International
IOR Rectifier

PD - 93804B

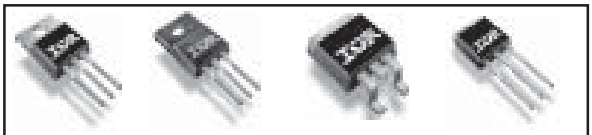
IRFB41N15D
IRFIB41N15D
IRFS41N15D
IRFSL41N15D

HEXFET® Power MOSFET

V_{DSS}	$R_{DS(on)}$ max	I_D
150V	0.045Ω	41A

Applications
- High frequency DC-DC converters

Benefits
- Low Gate-to-Drain Charge to Reduce Switching Losses
- Fully Characterized Capacitance Including Effective C_{OSS} to Simplify Design, (See App. Note AN1001)
- Fully Characterized Avalanche Voltage and Current



TO-220AB IRFB41N15D | TO-220 FullPak IRFIB41N15D | D^2Pak IRFS41N15D | TO-262 IRFSL41N15D

Absolute Maximum Ratings

	Parameter	Max.	Units
I_D @ T_C = 25°C	Continuous Drain Current, V_{GS} @ 10V	41	A
I_D @ T_C = 100°C	Continuous Drain Current, V_{GS} @ 10V	29	
I_{DM}	Pulsed Drain Current ①	164	
P_D @T_A = 25°C	Power Dissipation, D^2Pak	3.1	W
P_D @T_C = 25°C	Power Dissipation, TO-220	200	
P_D @T_C = 25°C	Power Dissipation, Fullpak	48	
	Linear Derating Factor, TO-220	1.3	W/°C
	Linear Derating Factor, Fullpak	0.32	
V_{GS}	Gate-to-Source Voltage	± 30	V
dv/dt	Peak Diode Recovery dv/dt ③	2.7	V/ns
T_J	Operating Junction and	-55 to + 175	°C
T_{STG}	Storage Temperature Range		
	Soldering Temperature, for 10 seconds	300 (1.6mm from case)	
	Mounting torque, 6-32 or M3 screw	1.1(10)	N•m (lbf•in)

Thermal Resistance

	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case	—	0.75	°C/W
$R_{\theta JC}$	Junction-to-Case, Fullpak	—	3.14	
$R_{\theta cs}$	Case-to-Sink, Flat, Greased Surface ⑥	0.50	—	
$R_{\theta JA}$	Junction-to-Ambient, TO-220 ⑥	—	62	
$R_{\theta JA}$	Junction-to-Ambient, D^2Pak ⑦	—	40	
$R_{\theta JA}$	Junction-to-Ambient, Fullpak	—	65	

Notes ① through ⑦ are on page 12

Static @ T_J = 25°C (unless otherwise specified)

	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(BR)DSS}$	Drain-to-Source Breakdown Voltage	150	—	—	V	V_{GS} = 0V, I_D = 250µA
$\Delta V_{(BR)DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	—	0.17	—	V/°C	Reference to 25°C, I_D = 1mA
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	—	—	0.045	Ω	V_{GS} = 10V, I_D = 25A ④
$V_{GS(th)}$	Gate Threshold Voltage	3.0	—	5.5	V	V_{DS} = V_{GS}, I_D = 250µA
I_{DSS}	Drain-to-Source Leakage Current	—	—	25	µA	V_{DS} = 150V, V_{GS} = 0V
		—	—	250		V_{DS} = 120V, V_{GS} = 0V, T_J = 150°C
I_{GSS}	Gate-to-Source Forward Leakage	—	—	100	nA	V_{GS} = 30V
	Gate-to-Source Reverse Leakage	—	—	-100		V_{GS} = -30V

Dynamic @ T_J = 25°C (unless otherwise specified)

	Parameter	Min.	Typ.	Max.	Units	Conditions
gfs	Forward Transconductance	18	—	—	S	V_{DS} = 50V, I_D = 25A
Q_g	Total Gate Charge	—	72	110		I_D = 25A
Q_{gs}	Gate-to-Source Charge	—	21	31	nC	V_{DS} = 120V
Q_{gd}	Gate-to-Drain ("Miller") Charge	—	35	52		V_{GS} = 10V ④
$t_{d(on)}$	Turn-On Delay Time	—	16	—		V_{DD} = 75V
t_r	Rise Time	—	63	—		I_D = 25A
$t_{d(off)}$	Turn-Off Delay Time	—	25	—	ns	R_G = 2.5Ω
t_f	Fall Time	—	14	—		V_{GS} = 10V ④
C_{iss}	Input Capacitance	—	2520	—		V_{GS} = 0V
C_{oss}	Output Capacitance	—	510	—		V_{DS} = 25V
C_{rss}	Reverse Transfer Capacitance	—	110	—	pF	f = 1.0MHz
C_{oss}	Output Capacitance	—	3090	—		V_{GS} = 0V, V_{DS} = 1.0V, f = 1.0MHz
C_{oss}	Output Capacitance	—	230	—		V_{GS} = 0V, V_{DS} = 120V, f = 1.0MHz
C_{oss} eff.	Effective Output Capacitance	—	250	—		V_{GS} = 0V, V_{DS} = 0V to 120V ⑤

