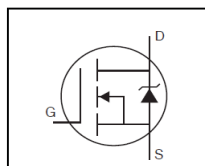


## 特性

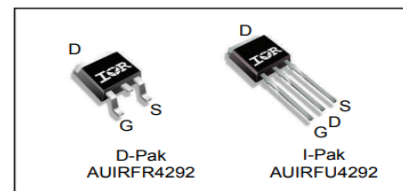
- 先进工艺技术
- 低导通电阻
- 工作温度 175°C
- 快速开关
- 允许达到  $T_{jmax}$  的重复雪崩
- 无铅，符合RoHS要求
- 汽车认证 \*



|              |      |              |
|--------------|------|--------------|
| $V_{DS}$     |      | <b>250V</b>  |
| $R_{DS(on)}$ | typ. | <b>275mΩ</b> |
|              | max. | <b>345mΩ</b> |
| $I_D$        |      | <b>9.3A</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   |

| Base part number | Package Type | Standard Pack       |          | Orderable Part Number | Note             |
|------------------|--------------|---------------------|----------|-----------------------|------------------|
|                  |              | Form                | Quantity |                       |                  |
| AUIRFU4292       | I-Pak        | Tube                | 75       | AUIRFU4292            |                  |
| AUIRFR4292       | D-Pak        | Tube                | 75       | AUIRFR4292            |                  |
|                  |              | Tape and Reel Left  | 3000     | AUIRFR4292TRL         |                  |
|                  |              | Tape and Reel Right | 3000     | AUIRFR4292TRR         | EOL notice # 530 |

## 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 ( $T_A$ ) 为 25°C，除非另有规定。

| Symbol                          | Parameter                                               | Max.                    | Units |
|---------------------------------|---------------------------------------------------------|-------------------------|-------|
| $I_D @ T_C = 25^\circ\text{C}$  | Continuous Drain Current, $V_{GS} @ 10V$                | 9.3                     | A     |
| $I_D @ T_C = 100^\circ\text{C}$ | Continuous Drain Current, $V_{GS} @ 10V$                | 6.6                     |       |
| $I_{DM}$                        | Pulsed Drain Current ①                                  | 40                      |       |
| $P_D @ T_C = 25^\circ\text{C}$  | Maximum Power Dissipation                               | 100                     | W     |
|                                 | Linear Derating Factor                                  | 0.67                    | W/°C  |
| $V_{GS}$                        | Gate-to-Source Voltage                                  | ± 20                    | V     |
| $E_{AS}$                        | Single Pulse Avalanche Energy (Thermally Limited) ②     | 130                     | mJ    |
| $E_{AS} (Tested)$               | Single Pulse Avalanche Energy Tested Value ⑥            | 97                      |       |
| $I_{AR}$                        | Avalanche Current ①                                     | See Fig.15,16, 12a, 12b | A     |
| $E_{AR}$                        | Repetitive Avalanche Energy ⑤                           |                         | mJ    |
| $T_J$<br>$T_{STG}$              | Operating Junction and<br>Storage Temperature Range     | -55 to + 175            | °C    |
|                                 | Soldering Temperature, for 10 seconds (1.6mm from case) | 300                     |       |

## 热阻抗

| Symbol          | Parameter                         | Typ. | Max. | Units |
|-----------------|-----------------------------------|------|------|-------|
| $R_{\theta JC}$ | Junction-to-Case                  | ---  | 1.5  | °C/W  |
| $R_{\theta JA}$ | Junction-to-Ambient (PCB Mount) ⑦ | ---  | 50   |       |
| $R_{\theta JA}$ | Junction-to-Ambient               | ---  | 110  |       |

HEXFET® 是英飞凌的注册商标。

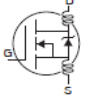
\*认证标准可在 [www.infineon.com](http://www.infineon.com) 上找到

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](http://infineon.com) 参考最新的英文版本（控制文档）。

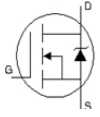
**静态参数特性在  $T_J = 25^\circ\text{C}$  时测得（除非另有规定）**

|                                 | Parameter                            | Min. | Typ. | Max. | Units               | Conditions                                            |
|---------------------------------|--------------------------------------|------|------|------|---------------------|-------------------------------------------------------|
| $V_{(BR)DSS}$                   | Drain-to-Source Breakdown Voltage    | 250  | ---  | ---  | V                   | $V_{GS} = 0V, I_D = 250\mu A$                         |
| $\Delta V_{(BR)DSS}/\Delta T_J$ | Breakdown Voltage Temp. Coefficient  | ---  | 0.31 | ---  | V/ $^\circ\text{C}$ | Reference to $25^\circ\text{C}$ , $I_D = 1mA$         |
| $R_{DS(on)}$                    | Static Drain-to-Source On-Resistance | ---  | 275  | 345  | m $\Omega$          | $V_{GS} = 10V, I_D = 5.6A$ ③                          |
| $V_{GS(th)}$                    | Gate Threshold Voltage               | 3.0  | ---  | 5.0  | V                   | $V_{DS} = V_{GS}, I_D = 50\mu A$                      |
| $g_{fs}$                        | Forward Trans conductance            | 6.2  | ---  | ---  | S                   | $V_{DS} = 50V, I_D = 5.6A$                            |
| $I_{DSS}$                       | Drain-to-Source Leakage Current      | ---  | ---  | 20   | $\mu A$             | $V_{DS} = 250V, V_{GS} = 0V$                          |
|                                 |                                      | ---  | ---  | 250  |                     | $V_{DS} = 250V, V_{GS} = 0V, T_J = 125^\circ\text{C}$ |
| $I_{GSS}$                       | Gate-to-Source Forward Leakage       | ---  | ---  | 200  | nA                  | $V_{GS} = 20V$                                        |
|                                 | Gate-to-Source Reverse Leakage       | ---  | ---  | -200 |                     | $V_{GS} = -20V$                                       |

