

HEXFET® Power MOSFET

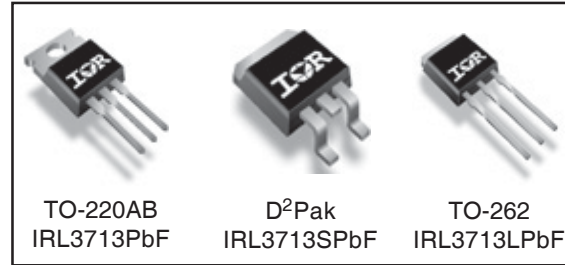
Applications

- High Frequency Isolated DC-DC Converters with Synchronous Rectification for Telecom and Industrial Use
- High Frequency Buck Converters for Computer Processor Power
- 100% R_G Tested

Benefits

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

| V _{DSS} | R _{DS(on)} max (mΩ) | I _D |
|------------------|------------------------------|-------------------|
| 30V | 3.0@V _{GS} = 10V | 260A [Ⓒ] |



| Base Part Number | Package Type | Standard Pack | | Orderable Part Number |
|------------------|--------------|---------------------|----------|-----------------------|
| | | Form | Quantity | |
| IRL3713PbF | TO-220 | Tube | 50 | IRL3713PbF |
| IRL3713SLPbF | TO-262 | Tube | 50 | IRL3713SLPbF |
| IRL3713SPbF | D²Pak | Tube | 50 | IRL3713SPbF |
| | | Tape and Reel Left | 800 | IRL3713STRLPbF |
| | | Tape and Reel Right | 800 | IRL3713STRRPbF |

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 | 260 [Ⓒ] | A |
| I _D @ T _C = 100°C | Continuous Drain Current, V _{GS} @ 10V | 180 [Ⓒ] | |
| I _{DM} | Pulsed Drain Current ^① | 1040 [Ⓒ] | |
| P _D @ T _C = 25°C | Maximum Power Dissipation | 330 | W |
| P _D @ T _C = 100°C | Maximum Power Dissipation | 170 | |
| | Linear Derating Factor | 2.2 | W/°C |
| T _J , T _{STG} | Junction and Storage Temperature Range | -55 to +175 | °C |

Thermal Resistance

| Symbol | Parameter | Typ | Max | Units |
|------------------|--|------|-------|-------|
| R _{θJC} | Junction-to-Case ^② | — | 0.45* | °C/W |
| R _{θCS} | Case-to-Sink, Flat, Greased Surface ^④ | 0.50 | — | |
| R _{θJA} | Junction-to-Ambient ^{④⑦} | — | 62 | |
| R _{θJA} | Junction-to-Ambient (PCB Mount) ^{⑤⑦} | — | 40 | |

* R_{θJC} (end of life) for D²Pak and TO-262 = 0.50°C/W. This is the maximum measured value after 1000 temperature cycles from -55 to 150°C and is accounted for by the physical wearout of the die attach medium.

Notes ^① through ^⑦ are on page 11

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

| Symbol | Parameter | Min | Typ | Max | Units | Conditions |
|--|--------------------------------------|-----|-------|------|-------|---|
| V _{(BR)DSS} | Drain-to-Source Breakdown Voltage | 30 | — | — | V | V _{GS} = 0V, I _D = 250μA |
| ΔV _{(BR)DSS} /ΔT _J | Breakdown Voltage Temp. Coefficient | — | 0.027 | — | V/°C | Reference to 25°C, I _D = 1mA |
| R _{DS(on)} | Static Drain-to-Source On-Resistance | — | 2.6 | 3.0 | mΩ | V _{GS} = 10V, I _D = 38A ③ |
| | | — | 3.3 | 4.0 | | V _{GS} = 4.5V, I _D = 30A ③ |
| V _{GS(th)} | Gate Threshold Voltage | 1.0 | — | 2.5 | V | V _{DS} = V _{GS} , I _D = 250μA |
| I _{DSS} | Drain-to-Source Leakage Current | — | — | 50 | μA | V _{DS} = 30V, V _{GS} = 0V |
| | | — | — | 20 | | V _{DS} = 24V, V _{GS} = 0V |
| | | — | — | 100 | | V _{DS} = 24V, V _{GS} = 0V, T _J = 125°C |
| I _{GSS} | Gate-to-Source Forward Leakage | — | — | 200 | nA | V _{GS} = 20V |
| | Gate-to-Source Reverse Leakage | — | — | -200 | | V _{GS} = -20V |

