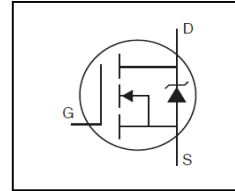# AUIRLL024Z

Features

- Advanced Process Technology
- Ultra Low On-Resistance
- Logic Level Gate Drive
- 150°C Operating Temperature
- Fast Switching
- Repetitive Avalanche Allowed up to Tjmax
- Lead-Free, RoHS Compliant
- Automotive Qualified *

HEXFET® Power MOSFET

V_{DSS}		**55V**
$R_{DS(on)}$	**typ.**	**48mΩ**
	max.	**60mΩ**
I_D		**5.0A**

SOT-223
AUIRLL024Z

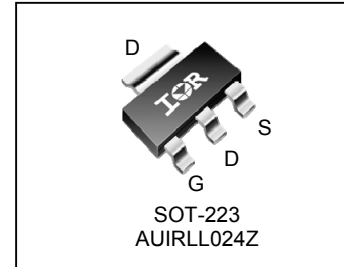| G	D	S
Gate	Drain	Source

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 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**	
AUIRLL024Z	SOT-223	Tape and Reel	2500	AUIRLL024ZTR

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_A = 25°C	Continuous Drain Current, V_{GS} @ 10V ⑦	5.0	A
I_D @ T_A = 70°C	Continuous Drain Current, V_{GS} @ 10V ⑦	4.0	
I_{DM}	Pulsed Drain Current ①	40	
P_D @T_A = 25°C	Maximum Power Dissipation (PCB Mount) ⑦	2.8	W
P_D @T_A = 25°C	Maximum Power Dissipation (PCB Mount) ⑧	1.0	
	Linear Derating Factor (PCB Mount) ⑦	0.02	W/°C
V_{GS}	Gate-to-Source Voltage	± 16	V
E_{AS}	Single Pulse Avalanche Energy (Thermally Limited) ②	21	mJ
$E_{AS\ (Tested)}$	Single Pulse Avalanche Energy (Tested Value) ⑥	38	
I_{AR}	Avalanche Current ①	See Fig. 12a, 12b, 15, 16	A
E_{AR}	Repetitive Avalanche Energy ⑤		mJ
T_J T_{STG}	Operating Junction and Storage Temperature Range	-55 to + 150	°C

Thermal Resistance

Symbol	Parameter	Typ.	Max.	Units
$R_{θJA}$	Junction-to-Ambient (PCB Mount, steady state) ⑦	——	45	°C/W
$R_{θJA}$	Junction-to-Ambient (PCB Mount, steady state) ⑧	——	120	

HEXFET® is a registered trademark of Infineon.

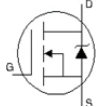*Qualification standards can be found at www.infineon.com

2015-10-29

Static @ 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
ΔV$_{(BR)DSS}$/ΔT$_J$	Breakdown Voltage Temp. Coefficient	——	0.049	——	V/°C	Reference to 25°C, I$_D$ = 1mA
R$_{DS(on)}$	Static Drain-to-Source On-Resistance	——	48	60	mΩ	V$_{GS}$ = 10V, I$_D$ = 3.0A ③
		——	——	80		V$_{GS}$ = 5.0V, I$_D$ = 3.0A ③
		——	——	100		V$_{GS}$ = 4.5V, I$_D$ = 3.0A ③
V$_{GS(th)}$	Gate Threshold Voltage	1.0	——	3.0	V	V$_{DS}$ = V$_{GS}$, I$_D$ = 250µA
gfs	Forward Trans conductance	7.5	——	——	S	V$_{DS}$ = 25V, I$_D$ = 3.0A
I$_{DSS}$	Drain-to-Source Leakage Current	——	——	20	µA	V$_{DS}$ = 55V, V$_{GS}$ = 0V
		——	——	250		V$_{DS}$ = 55V, V$_{GS}$ = 0V, T$_J$ = 125°C
I$_{GSS}$	Gate-to-Source Forward Leakage	——	——	200	nA	V$_{GS}$ = 16V
	Gate-to-Source Reverse Leakage	——	——	-200		V$_{GS}$ = -16V

Dynamic Electrical Characteristics @ T$_J$ = 25°C (unless otherwise specified)