Avalanche Characteristics

	Parameter	Typ.	Max.	Units
E_{AS}	Single Pulse Avalanche Energy②	—	470	mJ
I_{AR}	Avalanche Current ①	—	25	A
E_{AR}	Repetitive Avalanche Energy ①	—	20	mJ

Diode Characteristics

	Parameter	Min.	Typ.	Max.	Units	Conditions
I_S	Continuous Source Current (Body Diode)	—	—	41	A	MOSFET symbol showing the integral reverse p-n junction diode.
I_{SM}	Pulsed Source Current (Body Diode) ①	—	—	164		
V_{SD}	Diode Forward Voltage	—	—	1.3	V	T_J = 25°C, I_S = 25A, V_{GS} = 0V ④
t_{rr}	Reverse Recovery Time	—	170	260	ns	T_J = 25°C, I_F = 25A
Q_{rr}	Reverse Recovery Charge	—	1.3	1.9	µC	di/dt = 100A/µs ④
t_{on}	Forward Turn-On Time	Intrinsic turn-on time is negligible (turn-on is dominated by LS+LD)				

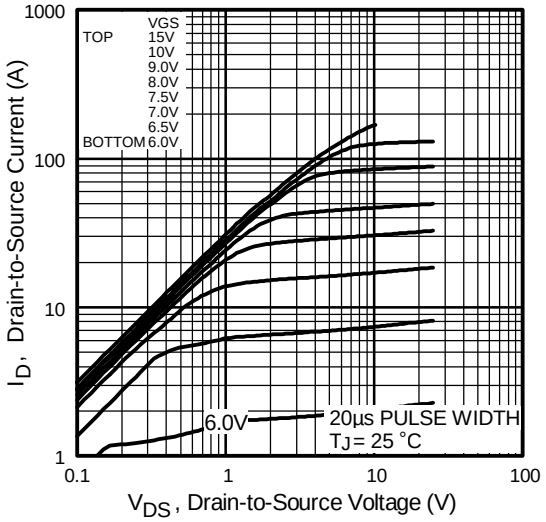


Fig 1. Typical Output Characteristics

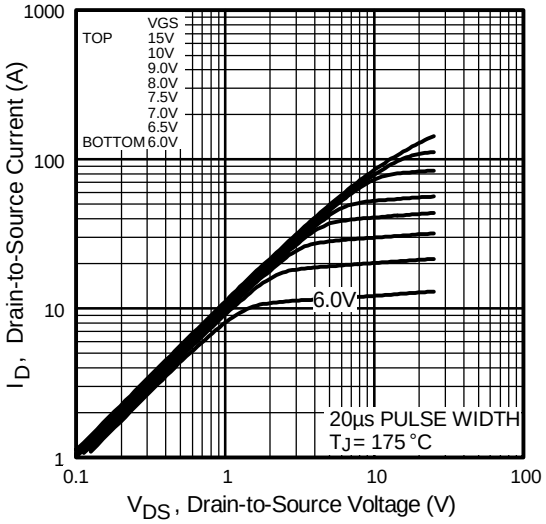


Fig 2. Typical Output Characteristics

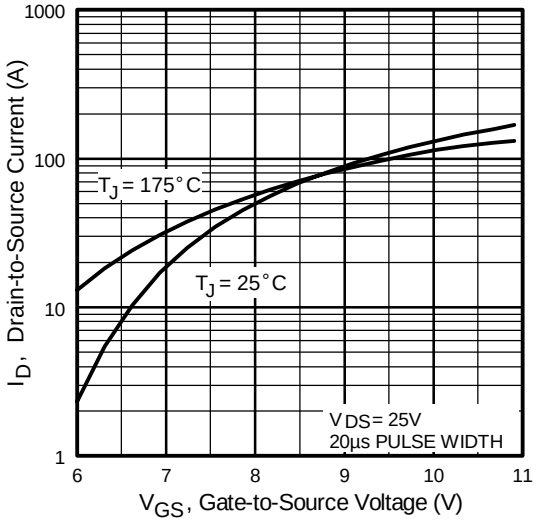


Fig 3. Typical Transfer Characteristics

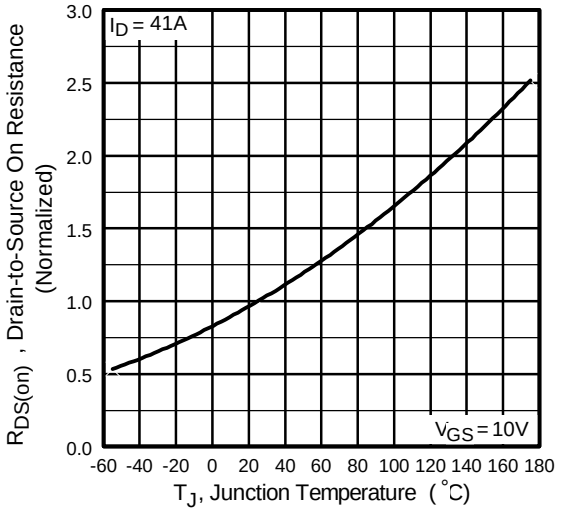


Fig 4. Normalized On-Resistance vs. Temperature

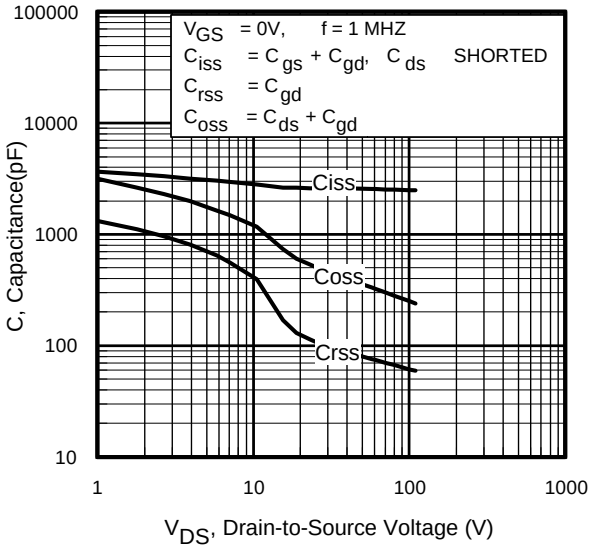


Fig 5. Typical Capacitance Vs. Drain-to-Source Voltage

