

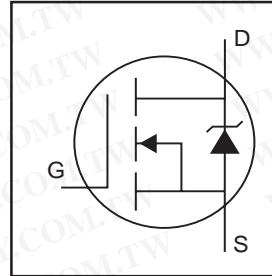
# International **IR** Rectifier

PD-90902B

## IRF640S/L

HEXFET® Power MOSFET

- Surface Mount (IRF640S)
- Low-profile through-hole (IRF640L)
- Available in Tape & Reel (IRF640S)
- Dynamic dv/dt Rating
- 150°C Operating Temperature
- Fast Switching
- Fully Avalanche Rated

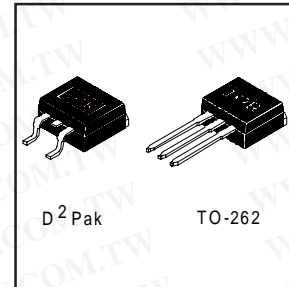


$V_{DS} = 200V$
$R_{DS(on)} = 0.18\Omega$
$I_D = 18A$

### Description

Third Generation HEXFETs from International Rectifier provide the designer with the best combinations of fast switching, ruggedized device design, low on-resistance and cost-effectiveness.

The D<sup>2</sup>Pak 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 D<sup>2</sup>Pak 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 (IRF640L) is available for low-profile applications.



### Absolute Maximum Ratings

	Parameter	Max.	Units
$I_D @ T_C = 25^\circ C$	Continuous Drain Current, $V_{GS} @ 10V$ ⑤	18	A
$I_D @ T_C = 100^\circ C$	Continuous Drain Current, $V_{GS} @ 10V$ ⑤	11	
$I_{DM}$	Pulsed Drain Current ①⑤	72	
$P_D @ T_A = 25^\circ C$	Power Dissipation	3.1	W
$P_D @ T_C = 25^\circ C$	Power Dissipation	130	W
	Linear Derating Factor	1.0	W/°C
$V_{GS}$	Gate-to-Source Voltage	$\pm 20$	V
$E_{AS}$	Single Pulse Avalanche Energy②⑤	580	mJ
$I_{AR}$	Avalanche Current①	18	A
$E_{AR}$	Repetitive Avalanche Energy①	13	mJ
dv/dt	Peak Diode Recovery dv/dt ③⑤	5.0	V/ns
$T_J$	Operating Junction and	-55 to + 175	°C
$T_{STG}$	Storage Temperature Range		
	Soldering Temperature, for 10 seconds	300 (1.6mm from case)	

### Thermal Resistance

	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case	—	1.0	°C/W
$R_{\theta JA}$	Junction-to-Ambient (PCB Mounted, steady-state)**	—	40	

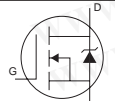
# IRF640S/L

International  
**IR** Rectifier

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

	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(BR)DSS}$	Drain-to-Source Breakdown Voltage	200	—	—	V	$V_{GS} = 0V, I_D = 250\mu A$
$\Delta V_{(BR)DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	—	0.29	—	V/°C	Reference to $25^\circ\text{C}, I_D = 1\text{mA}$ ⑤
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	—	—	0.18	$\Omega$	$V_{GS} = 10V, I_D = 11A$ ④
$V_{GS(th)}$	Gate Threshold Voltage	2.0	—	4.0	V	$V_{DS} = V_{GS}, I_D = 250\mu A$
$g_{fs}$	Forward Transconductance	6.7	—	—	S	$V_{DS} = 50V, I_D = 11A$ ⑤
$I_{DSS}$	Drain-to-Source Leakage Current	—	—	25	$\mu A$	$V_{DS} = 200V, V_{GS} = 0V$
		—	—	250		$V_{DS} = 160V, V_{GS} = 0V, T_J = 125^\circ\text{C}$
$I_{GSS}$	Gate-to-Source Forward Leakage	—	—	100	nA	$V_{GS} = 20V$
	Gate-to-Source Reverse Leakage	—	—	-100		$V_{GS} = -20V$
$Q_g$	Total Gate Charge	—	—	70	nC	$I_D = 18A$
$Q_{gs}$	Gate-to-Source Charge	—	—	13		$V_{DS} = 160V$
$Q_{gd}$	Gate-to-Drain ("Miller") Charge	—	—	39		$V_{GS} = 10V$ , See Fig. 6 and 13 ④⑤
$t_{d(on)}$	Turn-On Delay Time	—	14	—		$V_{DD} = 100V$
$t_r$	Rise Time	—	51	—	ns	$I_D = 18A$
$t_{d(off)}$	Turn-Off Delay Time	—	45	—		$R_G = 9.1\Omega$
$t_f$	Fall Time	—	36	—		$R_D = 5.4\Omega$ , See Fig. 10 ④⑤
$L_S$	Internal Source Inductance	—	7.5	—	nH	Between lead, and center of die contact
$C_{iss}$	Input Capacitance	—	1300	—	pF	$V_{GS} = 0V$
$C_{oss}$	Output Capacitance	—	430	—		$V_{DS} = 25V$
$C_{rss}$	Reverse Transfer Capacitance	—	130	—		$f = 1.0\text{MHz}$ , See Fig. 5⑤

