

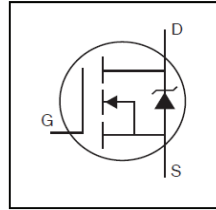


# THE DATASHEET OF AUIRFZ44VZS

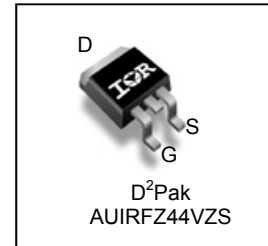


**Features**

- Advanced Process Technology
- Ultra Low On-Resistance
- 175°C Operating Temperature
- Fast Switching
- Repetitive Avalanche Allowed up to Tjmax
- Lead-Free, RoHS Compliant
- Automotive Qualified \*



|                                |              |
|--------------------------------|--------------|
| <b>V<sub>DSS</sub></b>         | <b>60V</b>   |
| <b>R<sub>DS(on)</sub> typ.</b> | <b>9.6mΩ</b> |
| <b>max.</b>                    | <b>12mΩ</b>  |
| <b>I<sub>D</sub></b>           | <b>57A</b>   |



**Description**

Specifically designed for Automotive applications, this HEXFET® Power MOSFET utilizes the latest processing techniques to achieve extremely low on-resistance per silicon area. Additional features of this design are a 175°C junction operating temperature, fast switching speed and improved repetitive avalanche rating. These features combine to make this design an extremely efficient and reliable device for use in Automotive applications and a wide variety of other applications

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

| Base part number | Package Type        | Standard Pack      |          | Orderable Part Number |
|------------------|---------------------|--------------------|----------|-----------------------|
|                  |                     | Form               | Quantity |                       |
| AUIRFZ44VZS      | D <sup>2</sup> -Pak | Tube               | 50       | AUIRFZ44VZS           |
|                  |                     | Tape and Reel Left | 800      | AUIRFZ44VZSTRL        |

**Absolute Maximum Ratings**

Stresses beyond those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. These are stress ratings only; and functional operation of the device at these or any other condition beyond those indicated in the specifications is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability. The thermal resistance and power dissipation ratings are measured under board mounted and still air conditions. Ambient temperature (TA) is 25°C, unless otherwise specified.

| Symbol                                  | Parameter   | Max.                      | Units |
|---|---|---------------------------|-------|
| I <sub>D</sub> @ T <sub>C</sub> = 25°C  | Continuous Drain Current, V <sub>GS</sub> @ 10V         | 57                        | A     |
| I <sub>D</sub> @ T <sub>C</sub> = 100°C | Continuous Drain Current, V <sub>GS</sub> @ 10V         | 40                        |       |
| I <sub>DM</sub>                         | Pulsed Drain Current ①                                  | 230                       |       |
| P <sub>D</sub> @ T <sub>C</sub> = 25°C  | Maximum Power Dissipation                               | 92                        | W     |
|   | Linear Derating Factor                                  | 0.61                      | W/°C  |
| V <sub>GS</sub>                         | Gate-to-Source Voltage                                  | ± 20                      | V     |
| E <sub>AS</sub> (Thermally Limited)     | Single Pulse Avalanche Energy (Thermally Limited) ②     | 73                        | mJ    |
| E <sub>AS</sub> (Tested)                | Single Pulse Avalanche Energy (Tested Limited) ③        | 110                       |       |
| I <sub>AR</sub>                         | Avalanche Current ④                                     | See Fig. 12a, 12b, 15, 16 | A     |
| E <sub>AR</sub>                         | Repetitive Avalanche Energy ⑤                           |                           | 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) |                           |       |

**Thermal Resistance**

| Symbol           | Parameter   | Typ. | Max. | Units |
|------------------|---|------|------|-------|
| R <sub>θJC</sub> | Junction-to-Case                                      | —    | 1.64 | °C/W  |
| R <sub>θJA</sub> | Junction-to-Ambient (PCB Mount), D <sup>2</sup> Pak ⑦ | —    | 40   |       |

HEXFET® is a registered trademark of Infineon.

\*Qualification standards can be found at [www.infineon.com](http://www.infineon.com)

**Static @ T<sub>J</sub> = 25°C (unless otherwise specified)**

|  | Parameter                            | Min. | Typ.  | Max. | Units | Conditions  |
|--|--------------------------------------|------|-------|------|-------|---|
| V <sub>(BR)DSS</sub>                   | Drain-to-Source Breakdown Voltage    | 60   | —     | —    | V     | V <sub>GS</sub> = 0V, I <sub>D</sub> = 250μA                        |
| ΔV <sub>(BR)DSS</sub> /ΔT <sub>J</sub> | Breakdown Voltage Temp. Coefficient  | —    | 0.061 | —    | V/°C  | Reference to 25°C, I <sub>D</sub> = 1mA                             |
| R <sub>DS(on)</sub>                    | Static Drain-to-Source On-Resistance | —    | 9.6   | 12   | mΩ    | V <sub>GS</sub> = 10V, I <sub>D</sub> = 34A ③                       |
| 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> = 250μA          |
| g <sub>fs</sub>                        | Forward Trans conductance            | 25   | —     | —    | S     | V <sub>DS</sub> = 25V, I <sub>D</sub> = 34A                         |
| I <sub>DSS</sub>                       | Drain-to-Source Leakage Current      | —    | —     | 20   | μA    | V <sub>DS</sub> = 60V, V <sub>GS</sub> = 0V                         |
|  |                                      | —    | —     | 250  |       | V <sub>DS</sub> = 60V, V <sub>GS</sub> = 0V, T <sub>J</sub> = 125°C |
| I <sub>GSS</sub>                       | Gate-to-Source Forward Leakage       | —    | —     | 200  | nA    | V <sub>GS</sub> = 20V   |
|  | Gate-to-Source Reverse Leakage       | —    | —     | -200 |       | V <sub>GS</sub> = -20V  |

