

SMPS MOSFET

IRFR3706CPbF
 IRFU3706CPbF

Applications

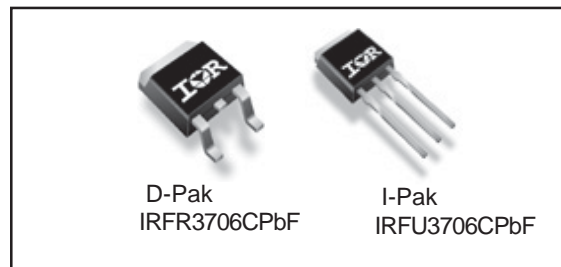
- High Frequency Isolated DC-DC Converters with Synchronous Rectification for Telecom and Industrial Use
- High Frequency Buck Converters for Computer Processor Power
- Lead-Free

HEXFET® Power MOSFET

| | | |
|------------------------|-------------------------------|------------------------|
| V_{DSS} | R_{DS(on)} max | I_D |
| 20V | 9.0mΩ | 75A^④ |

Benefits

- Ultra-Low Gate Impedance
- Very Low R_{DS(on)} at 4.5V V_{GS}
- 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 | ± 12 | V |
| I _D @ T _C = 25°C | Continuous Drain Current, V _{GS} @ 10V | 75 ^④ | A |
| I _D @ T _C = 100°C | Continuous Drain Current, V _{GS} @ 10V | 53 ^④ | |
| I _{DM} | Pulsed Drain Current ^① | 280 | |
| P _D @ T _C = 25°C | Maximum Power Dissipation ^③ | 88 | W |
| P _D @ T _C = 100°C | Maximum Power Dissipation ^③ | 44 | 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 ^⑤ | — | 1.7 | °C/W |
| R _{θJA} | Junction-to-Ambient (PCB mount)* ^⑤ | — | 50 | |
| R _{θJA} | Junction-to-Ambient ^⑤ | — | 110 | |

* 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 ⑤ are on page 10

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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 | — | 6.9 | 9.0 | mΩ | V _{GS} = 10V, I _D = 15A ③ |
| | | — | 8.1 | 11 | | V _{GS} = 4.5V, I _D = 12A ③ |
| | | — | 11.5 | 23 | | V _{GS} = 2.8V, I _D = 7.5A ③ |
| V _{GS(th)} | Gate Threshold Voltage | 0.6 | — | 2.0 | 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} = 12V |
| | Gate-to-Source Reverse Leakage | — | — | -200 | | V _{GS} = -12V |

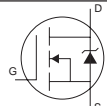
Dynamic @ T_J = 25°C (unless otherwise specified)

| Symbol | Parameter | Min. | Typ. | Max. | Units | Conditions |
|---------------------|---------------------------------|------|------|------|-------|--|
| g _{fs} | Forward Transconductance | 53 | — | — | S | V _{DS} = 16V, I _D = 57A |
| Q _g | Total Gate Charge | — | 23 | 35 | nC | I _D = 28A V _{DS} = 10V V _{GS} = 4.5V ③ V _{GS} = 0V, V _{DS} = 10V |
| Q _{gs} | Gate-to-Source Charge | — | 8.0 | 12 | | |
| Q _{gd} | Gate-to-Drain ("Miller") Charge | — | 5.5 | 8.3 | | |
| Q _{oss} | Output Gate Charge | — | 16 | 24 | | |
| R _g | Gate Resistance | — | 1.8 | — | | |
| t _{d(on)} | Turn-On Delay Time | — | 6.8 | — | ns | V _{DD} = 10V I _D = 28A R _G = 1.8Ω V _{GS} = 4.5V ③ |
| t _r | Rise Time | — | 87 | — | | |
| t _{d(off)} | Turn-Off Delay Time | — | 17 | — | | |
| t _f | Fall Time | — | 4.8 | — | | |
| C _{iss} | Input Capacitance | — | 2410 | — | pF | V _{GS} = 0V V _{DS} = 10V f = 1.0MHz |
| C _{oss} | Output Capacitance | — | 1070 | — | | |
| C _{rss} | Reverse Transfer Capacitance | — | 140 | — | | |

Avalanche Characteristics

| Symbol | Parameter | Typ. | Max. | Units |
|-----------------|--------------------------------|------|------|-------|
| E _{AS} | Single Pulse Avalanche Energy② | — | 220 | mJ |
| I _{AR} | Avalanche Current① | — | 28 | A |

