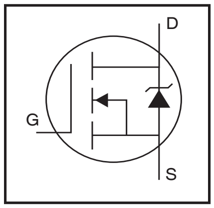
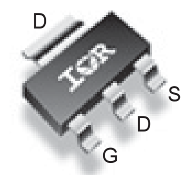
International Rectifier

AUIRFL024N

HEXFET® Power MOSFET



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



SOT-223
AUIRFL024N

G	D	S
Gate	Drain	Source

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 Tjmax
- Lead-Free, RoHS Compliant
- Automotive Qualified*

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_A = 25°C	Continuous Drain Current, V_{GS} @ 10V ⑥	4.0	A
I_D @ T_A = 25°C	Continuous Drain Current, V_{GS} @ 10V ⑤	2.8	
I_D @ T_A = 70°C	Continuous Drain Current, V_{GS} @ 10V ⑤	2.3	
I_{DM}	Pulsed Drain Current ①	11.2	
P_D @T_A = 25°C	Power Dissipation (PCB Mount) ⑥	2.1	W
P_D @T_A = 25°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 ①⑤	0.1	mJ
dv/dt	Peak Diode Recovery dv/dt ③	5.0	V/ns
T_J T_{STG}	Operating Junction and Storage Temperature Range	-55 to + 150	°C

Thermal Resistance

	Parameter	Typ.	Max.	Units
$R_{\theta JA}$	Junction-to-Ambient (PCB mount, steady state) ⑤	90	120	°C/W
$R_{\theta JA}$	Junction-to-Ambient (PCB mount, steady state) ⑥	50	60	

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

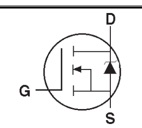
Static Electrical Characteristics @ T_J = 25°C (unless otherwise specified)

	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(BR)DSS}$	Drain-to-Source Breakdown Voltage	55	—	—	V	V_{GS} = 0V, I_D = 250µA
$\Delta V_{(BR)DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	—	0.056	—	V/°C	Reference to 25°C, I_D = 1mA
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	—	—	75	mΩ	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 = 250µA
gfs	Forward Transconductance	3.0	—	—	S	V_{DS} = 25V, I_D = 1.6A
I_{DSS}	Drain-to-Source Leakage Current	—	—	25	µA	V_{DS} = 55V, V_{GS} = 0V
		—	—	250		V_{DS} = 44V, V_{GS} = 0V, T_J = 125°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°C (unless otherwise specified)

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

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°C, I_S = 1.68A, V_{GS} = 0V ④
t_{rr}	Reverse Recovery Time	—	35	53	ns	T_J = 25°C, I_F = 1.68A
Q_{rr}	Reverse Recovery Charge	—	50	75	nC	di/dt = 100A/µs 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°C, L = 54.7mH R_G = 25Ω, I_{AS} = 2.8A. (See Figure 12)

③ $I_{SD} \le$ 1.68A, di/dt ≤ 155A/µs, $V_{DD} \le V_{(BR)DSS}$, $T_J \le$ 150°C .

④ Pulse width ≤ 300µs; duty cycle ≤ 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†

Qualification Level		Automotive (per AEC-Q101) ††	
		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		SOT-223	MSL1
ESD	Machine Model	Class M2 (+/- 150V)††† AEC-Q101-002	
	Human Body Model	Class H1A (+/- 350V)††† AEC-Q101-001	
	Charged Device Model	Class C5 (+/- 2000V)††† 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.

