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# FDS86140

## N-Channel PowerTrench<sup>®</sup> MOSFET

100 V, 11.2 A, 9.8 mΩ

### Features

- Max  $r_{DS(on)}$  = 9.8 mΩ at  $V_{GS} = 10$  V,  $I_D = 11.2$  A
- Max  $r_{DS(on)}$  = 16 mΩ at  $V_{GS} = 6$  V,  $I_D = 9$  A
- High performance trench technology for extremely low  $r_{DS(on)}$
- High power and current handling capability in a widely used surface mount package
- 100% UIL Tested
- RoHS Compliant

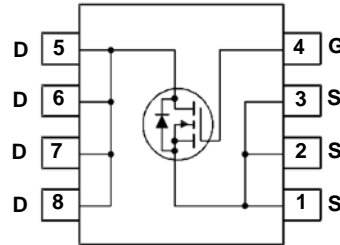
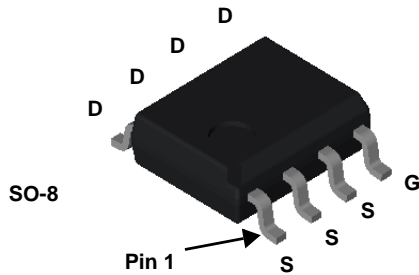


### General Description

This N-Channel MOSFET is produced using Fairchild Semiconductor's advanced PowerTrench<sup>®</sup> process that has been optimized for  $r_{DS(on)}$ , switching performance and ruggedness.

### Applications

- DC/DC Converters and Off-Line UPS
- Distributed Power Architectures and VRMs
- Primary Switch for 24 V and 48 V Systems
- High Voltage Synchronous Rectifier



### MOSFET Maximum Ratings $T_A = 25$ °C unless otherwise noted

| Symbol         | Parameter  | Ratings     | Units |
|----------------|--|-------------|-------|
| $V_{DS}$       | Drain to Source Voltage                          | 100         | V     |
| $V_{GS}$       | Gate to Source Voltage                           | ±20         | V     |
| $I_D$          | Drain Current -Continuous                        | 11.2        | A     |
|                | -Pulsed  | 50          |       |
| $E_{AS}$       | Single Pulse Avalanche Energy (Note 3)           | 264         | mJ    |
| $P_D$          | Power Dissipation $T_C = 25$ °C (Note 1)         | 5.0         | W     |
|                | Power Dissipation $T_A = 25$ °C (Note 1a)        | 2.5         |       |
| $T_J, T_{STG}$ | Operating and Storage Junction Temperature Range | -55 to +150 | °C    |

### Thermal Characteristics

|                 |   |    |      |
|-----------------|---|----|------|
| $R_{\theta JC}$ | Thermal Resistance, Junction to Case (Note 1)     | 25 | °C/W |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient (Note 1a) | 50 |      |

### Package Marking and Ordering Information

| Device Marking | Device   | Package | Reel Size | Tape Width | Quantity   |
|----------------|----------|---------|-----------|------------|------------|
| FDS86140       | FDS86140 | SO-8    | 13"       | 12 mm      | 2500 units |

## Electrical Characteristics $T_J = 25\text{ }^\circ\text{C}$ unless otherwise noted

| Symbol | Parameter | Test Conditions | Min | Typ | Max | Units |
|--------|-----------|-----------------|-----|-----|-----|-------|
|--------|-----------|-----------------|-----|-----|-----|-------|

### Off Characteristics

|                                      |   |   |     |    |           |                      |
|--------------------------------------|---|---|-----|----|-----------|----------------------|
| $BV_{DSS}$                           | Drain to Source Breakdown Voltage         | $I_D = 250\text{ }\mu\text{A}, V_{GS} = 0\text{ V}$                       | 100 |    |           | V                    |
| $\frac{\Delta BV_{DSS}}{\Delta T_J}$ | Breakdown Voltage Temperature Coefficient | $I_D = 250\text{ }\mu\text{A}$ , referenced to $25\text{ }^\circ\text{C}$ |     | 70 |           | mV/ $^\circ\text{C}$ |
| $I_{DSS}$                            | Zero Gate Voltage Drain Current           | $V_{DS} = 80\text{ V}, V_{GS} = 0\text{ V}$                               |     |    | 1         | $\mu\text{A}$        |
| $I_{GSS}$                            | Gate to Source Leakage Current            | $V_{GS} = \pm 20\text{ V}, V_{DS} = 0\text{ V}$                           |     |    | $\pm 100$ | nA                   |

