

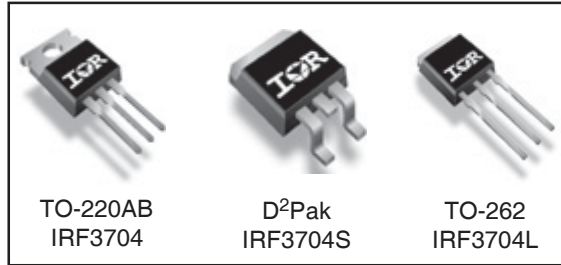
Applications

- High Frequency DC-DC Isolated Converters with Synchronous Rectification for Telecom and Industrial use
- High Frequency Buck Converters for Computer Processor Power
- Lead-Free

| | | |
|------------------------|-------------------------------|------------------------|
| V_{DSS} | R_{DS(on)} max | I_D |
| 20V | 9.0mΩ | 77A^⑤ |

Benefits

- Ultra-Low Gate Impedance
- Very Low R_{DS(on)}
- Fully Characterized Avalanche Voltage and Current



Absolute Maximum Ratings

| Symbol | Parameter | Max. | Units |
|--|---|-----------------|-------|
| V _{DS} | Drain-Source Voltage | 20 | V |
| V _{GS} | Gate-to-Source Voltage | ± 20 | V |
| I _D @ T _C = 25°C | Continuous Drain Current, V _{GS} @ 10V | 77 ^⑤ | A |
| I _D @ T _C = 70°C | Continuous Drain Current, V _{GS} @ 10V | 64 | |
| I _{DM} | Pulsed Drain Current ^① | 308 | |
| P _D @ T _C = 25°C | Maximum Power Dissipation ^③ | 87 | W |
| P _D @ T _C = 70°C | Maximum Power Dissipation ^③ | 61 | W |
| | Linear Derating Factor | 0.59 | mW/°C |
| T _J , T _{STG} | Junction and Storage Temperature Range | -55 to + 175 | °C |

Thermal Resistance

| | Parameter | Typ. | Max. | Units |
|------------------|--|------|------|-------|
| R _{θJC} | Junction-to-Case | — | 1.73 | °C/W |
| R _{θCS} | Case-to-Sink, Flat, Greased Surface ^④ | 0.50 | — | |
| R _{θJA} | Junction-to-Ambient ^④ | — | 62 | |
| R _{θJA} | Junction-to-Ambient (PCB mount)* | — | 40 | |

* When mounted on 1" square PCB (FR-4 or G-10 Material) .
 For recommended footprint and soldering techniques refer to application note #AN-994

Notes ① through ④ are on page 10

IRF3704/S/LPbF

International
IR Rectifier

Static @ T_J = 25°C (unless otherwise specified)

| | Parameter | Min. | Typ. | Max. | Units | Conditions |
|--|--------------------------------------|------|-------|------|-------|---|
| V _{(BR)DSS} | Drain-to-Source Breakdown Voltage | 20 | — | — | V | V _{GS} = 0V, I _D = 250μA |
| ΔV _{(BR)DSS} /ΔT _J | Breakdown Voltage Temp. Coefficient | — | 0.021 | — | V/°C | Reference to 25°C, I _D = 1mA |
| R _{DS(on)} | Static Drain-to-Source On-Resistance | — | 6.3 | 9.0 | mΩ | V _{GS} = 10V, I _D = 15A ③ |
| | | — | 9.8 | 13.5 | | 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 = 250μA |
| I _{DSS} | Drain-to-Source Leakage Current | — | — | 20 | μA | V _{DS} = 16V, V _{GS} = 0V |
| | | — | — | 100 | | V _{DS} = 16V, V _{GS} = 0V, T _J = 125°C |
| I _{GSS} | Gate-to-Source Forward Leakage | — | — | 200 | nA | V _{GS} = 16V |
| | Gate-to-Source Reverse Leakage | — | — | -200 | | V _{GS} = -16V |

