PD - 96131

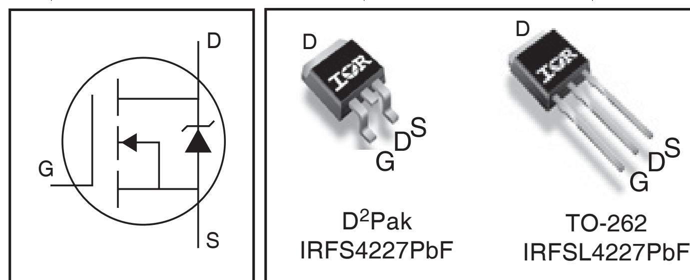
International
IOR Rectifier

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	mΩ
I_{RP} max @ T_C= 100°C	130	A
T_J max	175	°C



D²Pak IRFS4227PbF | TO-262 IRFSL4227PbF

G	D	S
Gate	Drain	Source

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	±30	V
I_D @ T_C = 25°C	Continuous Drain Current, V_{GS} @ 10V	62	A
I_D @ T_C = 100°C	Continuous Drain Current, V_{GS} @ 10V	44	
I_{DM}	Pulsed Drain Current ①	260	
I_{RP} @ T_C = 100°C	Repetitive Peak Current ⑤	130	
P_D @T_C = 25°C	Power Dissipation	330	W
P_D @T_C = 100°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	10lb·in (1.1N·m)	N

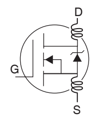
Thermal Resistance

	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case ④	—	0.45*	
$R_{\theta JA}$	Junction-to-Ambient (PCB Mounted) D²Pak ④⑥	—	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.

Notes ① through ⑥ are on page 8

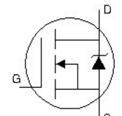
Electrical Characteristics @ T_J = 25°C (unless otherwise specified)

	Parameter	Min.	Typ.	Max.	Units	Conditions
BV_{DSS}	Drain-to-Source Breakdown Voltage	200	—	—	V	V_{GS} = 0V, I_D = 250μA
$\Delta BV_{DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	—	170	—	mV/°C	Reference to 25°C, I_D = 1mA
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	—	22	26	mΩ	V_{GS} = 10V, I_D = 46A ③
$V_{GS(th)}$	Gate Threshold Voltage	3.0	—	5.0	V	V_{DS} = V_{GS}, I_D = 250μA
$\Delta V_{GS(th)}/\Delta T_J$	Gate Threshold Voltage Coefficient	—	-13	—	mV/°C	
I_{DSS}	Drain-to-Source Leakage Current	—	—	20	μA	V_{DS} = 200V, V_{GS} = 0V
		—	—	1.0	mA	V_{DS} = 200V, V_{GS} = 0V, T_J = 125°C
I_{GSS}	Gate-to-Source Forward Leakage	—	—	100	nA	V_{GS} = 20V
	Gate-to-Source Reverse Leakage	—	—	-100		V_{GS} = -20V
g_{fs}	Forward Transconductance	49	—	—	S	V_{DS} = 25V, I_D = 46A
Q_g	Total Gate Charge	—	70	98	nC	V_{DD} = 100V, I_D = 46A, V_{GS} = 10V③
Q_{gd}	Gate-to-Drain Charge	—	23	—		
$t_{d(on)}$	Turn-On Delay Time	—	33	—	ns	V_{DD} = 100V, V_{GS} = 10V ③
t_r	Rise Time	—	20	—		I_D = 46A
$t_{d(off)}$	Turn-Off Delay Time	—	21	—		R_G = 2.5Ω
t_f	Fall Time	—	31	—		See Fig. 22
t_{st}	Shoot Through Blocking Time	100	—	—	ns	V_{DD} = 160V, V_{GS} = 15V, R_G= 4.7Ω
E_{PULSE}	Energy per Pulse	—	570	—	μJ	L = 220nH, C= 0.4μF, V_{GS} = 15V V_{DS} = 160V, R_G= 4.7Ω, T_J = 25°C
		—	910	—		L = 220nH, C= 0.4μF, V_{GS} = 15V V_{DS} = 160V, R_G= 4.7Ω, T_J = 100°C
C_{iss}	Input Capacitance	—	4600	—	pF	V_{GS} = 0V
C_{oss}	Output Capacitance	—	460	—		V_{DS} = 25V
C_{rss}	Reverse Transfer Capacitance	—	91	—		f = 1.0MHz,
C_{oss} eff.	Effective Output Capacitance	—	360	—		V_{GS} = 0V, V_{DS} = 0V to 160V
L_D	Internal Drain Inductance	—	4.5	—	nH	Between lead, 6mm (0.25in.) 
L_S	Internal Source Inductance	—	7.5	—		from package and center of die contact

Avalanche Characteristics

	Parameter	Typ.	Max.	Units
E_{AS}	Single Pulse Avalanche Energy②	—	140	mJ
E_{AR}	Repetitive Avalanche Energy ①	—	46	mJ
$V_{DS(Avalanche)}$	Repetitive Avalanche Voltage ①	240	—	V
I_{AS}	Avalanche Current ②	—	37	A

