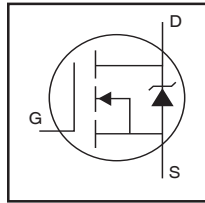


# AUIRFL024N

HEXFET® Power MOSFET

## Features

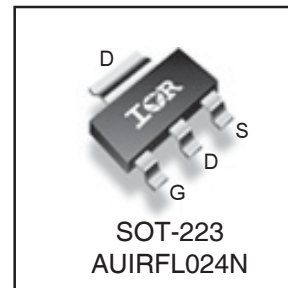
- Advanced Planar Technology
- Low On-Resistance
- Dynamic dV/dt Rating
- 150°C Operating Temperature
- Fast Switching
- Fully Avalanche Rated
- Repetitive Avalanche Allowed up to T<sub>Jmax</sub>
- Lead-Free, RoHS Compliant
- Automotive Qualified\*



$V_{(BR)DSS}$	<b>55V</b>
$R_{DS(on)}$ max.	<b>75mΩ</b>
$I_D$	<b>2.8A</b>

## 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.



<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<sub>A</sub>) is 25°C, unless otherwise specified.

	Parameter	Max.	Units
$I_D @ T_A = 25^\circ\text{C}$	Continuous Drain Current, $V_{GS} @ 10\text{V}$ ⑥	4.0	A
$I_D @ T_A = 25^\circ\text{C}$	Continuous Drain Current, $V_{GS} @ 10\text{V}$ ⑤	2.8	
$I_D @ T_A = 70^\circ\text{C}$	Continuous Drain Current, $V_{GS} @ 10\text{V}$ ⑤	2.3	
$I_{DM}$	Pulsed Drain Current ①	11.2	
$P_D @ T_A = 25^\circ\text{C}$	Power Dissipation (PCB Mount) ⑥	2.1	W
$P_D @ T_A = 25^\circ\text{C}$	Power Dissipation (PCB Mount) ⑤	1.0	
	Linear Derating Factor (PCB Mount) ⑤	8.3	mW/°C
$V_{GS}$	Gate-to-Source Voltage	± 20	V
$E_{AS}$	Single Pulse Avalanche Energy (Thermally Limited) ②	214	mJ
$I_{AR}$	Avalanche Current ①	2.8	A
$E_{AR}$	Repetitive Avalanche Energy ①③	0.1	mJ
dv/dt	Peak Diode Recovery dv/dt ③	5.0	V/ns
$T_J$	Operating Junction and	-55 to + 150	°C
$T_{STG}$	Storage Temperature Range		

## Thermal Resistance

	Parameter	Typ.	Max.	Units
$R_{\theta JA}$	Junction-to-Ambient (PCB mount, steady state) ④	90	120	°C/W
$R_{\theta JA}$	Junction-to-Ambient (PCB mount, steady state) ⑥	50	60	

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
$V_{(BR)DSS}$	Drain-to-Source Breakdown Voltage	55	—	—	V	$V_{GS} = 0V, I_D = 250\mu A$
$\Delta V_{(BR)DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	—	0.056	—	V/ $^\circ\text{C}$	Reference to $25^\circ\text{C}, I_D = 1\text{mA}$
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	—	—	75	m $\Omega$	$V_{GS} = 10V, I_D = 2.8A$ ④
$V_{GS(th)}$	Gate Threshold Voltage	2.0	—	4.0	V	$V_{DS} = V_{GS}, I_D = 250\mu A$
gfs	Forward Transconductance	3.0	—	—	S	$V_{DS} = 25V, I_D = 1.6A$
$I_{DSS}$	Drain-to-Source Leakage Current	—	—	25	$\mu A$	$V_{DS} = 55V, V_{GS} = 0V$
		—	—	250		$V_{DS} = 44V, V_{GS} = 0V, T_J = 125^\circ\text{C}$
$I_{GSS}$	Gate-to-Source Forward Leakage	—	—	100	nA	$V_{GS} = 20V$
	Gate-to-Source Reverse Leakage	—	—	-100		$V_{GS} = -20V$