Diode Characteristics

| Symbol | Parameter | Min. | Typ. | Max. | Units | Conditions |
|-----------------|--|------|------|------|-------|--|
| I _S | Continuous Source Current (Body Diode) | — | — | 75④ | A | MOSFET symbol showing the integral reverse p-n junction diode.  |
| I _{SM} | Pulsed Source Current (Body Diode) ① | — | — | 280 | | |
| V _{SD} | Diode Forward Voltage | — | 0.88 | 1.3 | V | T _J = 25°C, I _S = 36A, V _{GS} = 0V ③ |
| | | — | 0.82 | — | | T _J = 125°C, I _S = 36A, V _{GS} = 0V ③ |
| t _{rr} | Reverse Recovery Time | — | 45 | 68 | ns | T _J = 25°C, I _F = 36A, V _R = 20V |
| Q _{rr} | Reverse Recovery Charge | — | 65 | 98 | nC | di/dt = 100A/μs ③ |
| t _{rr} | Reverse Recovery Time | — | 49 | 74 | ns | T _J = 125°C, I _F = 36A, V _R = 20V |
| Q _{rr} | Reverse Recovery Charge | — | 78 | 120 | nC | di/dt = 100A/μs ③ |

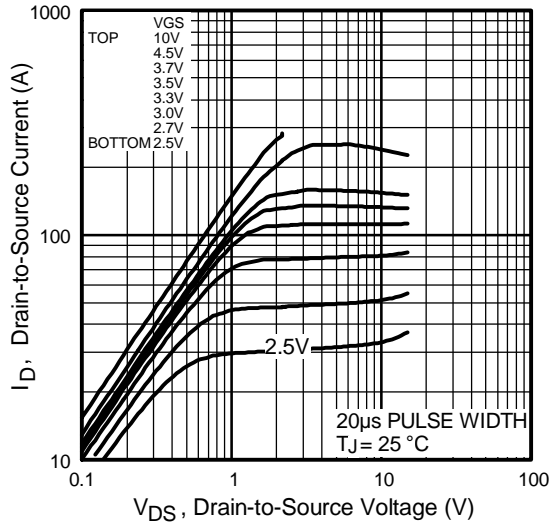


Fig 1. Typical Output Characteristics

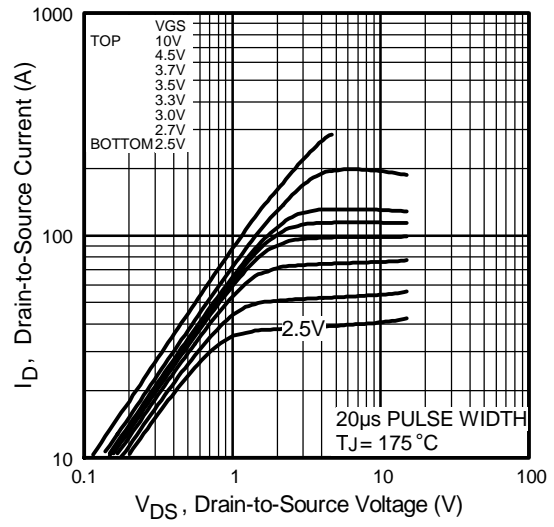


Fig 2. Typical Output Characteristics

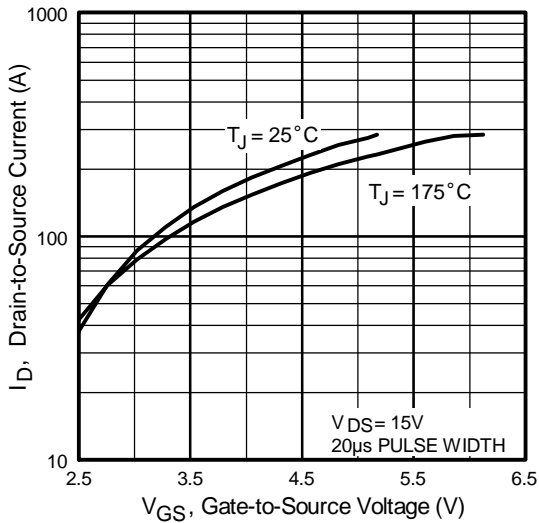


Fig 3. Typical Transfer Characteristics

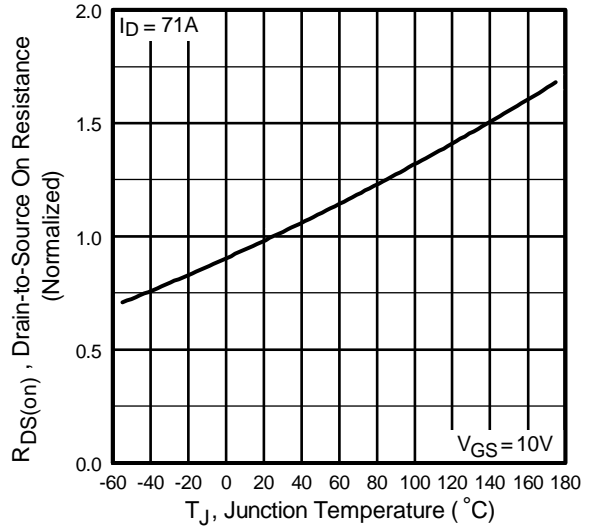


Fig 4. Normalized On-Resistance Vs. Temperature