Diode Characteristics

	Parameter	Min.	Typ.	Max.	Units	Conditions
I_S @ T_C = 25°C	Continuous Source Current (Body Diode)	—	—	62	A	MOSFET symbol showing the 
I_{SM}	Pulsed Source Current (Body Diode) ①	—	—	260		integral reverse p-n junction diode.
V_{SD}	Diode Forward Voltage	—	—	1.3	V	T_J = 25°C, I_S = 46A, V_{GS} = 0V ③
t_{rr}	Reverse Recovery Time	—	100	150	ns	T_J = 25°C, I_F = 46A, V_{DD} = 50V
Q_{rr}	Reverse Recovery Charge	—	430	640	nC	di/dt = 100A/μs ③

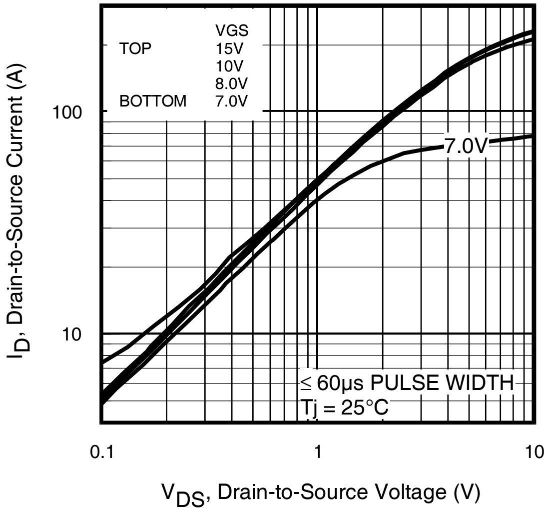


Fig 1. Typical Output Characteristics

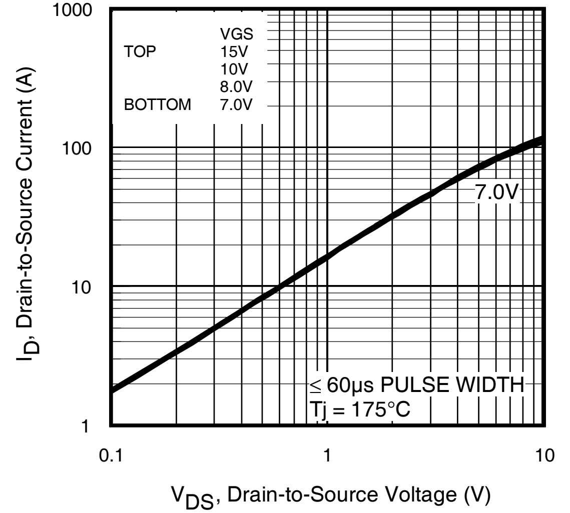


Fig 2. Typical Output Characteristics

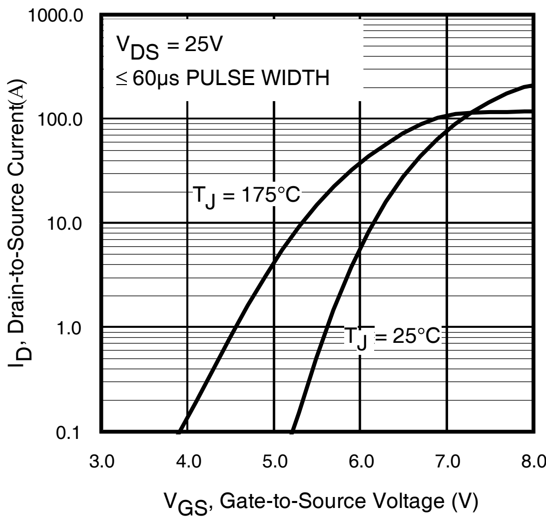


Fig 3. Typical Transfer Characteristics

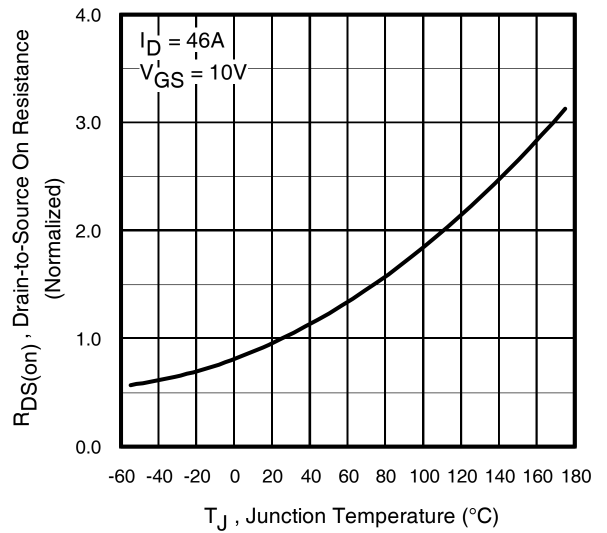


Fig 4. Normalized On-Resistance vs. Temperature

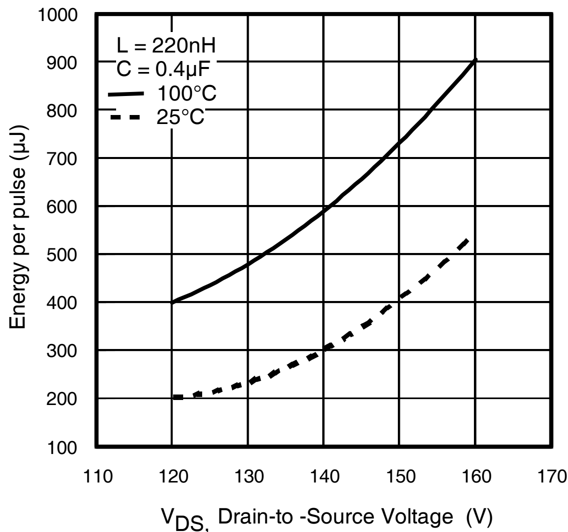


Fig 5. Typical E_{PULSE} vs. Drain-to-Source Voltage

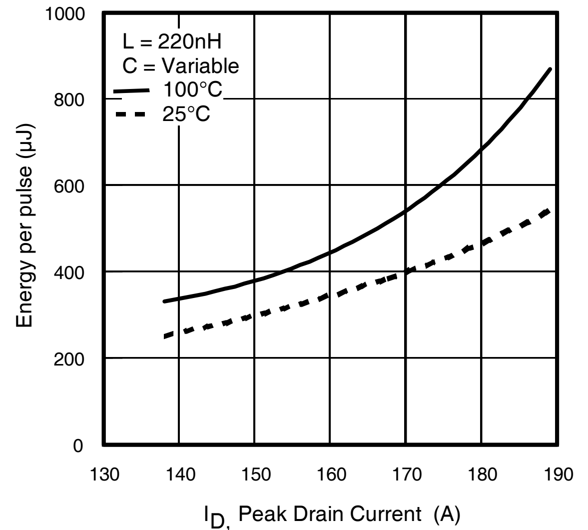


