

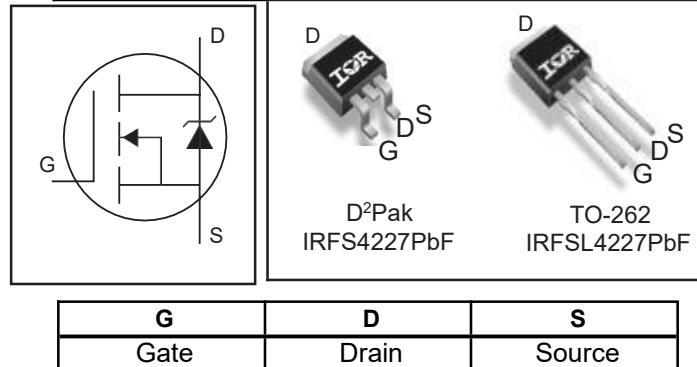
PDP SWITCH

**IRFS4227PbF**  
**IRFSL4227PbF**

**Features**

- Advanced Process Technology
- Key Parameters Optimized for PDP Sustain, Energy Recovery and Pass Switch Applications
- Low  $E_{PULSE}$  Rating to Reduce Power Dissipation in PDP Sustain, Energy Recovery and Pass Switch Applications
- Low  $Q_G$  for Fast Response
- High Repetitive Peak Current Capability for Reliable Operation
- Short Fall & Rise Times for Fast Switching
- 175°C Operating Junction Temperature for Improved Ruggedness
- Repetitive Avalanche Capability for Robustness and Reliability

Key Parameters		
$V_{DS}$ max	200	V
$V_{DS}$ (Avalanche) typ.	240	V
$R_{DS(ON)}$ typ. @ 10V	22	m
$I_{RP}$ max @ $T_c = 100^\circ\text{C}$	130	A
$T_J$ max	175	°C



**Description**

This HEXFET® Power MOSFET is specifically designed for Sustain, Energy Recovery & Pass switch applications in Plasma Display Panels. This MOSFET utilizes the latest processing techniques to achieve low on-resistance per silicon area and low  $E_{PULSE}$  rating. Additional features of this MOSFET are 175°C operating junction temperature and high repetitive peak current capability. These features combine to make this MOSFET a highly efficient, robust and reliable device for PDP driving applications

**Absolute Maximum Ratings**

	Parameter	Max.	Units
$V_{GS}$	Gate-to-Source Voltage	$\pm 30$	V
$I_D$ @ $T_c = 25^\circ\text{C}$	Continuous Drain Current, $V_{GS}$ @ 10V	62	A
$I_D$ @ $T_c = 100^\circ\text{C}$	Continuous Drain Current, $V_{GS}$ @ 10V	44	
$I_{DM}$	Pulsed Drain Current	260	
$I_{RP}$ @ $T_c = 100^\circ\text{C}$	Repetitive Peak Current	130	
$P_D$ @ $T_c = 25^\circ\text{C}$	Power Dissipation	330	W
$P_D$ @ $T_c = 100^\circ\text{C}$	Power Dissipation	190	
	Linear Derating Factor	2.2	W/°C
$T_J$ $T_{STG}$	Operating Junction and Storage Temperature Range	-40 to + 175	°C
	Soldering Temperature for 10 seconds	300	
	Mounting Torque, 6-32 or M3 Screw	10lbf in (1.1N m)	N

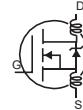
**Thermal Resistance**

	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case	—	0.45*	
$R_{\theta JA}$	Junction-to-Ambient (PCB Mounted) D2Pak	—	40	

\*  $R_{\theta JC}$  (end of life) for D2Pak and TO-262 = 0.65°C/W. This is the maximum measured value after 1000 temperature cycles from -55 to 150°C and is accounted for by the physical wearout of the die attach medium.

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

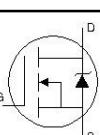
	Parameter	Min.	Typ.	Max.	Units	Conditions
$\text{BV}_{\text{DSS}}$	Drain-to-Source Breakdown Voltage	200	—	—	V	$V_{\text{GS}} = 0\text{V}, I_D = 250\mu\text{A}$
$\Delta \text{BV}_{\text{DSS}}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	—	170	—	mV/ $^\circ\text{C}$	Reference to $25^\circ\text{C}, I_D = 1\text{mA}$
$R_{\text{DS}(\text{on})}$	Static Drain-to-Source On-Resistance	—	22	26	$\text{m}\Omega$	$V_{\text{GS}} = 10\text{V}, I_D = 46\text{A}$
$V_{\text{GS}(\text{th})}$	Gate Threshold Voltage	3.0	—	5.0	V	$V_{\text{DS}} = V_{\text{GS}}, I_D = 250\mu\text{A}$
$\Delta V_{\text{GS}(\text{th})}/\Delta T_J$	Gate Threshold Voltage Coefficient	—	-13	—	mV/ $^\circ\text{C}$	
$I_{\text{DSS}}$	Drain-to-Source Leakage Current	—	—	20	$\mu\text{A}$	$V_{\text{DS}} = 200\text{V}, V_{\text{GS}} = 0\text{V}$
		—	—	200	$\mu\text{A}$	$V_{\text{DS}} = 200\text{V}, V_{\text{GS}} = 0\text{V}, T_J = 125^\circ\text{C}$
$I_{\text{GSS}}$	Gate-to-Source Forward Leakage	—	—	100	nA	$V_{\text{GS}} = 20\text{V}$
	Gate-to-Source Reverse Leakage	—	—	-100	nA	$V_{\text{GS}} = -20\text{V}$
$g_{\text{fs}}$	Forward Transconductance	49	—	—	S	$V_{\text{DS}} = 25\text{V}, I_D = 46\text{A}$
$Q_g$	Total Gate Charge	—	70	98	nC	$V_{\text{DD}} = 100\text{V}, I_D = 46\text{A}, V_{\text{GS}} = 10\text{V}$
$Q_{\text{gd}}$	Gate-to-Drain Charge	—	23	—		
$t_{\text{d}(\text{on})}$	Turn-On Delay Time	—	33	—		
$t_r$	Rise Time	—	20	—		
$t_{\text{d}(\text{off})}$	Turn-Off Delay Time	—	21	—		
$t_f$	Fall Time	—	31	—		
$t_{\text{st}}$	Shoot Through Blocking Time	100	—	—	ns	$V_{\text{DD}} = 160\text{V}, V_{\text{GS}} = 15\text{V}, R_G = 4.7\Omega$
$E_{\text{PULSE}}$	Energy per Pulse	—	570	—	$\mu\text{J}$	$L = 220\text{nH}, C = 0.4\mu\text{F}, V_{\text{GS}} = 15\text{V}$ $V_{\text{DS}} = 160\text{V}, R_G = 4.7\Omega, T_J = 25^\circ\text{C}$
		—	910	—		$L = 220\text{nH}, C = 0.4\mu\text{F}, V_{\text{GS}} = 15\text{V}$ $V_{\text{DS}} = 160\text{V}, R_G = 4.7\Omega, T_J = 100^\circ\text{C}$
$C_{\text{iss}}$	Input Capacitance	—	4600	—	pF	$V_{\text{GS}} = 0\text{V}$
$C_{\text{oss}}$	Output Capacitance	—	460	—		$V_{\text{DS}} = 25\text{V}$
$C_{\text{rss}}$	Reverse Transfer Capacitance	—	91	—		$f = 1.0\text{MHz},$
$C_{\text{oss eff.}}$	Effective Output Capacitance	—	360	—		$V_{\text{GS}} = 0\text{V}, V_{\text{DS}} = 0\text{V to } 160\text{V}$
$L_D$	Internal Drain Inductance	—	4.5	—	nH	Between lead, 6mm (0.25in.) from package
$L_S$	Internal Source Inductance	—	7.5	—		and center of die contact

