

International  
**IR** Rectifier

**SMPS MOSFET**

PD - 94357

IRFB52N15D

IRFS52N15D

IRFSL52N15D

HEXFET® Power MOSFET

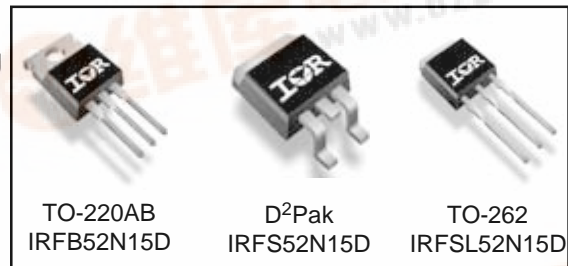
**Applications**

- High frequency DC-DC converters

V <sub>DSS</sub>	R <sub>DS(on)</sub> max	I <sub>D</sub>
150V	0.032Ω	60A

**Benefits**

- Low Gate-to-Drain Charge to Reduce Switching Losses
- Fully Characterized Capacitance Including Effective C<sub>oss</sub> to Simplify Design, (See App. Note AN1001)
- Fully Characterized Avalanche Voltage and Current



**Absolute Maximum Ratings**

	Parameter	Max.	Units
I <sub>D</sub> @ T <sub>C</sub> = 25°C	Continuous Drain Current, V <sub>GS</sub> @ 10V	60	A
I <sub>D</sub> @ T <sub>C</sub> = 100°C	Continuous Drain Current, V <sub>GS</sub> @ 10V	43	
I <sub>DM</sub>	Pulsed Drain Current ①	240	
P <sub>D</sub> @ T <sub>A</sub> = 25°C	Power Dissipation ⑦	3.8	W
P <sub>D</sub> @ T <sub>C</sub> = 25°C	Power Dissipation	320	
	Linear Derating Factor	2.1	W/°C
V <sub>GS</sub>	Gate-to-Source Voltage	± 30	V
dv/dt	Peak Diode Recovery dv/dt ③	5.5	V/ns
T <sub>J</sub>	Operating Junction and	-55 to + 175	°C
T <sub>STG</sub>	Storage Temperature Range		
	Soldering Temperature, for 10 seconds	300 (1.6mm from case )	
	Mounting torque, 6-32 or M3 screw⑥	10 lbf•in (1.1N•m)	

**Thermal Resistance**

	Parameter	Typ.	Max.	Units
R <sub>θJC</sub>	Junction-to-Case	—	0.47	°C/W
R <sub>θCS</sub>	Case-to-Sink, Flat, Greased Surface ⑥	0.50	—	
R <sub>θJA</sub>	Junction-to-Ambient⑥	—	62	
R <sub>θJA</sub>	Junction-to-Ambient⑦	—	40	

Notes ① through ⑦ are on page 11

www.irf.com



# IRFB/IRFS/IRFSL52N15D

International  
**IR** Rectifier

## Static @ $T_J = 25^\circ\text{C}$ (unless otherwise specified)

	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(BR)DSS}$	Drain-to-Source Breakdown Voltage	150	—	—	V	$V_{GS} = 0V, I_D = 250\mu A$
$\Delta V_{(BR)DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	—	0.16	—	V/°C	Reference to $25^\circ\text{C}, I_D = 1\text{mA}$
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	—	—	0.032	$\Omega$	$V_{GS} = 10V, I_D = 36A$ ④
$V_{GS(th)}$	Gate Threshold Voltage	3.0	—	5.0	V	$V_{DS} = V_{GS}, I_D = 250\mu A$
$I_{DSS}$	Drain-to-Source Leakage Current	—	—	25	$\mu A$	$V_{DS} = 150V, V_{GS} = 0V$
		—	—	250		$V_{DS} = 120V, V_{GS} = 0V, T_J = 150^\circ\text{C}$
$I_{GSS}$	Gate-to-Source Forward Leakage	—	—	100	nA	$V_{GS} = 30V$
	Gate-to-Source Reverse Leakage	—	—	-100		$V_{GS} = -30V$

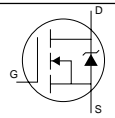
## Dynamic @ $T_J = 25^\circ\text{C}$ (unless otherwise specified)

