# UMW IPD50P04P4L11

-40V P-Channel MOSFET

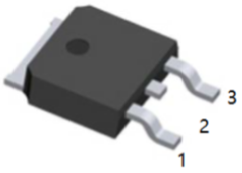
## 1.Features

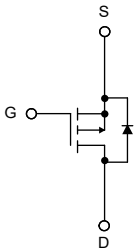
- $V_{DS\ (V)}$=-40V
- $I_D$=-50A
- $R_{DS(ON)}$<10.6mΩ($V_{GS}$=-10V)
- $R_{DS(ON)}$<17.2mΩ($V_{GS}$=-4.5V)
- AEC qualified
- 175°C operating temperature
- Intended for reverse battery protection

## 2.Pinning information

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

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




## 3.Absolute Maximum Ratings $T_J$= 25°C

| Parameter | Symbol | Conditions | Value | Units |
|---|---|---|---|---|
| Continuous drain current | $I_D$ | $T_C$=25°C, $V_{GS}$=-10V [1)] | -50 | A |
| | | $T_C$=100°C, $V_{GS}$=-10V [2)] | -40 | A |
| Pulsed drain current [2)] | $I_{D,pulse}$ | $T_C$=25°C | -200 | A |
| Avalanche energy, single pulse | $E_{AS}$ | $I_D$=-25A | 18 | mJ |
| Avalanche current, single pulse | $I_{AS}$ | | -50 | A |
| Gate source voltage | $V_{GS}$ | | ±16 [3)] | V |
| Power dissipation | $P_{tot}$ | $T_C$=25°C | 58 | W |
| Storage temperature | $T_J$,$T_{STG}$ | | -55 to 175 | °C |
| IEC cimatic category; DIN IEC 68-1 | | | 55/175/56 | |

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

| Parameter | Symbol | Conditions | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|
| Thermal resistance, junction -case | $R_{thJC}$ | | | | 2.6 | K/W |
| SMD version, device on PCB | $R_{thJA}$ | minimal footprint | | | 62 | K/W |
| | | 6 cm$^2$ cooling area [4]) | | | 40 | K/W |
| Drain-source breakdown voltage | $V_{(BR)DSS}$ | $V_{GS}$=0V, $I_D$=-1mA | -40 | | | V |
| Gate threshold voltage | $V_{GS(th)}$ | $V_{DS}$=$V_{GS}$, $I_D$=-85μA | -1.2 | -1.7 | -2.2 | V |
| Zero gate voltage drain current | $I_{DSS}$ | $V_{DS}$=-32V, $V_{GS}$=0V, $T_J$=25°C | | -0.03 | -1 | μA |
| | | $V_{DS}$=-32V,$V_{GS}$=0V,$T_J$=125°C [2]) | | -7 | -70 | μA |
| Gate-source leakage current | $I_{GSS}$ | $V_{GS}$=-16V, $V_{DS}$=0V | | | -100 | nA |
| Drain-source on-state resistance | $R_{DS(ON)}$ | $V_{GS}$=-4.5V, $I_D$=-30A | | 12.3 | 17.2 | mΩ |
| | | $V_{GS}$=-10V, $I_D$=-50A | | 8.2 | 10.6 | mΩ |
| Input capacitance | $C_{iss}$ | $V_{GS}$=0V, $V_{DS}$=-25V, f=1MHz | | 3000 | 3900 | pF |
| Output capacitance | $C_{oss}$ | | | 1100 | 1400 | pF |
| Reverse transfer capacitance | $C_{rss}$ | | | 37 | 74 | pF |
| Turn-on delay time | $t_{D(on)}$ | $V_{DD}$=-20V, $V_{GS}$=-10V $I_D$=-50A, $R_G$=3.5Ω | | 12 | | ns |
| Rise time | $t_r$ | | | 9 | | ns |
| Turn-off delay time | $t_{D(off)}$ | | | 46 | | ns |
| Fall time | $t_f$ | | | 39 | | ns |
| Gate to source charge | $Q_{gs}$ | $V_{DD}$=-32V, $I_D$=-50A $V_{GS}$=0 to -10V | | 11 | 14 | nC |
| Gate to drain charge | $Q_{gd}$ | | | 8 | 16 | nC |
| Gate charge total | $Q_g$ | | | 45 | 59 | nC |
| Gate plateau voltage | $V_{plateau}$ | | | -3.6 | | V |
| Diode continous forward current [2]) | $I_S$ | $T_C$=25°C | | | -50 | A |
| Diode pulse current [2]) | $I_{s,pulse}$ | | | | -200 | A |