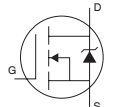
Dynamic @ T_J = 25°C (unless otherwise specified)

| Symbol | Parameter | Min. | Typ. | Max. | Units | Conditions |
|---------------------|---------------------------------|------|------|------|-------|---|
| g _{fs} | Forward Transconductance | 42 | — | — | S | V _{DS} = 10V, I _D = 57A |
| Q _g | Total Gate Charge | — | 19 | — | nC | I _D = 28.4A |
| Q _{gs} | Gate-to-Source Charge | — | 8.1 | — | | V _{DS} = 10V |
| Q _{gd} | Gate-to-Drain ("Miller") Charge | — | 6.4 | — | | V _{GS} = 4.5V ③ |
| Q _{oss} | Output Gate Charge | — | 16 | 24 | | V _{GS} = 0V, V _{DS} = 10V |
| t _{d(on)} | Turn-On Delay Time | — | 8.4 | — | ns | V _{DD} = 10V |
| t _r | Rise Time | — | 98 | — | | I _D = 28.4A |
| t _{d(off)} | Turn-Off Delay Time | — | 12 | — | | R _G = 1.8Ω |
| t _f | Fall Time | — | 5.0 | — | | V _{GS} = 4.5V ③ |
| C _{iss} | Input Capacitance | — | 1996 | — | pF | V _{GS} = 0V |
| C _{oss} | Output Capacitance | — | 1085 | — | | V _{DS} = 10V |
| C _{rss} | Reverse Transfer Capacitance | — | 155 | — | | f = 1.0MHz |

Avalanche Characteristics

| Symbol | Parameter | Typ. | Max. | Units |
|-----------------|--------------------------------|------|------|-------|
| E _{AS} | Single Pulse Avalanche Energy② | — | 216 | mJ |
| I _{AR} | Avalanche Current① | — | 71 | A |

Diode Characteristics

| Symbol | Parameter | Min. | Typ. | Max. | Units | Conditions |
|-----------------|---|------|------|------|-------|--|
| I _S | Continuous Source Current (Body Diode) | — | — | 77⑤ | A | MOSFET symbol showing the integral reverse p-n junction diode.  |
| I _{SM} | Pulsed Source Current (Body Diode) ① | — | — | 308 | | |
| V _{SD} | Diode Forward Voltage | — | 0.88 | 1.3 | V | T _J = 25°C, I _S = 35.5A, V _{GS} = 0V ③ |
| | | — | 0.82 | — | | T _J = 125°C, I _S = 35.5A, V _{GS} = 0V ③ |
| t _{rr} | Reverse Recovery Time | — | 38 | 57 | ns | T _J = 25°C, I _F = 35.5A, V _R = 20V |
| Q _{rr} | Reverse Recovery Charge | — | 45 | 68 | nC | di/dt = 100A/μs ③ |
| t _{rr} | Reverse Recovery Time | — | 41 | 62 | ns | T _J = 125°C, I _F = 35.5A, V _R = 20V |
| Q _{rr} | Reverse Recovery Charge | — | 50 | 75 | nC | di/dt = 100A/μs ③ |

