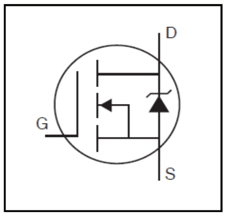
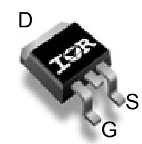
HEXFET® Power MOSFET

## 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 *




| | |
|---|---|
| $V_{DSS}$ | **60V** |
| $R_{DS(on)}$ **typ.** | **9.6mΩ** |
| **max.** | **12mΩ** |
| $I_D$ | **57A** |




D²Pak
AUIRFZ44VZS

| G | D | S |
|---|---|---|
| Gate | Drain | Source |

## 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

| Base part number | Package Type | Standard Pack | | Orderable Part Number |
|---|---|---|---|---|
| | | Form | Quantity | |
| AUIRFZ44VZS | D²-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 |
|---|---|---|---|
| $I_D$ @ $T_C$ = 25°C | Continuous Drain Current, $V_{GS}$ @ 10V | 57 | |
| $I_D$ @ $T_C$ = 100°C | Continuous Drain Current, $V_{GS}$ @ 10V | 40 | A |
| $I_{DM}$ | Pulsed Drain Current ① | 230 | |
| $P_D$ @$T_C$ = 25°C | Maximum Power Dissipation | 92 | W |
| | Linear Derating Factor | 0.61 | W/°C |
| $V_{GS}$ | Gate-to-Source Voltage | ± 20 | V |
| $E_{AS}$ (Thermally Limited) | Single Pulse Avalanche Energy (Thermally Limited) ② | 73 | mJ |
| $E_{AS}$ (Tested) | Single Pulse Avalanche Energy (Tested Limited) ⑥ | 110 | |
| $I_{AR}$ | Avalanche Current ① | See Fig. 12a, 12b, 15, 16 | 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 | |

## Thermal Resistance

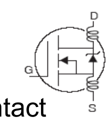
| Symbol | Parameter | Typ. | Max. | Units |
|---|---|---|---|---|
| $R_{\theta JC}$ | Junction-to-Case | —— | 1.64 | °C/W |
| $R_{\theta JA}$ | Junction-to-Ambient (PCB Mount), D² Pak ⑦ | —— | 40 | |

HEXFET® is a registered trademark of Infineon.
*Qualification standards can be found at www.infineon.com

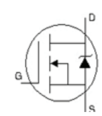
**Static @ $T_J$ = 25°C (unless otherwise specified)**

| | Parameter | Min. | Typ. | Max. | Units | Conditions |
|---|---|---|---|---|---|---|
| $V_{(BR)DSS}$ | Drain-to-Source Breakdown Voltage | 60 | —— | —— | V | $V_{GS}$ = 0V, $I_D$ = 250μA |
| $\Delta V_{(BR)DSS}/\Delta T_J$ | Breakdown Voltage Temp. Coefficient | —— | 0.061 | —— | V/°C | Reference to 25°C, $I_D$ = 1mA |
| $R_{DS(on)}$ | Static Drain-to-Source On-Resistance | —— | 9.6 | 12 | mΩ | $V_{GS}$ = 10V, $I_D$ = 34A ③ |
| $V_{GS(th)}$ | Gate Threshold Voltage | 2.0 | —— | 4.0 | V | $V_{DS}$ = $V_{GS}$, $I_D$ = 250μA |
| gfs | Forward Trans conductance | 25 | —— | —— | S | $V_{DS}$ = 25V, $I_D$ = 34A |
| $I_{DSS}$ | Drain-to-Source Leakage Current | —— | —— | 20 | μA | $V_{DS}$ = 60V, $V_{GS}$ = 0V |
| | | —— | —— | 250 | | $V_{DS}$ = 60V,$V_{GS}$ = 0V,$T_J$ =125°C |
| $I_{GSS}$ | Gate-to-Source Forward Leakage | —— | —— | 200 | nA | $V_{GS}$ = 20V |
| | Gate-to-Source Reverse Leakage | —— | —— | -200 | | $V_{GS}$ = -20V |

