

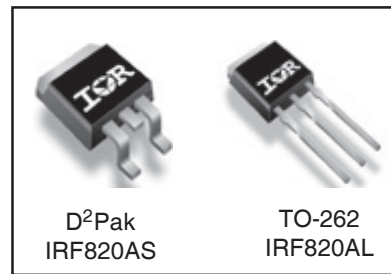
Applications

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

| V _{DSS} | R _{DS(on)} max | I _D |
|------------------|-------------------------|----------------|
| 500V | 3.0Ω | 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°C | Continuous Drain Current, V _{GS} @ 10V [Ⓞ] | 2.5 | A |
| I _D @ T _C = 100°C | Continuous Drain Current, V _{GS} @ 10V [Ⓞ] | 1.6 | |
| I _{DM} | Pulsed Drain Current ^① Ⓞ | 10 | |
| P _D @ T _C = 25°C | Power Dissipation | 50 | W |
| | Linear Derating Factor | 0.4 | W/°C |
| V _{GS} | Gate-to-Source Voltage | ± 30 | V |
| dv/dt | Peak Diode Recovery dv/dt ^③ Ⓞ | 3.4 | 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) | |
| | 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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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/°C | Reference to $25^\circ\text{C}, I_D = 1\text{mA}$ ⑥ |
| $R_{DS(on)}$ | Static Drain-to-Source On-Resistance | — | — | 3.0 | Ω | $V_{GS} = 10V, I_D = 1.5A$ 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 | μA | $V_{DS} = 500V, V_{GS} = 0V$ |
| | | — | — | 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 ④⑥ |
| $t_{d(on)}$ | 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 ④⑥ |
| C_{iss} | Input Capacitance | — | 340 | — | pF | $V_{GS} = 0V$ |
| C_{oss} | Output Capacitance | — | 53 | — | | $V_{DS} = 25V$ |
| C_{riss} | Reverse Transfer Capacitance | — | 2.7 | — | | $f = 1.0\text{MHz}$, See Fig. 5⑥ |
| C_{oss} | Output Capacitance | — | 490 | — | | $V_{GS} = 0V, V_{DS} = 1.0V, f = 1.0\text{MHz}$ |
| C_{oss} | Output Capacitance | — | 15 | — | | $V_{GS} = 0V, V_{DS} = 400V, f = 1.0\text{MHz}$ |
| $C_{oss\ eff.}$ | Effective Output Capacitance | — | 28 | — | | $V_{GS} = 0V, V_{DS} = 0V \text{ to } 400V$ ⑤⑥ |

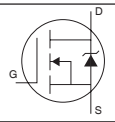
Avalanche Characteristics

| | Parameter | Typ. | Max. | Units |
|----------|---------------------------------|------|------|-------|
| E_{AS} | Single Pulse Avalanche Energy②⑥ | — | 140 | mJ |
| I_{AR} | Avalanche Current① | — | 2.5 | A |
| E_{AR} | Repetitive Avalanche Energy① | — | 5.0 | mJ |

Thermal Resistance

| | Parameter | Typ. | Max. | Units |
|-----------------|--|------|------|-------|
| $R_{\theta JC}$ | Junction-to-Case | — | 2.5 | °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) ①⑥ | — | — | 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 | $di/dt = 100A/\mu s$ ④⑥ |
| t_{on} | Forward Turn-On Time | Intrinsic turn-on time is negligible (turn-on is dominated by L_S+L_D) | | | | |