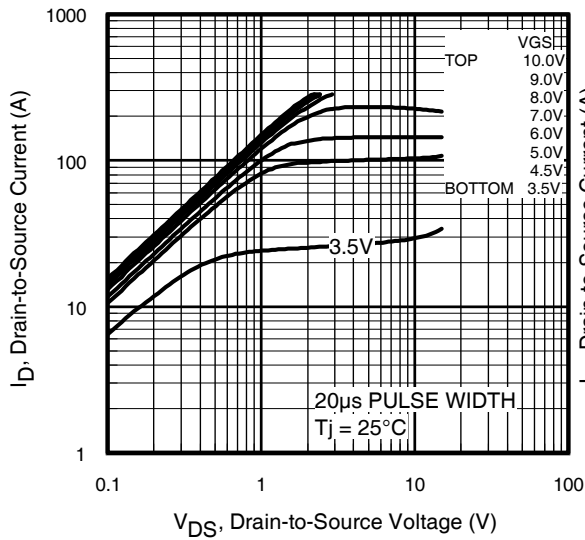


Fig 1. Typical Output Characteristics

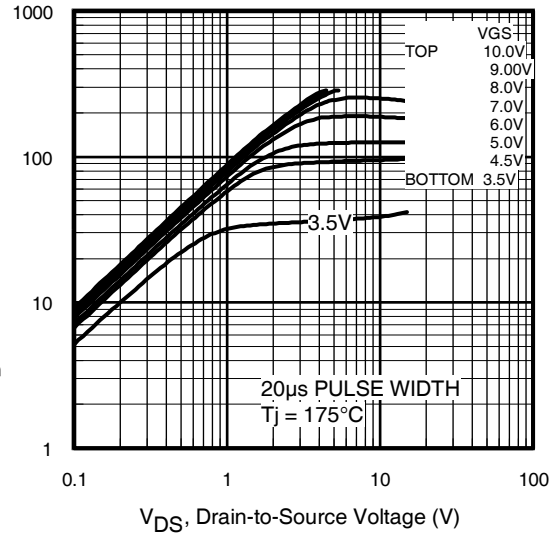


Fig 2. Typical Output Characteristics

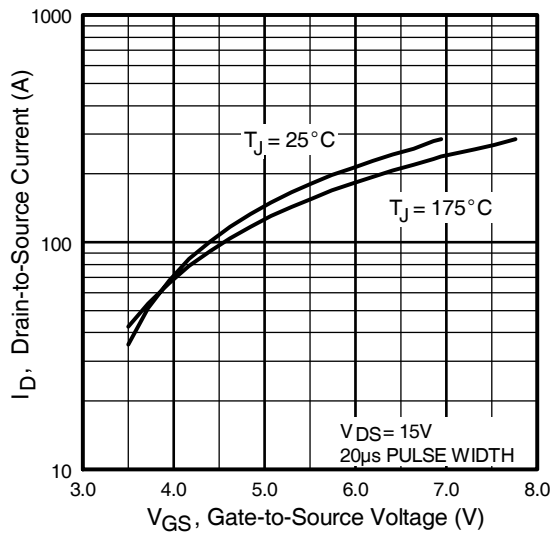


Fig 3. Typical Transfer Characteristics

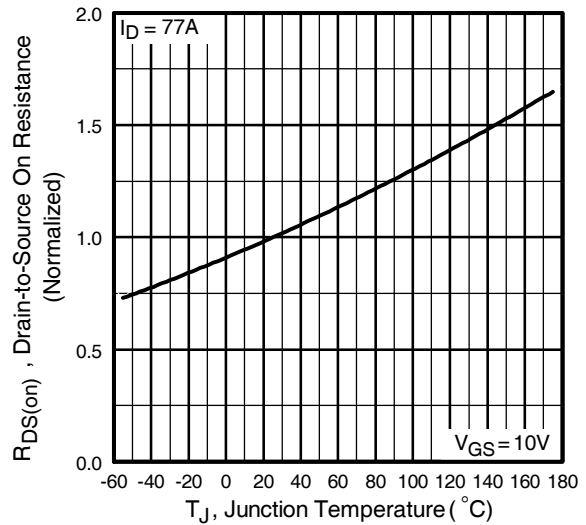


Fig 4. Normalized On-Resistance Vs. Temperature

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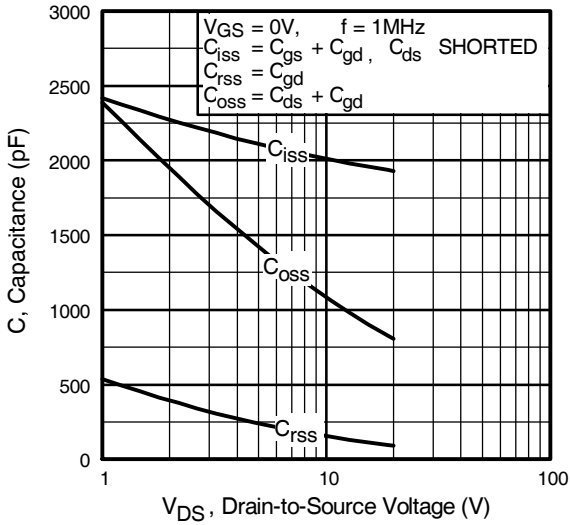


