

SMPS MOSFET

IRF3709PbF
IRF3709SPbF
IRF3709LPBF

HEXFET® Power MOSFET

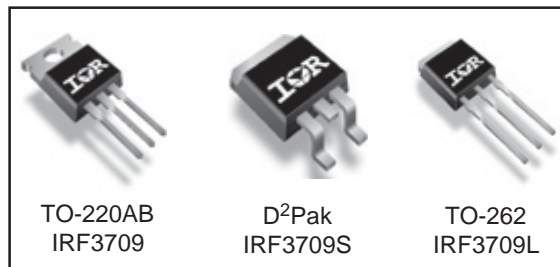
Applications

- High Frequency Isolated DC-DC Converters with Synchronous Rectification for Telecom and Industrial Use
- High Frequency Buck Converters for Server Processor Power Synchronous FET
- Optimized for Synchronous Buck Converters Including Capacitive Induced Turn-on Immunity
- Lead-Free

| | | |
|------------------------|-------------------------------|------------------------|
| V_{DSS} | R_{DS(on)} max | I_D |
| 30V | 9.0mΩ | 90A[Ⓒ] |

Benefits

- Ultra-Low Gate Impedance
- Very Low RDS(on) at 4.5V V_{GS}
- Fully Characterized Avalanche Voltage and Current



Absolute Maximum Ratings

| Symbol | Parameter | Max. | Units |
|---|---|-----------------|-------|
| V _{DS} | Drain-Source Voltage | 30 | V |
| V _{GS} | Gate-to-Source Voltage | ± 20 | V |
| I _D @ T _C = 25°C | Continuous Drain Current, V _{GS} @ 10V | 90 [Ⓒ] | A |
| I _D @ T _C = 100°C | Continuous Drain Current, V _{GS} @ 10V | 57 | |
| I _{DM} | Pulsed Drain Current [Ⓓ] | 360 | |
| P _D @ T _C = 25°C | Maximum Power Dissipation [Ⓒ] | 120 | W |
| P _D @ T _A = 25°C | Maximum Power Dissipation [Ⓔ] | 3.1 | W |
| | Linear Derating Factor | 0.96 | mW/°C |
| T _J , T _{STG} | Junction and Storage Temperature Range | -55 to + 150 | °C |

Thermal Resistance

| | Parameter | Typ. | Max. | Units |
|------------------|--|------|------|-------|
| R _{θJC} | Junction-to-Case | — | 1.04 | °C/W |
| R _{θCS} | Case-to-Sink, Flat, Greased Surface [Ⓓ] | 0.50 | — | |
| R _{θJA} | Junction-to-Ambient [Ⓓ] | — | 62 | |
| R _{θJA} | Junction-to-Ambient (PCB mount) [Ⓔ] | — | 40 | |

Notes [Ⓓ] through [Ⓔ] are on page 11

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International
IR Rectifier

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

| | Parameter | Min. | Typ. | Max. | Units | Conditions |
|---------------------------------|--------------------------------------|------|-------|------|-------|--|
| $V_{(BR)DSS}$ | Drain-to-Source Breakdown Voltage | 30 | — | — | V | $V_{GS} = 0V, I_D = 250\mu A$ |
| $\Delta V_{(BR)DSS}/\Delta T_J$ | Breakdown Voltage Temp. Coefficient | — | 0.029 | — | V/°C | Reference to $25^\circ\text{C}, I_D = 1mA$ |
| $R_{DS(on)}$ | Static Drain-to-Source On-Resistance | — | 6.4 | 9.0 | mΩ | $V_{GS} = 10V, I_D = 15A$ ③ |
| | | — | 7.4 | 10.5 | | $V_{GS} = 4.5V, I_D = 12A$ 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 | μA | $V_{DS} = 24V, V_{GS} = 0V$ |
| | | — | — | 100 | | $V_{DS} = 24V, V_{GS} = 0V, T_J = 125^\circ\text{C}$ |
| I_{GSS} | Gate-to-Source Forward Leakage | — | — | 200 | nA | $V_{GS} = 16V$ |
| | Gate-to-Source Reverse Leakage | — | — | -200 | | $V_{GS} = -16V$ |

