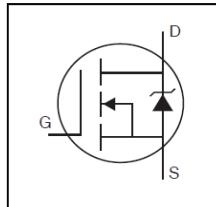


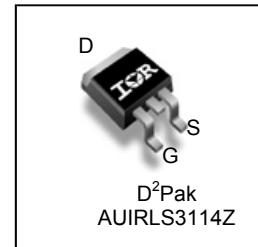
**Features**

- Advanced Process Technology
- Ultra Low On-Resistance
- Logic Level Gate Drive
- Enhanced dv/dt and di/dt capability
- 175°C Operating Temperature
- Fast Switching
- Repetitive Avalanche Allowed up to  $T_{jmax}$
- Lead-Free, RoHS Compliant
- Automotive Qualified \*



HEXFET® Power MOSFET

$V_{DSS}$	40V
$R_{DS(on)}$ typ.	3.8mΩ
	4.9mΩ
$I_D$ (Silicon Limited)	122A①
$I_D$ (Package 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.

Base part number	Package Type	Standard Pack		Orderable Part Number
		Form	Quantity	
AUIRLS3114Z	D <sup>2</sup> -Pak	Tube	50	AUIRLS3114Z
		Tape and Reel Left	800	AUIRLS3114ZTRL

**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 (TA) is 25°C, unless otherwise specified.

Symbol	Parameter	Max.	Units
$I_D$ @ $T_c = 25^\circ\text{C}$	Continuous Drain Current, $V_{GS} @ 10\text{V}$ (Silicon Limited)	122①	A
$I_D$ @ $T_c = 100^\circ\text{C}$	Continuous Drain Current, $V_{GS} @ 10\text{V}$ (Silicon Limited)	86①	
$I_D$ @ $T_c = 25^\circ\text{C}$	Continuous Drain Current, $V_{GS} @ 10\text{V}$ (Wirebond Limited)	56	
$I_{DM}$	Pulsed Drain Current ②	488	
$P_D$ @ $T_c = 25^\circ\text{C}$	Maximum Power Dissipation	143	W
	Linear Derating Factor	0.95	W/°C
$V_{GS}$	Gate-to-Source Voltage	± 16	V
$E_{AS}$	Single Pulse Avalanche Energy (Thermally Limited) ③	168	mJ
$E_{AS\ (Tested)}$	Single Pulse Avalanche Energy (Tested)	518	
$I_{AR}$	Avalanche Current ②	See Fig.15,16, 12a, 12b	A
$E_{AR}$	Repetitive Avalanche Energy ②		mJ
$dv/dt$	Peak Diode Recovery ④	2.3	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)	300	

**Thermal Resistance**

Symbol	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case ⑤	—	1.05	°C/W
$R_{\theta JA}$	Junction-to-Ambient (PCB Mount) ⑦	—	40	

HEXFET® is a registered trademark of Infineon.

\*Qualification standards can be found at [www.infineon.com](http://www.infineon.com)

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

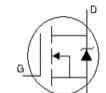
	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(\text{BR})\text{DSS}}$	Drain-to-Source Breakdown Voltage	40	—	—	V	$V_{GS} = 0V, I_D = 250\mu\text{A}$
$\Delta V_{(\text{BR})\text{DSS}}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	—	0.03	—	V/ $^\circ\text{C}$	Reference to $25^\circ\text{C}$ , $I_D = 1\text{mA}$ ②
$R_{DS(\text{on})}$	Static Drain-to-Source On-Resistance	—	3.8	4.9	$\text{m}\Omega$	$V_{GS} = 10\text{V}, I_D = 56\text{A}$ ⑤
$V_{GS(\text{th})}$	Gate Threshold Voltage	1.0	1.7	2.5	V	$V_{DS} = V_{GS}, I_D = 100\mu\text{A}$
$\Delta V_{GS(\text{th})}$	Gate Threshold Voltage Coefficient	—	-6.6	—	$\text{mV}/^\circ\text{C}$	
$g_{fs}$	Forward Trans conductance	103	—	—	S	$V_{DS} = 10\text{V}, I_D = 56\text{A}$
$R_{G(\text{Int})}$	Internal Gate Resistance	—	0.8	—	$\Omega$	
$I_{DSS}$	Drain-to-Source Leakage Current	—	—	20	$\mu\text{A}$	$V_{DS} = 40\text{V}, V_{GS} = 0\text{V}$
		—	—	250	$\mu\text{A}$	$V_{DS} = 40\text{V}, V_{GS} = 0\text{V}, T_J = 125^\circ\text{C}$
$I_{GSS}$	Gate-to-Source Forward Leakage	—	—	100	nA	$V_{GS} = 16\text{V}$
	Gate-to-Source Reverse Leakage	—	—	-100	nA	$V_{GS} = -16\text{V}$

