# UMW IRF8707TR

30V N-Channel MOSFET

## 1.Description

The UMW IRF8707TR has been optimized for parameters that are critical in synchronous buck operation including $R_{DS(ON)}$ 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.

## 2.Features

- $V_{DS\ (V)}$=30V
- $I_D$=11A
- $R_{DS(ON)}$<11.9mΩ($V_{GS}$=10V)
- $R_{DS(ON)}$<17.5mΩ($V_{GS}$=4.5V)

## 3.Application

- Control MOSFET of Sync-Buck Converters used for Notebook Processor Power
- Control MOSFET for Isolated DC-DC Converters in Networking Systems

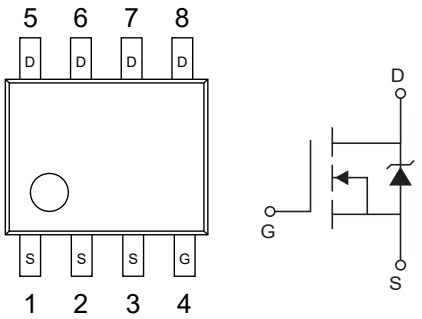
## 4.Benefits

- Very Low Gate Charge
- Very Low $R_{DS(ON)}$ at 4.5V $V_{GS}$
- Ultra-Low Gate Impedance
- 20V $V_{GS}$ Max. Gate Rating

## 5.Pinning information

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

**SOP-8**



## 6.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 | $I_D$ | 11 | A |
| Continuous Drain Current, $V_{GS}$=10V | $T_A$=70°C | | 9.1 | A |
| Pulsed Drain Current ① | | $I_{DM}$ | 88 | A |
| Power Dissipation | $T_A$=25°C | $P_D$ | 2.5 | W |
| Power Dissipation | $T_A$=70°C | | 1.6 | W |
| Linear Derating Factor | | | 0.02 | W/°C |
| Operating Junction and Storage Temperature Range | | $T_J$, $T_{STG}$ | -55 to 150 | °C |

## 7.Thermal Resistance Rating

| Parameter | Symbol | Typ | Max | Units |
|---|---|---|---|---|
| Junction-to-Drain Lead ⑤ | $R_{\theta JL}$ | | 20 | °C/W |
| Junction-to-Ambient ④ ⑤ | $R_{\theta JA}$ | | 50 | °C/W |