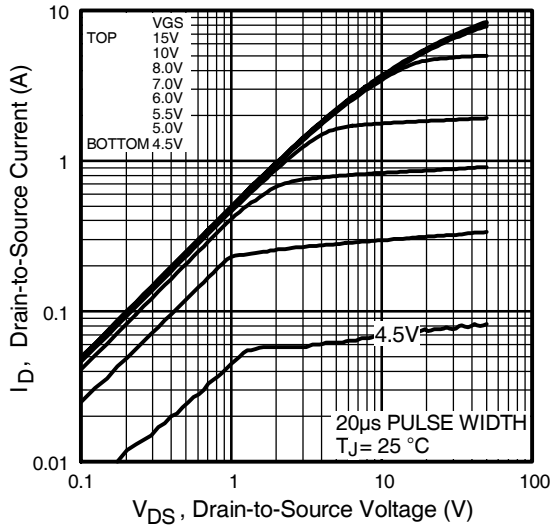


Fig 1. Typical Output Characteristics

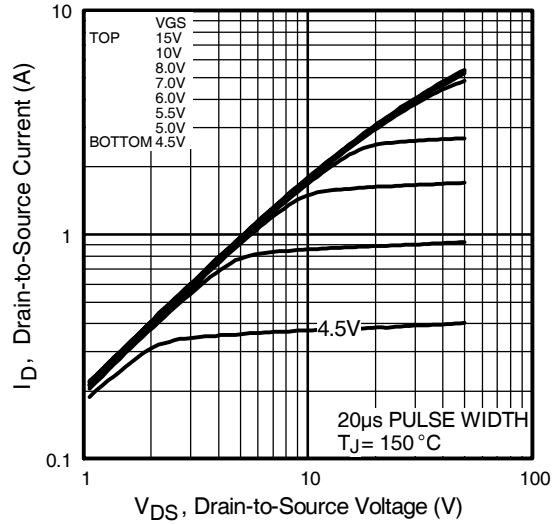


Fig 2. Typical Output Characteristics

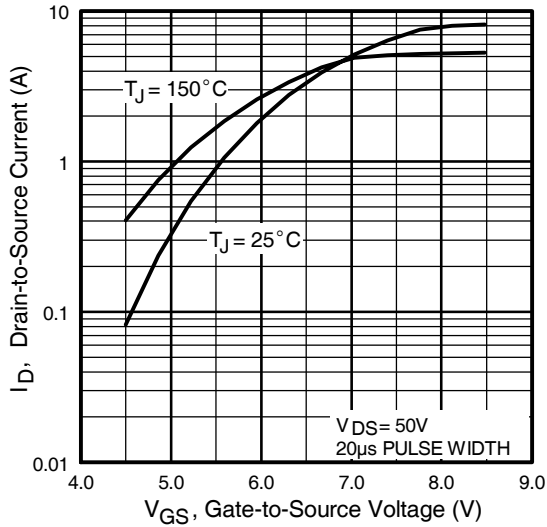


Fig 3. Typical Transfer Characteristics

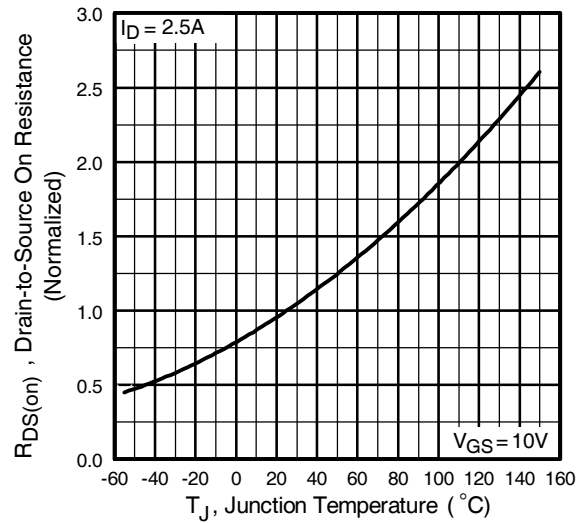


Fig 4. Normalized On-Resistance Vs. Temperature

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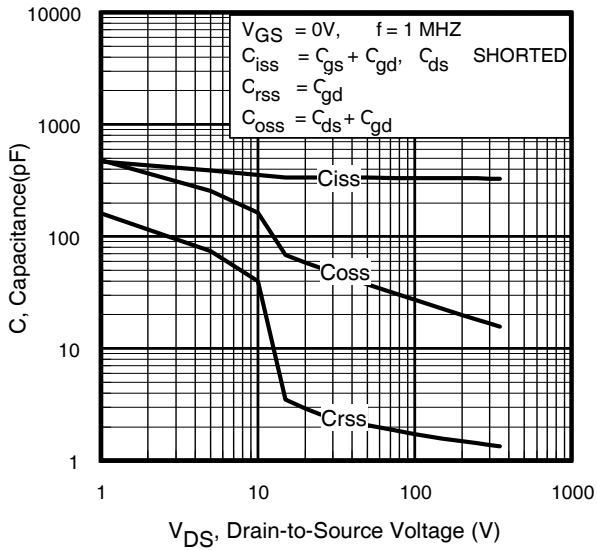


