

**Applications**

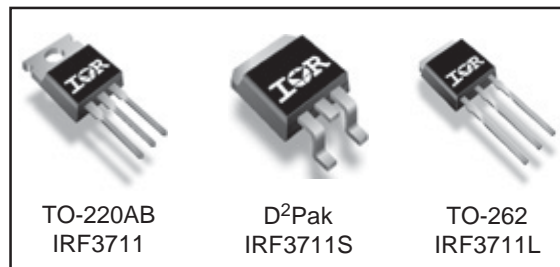
- High Frequency Isolated DC-DC Converters with Synchronous Rectification for Telecom and Industrial Use
- High Frequency Buck Converters for Server Processor Power Synchronous FET
- Optimized for Synchronous Buck Converters Including Capacitive Induced Turn-on Immunity

**Benefits**

- Ultra-Low Gate Impedance
- Very Low RDS(on) at 4.5V V<sub>GS</sub>
- Fully Characterized Avalanche Voltage and Current

HEXFET® Power MOSFET

<b>V<sub>DSS</sub></b>	<b>R<sub>DS(on)</sub> max</b>	<b>I<sub>D</sub></b>
<b>20V</b>	<b>6.0mΩ</b>	<b>110A<sup>⑥</sup></b>



**Absolute Maximum Ratings**

Symbol	Parameter	Max.	Units
V <sub>DS</sub>	Drain-Source Voltage	20	V
V <sub>GS</sub>	Gate-to-Source Voltage	± 20	V
I <sub>D</sub> @ T <sub>C</sub> = 25°C	Continuous Drain Current, V <sub>GS</sub> @ 10V	110 <sup>⑥</sup>	A
I <sub>D</sub> @ T <sub>C</sub> = 100°C	Continuous Drain Current, V <sub>GS</sub> @ 10V	69	
I <sub>DM</sub>	Pulsed Drain Current <sup>①</sup>	440	
P <sub>D</sub> @ T <sub>C</sub> = 25°C	Maximum Power Dissipation	120	W
P <sub>D</sub> @ T <sub>A</sub> = 25°C	Maximum Power Dissipation <sup>⑤</sup>	3.1	W
	Linear Derating Factor	0.96	W/°C
T <sub>J</sub> , T <sub>STG</sub>	Junction and Storage Temperature Range	-55 to + 150	°C

**Thermal Resistance**

	Parameter	Typ.	Max.	Units
R <sub>θJC</sub>	Junction-to-Case <sup>⑦</sup>	—	1.04	°C/W
R <sub>θCS</sub>	Case-to-Sink, Flat, Greased Surface <sup>④</sup>	0.50	—	
R <sub>θJA</sub>	Junction-to-Ambient <sup>④</sup> <sup>⑦</sup>	—	62	
R <sub>θJA</sub>	Junction-to-Ambient (PCB mount) <sup>⑤</sup> <sup>⑦</sup>	—	40	

Notes <sup>①</sup> through <sup>⑦</sup> are on page 11

# IRF3711/3711S/3711L

International  
**IR** Rectifier

## 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	20	—	—	V	V <sub>GS</sub> = 0V, I <sub>D</sub> = 250μA
ΔV <sub>(BR)DSS</sub> /ΔT <sub>J</sub>	Breakdown Voltage Temp. Coefficient	—	0.022	—	V/°C	Reference to 25°C, I <sub>D</sub> = 1mA
R <sub>DS(on)</sub>	Static Drain-to-Source On-Resistance	—	4.7	6.0	mΩ	V <sub>GS</sub> = 10V, I <sub>D</sub> = 15A ③
		—	6.2	8.5		V <sub>GS</sub> = 4.5V, I <sub>D</sub> = 12A ③
V <sub>GS(th)</sub>	Gate Threshold Voltage	1.0	—	3.0	V	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250μA
I <sub>DSS</sub>	Drain-to-Source Leakage Current	—	—	20	μA	V <sub>DS</sub> = 16V, V <sub>GS</sub> = 0V
		—	—	100		V <sub>DS</sub> = 16V, V <sub>GS</sub> = 0V, T <sub>J</sub> = 125°C
I <sub>GSS</sub>	Gate-to-Source Forward Leakage	—	—	200	nA	V <sub>GS</sub> = 16V
	Gate-to-Source Reverse Leakage	—	—	-200		V <sub>GS</sub> = -16V

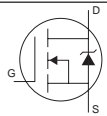
## Dynamic @ T<sub>J</sub> = 25°C (unless otherwise specified)