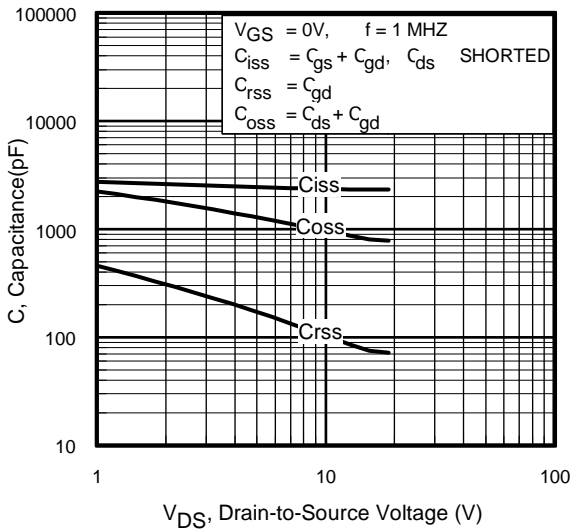


Fig 5. Typical Capacitance Vs. Drain-to-Source Voltage

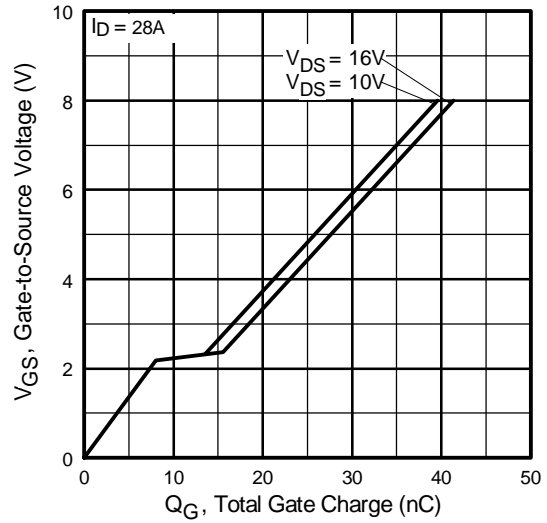


Fig 6. Typical Gate Charge Vs. Gate-to-Source Voltage

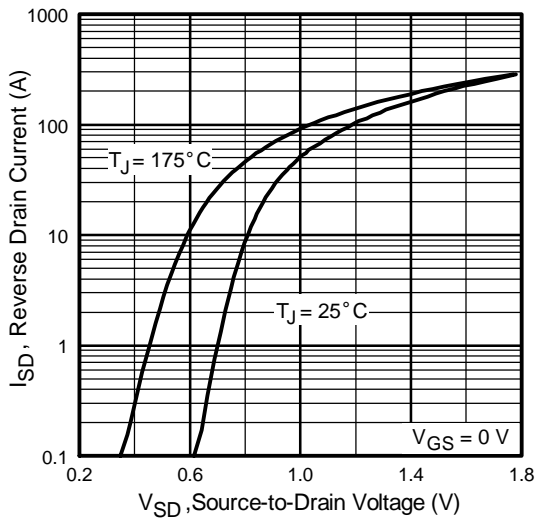


Fig 7. Typical Source-Drain Diode Forward Voltage

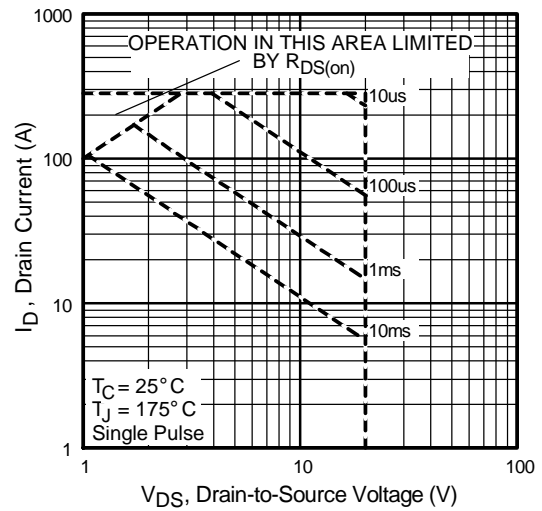


Fig 8. Maximum Safe Operating Area

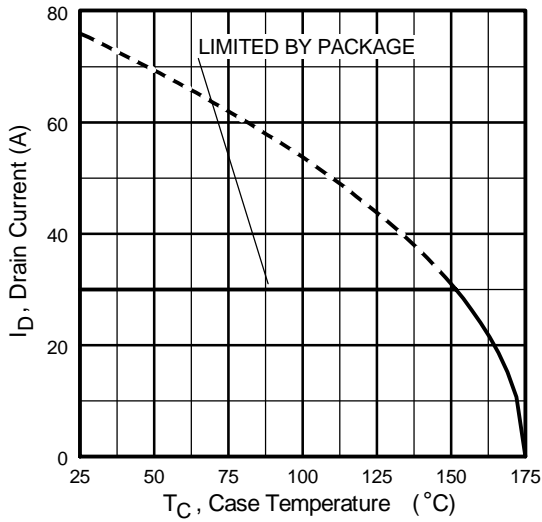


Fig 9. Maximum Drain Current Vs. Case Temperature

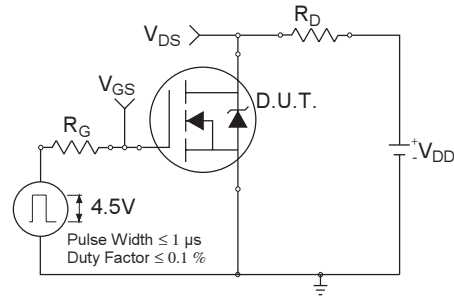


Fig 10a. Switching Time Test Circuit

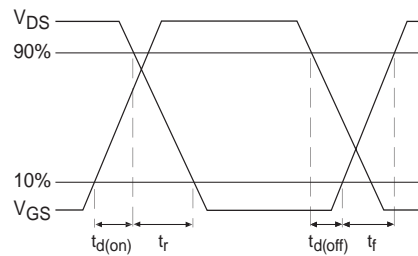


Fig 10b. Switching Time Waveforms