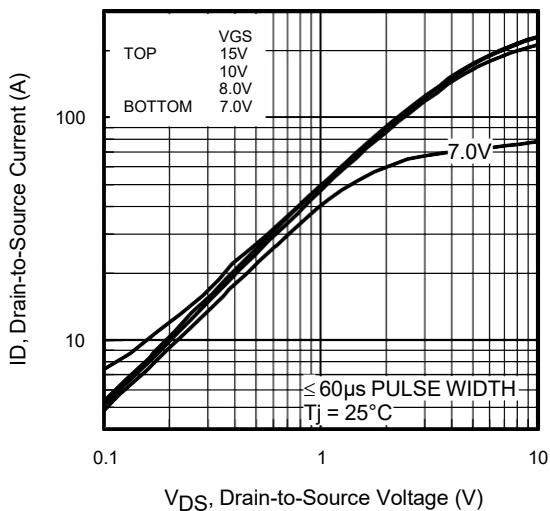
**Avalanche Characteristics**

	Parameter	Typ.	Max.	Units
$E_{\text{AS}}$	Single Pulse Avalanche Energy	—	140	mJ
$E_{\text{AR}}$	Repetitive Avalanche Energy	—	46	mJ
$V_{\text{DS}(\text{Avalanche})}$	Repetitive Avalanche Voltage	240	—	V
$I_{\text{AS}}$	Avalanche Current	—	37	A

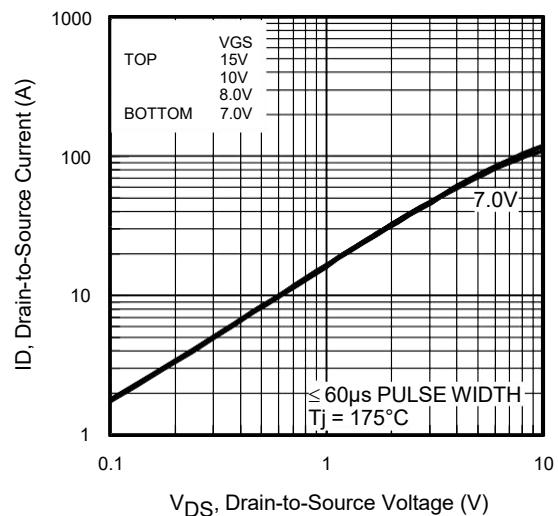
**Diode Characteristics**

	Parameter	Min.	Typ.	Max.	Units	Conditions
$I_s @ T_c = 25^\circ\text{C}$	Continuous Source Current (Body Diode)	—	—	62	A	MOSFET symbol showing the integral reverse p-n junction diode.
$I_{\text{SM}}$	Pulsed Source Current (Body Diode)	—	—	260		
$V_{\text{SD}}$	Diode Forward Voltage	—	—	1.3	V	$T_J = 25^\circ\text{C}, I_s = 46\text{A}, V_{\text{GS}} = 0\text{V}$
$t_{\text{rr}}$	Reverse Recovery Time	—	100	150	ns	$T_J = 25^\circ\text{C}, I_F = 46\text{A}, V_{\text{DD}} = 50\text{V}$
$Q_{\text{rr}}$	Reverse Recovery Charge	—	430	640	nC	$di/dt = 100\text{A}/\mu\text{s}$

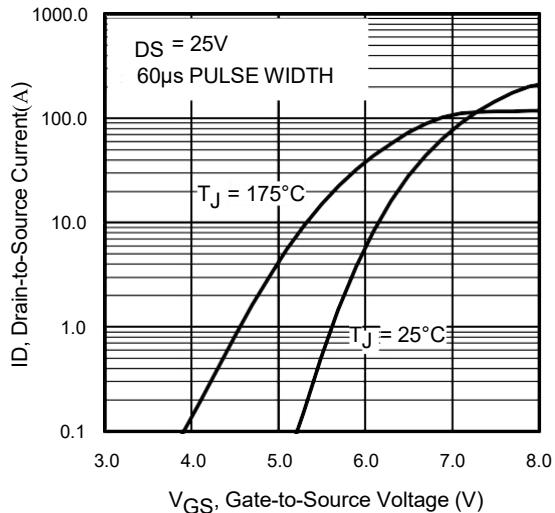




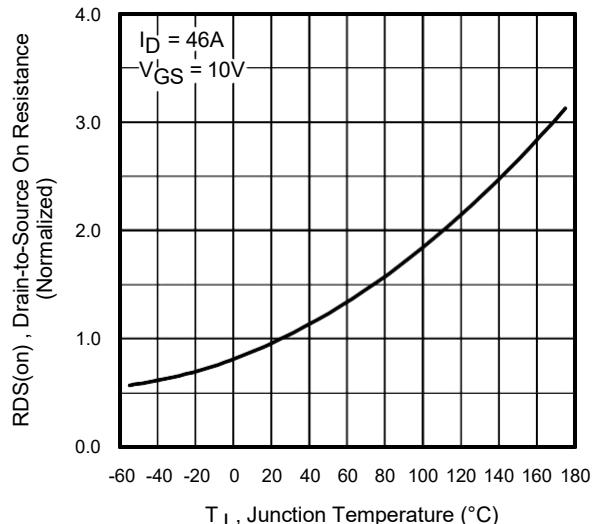
**Fig 1.** Typical Output Characteristics



