

# Silicon Carbide (SiC) Schottky Diode – EliteSiC, 40 A, 1200 V, D1, TO-247-3L

## FFSH40120ADN-F085

### Description

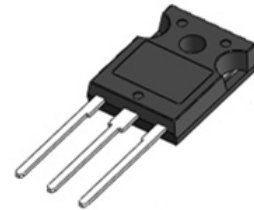
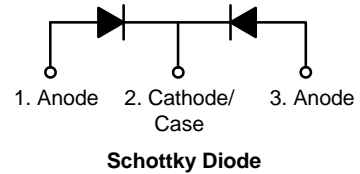
Silicon Carbide (SiC) Schottky Diodes use a completely new technology that provides superior switching performance and higher reliability compared to Silicon. No reverse recovery current, temperature independent switching characteristics, and excellent thermal performance sets Silicon Carbide as the next generation of power semiconductor. System benefits include highest efficiency, faster operating frequency, increased power density, reduced EMI, and reduced system size and cost.

### Features

- Max Junction Temperature 175°C
- Avalanche Rated 210 mJ
- High Surge Current Capacity
- Positive Temperature Coefficient
- Ease of Paralleling
- No Reverse Recovery/No Forward Recovery
- AEC-Q101 Qualified and PPAP Capable
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

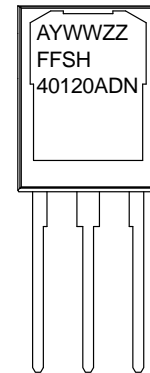
### Applications

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



TO-247-3LD  
 CASE 340CH

### MARKING DIAGRAM



- A = Assembly Location
- Y = Year
- WW = Work Week
- ZZ = Lot Traceability
- FFSH40120ADN = Specific Device Code

### ORDERING INFORMATION

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

# FFSH40120ADN-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                               | 1200                                     | V    |   |
| E <sub>AS</sub>                   | Single Pulse Avalanche Energy (Note 1)                        | 210                                      | mJ   |   |
| I <sub>F</sub>                    | Continuous Rectified Forward Current @ T <sub>C</sub> < 148°C | 20* / 40**                               | A    |   |
|                                   | Continuous Rectified Forward Current @ T <sub>C</sub> < 135°C | 25* / 50**                               |      |   |
| I <sub>F, Max</sub>               | Non-Repetitive Peak Forward Surge Current                     | T <sub>C</sub> = 25°C, 10 μs             | 1190 | A |
|                                   |   | T <sub>C</sub> = 150°C, 10 μs            | 990  | A |
| I <sub>F, SM</sub>                | Non-Repetitive Forward Surge Current                          | Half-Sine Pulse, t <sub>p</sub> = 8.3 ms | 135  | A |
| I <sub>F, RM</sub>                | Repetitive Forward Surge Current                              | Half-Sine Pulse, t <sub>p</sub> = 8.3 ms | 74   | A |
| P <sub>tot</sub>                  | Power Dissipation   | T <sub>C</sub> = 25°C                    | 220  | W |
|                                   |   | T <sub>C</sub> = 150°C                   | 37   | 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.

1. E<sub>AS</sub> of 210 mJ is based on starting T<sub>J</sub> = 25°C, L = 0.5 mH, I<sub>AS</sub> = 29 A, V = 50 V.

\*Per leg, \*\* Per Device

## THERMAL CHARACTERISTICS

| Symbol           | Parameter                                 | Value          | Unit |
|------------------|---|----------------|------|
| R <sub>θJC</sub> | Thermal Resistance, Junction to Case, Max | 0.68* / 0.34** | °C/W |

