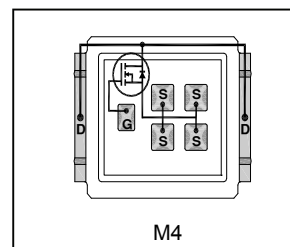


## Automotive DirectFET® Power MOSFET ②

- Advanced Process Technology
- Optimized for Automotive Motor Drive, DC-DC and other Heavy Load Applications
- Exceptionally Small Footprint and Low Profile
- High Power Density
- Low Parasitic Parameters
- Dual Sided Cooling
- 175°C Operating Temperature
- Repetitive Avalanche Capability for Robustness and Reliability
- Lead free, RoHS and Halogen free
- Automotive Qualified \*

|                          |              |
|--------------------------|--------------|
| $V_{(BR)DSS}$            | <b>40V</b>   |
| $R_{DS(on)}$ <b>typ.</b> | <b>2.5mΩ</b> |
| <b>max.</b>              | <b>3.0mΩ</b> |
| $I_D$ (Silicon Limited)  | <b>108A</b>  |
| $Q_g$ (typical)          | <b>72nC</b>  |



M4



DirectFET® ISOMETRIC

Applicable DirectFET® Outline and Substrate Outline ①

|           |           |  |  |           |           |  |           |           |           |  |
|-----------|-----------|--|--|-----------|-----------|--|-----------|-----------|-----------|--|
| <b>SB</b> | <b>SC</b> |  |  | <b>M2</b> | <b>M4</b> |  | <b>L4</b> | <b>L6</b> | <b>L8</b> |  |
|-----------|-----------|--|--|-----------|-----------|--|-----------|-----------|-----------|--|

**Description**

The AUIRF7736M2 combines the latest Automotive HEXFET® Power MOSFET Silicon technology with the advanced DirectFET® packaging technology to achieve exceptional performance in a package that has the footprint of an SO-8 or 5X6mm PQFN and only 0.7mm profile. The DirectFET® package is compatible with existing layout geometries used in power applications, PCB assembly equipment and vapor phase, infra-red or convection soldering techniques, when application note AN-1035 is followed regarding the manufacturing methods and processes. The DirectFET® package allows dual sided cooling to maximize thermal transfer in automotive power systems.

This HEXFET® Power MOSFET is designed for applications where efficiency and power density are of value. The advanced DirectFET® packaging platform coupled with the latest silicon technology allows the AUIRF7736M2 to offer substantial system level savings and performance improvement specifically in motor drive, high frequency DC-DC and other heavy load applications on ICE, HEV and EV platforms. This MOSFET utilizes the latest processing techniques to achieve low on-resistance and low  $Q_g$  per silicon area. Additional features of this MOSFET are 175°C operating junction temperature and high repetitive peak current capability. These features combine to make this MOSFET a highly efficient, robust and reliable device for high current automotive applications

| Base Part Number | Package Type         | Standard Pack |          | Orderable Part Number |
|------------------|----------------------|---------------|----------|-----------------------|
|                  |                      | Form          | Quantity |                       |
| AUIRF7736M2      | DirectFET Medium Can | Tape and Reel | 4800     | AUIRF7736M2TR         |

**Absolute Maximum Ratings**

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only; and functional operation of the device at these or any other condition beyond those indicated in the specifications is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability. The thermal resistance and power dissipation ratings are measured under board mounted and still air conditions. Ambient temperature ( $T_A$ ) is 25°C, unless otherwise specified.

|   | Parameter   | Max.                      | Units |
|---|---|---------------------------|-------|
| V <sub>DS</sub>                         | Drain-to-Source Voltage   | 40                        | V     |
| V <sub>GS</sub>                         | Gate-to-Source Voltage  | ±20                       |       |
| I <sub>D</sub> @ T <sub>C</sub> = 25°C  | Continuous Drain Current, V <sub>GS</sub> @ 10V (Silicon Limited) ④ | 108                       | A     |
| I <sub>D</sub> @ T <sub>C</sub> = 100°C | Continuous Drain Current, V <sub>GS</sub> @ 10V (Silicon Limited) ④ | 77                        |       |
| I <sub>D</sub> @ T <sub>A</sub> = 25°C  | Continuous Drain Current, V <sub>GS</sub> @ 10V (Silicon Limited) ③ | 22                        |       |
| I <sub>D</sub> @ T <sub>C</sub> = 25°C  | Continuous Drain Current, V <sub>GS</sub> @ 10V (Package Limited)   | 179                       |       |
| I <sub>DM</sub>                         | Pulsed Drain Current ⑤  | 432                       |       |
| P <sub>D</sub> @T <sub>C</sub> = 25°C   | Power Dissipation ④   | 63                        | W     |
| P <sub>D</sub> @T <sub>A</sub> = 25°C   | Power Dissipation ③   | 2.5                       |       |
| E <sub>AS</sub>                         | Single Pulse Avalanche Energy (Thermally Limited) ⑥                 | 54                        | mJ    |
| E <sub>AS</sub> (Tested)                | Single Pulse Avalanche Energy ⑥                                     | 286                       |       |
| I <sub>AR</sub>                         | Avalanche Current ⑤   | See Fig. 16, 17, 18a, 18b | A     |
| E <sub>AR</sub>                         | Repetitive Avalanche Energy ⑤                                       |                           | mJ    |
| T <sub>P</sub>                          | Peak Soldering Temperature  | 270                       | °C    |
| T <sub>J</sub>                          | Operating Junction and  | -55 to + 175              |       |
| T <sub>STG</sub>                        | Storage Temperature Range   |                           |       |

HEXFET® is a registered trademark of Infineon.

\*Qualification standards can be found at [www.infineon.com](http://www.infineon.com)

**Thermal Resistance**

| Symbol             | Parameter                | Typ. | Max. | Units |
|--------------------|--------------------------|------|------|-------|
| $R_{\theta JA}$    | Junction-to-Ambient ③    | —    | 60   | °C/W  |
| $R_{\theta JA}$    | Junction-to-Ambient ⑧    | 12.5 | —    |       |
| $R_{\theta JA}$    | Junction-to-Ambient ⑨    | 20   | —    |       |
| $R_{\theta J-Can}$ | Junction-to-Can ④⑩       | —    | 2.4  |       |
| $R_{\theta J-PCB}$ | Junction-to-PCB Mounted  | 1.0  | —    |       |
|                    | Linear Derating Factor ④ | 0.42 |      | W/°C  |

