

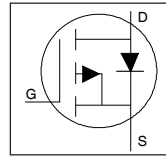
## Features

- Advanced Planar Technology
- Low On-Resistance
- P-Channel
- Dynamic  $dV/dt$  Rating
- 175°C Operating Temperature
- Fast Switching
- Fully Avalanche Rated
- Repetitive Avalanche Allowed up to  $T_{jmax}$
- Lead-Free, RoHS Compliant
- Automotive Qualified \*

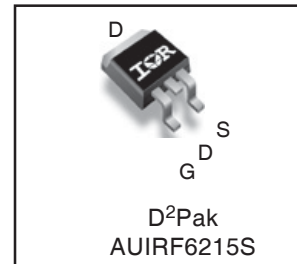
## Description

Specifically designed for Automotive applications, this cellular design of HEXFET® Power MOSFETs utilizes the latest processing techniques to achieve low on-resistance per silicon area. This benefit combined with the fast switching speed and ruggedized device design that HEXFET power MOSFETs are well known for, provides the designer with an extremely efficient and reliable device for use in Automotive and a wide variety of other applications.

## HEXFET® Power MOSFET



$V_{DSS}$	<b>-150V</b>
$R_{DS(on)}$ max.	<b>0.29Ω</b>
$I_D$	<b>-13A</b>



<b>G</b>	<b>D</b>	<b>S</b>
Gate	Drain	Source

## Absolute Maximum Ratings

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only; and functional operation of the device at these or any other condition beyond those indicated in the specifications is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability. The thermal resistance and power dissipation ratings are measured under board mounted and still air conditions. Ambient temperature ( $T_A$ ) is 25°C, unless otherwise specified.

	Parameter	Max.	Units
$I_D @ T_C = 25^\circ\text{C}$	Continuous Drain Current, $V_{GS} @ -10\text{V}$	-13	A
$I_D @ T_C = 100^\circ\text{C}$	Continuous Drain Current, $V_{GS} @ -10\text{V}$	-9.0	
$I_{DM}$	Pulsed Drain Current ①	-44	
$P_D @ T_A = 25^\circ\text{C}$	Maximum Power Dissipation	3.8	W
$P_D @ T_C = 25^\circ\text{C}$	Maximum Power Dissipation	110	
	Linear Derating Factor	0.71	W/°C
$V_{GS}$	Gate-to-Source Voltage	± 20	V
$E_{AS}$	Single Pulse Avalanche Energy ②	310	mJ
$I_{AR}$	Avalanche Current ①	-6.6	A
$E_{AR}$	Repetitive Avalanche Energy ①	11	mJ
$dv/dt$	Peak Diode Recovery $dv/dt$ ③	-5.0	V/ns
$T_J$	Operating Junction and	-55 to + 175	°C
$T_{STG}$	Storage Temperature Range		
	Soldering Temperature, for 10 seconds (1.6mm from case)		

## Thermal Resistance

	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case ④	—	1.4	°C/W
$R_{\theta JA}$	Junction-to-Ambient (PCB Mount, steady state) ⑤	—	40	

HEXFET® is a registered trademark of International Rectifier.

\*Qualification standards can be found at <http://www.irf.com/>

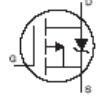
**Static Electrical Characteristics @ T<sub>J</sub> = 25°C (unless otherwise specified)**

	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
ΔBV <sub>DSS</sub> /ΔT <sub>J</sub>	Breakdown Voltage Temp. Coefficient	—	-0.20	—	V/°C	Reference to 25°C, I <sub>D</sub> = -1mA
R <sub>DS(on)</sub>	Static Drain-to-Source On-Resistance	—	—	0.29	Ω	V <sub>GS</sub> = -10V, I <sub>D</sub> = -6.6A ④
		—	—	0.58		V <sub>GS</sub> = -10V, I <sub>D</sub> = -6.6A, T <sub>J</sub> = 150°C ④
V <sub>GS(th)</sub>	Gate Threshold Voltage	-2.0	—	-4.0	V	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = -250μA
g <sub>fs</sub>	Forward Transconductance	3.6	—	—	S	V <sub>DS</sub> = -25V, I <sub>D</sub> = -6.6A
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> = -20V
	Gate-to-Source Reverse Leakage	—	—	100		V <sub>GS</sub> = 20V