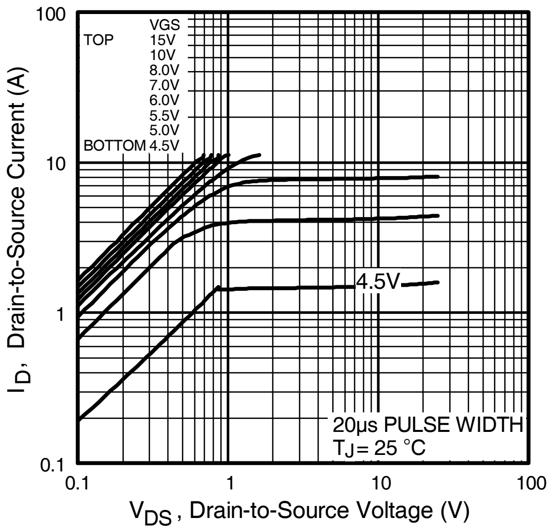


Fig 1. Typical Output Characteristics,

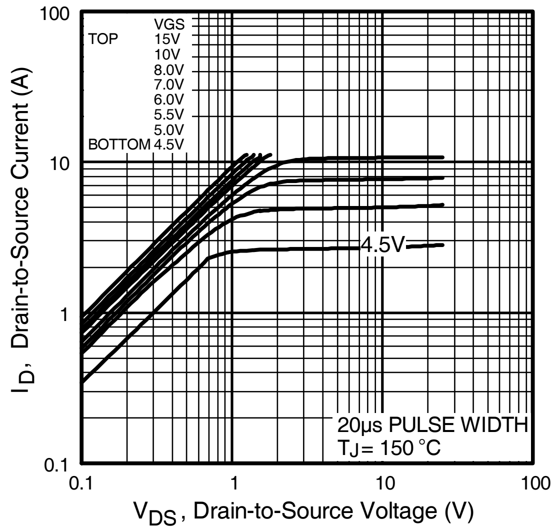


Fig 2. Typical Output Characteristics,

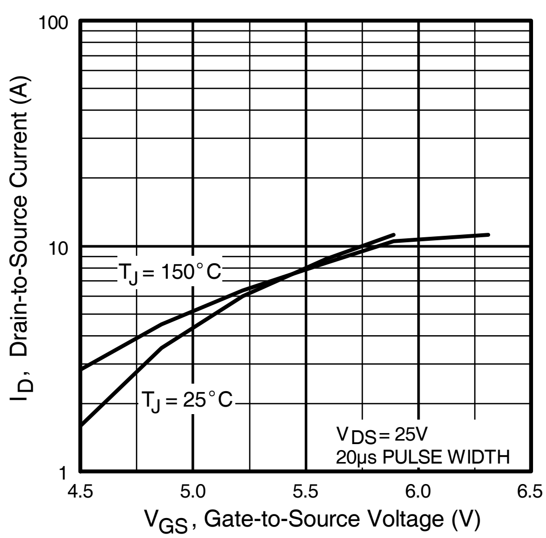


Fig 3. Typical Transfer Characteristics

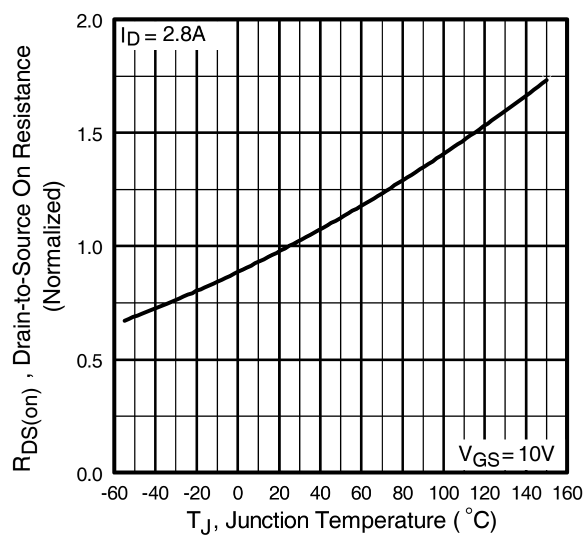


Fig 4. Normalized On-Resistance
Vs. Temperature

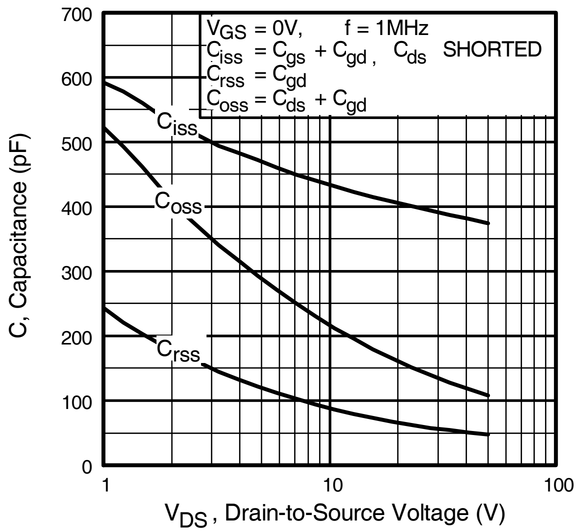


Fig 5. Typical Capacitance Vs. Drain-to-Source Voltage

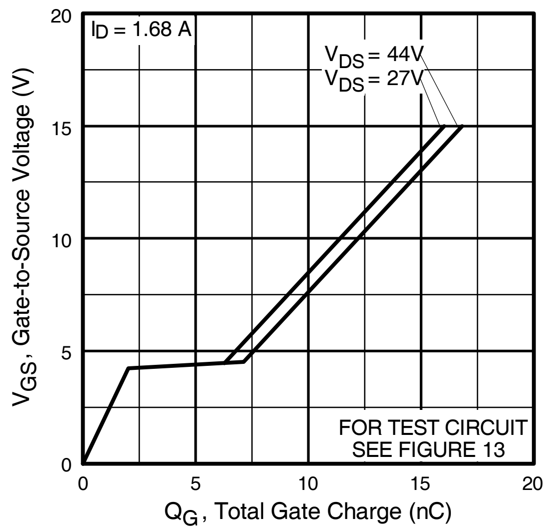


