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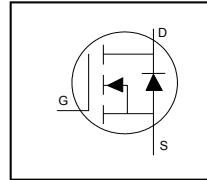
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- Logic - Level Gate Drive
- Advanced Process Technology
- Dynamic dv/dt Rating
- 175°C Operating Temperature
- Fast Switching
- Fully Avalanche Rated
- Lead-Free



$V_{DSS}$	<b>55V</b>
$R_{DS(on) \text{ max.}}$	<b>0.01<math>\Omega</math></b>
$I_D$	<b>89A<math>\text{\textcircled{D}}</math></b>



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

**Description**

Fifth Generation HEXFETs 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 package is universally preferred for all commercial industrial applications at power dissipation levels to approximately 50 watts. The low thermal resistance and low package cost of the TO-220 contribute to its wide acceptance throughout the industry.

Base part number	Package Type	Standard Pack		Orderable Part Number
		Form	Quantity	
IRL3705NPbF	TO-220	Tube	50	IRL3705NPbF

**Absolute Maximum Ratings**

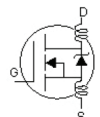
Symbol	Parameter	Max.	Units
$I_D @ T_C = 25^\circ\text{C}$	Continuous Drain Current, $V_{GS} @ 10\text{V}$	89 $\text{\textcircled{D}}$	A
$I_D @ T_C = 100^\circ\text{C}$	Continuous Drain Current, $V_{GS} @ 10\text{V}$	63	
$I_{DM}$	Pulsed Drain Current $\text{\textcircled{1}}$	310	
$P_D @ T_C = 25^\circ\text{C}$	Maximum Power Dissipation	170	W
	Linear Derating Factor	1.1	W/ $^\circ\text{C}$
$V_{GS}$	Gate-to-Source Voltage	$\pm 16$	V
$E_{AS}$	Single Pulse Avalanche Energy $\text{\textcircled{2}}$	340	mJ
$I_{AR}$	Avalanche Current $\text{\textcircled{1}}$	46	A
$E_{AR}$	Repetitive Avalanche Energy $\text{\textcircled{1}}$	17	mJ
dv/dt	Peak Diode Recovery dv/dt $\text{\textcircled{3}}$	5.0	V/ns
$T_J$	Operating Junction and	-55 to + 175	$^\circ\text{C}$
$T_{STG}$	Storage Temperature Range		
	Soldering Temperature, for 10 seconds (1.6mm from case)		
	Mounting torque, 6-32 or M3 screw	10 lbf•in (1.1N•m)	

**Thermal Resistance**

Symbol	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case	—	0.90	$^\circ\text{C/W}$
$R_{\theta CS}$	Case-to-Sink, Flat, Greased Surface	0.50	—	
$R_{\theta JA}$	Junction-to-Ambient	—	62	

