

### Applications

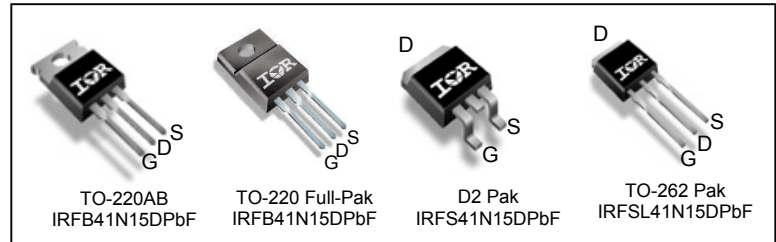
- High frequency DC-DC converters

HEXFET® Power MOSFET

$V_{DS}$	<b>150V</b>
$R_{DS(on) \max}$	<b>0.045Ω</b>
$I_D$	<b>41A</b>

### 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



<b>G</b>	<b>D</b>	<b>S</b>
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
$I_D @ T_C = 25^\circ\text{C}$	Continuous Drain Current, $V_{GS} @ 10\text{V}$	41	A
$I_D @ T_C = 100^\circ\text{C}$	Continuous Drain Current, $V_{GS} @ 10\text{V}$	29	
$I_{DM}$	Pulsed Drain Current ①	164	
$P_D @ T_A = 25^\circ\text{C}$	Maximum Power Dissipation D2-Pak	3.1	W
$P_D @ T_C = 25^\circ\text{C}$	Maximum Power Dissipation TO-220	200	
$P_D @ T_C = 25^\circ\text{C}$	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<sub>J</sub> = 25°C (unless otherwise specified)**

	Parameter	Min.	Typ.	Max.	Units	Conditions
V <sub>(BR)DSS</sub>	Drain-to-Source Breakdown Voltage	150	—	—	V	V <sub>GS</sub> = 0V, I <sub>D</sub> = 250μA
ΔV <sub>(BR)DSS/ΔT<sub>J</sub></sub>	Breakdown Voltage Temp. Coefficient	—	0.17	—	V/°C	Reference to 25°C, I <sub>D</sub> = 1mA
R <sub>DS(on)</sub>	Static Drain-to-Source On-Resistance	—	—	0.045	Ω	V <sub>GS</sub> = 10V, I <sub>D</sub> = 25A ④
V <sub>GS(th)</sub>	Gate Threshold Voltage	3.0	—	5.5	V	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250μA
I <sub>DSS</sub>	Drain-to-Source Leakage Current	—	—	25	μA	V <sub>DS</sub> = 150V, V <sub>GS</sub> = 0V
		—	—	250		V <sub>DS</sub> = 120V, 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> = 30V
	Gate-to-Source Reverse Leakage	—	—	-100		V <sub>GS</sub> = -30V

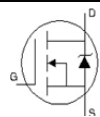
**Dynamic @ T<sub>J</sub> = 25°C (unless otherwise specified)**

g <sub>fs</sub>	Forward Trans conductance	18	—	—	S	V <sub>DS</sub> = 50V, I <sub>D</sub> = 25A
Q <sub>g</sub>	Total Gate Charge	—	72	110	nC	I <sub>D</sub> = 25A
Q <sub>gs</sub>	Gate-to-Source Charge	—	21	31		V <sub>DS</sub> = 120V
Q <sub>gd</sub>	Gate-to-Drain Charge	—	35	52		V <sub>GS</sub> = 10V ④
t <sub>d(on)</sub>	Turn-On Delay Time	—	16	—	ns	V <sub>DD</sub> = 75V
t <sub>r</sub>	Rise Time	—	63	—		I <sub>D</sub> = 25A
t <sub>d(off)</sub>	Turn-Off Delay Time	—	25	—		R <sub>G</sub> = 2.5Ω
t <sub>f</sub>	Fall Time	—	14	—		V <sub>GS</sub> = 10V ④
C <sub>iss</sub>	Input Capacitance	—	2520	—	pF	V <sub>GS</sub> = 0V
C <sub>oss</sub>	Output Capacitance	—	510	—		V <sub>DS</sub> = 25V
C <sub>riss</sub>	Reverse Transfer Capacitance	—	110	—		f = 1.0MHz
C <sub>oss</sub>	Output Capacitance	—	3090	—		V <sub>GS</sub> = 0V, V <sub>DS</sub> = 1.0V f = 1.0MHz
C <sub>oss</sub>	Output Capacitance	—	230	—		V <sub>GS</sub> = 0V, V <sub>DS</sub> = 120V f = 1.0MHz
C <sub>oss eff.</sub>	Effective Output Capacitance	—	250	—		V <sub>GS</sub> = 0V, V <sub>DS</sub> = 0V to 120V ⑤

**Avalanche Characteristics**

	Parameter	Typ.	Max.	Units
E <sub>AS</sub>	Single Pulse Avalanche Energy ②	—	470	mJ
I <sub>AR</sub>	Avalanche Current ①	—	25	A
E <sub>AR</sub>	Repetitive Avalanche Energy ①	—	20	mJ