**Dynamic Electrical Characteristics @ T<sub>J</sub> = 25°C (unless otherwise specified)**

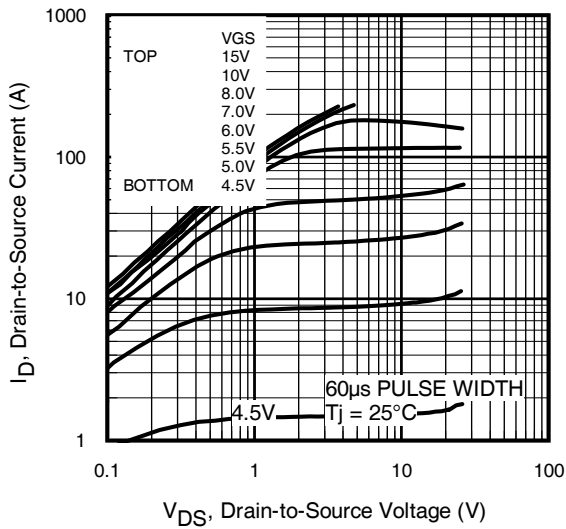
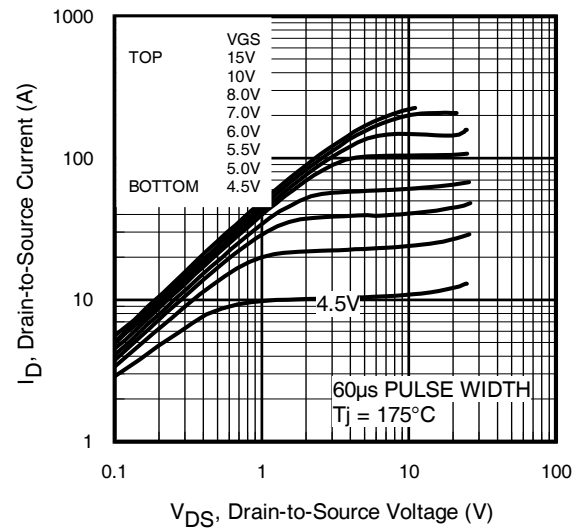
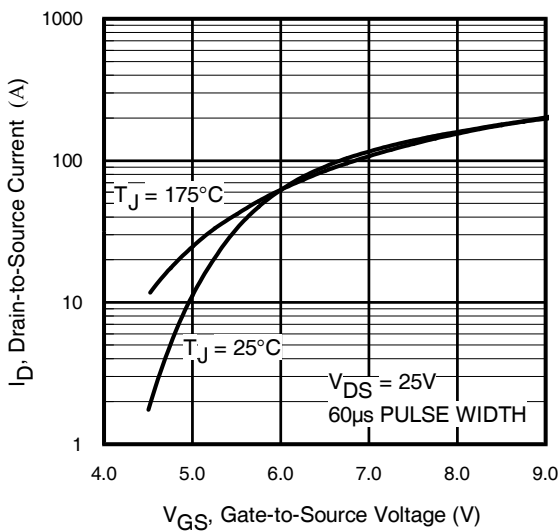
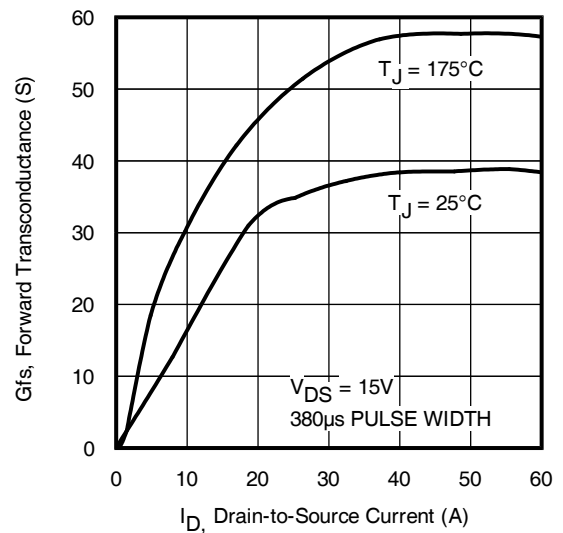
|                       |                              |   |      |    |    |  |
|-----------------------|------------------------------|---|------|----|----|--|
| Q <sub>g</sub>        | Total Gate Charge            | — | 43   | 65 | nC | I <sub>D</sub> = 34A<br>V <sub>DS</sub> = 48V<br>V <sub>GS</sub> = 10V ③   |
| Q <sub>gs</sub>       | Gate-to-Source Charge        | — | 11   | —  |    |  |
| Q <sub>gd</sub>       | Gate-to-Drain Charge         | — | 18   | —  |    |  |
| t <sub>d(on)</sub>    | Turn-On Delay Time           | — | 14   | —  | ns | V <sub>DD</sub> = 30V<br>I <sub>D</sub> = 34A<br>R <sub>G</sub> = 12Ω<br>V <sub>GS</sub> = 10V ③   |
| t <sub>r</sub>        | Rise Time                    | — | 62   | —  |    |  |
| t <sub>d(off)</sub>   | Turn-Off Delay Time          | — | 35   | —  |    |  |
| t <sub>f</sub>        | Fall Time                    | — | 38   | —  |    |  |
| L <sub>D</sub>        | Internal Drain Inductance    | — | 4.5  | —  | nH | Between lead,<br>6mm (0.25in.)<br>from package<br>and center of die contact  |
| L <sub>S</sub>        | Internal Source Inductance   | — | 7.5  | —  |    |  |
| C <sub>iss</sub>      | Input Capacitance            | — | 1690 | —  | pF | V <sub>GS</sub> = 0V<br>V <sub>DS</sub> = 25V<br>f = 1.0MHz<br>V <sub>GS</sub> = 0V, V <sub>DS</sub> = 1.0V, f = 1.0MHz<br>V <sub>GS</sub> = 0V, V <sub>DS</sub> = 48V, f = 1.0MHz<br>V <sub>GS</sub> = 0V, V <sub>DS</sub> = 0V to 48V④ |
| C <sub>oss</sub>      | Output Capacitance           | — | 270  | —  |    |  |
| C <sub>rss</sub>      | Reverse Transfer Capacitance | — | 130  | —  |    |  |
| C <sub>oss</sub>      | Output Capacitance           | — | 1870 | —  |    |  |
| C <sub>oss</sub>      | Output Capacitance           | — | 260  | —  |    |  |
| C <sub>oss eff.</sub> | Effective Output Capacitance | — | 510  | —  |    |  |

