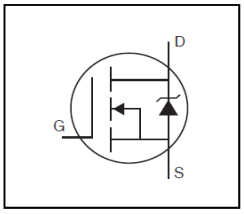
英飞凌AUIRL1404Z_S_L汽车级175°C超低导通电阻功率MOSFET

AUIRL1404Z
AUIRL1404ZS
AUIRL1404ZL

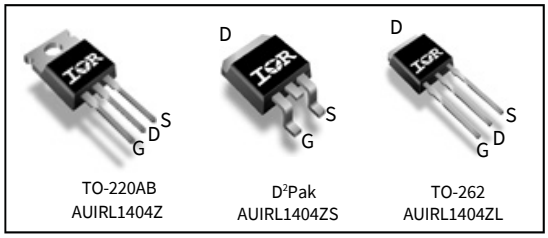
HEXFET®功率MOSFET

特性

- 逻辑电平
- 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 *



V_{DSS}	40V
$R_{DS(on)}$ typ.	2.5mΩ
max.	3.1mΩ
$I_{D\ (Silicon\ Limited)}$	180A⑩
$I_{D\ (Package\ Limited)}$	160A



G	D	S
Gate	Drain	Source

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。该设计的其他特点包括 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。

Base part number	Package Type	Standard Pack		Orderable Part Number
		Form	Quantity	
AUIRL1404Z	TO-220	Tube	50	AUIRL1404Z
AUIRL1404ZL	TO-262	Tube	50	AUIRL1404ZL
AUIRL1404ZS	D^2-Pak	Tube	50	AUIRL1404ZS
		Tape and Reel Left	800	AUIRL1404ZSTRL

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时间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。

Symbol	Parameter	Max.	Units
I_D @ T_C = 25°C	Continuous Drain Current, V_{GS} @ 10V (Silicon Limited)	180⑩	A
I_D @ T_C = 100°C	Continuous Drain Current, V_{GS} @ 10V (Silicon Limited)	130	
I_D @ T_C = 25°C	Continuous Drain Current, V_{GS} @ 10V (Package Limited)	160	
I_{DM}	Pulsed Drain Current ①	790	
P_D @T_C = 25°C	Maximum Power Dissipation	200	W
	Linear Derating Factor	1.3	W/°C
V_{GS}	Gate-to-Source Voltage	± 16	V
E_{AS}	Single Pulse Avalanche Energy (Thermally Limited) ②	190	mJ
E_{AS} (tested)	Single Pulse Avalanche Energy Tested Value ⑥	490	
I_{AR}	Avalanche Current ①	See Fig.15,16, 12a, 12b	A
E_{AR}	Repetitive Avalanche Energy ⑤		mJ
T_J T_{STG}	Operating Junction and Storage Temperature Range	-55 to + 175	°C
	Soldering Temperature, for 10 seconds (1.6mm from case)	300	
	Mounting torque, 6-32 or M3 screw	10 lbf•in (1.1N•m)	

热阻抗

Symbol	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case	---	0.75⑨	°C/W
$R_{\theta CS}$	Case-to-Sink, Flat, Greased Surface ⑦	0.50	---	
$R_{\theta JA}$	Junction-to-Ambient ⑦	---	62	
$R_{\theta JA}$	Junction-to-Ambient (PCB Mount, steady state) ⑦		40	

HEXFET® 是英飞凌的注册商标。

*认证标准可在 www.infineon.com 上找到

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 参考最新的英文版本（控制文档）。

静态参数特性在 T_J = 25°C 时测得（除非另有规定）

	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(BR)DSS}$	Drain-to-Source Breakdown Voltage	40	---	---	V	V_{GS} = 0V, I_D = 250μA
$\Delta V_{(BR)DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	---	0.034	---	V/°C	Reference to 25°C, I_D = 1mA
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	---	2.5	3.1	mΩ	V_{GS} = 10V, I_D = 75A ③**
		---	---	4.7		V_{GS} = 5.0V, I_D = 40A ③
		---	---	5.9		VGS = 4.5V, ID = 40A ③
$V_{GS(th)}$	Gate Threshold Voltage	1.4	---	2.7	V	V_{DS} = V_{GS}, I_D = 250μA
gfs	Forward Trans conductance	120	---	---	S	V_{DS} = 10V, I_D = 75A**
I_{DSS}	Drain-to-Source Leakage Current	---	---	20	μA	V_{DS} = 40V, V_{GS} = 0V
		---	---	250		V_{DS} = 40V,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

动态电气特性在 T_J = 25°C时测得（除非另有规定）

Q_g	Total Gate Charge	---	75	110	nC	I_D = 75A** V_{DS} = 32V V_{GS} = 5.0V③
Q_{gs}	Gate-to-Source Charge	---	28	---		
Q_{gd}	Gate-to-Drain Charge	---	40	---		
$t_{d(on)}$	Turn-On Delay Time	---	19	---	ns	V_{DD} = 20V I_D = 75A** R_G= 4.0Ω, V_{GS} = 5.0V ③
t_r	Rise Time	---	180	---		
$t_{d(off)}$	Turn-Off Delay Time	---	30	---		
t_f	Fall Time	---	49	---		
L_D	Internal Drain Inductance	---	4.5	---	nH	Between lead, 6mm (0.25in.) from package and center of die contact
L_S	Internal Source Inductance	---	7.5	---		
C_{iss}	Input Capacitance	---	5080	---	pF	V_{GS} = 0V V_{DS} = 25V ƒ = 1.0MHz
C_{oss}	Output Capacitance	---	970	---		
C_{rss}	Reverse Transfer Capacitance	---	570	---		
C_{oss}	Output Capacitance	---	3310	---		V_{GS} = 0V, V_{DS} = 1.0V ƒ = 1.0MHz
C_{oss}	Output Capacitance	---	870	---		V_{GS} = 0V, V_{DS} = 32V ƒ = 1.0MHz
$C_{oss\ eff.}$	Effective Output Capacitance	---	1280	---		V_{GS} = 0V, V_{DS} = 0V to 32V ④

