

# Silicon Carbide (SiC) Schottky Diode – EliteSiC, 40 A, 650 V, D2, TO-220-3L

## Product Preview

## FFSP4065BDN-F085

### 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 independent switching characteristics, and excellent thermal performance sets Silicon Carbide as the next generation of power semiconductor. System benefits include highest efficiency, faster operating frequency, increased power density, reduced EMI, and reduced system size & cost.

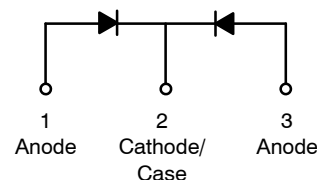
### Features

- Max Junction Temperature 175°C
- Avalanche Rated 94 mJ
- High Surge Current Capacity
- Positive Temperature Coefficient
- Ease of Paralleling
- No Reverse Recovery/No Forward Recovery
- AEC-Q101 Qualified
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

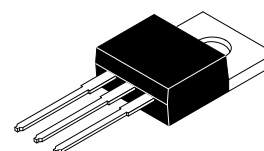
### Applications

- Automotive HEV-EV Onboard Chargers
- Automotive HEV-EV DC-DC Converters

This document contains information on a product under development. onsemi reserves the right to change or discontinue this product without notice.

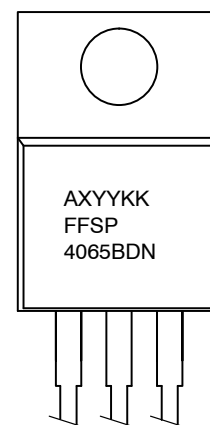


Schottky Diode



TO-220-3LD  
CASE 340AT

### MARKING DIAGRAM



|             |                           |
|-------------|---------------------------|
| A           | = Assembly Plant Code     |
| XXYY        | = Date Code (Year & Week) |
| KK          | = Lot Traceability Code   |
| FFSP4065BDN | = Specific Device Code    |

### ORDERING INFORMATION

See detailed ordering and shipping information on page 2 of this data sheet.

# FFSP4065BDN-F085

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

| Symbol                            | Parameter                                                     | Value                                    | Unit |
|-----------------------------------|---------------------------------------------------------------|------------------------------------------|------|
| V <sub>RRM</sub>                  | Peak Repetitive Reverse Voltage                               | 650                                      | V    |
| E <sub>AS</sub>                   | Single Pulse Avalanche Energy (Note 1)                        | 94*                                      | mJ   |
| I <sub>F</sub>                    | Continuous Rectified Forward Current @ T <sub>C</sub> < 136°C | 20*/40**                                 | A    |
| I <sub>F, Max</sub>               | Non-Repetitive Peak Forward Surge Current                     | T <sub>C</sub> = 25°C, 10 μs             | 882  |
|                                   |                                                               | T <sub>C</sub> = 150°C, 10 μs            | 798  |
| I <sub>F, SM</sub>                | Non-Repetitive Forward Surge Current<br>T <sub>C</sub> = 25°C | Half-Sine Pulse, t <sub>p</sub> = 8.3 ms | 84   |
| P <sub>tot</sub>                  | Power Dissipation                                             | T <sub>C</sub> = 25°C                    | 95   |
|                                   |                                                               | T <sub>C</sub> = 150°C                   | 16   |
| 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.

\* Per Leg, \*\* Per Device

1. E<sub>AS</sub> of 94 mJ is based on starting T<sub>J</sub> = 25°C, L = 0.5 mH, I<sub>AS</sub> = 19.4 A, V = 50 V.

## THERMAL CHARACTERISTICS

| Symbol           | Parameter                                 | Value      | Unit |
|------------------|-------------------------------------------|------------|------|
| R <sub>θJC</sub> | Thermal Resistance, Junction to Case, Max | 1.6*/0.8** | °C/W |