**Static Electrical Characteristics @  $T_J = 25^\circ\text{C}$  (unless otherwise specified)**

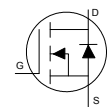
| Symbol                          | Parameter                            | Min. | Typ. | Max. | Units      | Conditions   |
|---------------------------------|--------------------------------------|------|------|------|------------|--|
| $V_{(BR)DSS}$                   | Drain-to-Source Breakdown Voltage    | 40   | —    | —    | V          | $V_{GS} = 0V, I_D = 250\mu A$                          |
| $\Delta V_{(BR)DSS}/\Delta T_J$ | Breakdown Voltage Temp. Coefficient  | —    | 0.03 | —    | V/°C       | Reference to $25^\circ\text{C}$ , $I_D = 1.0\text{mA}$ |
| $R_{DS(on)}$                    | Static Drain-to-Source On-Resistance | —    | 2.5  | 3.0  | m $\Omega$ | $V_{GS} = 10V, I_D = 65A$ ⑦                            |
| $V_{GS(th)}$                    | Gate Threshold Voltage               | 2.0  | 3.0  | 4.0  | V          | $V_{DS} = V_{GS}, I_D = 150\mu A$                      |
| $\Delta V_{GS(th)}/\Delta T_J$  | Gate Threshold Voltage Coefficient   | —    | -9.0 | —    | mV/°C      |  |
| $g_{fs}$                        | Forward Transconductance             | 115  | —    | —    | S          | $V_{DS} = 10V, I_D = 65A$                              |
| $R_G$                           | Internal Gate Resistance             | —    | 1.0  | —    | $\Omega$   |  |
| $I_{DSS}$                       | Drain-to-Source Leakage Current      | —    | —    | 5.0  | $\mu A$    | $V_{DS} = 40V, V_{GS} = 0V$                            |
|                                 |                                      | —    | —    | 250  |            | $V_{DS} = 40V, V_{GS} = 0V, T_J = 125^\circ\text{C}$   |
| $I_{GSS}$                       | Gate-to-Source Forward Leakage       | —    | —    | 100  | nA         | $V_{GS} = 20V$   |
|                                 | Gate-to-Source Reverse Leakage       | —    | —    | -100 |            | $V_{GS} = -20V$  |

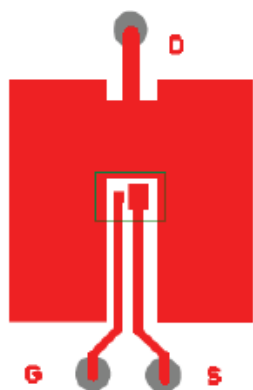
**Dynamic Electrical Characteristics @  $T_J = 25^\circ\text{C}$  (unless otherwise specified)**

| Symbol                | Parameter                            | Min. | Typ. | Max. | Units | Conditions   |
|-----------------------|--------------------------------------|------|------|------|-------|--|
| $Q_g$                 | Total Gate Charge                    | —    | 72   | 108  | nC    | $V_{DS} = 20V$<br>$V_{GS} = 10V$<br>$I_D = 65A$<br>See Fig.11      |
| $Q_{gs1}$             | Gate-to-Source Charge                | —    | 15   | —    |       |  |
| $Q_{gs2}$             | Gate-to-Source Charge                | —    | 6.3  | —    |       |  |
| $Q_{gd}$              | Gate-to-Drain ("Miller") Charge      | —    | 26   | —    |       |  |
| $Q_{godr}$            | Gate Charge Overdrive                | —    | 24.7 | —    |       |  |
| $Q_{sw}$              | Switch Charge ( $Q_{gs2} + Q_{gd}$ ) | —    | 32.3 | —    |       |  |
| $Q_{oss}$             | Output Charge                        | —    | 31   | —    | nC    | $V_{DS} = 16V, V_{GS} = 0V$  |
| $t_{d(on)}$           | Turn-On Delay Time                   | —    | 21   | —    | ns    | $V_{DD} = 20V, V_{GS} = 10V$ ⑦<br>$I_D = 65A$<br>$R_G = 6.8\Omega$ |
| $t_r$                 | Rise Time                            | —    | 43   | —    |       |  |
| $t_{d(off)}$          | Turn-Off Delay Time                  | —    | 39   | —    |       |  |
| $t_f$                 | Fall Time                            | —    | 27   | —    |       |  |
| $C_{iss}$             | Input Capacitance                    | —    | 4267 | —    | pF    | $V_{GS} = 0V$  |
| $C_{oss}$             | Output Capacitance                   | —    | 943  | —    |       | $V_{DS} = 25V$   |
| $C_{rss}$             | Reverse Transfer Capacitance         | —    | 422  | —    |       | $f = 1.0\text{ MHz}$   |
| $C_{oss}$             | Output Capacitance                   | —    | 3489 | —    |       | $V_{GS} = 0V, V_{DS} = 1.0V, f = 1.0\text{ MHz}$                   |
| $C_{oss}$             | Output Capacitance                   | —    | 843  | —    |       | $V_{GS} = 0V, V_{DS} = 32V, f = 1.0\text{ MHz}$                    |
| $C_{oss\text{ eff.}}$ | Effective Output Capacitance         | —    | 1222 | —    |       | $V_{GS} = 0V, V_{DS} = 0V\text{ to }32V$                           |

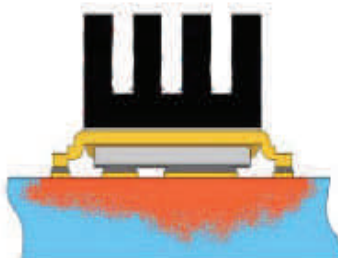
Notes ① through ⑩ are on page 3

**Diode Characteristics**

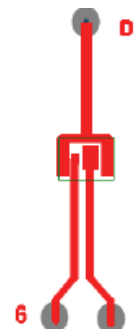
| Symbol   | Parameter                                 | Min. | Typ. | Max. | Units | Conditions   |
|----------|---|------|------|------|-------|--|
| $I_S$    | Continuous Source Current<br>(Body Diode) | —    | —    | 108  | A     | MOSFET symbol<br>showing the<br>integral reverse<br>p-n junction diode.<br> |
| $I_{SM}$ | Pulsed Source Current<br>(Body Diode) ⑤   | —    | —    | 432  |       |  |
| $V_{SD}$ | Diode Forward Voltage                     | —    | —    | 1.3  | V     | $T_J = 25^\circ\text{C}$ , $I_S = 65\text{A}$ , $V_{GS} = 0\text{V}$ ⑦   |
| $t_{rr}$ | Reverse Recovery Time                     | —    | 35   | 53   | ns    | $T_J = 25^\circ\text{C}$ , $I_F = 65\text{A}$ , $V_{DD} = 25\text{V}$  |
| $Q_{rr}$ | Reverse Recovery Charge                   | —    | 38   | 57   | nC    | $dv/dt = 100\text{A}/\mu\text{s}$ ⑦  |



③ Surface mounted on 1 in. square Cu board (still air).