Fig 6. Typical Gate Charge Vs. Gate-to-Source Voltage

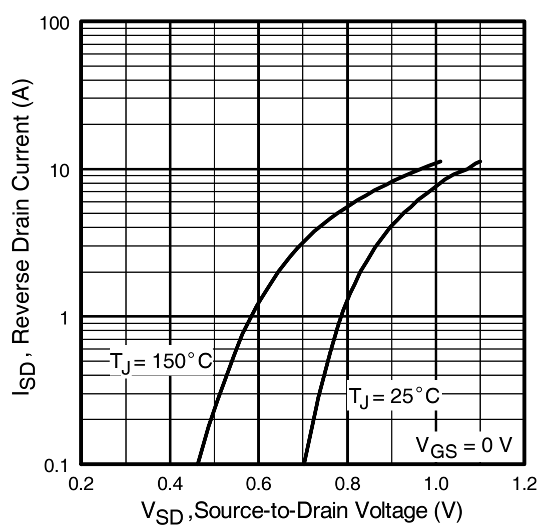


Fig 7. Typical Source-Drain Diode Forward Voltage

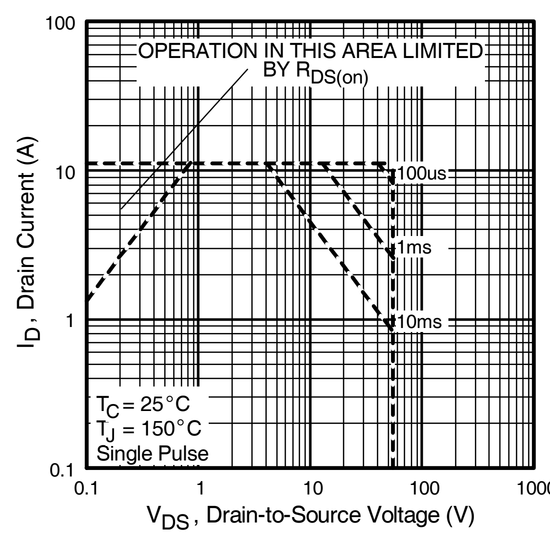


Fig 8. Maximum Safe Operating Area

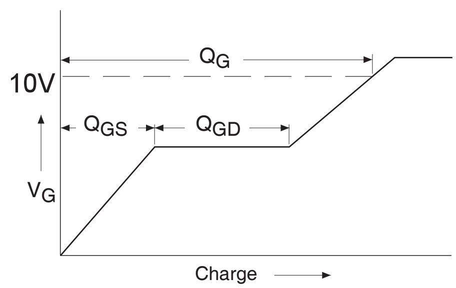


Fig 9a. Basic Gate Charge Waveform

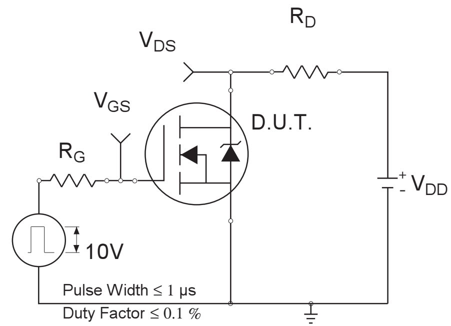


Fig 10a. Switching Time Test Circuit

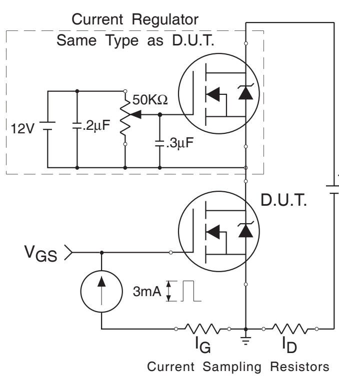


Fig 9b. Gate Charge Test Circuit

