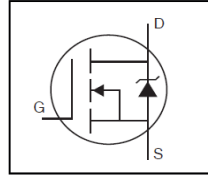


- Logic –Level Gate Drive
- Advanced Process Technology
- Isolated Package
- High Voltage Isolation = 2.5KVRMS ⑤
- Sink to Lead Creepage Dist. = 4.8mm
- Fully Avalanche Rated
- Lead-Free

HEXFET® Power MOSFET



<b>V<sub>DSS</sub></b>	<b>100V</b>
<b>R<sub>DS(on)</sub></b>	<b>0.044Ω</b>
<b>I<sub>D</sub></b>	<b>23A</b>



TO-220 Full-Pak

<b>G</b>	<b>D</b>	<b>S</b>
Gate	Drain	Source

### Description

Fifth Generation HEXFETs 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 TO-220 Full Pak eliminates the need for additional insulating hardware in commercial-industrial applications. The molding compound used provides a high isolation capability and a low thermal resistance between the tab and external heat sink. This isolation is equivalent to using a 100 micron mica barrier with standard TO-220 product. The Fullpak is mounted to a heat sink using a single clip or by a single screw fixing.

Base Part Number	Package Type	Standard Pack		Orderable Part Number
		Form	Quantity	
IRLI540NPbF	TO-220 Full-Pak	Tube	50	IRLI540NPbF

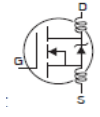
### Absolute Maximum Ratings

Symbol	Parameter	Max.	Units
I <sub>D</sub> @ T <sub>C</sub> = 25°C	Continuous Drain Current, V <sub>GS</sub> @ 10V	23	A
I <sub>D</sub> @ T <sub>C</sub> = 100°C	Continuous Drain Current, V <sub>GS</sub> @ 10V	16	
I <sub>DM</sub>	Pulsed Drain Current ①⑥	120	
P <sub>D</sub> @ T <sub>C</sub> = 25°C	Maximum Power Dissipation	54	W
	Linear Derating Factor	0.36	W/°C
V <sub>GS</sub>	Gate-to-Source Voltage	± 16	V
E <sub>AS</sub>	Single Pulse Avalanche Energy (Thermally Limited) ②⑥	310	mJ
I <sub>AR</sub>	Avalanche Current ①⑥	18	A
E <sub>AR</sub>	Repetitive Avalanche Energy ①	5.4	mJ
dv/dt	Peak Diode Recovery dv/dt③⑥	5.0	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 (1.6mm from case)	300	
	Mounting torque, 6-32 or M3 screw	10 lbf•in (1.1N•m)	

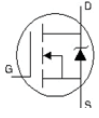
### Thermal Resistance

Symbol	Parameter	Typ.	Max.	Units
R <sub>θJC</sub>	Junction-to-Case	—	2.8	°C/W
R <sub>θJA</sub>	Junction-to-Ambient	—	65	