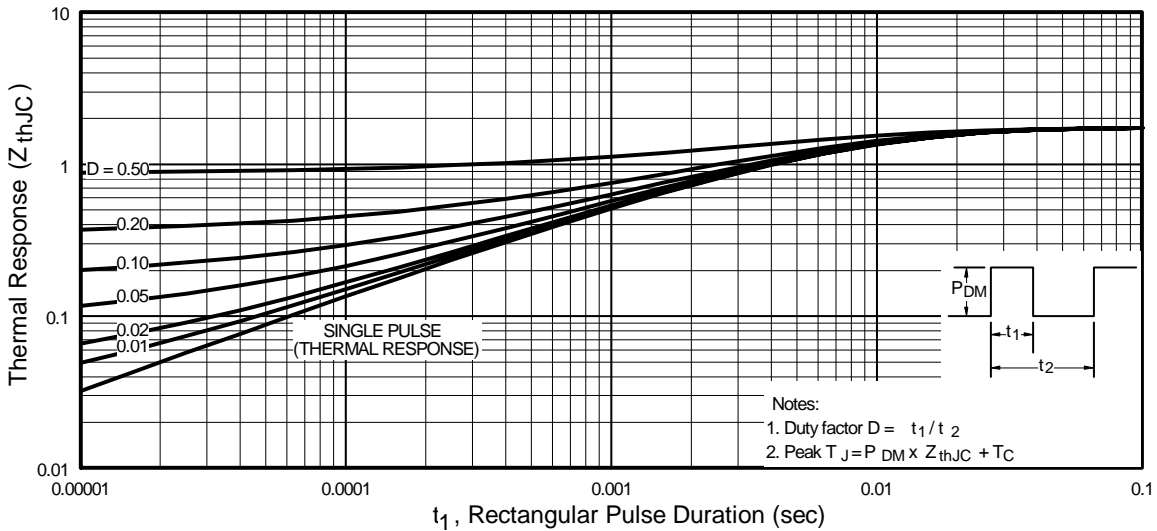


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Case

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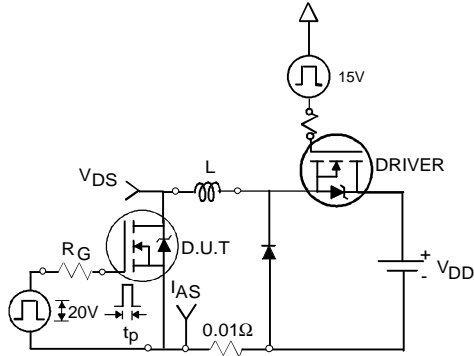


Fig 12a. Unclamped Inductive Test Circuit

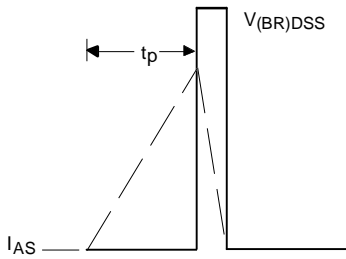


Fig 12b. Unclamped Inductive Waveforms

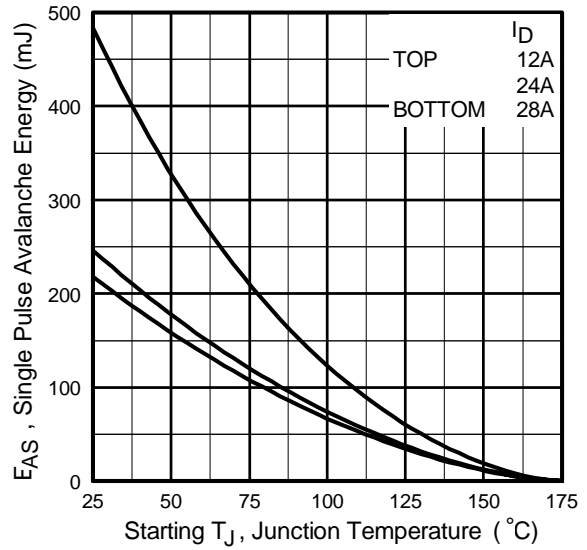


Fig 12c. Maximum Avalanche Energy Vs. Drain Current

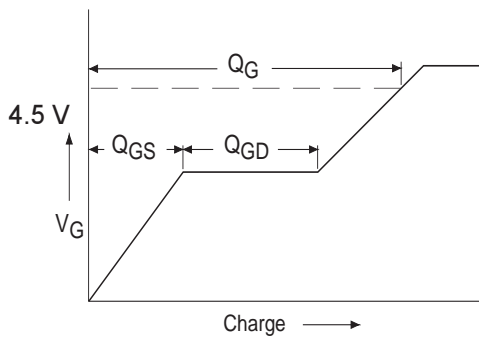


Fig 13a. Basic Gate Charge Waveform

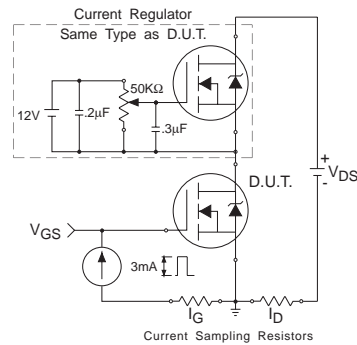
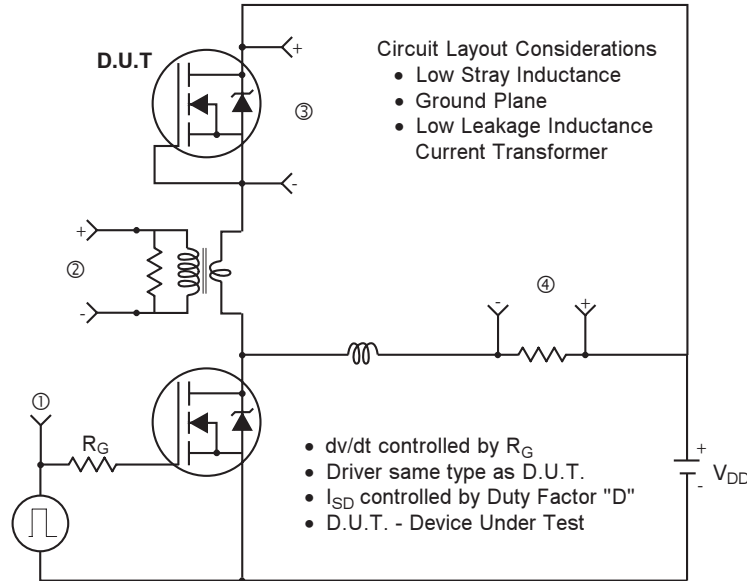


