

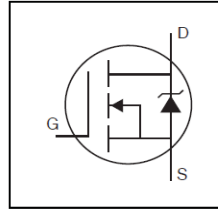
HEXFET®功率MOSFET

## 特性

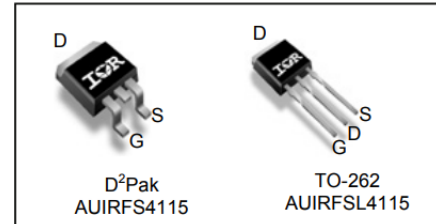
- 先进工艺技术
- 超低导通电阻
- 工作温度 175°C
- 快速开关
- 允许达到 Tjmax 的重复雪崩
- 无铅，符合RoHS要求
- 汽车认证\*

## 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。



|                          |               |
|--------------------------|---------------|
| $V_{DS}$                 | <b>150V</b>   |
| $R_{DS(on)}$ <b>typ.</b> | <b>10.3mΩ</b> |
|                          | <b>max.</b>   |
| $I_D$                    | <b>99A</b>    |



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

| Base part number | Package Type | Standard Pack      |          | Orderable Part Number |
|------------------|--------------|--------------------|----------|-----------------------|
|                  |              | Form               | Quantity |                       |
| AUIRFS4115       | TO-262       | Tube               | 50       | AUIRFS4115            |
| AUIRFS4115       | D²-Pak       | Tube               | 50       | AUIRFS4115            |
|                  |              | Tape and Reel Left | 800      | AUIRFS4115TRL         |

## 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。

| Symbol                          | Parameter   | Max.         | Units |
|---------------------------------|---|--------------|-------|
| $I_D @ T_C = 25^\circ\text{C}$  | Continuous Drain Current, $V_{GS} @ 10\text{V}$         | 99           | A     |
| $I_D @ T_C = 100^\circ\text{C}$ | Continuous Drain Current, $V_{GS} @ 10\text{V}$         | 70           |       |
| $I_{DM}$                        | Pulsed Drain Current ①                                  | 396          |       |
| $P_D @ T_C = 25^\circ\text{C}$  | Maximum Power Dissipation                               | 375          | W     |
|                                 | Linear Derating Factor                                  | 2.5          | W/°C  |
| $V_{GS}$                        | Gate-to-Source Voltage                                  | ± 20         | V     |
| dv/dt                           | Peak Diode Recovery ③                                   | 18           | V/ns  |
| $E_{AS}$                        | Single Pulse Avalanche Energy (Thermally Limited) ②     | 230          | 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 ⑧⑨                       | ---  | 0.40 | °C/W  |
| $R_{\theta JA}$ | Junction-to-Ambient (PCB Mount), D² Pak ⑦ | ---  | 40   |       |

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）。

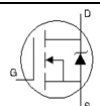
**静态参数特性在  $T_J = 25^\circ\text{C}$  时测得 (除非另有规定)**

|                                 | Parameter                            | Min. | Typ. | Max. | Units               | Conditions  |
|---------------------------------|--------------------------------------|------|------|------|---------------------|---|
| $V_{(BR)DSS}$                   | Drain-to-Source Breakdown Voltage    | 150  | ---  | ---  | V                   | $V_{GS} = 0V, I_D = 250\mu A$                         |
| $\Delta V_{(BR)DSS}/\Delta T_J$ | Breakdown Voltage Temp. Coefficient  | ---  | 0.18 | ---  | V/ $^\circ\text{C}$ | Reference to $25^\circ\text{C}, I_D = 3.5\text{mA}$ ① |
| $R_{DS(on)}$                    | Static Drain-to-Source On-Resistance | ---  | 10.3 | 12.1 | m $\Omega$          | $V_{GS} = 10V, I_D = 62A$ ④                           |
| $V_{GS(th)}$                    | Gate Threshold Voltage               | 3.0  | ---  | 5.0  | V                   | $V_{DS} = V_{GS}, I_D = 250\mu A$                     |
| $g_{fs}$                        | Forward Trans conductance            | 97   | ---  | ---  | S                   | $V_{DS} = 50V, I_D = 62A$                             |
| $I_{DSS}$                       | Drain-to-Source Leakage Current      | ---  | ---  | 20   | $\mu A$             | $V_{DS} = 150V, V_{GS} = 0V$                          |
|                                 |                                      | ---  | ---  | 250  |                     | $V_{DS} = 150V, V_{GS} = 0V, T_J = 125^\circ\text{C}$ |
| $I_{GSS}$                       | Gate-to-Source Forward Leakage       | ---  | ---  | 100  | nA                  | $V_{GS} = 20V$  |
|                                 | Gate-to-Source Reverse Leakage       | ---  | ---  | -100 |                     | $V_{GS} = -20V$                                       |
| $R_G$                           | Internal Gate Resistance             | ---  | 2.3  | ---  | $\Omega$            |   |