\*Per leg, \*\* Per Device

## 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> = 20 A, T <sub>C</sub> = 25°C    | -   | 1.45 | 1.75 | V    |
|                |                         | I <sub>F</sub> = 20 A, T <sub>C</sub> = 125°C   | -   | 1.7  | 2.0  |      |
|                |                         | I <sub>F</sub> = 20 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                                       | -   | 120  | -    | nC   |
| C              | Total Capacitance       | V <sub>R</sub> = 1 V, f = 100 kHz               | -   | 1220 | -    | pF   |
|                |                         | V <sub>R</sub> = 400 V, f = 100 kHz             | -   | 111  | -    |      |
|                |                         | V <sub>R</sub> = 800 V, f = 100 kHz             | -   | 88   | -    |      |

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                                | Shipping        |
|-------------------|--------------|--|-----------------|
| FFSH40120ADN-F085 | FFSH40120ADN | TO-247-3LD<br>(Pb-Free / Halogen Free) | 30 Units / Tube |

TYPICAL CHARACTERISTICS

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

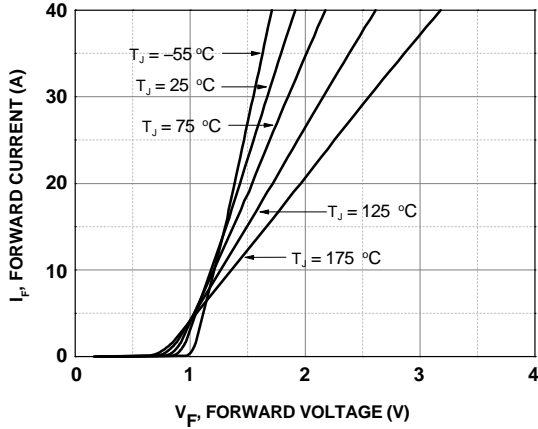


Figure 1. Forward Characteristics

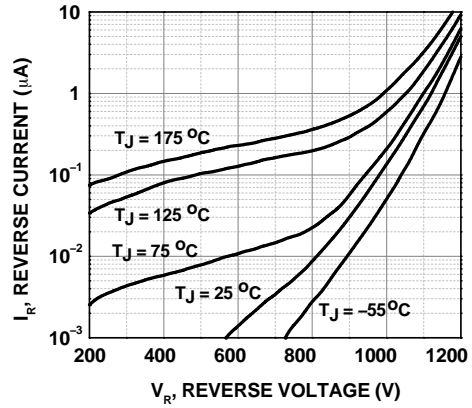


Figure 2. Reverse Characteristics

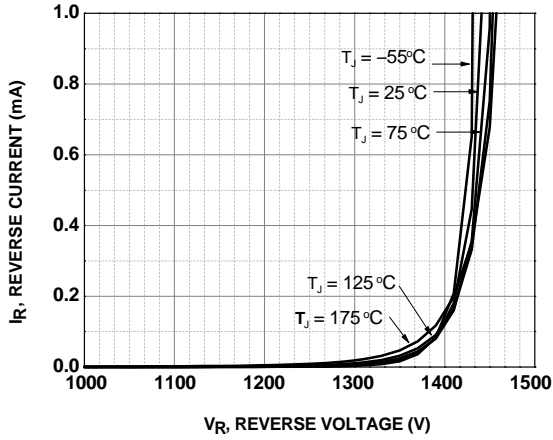


Figure 3. Reverse Characteristics

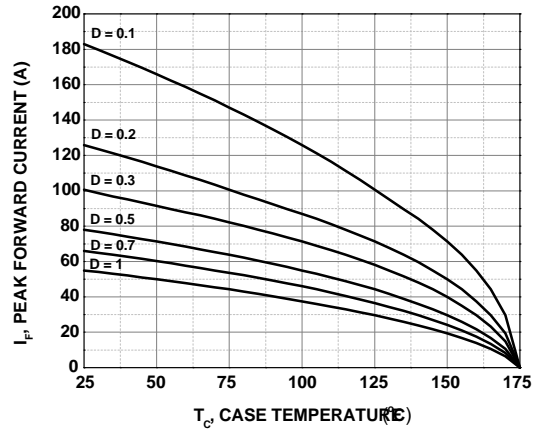


Figure 4. Current Derating

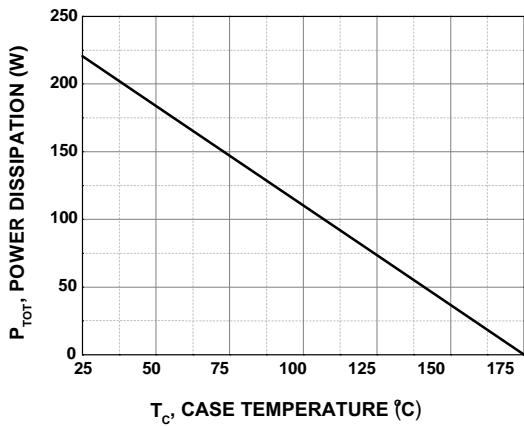


Figure 5. Power Derating

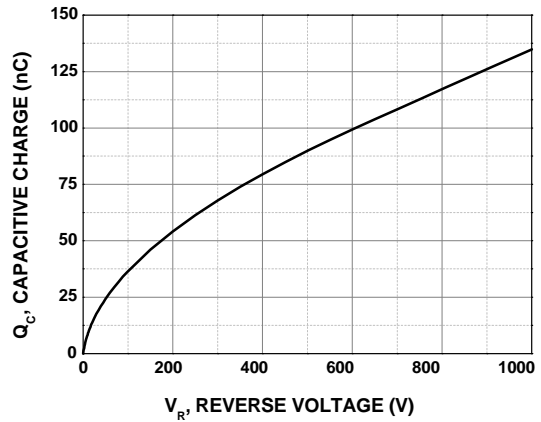


Figure 6. Capacitive Charge vs. Reverse Voltage

# FFSH40120ADN-F085

## TYPICAL CHARACTERISTICS

( $T_J = 25^\circ\text{C}$  UNLESS OTHERWISE NOTED; PER LEG; CONTINUED)