**动态电气特性在  $T_J = 25^\circ\text{C}$  时测得（除非另有规定）**

|                 |                              |     |     |     |    |                                                                                                                                                                               |
|-----------------|------------------------------|-----|-----|-----|----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| $Q_g$           | Total Gate Charge            | --- | 13  | 20  | nC | $I_D = 5.6A, V_{DS} = 125V$<br>$V_{GS} = 10V$ ③                                                                                                                               |
| $Q_{gs}$        | Gate-to-Source Charge        | --- | 4.7 | --- |    |                                                                                                                                                                               |
| $Q_{gd}$        | Gate-to-Drain Charge         | --- | 4.8 | --- |    |                                                                                                                                                                               |
| $t_{d(on)}$     | Turn-On Delay Time           | --- | 11  | --- | ns | $V_{DD} = 250V, I_D = 5.6A, R_G = 15\Omega$<br>$V_{GS} = 10V$ ③                                                                                                               |
| $t_r$           | Rise Time                    | --- | 15  | --- |    |                                                                                                                                                                               |
| $t_{d(off)}$    | Turn-Off Delay Time          | --- | 16  | --- |    |                                                                                                                                                                               |
| $t_f$           | Fall Time                    | --- | 8.4 | --- |    |                                                                                                                                                                               |
| $L_D$           | 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            | --- | 705 | --- | pF | $V_{GS} = 0V$<br>$V_{DS} = 25V, f = 1.0MHz$<br>$V_{GS} = 0V, V_{DS} = 1.0V, f = 1.0MHz$<br>$V_{GS} = 0V, V_{DS} = 200V, f = 1.0MHz$<br>$V_{GS} = 0V, V_{DS} = 0V$ to $200V$ ④ |
| $C_{oss}$       | Output Capacitance           | --- | 71  | --- |    |                                                                                                                                                                               |
| $C_{rss}$       | Reverse Transfer Capacitance | --- | 20  | --- |    |                                                                                                                                                                               |
| $C_{oss}$       | Output Capacitance           | --- | 600 | --- |    |                                                                                                                                                                               |
| $C_{oss}$       | Output Capacitance           | --- | 26  | --- |    |                                                                                                                                                                               |
| $C_{oss\ eff.}$ | Effective Output Capacitance | --- | 65  | --- |    |                                                                                                                                                                               |

**二极管特性**

|          | Parameter                              | Min.                                                                        | Typ. | Max. | Units | Conditions                                                                                                                                           |
|----------|----------------------------------------|-----------------------------------------------------------------------------|------|------|-------|------------------------------------------------------------------------------------------------------------------------------------------------------|
| $I_S$    | Continuous Source Current (Body Diode) | ---                                                                         | ---  | 9.3  | 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     | $T_J = 25^\circ\text{C}, I_S = 5.6A, V_{GS} = 0V$ ③                                                                                                  |
| $t_{rr}$ | Reverse Recovery Time                  | ---                                                                         | 110  | 165  | ns    | $T_J = 25^\circ\text{C}, I_F = 5.6A, V_{DD} = 125V$                                                                                                  |
| $Q_{rr}$ | Reverse Recovery Charge                | ---                                                                         | 390  | 585  | nC    | $di/dt = 100A/\mu s$ ③                                                                                                                               |
| $t_{on}$ | 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  $T_J = 25^\circ\text{C}$ ， $L = 8.1mH$ ， $R_G = 50\Omega$ ， $I_{AS} = 5.6A$ ， $V_{GS} = 10V$ 。不建议在高于此值的情况运行器件。
- ③ 脉冲宽度  $\leq 1.0ms$ ；占空比  $\leq 2\%$ 。
- 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，初始结温为  $T_J = 25^\circ\text{C}$ ， $L = 8.1mH$ ， $R_G = 50\Omega$ ， $I_{AS} = 5.6A$ ， $V_{GS} = 10V$ 。
- ⑦ 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
- ⑧  $R_\theta$  在  $T_J$  约  $90^\circ\text{C}$  时测得