Symbol	Parameter	Min.	Typ.	Max.	Units	Conditions
g <sub>fs</sub>	Forward Transconductance	53	—	—	S	V <sub>DS</sub> = 16V, I <sub>D</sub> = 30A
Q <sub>g</sub>	Total Gate Charge	—	29	44	nC	I <sub>D</sub> = 15A
Q <sub>gs</sub>	Gate-to-Source Charge	—	7.3	—		V <sub>DS</sub> = 10V
Q <sub>gd</sub>	Gate-to-Drain ("Miller") Charge	—	8.9	—		V <sub>GS</sub> = 4.5V
Q <sub>oss</sub>	Output Gate Charge	—	33	—		V <sub>GS</sub> = 0V, V <sub>DS</sub> = 10V
R <sub>g</sub>	Gate Resistance	0.3	—	2.5	Ω	
t <sub>d(on)</sub>	Turn-On Delay Time	—	12	—	ns	V <sub>DD</sub> = 10V
t <sub>r</sub>	Rise Time	—	220	—		I <sub>D</sub> = 30A
t <sub>d(off)</sub>	Turn-Off Delay Time	—	17	—		R <sub>G</sub> = 1.8Ω
t <sub>f</sub>	Fall Time	—	12	—		V <sub>GS</sub> = 4.5V ③
C <sub>iss</sub>	Input Capacitance	—	2980	—	pF	V <sub>GS</sub> = 0V
C <sub>oss</sub>	Output Capacitance	—	1770	—		V <sub>DS</sub> = 10V
C <sub>rss</sub>	Reverse Transfer Capacitance	—	280	—		f = 1.0MHz

## Avalanche Characteristics

Symbol	Parameter	Typ.	Max.	Units
E <sub>AS</sub>	Single Pulse Avalanche Energy②	—	460	mJ
I <sub>AR</sub>	Avalanche Current①	—	30	A

## Diode Characteristics

Symbol	Parameter	Min.	Typ.	Max.	Units	Conditions
I <sub>S</sub>	Continuous Source Current (Body Diode)	—	—	110⑥	A	MOSFET symbol showing the integral reverse p-n junction diode. 
I <sub>SM</sub>	Pulsed Source Current (Body Diode) ①	—	—	440		
V <sub>SD</sub>	Diode Forward Voltage	—	0.88	1.3	V	T <sub>J</sub> = 25°C, I <sub>S</sub> = 30A, V <sub>GS</sub> = 0V ③
		—	0.82	—		T <sub>J</sub> = 125°C, I <sub>S</sub> = 30A, V <sub>GS</sub> = 0V ③
t <sub>rr</sub>	Reverse Recovery Time	—	50	75	ns	T <sub>J</sub> = 25°C, I <sub>F</sub> = 16A, V <sub>R</sub> = 10V
Q <sub>rr</sub>	Reverse Recovery Charge	—	61	92	nC	di/dt = 100A/μs ③
t <sub>rr</sub>	Reverse Recovery Time	—	48	72	ns	T <sub>J</sub> = 125°C, I <sub>F</sub> = 16A, V <sub>R</sub> = 10V
Q <sub>rr</sub>	Reverse Recovery Charge	—	65	98	nC	di/dt = 100A/μs ③