| | | | | | | |
|---|---|---|---|---|---|---|
| Diode forward voltage | $V_{SD}$ | $V_{GS}$=0V, $I_F$=-50A, $T_J$=25°C | | -1 | -1.3 | V |
| Reverse recovery time [2)] | $t_{rr}$ | $V_R$=-20V, $I_F$=50A, $di_F/dt$=-100A/µs | | 40 | | ns |
| Reverse recovery charge [2)] | $Q_{rr}$ | | | 32 | | nC |

Notes:

[1)] Current is limited by bondwire; with an $R_{thJC}$ = 2.6K/W the chip is able to carry 60A at 25°C.

[2)] Specified by design. Not subject to production test.

[4)] $V_{GS}$=+5V/-16V according AEC; $V_{GS}$=+16V for max 168h at $T_J$=175°C

[5)] Device on 40 mm x 40 mm x 1.5 mm epoxy PCB FR4 with 6 $cm^2$ (one layer, 70 µm thick) copper area for drain connection. PCB is vertical in still air.

## 5.1Typical characteristic

$P_{tot}=f(T_C)$; $V_{GS}\leq$-6V

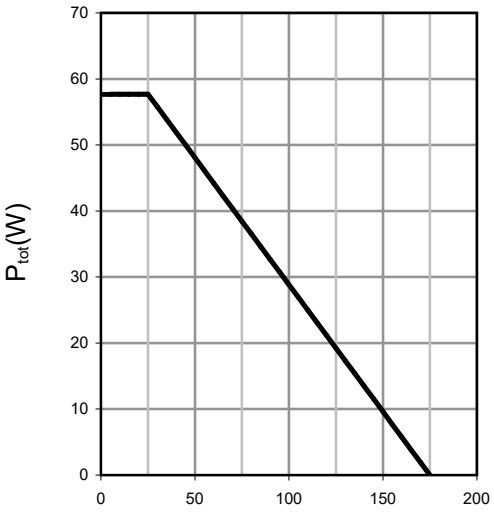



Fig 1. Power dissipation

$I_D=f(T_C)$; $V_{GS}\leq$-6V

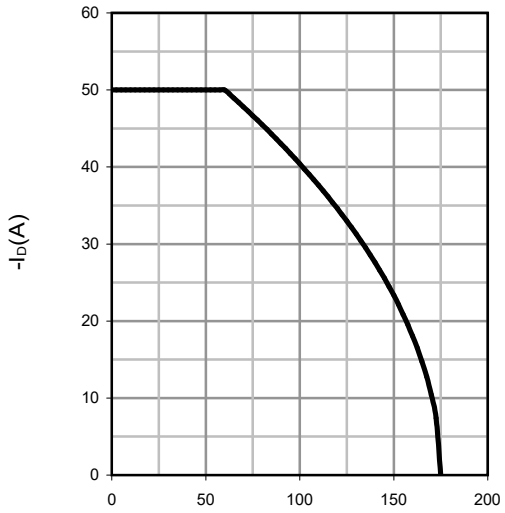



Fig 2. Drain current

ID=f($V_{DS}$); $T_C$=25°C; D=0; parameter: $t_p$

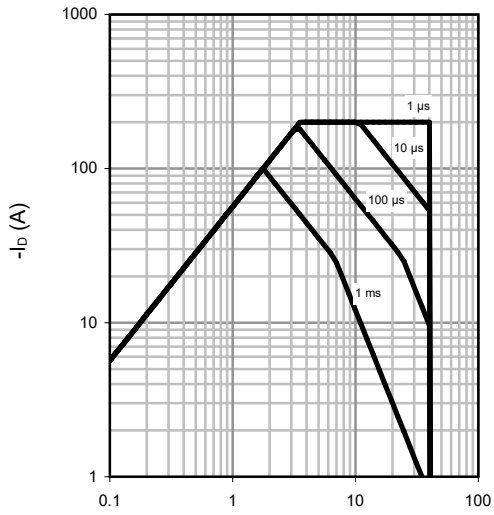



Fig 3. Safe operating area

$Z_{thJC}=f(t_p)$; parameter: D=$t_p$/T

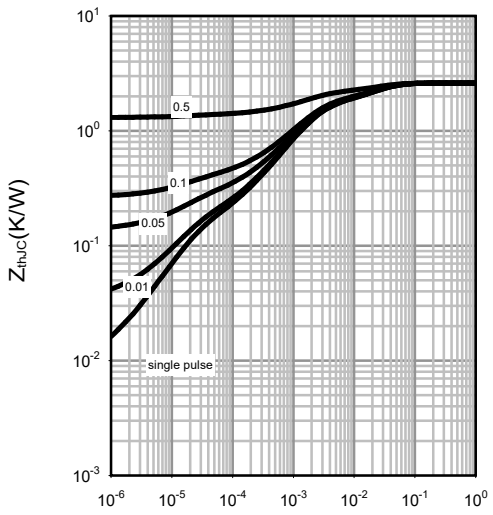