Notes ① through ⑤ are on page 9

## 8.Electrical Characteristics $T_J$=25°C

| 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 | | 0.022 | | V/°C |
| Static Drain-to-Source On-Resistance | $R_{DS(ON)}$ | $V_{GS}$=10V, $I_D$=11A ③ | | 9.3 | 11.9 | mΩ |
| | | $V_{GS}$=4.5V, $I_D$=8.8A ③ | | 14.2 | 17.5 | |
| Gate Threshold Voltage | $V_{GS(th)}$ | $V_{DS}$=$V_{GS}$, $I_D$=25μA | 1.35 | 1.8 | 2.35 | V |
| Gate Threshold Voltage Coefficient | $\Delta V_{GS(th)}$ | $V_{DS}$=$V_{GS}$, $I_D$=25μA | | -5.8 | | 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 | $g_{FS}$ | $V_{DS}$=15V, $I_D$=8.8A | 25 | | | S |
| Total Gate Charge | $Q_g$ | $V_{DS}$=15V<br>$V_{GS}$=4.5V<br>$I_D$=8.8A<br>See Fig. 15 & 16 | | 6.2 | 9.3 | nC |
| Pre-Vth Gate-to-Source Charge | $Q_{gs1}$ | | | 1.4 | | nC |
| Post-Vth Gate-to-Source Charge | $Q_{gs2}$ | | | 0.7 | | nC |
| Gate-to-Drain Charge | $Q_{gd}$ | | | 2.2 | | nC |
| Gate Charge Overdrive | $Q_{godr}$ | | | 1.9 | | nC |
| Switch Charge ($Q_{gs2}$ + $Q_{gd}$) | $Q_{sw}$ | | | 2.9 | | nC |
| Output Charge | $Q_{oss}$ | $V_{GS}$=0V, $V_{DS}$=16V | | 3.7 | | nC |
| Gate Resistance | $R_G$ | | | 2.2 | 3.7 | Ω |
| Turn-On Delay Time | $t_{D(on)}$ | $V_{DD}$=15V<br>$V_{GS}$=4.5V<br>$I_D$=8.8A<br>$R_G$=1.8Ω, See Fig. 18 | | 6.7 | | ns |
| Rise Time | $t_r$ | | | 7.9 | | ns |
| Turn-Off Delay Time | $t_{D(off)}$ | | | 7.3 | | ns |
| Fall Time | $t_f$ | | | 4.4 | | ns |
| Input Capacitance | $C_{iss}$ | $V_{GS}$=0V<br>$V_{DS}$=15V<br>$f$=1.0MHz | | 760 | | pF |
| Output Capacitance | $C_{oss}$ | | | 170 | | pF |
| Reverse Transfer Capacitance | $C_{rss}$ | | | 82 | | pF |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Avalanche Characteristics** | | | | | | |
| Single Pulse Avalanche Energy ② | $E_{AS}$ | | | | 53 | mJ |
| Avalanche Current ① | $I_{AR}$ | | | | 8.8 | A |
| **Diode Characteristics** | | | | | | |
| Continuous Source Current (Body Diode) | $I_S$ | MOSFET symbol showing the | | | 3.1 | A |
| Pulsed Source Current (Body Diode) ① | $I_{SM}$ | integral reverse p-n junction diode. | | | 88 | A |
| Diode Forward Voltage | $V_{SD}$ | $T_J$=25°C,$I_S$=8.8A,$V_{GS}$=0V ③ | | | 1 | V |
| Reverse Recovery Time | $t_{rr}$ | $T_J$=25°C,$I_F$=8.8A, $V_{DD}$=15V | | 12 | 18 | ns |
| Reverse Recovery Charge | $Q_{rr}$ | dI/dt=300A/μs ③ | | 13 | 20 | nC |
| Forward Turn-On Time | $t_{on}$ | Intrinsic turn-on time is negligible (turn-on is dominated by $L_S$+$L_D$) | | | | |

Notes:

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

② Starting $T_J$=25°C, L=1.38mH, $R_G$=25Ω, $I_{AS}$=8.8A.

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.