Fig 5. Typical Capacitance Vs. Drain-to-Source Voltage

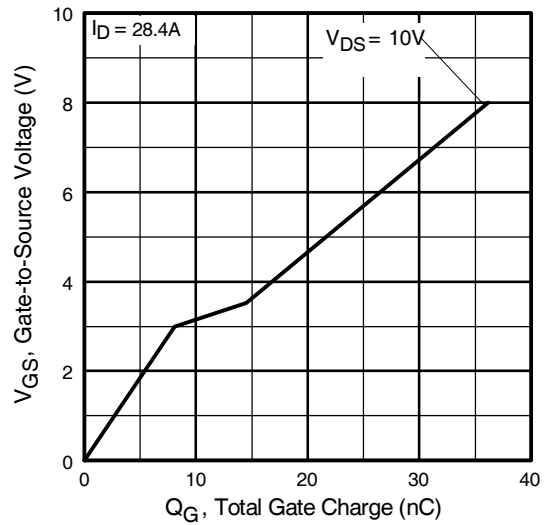


Fig 6. Typical Gate Charge Vs. Gate-to-Source Voltage

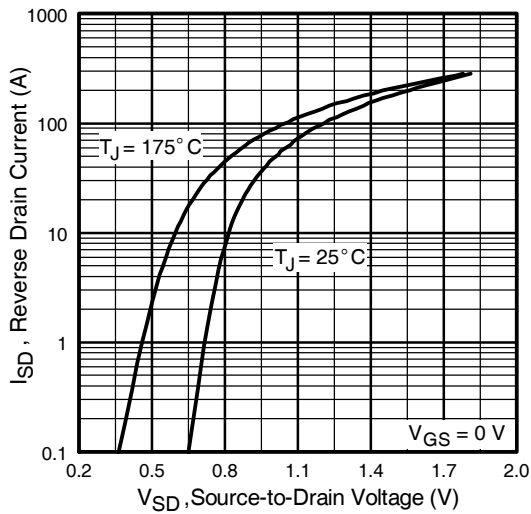


Fig 7. Typical Source-Drain Diode Forward Voltage

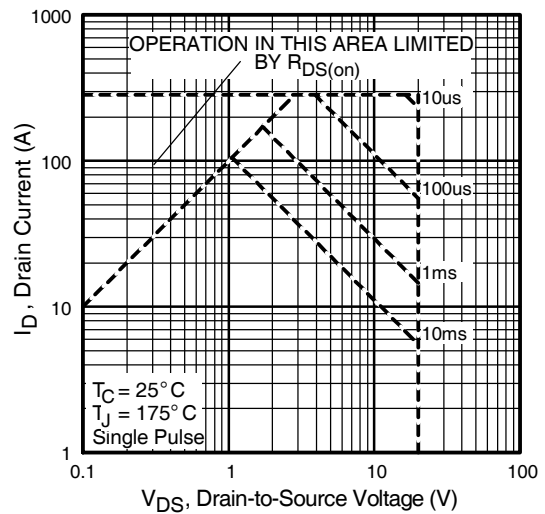


Fig 8. Maximum Safe Operating Area

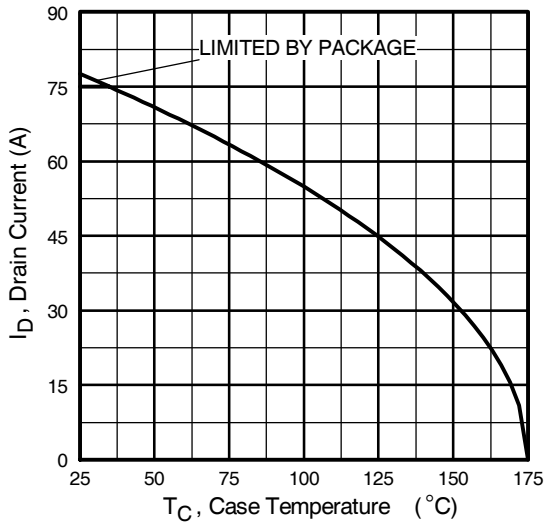


