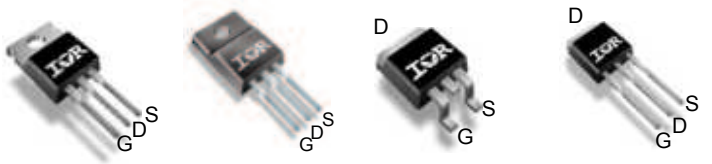
HEXFET® Power MOSFET

V_{DSS}	150V
$R_{DS(on)}$ max	0.045Ω
I_D	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
- Lead-Free



TO-220AB IRFB41N15DPbF | TO-220 Full-Pak IRFB41N15DPbF | D2 Pak IRFS41N15DPbF | TO-262 Pak IRFSL41N15DPbF

G	D	S
Gate	Drain	Source

Base part number	Package Type	Standard Pack		Orderable Part Number
		Form	Quantity	
IRFB41N15DPbF	TO-220	Tube	50	IRFB41N15DPbF
IRFSL41N15DPbF	TO-262	Tube	50	IRFSL41N15DPbF
IRFIB41N15DPbF	TO-220 Full-Pak	Tube	50	IRFIB41N15DPbF
IRFS41N15DPbF	D2-Pak	Tube	50	IRFS41N15DPbF
		Tape and Reel Left	800	IRFS41N15DTRLPbF

Absolute Maximum Ratings

Symbol	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	Maximum Power Dissipation D2-Pak	3.1	W
P_D @T_C = 25°C	Maximum Power Dissipation TO-220	200	
P_D @T_C = 25°C	Maximum Power Dissipation TO-220 Full-Pak	48	
	Linear Derating Factor TO-220	1.3	W/°C
	Linear Derating Factor TO-220 Full-Pak	0.32	
V_{GS}	Gate-to-Source Voltage	± 30	V
dv/dt	Peak Diode Recovery dv/dt③	2.7	V/ns
T_J T_{STG}	Operating Junction and Storage Temperature Range	-55 to + 175	°C
	Soldering Temperature, for 10 seconds (1.6mm from case)	300	
	Mounting torque, 6-32 or M3 screw⑥	10 lbf•in (1.1N•m)	

Thermal Resistance

Symbol	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case	——	0.75	°C/W
$R_{\theta JC}$	Junction-to-Case, TO-220 Full-Pak	——	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,D2-Pak ⑦	——	40	
$R_{\theta JA}$	Junction-to-Ambient, TO-220 Full-Pak	——	65	

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} = 150 V, 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

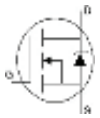
Dynamic @ T_J = 25°C (unless otherwise specified)

gfs	Forward Trans conductance	18	—	—	S	V_{DS} = 50V, I_D = 25A
Q_g	Total Gate Charge	—	72	110	nC	I_D = 25A
Q_{gs}	Gate-to-Source Charge	—	21	31		V_{DS} = 120V
Q_{gd}	Gate-to-Drain Charge	—	35	52		V_{GS} = 10V ④
$t_{d(on)}$	Turn-On Delay Time	—	16	—	ns	V_{DD} = 75V
t_r	Rise Time	—	63	—		I_D = 25A
$t_{d(off)}$	Turn-Off Delay Time	—	25	—		R_G= 2.5Ω
t_f	Fall Time	—	14	—		V_{GS} = 10V ④
C_{iss}	Input Capacitance	—	2520	—	pF	V_{GS} = 0V
C_{oss}	Output Capacitance	—	510	—		V_{DS} = 25V
C_{rss}	Reverse Transfer Capacitance	—	110	—		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 120V⑤

Avalanche Characteristics

	Parameter	Typ.	Max.	Units
E_{AS}	Single Pulse Avalanche Energy ②	—	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 L_S+L_D)				

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} ≤ 25A, di/dt ≤ 340A/µs, V_{DD} ≤ $V_{(BR)DSS}$, T_J ≤ 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 D^2Pak, when mounted on 1" square PCB (FR-4 or G-10 Material). For recommended footprint and soldering techniques refer to application note #AN-994.