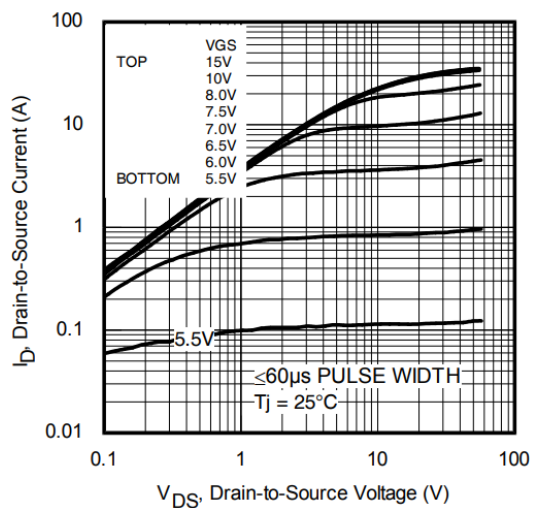


图 1 典型输出特性

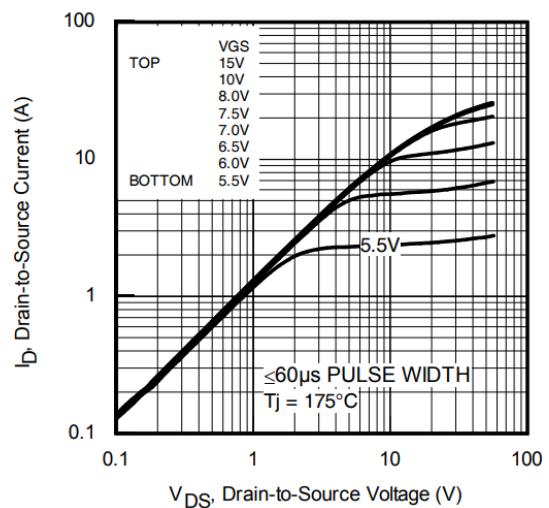


图 2 典型输出特性

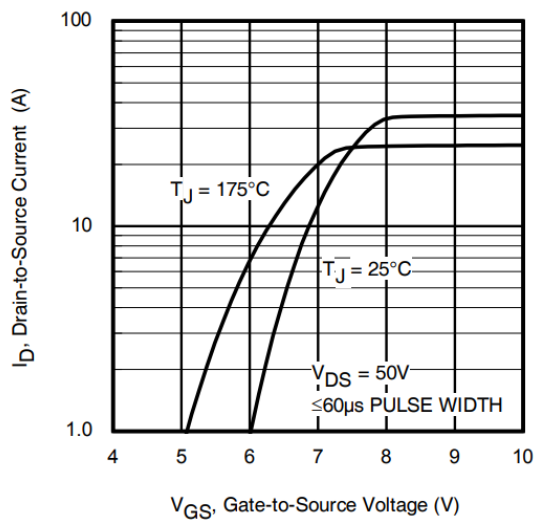


图 3 典型转移特性

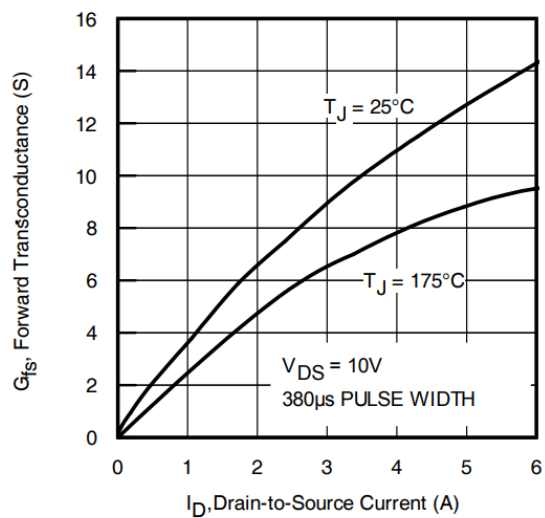


图 4 典型正向跨导与漏极电流关系曲线

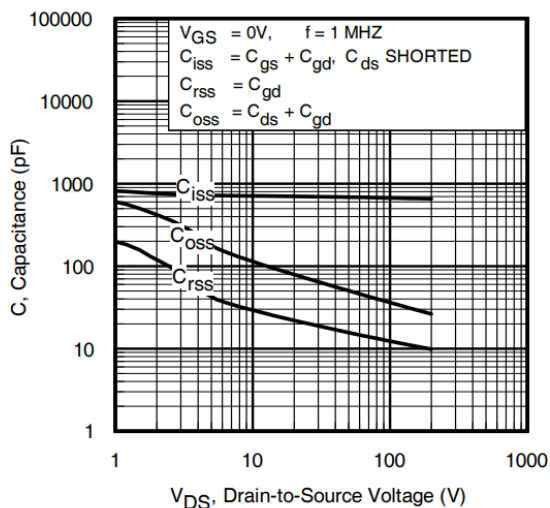


图 5.典型电容与漏源电压关系曲线

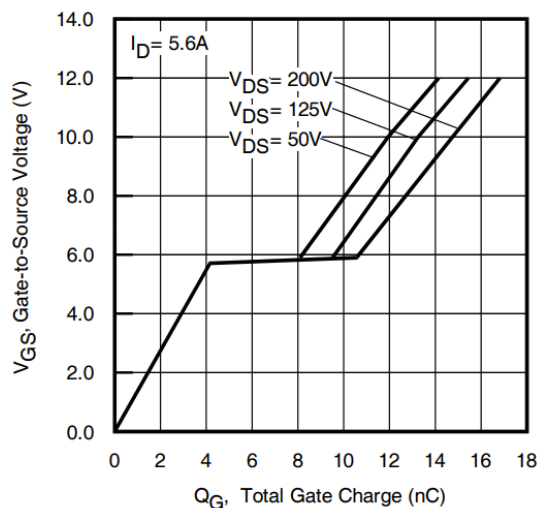


图 6.典型栅极电荷与栅源电压关系曲线

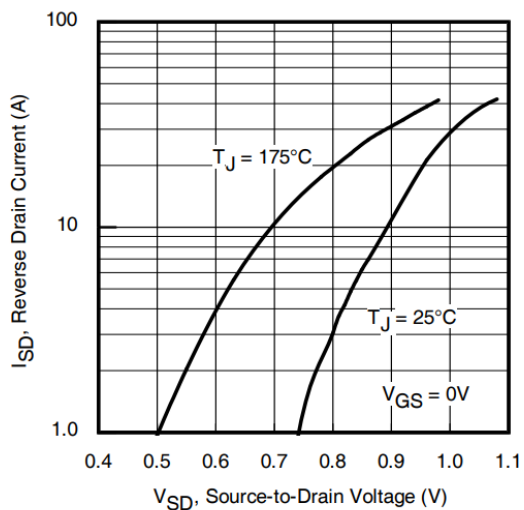


图 7典型源漏二极管正向电压

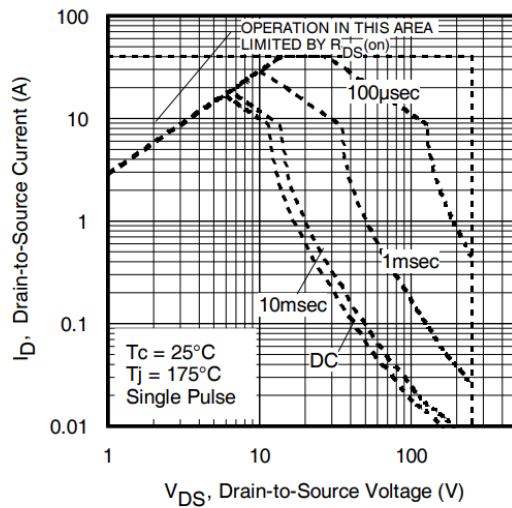