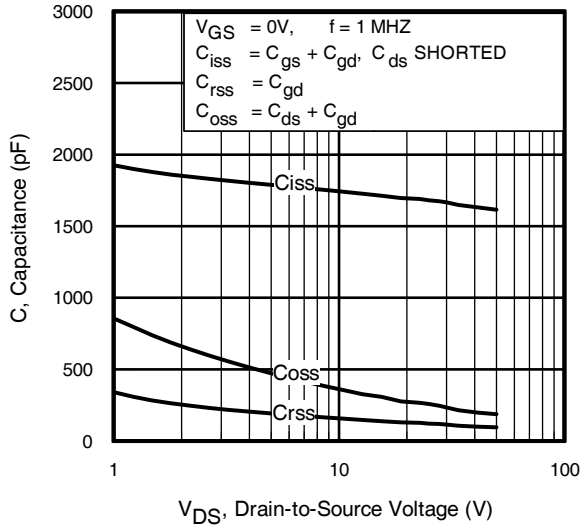
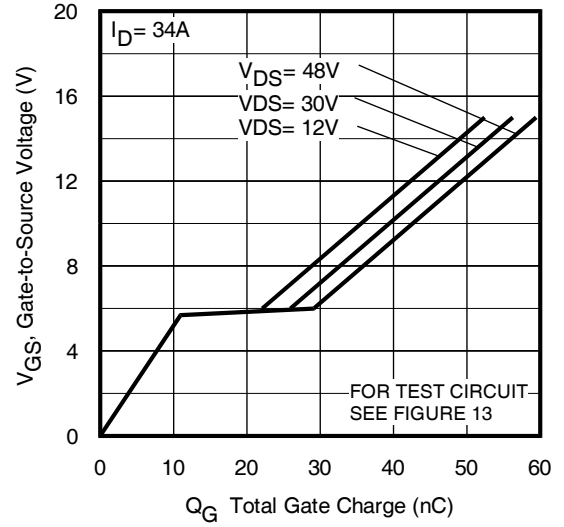
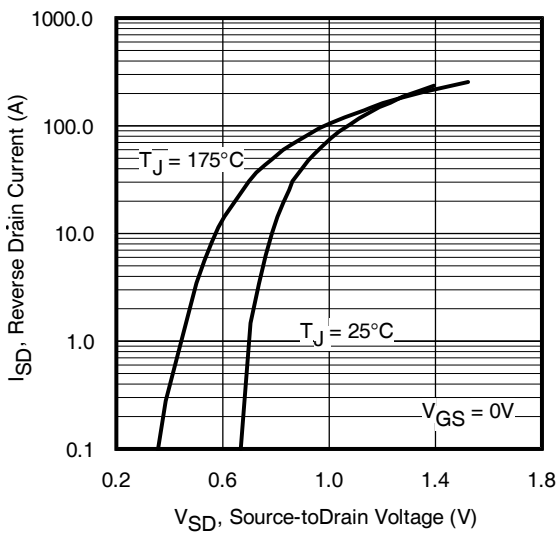
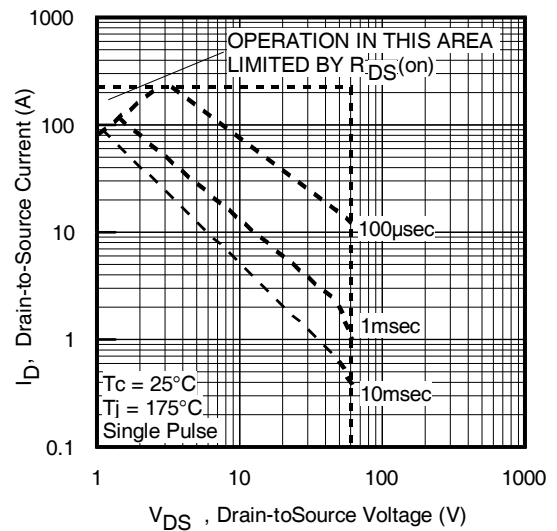
**Diode Characteristics**