Fig 13b. Gate Charge Test Circuit

Peak Diode Recovery dv/dt Test Circuit



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

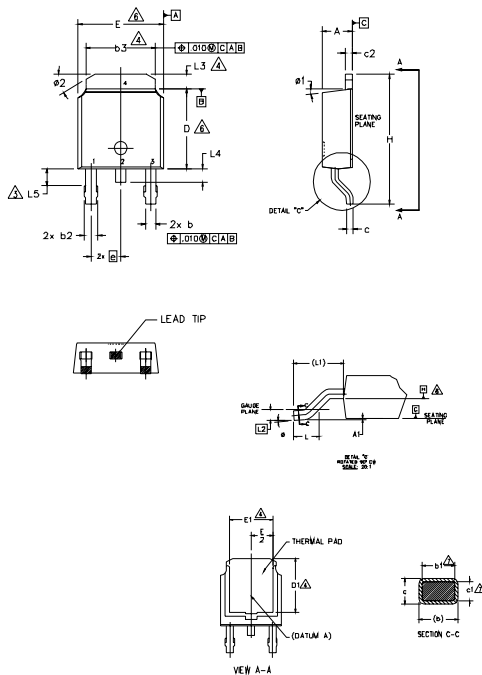
Fig 14. For N-Channel HEXFET® Power MOSFETs

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D-Pak (TO-252AA) Package Outline

Dimensions are shown in millimeters (inches)



NOTES:

- 1.- DIMENSIONING AND TOLERANCING PER ASME Y14.5M-1994
- 2.- DIMENSIONS ARE SHOWN IN INCHES [MILLIMETERS]
- 3.- LEAD DIMENSION UNCONTROLLED IN L5.
- 4.- DIMENSION D1, E1, L3 & b3 ESTABLISH A MINIMUM MOUNTING SURFACE FOR THERMAL PAD.
- 5.- SECTION C-C DIMENSIONS APPLY TO THE FLAT SECTION OF THE LEAD BETWEEN .005 AND 0.10 [0.13 AND 0.25] FROM THE LEAD TIP.
- 6.- DIMENSION D & E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED .005 [0.13] PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTMOST EXTREMES OF THE PLASTIC BODY.
- 7.- DIMENSION b1 & c1 APPLIED TO BASE METAL ONLY.
- 8.- DATUM A & B TO BE DETERMINED AT DATUM PLANE H.
- 9.- OUTLINE CONFORMS TO JEDEC OUTLINE TO-252AA.

| SYMBOL | DIMENSIONS | | | | NOTES |
|--------|-------------|-------|-----------|------|-------|
| | MILLIMETERS | | INCHES | | |
| | MIN. | MAX. | MIN. | MAX. | |
| A | 2.18 | 2.39 | .086 | .094 | |
| A1 | - | 0.13 | - | .005 | |
| b | 0.84 | 0.89 | .025 | .035 | |
| b1 | 0.65 | 0.79 | .025 | .031 | 7 |
| b2 | 0.76 | 1.14 | .030 | .045 | |
| b3 | 4.95 | 5.46 | .195 | .215 | 4 |
| c | 0.46 | 0.61 | .018 | .024 | |
| c1 | 0.41 | 0.56 | .016 | .022 | 7 |
| c2 | 0.46 | 0.89 | .018 | .035 | |
| D | 5.97 | 6.22 | .235 | .245 | 6 |
| D1 | 5.21 | - | .205 | - | 4 |
| E | 6.35 | 6.73 | .250 | .265 | 6 |
| E1 | 4.32 | - | .170 | - | 4 |
| e | 2.29 BSC | | .090 BSC | | |
| H | 9.40 | 10.41 | .370 | .410 | |
| L | 1.40 | 1.78 | .055 | .070 | |
| L1 | 2.74 BSC | | .108 REF. | | |
| L2 | 0.51 BSC | | .020 BSC | | |
| L3 | 0.89 | 1.27 | .035 | .050 | 4 |
| L4 | - | 1.02 | - | .040 | |
| L5 | 1.14 | 1.52 | .045 | .060 | 3 |
| ø1 | 0" | 10" | 0" | 10" | |
| ø2 | 0" | 15" | 0" | 15" | |
| | 25" | 35" | 25" | 35" | |