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

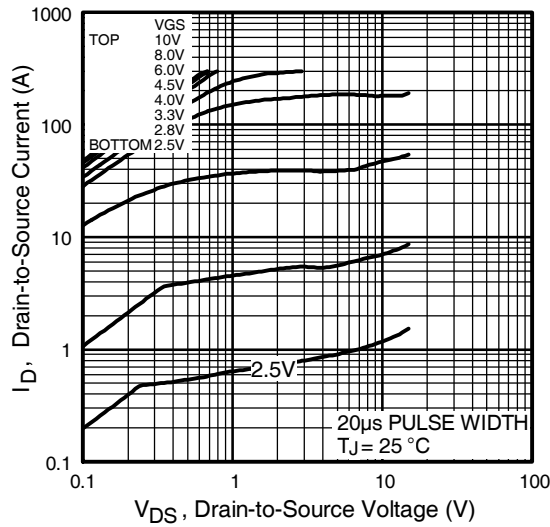
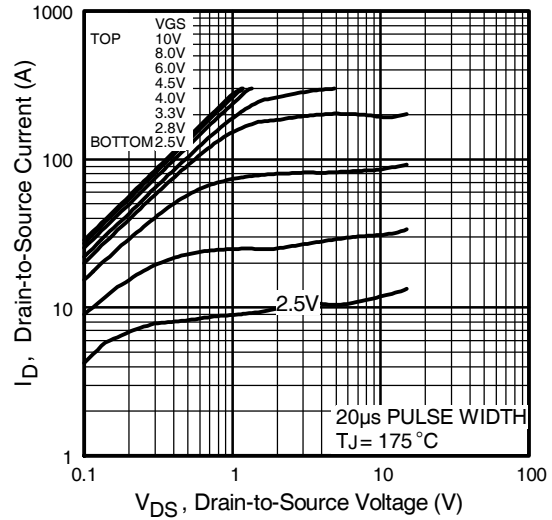
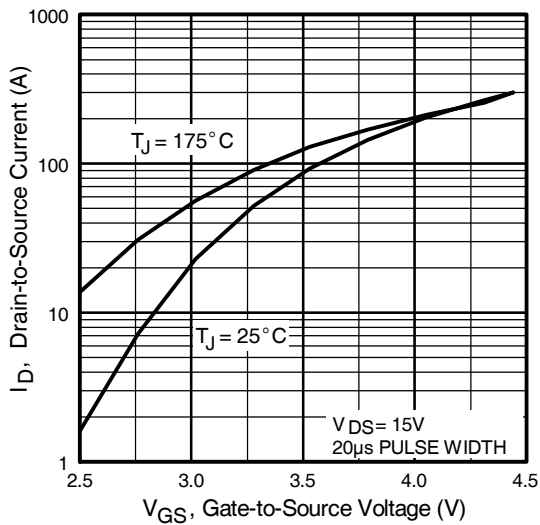
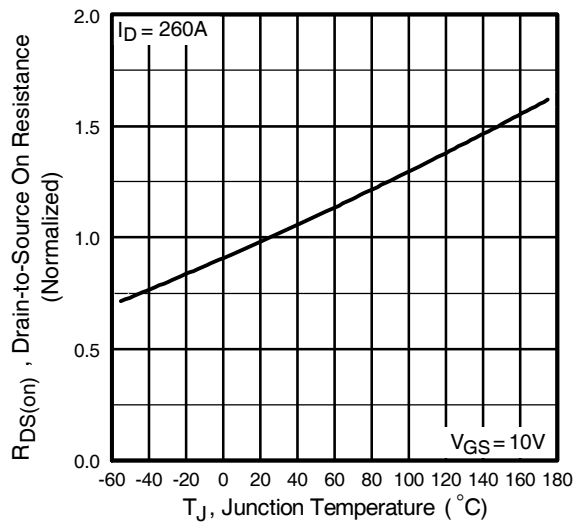
| Symbol | Parameter | Min | Typ | Max | Units | Conditions |
|---------------------|---------------------------------|-----|------|-----|-------|--|
| g _{fs} | Forward Transconductance | 76 | — | — | S | V _{DS} = 15V, I _D = 30A |
| Q _g | Total Gate Charge | — | 75 | 110 | nC | I _D = 30A V _{DS} = 15V V _{GS} = 4.5V ④ |
| Q _{gs} | Gate-to-Source Charge | — | 24 | — | | |
| Q _{gd} | Gate-to-Drain ("Miller") Charge | — | 37 | — | | |
| Q _{OSS} | Output Gate Charge | — | 61 | 92 | | |
| R _G | Gate Resistance | 0.5 | — | 3.4 | Ω | |
| t _{d(on)} | Turn-On Delay Time | — | 16 | — | ns | V _{DD} = 15V I _D = 30A R _G = 1.8Ω V _{GS} = 4.5V ③ |
| t _r | Rise Time | — | 160 | — | | |
| t _{d(off)} | Turn-Off Delay Time | — | 40 | — | | |
| t _f | Fall Time | — | 57 | — | | |
| C _{iss} | Input Capacitance | — | 5890 | — | pF | V _{GS} = 0V V _{DS} = 15V f = 1.0MHz |
| C _{OSS} | Output Capacitance | — | 3130 | — | | |
| C _{rss} | Reverse Transfer Capacitance | — | 630 | — | | |

