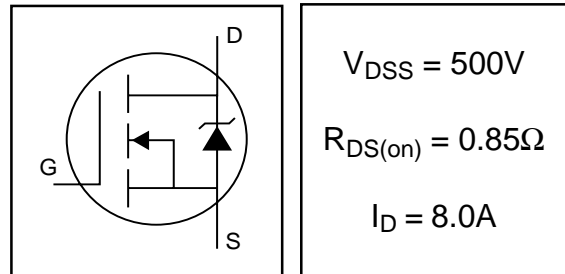


**IRF840LCS**  
**IRF840LCL**  
HEXFET® Power MOSFET

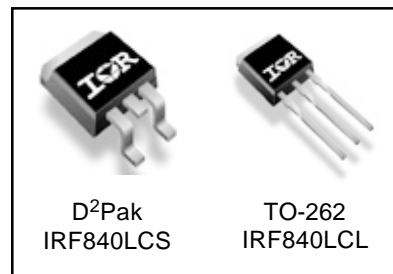
- Ultra Low Gate Charge
- Reduced Gate Drive Requirement
- Enhanced 30V  $V_{GS}$  Rating
- Reduced  $C_{ISS}$ ,  $C_{OSS}$ ,  $C_{RSS}$
- Extremely High Frequency Operation
- Repetitive Avalanche Rated



**Description**

This new series of low charge HEXFET® power MOSFETs achieve significant lower gate charge over conventional MOSFETs. Utilizing the new LCDMOS (low charge device MOSFETs) technology, the device improvements are achieved without added product cost, allowing for reduce gate drive requirements and total system savings. In addition, reduced switching losses and improved efficiency and achievable in a variety of high frequency applications. Frequencies of a few MHz at high current are possible using the new low charge MOSFETs.

These device improvements combined with the proven ruggedness and reliability that characterize of HEXFET power MOSFETs offer the designer a new power transistor standard for switching applications.



**Absolute Maximum Ratings**

	Parameter	Max.	Units
$I_D @ T_C = 25^\circ\text{C}$	Continuous Drain Current, $V_{GS} @ 10\text{V}^{\text{⑤}}$	8.0	A
$I_D @ T_C = 100^\circ\text{C}$	Continuous Drain Current, $V_{GS} @ 10\text{V}^{\text{⑤}}$	5.1	
$I_{DM}$	Pulsed Drain Current ①⑤	28	
$P_D @ T_A = 25^\circ\text{C}$	Power Dissipation	3.1	W
$P_D @ T_C = 25^\circ\text{C}$	Power Dissipation	125	W
	Linear Derating Factor	1.0	W/°C
$V_{GS}$	Gate-to-Source Voltage	$\pm 30$	V
$E_{AS}$	Single Pulse Avalanche Energy, ⑤	510	mJ
$I_{AR}$	Avalanche Current①	8.0	A
$E_{AR}$	Repetitive Avalanche Energy①	13	mJ
$dv/dt$	Peak Diode Recovery $dv/dt$ ③⑤	3.5	V/ns
$T_J$	Operating Junction and	-55 to + 150	°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	

