

IRF1010NSPbF IRF1010NLPbF

HEXFET® Power MOSFET

- Advanced Process Technology
- Ultra Low On-Resistance
- Dynamic dv/dt Rating
- 175°C Operating Temperature
- Fast Switching
- Fully Avalanche Rated
- Lead-Free

Description

Advanced HEXFET® Power MOSFETs from International Rectifier utilize advanced processing techniques to achieve extremely low on-resistance per silicon area. This benefit, combined with the fast switching speed and ruggedized device design that HEXFET power MOSFETs are well known for, provides the designer with an extremely efficient and reliable device for use in a wide variety of applications.

The D²Pak is a surface mount power package capable of accommodating die sizes up to HEX-4. It provides the highest power capability and the lowest possible on-resistance in any existing surface mount package. The D²Pak is suitable for high current applications because of its low internal connection resistance and can dissipate up to 2.0W in a typical surface mount application.

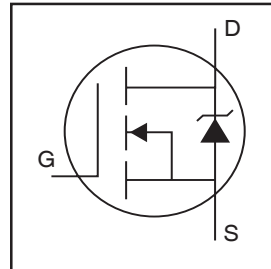
The through-hole version (IRF1010NL) is available for low-profile applications.

Absolute Maximum Ratings

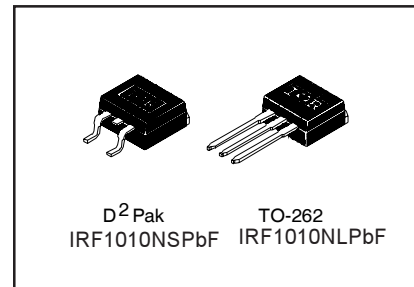
| | Parameter | Max. | Units |
|---------------------------------|---|--------------------|-------|
| $I_D @ T_C = 25^\circ\text{C}$ | Continuous Drain Current, $V_{GS} @ 10\text{V} \text{ ⑧}$ | 85 ^⑦ | A |
| $I_D @ T_C = 100^\circ\text{C}$ | Continuous Drain Current, $V_{GS} @ 10\text{V} \text{ ⑧}$ | 60 | |
| I_{DM} | Pulsed Drain Current ^{① ⑧} | 290 | |
| $P_D @ T_C = 25^\circ\text{C}$ | Power Dissipation | 180 | W |
| | Linear Derating Factor | 1.2 | W/°C |
| V_{GS} | Gate-to-Source Voltage | ± 20 | V |
| I_{AR} | Avalanche Current ^① | 43 | A |
| E_{AR} | Repetitive Avalanche Energy ^① | 18 | mJ |
| dv/dt | Peak Diode Recovery dv/dt ^{③ ⑧} | 3.6 | V/ns |
| T_J | Operating Junction and Storage Temperature Range | -55 to + 175 | °C |
| T_{STG} | | | |
| | | | |
| | Mounting torque, 6-32 or M3 screw | 10 lbf•in (1.1N•m) | |

Thermal Resistance

| | Parameter | Typ. | Max. | Units |
|-----------------|--|------|------|-------|
| $R_{\theta JC}$ | Junction-to-Case | — | 0.85 | °C/W |
| $R_{\theta JA}$ | Junction-to-Ambient (PCB Mounted, steady-state)** | — | 40 | |



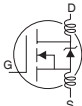
| |
|---------------------------------|
| $V_{DSS} = 55\text{V}$ |
| $R_{DS(on)} = 11\text{m}\Omega$ |
| $I_D = 85\text{A} \text{ ⑦}$ |



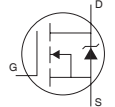
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IR Rectifier

Electrical Characteristics @ T_J = 25°C (unless otherwise specified)