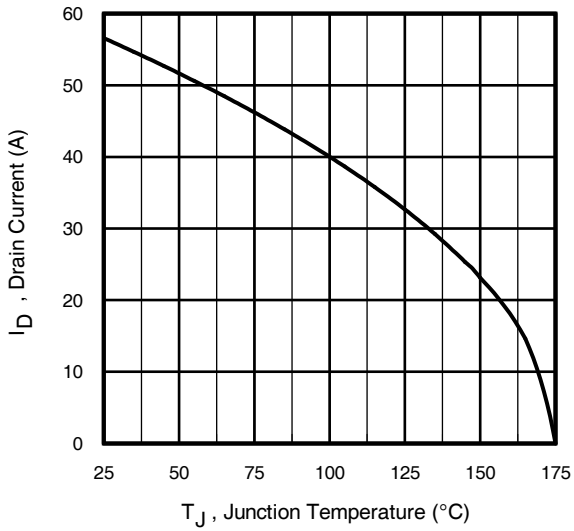
|                 | Parameter                                 | Min.   | Typ. | Max. | Units | Conditions  |
|-----------------|---|--|------|------|-------|---|
| I <sub>S</sub>  | Continuous Source Current<br>(Body Diode) | —  | —    | 57   | A     | MOSFET symbol<br>showing the<br>integral reverse<br>p-n junction diode. |
| I <sub>SM</sub> | Pulsed Source Current<br>(Body Diode) ①   | —  | —    | 230  |       |   |
| V <sub>SD</sub> | Diode Forward Voltage                     | —  | —    | 1.3  | V     | T <sub>J</sub> = 25°C, I <sub>S</sub> = 34A, V <sub>GS</sub> = 0V ③     |
| t <sub>rr</sub> | Reverse Recovery Time                     | —  | 23   | 35   | ns    | T <sub>J</sub> = 25°C, I <sub>F</sub> = 34A, V <sub>DD</sub> = 30V      |
| Q <sub>rr</sub> | Reverse Recovery Charge                   | —  | 17   | 26   | nC    | di/dt = 100A/μs ③   |
| t <sub>on</sub> | Forward Turn-On Time                      | Intrinsic turn-on time is negligible (turn-on is dominated by L <sub>S</sub> +L <sub>D</sub> ) |      |      |       |   |

**Notes:**

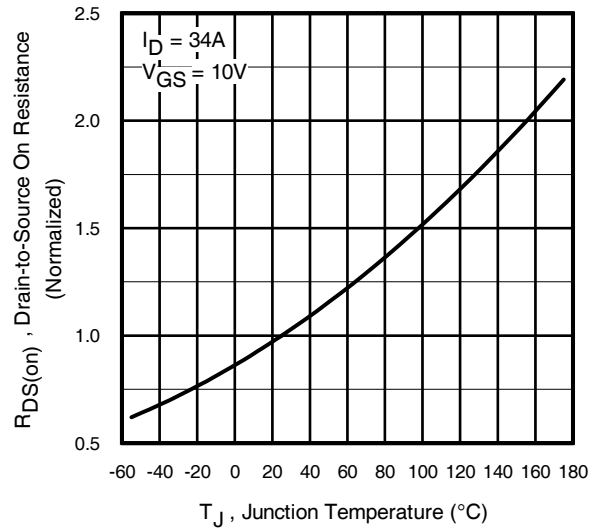
- ① Repetitive rating; pulse width limited by max. junction temperature. (See fig.11)
- ② Limited by T<sub>Jmax</sub>, starting T<sub>J</sub> = 25°C, L = 0.12mH, R<sub>G</sub> = 25Ω, I<sub>AS</sub> = 34A, V<sub>GS</sub> = 10V. Part not recommended for use above this value.
- ③ Pulse width ≤ 400μs; duty cycle ≤ 2%.
- ④ C<sub>oss eff.</sub> is a fixed capacitance that gives the same charging time as C<sub>oss</sub> while V<sub>DS</sub> is rising from 0 to 80% V<sub>DSS</sub>.
- ⑤ Limited by T<sub>Jmax</sub>, see Fig.12a, 12b, 15, 16 for typical repetitive avalanche performance.
- ⑥ This value determined from sample failure population. 100% tested to this value in production, starting T<sub>J</sub> = 25°C, L = 0.12mH, R<sub>G</sub> = 25Ω, I<sub>AS</sub> = 34A, V<sub>GS</sub> = 10V.
- ⑦ This is applied to D<sup>2</sup>Pak, when mounted on 1" square PCB (FR-4 or G-10 Material). For recommended footprint and soldering techniques refer to application note #AN-994..