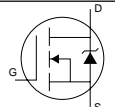
# IRF840LCS/LCL

International  
 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	500	—	—	V	$V_{GS} = 0V, I_D = 250\mu A$
$\Delta V_{(BR)DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	—	0.63	—	V/°C	Reference to $25^\circ\text{C}, I_D = 1\text{mA}$ ⑤
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	—	—	0.85	$\Omega$	$V_{GS} = 10V, I_D = 4.8A$ 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	4.0	—	—	S	$V_{DS} = 50V, I_D = 4.8A$ ④
$I_{DSS}$	Drain-to-Source Leakage Current	—	—	25	$\mu A$	$V_{DS} = 500V, V_{GS} = 0V$
		—	—	250		$V_{DS} = 400V, V_{GS} = 0V, T_J = 125^\circ\text{C}$
$I_{GSS}$	Gate-to-Source Forward Leakage	—	—	100	nA	$V_{GS} = 20V$
	Gate-to-Source Reverse Leakage	—	—	-100		$V_{GS} = -20V$
$Q_g$	Total Gate Charge	—	—	39	nC	$I_D = 8.0A$
$Q_{gs}$	Gate-to-Source Charge	—	—	10		$V_{DS} = 400V$
$Q_{gd}$	Gate-to-Drain ("Miller") Charge	—	—	19		$V_{GS} = 10V$ , See Fig. 6 and 13 ④ ⑤
$t_{d(on)}$	Turn-On Delay Time	—	12	—	ns	$V_{DD} = 250V$
$t_r$	Rise Time	—	25	—		$I_D = 8.0A$
$t_{d(off)}$	Turn-Off Delay Time	—	27	—		$R_G = 9.1\Omega$
$t_f$	Fall Time	—	19	—		$R_D = 30\Omega$ , See Fig. 10 ④ ⑤
$L_S$	Internal Source Inductance	—	7.5	—	nH	Between lead, and center of die contact
$C_{iss}$	Input Capacitance	—	1100	—	pF	$V_{GS} = 0V$
$C_{oss}$	Output Capacitance	—	170	—		$V_{DS} = 25V$
$C_{rss}$	Reverse Transfer Capacitance	—	18	—		$f = 1.0\text{MHz}$ , See Fig. 5 ⑤

## Source-Drain Ratings and Characteristics

	Parameter	Min.	Typ.	Max.	Units	Conditions
$I_S$	Continuous Source Current (Body Diode)	—	—	8.0	A	MOSFET symbol showing the integral reverse p-n junction diode. 
$I_{SM}$	Pulsed Source Current (Body Diode) ① ⑤	—	—	28		
$V_{SD}$	Diode Forward Voltage	—	—	2.0	V	$T_J = 25^\circ\text{C}, I_S = 8.0A, V_{GS} = 0V$ ④
$t_{rr}$	Reverse Recovery Time	—	490	740	ns	$T_J = 25^\circ\text{C}, I_F = 8.0A$
$Q_{rr}$	Reverse Recovery Charge	—	3.0	4.5	$\mu C$	$di/dt = 100A/\mu s$ ④ ⑤
$t_{on}$	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  $T_J = 25^\circ\text{C}$ ,  $L = 14\text{mH}$ ,  $R_G = 25\Omega$ ,  $I_{AS} = 8.0A$ . (See Figure 12)
- ③  $I_{SD} \leq 8.0A$ ,  $di/dt \leq 100A/\mu s$ ,  $V_{DD} \leq V_{(BR)DSS}$ ,  $T_J \leq 150^\circ\text{C}$
- ④ Pulse width  $\leq 300\mu s$ ; duty cycle  $\leq 2\%$ .
- ⑤ Uses IRF840LC data and test conditions

\*\* When mounted on 1" square PCB (FR-4 or G-10 Material).  
 For recommended soldering techniques refer to application note #AN-994.