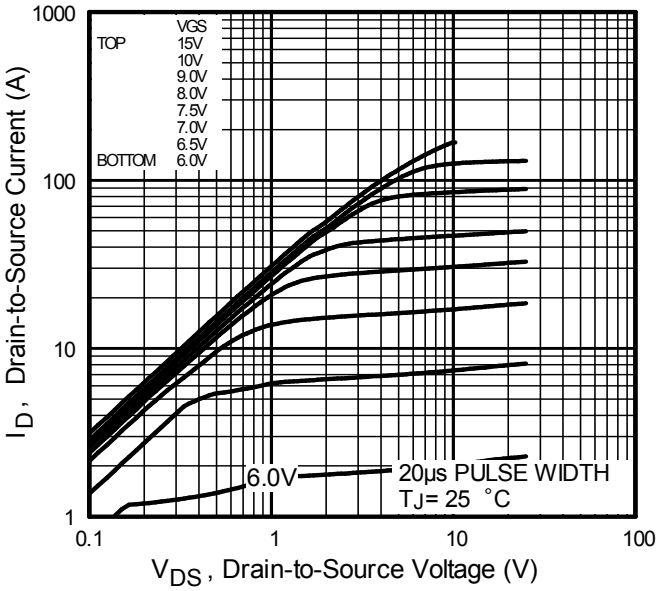


Fig. 1 Typical Output Characteristics

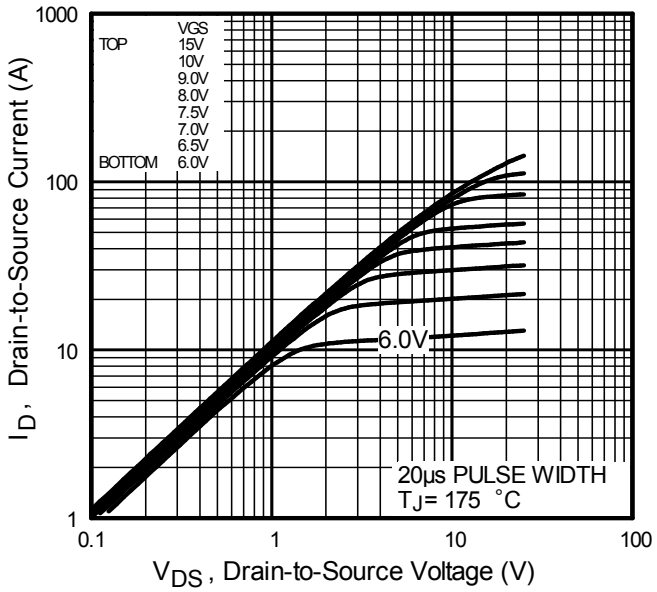


Fig. 2 Typical Output Characteristics

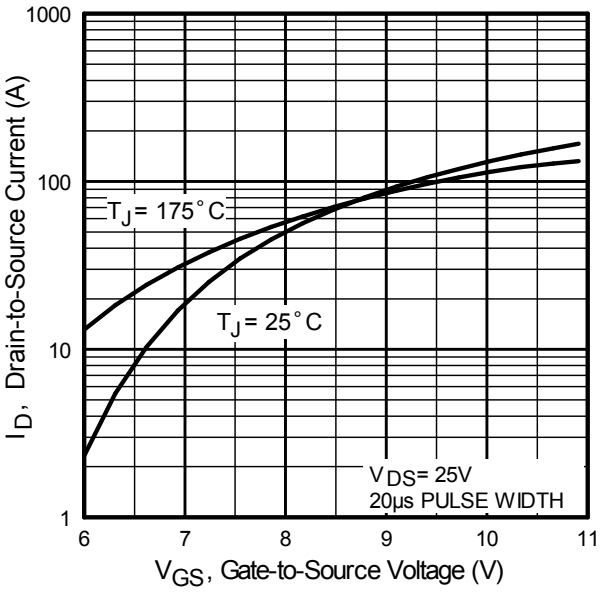


Fig. 3 Typical Transfer Characteristics

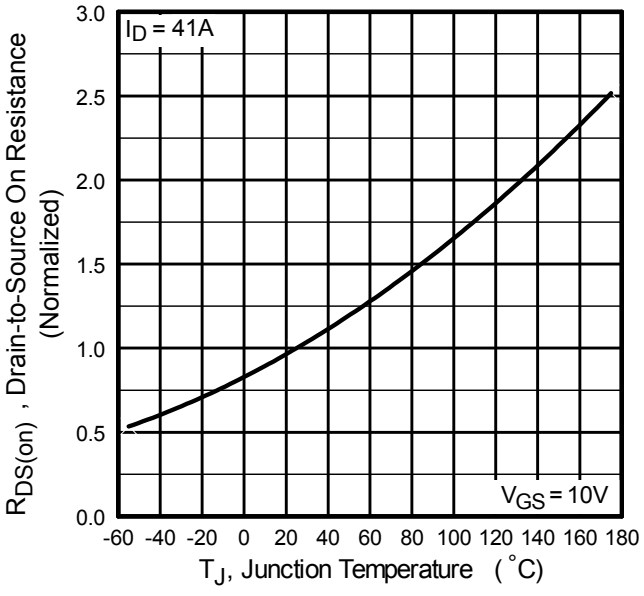


Fig. 4 Normalized On-Resistance vs. Temperature

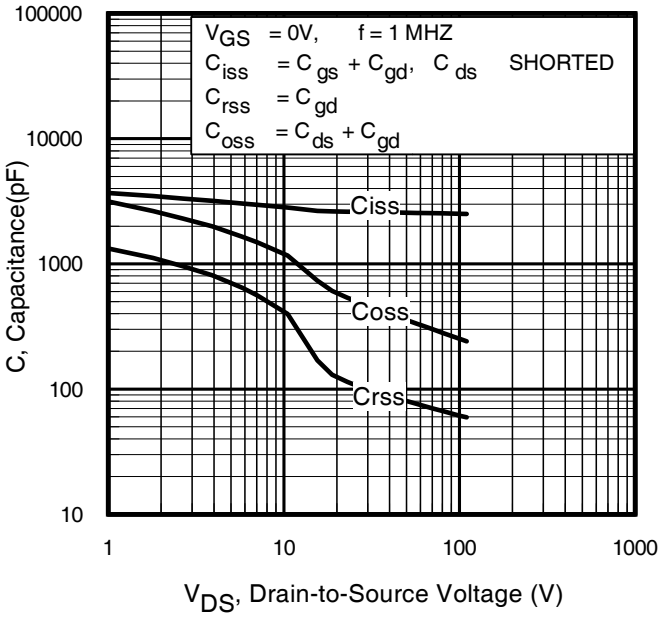


Fig 5. Typical Capacitance vs. Drain-to-Source Voltage