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

$Q_g$	Total Gate Charge	—	35	53	nC	$I_D = 56\text{A}$ $V_{DS} = 20\text{V}$ $V_{GS} = 4.5\text{V}$ ⑤
$Q_{gs}$	Gate-to-Source Charge	—	11	—		
$Q_{qd}$	Gate-to-Drain Charge	—	16	—		
$t_{d(on)}$	Turn-On Delay Time	—	28	—		
$t_r$	Rise Time	—	271	—	ns	$V_{DD} = 20\text{V}$ $I_D = 56\text{A}$ $R_G = 3.7\Omega$ $V_{GS} = 4.5\text{V}$ ⑤
$t_{d(off)}$	Turn-Off Delay Time	—	43	—		
$t_f$	Fall Time	—	60	—		
$C_{iss}$	Input Capacitance	—	3617	—		
$C_{oss}$	Output Capacitance	—	633	—	pF	$V_{GS} = 0\text{V}$ $V_{DS} = 25\text{V}$ $f = 1.0\text{MHz}$ , See Fig. 5
$C_{rss}$	Reverse Transfer Capacitance	—	345	—		
$C_{oss}$	Output Capacitance	—	2378	—		$V_{GS} = 0\text{V}, V_{DS} = 1.0\text{V}, f = 1.0\text{MHz}$
$C_{oss}$	Output Capacitance	—	570	—		$V_{GS} = 0\text{V}, V_{DS} = 32\text{V}, f = 1.0\text{MHz}$
$C_{oss\ eff.}$	Effective Output Capacitance	—	875	—		$V_{GS} = 0\text{V}, V_{DS} = 0\text{V to } 32\text{V}$ ⑥

**Diode Characteristics**

	Parameter	Min.	Typ.	Max.	Units	Conditions
$I_s$	Continuous Source Current (Body Diode)	—	—	122①	A	MOSFET symbol showing the integral reverse p-n junction diode.
$I_{SM}$	Pulsed Source Current (Body Diode) ②	—	—	488		
$V_{SD}$	Diode Forward Voltage	—	—	1.3	V	$T_J = 25^\circ\text{C}, I_s = 56\text{A}, V_{GS} = 0\text{V}$ ⑤
$t_{rr}$	Reverse Recovery Time	—	33	50	ns	$T_J = 25^\circ\text{C}, I_F = 56\text{A}, V_{DD} = 20\text{V}$
$Q_{rr}$	Reverse Recovery Charge	—	32	48	nC	$di/dt = 100\text{A}/\mu\text{s}$ ⑤
$t_{on}$	Forward Turn-On Time	Intrinsic turn-on time is negligible (turn-on is dominated by $L_s + L_D$ )				


**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.
- ② Repetitive rating; pulse width limited by max. junction temperature.
- ③ Limited by  $T_{J\text{max}}$ , starting  $T_J = 25^\circ\text{C}$ ,  $L = 0.107\text{mH}$ ,  $R_G = 50\Omega$ ,  $I_{AS} = 56\text{A}$ ,  $V_{GS} = 10\text{V}$ . Part not recommended for use above this value.
- ④  $I_{SD} \leq 56\text{A}$ ,  $di/dt \leq 263\text{A}/\mu\text{s}$ ,  $V_{DD} \leq V_{(\text{BR})\text{DSS}}$ ,  $T_J \leq 175^\circ\text{C}$ .
- ⑤ Pulse width  $\leq 1.0\text{ms}$ ; duty cycle  $\leq 2\%$ .
- ⑥  $C_{oss\ eff.}$  is a fixed capacitance that gives the same charging time as  $C_{oss}$  while  $V_{DS}$  is rising from 0 to 80%  $V_{DSS}$ .
- ⑦ When mounted on 1" square PCB (FR-4 or G-10 Material). For recommended footprint and soldering techniques refer to application note #AN-994
- ⑧  $R_\theta$  is measured at  $T_J$  approximately  $90^\circ\text{C}$ .