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

	Parameter	Min.	Typ.	Max.	Units	Conditions
$Q_g$	Total Gate Charge	—	—	18.3	nC	$I_D = 1.68A$ $V_{DS} = 28V$ $V_{GS} = 10V$ , See Fig. 6 and 9 ④
$Q_{gs}$	Gate-to-Source Charge	—	—	3.0		
$Q_{gd}$	Gate-to-Drain ("Miller") Charge	—	—	7.7		
$t_{d(on)}$	Turn-On Delay Time	—	8.1	—	ns	$V_{DD} = 28V$ $I_D = 1.68A$ $R_G = 24\ \Omega$ $R_D = 17\ \Omega$ , See Fig. 10 ④
$t_r$	Rise Time	—	13.4	—		
$t_{d(off)}$	Turn-Off Delay Time	—	22.2	—		
$t_f$	Fall Time	—	17.7	—		
$C_{iss}$	Input Capacitance	—	400	—	pF	$V_{GS} = 0V$ $V_{DS} = 25V$ $f = 1.0\text{MHz}$ , See Fig. 5
$C_{oss}$	Output Capacitance	—	145	—		
$C_{rss}$	Reverse Transfer Capacitance	—	60	—		

## Diode Characteristics

	Parameter	Min.	Typ.	Max.	Units	Conditions
$I_S$	Continuous Source Current (Body Diode)	—	—	2.8	A	MOSFET symbol showing the integral reverse p-n junction diode.
$I_{SM}$	Pulsed Source Current (Body Diode) ①	—	—	11.2		
$V_{SD}$	Diode Forward Voltage	—	—	1.0	V	$T_J = 25^\circ\text{C}, I_S = 1.68A, V_{GS} = 0V$ ④
$t_{rr}$	Reverse Recovery Time	—	35	53	ns	$T_J = 25^\circ\text{C}, I_F = 1.68A$
$Q_{rr}$	Reverse Recovery Charge	—	50	75	nC	$di/dt = 100A/\mu s$ ④
$t_{on}$	Forward Turn-On Time	Intrinsic turn-on time is negligible (turn-on is dominated by LS+LD)				

### Notes:

- ① Repetitive rating; pulse width limited by max. junction temperature. ( See fig. 11)
- ②  $V_{DD} = 25V$ , starting  $T_J = 25^\circ\text{C}$ ,  $L = 54.7\text{mH}$   
 $R_G = 25\ \Omega$ ,  $I_{AS} = 2.8A$ . (See Figure 12)
- ③  $I_{SD} \leq 1.68A$ ,  $di/dt \leq 155A/\mu s$ ,  $V_{DD} \leq V_{(BR)DSS}$ ,  
 $T_J \leq 150^\circ\text{C}$ .

- ④ Pulse width  $\leq 300\mu s$ ; duty cycle  $\leq 2\%$ .
- ⑤ When mounted on FR-4 board using minimum recommended footprint.
- ⑥ When mounted on 1 inch square copper board, for comparison with other SMD devices.

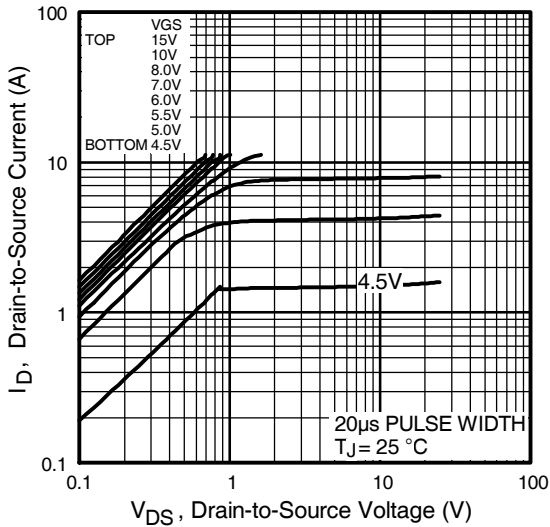
**Qualification Information<sup>†</sup>**

<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>		SOT-223	MSL1
<b>ESD</b>	Machine Model	Class M2 (+/- 150V) <sup>†††</sup> AEC-Q101-002	
	Human Body Model	Class H1A (+/- 350V) <sup>†††</sup> AEC-Q101-001	
	Charged Device Model	Class C5 (+/- 2000V) <sup>†††</sup> AEC-Q101-005	
<b>RoHS Compliant</b>		Yes	

