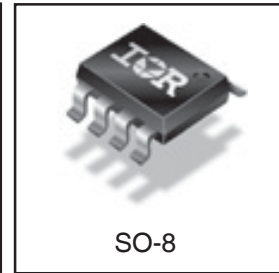
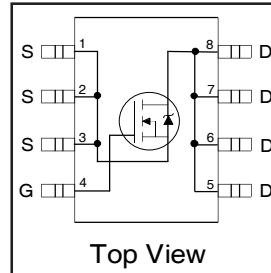


|                                                  |     |           |
|--------------------------------------------------|-----|-----------|
| $V_{DS}$                                         | 60  | V         |
| $R_{DS(on) \text{ max}}$<br>(@ $V_{GS} = 10V$ )  | 26  | $m\Omega$ |
| $R_{DS(on) \text{ max}}$<br>(@ $V_{GS} = 4.5V$ ) | 30  |           |
| $Q_g$ (typical)                                  | 21  | nC        |
| $I_D$<br>(@ $T_A = 25^\circ C$ )                 | 7.0 | A         |

### HEXFET® Power MOSFET



### Applications

- High frequency DC-DC converters

#### Features

|                                                   |
|---------------------------------------------------|
| Industry-standard pinout SO-8 Package             |
| Compatible with Existing Surface Mount Techniques |
| RoHS Compliant, Halogen-Free                      |
| MSL1, Industrial qualification                    |



#### Benefits

|                            |
|----------------------------|
| Multi-Vendor Compatibility |
| Easier Manufacturing       |
| Environmentally Friendlier |
| Increased Reliability      |

| Base Part Number | Package Type | Standard Pack |          | Orderable Part Number |
|------------------|--------------|---------------|----------|-----------------------|
|                  |              | Form          | Quantity |                       |
| IRF7478PbF-1     | SO-8         | Tube/Bulk     | 95       | IRF7478PbF-1          |
|                  |              | Tape and Reel | 4000     | IRF7478TRPbF-1        |

### Absolute Maximum Ratings

|                            | Parameter                                | Max.                   | Units |
|----------------------------|------------------------------------------|------------------------|-------|
| $I_D$ @ $T_A = 25^\circ C$ | Continuous Drain Current, $V_{GS}$ @ 10V | 7.0                    | A     |
| $I_D$ @ $T_A = 70^\circ C$ | Continuous Drain Current, $V_{GS}$ @ 10V | 5.6                    |       |
| $I_{DM}$                   | Pulsed Drain Current ①                   | 56                     |       |
| $P_D$ @ $T_A = 25^\circ C$ | Power Dissipation④                       | 2.5                    | W     |
|                            | Linear Derating Factor                   | 0.02                   | W/°C  |
| $V_{GS}$                   | Gate-to-Source Voltage                   | ± 20                   | V     |
| dv/dt                      | Peak Diode Recovery dv/dt ⑥              | 3.7                    | V/ns  |
| $T_J$                      | Operating Junction and                   | -55 to + 150           | °C    |
| $T_{STG}$                  | Storage Temperature Range                |                        |       |
|                            | Soldering Temperature, for 10 seconds    | 300 (1.6mm from case ) |       |