二极管特性

	Parameter	Min.	Typ.	Max.	Units	Conditions
I_S	Continuous Source Current (Body Diode)	---	---	180	A	MOSFET symbol showing the integral reverse p-n junction diode.
I_{SM}	Pulsed Source Current (Body Diode) ①	---	---	790		
V_{SD}	Diode Forward Voltage	---	---	1.3	V	T_J = 25°C,I_S = 75A**,V_{GS} = 0V ③
t_{rr}	Reverse Recovery Time	---	26	39	ns	T_J = 25°C ,I_F = 75A** , V_{DD} = 20V di/dt = 100A/μs ③
Q_{rr}	Reverse Recovery Charge	---	18	27	nC	
t_{on}	Forward Turn-On Time	Intrinsic turn-on time is negligible (turn-on is dominated by L_S+L_D)				

注：

① 重复额定值；脉冲宽度受最高结温限制。（见图11）

② 受 T_{Jmax}限制，初始 T_J = 25°C、L = 0.066mH、R_G = 25Ω、I_{AS} = 75A、V_{GS} =10V。不建议在高于此值的情况运行器件。

③ 脉冲宽度≤ 1.0ms；占空比≤ 2%。

④ C_{oss} eff. 是一个固定电容值， 当 V_{DS} 从 0 上升至 80% V_{DSS}时，其充电时间与 C_{oss} 相同。

⑤ 受T_{Jmax} 限制 ，典型重复的雪崩性能见图12a、12b、15、16。

⑥ 该值由样片故障总数决定。生产环境100%按照此值进行测试。

⑦ 仅适用于 TO-220AB 封装。

⑧ 安装在 1 英寸方形PCB （FR-4 或 G-10 材料）上时。有关推荐的封装和焊接技术，请参阅应用注释 #AN-994

⑨ TO-220 器件的 Rth 值为 0.65°C/W。

⑩ 根据最大允许结温计算连续电流。键合线电流限制为160A。注意，由于器件引线发热而引起的电流限制可能出现在某些引线安装布置中。

**所有交流和直流测试条件基于旧的封装限制电流=75A。

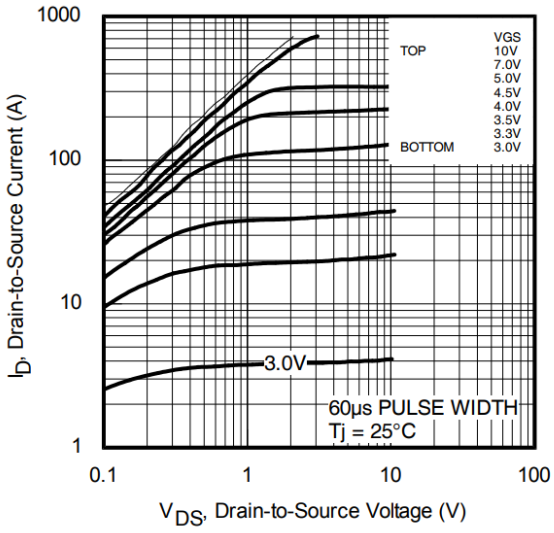