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

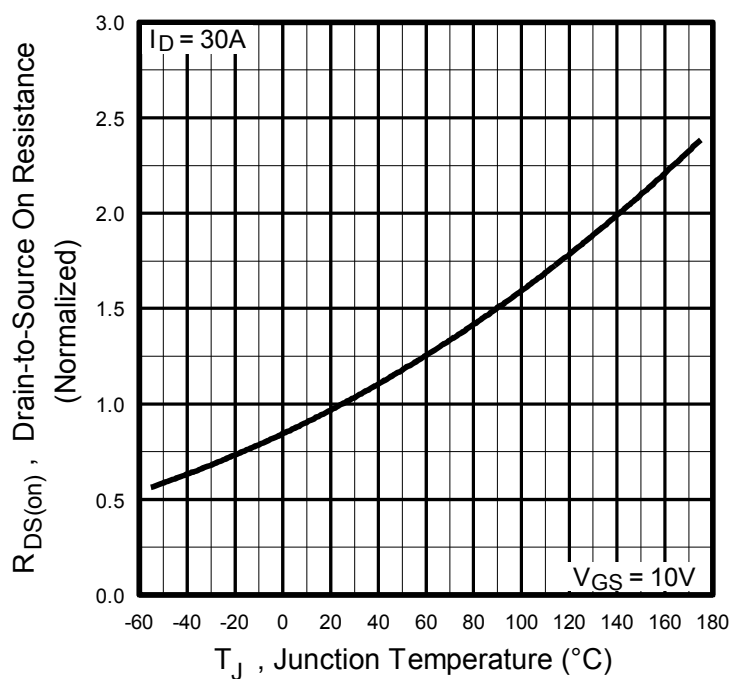
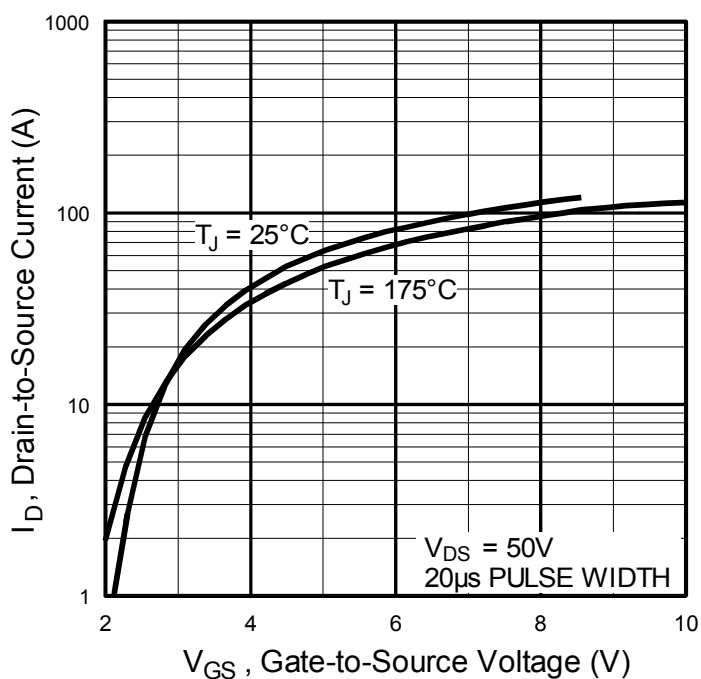
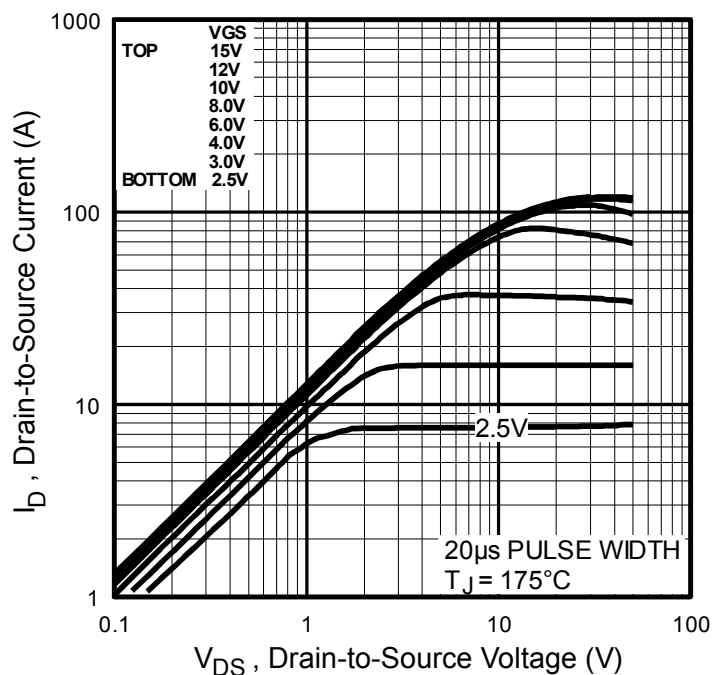
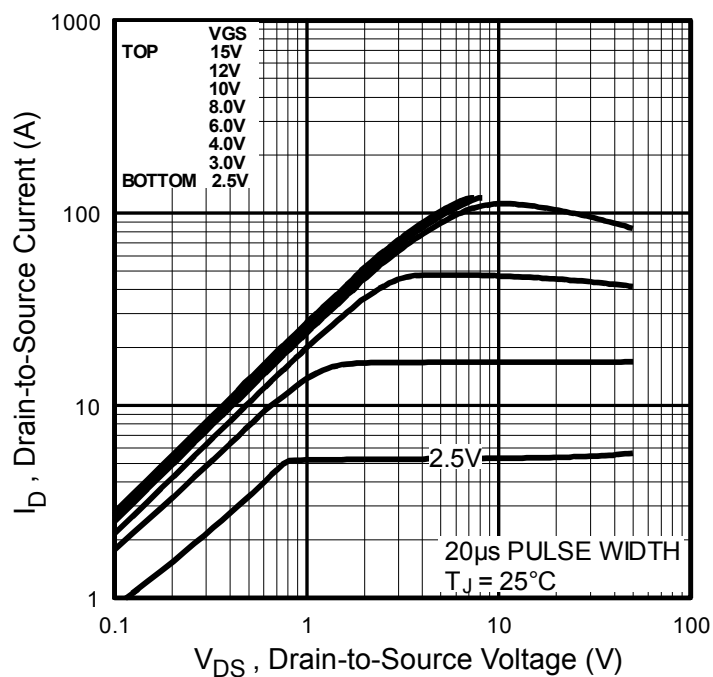
	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(BR)DSS}$	Drain-to-Source Breakdown Voltage	100	—	—	V	$V_{GS} = 0V, I_D = 250\mu A$
$\Delta V_{(BR)DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	—	0.11	—	V/ $^\circ\text{C}$	Reference to $25^\circ\text{C}$ , $I_D = 1mA$ ⑥
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	—	—	0.044	$\Omega$	$V_{GS} = 10V, I_D = 12A$
		—	—	0.053		$V_{GS} = 5.0V, I_D = 12A$
		—	—	0.063		$V_{GS} = 4.0V, I_D = 10A$
$V_{GS(th)}$	Gate Threshold Voltage	1.0	—	2.0	V	$V_{DS} = V_{GS}, I_D = 250\mu A$
$g_{fs}$	Forward Trans conductance	14	—	—	S	$V_{DS} = 25V, I_D = 18A$ ⑥
$I_{DSS}$	Drain-to-Source Leakage Current	—	—	25	$\mu A$	$V_{DS} = 100V, V_{GS} = 0V$
		—	—	250		$V_{DS} = 80V, V_{GS} = 0V, T_J = 150^\circ\text{C}$
$I_{GSS}$	Gate-to-Source Forward Leakage	—	—	100	nA	$V_{GS} = 16V$
	Gate-to-Source Reverse Leakage	—	—	-100		$V_{GS} = -16V$
$Q_g$	Total Gate Charge	—	—	74	nC	$I_D = 18A$
$Q_{gs}$	Gate-to-Source Charge	—	—	9.4		$V_{DS} = 80V$
$Q_{gd}$	Gate-to-Drain Charge	—	—	38		$V_{GS} = 5.0V$ , See Fig. 6 and 13 ④ ⑥
$t_{d(on)}$	Turn-On Delay Time	—	11	—		$V_{DD} = 50V$
$t_r$	Rise Time	—	81	—	ns	$I_D = 18A$
$t_{d(off)}$	Turn-Off Delay Time	—	39	—		$R_G = 5.0\Omega, V_{GS} = 5.0V$
$t_f$	Fall Time	—	62	—		$R_D = 2.7\Omega$ , See Fig. 10 ④ ⑥
$L_D$	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	—	1800	—	pF	$V_{GS} = 0V$
$C_{oss}$	Output Capacitance	—	350	—		$V_{DS} = 25V$
$C_{rss}$	Reverse Transfer Capacitance	—	170	—		$f = 1.0MHz$ , See Fig. 5 ⑥
$C$	Drain to Sink Capacitance	—	12	—		$f = 1.0MHz$