	Parameter	Min.	Typ.	Max.	Units	Conditions
Q$_g$	Total Gate Charge	——	7.0	11	nC	I$_D$ = 3.0A
Q$_{gs}$	Gate-to-Source Charge	——	1.5	——		V$_{DS}$ = 44V
Q$_{gd}$	Gate-to-Drain Charge	——	4.0	——		V$_{GS}$ = 5.0V ③
t$_{d(on)}$	Turn-On Delay Time	——	8.6	——	ns	V$_{DD}$ = 28V
t$_r$	Rise Time	——	33	——		I$_D$ = 3.0A
t$_{d(off)}$	Turn-Off Delay Time	——	20	——		R$_G$ = 56Ω
t$_f$	Fall Time	——	15	——		V$_{GS}$ = 5.0V ③
C$_{iss}$	Input Capacitance	——	380	——	pF	V$_{GS}$ = 0V
C$_{oss}$	Output Capacitance	——	66	——		V$_{DS}$ = 25V
C$_{rss}$	Reverse Transfer Capacitance	——	36	——		f = 1.0MHz
C$_{oss}$	Output Capacitance	——	220	——		V$_{GS}$ = 0V, V$_{DS}$ = 1.0V, f = 1.0MHz
C$_{oss}$	Output Capacitance	——	53	——		V$_{GS}$ = 0V, V$_{DS}$ = 44V, f = 1.0MHz
C$_{oss\ eff.}$	Effective Output Capacitance	——	93	——		V$_{GS}$ = 0V, V$_{DS}$ = 0V to 44V ④

Diode Characteristics

	Parameter	Min.	Typ.	Max.	Units	Conditions
I$_S$	Continuous Source Current (Body Diode)	——	——	5.0	A	MOSFET symbol showing the integral reverse p-n junction diode.
I$_{SM}$	Pulsed Source Current (Body Diode) ①	——	——	40		
V$_{SD}$	Diode Forward Voltage	——	——	1.3	V	T$_J$ = 25°C, I$_S$ = 3.0A, V$_{GS}$ = 0V ④
t$_{rr}$	Reverse Recovery Time	——	15	23	ns	T$_J$ = 25°C, I$_F$ = 3.0A, V$_{DD}$ = 28V
Q$_{rr}$	Reverse Recovery Charge	——	9.1	14	nC	di/dt = 100A/µs ③
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 Limited by T$_{Jmax}$, Starting T$_J$ = 25°C, L = 4.8mH, R$_G$ = 25Ω, I$_{AS}$ = 3.A. V$_{GS}$ = 10V.Part not recommended for use above this value.

③ Pulse width ≤ 1.0ms; duty cycle ≤ 2%.

④ 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$_{DSS}$.

⑤ Limited by T$_{Jmax}$, see Fig.12a, 12b, 15, 16 for typical repetitive avalanche performance.

⑥ This value determined from sample failure population, starting T$_J$ = 25°C, L = 4.8mH, R$_G$ = 25Ω, I$_{AS}$ = 3.0A, V$_{GS}$ =10V.

⑦ When mounted on 1 inch square copper board.

⑧ When mounted on FR-4 board using minimum recommended footprint.

