# UMW IRF9321TR

-30V P-Channel MOSFET

## 1.Features

- $V_{DS\ (V)}$=-30V
- $I_D$=-15A
- $R_{DS(ON)}$<7.2mΩ($V_{GS}$=-10V)
- $R_{DS(ON)}$<11.2mΩ($V_{GS}$=-4.5V)
- Industry-Standard SO8 Package
- RoHS Compliant Containing no Lead, no Bromide and no Halogen

## 2.Application

- Charge and Discharge Switch for Notebook PC Battery Application

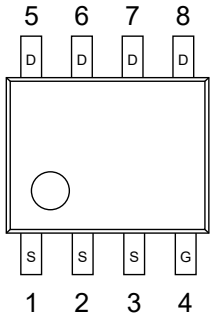
## 3.Benefits

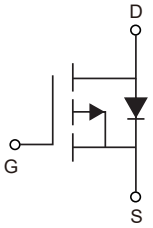
- Multi-Vendor Compatibility
- Environmentally Friendlier

## 4.Pinning information

| Pin | Symbol | Description |
|---|---|---|
| 1,2,3 | S | SOURCE |
| 4 | G | GATE |
| 5,6,7,8 | D | DRAIN |

**SOP-8**




## 5.Absolute Maximum Ratings

| Parameter | | Symbol | Rating | Units |
|---|---|---|---|---|
| Drain- Source Voltage | | $V_{DS}$ | -30 | V |
| Gate-to-Source Voltage | | $V_{GS}$ | ±20 | V |
| Continuous Drain Current, $V_{GS}$=-10V | $T_A$=25°C | $I_D$ | -15 | A |
| Continuous Drain Current, $V_{GS}$=-10V | $T_A$=70°C | | -12 | A |
| Pulsed Drain Current ① | | $I_{DM}$ | -120 | A |
| Power Dissipation ④ | $T_A$=25°C | $P_D$ | 2.5 | W |
| Power Dissipation ④ | $T_A$=70°C | | 1.6 | W |
| Linear Derating Factor | | | 0.02 | W/°C |
| Junction and Storage Temperature Range | | $T_J$, $T_{STG}$ | -55 to 150 | °C |

## 6.Electrical Characteristics TA = 25°C unless otherwise noted

| Parameter | Symbol | Conditions | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|
| **Static** | | | | | | |
| Drain-Source Breakdown Voltage | $BV_{DSS}$ | $I_D$=-250μA, $V_{GS}$=0V | -30 | | | V |
| Breakdown Voltage Temp. Coefficient | $\Delta BV_{DSS}/\Delta T_J$ | $I_D$=-1mA,Reference to 25°C | | 0.021 | | V/°C |
| Static Drain-to-Source On-Resistance | $R_{DS(ON)}$ | $V_{GS}$=-10V, $I_D$=-15A ③ | | 5.9 | 7.2 | mΩ |
| | | $V_{GS}$=-4.5V, $I_D$=-12A ③ | | 9.3 | 11.2 | |
| Gate Threshold Voltage | $V_{GS(th)}$ | $V_{DS}$=$V_{GS}$, $I_D$=-50μA | -1.3 | -1.8 | -2.4 | V |
| Gate Threshold Voltage Coefficient | $\Delta V_{GS(th)}$ | | | -5.9 | | mV/°C |
| Drain-to-Source Leakage Current | $I_{DSS}$ | $V_{DS}$=-24V, $V_{GS}$=0V | | | -1 | μA |
| | | $V_{DS}$=-24V,$V_{GS}$=0V,$T_J$=125°C | | | -150 | μA |
| Gate-to-Source Forward Leakage | $I_{GSS}$ | $V_{GS}$=-20V | | | -100 | nA |
| Gate-to-Source Reverse Leakage | | $V_{GS}$=20V | | | 100 | nA |
| Forward Transconductance | $g_{FS}$ | $V_{DS}$=-10V, $I_D$=-12A | 30 | | | S |
| Total Gate Charge ⑥ | $Q_g$ | $V_{DS}$=-15V,$V_{GS}$=-4.5V,$I_D$=-12A | | 34 | | nC |
| Total Gate Charge ⑥ | $Q_g$ | $V_{DS}$=-10V | | 65 | 98 | nC |
| Gate-to-Source Charge ⑥ | $Q_{gs}$ | $V_{GS}$=-15V | | 10 | | nC |
| Gate-to-Drain Charge ⑥ | $Q_{gd}$ | $I_D$=-12A | | 16 | | nC |
| Gate Resistance ⑥ | $R_g$ | | | 18 | | Ω |
| Turn-On Delay Time | $t_{D(on)}$ | $V_{DD}$=-30V, $V_{GS}$=-4.5V ③ | | 21 | | ns |
| Rise Time | $t_r$ | $I_D$=-1A | | 79 | | ns |
| Turn-Off Delay Time | $t_{D(off)}$ | $R_G$=6.8Ω | | 185 | | ns |
| Fall Time | $t_f$ | See Figs. 19a &19b | | 145 | | ns |
| Input Capacitance | $C_{iss}$ | $V_{GS}$=0V | | 2590 | | pF |
| Output Capacitance | $C_{oss}$ | $V_{DS}$=-25V | | 590 | | pF |
| Reverse Transfer Capacitance | $C_{rss}$ | $f$=1.0MHz | | 360 | | pF |
| **Avalanche Characteristics** | | | | | | |
| Single Pulse Avalanche Energy ② | $E_{AS}$ | | | | 310 | mJ |
| Avalanche Current ① | $I_{AR}$ | | | | -12 | A |