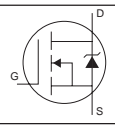
Dynamic @ $T_J = 25^\circ\text{C}$ (unless otherwise specified)

| Symbol | Parameter | Min. | Typ. | Max. | Units | Conditions |
|--------------|---------------------------------|------|------|------|-------|-----------------------------|
| g_{fs} | Forward Transconductance | 53 | — | — | S | $V_{DS} = 15V, I_D = 30A$ |
| Q_g | Total Gate Charge | — | 27 | 41 | nC | $I_D = 15A$ |
| Q_{gs} | Gate-to-Source Charge | — | 6.7 | — | | $V_{DS} = 16V$ |
| Q_{gd} | Gate-to-Drain ("Miller") Charge | — | 9.7 | — | | $V_{GS} = 5.0V$ ③ |
| Q_{oss} | Output Gate Charge | — | 22 | — | | $V_{GS} = 0V, V_{DS} = 10V$ |
| $t_{d(on)}$ | Turn-On Delay Time | — | 11 | — | ns | $V_{DD} = 15V$ |
| t_r | Rise Time | — | 171 | — | | $I_D = 30A$ |
| $t_{d(off)}$ | Turn-Off Delay Time | — | 21 | — | | $R_G = 1.8\Omega$ |
| t_f | Fall Time | — | 9.2 | — | | $V_{GS} = 4.5V$ ③ |
| C_{iss} | Input Capacitance | — | 2672 | — | pF | $V_{GS} = 0V$ |
| C_{oss} | Output Capacitance | — | 1064 | — | | $V_{DS} = 16V$ |
| C_{rss} | Reverse Transfer Capacitance | — | 109 | — | | $f = 1.0MHz$ |

Avalanche Characteristics

| Symbol | Parameter | Typ. | Max. | Units |
|----------|--------------------------------|------|------|-------|
| E_{AS} | Single Pulse Avalanche Energy② | — | 382 | mJ |
| I_{AR} | Avalanche Current① | — | 30 | A |

Diode Characteristics

| Symbol | Parameter | Min. | Typ. | Max. | Units | Conditions |
|----------|---|------|------|------|-------|--|
| I_S | Continuous Source Current (Body Diode) | — | — | 90⑥ | A | MOSFET symbol showing the integral reverse p-n junction diode.  |
| I_{SM} | Pulsed Source Current (Body Diode) ① | — | — | 360 | | |
| V_{SD} | Diode Forward Voltage | — | 0.88 | 1.3 | V | $T_J = 25^\circ\text{C}, I_S = 30A, V_{GS} = 0V$ ③ |
| | | — | 0.82 | — | | $T_J = 125^\circ\text{C}, I_S = 30A, V_{GS} = 0V$ ③ |
| t_{rr} | Reverse Recovery Time | — | 48 | 72 | ns | $T_J = 25^\circ\text{C}, I_F = 30A, V_R = 15V$ |
| Q_{rr} | Reverse Recovery Charge | — | 46 | 69 | nC | $di/dt = 100A/\mu s$ ③ |
| t_{rr} | Reverse Recovery Time | — | 48 | 72 | ns | $T_J = 125^\circ\text{C}, I_F = 30A, V_R = 15V$ |
| Q_{rr} | Reverse Recovery Charge | — | 52 | 78 | nC | $di/dt = 100A/\mu s$ ③ |