Fig 9. Maximum Drain Current Vs. Case Temperature

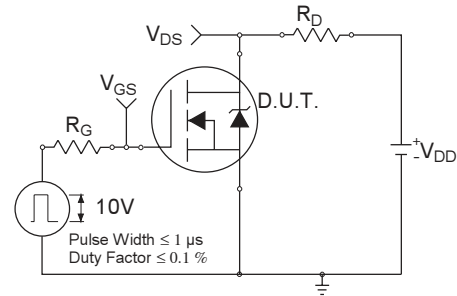


Fig 10a. Switching Time Test Circuit

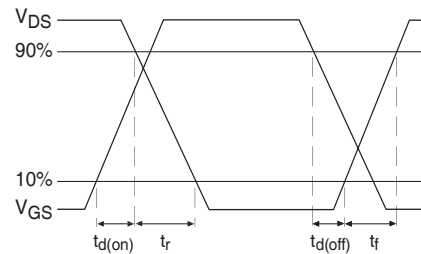


Fig 10b. Switching Time Waveforms

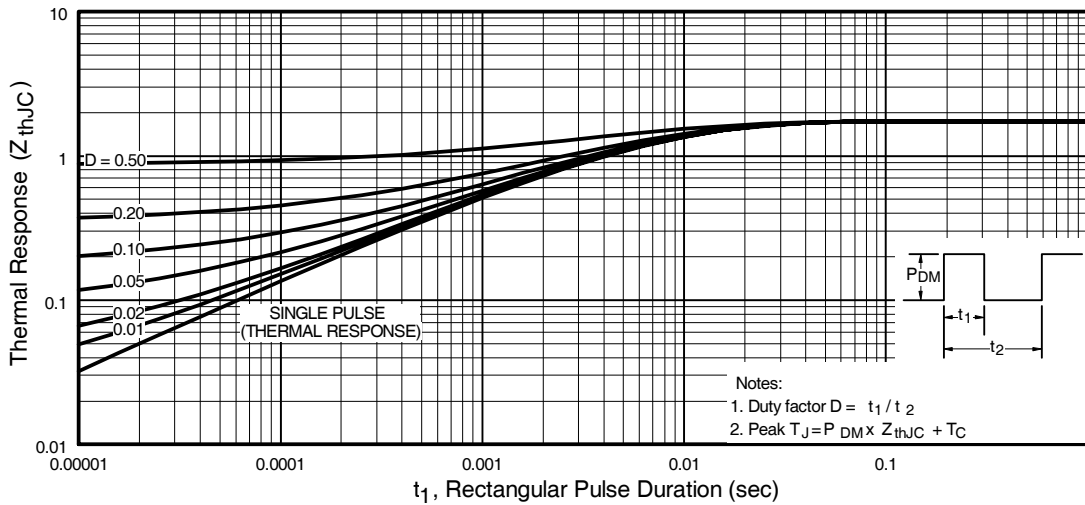


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Ambient

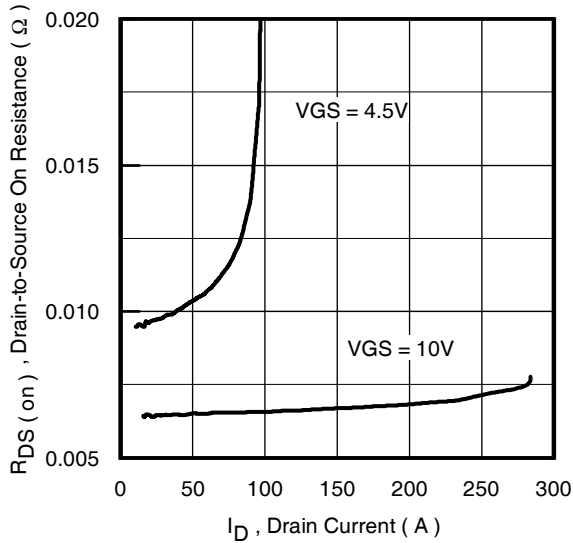


Fig 12. On-Resistance Vs. Drain Current

