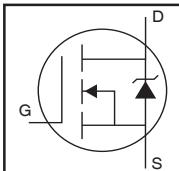


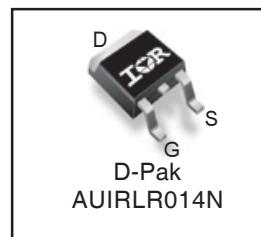
# AUIRLR014N

- Advanced Planar Technology
- Logic-Level Gate Drive
- Low On-Resistance
- 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\*



HEXFET® Power MOSFET

$V_{(BR)DSS}$	<b>55V</b>
$R_{DS(on)}$ max.	<b>0.14Ω</b>
$I_D$	<b>10A</b>



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

## 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.

## 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, $V_{GS}$ @ 10V	10	A
$I_D$ @ $T_C = 100^\circ\text{C}$	Continuous Drain Current, $V_{GS}$ @ 10V	7.1	
$I_{DM}$	Pulsed Drain Current ①	40	
$P_D$ @ $T_C = 25^\circ\text{C}$	Power Dissipation	28	W
	Linear Derating Factor	0.2	W/°C
$V_{GS}$	Gate-to-Source Voltage	± 16	V
$E_{AS}$	Single Pulse Avalanche Energy (Thermally Limited) ②	35	mJ
$I_{AR}$	Avalanche Current ①	6.0	A
$E_{AR}$	Repetitive Avalanche Energy ①	2.8	mJ
$dv/dt$	Peak Diode Recovery ③	5.0	V/ns
$T_J$	Operating Junction and	-55 to + 175	
$T_{STG}$	Storage Temperature Range	°C	
	Soldering Temperature, for 10 seconds (1.6mm from case )	300	

## Thermal Resistance

	Parameter	Typ.	Max.	Units
$R_{0JC}$	Junction-to-Case ④	—	5.3	°C/W
$R_{0JA}$	Junction-to-Ambient (PCB mount) ⑥	—	50	
$R_{0JA}$	Junction-to-Ambient	—	110	

HEXFET® is a registered trademark of International Rectifier.

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

Static Electrical Characteristics @  $T_J = 25^\circ\text{C}$  (unless otherwise specified)

	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(\text{BR})\text{DSS}}$	Drain-to-Source Breakdown Voltage	55	—	—	V	$V_{\text{GS}} = 0\text{V}$ , $I_D = 250\mu\text{A}$
$\Delta V_{(\text{BR})\text{DSS}/\Delta T_J}$	Breakdown Voltage Temp. Coefficient	—	0.056	—	V/ $^\circ\text{C}$	Reference to $25^\circ\text{C}$ , $I_D = 1\text{mA}$
$R_{\text{DS}(\text{on})}$	Static Drain-to-Source On-Resistance	—	—	0.14		$V_{\text{GS}} = 10\text{V}$ , $I_D = 6.0\text{A}$ ④
		—	—	0.21	$\Omega$	$V_{\text{GS}} = 4.5\text{V}$ , $I_D = 5.0\text{A}$ ④
$V_{\text{GS}(\text{th})}$	Gate Threshold Voltage	1.0	—	3.0	V	$V_{\text{DS}} = V_{\text{GS}}$ , $I_D = 250\mu\text{A}$
$g_{\text{fs}}$	Forward Transconductance	3.1	—	—	S	$V_{\text{DS}} = 25\text{V}$ , $I_D = 6.0\text{A}$
$I_{\text{DSS}}$	Drain-to-Source Leakage Current	—	—	25	$\mu\text{A}$	$V_{\text{DS}} = 55\text{V}$ , $V_{\text{GS}} = 0\text{V}$
		—	—	250		$V_{\text{DS}} = 55\text{V}$ , $V_{\text{GS}} = 0\text{V}$ , $T_J = 150^\circ\text{C}$
$I_{\text{GSS}}$	Gate-to-Source Forward Leakage	—	—	100	nA	$V_{\text{GS}} = 16\text{V}$
	Gate-to-Source Reverse Leakage	—	—	-100		$V_{\text{GS}} = -16\text{V}$

Dynamic Electrical Characteristics @  $T_J = 25^\circ\text{C}$  (unless otherwise specified)