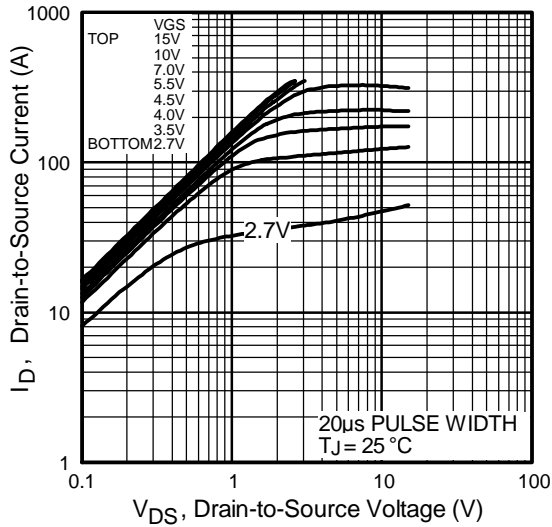


Fig 1. Typical Output Characteristics

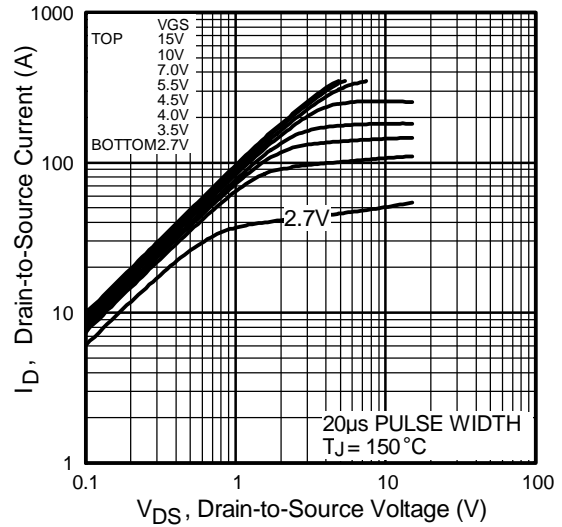


Fig 2. Typical Output Characteristics

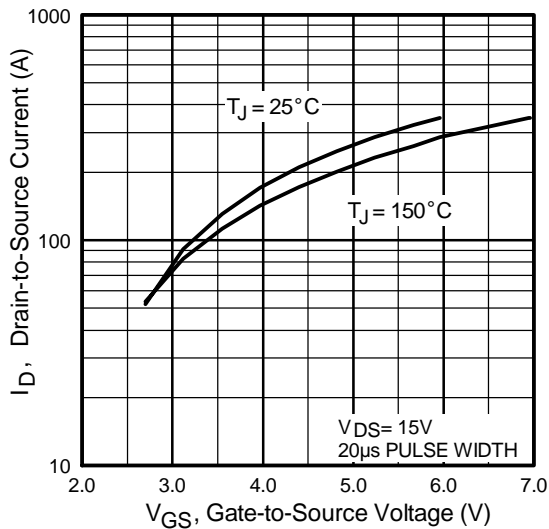


Fig 3. Typical Transfer Characteristics

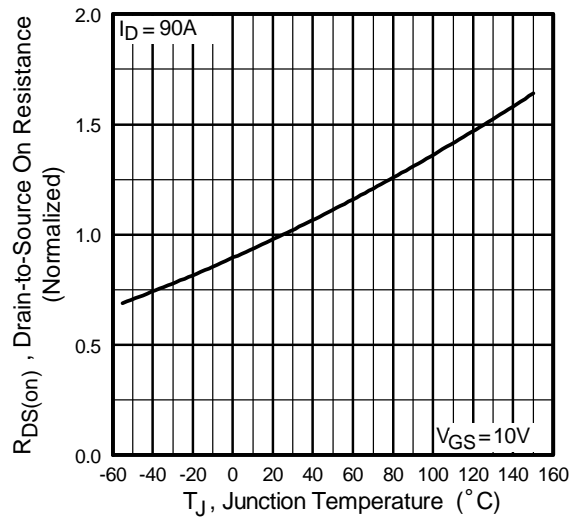


Fig 4. Normalized On-Resistance Vs. Temperature

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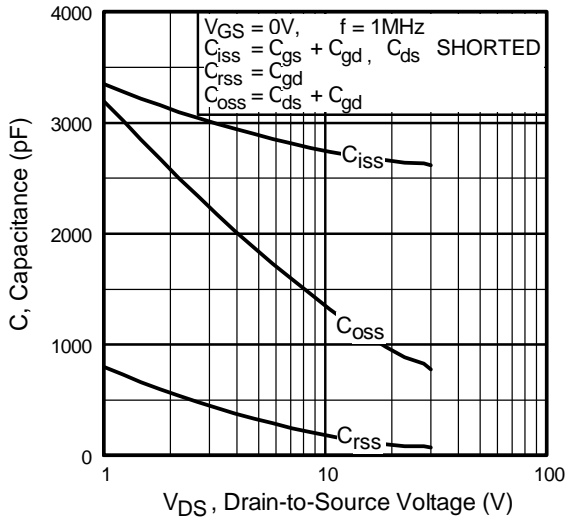