Fig 6. Typical E_{PULSE} vs. Drain Current

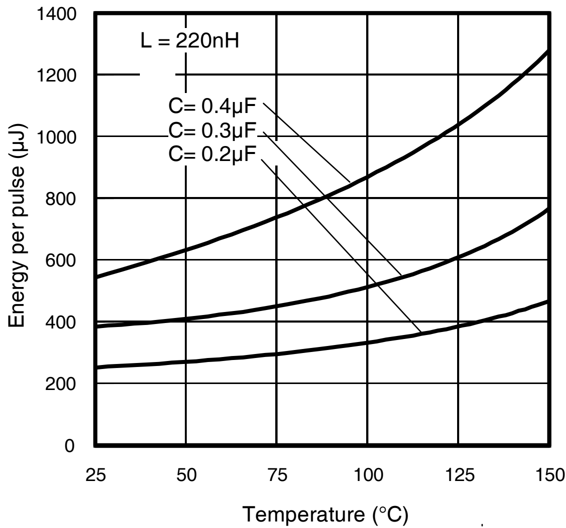


Fig 7. Typical E_{PULSE} vs.Temperature

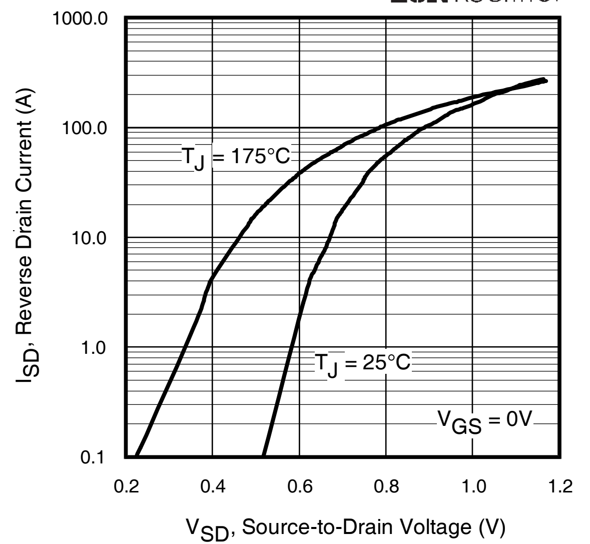


Fig 8. Typical Source-Drain Diode Forward Voltage

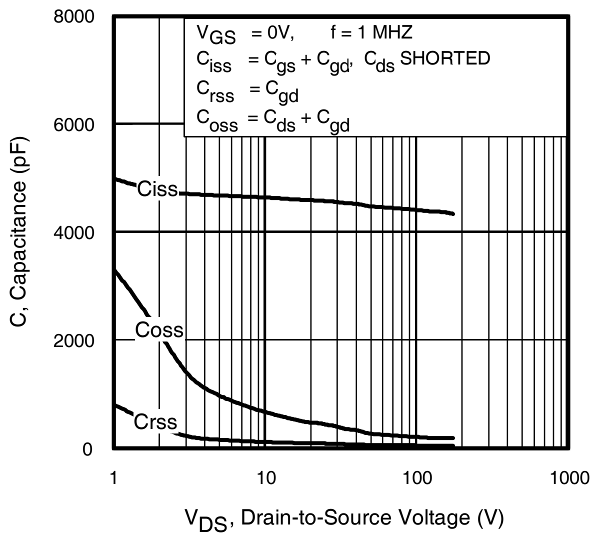


Fig 9. Typical Capacitance vs.Drain-to-Source Voltage

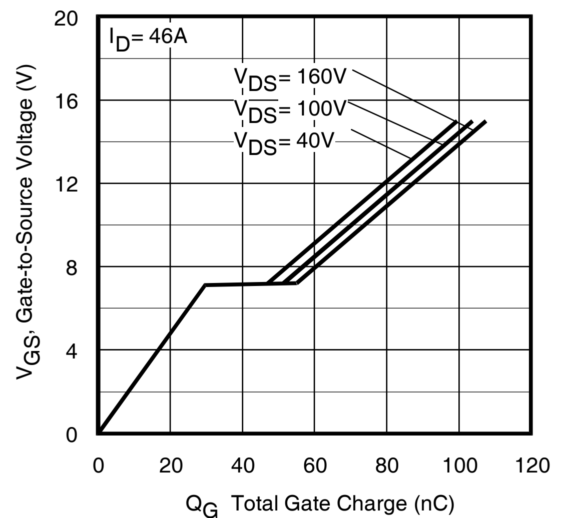


Fig 10. Typical Gate Charge vs.Gate-to-Source Voltage

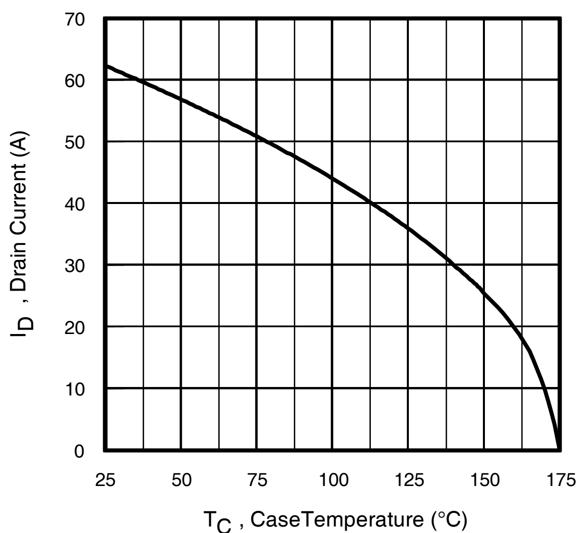


Fig 11. Maximum Drain Current vs. Case Temperature