	Parameter	Min.	Typ.	Max.	Units	Conditions
$Q_g$	Total Gate Charge	—	—	7.9	nC	$I_D = 6.0\text{A}$
$Q_{\text{gs}}$	Gate-to-Source Charge	—	—	1.4		$V_{\text{DS}} = 44\text{V}$
$Q_{\text{gd}}$	Gate-to-Drain ("Miller") Charge	—	—	4.4		$V_{\text{GS}} = 5.0\text{V}$ , See Fig. 6 & 13 ④
$t_{\text{d}(\text{on})}$	Turn-On Delay Time	—	6.5	—	ns	$V_{\text{DD}} = 28\text{V}$
$t_r$	Rise Time	—	47	—		$I_D = 6.0\text{A}$
$t_{\text{d}(\text{off})}$	Turn-Off Delay Time	—	12	—		$R_G = 6.2\Omega$ , $V_{\text{GS}} = 5.0\text{V}$
$t_f$	Fall Time	—	23	—		$R_D = 4.5\Omega$ , See Fig. 10 ④
$L_D$	Internal Drain Inductance	—	4.5	—	nH	Between lead, 6mm (0.25in.) from package and center of die contact
$L_S$	Internal Source Inductance	—	7.5	—		
$C_{\text{iss}}$	Input Capacitance	—	265	—		$V_{\text{GS}} = 0\text{V}$
$C_{\text{oss}}$	Output Capacitance	—	80	—	pF	$V_{\text{DS}} = 25\text{V}$
$C_{\text{rss}}$	Reverse Transfer Capacitance	—	38	—		$f = 1.0\text{MHz}$ , See Fig. 5

## Diode Characteristics

	Parameter	Min.	Typ.	Max.	Units	Conditions
$I_S$	Continuous Source Current (Body Diode)	—	—	10	A	MOSFET symbol showing the integral reverse p-n junction diode.
$I_{\text{SM}}$	Pulsed Source Current (Body Diode) ①	—	—	40		
$V_{\text{SD}}$	Diode Forward Voltage	—	—	1.3	V	$T_J = 25^\circ\text{C}$ , $I_S = 6.0\text{A}$ , $V_{\text{GS}} = 0\text{V}$ ④
$t_{\text{rr}}$	Reverse Recovery Time	—	37	56	ns	$T_J = 25^\circ\text{C}$ , $I_F = 6.0\text{A}$
$Q_{\text{rr}}$	Reverse Recovery Charge	—	48	71	nC	$\text{di}/\text{dt} = 100\text{A}/\mu\text{s}$ ④
$t_{\text{on}}$	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. ( See fig. 11 )
- ② Starting  $T_J = 25^\circ\text{C}$ ,  $L = 1.96\text{mH}$
- $R_G = 25\Omega$ ,  $I_{AS} = 6\text{A}$ . (See Figure 12)
- ③  $I_{SD} \leq 6.0\text{A}$ ,  $\text{di}/\text{dt} \leq 210\text{A}/\mu\text{s}$ ,  $V_{\text{DD}} \leq V_{(\text{BR})\text{DSS}}$ ,  $T_J \leq 175^\circ\text{C}$ .
- ④ Pulse width  $\leq 300\mu\text{s}$ ; duty cycle  $\leq 2\%$ .
- ⑤ This is applied for I-PAK,  $L_S$  of D-PAK is measured between lead and center of die contact.
- ⑥ When mounted on 1" square PCB (FR-4 or G-10 Material). For recommended footprint and soldering techniques refer to application note #AN-994.

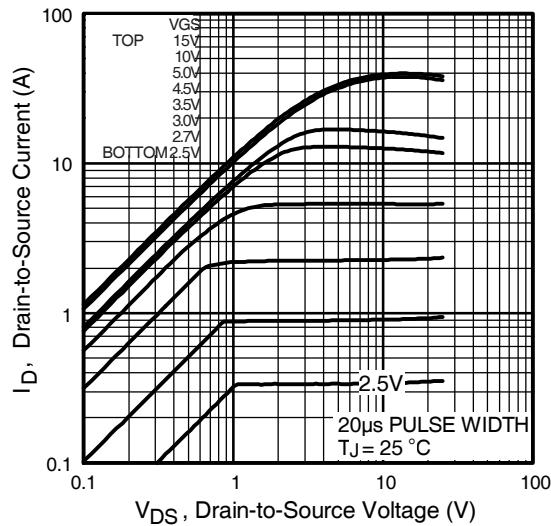
**Qualification Information<sup>†</sup>**

<b>Qualification Level</b>		Automotive (per AEC-Q101) <sup>††</sup>	
		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-PAK	MSL1
<b>ESD</b>	Machine Model	Class M1B (+/- 75V) <sup>†††</sup> AEC-Q101-002	
	Human Body Model	Class H1A (+/- 300V) <sup>†††</sup> AEC-Q101-001	
	Charged Device Model	Class C5 (+/- 2000V) <sup>†††</sup> AEC-Q101-005	
<b>RoHS Compliant</b>		Yes	