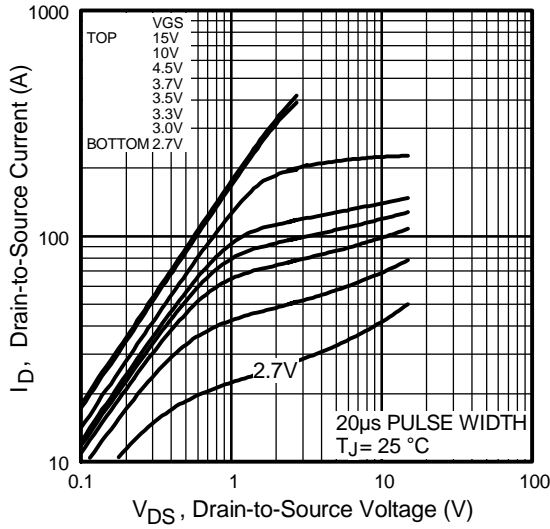


Fig 1. Typical Output Characteristics

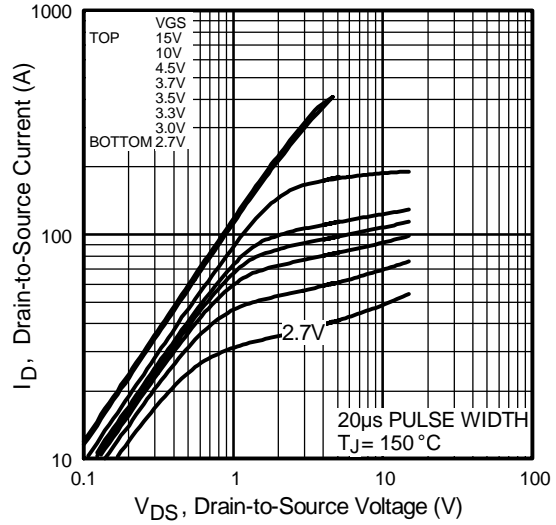


Fig 2. Typical Output Characteristics

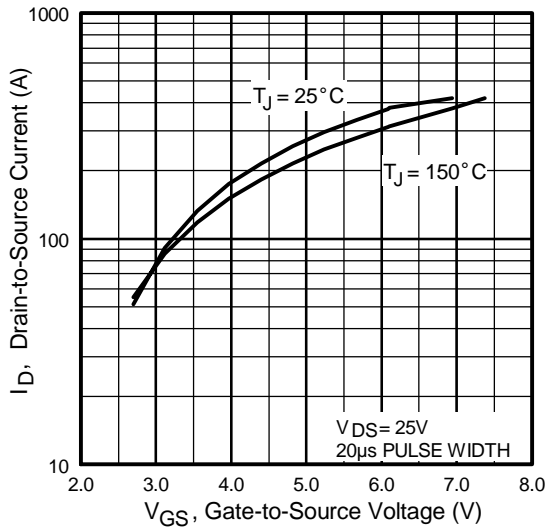


Fig 3. Typical Transfer Characteristics

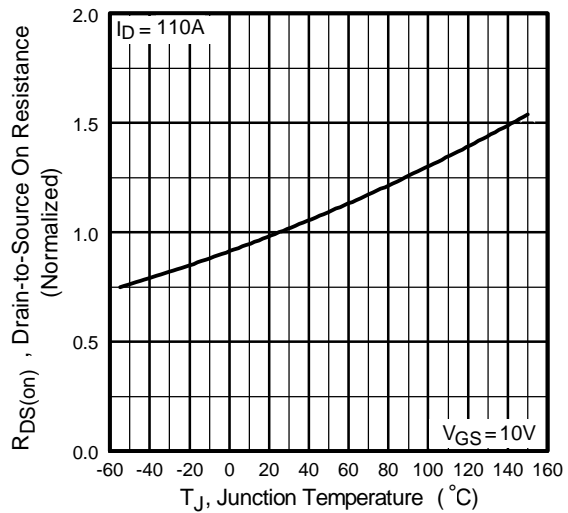
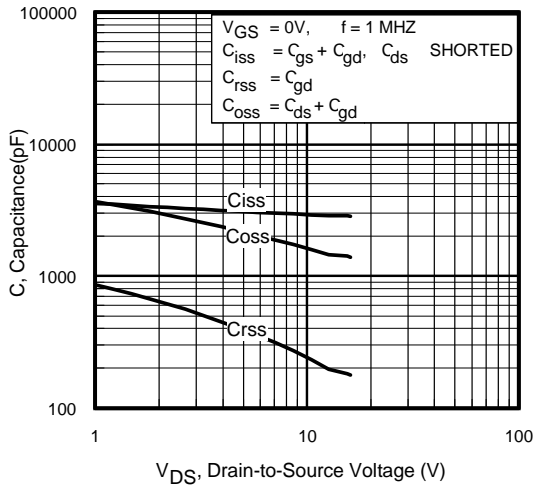
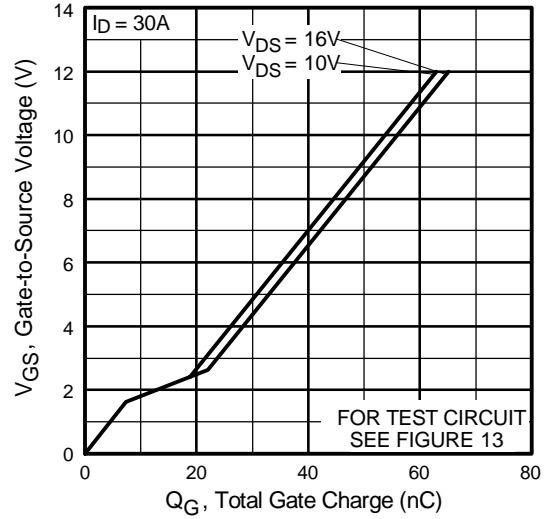