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

	Parameter	Min.	Typ.	Max.	Units	Conditions
Q <sub>g</sub>	Total Gate Charge	—	—	66	nC	I <sub>D</sub> = -6.6A
Q <sub>gs</sub>	Gate-to-Source Charge	—	—	8.1		V <sub>DS</sub> = -120V
Q <sub>gd</sub>	Gate-to-Drain ("Miller") Charge	—	—	35		V <sub>GS</sub> = -10V ④
t <sub>d(on)</sub>	Turn-On Delay Time	—	14	—	ns	V <sub>DD</sub> = -75V
t <sub>r</sub>	Rise Time	—	36	—		I <sub>D</sub> = -6.6A
t <sub>d(off)</sub>	Turn-Off Delay Time	—	53	—		R <sub>G</sub> = 6.8Ω
t <sub>f</sub>	Fall Time	—	37	—		R <sub>D</sub> = 12Ω ⑤
L <sub>S</sub>	Internal Source Inductance	—	7.5	—		nH
C <sub>iss</sub>	Input Capacitance	—	860	—	pF	V <sub>GS</sub> = 0V
C <sub>oss</sub>	Output Capacitance	—	220	—		V <sub>DS</sub> = -25V
C <sub>rss</sub>	Reverse Transfer Capacitance	—	130	—		f = 1.0MHz, See Fig. 5

**Diode Characteristics**

	Parameter	Min.	Typ.	Max.	Units	Conditions
I <sub>S</sub>	Continuous Source Current (Body Diode)	—	—	-11	A	MOSFET symbol showing the integral reverse p-n junction diode. 
I <sub>SM</sub>	Pulsed Source Current (Body Diode) ①	—	—	-44		
V <sub>SD</sub>	Diode Forward Voltage	—	—	-1.6	V	T <sub>J</sub> = 25°C, I <sub>S</sub> = -6.6A, V <sub>GS</sub> = 0V ④
t <sub>rr</sub>	Reverse Recovery Time	—	160	240	ns	T <sub>J</sub> = 25°C, I <sub>F</sub> = -6.6A
Q <sub>rr</sub>	Reverse Recovery Charge	—	1.2	1.7	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. (See fig. 11)
- ② Starting T<sub>J</sub> = 25°C, L = 14mH, R<sub>G</sub> = 25Ω, I<sub>AS</sub> = -6.6A. (See Figure 12)
- ③ I<sub>SD</sub> ≤ -6.6A, di/dt ≤ 620A/μs, V<sub>DD</sub> ≤ V<sub>(BR)DSS</sub>, T<sub>J</sub> ≤ 175°C.

- ④ Pulse width ≤ 300μs; duty cycle ≤ 2%.
- ⑤ 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 R<sub>θ</sub> is measured at T<sub>J</sub> approximately 90°C

**Qualification Information<sup>†</sup>**

<b>Qualification Level</b>		Automotive (per AEC-Q101)	
		Comments: This part number(s) passed Automotive qualification. IR's Industrial and Consumer qualification level is granted by extension of the higher Automotive level.	
<b>Moisture Sensitivity Level</b>		D <sup>2</sup> Pak	MSL1
<b>ESD</b>	Machine Model	Class M3 (+/- 400V) <sup>††</sup> AEC-Q101-002	
	Human Body Model	Class H1B (+/- 1000V) <sup>††</sup> AEC-Q101-001	
	Charged Device Model	Class C5 (+/- 1125V) <sup>††</sup> AEC-Q101-005	
<b>RoHS Compliant</b>		Yes	

<sup>†</sup> Qualification standards can be found at International Rectifier's web site: <http://www.irf.com/>

<sup>††</sup> Highest passing voltage.

