

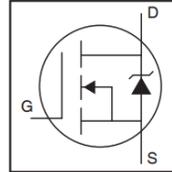
英飞凌 **AUIRFS\_SL4410Z** 汽车级  
**175°C** 超低导通电阻功率  
**MOSFET**

**AUIRFS4410Z**  
**AUIRFSL4410Z**

**特性**

- 先进工艺技术
- 超低导通电阻
- 工作温度 175°C
- 快速开关
- 允许达到 Tjmax 的重复雪崩
- 无铅，符合RoHS要求
- 汽车认证\*

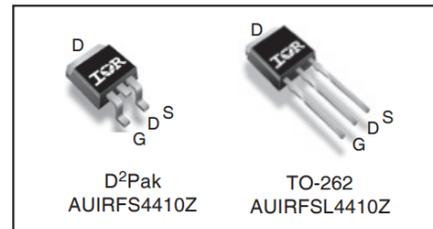
HEXFET® 功率 MOSFET



<b>V<sub>DS</sub></b>	<b>100V</b>
<b>R<sub>DS(on)</sub></b> <b>typ. max.</b>	<b>7.2mΩ</b>
	<b>9.0mΩ</b>
<b>I<sub>D</sub></b>	<b>97A</b>

**描述**

这款 HEXFET® 功率 MOSFET 专为汽车应用而设计，采用最新的工艺技术实现单位硅面积极低的导通电阻。该设计的特点包括 175°C 工作结温、开关速度快和提高重复雪崩额定值。通过结合以上特点，使该设计成为一种极其高效和可靠的器件，可用于汽车应用和各种其他应用。



<b>G</b>	<b>D</b>	<b>S</b>
Gate	Drain	Source

**绝对最大额定值**

超过“绝对最大额定值”所列值的应力可能会对器件造成永久性损坏。这些仅仅是应力额定值，并不意味着器件在这些或任何其他超过该规范所示的条件下能够正常运行。延长暴露在绝对最大额定值条件的可能会影响器件的可靠性。热阻抗和功率耗散额定值是在装板和静止空气条件下测得的。环境温度 (TA) 为 25°C，除非另有规定。

	<b>Parameter</b>	<b>Max.</b>	<b>Units</b>
I <sub>D</sub> @ T <sub>C</sub> = 25°C	Continuous Drain Current, V <sub>GS</sub> @ 10V	97	A
I <sub>D</sub> @ T <sub>C</sub> = 100°C	Continuous Drain Current, V <sub>GS</sub> @ 10V	69	
I <sub>DM</sub>	Pulsed Drain Current (Q)	390	
P <sub>D</sub> @ T <sub>C</sub> = 25°C	Maximum Power Dissipation	230	W
	Linear Derating Factor	1.5	W/°C
V <sub>GS</sub>	Gate-to-Source Voltage	± 20	V
dv/dt	Peak Diode Recovery CT	16	V/ns
E <sub>AS</sub> (Thermally limited)	Single Pulse Avalanche Energy 0	242	mJ
I <sub>AR</sub>	Avalanche Current	See Fig. 14, 15, 22a, 22b,	A
E <sub>AR</sub>	Repetitive Avalanche Energy ©		mJ
T <sub>J</sub>	Operating Junction and	-55 to + 175	°C
T <sub>STG</sub>	Storage Temperature Range		
	Soldering Temperature, for 10 seconds (1.6mm from case)		

**热阻抗**

	<b>Parameter</b>	<b>Typ.</b>	<b>Max.</b>	<b>Units</b>
R <sub>θJC</sub>	Junction-to-Case	---	0.65	°C/W
R <sub>θJA</sub>	Junction-to-Ambient (PCB Mount), D²Pak CV	---	40	

HEXFET® 是国际整流器的注册商标。

\*认证标准可在 [www.infineon.com](http://www.infineon.com) 上找到

[www.irf.com](http://www.irf.com)

本数据手册的原文使用英文撰写。为方便起见，英飞凌提供了译文；由于翻译过程中可能使用了自动化工具，英飞凌不保证译文的准确性。为确认准确性，请务必访问 [infineon.com](http://infineon.com) 参考最新的英文版本（控制文档）。

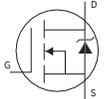
静态电气特性@T<sub>J</sub> = 25°C (除非另有说明)

	Parameter	Min.	Typ.	Max.	Units	Conditions
V <sub>(BR)DSS</sub>	Drain-to-Source Breakdown Voltage	100	---	---	V	V <sub>GS</sub> = 0V, I <sub>D</sub> = 250μA
ΔV <sub>(BR)DSS</sub> /ΔT <sub>J</sub>	Breakdown Voltage Temp. Coefficient	---	0.12	---	V/°C	Reference to 25°C, I <sub>D</sub> = 5mAG)
R <sub>DS(on)</sub>	Static Drain-to-Source On-Resistance	---	7.2	9.0	mΩ	V <sub>GS</sub> = 10V, I <sub>D</sub> = 58A @)
V <sub>GS(th)</sub>	Gate Threshold Voltage	2.0	---	4.0	V	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 150μA
g <sub>fs</sub>	Forward Transconductance	140	---	---	S	V <sub>DS</sub> = 10V, I <sub>D</sub> = 58A
I <sub>DSS</sub>	Drain-to-Source Leakage Current	---	---	20	μA	V <sub>DS</sub> = 100V, V <sub>GS</sub> = 0V
		---	---	250		V <sub>DS</sub> = 80V, V <sub>GS</sub> = 0V, T <sub>J</sub> = 125°C
I <sub>GSS</sub>	Gate-to-Source Forward Leakage	---	---	100	nA	V <sub>GS</sub> = 20V
	Gate-to-Source Reverse Leakage	---	---	-100		V <sub>GS</sub> = -20V
R <sub>G</sub>	Internal Gate Resistance	---	0.70	---	Ω	

动态电气特性在 T<sub>J</sub> = 25°C时测得 (除非另有规定)