	Parameter	Min.	Typ.	Max.	Units	Conditions
$g_{fs}$	Forward Transconductance	19	—	—	S	$V_{DS} = 50V, I_D = 36A$
$Q_g$	Total Gate Charge	—	79	120	nC	$I_D = 36A$
$Q_{gs}$	Gate-to-Source Charge	—	25	37		$V_{DS} = 120V$
$Q_{gd}$	Gate-to-Drain ("Miller") Charge	—	34	51		$V_{GS} = 10V$ , ④
$t_{d(on)}$	Turn-On Delay Time	—	16	—		ns
$t_r$	Rise Time	—	47	—	$I_D = 36A$	
$t_{d(off)}$	Turn-Off Delay Time	—	28	—	$R_G = 2.5\Omega$	
$t_f$	Fall Time	—	25	—	$V_{GS} = 10V$ ④	
$C_{iss}$	Input Capacitance	—	2770	—	pF	$V_{GS} = 0V$
$C_{oss}$	Output Capacitance	—	590	—		$V_{DS} = 25V$
$C_{rss}$	Reverse Transfer Capacitance	—	110	—		$f = 1.0\text{MHz}$
$C_{oss}$	Output Capacitance	—	3940	—		$V_{GS} = 0V, V_{DS} = 1.0V, f = 1.0\text{MHz}$
$C_{oss}$	Output Capacitance	—	260	—		$V_{GS} = 0V, V_{DS} = 120V, f = 1.0\text{MHz}$
$C_{oss\ eff.}$	Effective Output Capacitance	—	550	—		$V_{GS} = 0V, V_{DS} = 0V\ \text{to}\ 120V$ ⑤

## Avalanche Characteristics

	Parameter	Typ.	Max.	Units
$E_{AS}$	Single Pulse Avalanche Energy②⑥	—	470	mJ
$I_{AR}$	Avalanche Current①	—	36	A
$E_{AR}$	Repetitive Avalanche Energy①	—	32	mJ

## Diode Characteristics

	Parameter	Min.	Typ.	Max.	Units	Conditions
$I_S$	Continuous Source Current (Body Diode)	—	—	60	A	MOSFET symbol showing the integral reverse p-n junction diode. 
$I_{SM}$	Pulsed Source Current (Body Diode) ①⑥	—	—	240		
$V_{SD}$	Diode Forward Voltage	—	—	1.5	V	$T_J = 25^\circ\text{C}, I_S = 36A, V_{GS} = 0V$ ④
$t_{rr}$	Reverse Recovery Time	—	140	210	nS	$T_J = 25^\circ\text{C}, I_F = 36A$
$Q_{rr}$	Reverse Recovery Charge	—	780	1170	nC	$di/dt = 100A/\mu s$ ④
$t_{on}$	Forward Turn-On Time	Intrinsic turn-on time is negligible (turn-on is dominated by $L_S + L_D$ )				