图 8.最大安全工作区

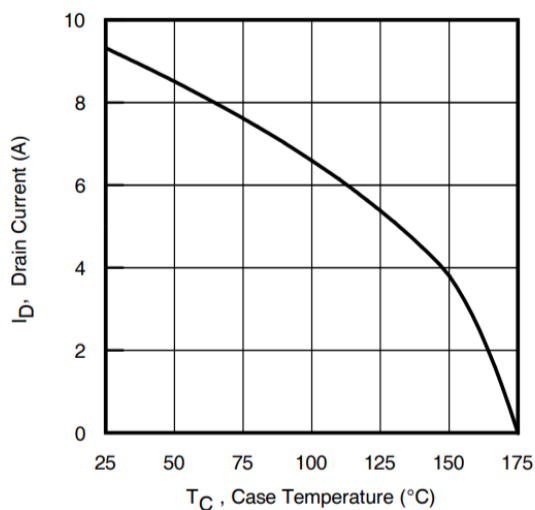


图 9.最大漏极电流与壳温

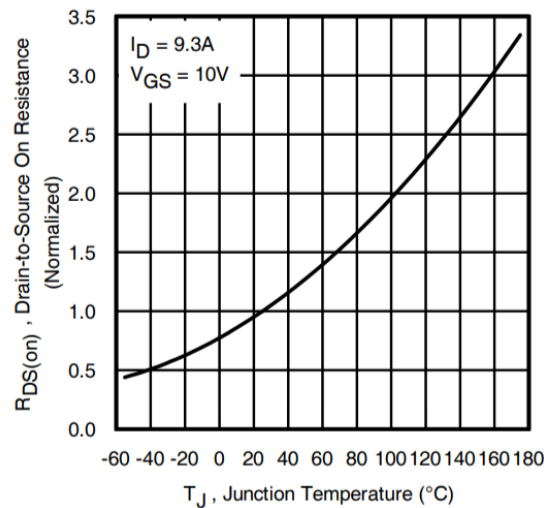


图 10.归一化导通电阻与温度的关系曲线

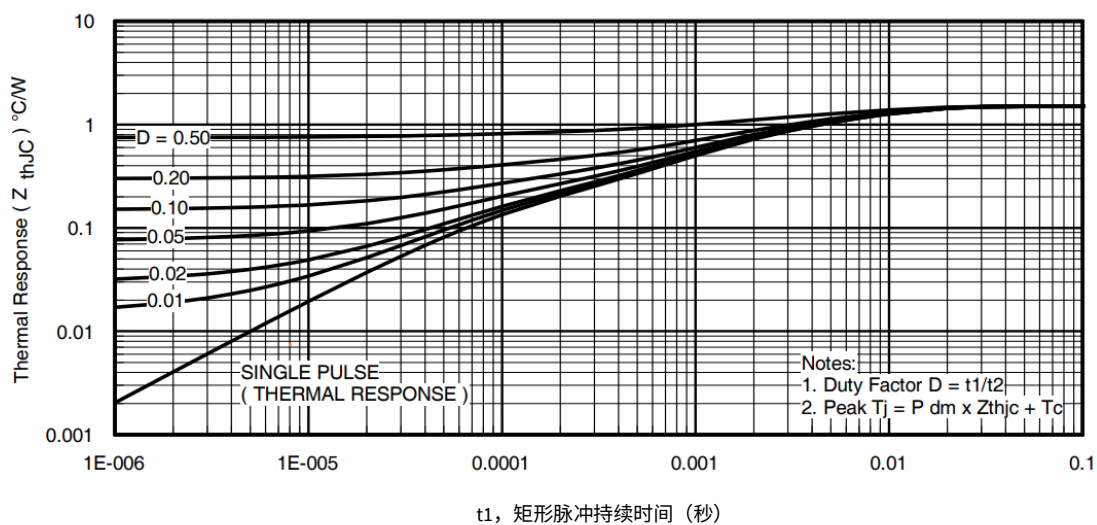
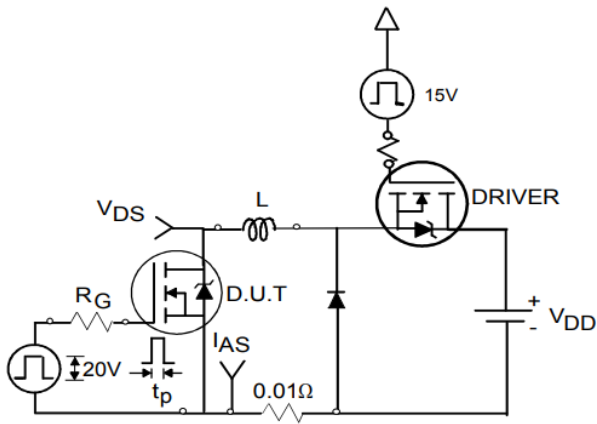
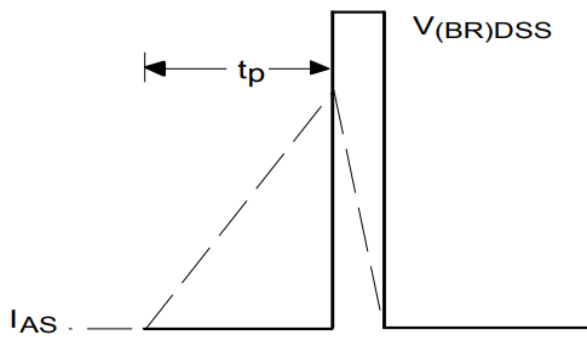
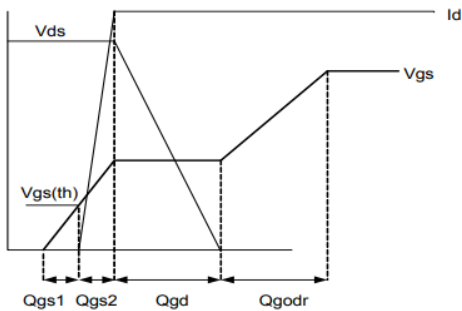
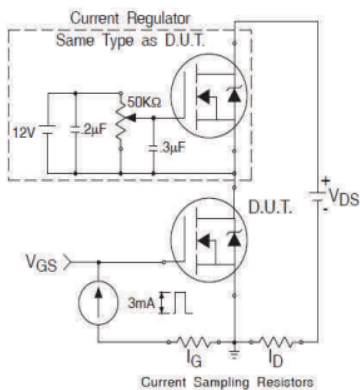
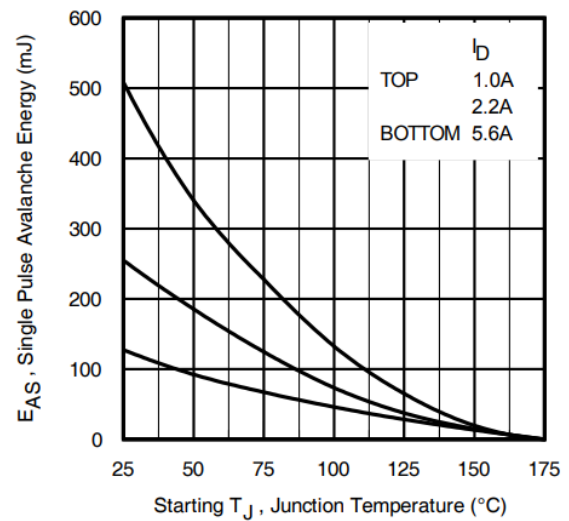
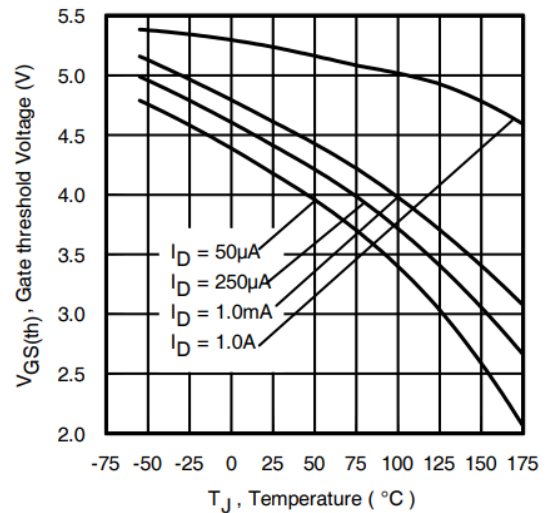