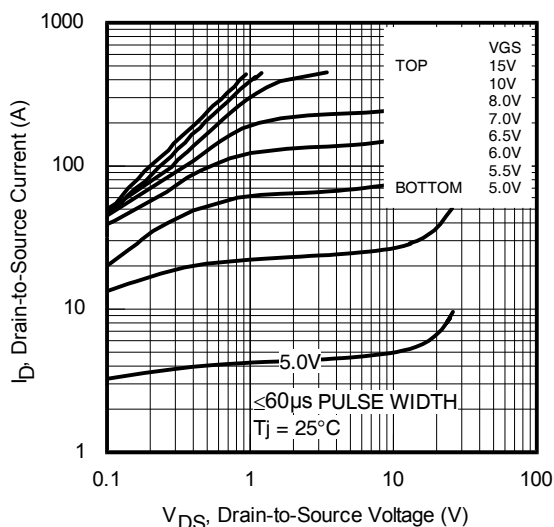
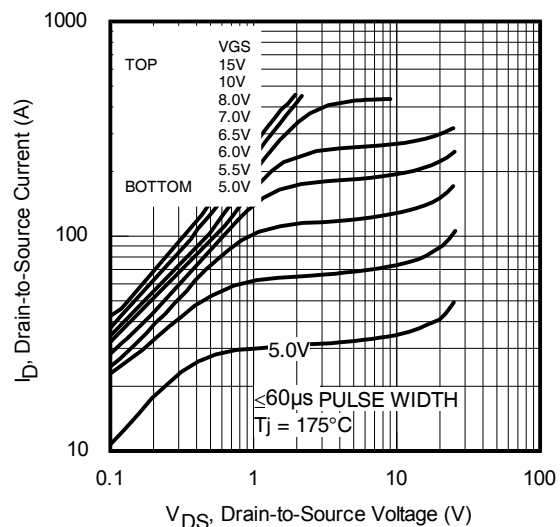
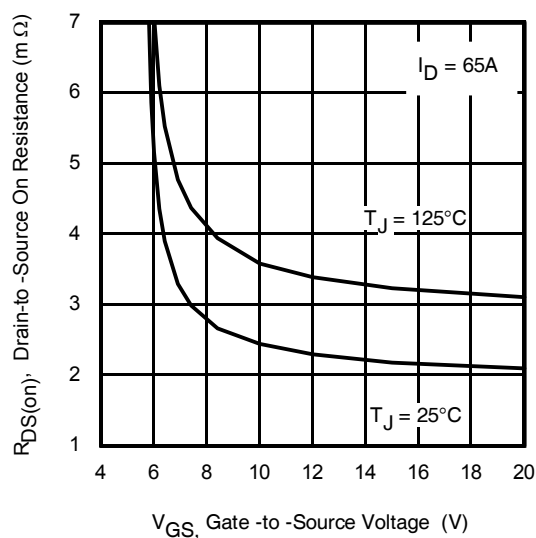
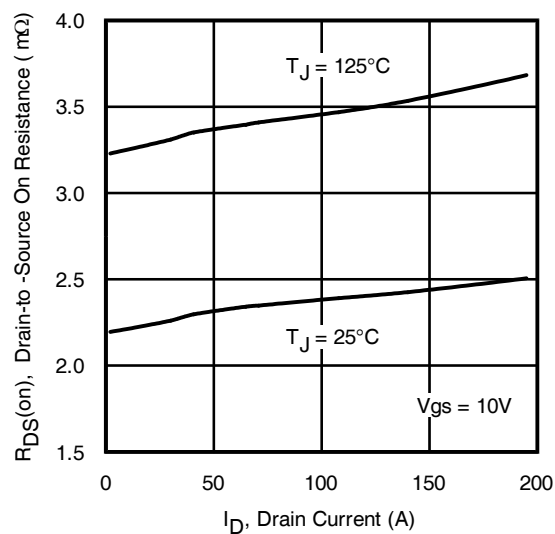
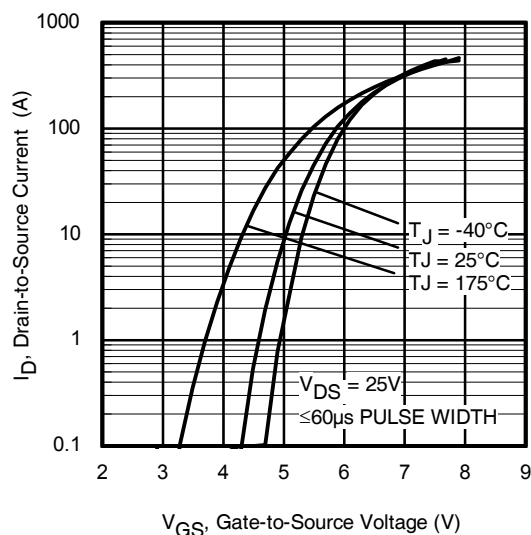
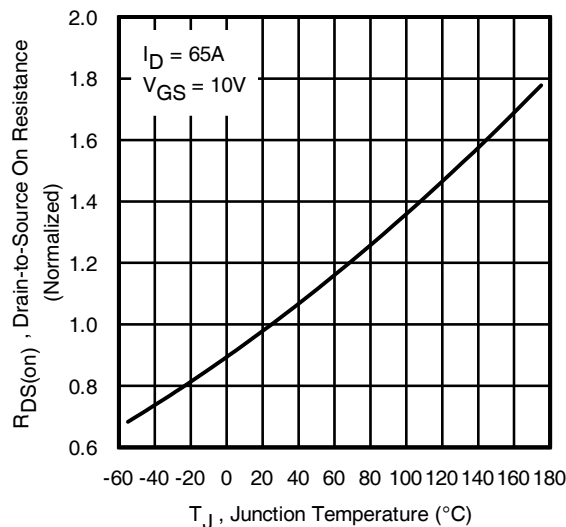


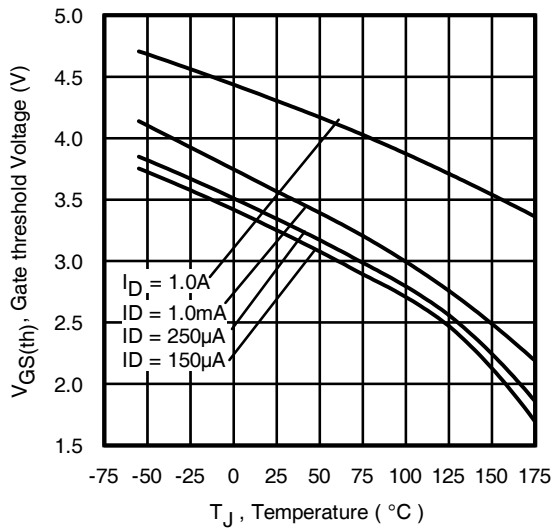
⑨ Mounted to a PCB with small clip heatsink (still air)



