



# THE DATASHEET OF FDD8750



# FDD8750

## N-Channel PowerTrench® MOSFET

25V, 2.7A, 40mΩ

### Features

- Max  $r_{DS(on)}$  = 40mΩ at  $V_{GS} = 10V$ ,  $I_D = 2.7A$
- Max  $r_{DS(on)}$  = 60mΩ at  $V_{GS} = 4.5V$ ,  $I_D = 2.7A$
- Low gate charge:  $Q_{g(10)}$  = 6nC(Typ)
- Low gate resistance
- Avalanche rated and 100% tested
- RoHS Compliant

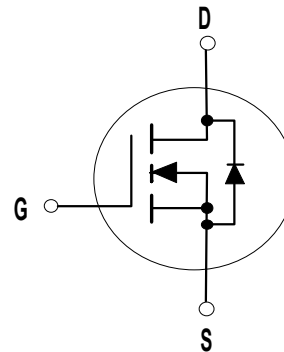
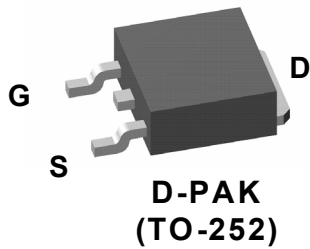


### General Description

This N-Channel MOSFET has been designed specifically to improve the overall efficiency of DC/DC converters using either synchronous or conventional switching PWM controllers. It has been optimized for low gate charge, low  $r_{DS(on)}$  and fast switching speed.

### Application

- Low current DC-DC switching
- Linear regulation



### MOSFET Maximum Ratings $T_C = 25^\circ\text{C}$ unless otherwise noted

| Symbol         | Parameter  | Conditions                         | Ratings     | Units            |
|----------------|--|------------------------------------|-------------|------------------|
| $V_{DS}$       | Drain to Source Voltage                          |                                    | 25          | V                |
| $V_{GS}$       | Gate to Source Voltage                           |                                    | $\pm 20$    | V                |
| $I_D$          | Drain Current -Continuous(Package Limited)       | $T_C = 25^\circ\text{C}$           | 2.7         | A                |
|                | -Continuous(Silicon Limited)                     | $T_C = 25^\circ\text{C}$ (Note 1)  | 16          |                  |
|                | -Continuous                                      | $T_A = 25^\circ\text{C}$ (Note 1a) | 6.5         |                  |
|                | -Pulsed  |                                    | 14          |                  |
| $E_{AS}$       | Drain-Source Avalanche Energy                    | (Note 3)                           | 19          | mJ               |
| $P_D$          | Power Dissipation                                | $T_C = 25^\circ\text{C}$           | 18          | W                |
|                | Power Dissipation                                | (Note 1a)                          | 3.7         |                  |
| $T_J, T_{STG}$ | Operating and Storage Junction Temperature Range |                                    | -55 to +175 | $^\circ\text{C}$ |

### Thermal Characteristics

|                 |   |           |    |                    |
|-----------------|---|-----------|----|--------------------|
| $R_{\theta JC}$ | Thermal Resistance, Junction to Case    |           | 8  | $^\circ\text{C/W}$ |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient | (Note 1a) | 40 |                    |

### Package Marking and Ordering Information

| Device Marking | Device  | Package       | Reel Size | Tape Width | Quantity   |
|----------------|---------|---------------|-----------|------------|------------|
| FDD8750        | FDD8750 | D-PAK(TO-252) | 13"       | 12mm       | 2500 units |

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

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

### Off Characteristics

|                                      |   |  |    |    |           |                      |
|--------------------------------------|---|--|----|----|-----------|----------------------|
| $BV_{DSS}$                           | Drain to Source Breakdown Voltage         | $I_D = 250\mu\text{A}, V_{GS} = 0\text{V}$                             | 25 |    |           | V                    |
| $\frac{\Delta BV_{DSS}}{\Delta T_J}$ | Breakdown Voltage Temperature Coefficient | $I_D = 250\mu\text{A}$ , referenced to $25^\circ\text{C}$              |    | 18 |           | mV/ $^\circ\text{C}$ |
| $I_{DSS}$                            | Zero Gate Voltage Drain Current           | $V_{DS} = 20\text{V}, V_{GS} = 0\text{V}$<br>$T_J = 150^\circ\text{C}$ |    |    | 1<br>250  | $\mu\text{A}$        |
| $I_{GSS}$                            | Gate to Source Leakage Current            | $V_{GS} = \pm 20\text{V}, V_{DS} = 0\text{V}$                          |    |    | $\pm 100$ | nA                   |