**Fig. 1** Typical Output Characteristics

**Fig. 2** Typical Output Characteristics

**Fig. 3** Typical Transfer Characteristics

**Fig. 4** Typical Forward Trans conductance Vs. Drain Current

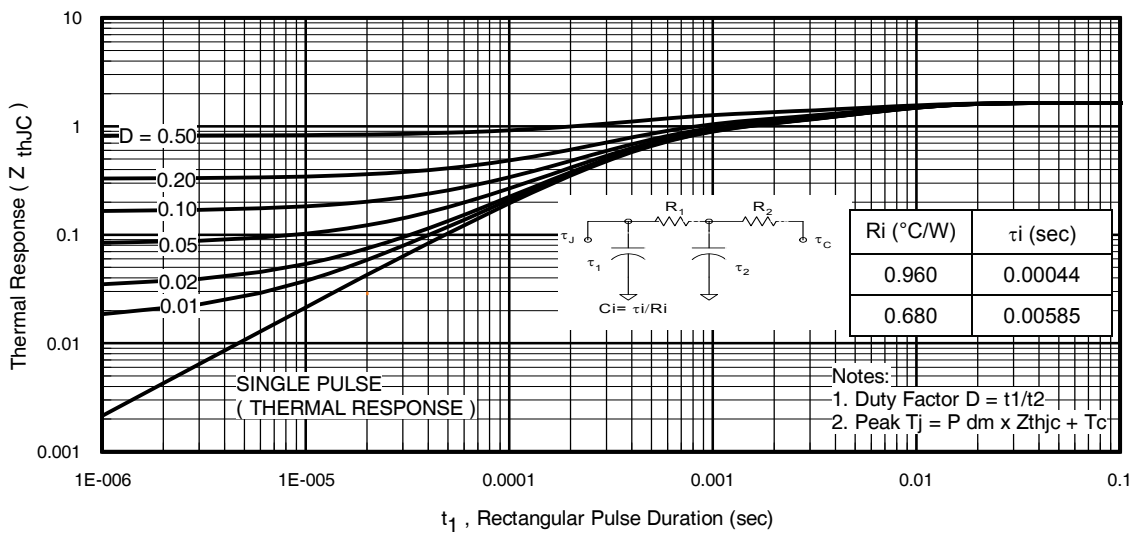

**Fig 5.** Typical Capacitance vs. Drain-to-Source Voltage

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

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