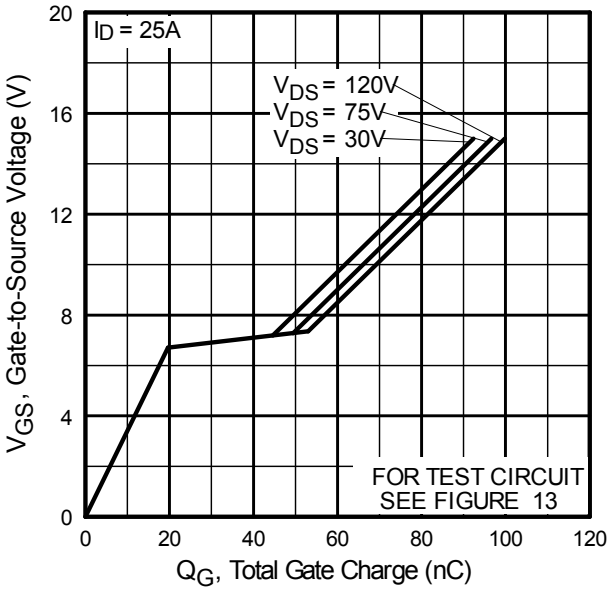


Fig 6. Typical Gate Charge vs. Gate-to-Source Voltage

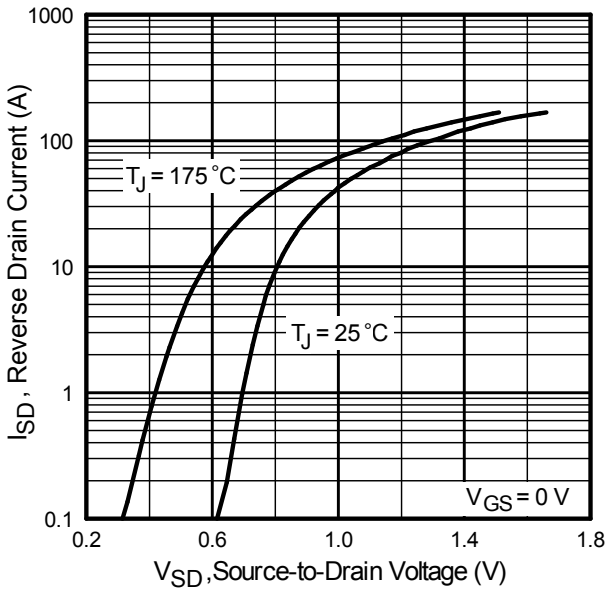


Fig. 7 Typical Source-to-Drain Diode Forward Voltage

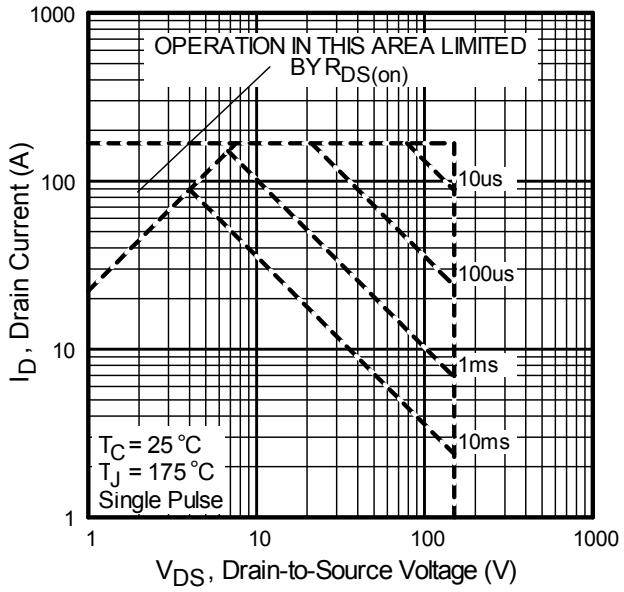


Fig 8. Maximum Safe Operating Area

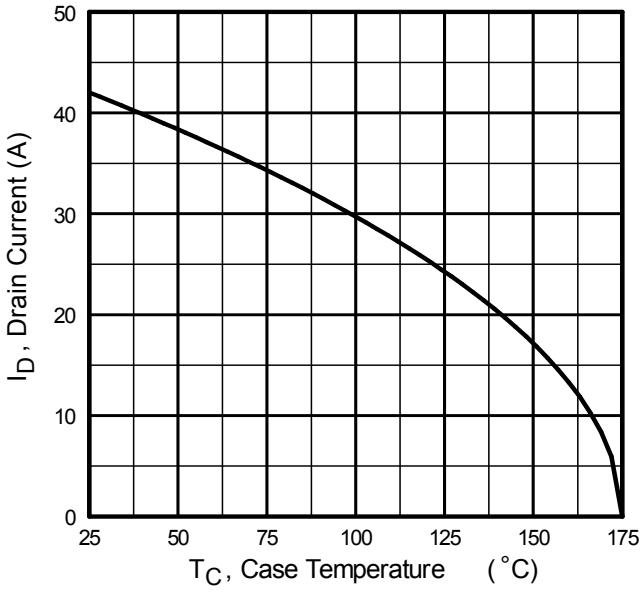


Fig 9. Maximum Drain Current vs. Case Temperature