图 1典型输出特性

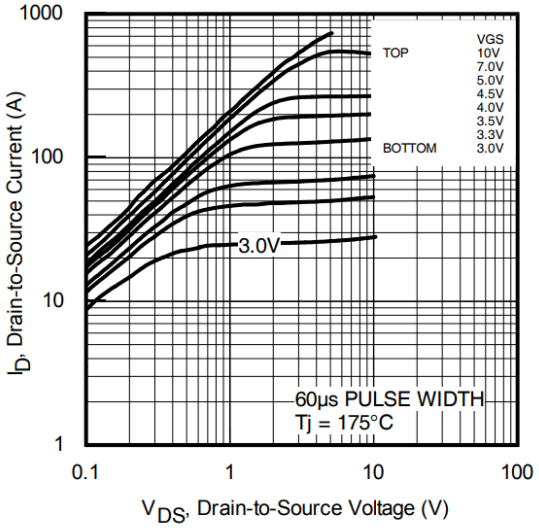


图 2典型输出特性

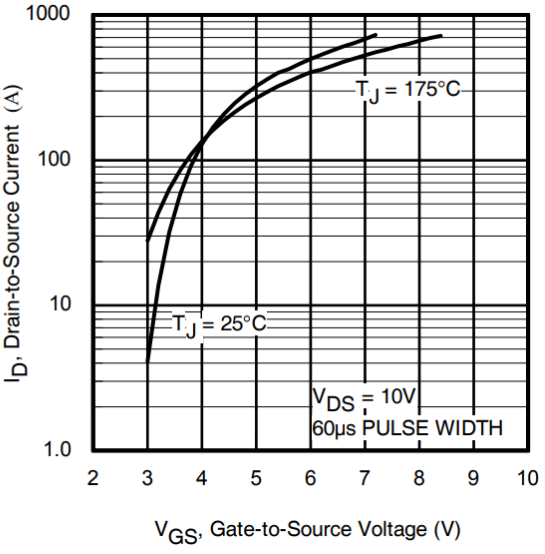


图3典型转移特性

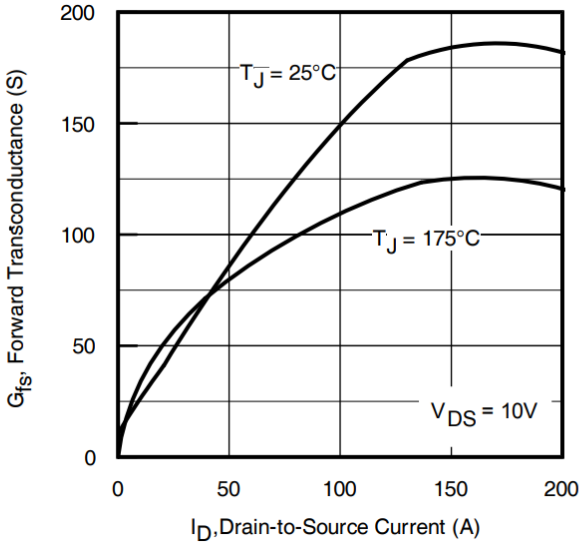


图 4典型正向跨导与漏极电流

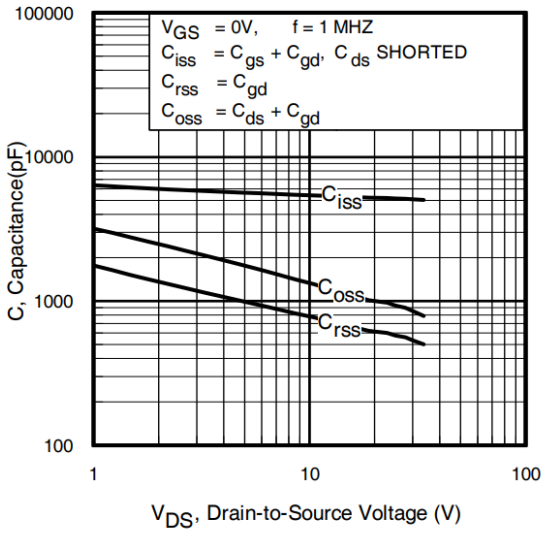


图 5.典型电容值与漏源电压的关系

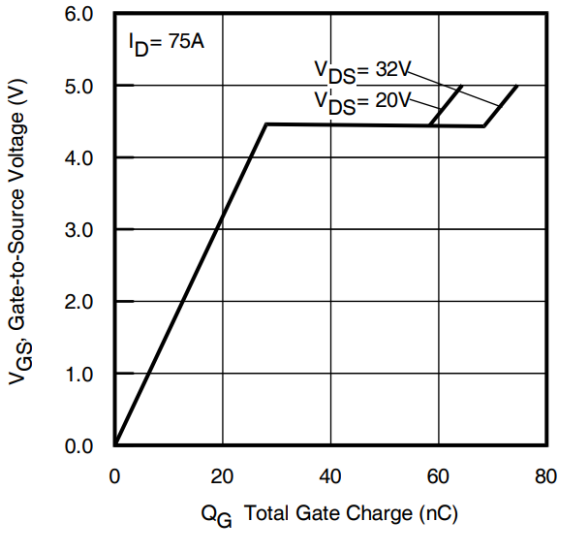


图 6.典型栅极电荷与栅源电压的关系

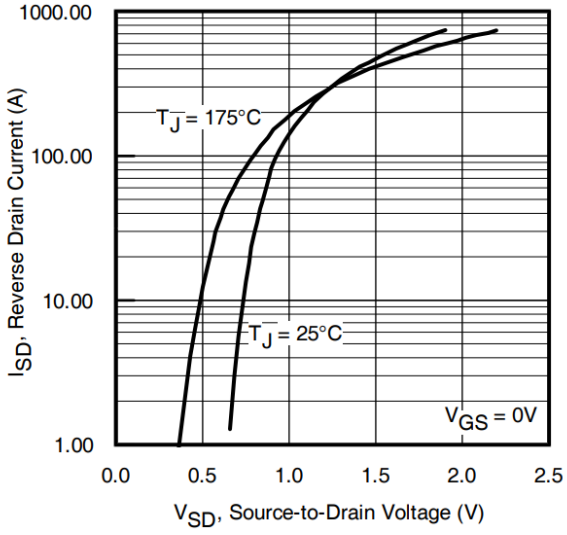


图 7典型源漏二极管正向电压

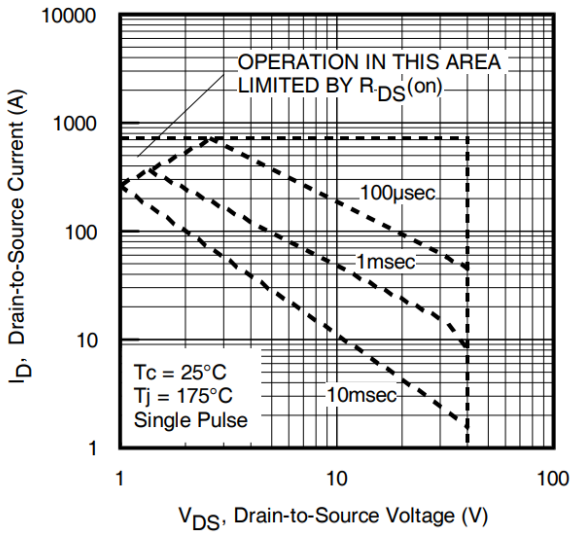


图 8.最大安全工作区

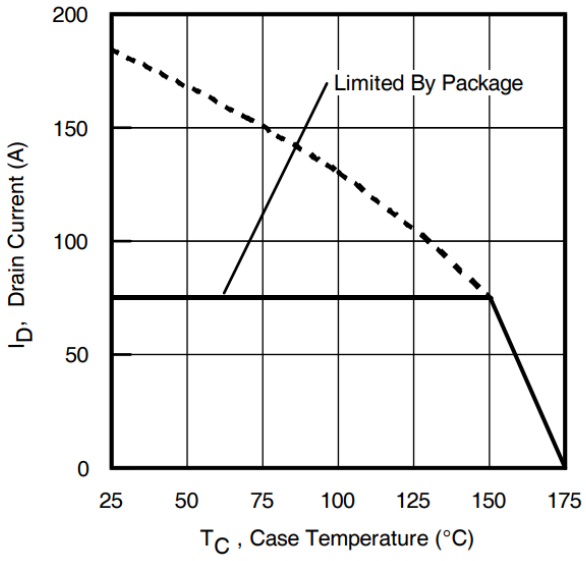


图 9.最大漏极电流与壳温

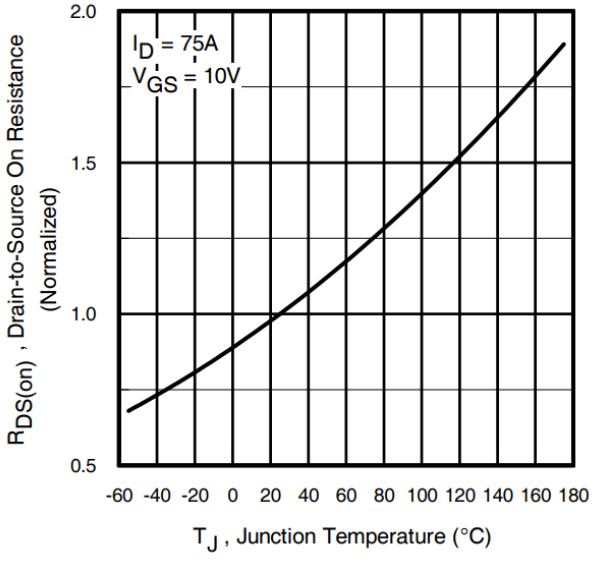
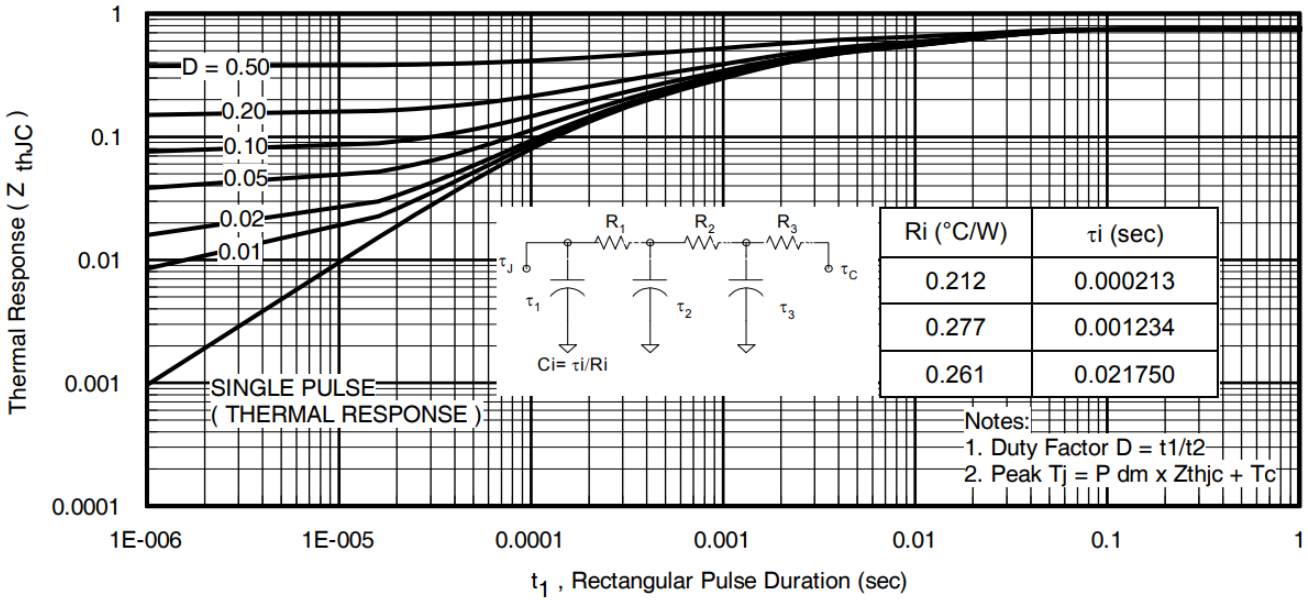


