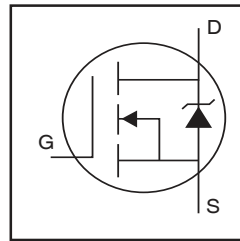


# AUIRF1324WL

## WIDELEAD HEXFET® Power MOSFET

### Features

- Advanced Process Technology
- Ultra Low On-Resistance
- 50% Lower Lead Resistance
- 175°C Operating Temperature
- Fast Switching
- Repetitive Avalanche Allowed up to  $T_{jmax}$
- Lead-Free, RoHS Compliant
- Automotive Qualified \*



$V_{(BR)DSS}$		<b>24V</b>
$R_{DS(on)}$	typ.	<b>1.16mΩ</b>
	max.	<b>1.30mΩ</b>
$I_D$ (Silicon Limited)		<b>382A</b> ①
$I_D$ (Package Limited)		<b>240A</b>

### Description

Specifically design for automotive applications this Widelead TO-262 package part has the advantage of having over 50% lower lead resistance and delivering over 20% lower  $R_{ds(on)}$  when compared with a traditional TO-262 package housing the same silicon die. This greatly helps in reducing condition losses, achieving higher current levels or enabling a system to run cooler and have improved efficiency. Additional features of this design are a 175°C junction operating temperature, fast switching speed and improved repetitive avalanche rating. These features combine to make this design an extremely efficient and reliable device for use in Automotive and other applications.



<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
$I_D @ T_C = 25^\circ C$	Continuous Drain Current, $V_{GS} @ 10V$ (Silicon Limited)	382①	A
$I_D @ T_C = 100^\circ C$	Continuous Drain Current, $V_{GS} @ 10V$ (Silicon Limited)	270①	
$I_D @ T_C = 25^\circ C$	Continuous Drain Current, $V_{GS} @ 10V$ (Package Limited)	240	
$I_{DM}$	Pulsed Drain Current ②	1530	
$P_D @ T_C = 25^\circ C$	Maximum Power Dissipation	300	W
	Linear Derating Factor	2.0	W/°C
$V_{GS}$	Gate-to-Source Voltage	± 20	V
$E_{AS}$ (Thermally limited)	Single Pulse Avalanche Energy ③	530	mJ
$I_{AR}$	Avalanche Current ②	See Fig. 14, 15, 22a, 22b,	A
$E_{AR}$	Repetitive Avalanche Energy ②		mJ
dv/dt	Peak Diode Recovery ④	1.3	V/ns
$T_J$ $T_{STG}$	Operating Junction and Storage Temperature Range	-55 to + 175	°C
	Soldering Temperature, for 10 seconds	300 (1.6mm from case)	

### Thermal Resistance

	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case ⑧	—	0.50	°C/W

HEXFET® is a registered trademark of International Rectifier.

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

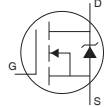
**Static Electrical Characteristics @ T<sub>J</sub> = 25°C (unless otherwise specified)**

	Parameter	Min.	Typ.	Max.	Units	Conditions
V <sub>(BR)DSS</sub>	Drain-to-Source Breakdown Voltage	24	—	—	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> = 5mA ⑤
R <sub>DS(on)</sub>	Static Drain-to-Source On-Resistance	—	1.16	1.30	mΩ	V <sub>GS</sub> = 10V, I <sub>D</sub> = 195A ⑤
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	210	—	—	S	V <sub>DS</sub> = 10V, I <sub>D</sub> = 195A
R <sub>G</sub>	Internal Gate Resistance	—	2.4	—	Ω	
I <sub>DSS</sub>	Drain-to-Source Leakage Current	—	—	20	μA	V <sub>DS</sub> = 24V, V <sub>GS</sub> = 0V
		—	—	250		V <sub>DS</sub> = 19V, 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> = 20V
	Gate-to-Source Reverse Leakage	—	—	-200		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	—	120	180	nC	I <sub>D</sub> = 195A
Q <sub>gs</sub>	Gate-to-Source Charge	—	58	—		V <sub>DS</sub> = 12V
Q <sub>gd</sub>	Gate-to-Drain ("Miller") Charge	—	36	—		V <sub>GS</sub> = 10V ⑤
Q <sub>sync</sub>	Total Gate Charge Sync. (Q <sub>g</sub> - Q <sub>gd</sub> )	—	84	—		I <sub>D</sub> = 195A, V <sub>DS</sub> = 0V, V <sub>GS</sub> = 10V ⑤
t <sub>d(on)</sub>	Turn-On Delay Time	—	18	—	ns	V <sub>DD</sub> = 16V
t <sub>r</sub>	Rise Time	—	200	—		I <sub>D</sub> = 195A
t <sub>d(off)</sub>	Turn-Off Delay Time	—	75	—		R <sub>G</sub> = 2.7Ω
t <sub>f</sub>	Fall Time	—	110	—		V <sub>GS</sub> = 10V ⑤
C <sub>iss</sub>	Input Capacitance	—	7630	—	pF	V <sub>GS</sub> = 0V
C <sub>oss</sub>	Output Capacitance	—	3390	—		V <sub>DS</sub> = 19V
C <sub>rss</sub>	Reverse Transfer Capacitance	—	1960	—		f = 1.0MHz, See Fig.5
C <sub>oss</sub> eff. (ER)	Effective Output Capacitance (Energy Related)	—	4660	—		V <sub>GS</sub> = 0V, V <sub>DS</sub> = 0V to 19V ⑦, See Fig.11
C <sub>oss</sub> eff. (TR)	Effective Output Capacitance (Time Related)	—	4685	—		V <sub>GS</sub> = 0V, V <sub>DS</sub> = 0V to 19V ⑥