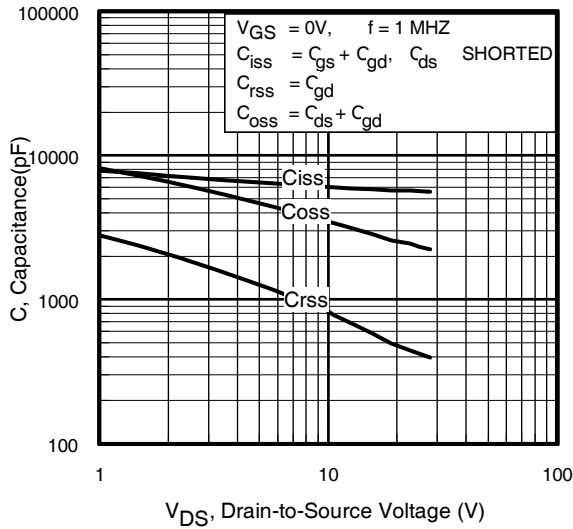
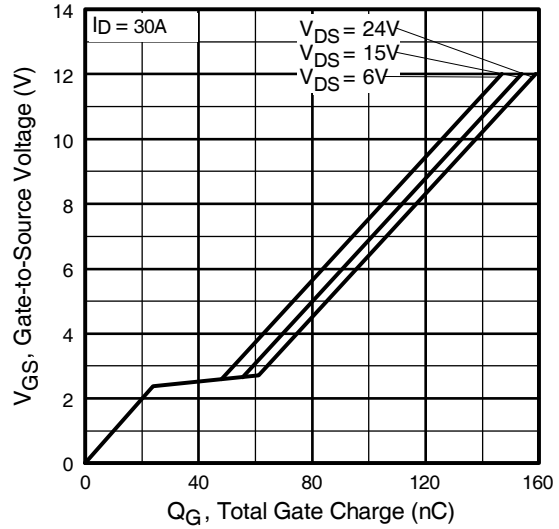
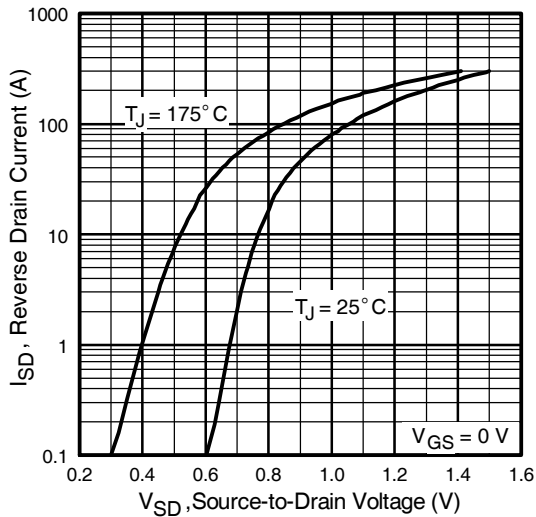
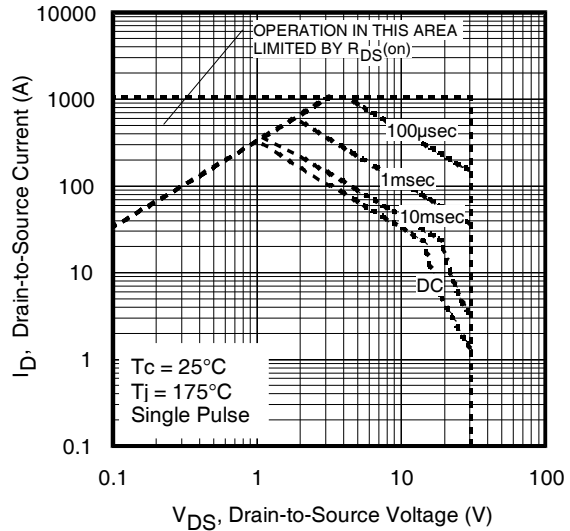
Avalanche Characteristics

| Symbol | Parameter | Typ | Max | Units |
|-----------------|---------------------------------|-----|------|-------|
| E _{AS} | Single Pulse Avalanche Energy ② | — | 1530 | mJ |
| I _{AR} | Avalanche Current ① | — | 46 | A |