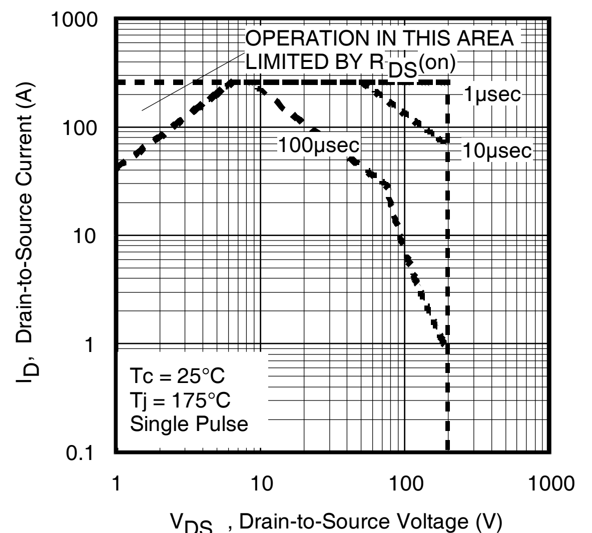


Fig 12. Maximum Safe Operating Area

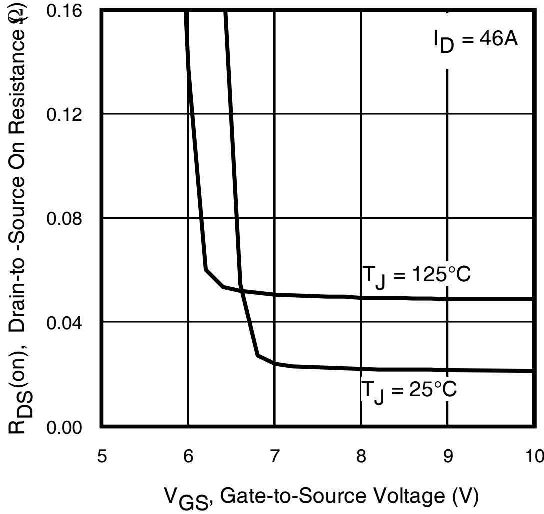


Fig 13. On-Resistance Vs. Gate Voltage

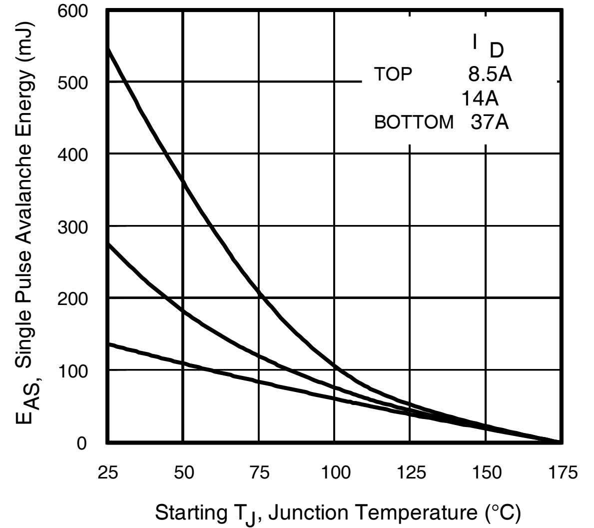


Fig 14. Maximum Avalanche Energy Vs. Temperature

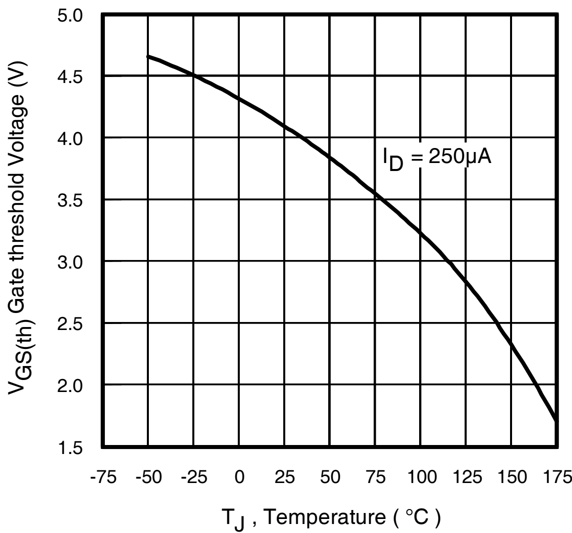


Fig 15. Threshold Voltage vs. Temperature

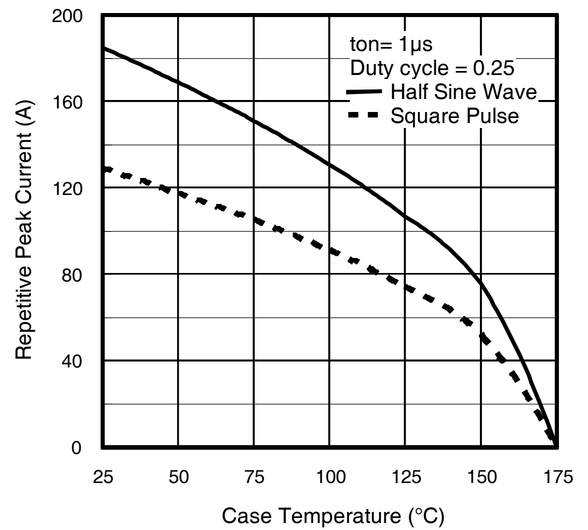
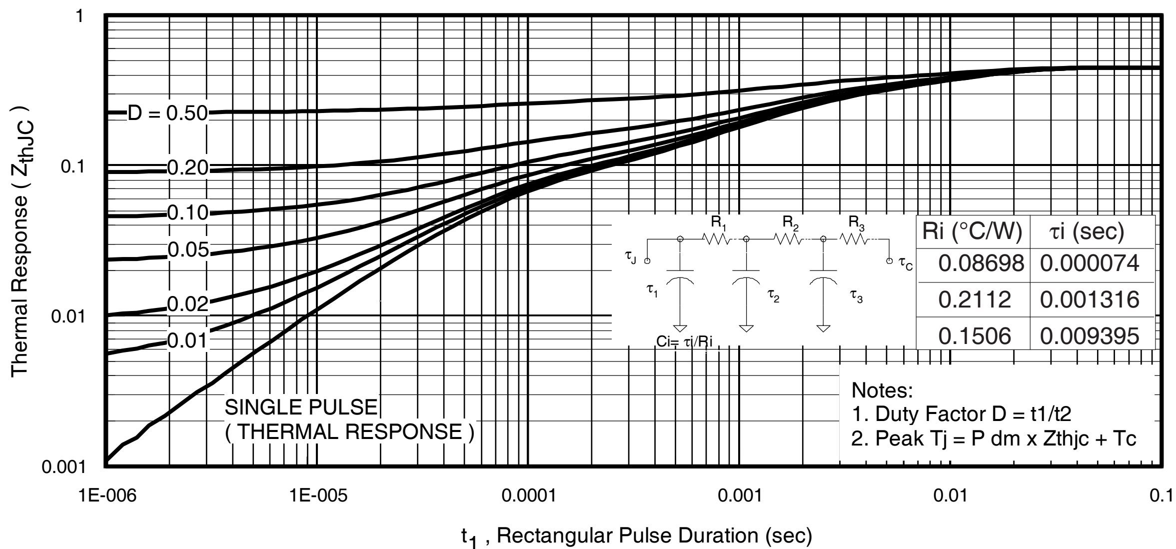
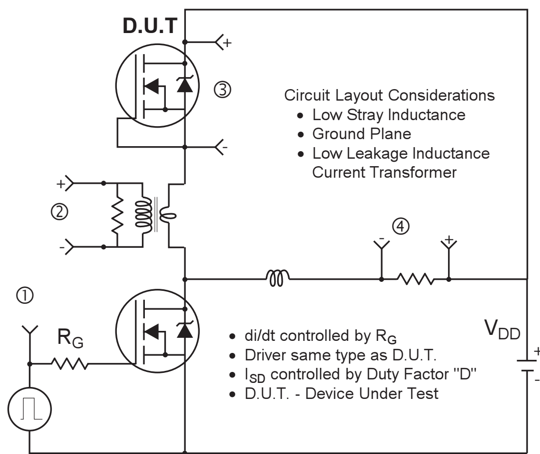