| | Parameter | Min. | Typ. | Max. | Units | Conditions |
|--|--------------------------------------|------|--------|-------|-------|--|
| V _{(BR)DSS} | Drain-to-Source Breakdown Voltage | 55 | — | — | V | V _{GS} = 0V, I _D = 250μA |
| ΔV _{(BR)DSS} /ΔT _J | Breakdown Voltage Temp. Coefficient | — | 0.058 | — | V/°C | Reference to 25°C, I _D = 1mA ⑧ |
| R _{DS(on)} | Static Drain-to-Source On-Resistance | — | — | 11 | mΩ | V _{GS} = 10V, I _D = 43A ④ |
| V _{GS(th)} | Gate Threshold Voltage | 2.0 | — | 4.0 | V | V _{DS} = V _{GS} , I _D = 250μA |
| g _{fs} | Forward Transconductance | 32 | — | — | S | V _{DS} = 25V, I _D = 43A ④③ |
| I _{DSS} | Drain-to-Source Leakage Current | — | — | 25 | μA | V _{DS} = 55V, V _{GS} = 0V |
| | | — | — | 250 | | V _{DS} = 44V, V _{GS} = 0V, T _J = 150°C |
| I _{GSS} | Gate-to-Source Forward Leakage | — | — | 100 | nA | V _{GS} = 20V |
| | Gate-to-Source Reverse Leakage | — | — | -100 | | V _{GS} = -20V |
| Q _g | Total Gate Charge | — | — | 120 | nC | I _D = 43A |
| Q _{gs} | Gate-to-Source Charge | — | — | 19 | | V _{DS} = 44V |
| Q _{gd} | Gate-to-Drain ("Miller") Charge | — | — | 41 | | V _{GS} = 10V, See Fig. 6 and 13 ④③ |
| t _{d(on)} | Turn-On Delay Time | — | 13 | — | ns | V _{DD} = 28V |
| t _r | Rise Time | — | 76 | — | | I _D = 43A |
| t _{d(off)} | Turn-Off Delay Time | — | 39 | — | | R _G = 3.6Ω |
| t _f | Fall Time | — | 48 | — | | V _{GS} = 10V, See Fig. 10 ④③ |
| L _D | Internal Drain Inductance | — | 4.5 | — | nH | Between lead, 6mm (0.25in.) from package and center of die contact |
| L _S | Internal Source Inductance | — | 7.5 | — | |  |
| C _{iss} | Input Capacitance | — | 3210 | — | pF | V _{GS} = 0V |
| C _{oss} | Output Capacitance | — | 690 | — | | V _{DS} = 25V |
| C _{rss} | Reverse Transfer Capacitance | — | 140 | — | | f = 1.0MHz, See Fig. 5 ③ |
| E _{AS} | Single Pulse Avalanche Energy ②③ | — | 1030 ④ | 250 ⑥ | | mJ |

Source-Drain Ratings and Characteristics

| | Parameter | Min. | Typ. | Max. | Units | Conditions |
|-----------------|---|--|------|------|-------|---|
| I _S | Continuous Source Current (Body Diode) | — | — | 85 ⑦ | A | MOSFET symbol showing the integral reverse p-n junction diode. |
| I _{SM} | Pulsed Source Current (Body Diode) ① | — | — | 290 | |  |
| V _{SD} | Diode Forward Voltage | — | — | 1.3 | V | T _J = 25°C, I _S = 43A, V _{GS} = 0V ④ |
| t _{rr} | Reverse Recovery Time | — | 69 | 100 | ns | T _J = 25°C, I _F = 43A |
| Q _{rr} | Reverse Recovery Charge | — | 220 | 230 | nC | di/dt = 100A/μs ④ ③ |
| t _{on} | Forward Turn-On Time | Intrinsic turn-on time is negligible (turn-on is dominated by L _S +L _D) | | | | |

Notes:

- ① Repetitive rating; pulse width limited by max. junction temperature. (See fig. 11)
- ② Starting T_J = 25°C, L = 270μH
R_G = 25Ω, I_{AS} = 43A, V_{GS} = 10V (See Figure 12)
- ③ I_{SD} ≤ 43A, di/dt ≤ 210A/μs, V_{DD} ≤ V_{(BR)DSS},
T_J ≤ 175°C
- ④ Pulse width ≤ 400μs; duty cycle ≤ 2%.
- ⑤ This is a typical value at device destruction and represents operation outside rated limits.

- ⑥ This is a calculated value limited to T_J = 175°C .
 - ⑦ Calculated continuous current based on maximum allowable junction temperature. Package limitation current is 75A.
 - ⑧ Uses IRF1010N 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.