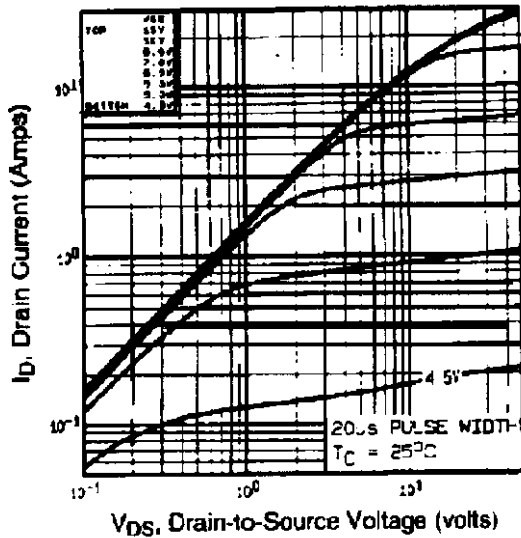


Fig 1. Typical Output Characteristics

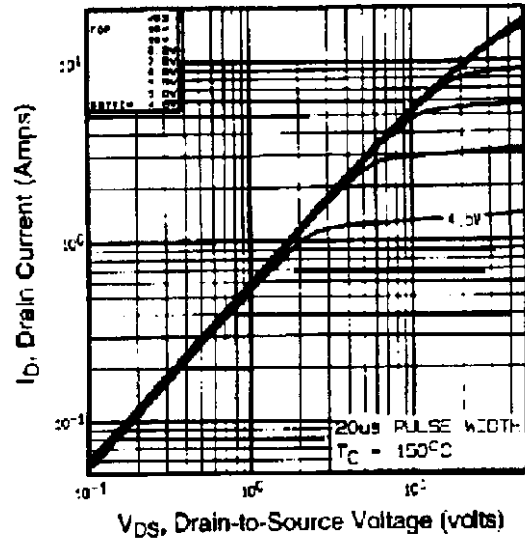


Fig 2. Typical Output Characteristics

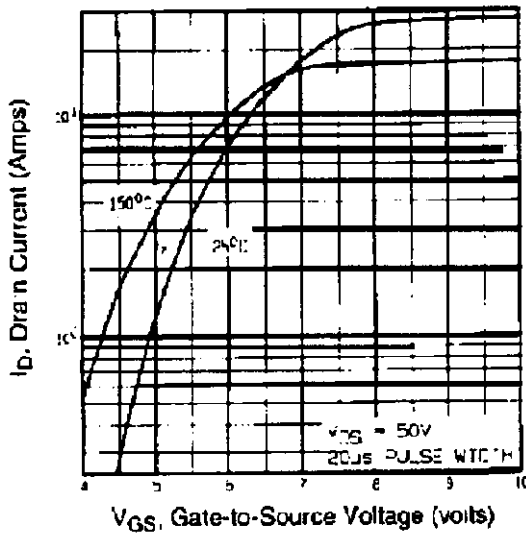


Fig 3. Typical Transfer Characteristics

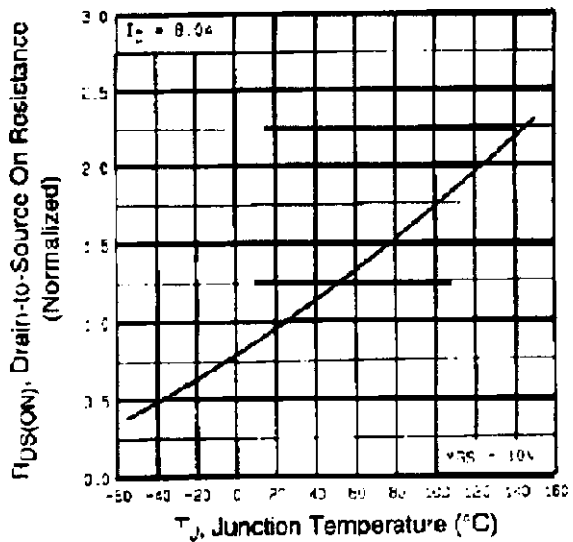
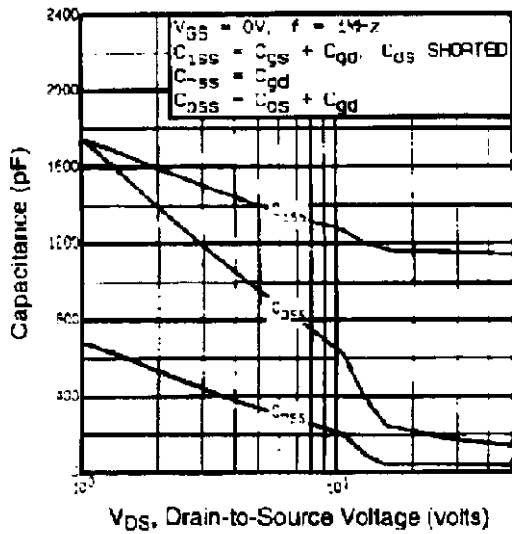
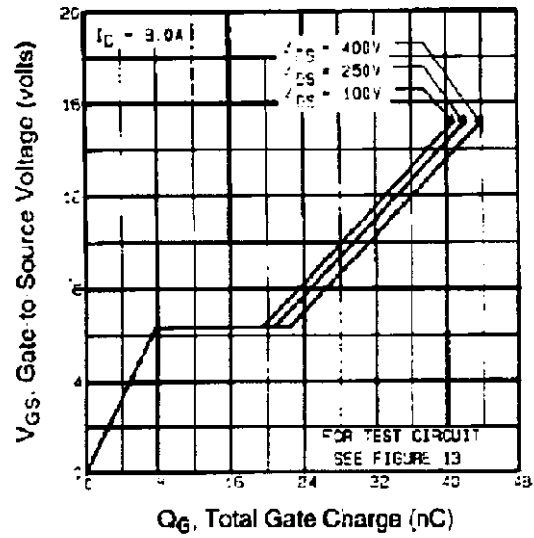


