

International  
**IR** Rectifier

**SMPS MOSFET**

PD- 93774A  
IRF820AS  
IRF820AL  
HEXFET® Power MOSFET

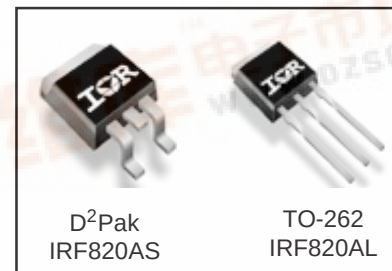
#### Applications

- Switch Mode Power Supply (SMPS)
- Uninterruptable Power Supply
- High speed power switching

| $V_{DSS}$ | $R_{DS(on)}$ max | $I_D$ |
|-----------|------------------|-------|
| 500V      | 3.0 $\Omega$     | 2.5A  |

#### Benefits

- Low Gate Charge  $Q_g$  Results in Simple Drive Requirement
- Improved Gate, Avalanche and Dynamic  $dv/dt$  Ruggedness
- Fully Characterized Capacitance and Avalanche Voltage and Current
- Effective  $C_{OSS}$  specified (See AN 1001)



#### Absolute Maximum Ratings

|                                   | Parameter                                 | Max.                   | Units               |
|-----------------------------------|-------------------------------------------|------------------------|---------------------|
| $I_D$ @ $T_C = 25^\circ\text{C}$  | Continuous Drain Current, $V_{GS}$ @ 10V⑥ | 2.5                    | A                   |
| $I_D$ @ $T_C = 100^\circ\text{C}$ | Continuous Drain Current, $V_{GS}$ @ 10V⑥ | 1.6                    |                     |
| $I_{DM}$                          | Pulsed Drain Current ①⑥                   | 10                     |                     |
| $P_D$ @ $T_C = 25^\circ\text{C}$  | Power Dissipation                         | 50                     | W                   |
|                                   | Linear Derating Factor                    | 0.4                    | W/ $^\circ\text{C}$ |
| $V_{GS}$                          | Gate-to-Source Voltage                    | $\pm 30$               | V                   |
| $dv/dt$                           | Peak Diode Recovery $dv/dt$ ③⑥            | 3.4                    | V/ns                |
| $T_J$                             | Operating Junction and                    | -55 to + 150           | $^\circ\text{C}$    |
| $T_{STG}$                         | Storage Temperature Range                 |                        |                     |
|                                   | Soldering Temperature, for 10 seconds     | 300 (1.6mm from case ) |                     |
|                                   | Mounting torque, 6-32 or M3 screw         | 10 lbf•in (1.1N•m)     |                     |

#### Typical SMPS Topologies:

- Two Transistor Forward
- Half Bridge and Full Bridge

Notes ① through ⑤ are on page 8  
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# IRF820AS/L

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

|                                 | Parameter                            | Min. | Typ. | Max. | Units               | Conditions                                            |
|---------------------------------|--------------------------------------|------|------|------|---------------------|-------------------------------------------------------|
| $V_{(BR)DSS}$                   | Drain-to-Source Breakdown Voltage    | 500  | —    | —    | V                   | $V_{GS} = 0V, I_D = 250\mu A$                         |
| $\Delta V_{(BR)DSS}/\Delta T_J$ | Breakdown Voltage Temp. Coefficient  | —    | 0.60 | —    | V/ $^\circ\text{C}$ | Reference to $25^\circ\text{C}$ , $I_D = 1mA$ ⑥       |
| $R_{DS(on)}$                    | Static Drain-to-Source On-Resistance | —    | —    | 3.0  | $\Omega$            | $V_{GS} = 10V, I_D = 1.5A$ ④                          |
| $V_{GS(th)}$                    | Gate Threshold Voltage               | 2.0  | —    | 4.5  | V                   | $V_{DS} = V_{GS}, I_D = 250\mu A$                     |
| $I_{DSS}$                       | Drain-to-Source Leakage Current      | —    | —    | 25   | $\mu A$             | $V_{DS} = 500V, V_{GS} = 0V$                          |
|                                 |                                      | —    | —    | 250  |                     | $V_{DS} = 400V, V_{GS} = 0V, T_J = 125^\circ\text{C}$ |
| $I_{GSS}$                       | Gate-to-Source Forward Leakage       | —    | —    | 100  | nA                  | $V_{GS} = 30V$                                        |
|                                 | Gate-to-Source Reverse Leakage       | —    | —    | -100 |                     | $V_{GS} = -30V$                                       |

