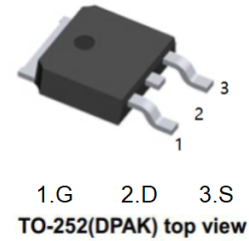


### General Description

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.

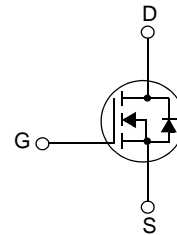


### Application

- Vcore DC-DC for Desktop Computers and Servers
- VRM for Intermediate Bus Architecture

### Features

- $V_{DS}(V) = 20V$
- $I_D = 35A$  ( $V_{GS} = 10V$ )
- $R_{DS(ON)} < 5.5m\Omega$  ( $V_{GS} = 10V$ )
- $R_{DS(ON)} < 8.5m\Omega$  ( $V_{GS} = 4.5V$ )
- Low gate charge:  $Q_{g(TOT)} = 34nC(Typ)$ ,  $V_{GS} = 10V$
- Low gate resistance



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

| Symbol         | Parameter                                   | Ratings    | Units      |
|----------------|---|------------|------------|
| $V_{DS}$       | Drain to Source Voltage                     | 20         | V          |
| $V_{GS}$       | Gate to Source Voltage                      | $\pm 20$   | V          |
| $I_D$          | Drain Current -Continuous (Package Limited) | 35         | A          |
|                | -Continuous (Die Limited)                   | 93         |            |
|                | -Pulsed (Note 1)                            | 354        |            |
| $E_{AS}$       | Single Pulse Avalanche Energy (Note 2)      | 144        | mJ         |
| $P_D$          | Power Dissipation                           | 77         | W          |
| $T_J, T_{STG}$ | Operating and Storage Temperature           | -55 to 175 | $^\circ C$ |

### Thermal Characteristics

|                 |  |      |              |
|-----------------|--|------|--------------|
| $R_{\theta JC}$ | Thermal Resistance, Junction to Case TO-252                                      | 1.94 | $^\circ C/W$ |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient TO-252                                   | 100  | $^\circ C/W$ |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient TO-252, 1in <sup>2</sup> copper pad area | 52   | $^\circ C/W$ |