Diode Characteristics

| Symbol | Parameter | Min | Typ | Max | Units | Conditions |
|-----------------|---|-----|------|--------|-------|---|
| I _S | Continuous Source Current (Body Diode) | — | — | 260 ⑥ | A | MOSFET symbol showing the integral reverse p-n junction diode. |
| I _{SM} | Pulsed Source Current (Body Diode) ①⑥ | — | — | 1040 ⑥ | | |
| V _{SD} | Diode Forward Voltage | — | 0.80 | 1.3 | V | T _J = 25°C, I _S = 30A, V _{GS} = 0V ③ |
| | | — | 0.68 | — | | T _J = 125°C, I _S = 30A, V _{GS} = 0V ③ |
| t _{rr} | Reverse Recovery Time | — | 75 | 110 | ns | T _J = 25°C, I _F = 30A, V _R = 0V |
| Q _{rr} | Reverse Recovery Charge | — | 140 | 210 | nC | di/dt = 100A/μs ③ |
| t _{rr} | Reverse Recovery Time | — | 78 | 120 | ns | T _J = 125°C, I _F = 30A, V _R = 20V |
| Q _{rr} | Reverse Recovery Charge | — | 160 | 240 | 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


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

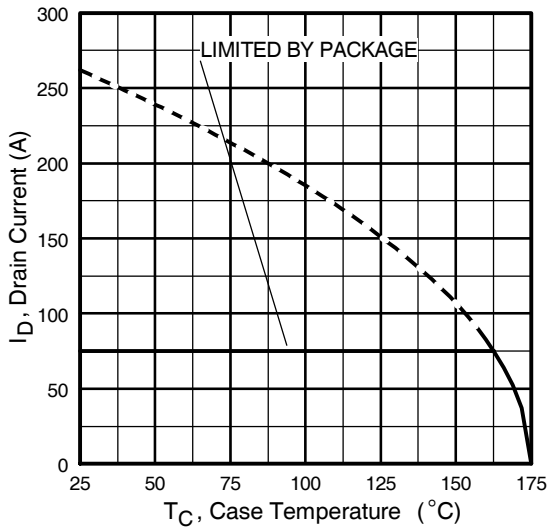


Fig 9. Maximum Drain Current Vs. Case Temperature

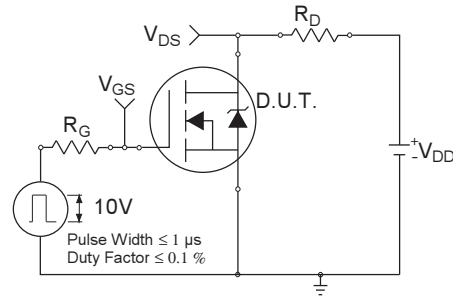


Fig 10a. Switching Time Test Circuit

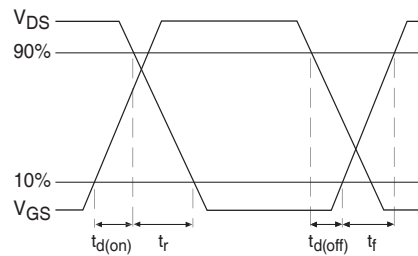


Fig 10b. Switching Time Waveforms

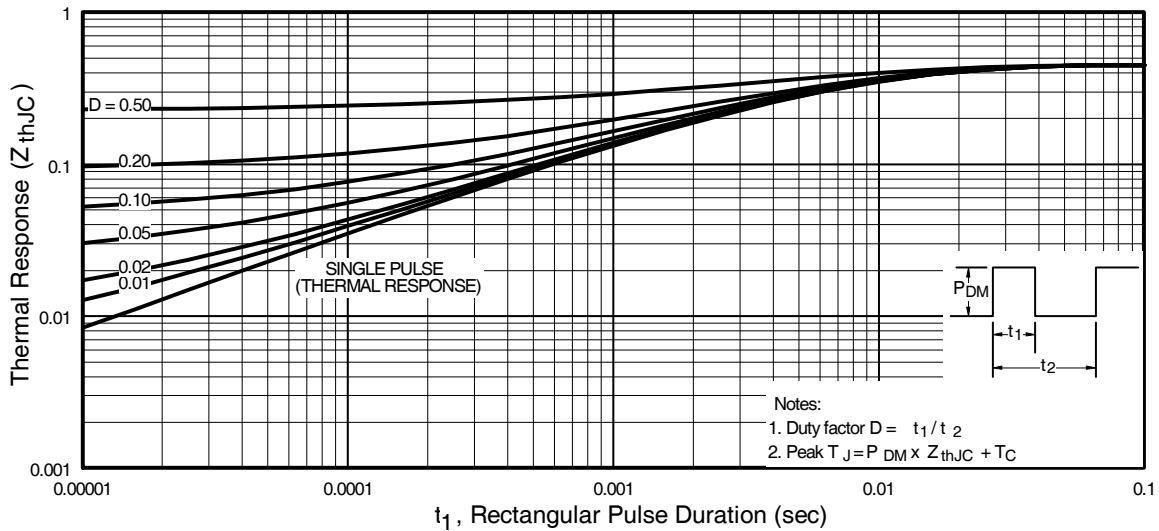
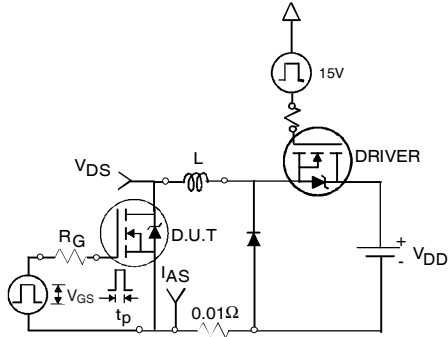
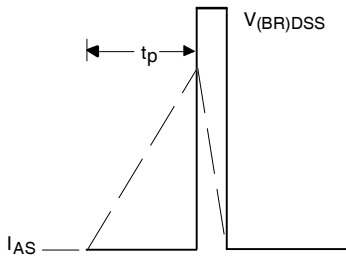
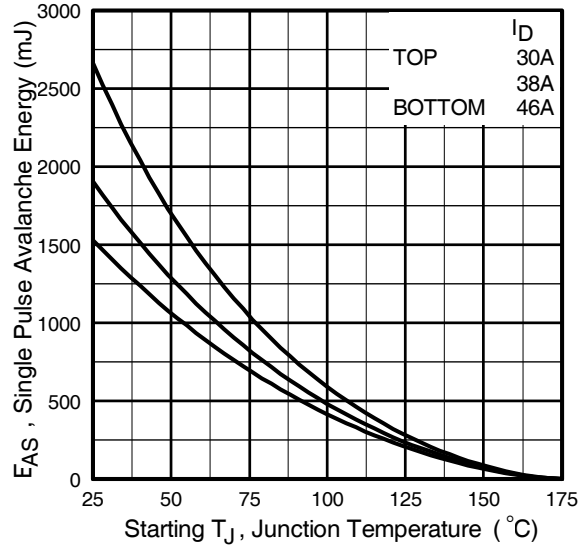
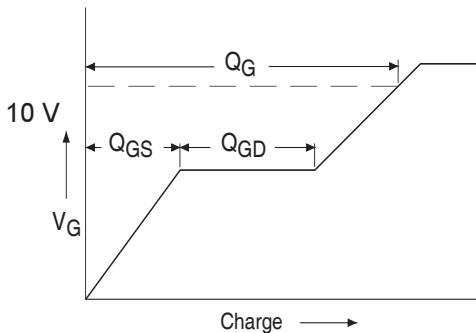
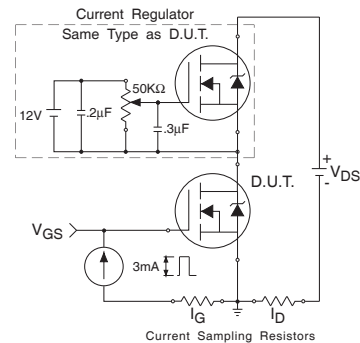
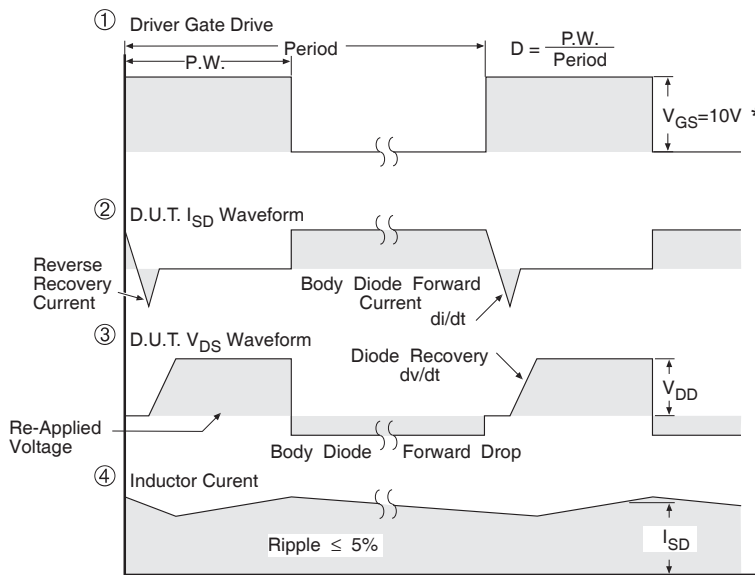
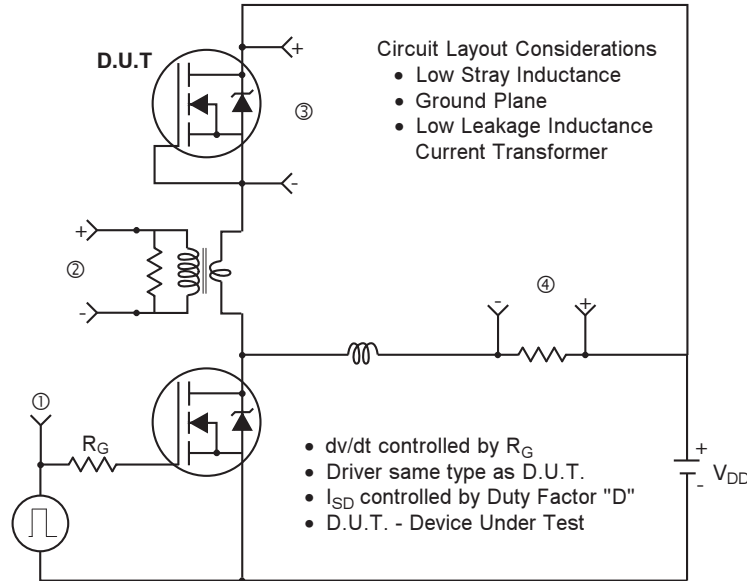