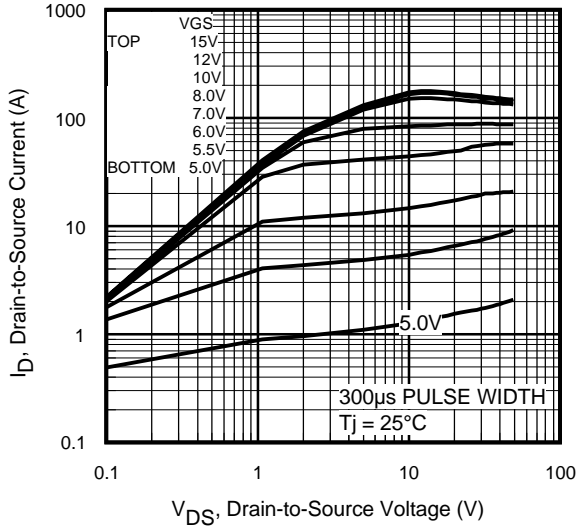


Fig 1. Typical Output Characteristics

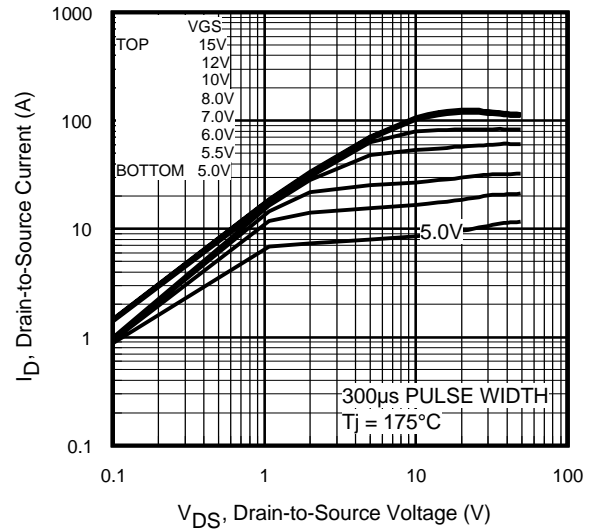


Fig 2. Typical Output Characteristics

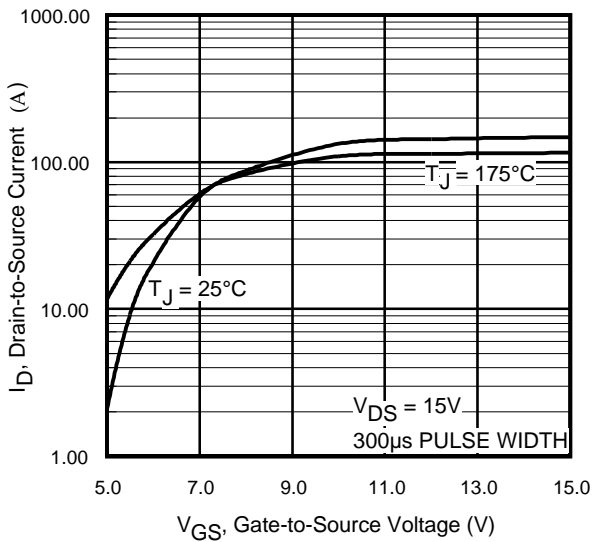


Fig 3. Typical Transfer Characteristics

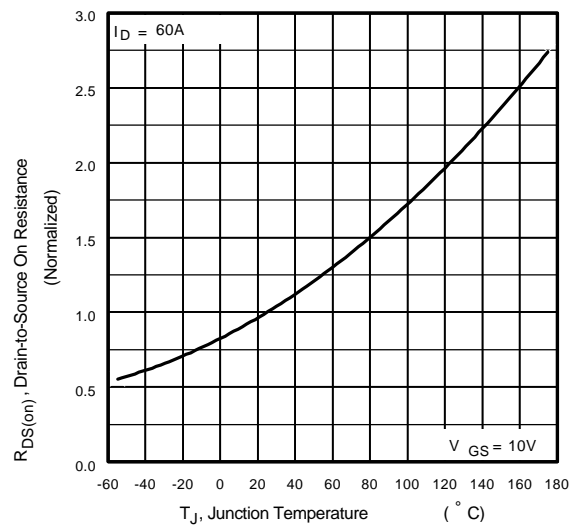
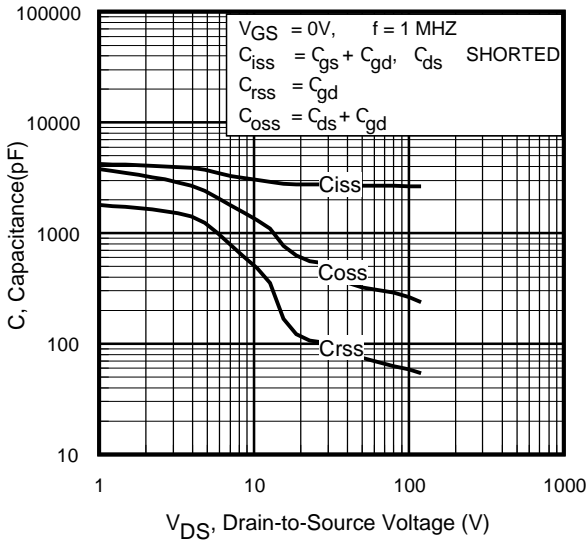
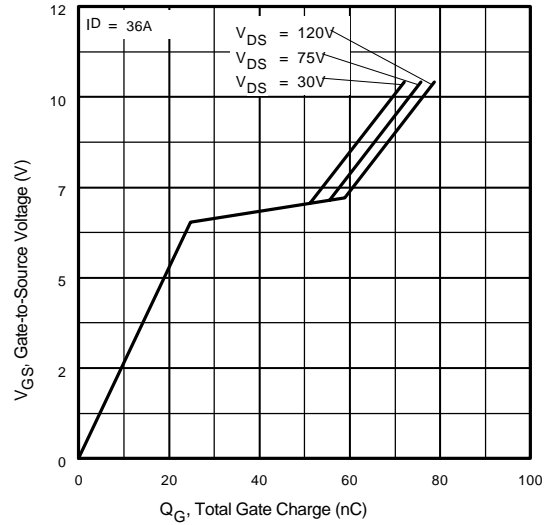