\* Per Leg, \*\* Per Device

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

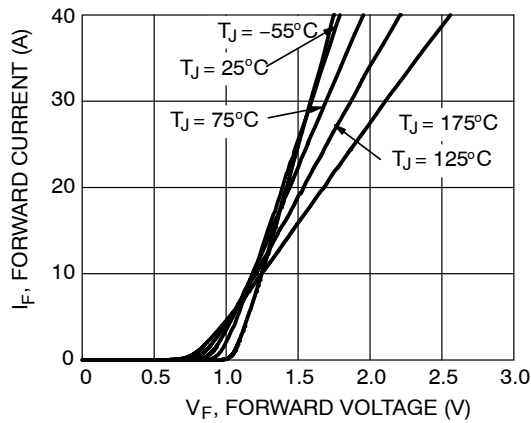
| Symbol         | Parameter               | Test Condition                                 | Min | Typ  | Max | Unit |
|----------------|-------------------------|------------------------------------------------|-----|------|-----|------|
| V <sub>F</sub> | Forward Voltage         | I <sub>F</sub> = 20 A, T <sub>C</sub> = 25°C   | –   | 1.38 | 1.7 | V    |
|                |                         | I <sub>F</sub> = 20 A, T <sub>C</sub> = 125°C  | –   | 1.6  | 2.0 |      |
|                |                         | I <sub>F</sub> = 20 A, T <sub>C</sub> = 175°C  | –   | 1.72 | 2.4 |      |
| I <sub>R</sub> | Reverse Current         | V <sub>R</sub> = 650 V, T <sub>C</sub> = 25°C  | –   | 0.5  | 40  | μA   |
|                |                         | V <sub>R</sub> = 650 V, T <sub>C</sub> = 125°C | –   | 1    | 80  |      |
|                |                         | V <sub>R</sub> = 650 V, T <sub>C</sub> = 175°C | –   | 2    | 160 |      |
| Q <sub>C</sub> | Total Capacitive Charge | V = 400 V                                      | –   | 51   | –   | nC   |
| C              | Total Capacitance       | V <sub>R</sub> = 1 V, f = 100 kHz              | –   | 866  | –   | pF   |
|                |                         | V <sub>R</sub> = 300 V, f = 100 kHz            | –   | 80   | –   |      |
|                |                         | V <sub>R</sub> = 600 V, f = 100 kHz            | –   | 70   | –   |      |

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.

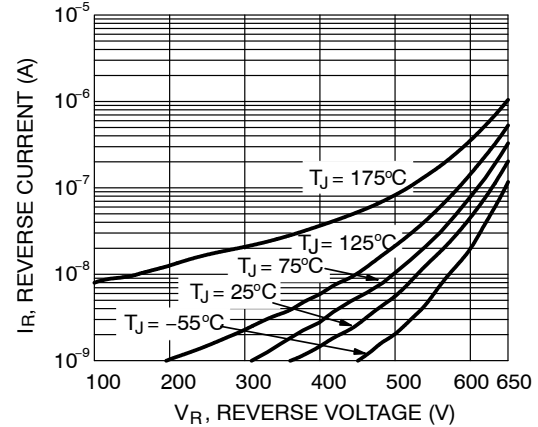
## PACKAGE MARKING AND ORDERING INFORMATION

| Part Number      | Top Marking | Package                                | Shipping        |
|------------------|-------------|----------------------------------------|-----------------|
| FFSP4065BDN-F085 | FFSP4065BDN | TO-220-3LD<br>(Pb-Free / Halogen Free) | 50 Units / Tube |

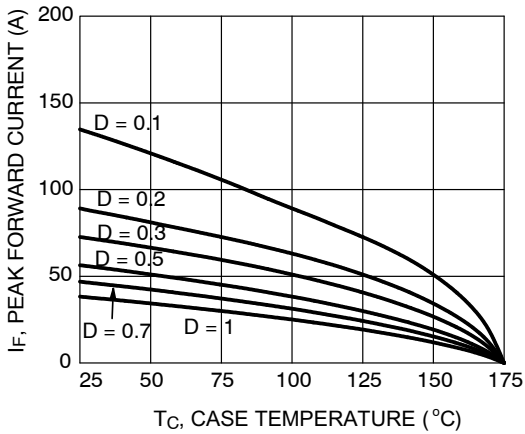
**TYPICAL CHARACTERISTICS**  
( $T_J = 25^\circ\text{C}$  UNLESS OTHERWISE NOTED (PER LEG))