2015-10-29
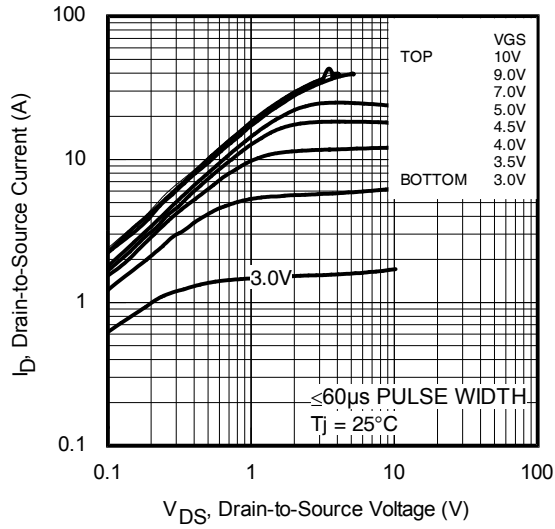
Fig. 1 Typical Output Characteristics
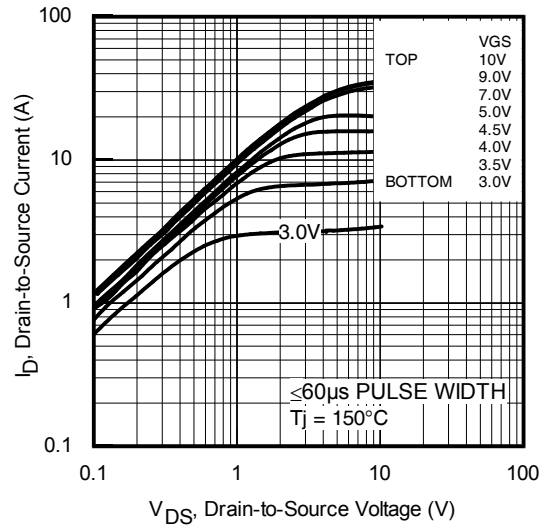
Fig. 2 Typical Output Characteristics
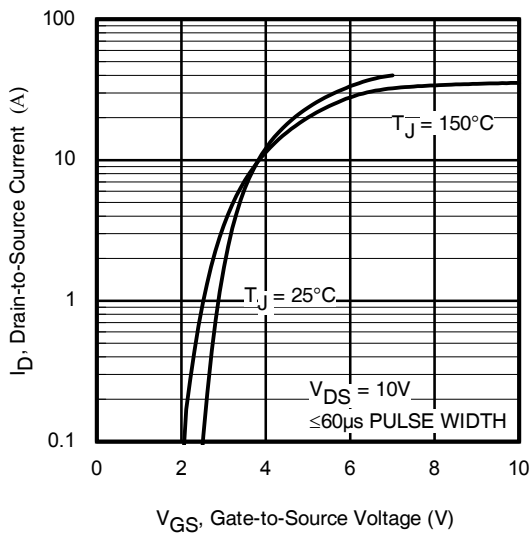
Fig. 3 Typical Transfer Characteristics
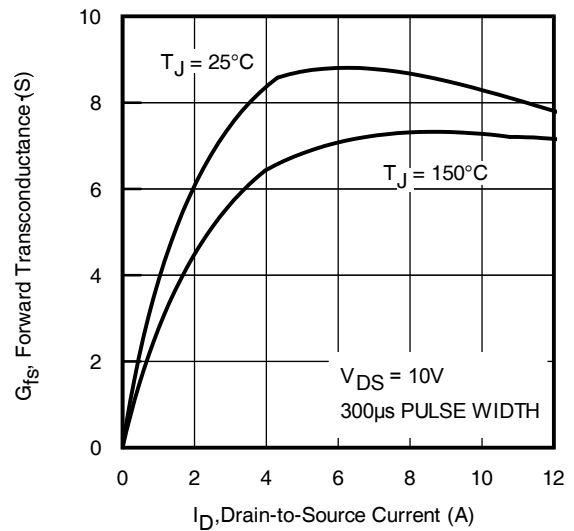
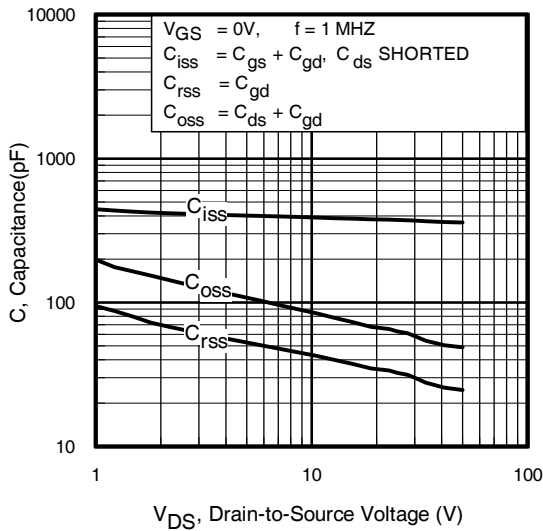**Fig. 4** Typical Forward Trans conductance vs. Drain Current

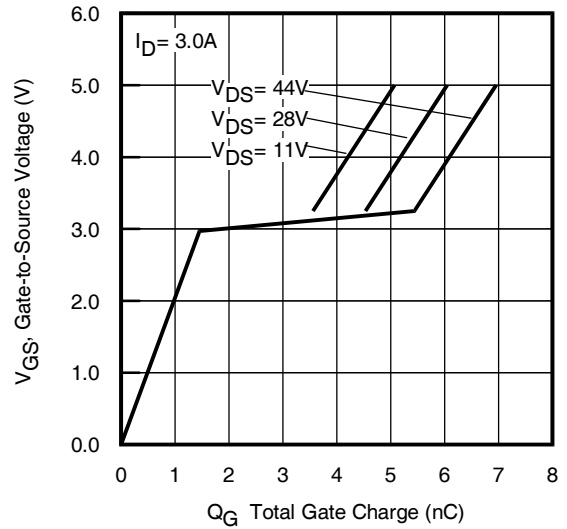**Fig 5.** Typical Capacitance vs.
Drain-to-Source Voltage
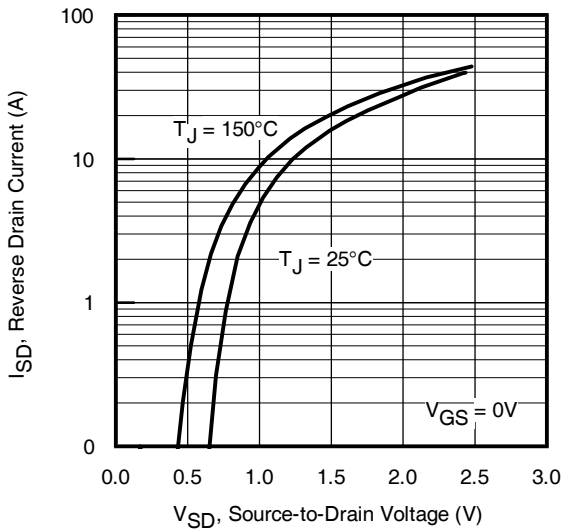