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

| Symbol                                 | Parameter  | Test Conditions   | Min   | Typ  | Max       | Units                |
|--|--|---|---|------|-----------|----------------------|
| $BV_{DSS}$                             | Drain to Source Breakdown Voltage                        | $I_D = 250\mu\text{A}, V_{GS} = 0\text{V}$  | 20  |      |           | V                    |
| $\frac{\Delta BV_{DSS}}{\Delta T_J}$   | Breakdown Voltage Temperature Coefficient                | $I_D = 250\mu\text{A}$ , referenced to $25^\circ\text{C}$                           |   | 14.6 |           | mV/ $^\circ\text{C}$ |
| $I_{DSS}$                              | Zero Gate Voltage Drain Current                          | $V_{DS} = 16\text{V}$ ,   |   |      | 1         | $\mu\text{A}$        |
| $I_{GSS}$                              | Gate to Source Leakage Current                           | $V_{GS} = \pm 20\text{V}$   |   |      | $\pm 100$ | nA                   |
| $V_{GS(th)}$                           | Gate to Source Threshold Voltage                         | $V_{GS} = V_{DS}, I_D = 250\mu\text{A}$   | 1.2   | 1.6  | 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 $25^\circ\text{C}$                           |   | -6.7 |           | mV/ $^\circ\text{C}$ |
| $r_{DS(on)}$                           | Drain to Source On Resistance                            | $V_{GS} = 10\text{V}, I_D = 35\text{A}$   |   | 4.0  | 5.5       | m $\Omega$           |
|  |  | $V_{GS} = 4.5\text{V}, I_D = 33\text{A}$  |   | 5.7  | 8.5       |                      |
|  |  | $V_{GS} = 10\text{V}, I_D = 35\text{A}$<br>$T_J = 175^\circ\text{C}$                |   | 6.5  | 8.9       |                      |
| $g_{FS}$                               | Forward Transconductance                                 | $V_{DS} = 10\text{V}, I_D = 35\text{A}$   |   | 175  |           | S                    |
| $C_{iss}$                              | Input Capacitance  | $V_{DS} = 10\text{V}, V_{GS} = 0\text{V}$ ,<br>$f = 1\text{MHz}$                    |   | 1865 | 2480      | pF                   |
| $C_{oss}$                              | Output Capacitance                                       |   |   | 550  | 730       | pF                   |
| $C_{rss}$                              | Reverse Transfer Capacitance                             |   |   | 335  | 445       | pF                   |
| $R_g$                                  | Gate Resistance  |   | $f = 1\text{MHz}$   |      | 1.2       |                      |
| $t_{d(on)}$                            | Turn-On Delay Time                                       | $V_{DD} = 10\text{V}, I_D = 35\text{A}$<br>$V_{GS} = 10\text{V}, R_{GS} = 10\Omega$ |   | 9    | 18        | ns                   |
| $t_r$                                  | Rise Time  |   |   | 11   | 20        | ns                   |
| $t_{d(off)}$                           | Turn-Off Delay Time                                      |   |   | 47   | 75        | ns                   |
| $t_f$                                  | Fall Time  |   |   | 25   | 40        | ns                   |
| $Q_{g(TOT)}$                           | Total Gate Charge at 10V                                 | $V_{GS} = 0\text{V}$ to 10V   | $V_{DD} = 10\text{V}$<br>$I_D = 35\text{A}$<br>$I_g = 1.0\text{mA}$ | 34   | 48        | nC                   |
| $Q_{g(5)}$                             | Total Gate Charge at 5V                                  | $V_{GS} = 0\text{V}$ to 5V  |   | 16   | 22        | nC                   |
| $Q_{gs}$                               | Gate to Source Gate Charge                               |   |   | 3.2  |           | nC                   |
| $Q_{gd}$                               | Gate to Drain "Miller" Charge                            |   |   | 5.9  |           | nC                   |
| $V_{SD}$                               | Source to Drain Diode Forward Voltage                    | $V_{GS} = 0\text{V}, I_S = 35\text{A}$  |   |      | 0.89      | 1.25                 |
|  |  | $V_{GS} = 0\text{V}, I_S = 15\text{A}$  |   | 0.82 | 1.2       |                      |
| $t_{rr}$                               | Reverse Recovery Time                                    | $I_F = 35\text{A}, di/dt = 100\text{A}/\mu\text{s}$                                 |   | 30   | 45        | ns                   |
| $Q_{rr}$                               | Reverse Recovery Charge                                  | $I_F = 35\text{A}, di/dt = 100\text{A}/\mu\text{s}$                                 |   | 23   | 35        | nC                   |

**Notes:**

- 1: Pulse time < 300 $\mu\text{s}$ , Duty cycle = 2%.
- 2: Starting  $T_J = 25^\circ\text{C}$ ,  $L = 0.3\text{mH}$ ,  $I_{AS} = 31\text{A}$ ,  $V_{DD} = 18\text{V}$ ,  $V_{GS} = 10\text{V}$ .