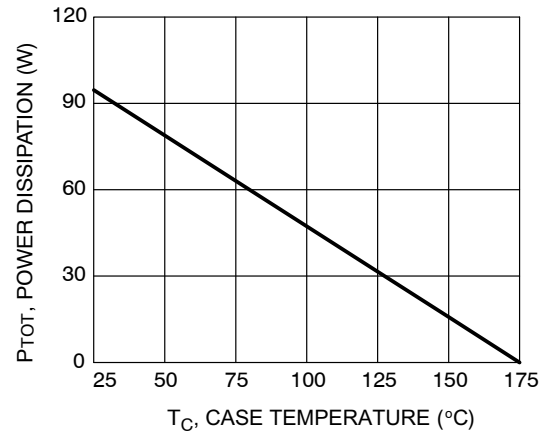
**Figure 1. Forward Characteristics**



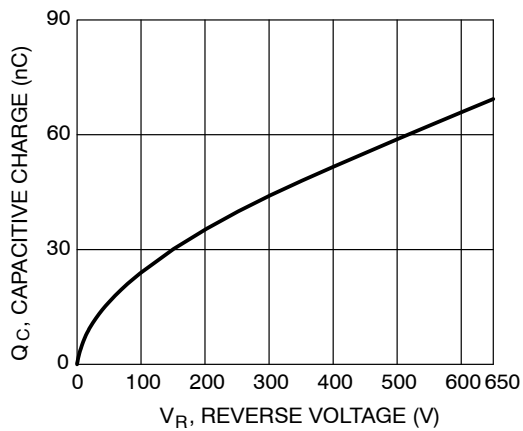
**Figure 2. Reverse Characteristics**



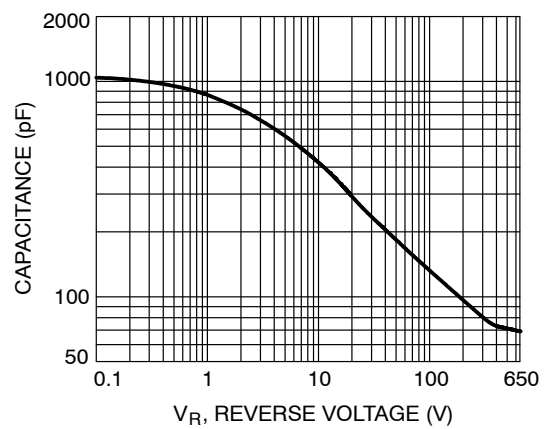
**Figure 3. Current Derating**



**Figure 4. Power Derating**

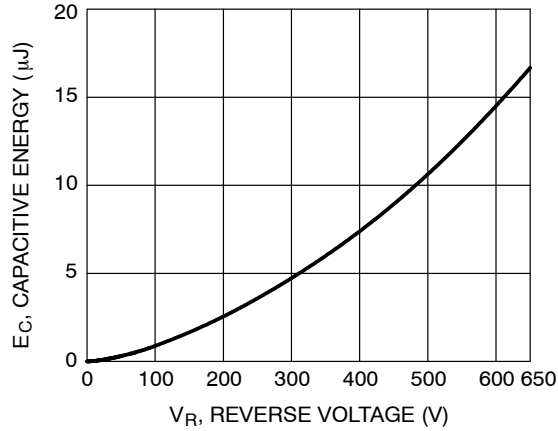


**Figure 5. Capacitive Charge vs. Reverse Voltage**

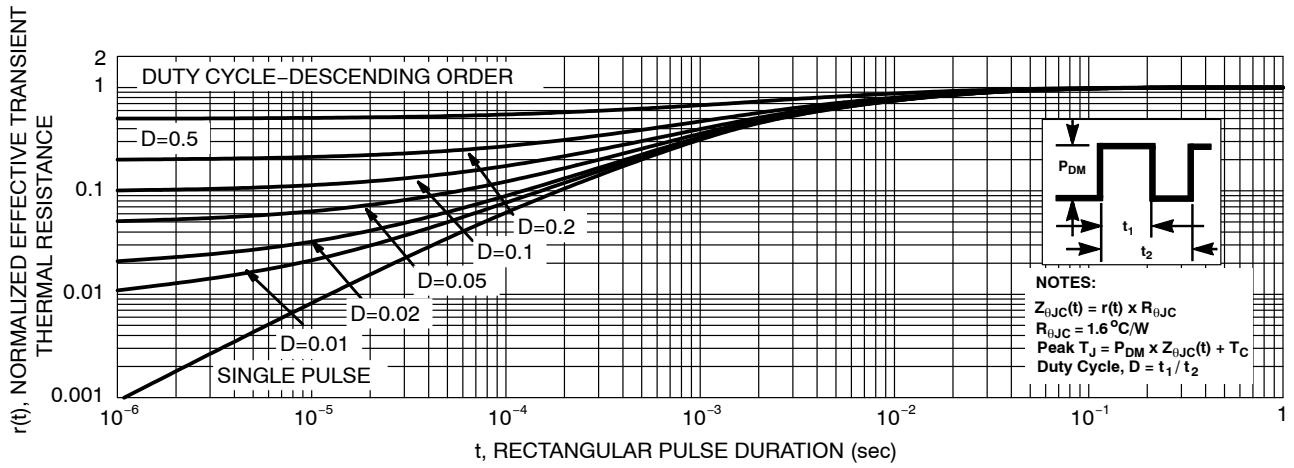


**Figure 6. Capacitance vs. Reverse Voltage**

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



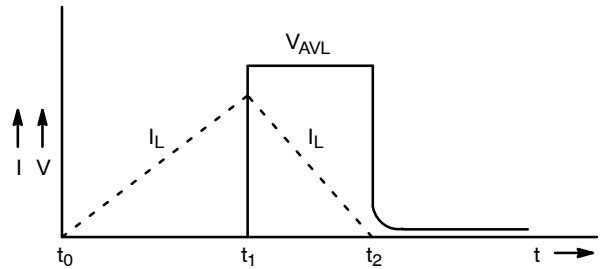
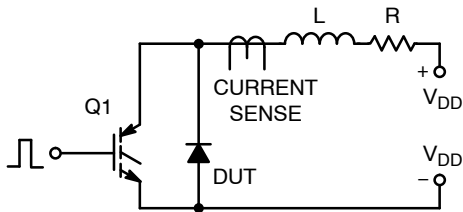
**Figure 7. Capacitance Stored Energy**



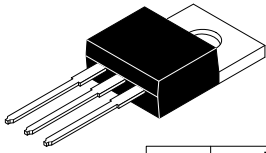
**Figure 8. Junction-to-Case Transient Thermal Response Curve**

**TEST CIRCUIT AND WAVEFORMS**

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



**Figure 9. Unclamped Inductive Switching Test Circuit & Waveform**



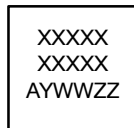
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ISSUE B

