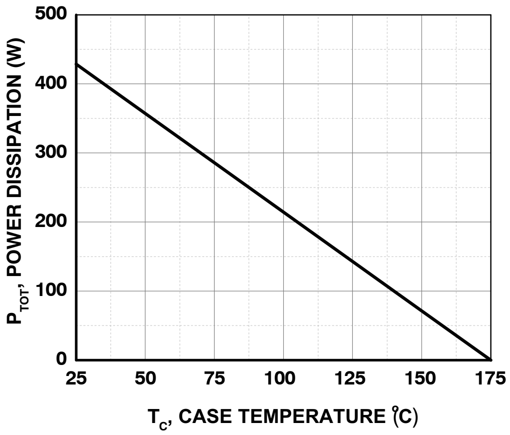

Figure 5. Power Derating

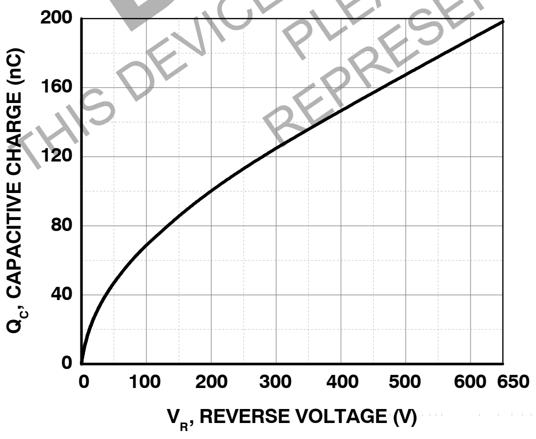

Figure 6. Capacitive Charge vs. Reverse Voltage

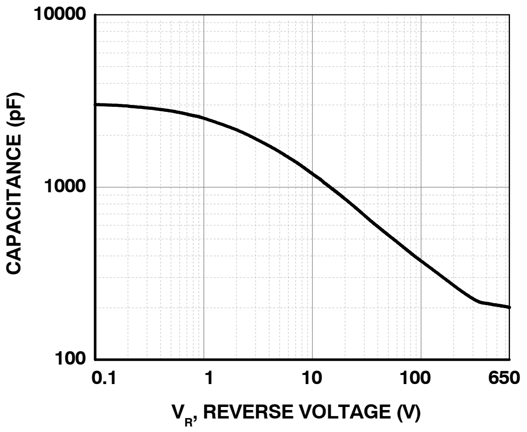

Figure 7. Capacitance vs. Reverse Voltage

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TYPICAL CHARACTERISTICS

(T_J = 25°C unless otherwise noted)

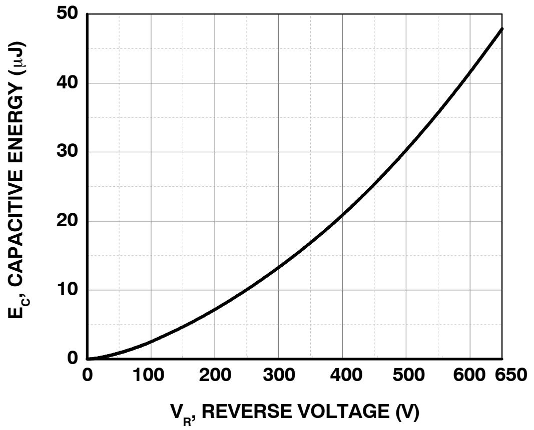

Figure 8. Capacitance Stored Energy

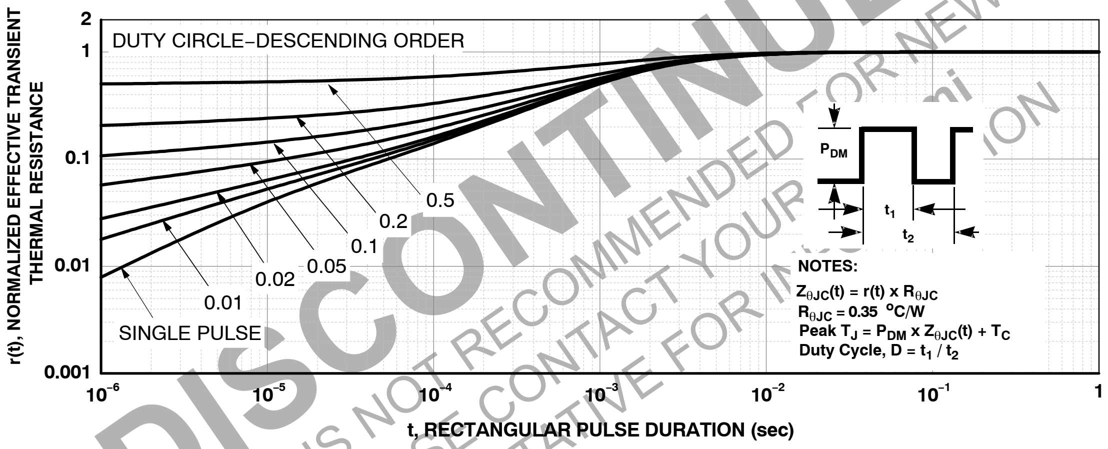

Figure 9. Junction−to−Case Transient Thermal Response Curve

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TEST CIRCUIT AND WAVEFORMS

$L = 0.5$ mH
$R < 0.1\ \Omega$
$V_{DD} = 50$ V
EAVL = 1/2LI2 $[V_{R(AVL)} / (V_{R(AVL)} - V_{DD})]$
Q1 = IGBT $(BV_{CES} >$ DUT $V_{R(AVL)})$

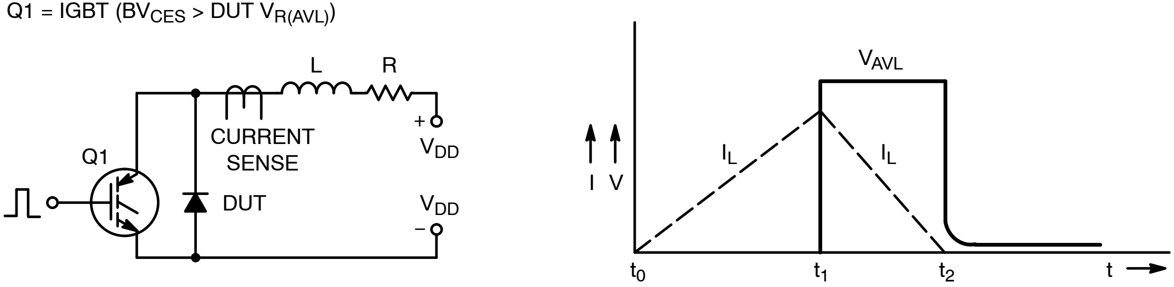

Figure 10. Unclamped Inductive Switching Test Circuit & Waveform

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