**Diode Characteristics**

	Parameter	Min.	Typ.	Max.	Units	Conditions
I <sub>S</sub>	Continuous Source Current (Body Diode)	—	—	382①	A	MOSFET symbol showing the integral reverse p-n junction diode. 
I <sub>SM</sub>	Pulsed Source Current (Body Diode) ②	—	—	1530		
V <sub>SD</sub>	Diode Forward Voltage	—	—	1.3	V	T <sub>J</sub> = 25°C, I <sub>S</sub> = 195A, V <sub>GS</sub> = 0V ⑤
t <sub>rr</sub>	Reverse Recovery Time	—	46	69	ns	T <sub>J</sub> = 25°C V <sub>R</sub> = 20V,
		—	45	68		T <sub>J</sub> = 125°C I <sub>F</sub> = 195A
Q <sub>rr</sub>	Reverse Recovery Charge	—	395	593	nC	T <sub>J</sub> = 25°C di/dt = 100A/μs ⑤
		—	345	518		T <sub>J</sub> = 125°C
I <sub>RRM</sub>	Reverse Recovery Current	—	1.9	—	A	T <sub>J</sub> = 25°C
t <sub>on</sub>	Forward Turn-On Time	Intrinsic turn-on time is negligible (turn-on is dominated by LS+LD)				

**Notes:**

- ① Calculated continuous current based on maximum allowable junction temperature. Package limitation current is 240A. Note that current limitations arising from heating of the device leads may occur with some lead mounting arrangements. (Refer to AN-1140 <http://www.irf.com/technical-info/appnotes/an-1140.pdf>)
- ② Repetitive rating; pulse width limited by max. junction temperature.
- ③ Limited by T<sub>Jmax</sub>, starting T<sub>J</sub> = 25°C, L = 0.028mH  
R<sub>G</sub> = 50Ω, I<sub>AS</sub> = 195A, V<sub>GS</sub> = 10V. Part not recommended for use above this value.
- ④ I<sub>SD</sub> ≤ 195A, di/dt ≤ 600A/μs, V<sub>DD</sub> ≤ V<sub>(BR)DSS</sub>, T<sub>J</sub> ≤ 175°C.
- ⑤ Pulse width ≤ 400μs; duty cycle ≤ 2%.
- ⑥ C<sub>oss</sub> eff. (TR) 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>.
- ⑦ C<sub>oss</sub> eff. (ER) is a fixed capacitance that gives the same energy as C<sub>oss</sub> while V<sub>DS</sub> is rising from 0 to 80% V<sub>DSS</sub>.
- ⑧ 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) <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>		TO-262 WideLead	MSL1
<b>ESD</b>	Machine Model	Class M4 (+/- 425V) <sup>†††</sup> AEC-Q101-002	
	Human Body Model	Class H2 (+/- 4000V) <sup>†††</sup> AEC-Q101-001	
	Charged Device Model	Class C5 (+/- 1125V) <sup>†††</sup> AEC-Q101-005	
<b>RoHS Compliant</b>		Yes	

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

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

††† Highest passing voltage.

