

# SFC85N90

## 85 AMP, 900 VOLTS, 17 mΩ SiC Power MOSFET Enhancement Mode N-Channel

### DESIGNER'S DATA SHEET

#### Part Number / Ordering Information <sup>1/</sup>

SFC85N90

#### Screening <sup>2/</sup>

— = Not Screened  
 TX = TX Level  
 TXV = TXV Level  
 S = S Level

#### Package

S2 = SMD2  
 S1 = SMD1  
 S1L = SMD1 with leads

#### Features:

- Fast Switching, Low Capacitance
- High Blocking Voltage, Low  $R_{DS(ON)}$
- Easy to Parallel, Simple to Drive
- Resistant to Latch-Up
- Hermetically Sealed Power Packaging
- TX, TXV, S-Level Screening Available

#### Applications:

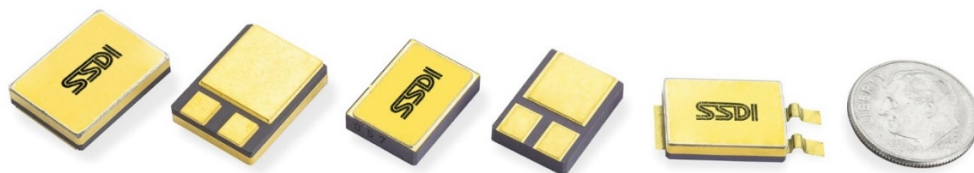
- High Voltage DC-DC Converters
- PFC Boost Converters
- Switch Mode Power Supplies
- Motor Drive
- Aerospace, Hi-Rel, Military

| Maximum Ratings <sup>3/</sup>                                                            | Symbol                       | Value           | Unit |
|------------------------------------------------------------------------------------------|------------------------------|-----------------|------|
| Drain – Source Voltage<br>$V_{GS} = 0\text{ V}, V_{GS} = 100\text{ }\mu\text{A}$         | $V_{DS}$                     | 900             | V    |
| Gate – Source Voltage, dynamic <sup>4/</sup><br>AC ( $f > 1\text{ Hz}$ )                 | $V_{GS1}$                    | -8, +19         | V    |
| Gate – Source Voltage, static <sup>5/</sup>                                              | $V_{GS2}$                    | -4, +15         | V    |
| Continuous Drain Current <sup>6/</sup><br>$V_{GS} = 15\text{ V}, T_C = 25^\circ\text{C}$ | $I_{D1}$                     | 85              | A    |
| Pulsed Drain Current<br>Pulse width $t_P$ limited by $T_{Jmax}$                          | $I_{D2}$                     | 450             | A    |
| Total Power Dissipation                                                                  | $P_D$                        | 288             | W    |
| Operating & Storage Temperature                                                          | $T_{OP} \text{ \& } T_{STG}$ | -55 to +175     | °C   |
| Maximum Thermal Resistance<br>Junction to Case                                           | $R_{\theta JC}$              | 0.52 (typ 0.38) | °C/W |

SMD2 (S2)

SMD1 (S1)

SMD1 with Leads (S1L)\*\*



\*\*Customizable ribbon leads option (S1L) reduces risk of vibration stress and thermal fatigue  
 \*\*\*dime used for size reference

#### NOTES:

\*Pulse Test: Pulse Width = 300  $\mu\text{sec}$ , Duty Cycle = 2%.

1/ For ordering information, price, and availability - contact factory.

2/ Screening based on MIL-PRF-19500. Screening flows available on request.

3/ Unless otherwise specified, all electrical characteristics @25°C.

4/ When using MOSFET body diode  $V_{GSmax} = -4\text{ V} / +19\text{ V}$ .

5/ MOSFET can also safely operate at  $V_{GS} = 0 / +15\text{ V}$ .

6/ Package limited; die is rated at 190 A.

7/ Ionizing Radiation (total dose) per Mil-Std-750 Method 1019 Condition A, High Dose Rate, VDS bias of 720 V and VGS bias of 3.5 V.

**NOTE:** All specifications are subject to change without notification.  
 SCD's for these devices should be reviewed by SSDI prior to release.

