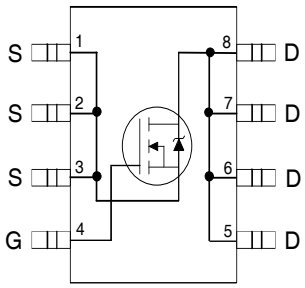
**30V N-Channel MOSFET**

## Description

The IRF8788TR has been optimized for parameters that are critical in synchronous buck operation including Rds(on) and gate charge to reduce both conduction and switching losses. The reduced total losses make this product ideal for high efficiency DC-DC converters that power the latest generation of processors for notebook and Netcom applications.




Top View

## Benefits

- $V_{DS\,(V)}$ = 30V
- $I_D$ = 24A ($V_{GS}$ =10V)
- $R_{DS(ON)}$ < 2.8mΩ ($V_{GS}$=10V)
- $R_{DS(ON)}$ < 3.8mΩ ($V_{GS}$=4.5V)
- Very Low Gate Charge
- Very Low $R_{DS(on)}$ at 4.5V $V_{GS}$
- Ultra-Low Gate Impedance
- Fully Characterized Avalanche Voltage and Current
- 20V $V_{GS}$ Max. Gate Rating

## Applications

- Synchronous MOSFET for Notebook Processor Power
- Synchronous Rectifier MOSFET for Isolated DC-DC Converters

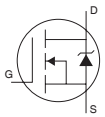
## Absolute Maximum Ratings

| | Parameter | Max. | Units |
|---|---|---|---|
| $V_{DS}$ | Drain-to-Source Voltage | 30 | V |
| $V_{GS}$ | Gate-to-Source Voltage | ±20 | |
| $I_D$ @ $T_A$ = 25°C | Continuous Drain Current, $V_{GS}$ @ 10V | 24 | A |
| $I_D$ @ $T_A$ = 70°C | Continuous Drain Current, $V_{GS}$ @ 10V | 19 | |
| $I_{DM}$ | Pulsed Drain Current ① | 190 | |
| $P_D$ @$T_A$ = 25°C | Power Dissipation | 2.5 | W |
| $P_D$ @$T_A$ = 70°C | Power Dissipation | 1.6 | |
| | Linear Derating Factor | 0.02 | W/°C |
| $T_J$<br>$T_{STG}$ | Operating Junction and<br>Storage Temperature Range | -55 to + 150 | °C |

## Thermal Resistance

| | Parameter | Typ. | Max. | Units |
|---|---|---|---|---|
| $R_{\theta JL}$ | Junction-to-Drain Lead ⑤ | | 20 | °C/W |
| $R_{\theta JA}$ | Junction-to-Ambient ④⑤ | | 50 | |