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

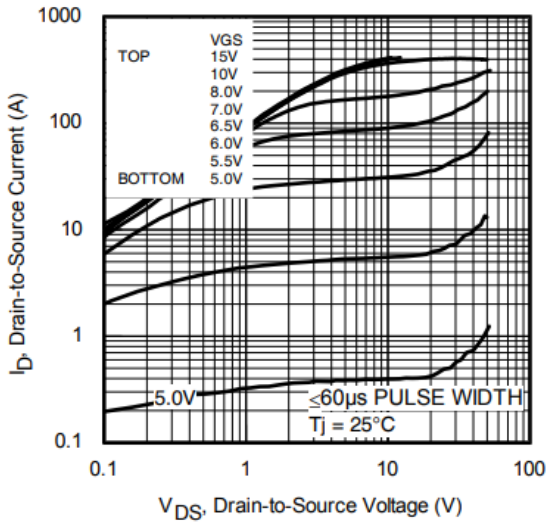
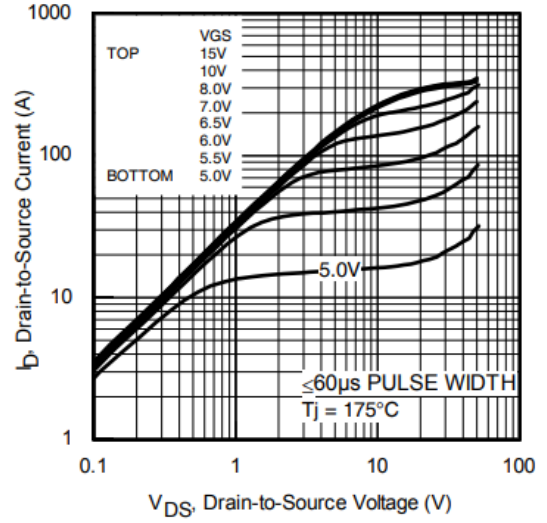
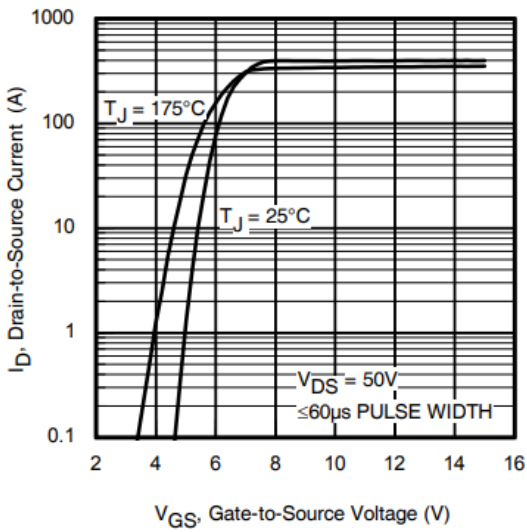
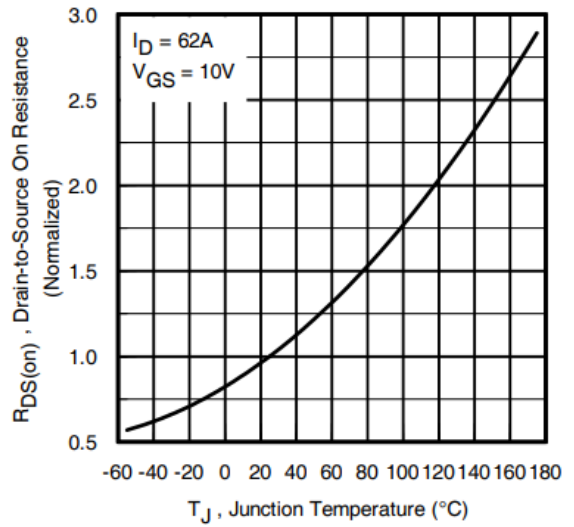
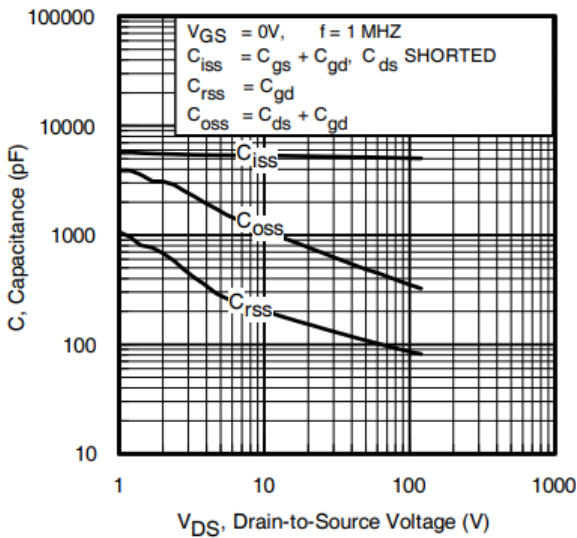
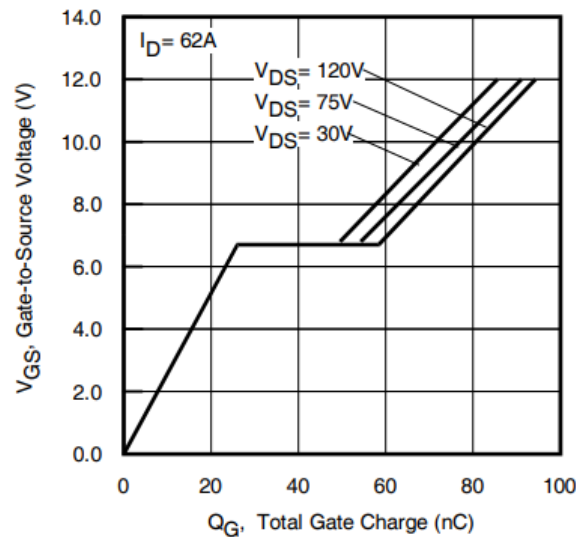
|                     |   |     |      |     |  |   |
|---------------------|---|-----|------|-----|--|---|
| $Q_g$               | Total Gate Charge                             | --- | 77   | 120 | nC                                     | $I_D = 62A, V_{DS} = 75V, V_{GS} = 10V$ ④                   |
| $Q_{gs}$            | Gate-to-Source Charge                         | --- | 28   | --- |  |   |
| $Q_{gd}$            | Gate-to-Drain Charge                          | --- | 26   | --- |  |   |
| $Q_{sync}$          | Total Gate Charge Sync. ( $Q_g - Q_{gd}$ )    | --- | 51   | --- | ns                                     | $V_{DD} = 98V, I_D = 62A, R_G = 2.2\Omega, V_{GS} = 10V$ ④  |
| $t_{d(on)}$         | Turn-On Delay Time                            | --- | 18   | --- |  |   |
| $t_r$               | Rise Time                                     | --- | 73   | --- |  |   |
| $t_{d(off)}$        | Turn-Off Delay Time                           | --- | 41   | --- |  |   |
| $t_f$               | Fall Time                                     | --- | 39   | --- | pF                                     | $V_{GS} = 0V, V_{DS} = 50V, f = 1.0\text{MHz}$ , See Fig. 5 |
| $C_{iss}$           | Input Capacitance                             | --- | 5270 | --- |  |   |
| $C_{oss}$           | Output Capacitance                            | --- | 490  | --- |  |   |
| $C_{rss}$           | Reverse Transfer Capacitance                  | --- | 105  | --- |  |   |
| $C_{oss\ eff.(ER)}$ | Effective Output Capacitance (Energy Related) | --- | 460  | --- |  |   |
| $C_{oss\ eff.(TR)}$ | Effective Output Capacitance (Time Related)   | --- | 530  | --- | $V_{GS} = 0V, V_{DS} = 0V$ to $120V$ ⑤ |   |