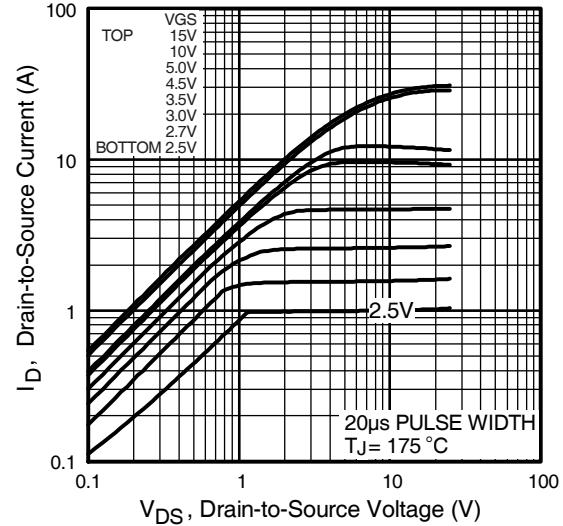
<sup>†</sup> Qualification standards can be found at International Rectifier's web site: <http://www.irf.com/>

<sup>††</sup> Exceptions (if any) to AEC-Q101 requirements are noted in the qualification report.

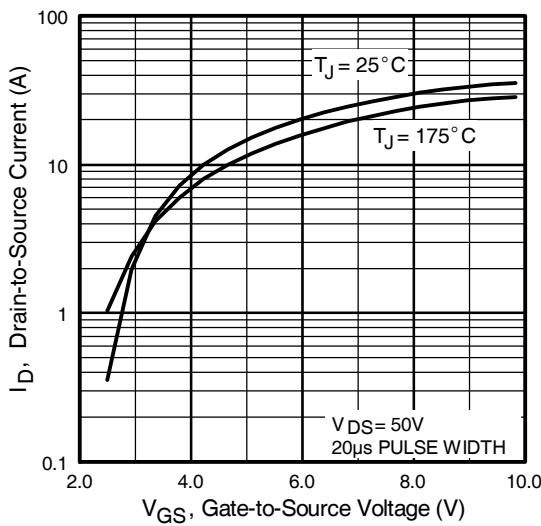
<sup>†††</sup> Highest passing voltage.



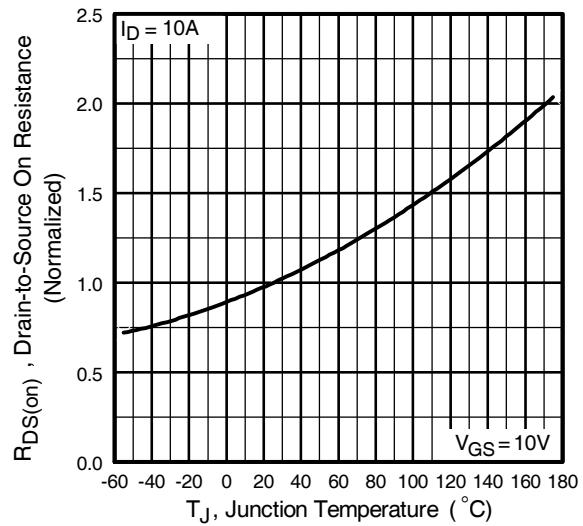
**Fig 1.** Typical Output Characteristics



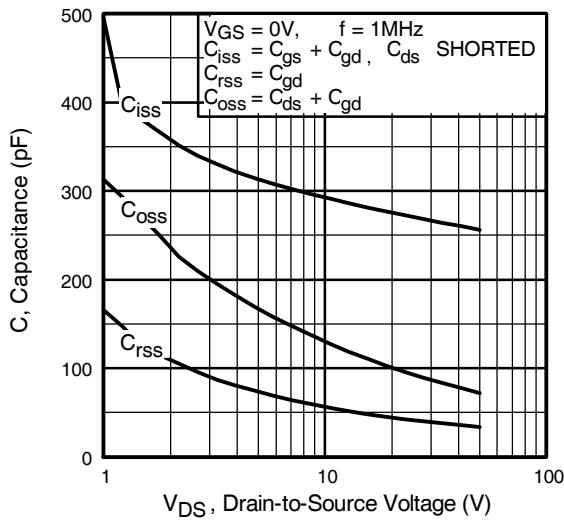
**Fig 2.** Typical Output Characteristics