## Static @ $T_J$ = 25°C (unless otherwise specified)

| | Parameter | Min. | Typ. | Max. | Units | Conditions |
|---|---|---|---|---|---|---|
| $BV_{DSS}$ | Drain-to-Source Breakdown Voltage | 30 | | | V | $V_{GS}$ = 0V, $I_D$ = 250μA |
| $\Delta BV_{DSS}/\Delta T_J$ | Breakdown Voltage Temp. Coefficient | | 0.024 | | V/°C | Reference to 25°C, $I_D$ = 1mA |
| $R_{DS(on)}$ | Static Drain-to-Source On-Resistance | | 2.3 | 2.8 | mΩ | $V_{GS}$ = 10V, $I_D$ = 24A ③ |
| | | | 3.04 | 3.8 | | $V_{GS}$ = 4.5V, $I_D$ = 19A ③ |
| $V_{GS(th)}$ | Gate Threshold Voltage | 1.35 | 1.80 | 2.35 | V | $V_{DS}$ = $V_{GS}$, $I_D$ = 100μA |
| $\Delta V_{GS(th)}$ | Gate Threshold Voltage Coefficient | | -6.59 | | mV/°C | |
| $I_{DSS}$ | Drain-to-Source Leakage Current | | | 1.0 | μA | $V_{DS}$ = 24V, $V_{GS}$ = 0V |
| | | | | 150 | | $V_{DS}$ = 24V, $V_{GS}$ = 0V, $T_J$ = 125°C |
| $I_{GSS}$ | Gate-to-Source Forward Leakage | | | 100 | nA | $V_{GS}$ = 20V |
| | Gate-to-Source Reverse Leakage | | | -100 | | $V_{GS}$ = -20V |
| gfs | Forward Transconductance | 95 | | | S | $V_{DS}$ = 15V, $I_D$ = 19A |
| $Q_g$ | Total Gate Charge | | 44 | 66 | nC | $V_{DS}$ = 15V<br>$V_{GS}$ = 4.5V<br>$I_D$ = 19A<br>See Figs. 17a & 17b |
| $Q_{gs1}$ | Pre-Vth Gate-to-Source Charge | | 12 | | | |
| $Q_{gs2}$ | Post-Vth Gate-to-Source Charge | | 4.7 | | | |
| $Q_{gd}$ | Gate-to-Drain Charge | | 14 | | | |
| $Q_{godr}$ | Gate Charge Overdrive | | 13.3 | | | |
| $Q_{sw}$ | Switch Charge ($Q_{gs2}$ + $Q_{gd}$) | | 18.7 | | | |
| $Q_{oss}$ | Output Charge | | 22 | | nC | $V_{DS}$ = 16V, $V_{GS}$ = 0V |
| $R_g$ | Gate Resistance | | 0.54 | 1.09 | Ω | |
| $t_{d(on)}$ | Turn-On Delay Time | | 23 | | ns | $V_{DD}$ = 15V, $V_{GS}$ = 4.5V<br>$I_D$ = 19A<br>$R_G$ = 1.8Ω<br>See Fig. 15a & 15b |
| $t_r$ | Rise Time | | 24 | | | |
| $t_{d(off)}$ | Turn-Off Delay Time | | 23 | | | |
| $t_f$ | Fall Time | | 11 | | | |
| $C_{iss}$ | Input Capacitance | | 5720 | | pF | $V_{GS}$ = 0V<br>$V_{DS}$ = 15V<br>$f$ = 1.0MHz |
| $C_{oss}$ | Output Capacitance | | 980 | | | |
| $C_{rss}$ | Reverse Transfer Capacitance | | 450 | | | |
| $I_S$ | Continuous Source Current (Body Diode) | | | 3.1 | A | MOSFET symbol showing the integral reverse p-n junction diode.  |
| $I_{SM}$ | Pulsed Source Current (Body Diode) ① | | | 190 | A | |
| $V_{SD}$ | Diode Forward Voltage | | | 1.0 | V | $T_J$ = 25°C, $I_S$ = 19A, $V_{GS}$ = 0V ③ |
| | | | | 0.75 | V | $T_J$ = 25°C, $I_S$ = 2.2A, $V_{GS}$ = 0V ③ |
| $t_{rr}$ | Reverse Recovery Time | | 24 | 36 | ns | $T_J$ = 25°C, $I_F$ = 19A, $V_{DD}$ = 15V |
| $Q_{rr}$ | Reverse Recovery Charge | | 33 | 50 | nC | di/dt = 230A/μs ③ |
| $t_{on}$ | Forward Turn-On Time | Intrinsic turn-on time is negligible (turn-on is dominated by LS+LD) | | | | |

## Avalanche Characteristics

| | Parameter | Typ. | Max. | Units |
|---|---|---|---|---|
| $E_{AS}$ | Single Pulse Avalanche Energy ② | | 230 | mJ |
| $I_{AR}$ | Avalanche Current ① | | 19 | A |