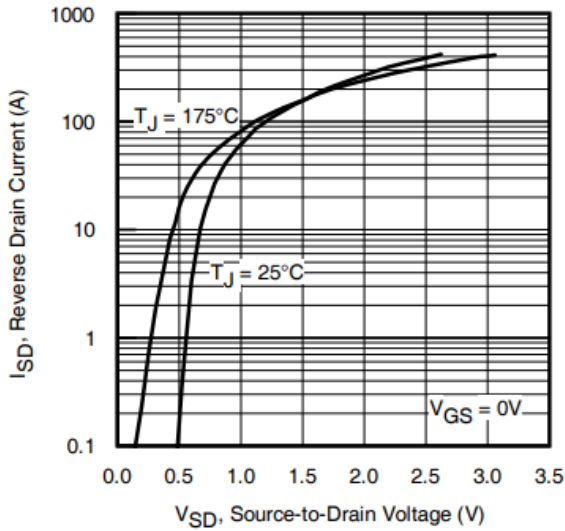
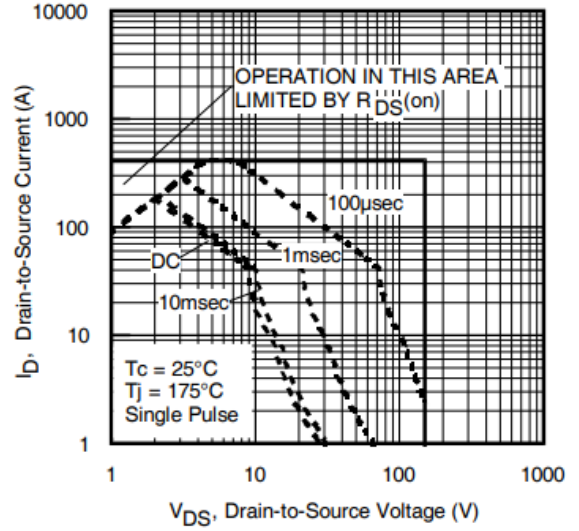
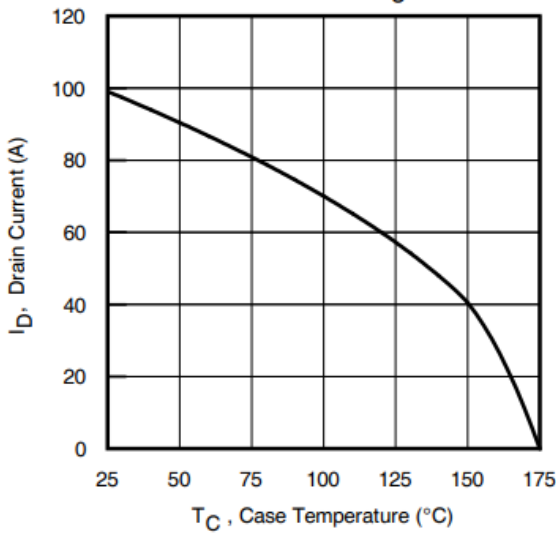
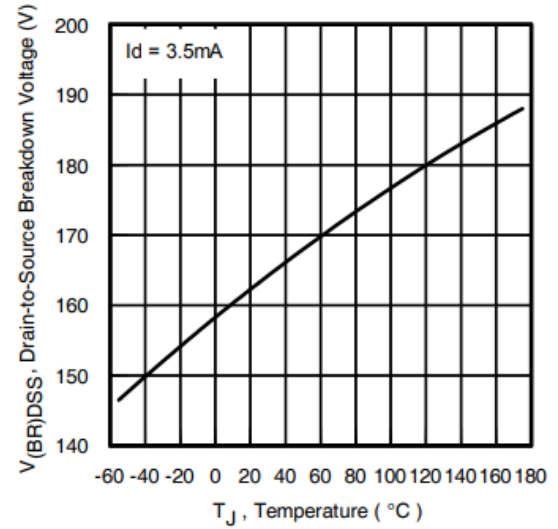
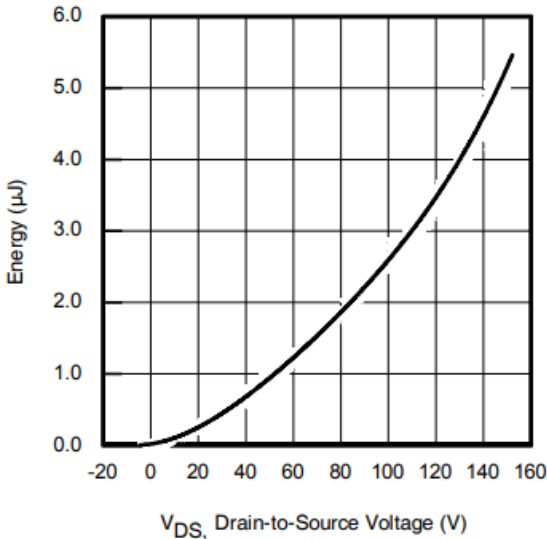
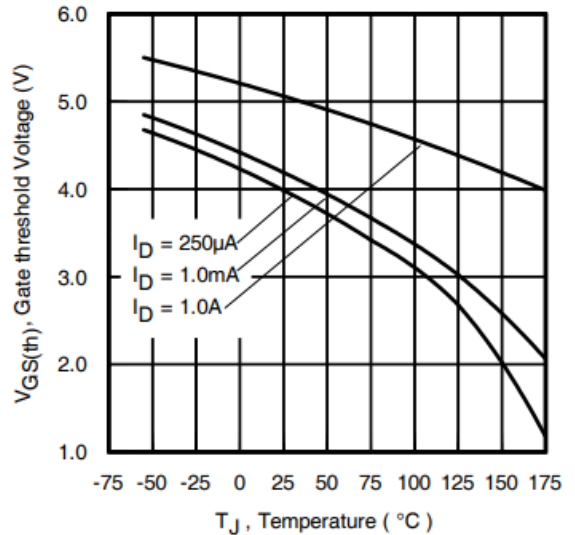
**二极管特性**