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

|                        | Parameter                       | Min. | Typ. | Max. | Units | Conditions                                      |
|------------------------|---------------------------------|------|------|------|-------|-------------------------------------------------|
| $g_{fs}$               | Forward Transconductance        | 1.4  | —    | —    | S     | $V_{DS} = 50V, I_D = 1.5A$ ⑥                    |
| $Q_g$                  | Total Gate Charge               | —    | —    | 17   | nC    | $I_D = 2.5A$                                    |
| $Q_{gs}$               | Gate-to-Source Charge           | —    | —    | 4.3  |       | $V_{DS} = 400V$                                 |
| $Q_{gd}$               | Gate-to-Drain ("Miller") Charge | —    | —    | 8.5  |       | $V_{GS} = 10V$ , See Fig. 6 and 13 ④ ⑥          |
| $t_{d(on)}$            | Turn-On Delay Time              | —    | 8.1  | —    | ns    | $V_{DD} = 250V$                                 |
| $t_r$                  | Rise Time                       | —    | 12   | —    |       | $I_D = 2.5A$                                    |
| $t_{d(off)}$           | Turn-Off Delay Time             | —    | 16   | —    |       | $R_G = 21\Omega$                                |
| $t_f$                  | Fall Time                       | —    | 13   | —    |       | $R_D = 97\Omega$ , See Fig. 10 ④ ⑥              |
| $C_{iss}$              | Input Capacitance               | —    | 340  | —    | pF    | $V_{GS} = 0V$                                   |
| $C_{oss}$              | Output Capacitance              | —    | 53   | —    |       | $V_{DS} = 25V$                                  |
| $C_{rss}$              | Reverse Transfer Capacitance    | —    | 2.7  | —    |       | $f = 1.0MHz$ , See Fig. 5 ⑥                     |
| $C_{oss}$              | Output Capacitance              | —    | 490  | —    |       | $V_{GS} = 0V, V_{DS} = 1.0V, f = 1.0MHz$        |
| $C_{oss}$              | Output Capacitance              | —    | 15   | —    |       | $V_{GS} = 0V, V_{DS} = 400V, f = 1.0MHz$        |
| $C_{oss \text{ eff.}}$ | Effective Output Capacitance    | —    | 28   | —    |       | $V_{GS} = 0V, V_{DS} = 0V \text{ to } 400V$ ⑤ ⑥ |

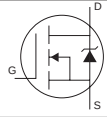
## Avalanche Characteristics

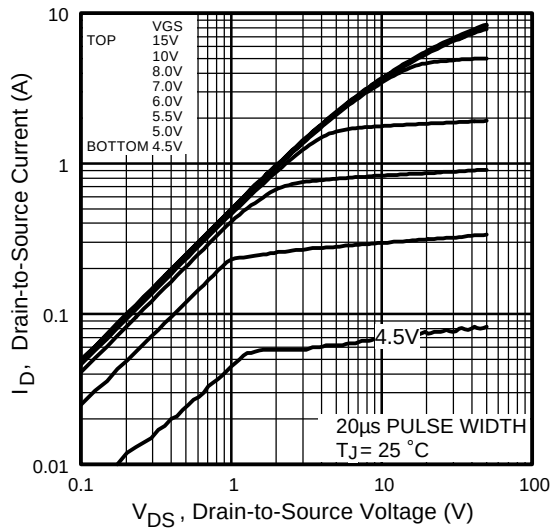
|          | Parameter                         | Typ. | Max. | Units |
|----------|-----------------------------------|------|------|-------|
| $E_{AS}$ | Single Pulse Avalanche Energy ② ⑥ | —    | 140  | mJ    |
| $I_{AR}$ | Avalanche Current ①               | —    | 2.5  | A     |
| $E_{AR}$ | Repetitive Avalanche Energy ①     | —    | 5.0  | mJ    |

## Thermal Resistance

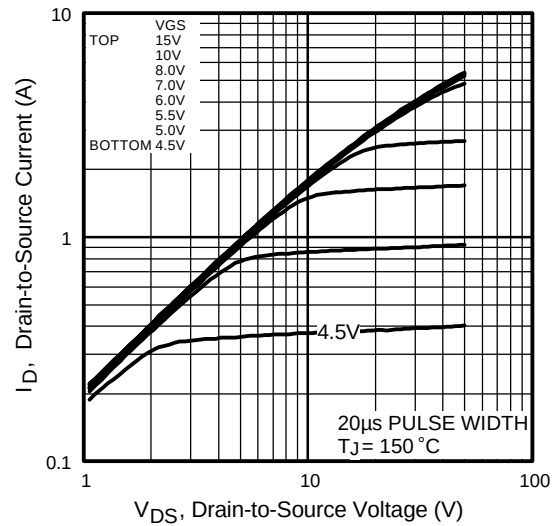
|                 | Parameter                                        | Typ. | Max. | Units              |
|-----------------|--------------------------------------------------|------|------|--------------------|
| $R_{\theta JC}$ | Junction-to-Case                                 | —    | 2.5  | $^\circ\text{C/W}$ |
| $R_{\theta JA}$ | Junction-to-Ambient (PCB Mounted, steady-state)* | —    | 62   |                    |