### On Characteristics (Note 2)

|  |  |   |     |     |     |                      |
|--|--|---|-----|-----|-----|----------------------|
| $V_{GS(th)}$                           | Gate to Source Threshold Voltage                         | $V_{GS} = V_{DS}, I_D = 250\mu\text{A}$                           | 1.2 | 2.0 | 2.5 | V                    |
| $\frac{\Delta V_{GS(th)}}{\Delta T_J}$ | Gate to Source Threshold Voltage Temperature Coefficient | $I_D = 250\mu\text{A}$ , referenced to $25^\circ\text{C}$         |     | -5  |     | mV/ $^\circ\text{C}$ |
| $r_{DS(on)}$                           | Static Drain to Source On Resistance                     | $V_{GS} = 10\text{V}, I_D = 2.7\text{A}$                          |     | 28  | 40  | m $\Omega$           |
|  |  | $V_{GS} = 4.5\text{V}, I_D = 2.7\text{A}$                         |     | 39  | 60  |                      |
|  |  | $V_{GS} = 10\text{V}, I_D = 2.7\text{A}, T_J = 150^\circ\text{C}$ |     | 44  | 63  |                      |

### Dynamic Characteristics

|           |                              |   |  |     |     |          |
|-----------|------------------------------|---|--|-----|-----|----------|
| $C_{iss}$ | Input Capacitance            | $V_{DS} = 13\text{V}, V_{GS} = 0\text{V},$<br>$f = 1\text{MHz}$ |  | 320 | 425 | pF       |
| $C_{oss}$ | Output Capacitance           |   |  | 80  | 110 | pF       |
| $C_{rss}$ | Reverse Transfer Capacitance |   |  | 50  | 75  | pF       |
| $R_g$     | Gate Resistance              | $f = 1\text{MHz}$   |  | 1.8 |     | $\Omega$ |

### Switching Characteristics

|              |                               |  |  |     |    |    |
|--------------|-------------------------------|--|--|-----|----|----|
| $t_{d(on)}$  | Turn-On Delay Time            | $V_{DD} = 13\text{V}, I_D = 2.7\text{A}$<br>$V_{GS} = 10\text{V}, R_{GEN} = 6\Omega$ |  | 3   | 10 | ns |
| $t_r$        | Rise Time                     |  |  | 12  | 22 | ns |
| $t_{d(off)}$ | Turn-Off Delay Time           |  |  | 8   | 16 | ns |
| $t_f$        | Fall Time                     |  |  | 5   | 10 | ns |
| $Q_g$        | Total Gate Charge             |  | $V_{GS} = 0\text{V to } 10\text{V}$          |     | 6  | 9  |
| $Q_{g(5)}$   | Total Gate Charge             | $V_{GS} = 0\text{V to } 5\text{V}$   | $V_{DD} = 13\text{V}$<br>$I_D = 2.7\text{A}$ | 3.4 | 5  | nC |
| $Q_{gs}$     | Gate to Source Gate Charge    |  |  | 1.1 |    | nC |
| $Q_{gd}$     | Gate to Drain "Miller" Charge |  |  | 1.2 |    | nC |

### Drain-Source Diode Characteristics

|          |                                       |  |  |     |     |    |
|----------|---------------------------------------|--|--|-----|-----|----|
| $V_{SD}$ | Source to Drain Diode Forward Voltage | $V_{GS} = 0\text{V}, I_S = 2.7\text{A}$ (Note 2)     |  | 0.8 | 1.6 | V  |
| $t_{rr}$ | Reverse Recovery Time                 | $I_F = 2.7\text{A}, di/dt = 100\text{A}/\mu\text{s}$ |  | 16  | 24  | ns |
| $Q_{rr}$ | Reverse Recovery Charge               |  |  | 7   | 11  | nC |