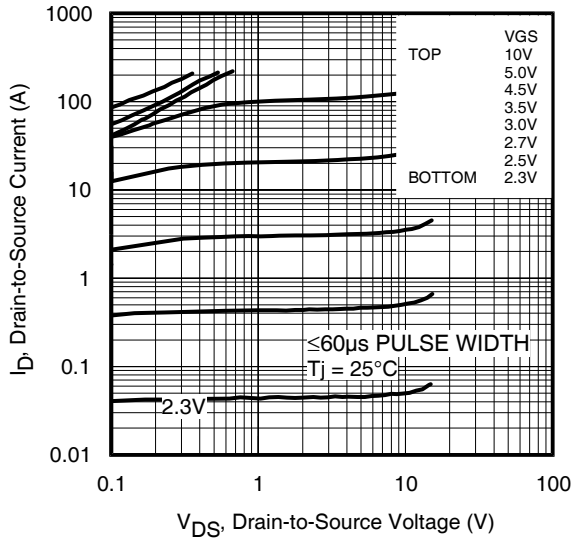



**Fig 1.** Typical Output Characteristics

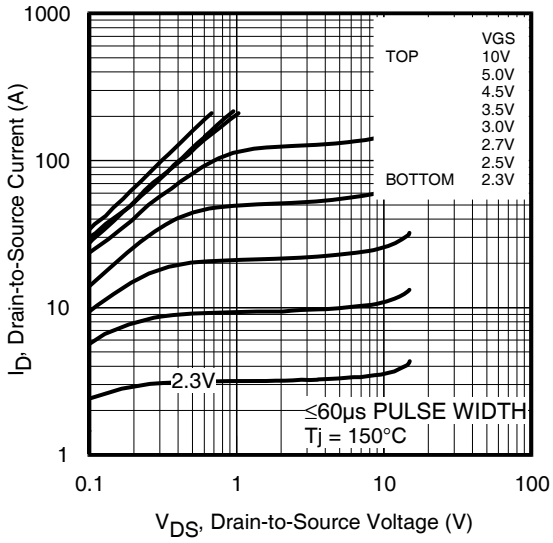



**Fig 2.** Typical Output Characteristics

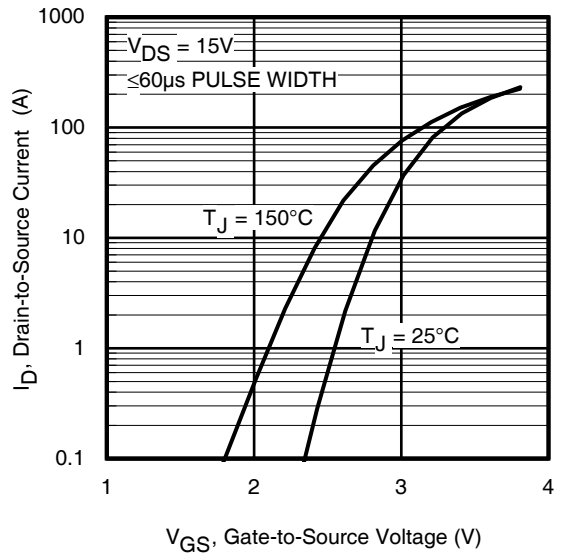



**Fig 3.** Typical Transfer Characteristics

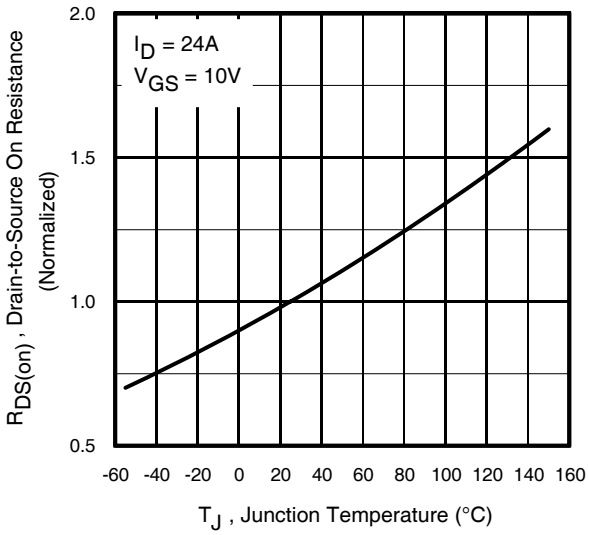



**Fig 4.** Normalized On-Resistance vs. Temperature

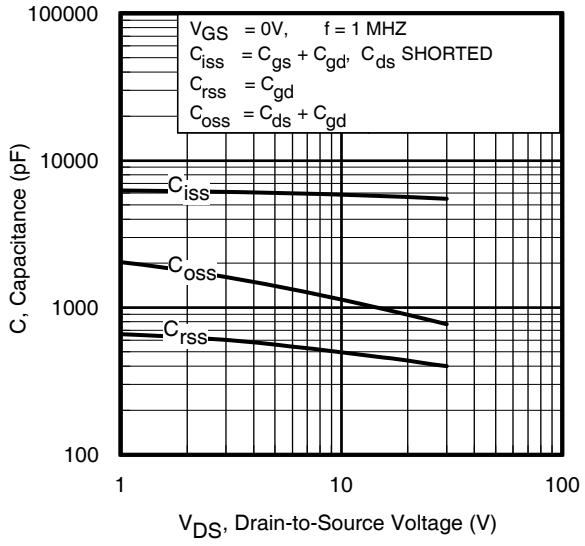



**Fig 5.** Typical Capacitance vs. Drain-to-Source Voltage

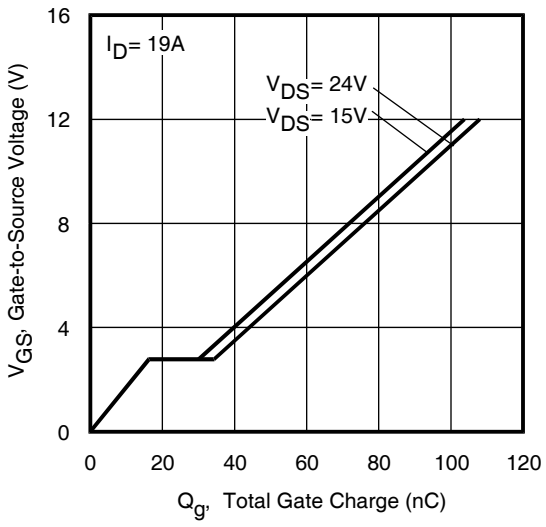