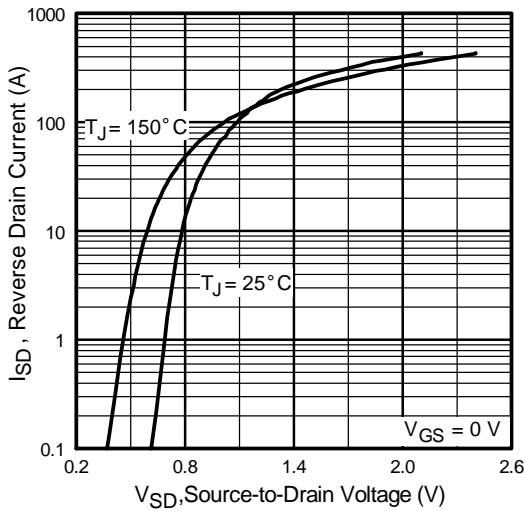
Fig 4. Normalized On-Resistance Vs. Temperature



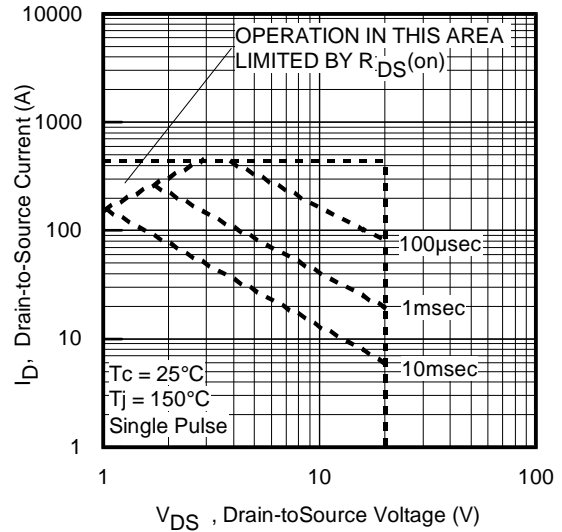
**Fig 5.** Typical Capacitance Vs. Drain-to-Source Voltage



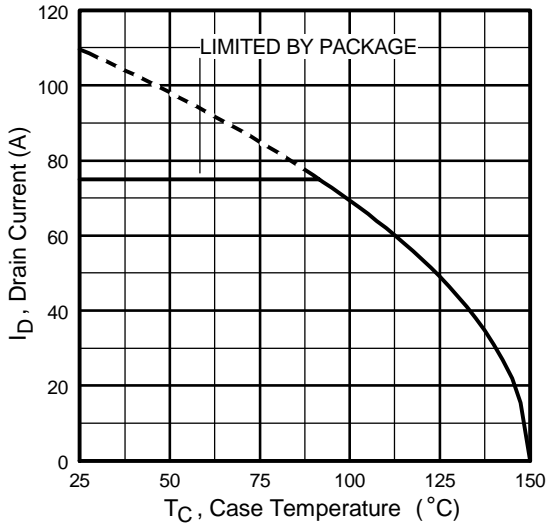
**Fig 6.** Typical Gate Charge Vs. Gate-to-Source Voltage



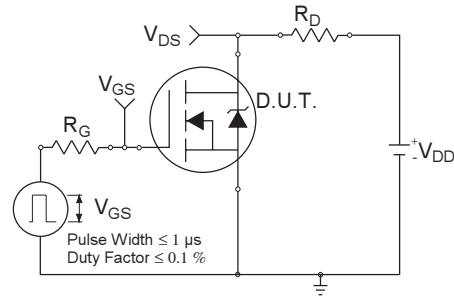
**Fig 7.** Typical Source-Drain Diode Forward Voltage