Fig 5. Typical Capacitance Vs. Drain-to-Source Voltage

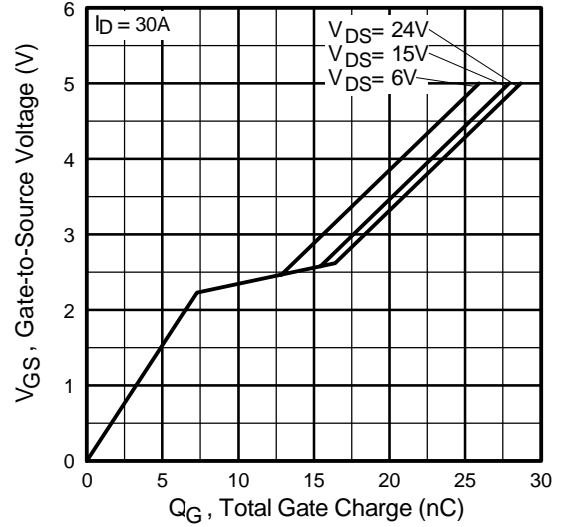


Fig 6. Typical Gate Charge Vs. Gate-to-Source Voltage

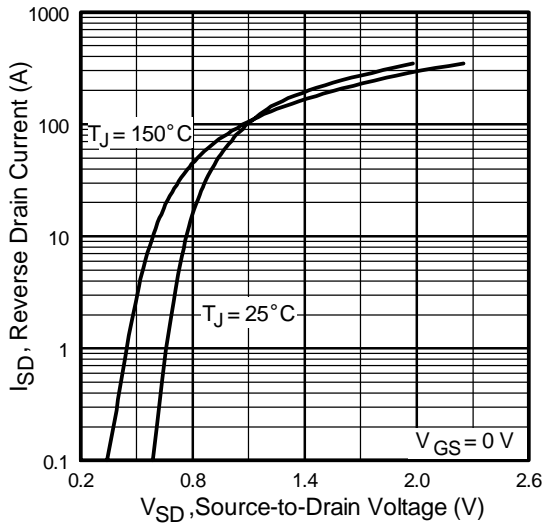


Fig 7. Typical Source-Drain Diode Forward Voltage

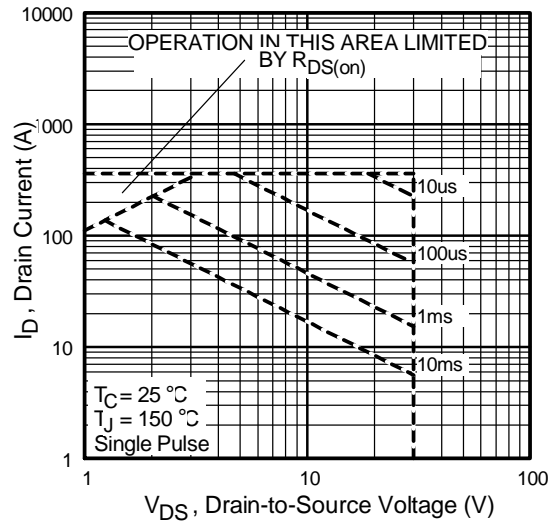


Fig 8. Maximum Safe Operating Area

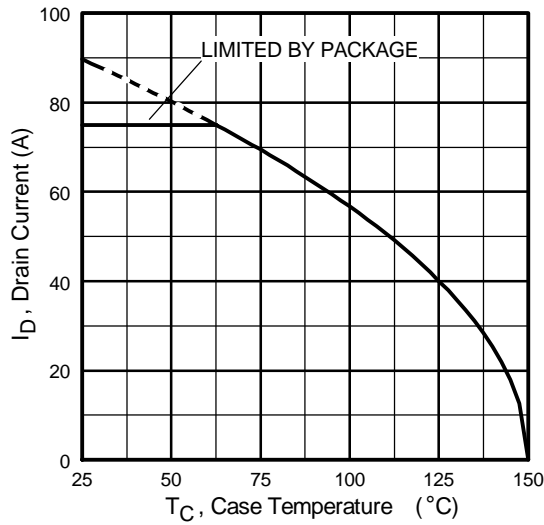