**DATA SHEET #: FT0083E**

**DOCX**



**Solid State Devices, Inc.**

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# SFC85N90

| Electrical Characteristics <sup>3/</sup>                                                                                                                                   |                                                                                                                  | Symbol               | Min      | Typ        | Max      | Unit |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------|----------------------|----------|------------|----------|------|
| Drain - Source Breakdown Voltage<br>V <sub>GS</sub> = 0 V, I <sub>D</sub> = 100 μA                                                                                         |                                                                                                                  | V <sub>(BR)DSS</sub> | 900      | -          | -        | V    |
| Gate Threshold Voltage<br>V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 33 mA<br>V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 33 mA, T <sub>J</sub> = 175°C |                                                                                                                  | V <sub>GS(th)</sub>  | 1.4<br>- | 2.0<br>1.7 | 3.5<br>- | V    |
| Zero Gate Voltage Drain Current<br>V <sub>DS</sub> = 900 V, V <sub>GS</sub> = 0 V                                                                                          |                                                                                                                  | I <sub>DSS</sub>     | -        | 4          | 100      | μA   |
| Gate - Source Leakage<br>V <sub>GS</sub> = 15 V, V <sub>DS</sub> = 0 V                                                                                                     |                                                                                                                  | I <sub>GSS</sub>     | -        | 1          | 250      | nA   |
| Drain - Source On-State Resistance*<br>V <sub>GS</sub> = 15 V, I <sub>D</sub> = 50 A<br>V <sub>GS</sub> = 15 V, I <sub>D</sub> = 50 A, T <sub>J</sub> = 175°C              |                                                                                                                  | R <sub>DS(on)</sub>  | -<br>-   | 10<br>19   | 17<br>-  | mΩ   |
| Forward Transconductance*<br>V <sub>DS</sub> = 20 V, I <sub>DS</sub> = 50 A<br>V <sub>DS</sub> = 20 V, I <sub>DS</sub> = 50 A, T <sub>J</sub> = 175°C                      |                                                                                                                  | g <sub>fs</sub>      | -<br>-   | 97<br>79   | -<br>-   | S    |
| Input Capacitance                                                                                                                                                          | V <sub>GS</sub> = 0 V, V <sub>DS</sub> = 50 V, f = 1 MHz,<br>V <sub>AC</sub> = 25 mV                             | C <sub>iss</sub>     | -        | 6500       | -        | pF   |
| Output Capacitance                                                                                                                                                         |                                                                                                                  | C <sub>oss</sub>     | -        | 1100       | -        |      |
| Reverse Transfer Capacitance                                                                                                                                               |                                                                                                                  | C <sub>rss</sub>     | -        | 12         | -        |      |
| C <sub>oss</sub> Stored Energy<br>V <sub>GS</sub> = 0 V, V <sub>DS</sub> = 900 V, f = 100 kHz, V <sub>AC</sub> = 25 mV                                                     |                                                                                                                  | E <sub>oss</sub>     | -        | 160        | -        | μJ   |
| Turn On Delay Time                                                                                                                                                         | V <sub>DD</sub> = 450 V, V <sub>GS</sub> = 0 V / 15 V,<br>I <sub>D</sub> = 35 A, R <sub>G(ext)</sub> = 3 Ω       | t <sub>d(on)</sub>   | -        | 40         | -        | ns   |
| Rise Time                                                                                                                                                                  |                                                                                                                  | t <sub>r</sub>       | -        | 60         | -        |      |
| Turn Off Delay Time                                                                                                                                                        |                                                                                                                  | t <sub>d(off)</sub>  | -        | 140        | -        |      |
| Fall Time                                                                                                                                                                  |                                                                                                                  | t <sub>f</sub>       | -        | 32         | -        |      |
| Internal Gate Resistance<br>V <sub>AC</sub> = 25 mV, f = 1 MHz                                                                                                             |                                                                                                                  | R <sub>G(Int)</sub>  | -        | 2          | -        | Ω    |
| Gate to Source Charge                                                                                                                                                      | V <sub>DS</sub> = 450 V, V <sub>GS</sub> = -4 V / 15 V<br>I <sub>D</sub> = 35 A                                  | Q <sub>gs</sub>      | -        | 14         | -        | nC   |
| Gate to Drain Charge                                                                                                                                                       |                                                                                                                  | Q <sub>gd</sub>      | -        | 50         | -        |      |
| Total Gate Charge                                                                                                                                                          |                                                                                                                  | Q <sub>g</sub>       | -        | 130        | -        |      |
| Reverse Diode Characteristics <sup>3/</sup>                                                                                                                                |                                                                                                                  | Symbol               | Min      | Typ        | Max      | Unit |
| Diode Forward Voltage*<br>V <sub>GS</sub> = -4 V, I <sub>SD</sub> = 50 A<br>V <sub>GS</sub> = -4 V, I <sub>SD</sub> = 50 A, T <sub>J</sub> = 175°C                         |                                                                                                                  | V <sub>SD</sub>      | -<br>-   | 4.6<br>4.1 | -<br>-   | V    |
| Reverse Recovery Time                                                                                                                                                      | V <sub>GS</sub> = 0 V, I <sub>SD</sub> = 10 A, V <sub>R</sub> = 30 V,<br>di/dt = 100 A/μs, T <sub>J</sub> = 25°C | t <sub>rr</sub>      | -        | 85         | -        | ns   |
| Reverse Recovery Charge                                                                                                                                                    |                                                                                                                  | Q <sub>rr</sub>      | -        | 160        | -        | nC   |
| Peak Reverse Recovery Current                                                                                                                                              |                                                                                                                  | I <sub>rrm</sub>     | -        | 4          | -        | A    |

NOTES: \*Pulse Test: Pulse Width = 300  $\mu\text{sec}$ , Duty Cycle = 2%.