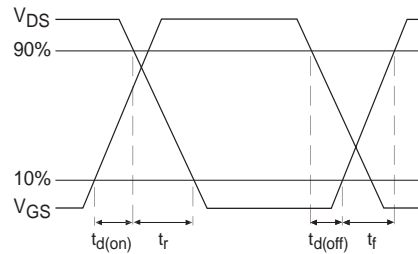
**Fig 8.** Maximum Safe Operating Area



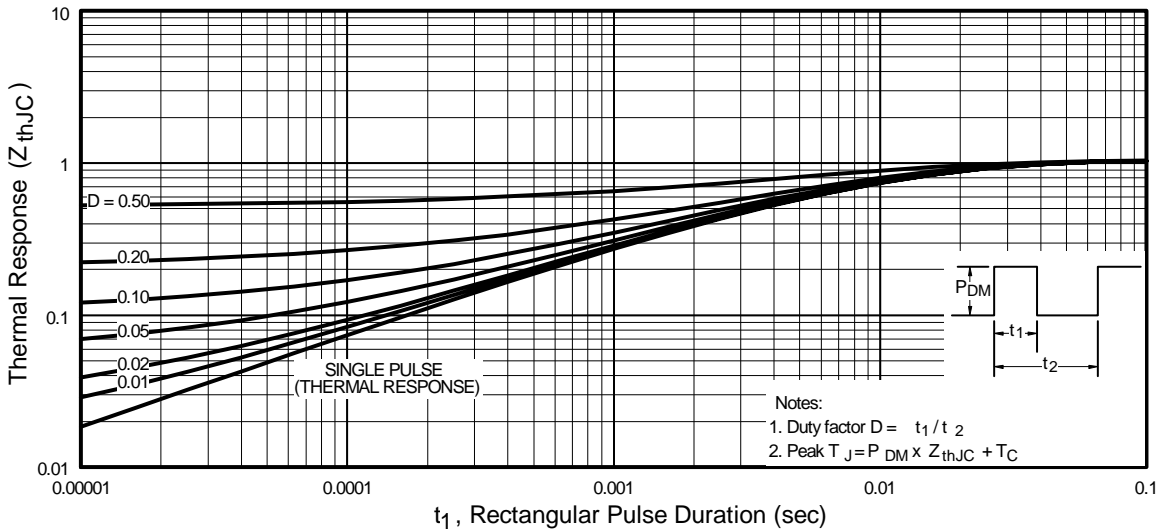
**Fig 9.** Maximum Drain Current Vs. Case Temperature



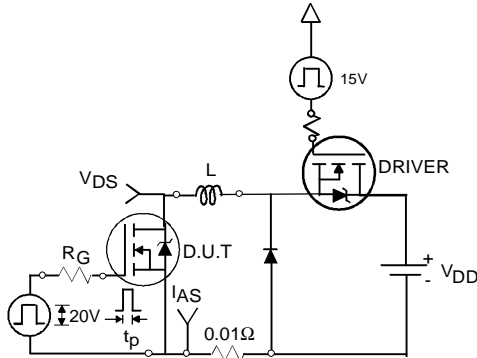
**Fig 10a.** Switching Time Test Circuit



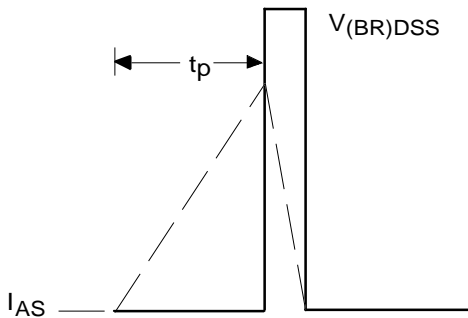
**Fig 10b.** Switching Time Waveforms



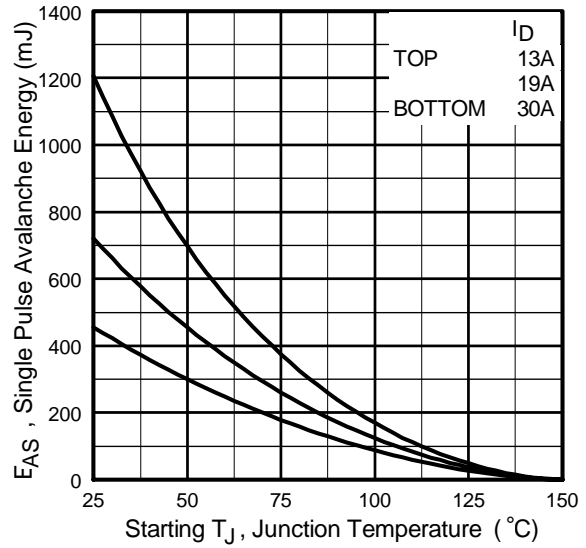
**Fig 11.** Maximum Effective Transient Thermal Impedance, Junction-to-Case