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

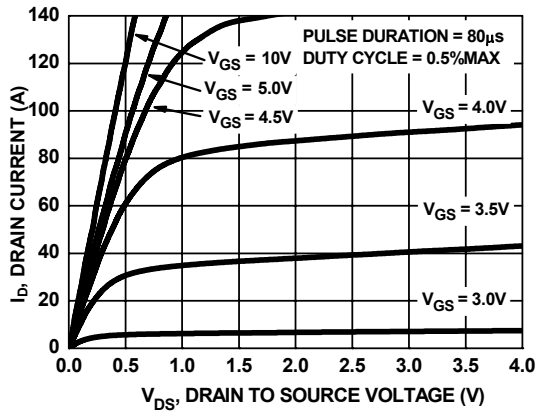


Figure 1. On Region Characteristics

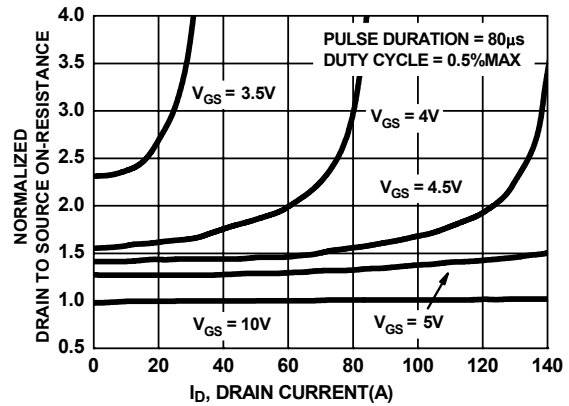


Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage

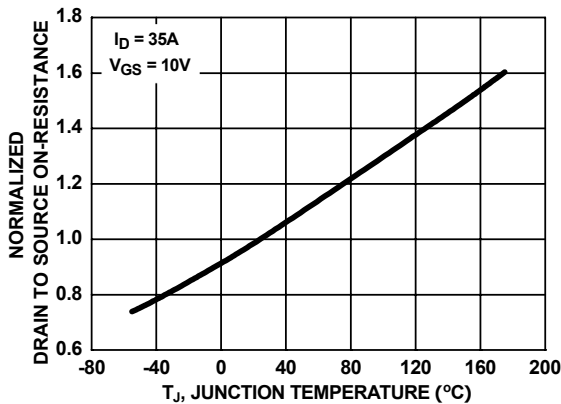


Figure 3. Normalized On Resistance vs Junction Temperature

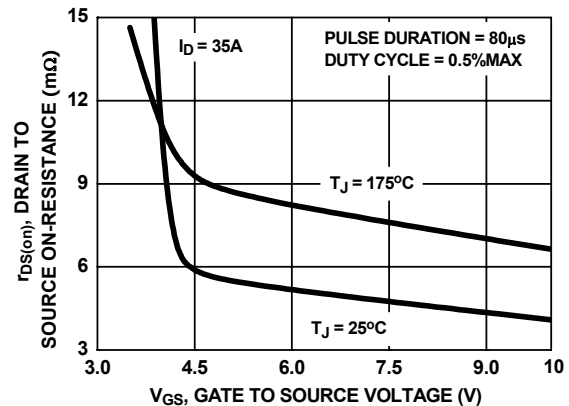


Figure 4. On-Resistance vs Gate to Source Voltage

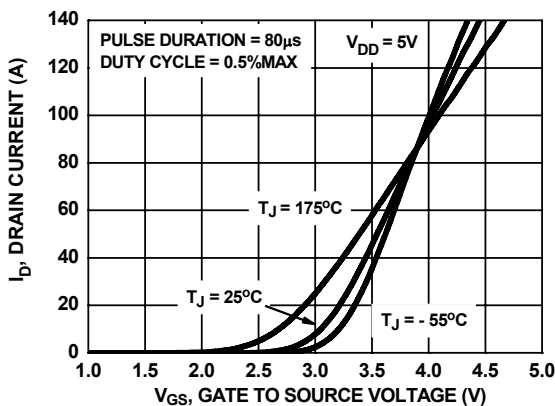


Figure 5. Transfer Characteristics

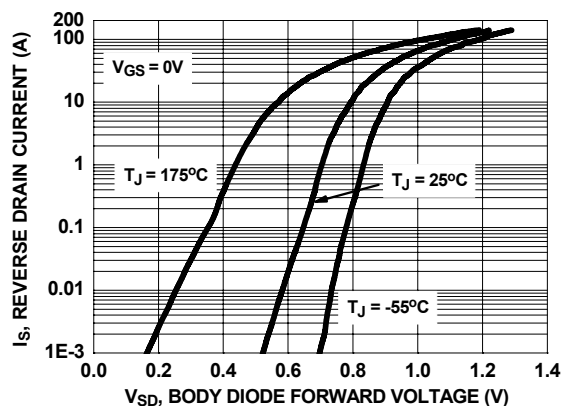


Figure 6. Source to Drain Diode Forward Voltage vs Source Current

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

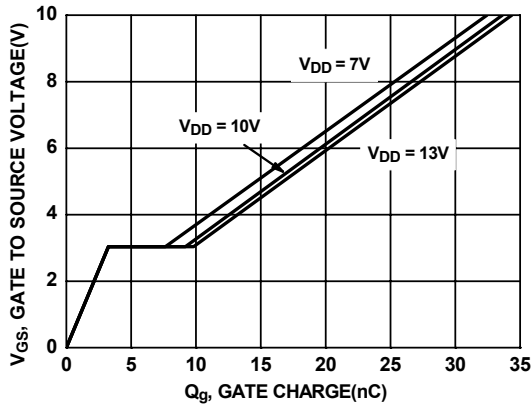


Figure 7. Gate Charge Characteristics

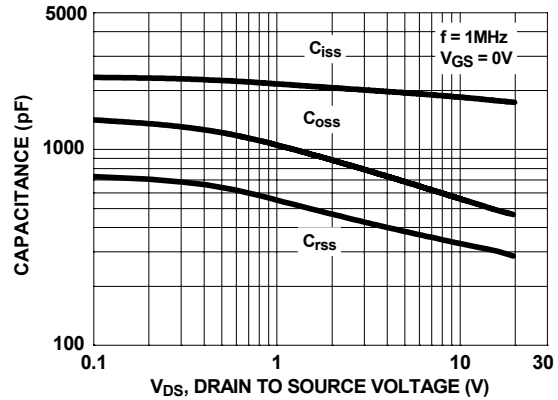


Figure 8. Capacitance vs Drain to Source Voltage

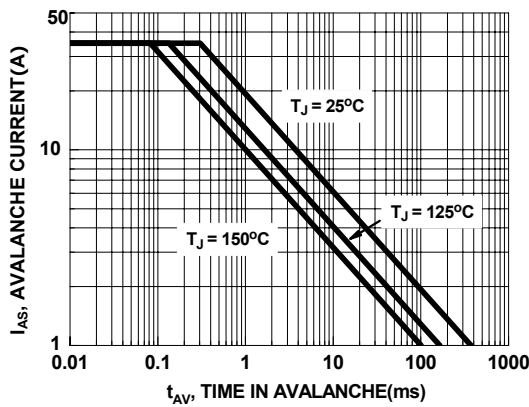


Figure 9. Unclamped Inductive Switching Capability

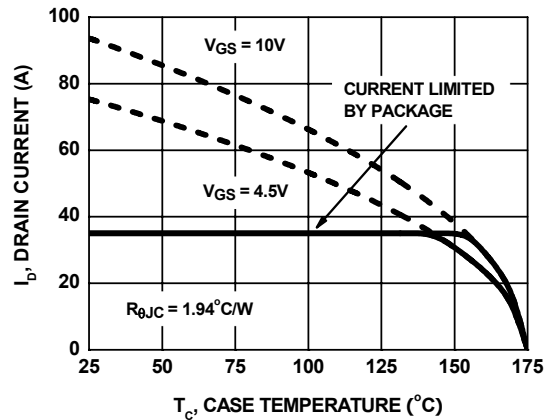