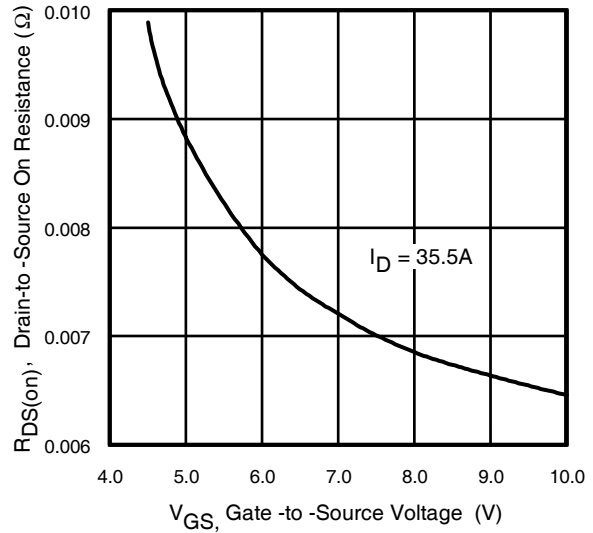


Fig 13. On-Resistance Vs. Gate Voltage

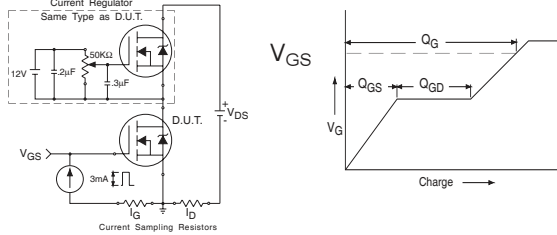


Fig 14a&b. Basic Gate Charge Test circuit and Waveforms

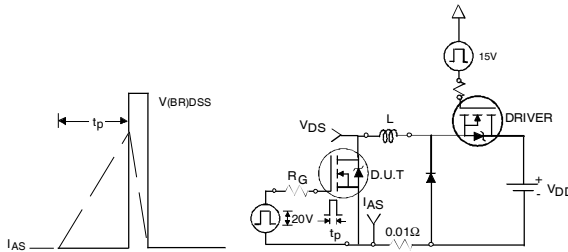


Fig 15a&b. Unclamped Inductive Test circuit and Waveforms

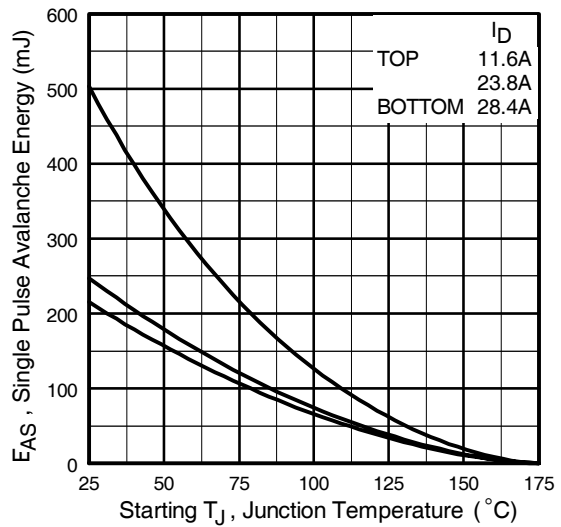
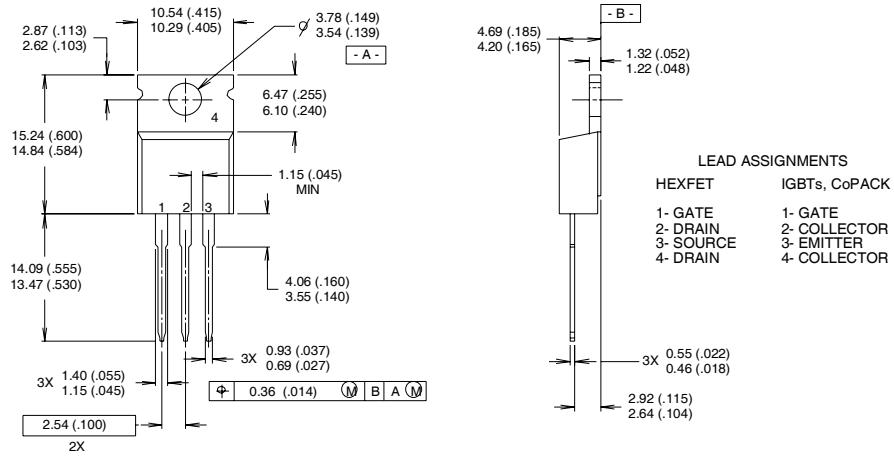