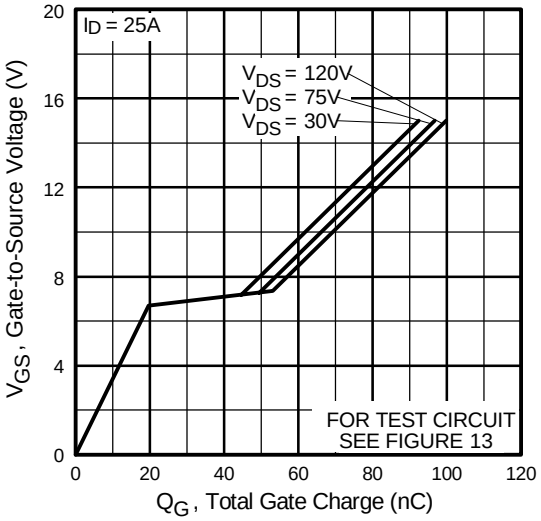


Fig 6. Typical Gate Charge Vs. Gate-to-Source Voltage

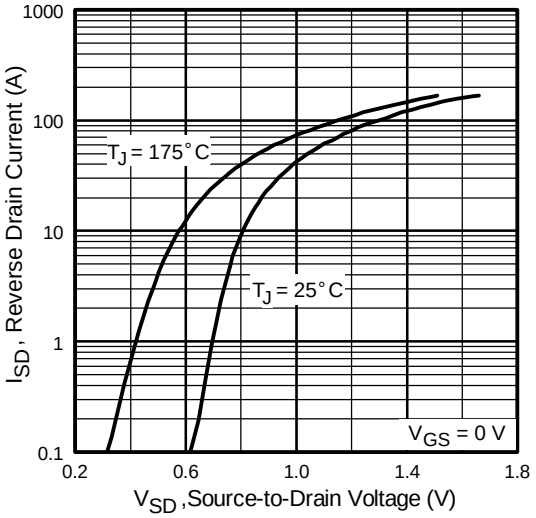


Fig 7. Typical Source-Drain Diode Forward Voltage

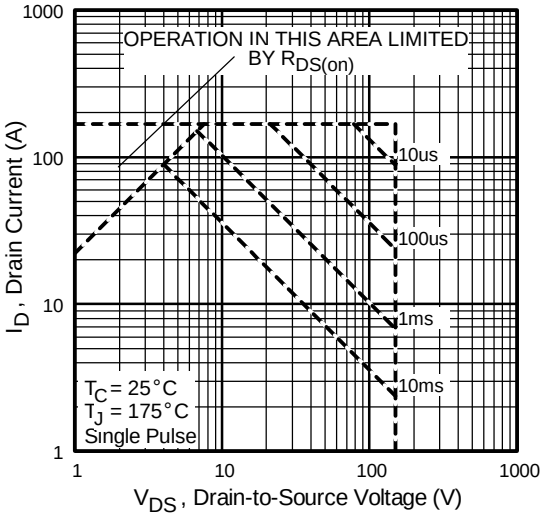


Fig 8. Maximum Safe Operating Area

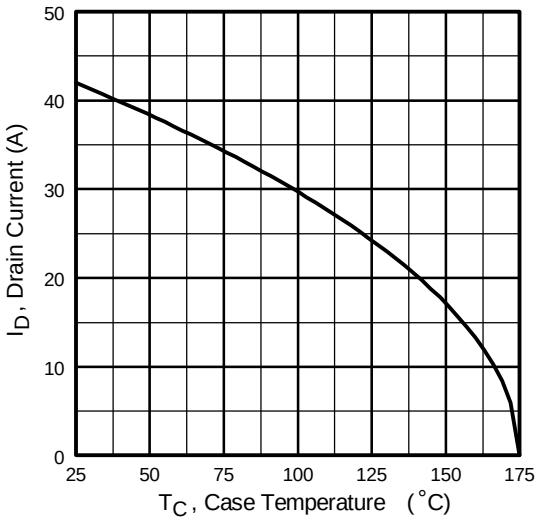


Fig 9. Maximum Drain Current Vs. Case Temperature

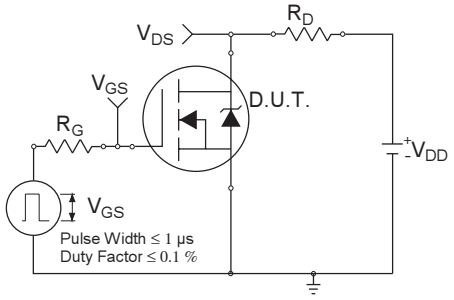


Fig 10a. Switching Time Test Circuit

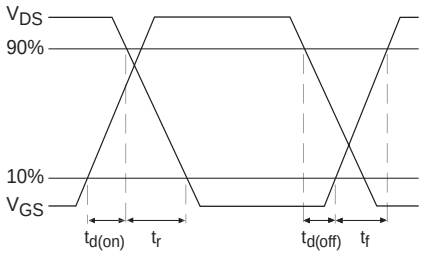


Fig 10b. Switching Time Waveforms

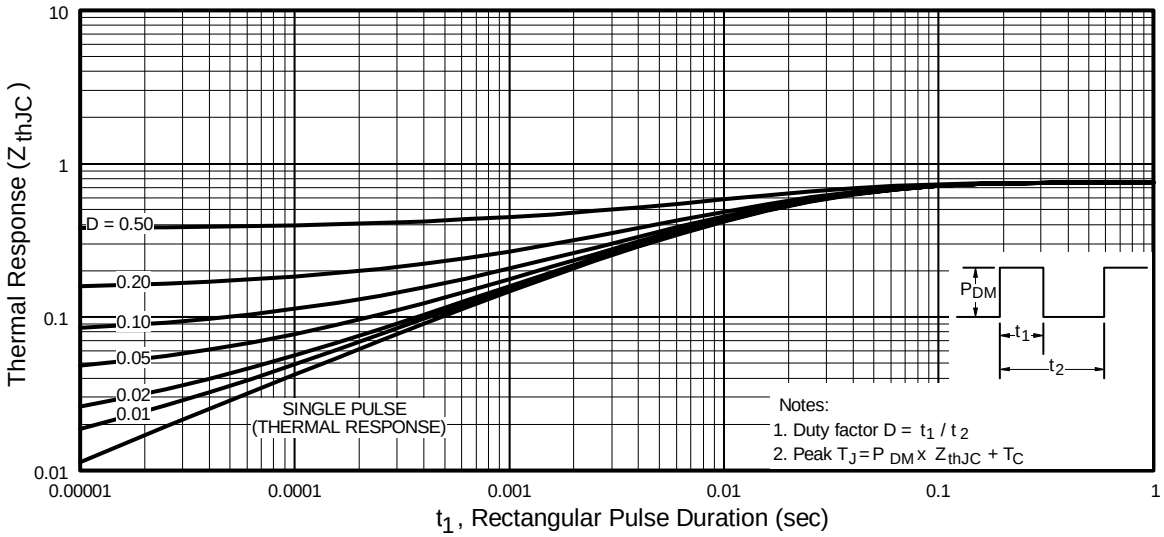