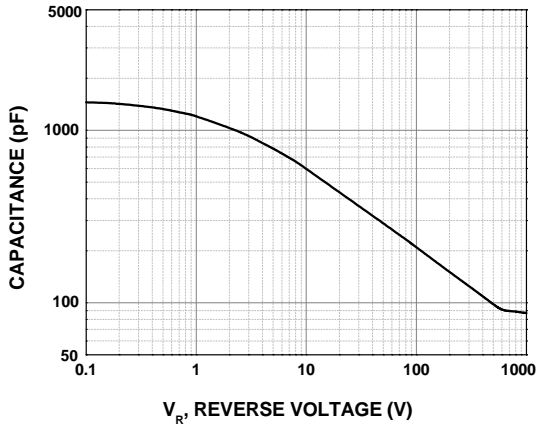


Figure 7. Capacitance vs. Reverse Voltage

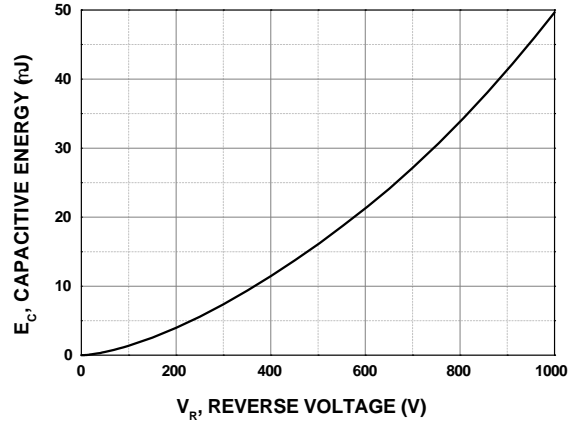


Figure 8. Capacitance Stored Energy

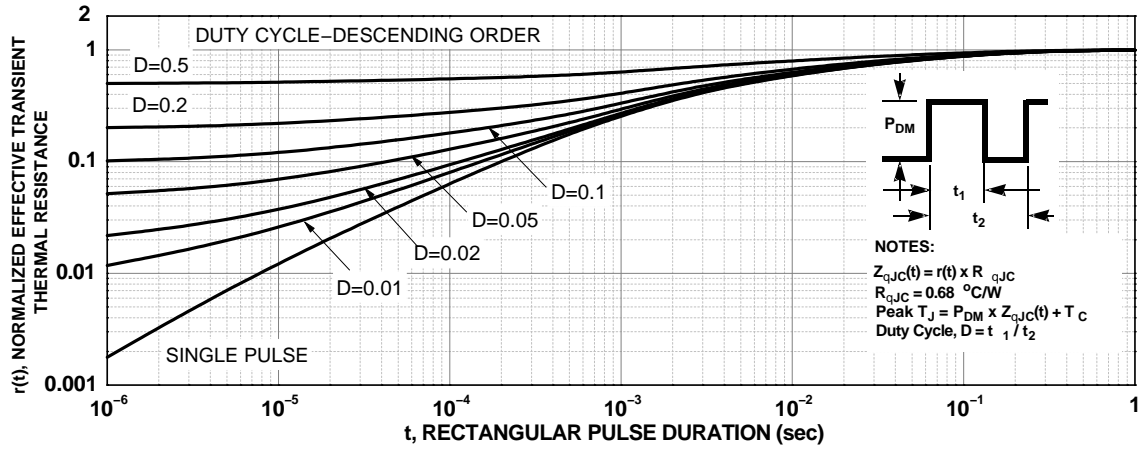


Figure 9. Junction-to-Case Transient Thermal Response Curve

TEST CIRCUIT AND WAVEFORMS

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

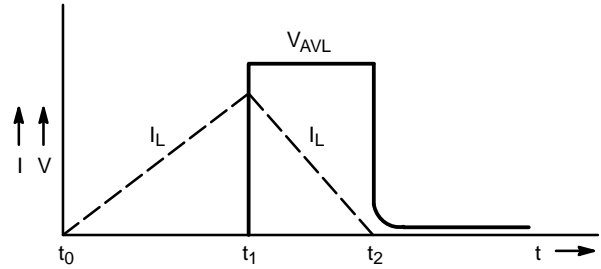
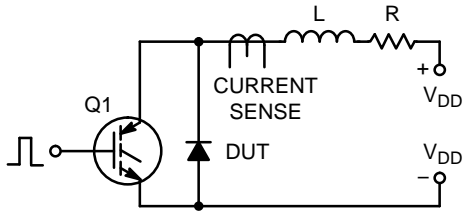