#### Notes:

- $R_{\theta JA}$  is the sum of the junction-to-case and case-to-ambient thermal resistance where the case thermal reference is defined as the solder mounting surface of the drain pins.  $R_{\theta JC}$  is guaranteed by design while  $R_{\theta JA}$  is determined by the user's board design.
  - 40°C/W when mounted on a 1 in<sup>2</sup> pad of 2 oz copper;
  - 96°C/W when mounted on a minimum pad.
- Pulse Test: Pulse Width < 300 $\mu\text{s}$ , Duty cycle < 2.0%.
- Starting  $T_J = 25^\circ\text{C}$ ,  $L = 3\text{mH}$ ,  $I_{AS} = 3.6\text{A}$ ,  $V_{DD} = 25\text{V}$ ,  $V_{GS} = 10\text{V}$ .

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

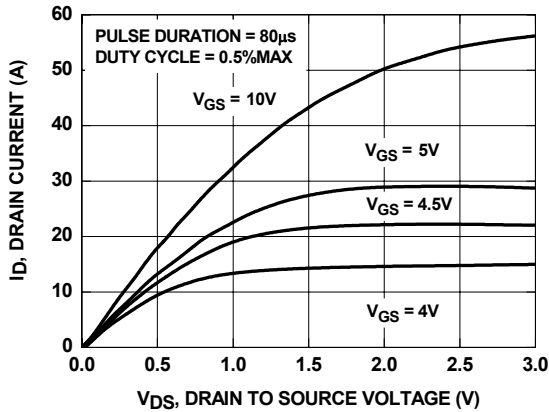