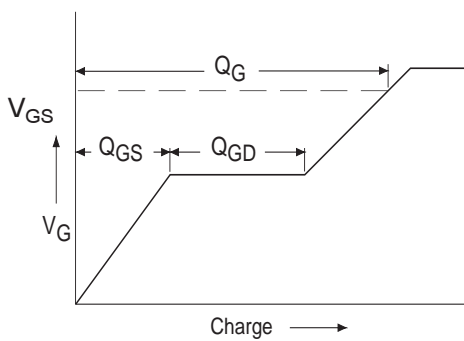
**Fig 12a.** Unclamped Inductive Test Circuit



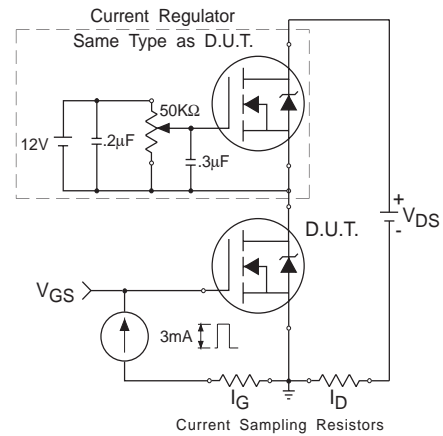
**Fig 12b.** Unclamped Inductive Waveforms



**Fig 12c.** Maximum Avalanche Energy Vs. Drain Current

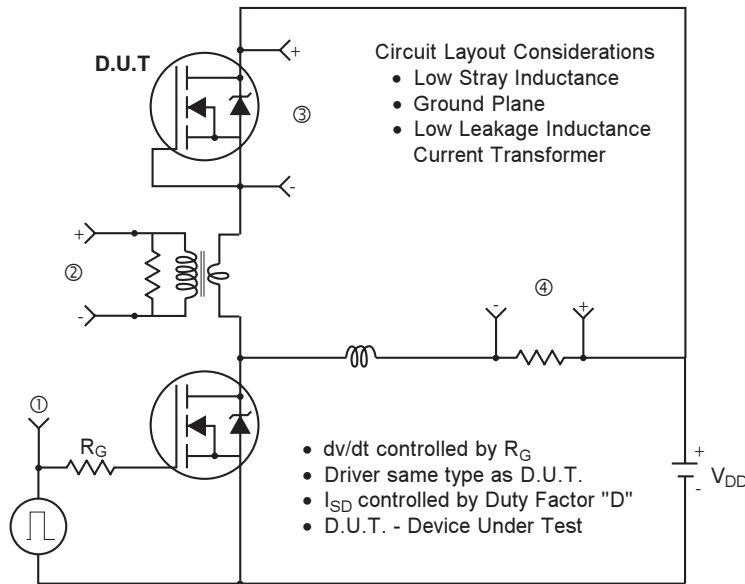


**Fig 13a.** Basic Gate Charge Waveform



**Fig 13b.** Gate Charge Test Circuit

## Peak Diode Recovery dv/dt Test Circuit



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

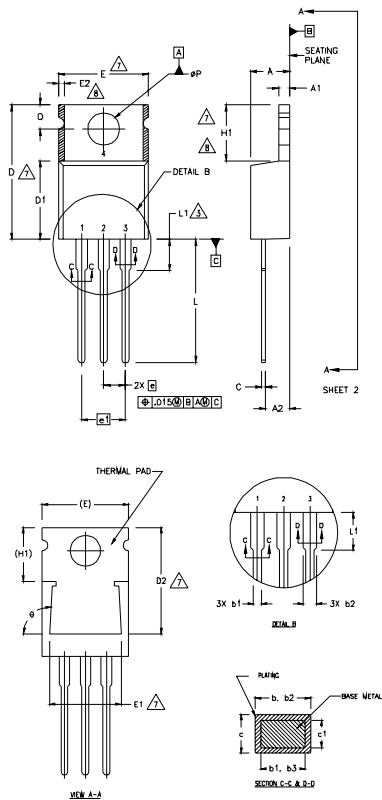
**Fig 14.** For N-Channel HEXFET® Power MOSFETs

# IRF3711/3711S/3711L

International  
**IRF** Rectifier

## TO-220AB Package Outline

Dimensions are shown in millimeters (inches)



**NOTES:**

- 1 DIMENSIONING AND TOLERANCING PER ASME Y14.5 M- 1994.
- 2 DIMENSIONS ARE SHOWN IN INCHES [MILLIMETERS].
- 3 LEAD DIMENSION AND FINISH UNCONTROLLED IN L1.
- 4 DIMENSION D & 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 & 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.