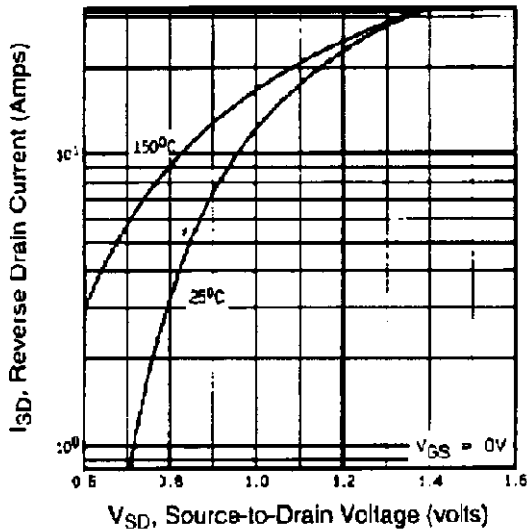
Fig 4. Normalized On-Resistance  
 Vs. Temperature



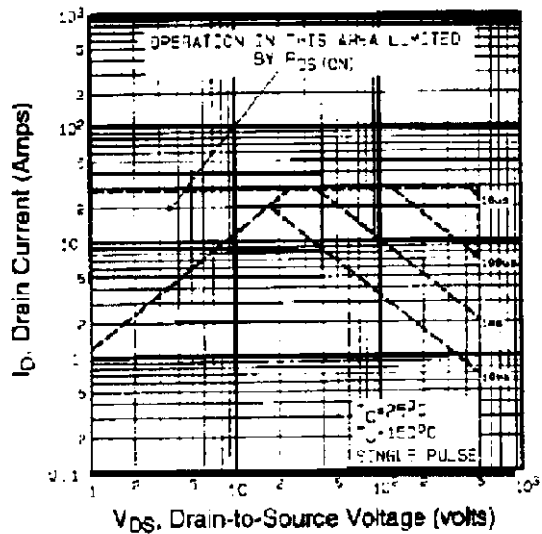
**Fig 5.** Typical Capacitance Vs. Drain-to-Source Voltage