## Source-Drain Ratings and Characteristics

	Parameter	Min.	Typ.	Max.	Units	Conditions
$I_S$	Continuous Source Current (Body Diode)	—	—	18	A	MOSFET symbol showing the integral reverse p-n junction diode. 
$I_{SM}$	Pulsed Source Current (Body Diode) ①⑤	—	—	72		
$V_{SD}$	Diode Forward Voltage	—	—	2.0	V	$T_J = 25^\circ\text{C}, I_S = 18A, V_{GS} = 0V$ ④
$t_{rr}$	Reverse Recovery Time	—	300	610	ns	$T_J = 25^\circ\text{C}, I_F = 18A$
$Q_{rr}$	Reverse Recovery Charge	—	3.4	7.1	$\mu C$	$di/dt = 100A/\mu s$ ④⑤
$t_{on}$	Forward Turn-On Time	Intrinsic turn-on time is negligible (turn-on is dominated by $L_S+L_D$ )				

### Notes:

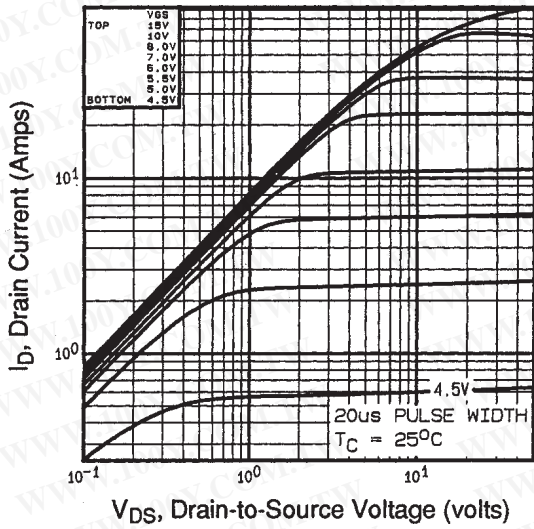
- ① Repetitive rating; pulse width limited by max. junction temperature. ( See fig. 11 )
- ②  $V_{DD} = 50V$ , starting  $T_J = 25^\circ\text{C}$ ,  $L = 2.7\text{mH}$ ,  $R_G = 25\Omega$ ,  $I_{AS} = 18A$ . (See Figure 12)
- ③  $I_{SD} \leq 18A$ ,  $di/dt \leq 150A/\mu s$ ,  $V_{DD} \leq V_{(BR)DSS}$ ,  $T_J \leq 150^\circ\text{C}$
- ④ Pulse width  $\leq 300\mu s$ ; duty cycle  $\leq 2\%$ .
- ⑤ Uses IRF640 data and test conditions

\*\* When mounted on 1" square PCB ( FR-4 or G-10 Material ).

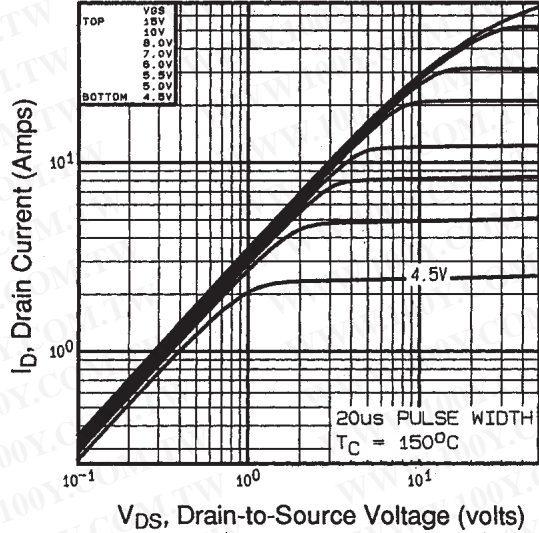
For recommended footprint and soldering techniques refer to application note #AN-994.