**Electrical Characteristics @ T<sub>J</sub> = 25°C (unless otherwise specified)**

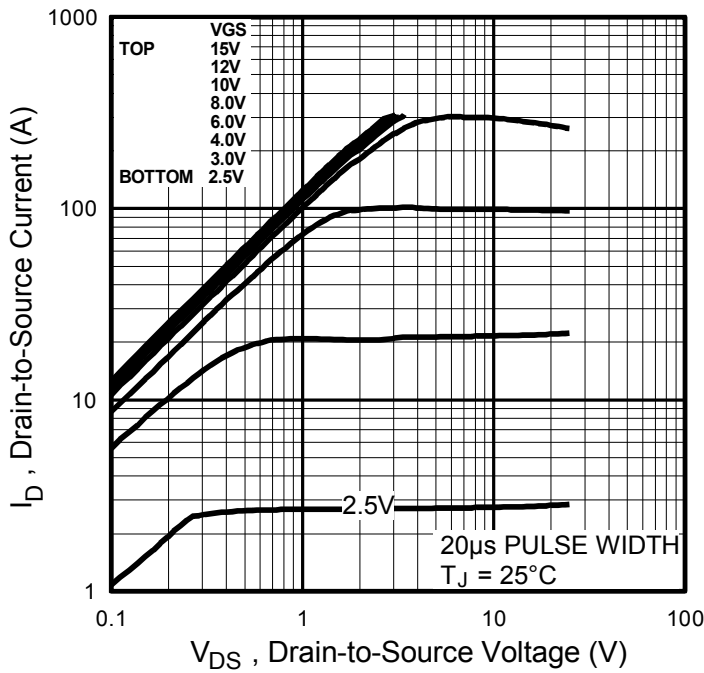
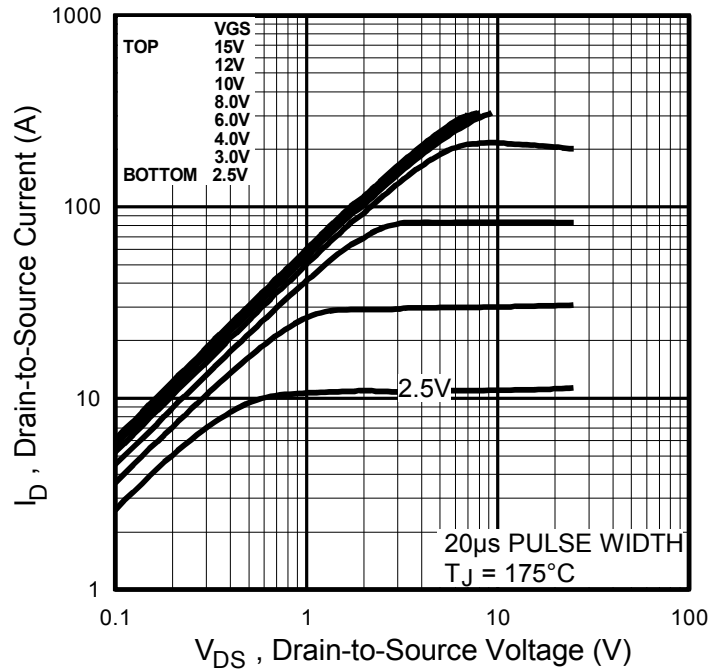
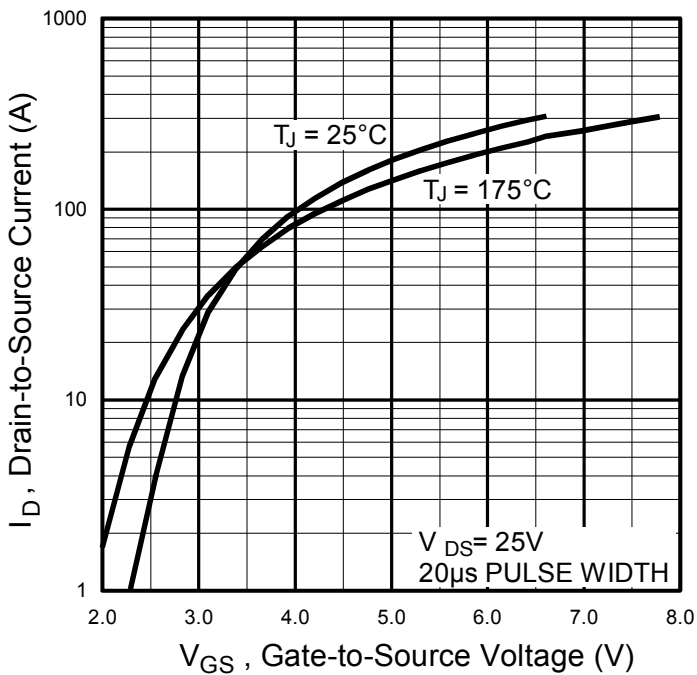
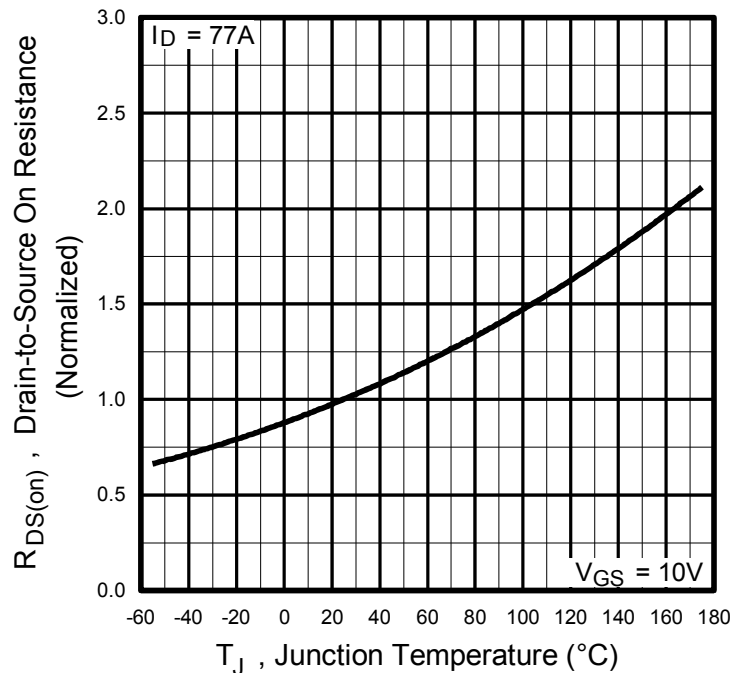
	Parameter	Min.	Typ.	Max.	Units	Conditions
V <sub>(BR)DSS</sub>	Drain-to-Source Breakdown Voltage	55	—	—	V	V <sub>GS</sub> = 0V, I <sub>D</sub> = 250μA
ΔV <sub>(BR)DSS</sub> /ΔT <sub>J</sub>	Breakdown Voltage Temp. Coefficient	—	0.056	—	V/°C	Reference to 25°C, I <sub>D</sub> = 1mA
R <sub>DS(on)</sub>	Static Drain-to-Source On-Resistance	—	—	0.010	Ω	V <sub>GS</sub> = 10V, I <sub>D</sub> = 46A <sup>④</sup>
		—	—	0.012		V <sub>GS</sub> = 5.0V, I <sub>D</sub> = 46A <sup>④</sup>
		—	—	0.018		V <sub>GS</sub> = 4.0V, I <sub>D</sub> = 39A <sup>④</sup>
V <sub>GS(th)</sub>	Gate Threshold Voltage	1.0	—	2.0	V	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250μA
g <sub>fs</sub>	Forward Trans conductance	50	—	—	S	V <sub>DS</sub> = 25V, I <sub>D</sub> = 46A
I <sub>DSS</sub>	Drain-to-Source Leakage Current	—	—	25	μA	V <sub>DS</sub> = 55V, V <sub>GS</sub> = 0V
		—	—	250		V <sub>DS</sub> = 44V, V <sub>GS</sub> = 0V, T <sub>J</sub> = 150°C
I <sub>GSS</sub>	Gate-to-Source Forward Leakage	—	—	100	nA	V <sub>GS</sub> = 16V
	Gate-to-Source Reverse Leakage	—	—	-100		V <sub>GS</sub> = -16V
Q <sub>g</sub>	Total Gate Charge	—	—	98	nC	I <sub>D</sub> = 46A
Q <sub>gs</sub>	Gate-to-Source Charge	—	—	19		V <sub>DS</sub> = 44V
Q <sub>gd</sub>	Gate-to-Drain Charge	—	—	49		V <sub>GS</sub> = 5.0V, See Fig. 6 and 13 <sup>④</sup>
t <sub>d(on)</sub>	Turn-On Delay Time	—	12	—	ns	V <sub>DD</sub> = 28V
t <sub>r</sub>	Rise Time	—	140	—		I <sub>D</sub> = 46A
t <sub>d(off)</sub>	Turn-Off Delay Time	—	37	—		R <sub>G</sub> = 1.8Ω, V <sub>GS</sub> = 5.0V
t <sub>f</sub>	Fall Time	—	78	—		R <sub>D</sub> = 0.59Ω, See Fig. 10 <sup>④</sup>
L <sub>D</sub>	Internal Drain Inductance	—	4.5	—	nH	Between lead, 6mm (0.25in.)
L <sub>S</sub>	Internal Source Inductance	—	7.5	—		from package and center of die contact
C <sub>iSS</sub>	Input Capacitance	—	3600	—	pF	V <sub>GS</sub> = 0V
C <sub>oSS</sub>	Output Capacitance	—	870	—		V <sub>DS</sub> = 25V
C <sub>rSS</sub>	Reverse Transfer Capacitance	—	320	—		f = 1.0MHz, See Fig. 5