## Diode Characteristics

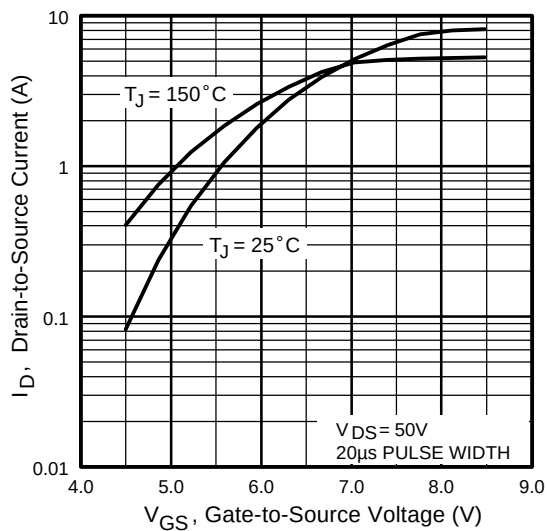
|          | Parameter                              | Min.                                                                        | Typ. | Max. | Units | Conditions                                                                                                                                           |
|----------|----------------------------------------|-----------------------------------------------------------------------------|------|------|-------|------------------------------------------------------------------------------------------------------------------------------------------------------|
| $I_S$    | Continuous Source Current (Body Diode) | —                                                                           | —    | 2.5  | A     | MOSFET symbol showing the integral reverse p-n junction diode.  |
| $I_{SM}$ | Pulsed Source Current (Body Diode) ① ⑥ | —                                                                           | —    | 10   |       |                                                                                                                                                      |
| $V_{SD}$ | Diode Forward Voltage                  | —                                                                           | —    | 1.6  | V     | $T_J = 25^\circ\text{C}, I_S = 2.5A, V_{GS} = 0V$ ④                                                                                                  |
| $t_{rr}$ | Reverse Recovery Time                  | —                                                                           | 330  | 500  | ns    | $T_J = 25^\circ\text{C}, I_F = 2.5A$                                                                                                                 |
| $Q_{rr}$ | Reverse Recovery Charge                | —                                                                           | 760  | 1140 | nC    | $di/dt = 100A/\mu s$ ④ ⑥                                                                                                                             |
| $t_{on}$ | Forward Turn-On Time                   | Intrinsic turn-on time is negligible (turn-on is dominated by $L_S + L_D$ ) |      |      |       |                                                                                                                                                      |



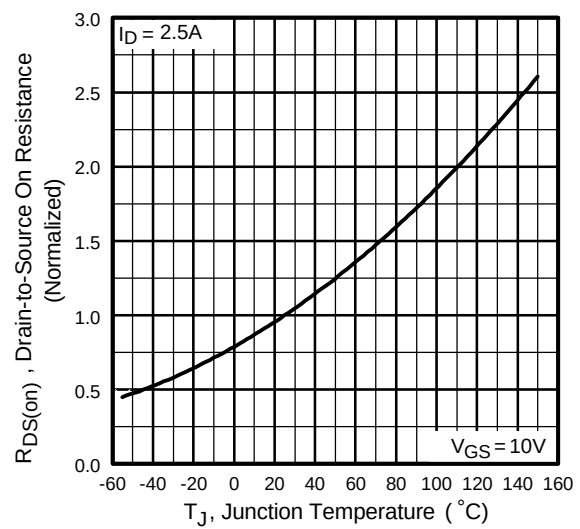
**Fig 1.** Typical Output Characteristics



**Fig 2.** Typical Output Characteristics



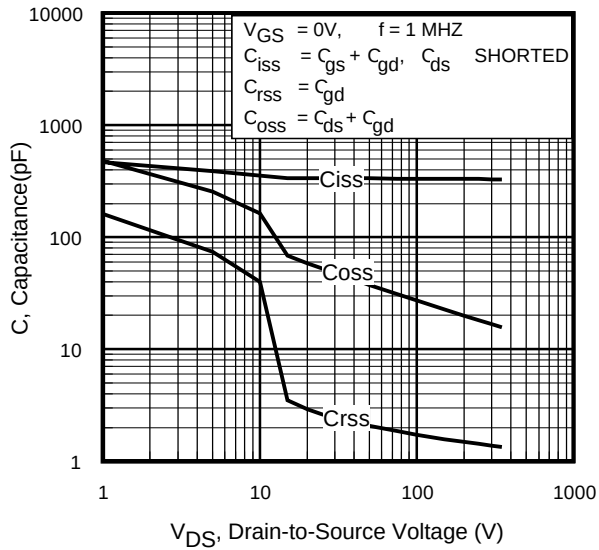
**Fig 3.** Typical Transfer Characteristics