Fig 9. Maximum Drain Current Vs. Case Temperature

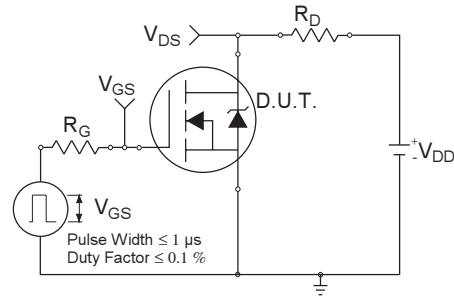


Fig 10a. Switching Time Test Circuit

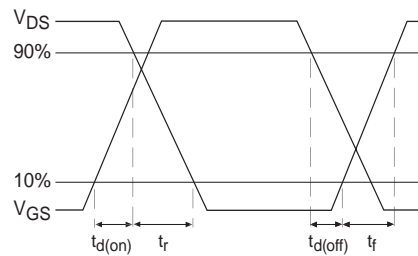


Fig 10b. Switching Time Waveforms

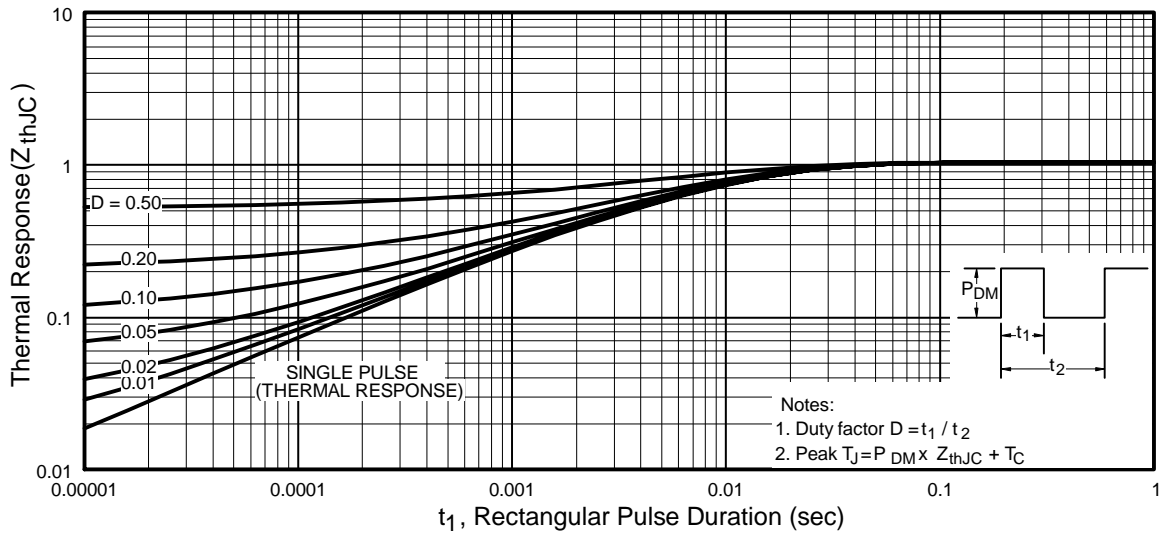


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Case

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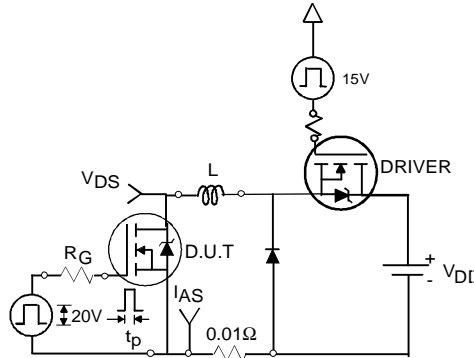