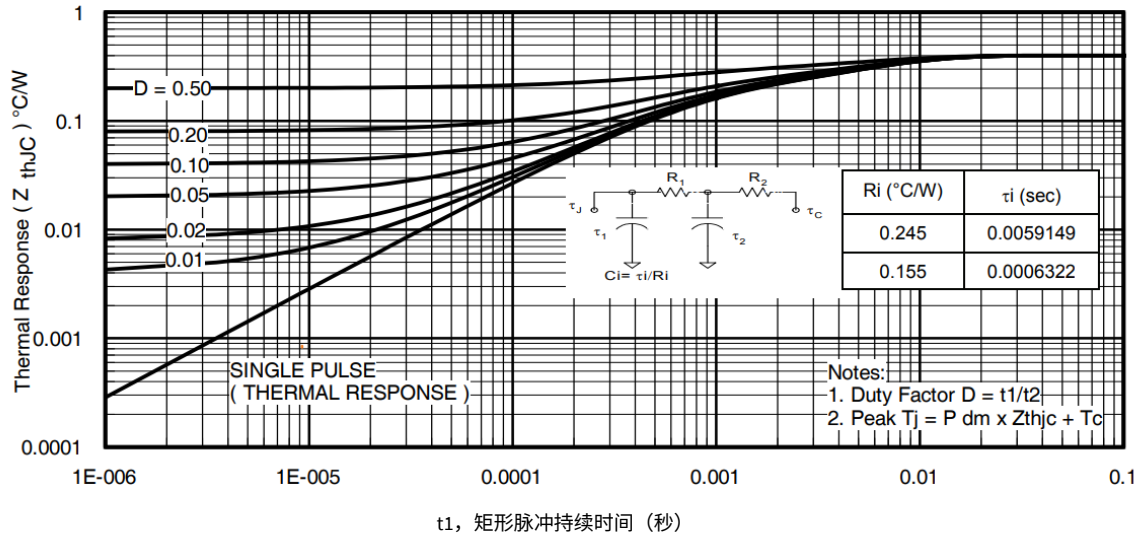
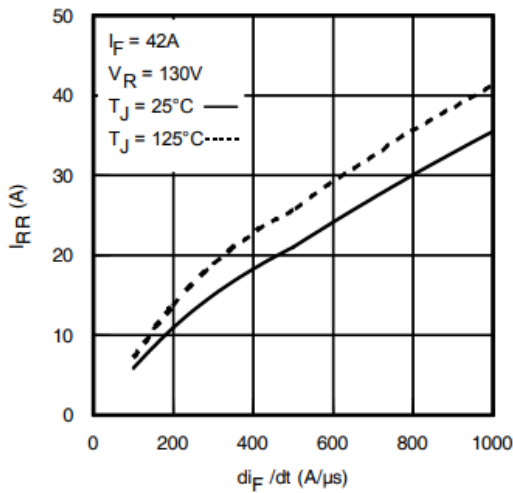
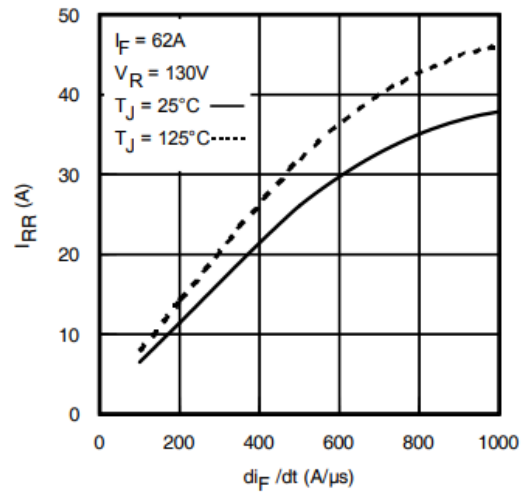
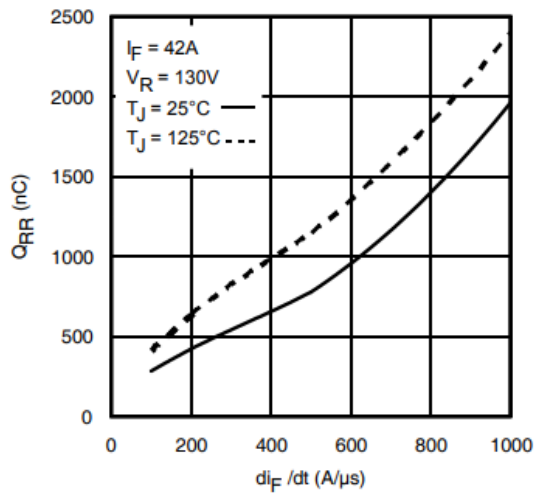
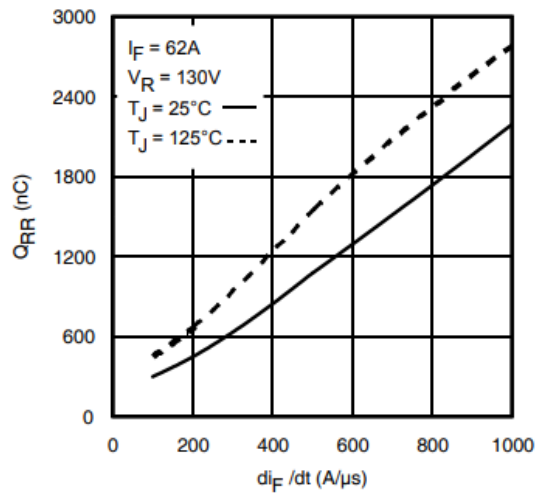
|           | Parameter                              | Min.  | Typ. | Max. | Units | Conditions   |
|-----------|--|---|------|------|-------|--|
| $I_S$     | Continuous Source Current (Body Diode) | ---   | ---  | 99   | A     | MOSFET symbol showing the integral reverse p-n junction diode.  |
| $I_{SM}$  | Pulsed Source Current (Body Diode) ①   | ---   | ---  | 396  |       |  |
| $V_{SD}$  | Diode Forward Voltage                  | ---   | ---  | 1.3  | V     | $T_J = 25^\circ\text{C}, I_S = 62A, V_{GS} = 0V$ ④   |
| $t_{rr}$  | Reverse Recovery Time                  | ---   | 86   | ---  | ns    | $T_J = 25^\circ\text{C}$ $V_{DD} = 130V$   |
|           |  | ---   | 110  | ---  |       | $T_J = 125^\circ\text{C}$ $I_F = 62A,$   |
| $Q_{rr}$  | Reverse Recovery Charge                | ---   | 300  | ---  | nC    | $T_J = 25^\circ\text{C}$ $di/dt = 100A/\mu s$ ④  |
|           |  | ---   | 450  | ---  |       | $T_J = 125^\circ\text{C}$  |
| $I_{RRM}$ | Reverse Recovery Current               | ---   | 6.5  | ---  | A     | $T_J = 25^\circ\text{C}$   |
| $t_{on}$  | Forward Turn-On Time                   | Intrinsic turn-on time is negligible (turn-on is dominated by $L_S + L_D$ ) |      |      |       |  |