**Fig 8.** Maximum Safe Operating Area



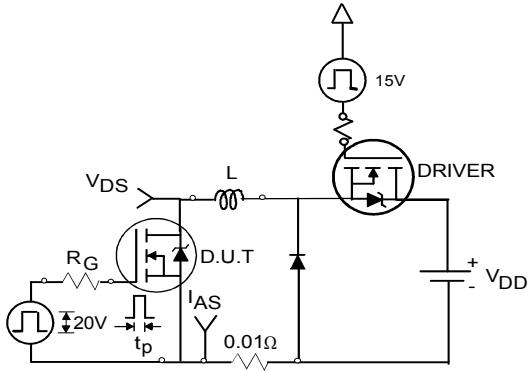
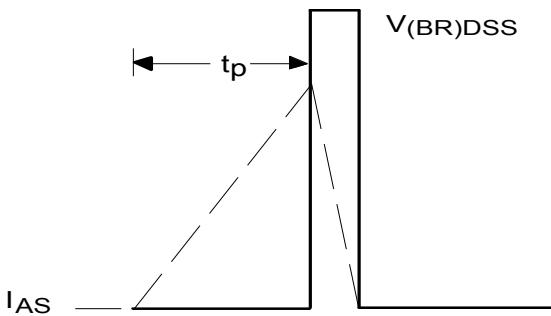
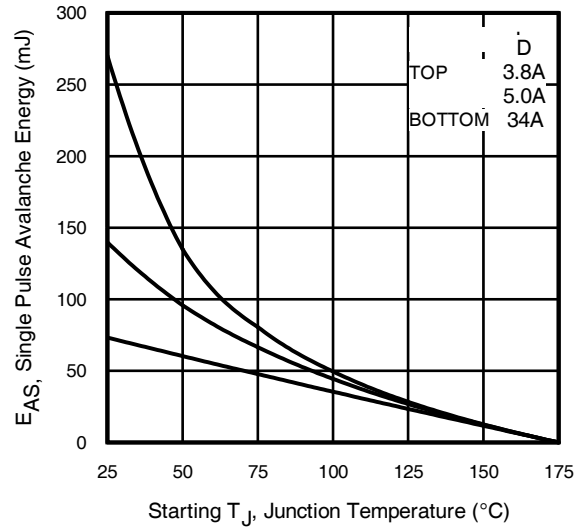
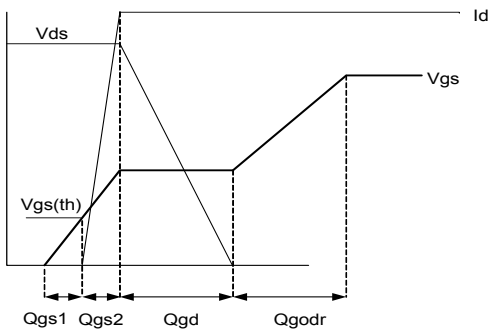
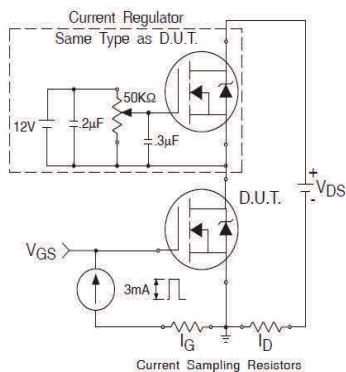
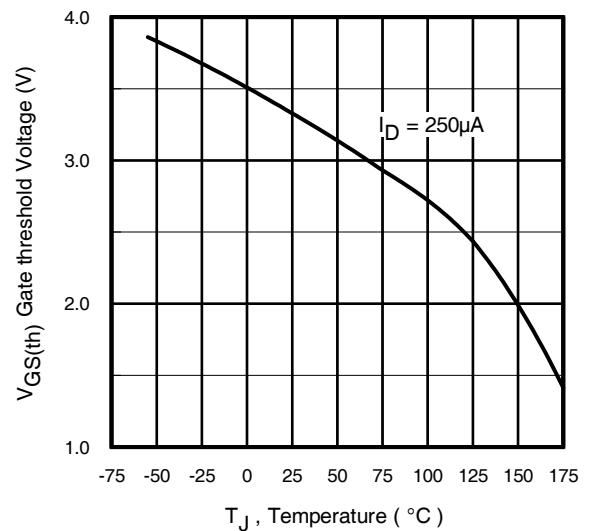
**Fig 9.** Maximum Drain Current Vs. Case Temperature

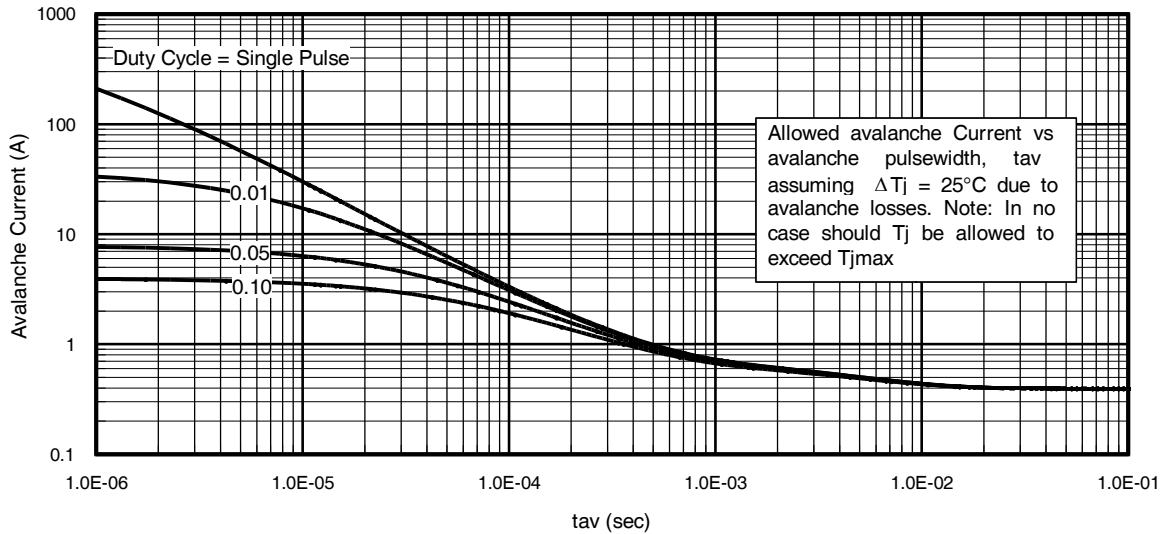
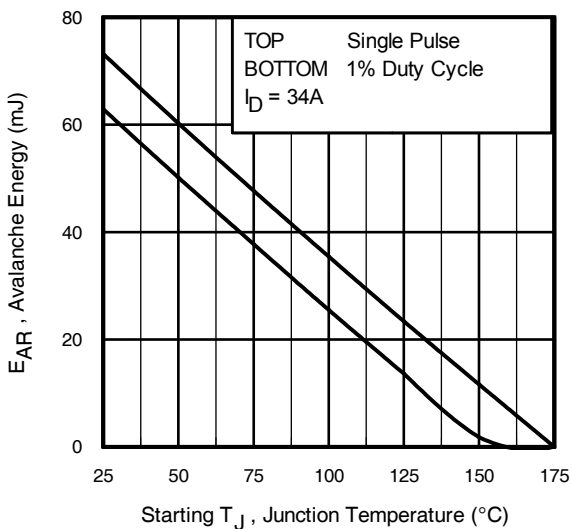