### Thermal Resistance

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

Notes ① through ⑥ are on page 8

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

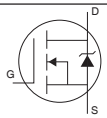
|                                 | Parameter                            | Min. | Typ.  | Max. | Units               | Conditions                                           |
|---------------------------------|--------------------------------------|------|-------|------|---------------------|------------------------------------------------------|
| $V_{(BR)DSS}$                   | Drain-to-Source Breakdown Voltage    | 60   | —     | —    | V                   | $V_{GS} = 0V, I_D = 250\mu A$                        |
| $\Delta V_{(BR)DSS}/\Delta T_J$ | Breakdown Voltage Temp. Coefficient  | —    | 0.065 | —    | V/ $^\circ\text{C}$ | Reference to $25^\circ\text{C}, I_D = 1\text{mA}$    |
| $R_{DS(on)}$                    | Static Drain-to-Source On-Resistance | —    | 20    | 26   | $\text{m}\Omega$    | $V_{GS} = 10V, I_D = 4.2A$ ③                         |
|                                 |                                      | —    | 23    | 30   |                     | $V_{GS} = 4.5V, I_D = 3.5A$ ③                        |
| $V_{GS(th)}$                    | Gate Threshold Voltage               | 1.0  | —     | 3.0  | V                   | $V_{DS} = V_{GS}, I_D = 250\mu A$                    |
| $I_{DSS}$                       | Drain-to-Source Leakage Current      | —    | —     | 20   | $\mu A$             | $V_{DS} = 48V, V_{GS} = 0V$                          |
|                                 |                                      | —    | —     | 100  |                     | $V_{DS} = 48V, V_{GS} = 0V, T_J = 125^\circ\text{C}$ |
| $I_{GSS}$                       | Gate-to-Source Forward Leakage       | —    | —     | 100  | nA                  | $V_{GS} = 20V$                                       |
|                                 | Gate-to-Source Reverse Leakage       | —    | —     | -100 |                     | $V_{GS} = -20V$                                      |

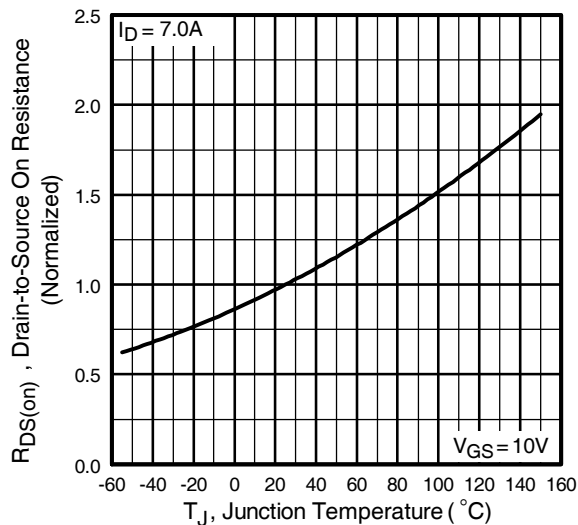
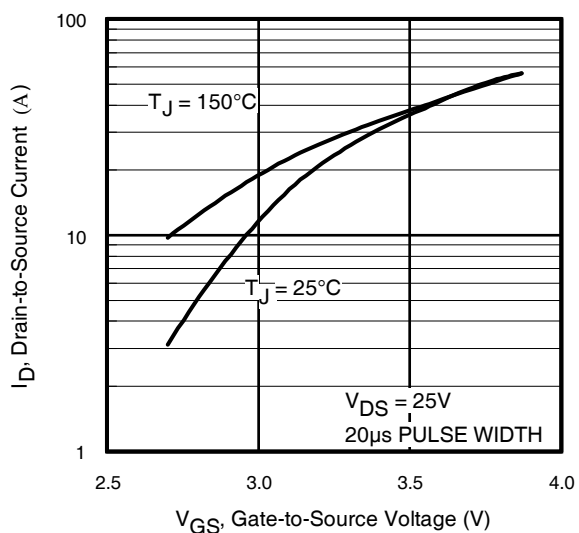
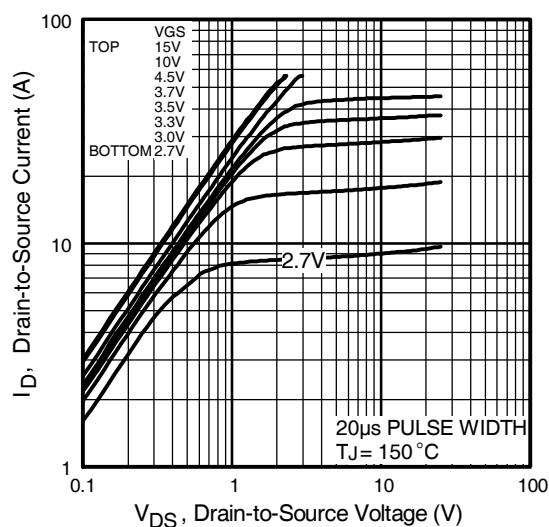
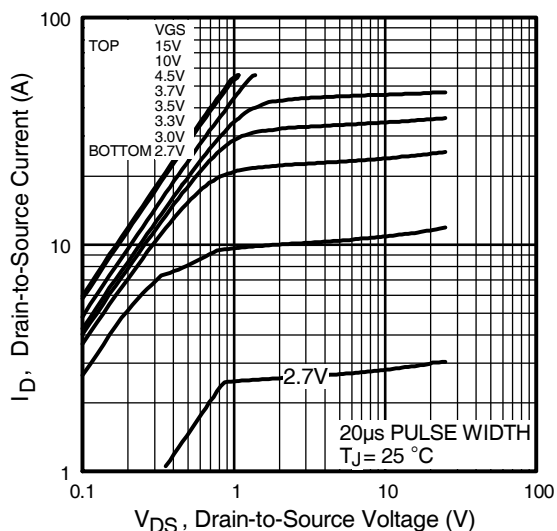
**Dynamic @  $T_J = 25^\circ\text{C}$  (unless otherwise specified)**