图 10.归一化导通电阻与温度的关系曲线



t1，矩形脉冲持续时间（秒）

图 11.最大有效瞬态热阻，结到壳

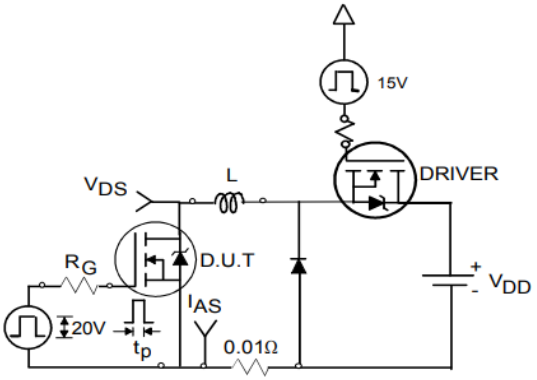


Fig 12a. Unclamped Inductive Test Circuit

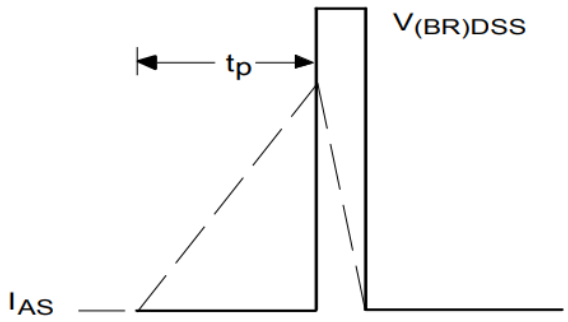


Fig 12b. Unclamped Inductive Waveforms

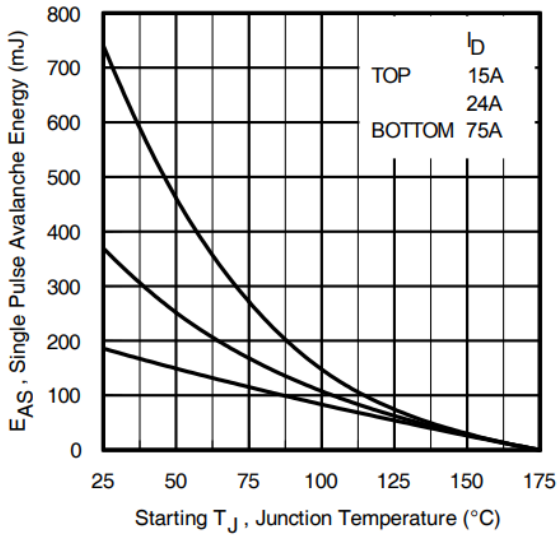


Fig 12c. Maximum Avalanche Energy vs. Drain Current

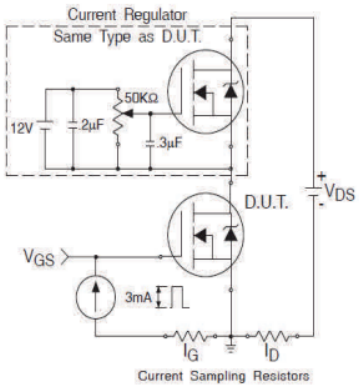


Fig 13a. Gate Charge Test Circuit

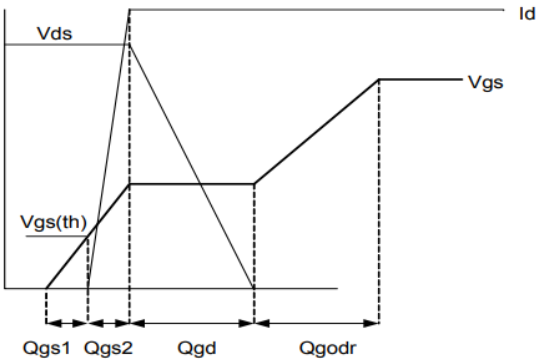


Fig 13b. Gate Charge Waveform

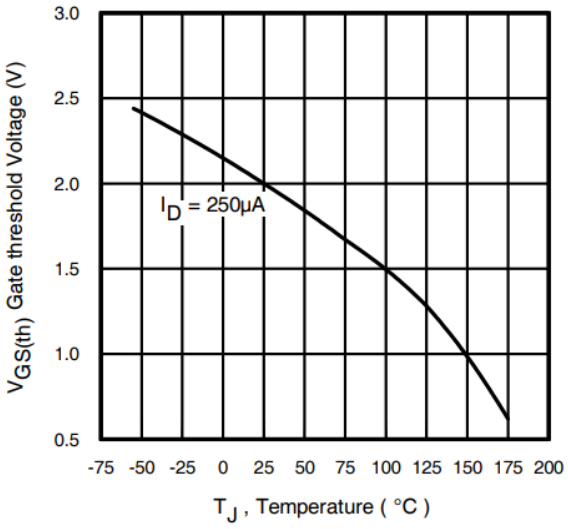


Fig 14. Threshold Voltage vs. Temperature

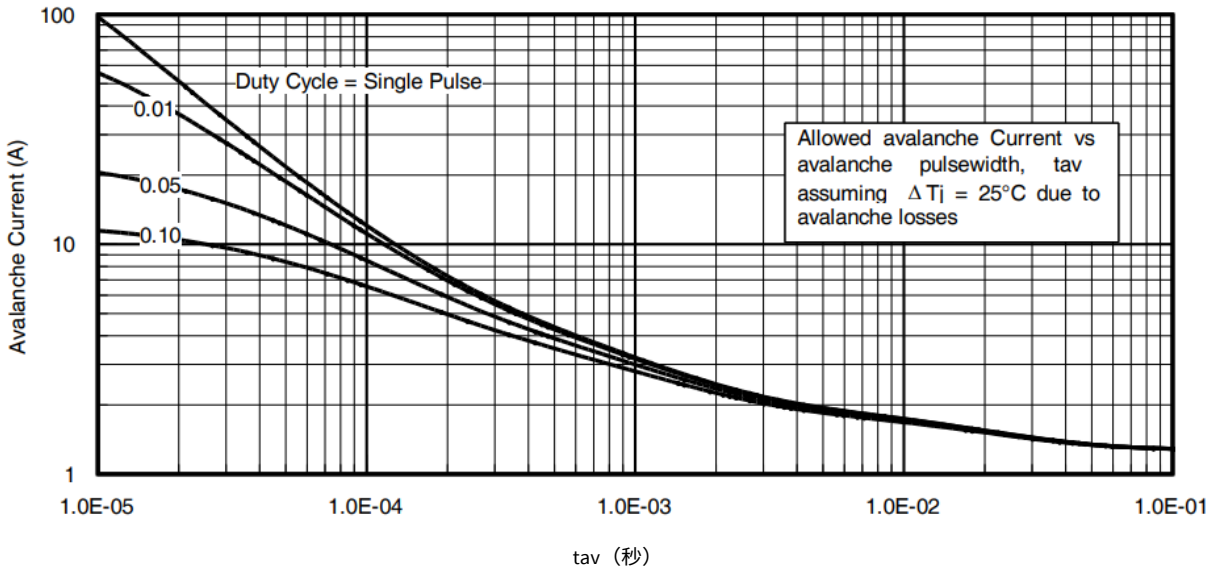


图 15.典型雪崩电流与脉冲宽度

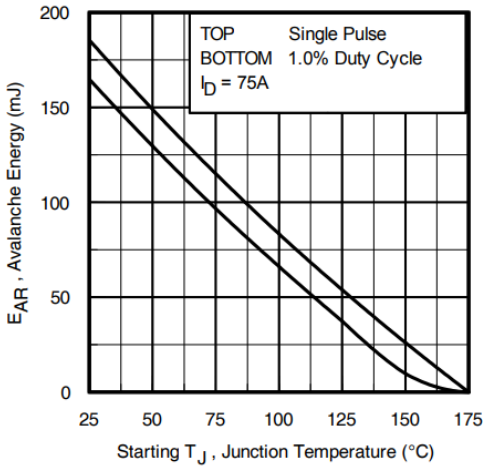


图 16.最大雪崩能量与温度的关系曲线

关于重复的雪崩曲线的注释，图 15、16：（有关更多信息，请参阅www.infineon.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 T_{jmax}的情况下。这对每种零件类型都是有效的。
2. 只要不超过 T_{jmax}，就可以在雪崩中安全运行。
3. 如下公式基于图 12a、12b 所示的电路和波形。
4. $P_{D\,(ave)}$ = 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. I_{av} = 可允许的雪崩电流。
7. Δ T = 可允许的结温上升，不得超过 T_{jmax} （图 14、15 中假设为 25°C）。
   t_{av} =雪崩的平均时间。
   D = 雪崩占空比 = t_{av} ·f
   Z_{thJC} (D, t_{av}) = 瞬态热阻抗，见图 13)