DATE 08 AUG 2022

| DIM | MILLIMETERS  |      |       |
|-----|--------------|------|-------|
|     | MIN.         | NOM. | MAX.  |
| A   | 4.00         | --   | 4.70  |
| A1  | SEE NOTE "F" |      |       |
| A2  | 2.10         | --   | 2.85  |
| b   | 0.55         | --   | 1.00  |
| b2  | 1.10         | --   | 1.62  |
| b4  | 1.42         | --   | 1.62  |
| c   | 0.36         | --   | 0.60  |
| D   | 13.90        | --   | 16.30 |
| D1  | 8.13         | --   | 9.40  |
| D2  | 11.50        | --   | 14.30 |
| D3  | 15.42        | --   | 16.51 |
| E   | 9.65         | --   | 10.67 |
| E1  | 7.59         | --   | 8.65  |
| e   | 2.40         | --   | 2.67  |
| H1  | 6.06         | --   | 6.69  |
| L   | 12.70        | --   | 14.04 |
| L1  | 2.70         | --   | 4.10  |
| P   | 3.50         | --   | 4.00  |
| Q   | 2.50         | --   | 3.40  |
| z   | 2.13 REF     |      |       |
| z1  | 2.06 REF     |      |       |
| θ   | 3°           | --   | 5°    |