International  
**IR** Rectifier

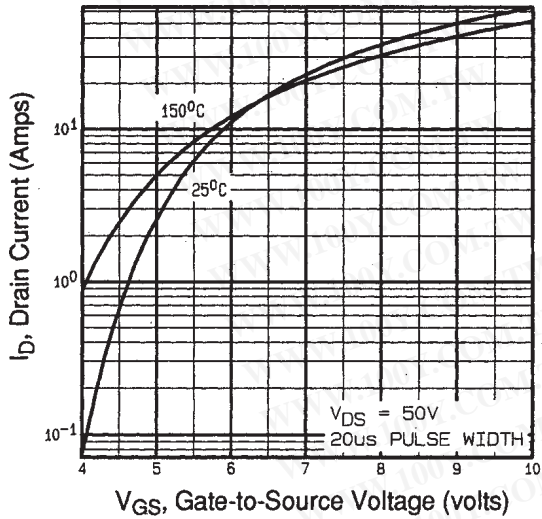
# IRF640S/L



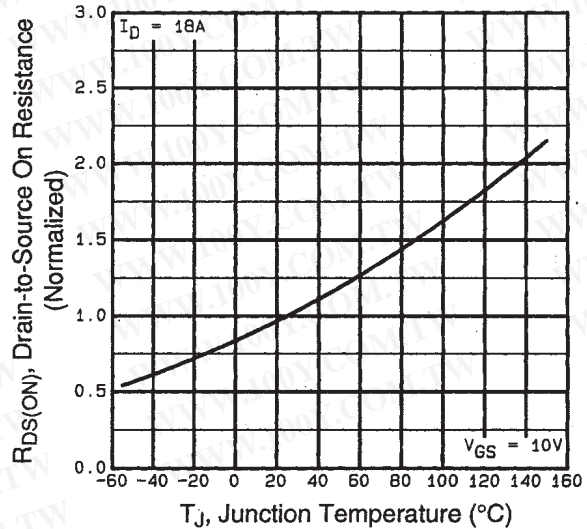
**Fig 1.** Typical Output Characteristics,  
 $T_J = 25^\circ\text{C}$



**Fig 2.** Typical Output Characteristics,  
 $T_J = 175^\circ\text{C}$



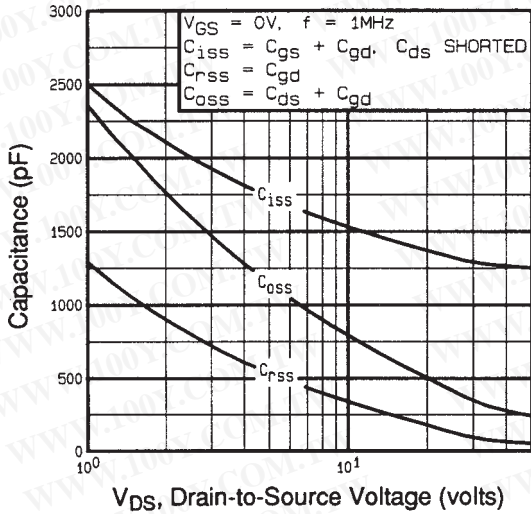
**Fig 3.** Typical Transfer Characteristics



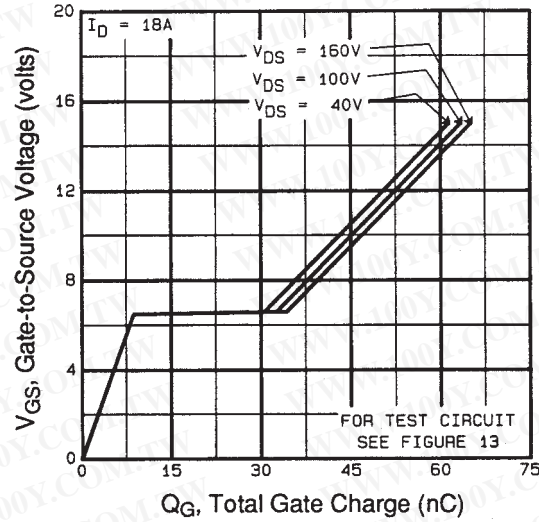
**Fig 4.** Normalized On-Resistance  
 Vs. Temperature

