PD - 96412

AUTOMOTIVE GRADE

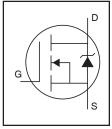


AUIRLS3114Z

HEXFET® Power MOSFET

Features

- Advanced Process Technology
- Ultra Low On-Resistance
- Enhanced dV/dT and dI/dT capability
- 175°C Operating Temperature
- Fast Switching
- Repetitive Avalanche Allowed up to Tjmax
- Lead-Free, RoHS Compliant
- Automotive Qualified *



V_{DSS}	40V
R _{DS(on)} typ.	$\mathbf{3.8m}\Omega$
max.	4.9m $Ω$
I _{D (Silicon Limited)}	122A①
I _{D (Wirebond Limited)}	56A



G	D	S
Gate	Drain	Source

Description

Specifically designed for Automotive applications, this HEXFET® Power MOSFET utilizes the latest processing techniques to achieve extremely low on-resistance per silicon area. 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 applications 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°C	Continuous Drain Current, V _{GS} @ 10V (Silicon Limited)	122①	
I _D @ T _C = 100°C	Continuous Drain Current, V _{GS} @ 10V (Silicon Limited)	86 ①	1 ,
I _D @ T _C = 25°C	Continuous Drain Current, V _{GS} @ 10V (Wirebond Limited)	56	Α
I _{DM}	Pulsed Drain Current ②	488	
$P_D @ T_C = 25^{\circ}C$	Maximum Power Dissipation	143	W
	Linear Derating Factor	0.95	W/°C
V_{GS}	Gate-to-Source Voltage	± 20	V
E _{AS (Thermally Limited)}	Single Pulse Avalanche Energy ③	168	m l
E _{AS (Tested)}	Single Pulse Avalanche Energy	518	mJ
I _{AR}	Avalanche Current ②	Coo Fig. 10c 10b 15 16	Α
E _{AR}	Repetitive Avalanche Energy ②	See Fig. 12a, 12b, 15, 16	mJ
dv/dt	Peak Diode Recovery ®	2.3	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	Тур.	Max.	Units			
$R_{\theta JC}$	Junction-to-Case ®		1.05	°C/W			
$R_{\theta JA}$	Junction-to-Ambient (PCB Mount) ⑦		40	C/VV			

HEXFET® is a registered trademark of International Rectifier.

^{*}Qualification standards can be found at http://www.irf.com/

Static Electrical Characteristics @ T_J = 25°C (unless otherwise specified)

	Parameter	Min.	Тур.	Max.	Units	Conditions
$V_{(BR)DSS}$	Drain-to-Source Breakdown Voltage	40			V	$V_{GS} = 0V, I_D = 250\mu A$
$\Delta V_{(BR)DSS}/\Delta T_{J}$	Breakdown Voltage Temp. Coefficient		0.03		V/°C	Reference to 25°C, I _D = 1mA [©]
R _{DS(on)}	Static Drain-to-Source On-Resistance	l	3.8	4.9	mΩ	$V_{GS} = 10V, I_D = 56A$ (5)
$V_{GS(th)}$	Gate Threshold Voltage	1	1.7	2.5	٧	$V_{DS} = V_{GS}, I_{D} = 100 \mu A$
$\Delta V_{GS(th)}$	Gate Threshold Voltage Coefficient		-6.6		mV/°C	$V_{DS} = V_{GS}, I_D = 100\mu A$
gfs	Forward Transconductance	103			S	$V_{DS} = 10V, I_{D} = 56A$
R_G	Internal Gate Resistance		0.8		Ω	
I _{DSS}	Drain-to-Source Leakage Current			20		$V_{DS} = 40V, V_{GS} = 0V$
				250	μA	$V_{DS} = 40V, V_{GS} = 0V, T_{J} = 125^{\circ}C$
I _{GSS}	Gate-to-Source Forward Leakage			100	^	V _{GS} = 16V
	Gate-to-Source Reverse Leakage			-100	nA	V _{GS} = -16V

Dynamic Electrical Characteristics @ T_J = 25°C (unless otherwise specified)