	Parameter	Min.	Typ.	Max.	Units	Conditions
Q <sub>g</sub>	Total Gate Charge	---	83	120	nC	I <sub>D</sub> = 58A V <sub>DS</sub> = 50V V <sub>GS</sub> = 10V @)
Q <sub>gs</sub>	Gate-to-Source Charge	---	19	---		
Q <sub>gd</sub>	Gate-to-Drain ("Miller") Charge	---	27	---		
Q <sub>sync</sub>	Total Gate Charge Sync. (Q <sub>g</sub> - Q <sub>gd</sub> )	---	56	---		I <sub>D</sub> = 58A, V <sub>DS</sub> = 0V, V <sub>GS</sub> = 10V @)
t <sub>d(on)</sub>	Turn-On Delay Time	---	16	---	ns	V <sub>DD</sub> = 65V I <sub>D</sub> = 58A R <sub>G</sub> = 2.7Ω V <sub>GS</sub> = 10V @)
t <sub>r</sub>	Rise Time	---	52	---		
t <sub>d(off)</sub>	Turn-Off Delay Time	---	43	---		
t <sub>f</sub>	Fall Time	---	57	---		
C <sub>iss</sub>	Input Capacitance	---	4820	---	pF	V <sub>GS</sub> = 0V V <sub>DS</sub> = 50V f = 1.0MHz, See Fig.5 V <sub>GS</sub> = 0V, V <sub>DS</sub> = 0V to 80V ®, See Fig.11 V <sub>GS</sub> = 0V, V <sub>DS</sub> = 0V to 80V ◆
C <sub>oss</sub>	Output Capacitance	---	340	---		
C <sub>rss</sub>	Reverse Transfer Capacitance	---	170	---		
C <sub>oss eff. (ER)</sub>	Effective Output Capacitance (Energy Related)	---	420	---		
C <sub>oss eff. (TR)</sub>	Effective Output Capacitance (Time Related)	---	690	---		

二极管特性

	Parameter	Min.	Typ.	Max.	Units	Conditions
I <sub>S</sub>	Continuous Source Current (Body Diode)	---	---	97	A	MOSFET symbol showing the integral reverse p-n junction diode. 
I <sub>SM</sub>	Pulsed Source Current (Body Diode) G)	---	---	390		
V <sub>SD</sub>	Diode Forward Voltage	---	---	1.3	V	T <sub>J</sub> = 25°C, I <sub>S</sub> = 58A, V <sub>GS</sub> = 0V @)
t <sub>rr</sub>	Reverse Recovery Time	---	38	57	ns	T <sub>J</sub> = 25°C V <sub>R</sub> = 85V,
		---	46	69		T <sub>J</sub> = 125°C I <sub>F</sub> = 58A
Q <sub>rr</sub>	Reverse Recovery Charge	---	53	80	nC	T <sub>J</sub> = 25°C di/dt = 100A/μs @)
		---	82	120		T <sub>J</sub> = 125°C
I <sub>RRM</sub>	Reverse Recovery Current	---	2.5	---	A	T <sub>J</sub> = 25°C
t <sub>on</sub>	Forward Turn-On Time	Intrinsic turn-on time is negligible (turn-on is dominated by LS+LD)				

注:

- ① 重复额定值; 脉冲宽度受最大结温限制
- ② 受 T<sub>Jmax</sub> 限制, 初始 T<sub>J</sub> = 25°C, L = 0.143mH  
R<sub>G</sub> = 25 Ω, I<sub>AS</sub> = 58A, V<sub>GS</sub> = 10V。 不建议在高于此值的情况运行器件。
- ③ I<sub>SD</sub> ≤ 58A, di/dt ≤ 610A/μs, V<sub>DD</sub> ≤ V<sub>(BR)DSS</sub>, T<sub>J</sub> ≤ 175°C.
- ④ 脉冲宽度 ≤ 400 μs; 占空比 ≤ 2%。

- ⑤ C<sub>oss eff. (TR)</sub> 是一个固定电容, 当 V<sub>DS</sub> 从 0 升至 80% V 时, 其充电时间与 C<sub>oss</sub> 相同
- ⑥ C<sub>oss eff. (ER)</sub> 是一个固定电容值, 当 V<sub>DS</sub> 从 0 上升至 80% V<sub>DSS</sub> 时, 其热量与 C<sub>oss</sub> 相同。
- ⑦ 安装在 1 英寸见方的 PCB (FR-4 或 G-10 材料) 上时。有关建议的封装和焊接技术, 请参阅应用注释 #AN-994。
- ⑧ R<sub>θ</sub> 是在 T<sub>J</sub> 约为 90°C 时测得的。

**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>		3L-D2 PAK	MSL1
		3L-TO-262	N/A
<b>ESD</b>	Machine Model	Class M4(+/- 800V) <sup>†††</sup> AEC-Q101-002	
	Human Body Model	Class H2(+/- 3000V) <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