**Dynamic Electrical Characteristics @ $T_J$ = 25°C (unless otherwise specified)**

| | | | | | | |
|---|---|---|---|---|---|---|
| $Q_g$ | Total Gate Charge | —— | 43 | 65 | nC | $I_D$ = 34A |
| $Q_{gs}$ | Gate-to-Source Charge | —— | 11 | —— | | $V_{DS}$ = 48V |
| $Q_{gd}$ | Gate-to-Drain Charge | —— | 18 | —— | | $V_{GS}$ = 10V ③ |
| $t_{d(on)}$ | Turn-On Delay Time | —— | 14 | —— | ns | $V_{DD}$ = 30V |
| $t_r$ | Rise Time | —— | 62 | —— | | $I_D$ = 34A |
| $t_{d(off)}$ | Turn-Off Delay Time | —— | 35 | —— | | $R_G$= 12Ω |
| $t_f$ | Fall Time | —— | 38 | —— | | $V_{GS}$ = 10V ③ |
| $L_D$ | 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 | —— | 1690 | —— | pF | $V_{GS}$ = 0V |
| $C_{oss}$ | Output Capacitance | —— | 270 | —— | | $V_{DS}$ = 25V |
| $C_{rss}$ | Reverse Transfer Capacitance | —— | 130 | —— | | $f$ = 1.0MHz |
| $C_{oss}$ | Output Capacitance | —— | 1870 | —— | | $V_{GS}$ = 0V, $V_{DS}$ = 1.0V,$f$ = 1.0MHz |
| $C_{oss}$ | Output Capacitance | —— | 260 | —— | | $V_{GS}$ = 0V, $V_{DS}$ = 48V,$f$ = 1.0MHz |
| $C_{oss\ eff.}$ | Effective Output Capacitance | —— | 510 | —— | | $V_{GS}$ = 0V, $V_{DS}$ = 0V to 48V④ |

**Diode Characteristics**

| | Parameter | Min. | Typ. | Max. | Units | Conditions |
|---|---|---|---|---|---|---|
| $I_S$ | Continuous Source Current (Body Diode) | —— | —— | 57 | A | MOSFET symbol showing the integral reverse p-n junction diode.  |
| $I_{SM}$ | Pulsed Source Current (Body Diode) ① | —— | —— | 230 | | |
| $V_{SD}$ | Diode Forward Voltage | —— | —— | 1.3 | V | $T_J$ = 25°C,$I_S$ = 34A,$V_{GS}$ = 0V ③ |
| $t_{rr}$ | Reverse Recovery Time | —— | 23 | 35 | ns | $T_J$ = 25°C ,$I_F$ = 34A, $V_{DD}$ = 30V |
| $Q_{rr}$ | Reverse Recovery Charge | —— | 17 | 26 | nC | di/dt = 100A/μs ③ |
| $t_{on}$ | Forward Turn-On Time | Intrinsic turn-on time is negligible (turn-on is dominated by $L_S$+$L_D$) | | | | |

**Notes:**

① Repetitive rating; pulse width limited by max. junction temperature. (See fig.11)
② Limited by $T_{Jmax}$, starting $T_J$ = 25°C, L = 0.12mH, $R_G$ = 25Ω, $I_{AS}$ = 34A, $V_{GS}$ =10V. Part not recommended for use above this value.
③ Pulse width ≤ 400μs; duty cycle ≤ 2%.
④ $C_{oss\ eff.}$ is a fixed capacitance that gives the same charging time as $C_{oss}$ while $V_{DS}$ is rising from 0 to 80% $V_{DSS}$ .
⑤ Limited by $T_{Jmax}$ , 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 $T_J$ = 25°C, L = 0.12mH, $R_G$ = 25Ω, $I_{AS}$ = 34A, $V_{GS}$ =10V. .
⑦ This is applied to $D^2$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..