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Case


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


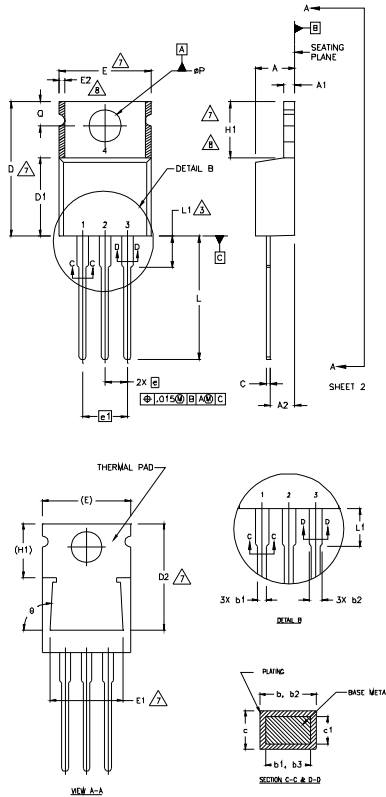
* $V_{GS} = 5V$ for Logic Level Devices

Fig 14. For N-Channel HEXFET® Power MOSFETs



TO-220AB Package Outline

Dimensions are shown in millimeters (inches)



- NOTES:
- 1 DIMENSIONING AND TOLERANCING PER ASME Y14.5 M- 1994.
 - 2 DIMENSIONS ARE SHOWN IN INCHES (MILLIMETERS).
 - 3 LEAD DIMENSION AND FINISH UNCONTROLLED IN L1.
 - 4 DIMENSION D & E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED .005" (0.127) PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY.
 - 5 DIMENSION b1 & c1 APPLY TO BASE METAL ONLY.
 - 6 CONTROLLING DIMENSION : INCHES.
 - 7 THERMAL PAD CONTOUR OPTIONAL WITHIN DIMENSIONS E,H1,D2 & E1
 - 8 DIMENSION E2 X H1 DEFINE A ZONE WHERE STAMPING AND SINGULATION IRREGULARITIES ARE ALLOWED.

LEAD ASSIGNMENTS

HEXLEET

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

IGBTs - CoPACK

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

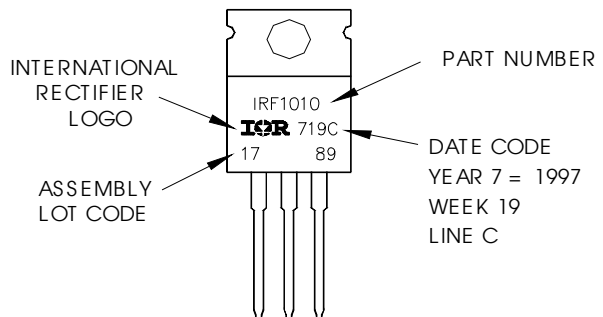
DIODES

- 1 - ANODE/OPEN
- 2 - CATHODE
- 3 - ANODE

| SYMBOL | DIMENSIONS | | | | NOTES |
|--------|-------------|-------|----------|------|-------|
| | MILLIMETERS | | INCHES | | |
| | MIN. | MAX. | MIN. | MAX. | |
| A | 3.56 | 4.82 | .140 | .190 | |
| A1 | 0.51 | 1.40 | .020 | .055 | |
| A2 | 2.04 | 2.92 | .080 | .115 | |
| b | 0.38 | 1.01 | .015 | .040 | |
| b1 | 0.38 | 0.96 | .015 | .038 | 5 |
| b2 | 1.15 | 1.77 | .045 | .070 | |
| b3 | 1.15 | 1.73 | .045 | .068 | |
| c | 0.36 | 0.61 | .014 | .024 | |
| c1 | 0.36 | 0.56 | .014 | .022 | 5 |
| D | 14.22 | 16.51 | .560 | .650 | 4 |
| D1 | 8.38 | 9.02 | .330 | .355 | |
| D2 | 12.19 | 12.88 | .480 | .507 | 7 |
| E | 9.66 | 10.66 | .380 | .420 | 4,7 |
| E1 | 8.38 | 8.89 | .330 | .350 | 7 |
| e | 2.54 BSC | | .100 BSC | | |
| e1 | 5.08 | | .200 BSC | | |
| H1 | 5.85 | 6.55 | .230 | .270 | 7,8 |
| L | 12.70 | 14.73 | .500 | .580 | |
| L1 | - | 6.35 | - | .250 | 3 |
| ØP | 3.54 | 4.08 | .139 | .161 | |
| Q | 2.54 | 3.42 | .100 | .135 | |
| Ø | 90°-93° | | 90°-93° | | |