### On Characteristics

|  |  |  |   |      |     |                      |
|--|--|--|---|------|-----|----------------------|
| $V_{GS(th)}$                           | Gate to Source Threshold Voltage                         | $V_{GS} = V_{DS}, I_D = 250\text{ }\mu\text{A}$                              | 2 | 2.7  | 4   | V                    |
| $\frac{\Delta V_{GS(th)}}{\Delta T_J}$ | Gate to Source Threshold Voltage Temperature Coefficient | $I_D = 250\text{ }\mu\text{A}$ , referenced to $25\text{ }^\circ\text{C}$    |   | -11  |     | mV/ $^\circ\text{C}$ |
| $r_{DS(on)}$                           | Static Drain to Source On Resistance                     | $V_{GS} = 10\text{ V}, I_D = 11.2\text{ A}$                                  |   | 8.1  | 9.8 | m $\Omega$           |
|  |  | $V_{GS} = 6\text{ V}, I_D = 9\text{ A}$                                      |   | 10.8 | 16  |                      |
|  |  | $V_{GS} = 10\text{ V}, I_D = 11.2\text{ A}, T_J = 125\text{ }^\circ\text{C}$ |   | 13.1 | 17  |                      |
| $g_{FS}$                               | Forward Transconductance                                 | $V_{DS} = 10\text{ V}, I_D = 11.2\text{ A}$                                  |   | 35   |     | S                    |

### Dynamic Characteristics

|           |                              |   |  |      |      |          |
|-----------|------------------------------|---|--|------|------|----------|
| $C_{iss}$ | Input Capacitance            | $V_{DS} = 50\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$ |  | 1940 | 2580 | pF       |
| $C_{oss}$ | Output Capacitance           |   |  | 440  | 585  | pF       |
| $C_{rss}$ | Reverse Transfer Capacitance |   |  | 20   | 30   | pF       |
| $R_g$     | Gate Resistance              |   |  | 0.9  |      | $\Omega$ |

### Switching Characteristics

|              |                               |  |                                       |      |      |    |    |
|--------------|-------------------------------|--|---------------------------------------|------|------|----|----|
| $t_{d(on)}$  | Turn-On Delay Time            | $V_{DD} = 50\text{ V}, I_D = 11.2\text{ A}, V_{GS} = 10\text{ V}, R_{GEN} = 6\text{ }\Omega$ |                                       | 13.7 | 25   | ns |    |
| $t_r$        | Rise Time                     |  |                                       | 5.6  | 11   | ns |    |
| $t_{d(off)}$ | Turn-Off Delay Time           |  |                                       | 23   | 38   | ns |    |
| $t_f$        | Fall Time                     |  |                                       | 4.8  | 10   | ns |    |
| $Q_g$        | Total Gate Charge             |  | $V_{GS} = 0\text{ V to } 10\text{ V}$ |      | 29   | 41 | nC |
| $Q_g$        | Total Gate Charge             |  | $V_{GS} = 0\text{ V to } 5\text{ V}$  |      | 16.5 | 23 | nC |
| $Q_{gs}$     | Gate to Source Charge         | $V_{DD} = 50\text{ V}, I_D = 11.2\text{ A}$  |                                       | 8.0  |      | nC |    |
| $Q_{gd}$     | Gate to Drain "Miller" Charge |  |                                       | 6.5  |      | nC |    |