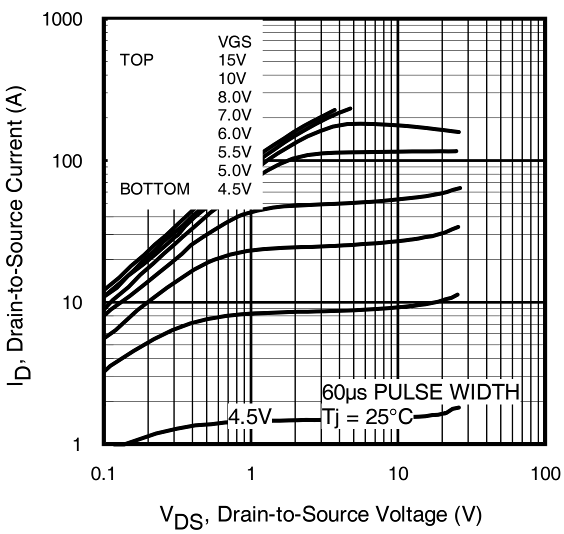



**Fig. 1** Typical Output Characteristics

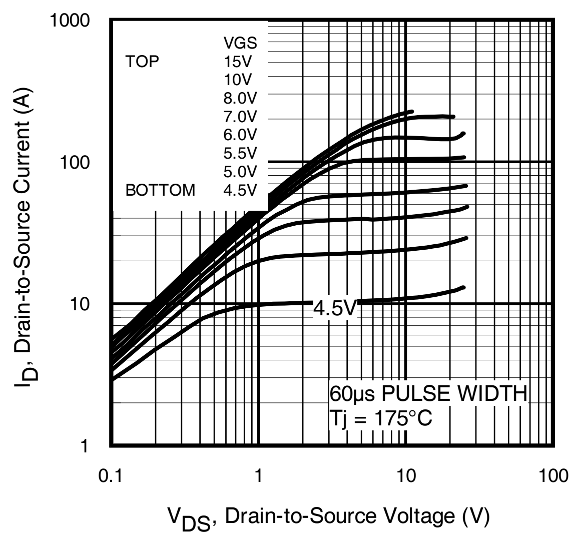



**Fig. 2** Typical Output Characteristics

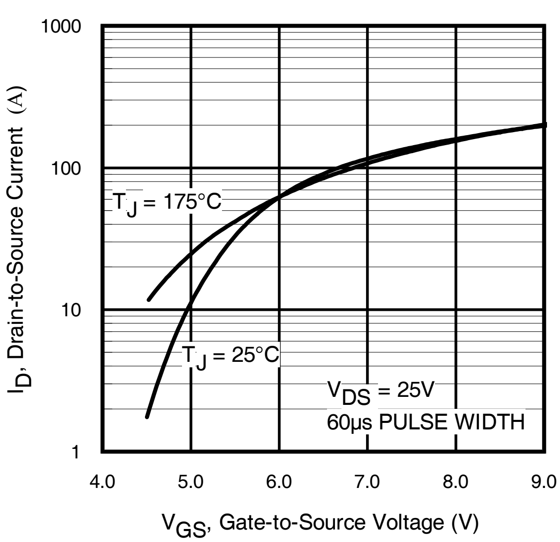



**Fig. 3** Typical Transfer Characteristics

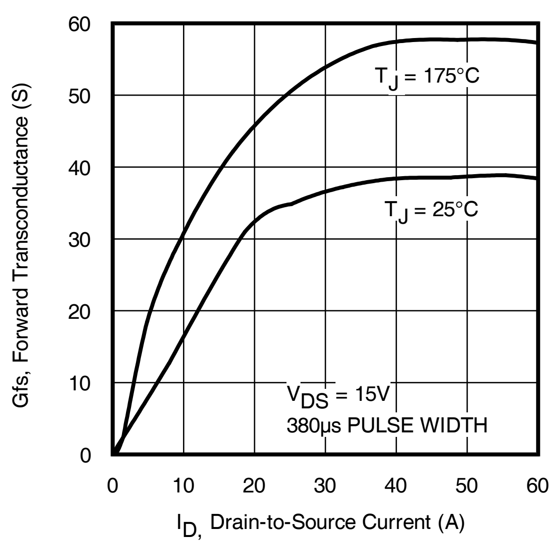



**Fig. 4** Typical Forward Trans conductance
Vs. Drain Current

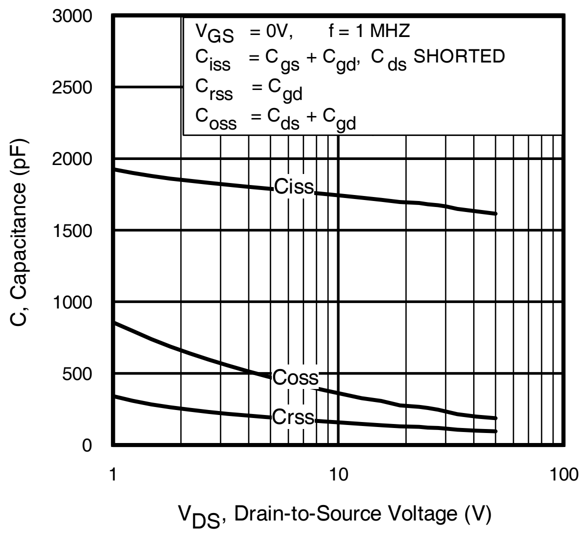



**Fig 5.** Typical Capacitance vs. Drain-to-Source Voltage

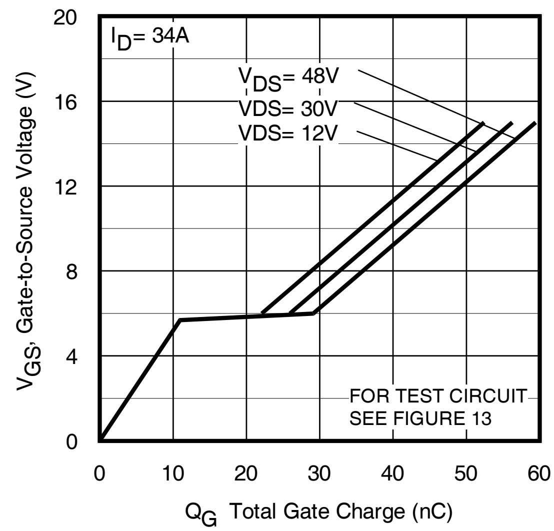