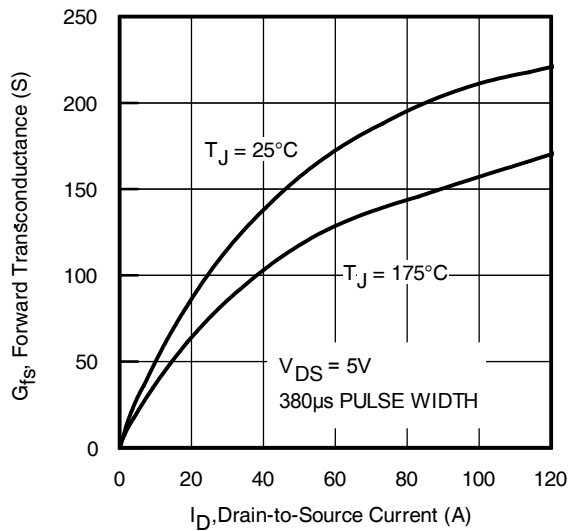
⑨ Mounted on minimum footprint full size board with metalized back and with small clip heatsink (still air).

- ① Click on this section to link to the appropriate technical paper.
- ② Click on this section to link to the DirectFET® Website.
- ③ Surface mounted on 1 in. square Cu board, steady state.
- ④  $T_C$  measured with thermocouple mounted to top (Drain) of part.
- ⑤ Repetitive rating; pulse width limited by max. junction temperature.
- ⑥ Starting  $T_J = 25^\circ\text{C}$ ,  $L = 0.026\text{mH}$ ,  $R_G = 50\Omega$ ,  $I_{AS} = 65\text{A}$ ,  $V_{GS} = 20\text{V}$ .
- ⑦ Pulse width  $\leq 400\mu\text{s}$ ; duty cycle  $\leq 2\%$ .
- ⑧ Used double sided cooling, mounting pad with large heatsink.
- ⑨ Mounted on minimum footprint full size board with metalized back and with small clip heat sink.
- ⑩  $R_\theta$  is measured at  $T_J$  of approximately  $90^\circ\text{C}$ .

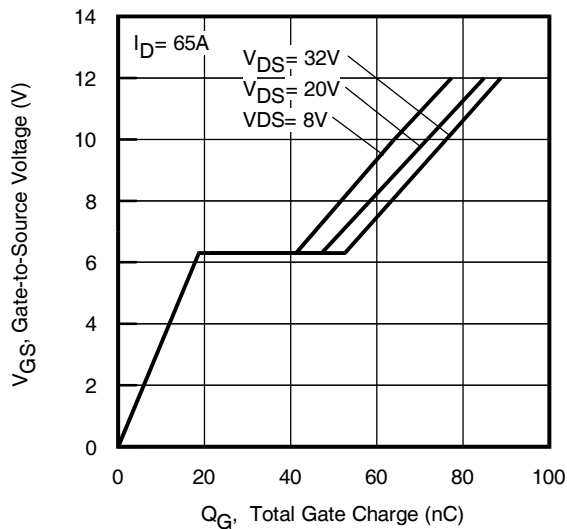

**Fig. 1** Typical Output Characteristics

**Fig. 2** Typical Output Characteristics

**Fig. 3** Typical On-Resistance vs. Gate Voltage

**Fig. 4** Typical On-Resistance vs. Drain Current

**Fig 5.** Transfer Characteristics

**Fig 6.** Normalized On-Resistance vs. Temperature



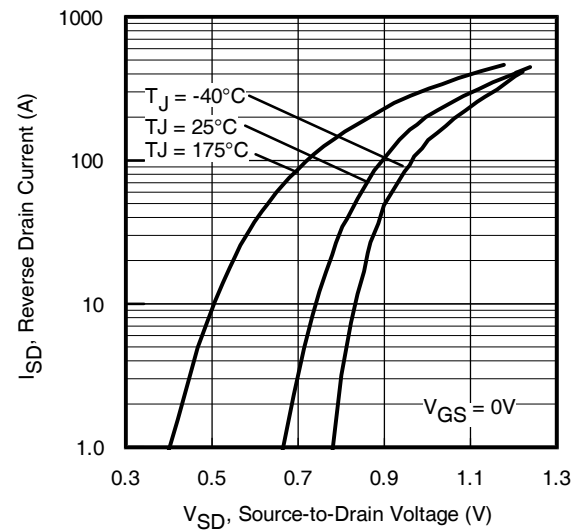
**Fig. 7** Typical Threshold Voltage vs. Junction Temperature



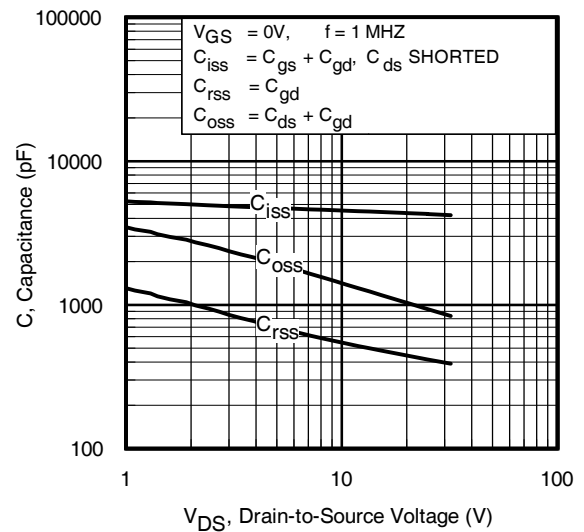
**Fig. 9.** Typical Forward Trans conductance vs. Drain Current



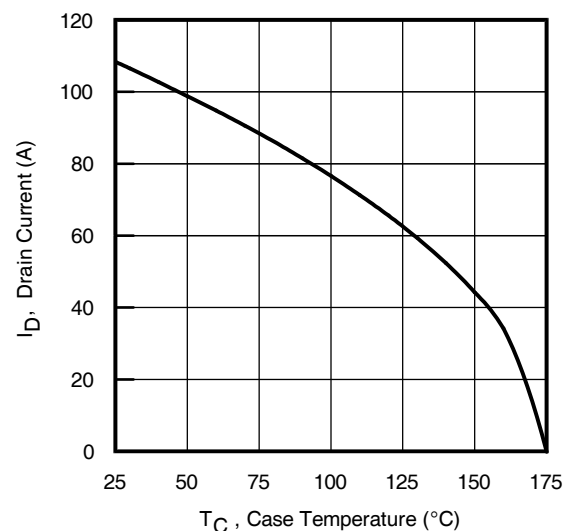
**Fig 11.** Typical Gate Charge vs. Gate-to-Source Voltage