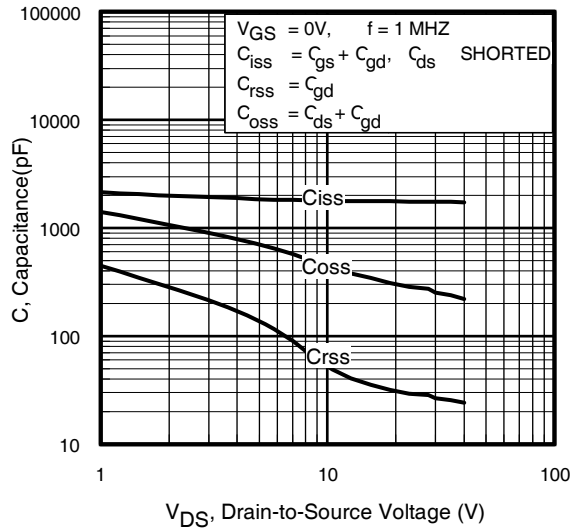
|                        | Parameter                       | Min. | Typ. | Max. | Units | Conditions                                      |
|------------------------|---------------------------------|------|------|------|-------|-------------------------------------------------|
| $g_{fs}$               | Forward Transconductance        | 17   | —    | —    | S     | $V_{DS} = 50V, I_D = 4.2A$                      |
| $Q_g$                  | Total Gate Charge               | —    | 21   | 31   | nC    | $I_D = 4.2A$                                    |
| $Q_{gs}$               | Gate-to-Source Charge           | —    | 4.3  | —    |       | $V_{DS} = 48V$                                  |
| $Q_{gd}$               | Gate-to-Drain ("Miller") Charge | —    | 9.6  | —    |       | $V_{GS} = 4.5V$                                 |
| $t_{d(on)}$            | Turn-On Delay Time              | —    | 7.7  | —    | ns    | $V_{DD} = 30V$                                  |
| $t_r$                  | Rise Time                       | —    | 2.6  | —    |       | $I_D = 4.2A$                                    |
| $t_{d(off)}$           | Turn-Off Delay Time             | —    | 44   | —    |       | $R_G = 6.2\Omega$                               |
| $t_f$                  | Fall Time                       | —    | 13   | —    |       | $V_{GS} = 10V$ ③                                |
| $C_{iss}$              | Input Capacitance               | —    | 1740 | —    | pF    | $V_{GS} = 0V$                                   |
| $C_{oss}$              | Output Capacitance              | —    | 300  | —    |       | $V_{DS} = 25V$                                  |
| $C_{rss}$              | Reverse Transfer Capacitance    | —    | 37   | —    |       | $f = 1.0\text{MHz}$                             |
| $C_{oss}$              | Output Capacitance              | —    | 1590 | —    |       | $V_{GS} = 0V, V_{DS} = 1.0V, f = 1.0\text{MHz}$ |
| $C_{oss}$              | Output Capacitance              | —    | 220  | —    |       | $V_{GS} = 0V, V_{DS} = 48V, f = 1.0\text{MHz}$  |
| $C_{oss \text{ eff.}}$ | Effective Output Capacitance    | —    | 410  | —    |       | $V_{GS} = 0V, V_{DS} = 0V \text{ to } 48V$ ⑤    |

| Symbol   | Parameter                      | Typ. | Max. | Units |
|----------|--------------------------------|------|------|-------|
| $E_{AS}$ | Single Pulse Avalanche Energy② | —    | 140  | mJ    |
| $I_{AR}$ | Avalanche Current①             | —    | 4.2  | A     |