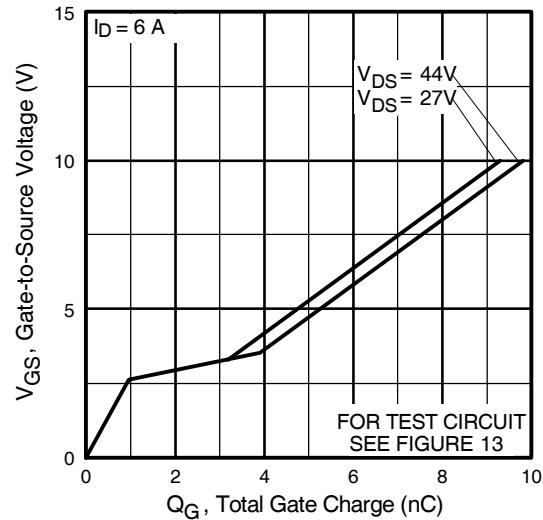
**Fig 3.** Typical Transfer Characteristics



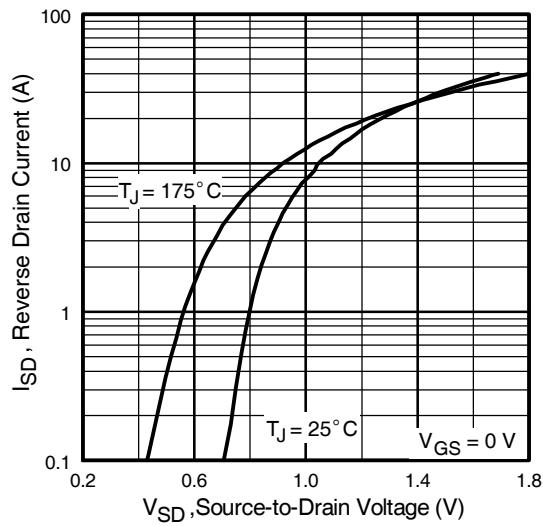
**Fig 4.** Normalized On-Resistance  
Vs. Temperature



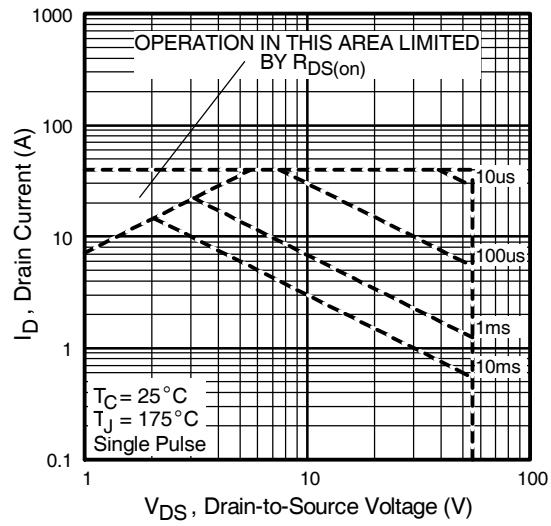
**Fig 5.** Typical Capacitance Vs.  
Drain-to-Source Voltage



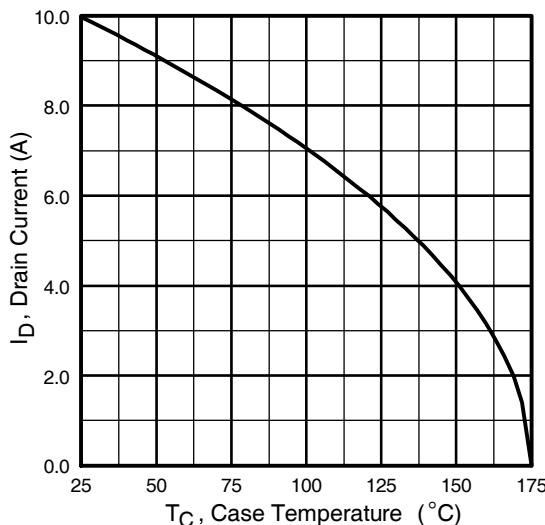
**Fig 6.** Typical Gate Charge Vs.  
Gate-to-Source Voltage



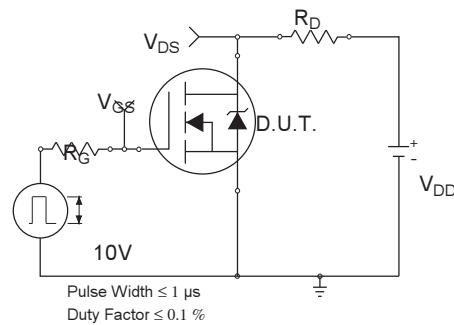
**Fig 7.** Typical Source-Drain Diode  
Forward Voltage