**Diode Characteristics**

	Parameter	Min.	Typ.	Max.	Units	Conditions
I <sub>S</sub>	Continuous Source Current (Body Diode)	—	—	41	A	MOSFET symbol showing the integral reverse p-n junction diode. 
I <sub>SM</sub>	Pulsed Source Current (Body Diode) ①	—	—	164		
V <sub>SD</sub>	Diode Forward Voltage	—	—	1.3	V	T <sub>J</sub> = 25°C, I <sub>S</sub> = 25A, V <sub>GS</sub> = 0V ④
t <sub>rr</sub>	Reverse Recovery Time	—	170	260	ns	T <sub>J</sub> = 25°C, I <sub>F</sub> = 25A
Q <sub>rr</sub>	Reverse Recovery Charge	—	1.3	1.9	μC	di/dt = 100A/μs ④
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.
- ② starting T<sub>J</sub> = 25°C, L = 1.5mH, R<sub>G</sub> = 25Ω, I<sub>AS</sub> = 25A.
- ③ I<sub>SD</sub> ≤ 25A, di/dt ≤ 340A/μs, V<sub>DD</sub> ≤ V<sub>(BR)DSS</sub>, T<sub>J</sub> ≤ 175°C.
- ④ Pulse width ≤ 300μs; duty cycle ≤ 2%.
- ⑤ C<sub>oss eff.</sub> is a fixed capacitance that gives the same charging time as C<sub>oss</sub> while V<sub>DS</sub> is rising from 0 to 80% V<sub>DSS</sub>.
- ⑥ This is only applied to TO-220AB package.
- ⑦ This is applied to D<sup>2</sup>Pak, when mounted on 1" square PCB (FR-4 or G-10 Material). For recommended footprint and soldering techniques refer to application note #AN-994.