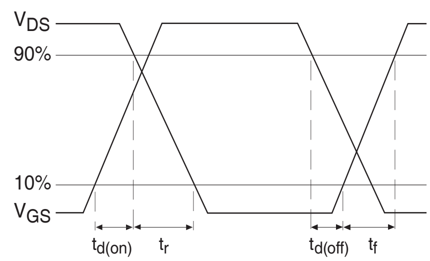


Fig 10b. Switching Time Waveforms

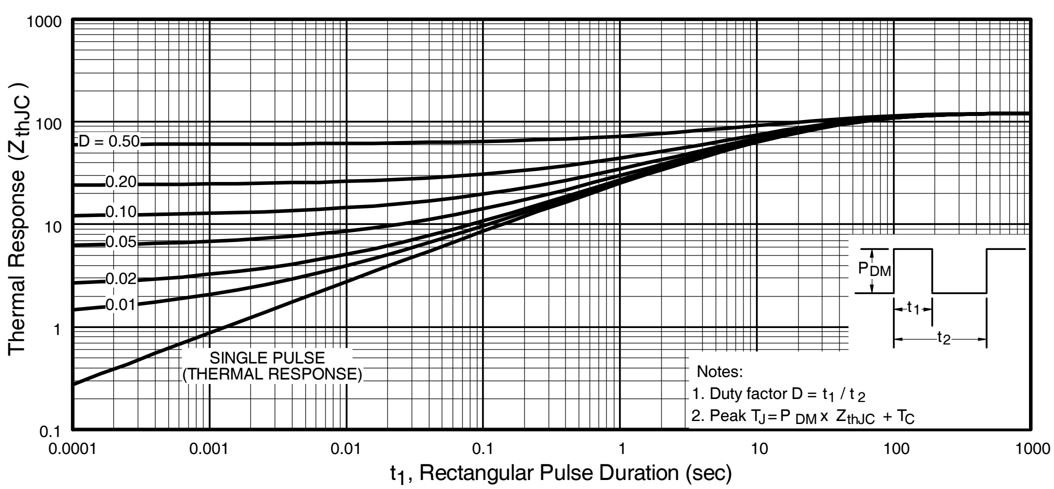


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Ambient

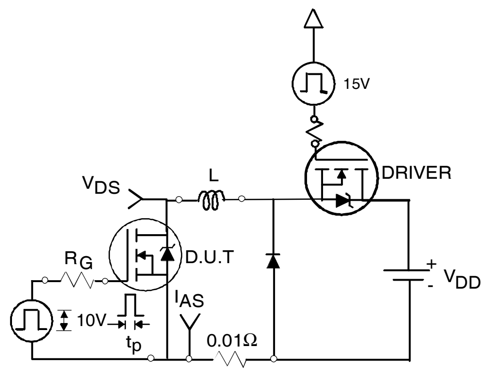


Fig 12a. Unclamped Inductive Test Circuit

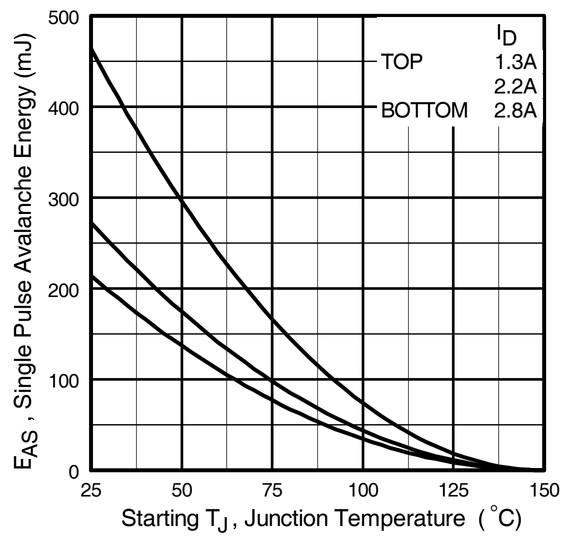


Fig 12c. Maximum Avalanche Energy Vs. Drain Current

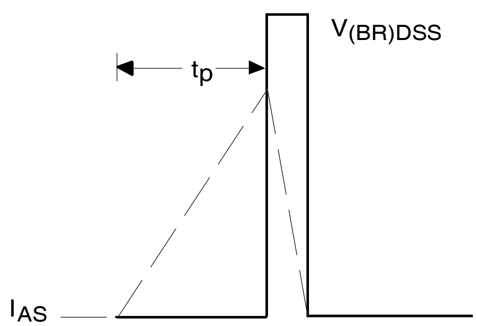


Fig 12b. Unclamped Inductive Waveforms