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Case

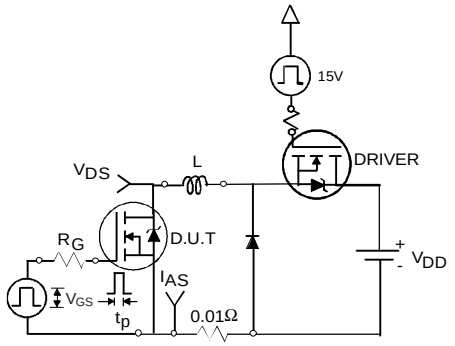


Fig 12a. Unclamped Inductive Test Circuit

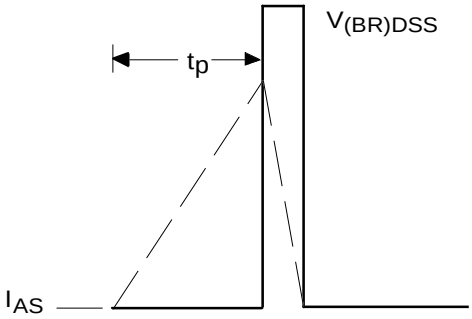


Fig 12b. Unclamped Inductive Waveforms

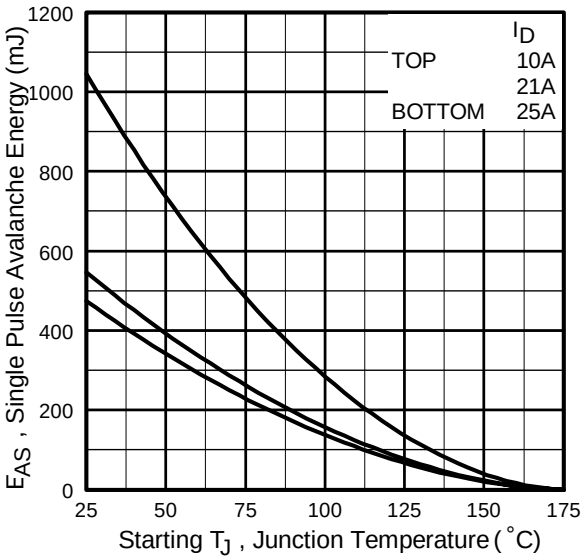


Fig 12c. Maximum Avalanche Energy Vs. Drain Current

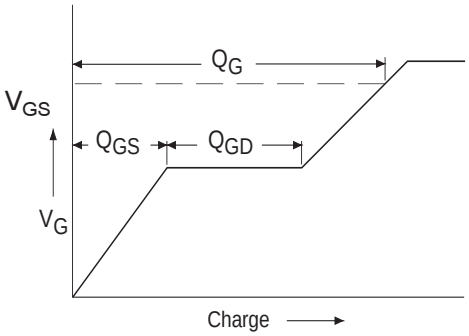


Fig 13a. Basic Gate Charge Waveform

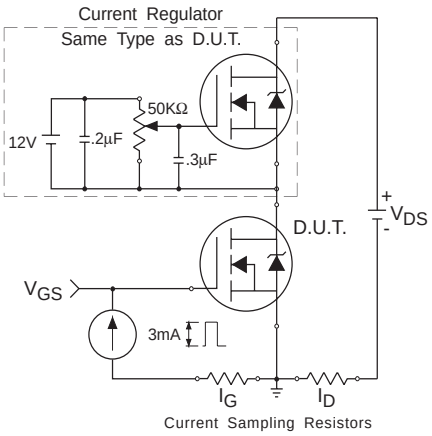


Fig 13b. Gate Charge Test Circuit

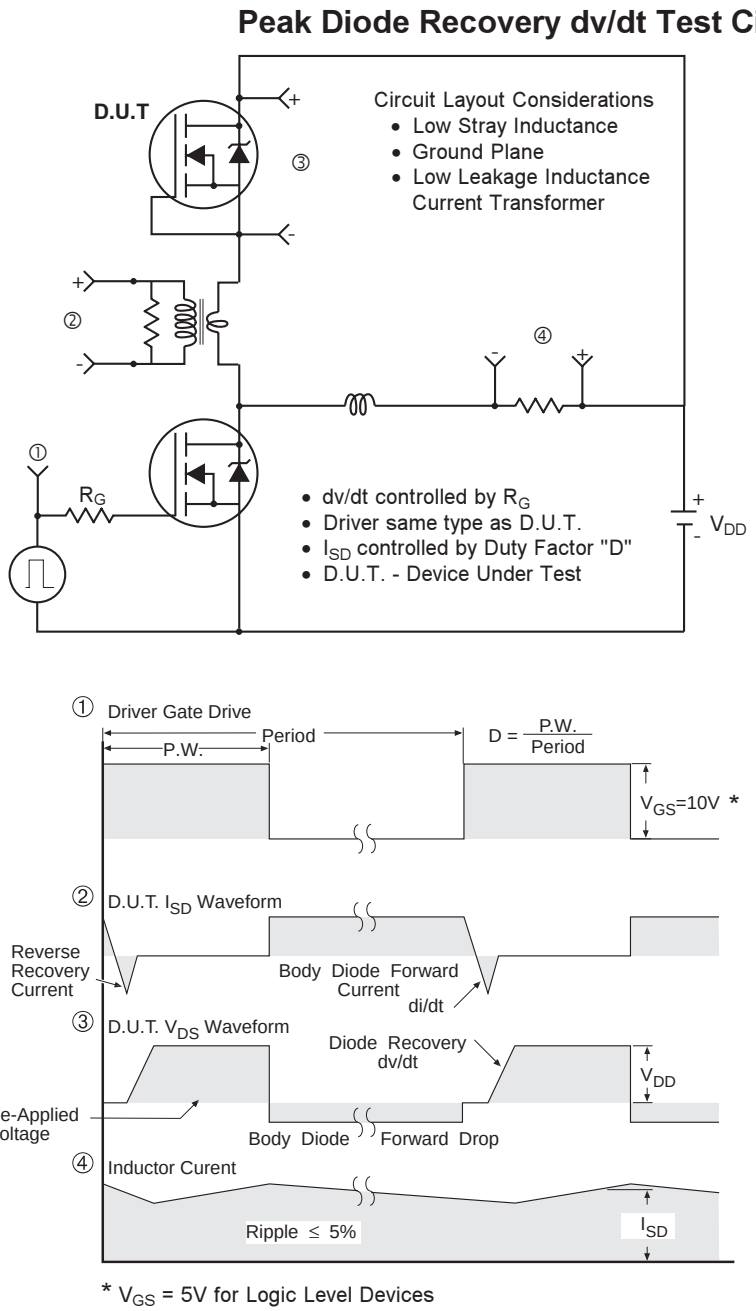
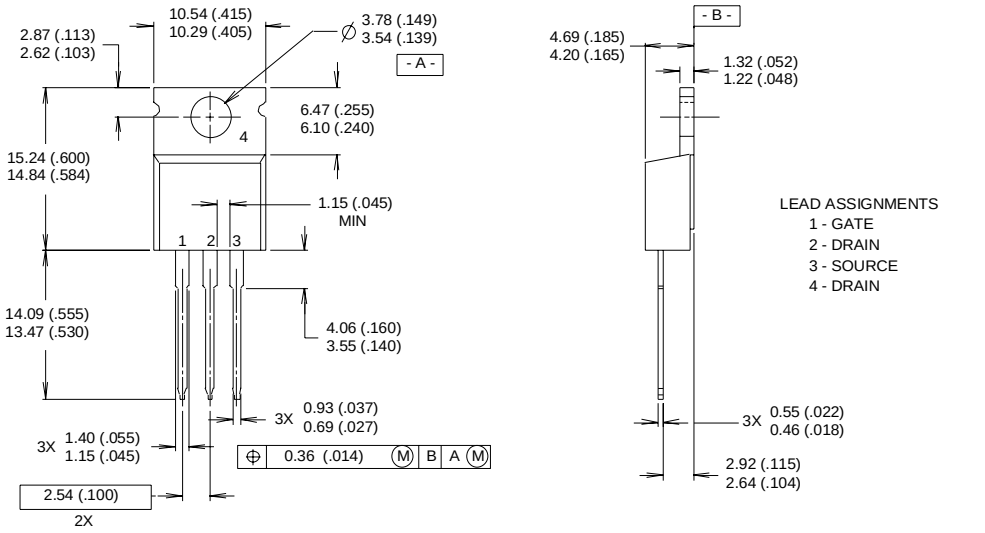