| Diode Characteristics | | | | | | |
|---|---|---|---|---|---|---|
| Continuous Source Current (Body Diode) | $I_S$ | MOSFET symbol showing the integral reverse p-n junction diode. | | | -2.5 | A |
| Pulsed Source Current (Body Diode) ① | $I_{SM}$ | | | | -120 | A |
| Diode Forward Voltage | $V_{SD}$ | $T_J$=25°C,$I_S$=-2.5A,$V_{GS}$=0V③ | | | -1.2 | V |
| Reverse Recovery Time | $t_{rr}$ | $T_J$=25°C, $I_F$=-2.5A,$V_{DD}$=-24V | | 38 | 57 | ns |
| Reverse Recovery Charge | $Q_{rr}$ | dI/dt=100A/μs ③ | | 24 | 36 | nC |
| **Thermal Resistance** | | | | | | |
| Junction-to-Drain Lead ⑤ | $R_{\theta JL}$ | | | | 20 | °C/W |
| Junction-to-Ambient ④ | $R_{\theta JA}$ | | | | 50 | °C/W |

Notes:

① Repetitive rating; pulse width limited by max. junction temperature.

② Starting $T_J$=25°C, L=4.3mH, $R_G$=25Ω, $I_{AS}$=-12A.

③ Pulse width ≤ 400μs; duty cycle ≤ 2%.

④ When mounted on 1 inch square copper board.

⑤ $R_\theta$ is measured at $T_J$ of approximately 90°C.