**Fig 10.** Normalized On-Resistance Vs. Temperature



**Fig 11.** Maximum Effective Transient Thermal Impedance, Junction-to-Case


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

**Fig 12b. Unclamped Inductive Waveforms**

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

**Fig 13a. Gate Charge Waveform**

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

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


**Fig 15.** Typical Avalanche Current Vs. Pulse width

**Notes on Repetitive Avalanche Curves , Figures 15, 16:  
(For further info, see AN-1005 at www.infineon.com)**

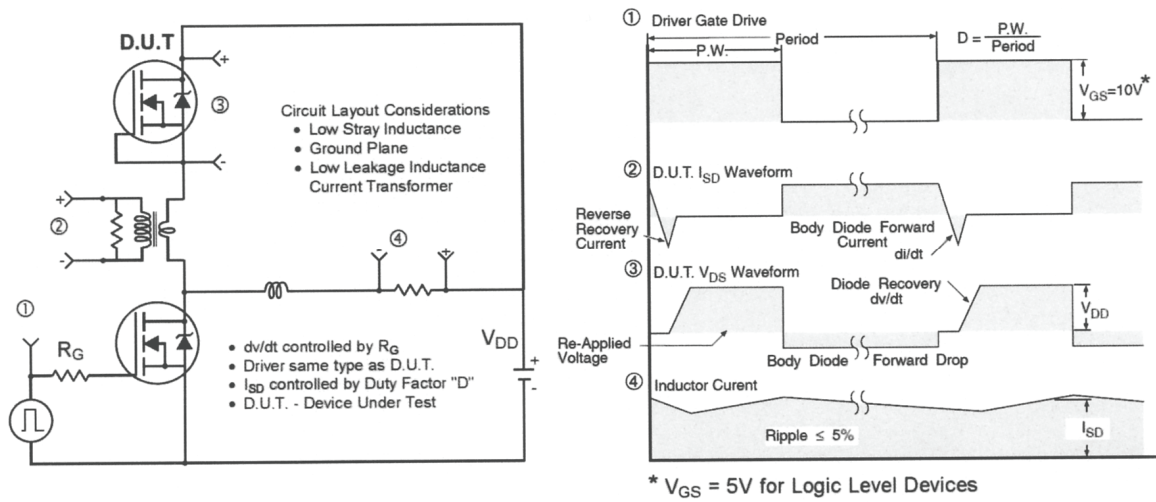
1. Avalanche failures assumption:  
Purely a thermal phenomenon and failure occurs at a temperature far in excess of  $T_{jmax}$ . This is validated for every part type.
2. Safe operation in Avalanche is allowed as long as  $T_{jmax}$  is not exceeded.
3. Equation below based on circuit and waveforms shown in Figures 12a, 12b.
4.  $P_{D(ave)}$  = Average power dissipation per single avalanche pulse.
5.  $BV$  = Rated breakdown voltage (1.3 factor accounts for voltage increase during avalanche).
6.  $I_{av}$  = Allowable avalanche current.
7.  $\Delta T$  = Allowable rise in junction temperature, not to exceed  $T_{jmax}$  (assumed as 25°C in Figure 14, 15).  
 $t_{av}$  = Average time in avalanche.  
 $D$  = Duty cycle in avalanche =  $t_{av} \cdot f$   
 $Z_{thJC}(D, t_{av})$  = Transient thermal resistance, see Figures 13)

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

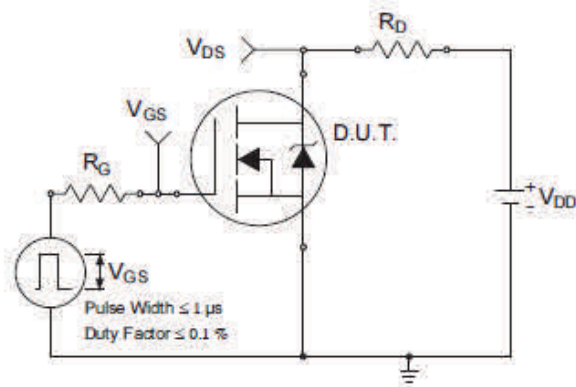
$$I_{av} = \frac{2\Delta T}{[1.3 \cdot BV \cdot Z_{th}]}$$

