

# IRLR8103VPbF

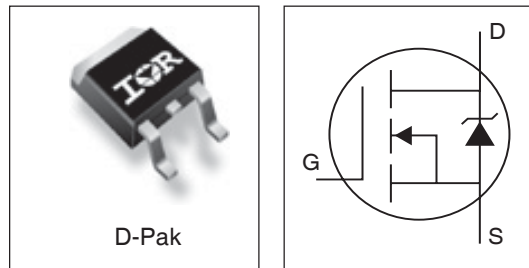
- N-Channel Application-Specific MOSFETs
- Ideal for CPU Core DC-DC Converters
- Low Conduction Losses
- Low Switching Losses
- Minimizes Parallel MOSFETs for high current applications
- 100%  $R_G$  Tested
- Lead-Free

### Description

This new device employs advanced HEXFET Power MOSFET technology to achieve an unprecedented balance of on-resistance and gate charge. The reduced conduction and switching losses make it ideal for high efficiency DC-DC converters that power the latest generation of microprocessors.

The IRLR8103V has been optimized for all parameters that are critical in synchronous buck converters including  $R_{DS(on)}$ , gate charge and  $C_{dv}/dt$ -induced turn-on immunity. The IRLR8103V offers an extremely low combination of  $Q_{sw}$  &  $R_{DS(on)}$  for reduced losses in both control and synchronous FET applications.

The package is designed for vapor phase, infra-red, convection, or wave soldering techniques. Power dissipation of greater than 2W is possible in a typical PCB mount application.



### DEVICE CHARACTERISTICS<sup>⑤</sup>

|              | <b>IRLR8103V</b> |
|--------------|------------------|
| $R_{DS(on)}$ | 7.9 m $\Omega$   |
| $Q_G$        | 27 nC            |
| $Q_{SW}$     | 12 nC            |
| $Q_{OSS}$    | 29nC             |

### Absolute Maximum Ratings

| Parameter                                                |           | Symbol         | IRLR8103V  | Units |
|----------------------------------------------------------|-----------|----------------|------------|-------|
| Drain-Source Voltage                                     |           | $V_{DS}$       | 30         | V     |
| Gate-Source Voltage                                      |           | $V_{GS}$       | $\pm 20$   |       |
| Continuous Drain or Source Current<br>( $V_{GS} > 10V$ ) | TC = 25°C | $I_D$          | 91         | A     |
|                                                          | TC = 90°C |                | 63         |       |
| Pulsed Drain Current <sup>①</sup>                        |           | $I_{DM}$       | 363        |       |
| Power Dissipation <sup>③</sup>                           | TC = 25°C | $P_D$          | 115        | W     |
|                                                          | TC = 90°C |                | 60         |       |
| Junction & Storage Temperature Range                     |           | $T_J, T_{STG}$ | -55 to 150 | °C    |
| Continuous Source Current (Body Diode)                   |           | $I_S$          | 91         | A     |
| Pulsed Source Current <sup>①</sup>                       |           | $I_{SM}$       | 363        |       |

### Thermal Resistance

| Parameter                                 | Symbol          | Typ. | Max. | Units |
|-------------------------------------------|-----------------|------|------|-------|
| Maximum Junction-to-Ambient <sup>③⑥</sup> | $R_{\theta JA}$ | —    | 50   | °C/W  |
| Maximum Junction-to-Case <sup>⑥</sup>     | $R_{\theta JC}$ | —    | 1.09 |       |