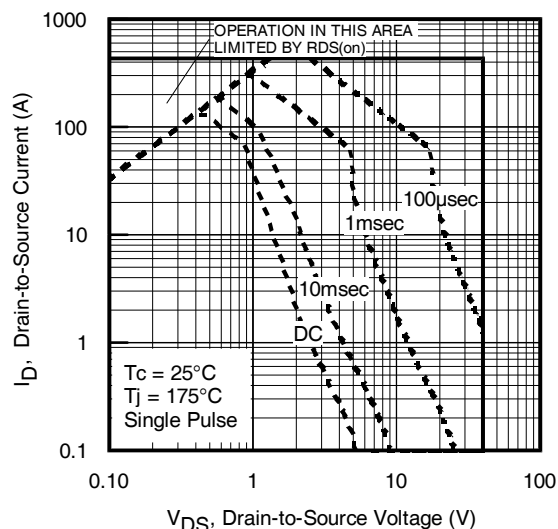
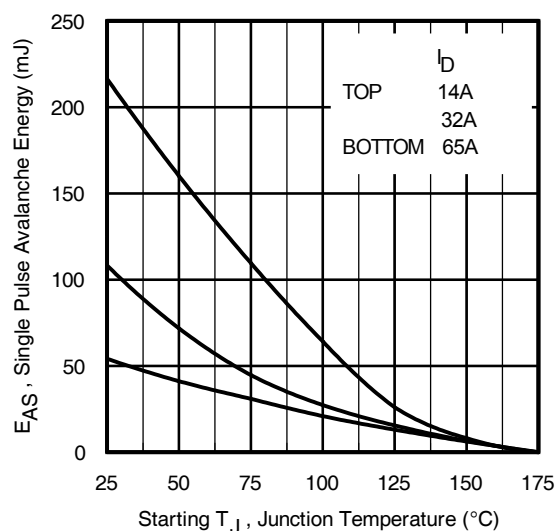
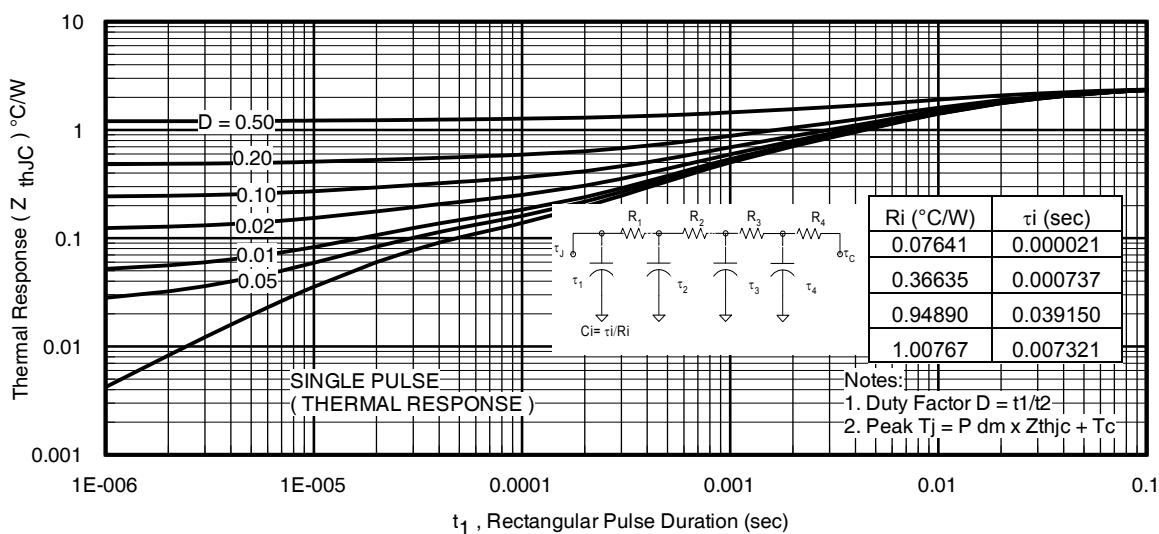
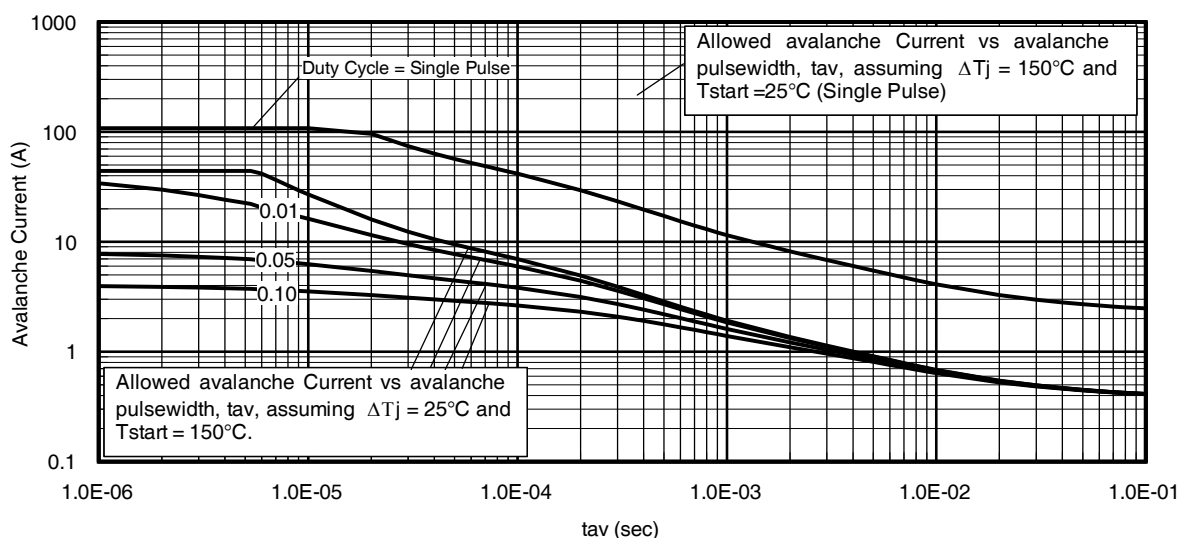
**Fig 8.** Typical Source-Drain Diode Forward Voltage