Figure 10. Unclamped Inductive Switching Test Circuit & Waveform

# MECHANICAL CASE OUTLINE

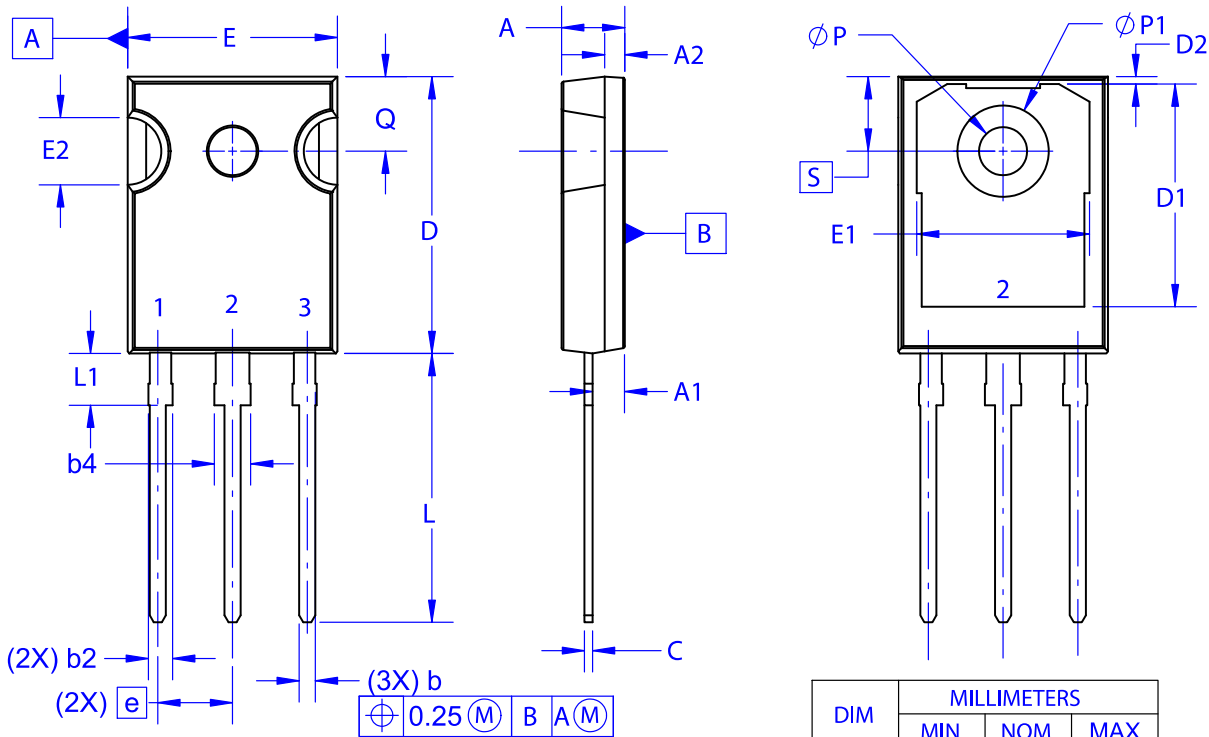
## PACKAGE DIMENSIONS

ON Semiconductor®



TO-247-3LD  
CASE 340CH  
ISSUE A

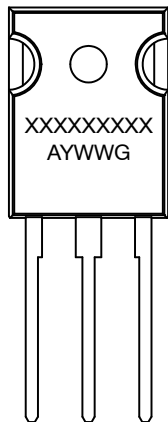
DATE 09 OCT 2019



NOTES: UNLESS OTHERWISE SPECIFIED.

- A. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.
- B. ALL DIMENSIONS ARE IN MILLIMETERS.
- C. DRAWING CONFORMS TO ASME Y14.5 - 2009.
- D. DIMENSION A1 TO BE MEASURED IN THE REGION DEFINED BY L1.
- E. LEAD FINISH IS UNCONTROLLED IN THE REGION DEFINED BY L1.

### GENERIC MARKING DIAGRAM\*



XXXX = Specific Device Code  
A = Assembly Location  
Y = Year  
WW = Work Week  
G = Pb-Free Package

\*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.

| DIM | MILLIMETERS |       |       |
|-----|-------------|-------|-------|
|     | MIN         | NOM   | MAX   |
| A   | 4.58        | 4.70  | 4.82  |
| A1  | 2.29        | 2.475 | 2.66  |
| A2  | 1.40        | 1.50  | 1.60  |
| D   | 20.32       | 20.57 | 20.82 |
| E   | 15.37       | 15.62 | 15.87 |
| E2  | 4.96        | 5.08  | 5.20  |
| e   | ~           | 5.56  | ~     |
| L   | 19.75       | 20.00 | 20.25 |
| L1  | 3.69        | 3.81  | 3.93  |
| ∅P  | 3.51        | 3.58  | 3.65  |
| Q   | 5.34        | 5.46  | 5.58  |
| S   | 5.34        | 5.46  | 5.58  |
| b   | 1.17        | 1.26  | 1.35  |
| b2  | 1.53        | 1.65  | 1.77  |
| b4  | 2.42        | 2.54  | 2.66  |
| c   | 0.51        | 0.61  | 0.71  |
| D1  | 13.08       | ~     | ~     |
| D2  | 0.51        | 0.93  | 1.35  |
| E1  | 12.81       | ~     | ~     |
| ∅P1 | 6.61        | 6.73  | 6.85  |

|                         |                    |   |
|-------------------------|--------------------|---|
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