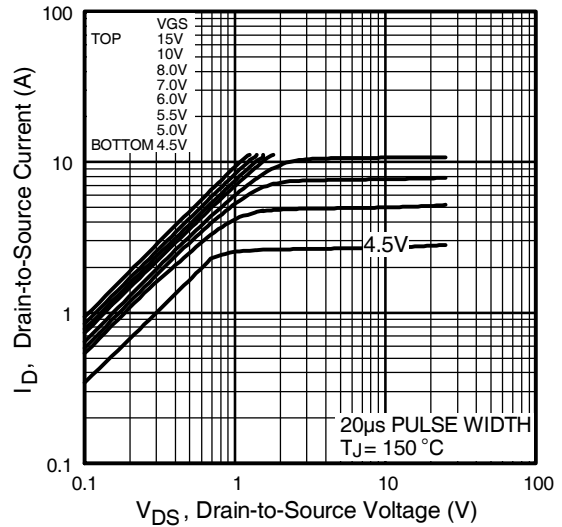
† Qualification standards can be found at International Rectifier's web site: <http://www.irf.com/>

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

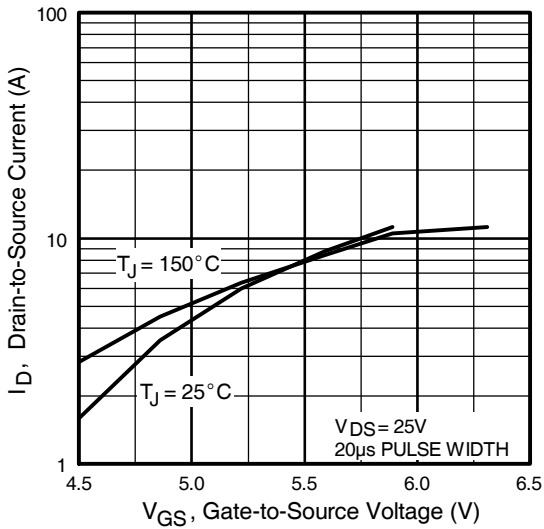
††† Highest passing voltage.



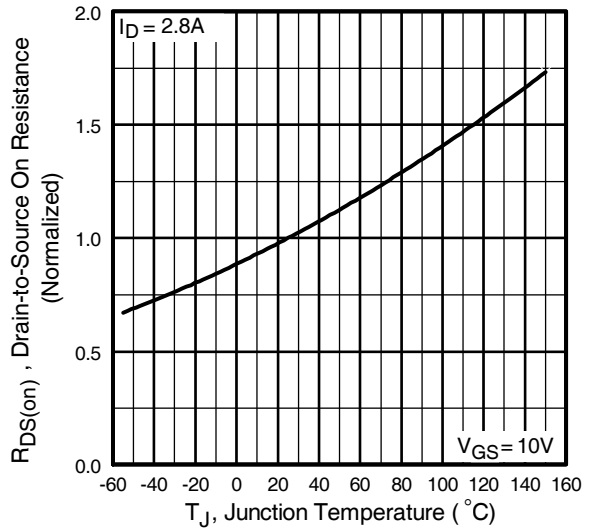
**Fig 1.** Typical Output Characteristics,



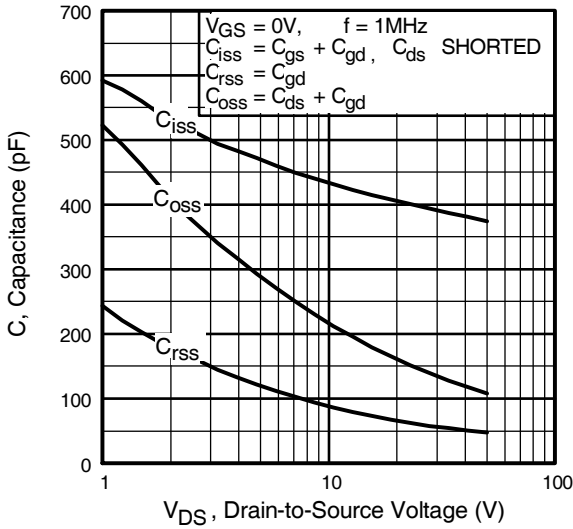
**Fig 2.** Typical Output Characteristics,