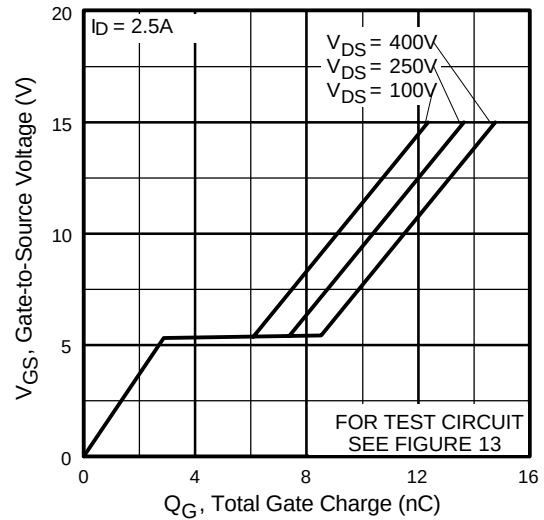
**Fig 4.** Normalized On-Resistance  
Vs. Temperature

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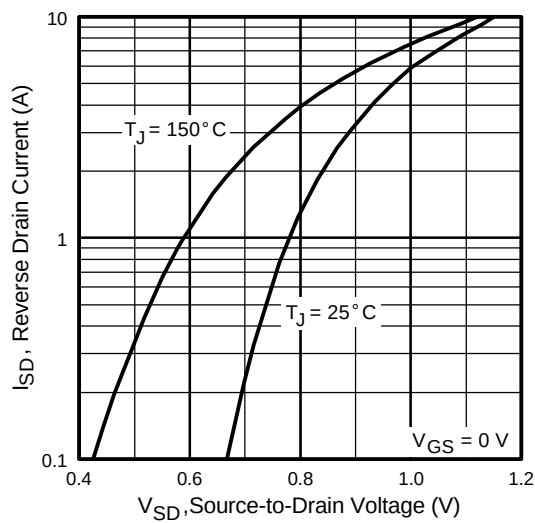
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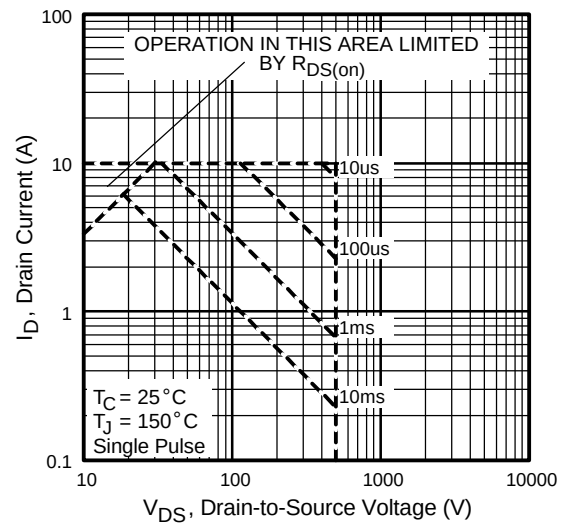
**Fig 5.** Typical Capacitance Vs. Drain-to-Source Voltage



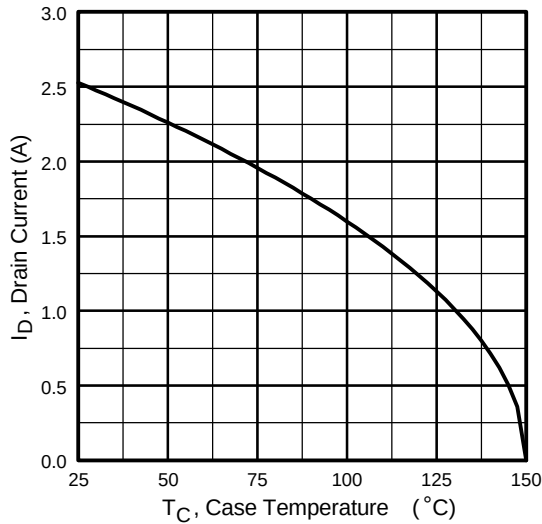
**Fig 6.** Typical Gate Charge Vs. Gate-to-Source Voltage



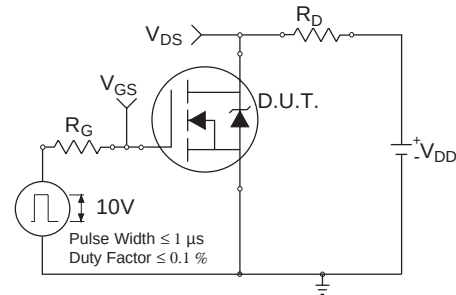
**Fig 7.** Typical Source-Drain Diode Forward Voltage