**LEAD ASSIGNMENTS**

**HERMET**

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

**IGBTs\_CoPAK**

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

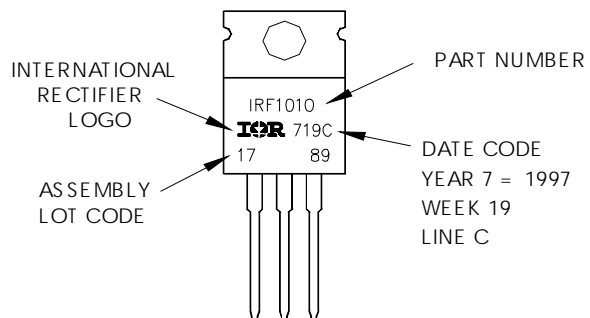
**DIODES**

- 1.- ANODE/OPEN
- 2.- CATHODE
- 3.- ANODE

SYMBOL	DIMENSIONS				NOTES
	MILLIMETERS		INCHES		
	MIN.	MAX.	MIN.	MAX.	
A	3.56	4.82	.140	.190	
A1	0.51	1.40	.020	.055	
A2	2.04	2.92	.080	.115	
b	0.38	1.01	.015	.040	
b1	0.38	0.96	.015	.038	5
b2	1.15	1.77	.045	.070	
b3	1.15	1.73	.045	.068	
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	12.19	12.88	.480	.507	7
E	9.66	10.66	.380	.420	4,7
E1	8.38	8.89	.330	.350	7
e	2.54 BSC		.100 BSC		
e1	5.08		.200 BSC		
H1	5.85	6.55	.230	.270	7,8
L	12.70	14.73	.500	.580	
L1	-	6.35	-	.250	
ØP	3.54	4.08	.139	.161	
Ø	2.54	3.42	.100	.135	
φ	90°-93°		90°-93°		

## TO-220AB Part Marking Information

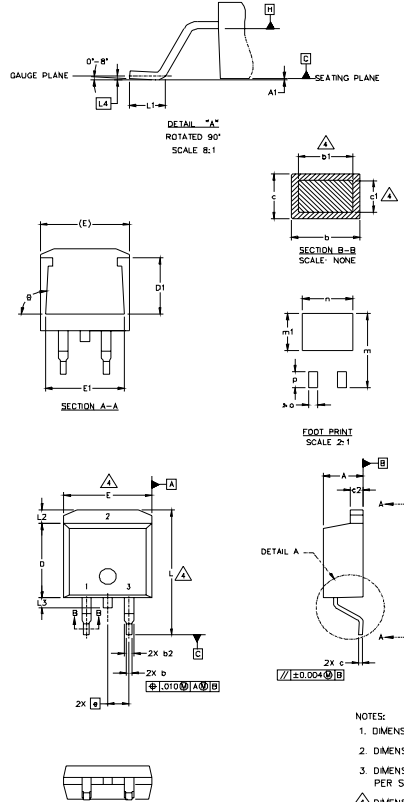
EXAMPLE: THIS IS AN IRF1010  
 LOT CODE 1789  
 ASSEMBLED ON WW 19, 1997  
 IN THE ASSEMBLY LINE "C"  
**Note:** "P" in assembly line position indicates "Lead-Free"





## D<sup>2</sup>Pak 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	4
b1	0.51	0.89	.020	.035	
b2	1.14	1.40	.045	.055	4
c	0.43	0.63	.017	.025	
c1	0.38	0.74	.015	.029	3
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.

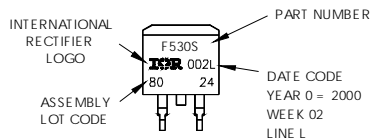
**NOTES:**

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 [0.005"] 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.