Fig 4. Normalized On-Resistance Vs. Temperature

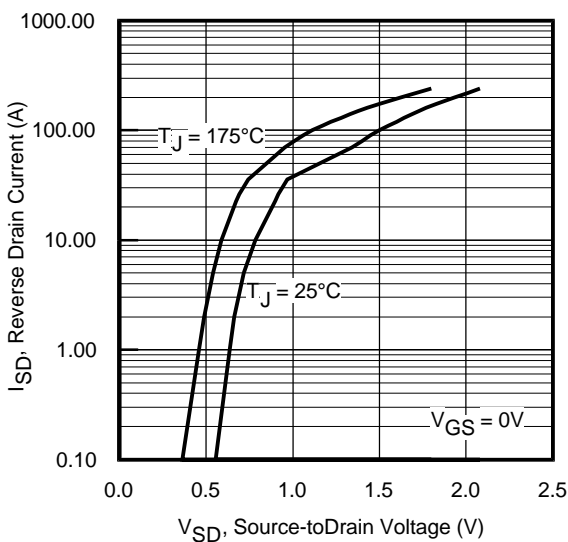
# IRFB/IRFS/IRFSL52N15D



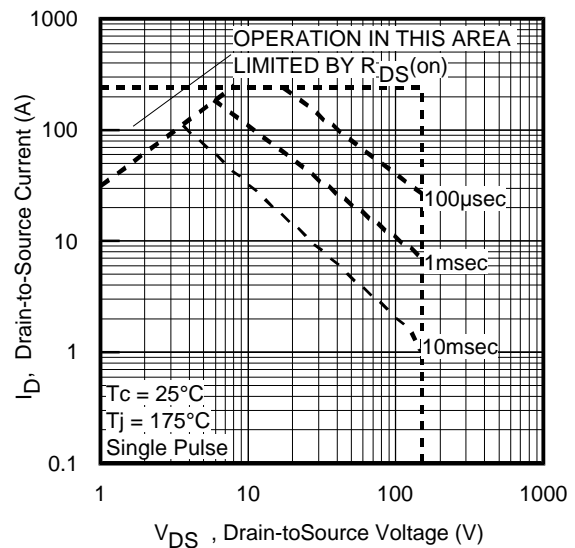
**Fig 5.** Typical Capacitance Vs. Drain-to-Source Voltage



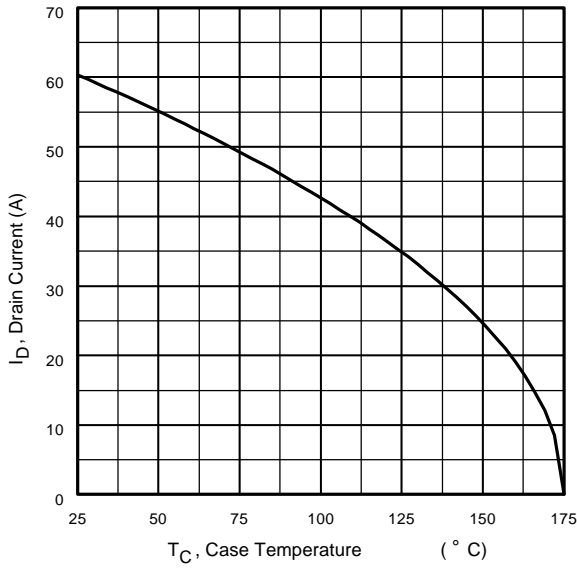
**Fig 6.** Typical Gate Charge Vs. Gate-to-Source Voltage



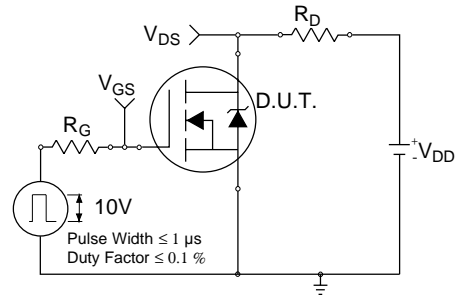
**Fig 7.** Typical Source-Drain Diode Forward Voltage



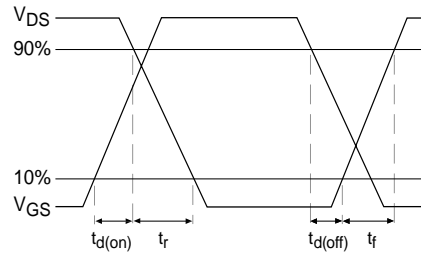
**Fig 8.** Maximum Safe Operating Area



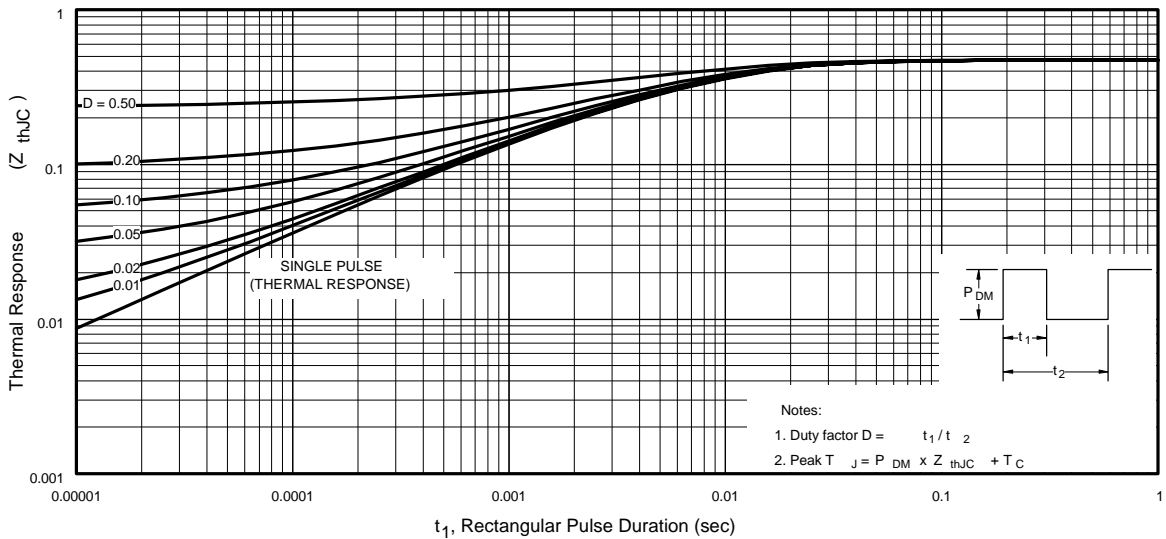
**Fig 9.** Maximum Drain Current Vs. Case Temperature