## 9.1Typical Characterisitics

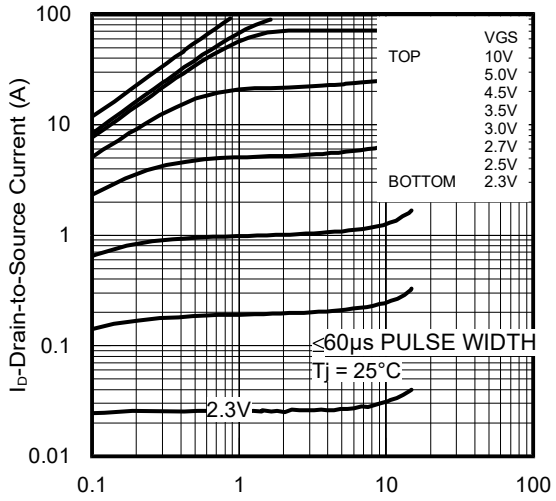



Fig 1. Typical Output Characteristics

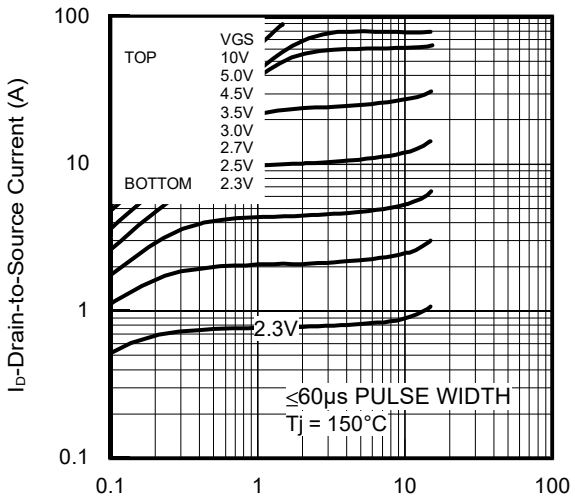



Fig 2. Typical Output Characteristics

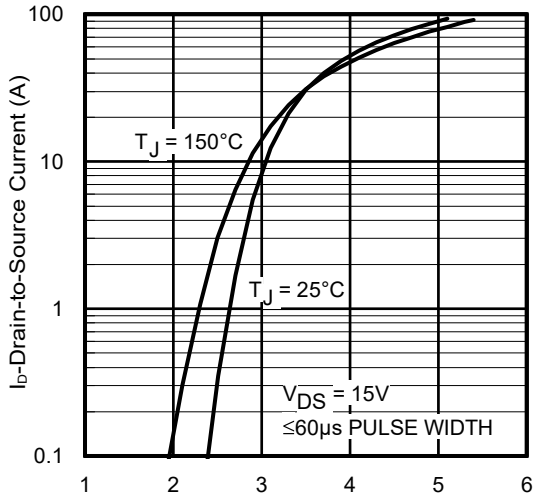



Fig 3. Typical Transfer Characteristics

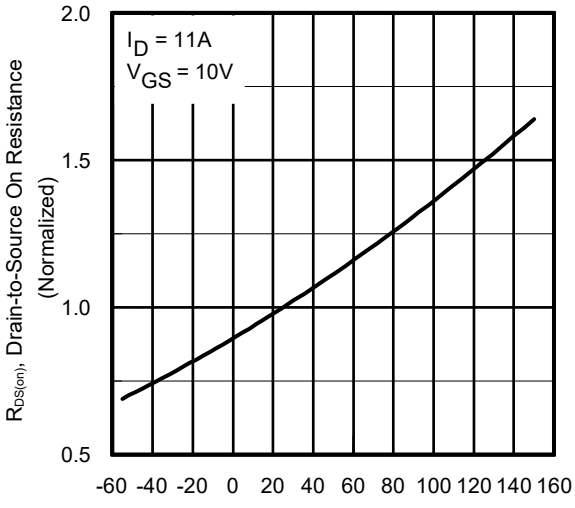
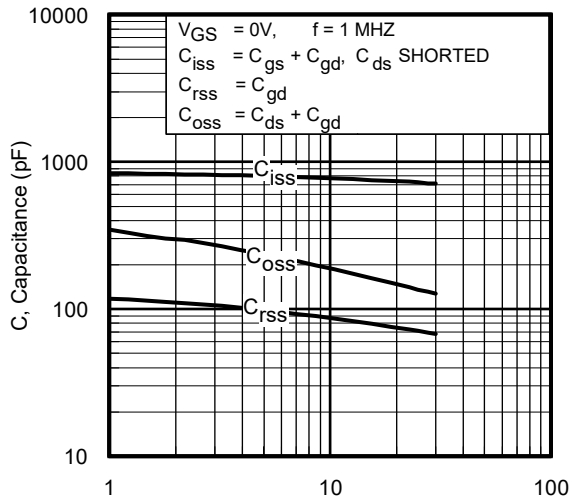


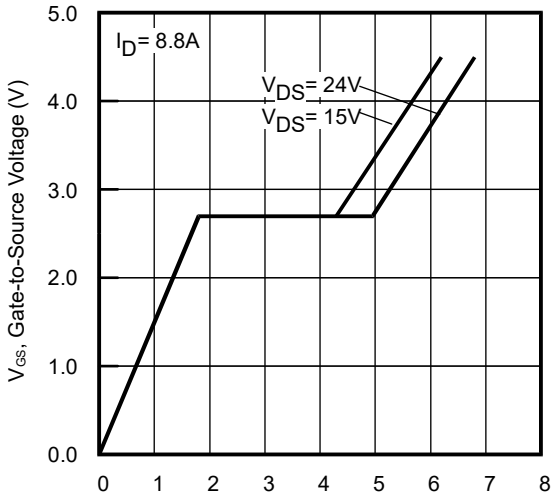

Fig 4. Nomalized On-ResistanceVs. Temperature

## 9.2Typical Characterisitics



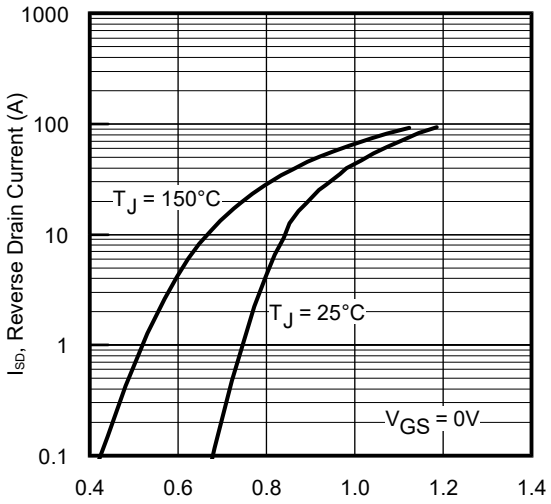

$V_{DS}$ ,Drain-to-Source Voltage (V)