Fig 14. For N-Channel HEXFET® Power MOSFETs

TO-220AB Package Outline

Dimensions are shown in millimeters (inches)

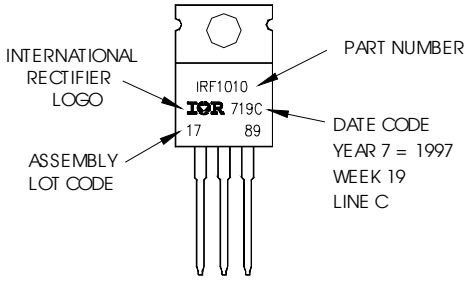


NOTES:

1 DIMENSIONING & TOLERANCING PER ANSI Y14.5M, 1982.
2 CONTROLLING DIMENSION : INCH
3 OUTLINE CONFORMS TO JEDEC OUTLINE TO-220AB.
4 HEATSINK & LEAD MEASUREMENTS DO NOT INCLUDE BURRS.

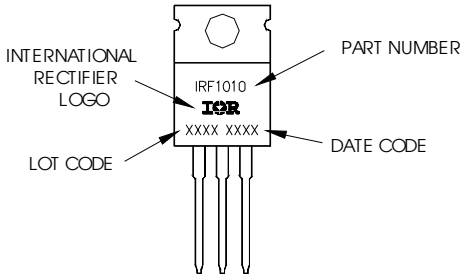
TO-220AB Part Marking Information

EXAMPLE: THIS IS AN IRF1010
LOT CODE 1789
ASSEMBLED ON WW 19, 1997
IN THE ASSEMBLY LINE "C"



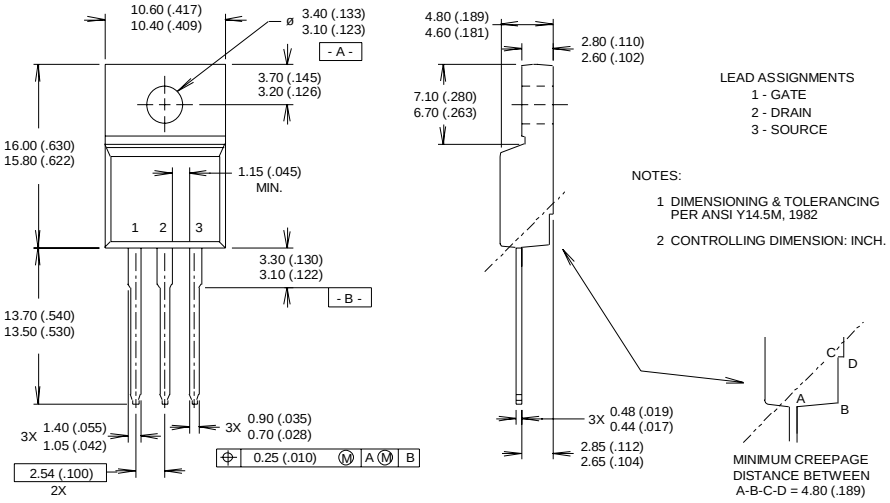
For GB Production

EXAMPLE: THIS IS AN IRF1010
LOT CODE 1789
ASSEMBLED ON WW 19, 1997
IN THE ASSEMBLY LINE "C"



TO-220 Full-Pak Package Outline

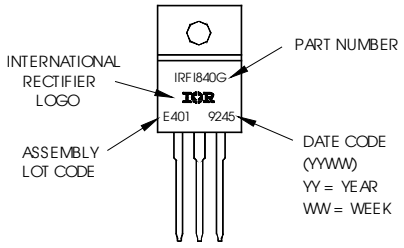
Dimensions are shown in millimeters (inches)



TO-220 Full-Pak Part Marking Information

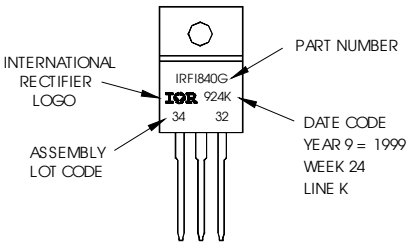
Notes: This part marking information applies to all devices produced before 02/26/2001 and currently for parts manufactured in GB.