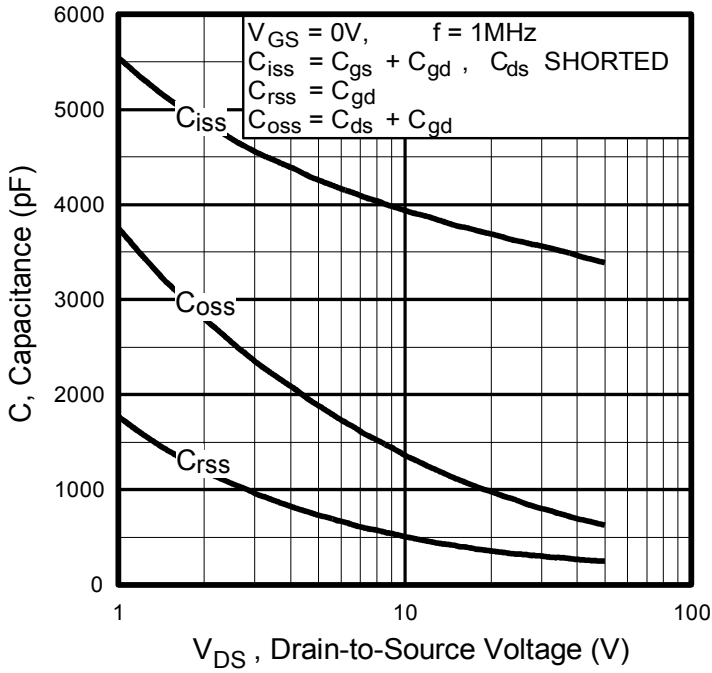

**Source-Drain Ratings and Characteristics**

	Parameter	Min.	Typ.	Max.	Units	Conditions
I <sub>S</sub>	Continuous Source Current (Body Diode)	—	—	89 <sup>⑤</sup>	A	MOSFET symbol showing the integral reverse p-n junction diode.
I <sub>SM</sub>	Pulsed Source Current (Body Diode) <sup>①</sup>	—	—	310		
V <sub>SD</sub>	Diode Forward Voltage	—	—	1.3	V	T <sub>J</sub> = 25°C, I <sub>S</sub> = 46A, V <sub>GS</sub> = 0V <sup>④</sup>
t <sub>rr</sub>	Reverse Recovery Time	—	94	140	ns	T <sub>J</sub> = 25°C, I <sub>F</sub> = 46A
Q <sub>rr</sub>	Reverse Recovery Charge	—	290	440	nC	di/dt = 100A/μs <sup>④</sup>
t <sub>on</sub>	Forward Turn-On Time	Intrinsic turn-on time is negligible (turn-on is dominated by L <sub>S</sub> + L <sub>D</sub> )				