### Drain-Source Diode Characteristics

|          |                                    |   |  |     |     |    |
|----------|------------------------------------|---|--|-----|-----|----|
| $V_{SD}$ | Source-Drain Diode Forward Voltage | $V_{GS} = 0\text{ V}, I_S = 11.2\text{ A}$ (Note 2)     |  | 0.8 | 1.3 | V  |
|          |                                    | $V_{GS} = 0\text{ V}, I_S = 2\text{ A}$ (Note 2)        |  | 0.7 | 1.2 |    |
| $t_{rr}$ | Reverse Recovery Time              | $I_F = 11.2\text{ A}, di/dt = 100\text{ A}/\mu\text{s}$ |  | 53  | 85  | ns |
| $Q_{rr}$ | Reverse Recovery Charge            |   |  | 59  | 94  | nC |

#### NOTES:

1.  $R_{\theta JA}$  is determined with the device mounted on a  $1\text{ in}^2$  pad 2 oz copper pad on a  $1.5 \times 1.5\text{ in.}$  board of FR-4 material.  $R_{\theta JC}$  is guaranteed by design while  $R_{\theta CA}$  is determined by the user's board design.



a)  $50\text{ }^\circ\text{C/W}$  when mounted on a  $1\text{ in}^2$  pad of 2 oz copper.



b)  $125\text{ }^\circ\text{C/W}$  when mounted on a minimum pad.

2. Pulse Test: Pulse Width  $< 300\text{ }\mu\text{s}$ , Duty cycle  $< 2.0\%$ .  
 3. Starting  $T_J = 25\text{ }^\circ\text{C}$ ,  $L = 1\text{ mH}$ ,  $I_{AS} = 23\text{ A}$ ,  $V_{DD} = 90\text{ V}$ ,  $V_{GS} = 10\text{ V}$ .