	Parameter	Min.	Тур.	Max.	Units	Conditions
Q_g	Total Gate Charge		35	53		I _D = 56A
Q_{gs}	Gate-to-Source Charge		11		nC	V _{DS} =20V
Q_{gd}	Gate-to-Drain ("Miller") Charge		16		1	V _{GS} = 4.5V ⑤
t _{d(on)}	Turn-On Delay Time		28	_		V _{DD} = 20V
t _r	Rise Time		271		1	I _D = 56A
t _{d(off)}	Turn-Off Delay Time		43		ns	$R_G = 3.7\Omega$
t _f	Fall Time		60		1	V _{GS} = 4.5V ⑤
C _{iss}	Input Capacitance		3617			$V_{GS} = 0V$
C _{oss}	Output Capacitance		633		1	V _{DS} = 25V
C _{rss}	Reverse Transfer Capacitance		345			f = 1.0 MHz, See Fig. 5
Coss	Output Capacitance	<u> </u>	2378	_	pF	$V_{GS} = 0V, V_{DS} = 1.0V, f = 1.0MHz$
Coss	Output Capacitance	<u> </u>	570	_	1	$V_{GS} = 0V, V_{DS} = 32V, f = 1.0MHz$
C _{oss} eff.	Effective Output Capacitance		875	l	1	V _{GS} = 0V, V _{DS} = 0V to 32V ⑥

Diode Characteristics

	Parameter	Min.	Тур.	Max.	Units	Conditions
Is	Continuous Source Current			122①		MOSFET symbol
	(Body Diode)			1220	A	showing the
I _{SM}	Pulsed Source Current			488] ^	integral reverse
	(Body Diode) ②			400		p-n junction diode.
V_{SD}	Diode Forward Voltage			1.3	V	$T_J = 25^{\circ}C, I_S = 56A, V_{GS} = 0V$ §
t _{rr}	Reverse Recovery Time		33	50		$T_J = 25$ °C, $I_F = 56A$, $V_{DD} = 20V$,
Q _{rr}	Reverse Recovery Charge		32	48	nC	di/dt = 100A/µs ⑤
t _{on}	Forward Turn-On Time	Intrinsion	Intrinsic turn-on time is negligible (turn-on is dominated by LS+LD)			

Notes:

- ① Calculated continuous current based on maximum allowable junction temperature. Bond wire current limit is 56A. Note that current limitations arising from heating of the device leads may occur with some lead mounting arrangements. (Refer to AN-1140)
- ② Repetitive rating; pulse width limited by max. junction temperature.
- ③ Limited by T_{Jmax} , starting $T_J = 25^{\circ}C$, L = 0.107mH, $R_G = 50\Omega$, $I_{AS} = 56A$, $V_{GS} = 10V$. Part not recommended for use above this value.

- $^{\circ}$ C_{oss} eff. is a fixed capacitance that gives the same charging time as C_{oss} while V_{DS} is rising from 0 to 80% V_{DSS}.
- When mounted on 1" square PCB (FR-4 or G-10 Material). For recommended footprint and soldering techniques refer to application note #AN-994.

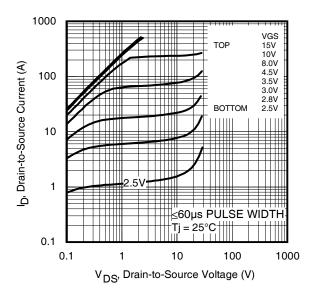
Qualification Information[†]

		Automotive (per AEC-Q101) ††			
Qualification Level		Comments: This part number(s) passed Automotive qualification. IR's Industrial and Consumer qualification level is granted by extension of the higher Automotive level.			
Moisture Sensitivity Level		3L-D2 PAK MSL1			
	Machine Model	Class M4(+/- 600V) ^{†††} (per AEC-Q101-002)			
ESD	Human Body Model	Class H1C(+/- 2000V) ^{†††} (per AEC-Q101-001)			
Charged Device Model		Class C5(+/- 2000V) ^{†††} (per AEC-Q101-005)			
RoHS Compliant		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