# IRF640S/L

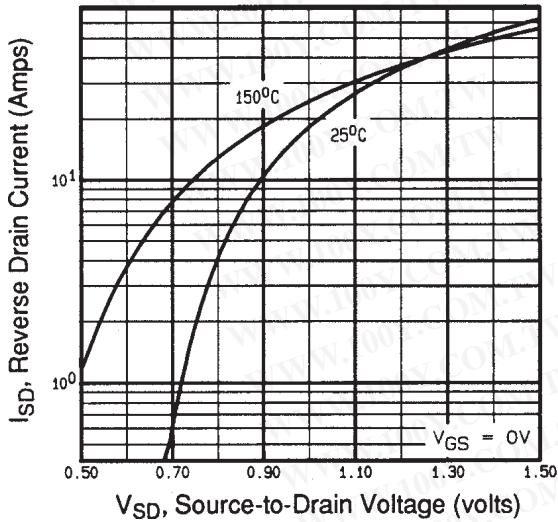
International  
**IR** Rectifier



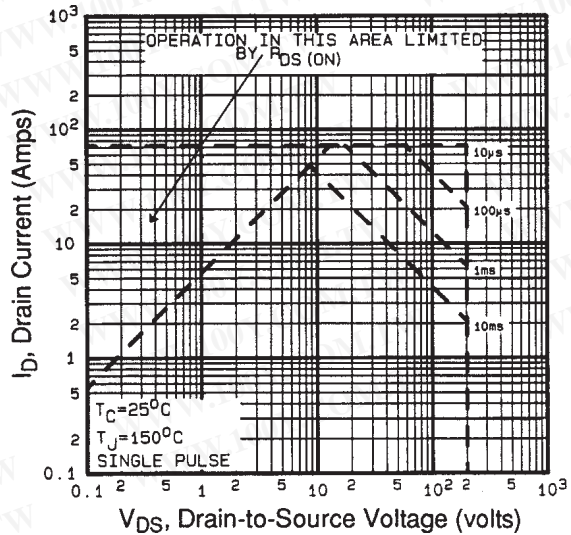
**Fig 5.** Typical Capacitance Vs. Drain-to-Source Voltage



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



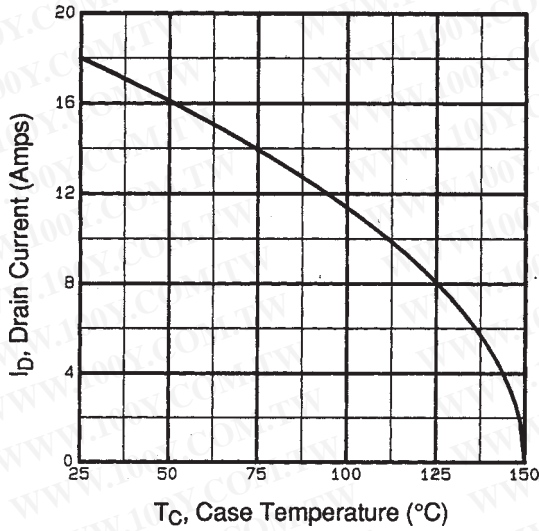
**Fig 7.** Typical Source-Drain Diode Forward Voltage