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## Radiation Performance

| Electrical Characteristics: 50K rads (Si) <sup>7/</sup> |                                                     | Symbol        | Min | Typ | Max | Unit          |
|---------------------------------------------------------|-----------------------------------------------------|---------------|-----|-----|-----|---------------|
| Drain - Source Breakdown Voltage                        | $V_{GS} = 0\text{ V}, I_D = 100\text{ }\mu\text{A}$ | $V_{(BR)DSS}$ | 900 | -   | -   | V             |
| Gate Threshold Voltage                                  | $V_{DS} = V_{GS}, I_D = 33\text{ mA}$               | $V_{GS(th)}$  | 1.4 | 1.8 | 3.5 | V             |
| Zero Gate Voltage Drain Current                         | $V_{DS} = 900\text{ V}, V_{GS} = 0\text{ V}$        | $I_{DSS}$     | -   | 6   | 100 | $\mu\text{A}$ |
| Gate - Source Leakage                                   | $V_{GS} = 15\text{ V}, V_{DS} = 0\text{ V}$         | $I_{GSS}$     | -   | 6   | 250 | nA            |
| Drain - Source On-State Resistance                      | $V_{GS} = 15\text{ V}, I_D = 50\text{ A}$           | $R_{DS(on)}$  | -   | 13  | 17  | m $\Omega$    |

| Electrical Characteristics: 100K rads (Si) <sup>7/</sup> |                                                     | Symbol        | Min | Typ | Max | Unit          |
|----------------------------------------------------------|-----------------------------------------------------|---------------|-----|-----|-----|---------------|
| Drain - Source Breakdown Voltage                         | $V_{GS} = 0\text{ V}, I_D = 100\text{ }\mu\text{A}$ | $V_{(BR)DSS}$ | 900 | -   | -   | V             |
| Gate Threshold Voltage                                   | $V_{DS} = V_{GS}, I_D = 33\text{ mA}$               | $V_{GS(th)}$  | 1.4 | 1.6 | 3.5 | V             |
| Zero Gate Voltage Drain Current                          | $V_{DS} = 900\text{ V}, V_{GS} = 0\text{ V}$        | $I_{DSS}$     | -   | 8   | 100 | $\mu\text{A}$ |
| Gate - Source Leakage                                    | $V_{GS} = 15\text{ V}, V_{DS} = 0\text{ V}$         | $I_{GSS}$     | -   | 6   | 250 | nA            |
| Drain - Source On-State Resistance                       | $V_{GS} = 15\text{ V}, I_D = 50\text{ A}$           | $R_{DS(on)}$  | -   | 13  | 17  | m $\Omega$    |

| Electrical Characteristics: 300K rads (Si) <sup>7/</sup> |                                                     | Symbol        | Min | Typ | Max | Unit          |
|----------------------------------------------------------|-----------------------------------------------------|---------------|-----|-----|-----|---------------|
| Drain - Source Breakdown Voltage                         | $V_{GS} = 0\text{ V}, I_D = 200\text{ }\mu\text{A}$ | $V_{(BR)DSS}$ | 900 | -   | -   | V             |
| Gate Threshold Voltage                                   | $V_{DS} = V_{GS}, I_D = 33\text{ mA}$               | $V_{GS(th)}$  | 1.0 | 1.2 | 3.5 | V             |
| Zero Gate Voltage Drain Current                          | $V_{DS} = 900\text{ V}, V_{GS} = 0\text{ V}$        | $I_{DSS}$     | -   | 80  | 200 | $\mu\text{A}$ |
| Gate - Source Leakage                                    | $V_{GS} = 15\text{ V}, V_{DS} = 0\text{ V}$         | $I_{GSS}$     | -   | 6   | 250 | nA            |
| Drain - Source On-State Resistance                       | $V_{GS} = 15\text{ V}, I_D = 50\text{ A}$           | $R_{DS(on)}$  | -   | 13  | 17  | m $\Omega$    |