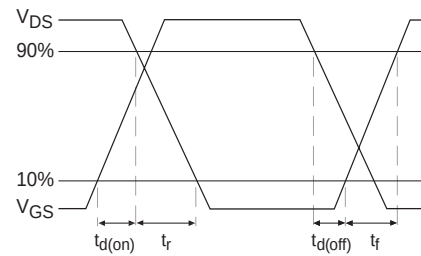
**Fig 8.** Maximum Safe Operating Area



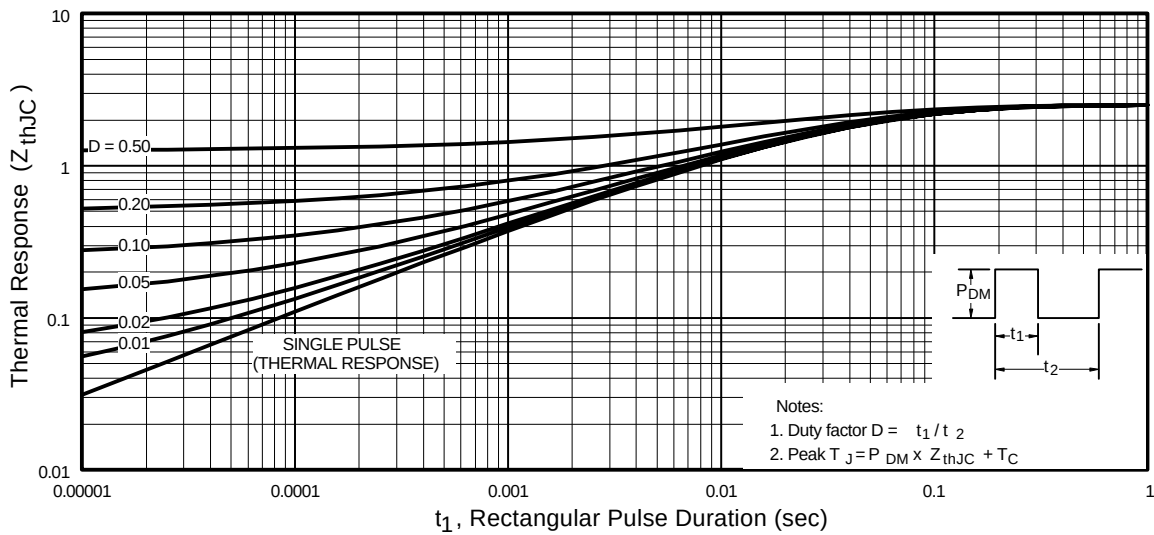
**Fig 9.** Maximum Drain Current Vs. Case Temperature



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



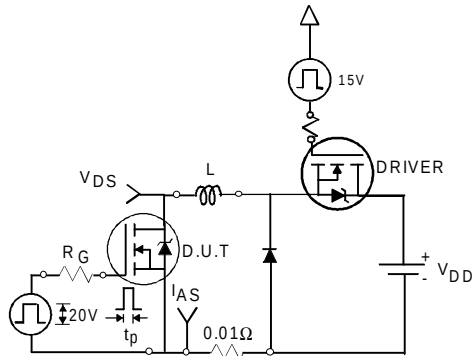
**Fig 10b.** Switching Time Waveforms



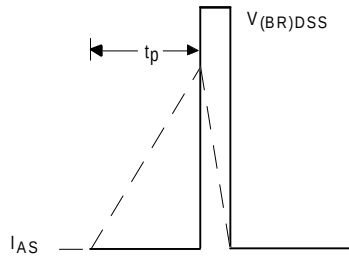
**Fig 11.** Maximum Effective Transient Thermal Impedance, Junction-to-Case

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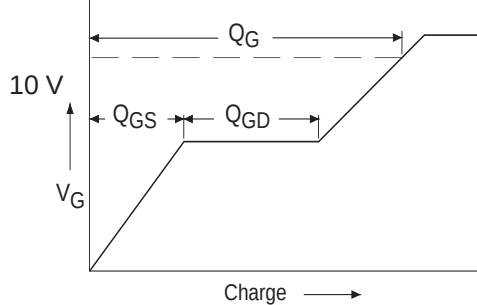
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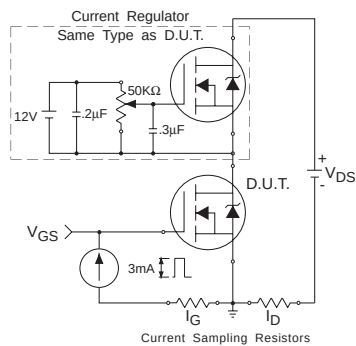
**Fig 12a.** Unclamped Inductive Test Circuit



