# UMW FDD8586

20V N-Channel MOSFET

## 1.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.

## 2.Features

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

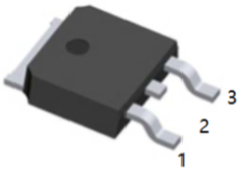
## 3.Application

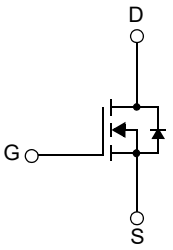
- Vcore DC-DC for Desktop Computers and Servers
- VRM for Intermediate Bus Architecture

## 4.Pinning information

| Pin | Symbol | Description |
|---|---|---|
| 1 | G | GATE |
| 2 | D | DRAIN |
| 3 | S | SOURCE |

**TO-252(DPAK)**
**top view**




## 5.Absolute Maximum Ratings $T_C$= 25°C

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

## 6.Thermal Characteristics

| Parameter | Symbol | Rating | Units |
|---|---|---|---|
| Thermal Resistance, Junction-to-Case TO-252 | $R_{\theta JC}$ | 1.94 | °C/W |
| Thermal Resistance, Junction-to-Ambient TO-252 | $R_{\theta JA}$ | 100 | °C/W |
| Thermal Resistance, Junction-to-Ambient TO-252,1in$^2$ copper pad area | $R_{\theta JA}$ | 52 | °C/W |

## 7.Electrical Characteristic ($T_J$=25°C unless otherwise noted)

| Parameter | Symbol | Conditions | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|
| Drain-Source Breakdown Voltage | $BV_{DSS}$ | $I_D$=250μA, $V_{GS}$=0V | 20 | | | V |
| Breakdown Voltage Temperature Coefficient | $\frac{\Delta BV_{DSS}}{\Delta T_J}$ | $I_D$=250μA<br>Referenced to 25°C | | 14.6 | | mV/°C |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | $V_{DS}$=16V | | | 1 | μA |
| Gate to Source Leakage Current | $I_{GSS}$ | $V_{GS}$=±20V | | | ±100 | nA |
| Gate to Source Threshold Voltage | $V_{GS(th)}$ | $V_{DS}$=$V_{GS}$, $I_D$=250μA | 1.2 | 1.6 | 2.5 | V |
| Gate to Source Threshold Voltage<br>Temperature Coefficient | $\frac{\Delta V_{GS(th)}}{\Delta T_J}$ | $I_D$=250μA<br>Referenced to 25°C | | -6.7 | | mV/°C |
| Drain to Source On Resistance | $R_{DS(ON)}$ | $V_{GS}$=10V, $I_D$=35A | | 4 | 5.5 | mΩ |
| | | $V_{GS}$=4.5V, $I_D$=33A | | 5.7 | 8.5 | mΩ |
| | | $V_{GS}$=10V,$I_D$=35A,$T_J$=175°C | | 6.5 | 8.9 | mΩ |
| Forward Transconductance | $g_{FS}$ | $V_{DS}$=10V, $I_D$=35A | | 175 | | S |
| Input Capacitance | $C_{iss}$ | $V_{DS}$=10V, $V_{GS}$=0V<br>f=1MHz | | 1865 | 2480 | pF |
| Output Capacitance | $C_{oss}$ | | | 550 | 730 | pF |
| Reverse Transfer Capacitance | $C_{rss}$ | | | 335 | 445 | pF |
| Gate Resistance | $R_g$ | f=1MHz | | 1.2 | | Ω |
| Turn-On DelayTime | $t_{D(on)}$ | $V_{DD}$=10V, $I_D$=35A<br>$V_{GS}$=10V, $R_{GEN}$=10Ω | | 9 | 18 | ns |
| Rise Time | $t_r$ | | | 11 | 20 | ns |
| Turn-Off DelayTime | $t_{D(off)}$ | | | 47 | 75 | ns |
| Fall Time | $t_f$ | | | 25 | 40 | ns |
| Total Gate Charge at 10V | $Q_{g(TOT)}$ | $V_{GS}$=0V to 10V; $V_{DD}$=10V | | 34 | 48 | nC |
| Total Gate Charge at 5V | $Q_{g(5)}$ | $V_{GS}$=0V to 5V; $I_D$=35A | | 16 | 22 | nC |
| Gate to Source Gate Charge | $Q_{gs}$ | $I_g$=1mA | | 3.2 | | nC |
| Gate to Drain “Miller” Charge | $Q_{gd}$ | | | 5.9 | | nC |
| Source to Drain Diode Forward Voltage | $V_{SD}$ | $V_{GS}$=0V, $I_S$=35A | | 0.89 | 1.25 | V |
| | | $V_{GS}$=0V, $I_S$=15A | | 0.82 | 1.2 | V |

| | | | | | | |
|---|---|---|---|---|---|---|
| Reverse Recovery Time | $t_{rr}$ | $I_F$=35A, di/dt=100A/μs | | 30 | 45 | ns |
| Reverse Recovery Charge | $Q_{rr}$ | $I_F$=35A, di/dt=100A/μs | | 23 | 35 | nC |

Notes:

1: Pulse time<300μs, Duty cycle = 2%.