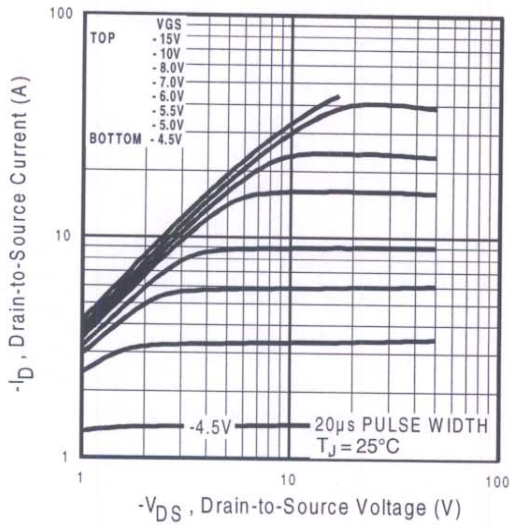


Fig 1. Typical Output Characteristics

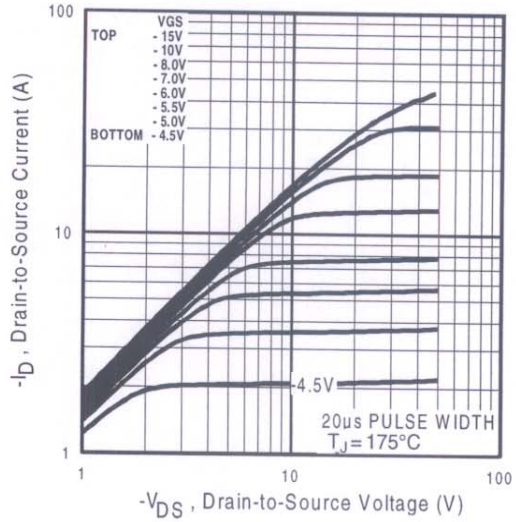


Fig 2. Typical Output Characteristics

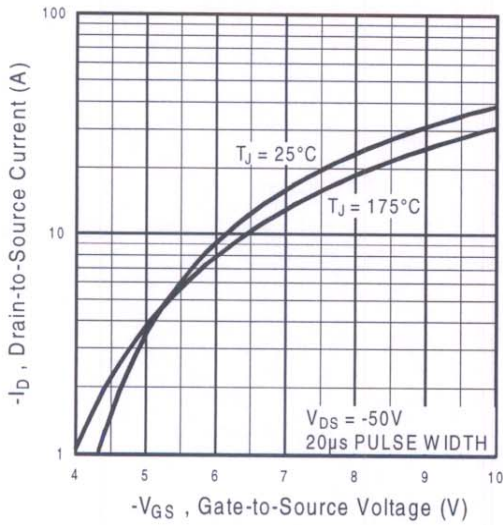


Fig 3. Typical Transfer Characteristics