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

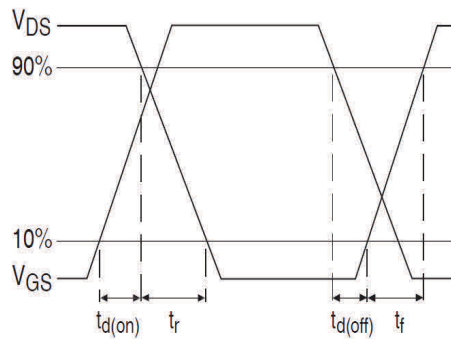
**Fig 16.** Maximum Avalanche Energy vs. Temperature



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

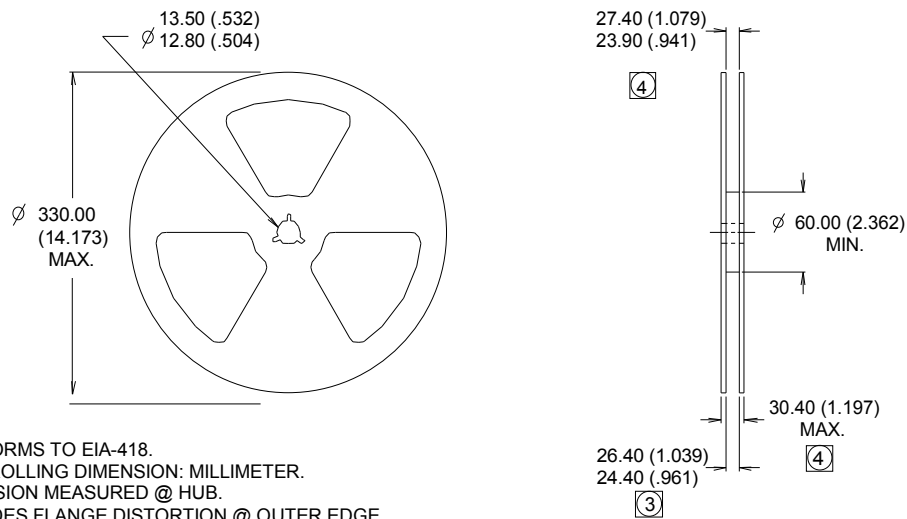
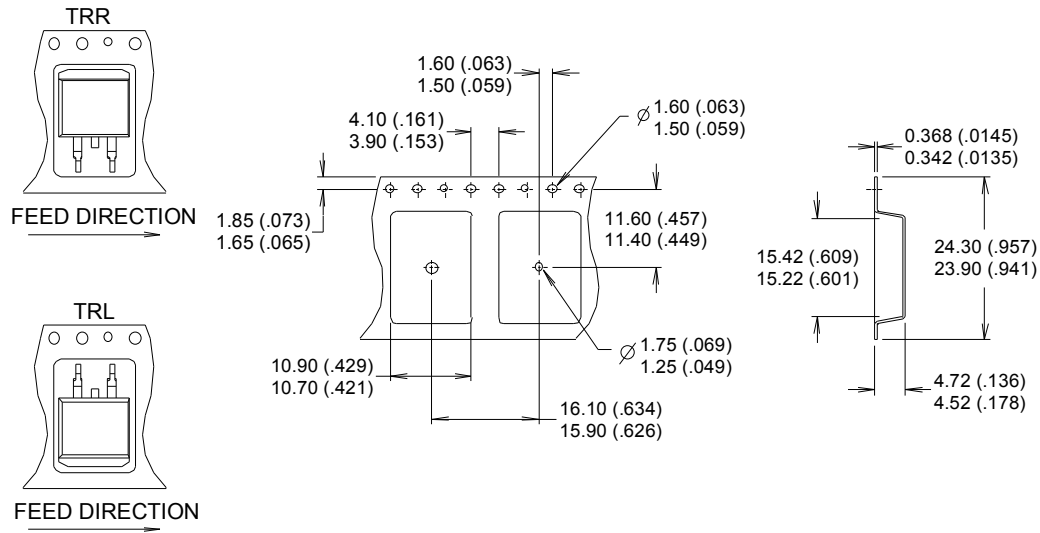


**Fig 18a. Switching Time Test Circuit**



**Fig 18b. Switching Time Waveforms**



**D<sup>2</sup>-Pak (TO-263AB) Tape & Reel Information (Dimensions are shown in millimeters (inches))**


- NOTES :
1. COMFORMS TO EIA-418.
  2. CONTROLLING DIMENSION: MILLIMETER.
  3. DIMENSION MEASURED @ HUB.
  4. INCLUDES FLANGE DISTORTION @ OUTER EDGE.

**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 |
| <b>ESD</b>                        | Machine Model        | Class M4 (+/- 425V) <sup>†</sup><br>AEC-Q101-002  |      |
|                                   | Human Body Model     | Class H1B (+/- 1000V) <sup>†</sup><br>AEC-Q101-001  |      |
|                                   | Charged Device Model | Class C5 (+/- 1125V) <sup>†</sup><br>AEC-Q101-005   |      |
| <b>RoHS Compliant</b>             |                      | Yes   |      |

† Highest passing voltage.

**Revision History**

| 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> |
| 10/13/2017 | <ul style="list-style-type: none"> <li>Corrected typo error on part marking on page 9.</li> </ul>  |

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