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

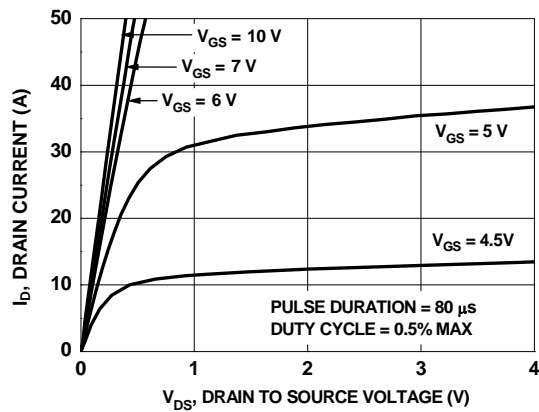


Figure 1. On Region Characteristics

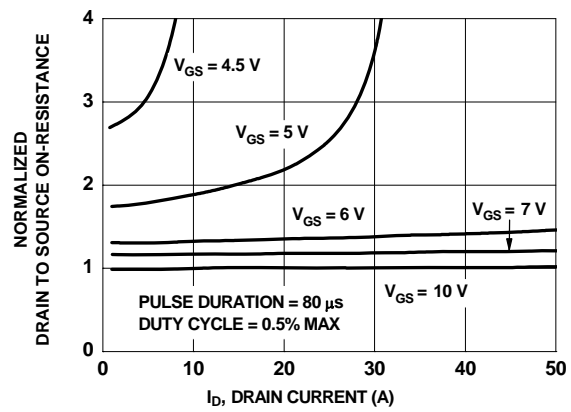


Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage

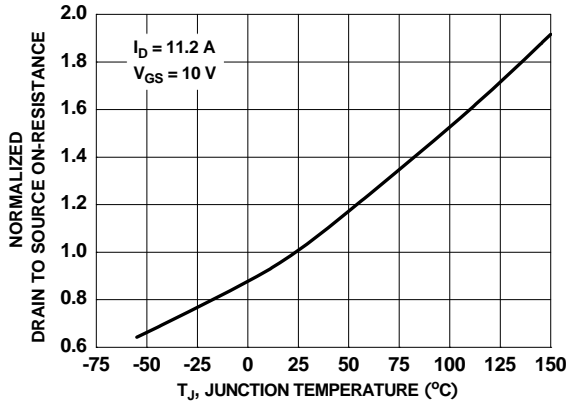


Figure 3. Normalized On Resistance vs Junction Temperature

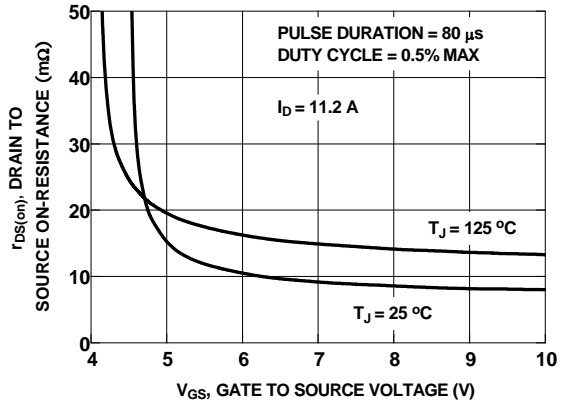


Figure 4. On-Resistance vs Gate to Source Voltage

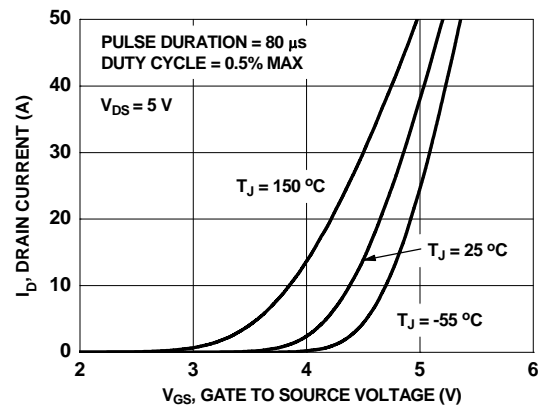


Figure 5. Transfer Characteristics

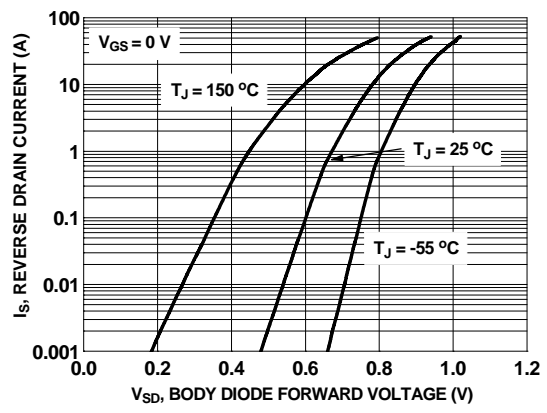
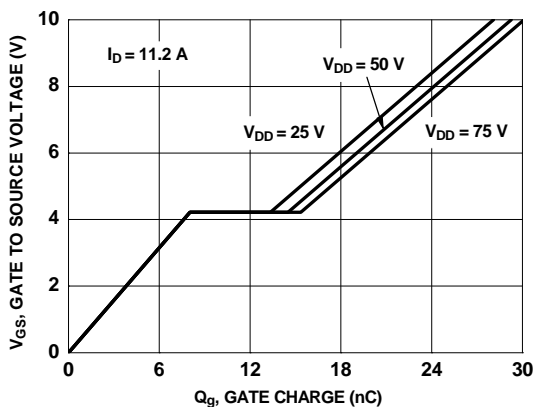
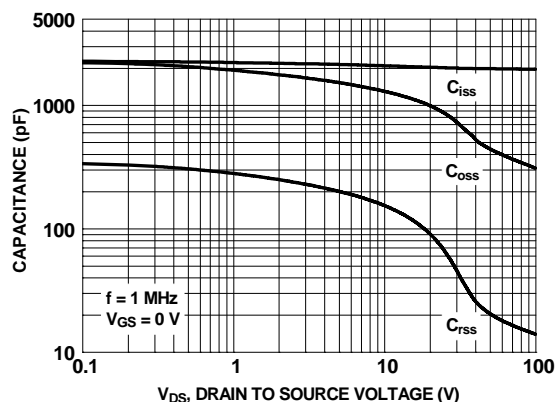