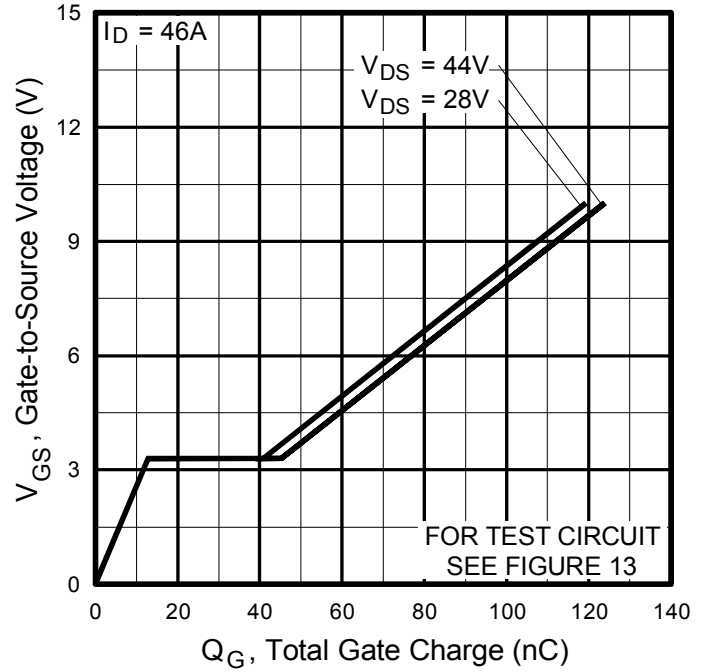
**Notes:**

- ① Repetitive rating; pulse width limited by max. junction temperature. (See fig.11)
- ② V<sub>DD</sub> = 25V, starting T<sub>J</sub> = 25°C, L = 320μH, R<sub>G</sub> = 25Ω, I<sub>AS</sub> = 46A.(See fig.12)
- ③ I<sub>SD</sub> ≤ 46A, di/dt ≤ 250A/μs, V<sub>DD</sub> ≤ V<sub>(BR)DSS</sub>, T<sub>J</sub> ≤ 175°C.
- ④ Pulse width ≤ 300μs; duty cycle ≤ 2%.
- ⑤ Calculated continuous current based on maximum allowable junction temperature; for recommended current- handling of the package refer to Design TIP # 93-4

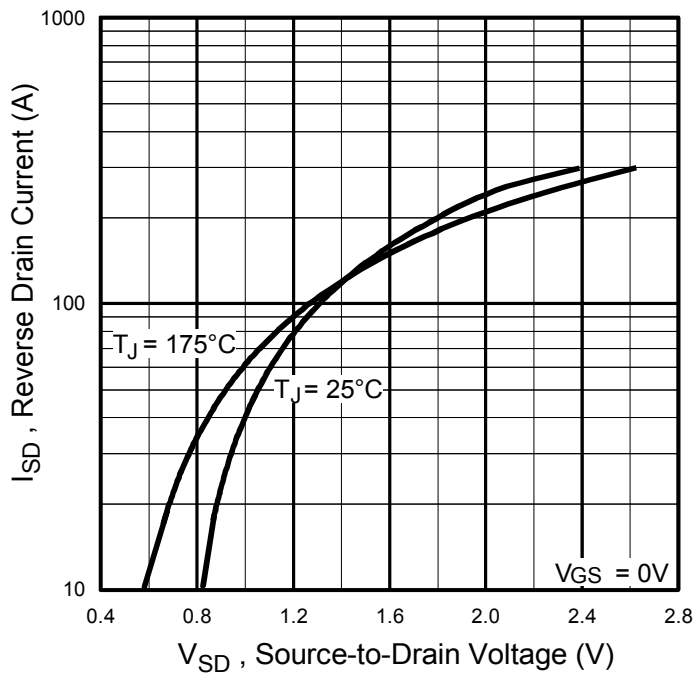

**Fig. 1** Typical Output Characteristics

**Fig. 2** Typical Output Characteristics

**Fig. 3** Typical Transfer Characteristics

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



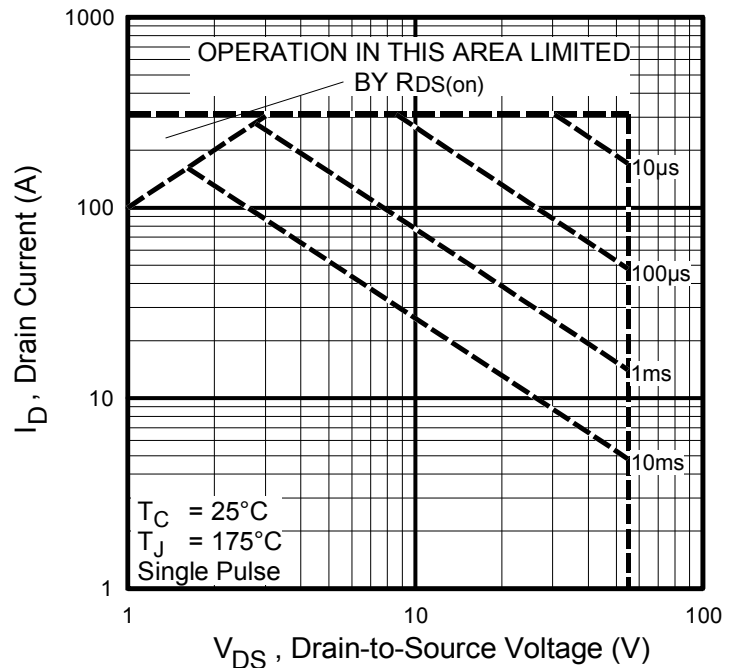
**Fig 5.** Typical Capacitance vs. Drain-to-Source Voltage