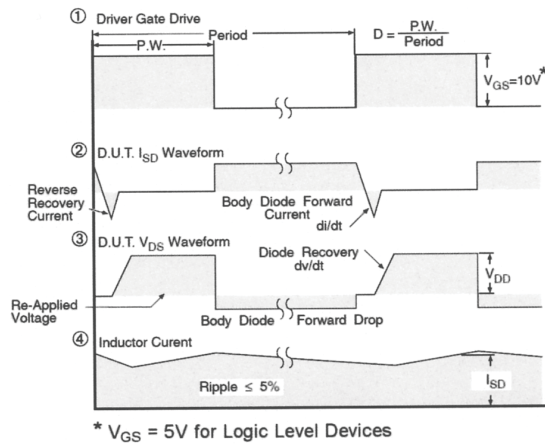
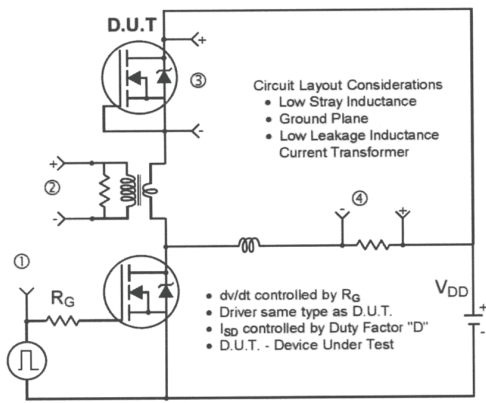
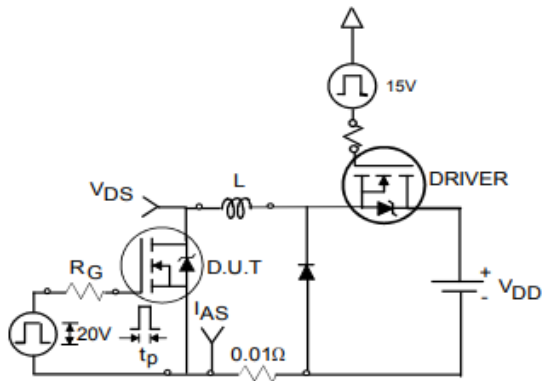
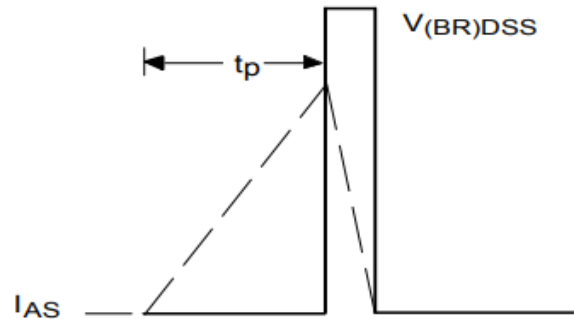
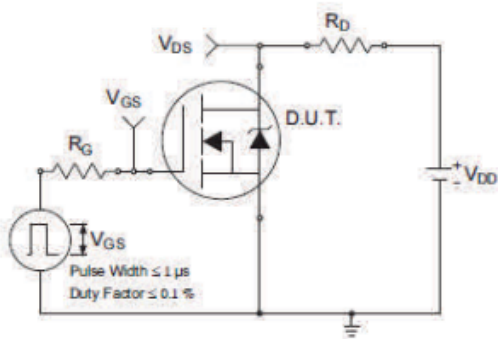
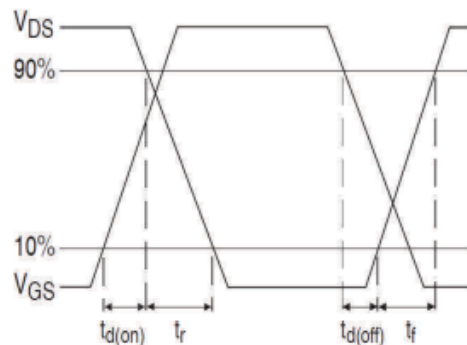
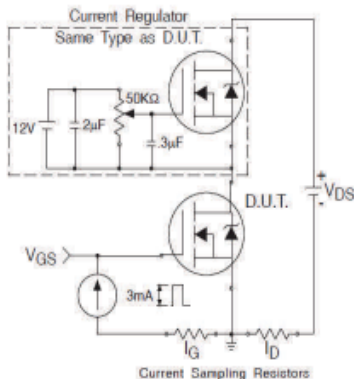
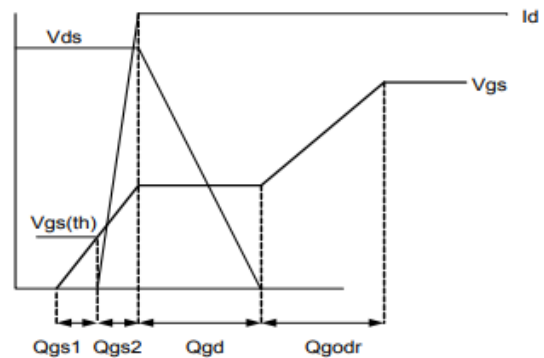
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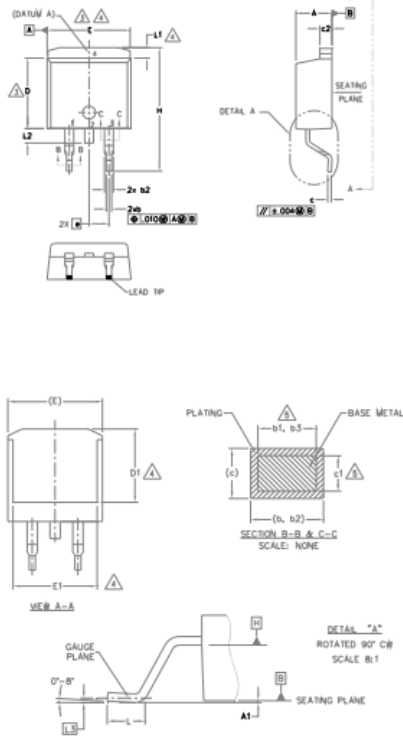
- ① 重复额定值; 脉冲宽度受最高结温限制。
- ② 受  $T_{Jmax}$  限制, 初始  $T_J = 25^\circ\text{C}$ 、 $L = 0.115\text{mH}$ 、 $R_G = 25\Omega$ 、 $I_{AS} = 63A$ 、 $V_{GS} = 10V$ 。不建议在高于此值的情况运行器件。
- ③  $I_{SD} \leq 62A$ 、 $di/dt \leq 1040A/\mu s$ 、 $V_{DD} \leq V_{(BR)DSS}$ 、 $T_J \leq 175^\circ\text{C}$ 。
- ④ 脉冲宽度  $\leq 400\mu s$ ; 占空比  $\leq 2\%$ 。
- ⑤  $C_{oss\ eff. (TR)}$  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。
- ⑥  $C_{oss\ eff. (ER)}$  是一个固定电容值, 当  $V_{DS}$  从 0 上升至  $80\% V_{DSS}$  时, 其产生与  $C_{oss}$  相同的热量。
- 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  $T_J$  约为  $90^\circ\text{C}$  时测得。
- ⑨  $R_{\theta JC}$  值标定于器件初始时刻