## 7.1Typical Characterisitics

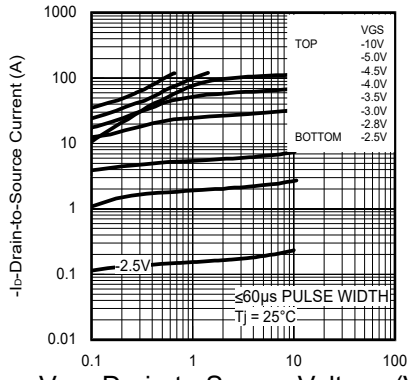



Fig 1. Typical Output Characteristics

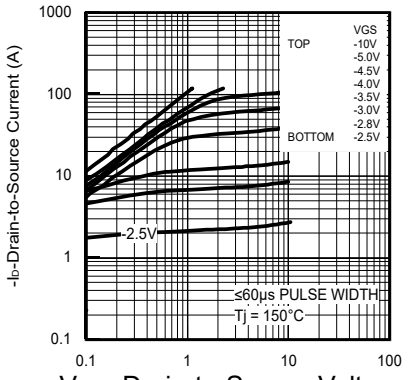



Fig 2. Typical Output Characteristics

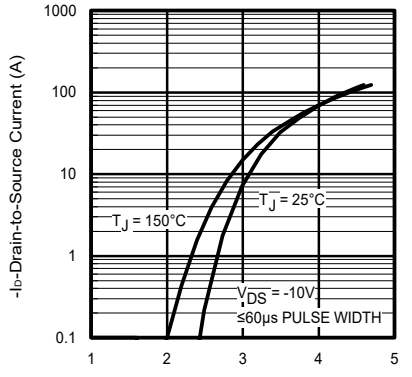



Fig 3. Typical Transfer Characteristics

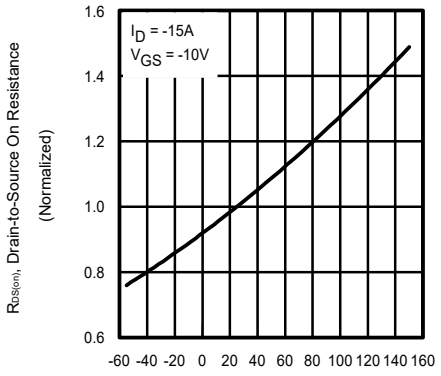



Fig 4. Nomalized On-ResistanceVs. Temperature

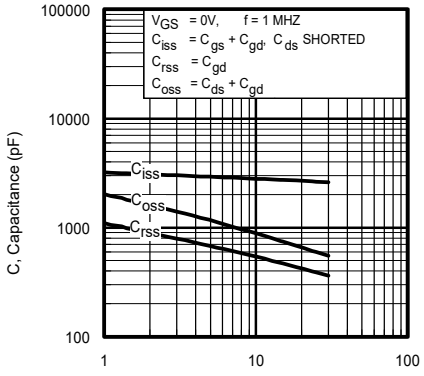



Fig 5. Typical Capacitance Vs. Drain-to-Source Voltage

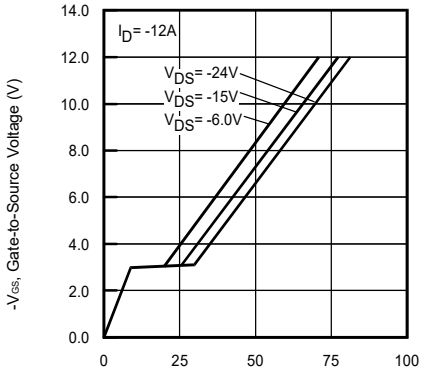
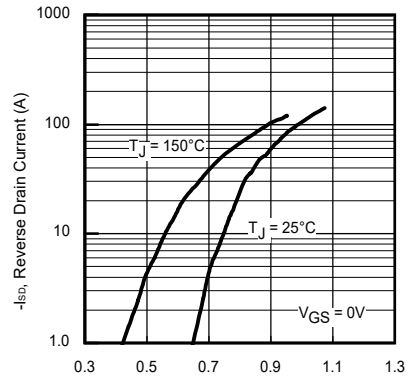


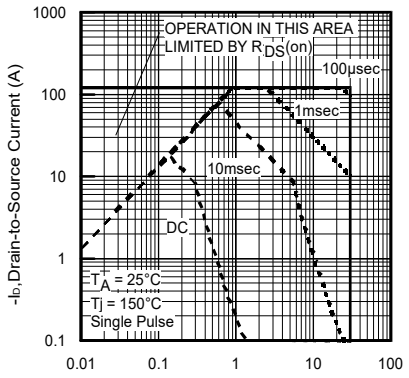

Fig 6. Typical Gate Charge Vs. Gate-to-Source Voltage

## 7.2Typical Characterisitics



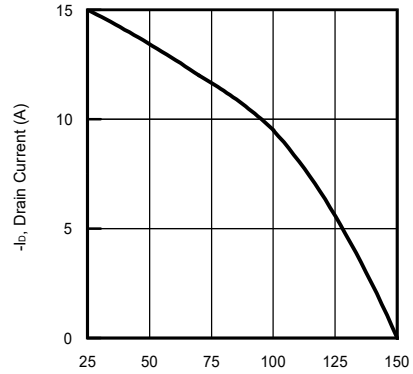

$-V_{SD}$, Source-to-Drain Voltage (V)