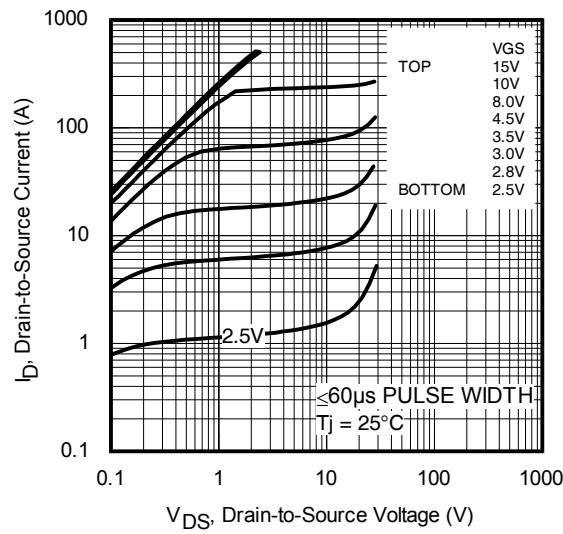


Fig. 1 Typical Output Characteristics

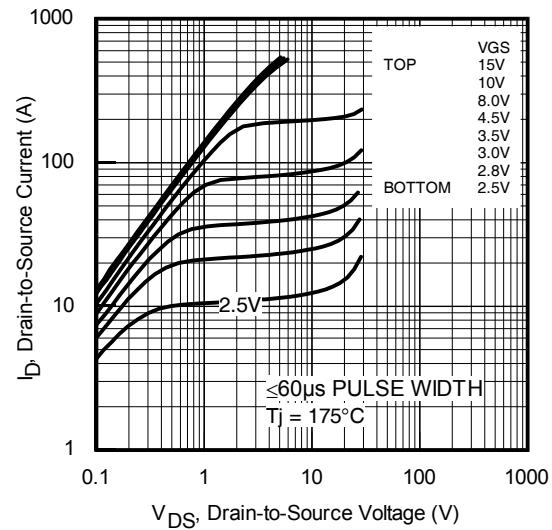


Fig. 2 Typical Output Characteristics

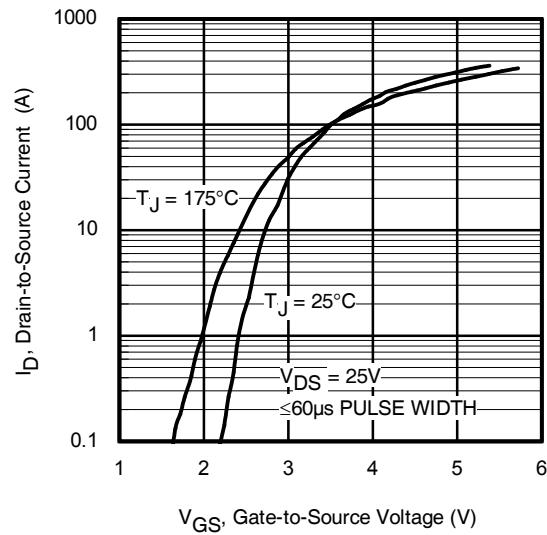


Fig. 3 Typical Transfer Characteristics

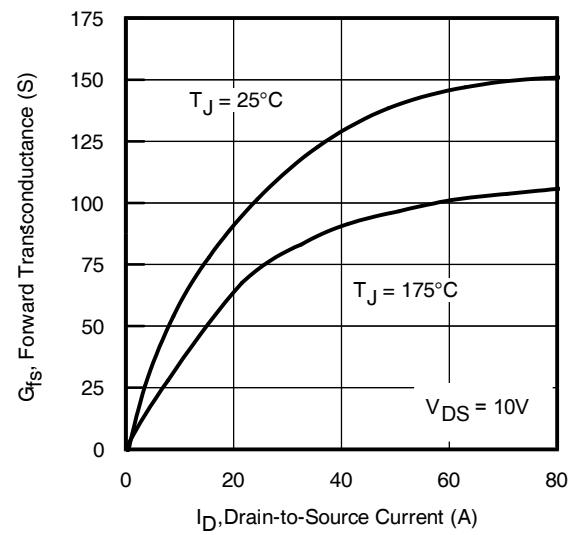
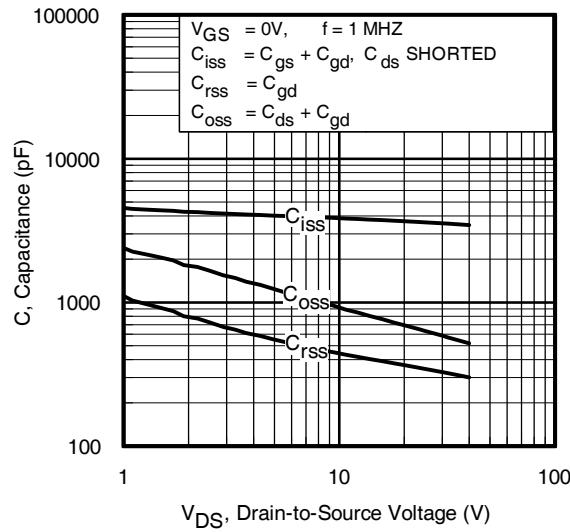
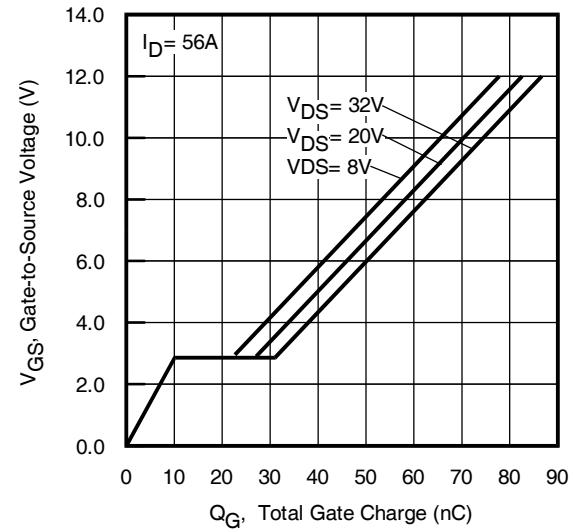


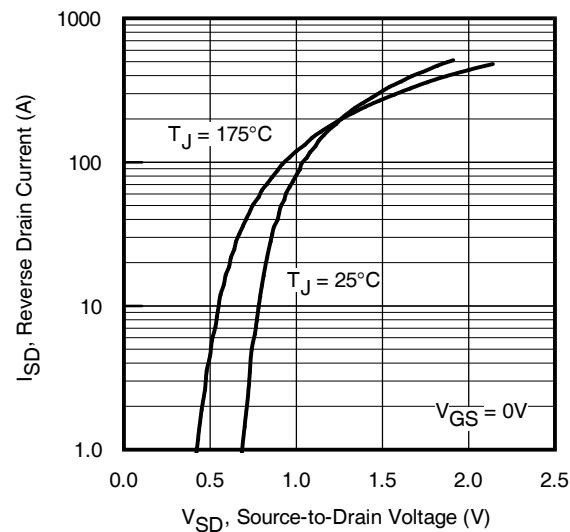
Fig. 4 Typical Forward Transconductance vs. Drain Current