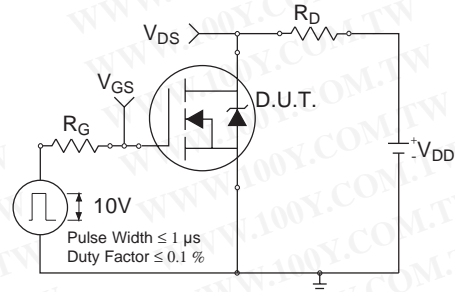
**Fig 8.** Maximum Safe Operating Area

International  
**IR** Rectifier

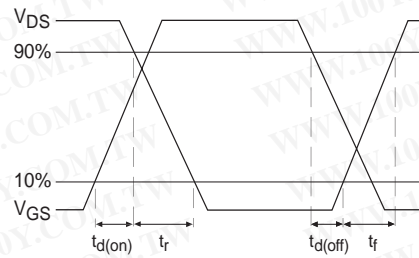
# IRF640S/L



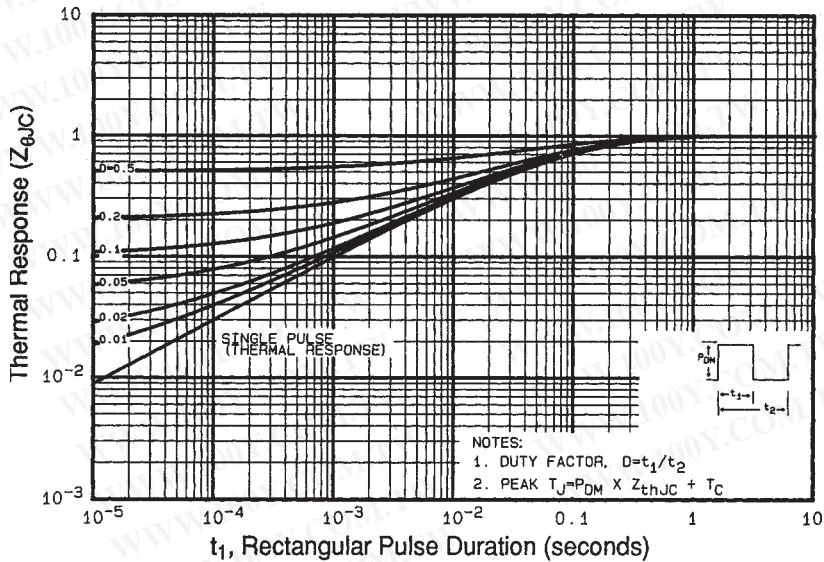
**Fig 9.** Maximum Drain Current Vs. Case Temperature



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



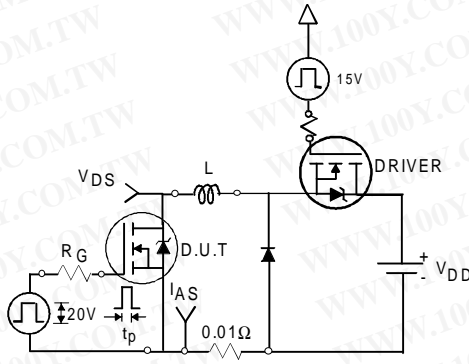
**Fig 10b.** Switching Time Waveforms



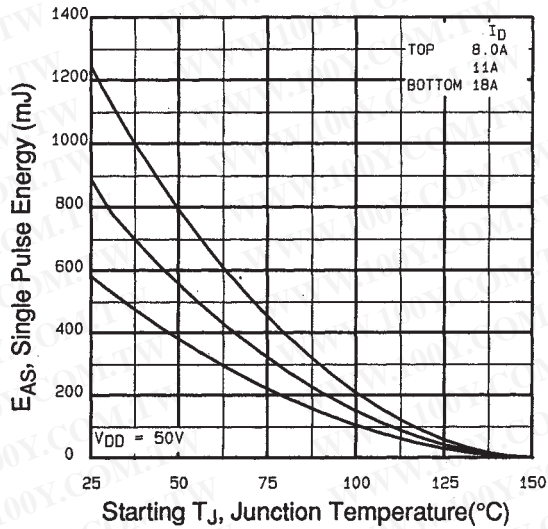
**Fig 11.** Maximum Effective Transient Thermal Impedance, Junction-to-Case

# IRF640S/L

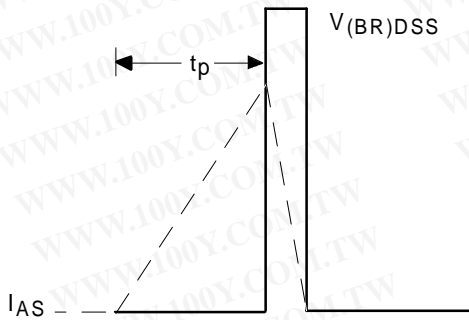
International  
**IR** Rectifier



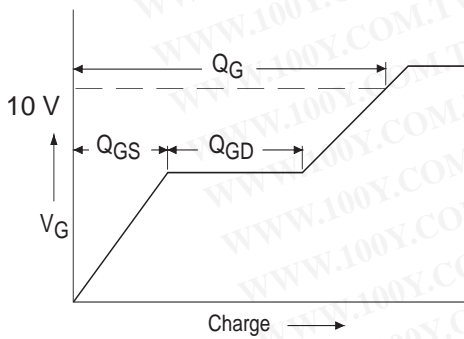
**Fig 12a.** Unclamped Inductive Test Circuit