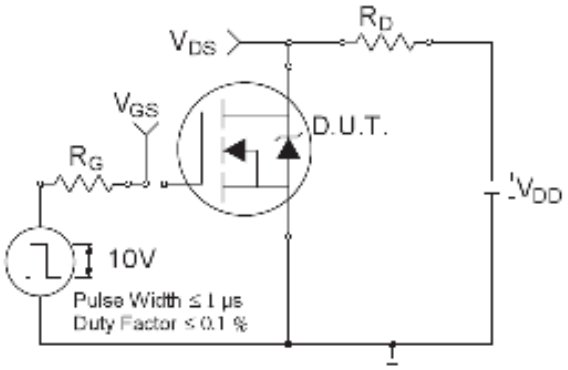


Fig 10a. Switching Time Test Circuit

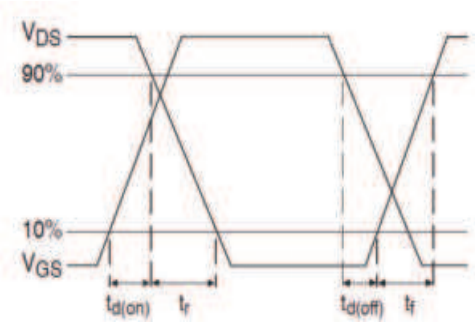


Fig 10b. Switching Time Waveforms

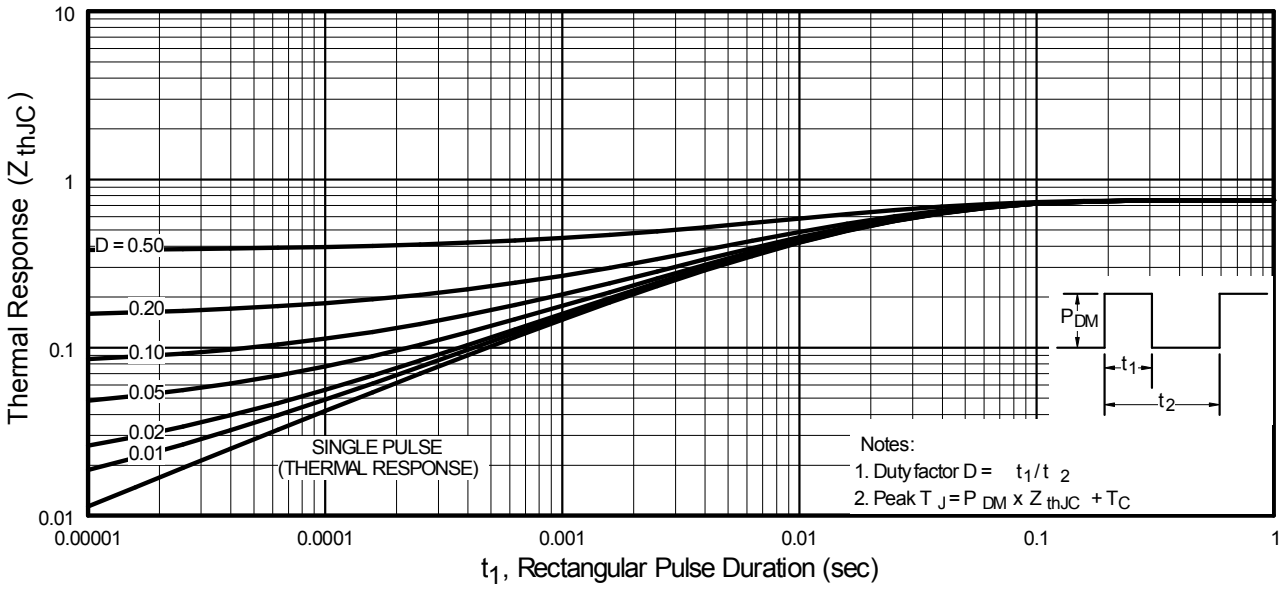


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Case

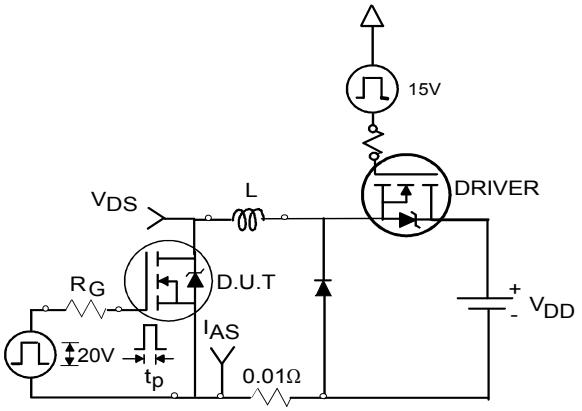


Fig 12a. Unclamped Inductive Test Circuit

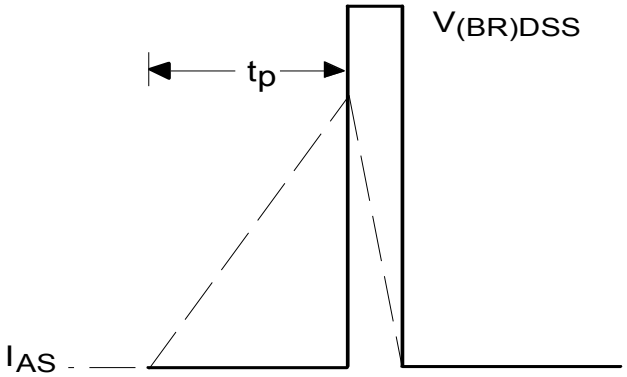


Fig 12b. Unclamped Inductive Waveforms