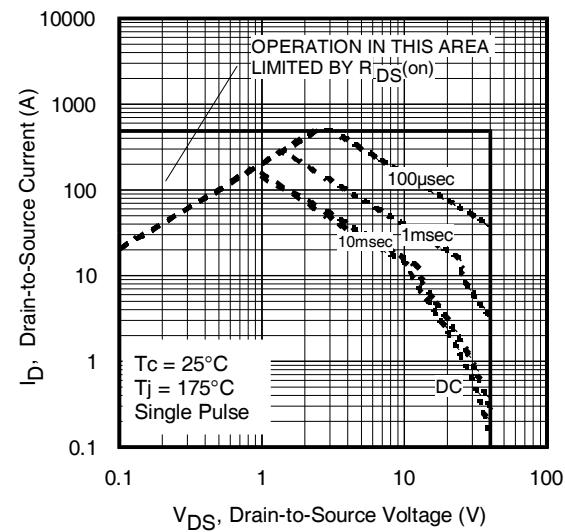
**Fig 5.** Typical Capacitance vs. Drain-to-Source Voltage



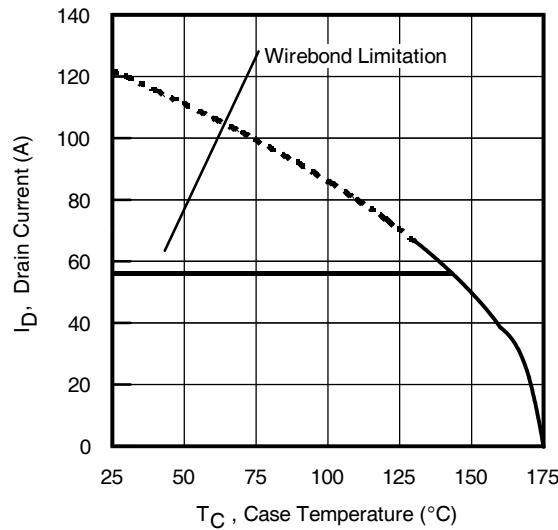
**Fig 6.** Typical Gate Charge vs. Gate-to-Source Voltage



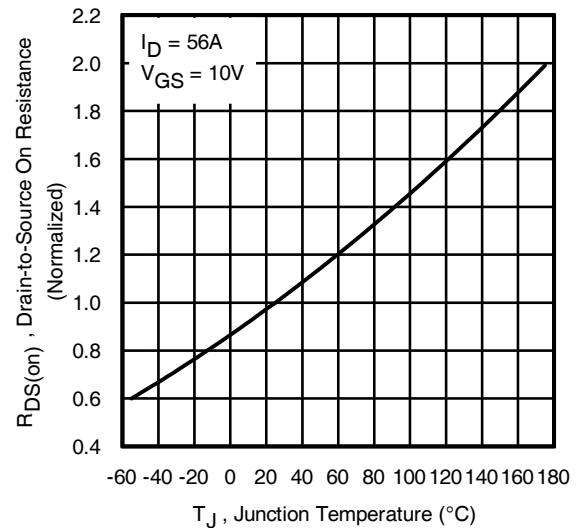
**Fig. 7** Typical Source-to-Drain Diode Forward Voltage