Fig 4. Max transient thermal impedance

## 5.2Typical characteristic

$I_D=f(V_{DS})$; $T_J$=25°C; parameter: $V_{GS}$

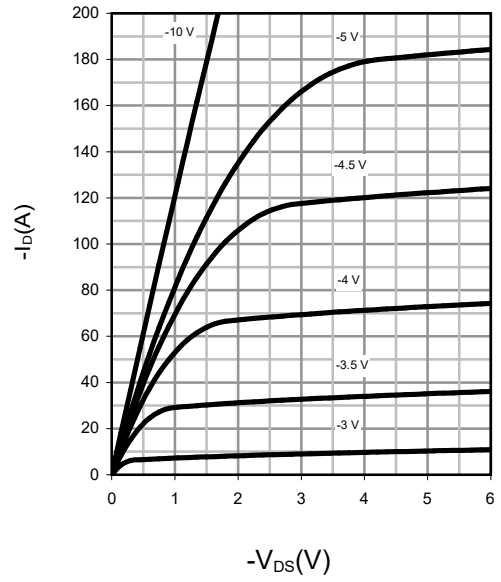



Fig 5. output characteristics

$R_{DS(ON)}=f(I_D)$; $T_J$=25°C; parameter: $V_{GS}$

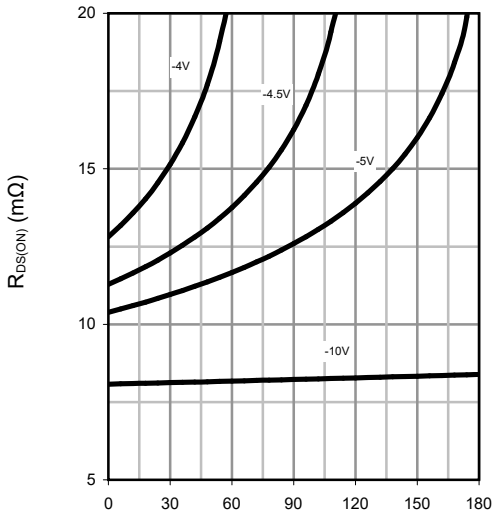



Fig 6. drain-source on resistance

$I_D=f(V_{GS})$; $V_{DS}$=-6V; parameter: $T_J$

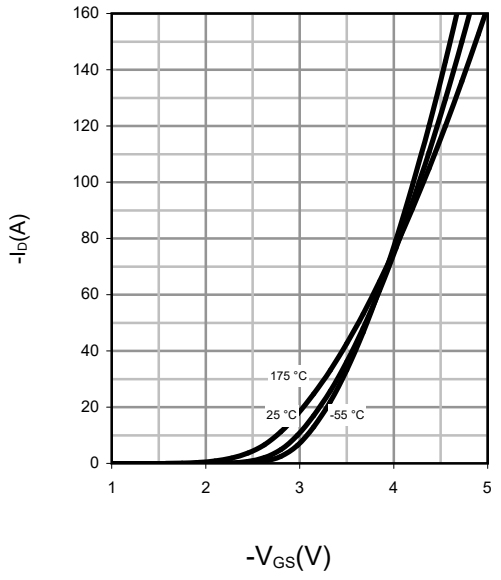



Fig 7. transfer characteristics

$R_{DS(ON)}$= $f(T_J)$; $I_D$=-50A; $V_{GS}$=-10V

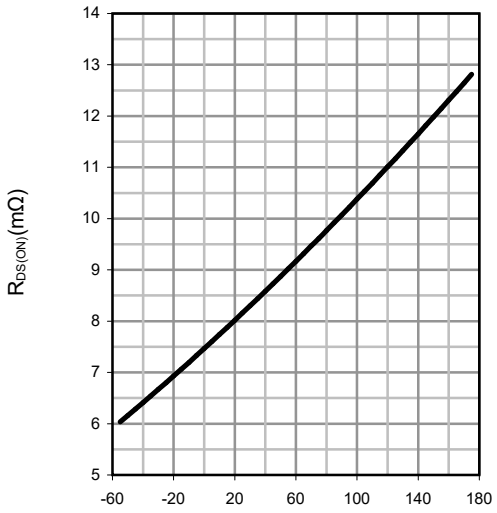



Fig 8. drain-source on-state resistance