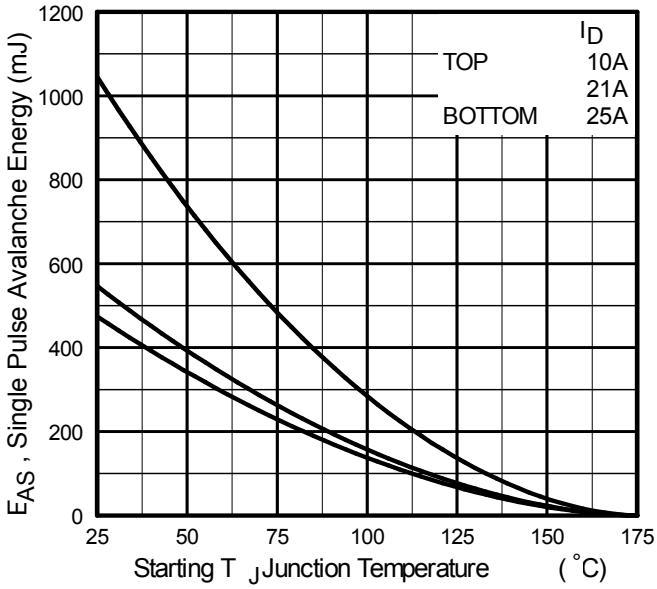


Fig 12c. Maximum Avalanche Energy vs. Drain Current

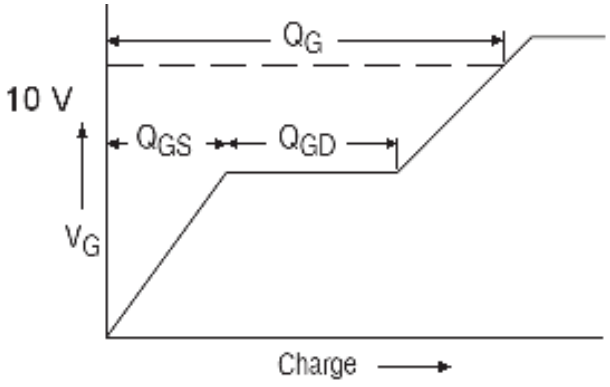


Fig 13a. Gate Charge Waveform

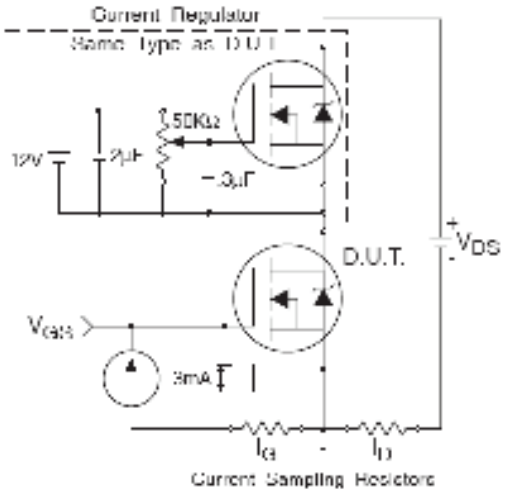
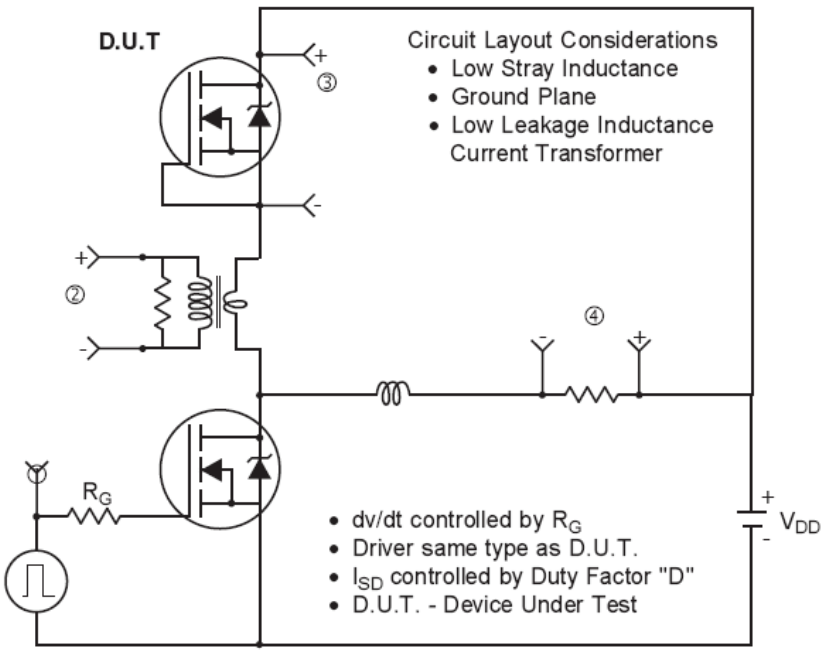


Fig 13b. Gate Charge Test Circuit

Peak Diode Recovery dv/dt Test Circuit



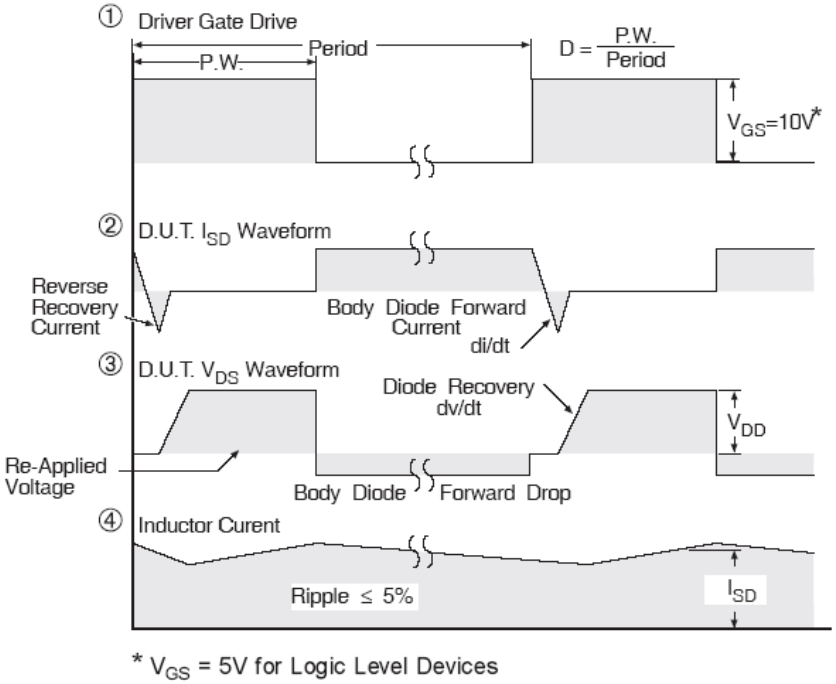
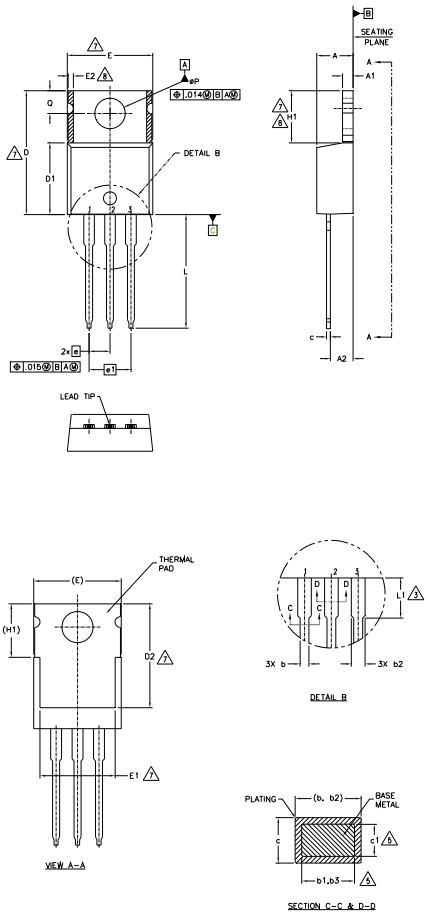