## Electrical Characteristics

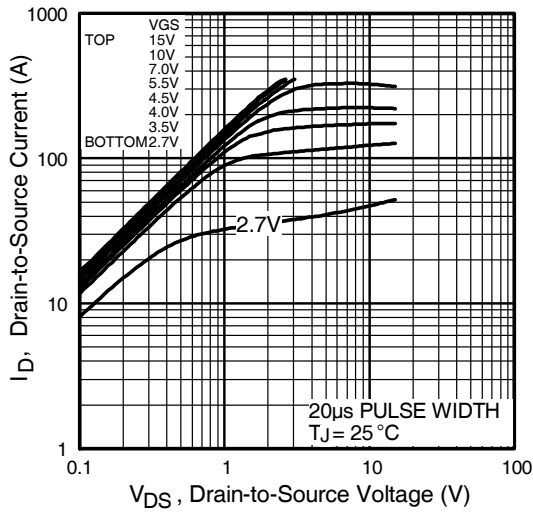
| Parameter                            | Symbol       | Min | Typ  | Max       | Units      | Conditions                                    |
|--------------------------------------|--------------|-----|------|-----------|------------|-----------------------------------------------|
| Drain-to-Source Breakdown Voltage    | $V_{DSS}$    | 30  | —    | —         | V          | $V_{GS} = 0V, I_D = 250\mu A$                 |
| Static Drain-Source On-Resistance    | $R_{DS(on)}$ | —   | 6.9  | 9.0       | m $\Omega$ | $V_{GS} = 10V, I_D = 15A$ ②                   |
|                                      |              | —   | 7.9  | 10.5      |            | $V_{GS} = 4.5V, I_D = 15A$ ②                  |
| Gate Threshold Voltage               | $V_{GS(th)}$ | 1.0 | —    | 3.0       | V          | $V_{DS} = V_{GS}, I_D = 250\mu A$             |
| Drain-to-Source Leakage Current      | $I_{DSS}$    | —   | —    | 50        | $\mu A$    | $V_{DS} = 30V, V_{GS} = 0V$                   |
|                                      |              | —   | —    | 20        | $\mu A$    | $V_{DS} = 24V, V_{GS} = 0$                    |
|                                      |              | —   | —    | 100       |            | $V_{DS} = 24V, V_{GS} = 0, T_J = 100^\circ C$ |
| Gate-Source Leakage Current          | $I_{GSS}$    | —   | —    | $\pm 100$ | nA         | $V_{GS} = \pm 20V$                            |
| Total Gate Charge, Control FET       | $Q_G$        | —   | 27   | —         | nC         | $V_{GS} = 5V, I_D = 15A, V_{DS} = 16V$        |
| Total Gate Charge, Synch FET         | $Q_G$        | —   | 23   | —         |            | $V_{GS} = 5V, V_{DS} < 100mV$                 |
| Pre-Vth Gate-Source Charge           | $Q_{GS1}$    | —   | 4.7  | —         |            | $V_{DS} = 16V, I_D = 15A$                     |
| Post-Vth Gate-Source Charge          | $Q_{GS2}$    | —   | 2.0  | —         |            |                                               |
| Gate to Drain Charge                 | $Q_{GD}$     | —   | 9.7  | —         |            |                                               |
| Switch Charge ( $Q_{gs2} + Q_{gd}$ ) | $Q_{SW}$     | —   | 12   | —         |            |                                               |
| Output Charge                        | $Q_{OSS}$    | —   | 29   | —         |            |                                               |
| Gate Resistance                      | $R_G$        | 0.8 | —    | 3.1       |            | $\Omega$                                      |
| Turn-On Delay Time                   | $t_{d(on)}$  | —   | 10   | —         | ns         | $V_{DD} = 16V$                                |
| Rise Time                            | $t_r$        | —   | 9    | —         |            | $I_D = 15A$                                   |
| Turn-Off Delay Time                  | $t_{d(off)}$ | —   | 24   | —         |            | $V_{GS} = 5.0V$                               |
| Fall Time                            | $t_f$        | —   | 18   | —         |            | Clamped Inductive Load                        |
| Input Capacitance                    | $C_{iss}$    | —   | 2672 | —         | pF         | $V_{GS} = 16V, V_{GS} = 0$                    |
| Output Capacitance                   | $C_{oss}$    | —   | 1064 | —         |            |                                               |
| Reverse Transfer Capacitance         | $C_{rss}$    | —   | 109  | —         |            |                                               |