**Fig 6.** Typical Gate Charge vs. Gate-to-Source Voltage

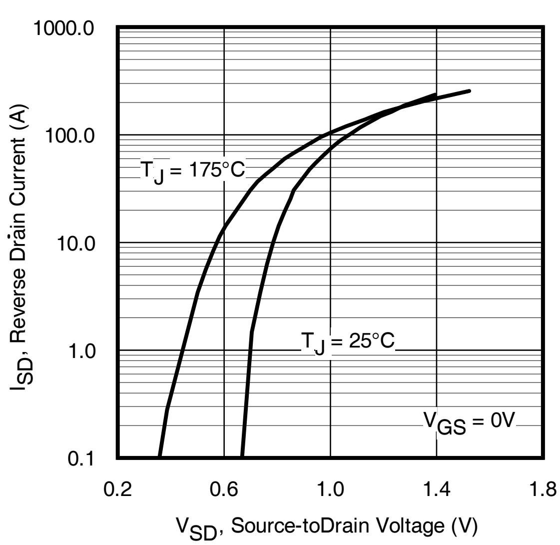



**Fig. 7** Typical Source-to-Drain Diode Forward Voltage

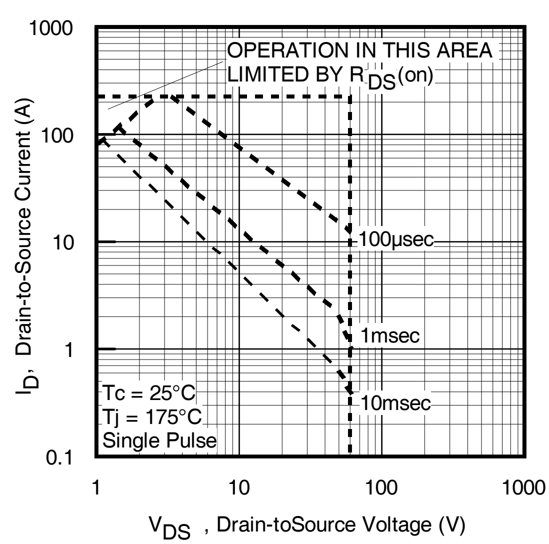



**Fig 8.** Maximum Safe Operating Area

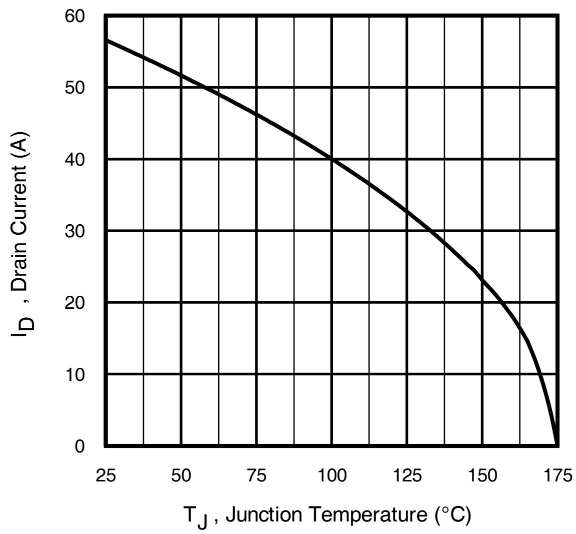



**Fig 9.** Maximum Drain Current Vs. Case Temperature

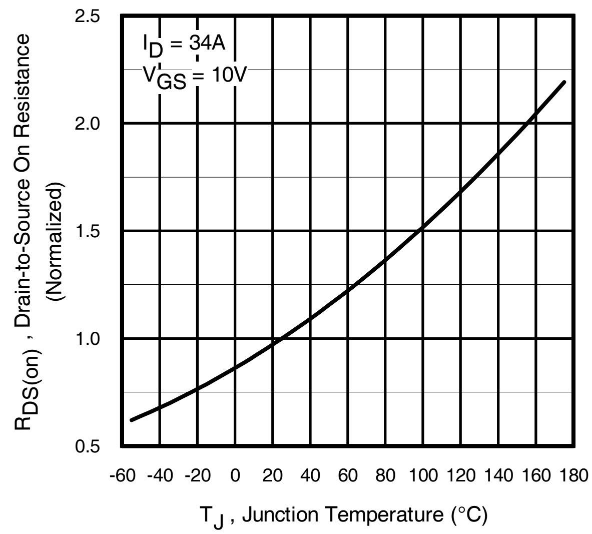



**Fig 10.** Normalized On-Resistance Vs. Temperature

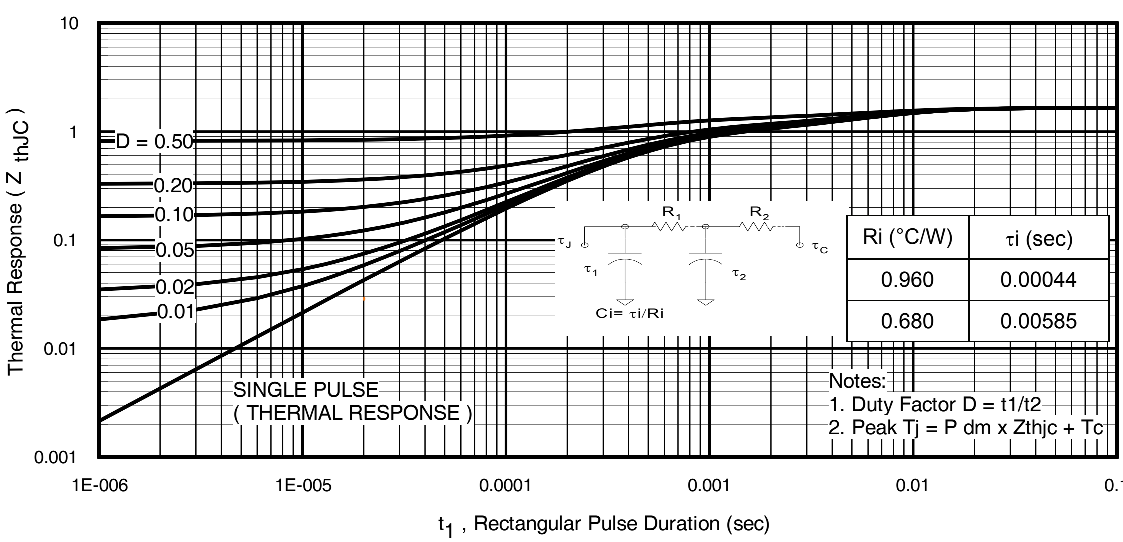