LEAD ASSIGNMENTS

HEXFET

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

IGBT & CoPAK

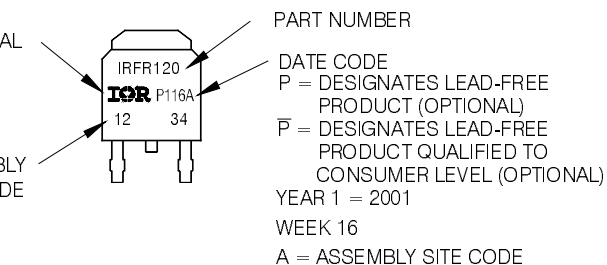
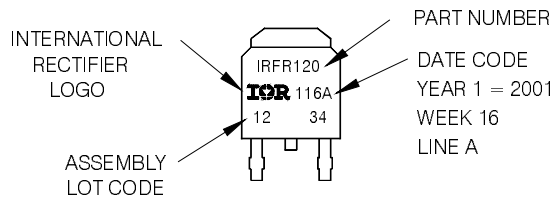
- 1.- GATE
- 2.- COLLECTOR
- 3.- EMITTER
- 4.- COLLECTOR

D-Pak (TO-252AA) Part Marking Information

EXAMPLE: THIS IS AN IRFR120
WITH ASSEMBLY
LOT CODE 1234
ASSEMBLED ON WW 16, 2001
IN THE ASSEMBLY LINE "A"

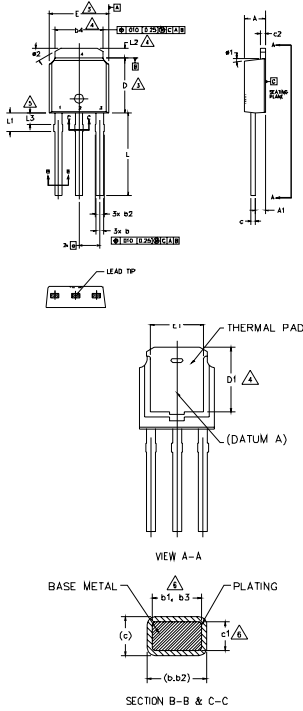
Note: "P" in assembly line position
indicates "Lead-Free"
"P" in assembly line position indicates
"Lead-Free" qualification to the Consumer-level

OR



I-Pak (TO-251AA) Package Outline

Dimensions are shown in millimeters (inches)



NOTES:

- 1.- DIMENSIONING AND TOLERANCING PER ASME Y14.5M-1994
- 2.- DIMENSION ARE SHOWN IN INCHES [MILLIMETERS]
- △ DIMENSION B & E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED .005 [0.13] PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTMOST EXTREMES OF THE PLASTIC BODY.
- △- THERMAL PAD CONTOUR OPTION WITHIN DIMENSION b4, L2, E1 & D1.
- △- LEAD DIMENSION UNCONTROLLED IN L3.
- △- DIMENSION b1, b3 & c1 APPLY TO BASE METAL ONLY.
- 7.- OUTLINE CONFORMS TO JEDEC OUTLINE TO-251AA (Date 06/02).
- 8.- CONTROLLING DIMENSION : INCHES.

| SYMBOL | DIMENSIONS | | | | NOTES |
|--------|-------------|------|----------|------|-------|
| | MILLIMETERS | | INCHES | | |
| | MIN. | MAX. | MIN. | MAX. | |
| A | 2.18 | 2.39 | .086 | .094 | |
| A1 | 0.89 | 1.14 | .035 | .045 | |
| b | 0.64 | 0.89 | .025 | .035 | |
| b1 | 0.65 | 0.79 | .025 | .031 | 6 |
| b2 | 0.76 | 1.14 | .030 | .045 | |
| b3 | 0.76 | 1.04 | .030 | .041 | 6 |
| b4 | 4.95 | 5.46 | .195 | .215 | 4 |
| c | 0.46 | 0.61 | .018 | .024 | |
| c1 | 0.41 | 0.56 | .016 | .022 | 6 |
| c2 | 0.46 | 0.89 | .018 | .035 | |
| D | 5.97 | 6.22 | .235 | .245 | 3 |
| D1 | 5.21 | - | .205 | - | 4 |
| E | 6.35 | 6.73 | .250 | .265 | 3 |
| E1 | 4.32 | - | .170 | - | 4 |
| e | 2.29 BSC | - | .090 BSC | - | |
| L | 8.89 | 9.65 | .350 | .380 | |
| L1 | 1.91 | 2.29 | .075 | .090 | |
| L2 | 0.89 | 1.27 | .035 | .050 | 4 |
| L3 | 1.14 | 1.52 | .045 | .060 | 5 |
| ø1 | 0" | 15" | 0" | 15" | |
| ø2 | 25" | 35" | 25" | 35" | |