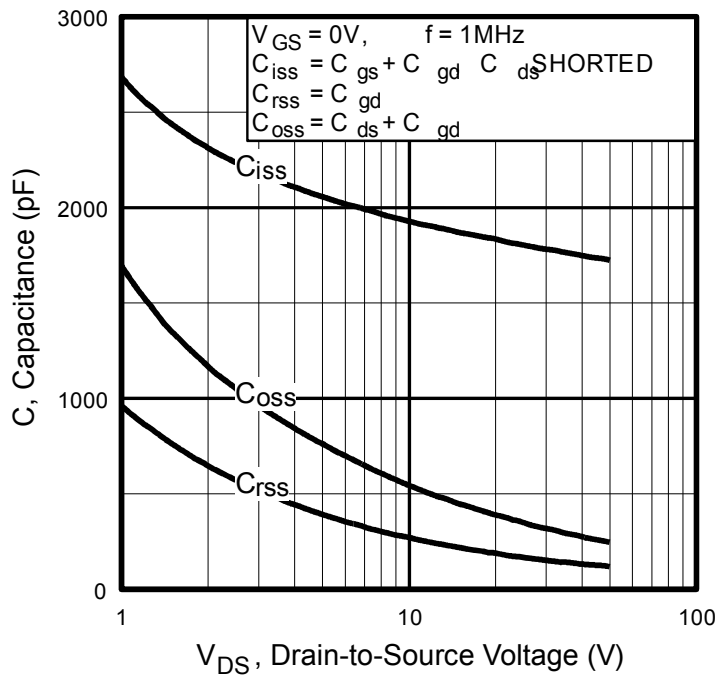
**Source-Drain Ratings and Characteristics**

	Parameter	Min.	Typ.	Max.	Units	Conditions
$I_S$	Continuous Source Current (Body Diode)	—	—	23	A	MOSFET symbol showing the integral reverse p-n junction diode. 
$I_{SM}$	Pulsed Source Current (Body Diode) ① ⑥	—	—	120		
$V_{SD}$	Diode Forward Voltage	—	—	1.3	V	$T_J = 25^\circ\text{C}, I_S = 18A, V_{GS} = 0V$ ④
$t_{rr}$	Reverse Recovery Time	—	190	290	ns	$T_J = 25^\circ\text{C}, I_F = 18A$
$Q_{rr}$	Reverse Recovery Charge	—	1.1	1.7	$\mu C$	$di/dt = 100A/\mu s$ ④ ⑥
$t_{on}$	Forward Turn-On Time	Intrinsic turn-on time is negligible (turn-on is dominated by $L_S + L_D$ )				