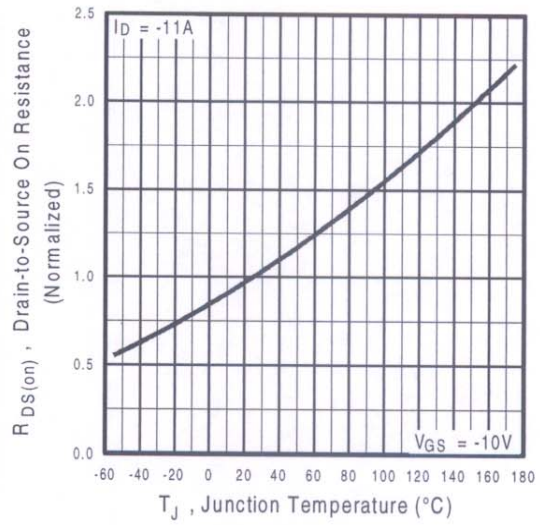
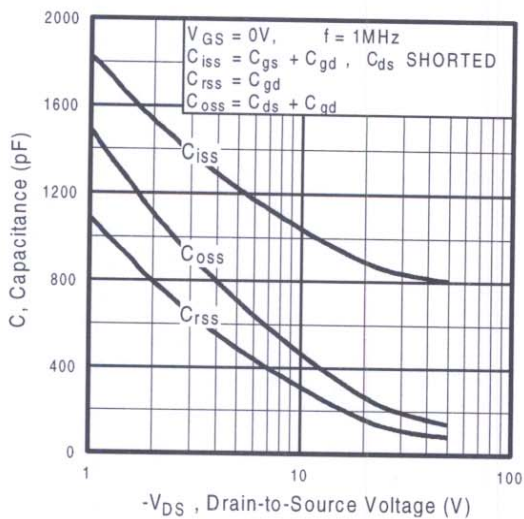
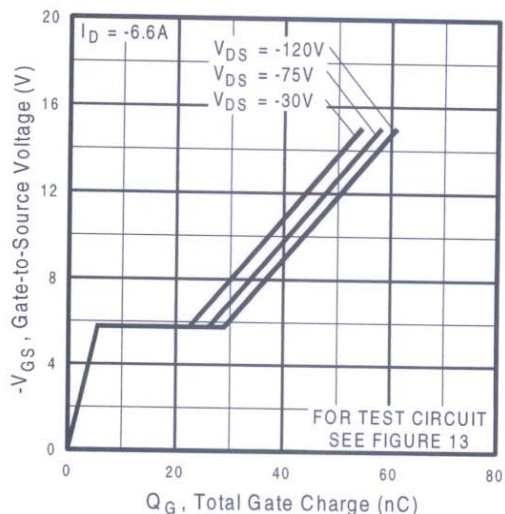
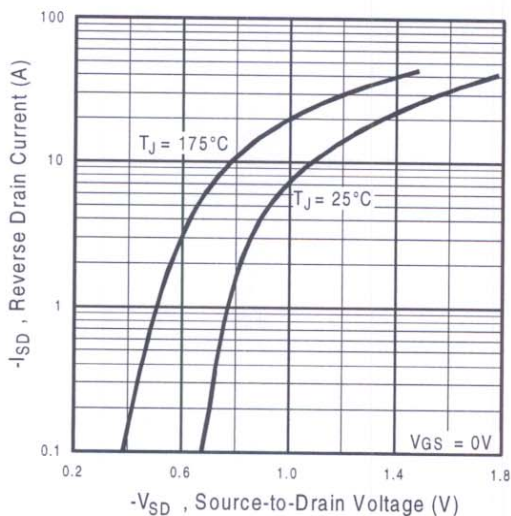
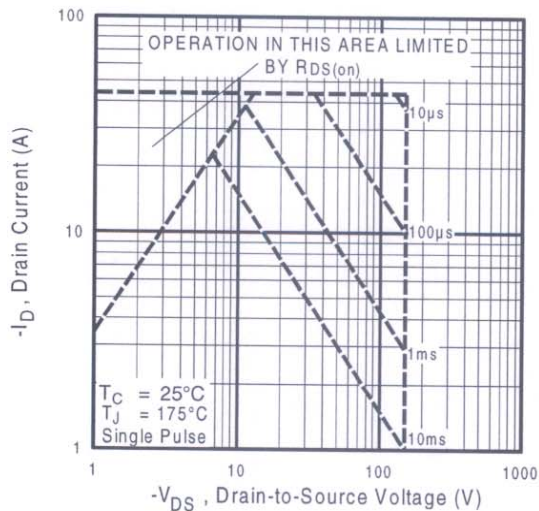
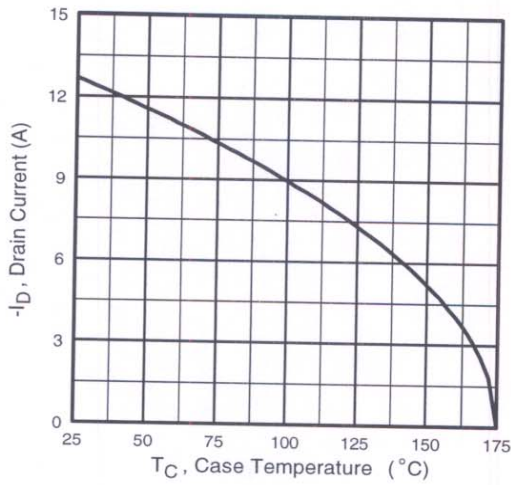
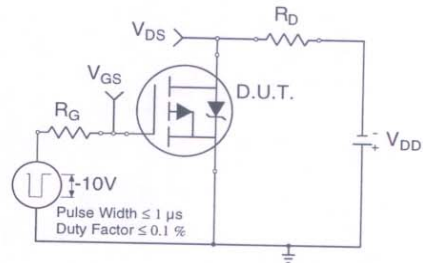