**Fig 11.** Maximum Effective Transient Thermal Impedance, Junction-to-Case

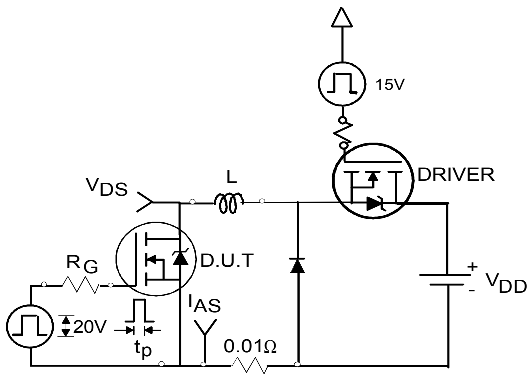



**Fig 12a.** Unclamped Inductive Test Circuit

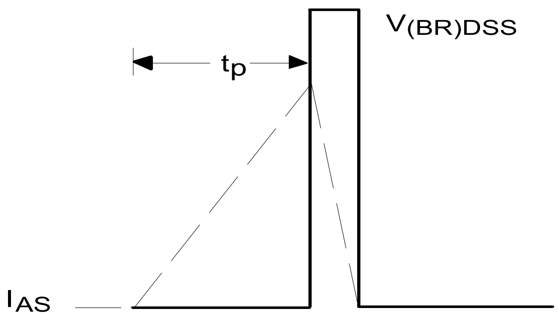



**Fig 12b.** Unclamped Inductive Waveforms

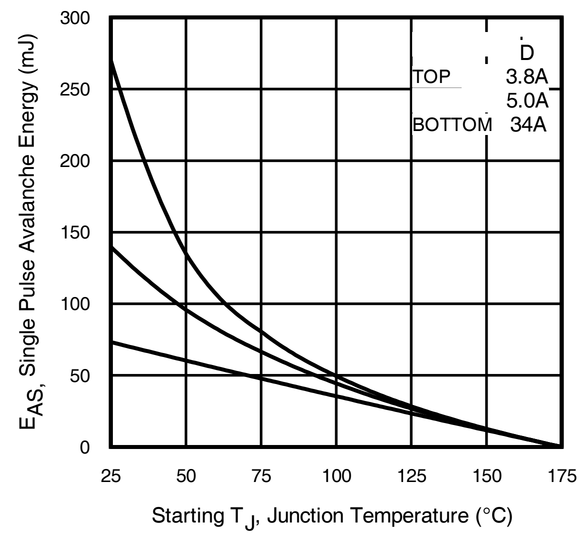



**Fig 12c.** Maximum Avalanche Energy vs. Drain Current

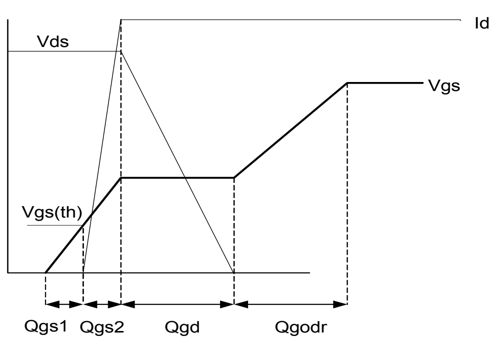



**Fig 13a.** Gate Charge Waveform

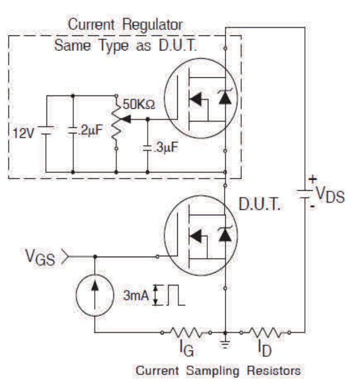