**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-to-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


**图 13.最大有效瞬态热阻，结到壳**

**Fig. 14 - Typical Recovery Current vs. diF/dt**

**Fig. 15 - Typical Recovery Current vs. diF/dt**

**Fig. 16 - Typical Stored Charge vs. diF/dt**

**Fig. 17 - Typical Stored Charge vs. diF/dt**


**图 18. N 沟道 HEXFET® 功率 MOSFET 二极管峰值恢复 dv/dt 测试电路**

**Fig 19a. Unclamped Inductive Test Circuit**

**Fig 19b. Unclamped Inductive Waveforms**

**Fig 20a. Switching Time Test Circuit**

**Fig 20b. Switching Time Waveforms**

**Fig 21a. Gate Charge Test Circuit**

**Fig 21b. Gate Charge Waveform**

**D<sup>2</sup> 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 [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, 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**

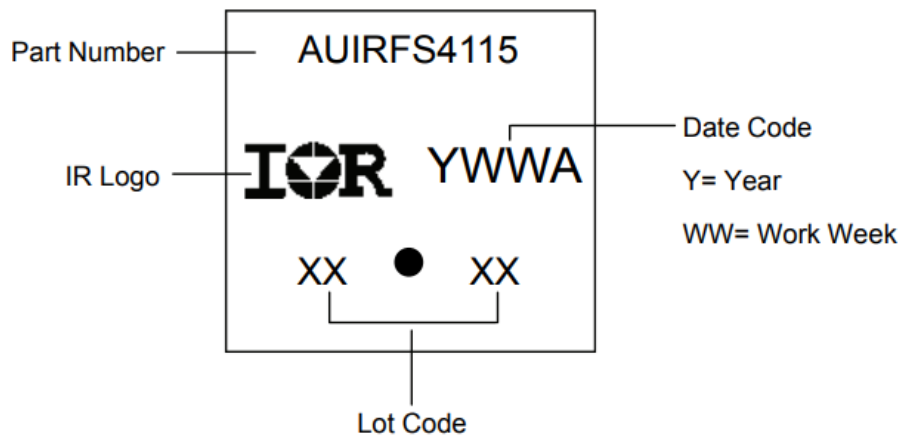
1. - ANODE (TWO DIE) / OPEN (ONE DIE)
- 2, 4. - CATHODE
3. - ANODE

**HEXFET**

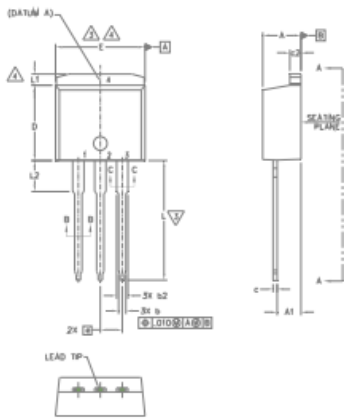
1. - GATE
- 2, 4. - DRAIN
3. - SOURCE

**IGBTs, CoPACK**

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

**D<sup>2</sup> 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**

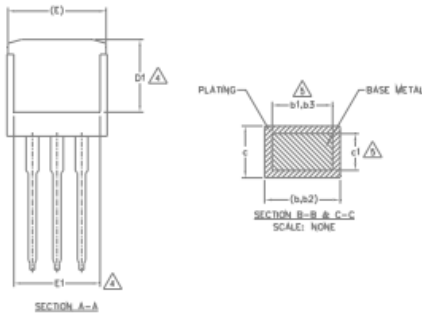
- 1.- GATE
- 2.- COLLECTOR
- 3.- EMITTER
- 4.- COLLECTOR