Fig 5. Typical Capacitance Vs. Drain-to-Source Voltage

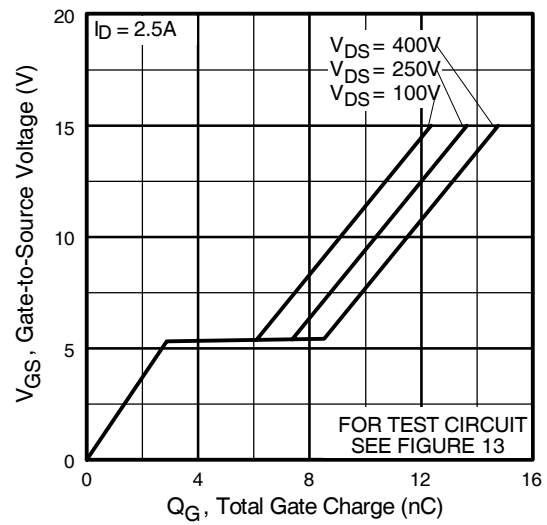


Fig 6. Typical Gate Charge Vs. Gate-to-Source Voltage

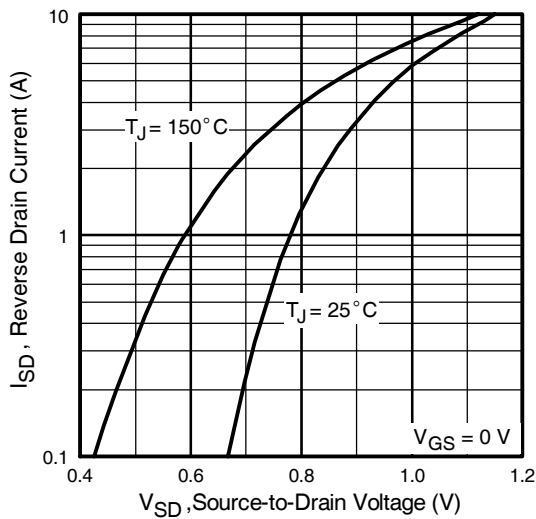


Fig 7. Typical Source-Drain Diode Forward Voltage

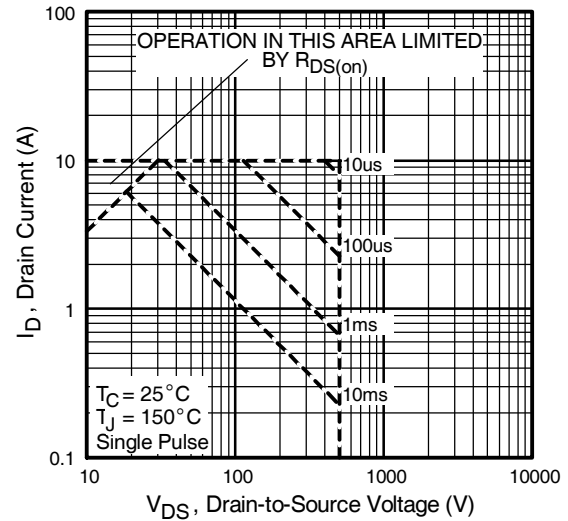


Fig 8. Maximum Safe Operating Area