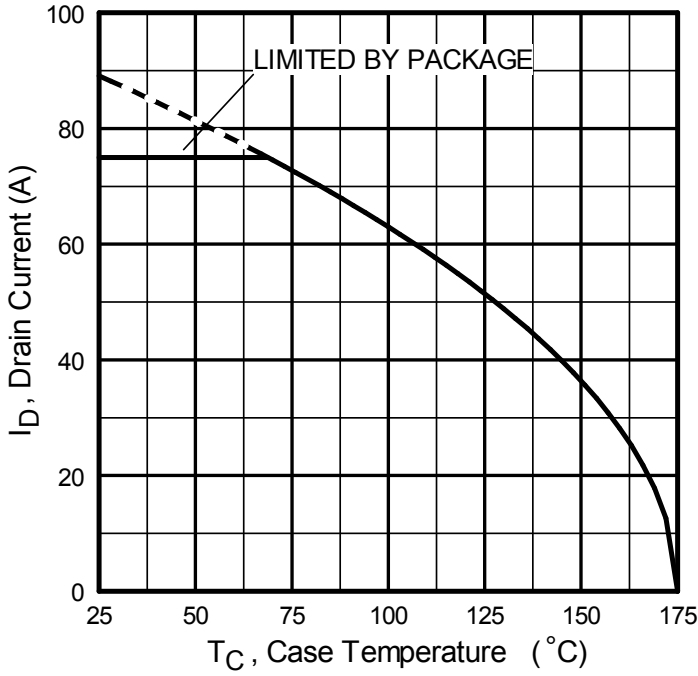
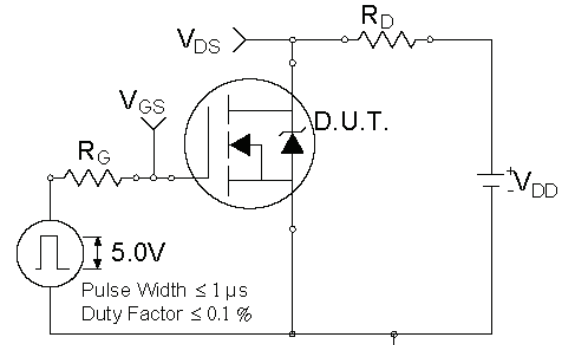
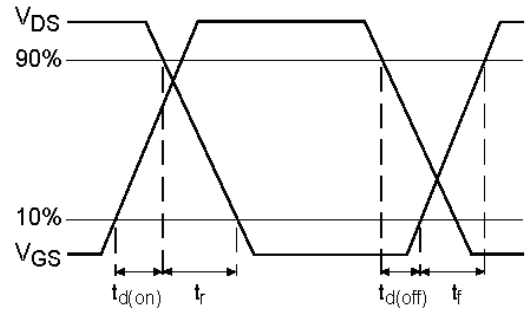
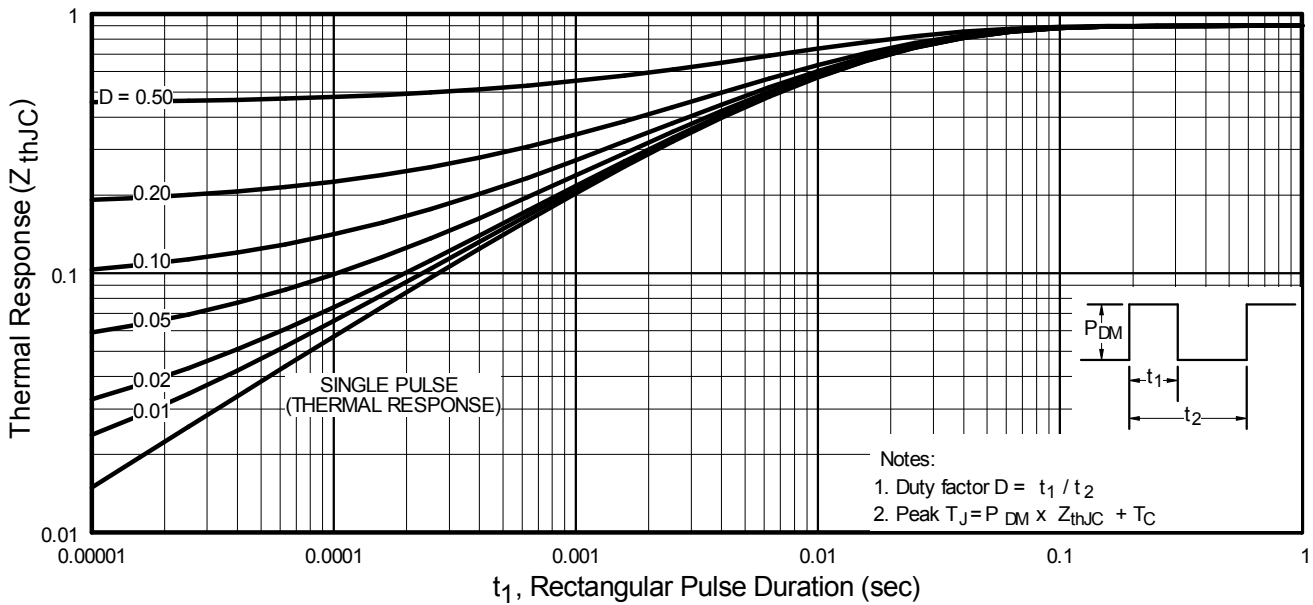
**Fig 6.** Typical Gate Charge vs. Gate-to-Source Voltage