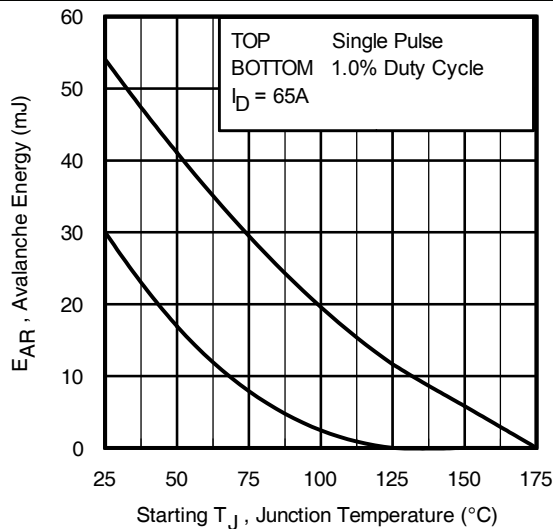


**Fig 10.** Typical Capacitance vs. Drain-to-Source Voltage



**Fig 12.** Maximum Drain Current vs. Case Temperature


**Fig 13. Maximum Safe Operating Area**

**Fig 14. Maximum Avalanche Energy vs. Temperature**

**Fig 15. Maximum Effective Transient Thermal Impedance, Junction-to-Case**

**Fig 16. Typical Avalanche Current vs. Pulse Width**


**Fig 17.** Maximum Avalanche Energy vs. Temperature

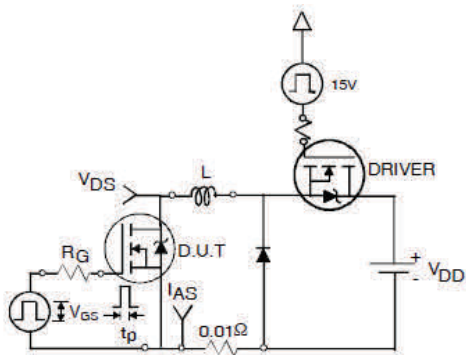
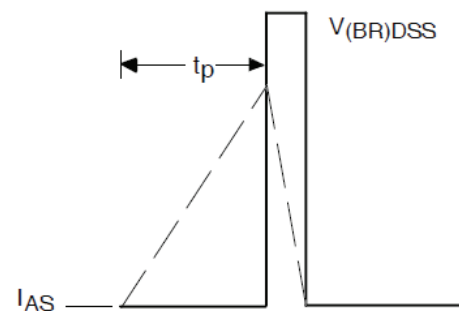
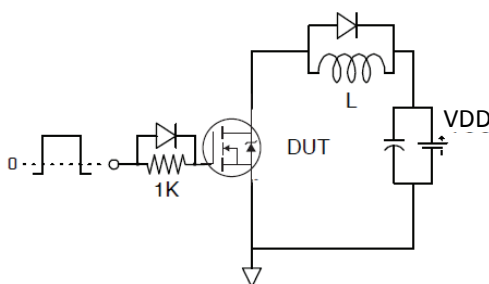
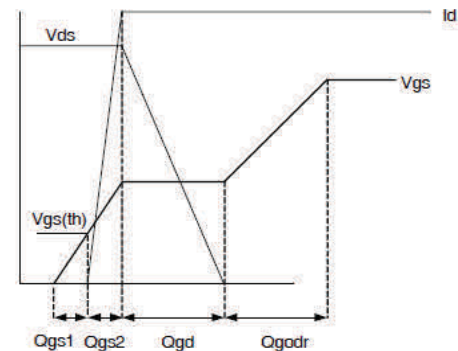
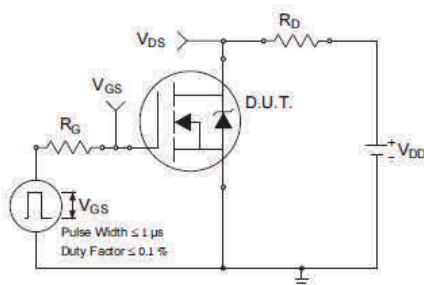
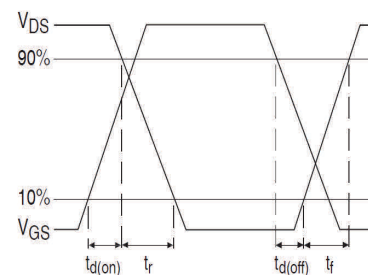
**Notes on Repetitive Avalanche Curves , Figures 16, 17:**
**(For further info, see AN-1005 at [www.infineon.com](http://www.infineon.com))**

1. Avalanche failures assumption:  
Purely a thermal phenomenon and failure occurs at a temperature far in excess of  $T_{jmax}$ . This is validated for every part type.
2. Safe operation in Avalanche is allowed as long as  $T_{jmax}$  is not exceeded.
3. Equation below based on circuit and waveforms shown in Figures 18a, 18b.
4.  $P_{D(ave)}$  = Average power dissipation per single avalanche pulse.
5.  $BV$  = Rated breakdown voltage (1.3 factor accounts for voltage increase during avalanche).
6.  $I_{av}$  = Allowable avalanche current.
7.  $\Delta T$  = Allowable rise in junction temperature, not to exceed  $T_{jmax}$  (assumed as 25°C in Figure 16, 17).  
 $t_{av}$  = Average time in avalanche.  
 $D$  = Duty cycle in avalanche =  $t_{av} \cdot f$   
 $Z_{thJC}(D, t_{av})$  = Transient thermal resistance, see Figures 15)