Fig 7. Typical Source-Drain Diode Forward Voltage



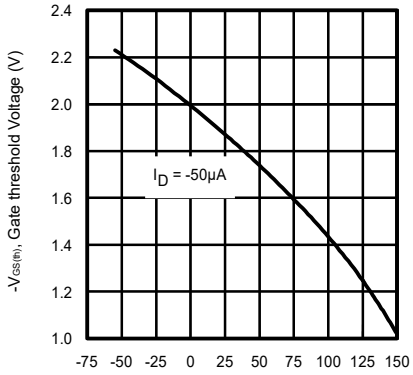

$-V_{DS}$, Drain-to-Source Voltage (V)

Fig 8. Maximum Safe Operating Area



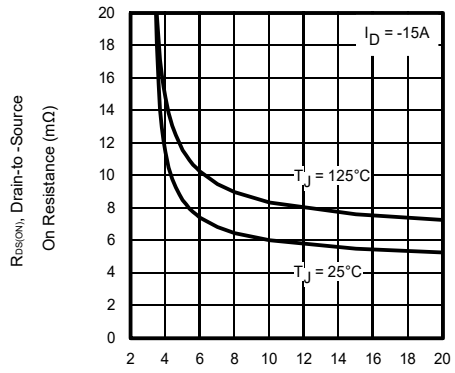

$T_A$ , Ambient Temperature (°C)

Fig 9. Maximum Drain Current vs. Ambient Temperature



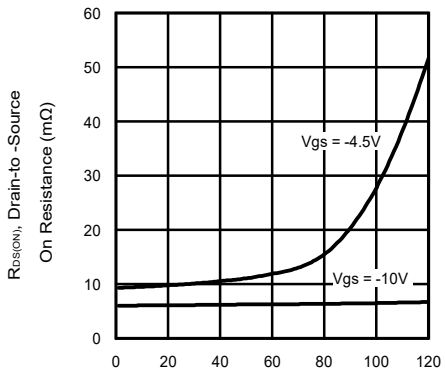

$T_J$ , Temperature ( °C )

Fig 10. Threshold Voltage vs. Temperature




$-V_{GS}$, Gate -to -Source Voltage (V)

Fig 11. On-Resistance vs. Gate Voltage




$-I_D$, Drain Current (A)