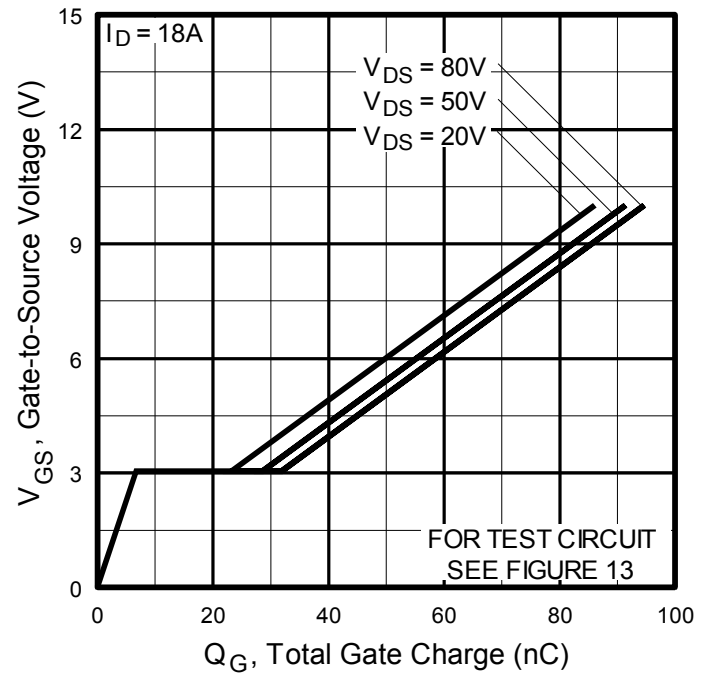
**Notes:**

- ① Repetitive rating; pulse width limited by max. junction temperature. (See fig. 11)
- ② Starting  $T_J = 25^\circ\text{C}$ ,  $L = 1.9mH$ ,  $R_G = 25\Omega$ ,  $I_{AS} = 18A$  (See fig. 12)
- ③  $I_{SD} \leq 18A$ ,  $di/dt \leq 180A/\mu s$ ,  $V_{DD} \leq V_{(BR)DSS}$ ,  $T_J \leq 175^\circ\text{C}$ .
- ④ Pulse width  $\leq 300\mu s$ ; duty cycle  $\leq 2\%$ .
- ⑤  $t = 60s$ ,  $f = 60Hz$
- ⑥ Uses IRL540N data and test conditions.

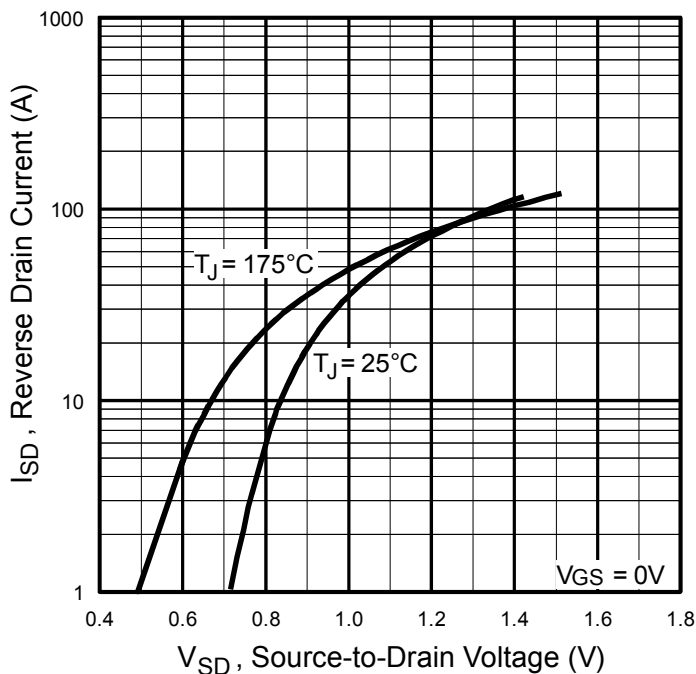

**Fig. 3 Typical Transfer Characteristics**
**Fig. 4 Normalized On-Resistance vs. Temperature**



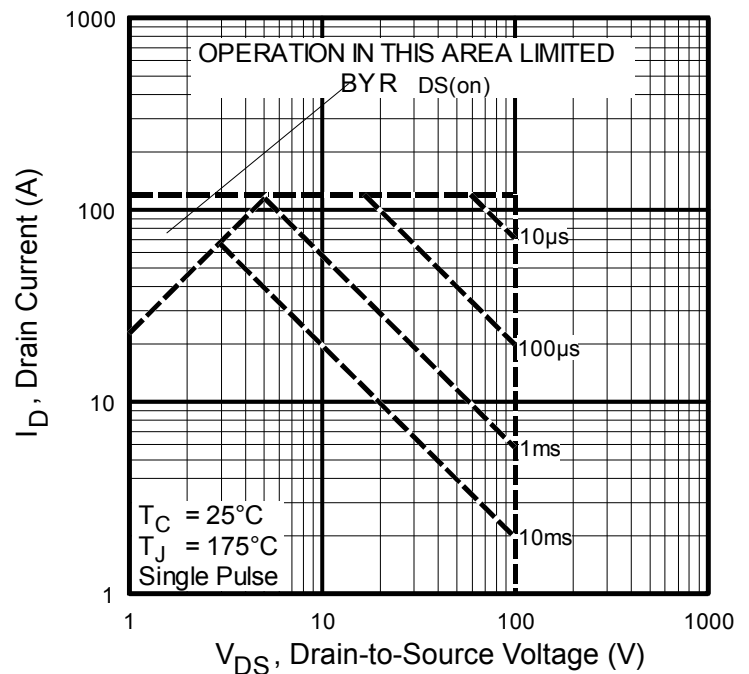
**Fig 5.** Typical Capacitance vs.  
Drain-to-Source Voltage