Fig 6. Typical Gate Charge vs.
Gate-to-Source Voltage

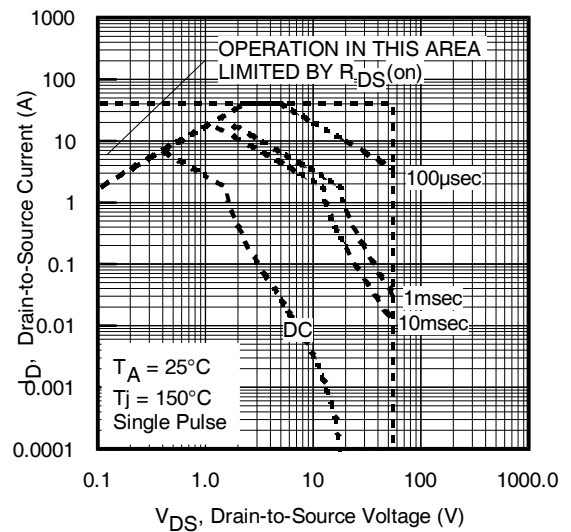**Fig. 7** Typical Source-to-Drain Diode
Forward Voltage

Fig 8. Maximum Safe Operating Area
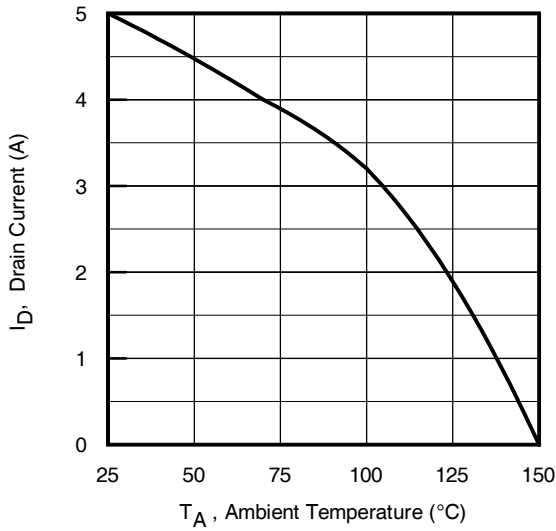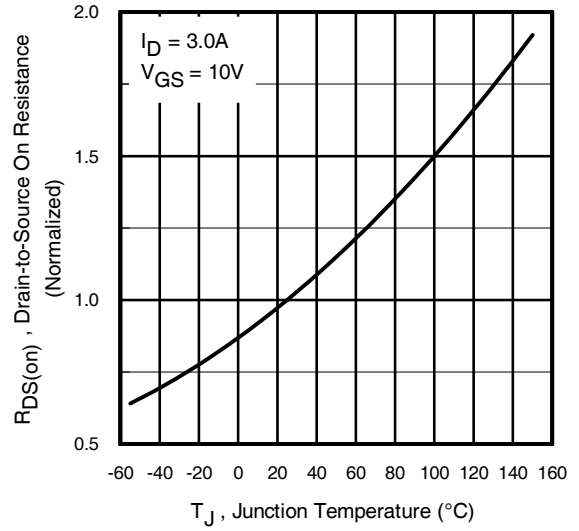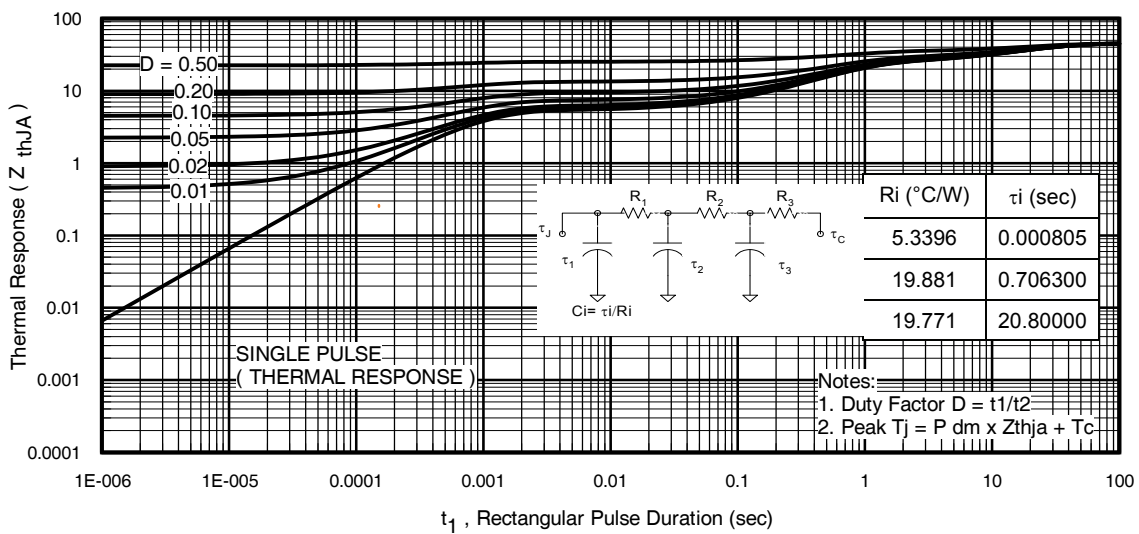
Fig 9. Maximum Drain Current Vs. Ambient Temperature