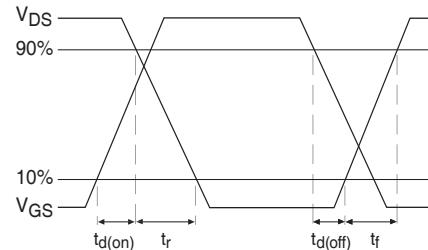
**Fig 8.** Maximum Safe Operating Area



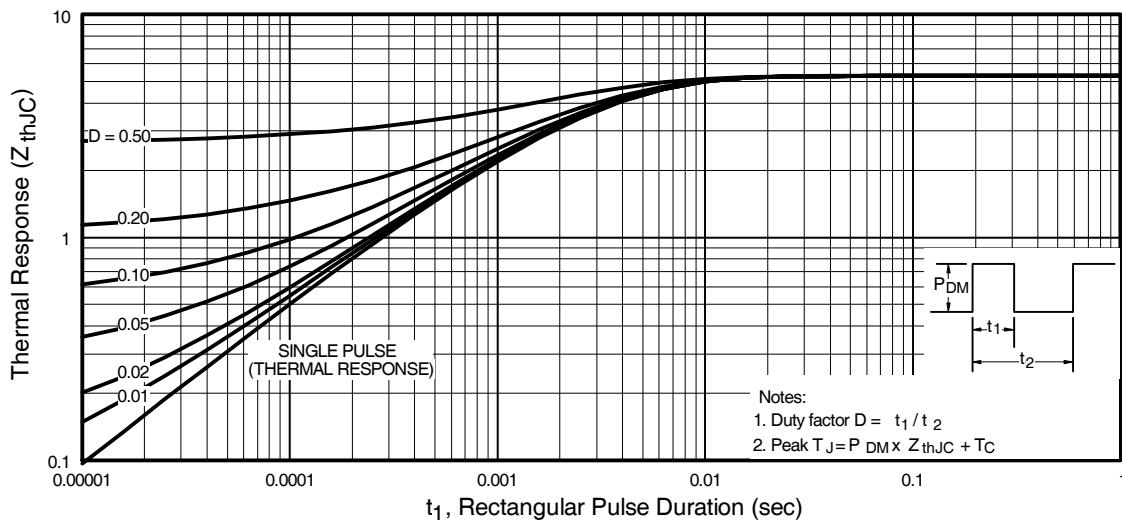
**Fig 9.** Maximum Drain Current Vs.  
Case Temperature



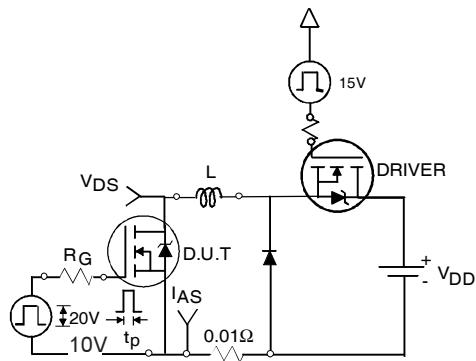
**Fig 10a.** Switching Time Test Circuit



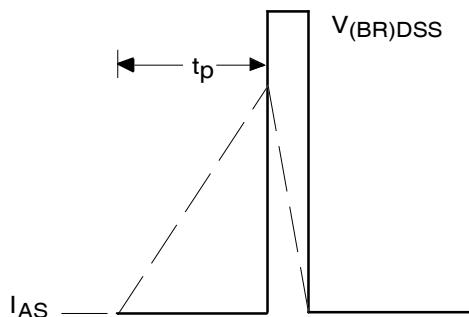
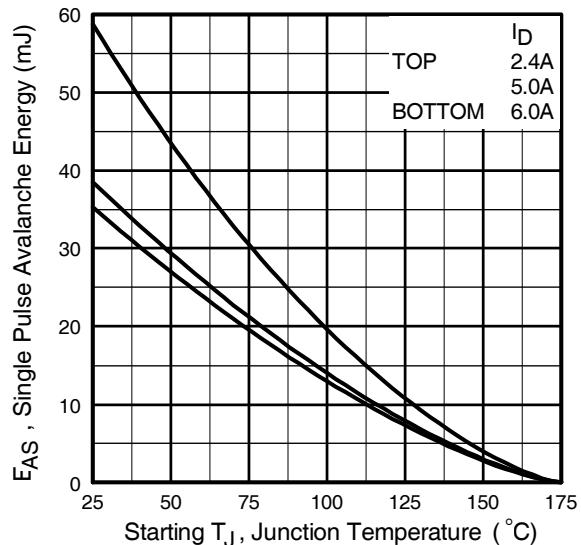
**Fig 10b.** Switching Time Waveforms