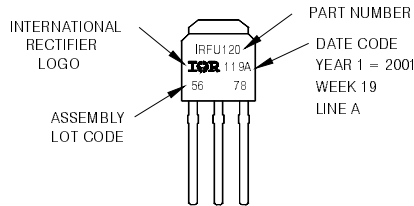
LEAD ASSIGNMENTS

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

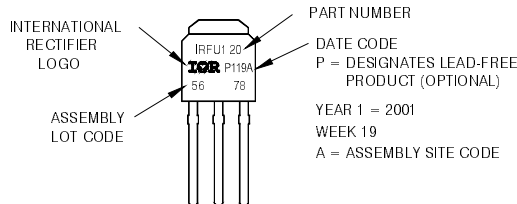
I-Pak (TO-251AA) Part Marking Information

EXAMPLE: THIS IS AN IRFU120
WITH ASSEMBLY
LOT CODE 5678
ASSEMBLED ON WW 19, 2001
IN THE ASSEMBLY LINE 'A'

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



OR

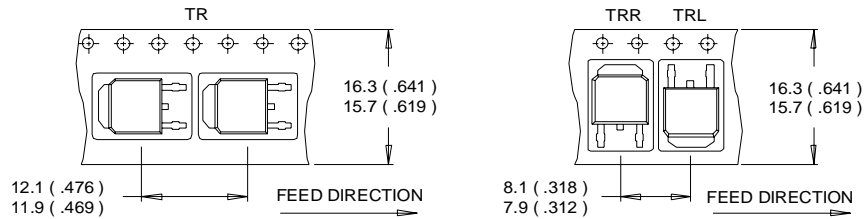


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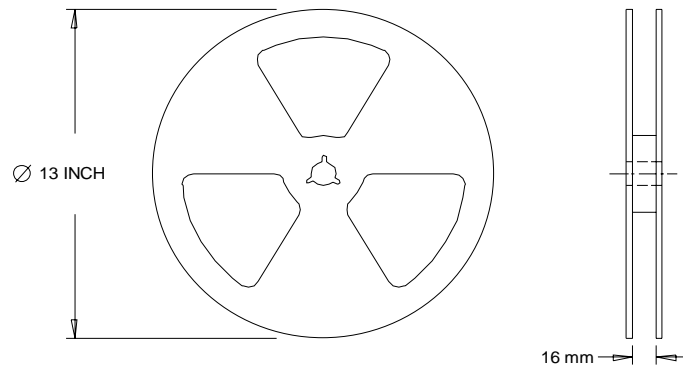
International
IR Rectifier

D-Pak (TO-252AA) Tape & Reel Information

Dimensions are shown in millimeters (inches)



- NOTES :
1. CONTROLLING DIMENSION : MILLIMETER.
 2. ALL DIMENSIONS ARE SHOWN IN MILLIMETERS (INCHES).
 3. OUTLINE CONFORMS TO EIA-481 & EIA-541.



- NOTES :
1. OUTLINE CONFORMS TO EIA-481.

Notes:

- ① Repetitive rating; pulse width limited by max. junction temperature.
- ② Starting $T_J = 25^\circ\text{C}$, $L = 0.54\text{mH}$
 $R_G = 25\Omega$, $I_{AS} = 28\text{A}$.
- ③ Pulse width $\leq 400\mu\text{s}$; duty cycle $\leq 2\%$.
- ④ Calculated continuous current based on maximum allowable junction temperature. Package limitation current is 30A.
- ⑤ R_θ is measured at T_J approximately 90°C

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

International
IR Rectifier

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TAC Fax: (310) 252-7903

Visit us at www.irf.com for sales contact information. 06/2006

www.irf.com

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