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



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



**Fig 8.** Maximum Safe Operating Area

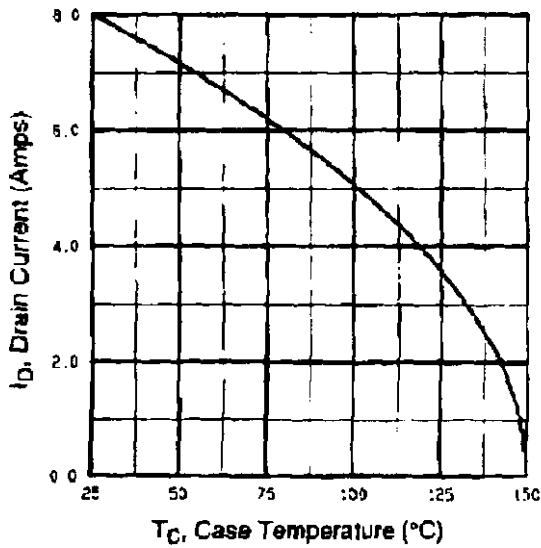


Fig 9. Maximum Drain Current Vs. Case Temperature

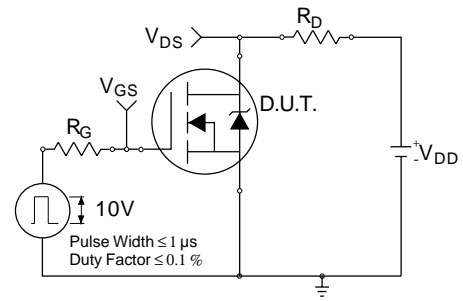


Fig 10a. Switching Time Test Circuit

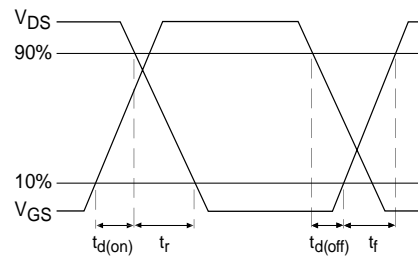


Fig 10b. Switching Time Waveforms

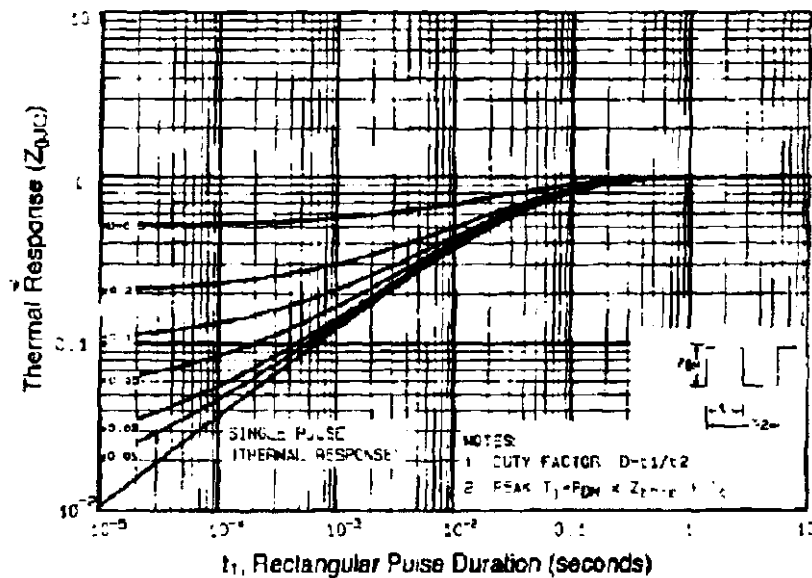
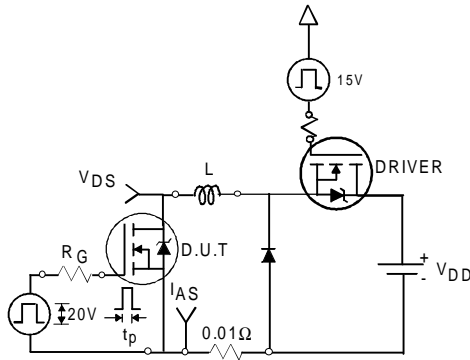
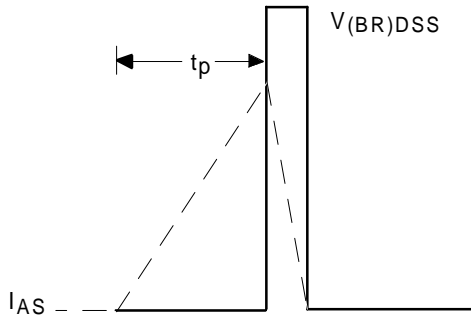