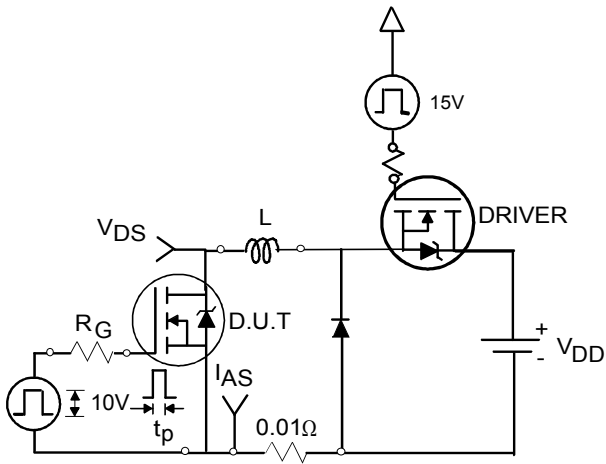
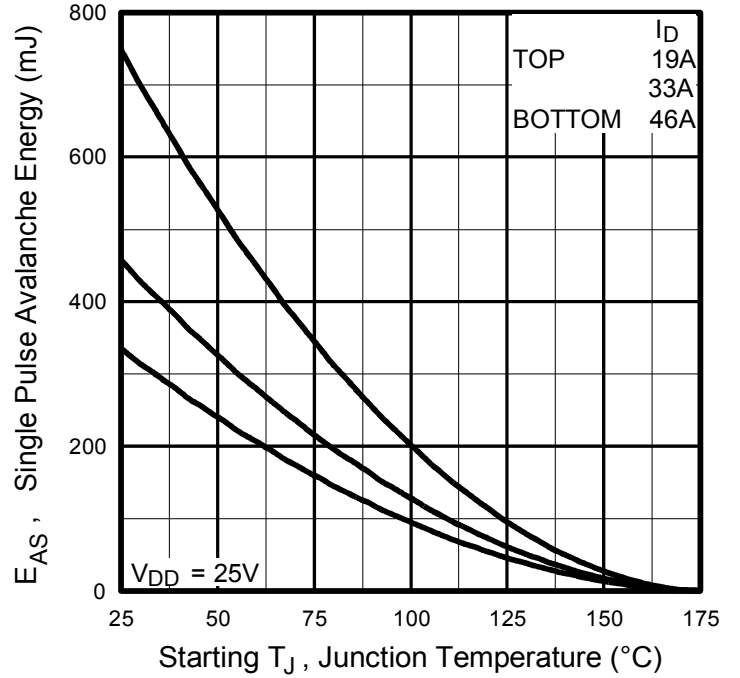
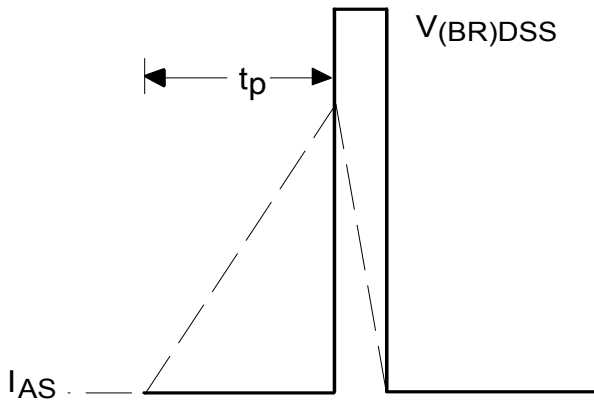
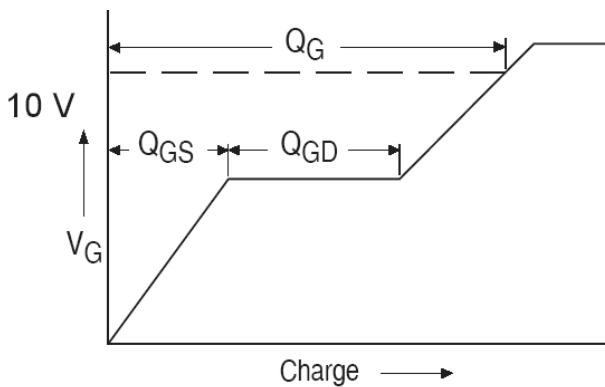
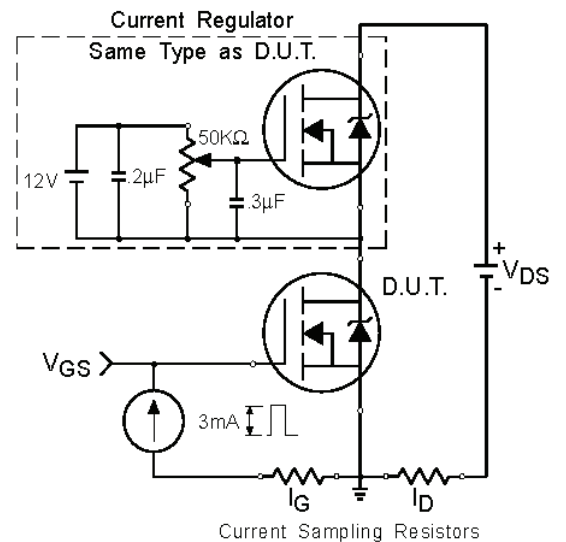