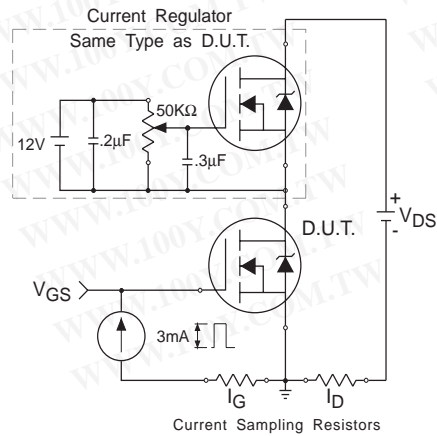
**Fig 12c.** Maximum Avalanche Energy Vs. Drain Current



**Fig 12b.** Unclamped Inductive Waveforms



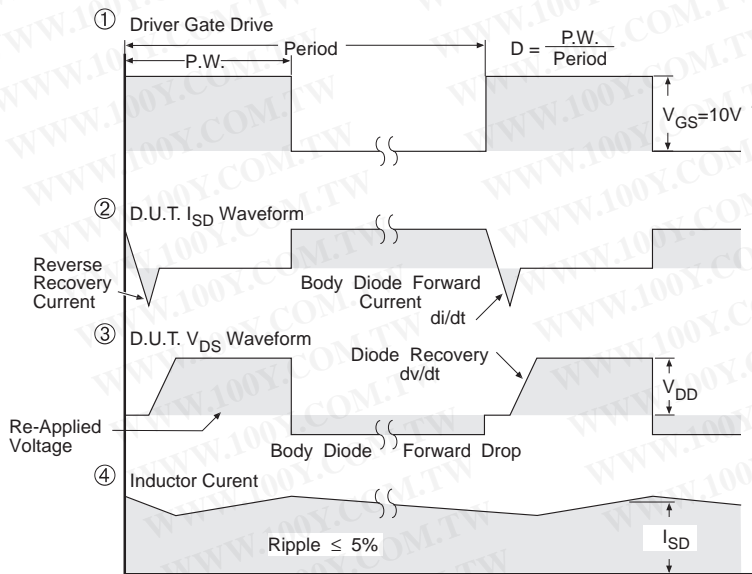
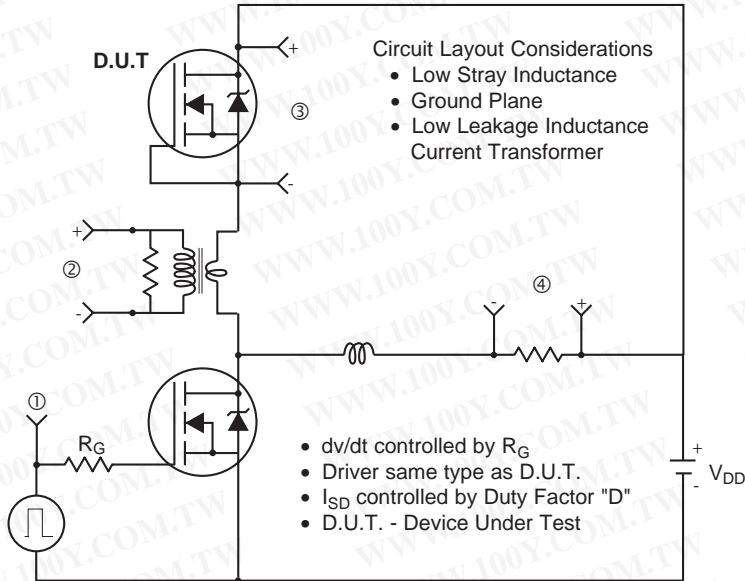
**Fig 13a.** Basic Gate Charge Waveform