Fig 4. Normalized On-Resistance Vs. Temperature

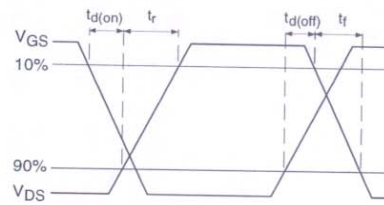

**Fig 5.** Typical Capacitance Vs. Drain-to-Source Voltage

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

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

**Fig 8.** Maximum Safe Operating Area



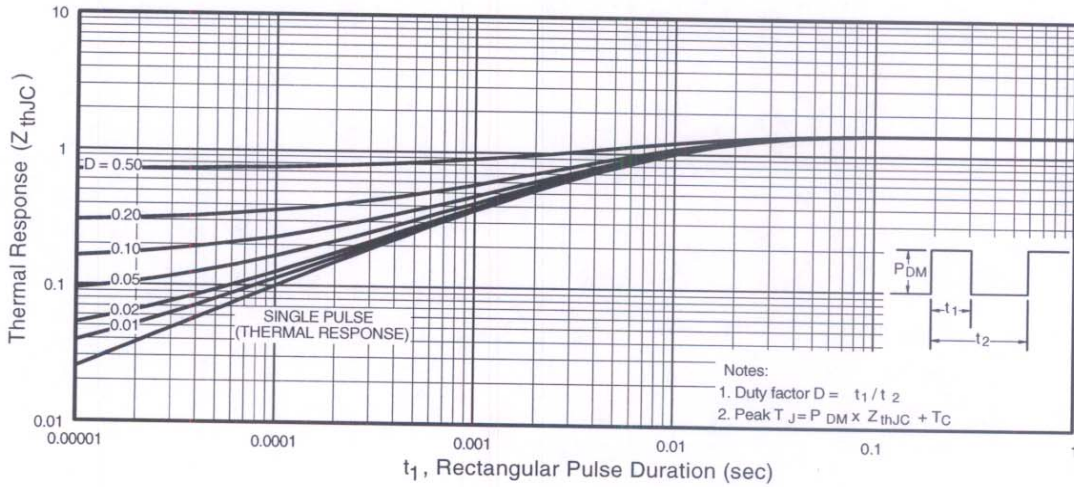
**Fig 9.** Maximum Drain Current Vs. Case Temperature