**Fig. 7** Typical Source-to-Drain Diode Forward Voltage

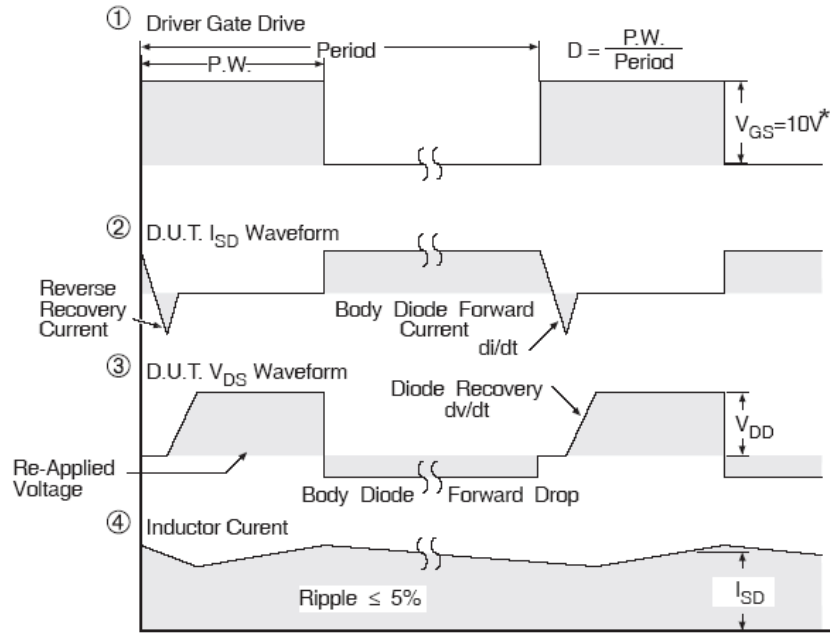
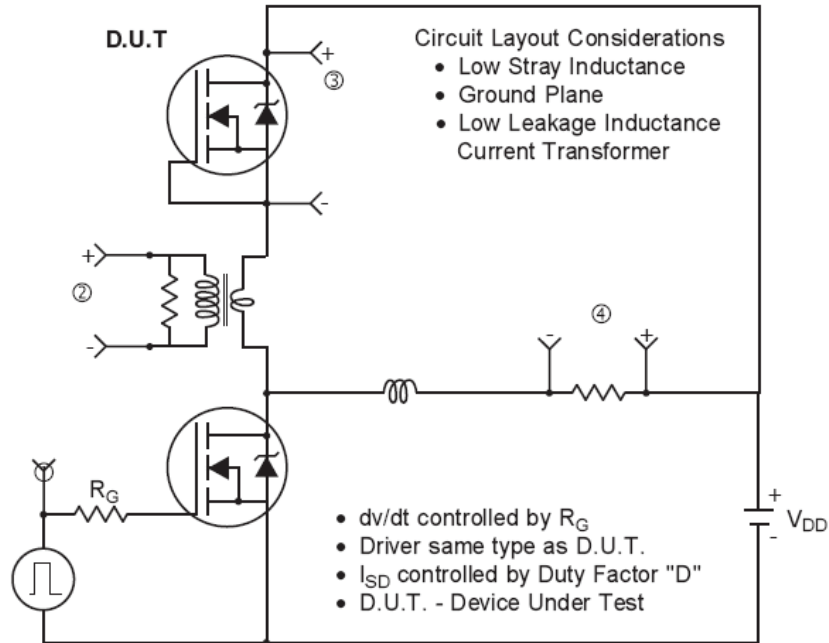