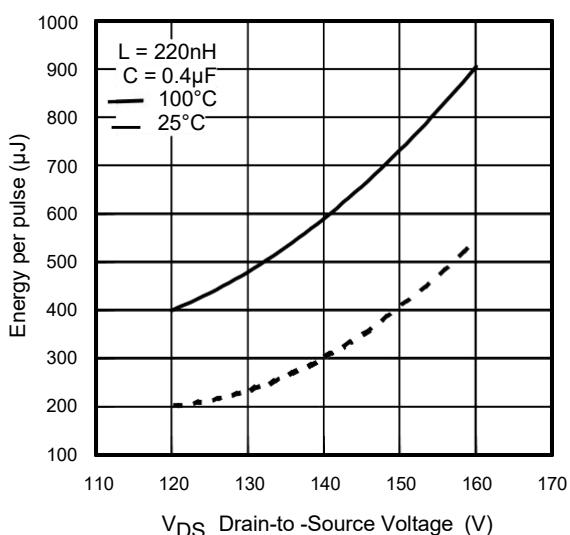
**Fig 2.** Typical Output Characteristics



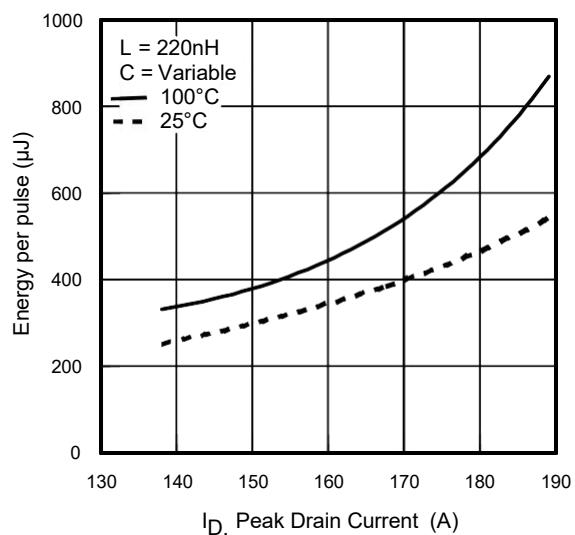
**Fig 3.** Typical Transfer Characteristics