**Fig 13b.** Gate Charge Test Circuit

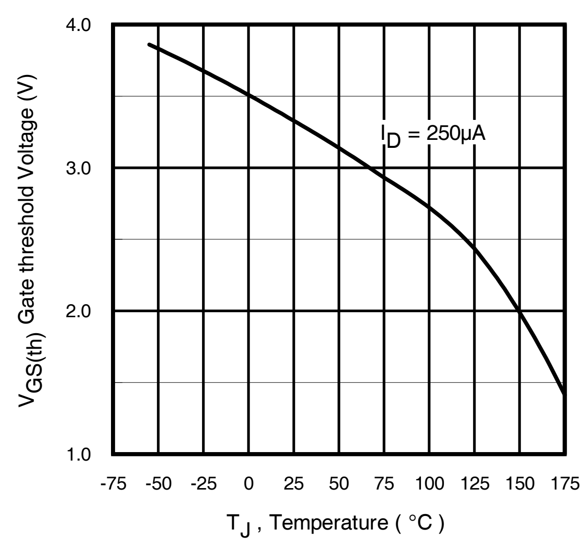



**Fig 14.** Threshold Voltage Vs. Temperature

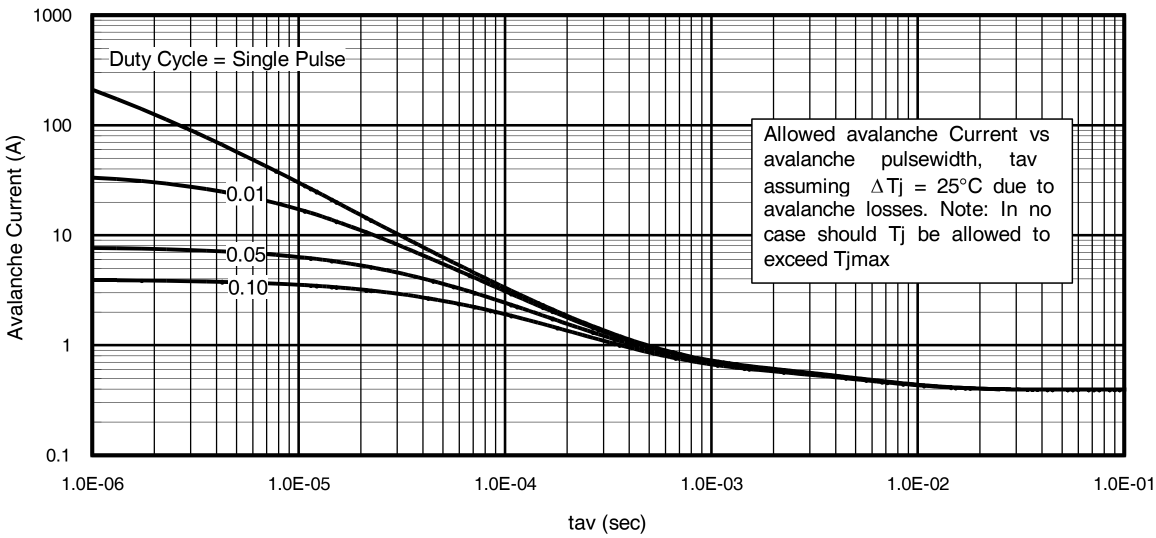
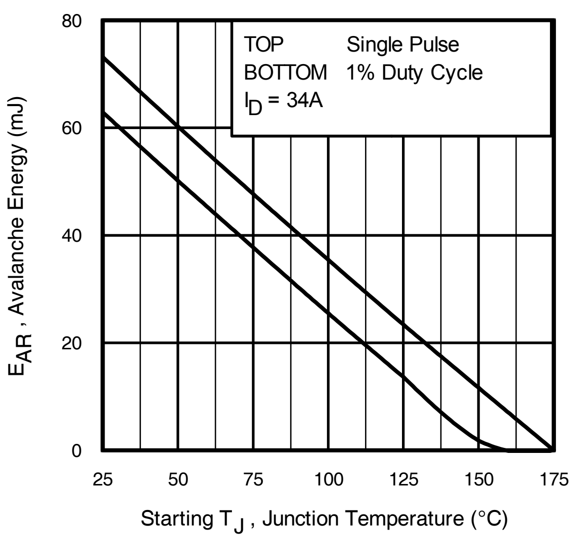



**Fig 15.** Typical Avalanche Current Vs. Pulse width




**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)

$$P_{D\ (ave)} = 1/2\ (1.3 \cdot BV \cdot I_{av}) = \Delta T / Z_{thJC}$$
$$I_{av} = 2\Delta T / [1.3 \cdot BV \cdot Z_{th}]$$
$$E_{AS\ (AR)} = P_{D\ (ave)} \cdot t_{av}$$