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

# IRF640S/L

## Peak Diode Recovery dv/dt Test Circuit



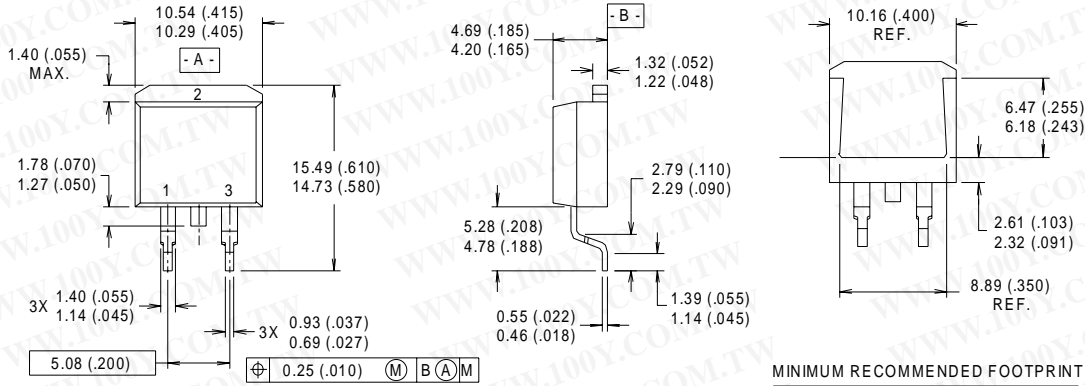
\*  $V_{GS} = 5V$  for Logic Level Devices

**Fig 14.** For N-Channel HEXFETS

# IRF640S/L

International  
**IR** Rectifier

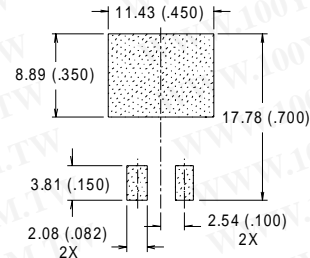
## D<sup>2</sup>Pak Package Outline



- 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.

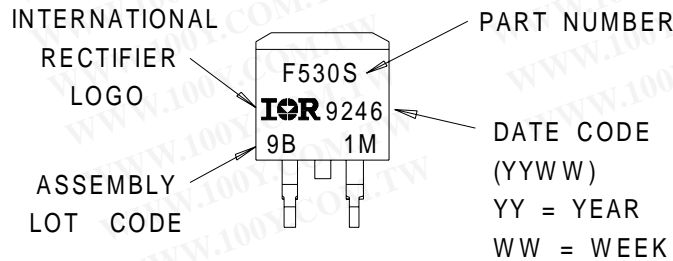
- LEAD ASSIGNMENTS
- 1 - GATE
  - 2 - DRAIN
  - 3 - SOURCE

MINIMUM RECOMMENDED FOOTPRINT



## Part Marking Information

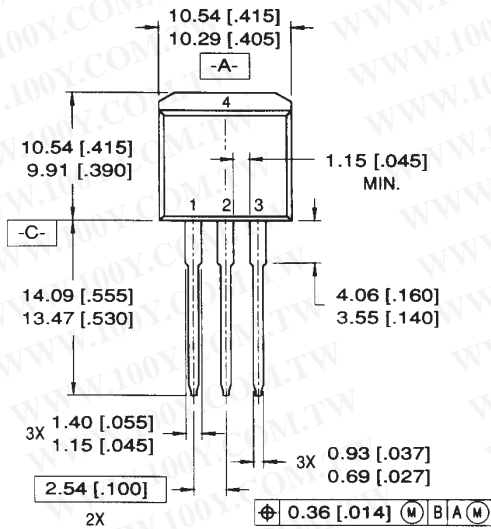
D<sup>2</sup>Pak



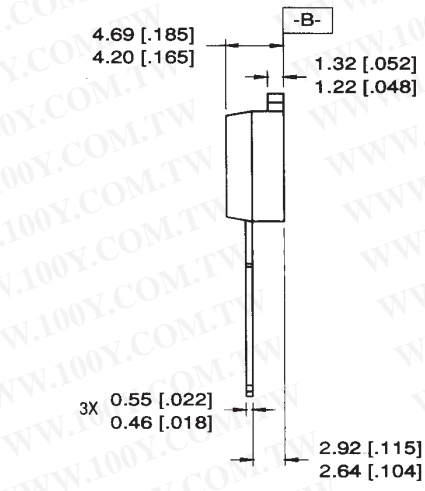
International  
**IR** Rectifier

# IRF640S/L

## Package Outline TO-262 Outline



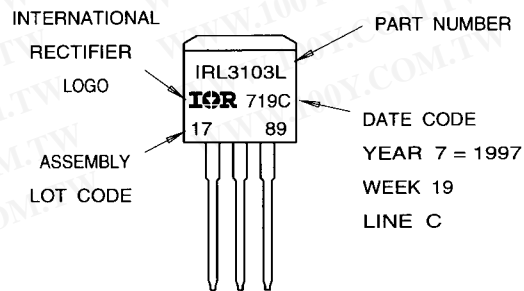
**LEAD ASSIGNMENTS**  
 1 = GATE      3 = SOURCE  
 2 = DRAIN    4 = DRAIN



- 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.