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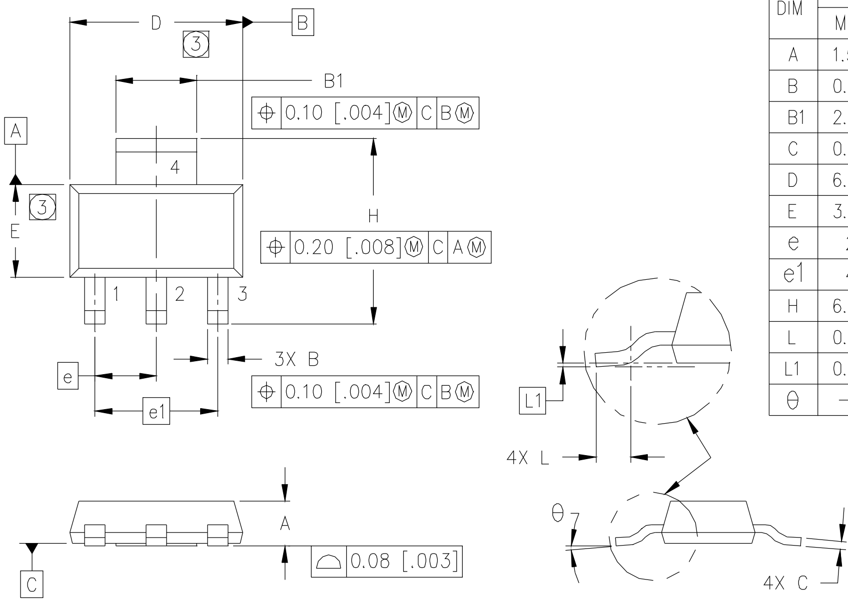
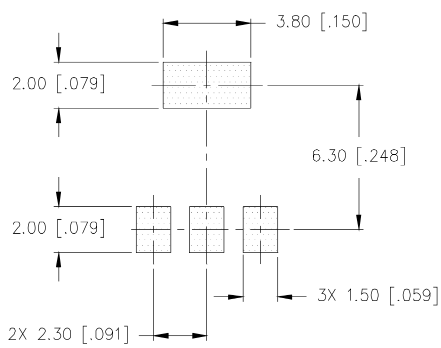
SOT-223 (TO-261AA) Package Outline

Dimensions are shown in milimeters (inches)



DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	1.55	1.80	.061	.071
B	0.65	0.85	.026	.033
B1	2.95	3.15	.116	.124
C	0.25	0.35	.010	.014
D	6.30	6.70	.248	.264
E	3.30	3.70	.130	.146
e	2.30 BSC		.0905 BSC	
e1	4.60 BSC		.181 BSC	
H	6.71	7.29	.264	.287
L	0.91	—	.036	—
L1	0.061 BSC		.0024 BSC	
θ	—	10°	—	10°