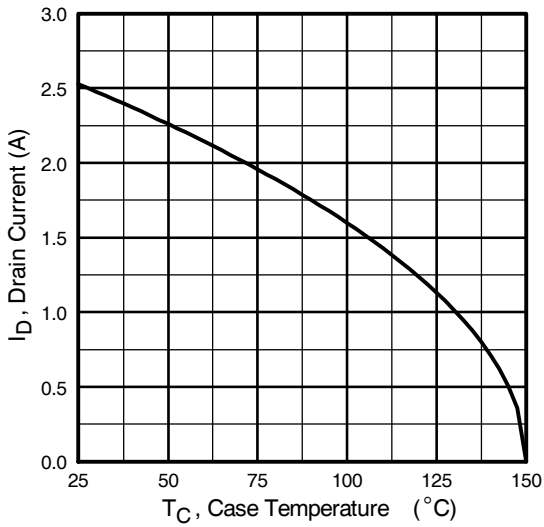


Fig 9. Maximum Drain Current Vs. Case Temperature



Fig 10a. Switching Time Test Circuit



Fig 10b. Switching Time Waveforms

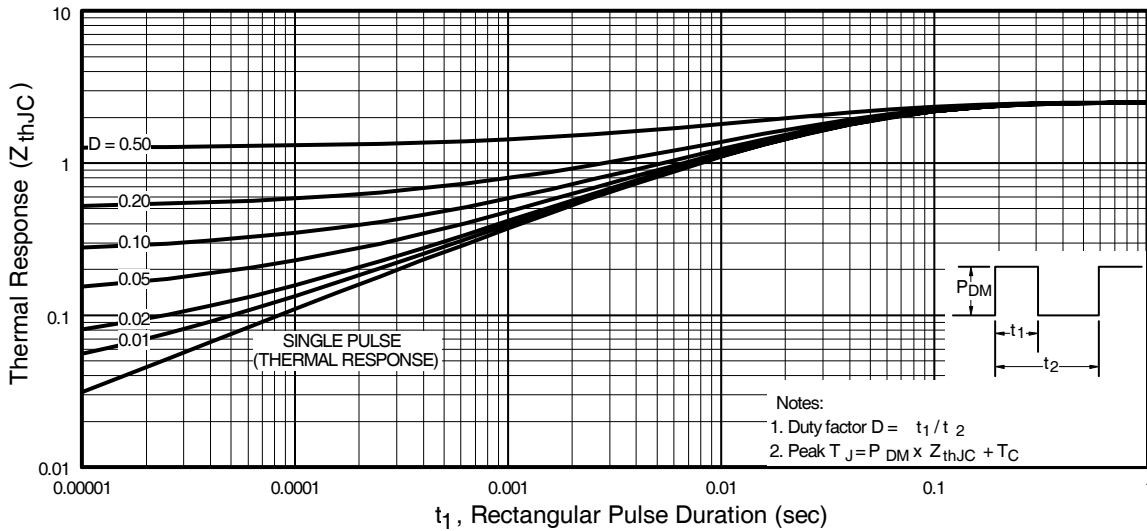


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Case

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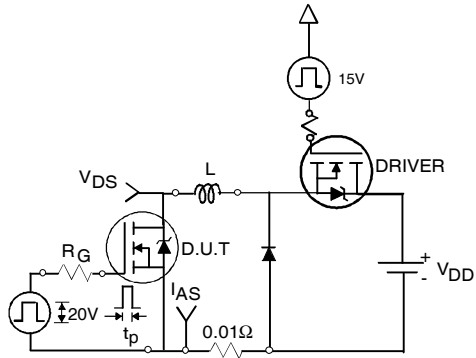