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



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



**Fig 8.** Maximum Safe Operating Area

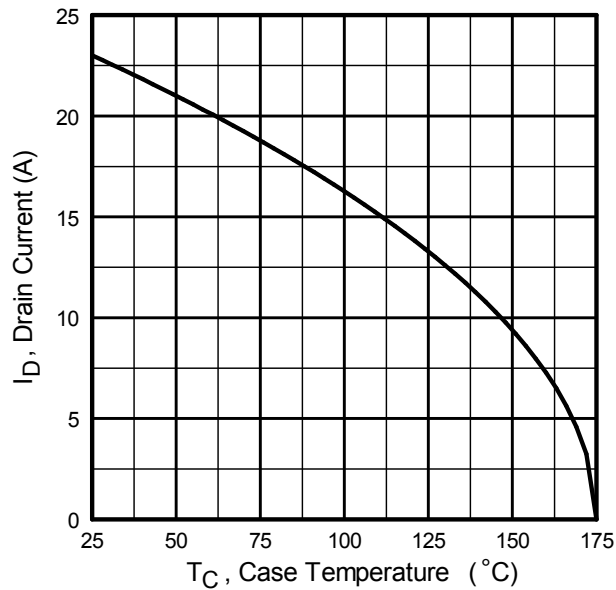


Fig 9. Maximum Drain Current vs. Case Temperature

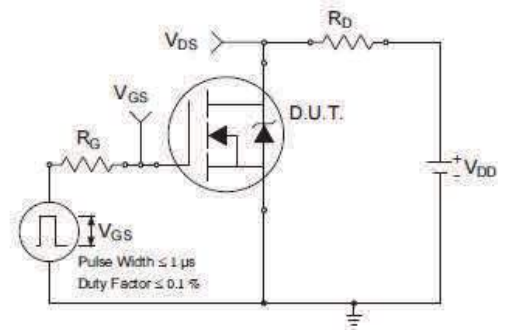


Fig 10a. Switching Time Test Circuit