Fig 12a. Unclamped Inductive Test Circuit

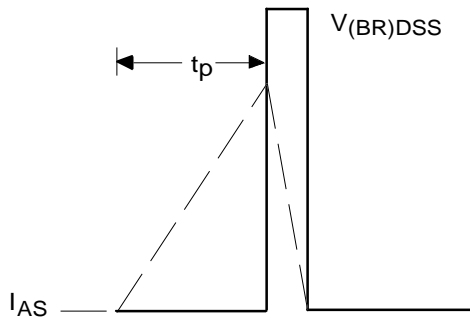


Fig 12b. Unclamped Inductive Waveforms

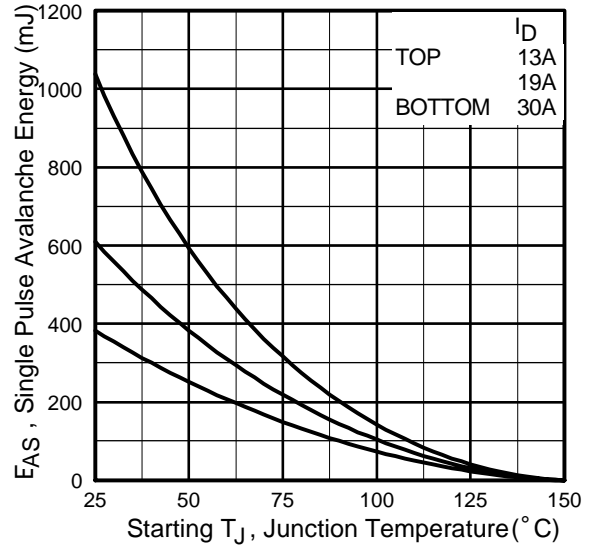


Fig 12c. Maximum Avalanche Energy Vs. Drain Current

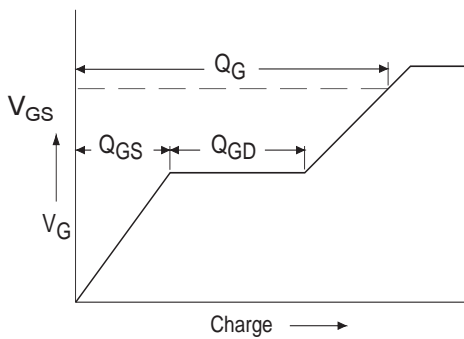


Fig 13a. Basic Gate Charge Waveform

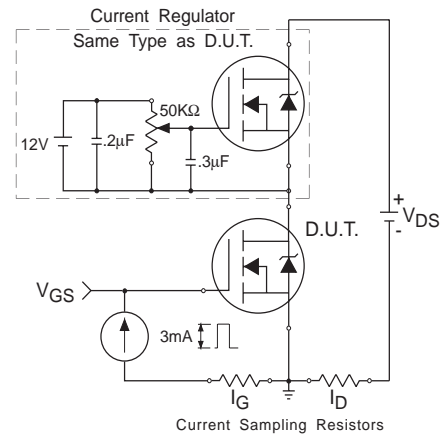
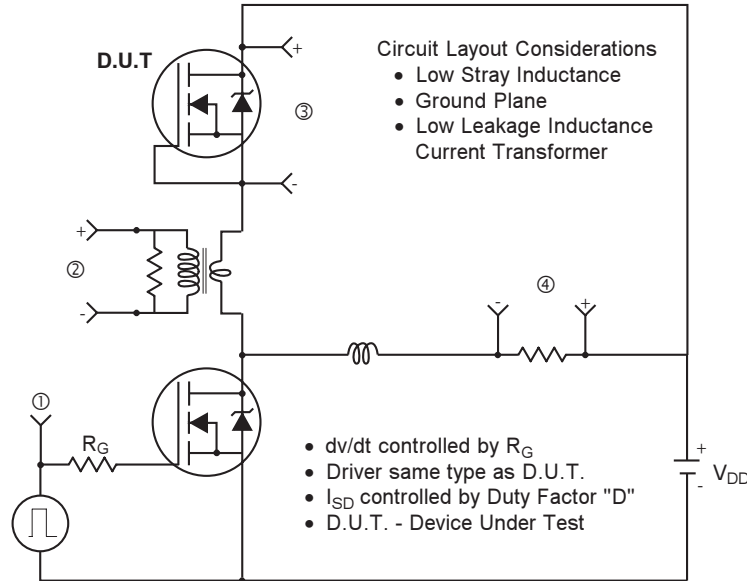


Fig 13b. Gate Charge Test Circuit

Peak Diode Recovery dv/dt Test Circuit



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

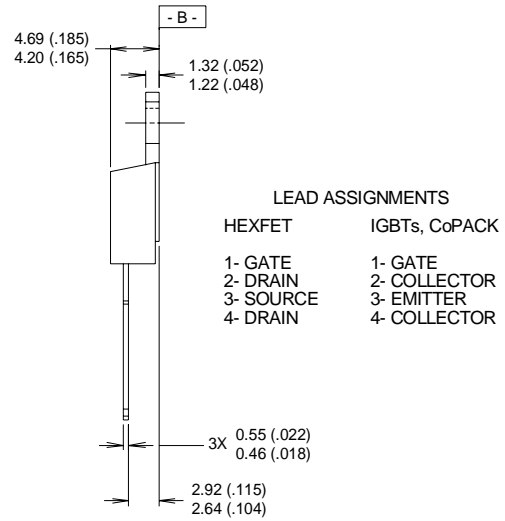
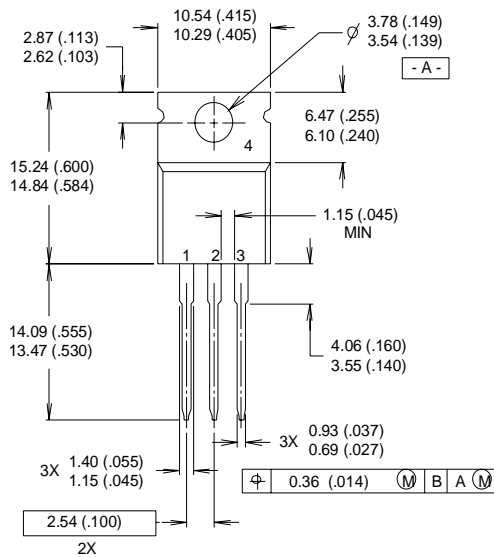
Fig 14. For N-Channel HEXFET® Power MOSFETs

IRF3709/S/LPbF



TO-220AB Package Outline

Dimensions are shown in millimeters (inches)