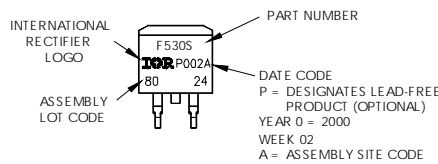
## D<sup>2</sup>Pak Part Marking Information

EXAMPLE: THIS IS AN IRF530S WITH LOT CODE 8024 ASSEMBLED ON WW02, 2000 IN THE ASSEMBLY LINE "L"

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



## OR

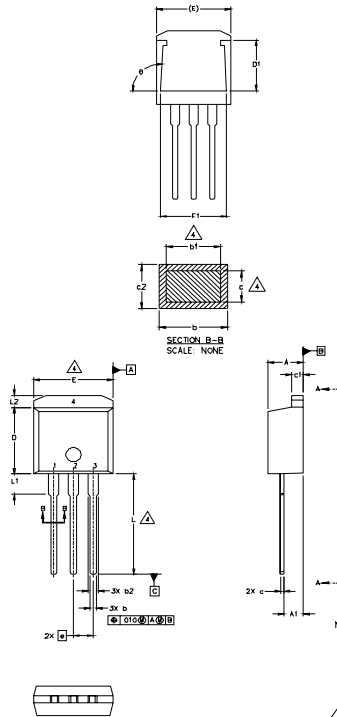


# IRF3711/3711S/3711L



## 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	4
A1	2.03	2.92	.080	.115	
b	0.51	0.99	.020	.039	
b1	0.51	0.89	.020	.035	
b2	1.14	1.40	.045	.055	4
c	0.38	0.63	.015	.025	
c1	1.14	1.40	.045	.055	3
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

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

#### IGBT

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

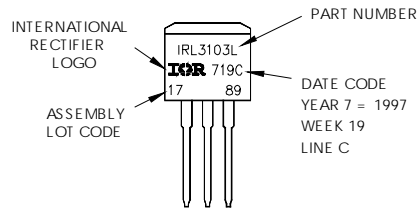
#### NOTES:

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.
4. DIMENSION b1 AND c1 APPLY TO BASE METAL ONLY.
5. CONTROLLING DIMENSION: INCH.

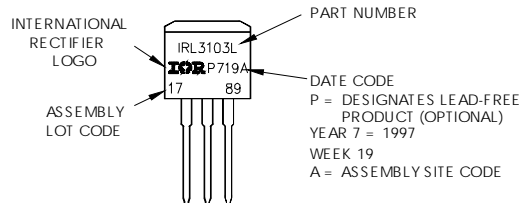
## TO-262 Part Marking Information

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

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

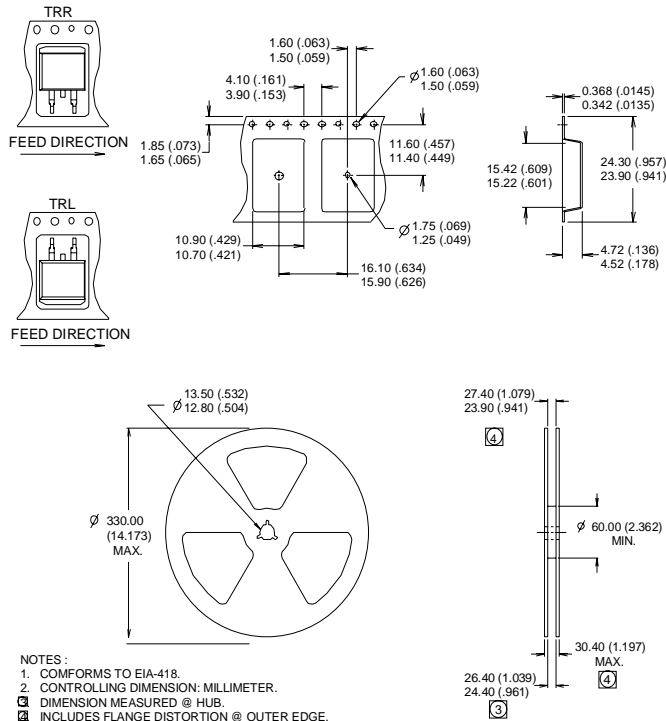


OR



## D<sup>2</sup>Pak Tape & Reel Information

Dimensions are shown in millimeters (inches)



### Notes:

- ① Repetitive rating; pulse width limited by max. junction temperature.
- ② Starting  $T_J = 25^\circ\text{C}$ ,  $L = 1.0\text{mH}$   
 $R_G = 25\Omega$ ,  $I_{AS} = 30\text{A}$ .
- ③ Pulse width  $\leq 400\mu\text{s}$ ; duty cycle  $\leq 2\%$ .
- ④ This is only applied to TO-220AB package
- ⑤ 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.
- ⑥ Calculated continuous current based on maximum allowable junction temperature. Package limitation current is 75A.
- ⑦  $R_\theta$  is measured at  $T_J$  approximately  $90^\circ\text{C}$

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.

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