Fig 10. Normalized On-Resistance vs. Temperature

Ri (°C/W)	τi (sec)
5.3396	0.000805
19.881	0.706300
19.771	20.80000

SINGLE PULSE
(THERMAL RESPONSE)

Notes:
1. Duty Factor D = t1/t2
2. Peak Tj = P dm x Zthja + Tc

Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Ambient
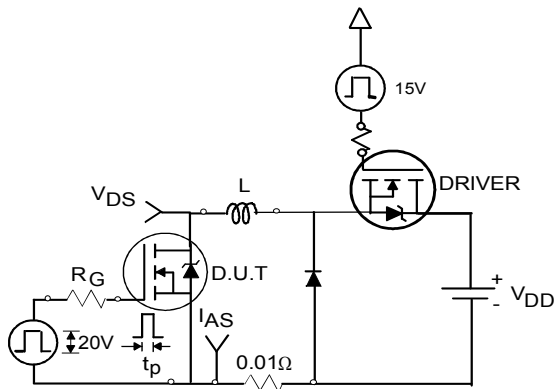
Fig 12a. Unclamped Inductive Test Circuit
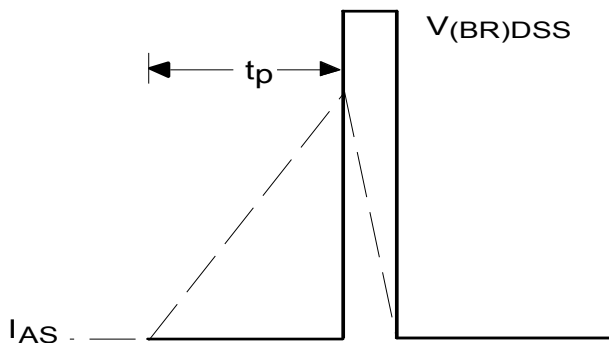
Fig 12b. Unclamped Inductive Waveforms

Fig 13a. Basic Gate Charge Waveform
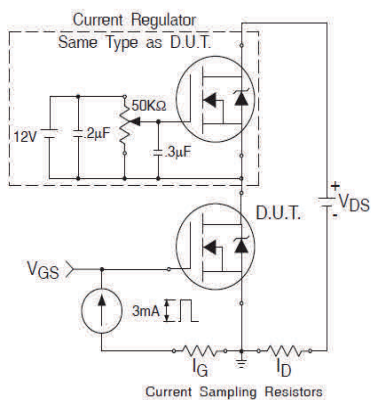
Fig 13b. Gate Charge Test Circuit

Fig 12c. Maximum Avalanche Energy Vs. Drain Current
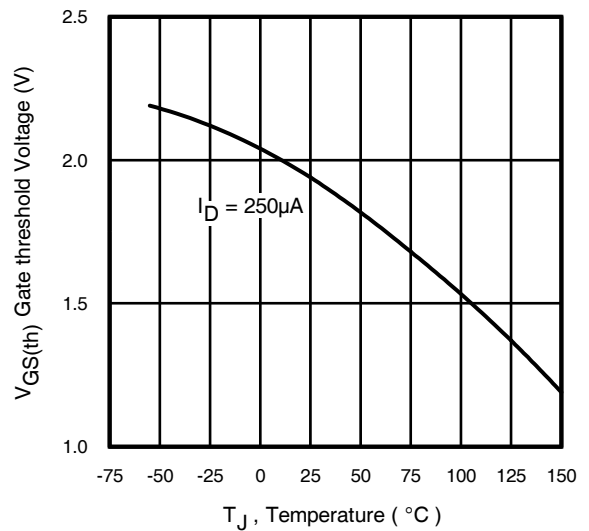
Fig 14. Threshold Voltage vs. Temperature
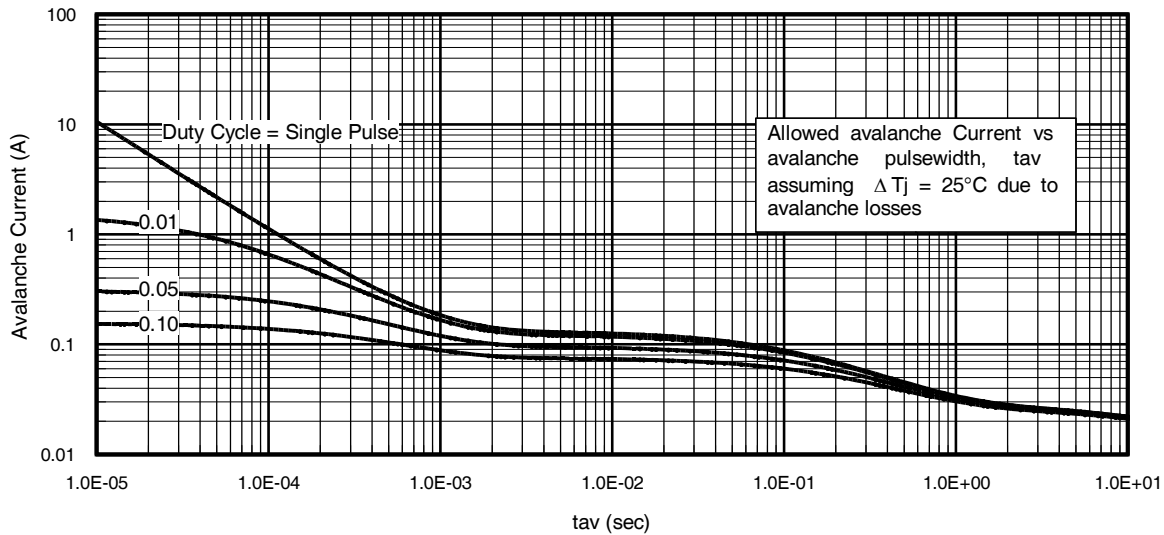
Fig 15. Typical Avalanche Current vs. Pulse width
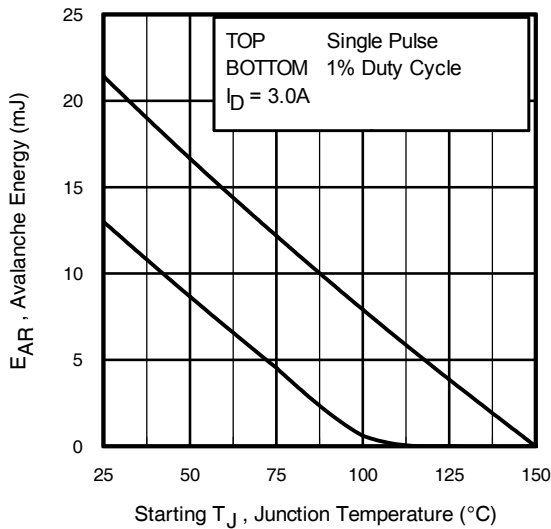
Fig 16. Maximum Avalanche Energy
vs. Temperature