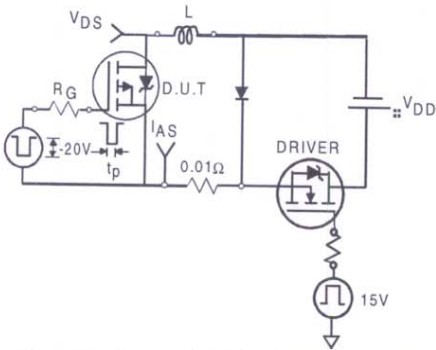
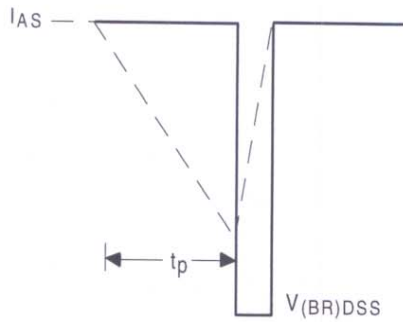
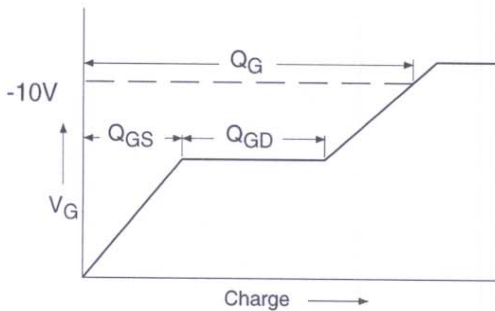
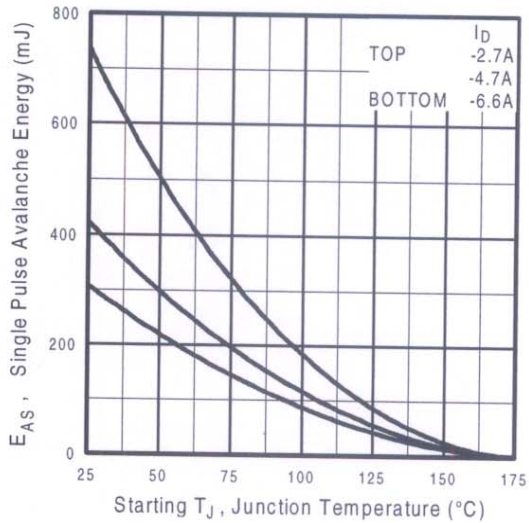
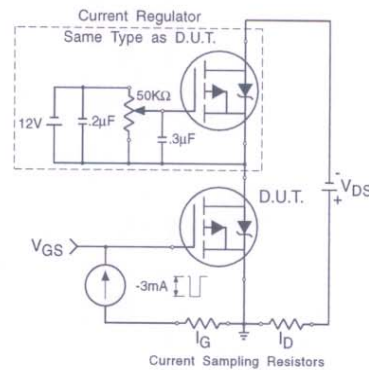
**Fig 10a.** Switching Time Test Circuit