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



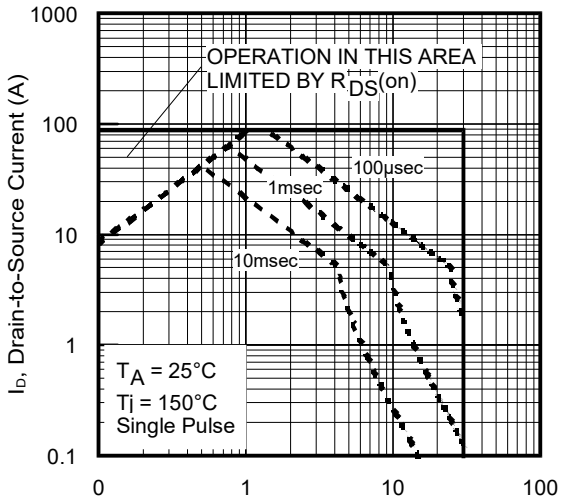

$Q_G$, Total Gate Charge (nC)

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




$V_{SD}$, 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

## 9.3Typical Characterisitics

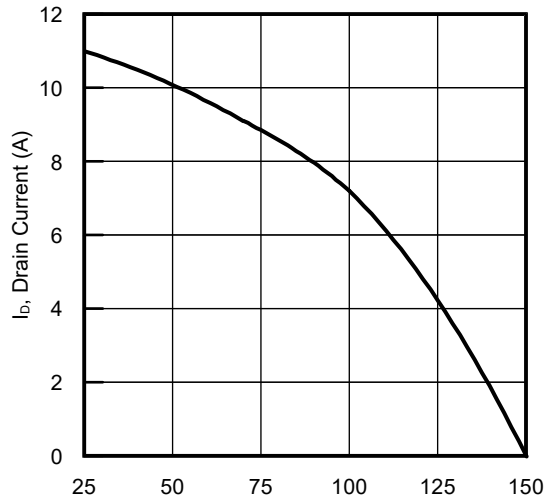



Fig 9. Maximum Drain Current Vs. Case Temperature

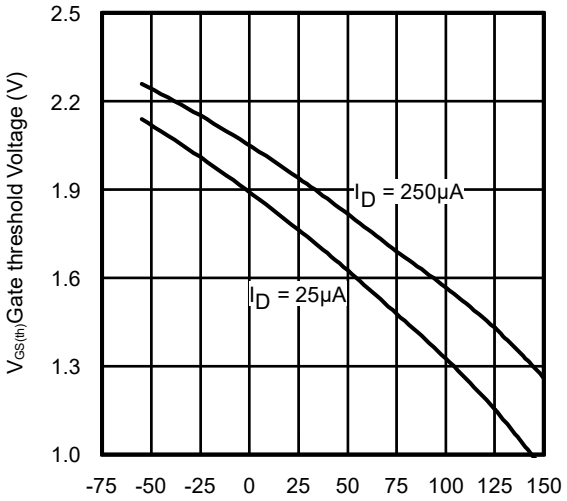



Fig 10. Threshold Voltage Vs. Temperature

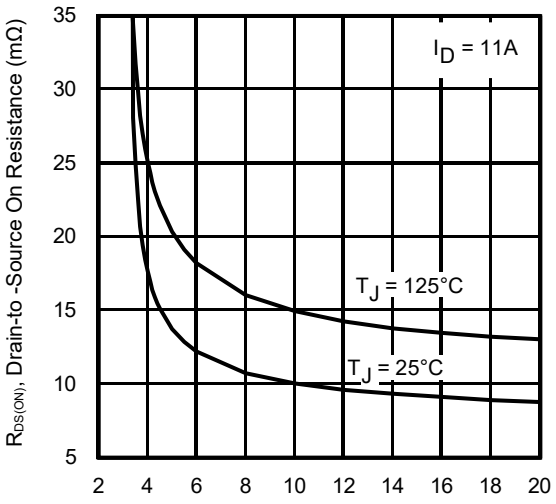



Fig 11. On-Resistance Vs. Drain Current

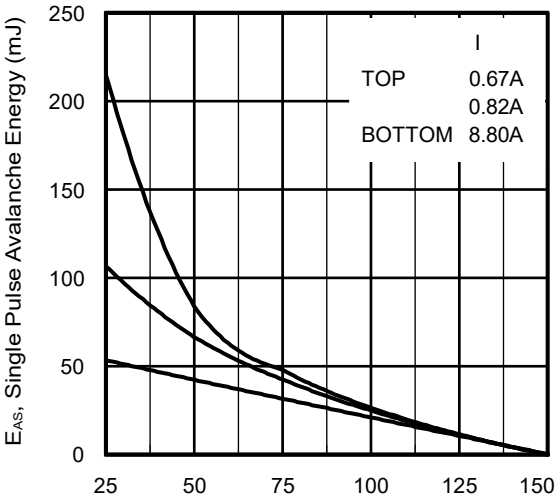