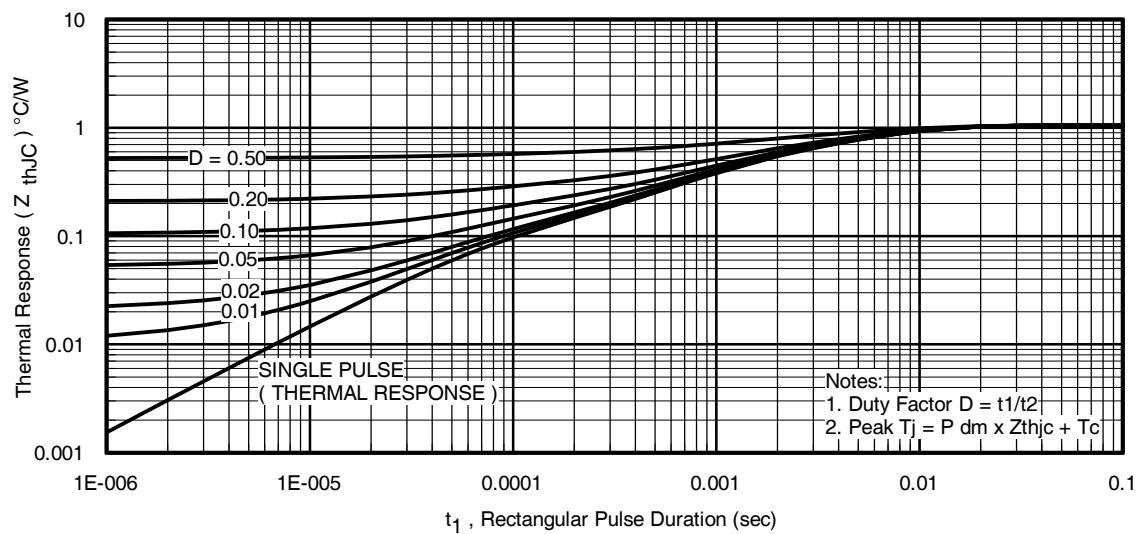
**Fig. 8.** Maximum Safe Operating Area



**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

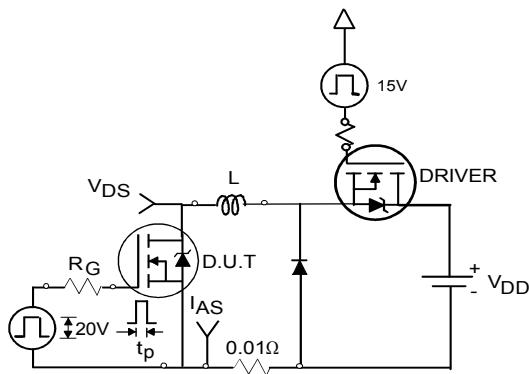


Fig 12a. Unclamped Inductive Test Circuit

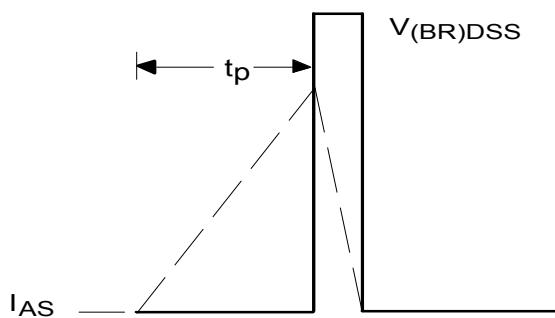


Fig 12b. Unclamped Inductive Waveforms

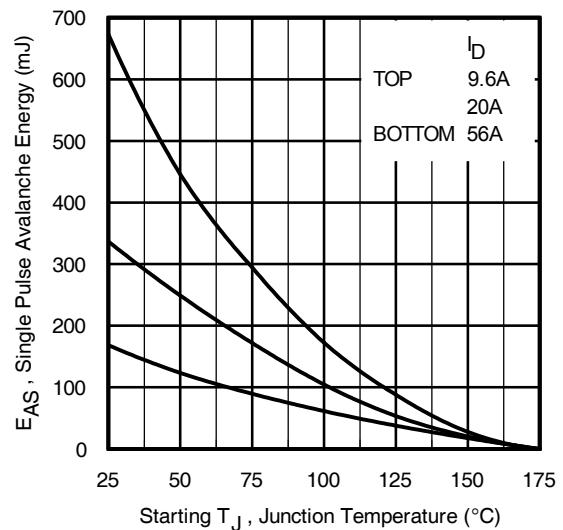


Fig 12c. Maximum Avalanche Energy vs. Drain Current

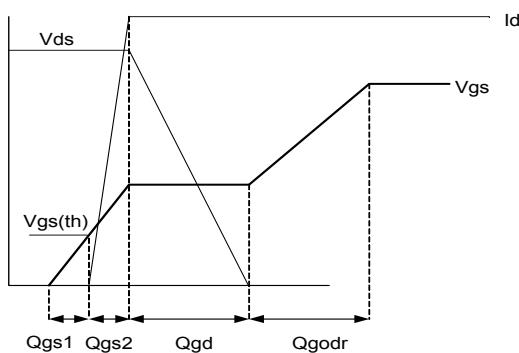


Fig 13a. Gate Charge Waveform

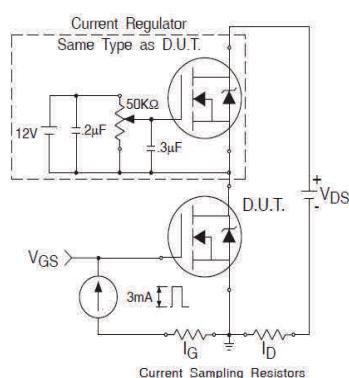


Fig 13b. Gate Charge Test Circuit

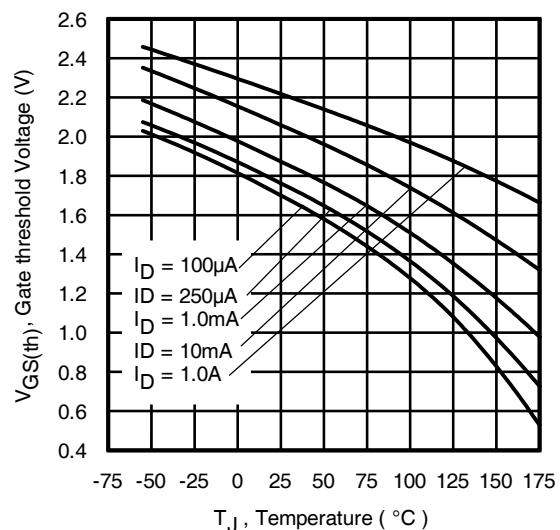
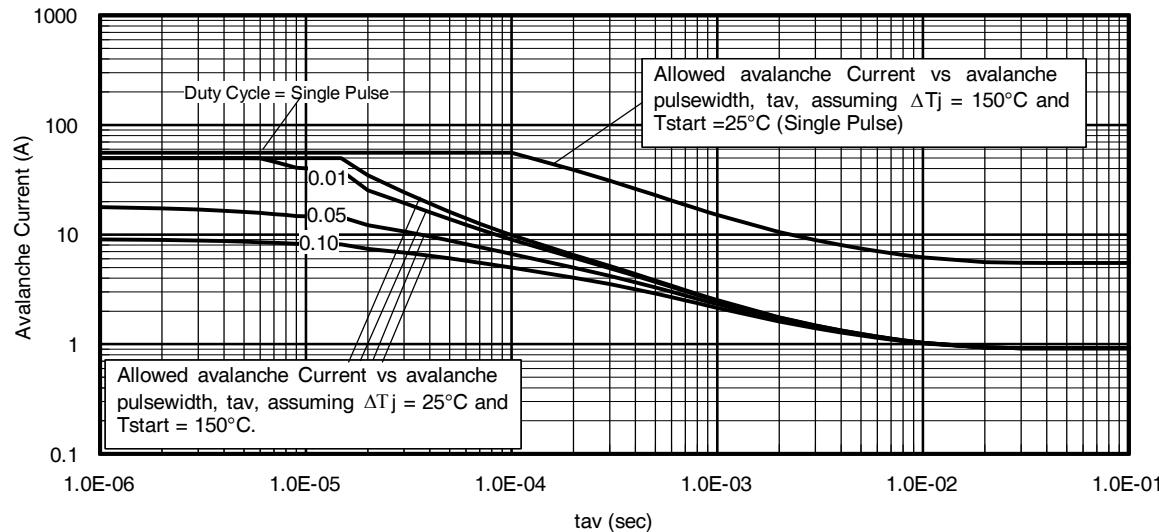
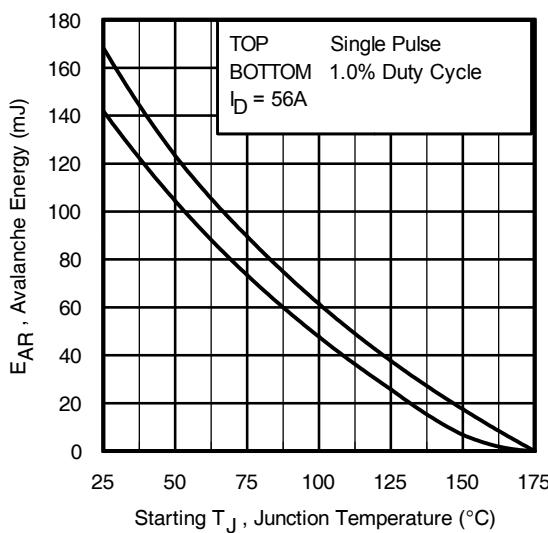


Fig. 14 - Threshold Voltage vs. Temperature