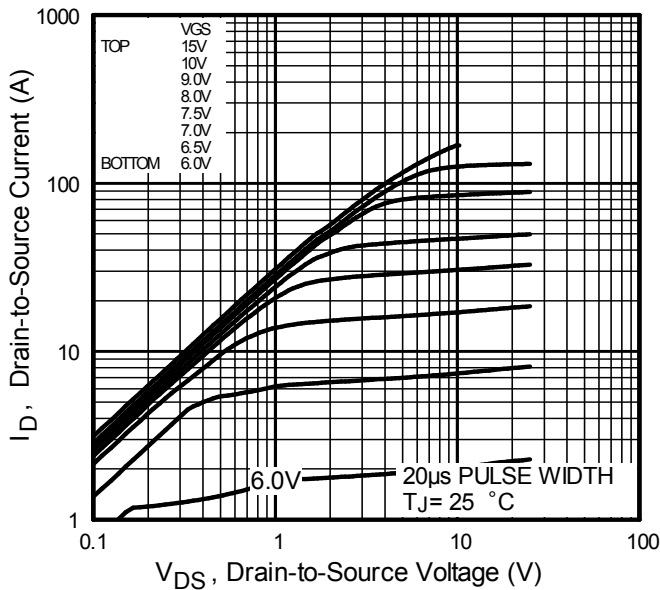


Fig. 1 Typical Output Characteristics

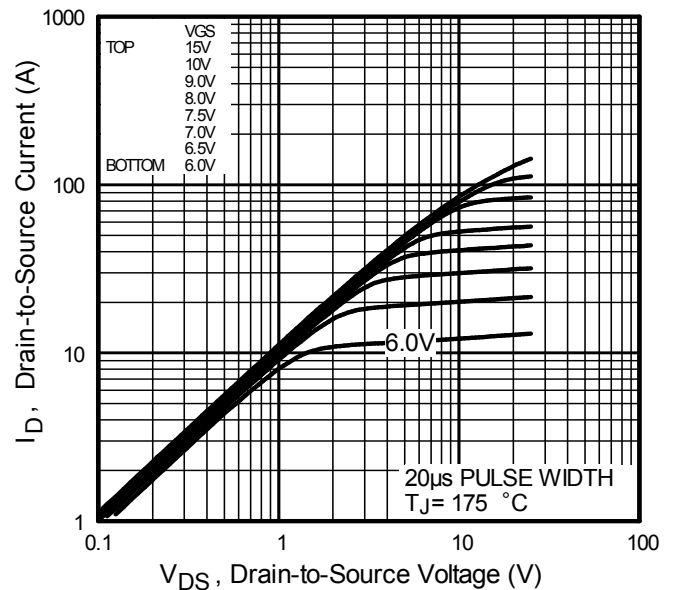


Fig. 2 Typical Output Characteristics

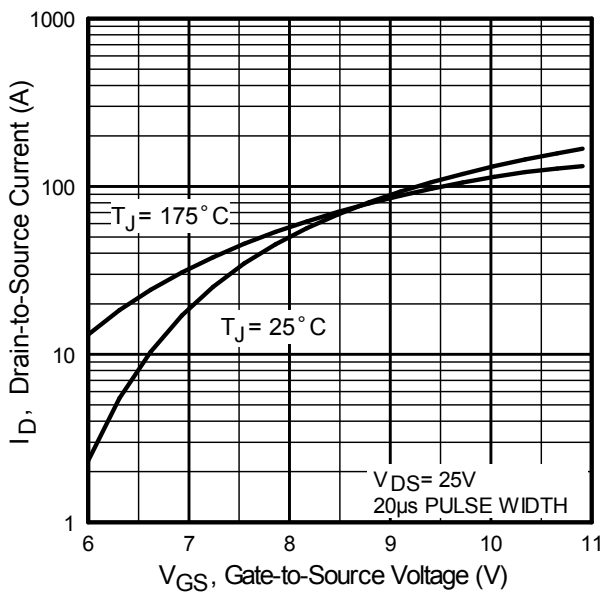


Fig. 3 Typical Transfer Characteristics

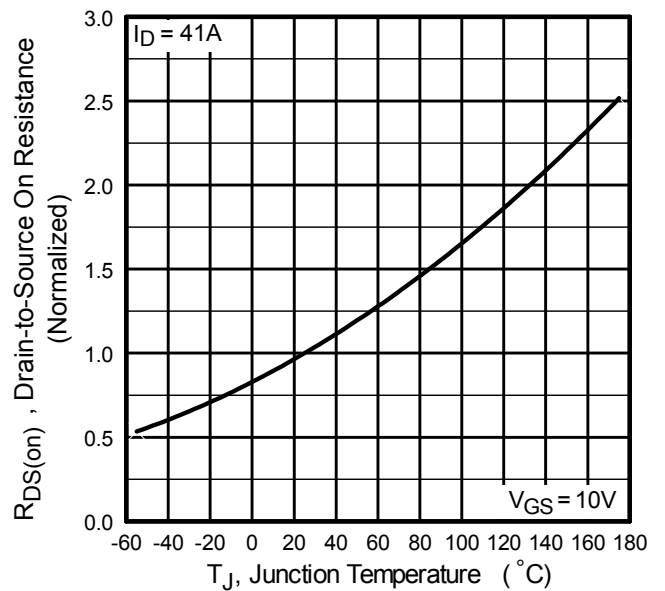
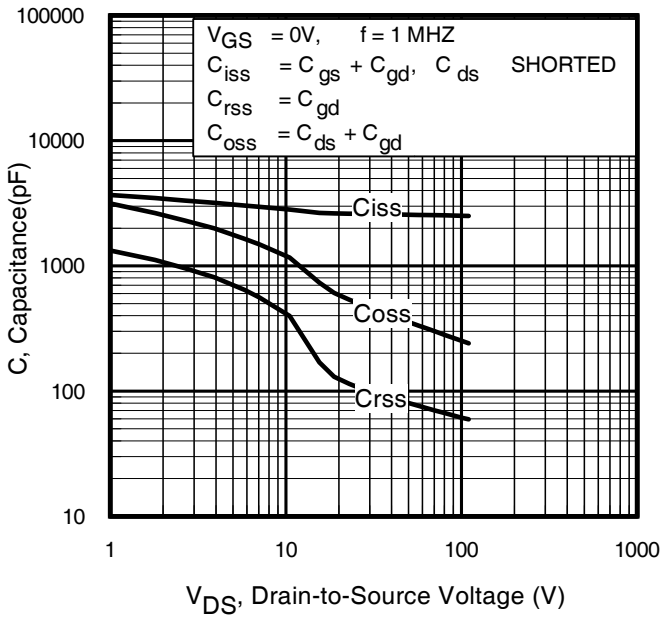
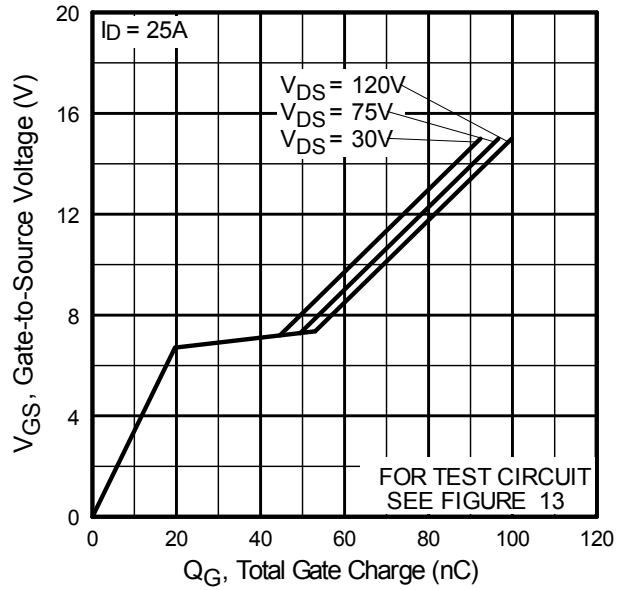


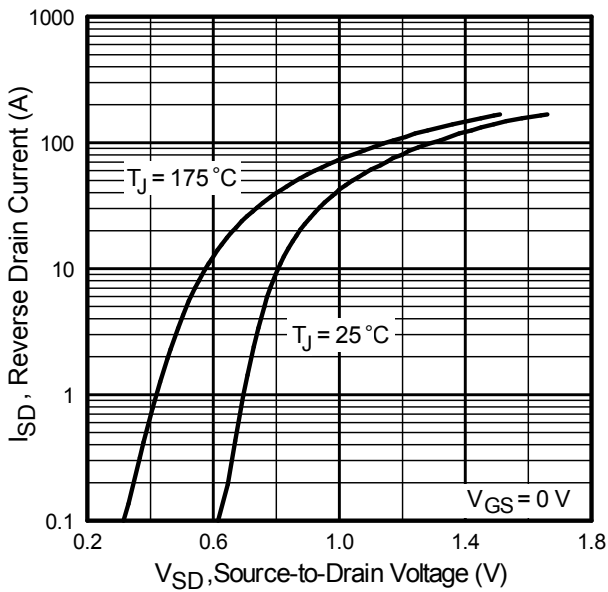
Fig. 4 Normalized On-Resistance vs. Temperature