Figure 1. On Region Characteristics

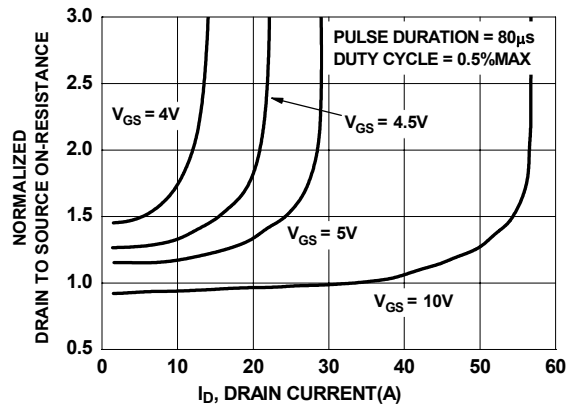


Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage

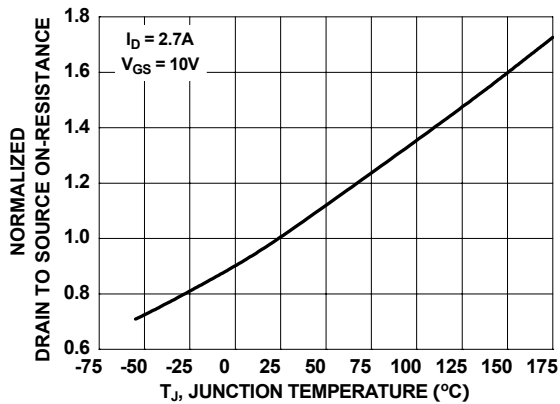


Figure 3. Normalized On Resistance vs Junction Temperature

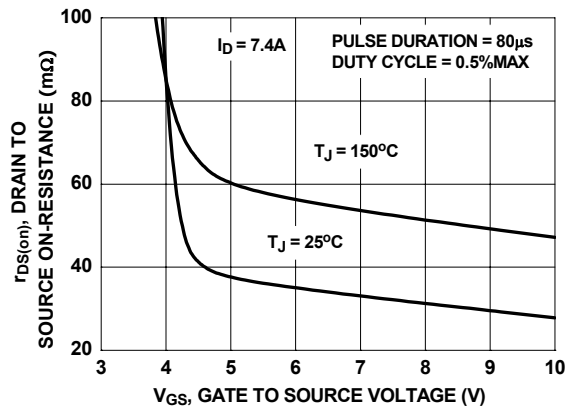


Figure 4. On-Resistance vs Gate to Source Voltage

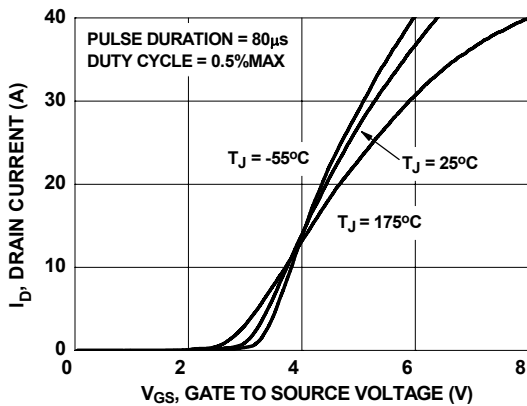


Figure 5. Transfer Characteristics

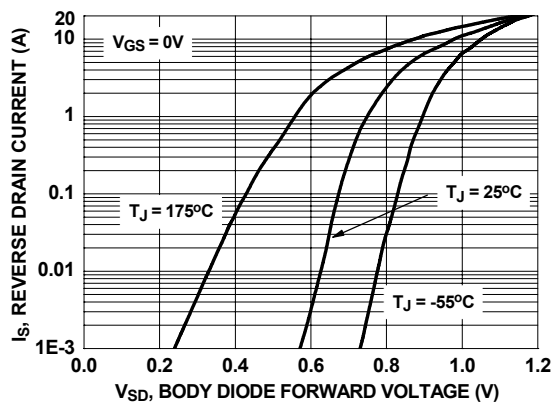
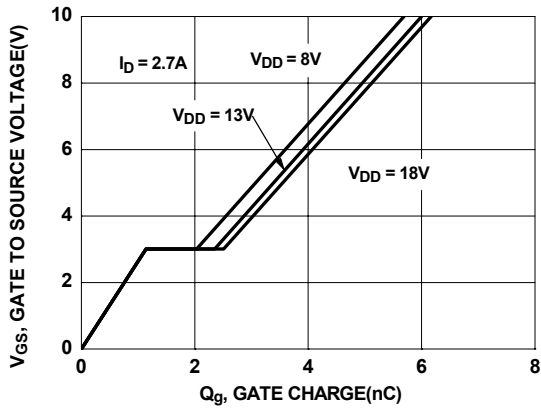
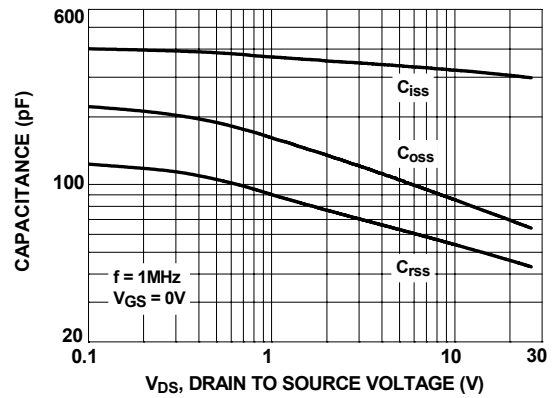


Figure 6. Source to Drain Diode Forward Voltage vs Source Current

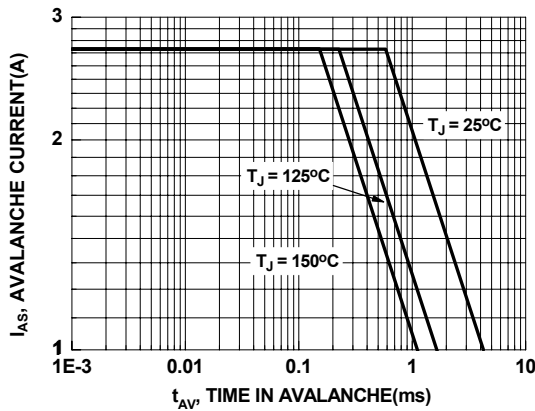
**Typical Characteristics**  $T_J = 25^\circ\text{C}$  unless otherwise noted