**Fig 15.** Avalanche Current vs. Pulse width



**Fig 16.** Maximum Avalanche Energy vs. Temperature

**Notes on Repetitive Avalanche Curves , Figures 15, 16:**  
(For further info, see AN-1005 at [www.infineon.com](http://www.infineon.com))

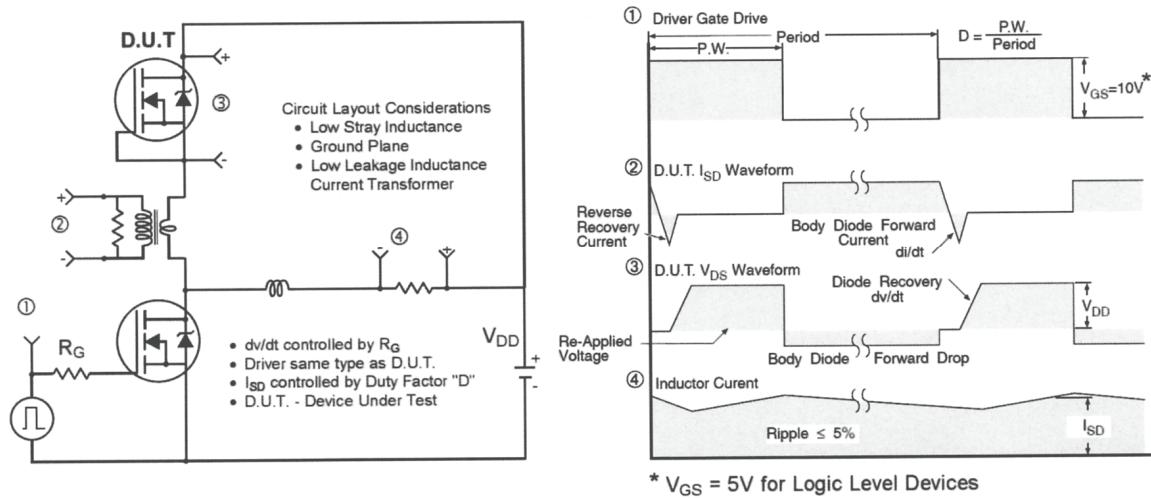
1. Avalanche failures assumption:  
Purely a thermal phenomenon and failure occurs at a temperature far in excess of  $T_{jmax}$ . This is validated for every part type.
2. Safe operation in Avalanche is allowed as long as  $T_{jmax}$  is not exceeded.
3. Equation below based on circuit and waveforms shown in Figures 12a, 12b.
4.  $P_D(\text{ave})$  = 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 11, 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)