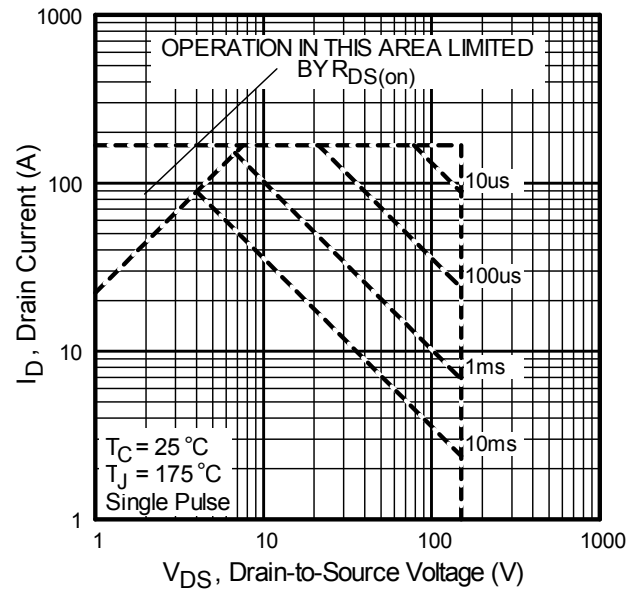
**Fig 5.** Typical Capacitance vs. Drain-to-Source Voltage