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

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

$$E_{AS\,(AR)} = P_{D\,(ave)} \cdot t_{av}$$

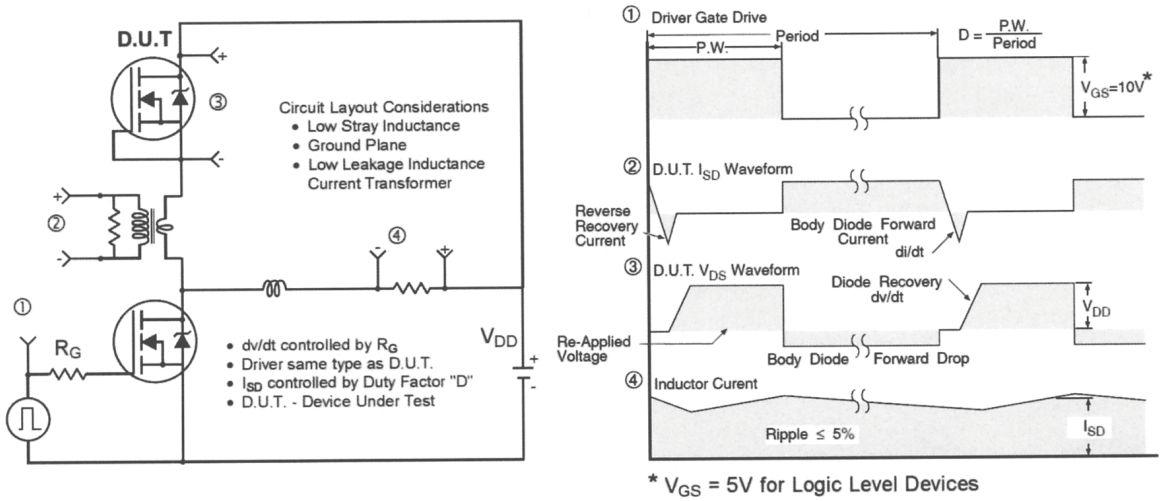


图 17. N 沟道 HEXFET® 功率 MOSFET 体内二极管峰值恢复 dv/dt 测试电路

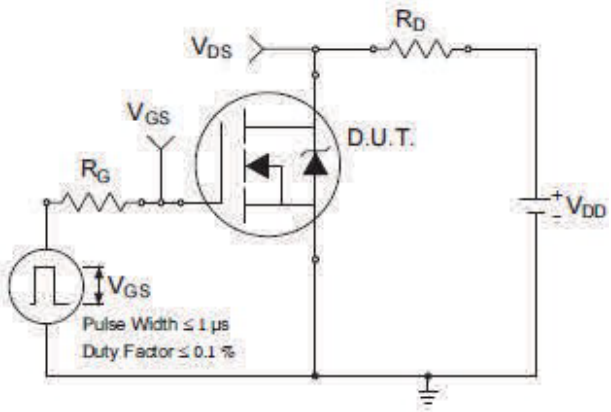


图 18a.开关时间测试电路

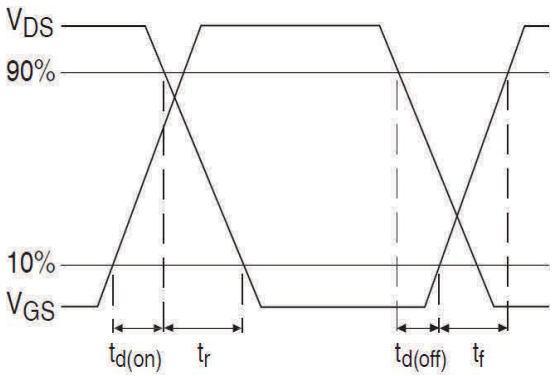
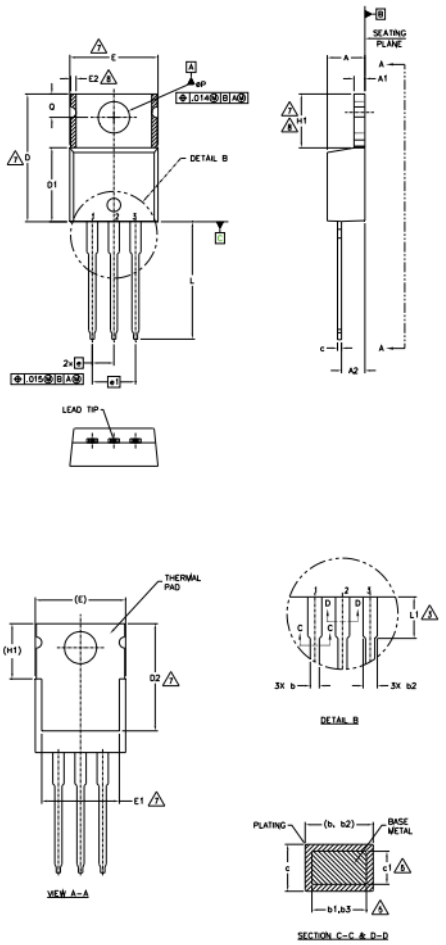


图 18b.开关时间波形

TO-220AB 封装外形（尺寸以毫米（英寸）为单位）



NOTES:

1.– DIMENSIONING AND TOLERANCING AS PER ASME Y14.5 M– 1994.
2.– DIMENSIONS ARE SHOWN IN INCHES [MILLIMETERS].
3.– LEAD DIMENSION AND FINISH UNCONTROLLED IN L1.
4.– DIMENSION D, D1 & E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED .005" (0.127) PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY.
5.– DIMENSION b1, b3 & c1 APPLY TO BASE METAL ONLY.
6.– CONTROLLING DIMENSION : INCHES.
7.– THERMAL PAD CONTOUR OPTIONAL WITHIN DIMENSIONS E,H1,D2 & E1
8.– DIMENSION E2 X H1 DEFINE A ZONE WHERE STAMPING AND SINGULATION IRREGULARITIES ARE ALLOWED.
9.– OUTLINE CONFORMS TO JEDEC TO-220, EXCEPT A2 (max.) AND D2 (min.) WHERE DIMENSIONS ARE DERIVED FROM THE ACTUAL PACKAGE OUTLINE.