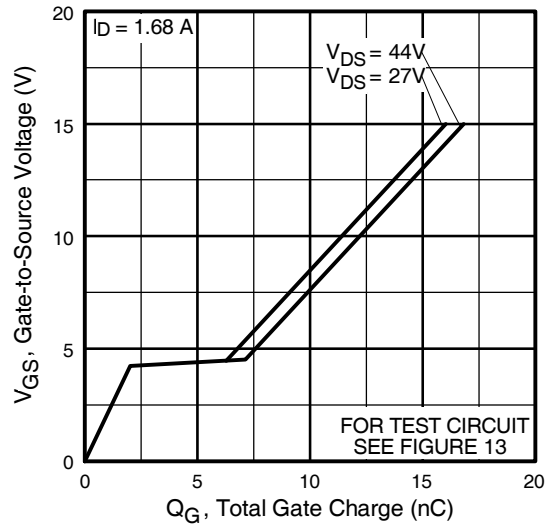
**Fig 3.** Typical Transfer Characteristics



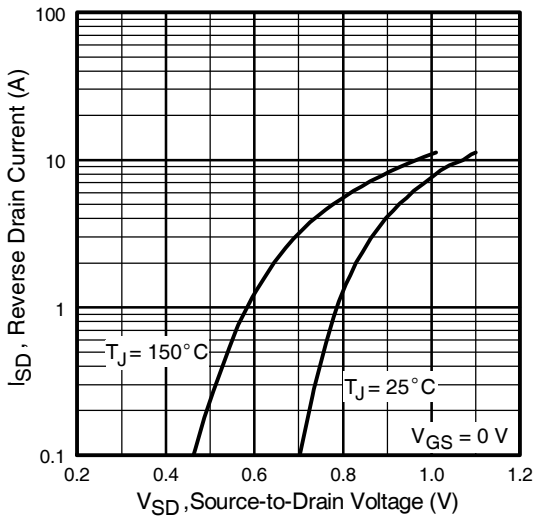
**Fig 4.** Normalized On-Resistance Vs. Temperature



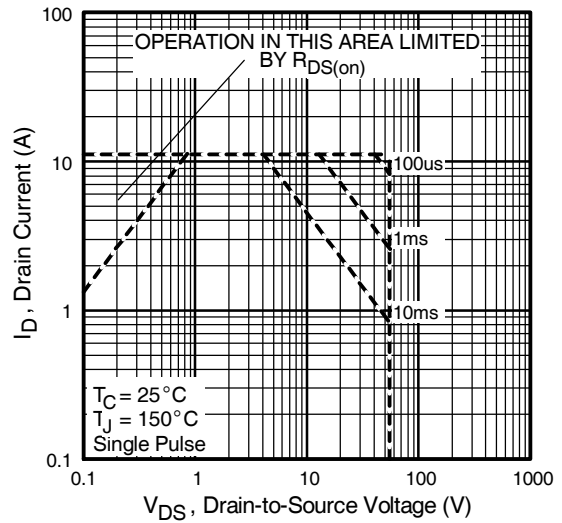
**Fig 5.** Typical Capacitance Vs. Drain-to-Source Voltage



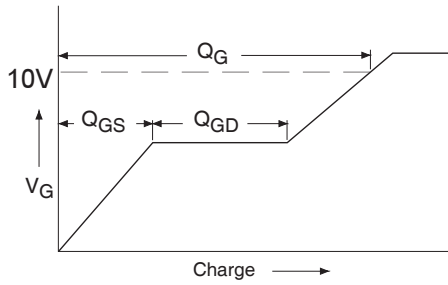
**Fig 6.** Typical Gate Charge Vs. Gate-to-Source Voltage



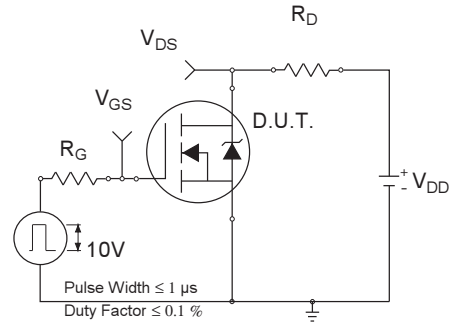
**Fig 7.** Typical Source-Drain Diode Forward Voltage