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Case

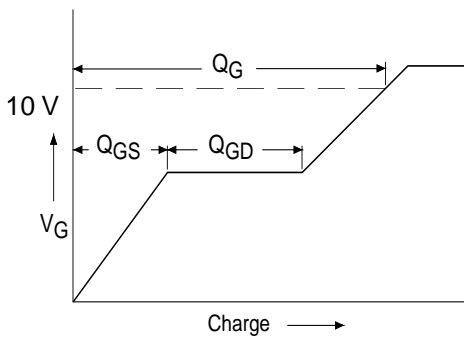
# IRF840LCS/LCL



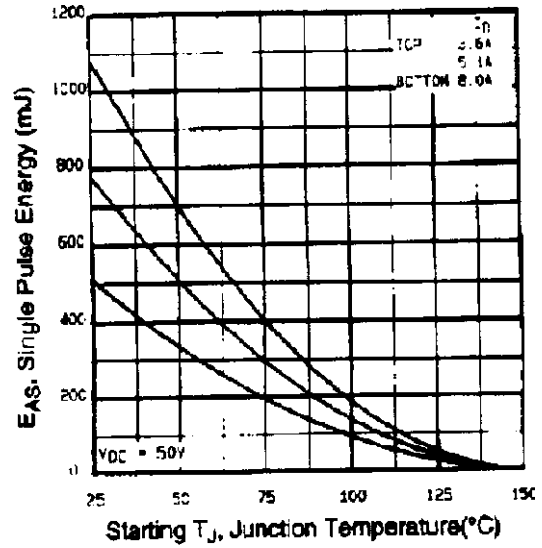
**Fig 12a.** Unclamped Inductive Test Circuit



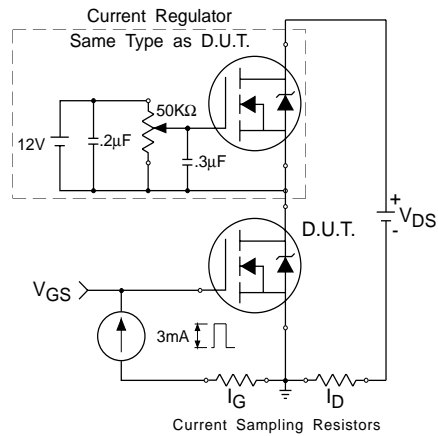
**Fig 12b.** Unclamped Inductive Waveforms



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

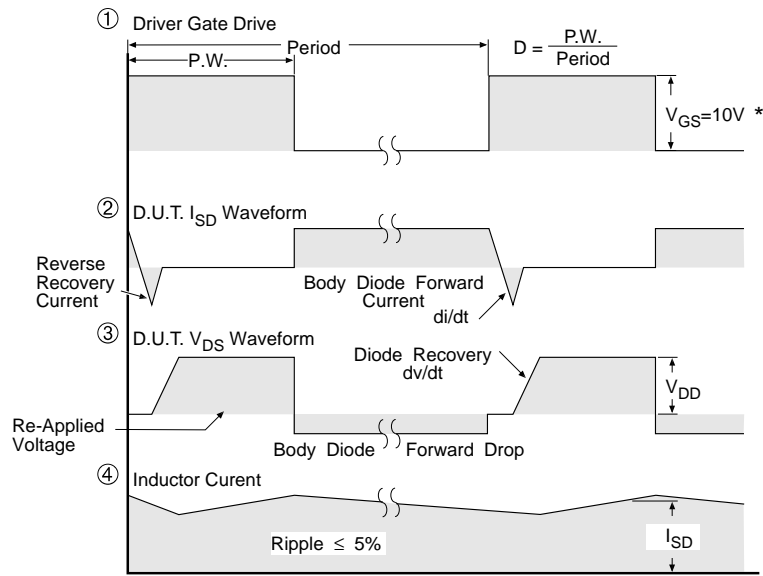
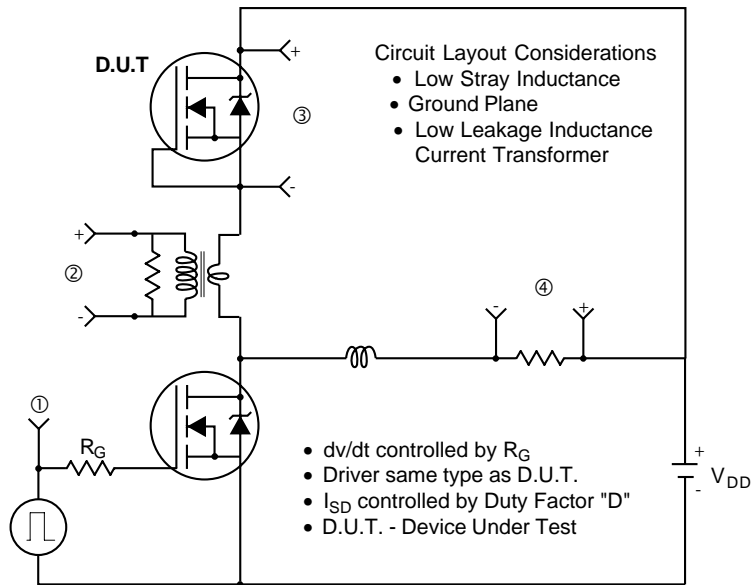