Figure 6. Source to Drain Diode Forward Voltage vs Source Current

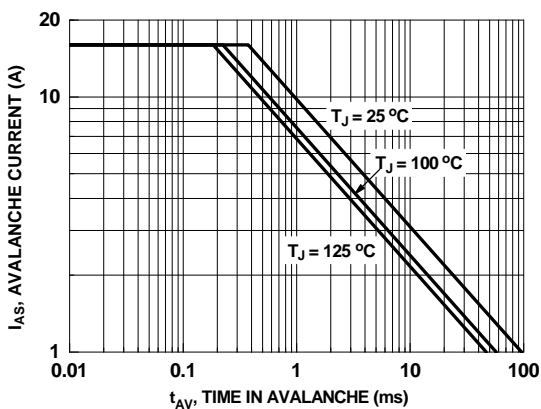
**Typical Characteristics**  $T_J = 25^\circ\text{C}$  unless otherwise noted



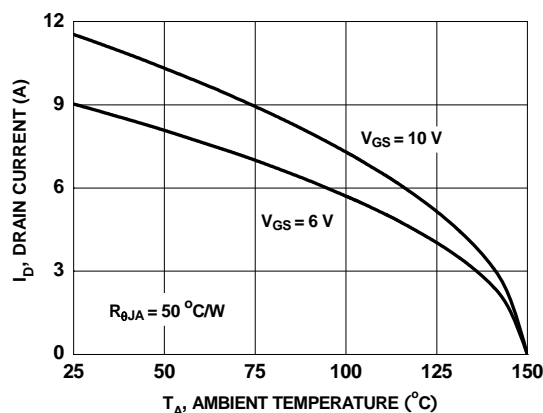
**Figure 7. Gate Charge Characteristics**



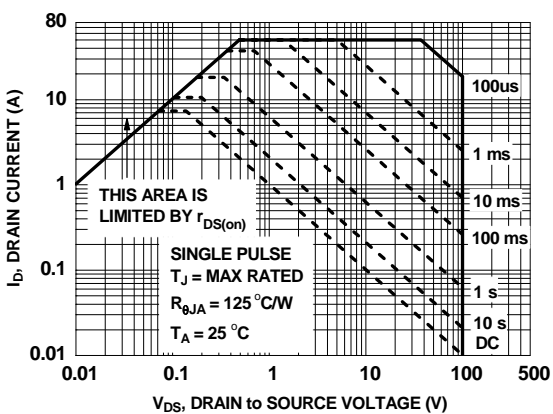
**Figure 8. Capacitance vs Drain to Source Voltage**



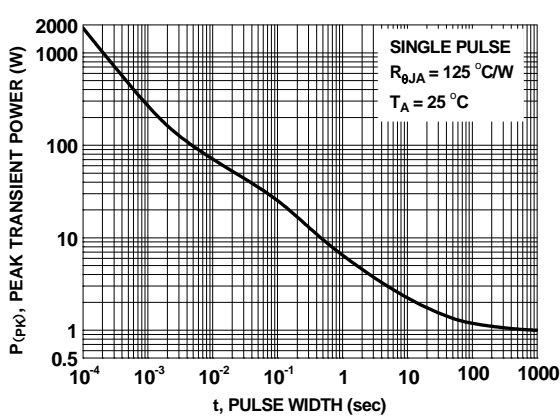
**Figure 9. Unclamped Inductive Switching Capability**