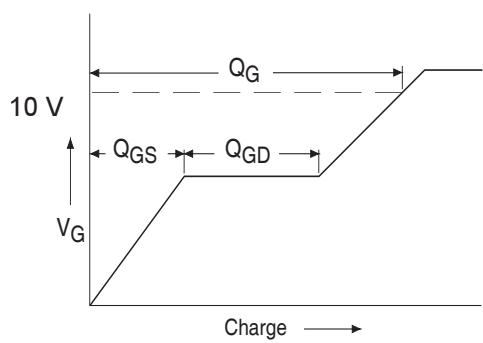
**Fig 11.** Maximum Effective Transient Thermal Impedance, Junction-to-Case



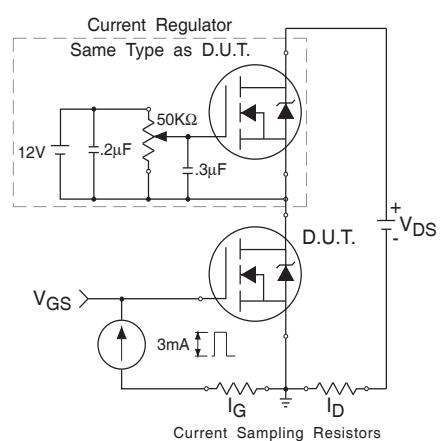
**Fig 12a.** Unclamped Inductive Test Circuit



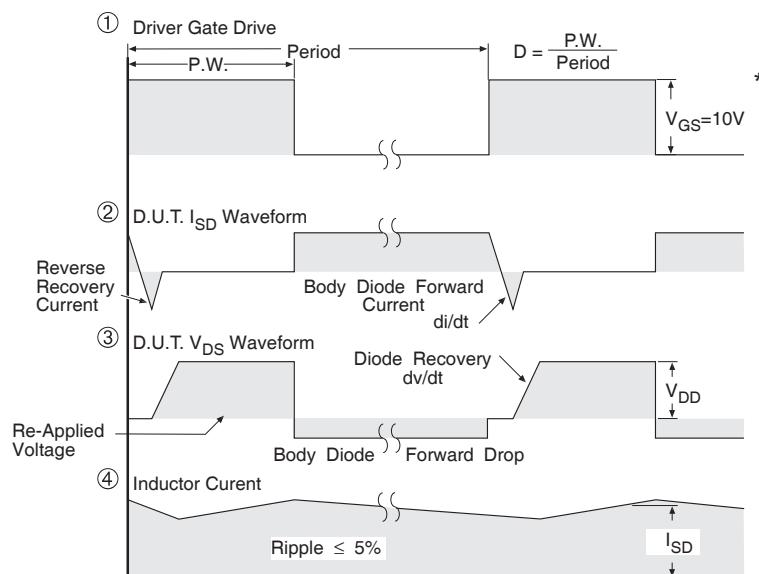
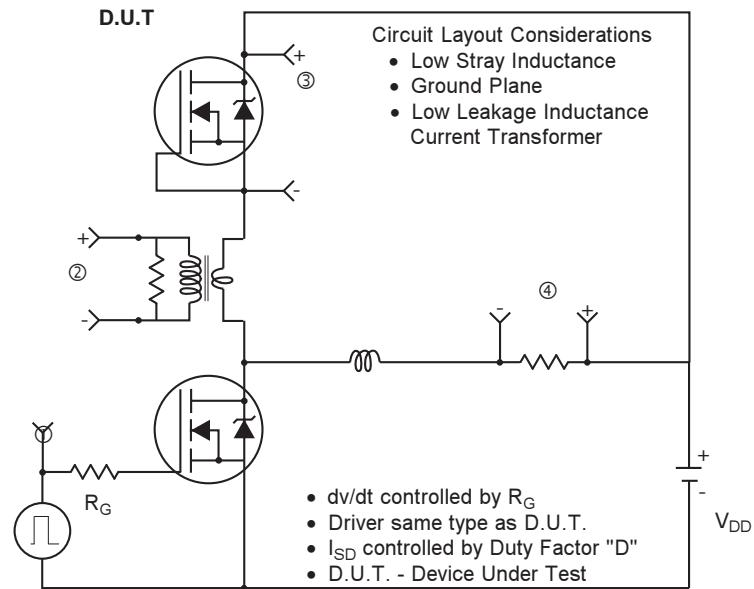
**Fig 12b.** Unclamped Inductive Waveforms