Fig 14. Peak Diode Recovery dv/dt Test Circuit for N-Channel HEXFET® Power MOSFETs

TO-220AB 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

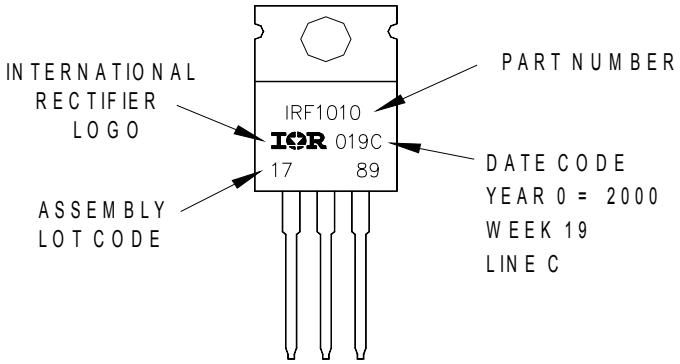
IGBTs, CoPACK
1.– GATE
2.– COLLECTOR
3.– EMITTER

DIODES
1.– ANODE
2.– CATHODE
3.– ANODE

TO-220AB Part Marking Information

EXAMPLE: THIS IS AN IRF1010
LOT CODE 1789
ASSEMBLED ON WW 19, 2000
IN THE ASSEMBLY LINE "C"

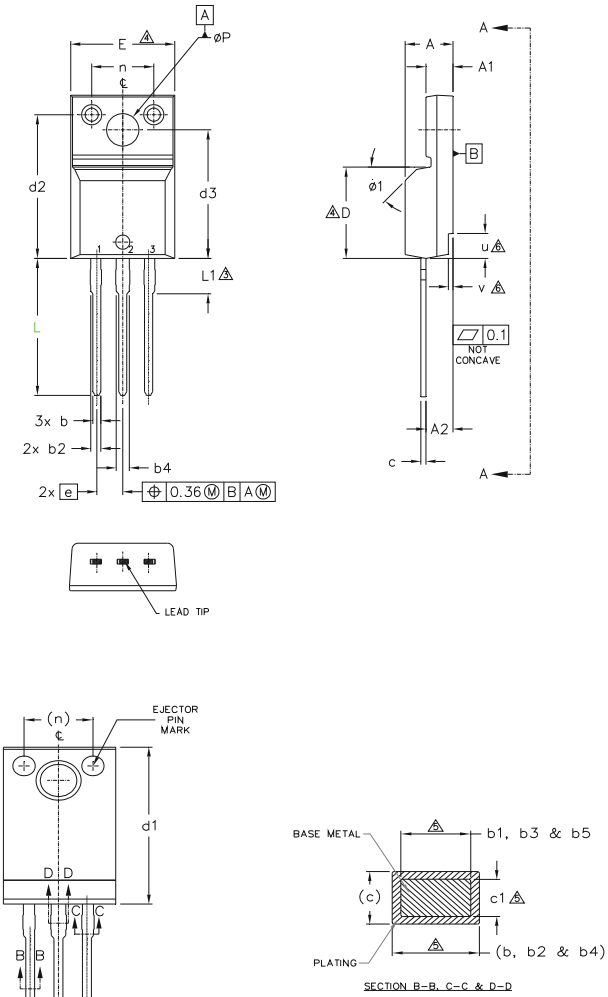
Note: "P" in assembly line position indicates "Lead - Free"



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

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

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.

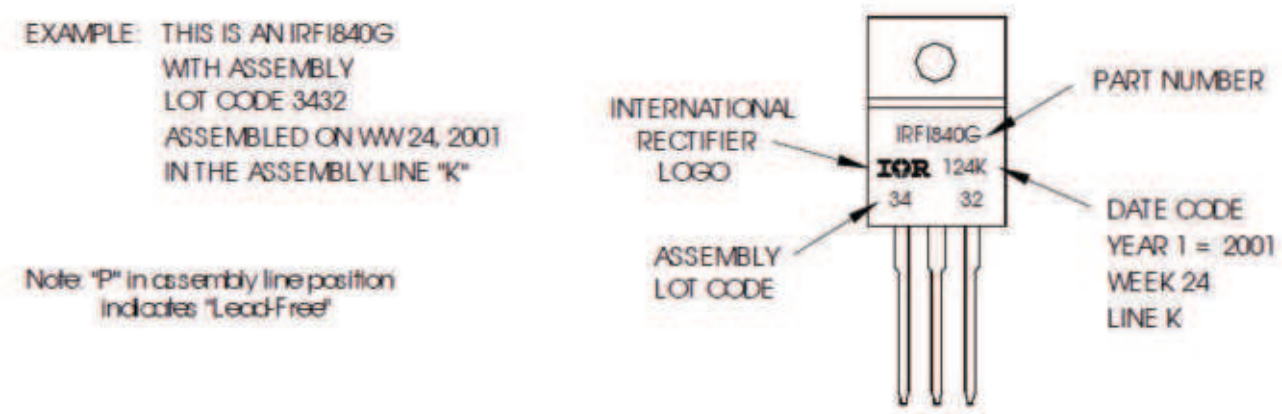
SYMBOL	DIMENSIONS				NOTES
	MILLIMETERS		INCHES		
	MIN.	MAX.	MIN.	MAX.	
A	4.57	4.83	.180	.190	
A1	2.57	2.82	.101	.111	
A2	2.51	2.92	.099	.115	
b	0.61	0.94	.024	.037	
b1	0.61	0.89	.024	.035	5
b2	0.76	1.27	.030	.050	
b3	0.76	1.22	.030	.048	5
b4	1.02	1.52	.040	.060	
b5	1.02	1.47	.040	.058	5
c	0.33	0.63	.013	.025	
c1	0.33	0.58	.013	.023	5
D	8.66	9.80	.341	.386	4
d1	15.80	16.13	.622	.635	
d2	13.97	14.22	.550	.560	
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	
L1	3.10	3.68	.122	.145	3
n	6.05	6.60	.238	.260	
øP	3.05	3.45	.120	.136	
u	2.39	2.49	.094	.098	6
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