EXAMPLE: THIS IS AN IRFI840G
WITH ASSEMBLY
LOT CODE E401



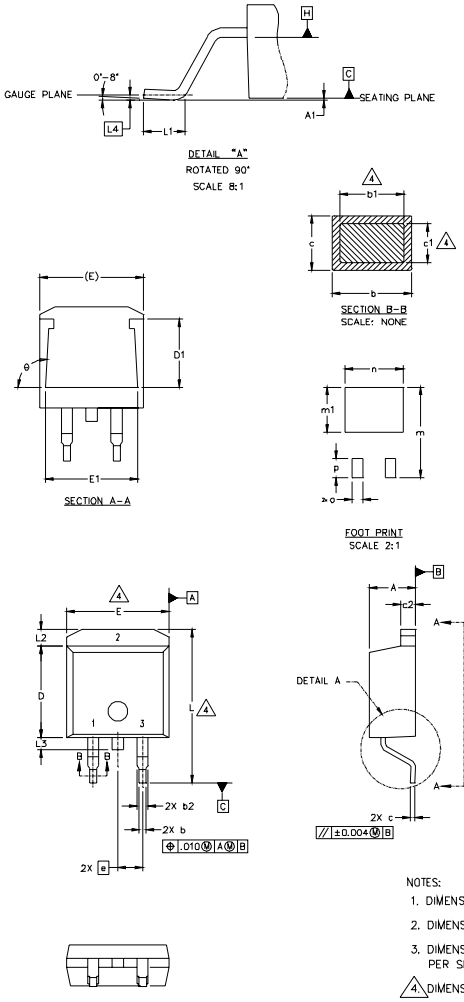
Notes: This part marking information applies to devices produced after 02/26/2001 in location other than GB.

EXAMPLE: THIS IS AN IRFI840G
WITH ASSEMBLY
LOT CODE 3432
ASSEMBLED ON WW 24 1999
IN THE ASSEMBLY LINE "K"



D²Pak Package Outline

Dimensions are shown in millimeters (inches)



SYMBOL	DIMENSIONS				NOTES
	MILLIMETERS		INCHES		
	MIN.	MAX.	MIN.	MAX.	
A	4.06	4.83	.160	.190	
A1		0.127		.005	
b	0.51	0.99	.020	.039	
b1	0.51	0.89	.020	.035	4
b2	1.14	1.40	.045	.055	
c	0.43	0.63	.017	.025	
c1	0.38	0.74	.015	.029	4
c2	1.14	1.40	.045	.055	
D	8.51	9.65	.335	.380	3
D1	5.33		.210		
E	9.65	10.67	.380	.420	3
E1	6.22		.245		
e	2.54 BSC		.100 BSC		
L	14.61	15.88	.575	.625	
L1	1.78	2.79	.070	.110	
L2		1.65		.065	
L3	1.27	1.78	.050	.070	
L4	0.25 BSC		.010 BSC		
m	17.78		.700		
m1	8.89		.350		
n	11.43		.450		
o	2.08		.082		
p	3.81		.150		
θ	90°	93°	90°	93°	

LEAD ASSIGNMENTS

HEXFET	IGBTs, CoPACK	DIODES
1.– GATE	1.– GATE	1.– ANODE *
2.– DRAIN	2.– COLLECTOR	2.– CATHODE
3.– SOURCE	3.– EMITTER	3.– ANODE

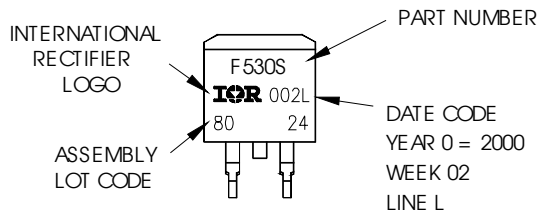
* PART DEPENDENT.

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.