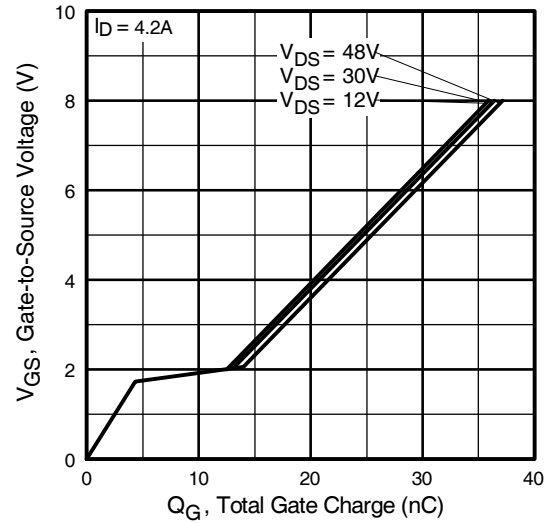
**Diode Characteristics**

|          | Parameter                              | Min. | Typ. | Max. | Units | Conditions                                                                                                                                           |
|----------|----------------------------------------|------|------|------|-------|------------------------------------------------------------------------------------------------------------------------------------------------------|
| $I_S$    | Continuous Source Current (Body Diode) | —    | —    | 2.3  | A     | MOSFET symbol showing the integral reverse p-n junction diode.  |
| $I_{SM}$ | Pulsed Source Current (Body Diode) ①   | —    | —    | 56   |       |                                                                                                                                                      |
| $V_{SD}$ | Diode Forward Voltage                  | —    | —    | 1.3  | V     | $T_J = 25^\circ\text{C}, I_S = 4.2A, V_{GS} = 0V$ ③                                                                                                  |
| $t_{rr}$ | Reverse Recovery Time                  | —    | 52   | 78   | ns    | $T_J = 25^\circ\text{C}, I_F = 4.2A$                                                                                                                 |
| $Q_{rr}$ | Reverse Recovery Charge                | —    | 100  | 150  | nC    | $di/dt = 100A/\mu s$ ③                                                                                                                               |

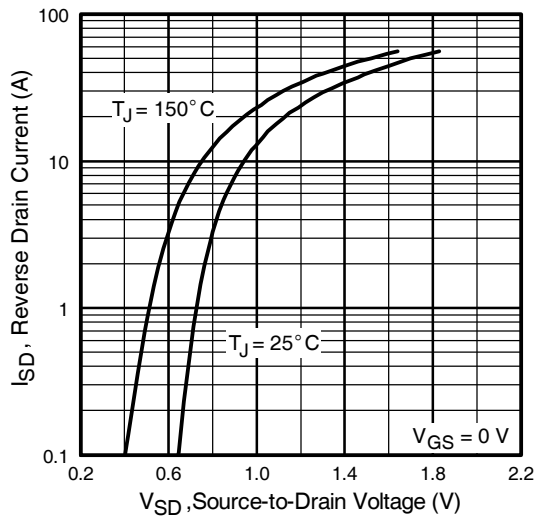




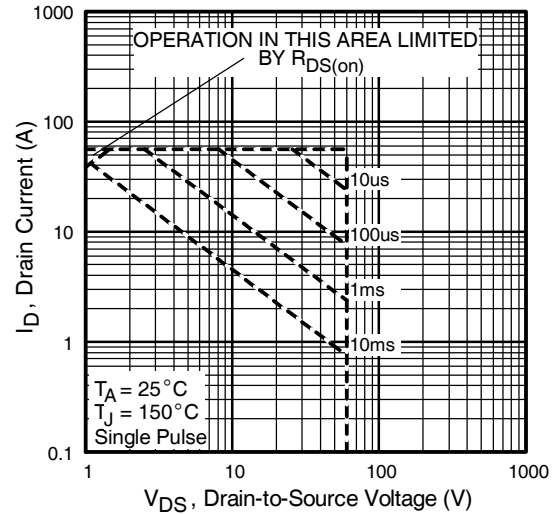
**Fig 5.** Typical Capacitance Vs. Drain-to-Source Voltage