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"

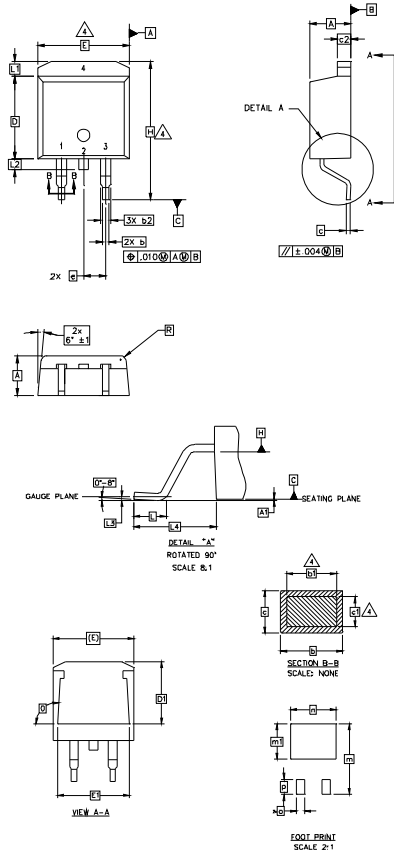


Note: For the most current drawing please refer to IR website at <http://www.irf.com/package/>



D²Pak Package Outline

Dimensions are shown in millimeters (inches)



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.

| SYMBOL | DIMENSIONS | | | | NOTES |
|--------|-------------|-------|--------|------|-------|
| | MILLIMETERS | | INCHES | | |
| | MIN. | MAX. | MIN. | MAX. | |
| A | 4.06 | 4.83 | .160 | .190 | |
| A1 | 0.00 | 0.254 | .000 | .010 | |
| b | 0.51 | 0.99 | .020 | .039 | |
| b1 | 0.51 | 0.89 | .020 | .035 | 4 |
| b2 | 1.14 | 1.78 | .045 | .070 | |
| c | 0.38 | 0.74 | .015 | .029 | |
| c1 | 0.38 | 0.58 | .015 | .023 | 4 |
| c2 | 1.14 | 1.65 | .045 | .065 | |
| D | 8.51 | 9.65 | .335 | .380 | 3 |
| D1 | 6.86 | | .270 | | |
| E | 9.65 | 10.67 | .380 | .420 | 3 |
| E1 | 6.22 | | .245 | | |
| e | 2.54 | BSC | .100 | BSC | |
| H | 14.61 | 15.88 | .575 | .625 | |
| L | 1.78 | 2.79 | .070 | .110 | |
| L1 | | 1.65 | | .065 | |
| L2 | 1.27 | 1.78 | .050 | .070 | |
| L3 | 0.25 | BSC | .010 | BSC | |
| L4 | 4.78 | 5.28 | .188 | .208 | |
| m | 17.78 | | .700 | | |
| m1 | 8.89 | | .350 | | |
| n | 11.43 | | .450 | | |
| o | 2.08 | | .082 | | |
| p | 3.81 | | .150 | | |
| R | 0.51 | 0.71 | .020 | .028 | |
| θ | 90° | 93° | 90° | 93° | |

LEAD ASSIGNMENTS

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

IGBTs, CoPACK

- 1.- GATE
 2, 4.- COLLECTOR
 3.- EMITTER

DIODES

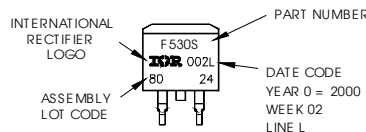
- 1.- ANODE *
 2, 4.- CATHODE
 3.- ANODE

* PART DEPENDENT.