**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

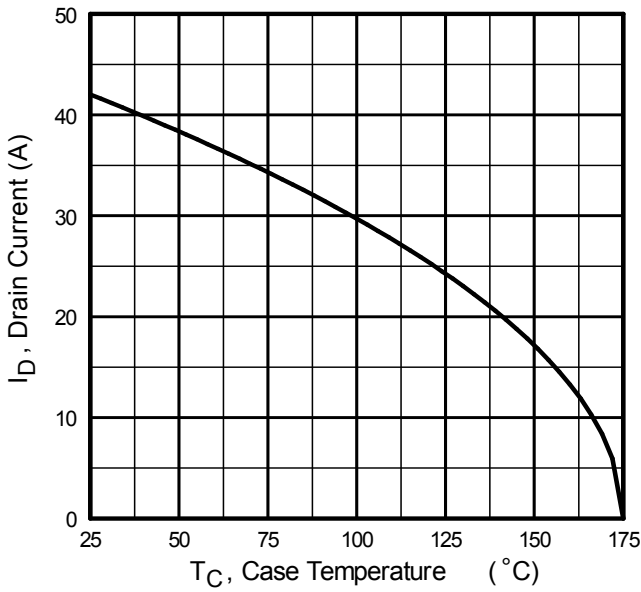


Fig 9. Maximum Drain Current vs. Case Temperature

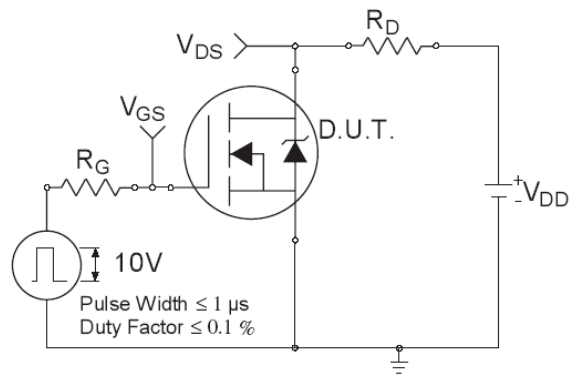


Fig 10a. Switching Time Test Circuit

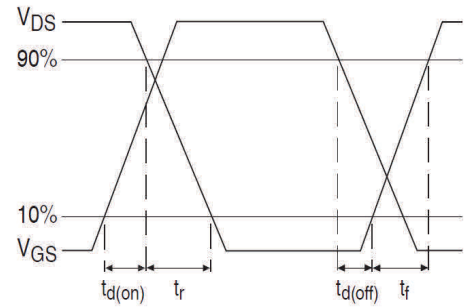


Fig 10b. Switching Time Waveforms

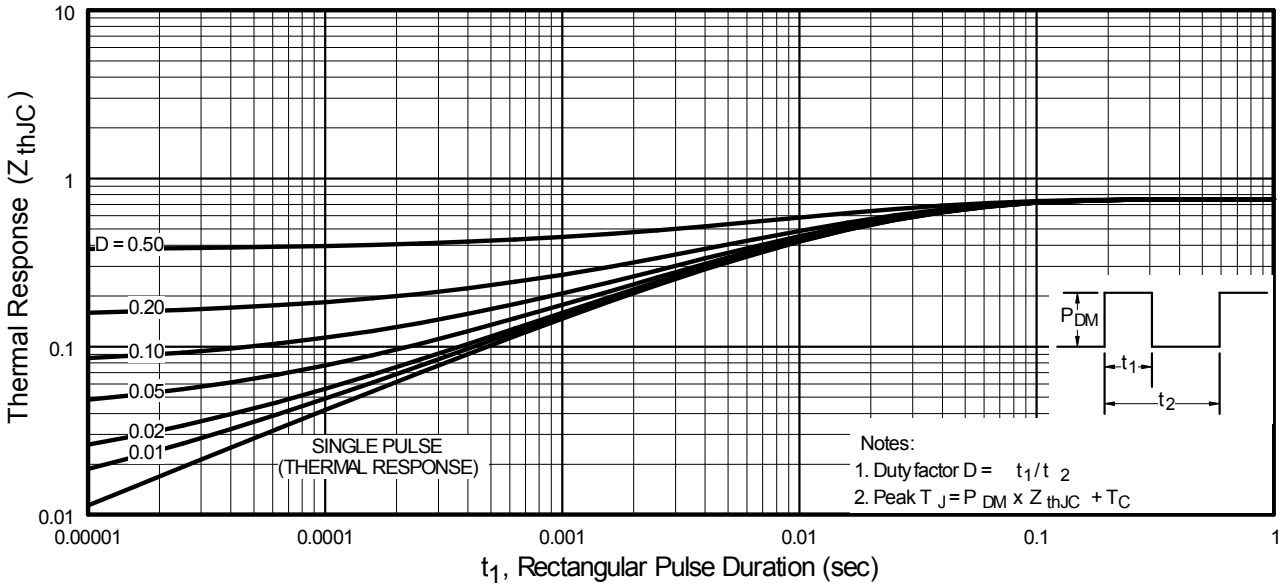


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Case

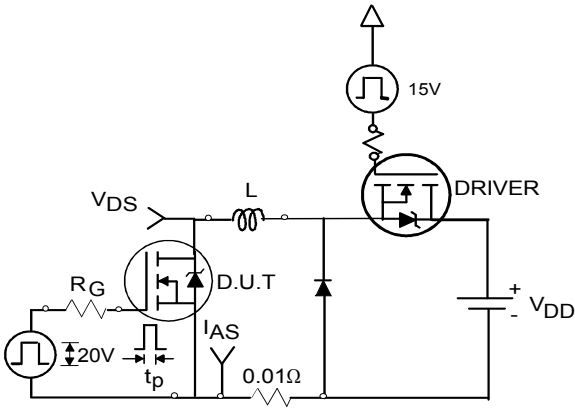


Fig 12a. Unclamped Inductive Test Circuit