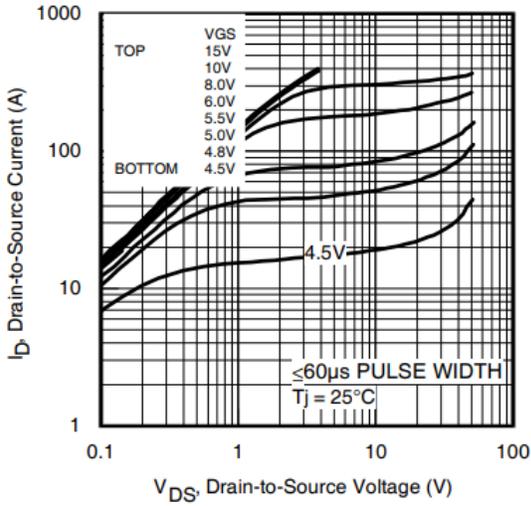


Fig 1. Typical Output Characteristics

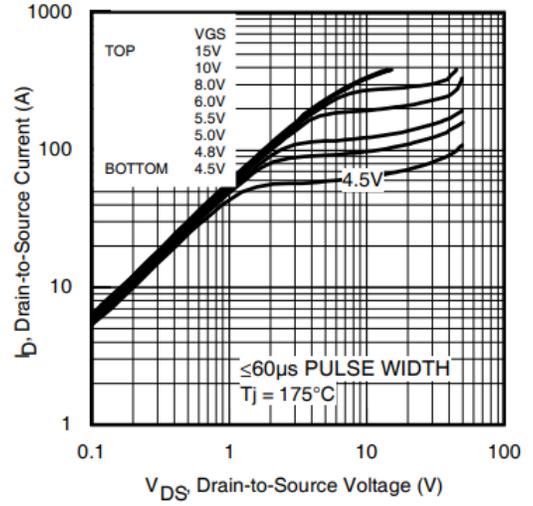


Fig 2. Typical Output Characteristics

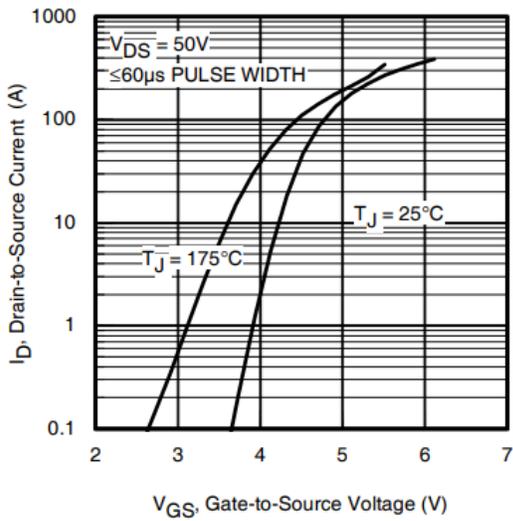


Fig 3. Typical Transfer Characteristics

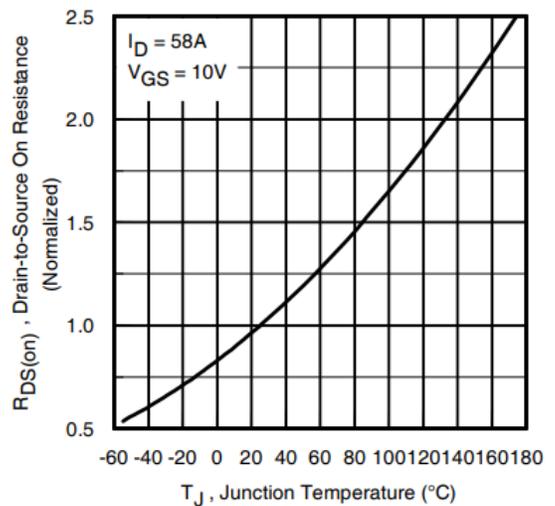


Fig 4. Normalized On-Resistance vs. Temperature

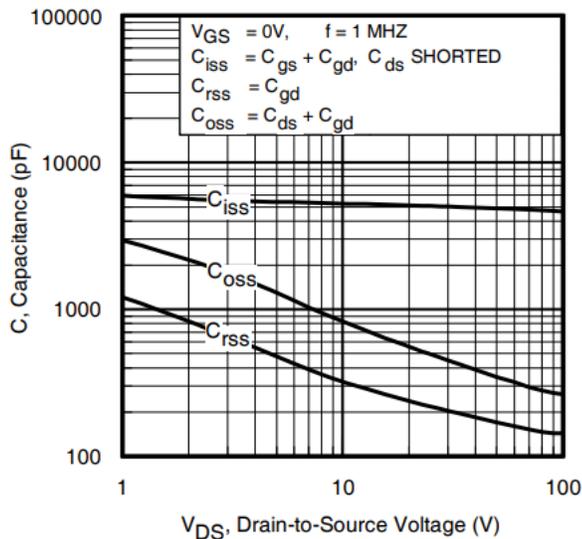


Fig 5. Typical Capacitance vs. Drain-to-Source Voltage

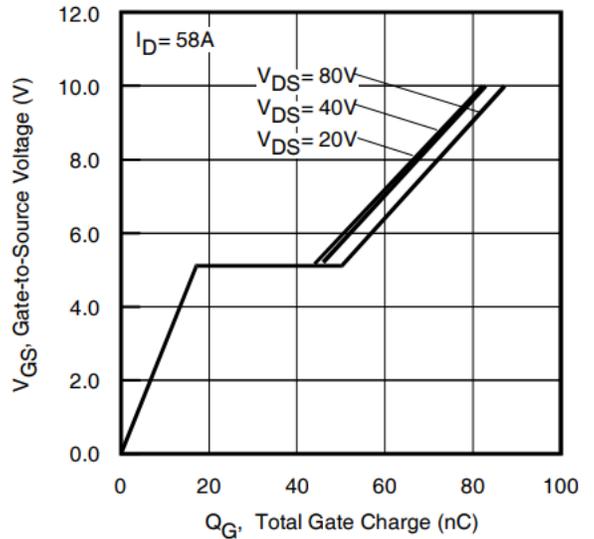
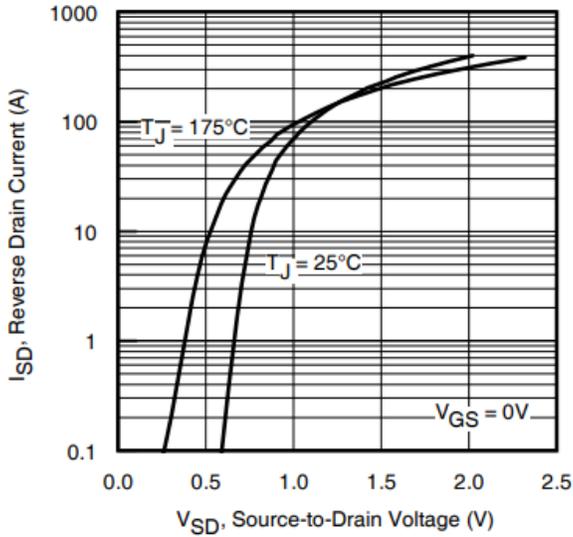
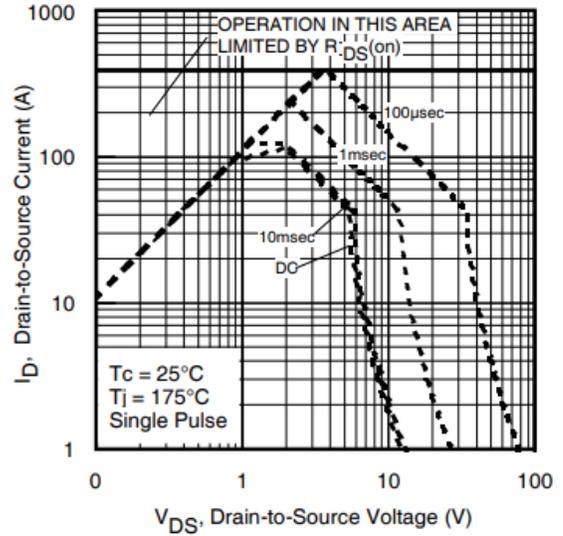