图 11.最大有效瞬态热阻，结到壳


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

**Fig 12b.** Unclamped Inductive Waveforms

**Fig 13a.** Gate Charge Waveform

**Fig 13b.** Gate Charge Test Circuit

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

**Fig 14.** Threshold Voltage Vs. Temperature

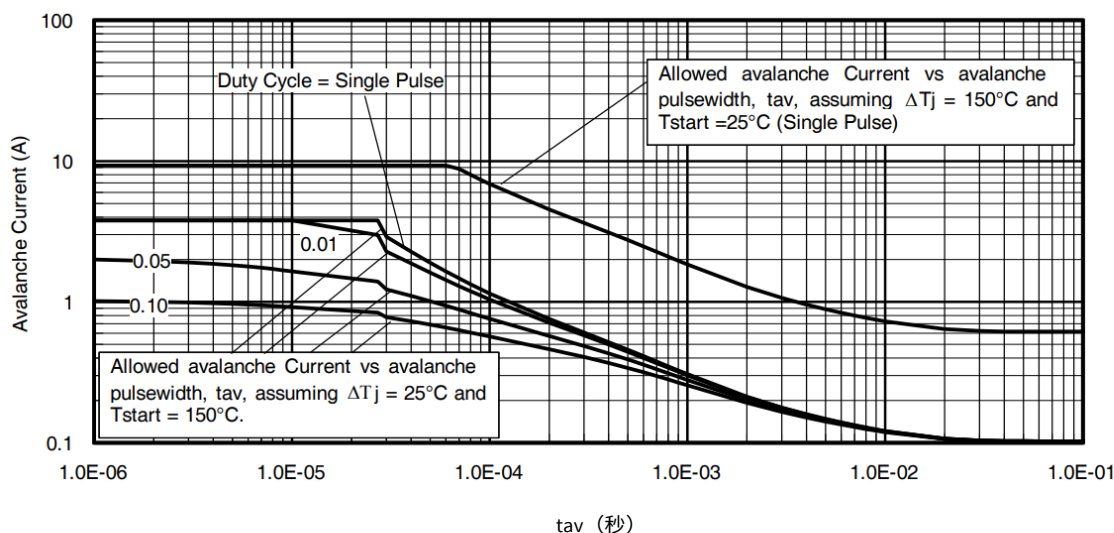


图 15.典型雪崩电流与脉冲宽度

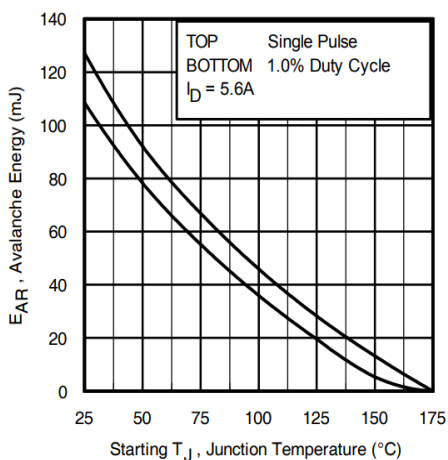


图 16.最大雪崩能量与温度的关系曲线

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](http://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.  $\Delta T$  = 可允许的结温上升，不得超过  $T_{jmax}$ （图 15、16 中假设为 25°C）。

$t_{av}$  = 雪崩的平均时间。

$D$  = 雪崩占空比 =  $t_{av} \cdot f$

$Z_{thJC}(D, t_{av})$  = 瞬态热阻抗，见图 13)

$$P_D(ave) = \frac{1}{2} (1.3 \cdot BV \cdot I_{av}) = \frac{\Delta T}{Z_{thJC}} I_{av} = \frac{2\Delta T}{[1.3 \cdot BV \cdot Z_{th}]}$$