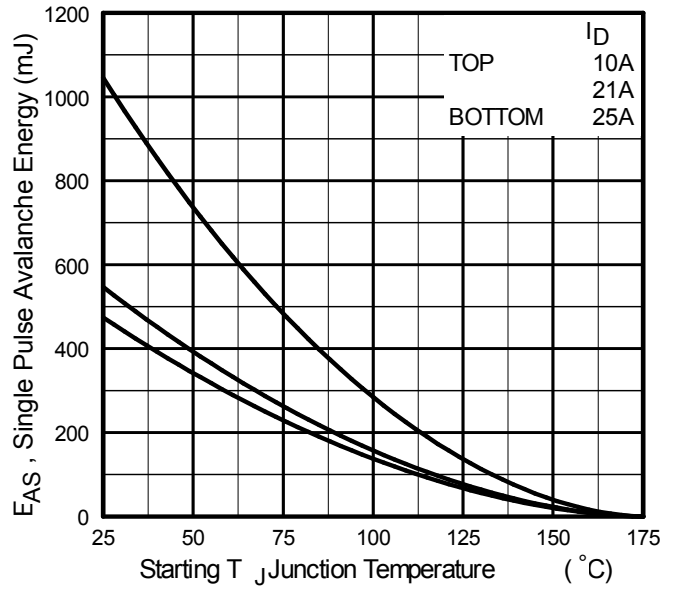


Fig 12c. Maximum Avalanche Energy vs. Drain Current

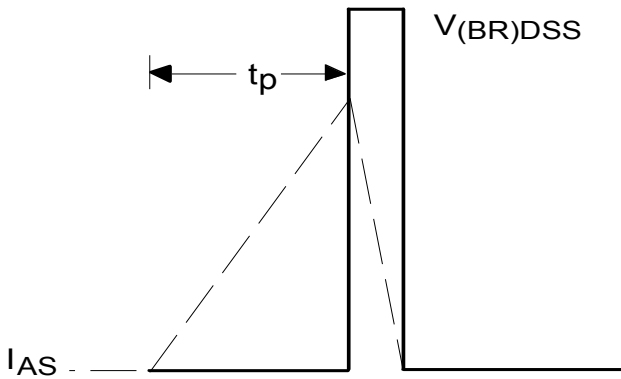


Fig 12b. Unclamped Inductive Waveforms

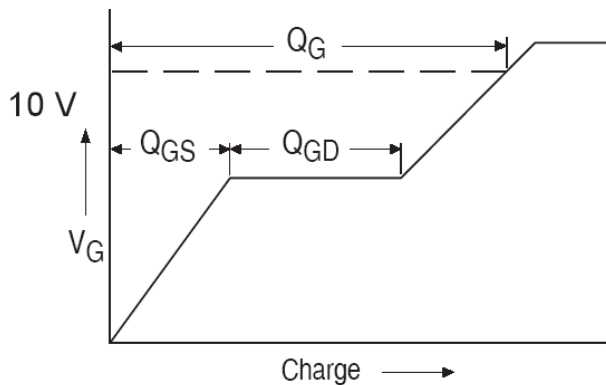


Fig 13a. Gate Charge Waveform

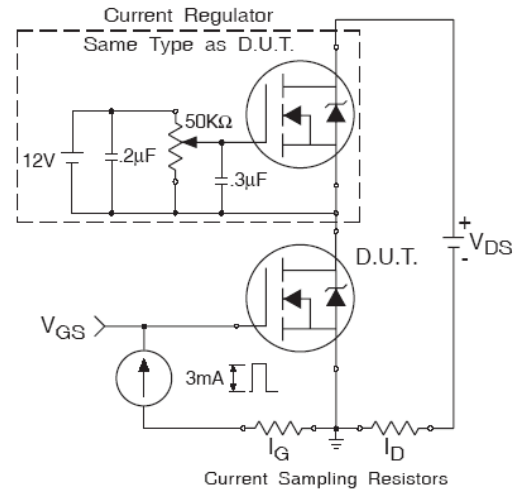
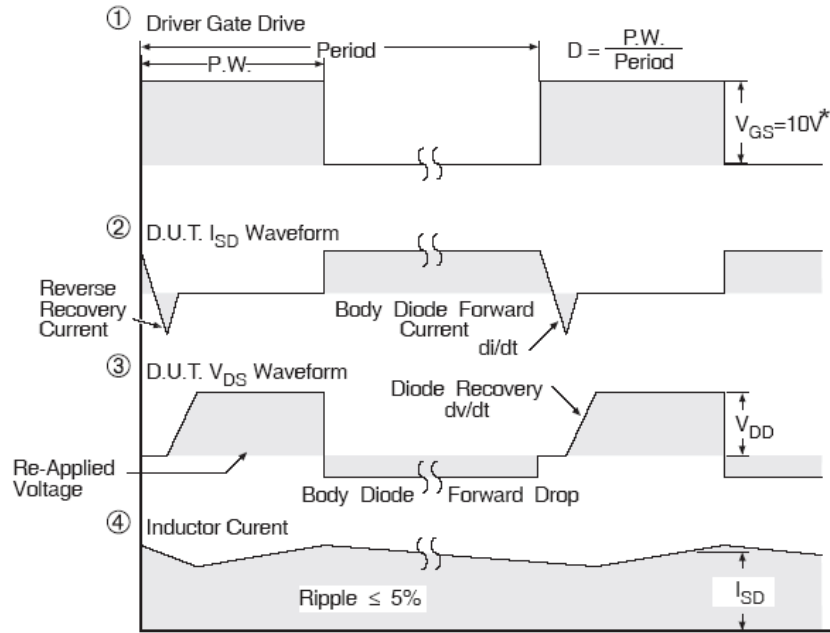
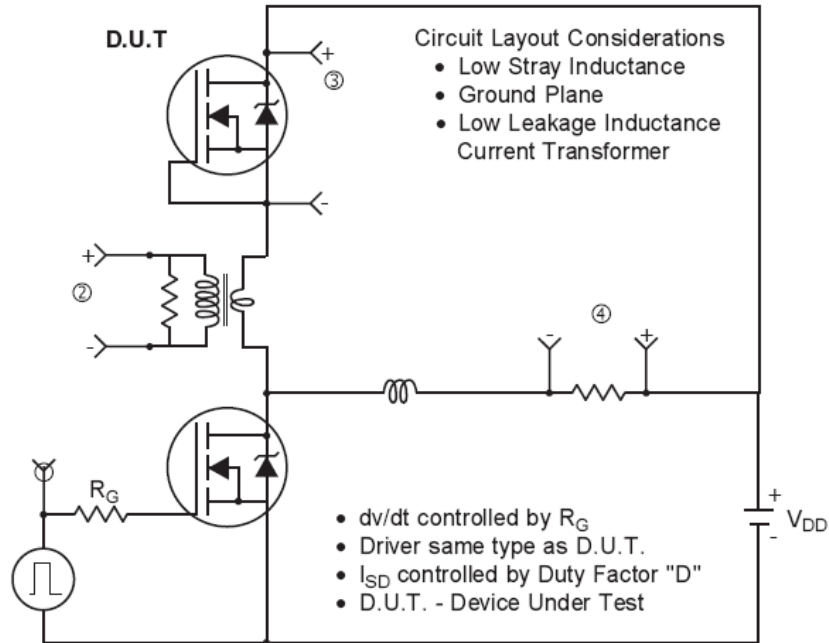


Fig 13b. Gate Charge Test Circuit

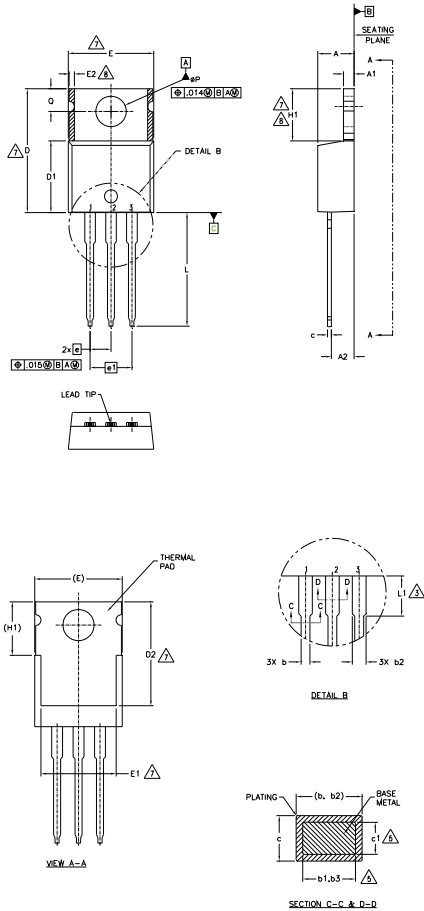
### Peak Diode Recovery dv/dt Test Circuit