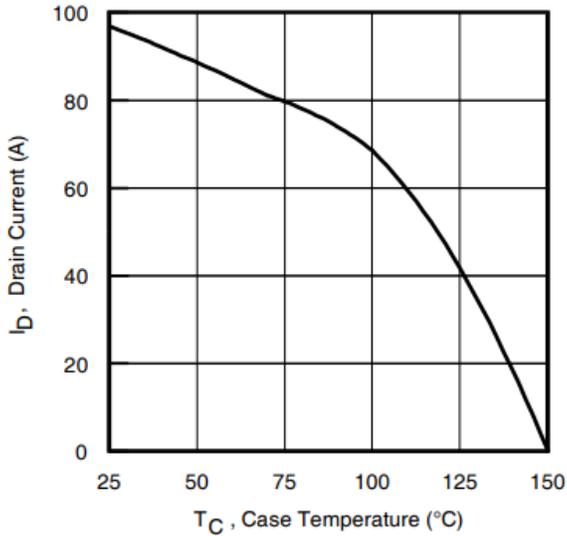
Fig 6. Typical Gate Charge vs. Gate-to-Source Voltage



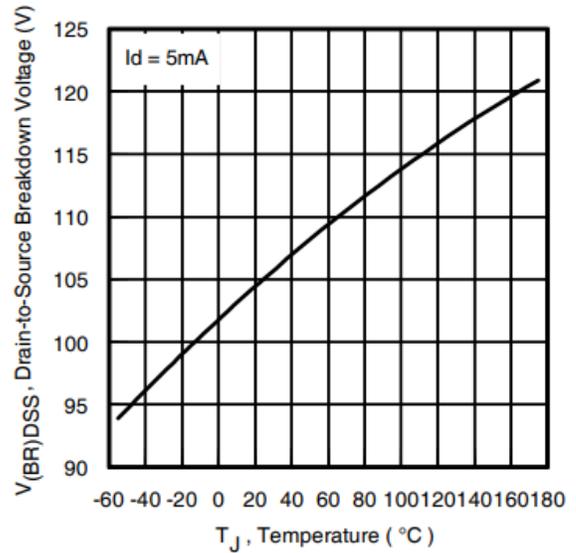
**Fig 7.** Typical Source-Drain Diode Forward Voltage



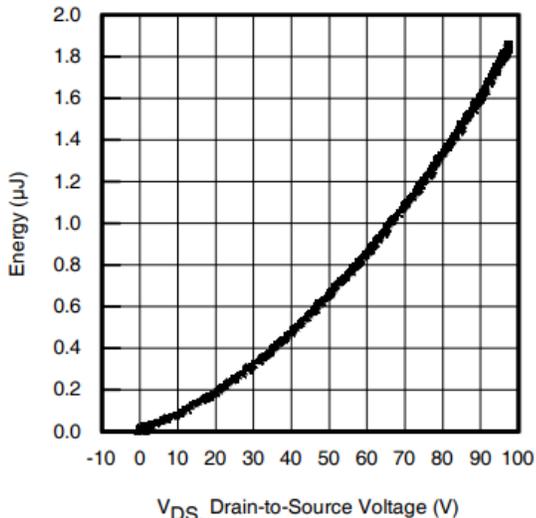
**Fig 8.** Maximum Safe Operating Area



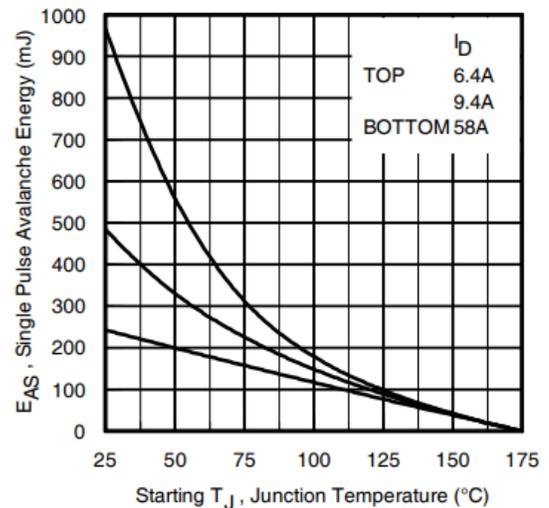
**Fig 9.** Maximum Drain Current vs. Case Temperature



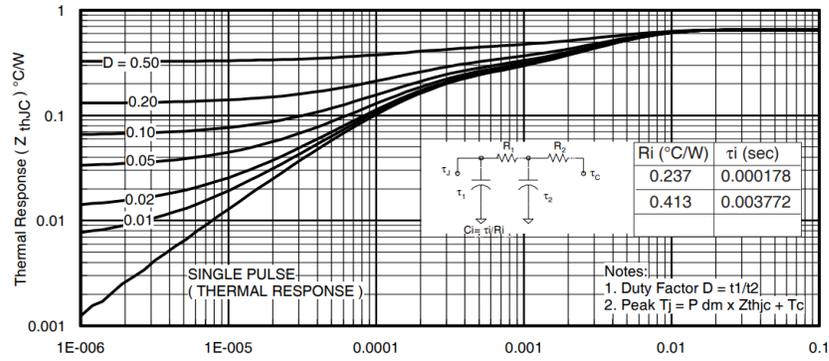
**Fig 10.** Drain-to-Source Breakdown Voltage



**Fig 11.** Typical  $C_{OSS}$  Stored Energy



**Fig 12.** Maximum Avalanche Energy vs. Drain Current



t1, 矩形脉冲持续时间 (秒)

图 13.最大有效瞬态热阻, 结到壳

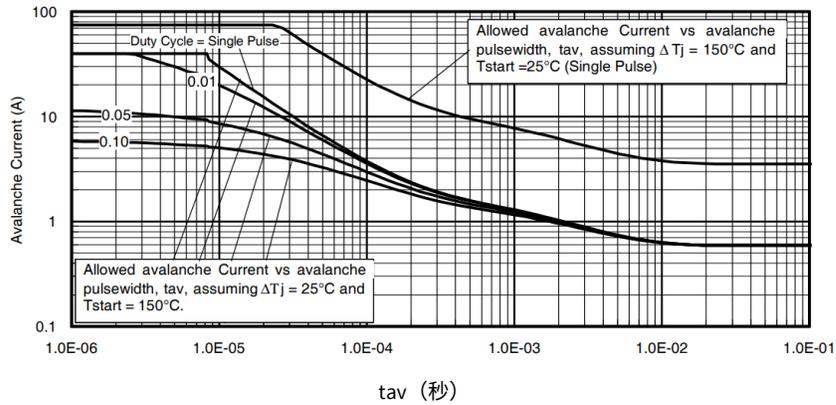


图 14.典型雪崩电流与脉冲宽度

关于重复的雪崩曲线的注释, 图 14、15: (有关详细信息, 请参阅www.irf.com上的 AN-1005)