**HEXFET**

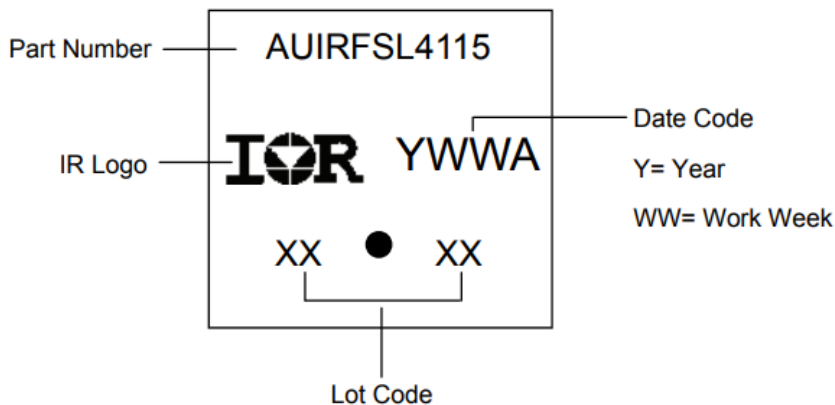
- 1.- GATE
- 2.- DRAIN
- 3.- SOURCE
- 4.- DRAIN

**DIODES**

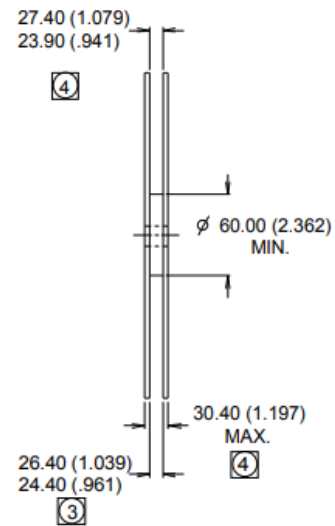
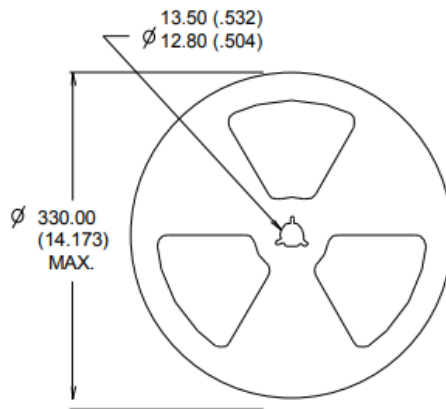
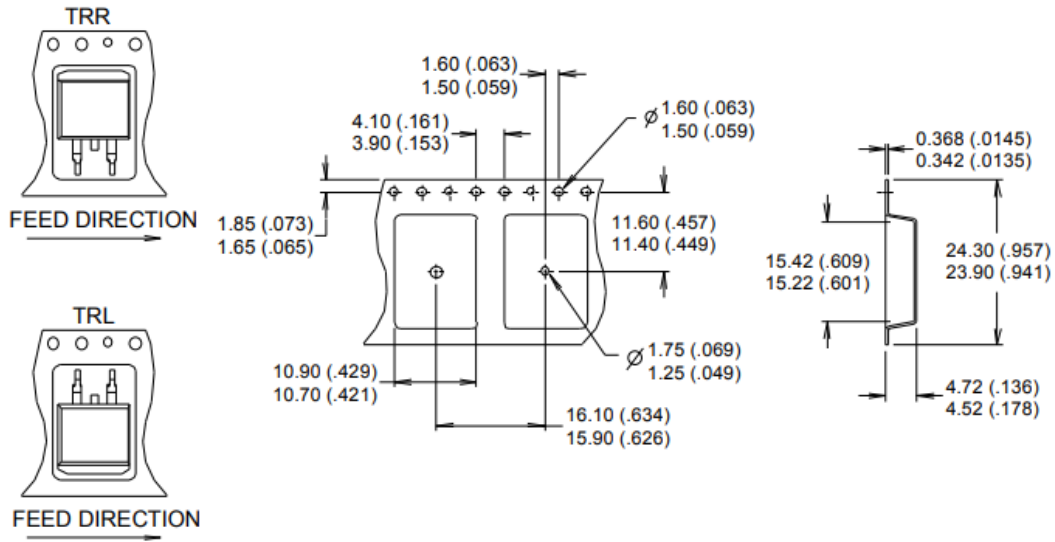
- 1.- ANODE (TWO DIE) / OPEN (ONE DIE)
- 2, 4.- CATHODE
- 3.- ANODE



| 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<sup>2</sup> Pak (TO-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.

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

**Qualification Information**

|                                   |                      |   |      |
|-----------------------------------|----------------------|---|------|
| <b>Qualification Level</b>        |                      | 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. |      |
| <b>Moisture Sensitivity Level</b> |                      | D <sup>2</sup> -Pak   | MSL1 |
|                                   |                      | TO-262  |      |
| <b>ESD</b>                        | Human Body Model     | Class H2 (+/- 4000V) <sup>†</sup><br>AEC-Q101-001   |      |
|                                   | Charged Device Model | Class C5 (+/- 2000V) <sup>†</sup><br>AEC-Q101-005   |      |
| <b>RoHS Compliant</b>             |                      | Yes   |      |

† 最高通过电压。

**修订记录**

| Date       | Comments   |
|------------|--|
| 10/27/2015 | <ul style="list-style-type: none"> <li>Updated datasheet with corporate template</li> <li>Corrected ordering table on page 1.</li> </ul> |

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