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

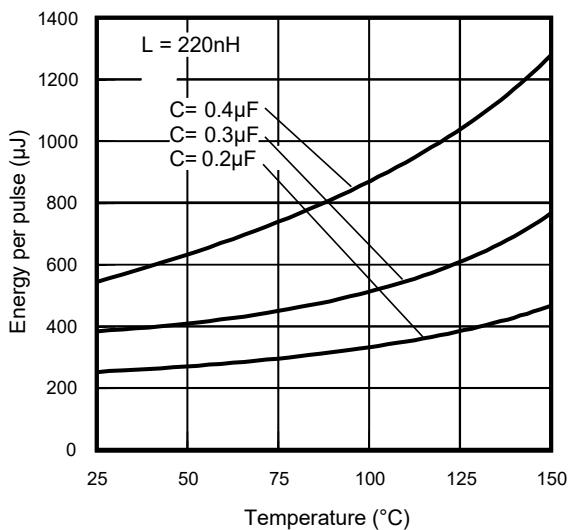


**Fig 5.** Typical  $E_{PULSE}$  vs. Drain-to-Source Voltage

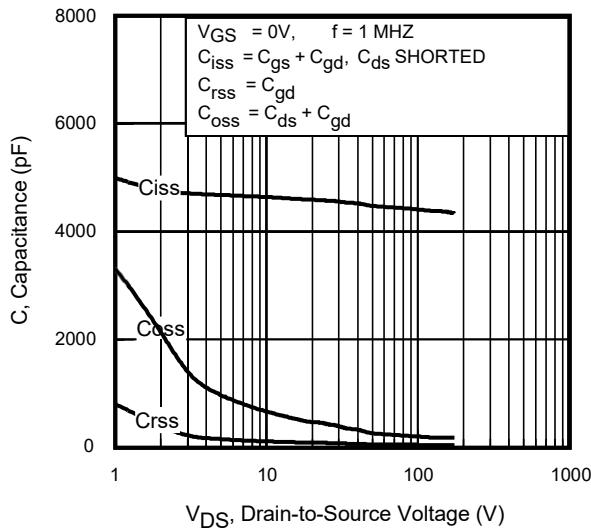


**Fig 6.** Typical  $E_{PULSE}$  vs. Drain Current

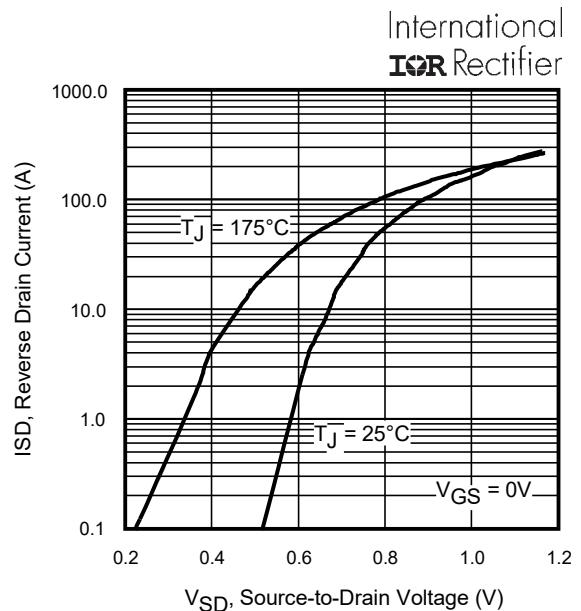
# IRFS/SL4227PbF



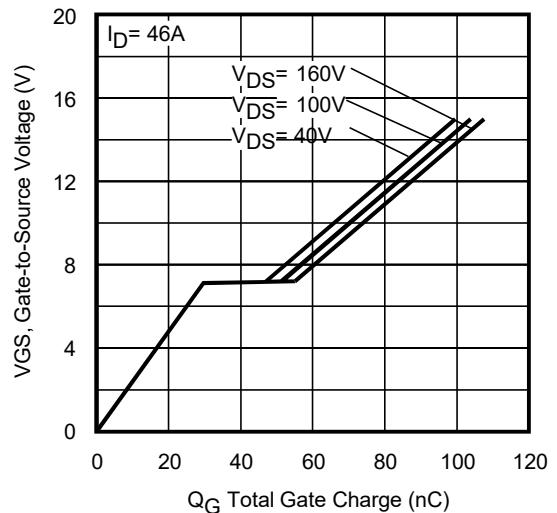
**Fig 7.** Typical  $E_{\text{PULSE}}$  vs.Temperature



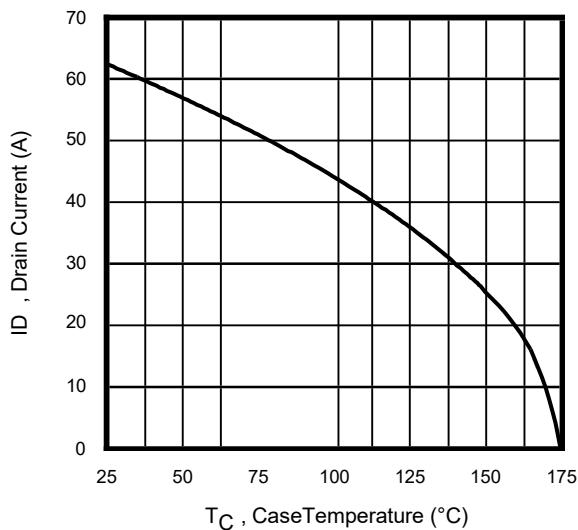
**Fig 9.** Typical Capacitance vs.Drain-to-Source Voltage



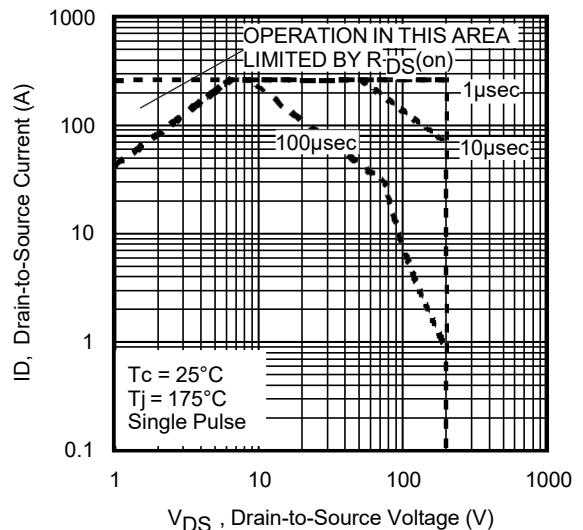
**Fig 8.** Typical Source-Drain Diode Forward Voltage