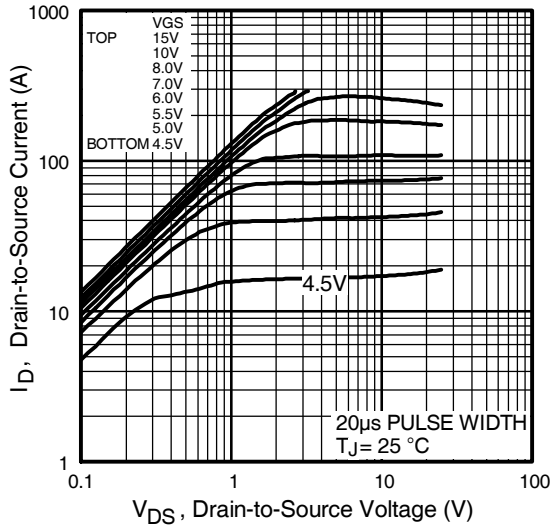


Fig 1. Typical Output Characteristics

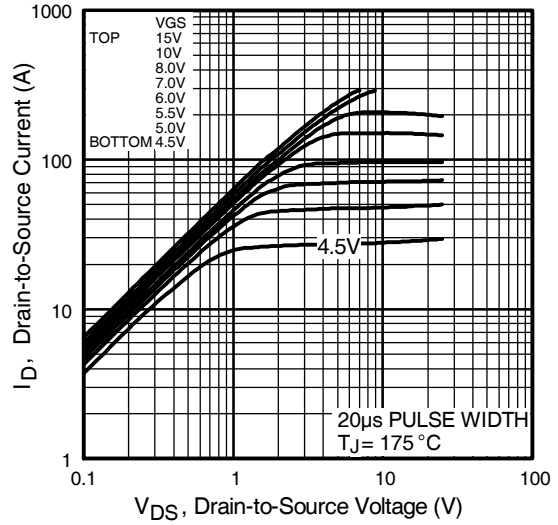


Fig 2. Typical Output Characteristics

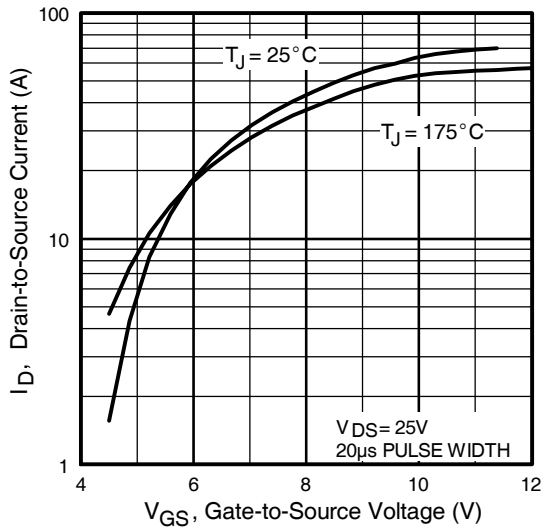


Fig 3. Typical Transfer Characteristics

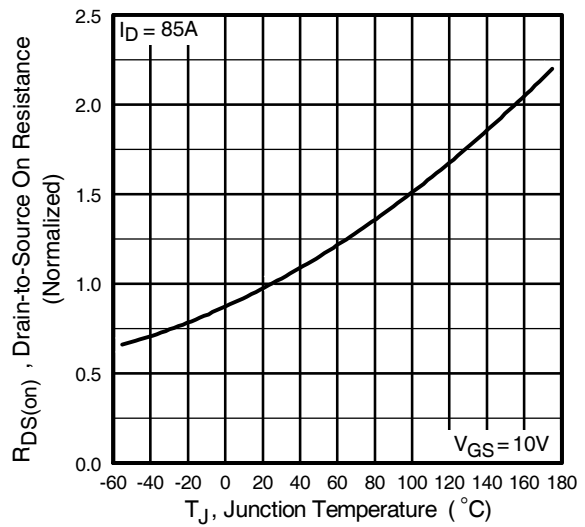


Fig 4. Normalized On-Resistance Vs. Temperature

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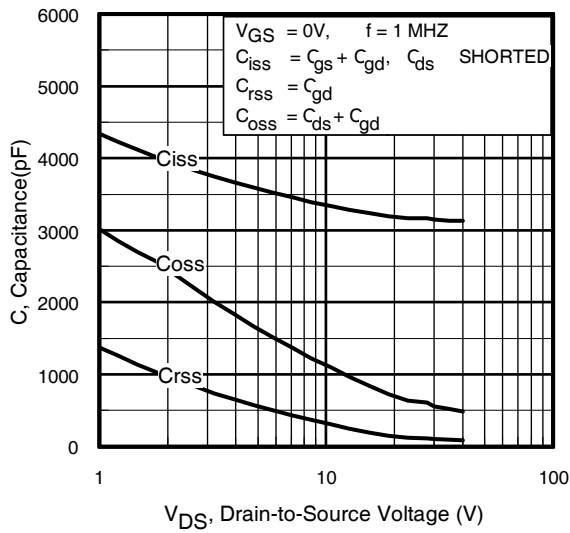