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

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

## TO-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**

**HEMFEET**

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

**IGBTs, CoPACK**

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

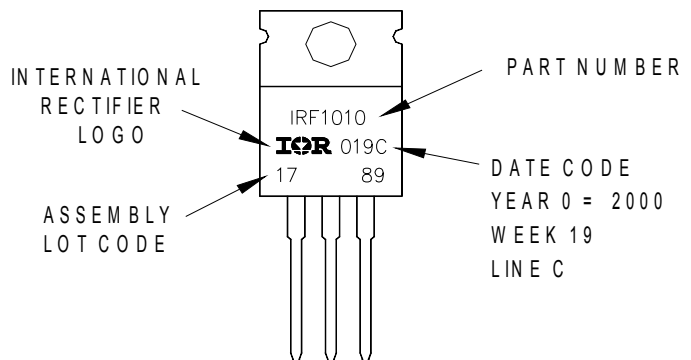
**DIODES**

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

## TO-220AB Part Marking Information

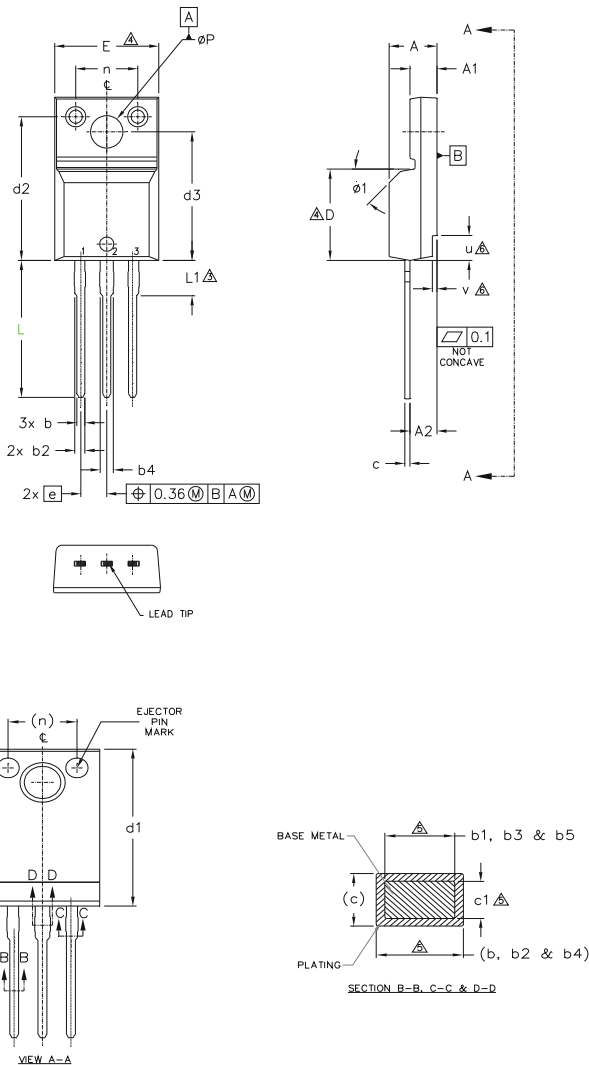
EXAMPLE: THIS IS AN IRF1010  
 LOT CODE 1789  
 ASSEMBLED ON WW 19, 2000  
 IN THE ASSEMBLY LINE "C"

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:**

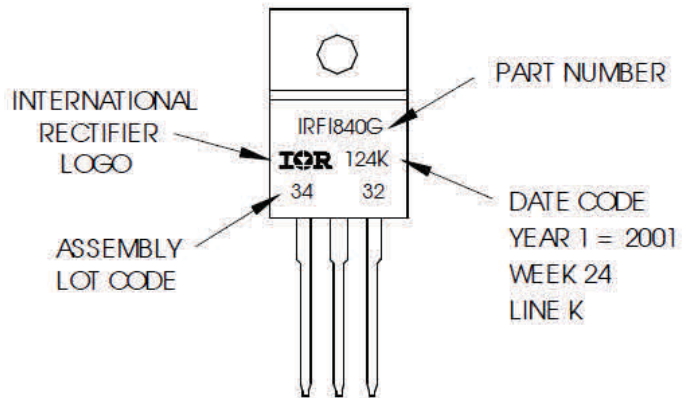
- 1.0 DIMENSIONING AND TOLERANCING AS PER ASME Y14.5 M- 1994.
- 2.0 DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES].
- 3.0 LEAD DIMENSION AND FINISH UNCONTROLLED IN L1.
- 4.0 DIMENSION D & E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED .005" (0.127) PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE 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	LEAD ASSIGNMENTS  HEXFET 1.- GATE 2.- DRAIN 3.- SOURCE
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	
b2	0.76	1.27	.030	.050	
b3	0.76	1.22	.030	.048	
b4	1.02	1.52	.040	.060	
b5	1.02	1.47	.040	.058	
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	IGBTs, CoPACK 1.- GATE 2.- COLLECTOR 3.- EMITTER
d2	13.97	14.22	.550	.560	
d3	12.29	12.93	.484	.509	
E	9.63	10.74	.379	.423	
e	2.54 BSC		.100 BSC		
L	13.21	13.72	.520	.540	3
L1	3.10	3.68	.122	.145	
n	6.05	6.60	.238	.260	6
phi P	3.05	3.45	.120	.136	
u	2.39	2.49	.094	.098	6
v	0.41	0.51	.016	.020	
phi 1	-	45°	-	45°	