1. 雪崩失效假设:

纯粹的热现象和失效发生在结温远超过 Tjmax的情况下。这对每种零件类型都是有效的。

2. 只要不超过 Tjmax, 就可以在雪崩中安全运行。

3. 如下公式基于图 22a、22b 所示的电路和波形。

4. Pd(ave) = 每个雪崩脉冲的平均功率耗散。

5. BV = 额定击穿电压 (1.3 倍系数, 考虑雪崩期间的电压增加)。

6. Iav = 可允许的雪崩电流。

7. ΔT = 可允许的结温上升, 不得超过 Tjmax (图 14、15 中假设为 25°C)。

tav = 雪崩的平均时间。  
D = 雪崩占空比 = tav · f

ZthJC (D, tav) = 瞬态热阻抗, 见图 13)

$$P_{D(ave)} = 1/2 ( 1.3 \cdot BV \cdot I_{av} ) = 1/2 I / Z_{thJC}$$

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

$$EAS (AR) = P_{D(ave)} \cdot t_{av}$$

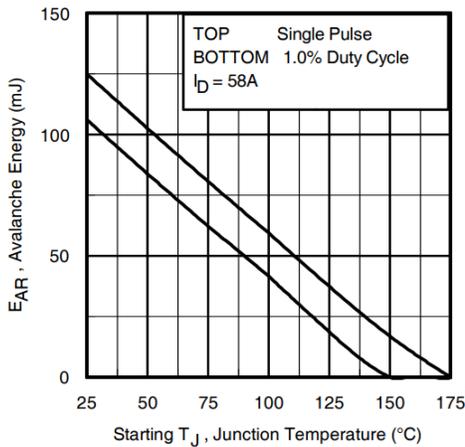


图 15.最大雪崩能量与温度的关系曲线

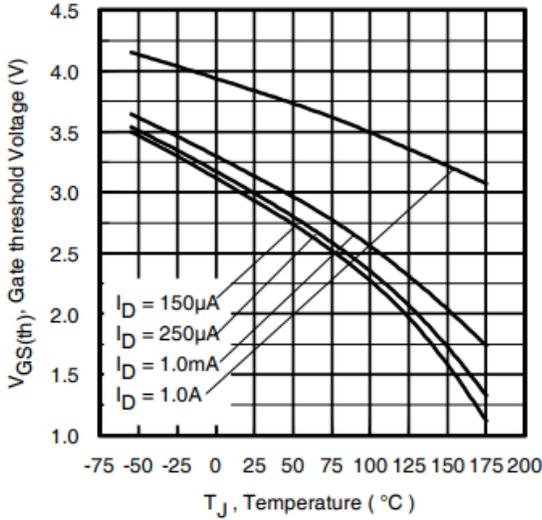


Fig. 16. Threshold Voltage vs. Temperature

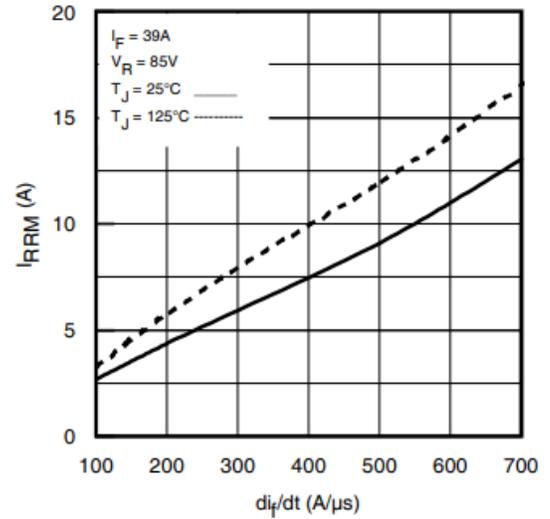


Fig. 17 - Typical Recovery Current vs.  $di_T/dt$

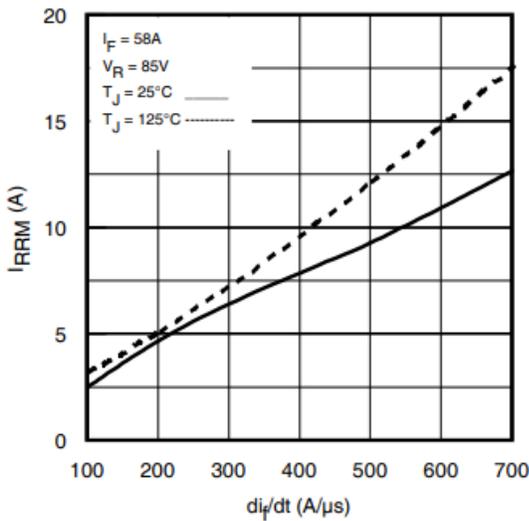


Fig. 18 - Typical Recovery Current vs.  $di_T/dt$