Fig 5. Typical Capacitance Vs. Drain-to-Source Voltage

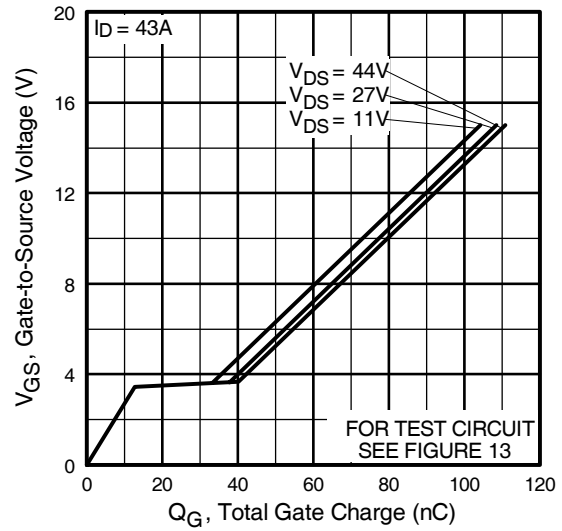


Fig 6. Typical Gate Charge Vs. Gate-to-Source Voltage

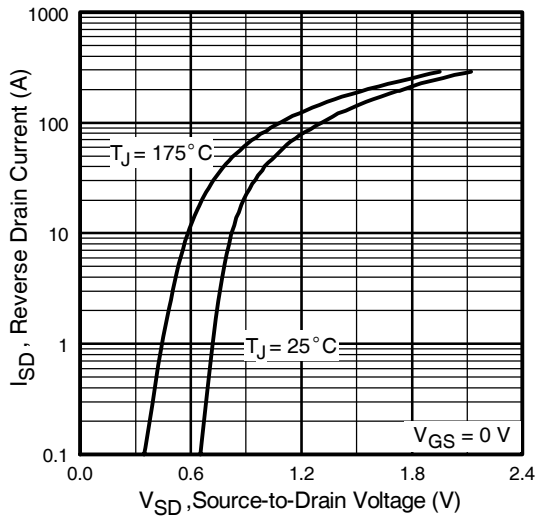


Fig 7. Typical Source-Drain Diode Forward Voltage

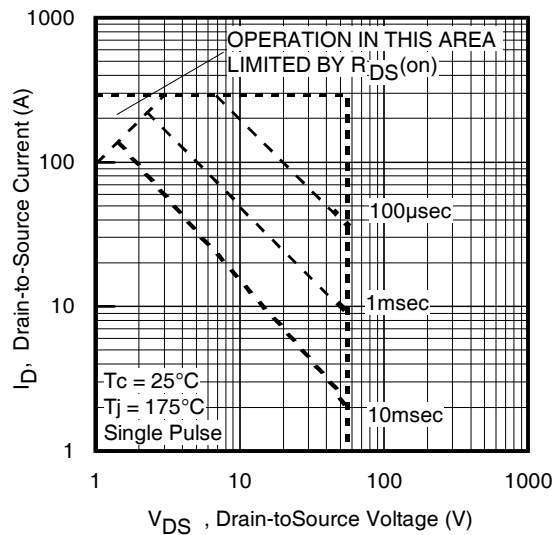


Fig 8. Maximum Safe Operating Area