Figure 10. Maximum Continuous Drain Current vs Case Temperature

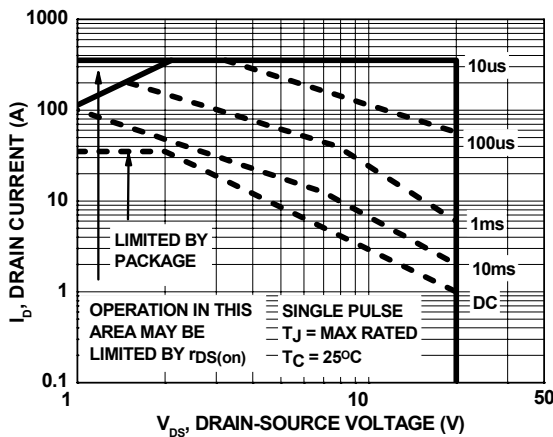


Figure 11. Forward Bias Safe Operating Area

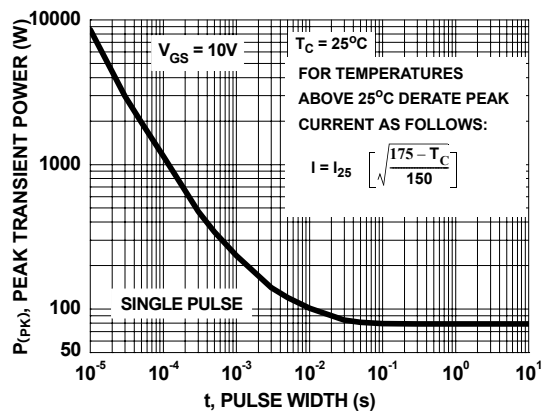


Figure 12. Single Pulse Maximum Power Dissipation

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

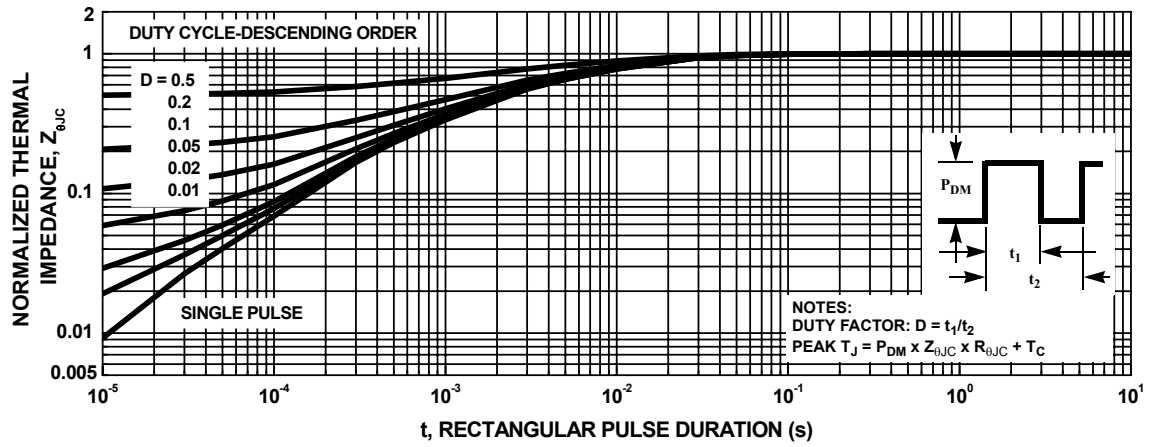
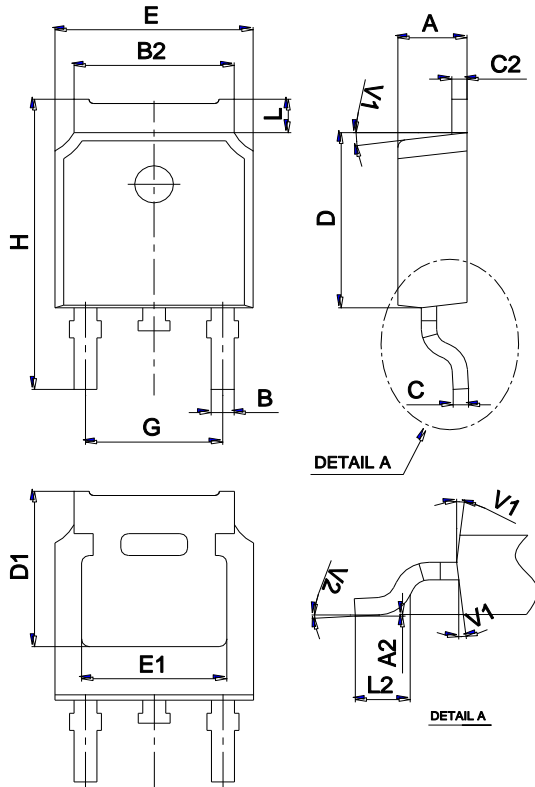


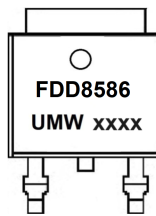
Figure 13. Transient Thermal Response Curve

Package Mechanical Data TO-252



| Ref. | Dimensions  |      |       |          |      |       |
|------|-------------|------|-------|----------|------|-------|
|      | Millimeters |      |       | Inches   |      |       |
|      | Min.        | Typ. | Max.  | Min.     | Typ. | Max.  |
| A    | 2.10        |      | 2.50  | 0.083    |      | 0.098 |
| A2   | 0           |      | 0.10  | 0        |      | 0.004 |
| B    | 0.66        |      | 0.86  | 0.026    |      | 0.034 |
| B2   | 5.18        |      | 5.48  | 0.202    |      | 0.216 |
| C    | 0.40        |      | 0.60  | 0.016    |      | 0.024 |
| C2   | 0.44        |      | 0.58  | 0.017    |      | 0.023 |
| D    | 5.90        |      | 6.30  | 0.232    |      | 0.248 |
| D1   | 5.30REF     |      |       | 0.209REF |      |       |
| E    | 6.40        |      | 6.80  | 0.252    |      | 0.268 |
| E1   | 4.63        |      |       | 0.182    |      |       |
| G    | 4.47        |      | 4.67  | 0.176    |      | 0.184 |
| H    | 9.50        |      | 10.70 | 0.374    |      | 0.421 |
| L    | 1.09        |      | 1.21  | 0.043    |      | 0.048 |
| L2   | 1.35        |      | 1.65  | 0.053    |      | 0.065 |
| V1   |             | 7°   |       |          | 7°   |       |
| V2   | 0°          |      | 6°    | 0°       |      | 6°    |

Marking



Ordering information

| Order code  | Package | Baseqty | Deliverymode  |
|-------------|---------|---------|---------------|
| UMW FDD8586 | TO-252  | 2500    | Tape and reel |

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