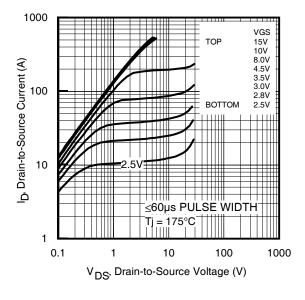
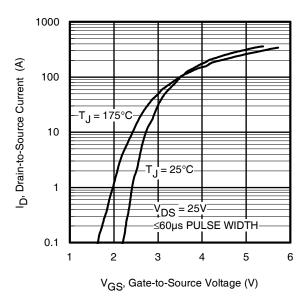


Fig 1. Typical Output Characteristics

Fig 2. Typical Output Characteristics



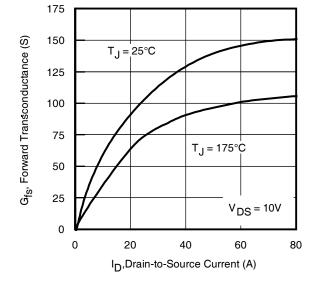
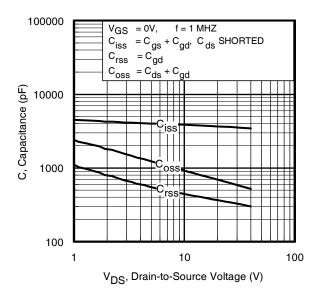


Fig 3. Typical Transfer Characteristics

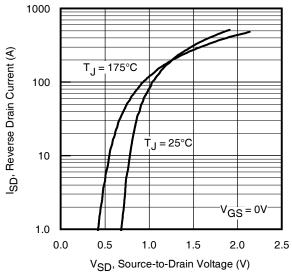
Fig 4. Typical Forward Transconductance vs. Drain Current



14.0 I_D= 56A 12.0 V_{GS}, Gate-to-Source Voltage (V) V_{DS}= 32V V_{DS}= 20V 10.0 VDS= 8V 8.0 6.0 4.0 2.0 0.0 0 10 20 30 40 50 60 70 80 90 Q_G, Total Gate Charge (nC)