**Fig 10.** Typical Gate Charge vs.Gate-to-Source Voltage



**Fig 11.** Maximum Drain Current vs. Case Temperature



**Fig 12.** Maximum Safe Operating Area

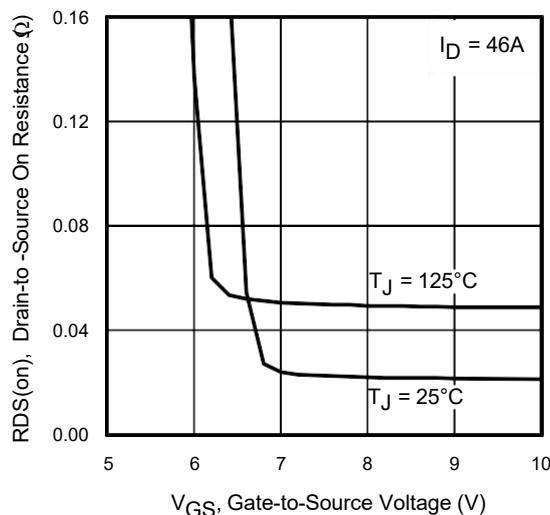


Fig 13. On-Resistance Vs. Gate Voltage

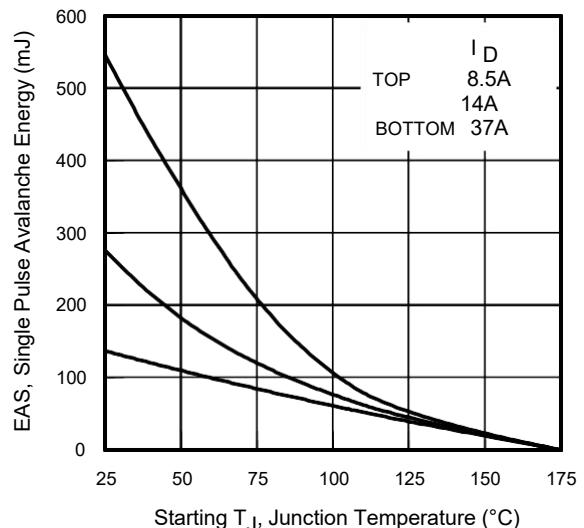


Fig 14. Maximum Avalanche Energy Vs. Temperature

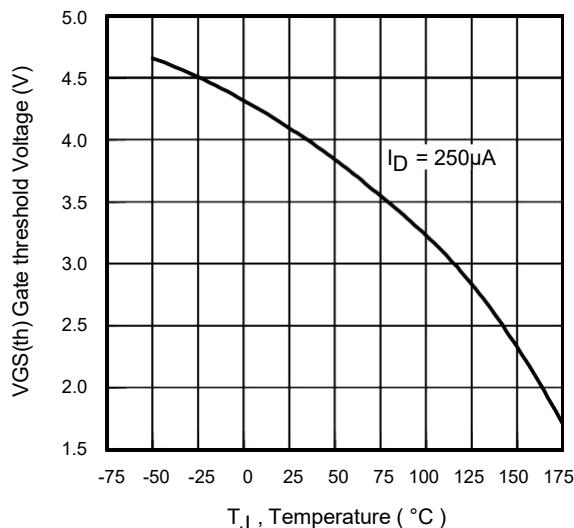


Fig 15. Threshold Voltage vs. Temperature

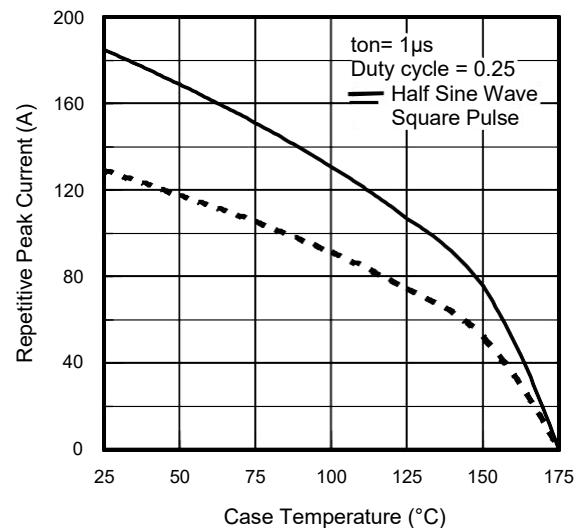


Fig 16. Typical Repetitive peak Current vs. Case temperature

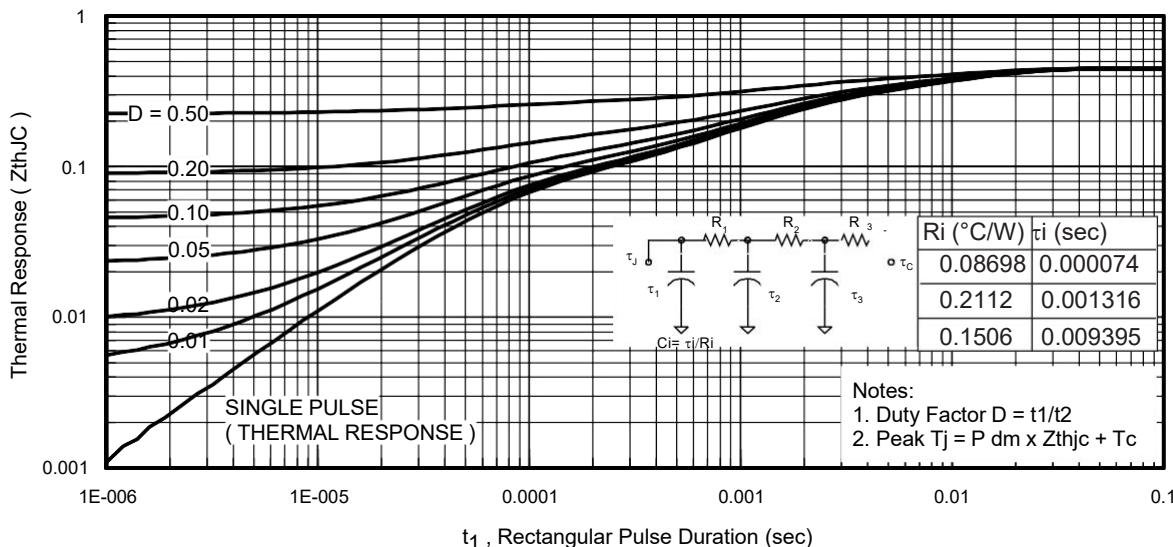
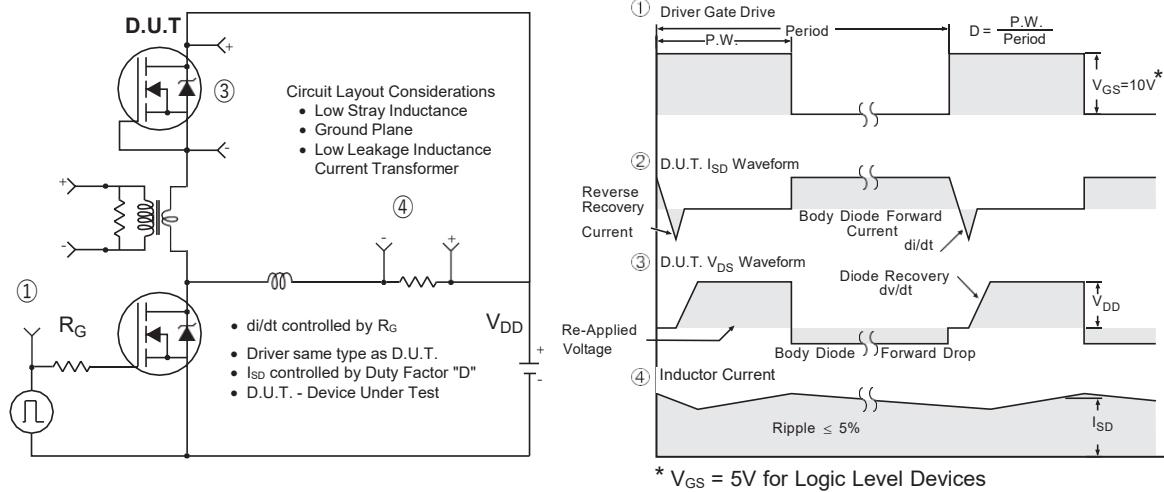
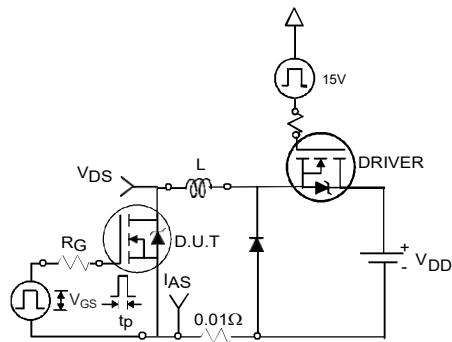


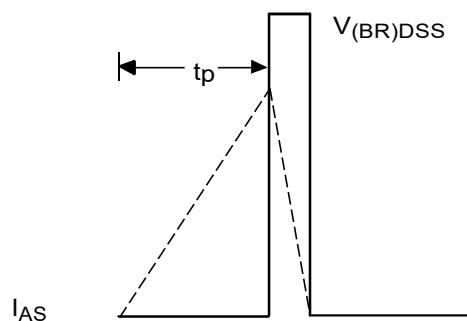
Fig 17. Maximum Effective Transient Thermal Impedance, Junction-to-Case