2: Starting $T_J$=25°C, L=0.3mH, $I_{AS}$=31A ,$V_{DD}$=18V, $V_{GS}$=10V.

## 8.1Typical characteristic

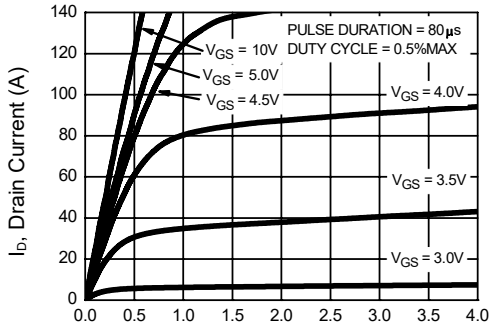



Figure 1: On-Region Characteristics

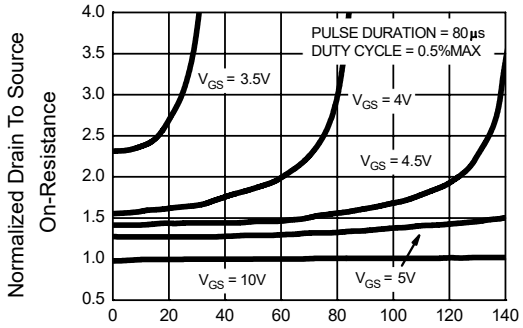



Figure 2: Normalized On-Resistance vs Drain Current and Gate Voltage

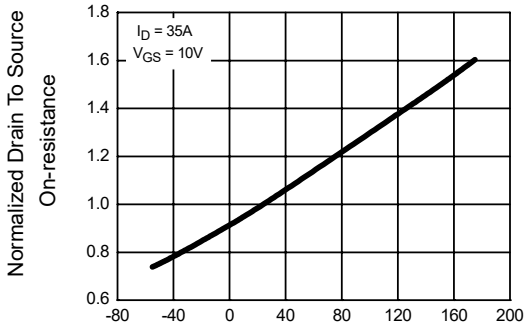



Figure 3: Normalized On Resistance vs Junction Temperature

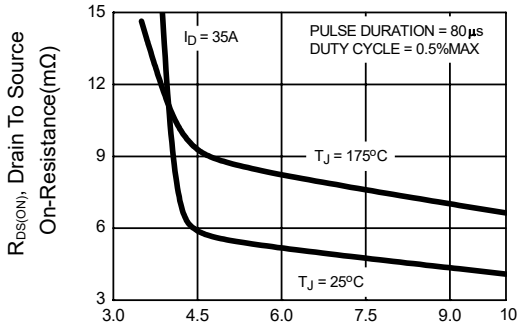



Figure 4: On-Resistance Variation with Gate-to-Source Voltage

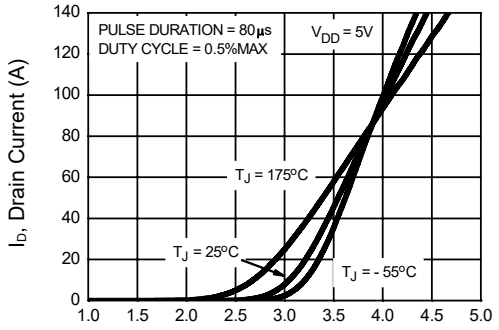



Figure 5: Transfer Characteristics

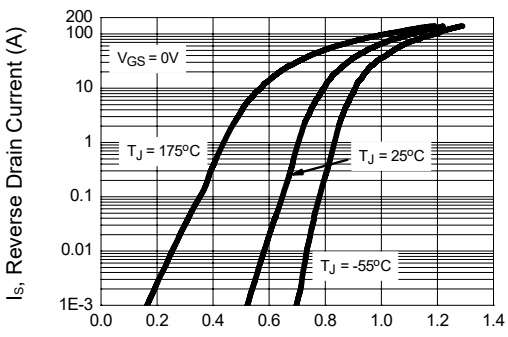



Figure 6: Source to Drain Diode Forward Voltage vs Source Current