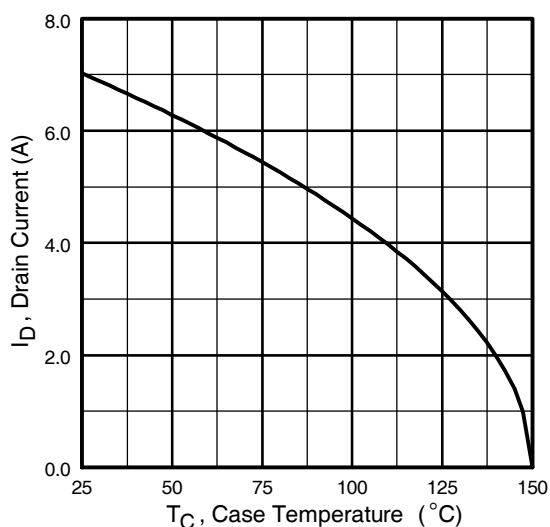
**Fig 6.** Typical Gate Charge Vs. Gate-to-Source Voltage



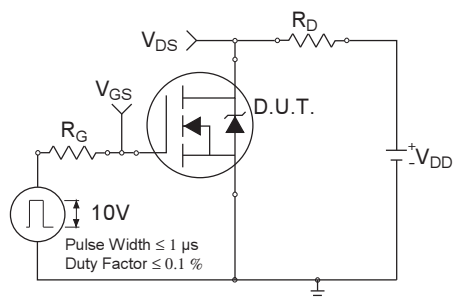
**Fig 7.** Typical Source-Drain Diode Forward Voltage



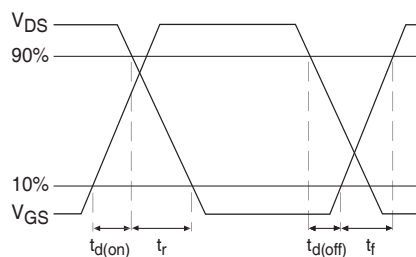
**Fig 8.** Maximum Safe Operating Area



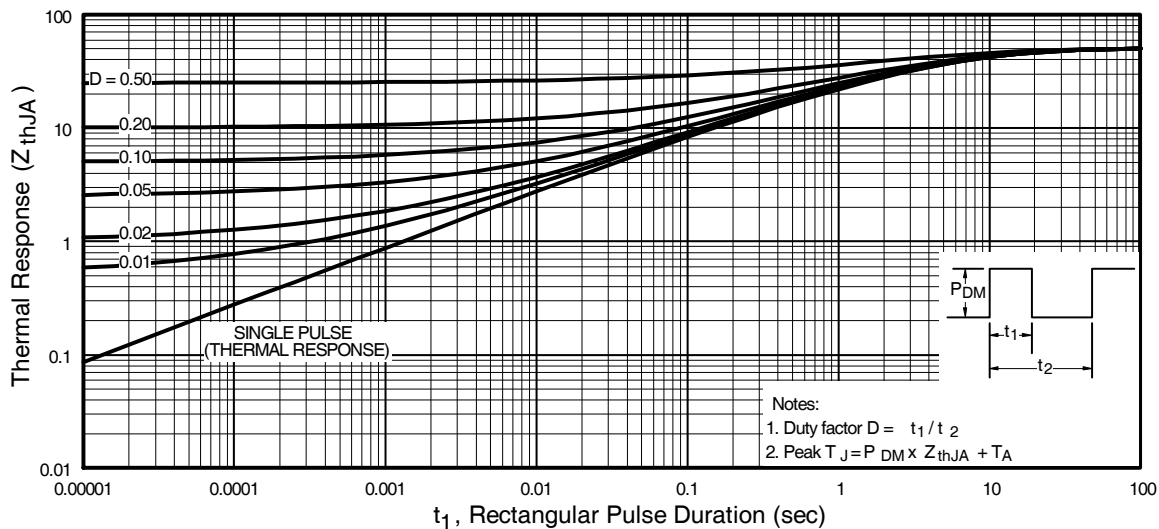
**Fig 9.** Maximum Drain Current Vs. Ambient Temperature