**Figure 10. Maximum Continuous Drain Current vs Ambient Temperature**

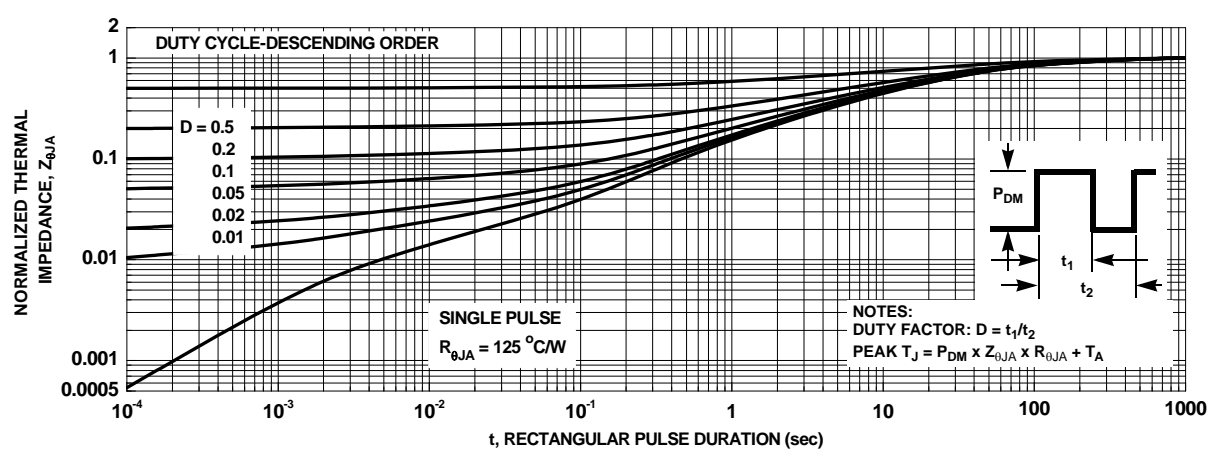


**Figure 11. Forward Bias Safe Operating Area**

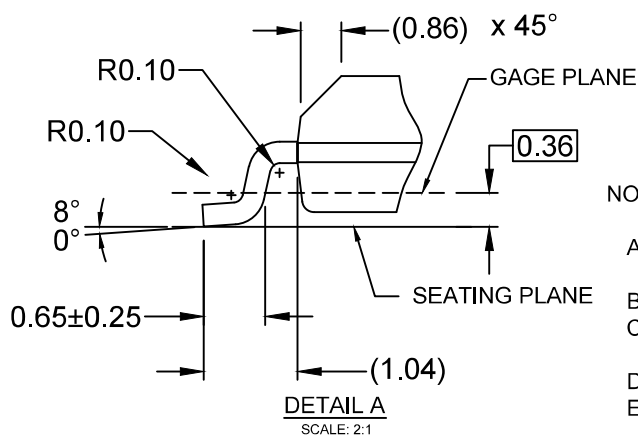
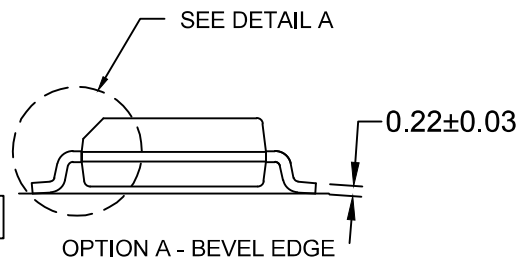
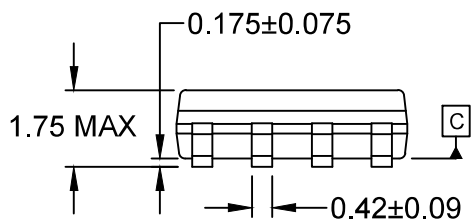
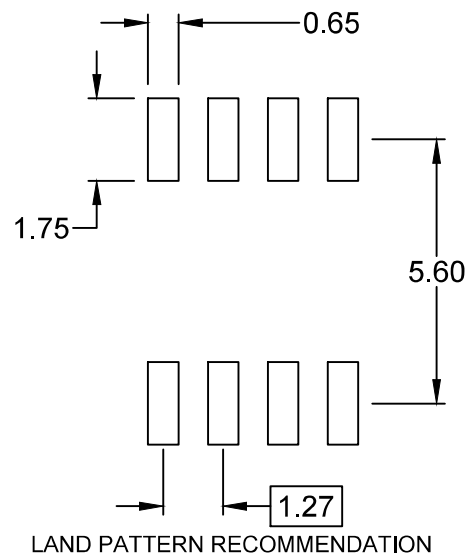


**Figure 12. Single Pulse Maximum Power Dissipation**

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



**Figure 13. Junction-to-Ambient Transient Thermal Response Curve**



NOTES:

- A) THIS PACKAGE CONFORMS TO JEDEC MS-012, VARIATION AA.
- B) ALL DIMENSIONS ARE IN MILLIMETERS.
- C) DIMENSIONS DO NOT INCLUDE MOLD FLASH OR BURRS.
- D) LANDPATTERN STANDARD: SOIC127P600X175-8M
- E) DRAWING FILENAME: M08Arev16



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