Fig 16. Typical Repetitive peak Current vs. Case temperature



Ri (°C/W)	τi (sec)
0.08698	0.000074
0.2112	0.001316
0.1506	0.009395

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



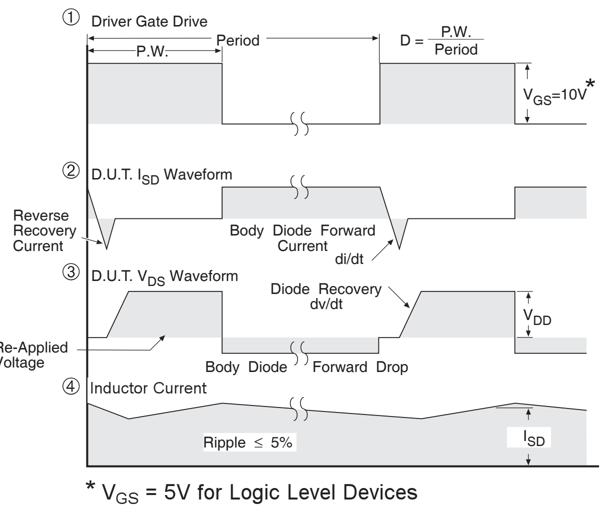


Fig 18. Diode Reverse Recovery Test Circuit for N-Channel HEXFET® Power MOSFETs

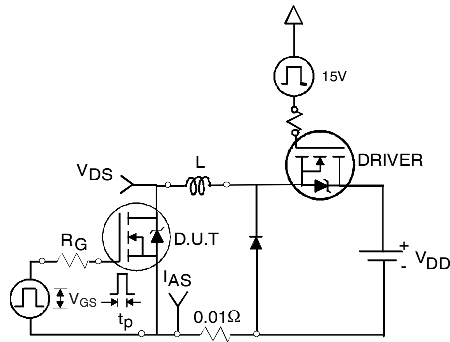


Fig 19a. Unclamped Inductive Test Circuit

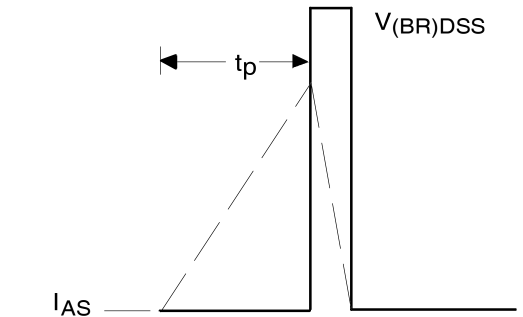


Fig 19b. Unclamped Inductive Waveforms

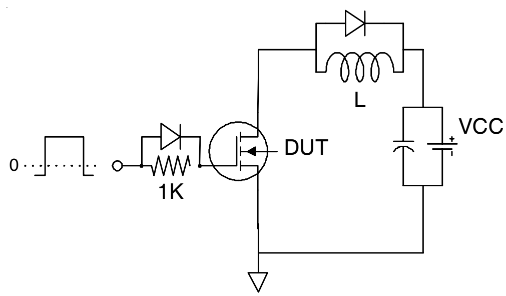


Fig 20a. Gate Charge Test Circuit

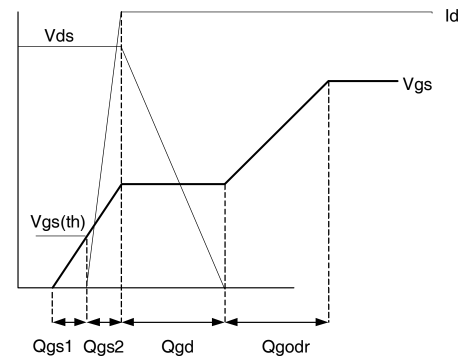


Fig 20b. Gate Charge Waveform

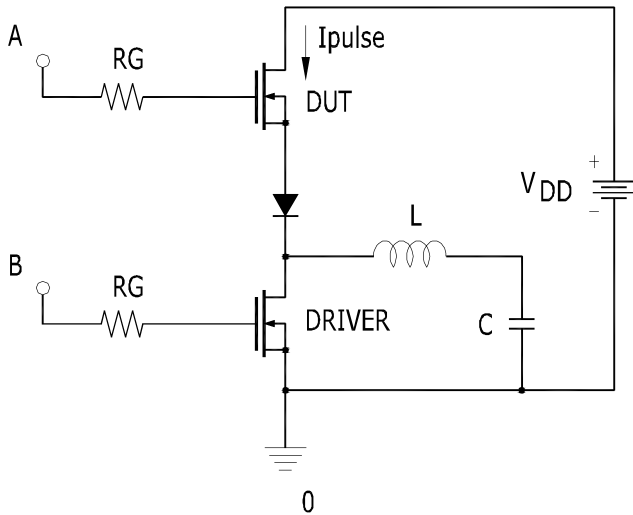


Fig 21a. t_{st} and E_{PULSE} Test Circuit

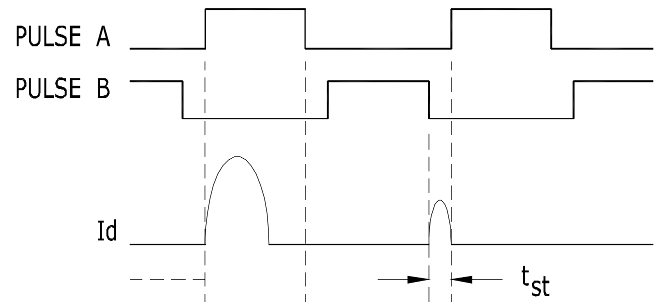


Fig 21b. t_{st} Test Waveforms

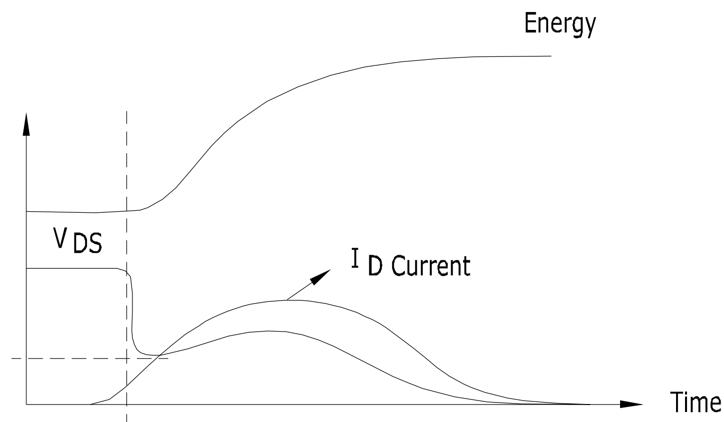


Fig 21c. E_{PULSE} Test Waveforms