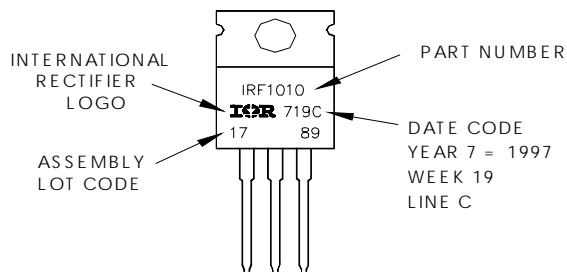
| LEAD ASSIGNMENTS | |
|------------------|---------------|
| HEXFET | IGBTs, CoPACK |
| 1- GATE | 1- GATE |
| 2- DRAIN | 2- COLLECTOR |
| 3- SOURCE | 3- EMITTER |
| 4- DRAIN | 4- COLLECTOR |

NOTES:

- 1 DIMENSIONING & TOLERANCING PER ANSI Y14.5M, 1982.
- 2 CONTROLLING DIMENSION : INCH
- 3 OUTLINE CONFORMS TO JEDEC OUTLINE TO-220AB.
- 4 HEATSINK & LEAD MEASUREMENTS DO NOT INCLUDE BURRS.

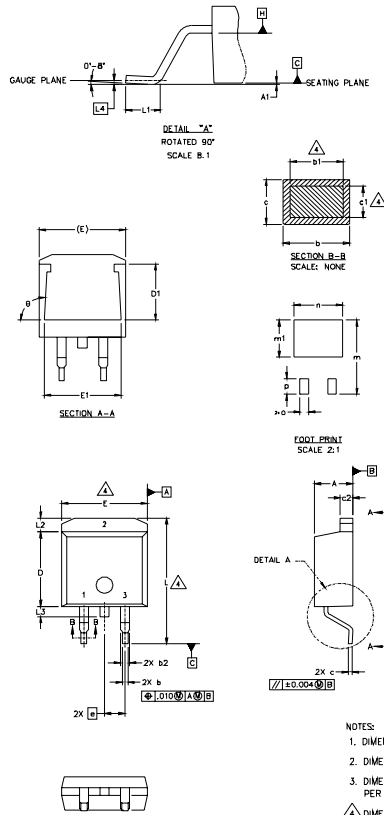
TO-220AB Part Marking Information

EXAMPLE: THIS IS AN IRF1010
 LOT CODE 1789
 ASSEMBLED ON WW 19, 1997
 IN THE ASSEMBLY LINE "C"
Note: "P" in assembly line position indicates "Lead-Free"



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 | 3 |
| c2 | 1.14 | 1.40 | .045 | .055 | |
| 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 | 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° | 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.

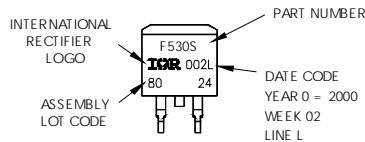
NOTES:

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 [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.

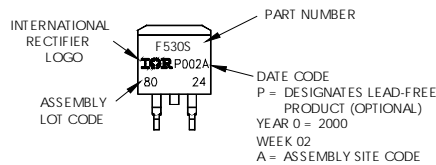
D²Pak Part Marking Information

EXAMPLE: THIS IS AN IRF530S WITH
LOT CODE 8024
ASSEMBLED ON WW02, 2000
IN THE ASSEMBLY LINE "L"

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



OR

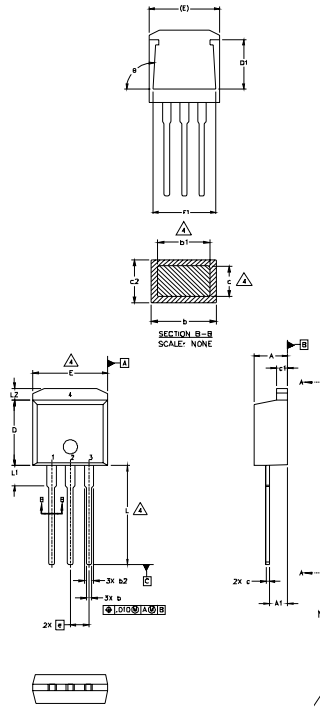


IRF3709/S/LPbF



TO-262 Package Outline

Dimensions are shown in millimeters (inches)



| SYMBOL | DIMENSIONS | | | | NOTES |
|--------|-------------|-------|--------|------|-------|
| | MILLIMETERS | | INCHES | | |
| | MIN. | MAX. | MIN. | MAX. | |
| A | 4.06 | 4.83 | .160 | .190 | |
| A1 | 2.03 | 2.92 | .080 | .115 | |
| b | 0.51 | 0.99 | .020 | .039 | |
| b1 | 0.51 | 0.89 | .020 | .035 | 4 |
| b2 | 1.14 | 1.40 | .045 | .055 | |
| c | 0.38 | 0.63 | .015 | .025 | 4 |
| c1 | 1.14 | 1.40 | .045 | .055 | |
| 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