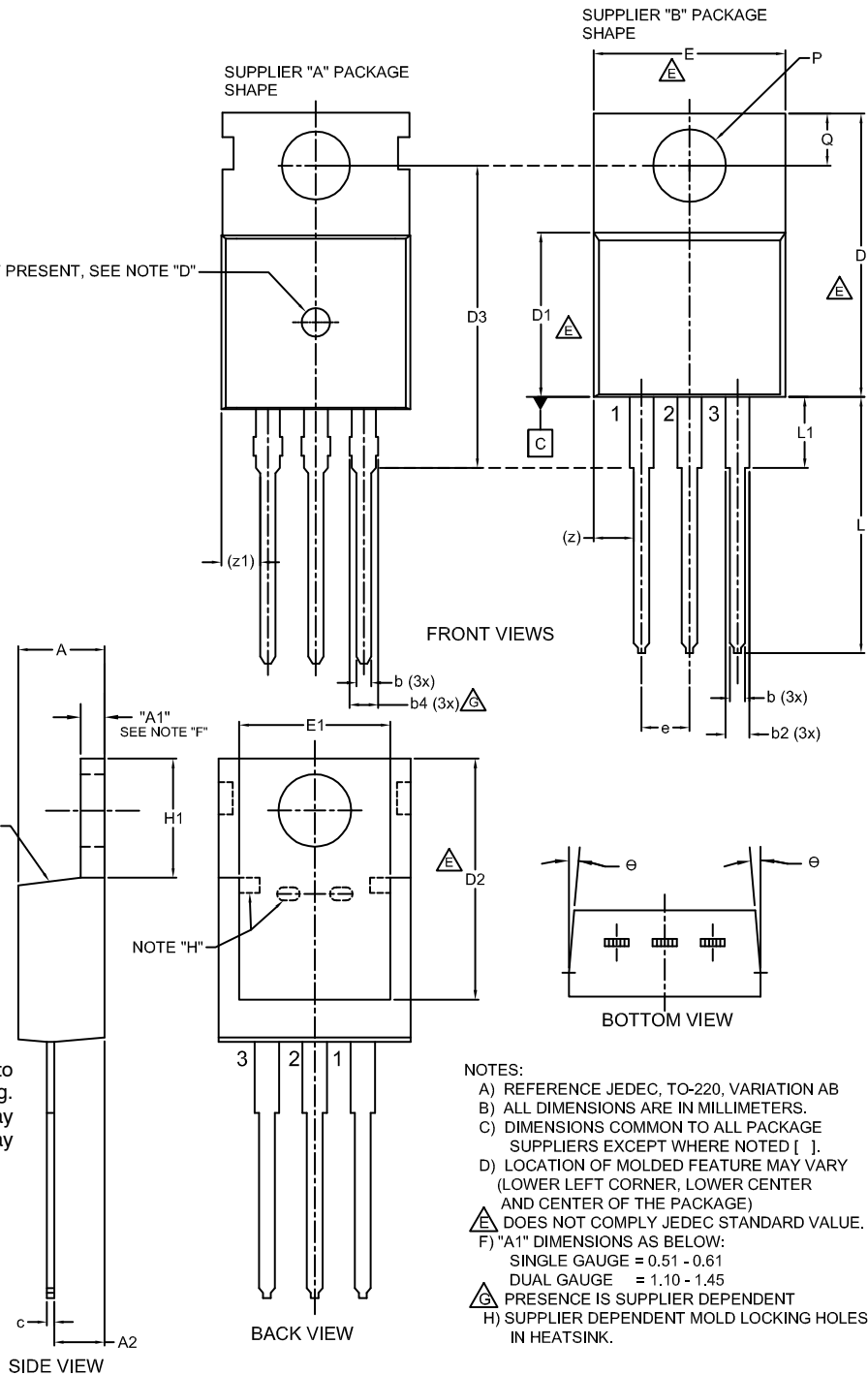
IF PRESENT, SEE NOTE "D"

GENERIC  
MARKING DIAGRAM\*



XXXX = Specific Device Code  
A = Assembly Location  
Y = Year  
WW = Work Week  
ZZ = Assembly Lot Code

\*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "▪", may or may not be present. Some products may not follow the Generic Marking.



|                  |             |                                                                                                                                                                                     |
|------------------|-------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
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| DESCRIPTION:     | TO-220-3LD  | PAGE 1 OF 1                                                                                                                                                                         |

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