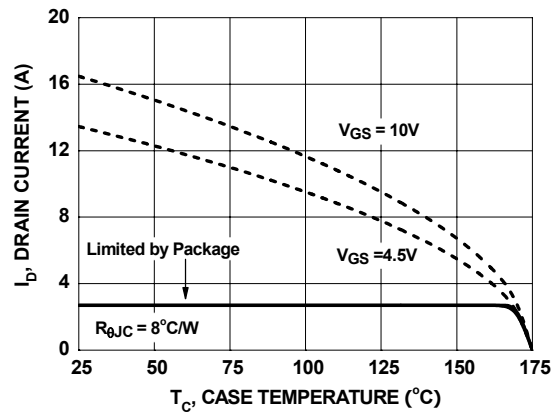
**Figure 7. Gate Charge Characteristics**



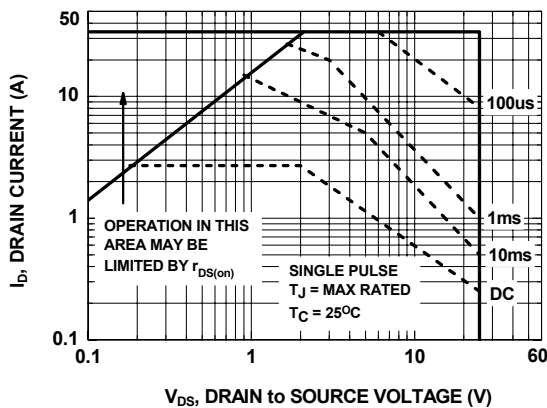
**Figure 8. Capacitance vs Drain to Source Voltage**



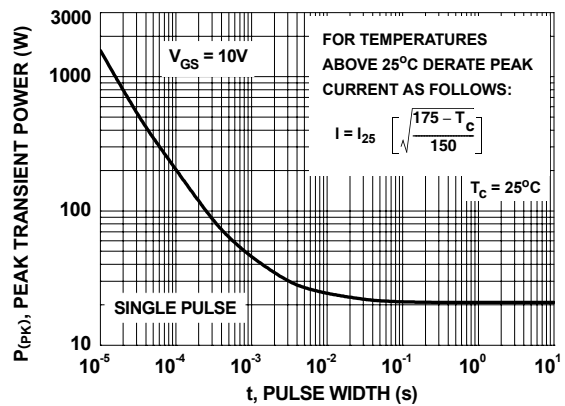
**Figure 9. Unclamped Inductive Switching Capability**



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

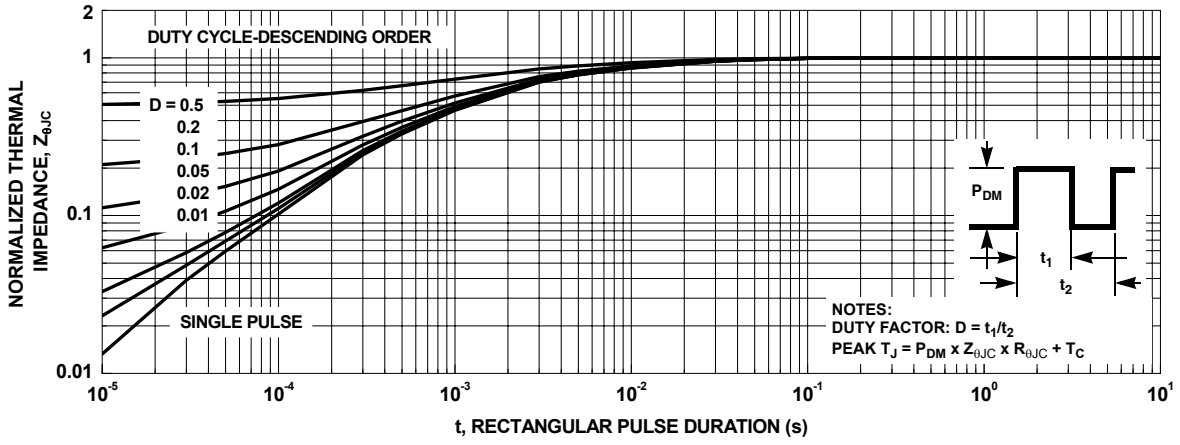


**Figure 11. Forward Bias Safe Operating Area**



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

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



**Figure 13. Transient Thermal Response Curve**

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