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



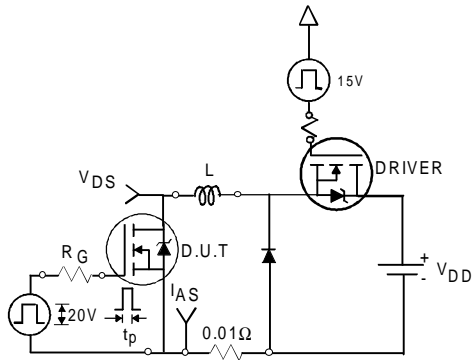
**Fig 10b.** Switching Time Waveforms



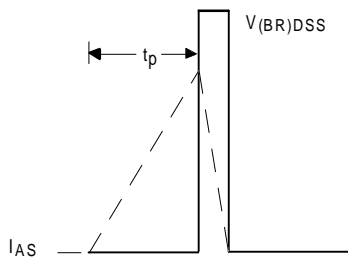
**Fig 11.** Maximum Effective Transient Thermal Impedance, Junction-to-Case

# IRFB/IRFS/IRFSL52N15D

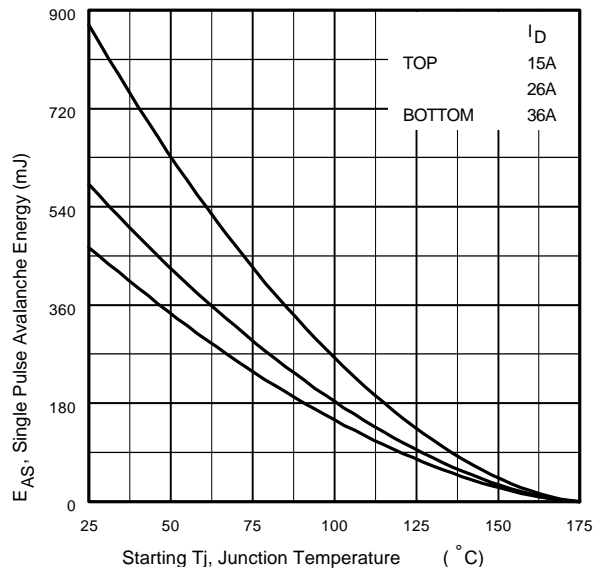
International  
**IR** Rectifier



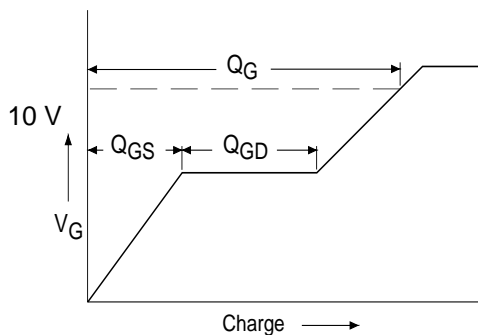
**Fig 12a.** Unclamped Inductive Test Circuit



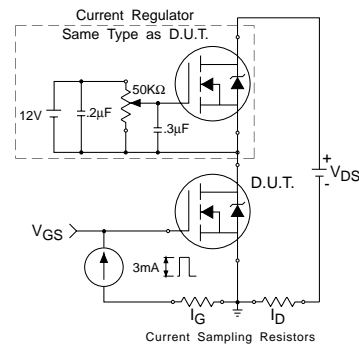
**Fig 12b.** Unclamped Inductive Waveforms