## Source-Drain Rating & Characteristics

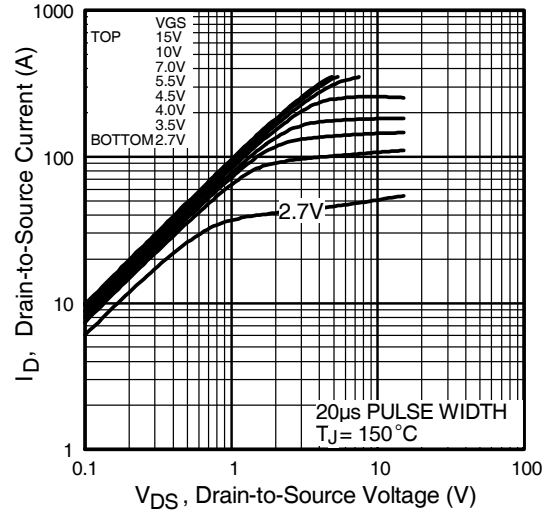
| Parameter                                          | Symbol      | Min | Typ | Max | Units | Conditions                                                                      |
|----------------------------------------------------|-------------|-----|-----|-----|-------|---------------------------------------------------------------------------------|
| Diode Forward Voltage                              | $V_{SD}$    | —   | 0.9 | 1.3 | V     | $I_S = 15A$ ②, $V_{GS} = 0V$                                                    |
| Reverse Recovery Charge ④                          | $Q_{rr}$    | —   | 103 | —   | nC    | $di/dt \sim 700A/\mu s$<br>$V_{DS} = 16V, V_{GS} = 0V, I_F = 15A$               |
| Reverse Recovery Charge (with Parallel Schottky) ④ | $Q_{rr(s)}$ | —   | 96  | —   | nC    | $di/dt = 700A/\mu s$ , (with 10BQ040)<br>$V_{DS} = 16V, V_{GS} = 0V, I_F = 15A$ |

### Notes:

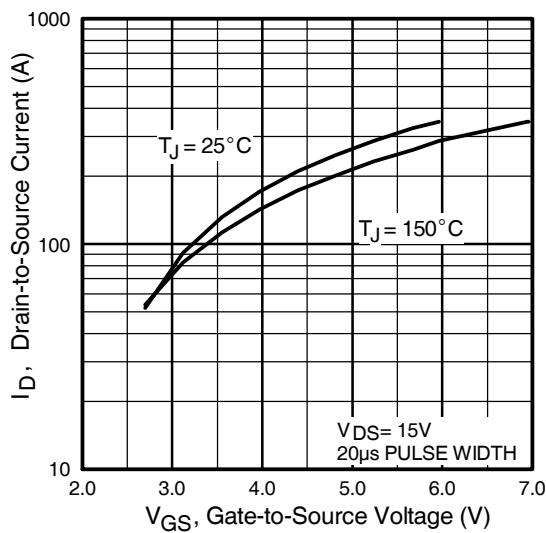
- ① Repetitive rating; pulse width limited by max. junction temperature.
- ② Pulse width  $\leq 400 \mu s$ ; duty cycle  $\leq 2\%$ .
- ③ When mounted on 1 inch square copper board,  $t < 10$  sec.
- ④ Typ = measured -  $Q_{oss}$
- ⑤ Typical values of  $R_{DS(on)}$  measured at  $V_{GS} = 4.5V$ ,  $Q_G$ ,  $Q_{SW}$  and  $Q_{OSS}$  measured at  $V_{GS} = 5.0V$ ,  $I_F = 15A$ .



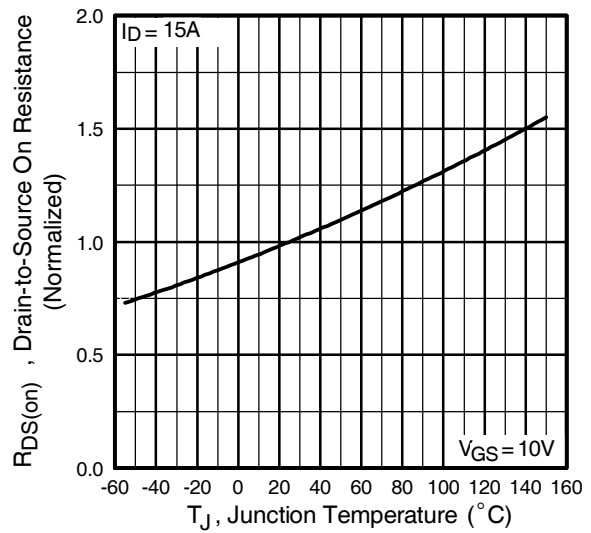
**Fig 1.** Typical Output Characteristics