## 8.2Typical characteristic

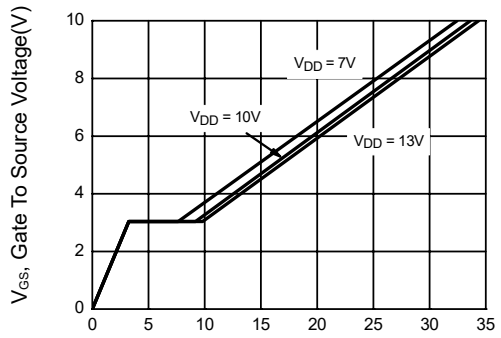



Figure 7: Gate Charge Characteristics

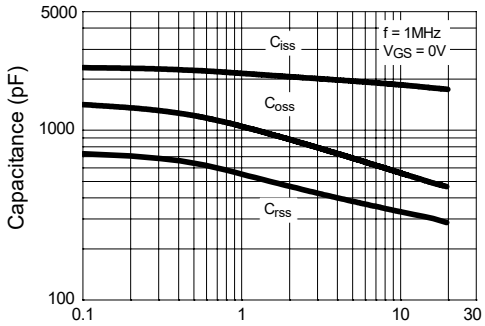



Figure 8: Capacitance vs Drain to Source Voltage

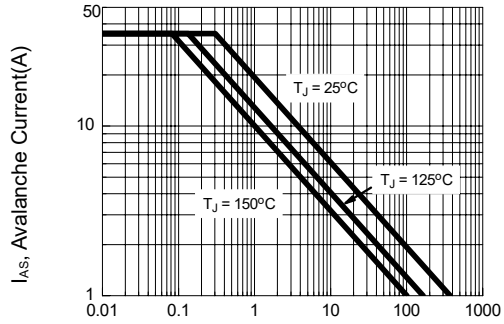



Figure 9: Unclamped Inductive Switching Capability

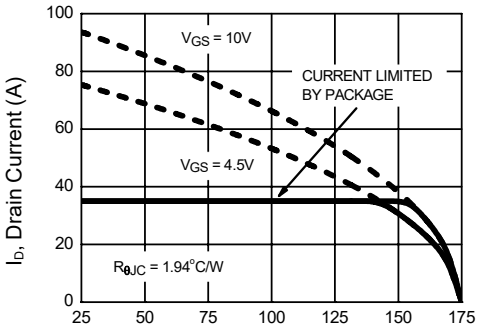



Figure 10: Maximum Continuous Drain Current vs Case Temperature

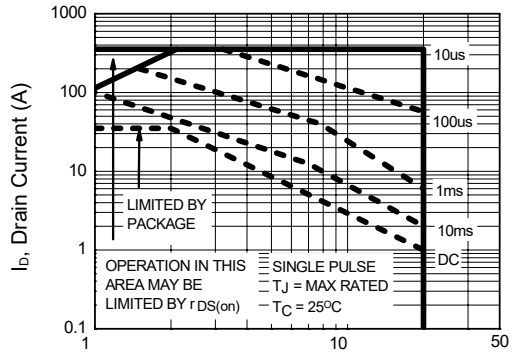



Figure 11: Forward Bias Safe Operating Area

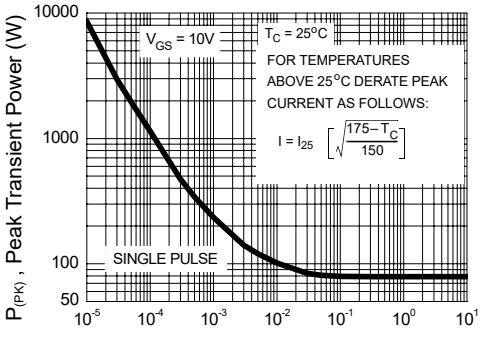



Figure 12: Single Pulse Maximum Power Dissipation

## 8.3Typical characteristic

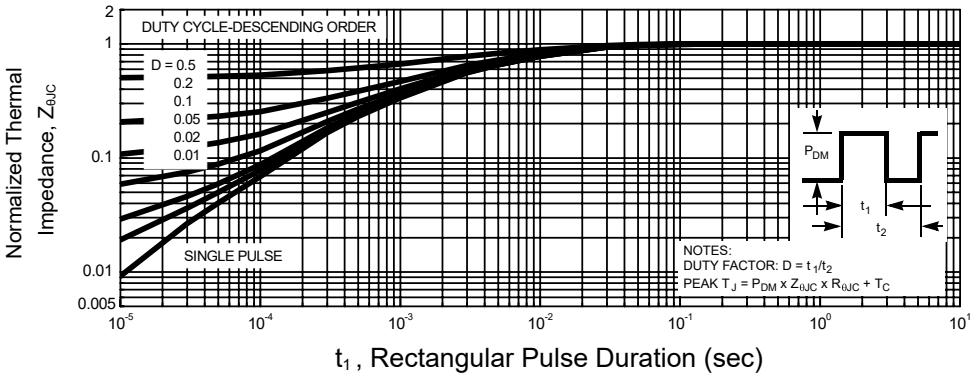
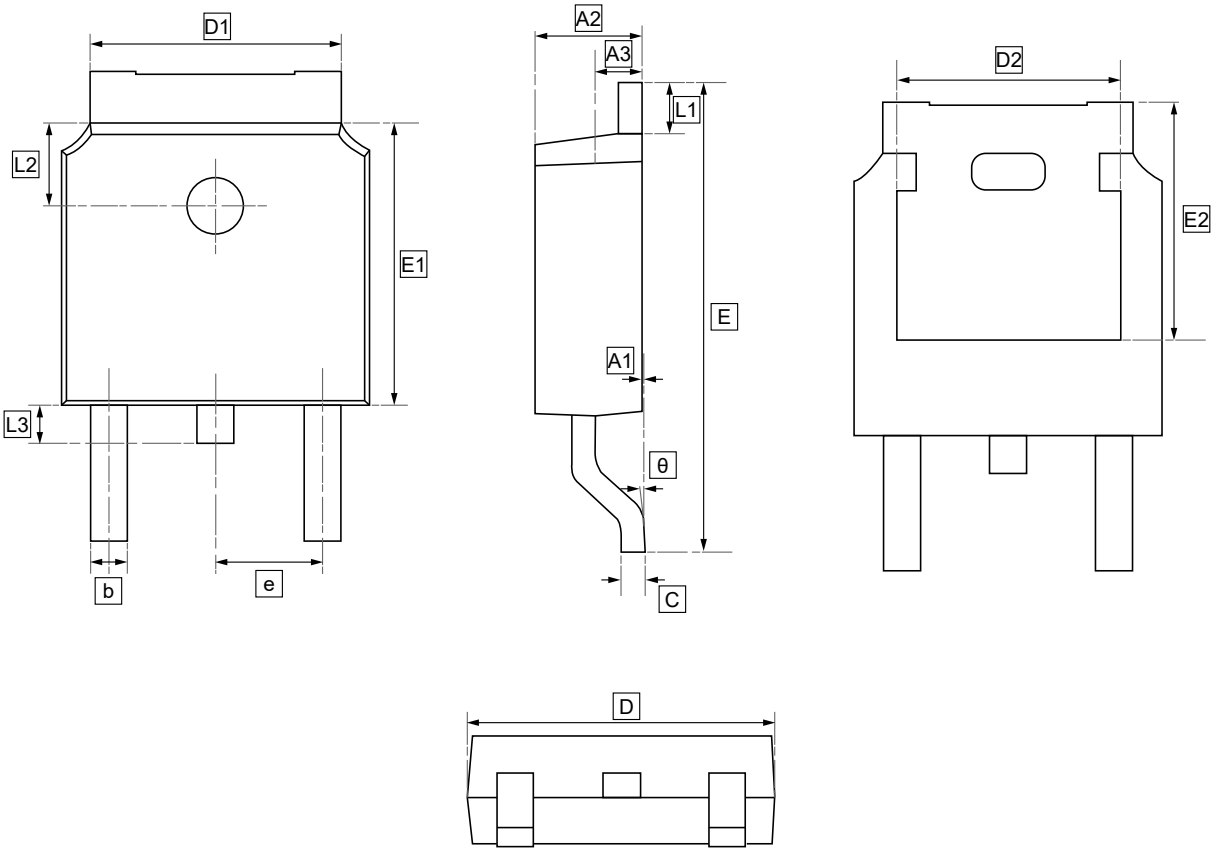



Figure 13: Transient Thermal Response Curve

