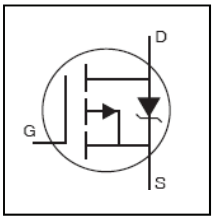
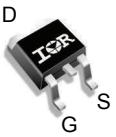
HEXFET® Power MOSFET

### Features

- Advanced Planar Technology
- P-Channel MOSFET
- Low On-Resistance
- Dynamic dV/dT Rating
- 175°C Operating Temperature
- Fast Switching
- Fully Avalanche Rated
- Repetitive Avalanche Allowed up to Tjmax
- Lead-Free, RoHS Compliant
- Automotive Qualified *




| | | |
|---|---|---|
| $V_{DSS}$ | | **-100V** |
| $R_{DS(on)}$ | **max.** | **0.205Ω** |
| $I_D$ | | **-13A** |




D-Pak
AUIRFR5410

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

### Description

Specifically designed for Automotive applications, this Cellular Planar design of HEXFET® Power MOSFETs utilizes the latest processing techniques to achieve low on-resistance per silicon area. This benefit combined with the fast switching speed and ruggedized device design that HEXFET power MOSFETs are well known for, provides the designer with an extremely efficient and reliable device for use in Automotive and a wide variety of other applications.

| Base part number | Package Type | Standard Pack | | Orderable Part Number |
|---|---|---|---|---|
| | | Form | Quantity | |
| AUIRFR5410 | D-Pak | Tube | 75 | AUIRFR5410 |
| | | Tape and Reel Left | 3000 | AUIRFR5410TRL |

### 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 | -13 | A |
| $I_D$ @ $T_C$ = 100°C | Continuous Drain Current, $V_{GS}$ @ -10V | -8.2 | |
| $I_{DM}$ | Pulsed Drain Current ① | -52 | |
| $P_D$ @$T_C$ = 25°C | Maximum Power Dissipation | 66 | W |
| | Linear Derating Factor | 0.53 | W/°C |
| $V_{GS}$ | Gate-to-Source Voltage | ± 20 | V |
| $E_{AS}$ | Single Pulse Avalanche Energy (Thermally Limited) ② | 194 | mJ |
| $I_{AR}$ | Avalanche Current ① | -8.4 | A |
| $E_{AR}$ | Repetitive Avalanche Energy ① | 6.3 | mJ |
| dv/dt | Pead Diode Recovery dv/dt③ | -5.0 | V/ns |
| $T_J$<br>$T_{STG}$ | Operating Junction and<br>Storage Temperature Range | -55 to + 150 | °C |
| | Soldering Temperature, for 10 seconds (1.6mm from case) | 300 | |

### Thermal Resistance

| Symbol | Parameter | Typ. | Max. | Units |
|---|---|---|---|---|
| $R_{\theta JC}$ | Junction-to-Case ⑤⑧ | — | 1.9 | °C/W |
| $R_{\theta JA}$ | Junction-to-Ambient ( PCB Mount) ⑦ | — | 50 | |
| $R_{\theta JA}$ | Junction-to-Ambient | — | 110 | |

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*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 | -100 | — | — | V | $V_{GS}$ = 0V, $I_D$ = -250µA |
| $\Delta V_{(BR)DSS}/\Delta T_J$ | Breakdown Voltage Temp. Coefficient | — | -0.12 | — | V/°C | Reference to 25°C, $I_D$ = -1mA |
| $R_{DS(on)}$ | Static Drain-to-Source On-Resistance | — | — | 0.205 | Ω | $V_{GS}$ = -10V, $I_D$ = -7.8A ④ |
| $V_{GS(th)}$ | Gate Threshold Voltage | -2.0 | — | -4.0 | V | $V_{DS}$ = $V_{GS}$, $I_D$ = -250µA |
| gfs | Forward Trans conductance | 3.2 | — | — | S | $V_{DS}$ = -25V, $I_D$ = -7.8A ④ |
| $I_{DSS}$ | Drain-to-Source Leakage Current | — | — | -25 | µA | $V_{DS}$ = -100V, $V_{GS}$ = 0V |
| | | — | — | -250 | | $V_{DS}$ = -80V,$V_{GS}$ = 0V,$T_J$ =150°C |
| $I_{GSS}$ | Gate-to-Source Forward Leakage | — | — | -100 | nA | $V_{GS}$ = -20V |
| | Gate-to-Source Reverse Leakage | — | — | 100 | | $V_{GS}$ = 20V |

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

| | | | | | | |
|---|---|---|---|---|---|---|
| $Q_g$ | Total Gate Charge | — | — | 58 | nC | $I_D$ = -8.4A |
| $Q_{gs}$ | Gate-to-Source Charge | — | — | 8.3 | | $V_{DS}$ = -80V |
| $Q_{gd}$ | Gate-to-Drain Charge | — | — | 32 | | $V_{GS}$ = -10V ④⑥ |
| $t_{d(on)}$ | Turn-On Delay Time | — | 15 | — | ns | $V_{DD}$ = -50V |
| $t_r$ | Rise Time | — | 58 | — | | $I_D$ = -8.4A |
| $t_{d(off)}$ | Turn-Off Delay Time | — | 45 | — | | $R_G$ = 9.1Ω |
| $t_f$ | Fall Time | — | 46 | — | | $R_D$ = 6.2Ω ④⑥ |
| $L_D$ | 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 | — | 760 | — | pF | $V_{GS}$ = 0V |
| $C_{oss}$ | Output Capacitance | — | 260 | — | | $V_{DS}$ = -25V |
| $C_{rss}$ | Reverse Transfer Capacitance | — | 170 | — | | $f$ = 1.0MHz⑥ |