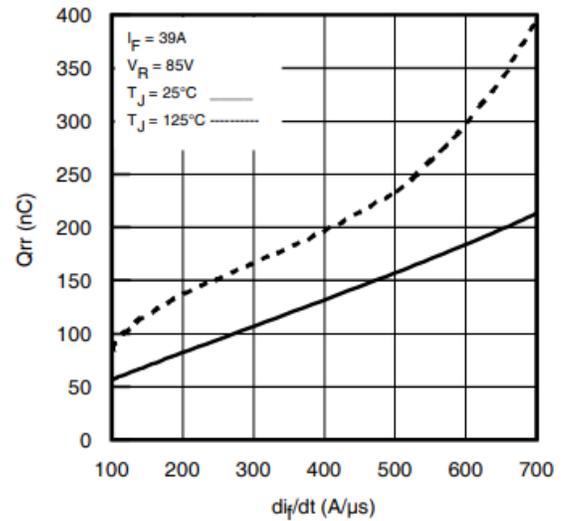


Fig. 19 - Typical Stored Charge vs.  $di_T/dt$

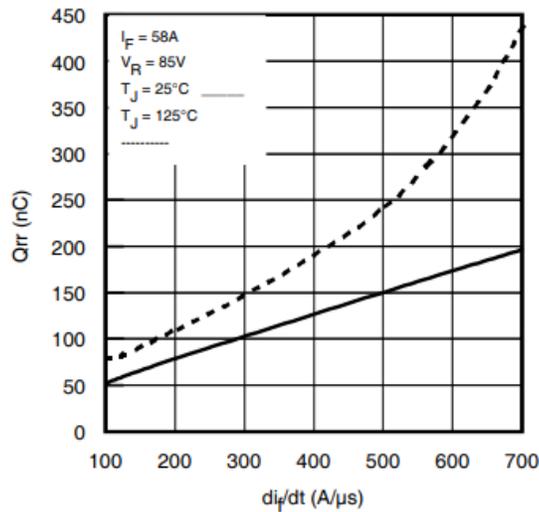
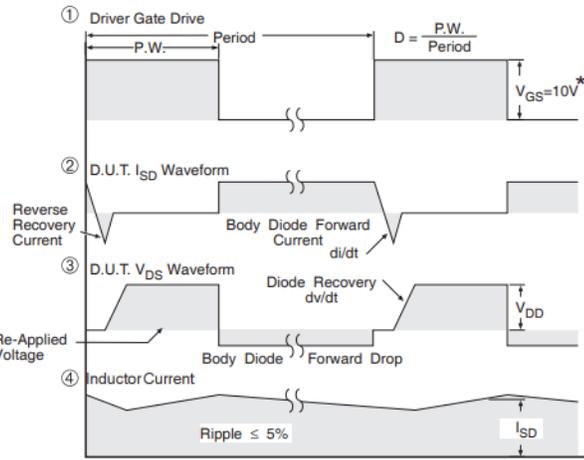
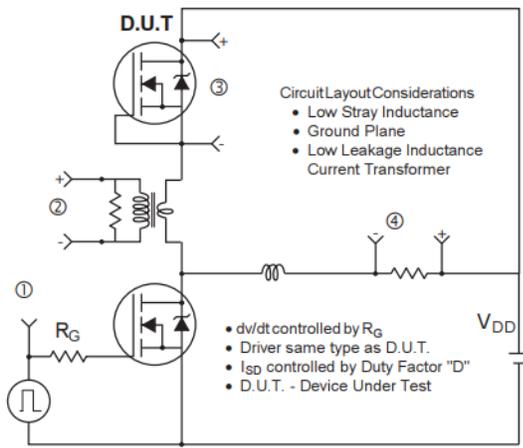
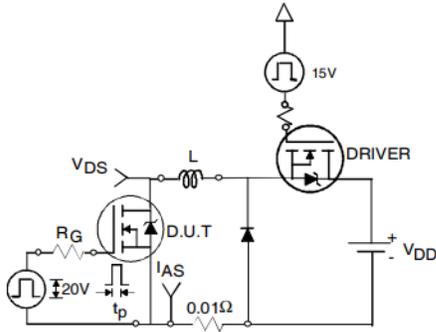


Fig. 20 - Typical Stored Charge vs.  $di_T/dt$

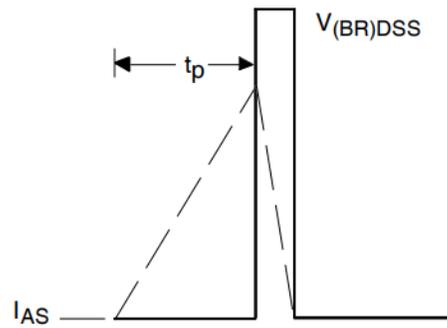


\*  $V_{GS} = 5V$  for Logic Level Devices

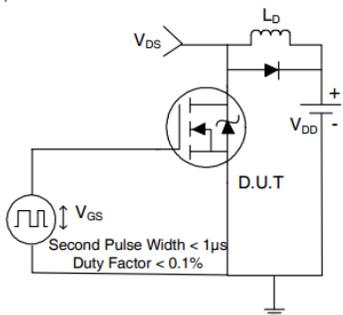
**Fig 21. Peak Diode Recovery  $dv/dt$  Test Circuit for N-Channel HEXFET® Power MOSFETs**



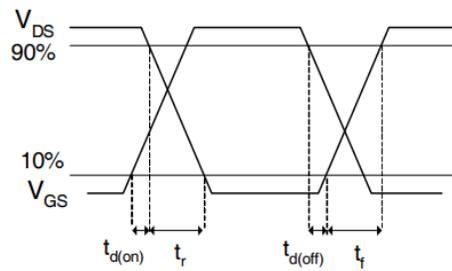
**Fig 22a. Unclamped Inductive Test Circuit**



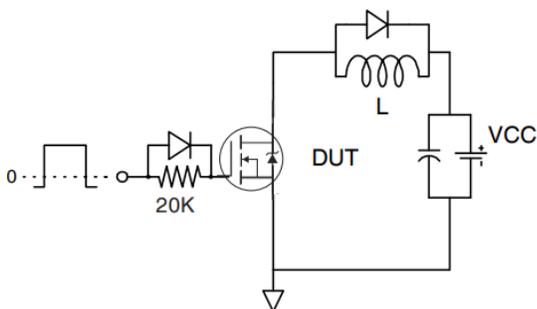
**Fig 22b. Unclamped Inductive Waveforms**



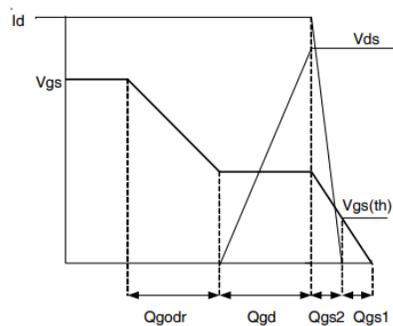
**Fig 23a. Switching Time Test Circuit**