## Part Marking Information TO-262

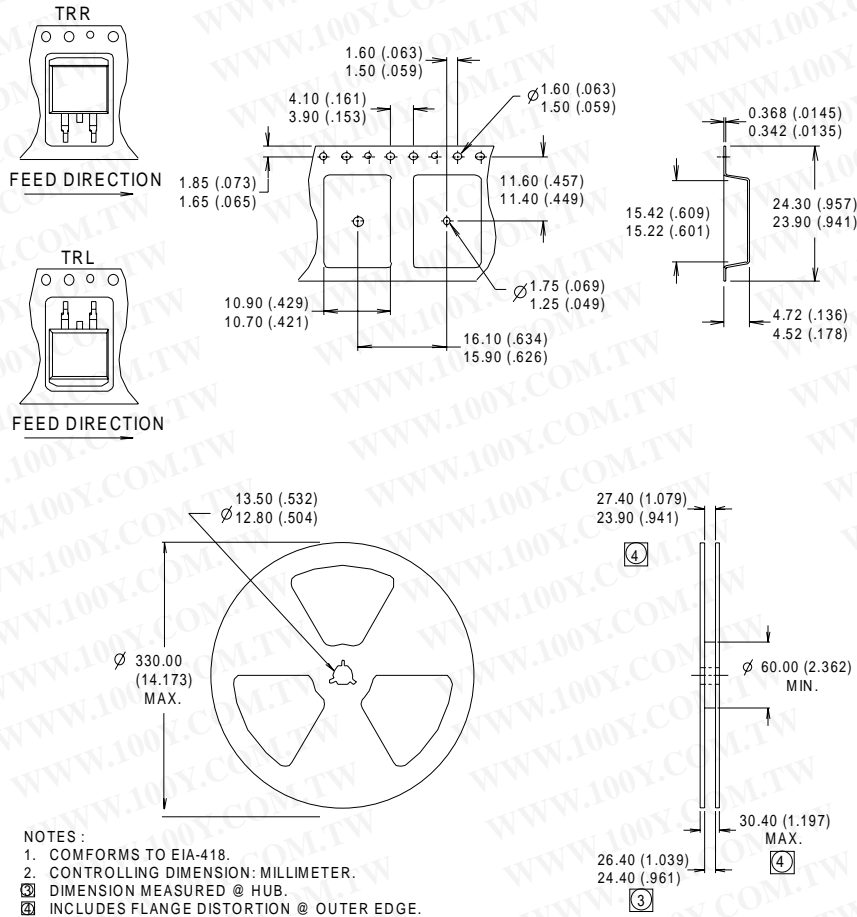
EXAMPLE: THIS IS AN IRL3103L  
 LOT CODE 1789  
 ASSEMBLED ON WW 19, 1997  
 IN THE ASSEMBLY LINE "C"



# IRF640S/L

International  
**IR** Rectifier

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



International  
**IR** Rectifier

**WORLD HEADQUARTERS:** 233 Kansas St., El Segundo, California 90245, Tel: (310) 322 3331

**IR GREAT BRITAIN:** Hurst Green, Oxted, Surrey RH8 9BB, UK Tel: ++ 44 1883 732020

**IR CANADA:** 15 Lincoln Court, Brampton, Ontario L6T3Z2, Tel: (905) 453 2200

**IR GERMANY:** Saalburgstrasse 157, 61350 Bad Homburg Tel: ++ 49 6172 96590

**IR ITALY:** Via Liguria 49, 10071 Borgaro, Torino Tel: ++ 39 11 451 0111

**IR FAR EAST:** K&H Bldg., 2F, 30-4 Nishi-Ikebukuro 3-Chome, Toshima-Ku, Tokyo Japan 171 Tel: 81 3 3983 0086

**IR SOUTHEAST ASIA:** 1 Kim Seng Promenade, Great World City West Tower, 13-11, Singapore 237994 Tel: ++ 65 838 4630

**IR TAIWAN:** 16 Fl. Suite D. 207, Sec. 2, Tun Haw South Road, Taipei, 10673, Taiwan Tel: 886-2-2377-9936

<http://www.irf.com/> Data and specifications subject to change without notice. 7/99