Fig 12a. Unclamped Inductive Test Circuit

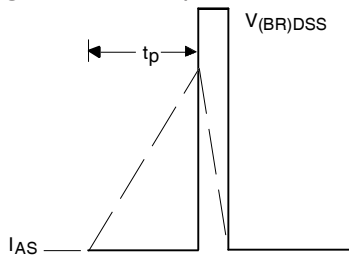


Fig 12b. Unclamped Inductive Waveforms

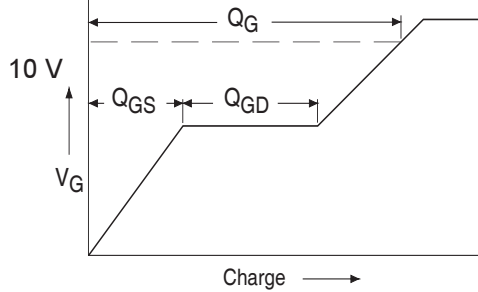


Fig 13a. Basic Gate Charge Waveform

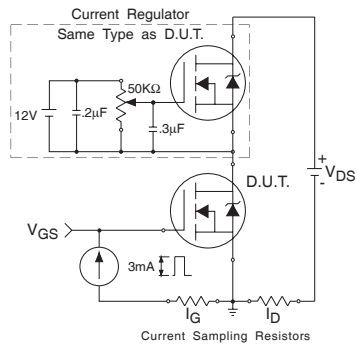


Fig 13b. Gate Charge Test Circuit

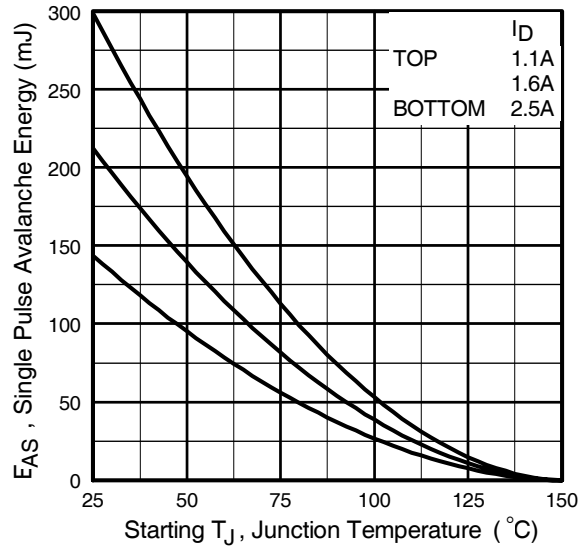


Fig 12c. Maximum Avalanche Energy Vs. Drain Current

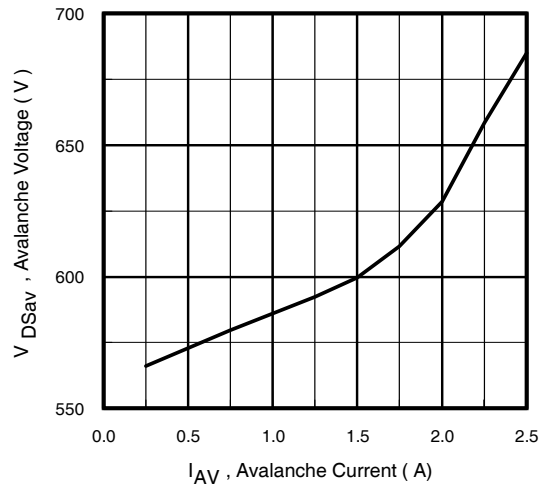
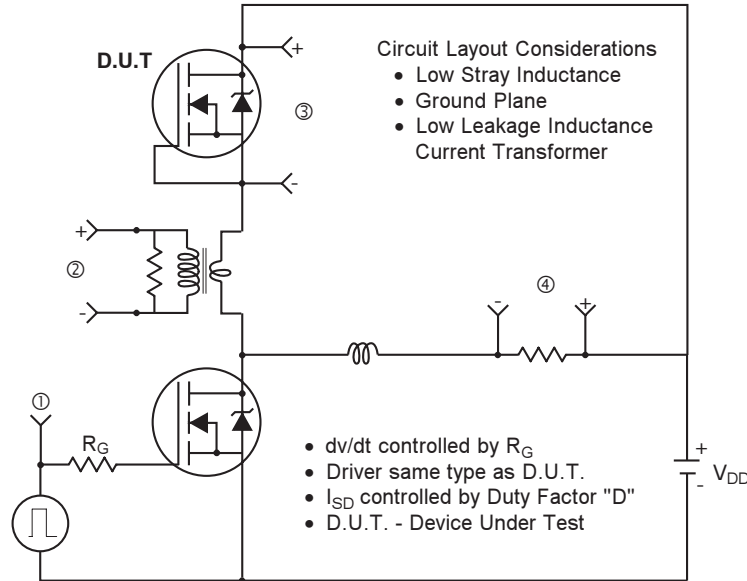


Fig 12d. Typical Drain-to-Source Voltage Vs. Avalanche Current

Peak Diode Recovery dv/dt Test Circuit



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

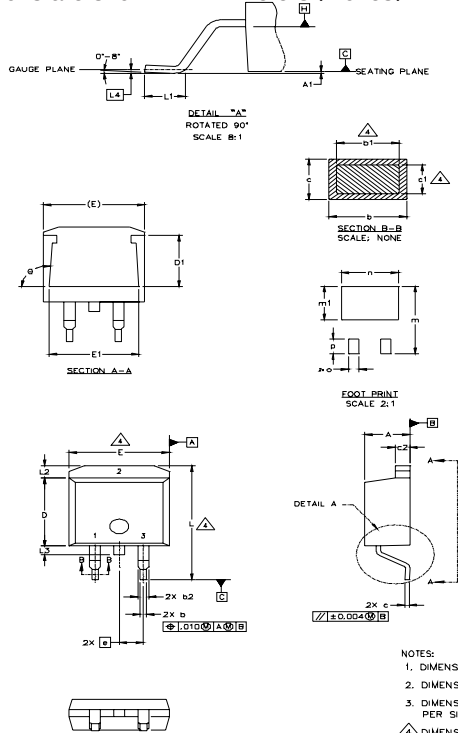
Fig 14. For N-Channel HEXFET® power MOSFETs