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

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





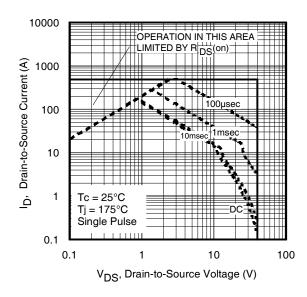


Fig 8. Maximum Safe Operating Area

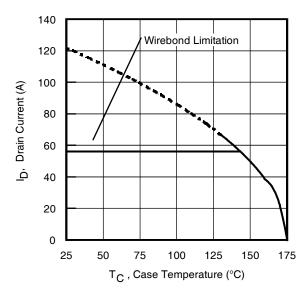


Fig 9. Maximum Drain Current vs. Case Temperature

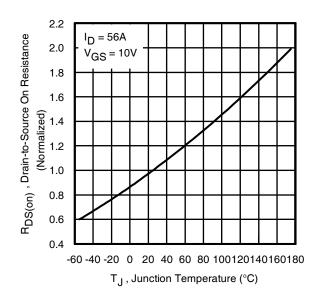


Fig 10. Normalized On-Resistance vs. Temperature

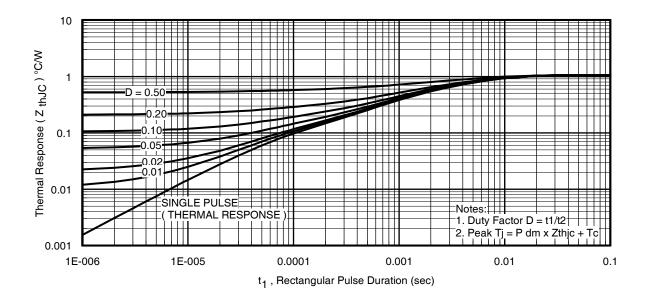


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Case

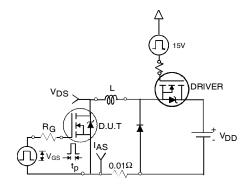


Fig 12a. Unclamped Inductive Test Circuit

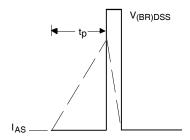


Fig 12b. Unclamped Inductive Waveforms

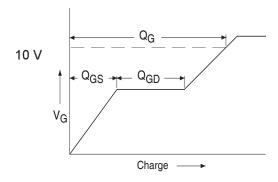


Fig 13a. Basic Gate Charge Waveform

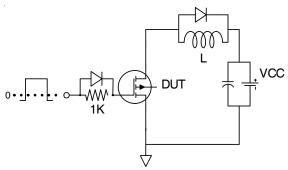


Fig 13b. Gate Charge Test Circuit www.irf.com

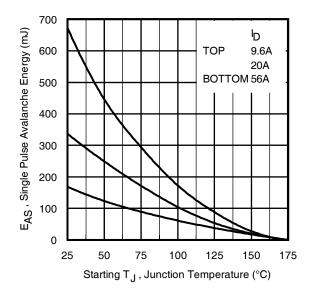


Fig 12c. Maximum Avalanche Energy vs. Drain Current

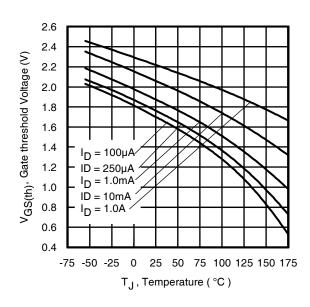


Fig 14. Threshold Voltage vs. Temperature

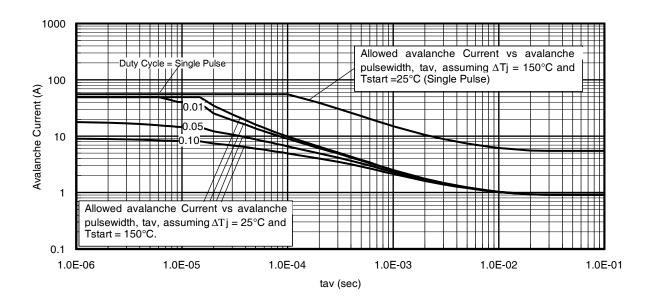


Fig 15. Typical Avalanche Current vs. Pulsewidth

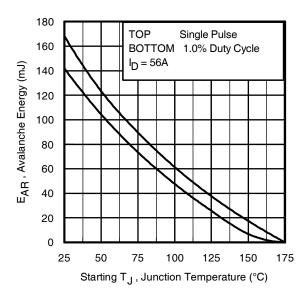


Fig 16. Maximum Avalanche Energy vs. Temperature

Notes on Repetitive Avalanche Curves, Figures 15, 16: (For further info, see AN-1005 at www.irf.com)

- 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.
- Safe operation in Avalanche is allowed as long asT_{jmax} is not exceeded.
- 3. Equation below based on circuit and waveforms shown in Figures 12a, 12b.
- 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. ΔT = Allowable rise in junction temperature, not to exceed T_{jmax} (assumed as 25°C in Figure 15, 16). t_{av} = Average time in avalanche.

D = Duty cycle in avalanche = $t_{av} \cdot f$

 $Z_{th,JC}(D, t_{av}) = Transient thermal resistance, see figure 11)$

$$\begin{split} P_{D \; (ave)} &= 1/2 \; (\; 1.3 \cdot \text{BV} \cdot \text{I}_{av}) = \triangle T / \; Z_{thJC} \\ I_{av} &= 2\triangle T / \; [1.3 \cdot \text{BV} \cdot Z_{th}] \\ E_{AS \; (AR)} &= P_{D \; (ave)} \cdot t_{av} \end{split}$$

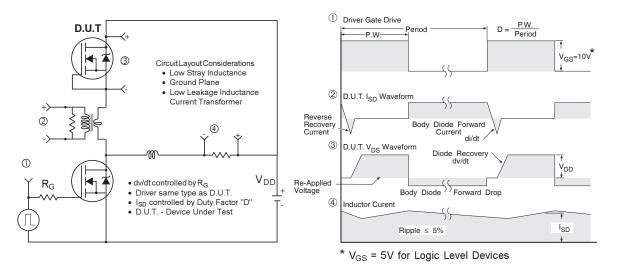


Fig 17. Peak Diode Recovery dv/dt Test Circuit for N-Channel HEXFET® Power MOSFETs