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

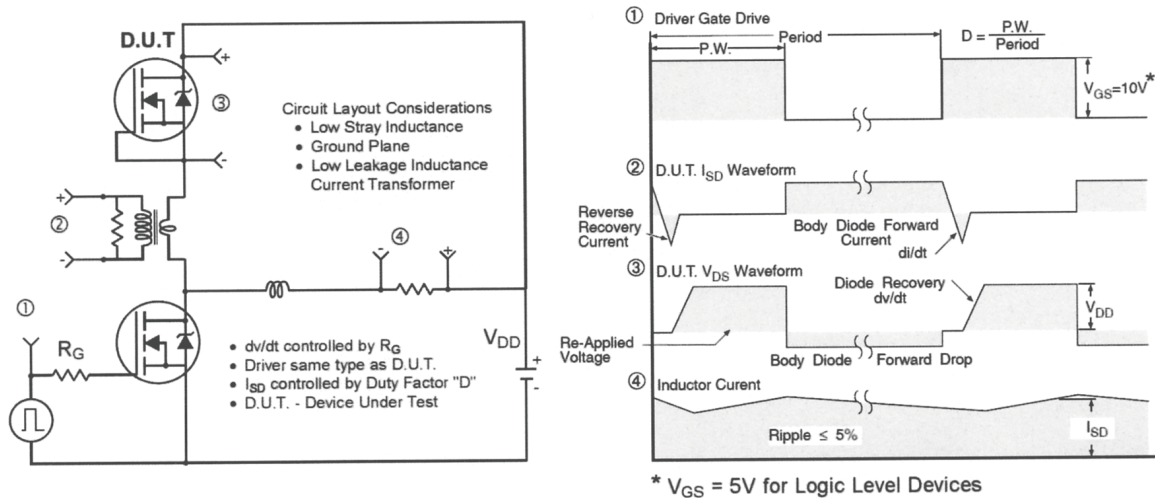


图 17. N 沟道 HEXFET® 功率 MOSFET 体内二极管峰值恢复 dv/dt 测试电路

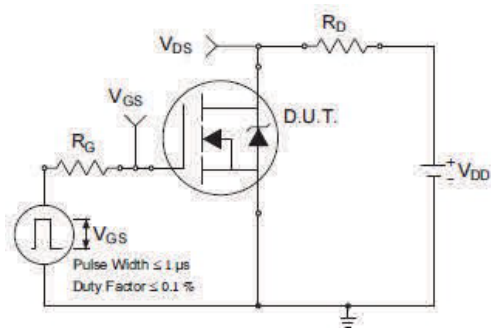


图 18a.开关时间测试电路

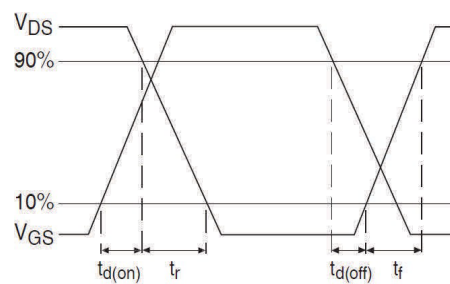
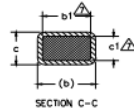
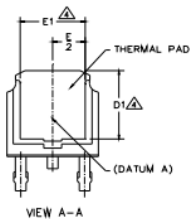
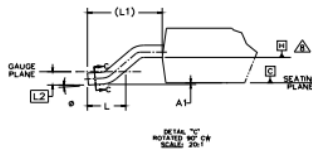
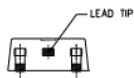
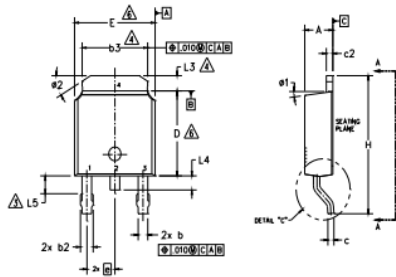


图 18b.开关时间波形

**D-Pak (TO-252AA) 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.- DIMENSION ARE SHOWN IN INCHES [MILLIMETERS]
- 3.- LEAD DIMENSION UNCONTROLLED IN L5.
- 4.- DIMENSION D1, E1, L3 & b3 ESTABLISH A MINIMUM MOUNTING SURFACE FOR THERMAL PAD.
- 5.- SECTION C-C DIMENSIONS APPLY TO THE FLAT SECTION OF THE LEAD BETWEEN .005 AND 0.10 [0.13 AND 0.25] FROM THE LEAD TIP.
- 6.- DIMENSION D & E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED .005 [0.13] PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTMOST EXTREMES OF THE PLASTIC BODY.
- 7.- DIMENSION b1 & c1 APPLIED TO BASE METAL ONLY.
- 8.- DATUM A & B TO BE DETERMINED AT DATUM PLANE H.
- 9.- OUTLINE CONFORMS TO JEDEC OUTLINE TO-252AA.

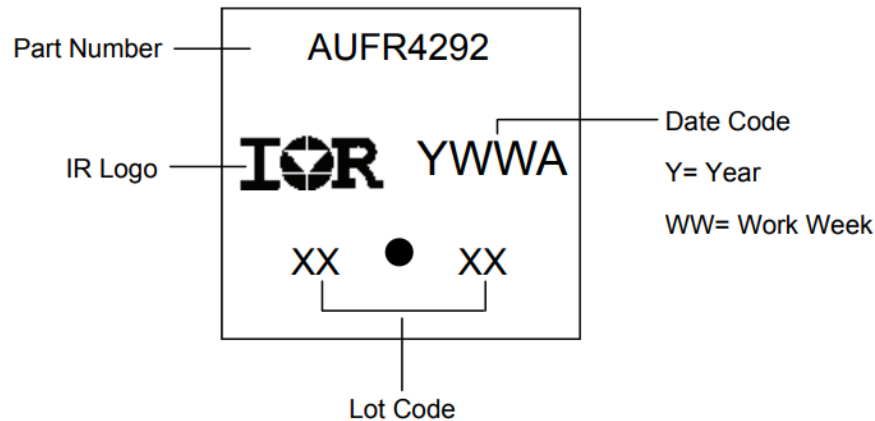
| SYMBOL | DIMENSIONS  |       |           |      | NOTES |
|--------|-------------|-------|-----------|------|-------|
|        | MILLIMETERS |       | INCHES    |      |       |
|        | MIN.        | MAX.  | MIN.      | MAX. |       |
| A      | 2.18        | 2.39  | .086      | .094 |       |
| A1     | —           | 0.13  | —         | .005 |       |
| b      | 0.64        | 0.89  | .025      | .035 |       |
| b1     | 0.65        | 0.79  | .025      | .031 | 7     |
| b2     | 0.76        | 1.14  | .030      | .045 |       |
| b3     | 4.95        | 5.46  | .195      | .215 | 4     |
| c      | 0.46        | 0.61  | .018      | .024 |       |
| c1     | 0.41        | 0.56  | .016      | .022 | 7     |
| c2     | 0.46        | 0.89  | .018      | .035 |       |
| D      | 5.97        | 6.22  | .235      | .245 | 6     |
| D1     | 5.21        | —     | .205      | —    | 4     |
| E      | 6.35        | 6.73  | .250      | .265 | 6     |
| E1     | 4.32        | —     | .170      | —    | 4     |
| e      | 2.29 BSC    |       | .090 BSC  |      |       |
| H      | 9.40        | 10.41 | .370      | .410 |       |
| L      | 1.40        | 1.78  | .055      | .070 |       |
| L1     | 2.74 BSC    |       | .108 REF. |      |       |
| L2     | 0.51 BSC    |       | .020 BSC  |      |       |
| L3     | 0.89        | 1.27  | .035      | .050 | 4     |
| L4     | —           | 1.02  | —         | .040 |       |
| L5     | 1.14        | 1.52  | .045      | .060 | 3     |
| Ø      | 0"          | 10"   | 0"        | 10"  |       |
| Ø1     | 0"          | 15"   | 0"        | 15"  |       |
| Ø2     | 25"         | 35"   | 25"       | 35"  |       |