Fig 12. Typical On-Resistance vs. Drain Current

## 7.3Typical Characterisitics

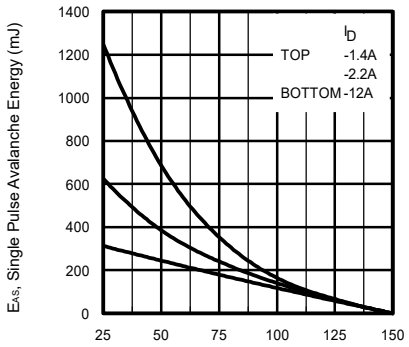



Fig 13. Maximum Avalanche Energy vs. Drain Current

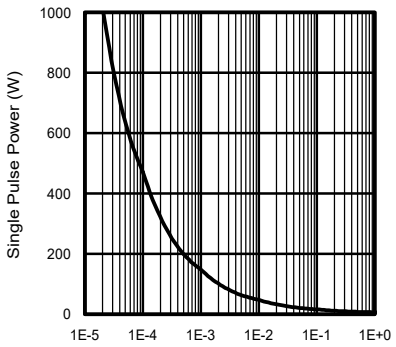



Fig 14. Typical Power vs. Time

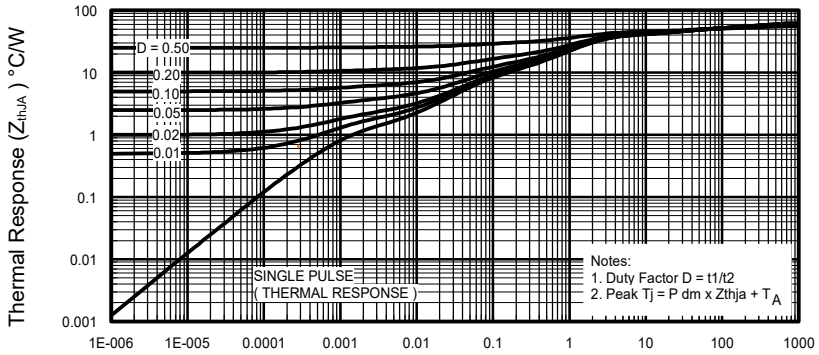
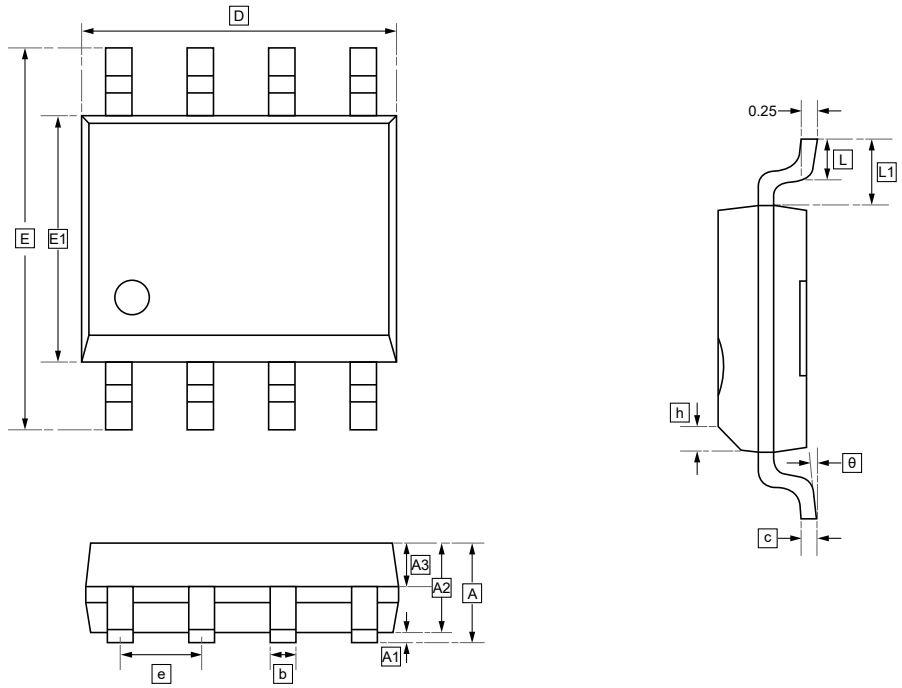



Fig 15. Maximum Effective Transient Themal Impedance, Junction-to-Ambient

## 8.SOP-8 Package Outline Dimensions

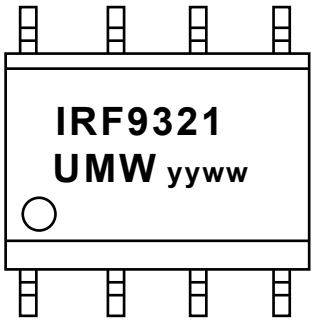



**DIMENSIONS (mm are the original dimensions)**

| Symbol | A | A1 | A2 | A3 | b | c | D | E | E1 | e | h | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Min | - | 0.05 | 1.30 | 0.60 | 0.39 | 0.20 | 4.80 | 5.80 | 3.80 | 1.24 | 0.30 | 0.50 |
| Max | 1.75 | 0.20 | 1.50 | 0.70 | 0.47 | 0.24 | 5.00 | 6.20 | 4.00 | 1.30 | 0.50 | 0.80 |

| Symbol | L1 | θ |
|---|---|---|
| Min | 1.00 | 0° |
| Max | 1.10 | 8° |

## 9.Ordering information




yy: Year Code
ww: Week Code

| Order Code | Package | Base QTY | Delivery Mode |
|---|---|---|---|
| UMW IRF9321TR | SOP-8 | 3000 | Tape and reel |

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