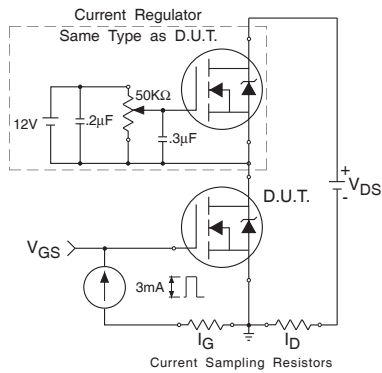
**Fig 8.** Maximum Safe Operating Area



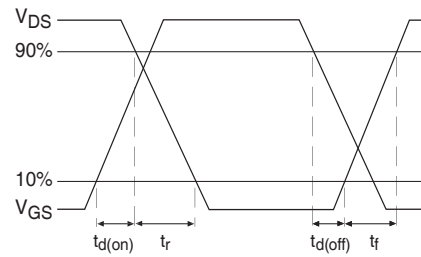
**Fig 9a.** Basic Gate Charge Waveform



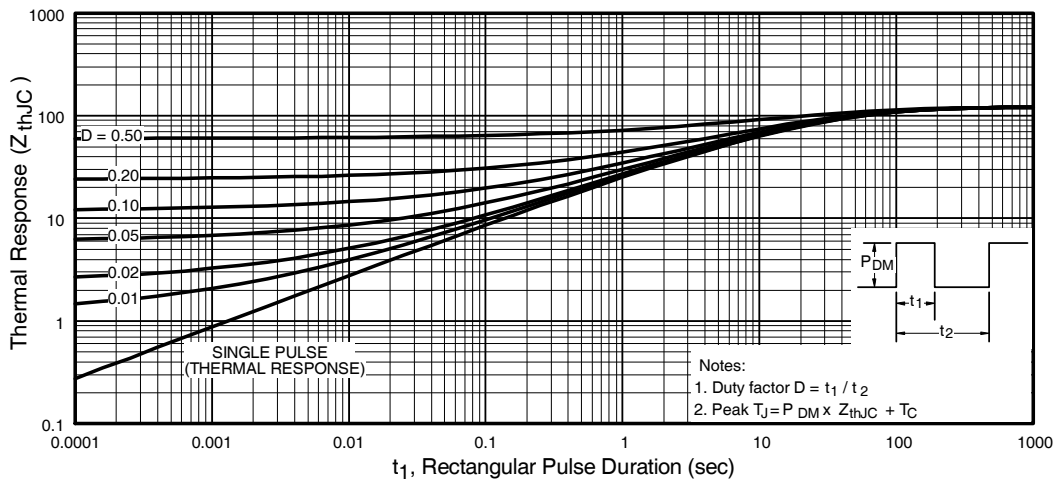
**Fig 10a.** Switching Time Test Circuit