**Fig 12c.** Maximum Avalanche Energy Vs. Drain Current



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

## Peak Diode Recovery dv/dt Test Circuit



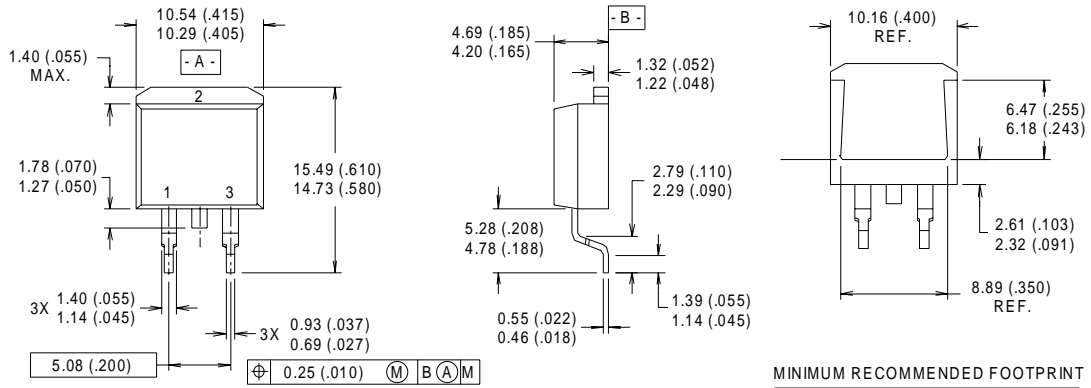
\*  $V_{GS} = 5V$  for Logic Level Devices