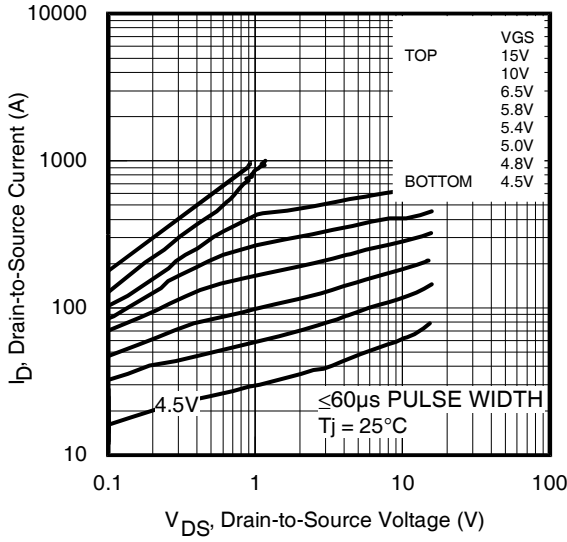


Fig 1. Typical Output Characteristics

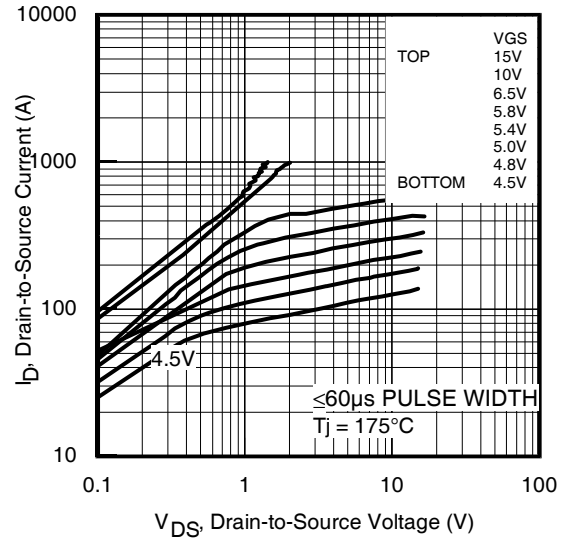


Fig 2. Typical Output Characteristics

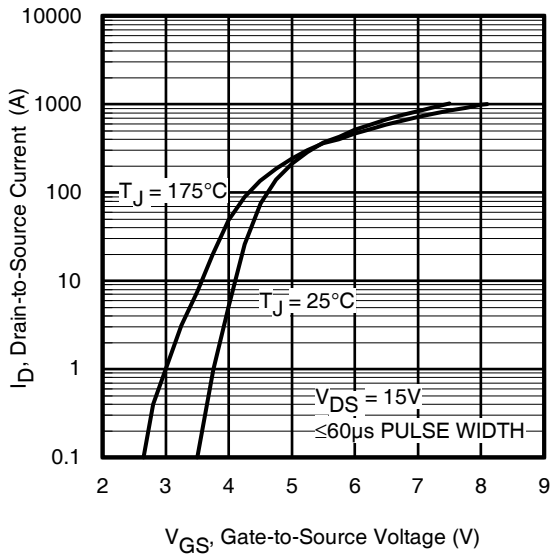


Fig 3. Typical Transfer Characteristics

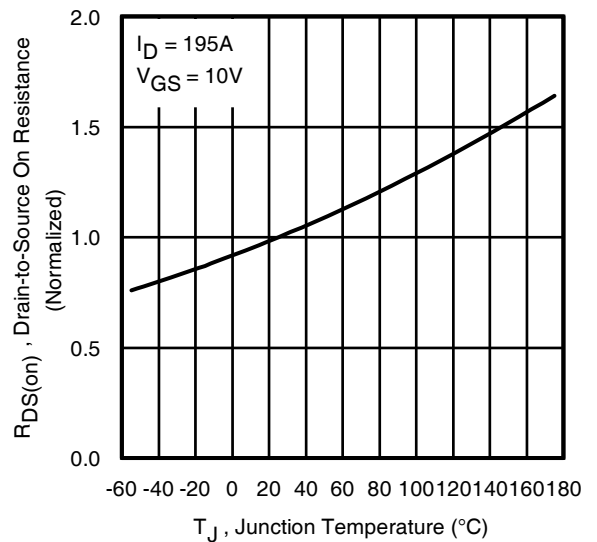


Fig 4. Normalized On-Resistance vs. Temperature

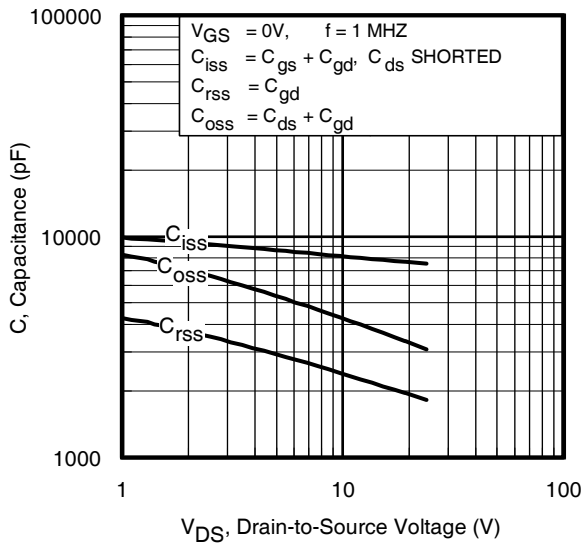