**LEAD ASSIGNMENTS**
**HEXFET**

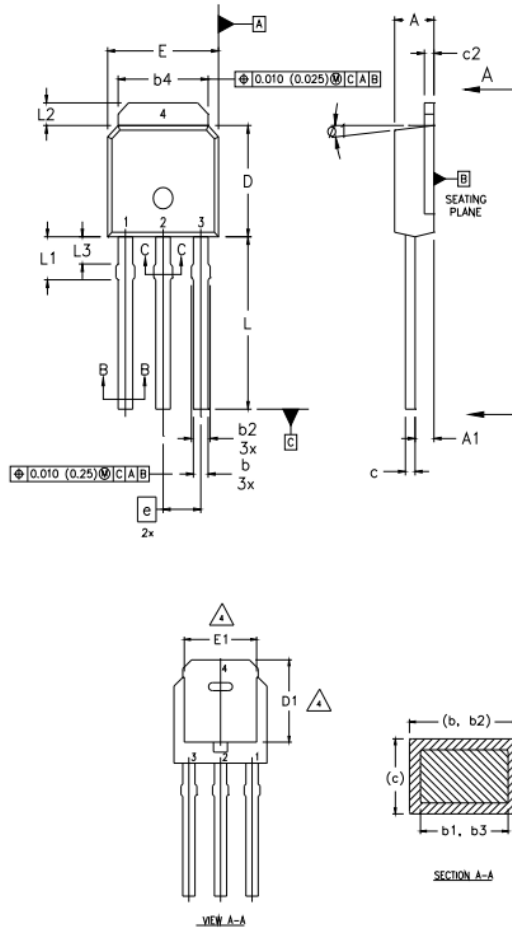
- 1.- GATE
- 2.- DRAIN
- 3.- SOURCE
- 4.- DRAIN

**IGBT & CoPAK**

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

**D-Pak (TO-252AA) 零件标识信息**


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

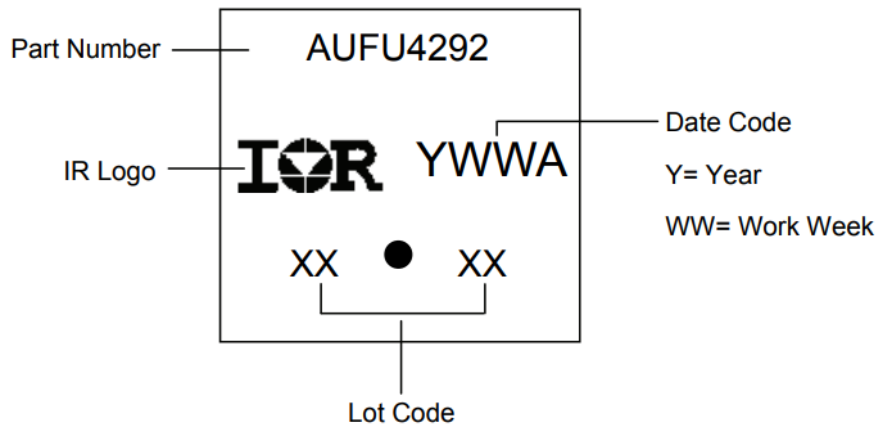
**I-Pak (TO-251AA) 封装外形 (尺寸以毫米 (英寸) 为单位)**

**NOTES:**

- 1 DIMENSIONING AND TOLERANCING PER ASME Y14.5 M- 1994.
- 2 DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES].
- 3 DIMENSION D & E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED 0.005" (0.127) PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY.
- 4 THERMAL PAD CONTOUR OPTION WITHIN DIMENSION b4, L2, E1 & D1.
- 5 LEAD DIMENSION UNCONTROLLED IN L3.
- 6 DIMENSION b1, b3 APPLY TO BASE METAL ONLY.
- 7 OUTLINE CONFORMS TO JEDEC OUTLINE TO-251AA.
- 8 CONTROLLING DIMENSION : INCHES.

**LEAD ASSIGNMENTS**
**HEXFET**

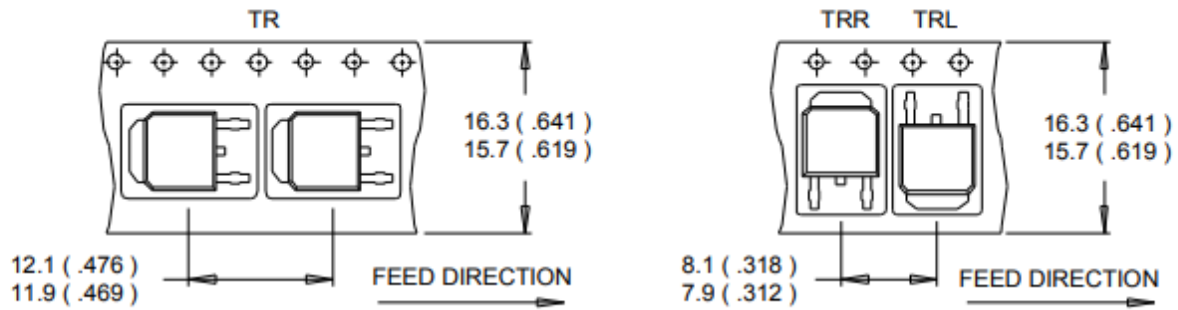
- 1.- GATE
- 2.- DRAIN
- 3.- SOURCE
- 4.- DRAIN