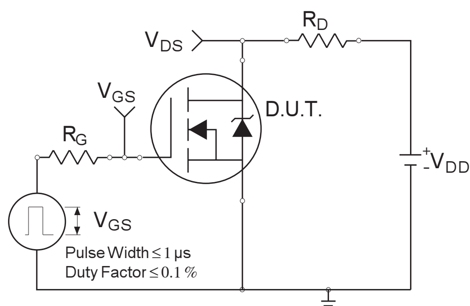


Fig 22a. Switching Time Test Circuit

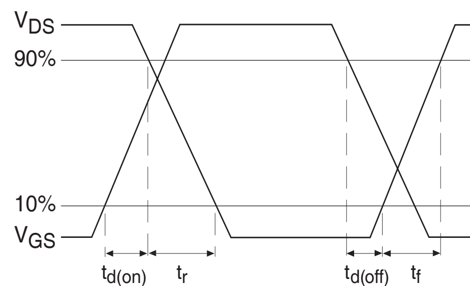
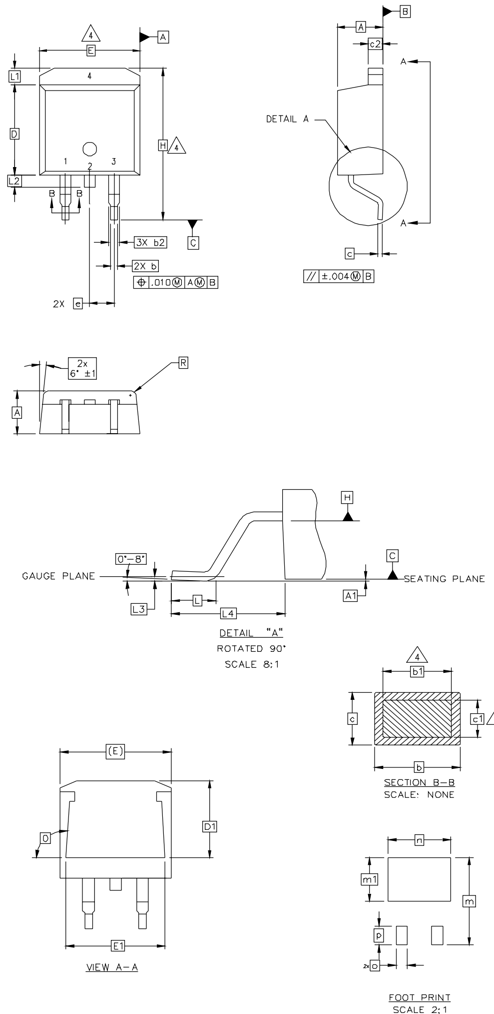


Fig 22b. Switching Time Waveforms

D²Pak 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 ASSIGNMENTS

HEXFET

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

IGBTs, CoPACK

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

DIODES

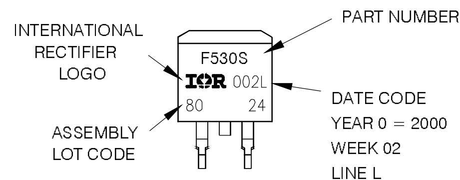
1.- ANODE *
2, 4.- CATHODE
3.- ANODE

* PART DEPENDENT.

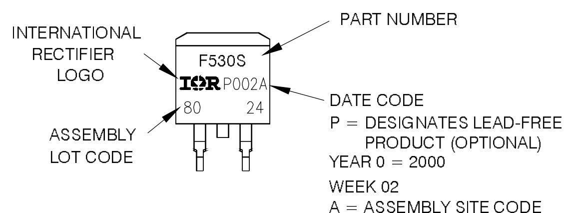
D²Pak Part Marking Information

EXAMPLE: THIS IS AN IRF530S WITH LOT CODE 8024
ASSEMBLED ON WW 02, 2000
IN THE ASSEMBLY LINE "L"

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



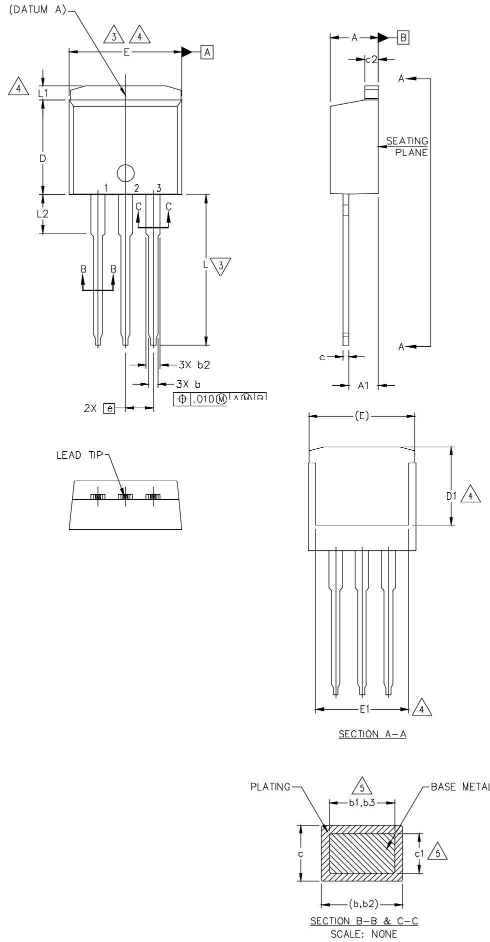
OR



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.