Fig 5. Typical Capacitance vs. Drain-to-Source Voltage

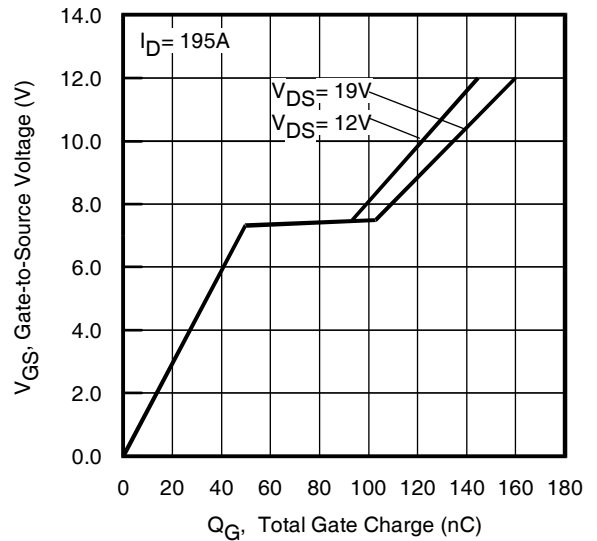
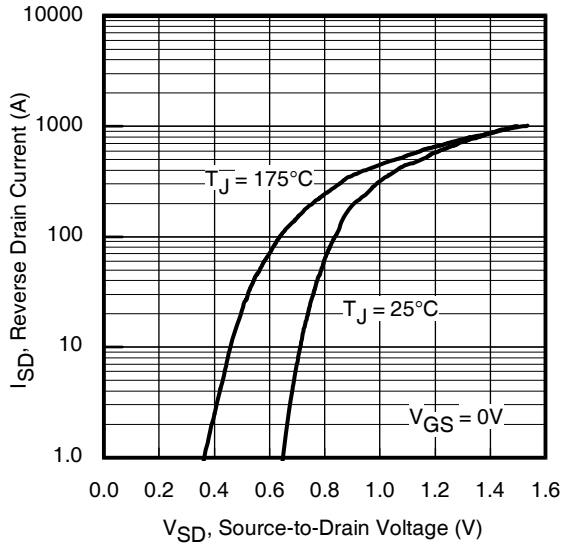
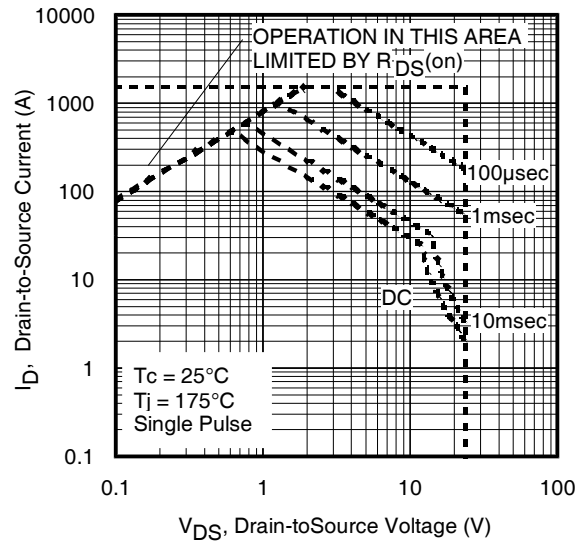


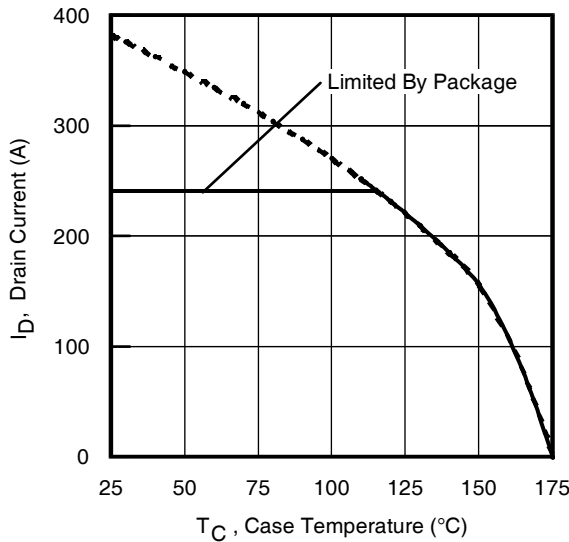
Fig 6. Typical Gate Charge vs. Gate-to-Source Voltage



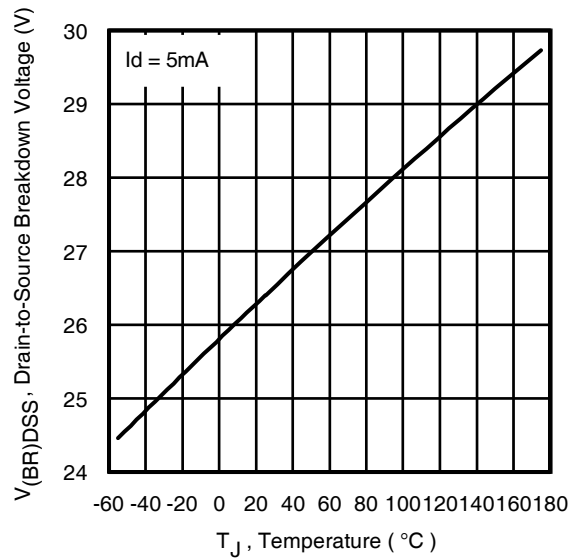
**Fig 7.** Typical Source-Drain Diode Forward Voltage