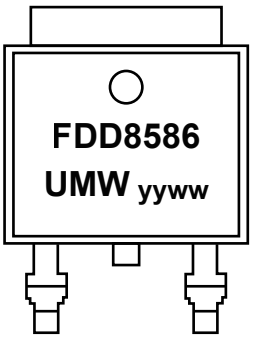
## 9.TO-252 Package Outline Dimensions




**DIMENSIONS (mm are the original dimensions)**

| Symbol | A1 | A2 | A3 | b | c | D | D1 | D2 | E | E1 | E2 | e | L1 | L2 | L3 | θ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Min | 0.00 | 2.18 | 0.90 | 0.65 | 0.46 | 6.35 | 4.95 | 4.32 | 9.40 | 5.97 | 5.21 | 2.286 | 0.89 | 1.70 | 0.60 | 0.00 |
| Max | 0.13 | 2.39 | 1.10 | 0.85 | 0.61 | 6.73 | 5.46 | 4.90 | 10.41 | 6.22 | 5.38 | BSC | 1.27 | 1.90 | 1.00 | 8.00 |

## 10.Ordering information




yy: Year Code
ww: Week Code

| Order Code | Package | Base QTY | Delivery Mode |
|---|---|---|---|
| UMW FDD8586 | TO-252 | 2500 | Tape and reel |

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