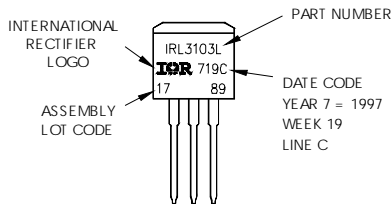
| HEXFET | IGBT |
|------------|---------------|
| 1 - GATE | 1 - GATE |
| 2 - DRAIN | 2 - COLLECTOR |
| 3 - SOURCE | 3 - EMITTER |
| 4 - DRAIN | |

- 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 [0.005"] PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTMOST EXTREMES OF THE PLASTIC BODY.
 4. DIMENSION D1 AND C1 APPLY TO BASE METAL ONLY.
 5. CONTROLLING DIMENSION: INCH.

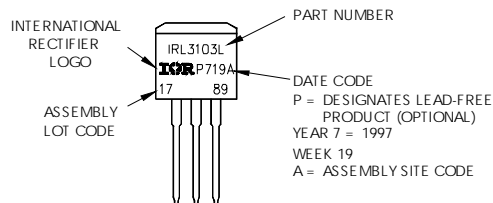
TO-262 Part Marking Information

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

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

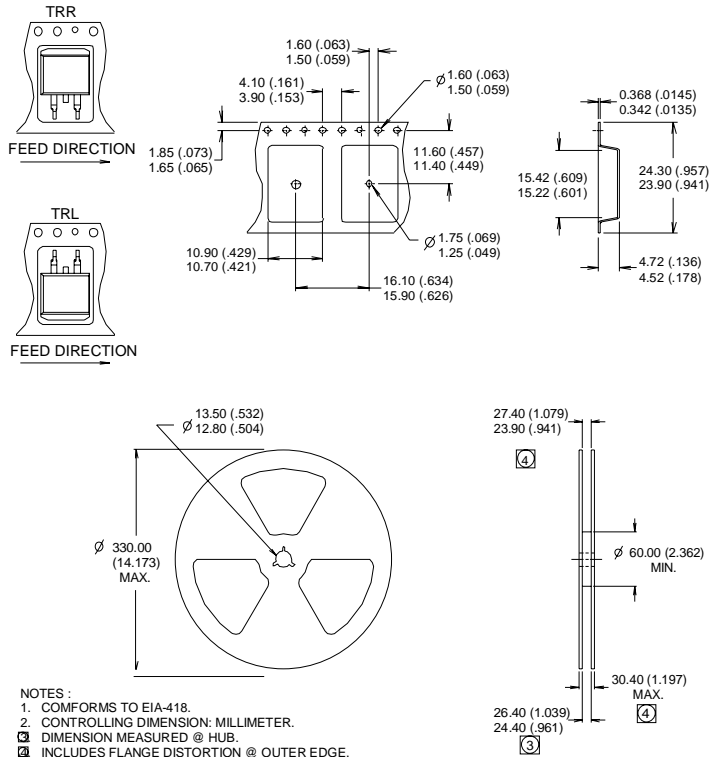


OR



D²Pak Tape & Reel Information

Dimensions are shown in millimeters (inches)



Notes:

- ① Repetitive rating; pulse width limited by max. junction temperature.
- ② Starting $T_J = 25^\circ\text{C}$, $L = 0.85\text{mH}$
 $R_G = 25\Omega$, $I_{AS} = 30\text{A}$.
- ③ Pulse width $\leq 400\mu\text{s}$; duty cycle $\leq 2\%$.
- ④ This is only applied to TO-220AB package.
- ⑤ This is applied to D²Pak, when mounted on 1" square PCB (FR-4 or G-10 Material).
 For recommended footprint and soldering techniques refer to application note #AN-994.
- ⑥ Calculated continuous current based on maximum allowable junction temperature. Package limitation current is 75A.

Data and specifications subject to change without notice.
 This product has been designed and qualified for the industrial market.
 Qualification Standards can be found on IR's Web site.

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

Mouser Electronics

Authorized Distributor

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