**Fig 8.** Maximum Safe Operating Area


**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 12c.** Maximum Avalanche Energy vs. Drain Current

**Fig 12b.** Unclamped Inductive Waveforms

**Fig 13a.** Gate Charge Waveform

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

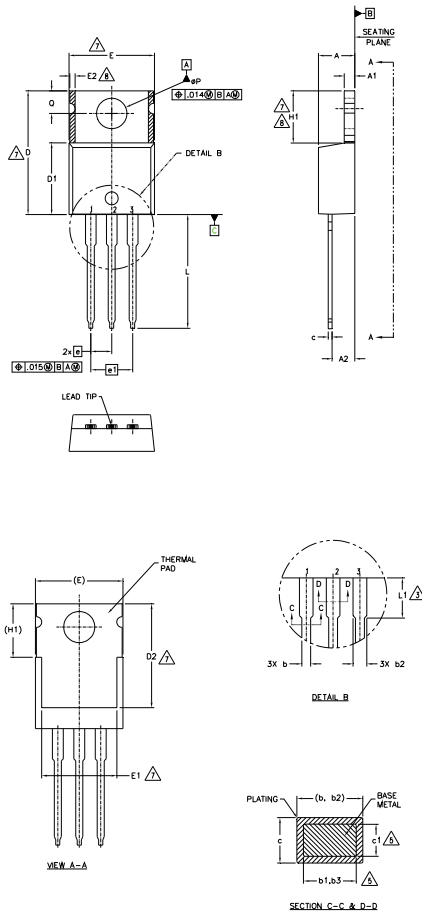
### Peak Diode Recovery dv/dt Test Circuit



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

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



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

**NOTES:**

- 1.- DIMENSIONING AND TOLERANCING AS PER ASME Y14.5 M- 1994.
- 2.- DIMENSIONS ARE SHOWN IN INCHES [MILLIMETERS].
- 3.- LEAD DIMENSION AND FINISH UNCONTROLLED IN L1.
- 4.- DIMENSION D, D1 & 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.
- 5.- DIMENSION b1, b3 & c1 APPLY TO BASE METAL ONLY.
- 6.- CONTROLLING DIMENSION : INCHES.
- 7.- THERMAL PAD CONTOUR OPTIONAL WITHIN DIMENSIONS E,H1,D2 & E1
- 8.- DIMENSION E2 X H1 DEFINE A ZONE WHERE STAMPING AND SINGULATION IRREGULARITIES ARE ALLOWED.
- 9.- OUTLINE CONFORMS TO JEDEC TO-220, EXCEPT A2 (max.) AND D2 (min.) WHERE DIMENSIONS ARE DERIVED FROM THE ACTUAL PACKAGE OUTLINE.

SYMBOL	DIMENSIONS				NOTES
	MILLIMETERS		INCHES		
	MIN.	MAX.	MIN.	MAX.	
A	3.56	4.83	.140	.190	
A1	1.14	1.40	.045	.055	
A2	2.03	2.92	.080	.115	
b	0.38	1.01	.015	.040	
b1	0.38	0.97	.015	.038	5
b2	1.14	1.78	.045	.070	
b3	1.14	1.73	.045	.068	5
c	0.36	0.61	.014	.024	
c1	0.36	0.56	.014	.022	5
D	14.22	16.51	.560	.650	4
D1	8.38	9.02	.330	.355	
D2	11.68	12.88	.460	.507	7
E	9.65	10.67	.380	.420	4,7
E1	6.86	8.89	.270	.350	7
E2	-	0.76	-	.030	8
e	2.54 BSC		.100 BSC		
e1	5.08 BSC		.200 BSC		
H1	5.84	6.86	.230	.270	7,8
L	12.70	14.73	.500	.580	
L1	3.56	4.06	.140	.160	3
øP	3.54	4.08	.139	.161	
Q	2.54	3.42	.100	.135	

**LEAD ASSIGNMENTS**
**HEXFET**

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

**IGBTs, CoPACK**

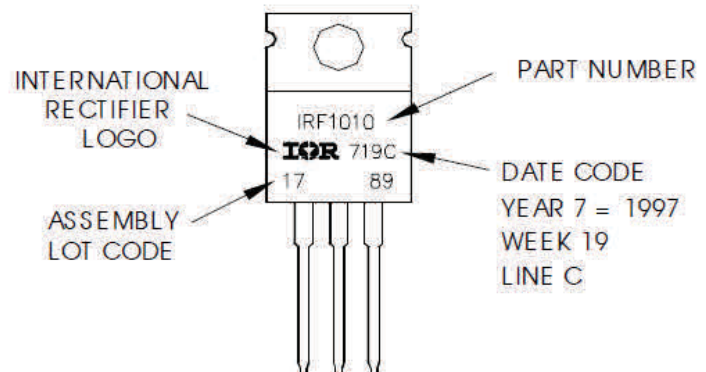
- 1- GATE
- 2- COLLECTOR
- 3- EMITTER

**DIODES**

- 1- ANODE
- 2- CATHODE
- 3- ANODE

**TO-220 Part Marking Information**

**EXAMPLE:** THIS IS AN IRF1010  
 LOT CODE 1789  
 ASSEMBLED ON WW 19, 1997  
 IN THE ASSEMBLY LINE "C"  
**Note:** "P" in assembly line position indicates "Lead-Free"



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

**Qualification Information**

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

† Applicable version of JEDEC standard at the time of product release.

**Revision History**

Date	Comments
05/25/2018	<ul style="list-style-type: none"> <li>Changed datasheet with Infineon logo - all pages.</li> <li>Corrected TO-220 Package outline on page 8.</li> <li>Added disclaimer on last page.</li> </ul>

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