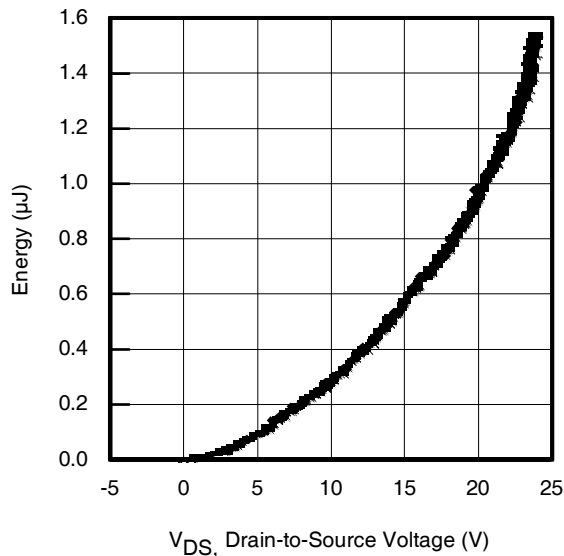
**Fig 8.** Maximum Safe Operating Area



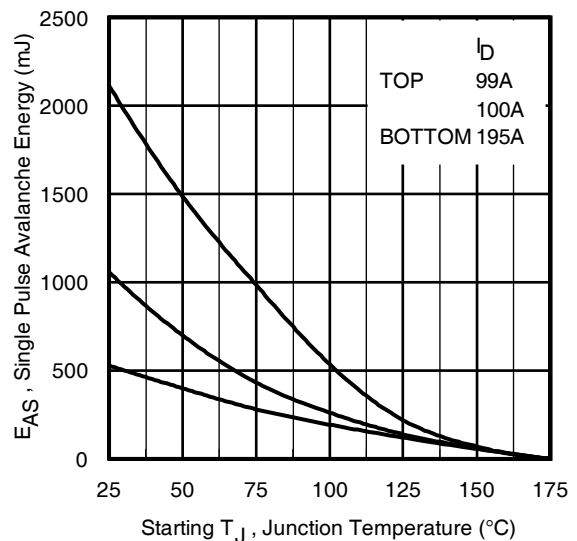
**Fig 9.** Maximum Drain Current vs. Case Temperature