**Fig 6.** Typical Gate Charge vs. Gate-to-Source Voltage

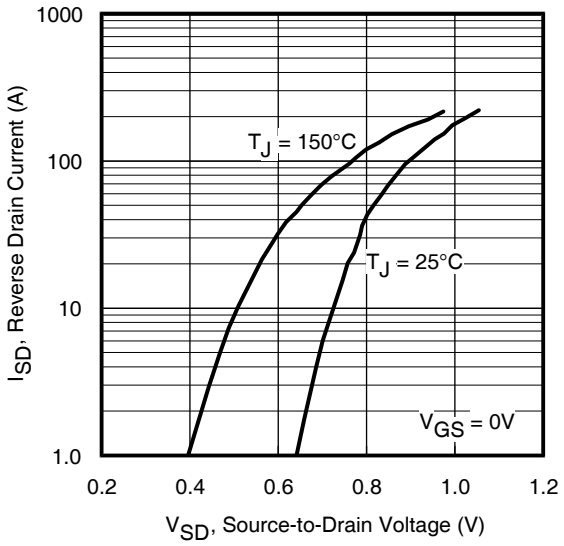



**Fig 7.** Typical Source-Drain Diode Forward Voltage

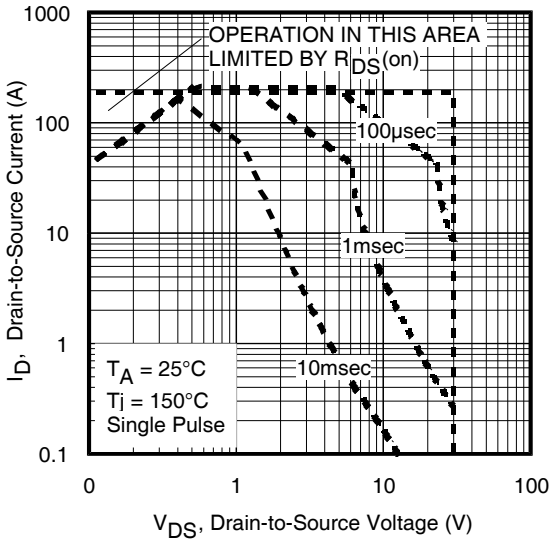



**Fig 8.** Maximum Safe Operating Area

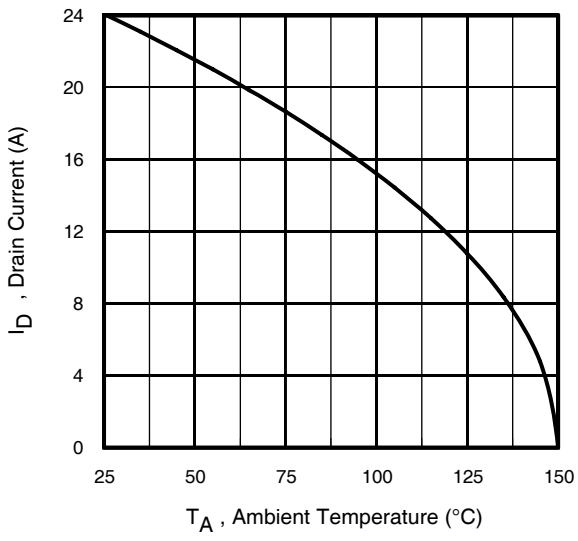



**Fig 9.** Maximum Drain Current vs. Ambient Temperature

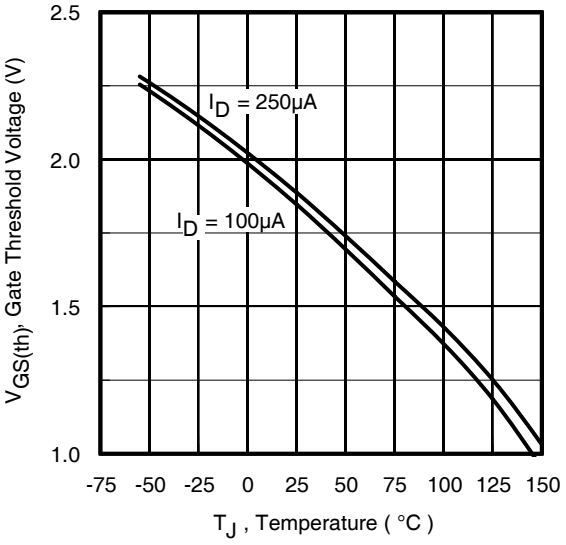



**Fig 10.** Threshold Voltage vs. Temperature

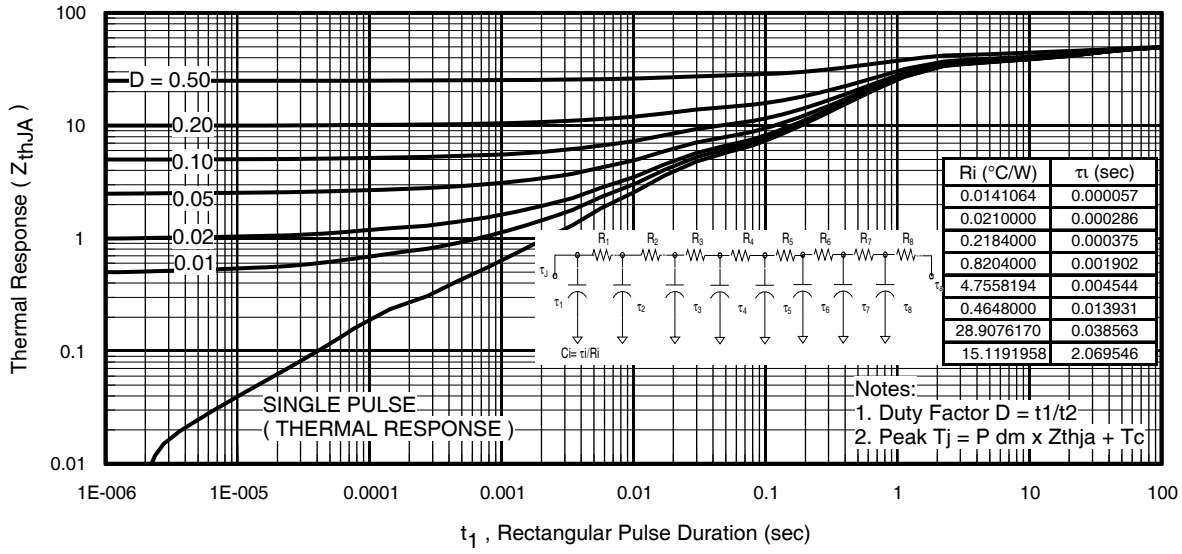



**Fig 11.** Maximum Effective Transient Thermal Impedance, Junction-to-Ambient

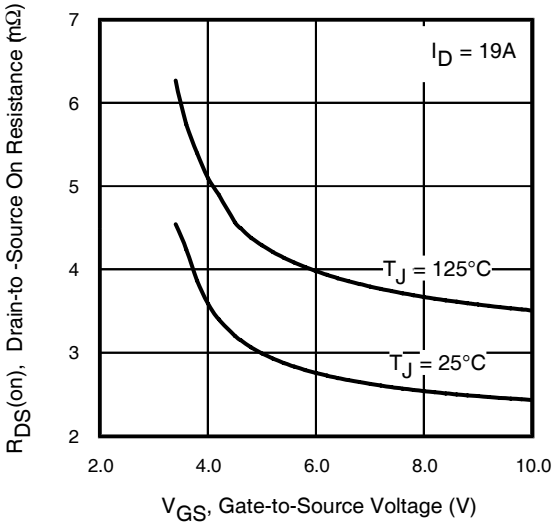