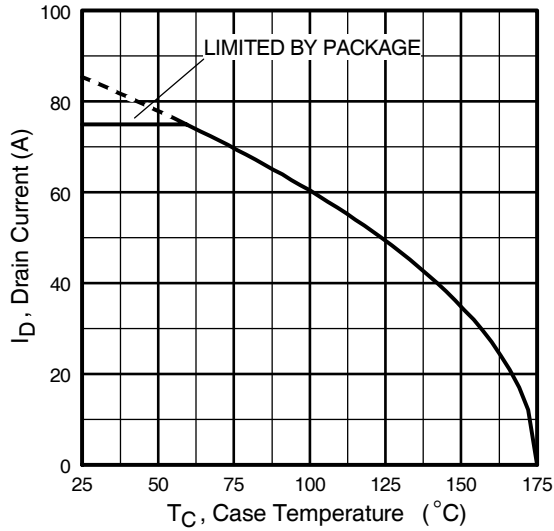


Fig 9. Maximum Drain Current Vs. Case Temperature



Fig 10a. Switching Time Test Circuit



Fig 10b. Switching Time Waveforms

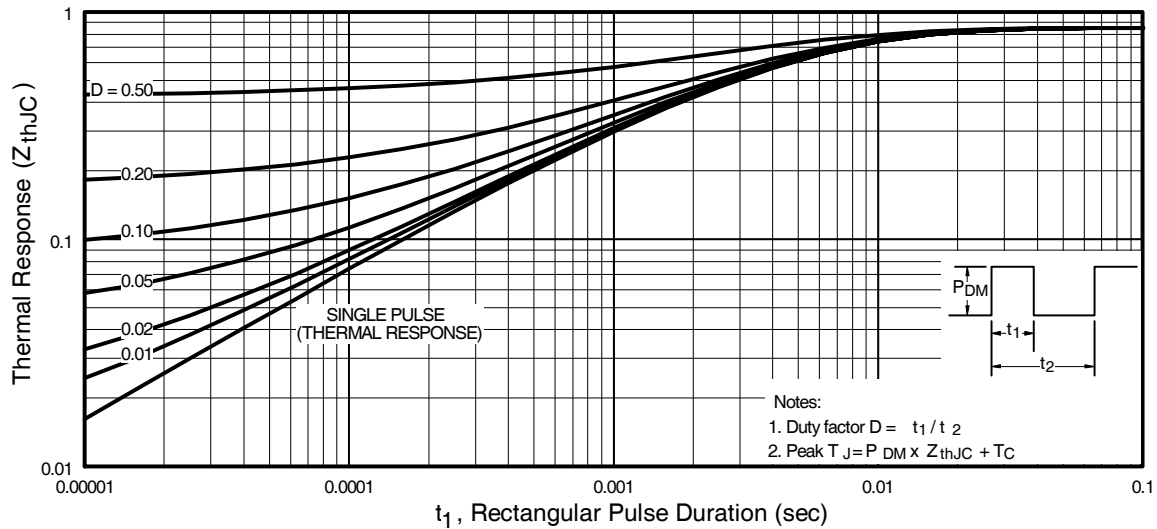


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Case

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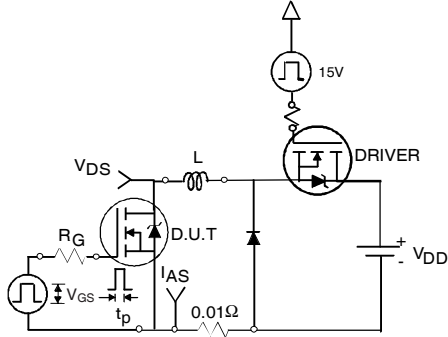