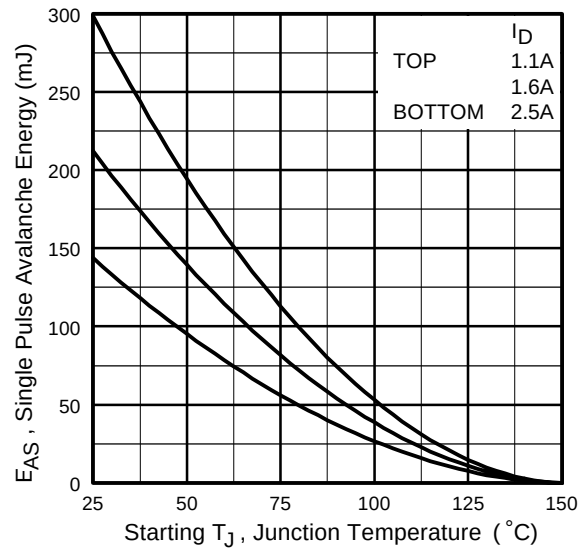
**Fig 12b.** Unclamped Inductive Waveforms



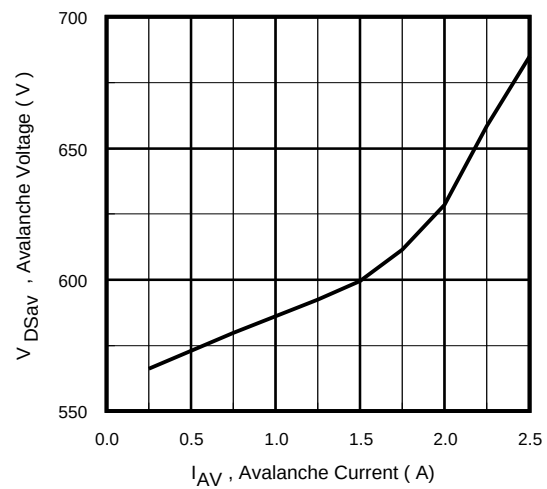
**Fig 13a.** Basic Gate Charge Test Circuit



**Fig 13b.** Gate Charge Test Circuit



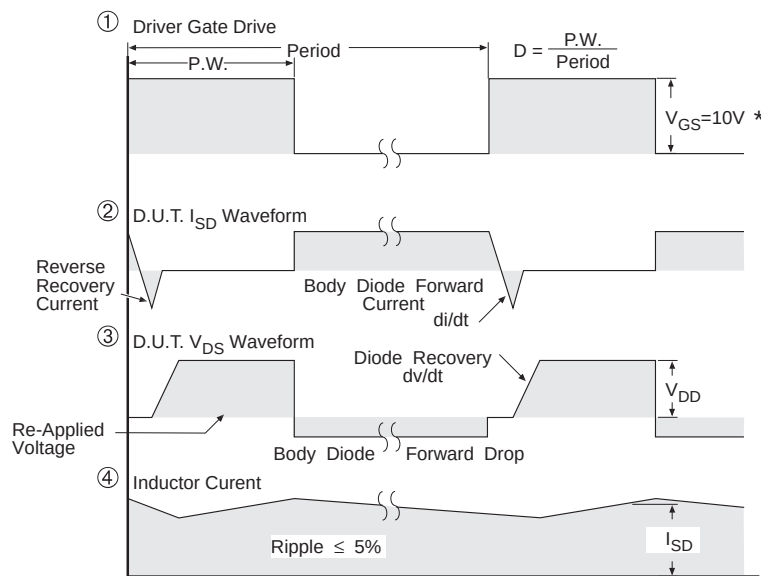
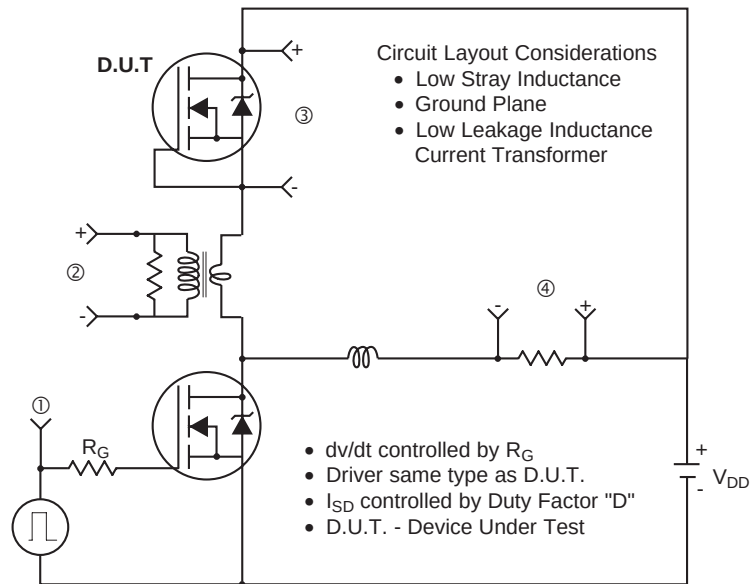
**Fig 12c.** Maximum Avalanche Energy Vs. Drain Current