**Fig 2.** Typical Output Characteristics



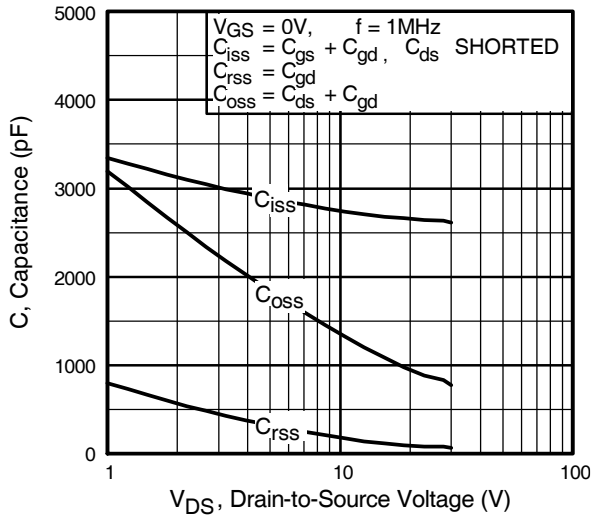
**Fig 3.** Typical Transfer Characteristics



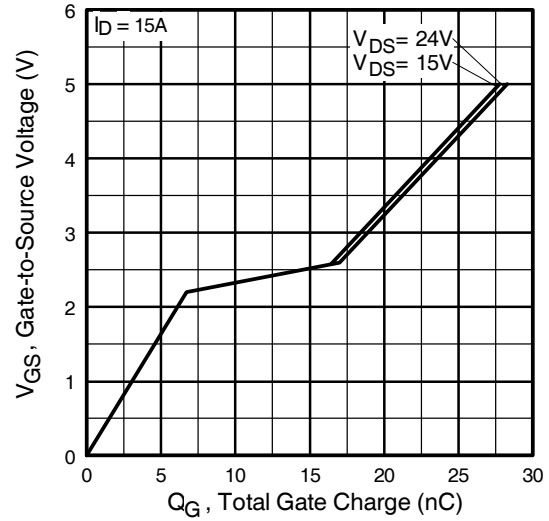
**Fig 4.** Normalized On-Resistance Vs. Temperature

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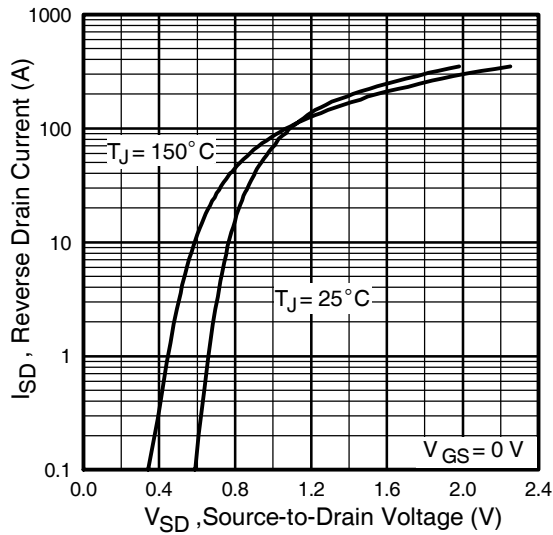
International  
**IR** Rectifier



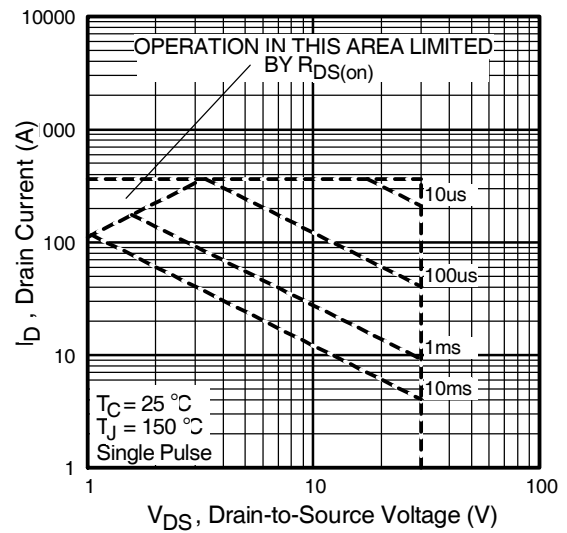
**Fig 5.** Typical Capacitance Vs. Drain-to-Source Voltage