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



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

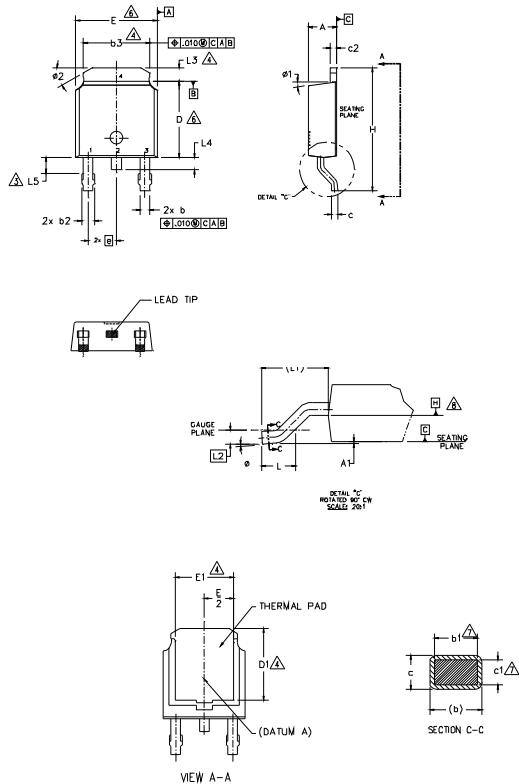
Peak Diode Recovery  $dv/dt$  Test Circuit

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

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

## D-Pak (TO-252AA) Package Outline

Dimensions are shown in millimeters (inches)



NOTES

- 1.- DIMENSIONING AND TOLERANCING PER ASME Y14.5M-1994
- 2.- DIMENSION ARE SHOWN IN INCHES [MILLIMETERS]
- 3.- LEAD DIMENSION UNCONTROLLED IN L5.
- 4.- DIMENSION D1, E1, L3 & b3 ESTABLISH A MINIMUM MOUNTING SURFACE FOR THERMAL PAD.
- 5.- SECTION C-C DIMENSIONS APPLY TO THE FLAT SECTION OF THE LEAD BETWEEN .005 AND 0.10 [0.13 AND 0.25] FROM THE LEAD TIP.
- 6.- DIMENSION D & E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED .005 [.013] PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTMOST EXTREMES OF THE PLASTIC BODY.
- 7.- DIMENSION b1 & c1 APPLIED TO BASE METAL ONLY.
- 8.- DATUM A & B TO BE DETERMINED AT DATUM PLANE H.
- 9.- OUTLINE CONFORMS TO JEDEC OUTLINE TO-252AA.

S Y M B O L	DIMENSIONS				N O T E S
	MILLIMETERS		INCHES		
	MIN.	MAX.	MIN.	MAX.	
A	2.18	2.39	.086	.094	
A1	—	0.13	—	.005	
b	0.64	0.89	.025	.035	
b1	0.65	0.79	.025	.031	7
b2	0.76	1.14	.030	.045	
b3	4.95	5.46	.195	.215	4
c	0.46	0.61	.018	.024	
c1	0.41	0.56	.016	.022	7
c2	0.46	0.89	.018	.035	
D	5.97	6.22	.235	.245	6
D1	5.21	—	.205	—	4
E	6.35	6.73	.250	.265	6
E1	4.32	—	.170	—	4
e	2.29 BSC	—	.090 BSC	—	
H	9.40	10.41	.370	.410	
L	1.40	1.78	.055	.070	
L1	2.74 BSC	—	.108 REF.	—	
L2	0.51 BSC	—	.020 BSC	—	
L3	0.89	1.27	.035	.050	4
L4	—	1.02	—	.040	
L5	1.14	1.52	.045	.060	3
ø	0°	10°	0°	10°	
ø1	0°	15°	0°	15°	
ø2	25°	35°	25°	35°	