**Fig 23b. Switching Time Waveforms**



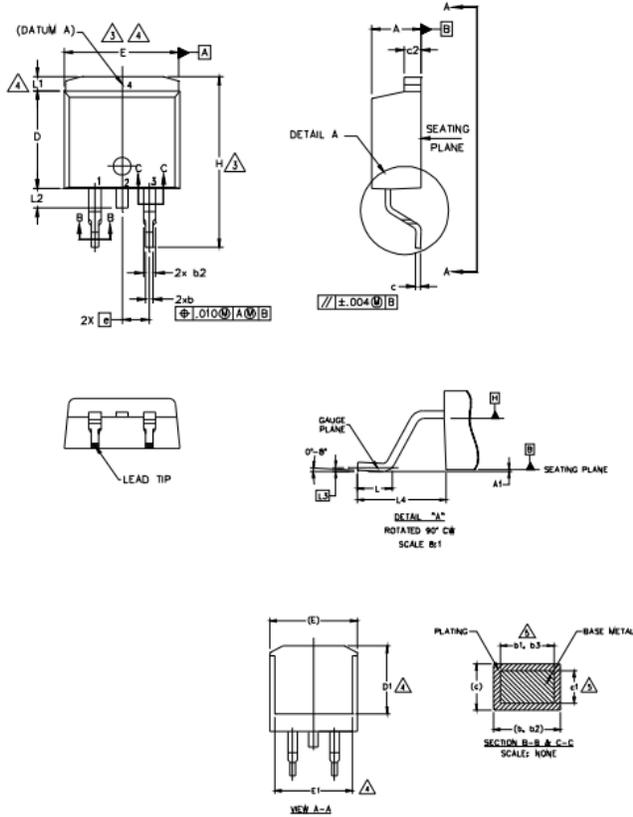
**Fig 24a. Gate Charge Test Circuit**



**Fig 24b. Gate Charge Waveform**

## D<sup>2</sup>Pak (TO-263AB) Package Outline

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 [0.005"] 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 b1 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.

SYMBOL	DIMENSIONS				NOTES
	MILLIMETERS		INCHES		
	MIN.	MAX.	MIN.	MAX.	
A	4.06	4.83	.160	.190	5
A1	0.00	0.254	.000	.010	
b	0.51	0.99	.020	.039	
b1	0.51	0.89	.020	.035	
b2	1.14	1.78	.045	.070	
b3	1.14	1.73	.045	.068	5
c	0.38	0.74	.015	.029	5
c1	0.38	0.58	.015	.023	
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	-	4
H	14.61	15.88	.575	.625	
L	1.78	2.79	.070	.110	
L1	-	1.65	-	.066	
L2	1.27	1.78	-	.070	4
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**

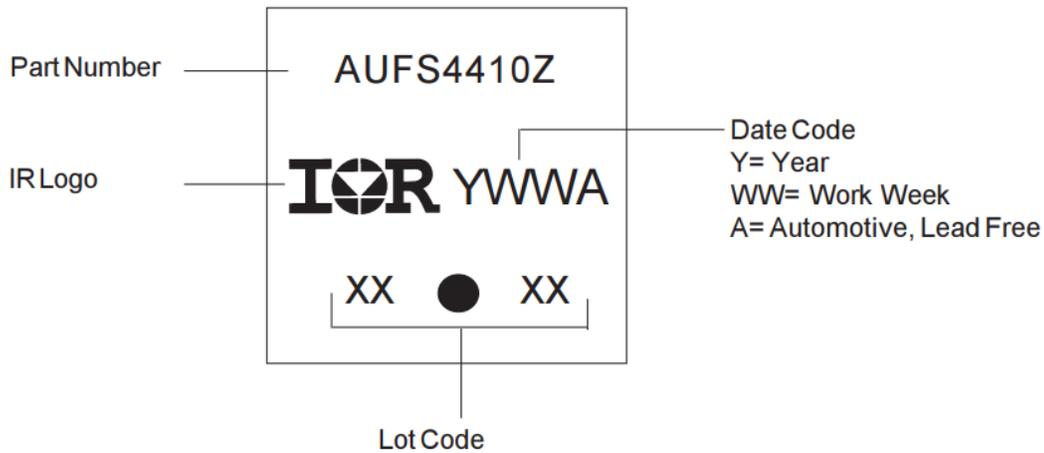
- 1.- GATE
2. 4.- COLLECTOR
- 3.- EMITTER

**DIODES**

- 1.- ANODE \*
2. 4.- CATHODE
- 3.- ANODE

\* PART DEPENDENT.

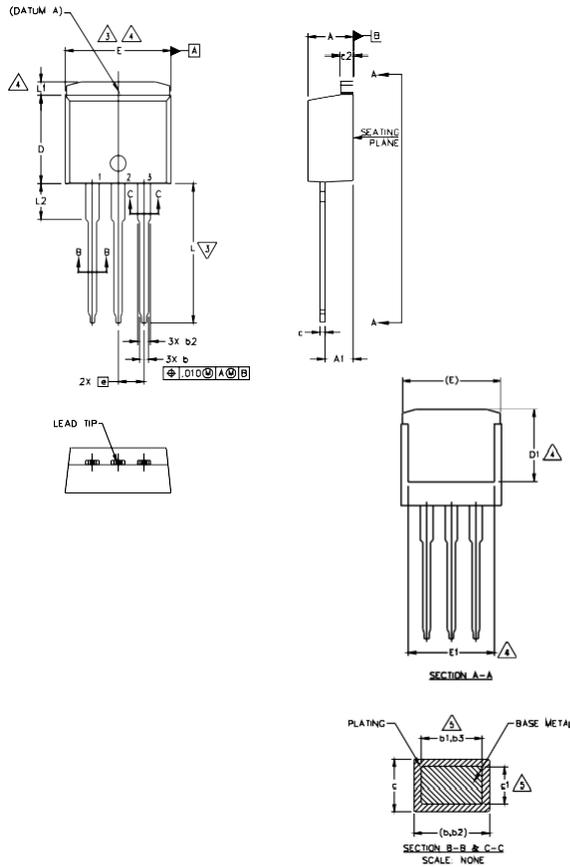
## D<sup>2</sup>Pak 零件标识信息



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

### TO-262 封装外形

尺寸以毫米 (英寸) 为单位



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 [0.005"] PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTMOST EXTREMES OF THE PLASTIC BODY.
4. THERMAL PAD CONTOUR OPTIONAL WITHIN DIMENSION E, L1, D1 & E1.
5. DIMENSION b1 AND c1 APPLY TO BASE METAL ONLY.
6. CONTROLLING DIMENSION: INCH.
7. - OUTLINE CONFORM TO JEDEC TO-262 EXCEPT A1(max.), b(min.), AND D1(min.) WHERE DIMENSIONS DERIVED THE ACTUAL PACKAGE OUTLINE.