**Fig 12.** On-Resistance vs. Gate Voltage

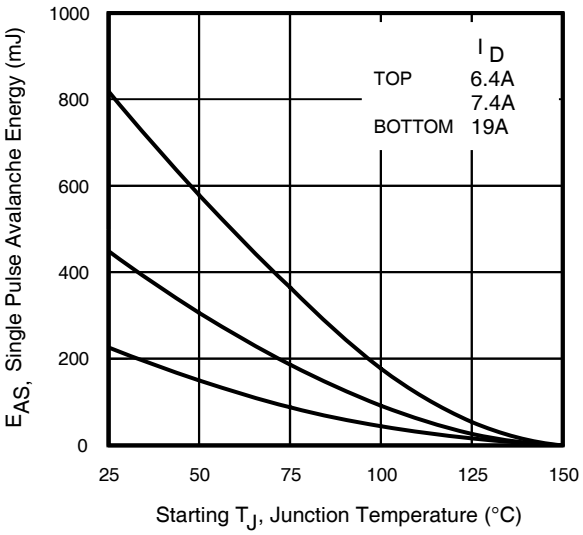
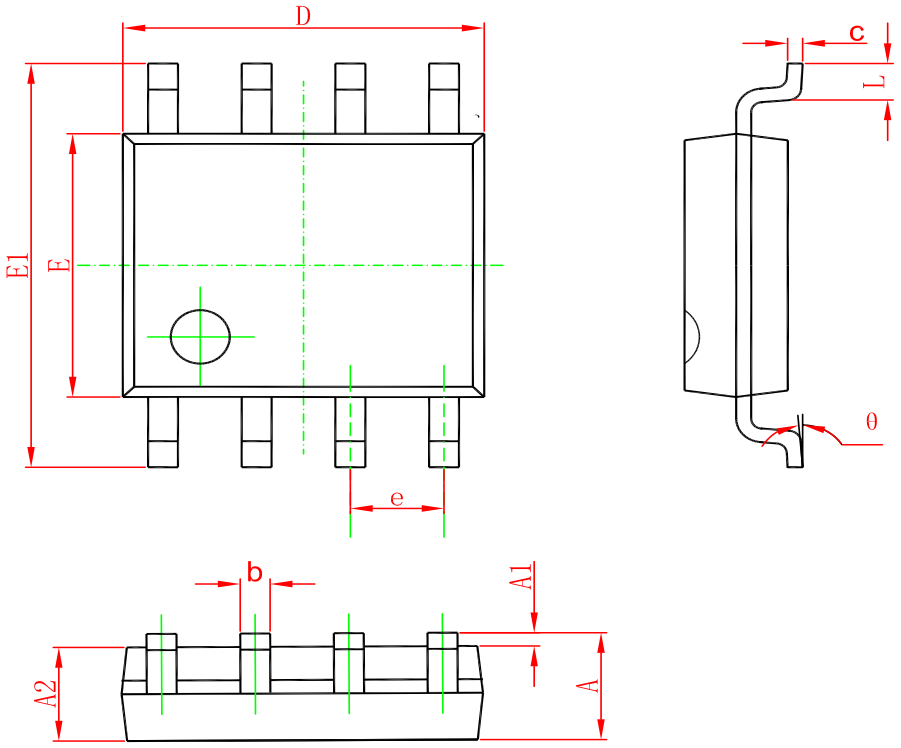



**Fig 13.** Maximum Avalanche Energy vs. Drain Current

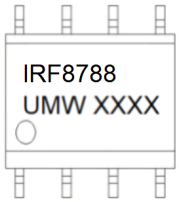
## PACKAGE OUTLINE DIMENSIONS

### SOP-8




| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|---|---|---|---|---|
| | Min | Max | Min | Max |
| A | 1.350 | 1.750 | 0.053 | 0.069 |
| A1 | 0.100 | 0.250 | 0.004 | 0.010 |
| A2 | 1.350 | 1.550 | 0.053 | 0.061 |
| b | 0.330 | 0.510 | 0.013 | 0.020 |
| c | 0.170 | 0.250 | 0.006 | 0.010 |
| D | 4.700 | 5.100 | 0.185 | 0.200 |
| E | 3.800 | 4.000 | 0.150 | 0.157 |
| E1 | 5.800 | 6.200 | 0.228 | 0.244 |
| e | 1.270(BSC) | | 0.050(BSC) | |
| L | 0.400 | 1.270 | 0.016 | 0.050 |
| θ | 0° | 8° | 0° | 8° |

## Marking




## Ordering information

| Order code | Package | Baseqty | Deliverymode |
|---|---|---|---|
| UMW IRF8788TR | SOP-8 | 3000 | Tape and reel |

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