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D²Pak Package Outline

Dimensions are shown in millimeters (inches)



| SYMBOL | DIMENSIONS | | | | NOTES |
|--------|-------------|-------|----------|------|-------|
| | MILLIMETERS | | INCHES | | |
| | MIN. | MAX. | MIN. | MAX. | |
| A | 4.06 | 4.83 | .160 | .190 | 4 |
| A1 | | 0.127 | | .005 | |
| b | 0.51 | 0.99 | .020 | .039 | |
| b1 | 0.51 | 0.89 | .020 | .035 | |
| b2 | 1.14 | 1.40 | .045 | .055 | 4 |
| c | 0.43 | 0.63 | .017 | .025 | |
| c1 | 0.38 | 0.74 | .015 | .029 | |
| c2 | 1.14 | 1.40 | .045 | .055 | 3 |
| D | 8.51 | 9.65 | .335 | .380 | |
| D1 | 5.33 | | .210 | | 3 |
| E | 9.65 | 10.67 | .380 | .420 | |
| E1 | 6.22 | | .245 | | |
| e | 2.54 BSC | | .100 BSC | | |
| L | 14.61 | 15.88 | .575 | .625 | |
| L1 | 1.78 | 2.79 | .070 | .110 | |
| L2 | | 1.65 | | .065 | |
| L3 | 1.27 | 1.78 | .050 | .070 | |
| L4 | 0.25 BSC | | .010 BSC | | |
| m | 17.78 | | .700 | | |
| m1 | 8.89 | | .350 | | |
| n | 11.43 | | .450 | | |
| o | 2.08 | | .082 | | |
| p | 3.81 | | .150 | | |
| θ | 90° | | 93° | | |

LEAD ASSIGNMENTS

| HEXFET | IGBTs, CoPACK | DIODES |
|------------|---------------|-------------|
| 1.- GATE | 1.- GATE | 1.- ANODE * |
| 2.- DRAIN | 2.- COLLECTOR | 2.- CATHODE |
| 3.- SOURCE | 3.- EMITTER | 3.- ANODE |

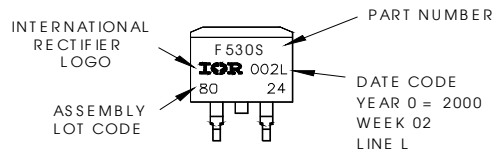
* PART DEPENDENT.

- NOTES:
 1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M-1994
 2. DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES].
 3. DIMENSION D & E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED 0.127 [005"] PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTMOST EXTREMES OF THE PLASTIC BODY.
 4. DIMENSION b1 AND c1 APPLY TO BASE METAL ONLY.
 5. CONTROLLING DIMENSION: INCH.

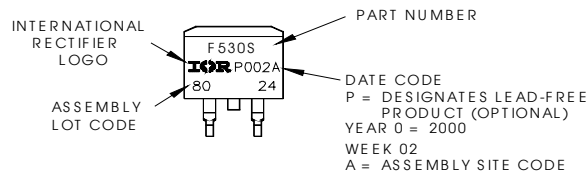
D²Pak Part Marking Information (Lead-Free)

EXAMPLE: THIS IS AN IRF530S WITH
 LOT CODE 8024
 ASSEMBLED ON WW 02, 2000
 IN THE ASSEMBLY LINE "L"

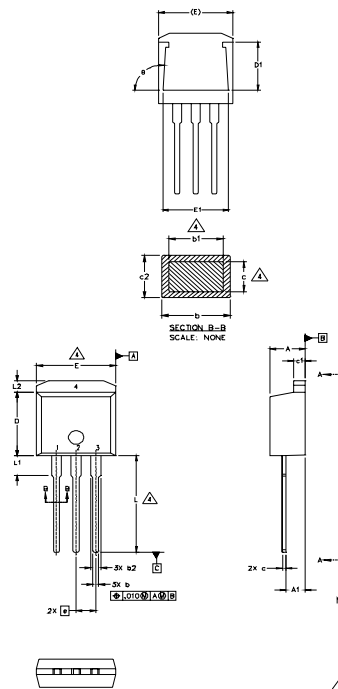
Note: "P" in assembly line
 position indicates "Lead-Free"