SYMBOL	DIMENSIONS				NOTES
	MILLIMETERS		INCHES		
	MIN.	MAX.	MIN.	MAX.	
A	3.56	4.83	.140	.190	
A1	1.14	1.40	.045	.055	
A2	2.03	2.92	.080	.115	
b	0.38	1.01	.015	.040	
b1	0.38	0.97	.015	.038	5
b2	1.14	1.78	.045	.070	
b3	1.14	1.73	.045	.068	5
c	0.36	0.61	.014	.024	
c1	0.36	0.56	.014	.022	5
D	14.22	16.51	.560	.650	4
D1	8.38	9.02	.330	.355	
D2	11.68	12.88	.460	.507	7
E	9.65	10.67	.380	.420	4,7
E1	6.86	8.89	.270	.350	7
E2	–	0.76	–	.030	8
e	2.54 BSC		.100 BSC		
e1	5.08 BSC		.200 BSC		
H1	5.84	6.86	.230	.270	7,8
L	12.70	14.73	.500	.580	
L1	3.56	4.06	.140	.160	3
øP	3.54	4.08	.139	.161	
Q	2.54	3.42	.100	.135	

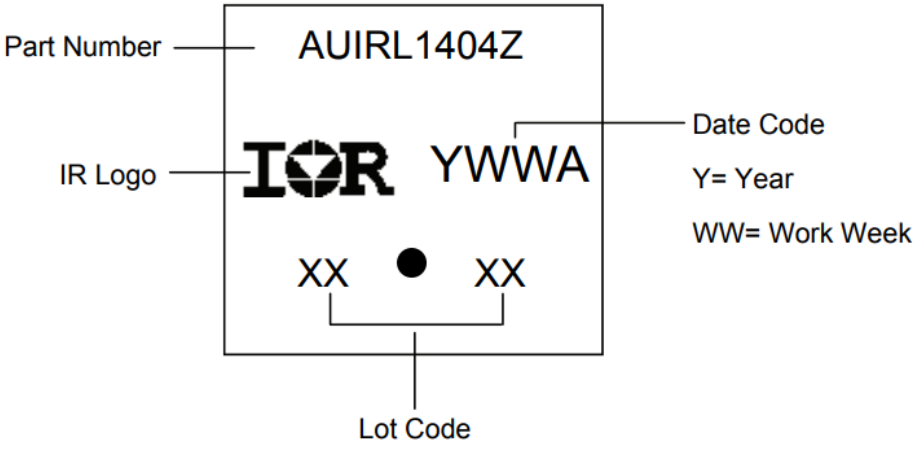
LEAD ASSIGNMENTS

HEXFET
1.– GATE
2.– DRAIN
3.– SOURCE

IGBTs, CoPACK
1.– GATE
2.– COLLECTOR
3.– EMITTER

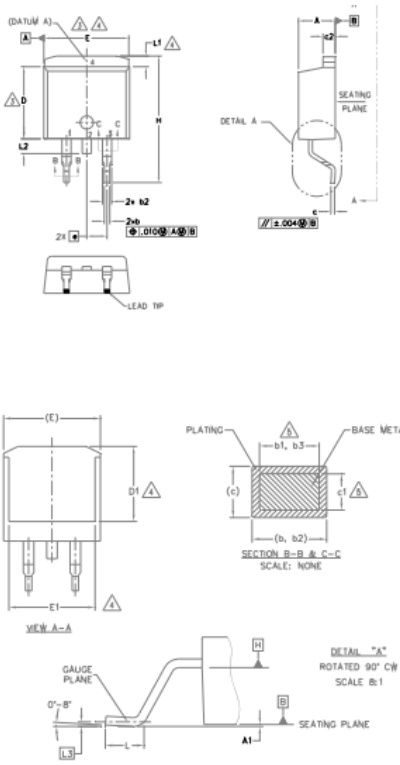
DIODES
1.– ANODE
2.– CATHODE
3.– ANODE

TO-220AB 零件标识信息



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

D ² Pak (TO-263AB) 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 [.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, b3 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	
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

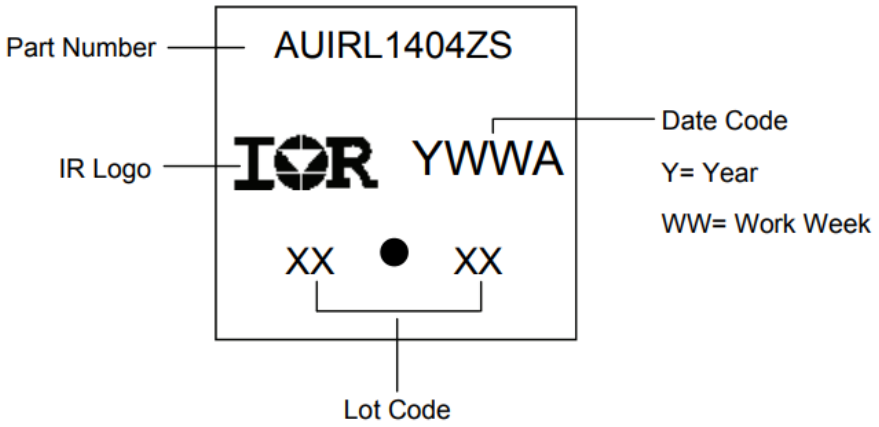
HEXFET

1.– GATE
2, 4.– DRAIN
3.– SOURCE

IGBTs, CoPACK

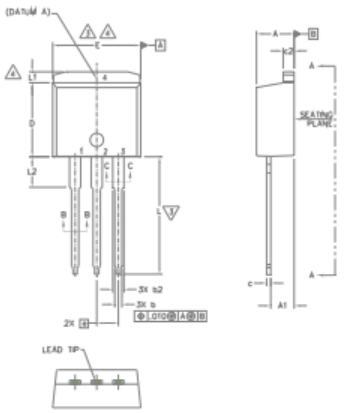
1.– GATE
2, 4.– COLLECTOR
3.– EMITTER

D ² Pak（TO-263AB）零件信息标识



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 [.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.