MINIMUM RECOMMENDED FOOTPRINT



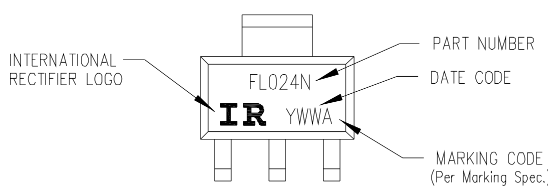
LEAD ASSIGNMENTS

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

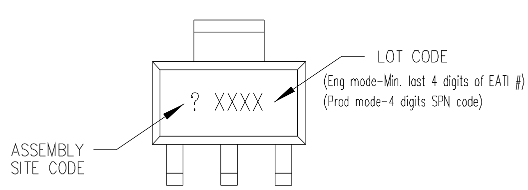
NOTES:

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

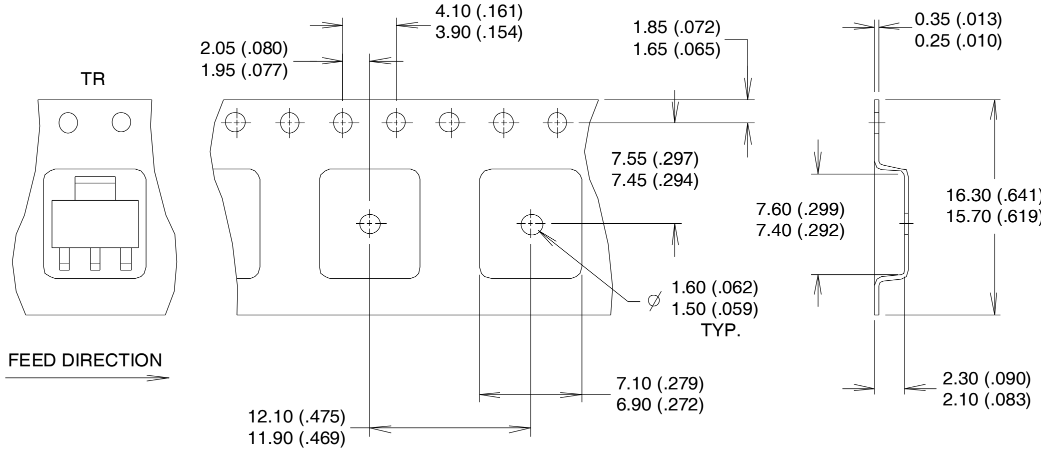


BOTTOM MARKING

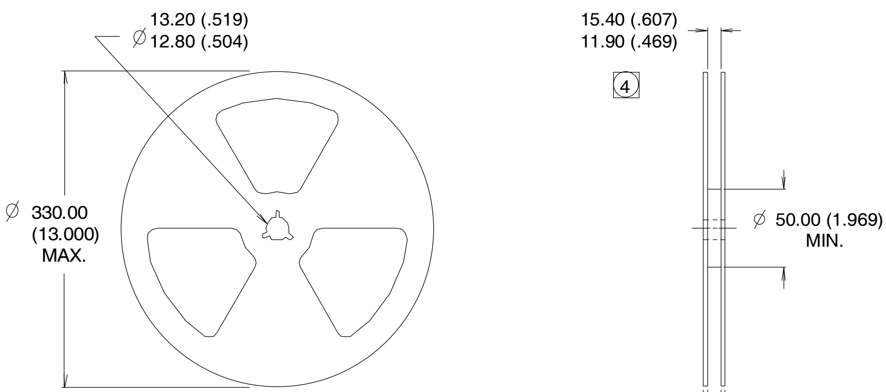
Note: For the most current drawing please refer to IR website at http://www.irf.com/package/

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

Dimensions are shown in milimeters (inches)



NOTES :
1. CONTROLLING DIMENSION: MILLIMETER.
2. OUTLINE CONFORMS TO EIA-481 & EIA-541.
3. EACH Ø330.00 (13.00) REEL CONTAINS 2,500 DEVICES.



NOTES :
1. OUTLINE COMFORMS 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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For technical support, please contact IR’s Technical Assistance Center
http://www.irf.com/technical-info/

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