Fig 15c. Maximum Avalanche Energy Vs. Drain Current

TO-220AB Package Outline

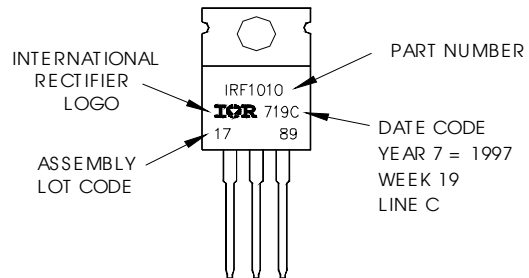
Dimensions are shown in millimeters (inches)



- 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"

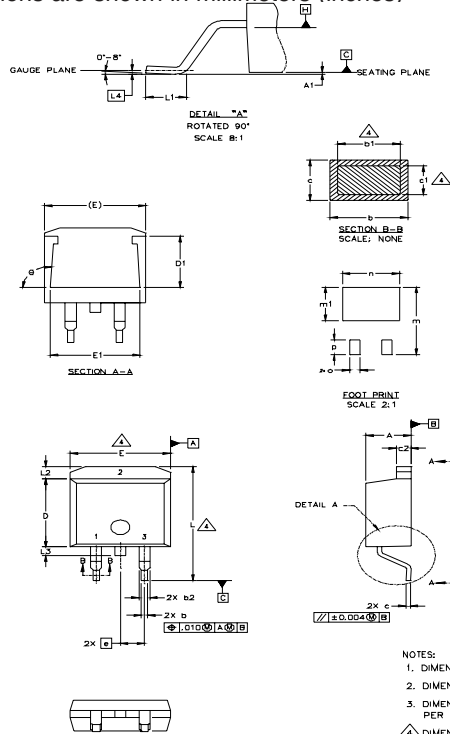


IRF3704/S/LPbF

International
IR Rectifier

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 | | |
| theta | 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.

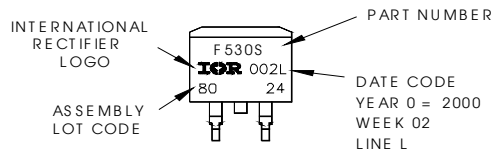
NOTES:

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 [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.

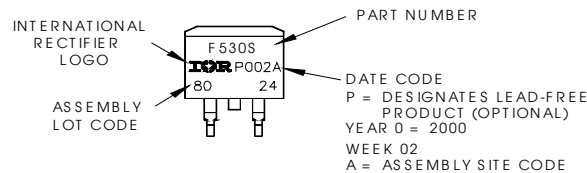
D²Pak Part Marking Information (Lead-Free)