LEAD ASSIGNMENTS

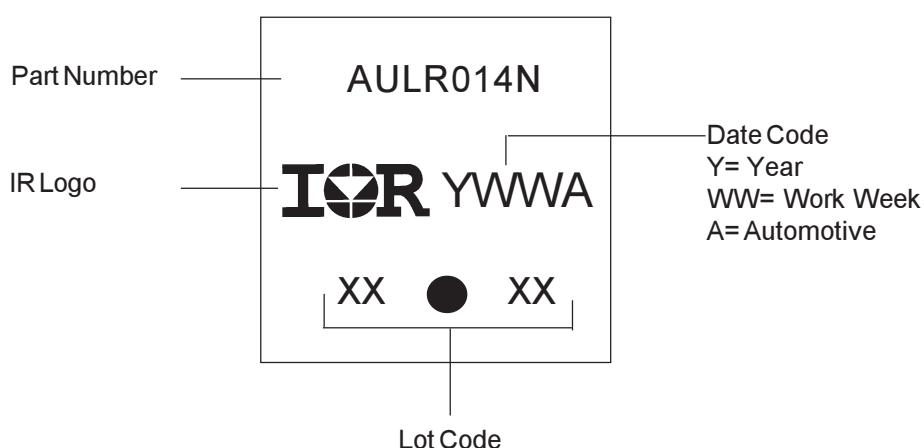
HEXFET

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

IGBT & CoPAK

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

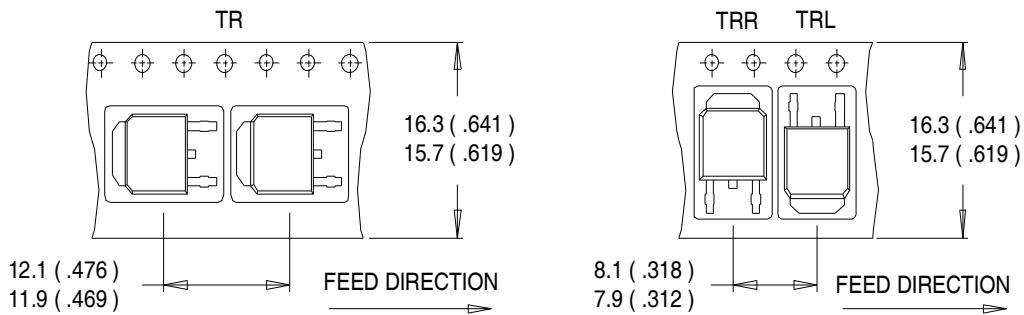
## D-Pak Part Marking Information



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

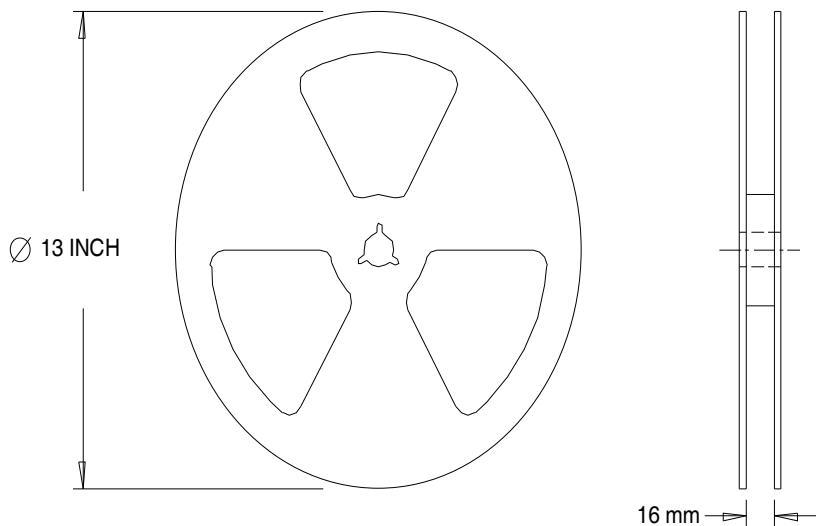
## D-Pak (TO-252AA) Tape & Reel Information

Dimensions are shown in millimeters (inches)



NOTES :

1. CONTROLLING DIMENSION : MILLIMETER.
2. ALL DIMENSIONS ARE SHOWN IN MILLIMETERS ( INCHES ).
3. OUTLINE CONFORMS TO EIA-481 & EIA-541.



NOTES :

1. OUTLINE CONFORMS TO EIA-481.

**Ordering Information**

<b>Base part number</b>	<b>Package Type</b>	<b>Standard Pack</b>		<b>Complete Part Number</b>
		<b>Form</b>	<b>Quantity</b>	
AUIRLR014N	Dpak	Tube	75	AUIRLR014N
		Tape and Reel	2000	AUIRLR014NTR
		Tape and Reel Left	3000	AUIRLR014NTRL
		Tape and Reel Right	3000	AUIRLR014NTRR

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

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