OR



TO-262 Package Outline



| SYMBOL | DIMENSIONS | | | | NOTES |
|--------|-------------|-------|----------|------|-------|
| | MILLIMETERS | | INCHES | | |
| | MIN. | MAX. | MIN. | MAX. | |
| A | 4.06 | 4.83 | .160 | .190 | 4 |
| A1 | 2.03 | 2.92 | .080 | .115 | |
| b | 0.51 | 0.99 | .020 | .039 | |
| b1 | 0.51 | 0.89 | .020 | .035 | |
| b2 | 1.14 | 1.40 | .045 | .055 | 4 |
| c | 0.38 | 0.63 | .015 | .025 | |
| c1 | 1.14 | 1.40 | .045 | .055 | 3 |
| c2 | 0.43 | .063 | .017 | .029 | |
| D | 8.51 | 9.65 | .335 | .380 | 3 |
| D1 | 5.33 | | .210 | | |
| E | 9.65 | 10.67 | .380 | .420 | 3 |
| E1 | 6.22 | | .245 | | |
| e | 2.54 BSC | | .100 BSC | | |
| L | 13.46 | 14.09 | .530 | .555 | |
| L1 | 3.56 | 3.71 | .140 | .146 | |
| L2 | | 1.65 | | .065 | |

LEAD ASSIGNMENTS

HEXFET

- 1.- GATE
- 2.- DRAIN
- 3.- SOURCE
- 4.- DRAIN

IGBT

- 1 - GATE
- 2 - COLLECTOR
- 3 - EMITTER

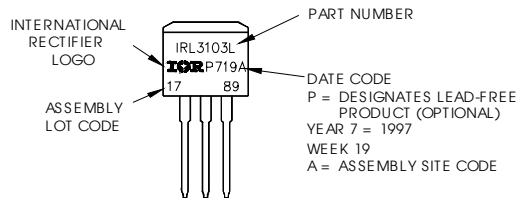
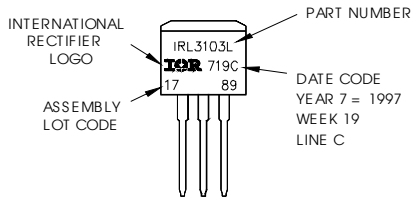
- NOTES:
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 2. DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES].
 3. DIMENSION D & E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED 0.127 [0.005] PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTMOST EXTREMES OF THE PLASTIC BODY.
 4. DIMENSION b1 AND c1 APPLY TO BASE METAL ONLY.
 5. CONTROLLING DIMENSION: INCH.

TO-262 Part Marking Information

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

Note: "P" in assembly line position indicates "Lead-Free"

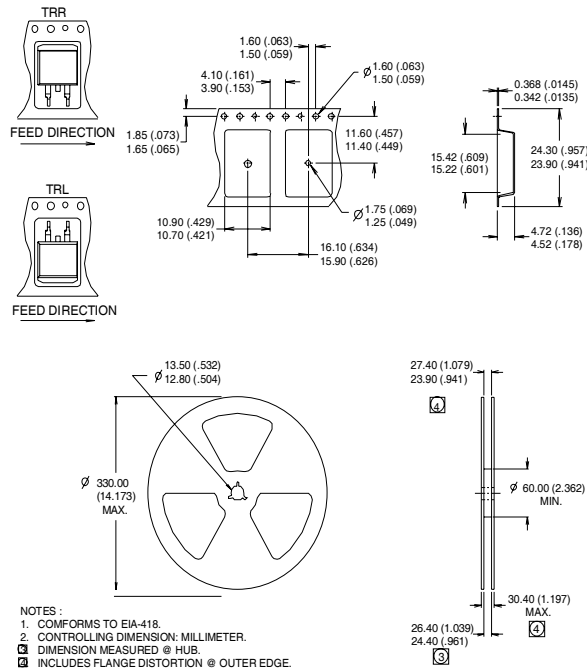
OR



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D²Pak Tape & Reel Information



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.

Data and specifications subject to change without notice.

International
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TAC Fax: (310) 252-7903

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