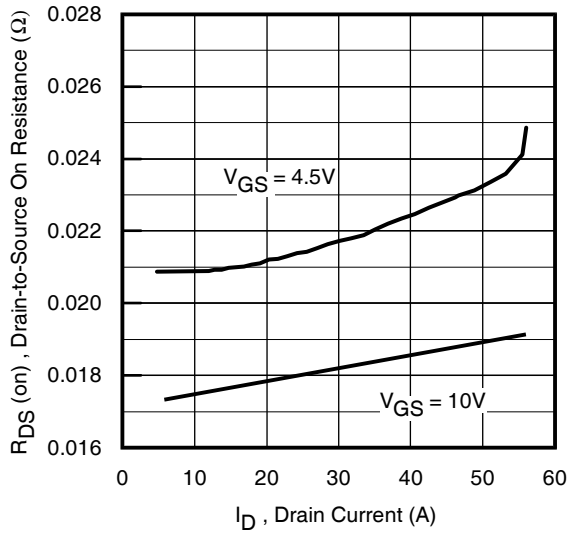
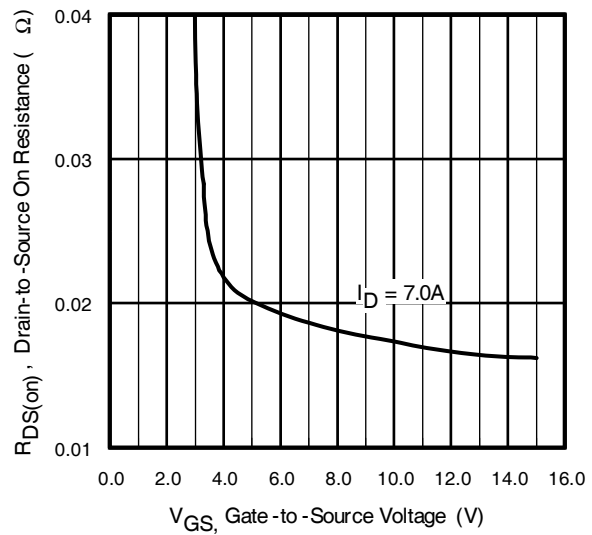
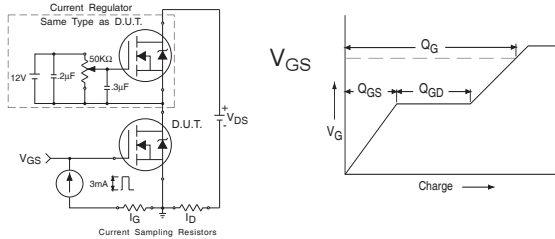
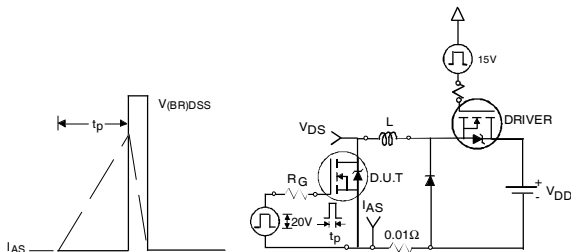
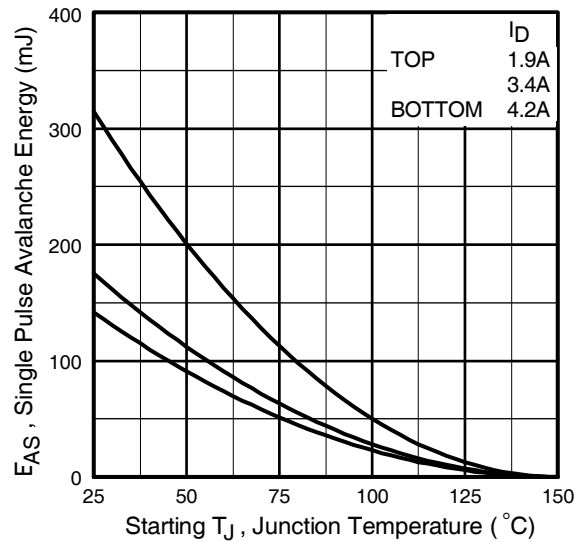
**Fig 10a.** Switching Time Test Circuit