**Fig 12d.** Typical Drain-to-Source Voltage Vs. Avalanche Current

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### Peak Diode Recovery dv/dt Test Circuit



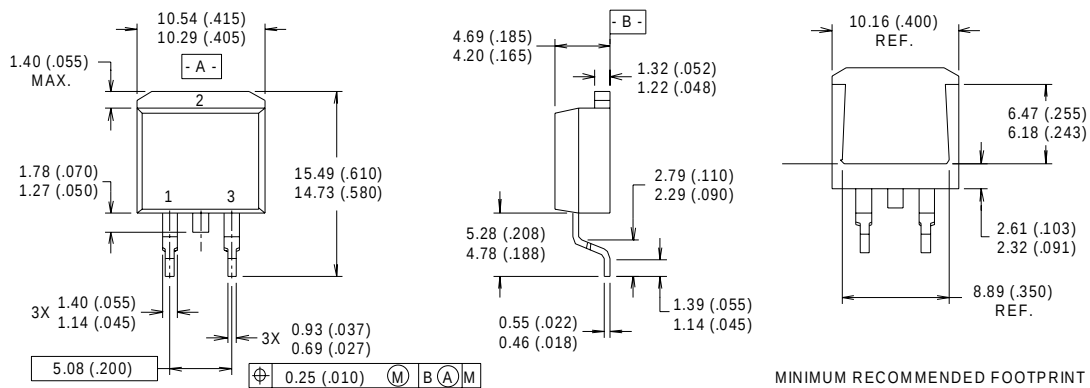
\*  $V_{GS} = 5V$  for Logic Level Devices

**Fig 14.** For N-Channel HEXFET® power MOSFETs

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## D<sup>2</sup>Pak Package Outline



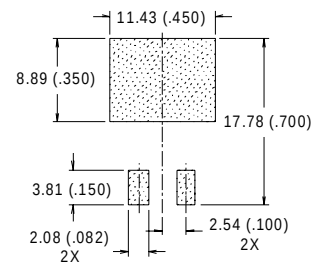
### NOTES:

- 1 DIMENSIONS AFTER SOLDER DIP.
- 2 DIMENSIONING & TOLERANCING PER ANSI Y14.5M, 1982.
- 3 CONTROLLING DIMENSION : INCH.
- 4 HEATSINK & LEAD DIMENSIONS DO NOT INCLUDE BURRS.

### LEAD ASSIGNMENTS

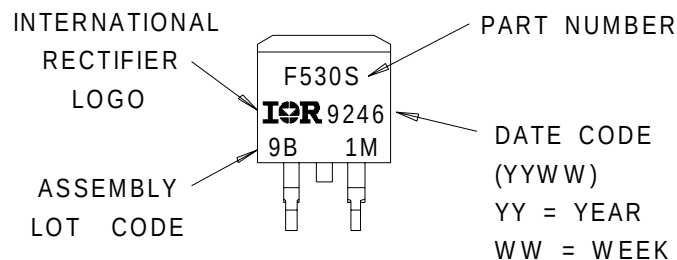
- 1 - GATE
- 2 - DRAIN
- 3 - SOURCE

### MINIMUM RECOMMENDED FOOTPRINT



## Part Marking Information

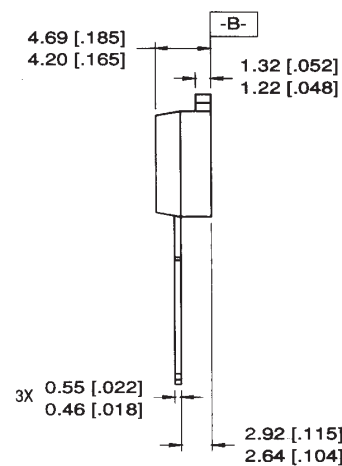
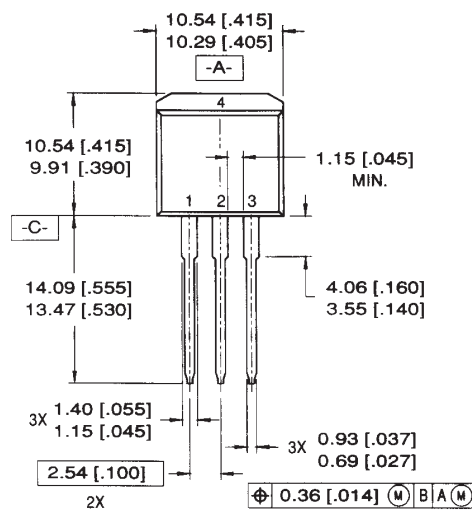
### D<sup>2</sup>Pak





## Package Outline

TO-262



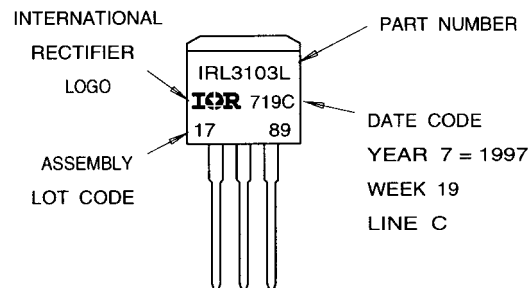
### NOTES:

1. DIMENSIONING & TOLERANCING PER ANSI Y14.5M-1982
2. CONTROLLING DIMENSION: INCH.
3. DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES].
4. HEATSINK & LEAD DIMENSIONS DO NOT INCLUDE BURRS.