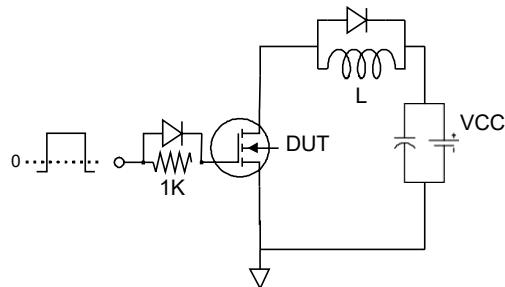
**Fig 18.** Diode Reverse Recovery Test Circuit for N-Channel HEXFET® Power MOSFETs



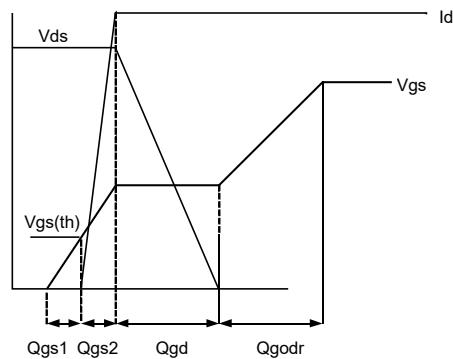
**Fig 19a.** Unclamped Inductive Test Circuit



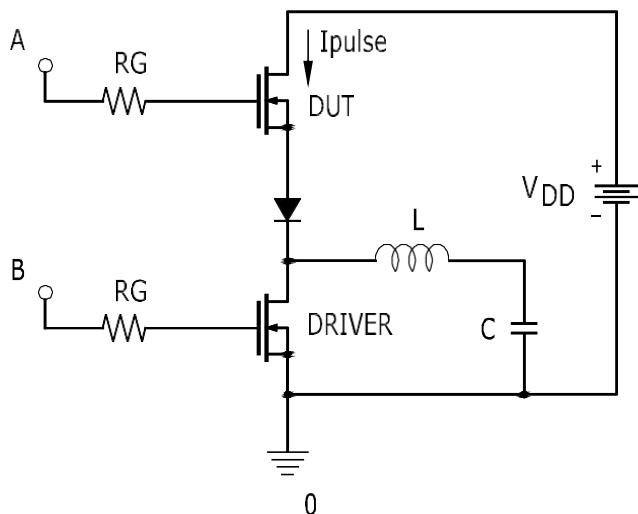
**Fig 19b.** Unclamped Inductive Waveforms



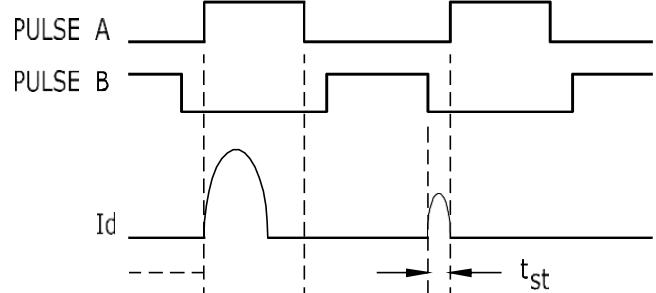
**Fig 20a.** Gate Charge Test Circuit



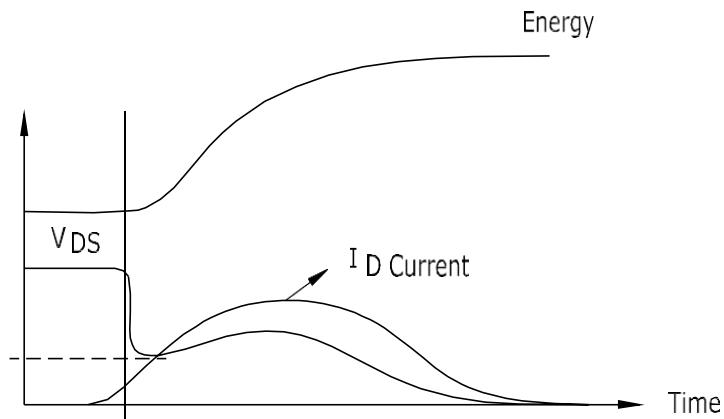
**Fig 20b.** Gate Charge Waveform



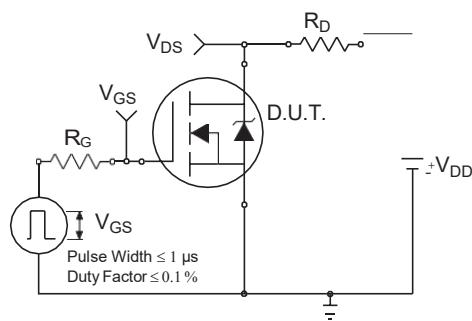
**Fig 21a.**  $t_{st}$  and  $E_{PULSE}$  Test Circuit