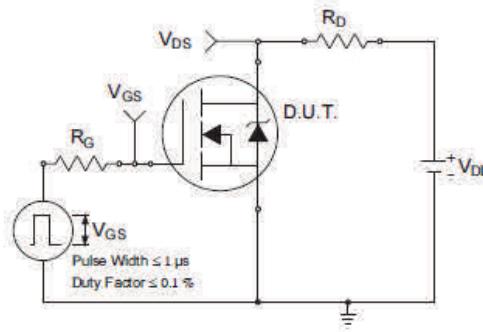
$$P_D(\text{ave}) = 1/2 ( 1.3 \cdot BV \cdot I_{av} ) = \Delta T / Z_{thJC}$$

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

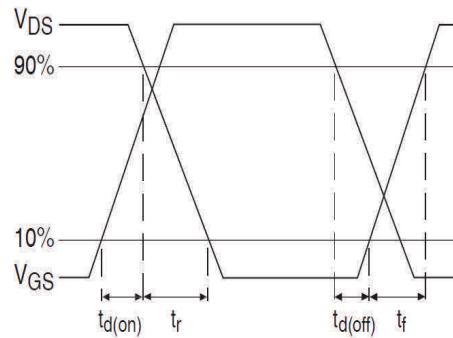
$$E_{AS(AR)} = P_D(\text{ave}) \cdot t_{av}$$



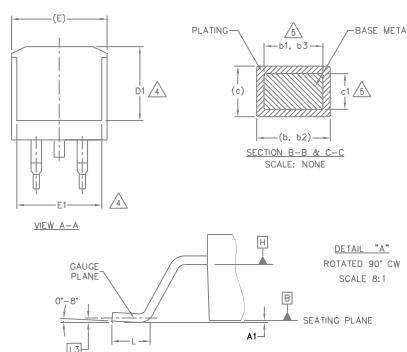
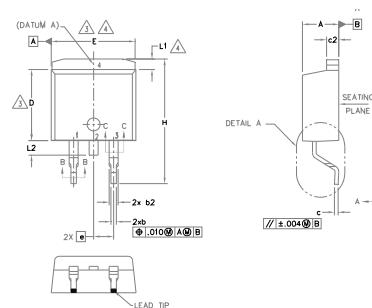
**Fig 17.** Peak Diode Recovery  $dv/dt$  Test Circuit for N-Channel HEXFET® Power MOSFETs



**Fig 18a.** Switching Time Test Circuit



**Fig 18b.** Switching Time Waveforms

**D<sup>2</sup>Pak (TO-263AB) Package Outline (Dimensions are shown in millimeters (inches))**


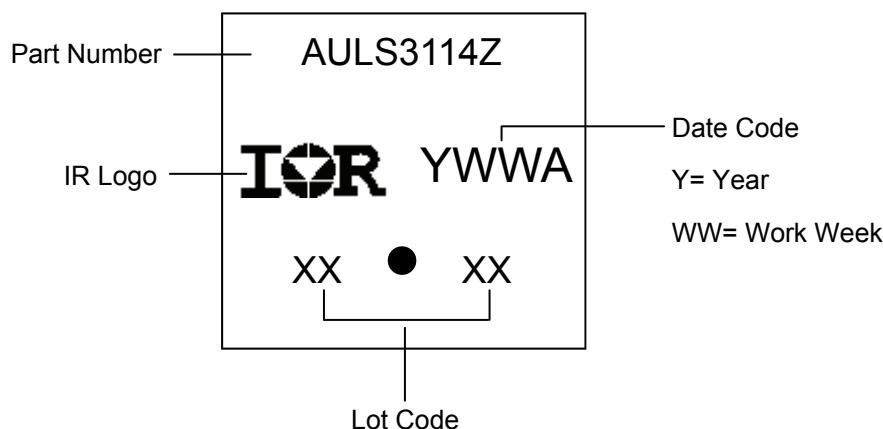
SYMBOL	DIMENSIONS				NOTES	
	MILLIMETERS		INCHES			
	MIN.	MAX.	MIN.	MAX.		
A	4.06	4.83	.160	.190		
A1	0.00	0.254	.000	.010		
b	0.51	0.99	.020	.039		
b1	0.51	0.89	.020	.035	5	
b2	1.14	1.78	.045	.070		
b3	1.14	1.73	.045	.068	5	
c	0.38	0.74	.015	.029		
c1	0.38	0.58	.015	.023	5	
c2	1.14	1.65	.045	.065		
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	—	1.68	—	.066	4	
L2	—	1.78	—	.070		
L3	0.25	BSC	.010	BSC		