**Fig 10.** Drain-to-Source Breakdown Voltage



**Fig 11.** Typical  $C_{OSS}$  Stored Energy



**Fig 12.** Maximum Avalanche Energy vs. Drain Current

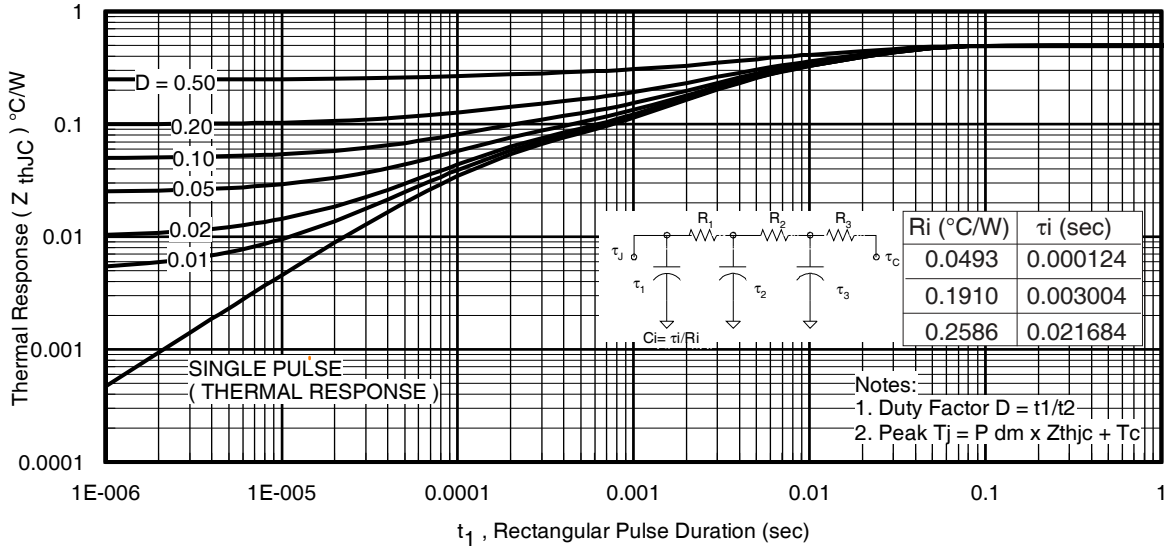


Fig 13. Maximum Effective Transient Thermal Impedance, Junction-to-Case

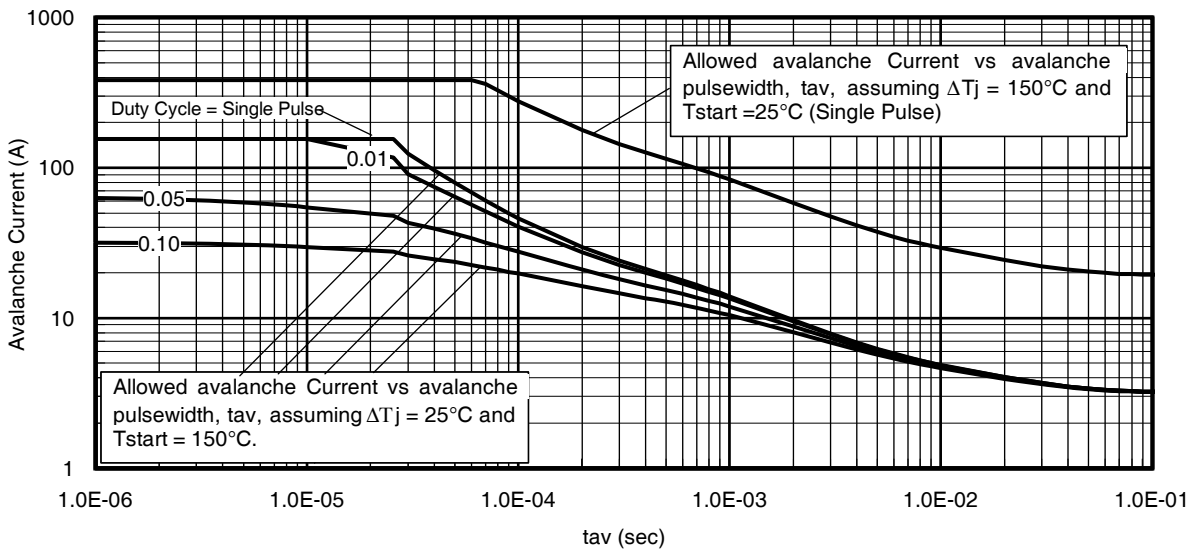
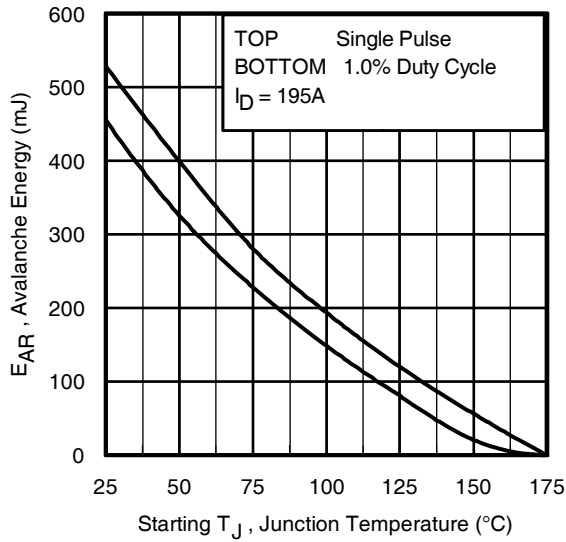


Fig 14. Typical Avalanche Current vs. Pulsewidth



**Notes on Repetitive Avalanche Curves , Figures 14, 15:  
(For further info, see AN-1005 at www.irf.com)**

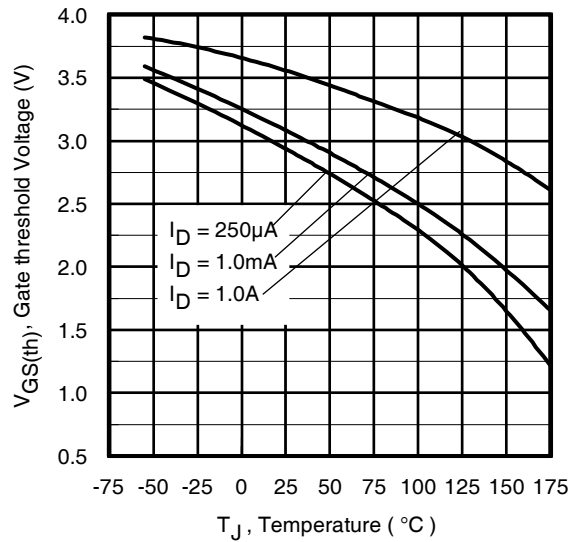
1. Avalanche failures assumption:  
Purely a thermal phenomenon and failure occurs at a temperature far in excess of  $T_{jmax}$ . This is validated for every part type.
2. Safe operation in Avalanche is allowed as long as  $T_{jmax}$  is not exceeded.
3. Equation below based on circuit and waveforms shown in Figure 22a, 22b.
4.  $P_{D(ave)}$  = Average power dissipation per single avalanche pulse.
5.  $BV$  = Rated breakdown voltage (1.3 factor accounts for voltage increase during avalanche).
6.  $I_{av}$  = Allowable avalanche current.
7.  $\Delta T$  = Allowable rise in junction temperature, not to exceed  $T_{jmax}$  (assumed as 25°C in Figure 14, 15).  
 $t_{av}$  = Average time in avalanche.  
 $D$  = Duty cycle in avalanche =  $t_{av} \cdot f$   
 $Z_{thJC}(D, t_{av})$  = Transient thermal resistance, see Figures 13)