**Fig 12c.** Maximum Avalanche Energy Vs. Drain Current

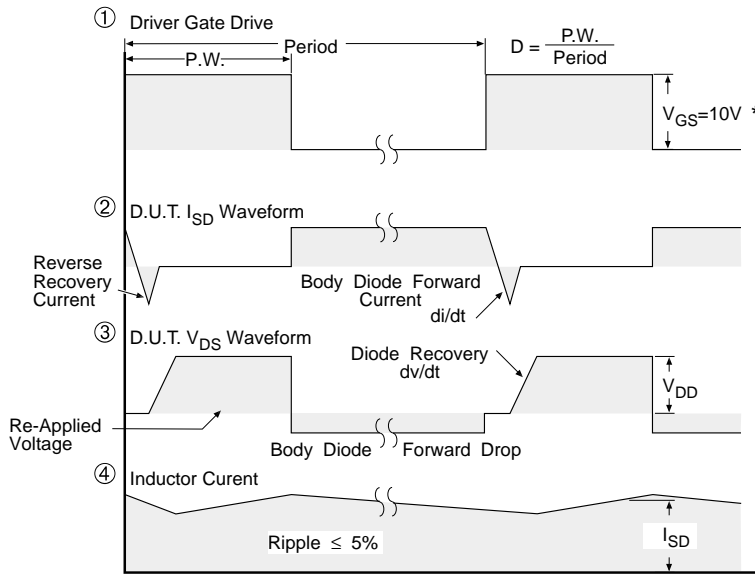
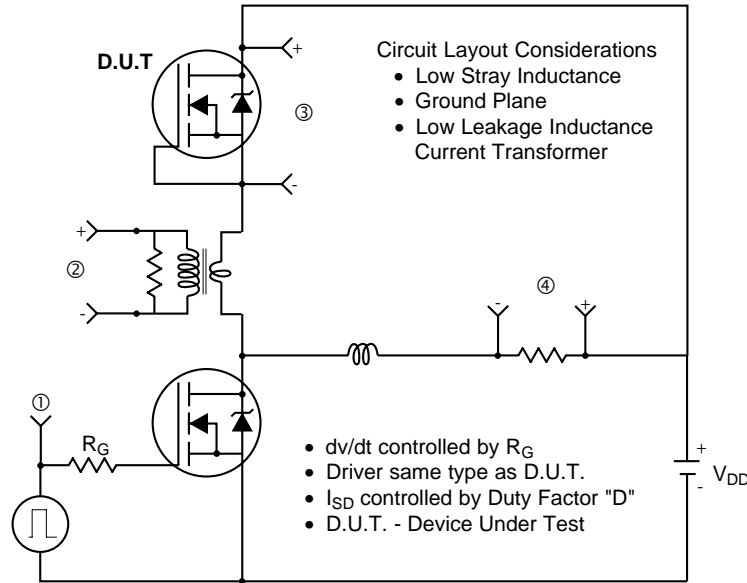


**Fig 13a.** Basic Gate Charge Waveform



**Fig 13b.** Gate Charge Test Circuit

**Peak Diode Recovery dv/dt Test Circuit**



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

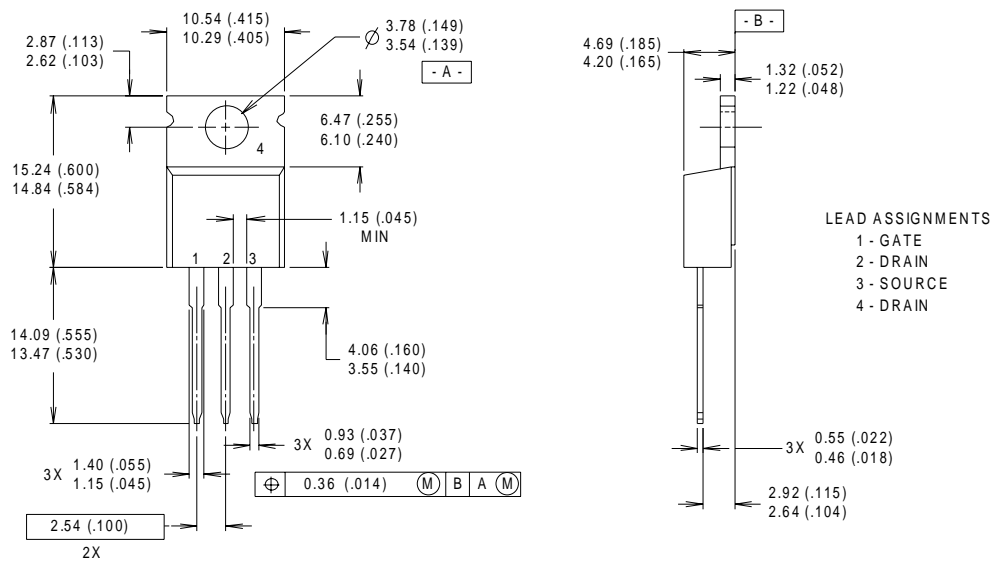
**Fig 14.** For N-Channel HEXFET<sup>®</sup> Power MOSFETs