## 5.3Typical characteristic

$V_{GS(th)}=f(T_J);V_{GS}=V_{DS}$; parameter:$I_D$

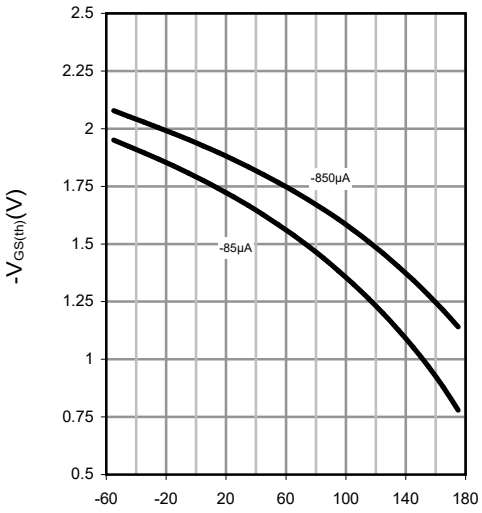



Fig 9. gate threshold voltage

$C=f(V_{DS})$; $V_{GS}=0V$; f=1MHZ

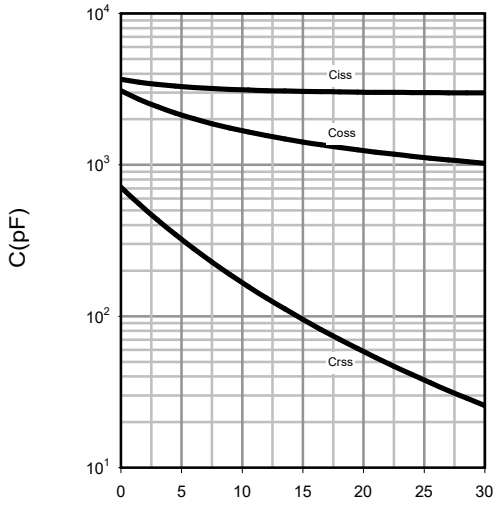



Fig 10. capacitances

$I_F=f(V_{SD})$; parameter: $T_J$

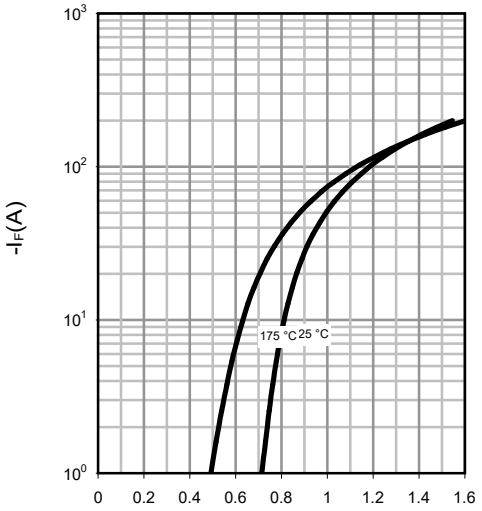



Fig 11. Typical forward diode characteristicis

$V_{BR(DSS)}=f(T_J)$; $I_D$=-1m A

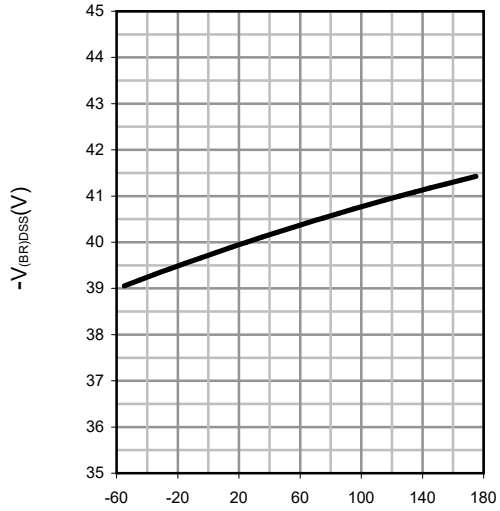



Fig 12. Drain-source breakdown voltage

## 5.4Typical characteristic

$V_{GS}=f(Q_{gate})$; $I_D$=-50A pulsed, parameter: $V_{DD}$