LEAD ASSIGNMENTS

IGBTs, CoPACK

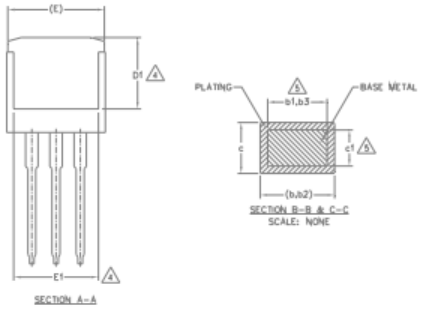
1.- GATE
2.- COLLECTOR
3.- EMITTER
4.- COLLECTOR

HEXFET

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

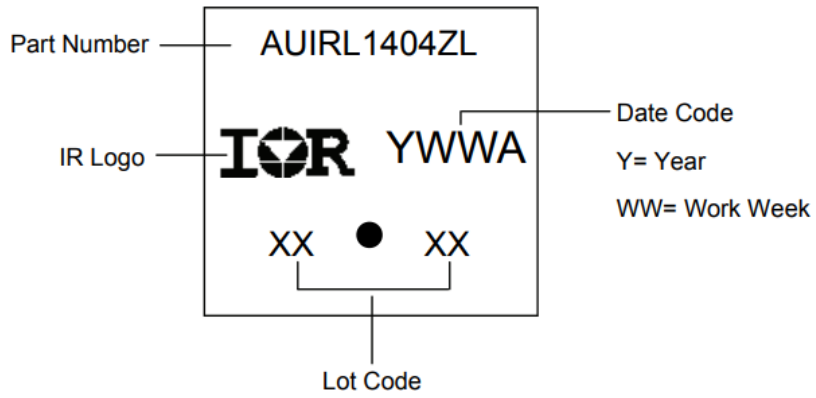
DIODES

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



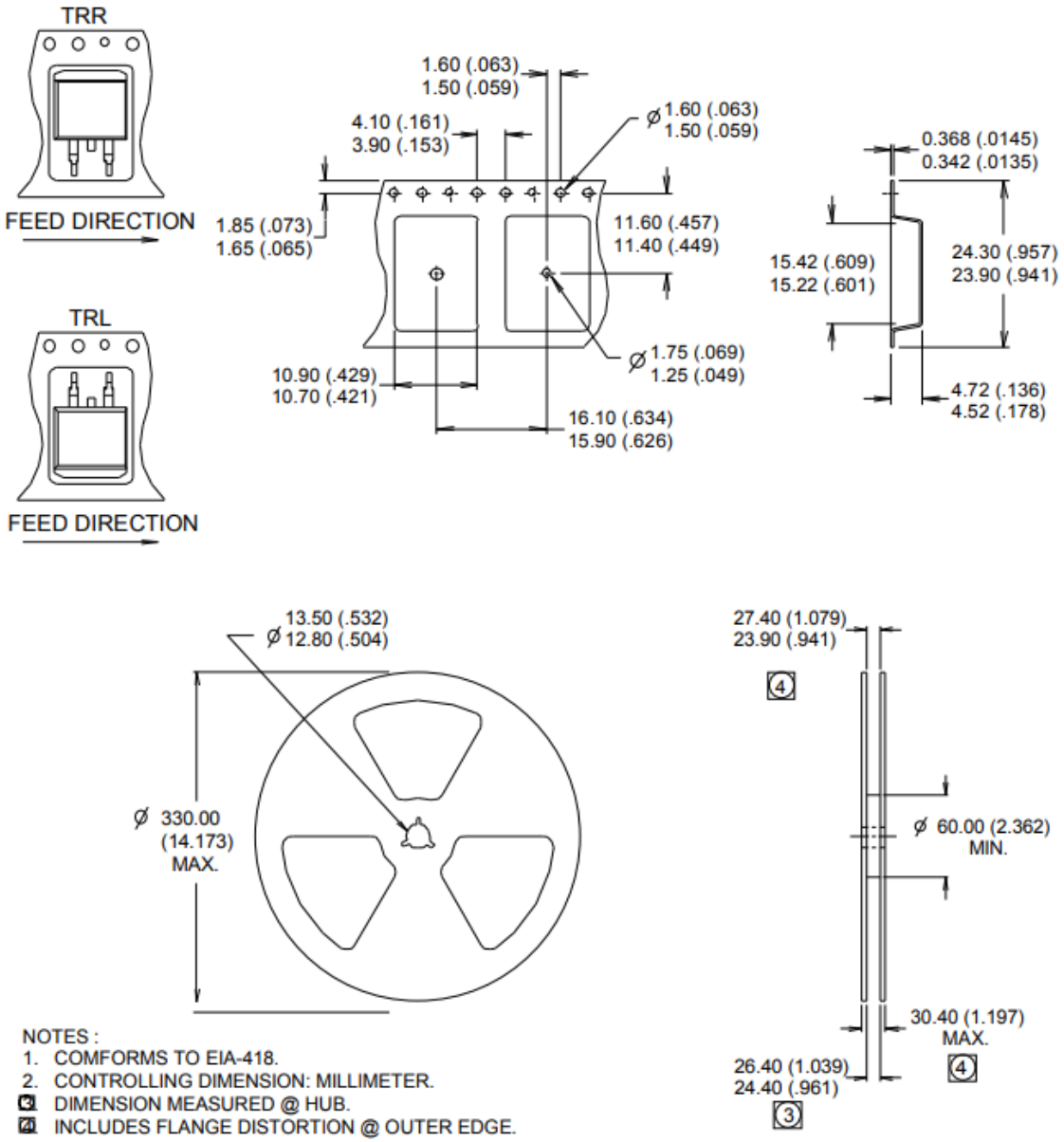
SYMBOL	DIMENSIONS				NOTES
	MILLIMETERS		INCHES		
	MIN.	MAX.	MIN.	MAX.	
A	4.06	4.83	.160	.190	
A1	2.03	3.02	.080	.119	
b	0.51	0.99	.020	.039	
b1	0.51	0.89	.020	.035	5
b2	1.14	1.78	.045	.070	
b3	1.14	1.73	.045	.068	5
c	0.38	0.74	.015	.029	
c1	0.38	0.58	.015	.023	5
c2	1.14	1.65	.045	.065	
D	8.38	9.65	.330	.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	

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 ² Pak（TO-263AB）卷、带信息（尺寸以毫米（英寸）为单位）



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		TO-220 Pak	N/A
		D^2-Pak	MSL1
		TO-262	
ESD	Machine Model	Class M4 (+/- 425V)† AEC-Q101-002	
	Human Body Model	Class H1C (+/- 2000V)† AEC-Q101-001	
	Charged Device Model	Class C5 (+/- 1125V)† AEC-Q101-005	
RoHS Compliant		Yes	

修订记录

Date	Comments
10/27/2015	• Updated datasheet with corporate template • Corrected ordering table on page 1.

Published by
Infineon Technologies AG 81726
München, Germany
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版本 **2025-10-30**

Infineon Technologies AG 出版，
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