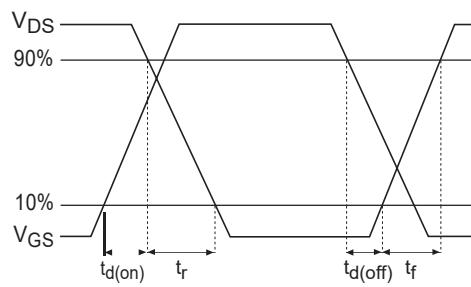
**Fig 21b.**  $t_{st}$  Test Waveforms



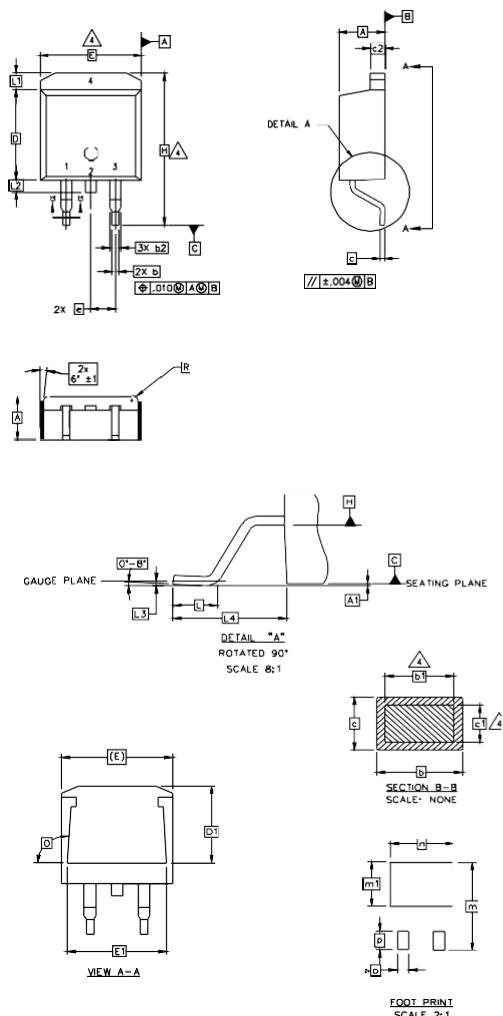
**Fig 21c.**  $E_{PULSE}$  Test Waveforms



**Fig 22a.** Switching Time Test Circuit



**Fig 22b.** Switching Time Waveforms

D<sup>2</sup>Pak Package Outline (Dimensions are shown in millimeters (inches))

## NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M-1994
2. DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES].
3. DIMENSION D & E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED 0.127 [.005"] PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTMOST EXTREMES OF THE PLASTIC BODY.
4. DIMENSION b1 AND c1 APPLY TO BASE METAL ONLY.
5. CONTROLLING DIMENSION: INCH.

SYMBOL	DIMENSIONS				NOTES	
	MILLIMETERS		INCHES			
	MIN.	MAX.	MIN.	MAX.		
A	4.06	4.83	.160	.190		
A1	0.00	0.254	.000	.010		
b	0.51	0.99	.020	.039		
b1	0.51	0.89	.020	.035	4	
b2	1.14	1.78	.045	.070		
c	0.38	0.74	.015	.029		
c1	0.38	0.58	.015	.023	4	
c2	1.14	1.65	.045	.065		
D	8.51	9.65	.335	.380	3	
D1	6.86		.270			
E	9.65	10.67	.380	.420	3	
E1	6.22		.245			
e	2.54	BSC	.100	BSC		
H	14.61	15.88	.575	.625		
L	1.78	2.79	.070	.110		
L1		1.65		.065		
L2	1.27	1.78	.050	.070		
L3	0.25	BSC	.010	BSC		
L4	4.78	5.28	.188	.208		
m	17.78		.700			
m1	8.89		.350			
n	11.43		.450			
o	2.08		.082			
p	3.81		.150			
R	0.51	0.71	.020	.028		
θ	90°	93°	90°	93°		

LEAD ASSIGNMENTSHEXFET

- 1.- GATE
- 2, 4.- DRAIN
- 3.- SOURCE

IGBTs, CoPACK

- 1.- GATE
- 2, 4.- COLLECTOR
- 3.- Emitter

DIODES

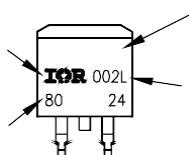
- 1.- ANODE \*
- 2, 4.- CATHODE
- 3.- ANODE

\* PART DEPENDENT.

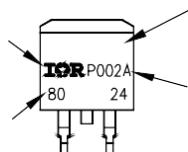
D<sup>2</sup>Pak Part Marking Information

EXAMPLE: /      /  
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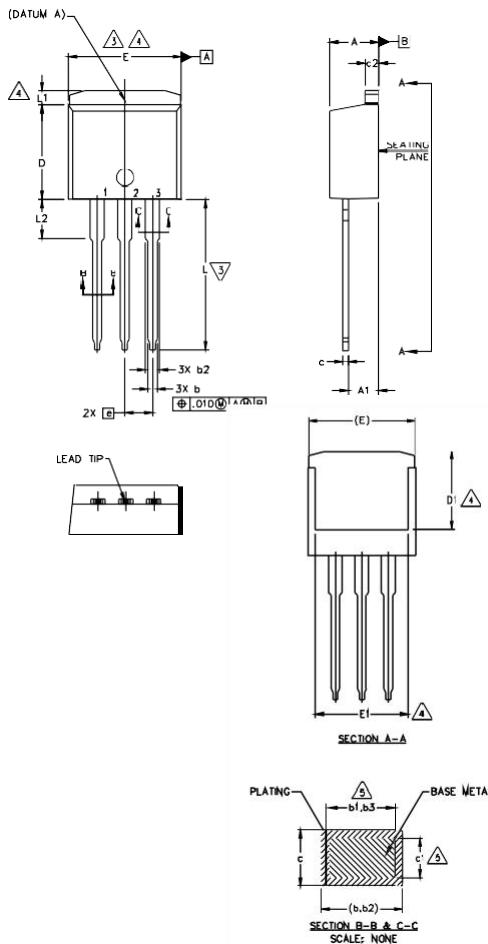
OR



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

## TO-262 Package Outline

Dimensions are shown in millimeters (inches)



### NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M-1994
2. DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES]
3. DIMENSION D & E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED 0.127 [.005"] PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTMOST EXTREMES OF THE PLASTIC BODY.
4. THERMAL PAD CONTOUR OPTIONAL WITHIN DIMENSION E, L1, D1 & E1.
5. DIMENSION b1 AND c1 APPLY TO BASE METAL ONLY.
6. CONTROLLING DIMENSION: INCH.
7. OUTLINE CONFORM TO JEDEC TO-262 EXCEPT A1(max.), b(min.), AND D1(min.) WHERE DIMENSIONS DERIVED THE ACTUAL PACKAGE OUTLINE.