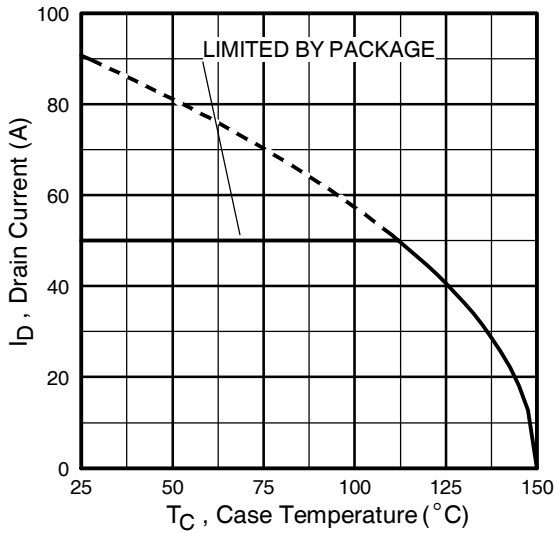
**Fig 6.** Typical Gate Charge Vs. Gate-to-Source Voltage



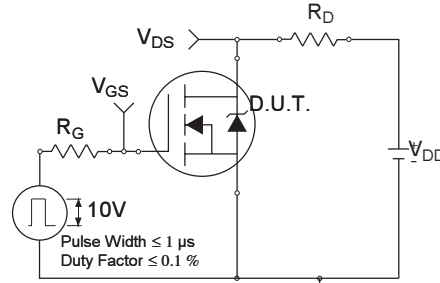
**Fig 7.** Typical Source-Drain Diode Forward Voltage



**Fig 8.** Maximum Safe Operating Area



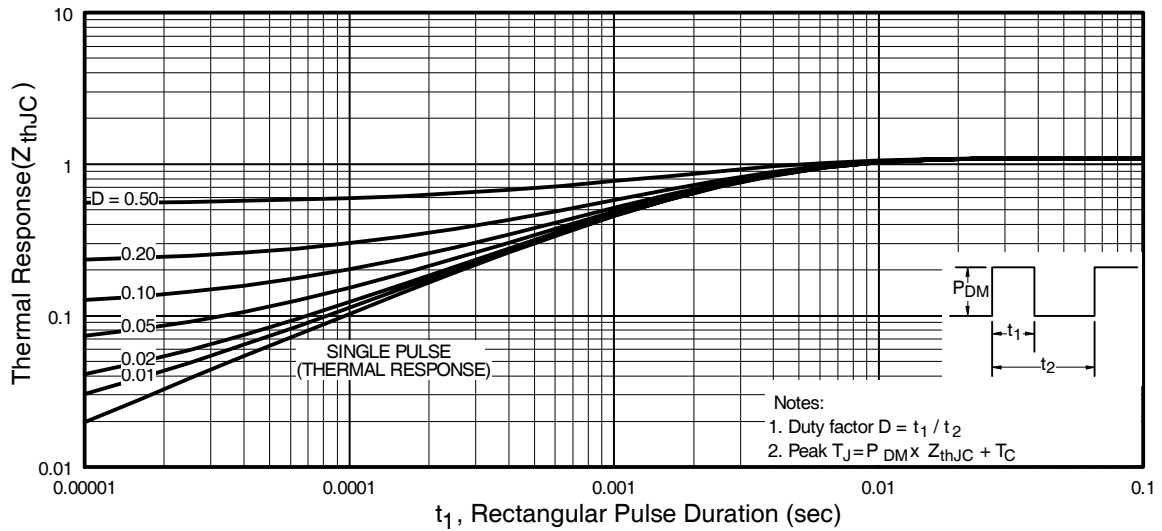
**Fig 9. Maximum Drain Current Vs. Case Temperature**