Notes on Repetitive Avalanche Curves , Figures 15, 16:
(For further info, see AN-1005 at www.infineon.com)
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. $P_{D (ave)}$ = 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 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)

$$P_{D (ave)} = 1/2\ (\ 1.3 \cdot BV \cdot I_{av}) = \Delta T /\ Z_{thJC}$$
$$I_{av} = 2\Delta T /\ [1.3 \cdot BV \cdot Z_{th}]$$
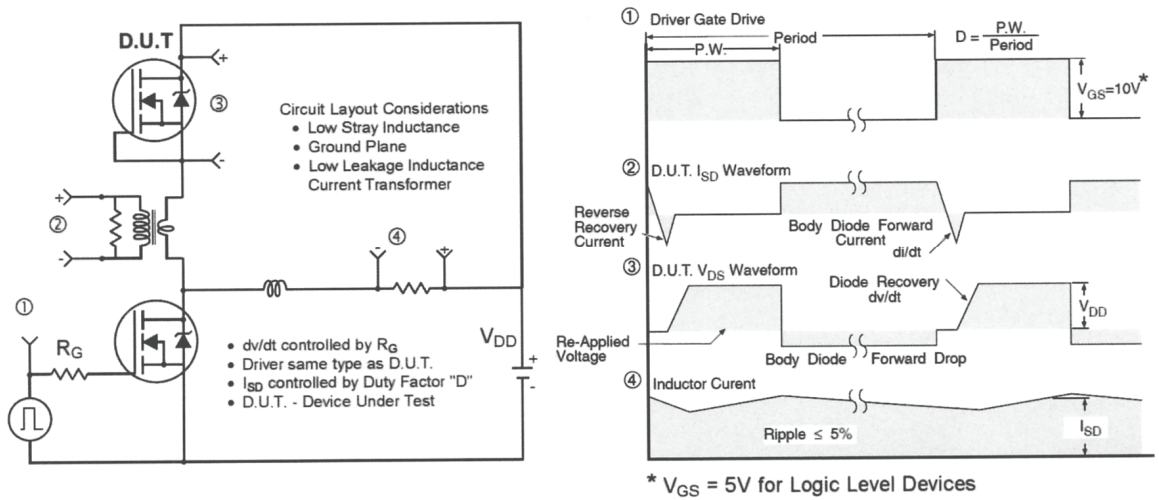$$E_{AS (AR)} = P_{D (ave)} \cdot t_{av}$$