SYMBOL	DIMENSIONS				NOTES
	MILLIMETERS		INCHES		
	MIN.	MAX.	MIN.	MAX.	
A	4.06	4.83	.160	.190	
A1	2.03	3.02	.080	.119	
b	0.51	0.99	.020	.039	
b1	0.51	0.89	.020	.035	5
b2	1.14	1.78	.045	.070	
b3	1.14	1.73	.045	.068	5
c	0.38	0.74	.015	.029	
c1	0.38	0.58	.015	.023	5
c2	1.14	1.65	.045	.065	
D	8.38	9.65	.330	.380	3
D1	6.86	–	.270	–	4
E	9.65	10.67	.380	.420	3,4
E1	6.22	–	.245		4
e	2.54 BSC		.100 BSC		
L	13.46	14.10	.530	.555	
L1	–	1.65	–	.065	4
L2	3.56	3.71	.140	.146	

LEAD ASSIGNMENTS

HEXFET

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

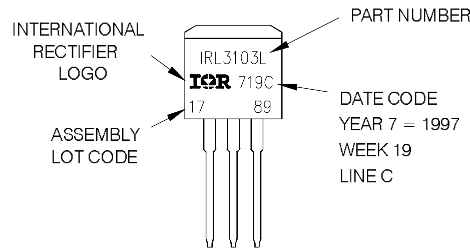
IGBTs, CoPACK

1.– GATE
2.– COLLECTOR
3.– EMITTER
4.– COLLECTOR

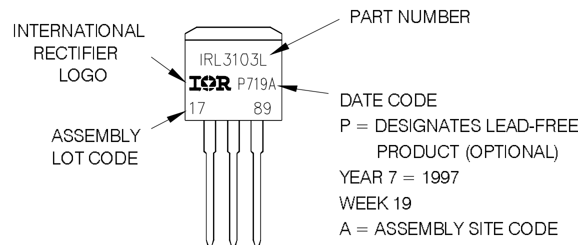
TO-262 Part Marking Information

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

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

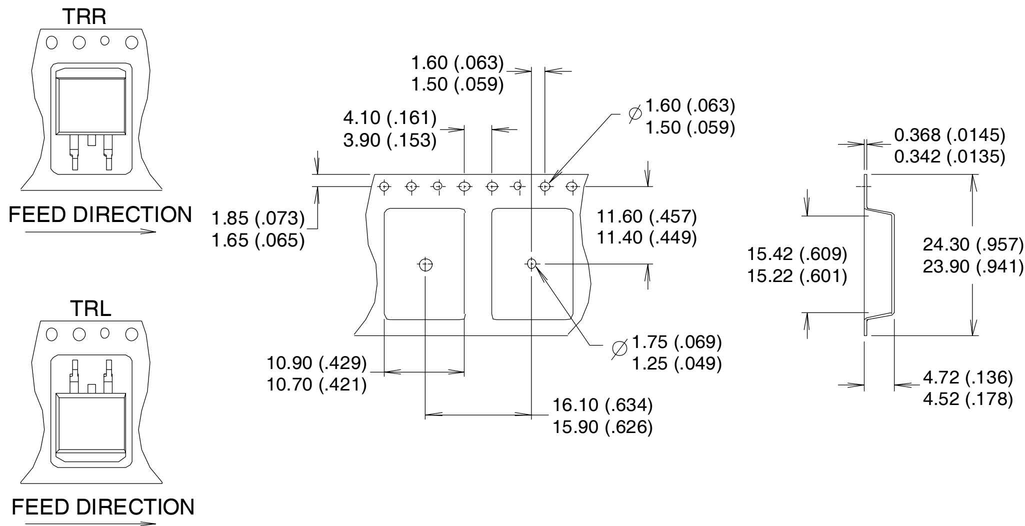


OR



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

D^2Pak Tape & Reel Information



13.50 (.532)
12.80 (.504)
330.00
(14.173)
MAX.
27.40 (1.079)
23.90 (.941)
60.00 (2.362)
MIN.
30.40 (1.197)
MAX.
26.40 (1.039)
24.40 (.961)

NOTES :
1. COMFORMS TO EIA-418.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION MEASURED @ HUB.
4. INCLUDES FLANGE DISTORTION @ OUTER EDGE.

Notes:

① Repetitive rating; pulse width limited by max. junction temperature.
② Starting T_J = 25°C, L = 0.2mH, R_G = 25Ω, I_{AS} = 37A.
③ Pulse width ≤ 400µs; duty cycle ≤ 2%.
④ R_θ is measured at T_J of approximately 90°C.
⑤ Half sine wave with duty cycle = 0.25, ton=1µsec.
⑥ 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
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