**Fig 10a. Switching Time Test Circuit**



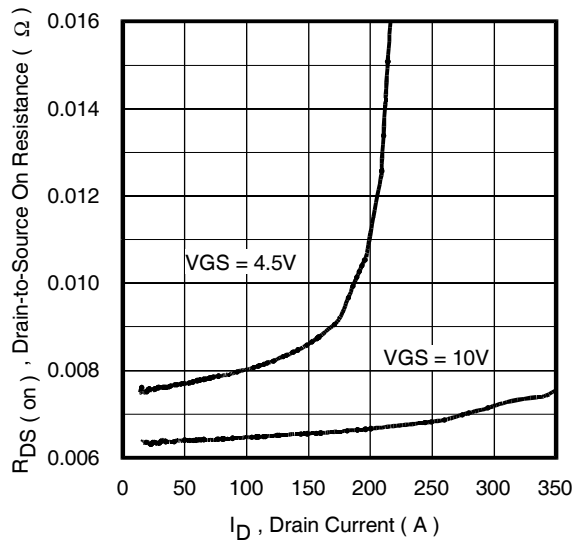
**Fig 10b. Switching Time Waveforms**



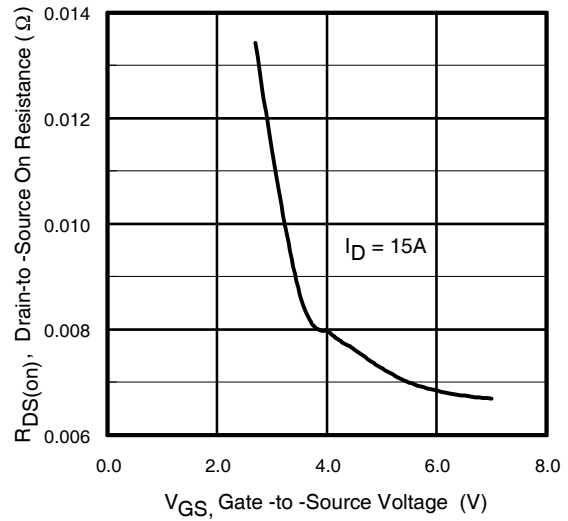
**Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Case**

# IRLR8103VPbF

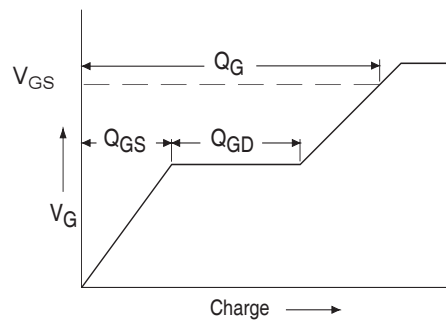
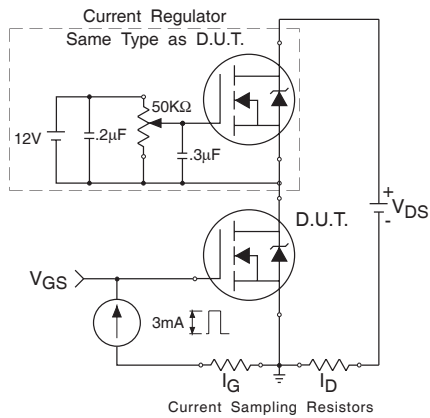
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**IR** Rectifier



**Fig 12.** On-Resistance Vs. Drain Current



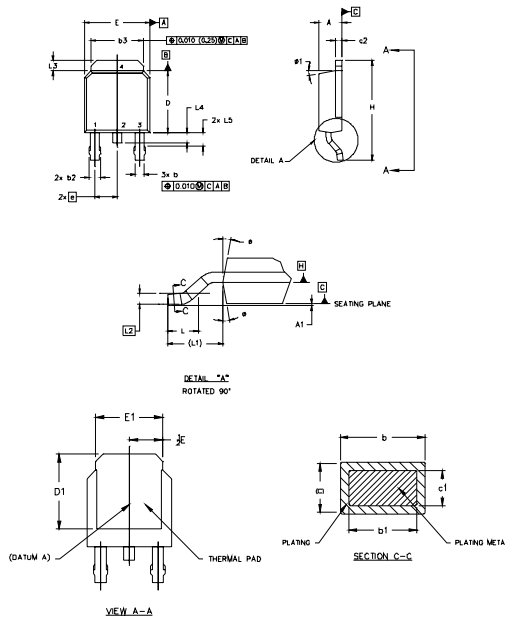
**Fig 13.** On-Resistance Vs. Gate Voltage



**Fig 14a&b.** Basic Gate Charge Test Circuit and Waveform

## D-Pak (TO-252AA) Package Outline

Dimensions are shown in millimeters (inches)



NOTES:

- 1.0 DIMENSIONING AND TOLERANCING PER ASME Y14.5 M- 1994.
- 2.0 DIMENSIONS ARE SHOWN IN INCHES [MILLIMETERS].
- 3.0 LEAD DIMENSION UNCONTROLLED IN L5.
- 4.0 DIMENSION D1 AND E1 ESTABLISH A MINIMUM MOUNTING SURFACE FOR THERMAL PAD.
- 5.0 SECTION C-C DIMENSIONS APPLY TO THE FLAT SECTION OF THE LEAD BETWEEN .005 (0.127) AND .010 (0.254) FROM THE LEAD TIP.
- 6.0 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.
- 7.0 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        | 0.13  |        | .005 |       |
| b      | 0.84        | 0.88  | .035   | .035 | 5     |
| b1     | 0.84        | 0.79  | .035   | .033 | 5     |
| b2     | 0.76        | 1.14  | .030   | .045 |       |
| b3     | 4.93        | 5.46  | .193   | .215 |       |
| c      | 0.48        | 0.61  | .018   | .024 | 5     |
| c1     | 0.41        | 0.56  | .016   | .022 | 5     |
| c2     | 0.96        | 0.98  | .038   | .039 | 5     |
| D      | 0.97        | 0.22  | .239   | .249 | 6     |
| D1     | 0.21        | -     | .005   | -    | 4     |
| E      | 6.35        | 6.13  | .250   | .243 | 6     |
| E1     | 4.32        | -     | .170   | -    | 4     |
| #      | 2.29        |       | .090   | BSC  |       |
| H      | 6.48        | 10.41 | .255   | .410 |       |
| L      | 1.40        | 1.76  | .055   | .070 |       |
| L1     | 2.74        | REF.  | .108   | REF. |       |
| L2     | 0.50        | BSC   | .020   | BSC  |       |
| L3     | 0.88        | 1.27  | .035   | .050 |       |
| L4     | 1.02        |       | .040   |      |       |
| L5     | 1.14        | 1.52  | .045   | .060 | 3     |
| #      | 0"          | 10"   | 0"     | 10"  |       |
| #1     | 0"          | 10"   | 0"     | 10"  |       |

LEAD ASSIGNMENTS

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

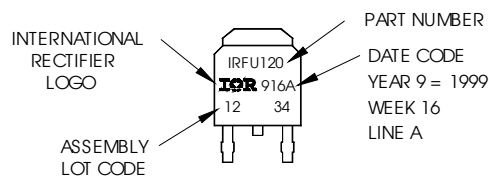
IGETS COPACK

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

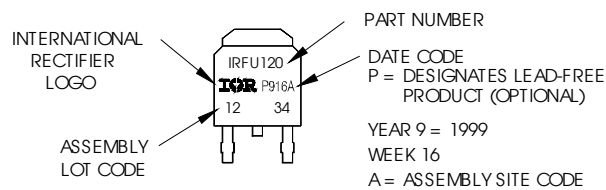
## D-Pak (TO-252AA) Part Marking Information

EXAMPLE: THIS IS AN IRFR120  
WITH ASSEMBLY  
LOT CODE 1234  
ASSEMBLED ON WW 16, 1999  
IN THE ASSEMBLY LINE "A"

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



OR

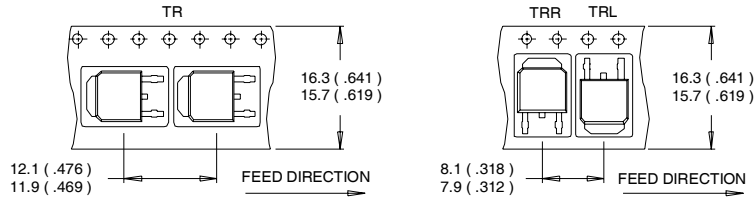


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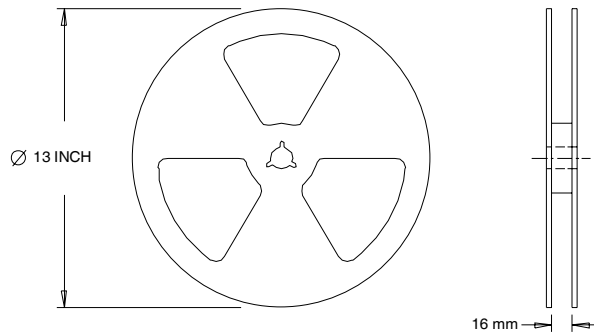
International  
**IR** Rectifier

## 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.

Data and specifications subject to change without notice.

International  
**IR** Rectifier

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:  
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