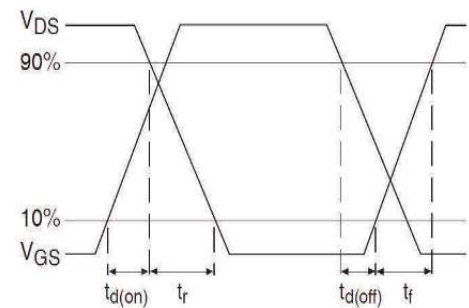


Fig 10b. Switching Time Waveforms

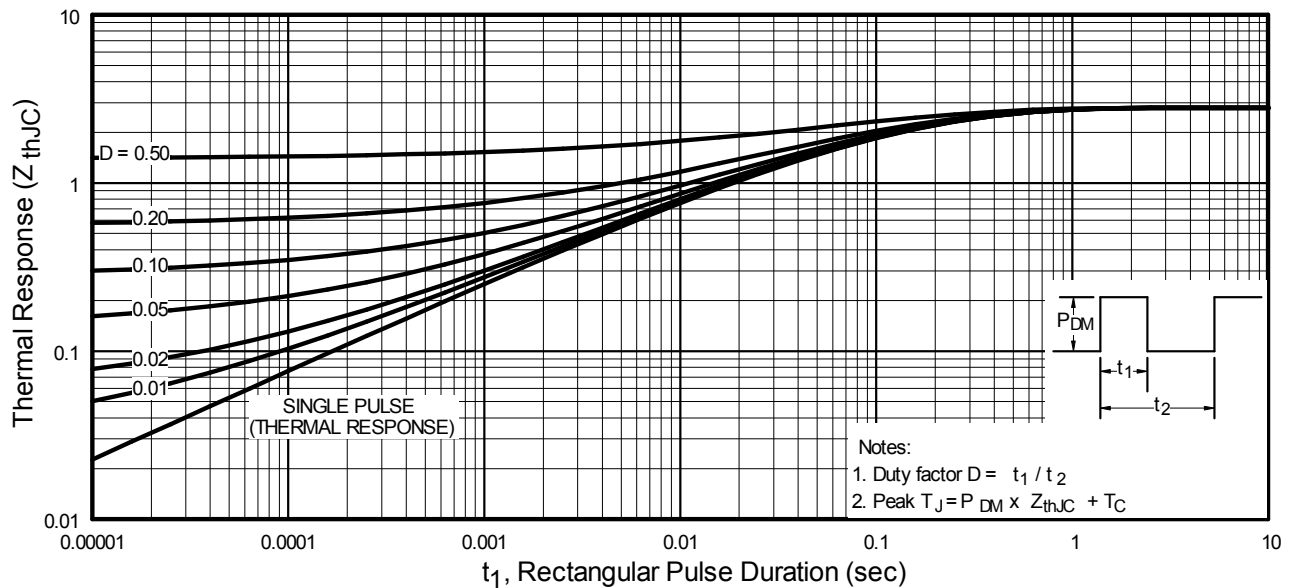


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Case

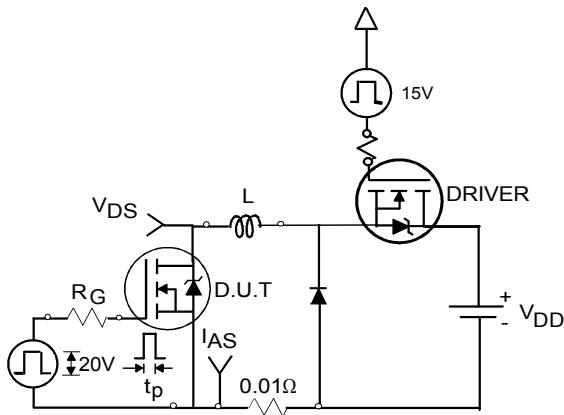


Fig 12a. Unclamped Inductive Test Circuit

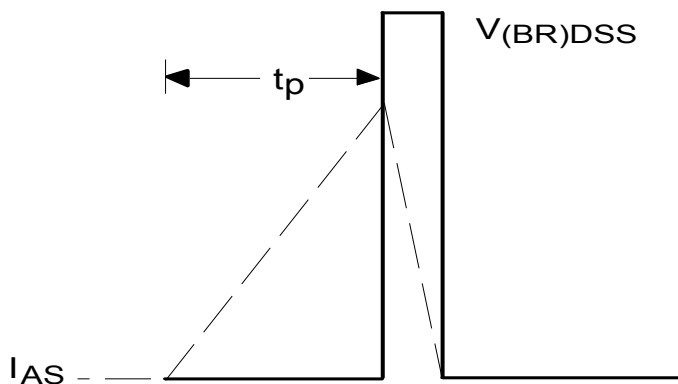


Fig 12b. Unclamped Inductive Waveforms