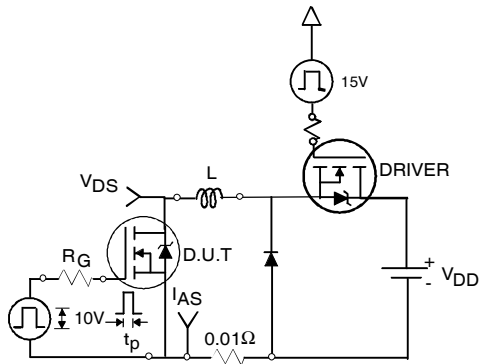
**Fig 9b.** Gate Charge Test Circuit



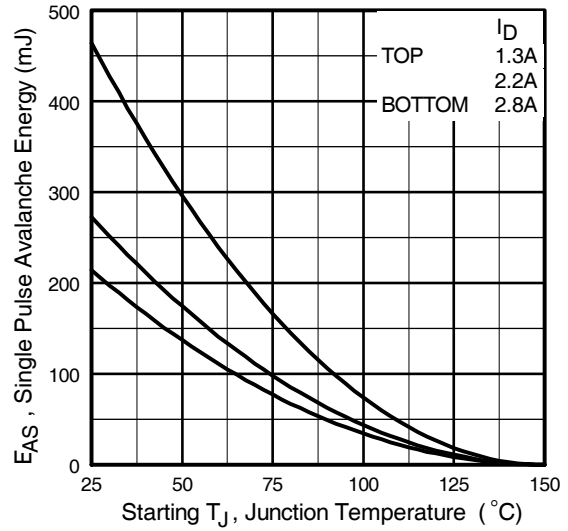
**Fig 10b.** Switching Time Waveforms



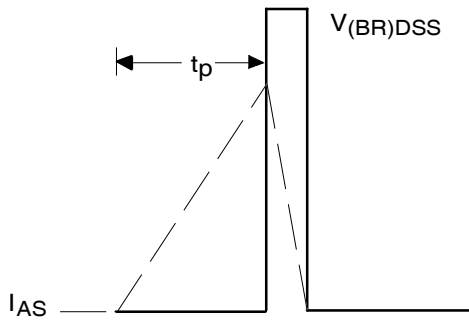
**Fig 11.** Maximum Effective Transient Thermal Impedance, Junction-to-Ambient



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



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

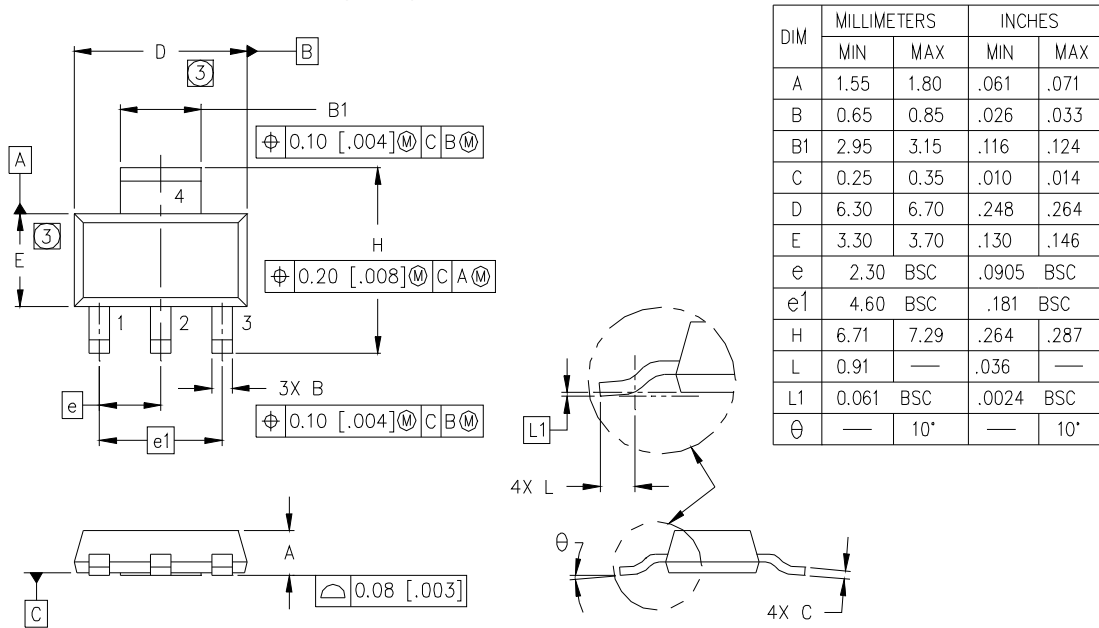


**Fig 12b.** Unclamped Inductive Waveforms

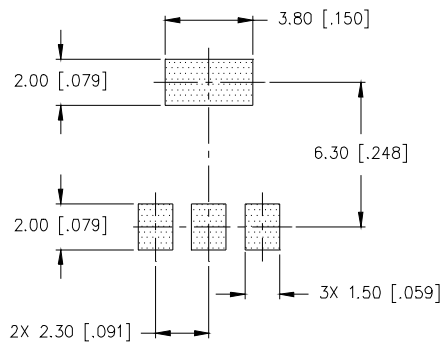
# AUIRFL024N

## SOT-223 (TO-261AA) Package Outline

Dimensions are shown in millimeters (inches)