$$P_{D(ave)} = 1/2 (1.3 \cdot BV \cdot I_{av}) = \Delta T / Z_{thJC}$$

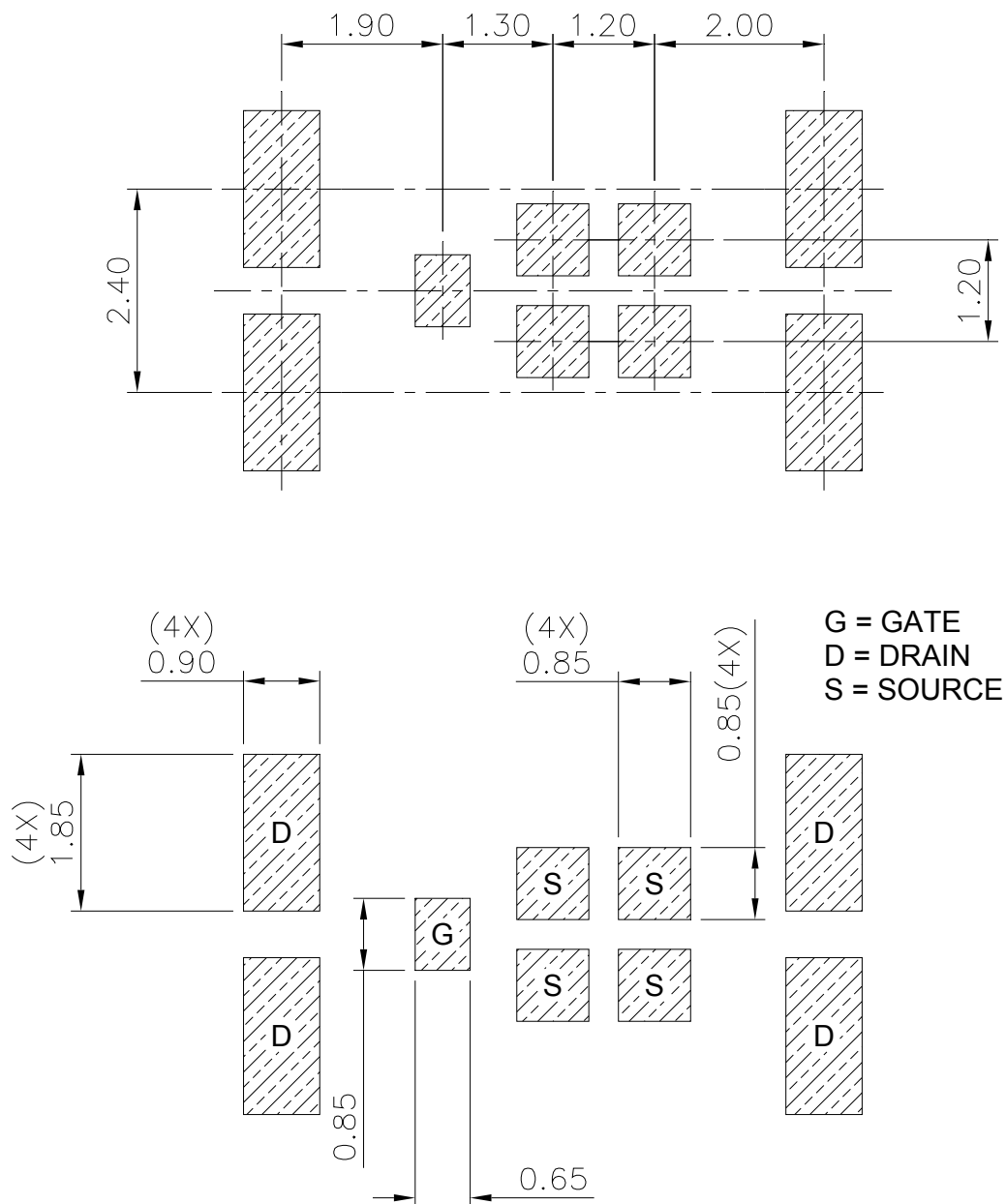
$$I_{av} = 2\Delta T / [1.3 \cdot BV \cdot Z_{th}]$$

$$E_{AS(AR)} = P_{D(ave)} \cdot t_{av}$$


**Fig 18a.** Unclamped Inductive Test Circuit

**Fig 18b.** Unclamped Inductive Waveforms

**Fig 19a.** Gate Charge Test Circuit

**Fig 19b.** Gate Charge Waveform

**Fig 20a.** Switching Time Test Circuit

**Fig 20b.** Switching Time Waveforms

**DirectFET® Board Footprint, M4 (Medium Size Can).**

Please see DirectFET® application note AN-1035 for all details regarding the assembly of DirectFET®. This includes all recommendations for stencil and substrate designs.

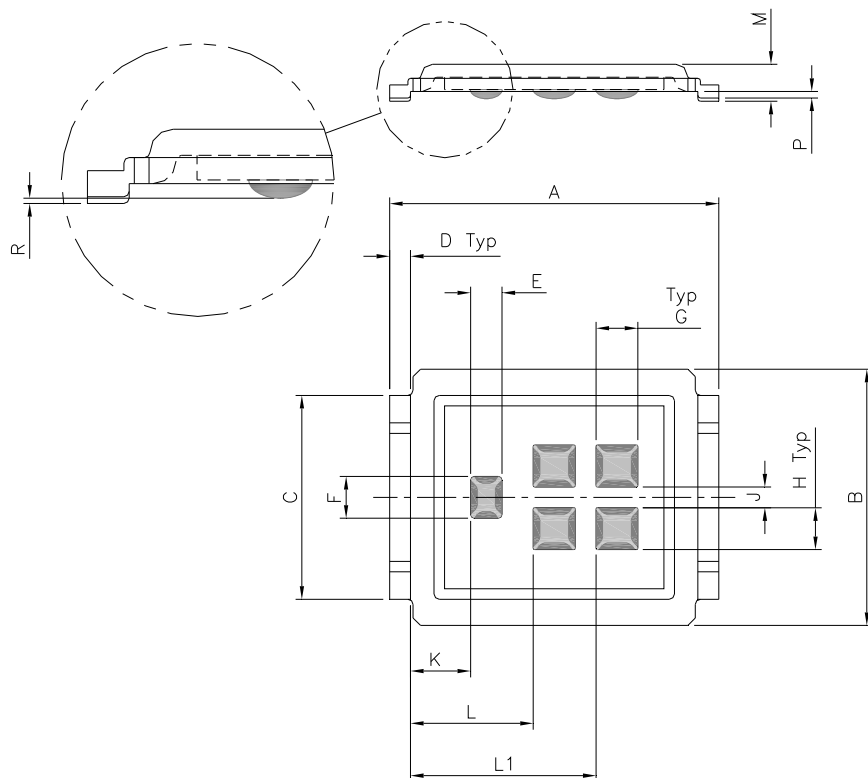


Note: For the most current drawing please refer to IR website at <http://www.irf.com/package/>