**LEAD ASSIGNMENTS**

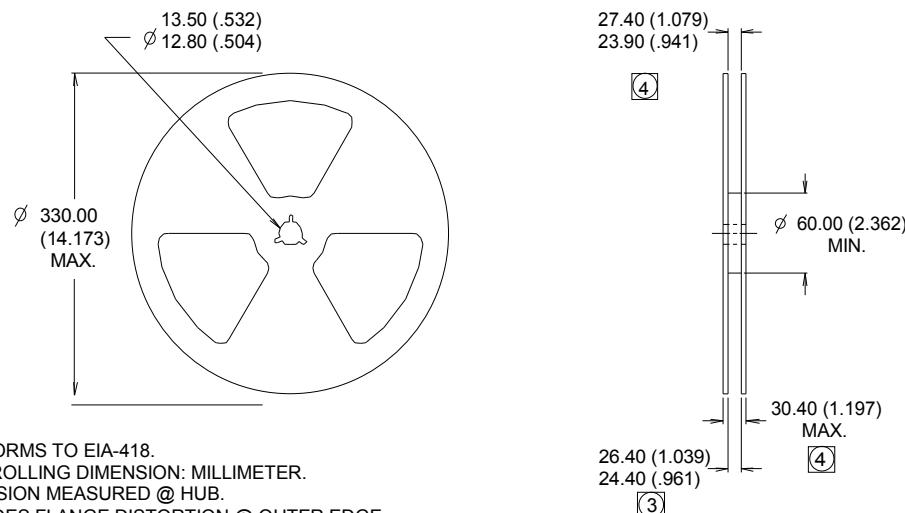
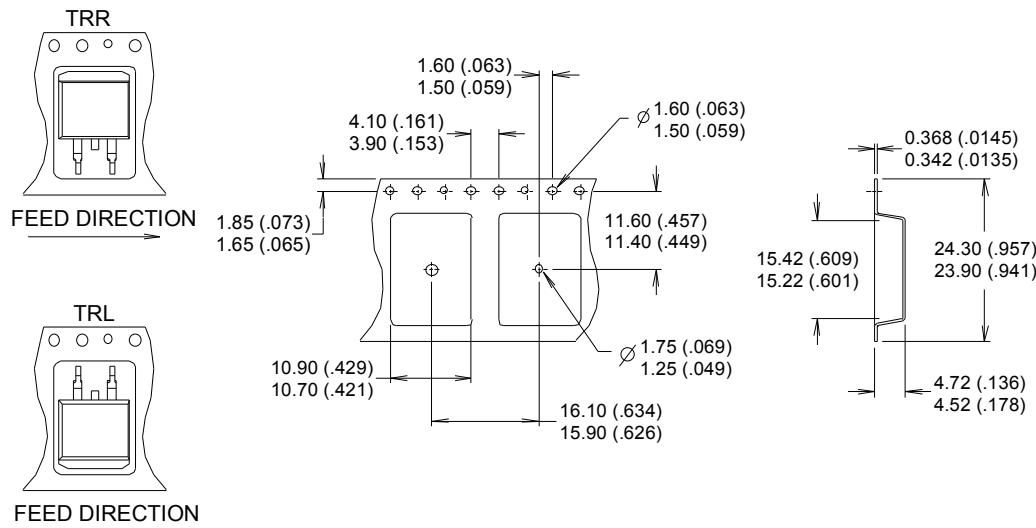
**DIODES**  
1. - ANODE (TWO DIE) / OPEN (ONE DIE)  
2. 4. - CATHODE  
3. - ANODE

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

**IGRTs, CoPACK**  
1. - GATE  
2. 4. - COLLECTOR  
3. - Emitter

**D<sup>2</sup>Pak (TO-263AB) 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 (TO-263AB) 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/>

## Qualification Information

<b>Qualification Level</b>		Automotive (per AEC-Q101)	
		Comments: This part number(s) passed Automotive qualification. Infineon'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 M4 (+/- 600V) <sup>†</sup> AEC-Q101-002	
	Human Body Model	Class H1C (+/- 2000V) <sup>†</sup> AEC-Q101-001	
	Charged Device Model	Class C5 (+/- 2000V) <sup>†</sup> AEC-Q101-005	
<b>RoHS Compliant</b>		Yes	

<sup>†</sup> Highest passing voltage.

## Revision History

Date	Comments
3/3/2014	<ul style="list-style-type: none"> <li>Added "Logic Level Gate Drive" bullet in the features section on page 1</li> <li>Updated data sheet with new IR corporate template</li> </ul>
11/6/2015	<ul style="list-style-type: none"> <li>Updated datasheet with corporate template</li> <li>Corrected ordering table on page 1.</li> </ul>

## Published by

Infineon Technologies AG  
81726 München, Germany

© Infineon Technologies AG 2015

All Rights Reserved.

## IMPORTANT NOTICE

The information given in this document shall in no event be regarded as a guarantee of conditions or characteristics ("Beschaffenheitsgarantie"). With respect to any examples, hints or any typical values stated herein and/or any information regarding the application of the product, Infineon Technologies hereby disclaims any and all warranties and liabilities of any kind, including without limitation warranties of non-infringement of intellectual property rights of any third party.

In addition, any information given in this document is subject to customer's compliance with its obligations stated in this document and any applicable legal requirements, norms and standards concerning customer's products and any use of the product of Infineon Technologies in customer's applications.

The data contained in this document is exclusively intended for technically trained staff. It is the responsibility of customer's technical departments to evaluate the suitability of the product for the intended application and the completeness of the product information given in this document with respect to such application.

For further information on the product, technology, delivery terms and conditions and prices please contact your nearest Infineon Technologies office ([www.infineon.com](http://www.infineon.com)).

## WARNINGS

Due to technical requirements products may contain dangerous substances. For information on the types in question please contact your nearest Infineon Technologies office.

Except as otherwise explicitly approved by Infineon Technologies in a written document signed by authorized representatives of Infineon Technologies, Infineon Technologies' products may not be used in any applications where a failure of the product or any consequences of the use thereof can reasonably be expected to result in personal injury.