# IRFB/IRFS/IRFSL52N15D

International  
**IR** Rectifier

## TO-220AB Package Outline

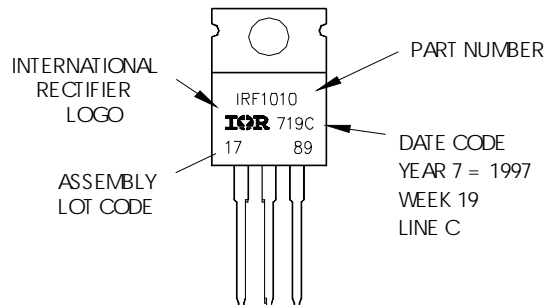
Dimensions are shown in millimeters (inches)



- NOTES:
- 1 DIMENSIONING & TOLERANCING PER ANSII Y14.5M, 1982.
  - 2 CONTROLLING DIMENSION : INCH
  - 3 OUTLINE CONFORMS TO JEDEC OUTLINE TO-220AB.
  - 4 HEATSINK & LEAD MEASUREMENTS DO NOT INCLUDE BURRS.

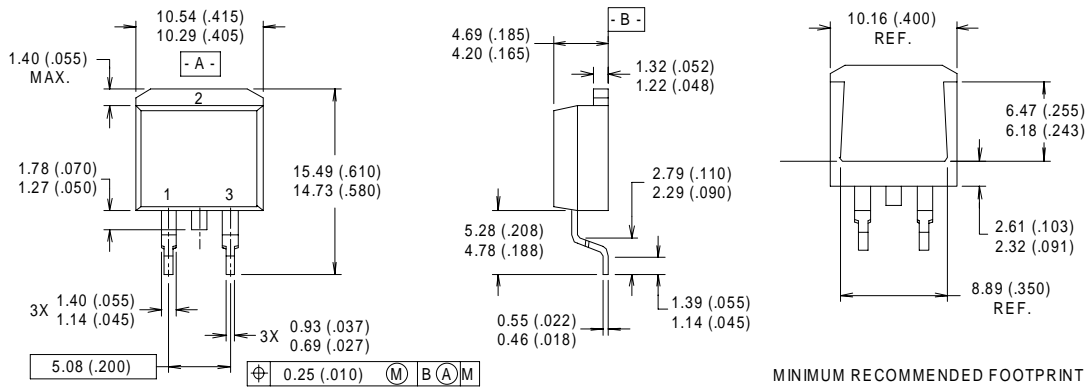
## TO-220AB Part Marking Information

EXAMPLE: THIS IS AN IRF1010  
LOT CODE 1789  
ASSEMBLED ON VVW19, 1997  
IN THE ASSEMBLY LINE "C"





## D<sup>2</sup>Pak Package Outline



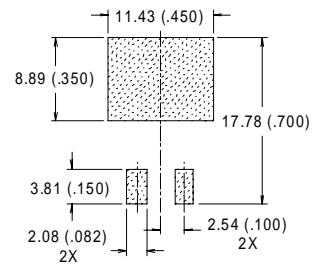
**NOTES:**

- 1 DIMENSIONS AFTER SOLDER DIP.
- 2 DIMENSIONING & TOLERANCING PER ANSI Y14.5M, 1982.
- 3 CONTROLLING DIMENSION : INCH.
- 4 HEATSINK & LEAD DIMENSIONS DO NOT INCLUDE BURRS.