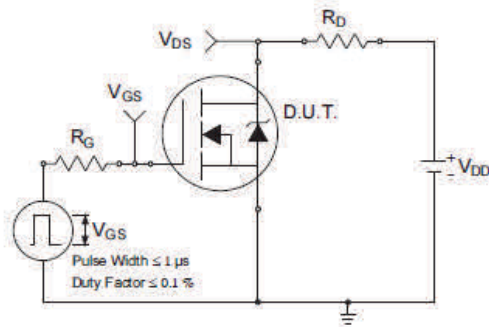Fig 17. Peak Diode Recovery dv/dt Test Circuit for N-Channel HEXFET® Power MOSFETs
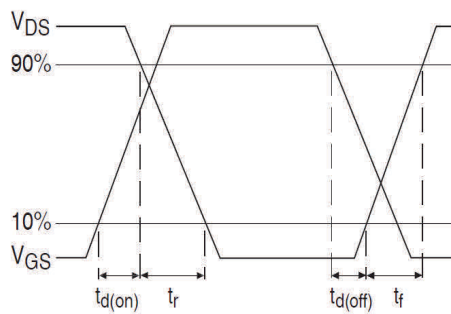

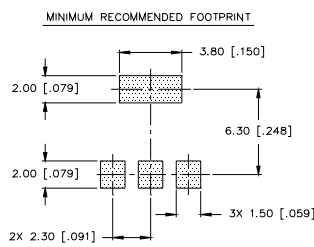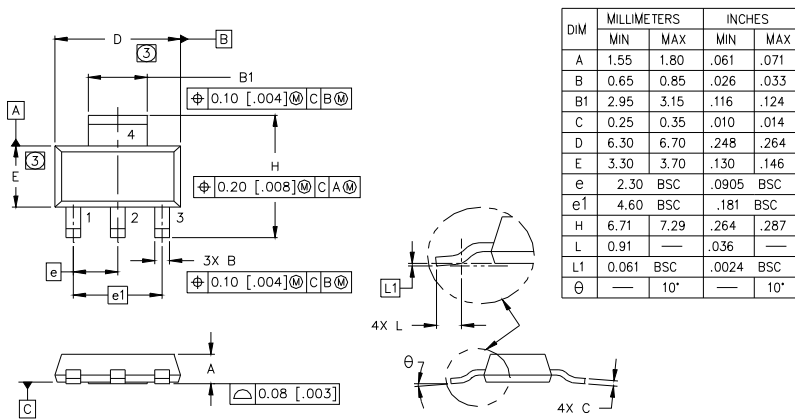Fig 18a. Switching Time Test Circuit

Fig 18b. Switching Time Waveforms

SOT-223 (TO-261AA) Package Outline (Dimensions are shown in millimeters (inches)

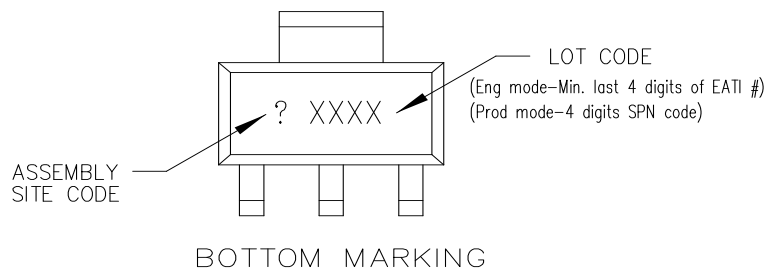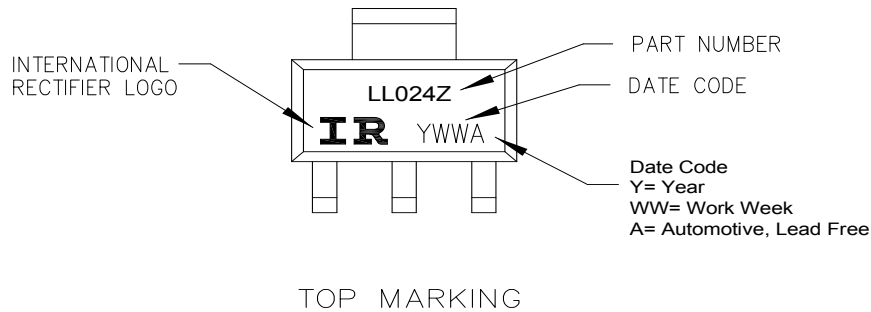| DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	1.55	1.80	.061	.071
B	0.65	0.85	.026	.033
B1	2.95	3.15	.116	.124
C	0.25	0.35	.010	.014
D	6.30	6.70	.248	.264
E	3.30	3.70	.130	.146
e	2.30	BSC	.0905	BSC
e1	4.60	BSC	.181	BSC
H	6.71	7.29	.264	.287
L	0.91	—	.036	—
L1	0.061	BSC	.0024	BSC
θ	—	10°	—	10°