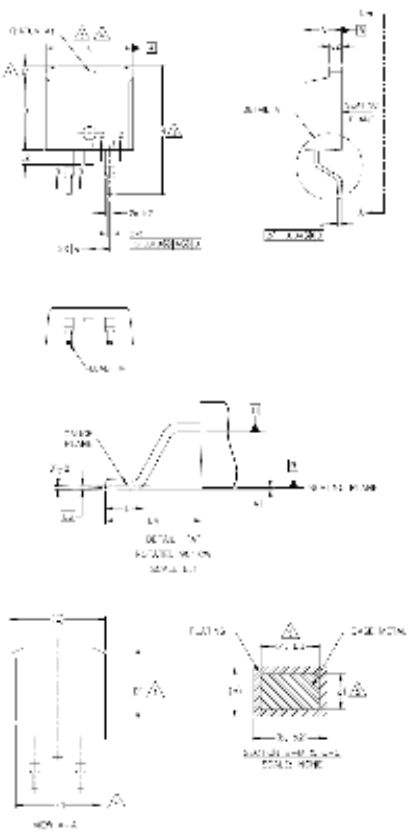


TO-220AB Full-Pak packages are not recommended for Surface Mount Application.

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

D2-Pak (TO-263AB) 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 AT DATUM H.
4. THERMAL PAD CONTOUR OPTIONAL WITHIN DIMENSION E, L1, D1 & E1.
5. DIMENSION b1 AND c1 APPLY TO BASE METAL ONLY.
6. DATUM A & B TO BE DETERMINED AT DATUM PLANE H.
7. CONTROLLING DIMENSION: INCH.
8. OUTLINE CONFORMS TO JEDEC OUTLINE TO-263AB.

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	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		
H	14.61	15.88	.575	.625	
L	1.78	2.79	.070	.110	
L1	–	1.65	–	.066	4
L2	–	1.78	–	.070	
L3	0.25 BSC		.010 BSC		
L4	4.78	5.28	.188	.208	

LEAD ASSIGNMENTS

DIODES

1.- ANODE (TWO DIE) / OPEN (ONE DIE)
2, 4.- CATHODE
3.- ANODE

HEXFET

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

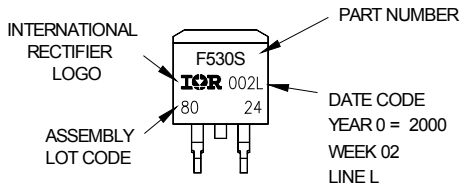
IGBTs, CoPACK

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

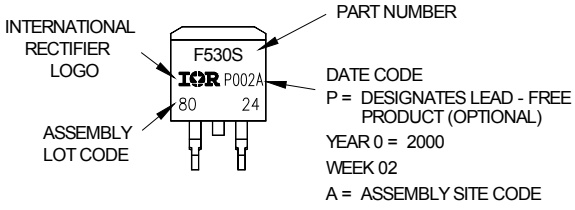
D2-Pak (TO-263AB) Part Marking Information

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"

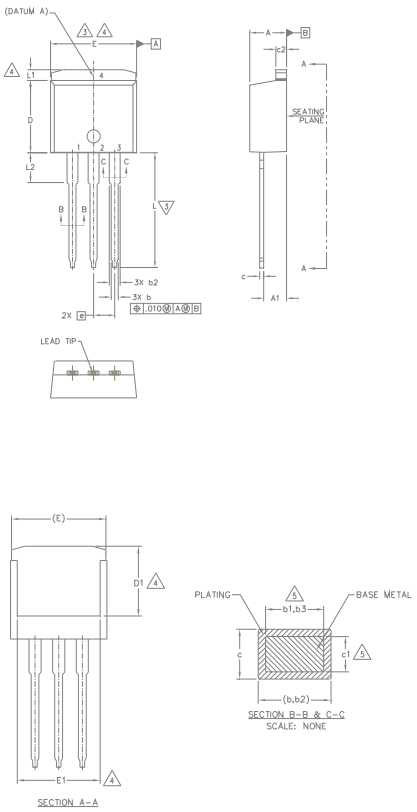


OR



Note: For the most current drawing please refer to 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.

LEAD ASSIGNMENTS

IGBTs, CoPACK

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

HEXFET

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

DIODES

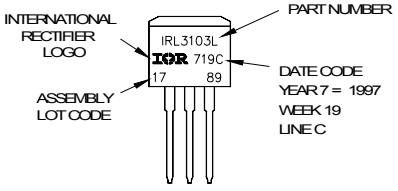
1.- ANODE (TWO DIE) / OPEN (ONE DIE)
2, 4.- CATHODE
3.- ANODE

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	

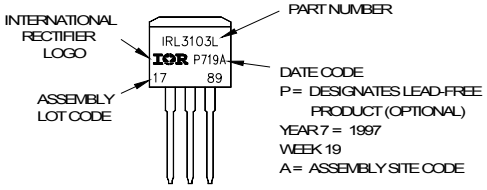
TO-262 Part Marking Information

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"