**TO-220 Full-Pak Part Marking Information**

EXAMPLE: THIS IS AN IRF1840G  
WITH ASSEMBLY  
LOT CODE 3432  
ASSEMBLED ON WW 24, 2001  
IN THE ASSEMBLY LINE "K"

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

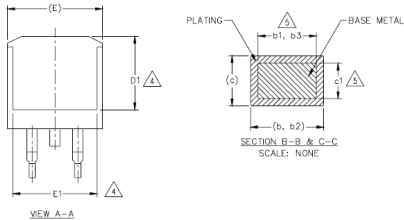
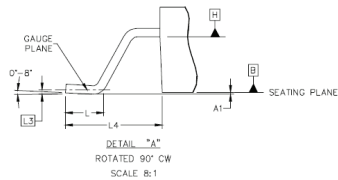
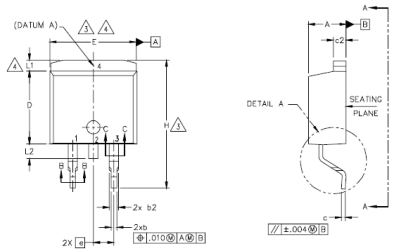


TO-220AB Full-Pak packages are not recommended for Surface Mount Application.

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

**D2-Pak (TO-263AB) Package Outline**  
 shown in millimeters (inches)

(Dimensions are



## 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 [0.005"] 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	5 5 5 3 4 3,4 4 4
A1	0.00	0.254	.000	.010	
b	0.51	0.99	.020	.039	
b1	0.51	0.89	.020	.035	
b2	1.14	1.78	.045	.070	
b3	1.14	1.73	.045	.068	
c	0.38	0.74	.015	.029	
c1	0.38	0.58	.015	.023	
c2	1.14	1.65	.045	.065	
D	8.38	9.65	.330	.380	
D1	6.86	—	.270	—	
E	9.65	10.67	.380	.420	
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	—	.066	
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

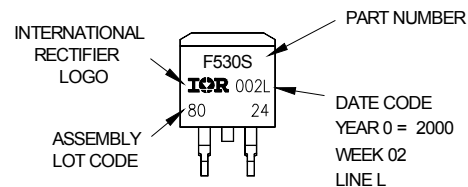
## IGBTs, CoPACK

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

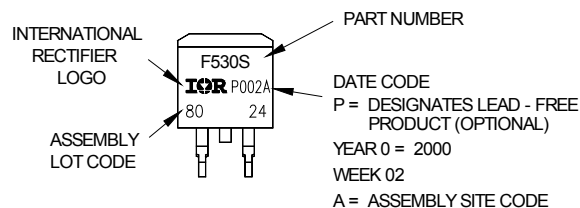
**D2-Pak (TO-263AB) Part Marking Information**

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"

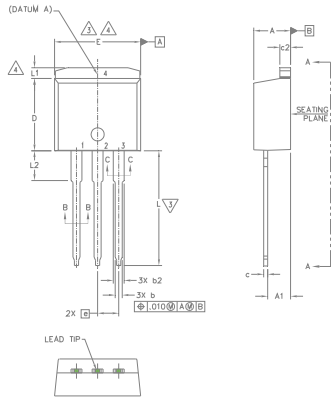


OR



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

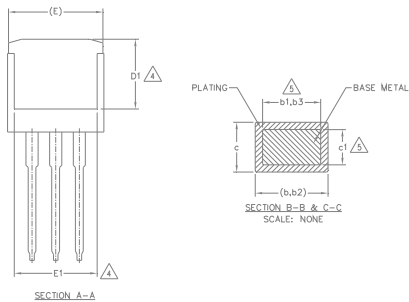
- 1.- GATE
- 2.- COLLECTOR
- 3.- EMITTER
- 4.- COLLECTOR

#### HEXFET

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

#### DIODES

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

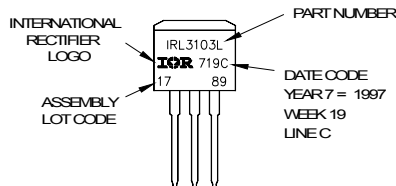


SYMBOL	DIMENSIONS				NOTES
	MILLIMETERS		INCHES		
	MIN.	MAX.	MIN.	MAX.	
A	4.06	4.83	.160	.190	
A1	2.03	3.02	.080	.119	
b	0.51	0.99	.020	.039	
b1	0.51	0.89	.020	.035	5
b2	1.14	1.78	.045	.070	
b3	1.14	1.73	.045	.068	5
c	0.38	0.74	.015	.029	
c1	0.38	0.58	.015	.023	5
c2	1.14	1.65	.045	.065	
D	8.38	9.65	.330	.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	

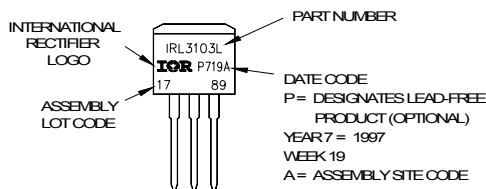
## TO-262 Part Marking Information

EXAMPLE: THIS IS AN IRL3103L  
 LOT CODE 1789  
 ASSEMBLED ON WW19, 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/>



**Qualification Information**

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

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

**Revision History**

Date	Comments
04/27/2017	<ul style="list-style-type: none"> <li>Changed datasheet with Infineon logo - all pages.</li> <li>Corrected Package Outline on page 8,9,10,11.</li> <li>Added disclaimer on last page.</li> </ul>

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