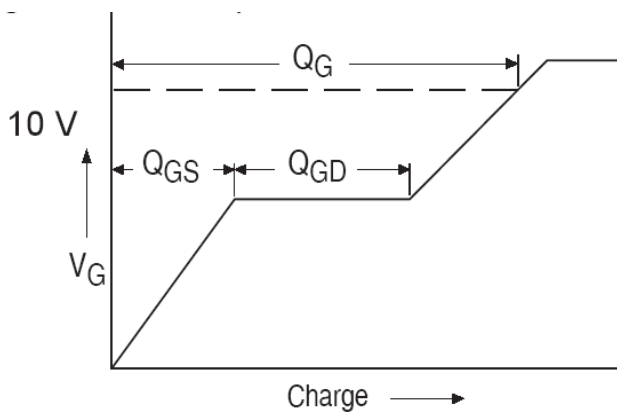


Fig 13a. Gate Charge Waveform

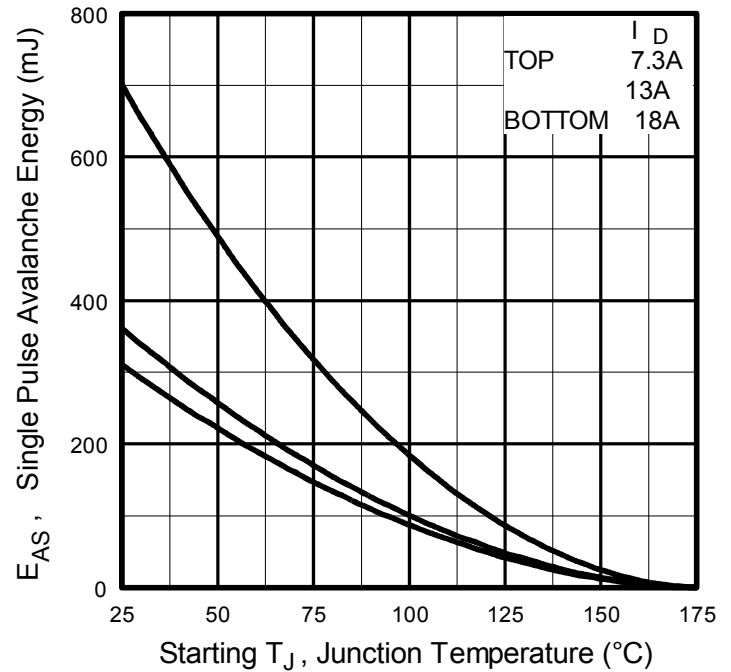


Fig 12c. Maximum Avalanche Energy vs. Drain Current

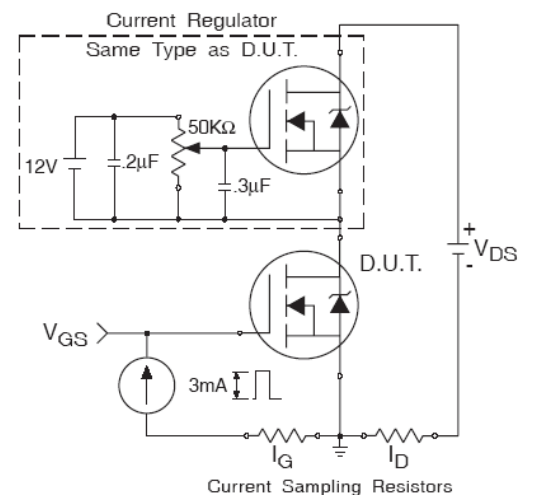
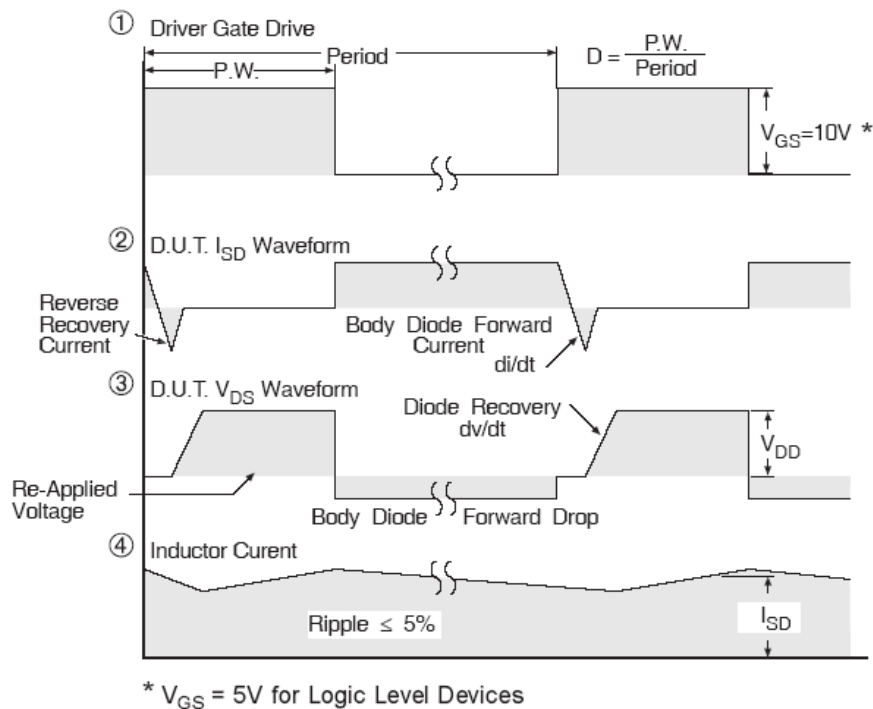
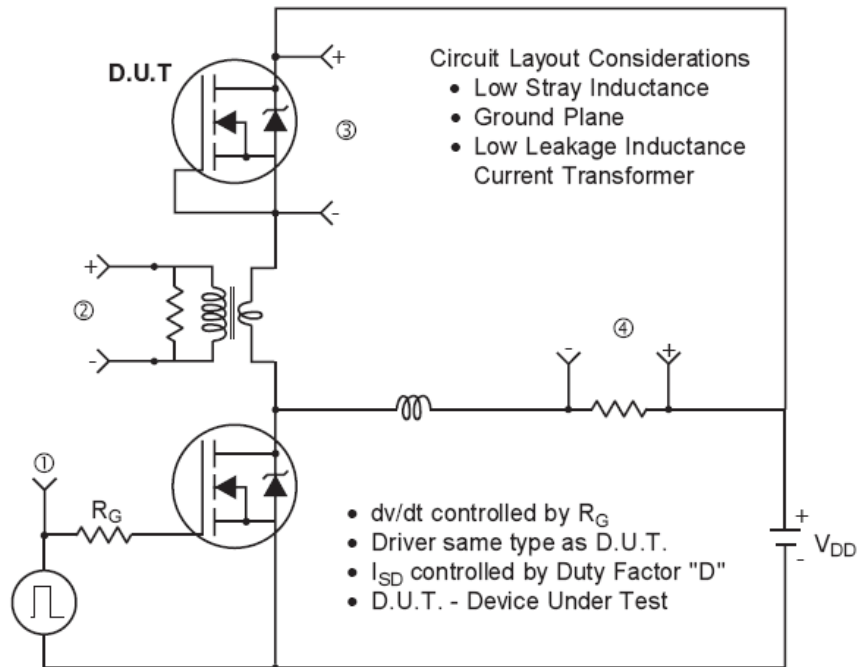
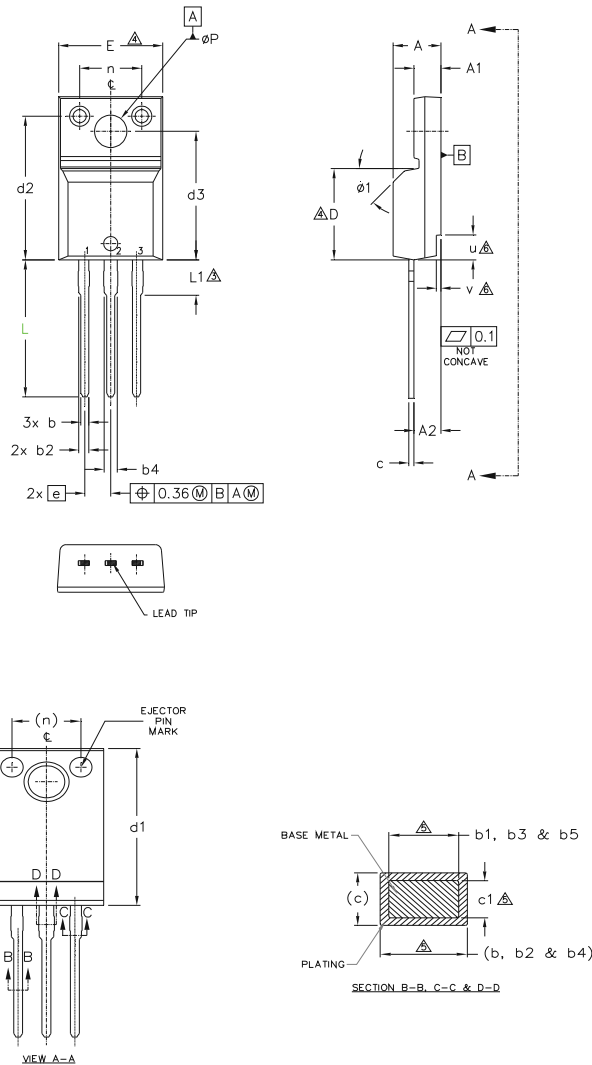