### MINIMUM RECOMMENDED FOOTPRINT



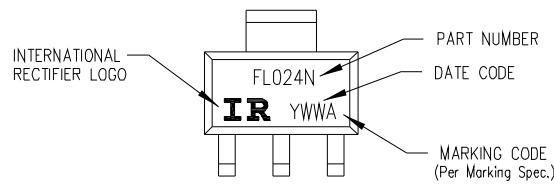
### LEAD ASSIGNMENTS

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

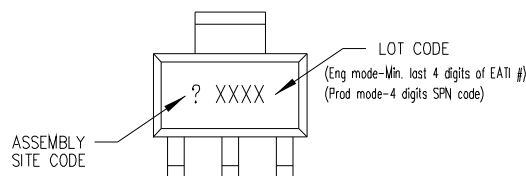
### NOTES:

1. DIMENSIONING & TOLERANCING PER ASME Y14.5M-1994.
2. CONTROLLING DIMENSION: INCH.
- ③ DIMENSIONS DO NOT INCLUDE MOLD FLASH.
4. OUTLINE CONFORMS TO JEDEC OUTLINE TO-261AA.
5. DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES].

## SOT-223 (TO-261AA) Part Marking Information



TOP MARKING

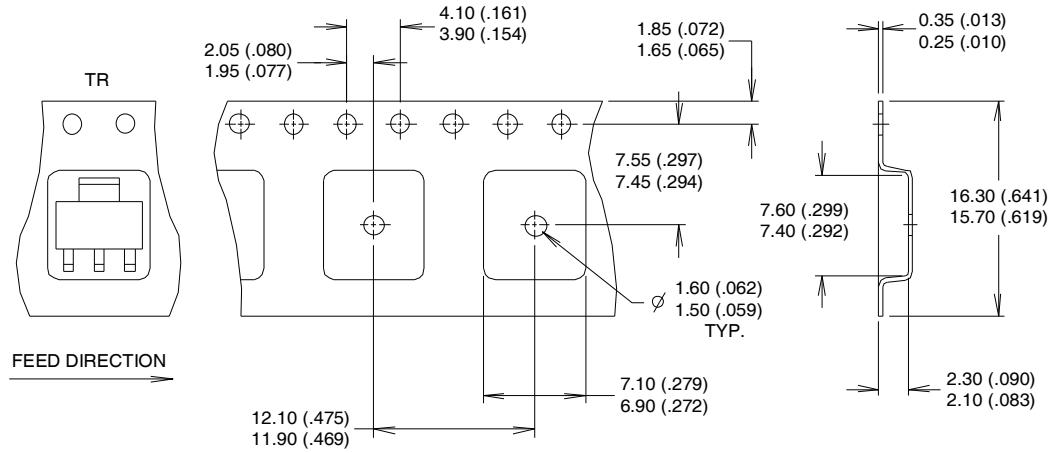


BOTTOM MARKING

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

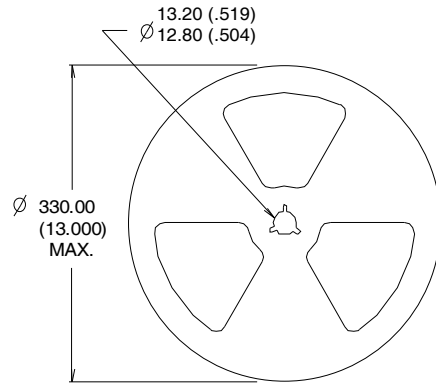
## SOT-223 (TO-261AA) Tape & Reel Information

Dimensions are shown in millimeters (inches)



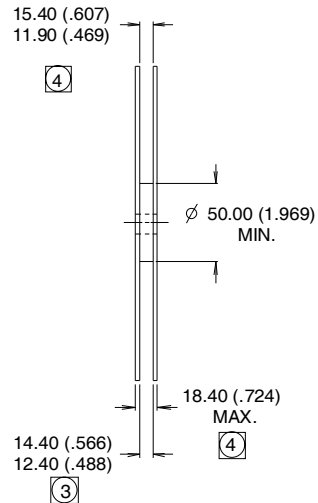
**NOTES :**

1. CONTROLLING DIMENSION: MILLIMETER.
2. OUTLINE CONFORMS TO EIA-481 & EIA-541.
3. EACH  $\varnothing 330.00$  (13.00) REEL CONTAINS 2,500 DEVICES.



**NOTES :**

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



## Ordering Information

Base part number	Package Type	Standard Pack		Complete Part Number
		Form	Quantity	
AUIRFL024N	SOT-223	Tube	95	AUIRFL024N
		Tape and Reel	2500	AUIRFL024NTR

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

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