DIMENSION	DIMENSIONS				NOTES	
	MILLIMETERS		INCHES			
	MIN.	MAX.	MIN.	MAX.		
A	4.06	4.83	.160	.190		
A <sub>1</sub>	4.06	4.83	.160	.190		
b	2.03	2.95	.080	.119		
b <sub>1</sub>	2.01	2.93	.079	.118		
c	0.51	0.99	.020	.039		
c <sub>1</sub>	0.51	0.89	.020	.035		
b <sub>2</sub>	0.51	0.59	.020	.035		
b <sub>3</sub>	1.14	1.78	.045	.070		
b <sub>4</sub>	1.14	1.73	.045	.068		
b <sub>5</sub>	0.38	0.74	.015	.029		
b <sub>6</sub>	0.38	0.59	.015	.024		
b <sub>7</sub>	0.12	1.65	.045	.065		
b <sub>8</sub>	1.14	1.65	.045	.065		
b <sub>9</sub>	0.38	9.65	.350	.380		
b <sub>10</sub>	0.38	9.65	.350	.380		
D <sub>1</sub>	—	—	.270	—		
E	9.65	10.67	.380	.420	3,4	
E <sub>1</sub>	5.22	—	.245	—	4	
e	2.54	BSC	.100	BSC		
L	13.46	14.10	.530	.555		
L <sub>1</sub>	—	1.65	—	.065		
L <sub>2</sub>	3.56	3.71	.140	.146	4	

### LEAD ASSIGNMENTS

#### HEXFET

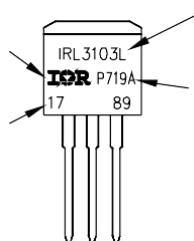
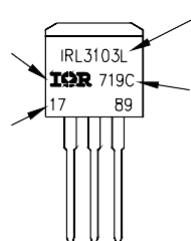
- 1.- GATE
- 2.- DRAIN
- 3.- SOURCE
- 4.- DRAIN

#### IGBTs, CoPACK

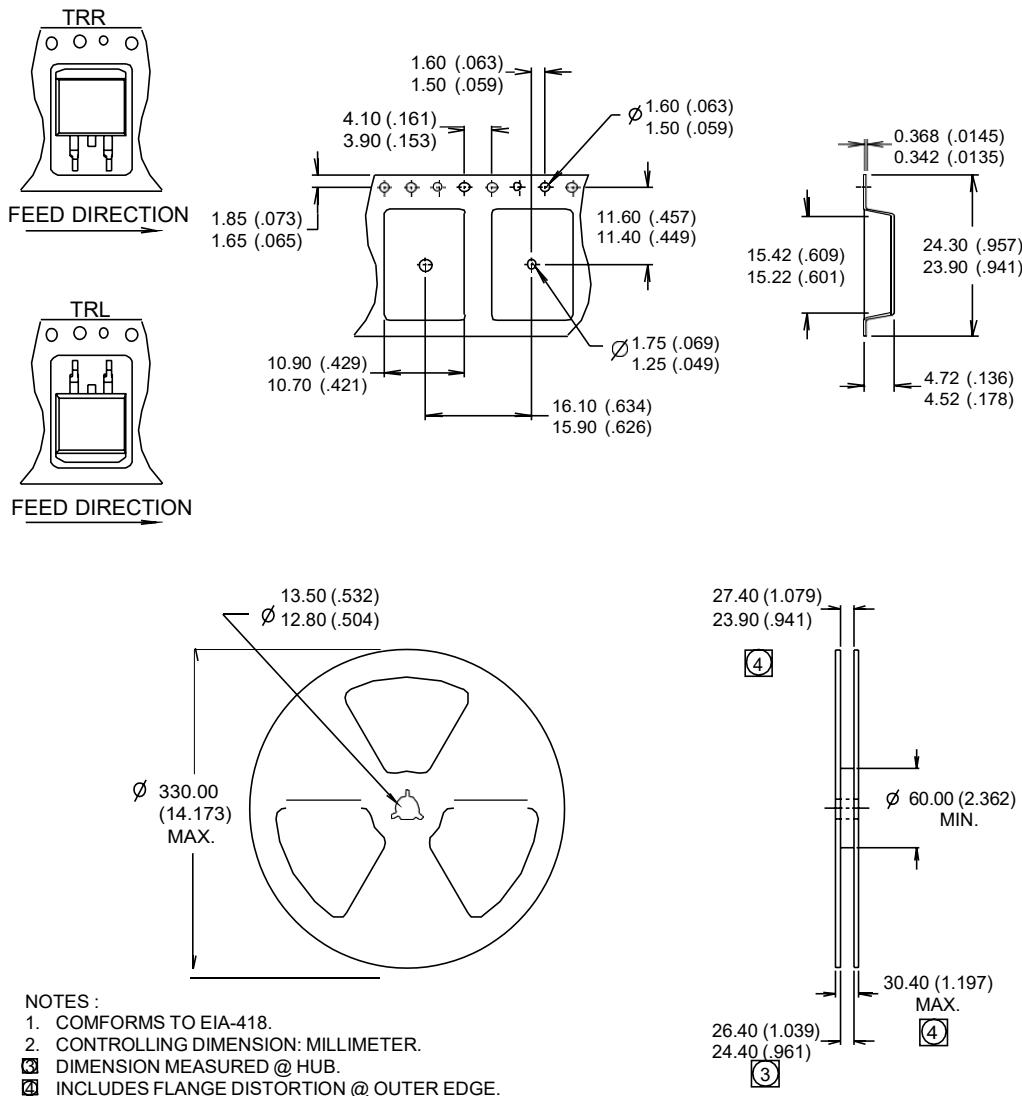
- 1.- GATE
- 2.- COLLECTOR
- 3.- Emitter
- 4.- COLLECTOR

## TO-262 Part Marking Information

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



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

D<sup>2</sup>Pak Tape & Reel Information**Notes:**

- ① Repetitive rating; pulse width limited by max. junction temperature.  
Starting  $T_J = 25^\circ\text{C}$ ,  $L = 0.2\text{mH}$ ,  $R_G = 25\Omega$ ,  $I_{AS} = 37\text{A}$ .
- ③ Pulse width  $\leq 400\mu\text{s}$ ; duty cycle  $\leq 2\%$ .
- ④  $R_\theta$  is measured at  $T_J$  of approximately  $90^\circ\text{C}$ .  
Half sine wave with duty cycle = 0.25,  $t_{on}$ =1usec.
- ⑤ When mounted on 1" square PCB (FR-4 or G-10 Material). For recommended footprint and soldering techniques refer to application note #AN-994.

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

Data and specifications subject to change without notice.  
This product has been designed and qualified for the Industrial market.  
Qualification Standards can be found on IR's Web site.

International  
**IR** Rectifier

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