Fig 13b. Gate Charge Test Circuit

# Peak Diode Recovery dv/dt Test Circuit



**Fig 14.** Peak Diode Recovery dv/dt Test Circuit for N-Channel HEXFET® Power MOSFETs

**TO-220 Full-Pak Package Outline (Dimensions are shown in millimeters (inches))**

**NOTES:**

- 1.0 DIMENSIONING AND TOLERANCING AS PER ASME Y14.5 M- 1994.
- 2.0 DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES].
- 3.0 LEAD DIMENSION AND FINISH UNCONTROLLED IN L1.
- 4.0 DIMENSION D & E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED .005" (0.127) PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTER MOST EXTREMES OF THE PLASTIC BODY.
- 5.0 DIMENSION b1, b3, b5 & c1 APPLY TO BASE METAL ONLY.
- 6.0 STEP OPTIONAL ON PLASTIC BODY DEFINED BY DIMENSIONS u & v.
- 7.0 CONTROLLING DIMENSION : INCHES.

S Y M B O L	D I M E N S I O N S				N O T E S
	M I L L I M E T E R S		I N C H E S		
	M I N.	M A X.	M I N.	M A X.	
A	4.57	4.83	.180	.190	5
A1	2.57	2.82	.101	.111	
A2	2.51	2.92	.099	.115	
b	0.61	0.94	.024	.037	
b1	0.61	0.89	.024	.035	
b2	0.76	1.27	.030	.050	5
b3	0.76	1.22	.030	.048	
b4	1.02	1.52	.040	.060	5
b5	1.02	1.47	.040	.058	
c	0.33	0.63	.013	.025	5
c1	0.33	0.58	.013	.023	
D	8.66	9.80	.341	.386	4
d1	15.80	16.13	.622	.635	
d2	13.97	14.22	.550	.560	4
d3	12.29	12.93	.484	.509	
E	9.63	10.74	.379	.423	4
e	2.54 BSC		.100 BSC		
L	13.21	13.72	.520	.540	3
L1	3.10	3.68	.122	.145	
n	6.05	6.60	.238	.260	
øP	3.05	3.45	.120	.136	6
u	2.39	2.49	.094	.098	
v	0.41	0.51	.016	.020	6
ø1	—	45°	—	45°	

**LEAD ASSIGNMENTS**
**HEXFET**

- 1.— GATE
- 2.— DRAIN
- 3.— SOURCE

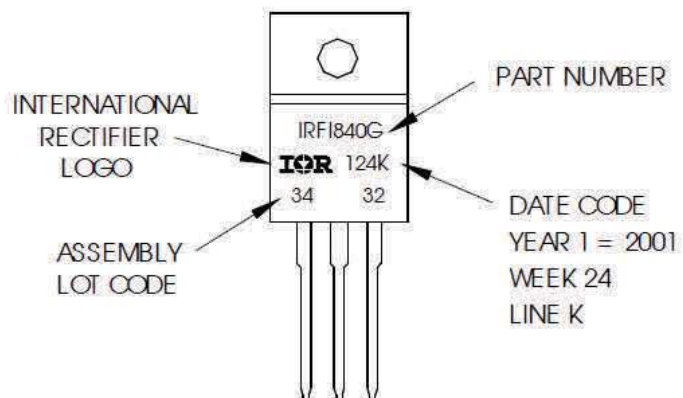
**IGBTs, CoPACK**

- 1.— GATE
- 2.— COLLECTOR
- 3.— EMITTER

**TO-220 Full-Pak Part Marking Information**

EXAMPLE: THIS IS AN IRFI840G  
WITH ASSEMBLY  
LOT CODE 3432  
ASSEMBLED ON WW 24, 2001  
IN THE ASSEMBLY LINE "K"

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



TO-220AB Full-Pak packages are not recommended for Surface Mount Application.

Note: For the most current drawing please refer to website at <http://www.irf.com/package/>



## Qualification Information

Qualification Level	Industrial (per JEDEC JESD47F) <sup>†</sup>	
Moisture Sensitivity Level	TO-220 Full-Pak	N/A
RoHS Compliant	Yes	

<sup>†</sup> Applicable version of JEDEC standard at the time of product release.

## Revision History

Date	Comments
04/27/2017	<ul style="list-style-type: none"> <li>Changed datasheet with Infineon logo - all pages.</li> <li>Corrected Package Outline on page 8.</li> <li>Added disclaimer on last page.</li> </ul>

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Document reference  
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