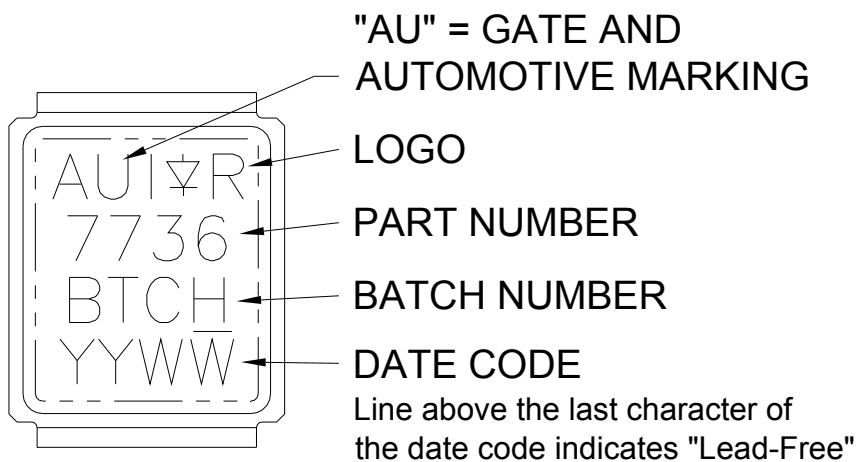


**DirectFET® Outline Dimension, M4 Outline (Medium Size Can).**

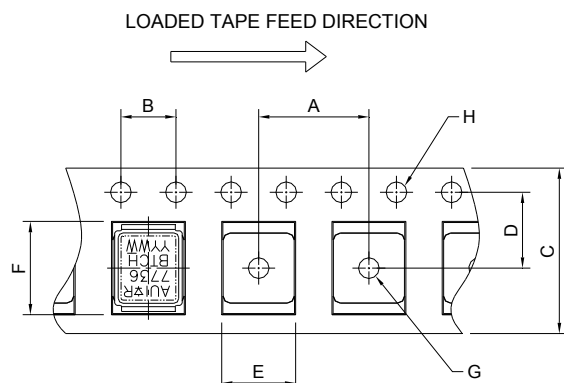
Please see DirectFET® application note AN-1035 for all details regarding the assembly of DirectFET®. This includes all recommendations for stencil and substrate designs.



| CODE | DIMENSIONS |      |          |       |
|------|------------|------|----------|-------|
|      | METRIC     |      | IMPERIAL |       |
| A    | 6.25       | 6.35 | 0.246    | 0.250 |
| B    | 4.80       | 5.05 | 0.189    | 0.199 |
| C    | 3.85       | 3.95 | 0.152    | 0.156 |
| D    | 0.35       | 0.45 | 0.014    | 0.018 |
| E    | 0.58       | 0.62 | 0.023    | 0.024 |
| F    | 0.78       | 0.82 | 0.031    | 0.032 |
| G    | 0.78       | 0.82 | 0.031    | 0.032 |
| H    | 0.78       | 0.82 | 0.031    | 0.032 |
| J    | 0.38       | 0.42 | 0.015    | 0.017 |
| K    | 1.10       | 1.20 | 0.043    | 0.047 |
| L    | 2.30       | 2.40 | 0.090    | 0.094 |
| L1   | 3.50       | 3.60 | 0.138    | 0.142 |
| M    | 0.68       | 0.74 | 0.027    | 0.029 |
| P    | 0.09       | 0.17 | 0.003    | 0.007 |
| R    | 0.02       | 0.08 | 0.001    | 0.003 |

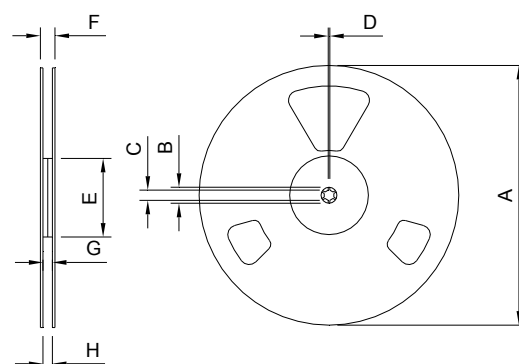
**DirectFET® Part Marking**


Note: For the most current drawing please refer to IR website at <http://www.irf.com/package/>

**DirectFET® Tape & Reel Dimension (Showing component orientation)**


NOTE: CONTROLLING  
DIMENSIONS IN MM

| CODE | METRIC |       | IMPERIAL |       |
|------|--------|-------|----------|-------|
|      | MIN    | MAX   | MIN      | MAX   |
| A    | 7.90   | 8.10  | 0.311    | 0.319 |
| B    | 3.90   | 4.10  | 0.154    | 0.161 |
| C    | 11.90  | 12.30 | 0.469    | 0.484 |
| D    | 5.45   | 5.55  | 0.215    | 0.219 |
| E    | 5.10   | 5.30  | 0.201    | 0.209 |
| F    | 6.50   | 6.70  | 0.256    | 0.264 |
| G    | 1.50   | N.C   | 0.059    | N.C   |
| H    | 1.50   | 1.60  | 0.059    | 0.063 |



NOTE: Controlling dimensions in mm  
Std reel quantity is 4800 parts, ordered as AUIRF7736M2TR.

| REEL DIMENSIONS            |        |      |          |       |
|----------------------------|--------|------|----------|-------|
| STANDARD OPTION (QTY 4800) |        |      |          |       |
| CODE                       | METRIC |      | IMPERIAL |       |
|                            | MIN    | MAX  | MIN      | MAX   |
| A                          | 330.0  | N.C  | 12.992   | N.C   |
| B                          | 20.2   | N.C  | 0.795    | N.C   |
| C                          | 12.8   | 13.2 | 0.504    | 0.520 |
| D                          | 1.5    | N.C  | 0.059    | N.C   |
| E                          | 100.0  | N.C  | 3.937    | N.C   |
| F                          | N.C    | 18.4 | N.C      | 0.724 |
| G                          | 12.4   | 14.4 | 0.488    | 0.567 |
| H                          | 11.9   | 15.4 | 0.469    | 0.606 |

Note: For the most current drawing please refer to IR website at <http://www.irf.com/package/>

**Qualification Information**

|                                   |                      |   |             |
|-----------------------------------|----------------------|---|-------------|
| <b>Qualification Level</b>        |                      | Automotive<br>(per AEC-Q101)  |             |
|                                   |                      | Comments: This part number(s) passed Automotive qualification. Infineon's Industrial and Consumer qualification level is granted by extension of the higher Automotive level. |             |
| <b>Moisture Sensitivity Level</b> |                      | DFET2 Medium Can  | MSL1, 260°C |
| <b>ESD</b>                        | Machine Model        | Class M4 (+/- 400V) <sup>†</sup><br>AEC-Q101-002  |             |
|                                   | Human Body Model     | Class H3B (+/- 8000V) <sup>†</sup><br>AEC-Q101-001  |             |
|                                   | Charged Device Model | N/A<br>AEC-Q101-005   |             |
| <b>RoHS Compliant</b>             |                      | Yes   |             |

† Highest passing voltage.

**Revision History**

| Date      | Comments  |
|-----------|---|
| 10/5/2015 | <ul style="list-style-type: none"> <li>Updated datasheet with corporate template</li> <li>Corrected ordering table on page 1.</li> <li>Updated Tape and Reel option on page 10</li> </ul> |

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