## Part Marking Information

TO-262

EXAMPLE: THIS IS AN IRL3103L  
LOT CODE 1789  
ASSEMBLED ON WW 19, 1997  
IN THE ASSEMBLY LINE "C"

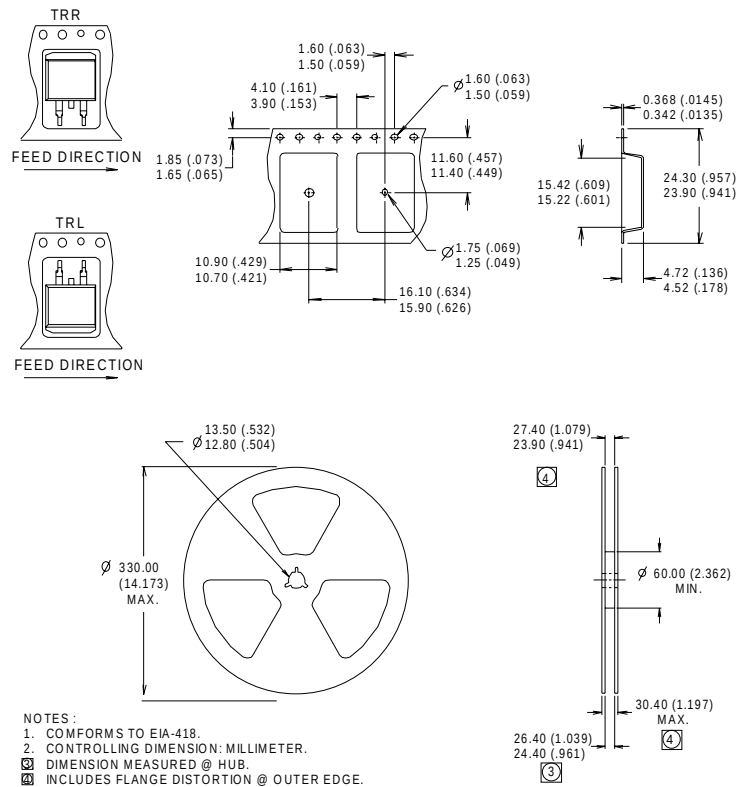


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## Tape & Reel Information

### D<sup>2</sup>Pak



### Notes:

- ① Repetitive rating; pulse width limited by max. junction temperature. ( See fig. 11 )
  - ② Starting  $T_J = 25^\circ\text{C}$ ,  $L = 45\text{mH}$ ,  $R_G = 25\Omega$ ,  $I_{AS} = 2.5\text{A}$ . (See Figure 12)
  - ③  $I_{SD} \leq 2.5\text{A}$ ,  $di/dt \leq 270\text{A}/\mu\text{s}$ ,  $V_{DD} \leq V_{(BR)DSS}$ ,  $T_J \leq 150^\circ\text{C}$
  - ④ Pulse width  $\leq 300\mu\text{s}$ ; duty cycle  $\leq 2\%$ .
  - ⑤  $C_{OSS}$  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 Uses IRF820A data and test conditions
- \* When mounted on 1" square PCB ( FR-4 or G-10 Material ).  
For recommended footprint and soldering techniques refer to application note #AN-994.

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**IR CANADA:** 15 Lincoln Court, Brampton, Ontario L6T3Z2, Tel: (905) 453 2200  
**IR GERMANY:** Saalburgstrasse 157, 61350 Bad Homburg Tel: ++ 49 (0) 6172 96590  
**IR ITALY:** Via Liguria 49, 10071 Borgaro, Torino Tel: ++ 39 011 451 0111  
**IR JAPAN:** K&H Bldg., 2F, 30-4 Nishi-Ikebukuro 3-Chome, Toshima-Ku, Tokyo 171 Tel: 81 (0)3 3983 0086  
**IR SOUTHEAST ASIA:** 1 Kim Seng Promenade, Great World City West Tower, 13-11, Singapore 237994 Tel: ++ 65 (0)838 4630  
**IR TAIWAN:** 16 Fl. Suite D. 207, Sec. 2, Tun Haw South Road, Taipei, 10673 Tel: 886-(0)2 2377 9936  
*Data and specifications subject to change without notice. 5/00*