**LEAD ASSIGNMENTS**

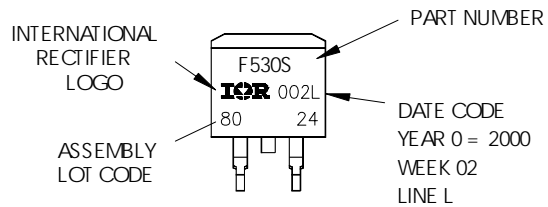
- 1 - GATE
- 2 - DRAIN
- 3 - SOURCE

**MINIMUM RECOMMENDED FOOTPRINT**



## D<sup>2</sup>Pak Part Marking Information

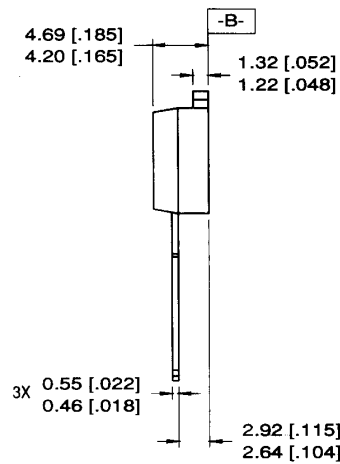
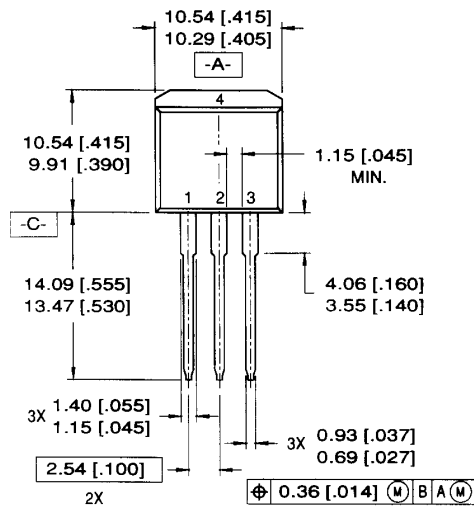
EXAMPLE: THIS IS AN IRF530S WITH  
 LOT CODE 8024  
 ASSEMBLED ON WW02, 2000  
 IN THE ASSEMBLY LINE "L"



# IRFB/IRFS/IRFSL52N15D

International  
**IR** Rectifier

## TO-262 Package Outline



**NOTES:**

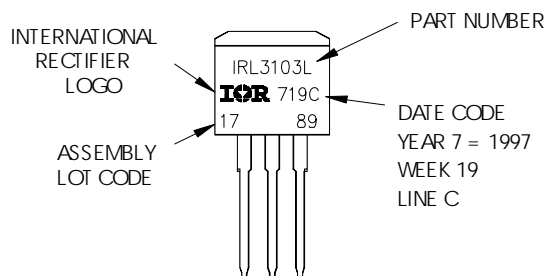
1. DIMENSIONING & TOLERANCING PER ANSI Y14.5M-1982
2. CONTROLLING DIMENSION: INCH.
3. DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES].
4. HEATSINK & LEAD DIMENSIONS DO NOT INCLUDE BURRS.

**LEAD ASSIGNMENTS**

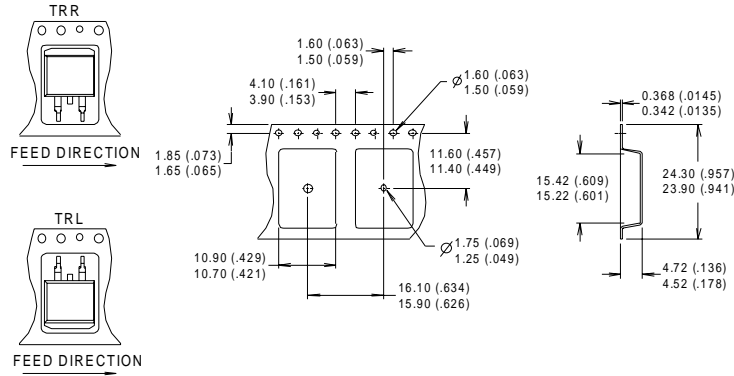
- |           |            |
|-----------|------------|
| 1 = GATE  | 3 = SOURCE |
| 2 = DRAIN | 4 = DRAIN  |

## TO-262 Part Marking Information

EXAMPLE: THIS IS AN IRL3103L  
 LOT CODE 1789  
 ASSEMBLED ON WW19, 1997  
 IN THE ASSEMBLY LINE "C"



## D<sup>2</sup>Pak Tape & Reel Information



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

### Notes:

- ① Repetitive rating; pulse width limited by max. junction temperature.
- ② Starting  $T_J = 25^\circ\text{C}$ ,  $L = 0.72\text{mH}$   
 $R_G = 25\Omega$ ,  $I_{AS} = 36\text{A}$ .
- ③  $I_{SD} \leq 36\text{A}$ ,  $di/dt \leq 400\text{A}/\mu\text{s}$ ,  $V_{DD} \leq V_{(BR)DSS}$ ,  
 $T_J \leq 175^\circ\text{C}$ .
- ④ Pulse width  $\leq 300\mu\text{s}$ ; duty cycle  $\leq 2\%$ .
- ⑤  $C_{OSS}$  eff. is a fixed capacitance that gives the same charging time as  $C_{OSS}$  while  $V_{DS}$  is rising from 0 to 80%  $V_{DSS}$ .
- ⑥ This is only applied to TO-220AB package.
- ⑦ This is applied to D<sup>2</sup>Pak, when mounted on 1" square PCB ( FR-4 or G-10 Material ).  
 For recommended footprint and soldering techniques refer to application note #AN-994.

Data and specifications subject to change without notice.  
 This product has been designed and qualified for the Automotive [Q101] (IRFB52N15D),  
 & Industrial (IRFS/SL52N15D) market.  
 Qualification Standards can be found on IR's Web site.

International  
**IR** Rectifier

IR WORLD HEADQUARTERS: 233 Kansas St., El Segundo, California 90245, USA Tel: (310) 252-7105  
 TAC Fax: (310) 252-7903

Visit us at [www.irf.com](http://www.irf.com) for sales contact information.12/01