SYMBOL	DIMENSIONS				NOTES
	MILLIMETERS		INCHES		
	MIN.	MAX.	MIN.	MAX.	
A	4.06	4.83	.160	.190	
A1	2.03	3.02	.080	.119	
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		
L	13.46	14.10	.530	.555	
L1	-	1.65	-	.065	4
L2	3.56	3.71	.140	.146	

LEAD ASSIGNMENTS

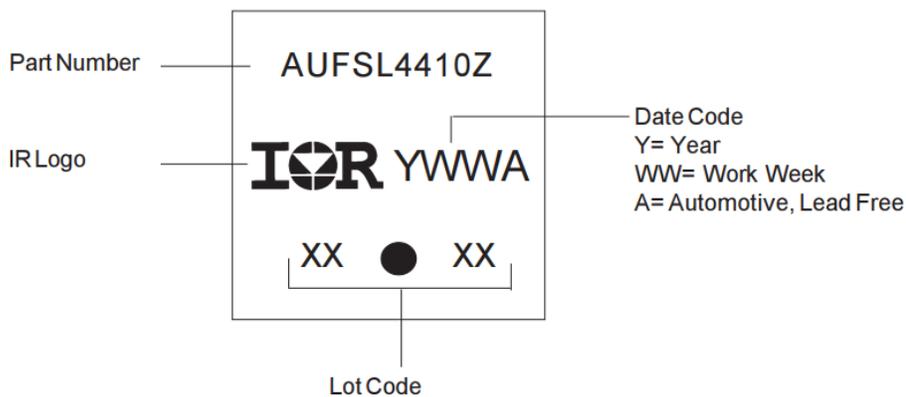
HEXFET

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

IGBTs, CoPACK

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

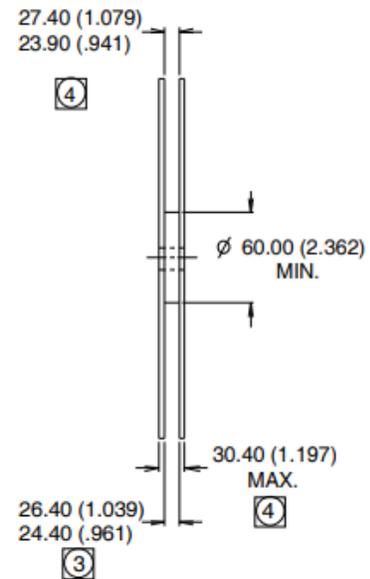
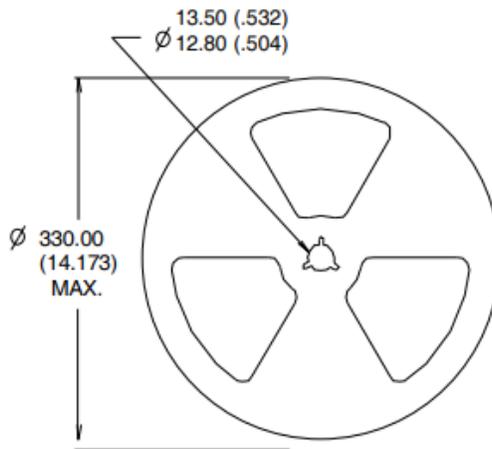
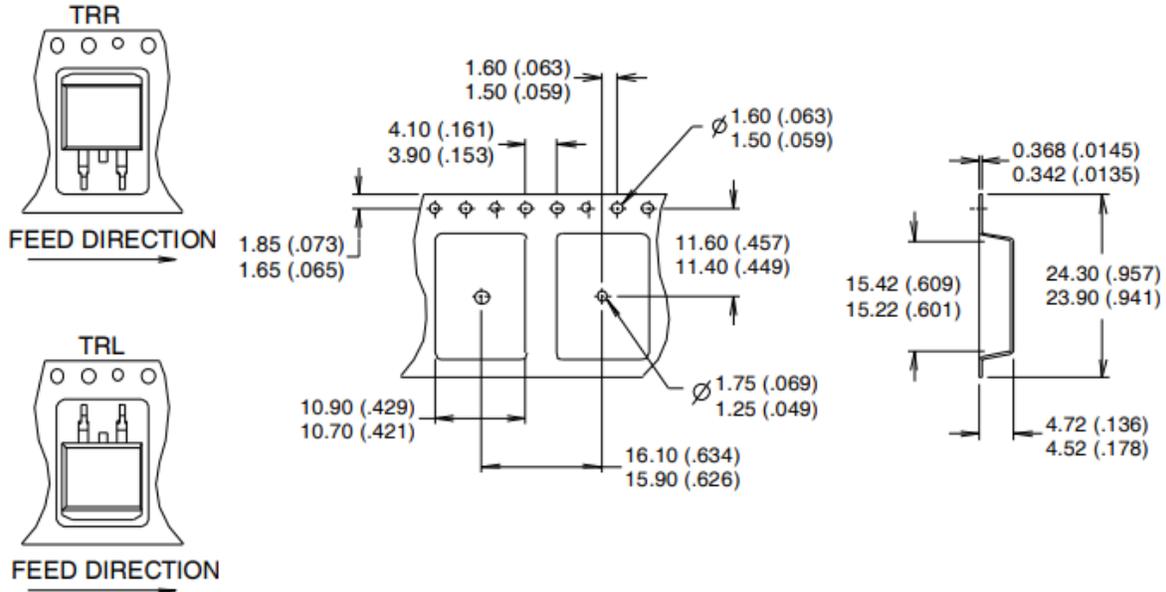
### TO-262 零件标识信息



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

## D<sup>2</sup> Pak (T0-263AB) 卷带信息

尺寸以毫米 (英寸) 为单位



**NOTES :**

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	
AUIRFSL4410Z	TO-262	Tube	50	AUIRFSL4410Z
AUIRFS4410Z	D2Pak	Tube	50	AUIRFS4410Z
		Tape and Reel Left	800	AUIRFS4410ZTRL
		Tape and Reel Right	800	AUIRFS4410ZTRR



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