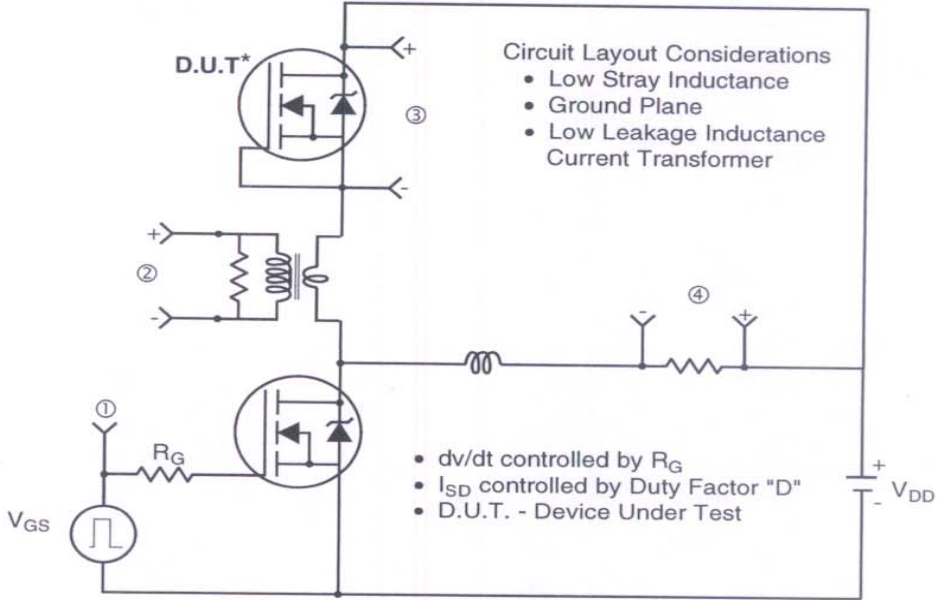
**Fig 10b.** Switching Time Waveforms



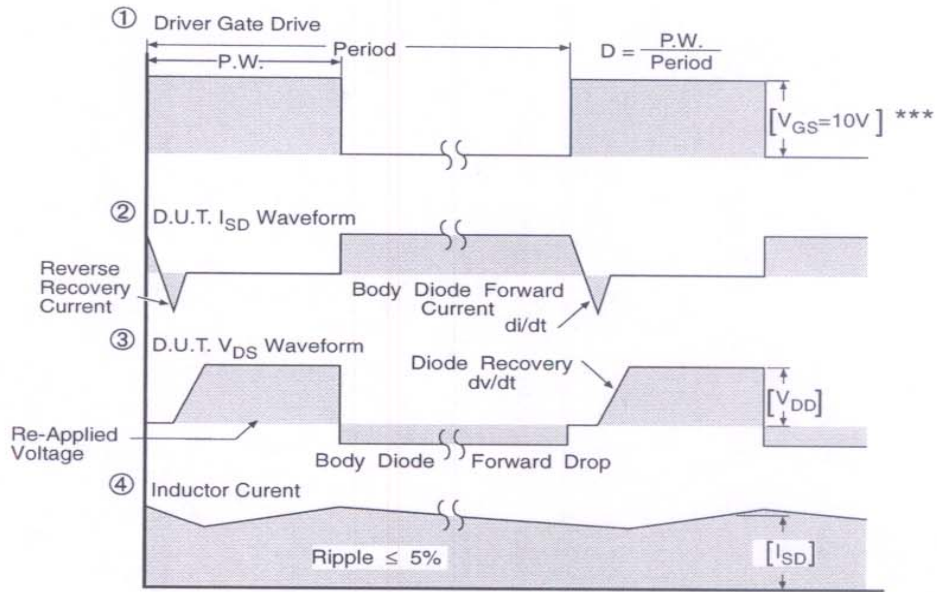
**Fig 11.** Maximum Effective Transient Thermal Impedance, Junction-to-Case


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

**Fig 12b. Unclamped Inductive Waveforms**

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

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

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

**Peak Diode Recovery dv/dt Test Circuit**



\* Reverse Polarity of D.U.T. for P-Channel



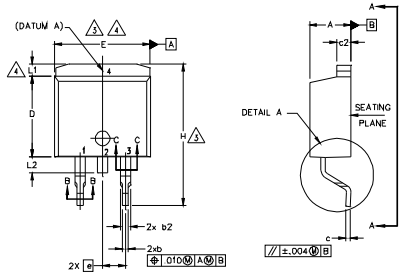
\*\*\*  $V_{GS} = 5.0V$  for Logic Level and 3V Drive Devices

**Fig 14. For P-Channel HEXFETS**



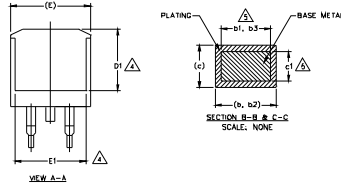
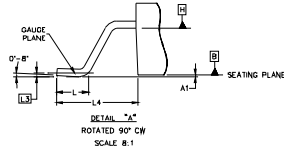
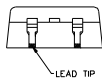
## D<sup>2</sup>Pak Package Outline

(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	1.27	1.78	-	.070	
L3	0.25 BSC		.010 BSC		
L4	4.78	5.28	.188	.208	

LEAD ASSIGNMENTS

HEXFET

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

IGBTs, CoPACK

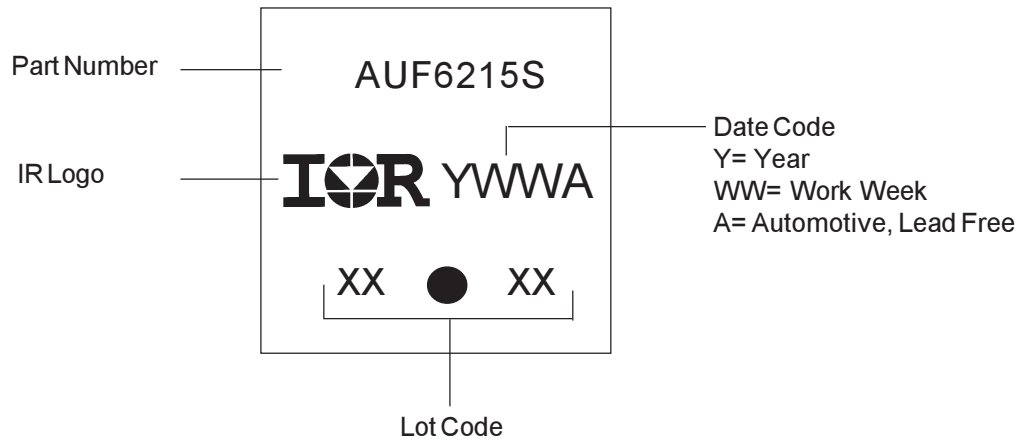
- 1.- GATE
- 2, 4.- COLLECTOR
- 3.- EMITTER