$$P_{D(ave)} = 1/2 ( 1.3 \cdot BV \cdot I_{av} ) = \Delta T / Z_{thJC}$$

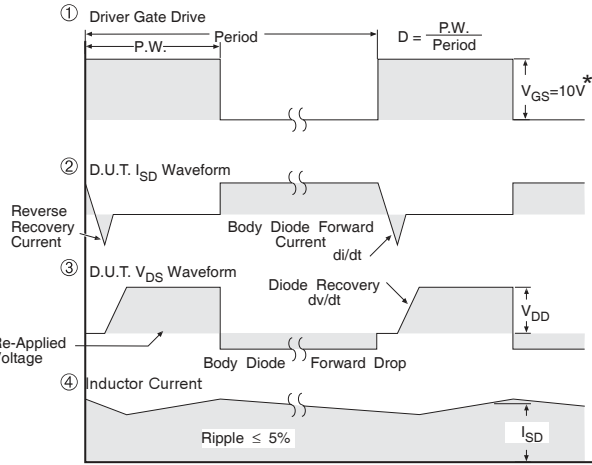
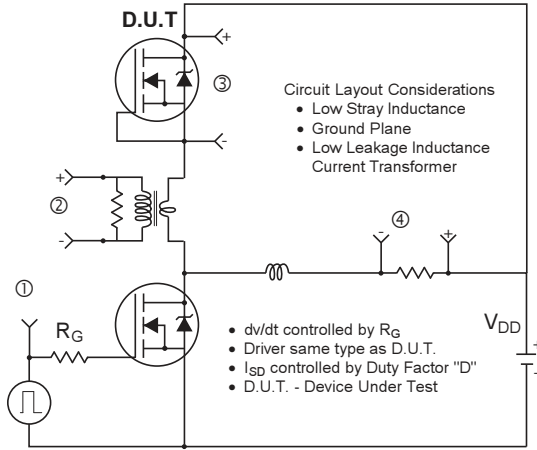
$$I_{av} = 2\Delta T / [1.3 \cdot BV \cdot Z_{th}]$$

$$E_{AS(AR)} = P_{D(ave)} \cdot t_{av}$$

**Fig 15.** Maximum Avalanche Energy vs. Temperature

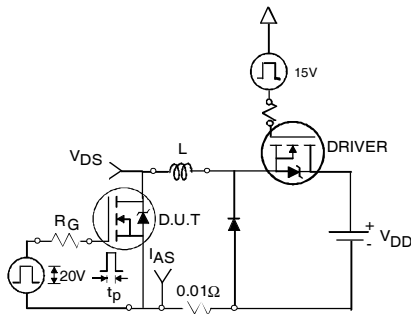


**Fig 16.** Threshold Voltage vs. Temperature

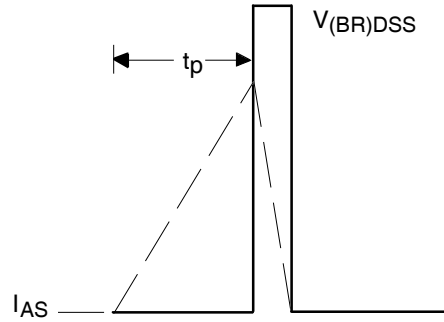


\*  $V_{GS} = 5V$  for Logic Level Devices

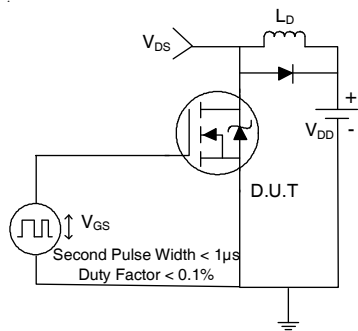
**Fig 21. Peak Diode Recovery dv/dt Test Circuit for N-Channel HEXFET® Power MOSFETs**



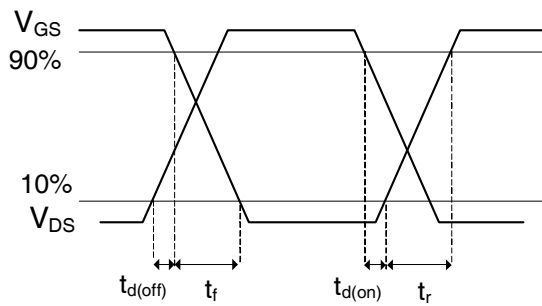
**Fig 22a. Unclamped Inductive Test Circuit**



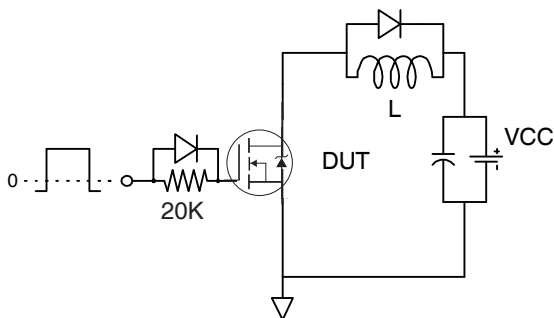
**Fig 22b. Unclamped Inductive Waveforms**



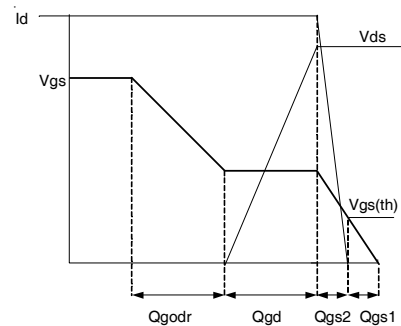
**Fig 23a. Switching Time Test Circuit**