LEAD ASSIGNMENTS
1 = GATE
2 = DRAIN
3 = SOURCE
4 = DRAIN
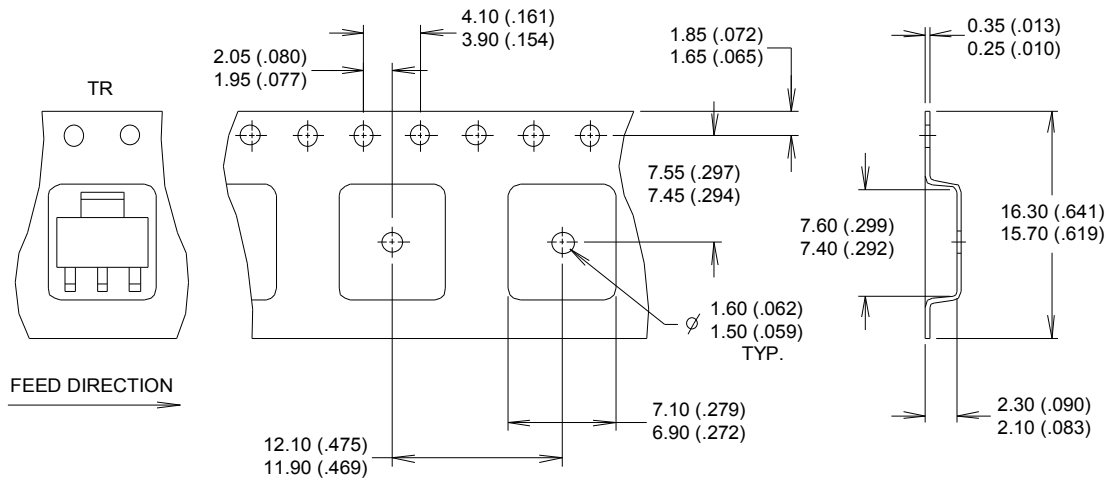
MINIMUM RECOMMENDED FOOTPRINT

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.
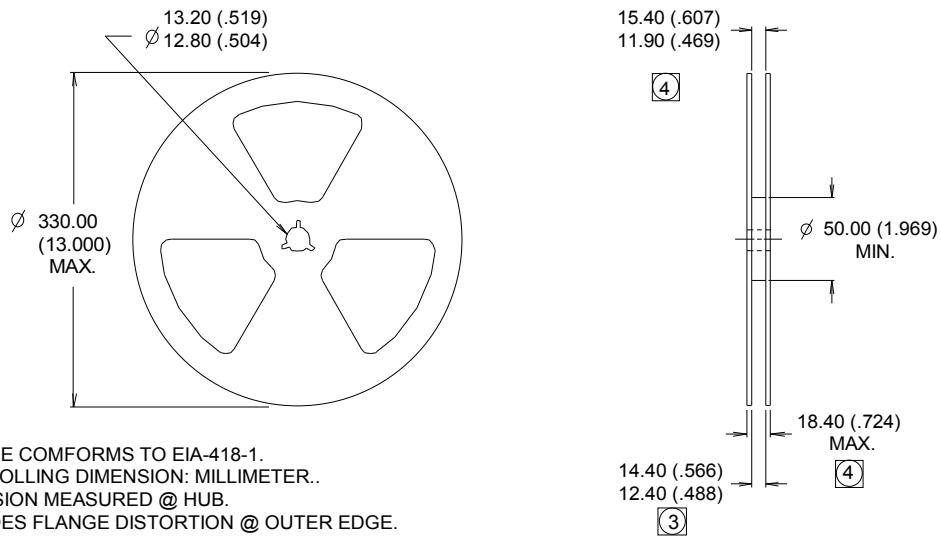5. DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES].

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 and Reel (Dimensions are shown in millimeters (inches)

TR

FEED DIRECTION

4.10 (.161)
3.90 (.154)

2.05 (.080)
1.95 (.077)

1.85 (.072)
1.65 (.065)

0.35 (.013)
0.25 (.010)

7.55 (.297)
7.45 (.294)

7.60 (.299)
7.40 (.292)

16.30 (.641)
15.70 (.619)

∅ 1.60 (.062)
1.50 (.059)
TYP.

7.10 (.279)
6.90 (.272)

12.10 (.475)
11.90 (.469)

2.30 (.090)
2.10 (.083)

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

13.20 (.519)
∅ 12.80 (.504)

∅ 330.00
(13.000)
MAX.

15.40 (.607)
11.90 (.469)
④

∅ 50.00 (1.969)
MIN.

18.40 (.724)
MAX.
④

14.40 (.566)
12.40 (.488)
③

NOTES :
1. OUTLINE COMFORMS TO EIA-418-1.
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

Qualification Level	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.	
Moisture Sensitivity Level	SOT-223	MSL1
ESD	Machine Model	Class M1B (+/- 100V)† AEC-Q101-002
	Human Body Model	Class H0 (+/- 250V)† AEC-Q101-001
	Charged Device Model	Class C5 (+/- 1125V)† AEC-Q101-005
RoHS Compliant	Yes	

† Highest passing voltage.

Revision History

Date	Comments
3/26/2014	• Added "Logic Level Gate Drive" bullet in the features section on page 1 • Updated part marking on page 9 • Updated data sheet with new IR corporate template
10/29/2015	• Updated datasheet with corporate template • Corrected ordering table on page 1.