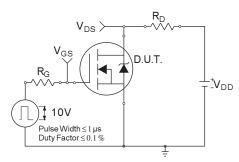


Fig 18a. Switching Time Test Circuit

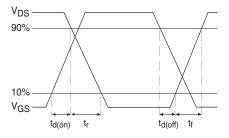
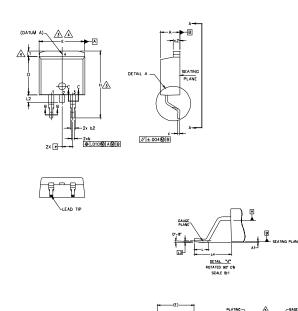


Fig 18b. Switching Time Waveforms

$D^2 Pak \ \ Package \ \ Outline \ \ \ (\hbox{\tiny Dimensions are shown in millimeters (inches)})$



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 61 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.

S		N O T			
M B O	MILLIM	ETERS	INC	INCHES	
L	MIN.	MAX.	MIN.	MAX.	Ë
Α	4.06	4.83	.160	.190	
A1	0.00	0.254	.000	.010	
ь	0.51	0.99	.020	.039	
ь1	0.51	0.89	.020	.035	5
b2	1,14	1.78	.045	.070	
b3	1,14	1.73	.045	.068	5
С	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
Ε	9.65	10,67	.380	.420	3,4
E1	6.22	-	.245		4
е	2.54	BSC	.100	BSC	
Н	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

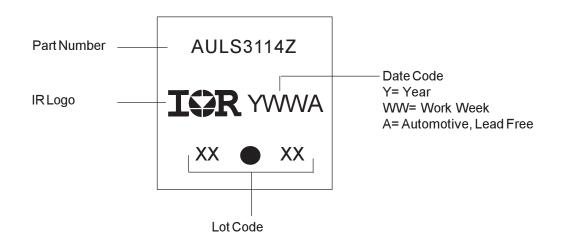
IGBTs, CoPACK

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

DIODES

- 1.- ANODE *
 2. 4.- CATHODE
 3.- ANODE
- * PART DEPENDENT.

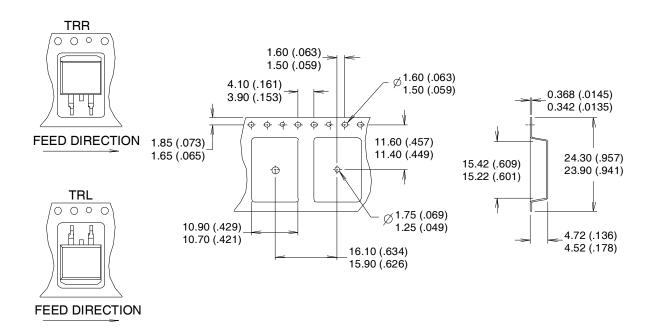
D²Pak Part Marking Information

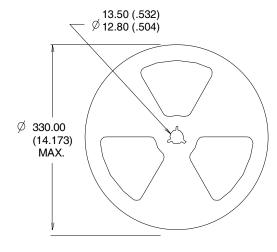


Note: For the most current drawing please refer to IR website at http://www.irf.com/package/

D²Pak (TO-263AB) Tape & Reel Information

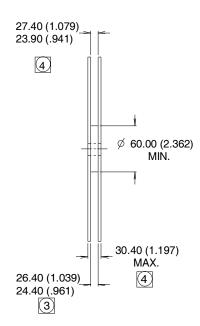
Dimensions are shown in millimeters (inches)







- 1. COMFORMS TO EIA-418.
- 2. CONTROLLING DIMENSION: MILLIMETER.
- 3 DIMENSION MEASURED @ HUB.
- 4 INCLUDES FLANGE DISTORTION @ OUTER EDGE.



Ordering Information

Base part	Package Type	Standard Pack		Complete Part Number
		Form	Quantity	
AUIRLS3114Z	D2Pak	Tube	50	AUIRLS3114Z
		Tape and Reel Left	800	AUIRLS3114ZTRL
_		Tape and Reel Right	800	AUIRLS3114ZTRR

AUIRLS3114Z

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