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

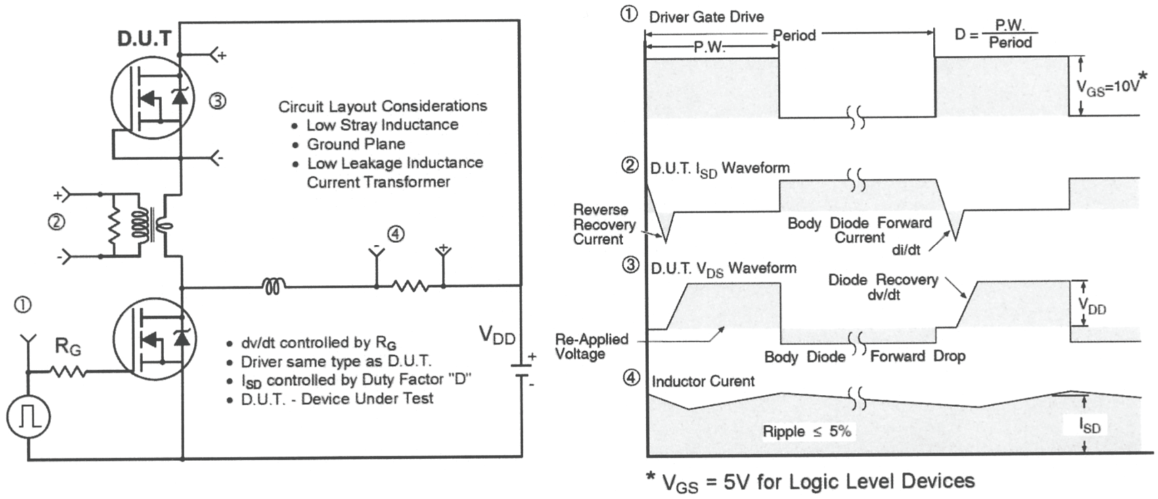



**Fig 17.** Peak Diode Recovery dv/dt Test Circuit for N-Channel HEXFET® Power MOSFETs

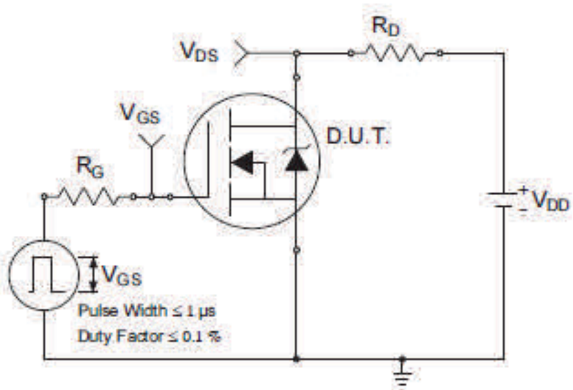



**Fig 18a.** Switching Time Test Circuit

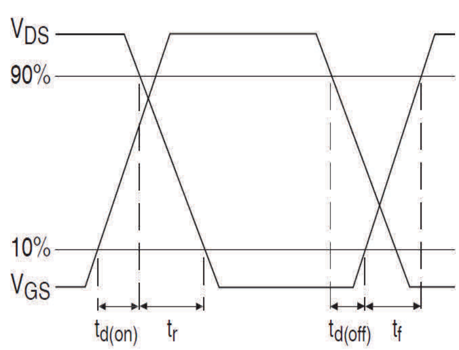
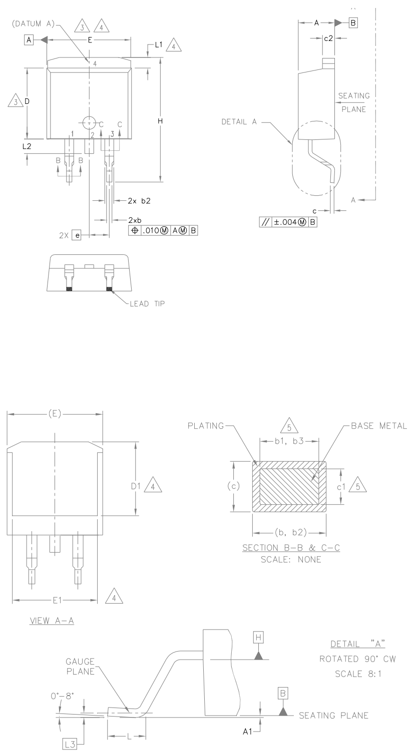



**Fig 18b.** Switching Time Waveforms

## D²-Pak (TO-263AB) Package Outline (Dimensions are shown in millimeters (inches))




NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M–1994
2. DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES].
3. DIMENSION D & E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED 0.127 [.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