| SYMBOL | DIMENSIONS  |      |           |       | NOTES |
|--------|-------------|------|-----------|-------|-------|
|        | MILLIMETERS |      | INCHES    |       |       |
|        | MIN.        | MAX. | MIN.      | MAX.  |       |
| A      | 2.18        | 2.39 | 0.086     | .094  |       |
| A1     | 0.89        | 1.14 | 0.035     | 0.045 |       |
| b      | 0.64        | 0.89 | 0.025     | 0.035 |       |
| b1     | 0.64        | 0.79 | 0.025     | 0.031 | 4     |
| b2     | 0.76        | 1.14 | 0.030     | 0.045 |       |
| b3     | 0.76        | 1.04 | 0.030     | 0.041 |       |
| b4     | 5.00        | 5.46 | 0.195     | 0.215 | 4     |
| c      | 0.46        | 0.61 | 0.018     | 0.024 |       |
| c1     | 0.41        | 0.56 | 0.016     | 0.022 |       |
| c2     | .046        | 0.86 | 0.018     | 0.035 |       |
| D      | 5.97        | 6.22 | 0.235     | 0.245 | 3, 4  |
| D1     | 5.21        | —    | 0.205     | —     | 4     |
| E      | 6.35        | 6.73 | 0.250     | 0.265 | 3, 4  |
| E1     | 4.32        | —    | 0.170     | —     | 4     |
| e      | 2.29        |      | 0.090 BSC |       |       |
| L      | 8.89        | 9.60 | 0.350     | 0.380 |       |
| L1     | 1.91        | 2.29 | 0.075     | 0.090 |       |
| L2     | 0.89        | 1.27 | 0.035     | 0.050 | 4     |
| L3     | 1.14        | 1.52 | 0.045     | 0.060 | 5     |
| ø1     | 0"          | 15"  | 0"        | 15"   |       |

**I-Pak (TO-251AA) 零件标识信息**


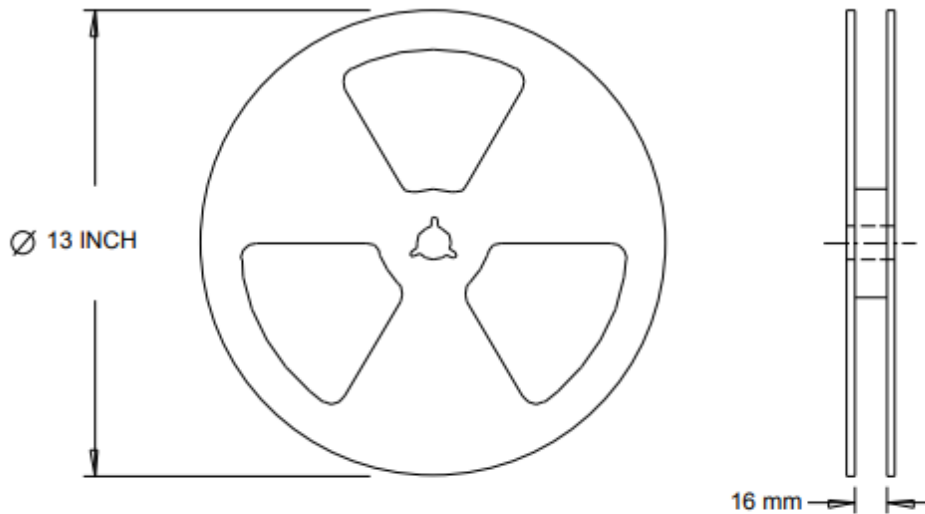
Note: For the most current drawing please refer to IR website at <http://www.irf.com/package/>

D- Pak(TO-252AA)卷料和带料信息 (尺寸以毫米 (英寸) 为单位)



NOTES :

1. CONTROLLING DIMENSION : MILLIMETER.
2. ALL DIMENSIONS ARE SHOWN IN MILLIMETERS ( INCHES ).
3. OUTLINE CONFORMS TO EIA-481 & EIA-541.



NOTES :

1. OUTLINE CONFORMS TO EIA-481.

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

## Qualification Information

|                            |                      |                                                                                                                                                                               |      |
|----------------------------|----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|
| Qualification Level        |                      | Automotive<br>(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 |                      | D-Pak                                                                                                                                                                         | MSL1 |
|                            |                      | I-Pak                                                                                                                                                                         |      |
| ESD                        | Machine Model        | Class M1B (+/- 100V) <sup>†</sup><br>AEC-Q101-002                                                                                                                             |      |
|                            | Human Body Model     | Class H1A (+/- 500V) <sup>†</sup><br>AEC-Q101-001                                                                                                                             |      |
|                            | Charged Device Model | Class C5 (+/- 2000V) <sup>†</sup><br>AEC-Q101-005                                                                                                                             |      |
| RoHS Compliant             |                      | Yes                                                                                                                                                                           |      |

† 最高通过电压。

## 修订记录

| Date       | Comments                                                                                                                                                                                                                                                                                                                                        |
|------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 9/2/2014   | <ul style="list-style-type: none"> <li>Updated datasheet with IR corporate template.</li> <li>Updated SOA curve Fig 8 from "50V" <math>V_{DS}</math> to "250V" on page 4.</li> <li>Updated Package outline on page 9 &amp; 10</li> <li>Updated ordering information to reflect the End-Of-life (EOL) of the option (EOL notice #530)</li> </ul> |
| 10/12/2015 | <ul style="list-style-type: none"> <li>Updated datasheet with corporate template</li> <li>Corrected ordering table on page 1.</li> </ul>                                                                                                                                                                                                        |

## Published by

Infineon Technologies AG 81726

München, Germany

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版本 2025-10-30

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