**Fig 14.** For N-Channel HEXFET® Power MOSFETs

# IRF840LCS/LCL

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



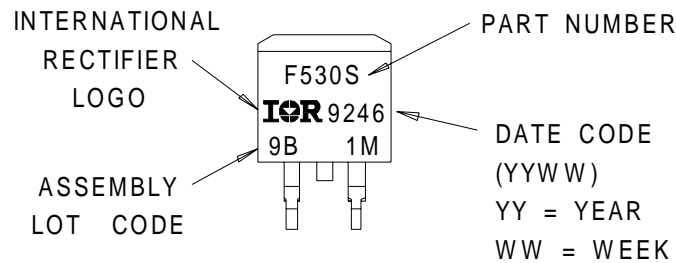
**NOTES:**

- 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**

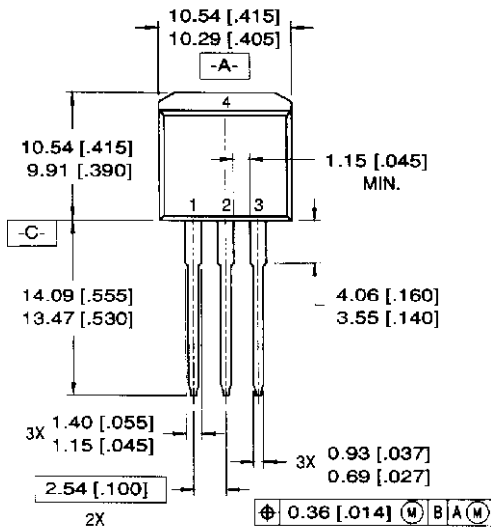
- 1 - GATE
- 2 - DRAIN
- 3 - SOURCE

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



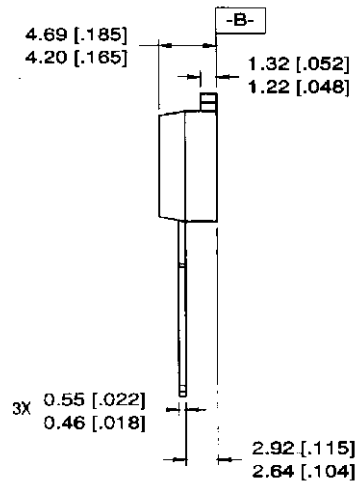


## TO-262 Package Outline



**LEAD ASSIGNMENTS**

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

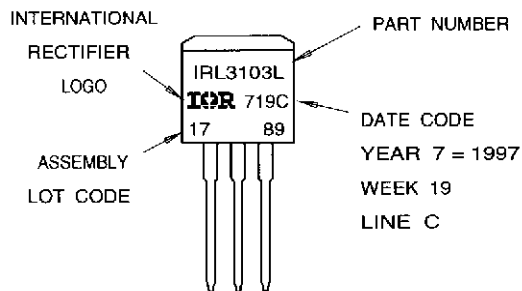


**NOTES:**

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.

## TO-262 Part Marking Information

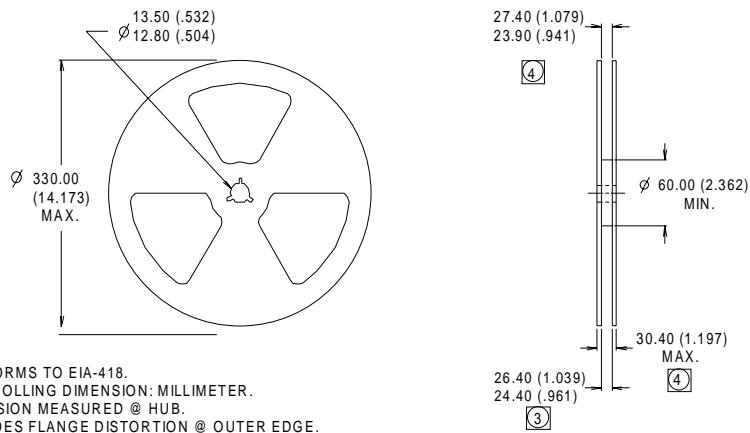
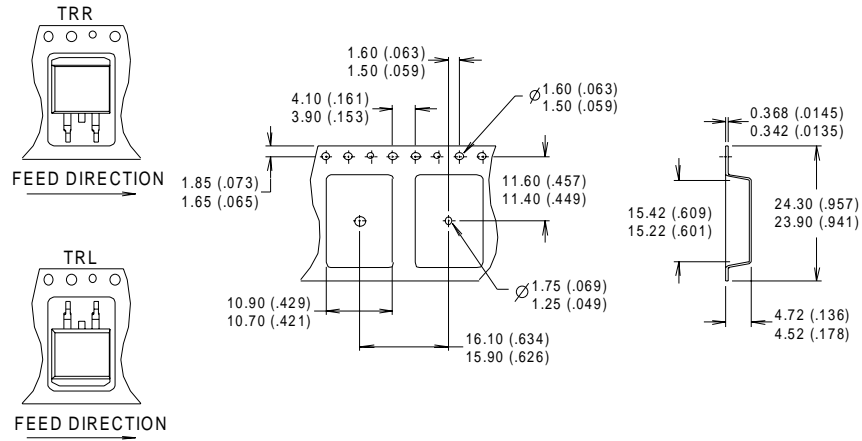
EXAMPLE: THIS IS AN IRL3103L  
 LOT CODE 1789  
 ASSEMBLED ON WW 19, 1997  
 IN THE ASSEMBLY LINE "C"



# IRF840LCS/LCL

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## 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.

International  
**IR** Rectifier

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**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 JAPAN:** 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

*Data and specifications subject to change without notice. 1/2000*



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