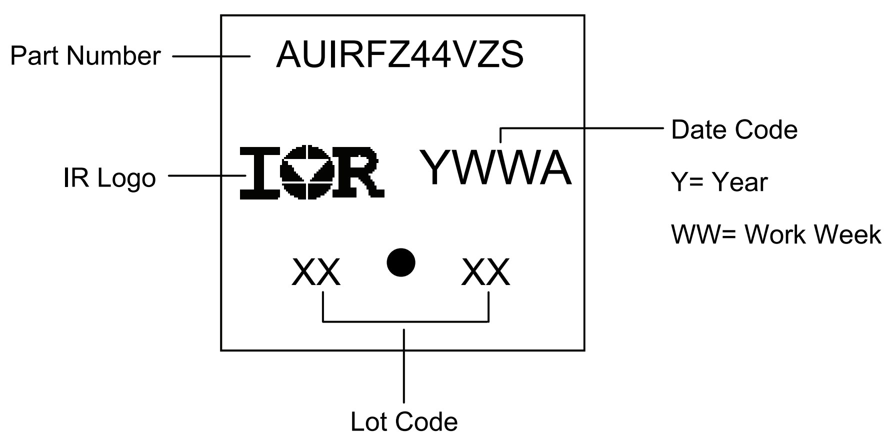
HEXFET

1.– GATE
2, 4.– DRAIN
3.– SOURCE

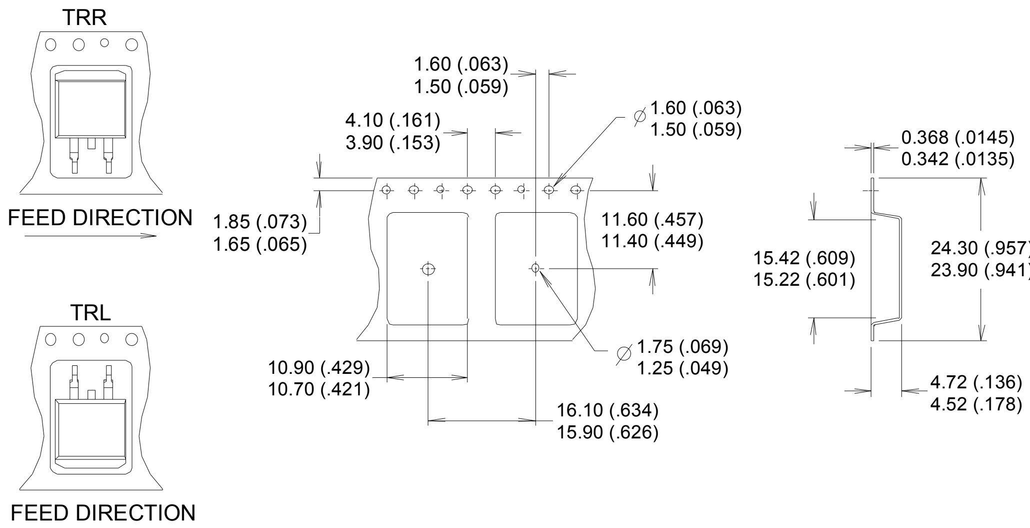
IGBTs, CoPACK

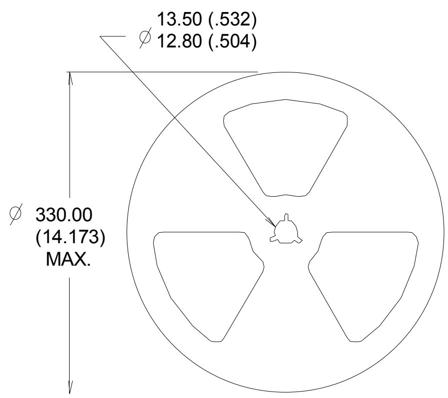
1.– GATE
2, 4.– COLLECTOR
3.– EMITTER

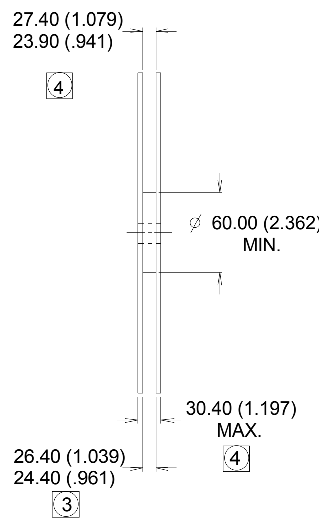
## D²-Pak (TO-263AB) Part Marking Information



**D²-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

| | | | |
|---|---|---|---|
| **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** | | $D^2$-Pak | MSL1 |
| **ESD** | Machine Model | Class M4 (+/- 425V)† AEC-Q101-002 | |
| | Human Body Model | Class H1B (+/- 1000V)† AEC-Q101-001 | |
| | Charged Device Model | Class C5 (+/- 1125V)† AEC-Q101-005 | |
| **RoHS Compliant** | | Yes | |

† Highest passing voltage.

## Revision History

| Date | Comments |
|---|---|
| 10/27/2015 | • Updated datasheet with corporate template<br>• Corrected ordering table on page 1. |
| 10/13/2017 | • Corrected typo error on part marking on page 9. |



**IMPORTANT NOTICE**

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