**Fig 10b.** Switching Time Waveforms

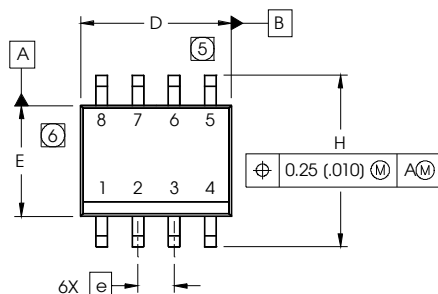


**Fig 11.** Maximum Effective Transient Thermal Impedance, Junction-to-Ambient

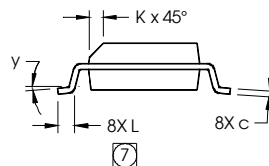
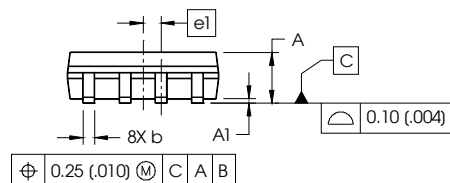

**Fig 12. On-Resistance Vs. Drain Current**

**Fig 13. On-Resistance Vs. Gate Voltage**

**Fig 14a&b. Basic Gate Charge Test Circuit and Waveform**

**Fig 15a&b. Unclamped Inductive Test circuit and Waveforms**

**Fig 15c. Maximum Avalanche Energy Vs. Drain Current**

## SO-8 Package Outline

Dimensions are shown in millimeters (inches)

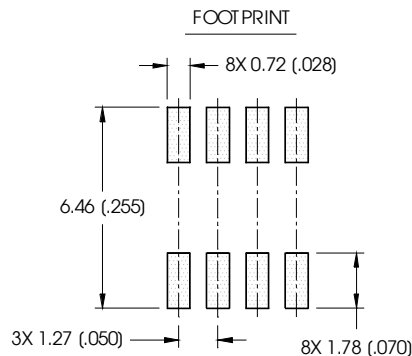


| DIM | INCHES     |       | MILLIMETERS |      |
|-----|------------|-------|-------------|------|
|     | MIN        | MAX   | MIN         | MAX  |
| A   | .0532      | .0688 | 1.35        | 1.75 |
| A1  | .0040      | .0098 | 0.10        | 0.25 |
| b   | .013       | .020  | 0.33        | 0.51 |
| c   | .0075      | .0098 | 0.19        | 0.25 |
| D   | .189       | .1968 | 4.80        | 5.00 |
| E   | .1497      | .1574 | 3.80        | 4.00 |
| e   | .050 BASIC |       | 1.27 BASIC  |      |
| e1  | .025 BASIC |       | 0.635 BASIC |      |
| H   | .2284      | .2440 | 5.80        | 6.20 |
| K   | .0099      | .0196 | 0.25        | 0.50 |
| L   | .016       | .050  | 0.40        | 1.27 |
| y   | 0°         | 8°    | 0°          | 8°   |



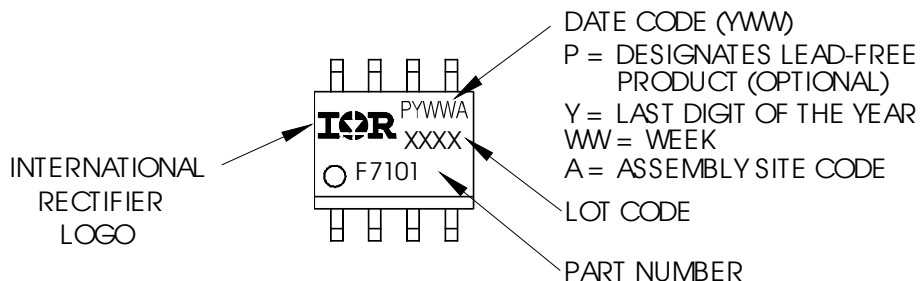
### NOTES:

1. DIMENSIONING & TOLERANCING PER ASME Y14.5M-1994.
2. CONTROLLING DIMENSION: MILLIMETER
3. DIMENSIONS ARE SHOWN IN MILLIMETERS (INCHES).
4. OUTLINE CONFORMS TO JEDEC OUTLINE MS-012AA.
- ⑤ DIMENSION DOES NOT INCLUDE MOLD PROTRUSIONS. MOLD PROTRUSIONS NOT TO EXCEED 0.15 (.006).
- ⑥ DIMENSION DOES NOT INCLUDE MOLD PROTRUSIONS. MOLD PROTRUSIONS NOT TO EXCEED 0.25 (.010).
- ⑦ DIMENSION IS THE LENGTH OF LEAD FOR SOLDERING TO A SUBSTRATE.

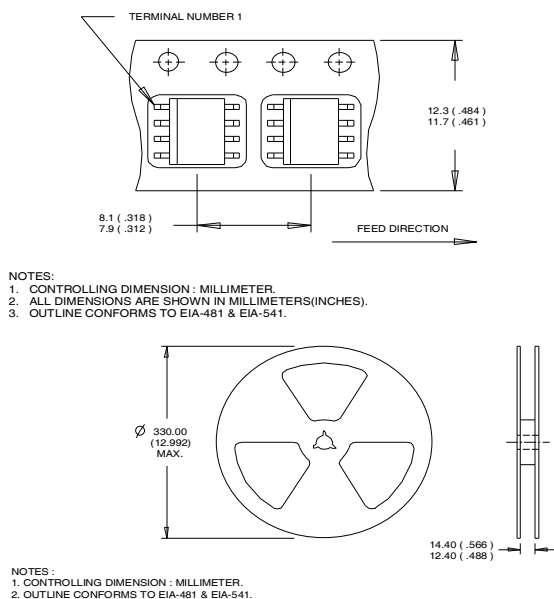


## SO-8 Part Marking

EXAMPLE: THIS IS AN IRF7101 (MOSFET)



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

**SO-8 Tape and Reel** (Dimensions are shown in millimeters (inches))


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

**Qualification information<sup>†</sup>**

|                            |                                                            |                                               |
|----------------------------|------------------------------------------------------------|-----------------------------------------------|
| Qualification level        | Industrial<br>(per JEDEC JESD47F <sup>††</sup> guidelines) |                                               |
| Moisture Sensitivity Level | SO-8                                                       | MSL1<br>(per JEDEC J-STD-020D <sup>††</sup> ) |
| RoHS compliant             | Yes                                                        |                                               |

<sup>†</sup> Qualification standards can be found at International Rectifier's web site: <http://www.irf.com/product-info/reliability>

<sup>††</sup> Applicable version of JEDEC standard at the time of product release

**Notes:**

- ① Repetitive rating; pulse width limited by max. junction temperature.
- ② Starting  $T_J = 25^\circ\text{C}$ ,  $L = 16\text{mH}$ ,  $R_G = 25\Omega$ ,  $I_{AS} = 4.2\text{A}$ .
- ③ Pulse width  $\leq 400\mu\text{s}$ ; duty cycle  $\leq 2\%$ .
- ④ When mounted on 1 inch square copper board
- ⑤  $C_{OSS\text{ eff.}}$  is a fixed capacitance that gives the same charging time as  $C_{OSS}$  while  $V_{DS}$  is rising from 0 to 80%  $V_{DSS}$
- ⑥  $I_{SD} \leq 4.2\text{A}$ ,  $di/dt \leq 160\text{A}/\mu\text{s}$ ,  $V_{DD} \leq V_{(BR)DSS}$ ,  $T_J \leq 150^\circ\text{C}$

International  
 Rectifier

**IR WORLD HEADQUARTERS:** 101 N. Sepulveda Blvd., El Segundo, California 90245, USA

To contact International Rectifier, please visit <http://www.irf.com/whoto-call/>