Fig 12. Maximum Avalanche Energy Vs. Drain Current

## 9.4Typical Characterisitics

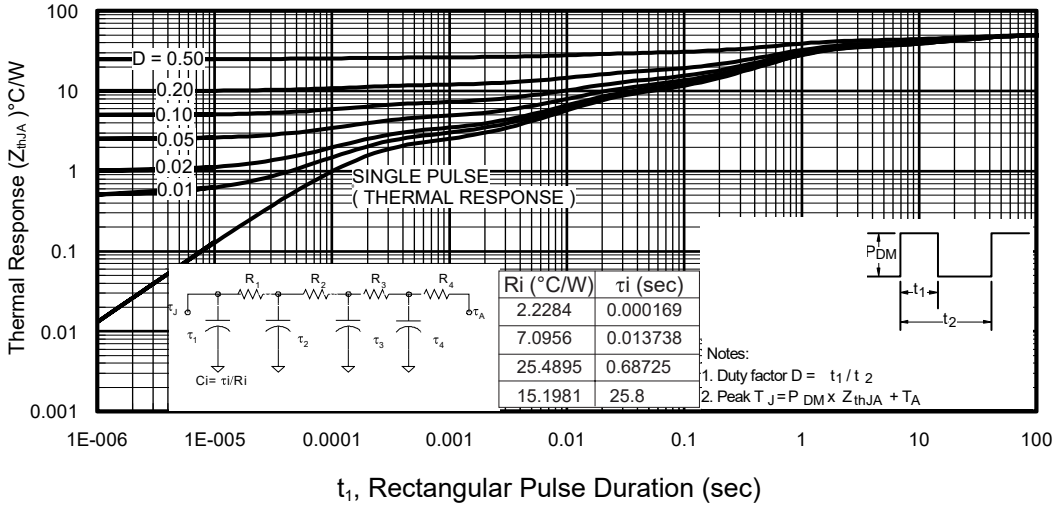



Fig 13. Maximum Effective Transient Themal Impedance, Junction-to-Ambient

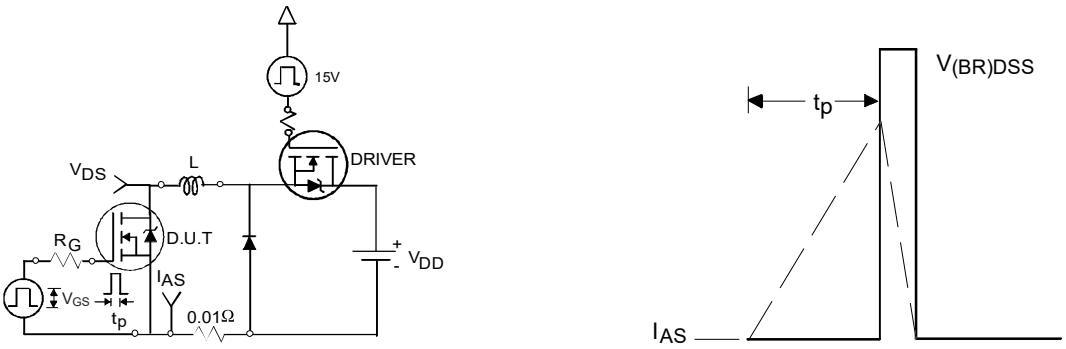



Fig 14.Unclamped Inductive Test Circuit and Waveform

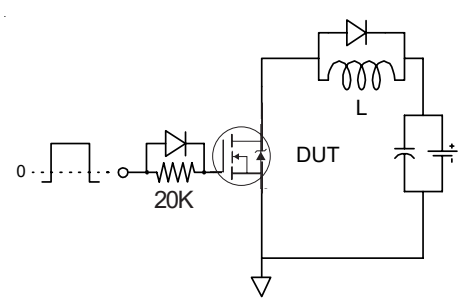



Fig 15. Gate Charge Test Circuit

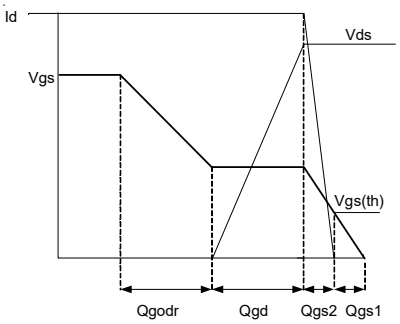
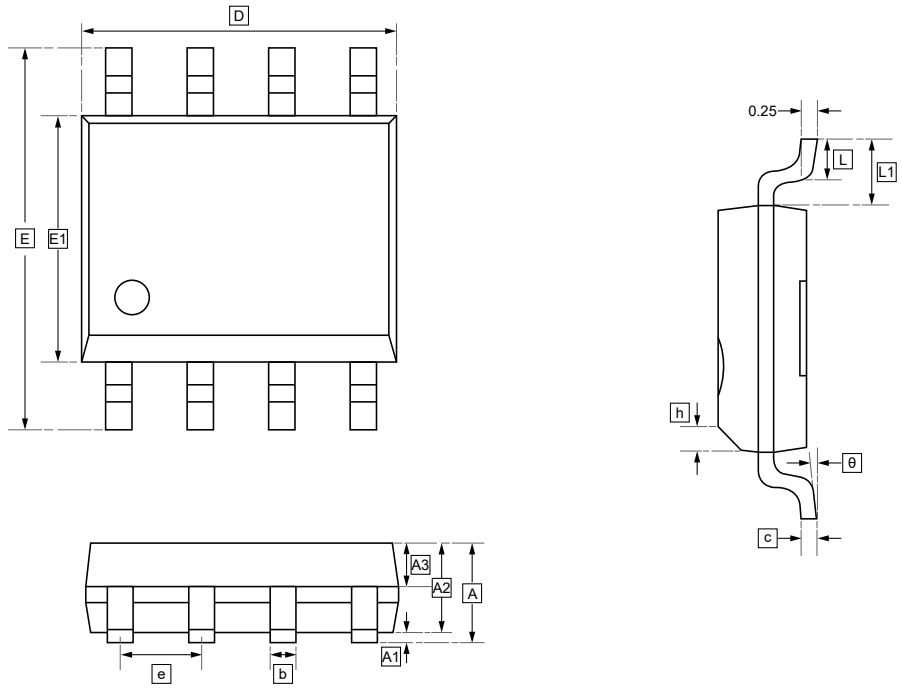



Fig 16. Gate Charge Waveform

## 10.SOP-8 Package Outline Dimensions

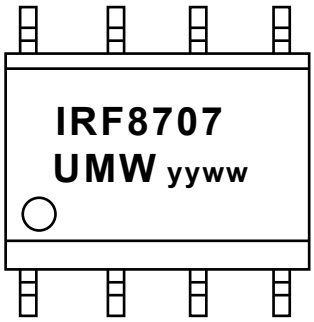



**DIMENSIONS (mm are the original dimensions)**

| Symbol | A | A1 | A2 | A3 | b | c | D | E | E1 | e | h | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Min** | - | 0.05 | 1.30 | 0.60 | 0.39 | 0.20 | 4.70 | 5.80 | 3.80 | 1.24 | 0.30 | 0.50 |
| **Max** | 1.75 | 0.20 | 1.50 | 0.70 | 0.47 | 0.24 | 5.10 | 6.20 | 4.00 | 1.30 | 0.50 | 0.80 |

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

## 11.Ordering information




yy: Year Code
ww: Week Code

| Order Code | Package | Base QTY | Delivery Mode |
|---|---|---|---|
| UMW IRF8707TR | SOP-8 | 3000 | Tape and reel |

## 12.Disclaimer

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