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

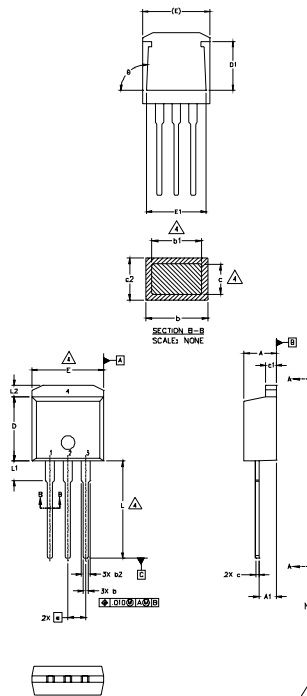
Note: "P" in assembly line position indicates "Lead-Free"



OR



TO-262 Package Outline



| SYMBOL | DIMENSIONS | | | | NOTES |
|--------|-------------|-------|----------|------|-------|
| | MILLIMETERS | | INCHES | | |
| | MIN. | MAX. | MIN. | MAX. | |
| A | 4.06 | 4.83 | .160 | .190 | |
| 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 | |

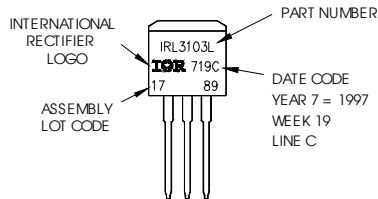
LEAD ASSIGNMENTS

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

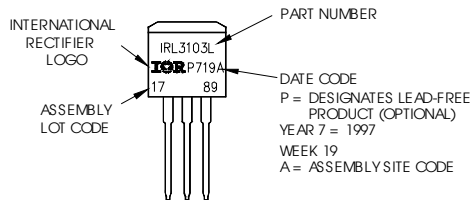
- NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M-1994
 2. DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES].
 3. DIMENSION D & E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED 0.127 [0.005"] PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTMOST EXTREMES OF THE PLASTIC BODY.
 4. DIMENSION b1 AND c1 APPLY TO BASE METAL ONLY.
 5. CONTROLLING DIMENSION: INCH.

TO-262 Part Marking Information

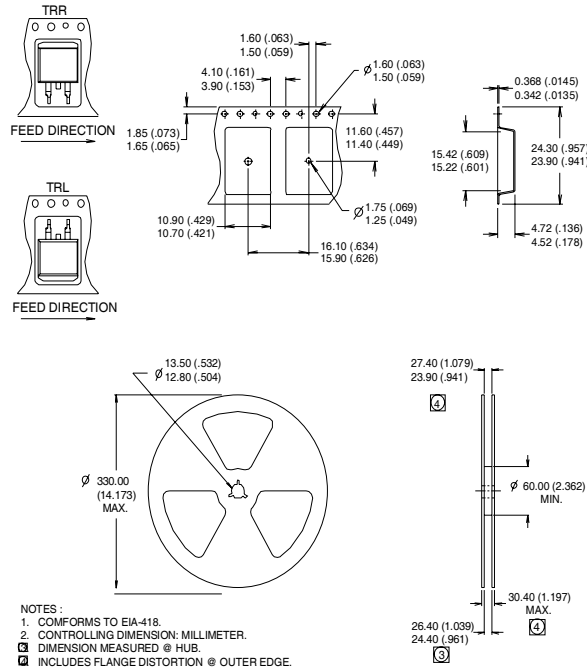
EXAMPLE: THIS IS AN IRL3103L
 LOT CODE 1789
 ASSEMBLED ON WW 19, 1997
 IN THE ASSEMBLY LINE "C"
 Note: "P" in assembly line
 position indicates "Lead-Free"



OR



D²Pak Tape & Reel Information



Notes:

- ① Repetitive rating; pulse width limited by max. junction temperature.
- ② Starting $T_J = 25^\circ\text{C}$, $L = 0.5\text{ mH}$
 $R_G = 25\Omega$, $I_{AS} = 28.4\text{ A}$.
- ③ Pulse width $\leq 300\mu\text{s}$; duty cycle $\leq 2\%$.
- ④ This is only applied to TO-220AB package
- ⑤ Calculated continuous current based on maximum allowable junction temperature. Package limitation current is 75A.

Data and specifications subject to change without notice.

International
IR Rectifier

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TAC Fax: (310) 252-7903

Visit us at www.irf.com for sales contact information.07/04

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