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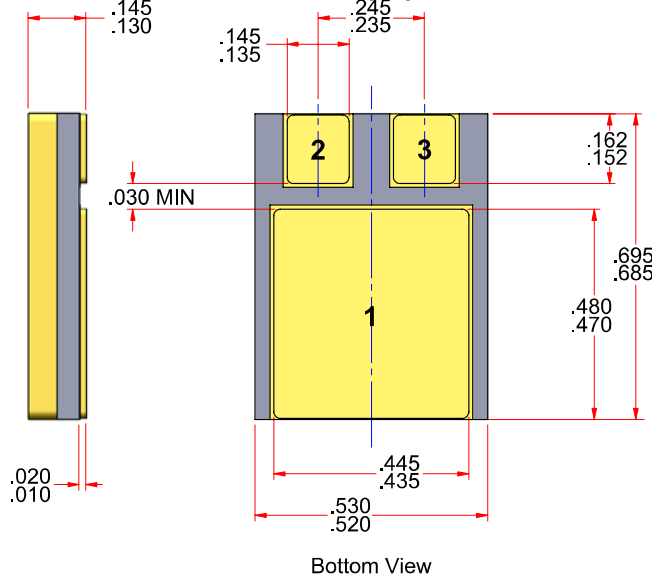


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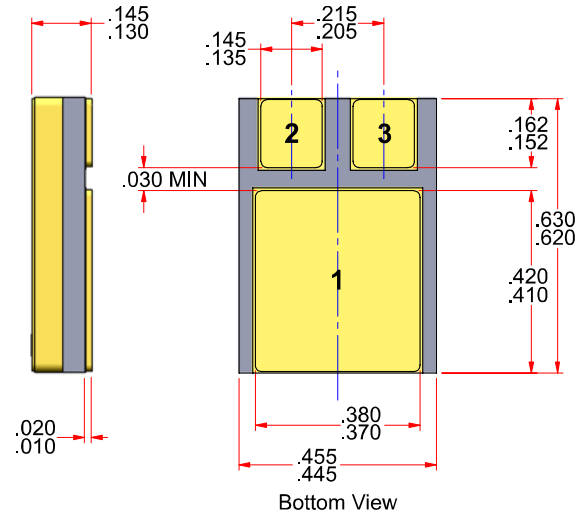
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## PACKAGE OUTLINE: SMD2 (S2)



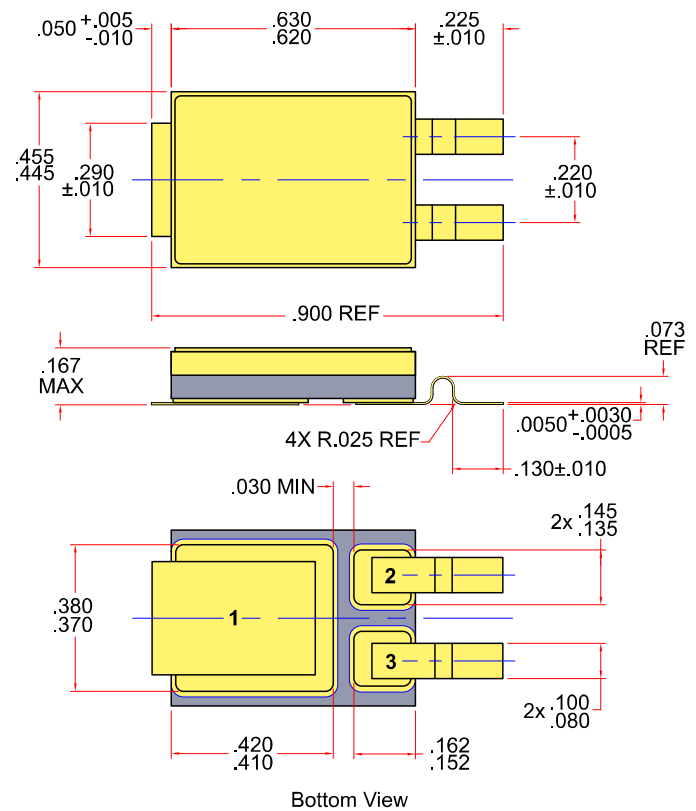
## PACKAGE OUTLINE: SMD1 (S1)



### Pin Assignment:

| Package               | Drain | Source | Gate  |
|-----------------------|-------|--------|-------|
| SMD2 (S2)             | Pin 1 | Pin 2  | Pin 3 |
| SMD1 (S1)             | Pin 1 | Pin 2  | Pin 3 |
| SMD1 with Leads (S1L) | Pin 1 | Pin 2  | Pin 3 |

## PACKAGE OUTLINE: SMD1 with Leads (S1L)



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