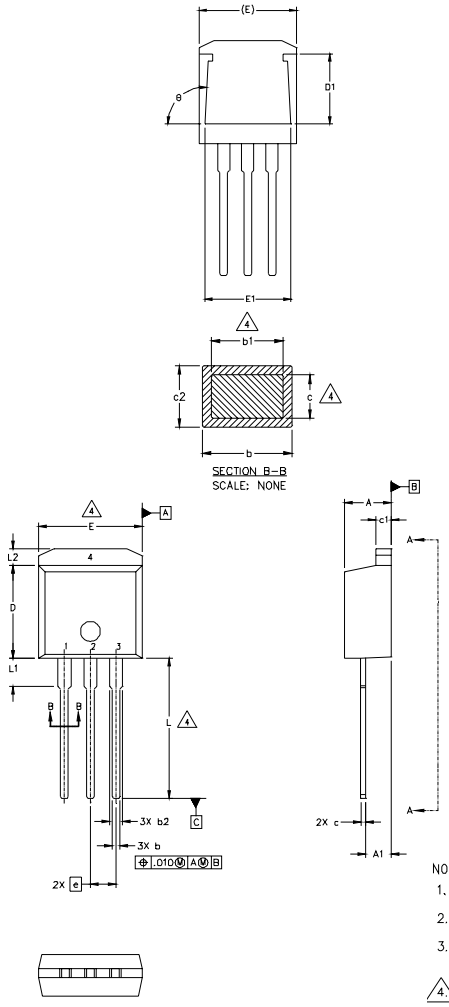
D²Pak Part Marking Information

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



TO-262 Package Outline

Dimensions are shown in millimeters (inches)



SYMBOL	DIMENSIONS				NOTES
	MILLIMETERS		INCHES		
	MIN.	MAX.	MIN.	MAX.	
A	4.06	4.83	.160	.190	
A1	2.03	2.92	.080	.115	
b	0.51	0.99	.020	.039	
b1	0.51	0.89	.020	.035	4
b2	1.14	1.40	.045	.055	
c	0.38	0.63	.015	.025	4
c1	1.14	1.40	.045	.055	
c2	0.43	.063	.017	.029	
D	8.51	9.65	.335	.380	3
D1	5.33		.210		
E	9.65	10.67	.380	.420	3
E1	6.22		.245		
e	2.54 BSC		.100 BSC		
L	13.46	14.09	.530	.555	
L1	3.56	3.71	.140	.146	
L2		1.65		.065	

LEAD ASSIGNMENTS

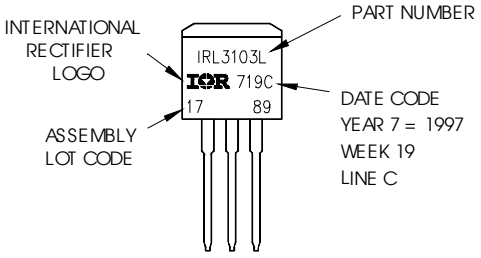
HEXFET	IGBT
1.– GATE	1- GATE
2.– DRAIN	2- COLLECTOR
3.– SOURCE	3- EMITTER
4.– DRAIN	

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.

TO-262 Part Marking Information

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



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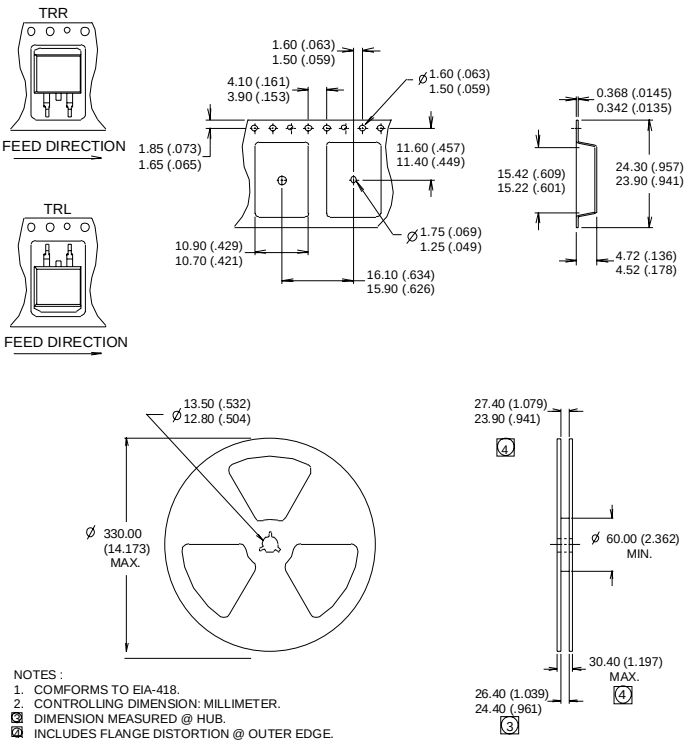
IOR Rectifier

D²Pak Tape & Reel Information



Notes:

① Repetitive rating; pulse width limited by max. junction temperature.

② Starting T_J = 25°C, L = 1.5mH, R_G = 25Ω, I_{AS} = 25A.

③ $I_{SD} \leq$ 25A, di/dt ≤ 340A/µs, $V_{DD} \leq V_{(BR)DSS}$, $T_J \leq$ 175°C.

④ Pulse width ≤ 300µs; duty cycle ≤ 2%.

⑤ C_{oss} eff. is a fixed capacitance that gives the same charging time as C_{oss} while V_{DS} is rising from 0 to 80% V_{DSS}

⑥ This is only applied to TO-220AB package.

⑦ This is applied to D²Pak, when mounted on 1" square PCB (FR-4 or G-10 Material). For recommended footprint and soldering techniques refer to application note #AN-994.

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

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
IOR Rectifier

IR WORLD HEADQUARTERS: 233 Kansas St., El Segundo, California 90245, USA Tel: (310) 252-7105
TAC Fax: (310) 252-7903
Visit us at www.irf.com for sales contact information.07/03

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