DIODES

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

\* PART DEPENDENT.

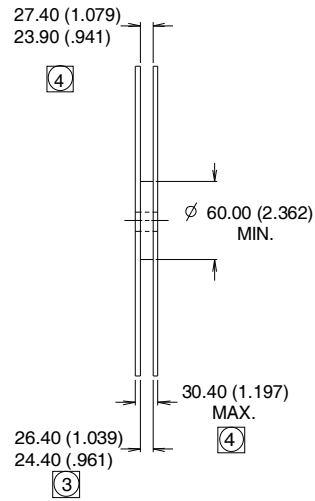
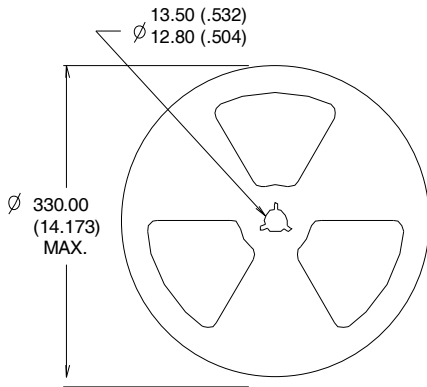
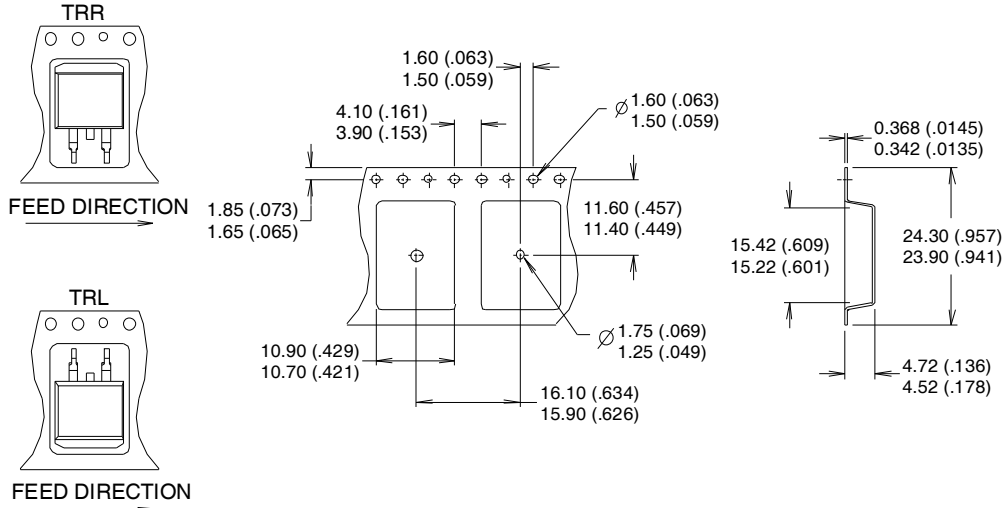
## D<sup>2</sup>Pak Part Marking Information



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

## D<sup>2</sup>Pak 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/>

**Ordering Information**

Base part number	Package Type	Standard Pack		Complete Part Number
		Form	Quantity	
AUIRF6215STRL	D2Pak	Tube	50	AUIRF6215S
		Tape and Reel Left	800	AUIRF6215STRL
		Tape and Reel Right	800	AUIRF6215STRR

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<http://www.irf.com/technical-info/>

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