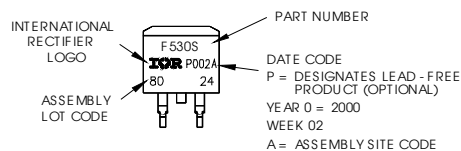
D²Pak Part Marking Information

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

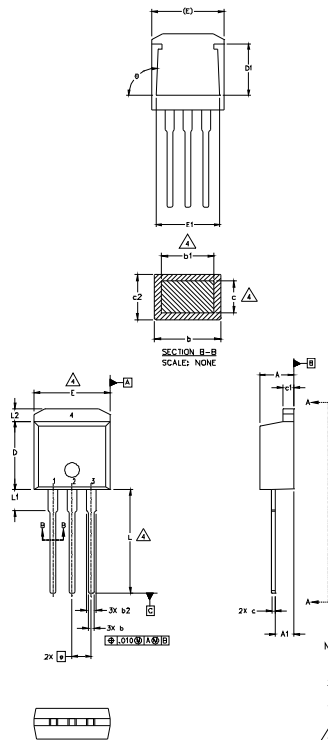


Note: For the most current drawing please refer to IR website at <http://www.irf.com/package/>



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 | |

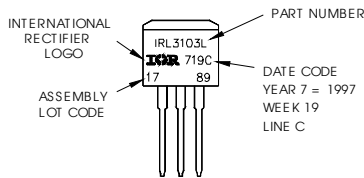
LEAD ASSIGNMENTS

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

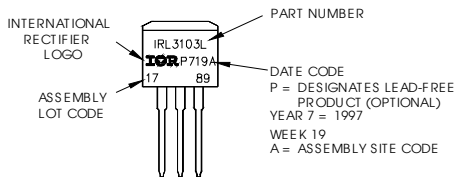
- NOTES:
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 4. DIMENSION b1 AND c1 APPLY TO BASE METAL ONLY.
 5. CONTROLLING DIMENSION: INCH.

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"



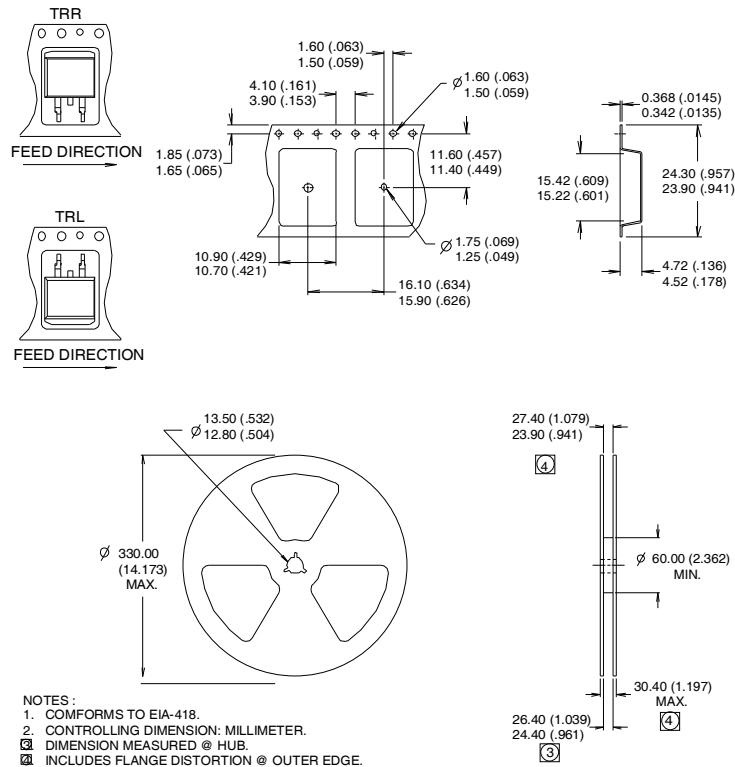
OR



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

D²Pak Tape & Reel Information

Dimensions are shown in millimeters (inches)



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

Notes:

- ① Repetitive rating; pulse width limited by max. junction temperature.
- ② Starting $T_J = 25^\circ\text{C}$, $L = 1.4\text{mH}$, $R_G = 25\Omega$, $I_{AS} = 46\text{A}$, $V_{GS} = 10\text{V}$.
- ③ Pulse width $\leq 400\mu\text{s}$; duty cycle $\leq 2\%$.
- ④ This is only applied to TO-220A 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.
- ⑦ R_{θ} is measured at T_J approximately 90°C .

Qualification information[†]

| | | |
|----------------------------|--|---|
| Qualification level | Industrial (per JEDEC JESD47F ^{††} guidelines) | |
| Moisture Sensitivity Level | TO-220 PAK | N/A |
| | TO-262 PAK | |
| | D2-PAK | MSL1 (per JEDEC J-STD-020D ^{††}) |
| RoHS compliant | Yes | |

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

^{††} Applicable version of JEDEC standard at the time of product release

Revision History

| Date | Comments |
|-----------|---|
| 6/17/2013 | <ul style="list-style-type: none"> • Updated ds with New IR Corporate Template • Updated Fig8-SOA curve with Spirito effect on page 4 |

International
 Rectifier

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