**Fig 23b. Switching Time Waveforms**



**Fig 24a. Gate Charge Test Circuit**

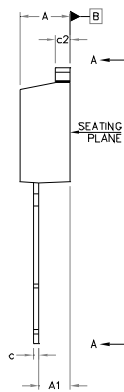
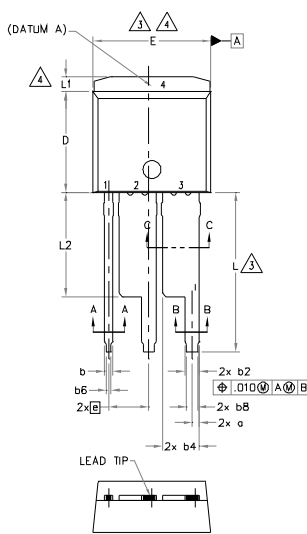


**Fig 24b. Gate Charge Waveform**



**TO-262 WideLead Package Outline**

Dimensions are shown in millimeters (inches)



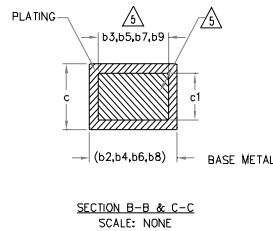
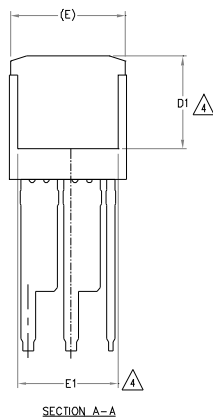
SYMBOL	DIMENSIONS				NOTES
	MILLIMETERS		INCHES		
	MIN.	MAX.	MIN.	MAX.	
A	4.06	4.83	.160	.190	5
A1	2.03	3.02	.080	.119	
a	0.20	0.51	.008	.020	5
b	0.51	0.91	.020	.036	
b1	0.51	0.81	.020	.032	5
b2	1.07	1.47	0.42	.058	
b3	1.07	1.37	.042	.054	5
b4	3.05	3.45	.120	.136	
b5	3.05	3.35	.120	.132	5
b6	0.25	0.61	.010	.024	
b7	0.25	0.51	.010	.020	5
b8	0.76	1.17	.030	.046	
b9	0.76	1.07	.030	.022	5
c	0.38	0.74	.015	.029	
c1	0.38	0.58	.015	.023	5
c2	1.14	1.65	.045	.065	
D	8.51	9.65	.335	.380	3
D1	6.86	7.42	.270	.292	
E	9.65	10.67	.380	.420	3,4
E1	6.22	8.48	.245	.334	
e	3.81 BSC		.150 BSC		4
L	13.46	14.10	.530	.555	
L1	-	1.65	-	.065	4
L2	8.64	9.40	.340	.370	

- 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. THERMAL PAD CONTOUR OPTIONAL WITHIN DIMENSION E, L1, D1 & E1.
  5. DIMENSION b3, b5, b7, b9 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.

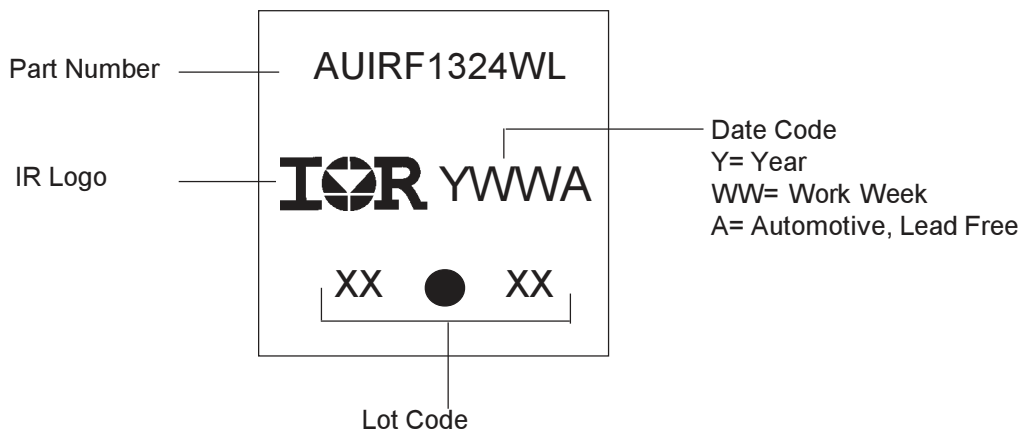
**LEAD ASSIGNMENTS**

**HEXFET**

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



**TO-262 WideLead Part Marking Information**



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

**Ordering Information**

Base part number	Package Type	Standard Pack		Complete Part Number
		Form	Quantity	
AUIRF1324WL	TO-262 WideLead	Tube	50	AUIRF1324WL

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IR warrants performance of its hardware products to the specifications applicable at the time of sale in accordance with IR's standard warranty. Testing and other quality control techniques are used to the extent IR deems necessary to support this warranty. Except where mandated by government requirements, testing of all parameters of each product is not necessarily performed.

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For technical support, please contact IR's Technical Assistance Center

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

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