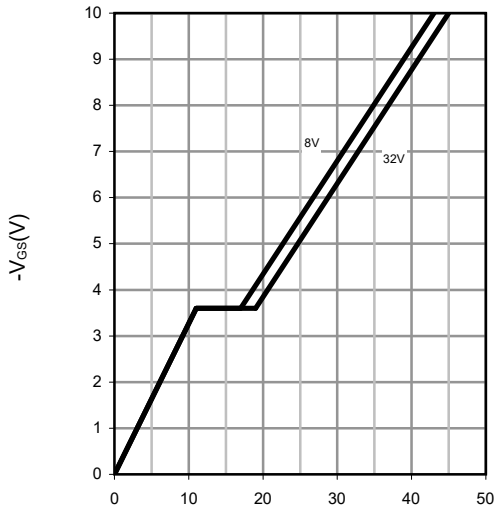



Fig 13. gate charge

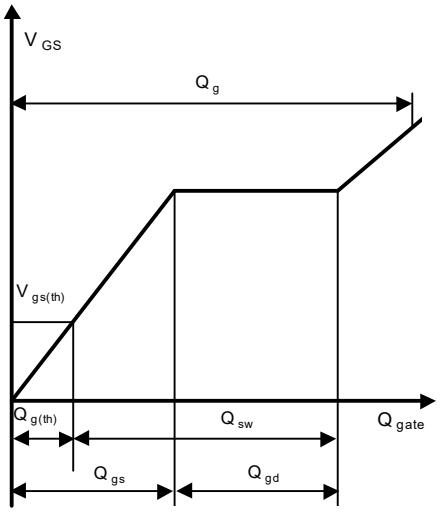
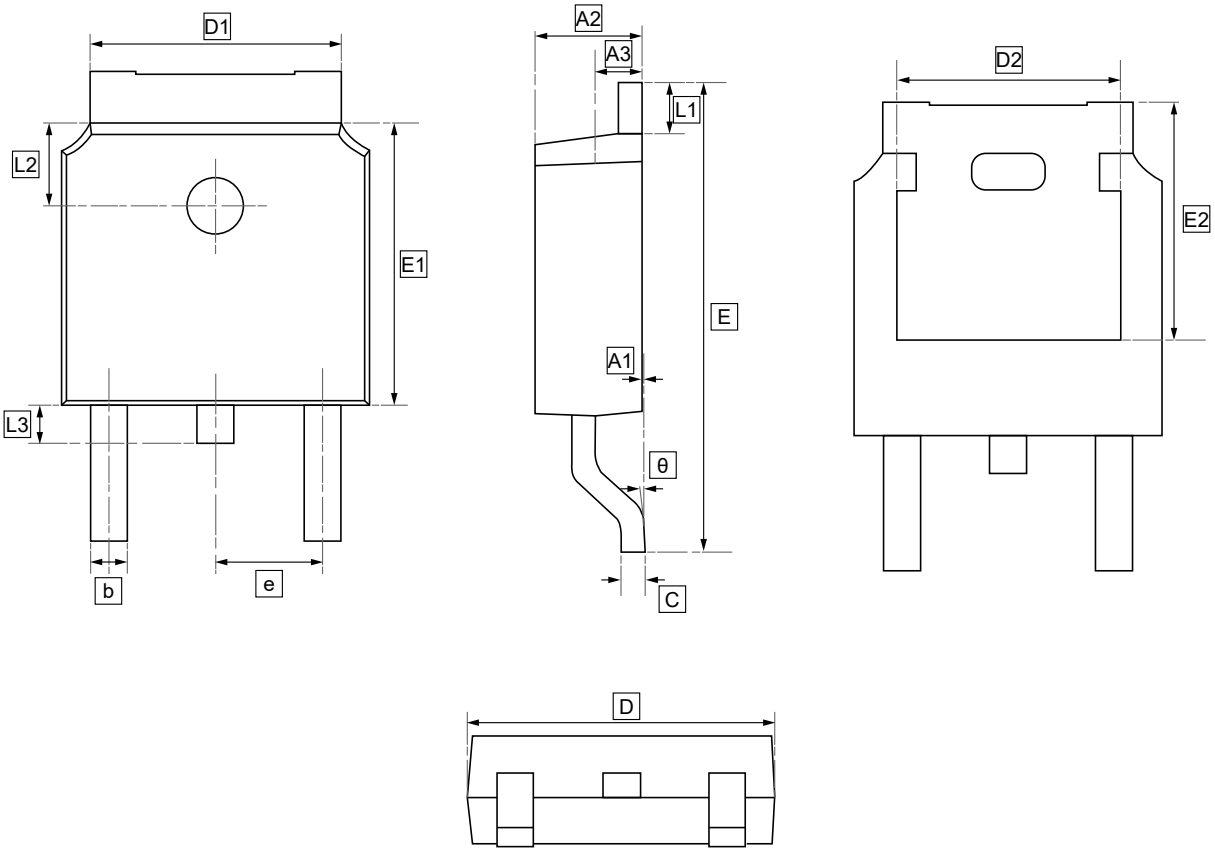



Fig 14. Gate charge waveforms

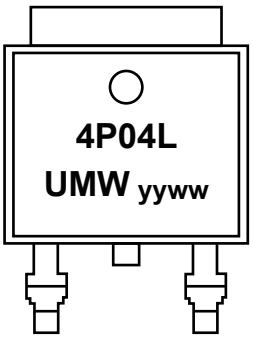
## 6.TO-252 Package Outline Dimensions




**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 |

## 7.Ordering information




yy: Year Code
ww: Week Code

| Order Code | Package | Base QTY | Delivery Mode |
|---|---|---|---|
| UMW IPD50P04P4L11 | TO-252 | 2500 | Tape and reel |

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