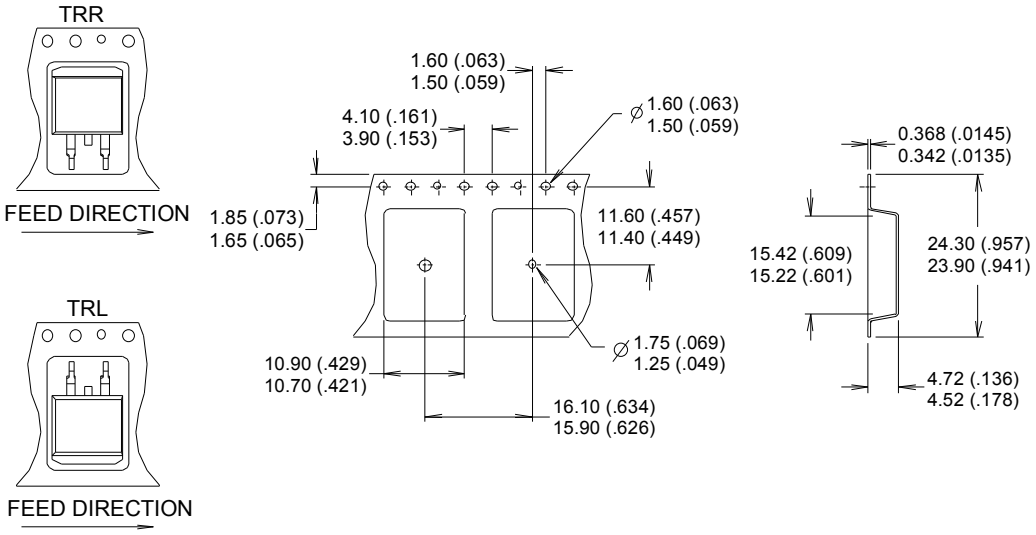


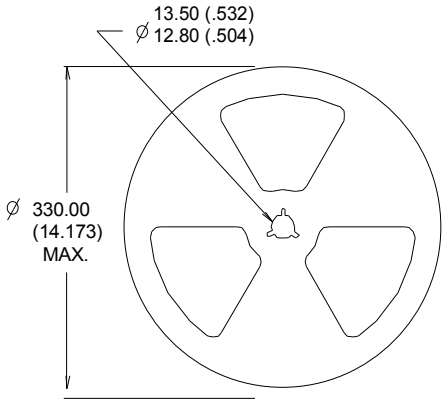
OR

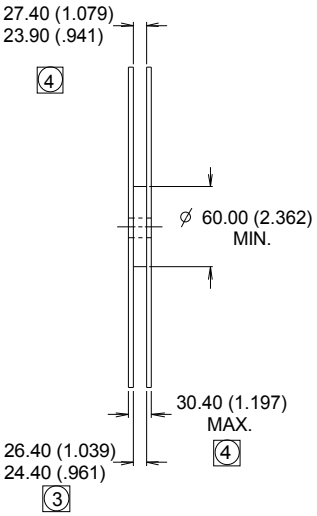


Note: For the most current drawing please refer to website at http://www.irf.com/package/

D2-Pak (TO-263AB) Tape & Reel Information (Dimensions are shown in millimeters (inches))







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

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

Qualification Information

Qualification Level	Industrial (per JEDEC JESD47F) †	
Moisture Sensitivity Level	TO-220AB	N/A
	TO-220 Full-Pak	
	TO-262	
	D2-Pak	MSL1 (per JEDEC J-STD-020D) ††
RoHS Compliant	Yes	

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

Revision History

Date	Comments
04/27/2017	• Changed datasheet with Infineon logo - all pages. • Corrected Package Outline on page 8,9,10,11. • Added disclaimer on last page.

Trademarks of Infineon Technologies AG
µHVIC™, µIPM™, µPFC™, AU-ConvertIR™, AURIX™, C166™, CanPAK™, CIPOS™, CIPURSE™, CoolDP™, CoolGaN™, COOLiR™, CoolMOS™, CoolSET™, CoolSiC™, DAVE™, DI-POL™, DirectFET™, DrBlade™, EasyPIM™, EconoBRIDGE™, EconoDUAL™, EconoPACK™, EconoPIM™, EiceDRIVER™, eupec™, FCOS™, GaNpowIR™, HEXFET™, HITFET™, HybridPACK™, iMOTION™, IRAM™, ISOFACE™, IsoPACK™, LEDrivIR™, LITIX™, MIPAQ™, ModSTACK™, my-d™, NovalithIC™, OPTIGA™, OptiMOS™, ORIGA™, PowIRaudio™, PowIRStage™, PrimePACK™, PrimeSTACK™, PROFET™, PRO-SIL™, RASIC™, REAL3™, SmartLEWIS™, SOLID FLASH™, SPOC™, StrongIRFET™, SupIRBuck™, TEMPFET™, TRENCHSTOP™, TriCore™, UHVIC™, XHP™, XMC™

Trademarks updated November 2015

Other Trademarks
All referenced product or service names and trademarks are the property of their respective owners.

Edition 2016-04-19
Published by
Infineon Technologies AG
81726 Munich, Germany

© 2016 Infineon Technologies AG. All Rights Reserved.

Do you have a question about this document?
Email: erratum@infineon.com

Document reference
ifx1

IMPORTANT NOTICE
The information given in this document shall in no event be regarded as a guarantee of conditions or **characteristics ("Beschaffenheitsgarantie") .**

With respect to any examples, hints or any typical values stated herein and/or any information regarding the application of the product, Infineon Technologies hereby disclaims any and all warranties and liabilities of any kind, including without limitation warranties of non-infringement of intellectual property rights of any third party.

In addition, any information given in this document **is subject to customer's compliance with its** obligations stated in this document and any applicable legal requirements, norms and standards concerning customer's products and any use of the product of Infineon Technologies in **customer's applications.**

The data contained in this document is exclusively intended for technically trained staff. It is the **responsibility of customer's technical departments** to evaluate the suitability of the product for the intended application and the completeness of the product information given in this document with respect to such application.

For further information on the product, technology, delivery terms and conditions and prices please contact your nearest Infineon Technologies office (www.infineon.com).

Please note that this product is not qualified according to the AEC Q100 or AEC Q101 documents of the Automotive Electronics Council.

WARNINGS
Due to technical requirements products may contain dangerous substances. For information on the types in question please contact your nearest Infineon Technologies office.

Except as otherwise explicitly approved by Infineon Technologies in a written document signed by authorized representatives of Infineon Technologies, **Infineon Technologies' products may** not be used in any applications where a failure of the product or any consequences of the use thereof can reasonably be expected to result in personal injury.