Fig 12a. Unclamped Inductive Test Circuit



Fig 12b. Unclamped Inductive Waveforms

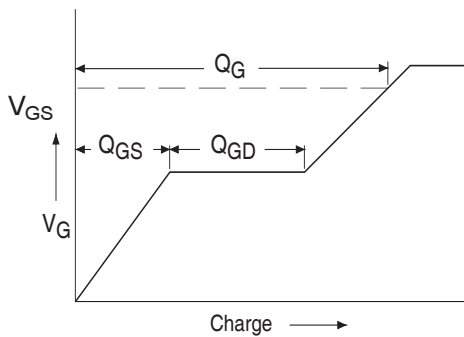


Fig 13a. Basic Gate Charge Waveform

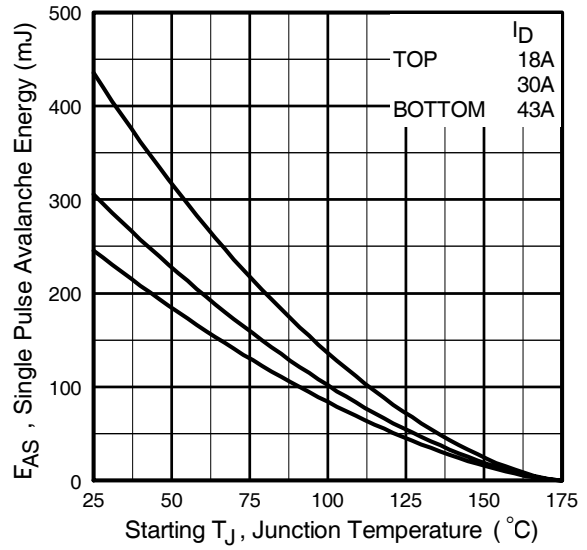


Fig 12c. Maximum Avalanche Energy Vs. Drain Current



Fig 13b. Gate Charge Test Circuit

Peak Diode Recovery dv/dt Test Circuit



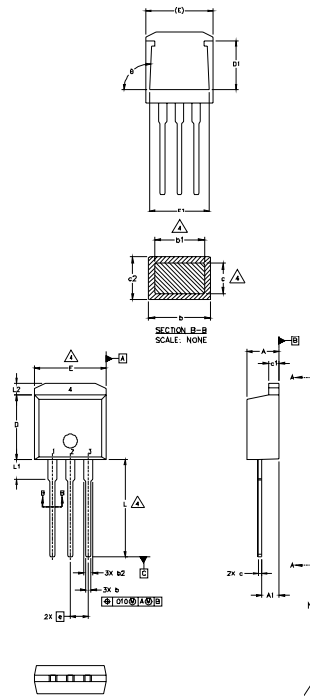
* Reverse Polarity of D.U.T for P-Channel



*** $V_{GS} = 5.0V$ for Logic Level and 3V Drive Devices

Fig 14. For N-channel HEXFET® power MOSFETs

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 | |
| D1 | 5.33 | | .210 | | 3 |
| E | 9.65 | 10.67 | .380 | .420 | |
| 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

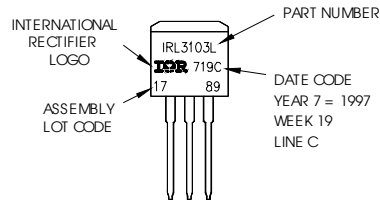
- IGBT
HEXFET
- 1.- GATE
 - 2.- DRAIN
 - 3.- SOURCE
 - 4.- DRAIN
- 1- GATE
2- COLLECTOR
3- EMITTER

- 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.

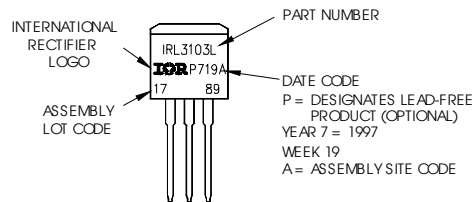
TO-262 Part Marking Information

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

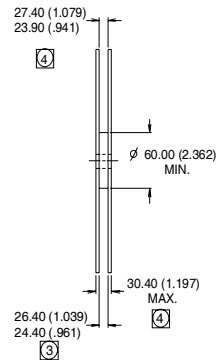
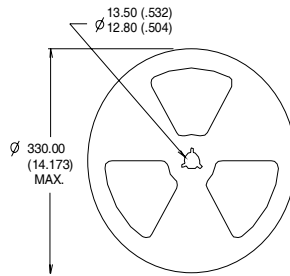
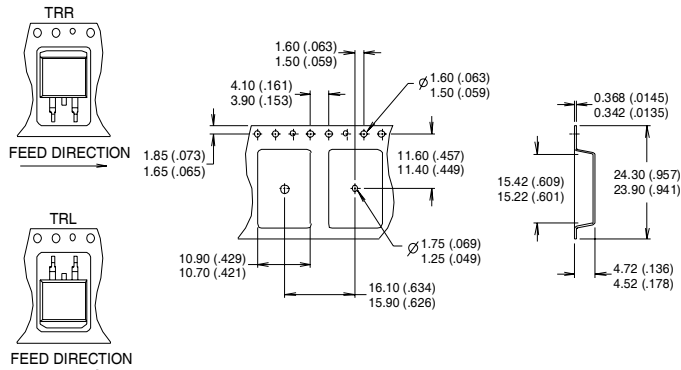


IRF1010NS/LPbF

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D²Pak Tape & Reel Information

Dimensions are shown in millimeters (inches)



- NOTES :
1. CONFORMS TO EIA-418.
 2. CONTROLLING DIMENSION: MILLIMETER.
 - ③ DIMENSION MEASURED @ HUB.
 - ④ INCLUDES FLANGE DISTORTION @ OUTER EDGE.

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.

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IR WORLD HEADQUARTERS: 233 Kansas St., El Segundo, California 90245, USA Tel: (310) 252-7105
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Note: For the most current drawings please refer to the IR website at:
<http://www.irf.com/package/>

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[35PN H6327](#) [BCR 523U E6327](#) [BCR 533 E6327](#)