**Diode Characteristics**

| | Parameter | Min. | Typ. | Max. | Units | Conditions |
|---|---|---|---|---|---|---|
| $I_S$ | Continuous Source Current (Body Diode) | — | — | -13 | A | MOSFET symbol showing the integral reverse p-n junction diode. |
| $I_{SM}$ | Pulsed Source Current (Body Diode) ① | — | — | -52 | | |
| $V_{SD}$ | Diode Forward Voltage | — | — | -1.6 | V | $T_J$ = 25°C,$I_S$ = -7.8A, $V_{GS}$ = 0V ④ |
| $t_{rr}$ | Reverse Recovery Time | — | 130 | 190 | ns | $T_J$ = 25°C ,$I_F$ = -8.4A |
| $Q_{rr}$ | Reverse Recovery Charge | — | 650 | 970 | nC | di/dt = 100A/µs④ |
| $t_{on}$ | 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 Starting $T_J$ = 25°C, L = 6.4mH, $R_G$ = 25Ω, $I_{AS}$ = -7.8A (See fig. 12)

③ $I_{SD}$ ≤ -7.8A, di/dt ≤ 200A/µs, $V_{DD}$ ≤ $V_{(BR)DSS}$, $T_J$ ≤ 150°C.

④ Pulse width ≤ 300µs; duty cycle ≤ 2%.

⑤ This is applied for I-PAK, LS of D-PAK is measured between lead and center of die contact.

⑥ Uses IRF9530N data and test conditions.

⑦ When mounted on 1" square PCB (FR-4 or G-10 Material). For recommended footprint and soldering techniques refer to application note #AN-994

⑧ $R_\theta$ is measured at $T_J$ approximately 90°C

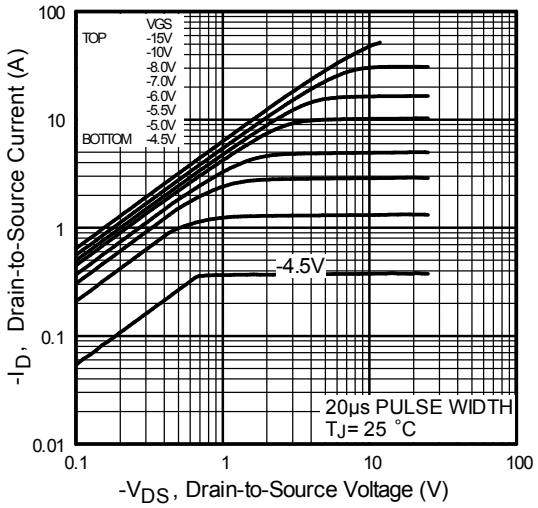



**Fig. 1** Typical Output Characteristics

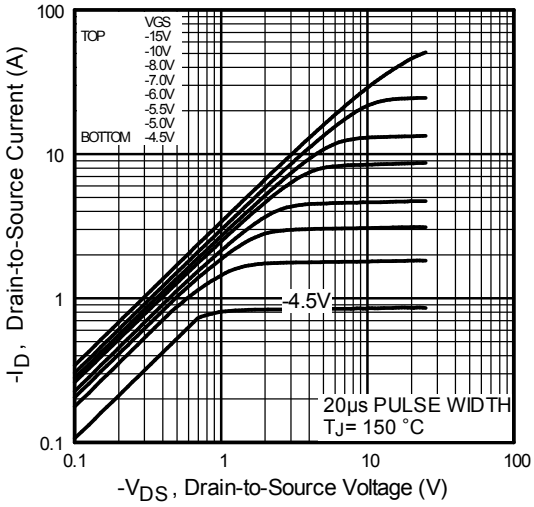



**Fig. 2** Typical Output Characteristics

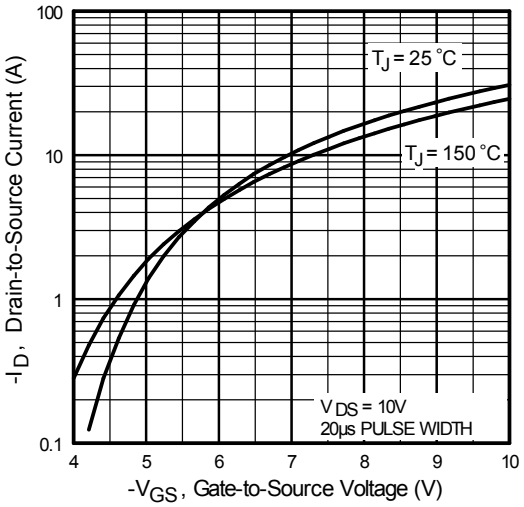



**Fig. 3** Typical Transfer Characteristics

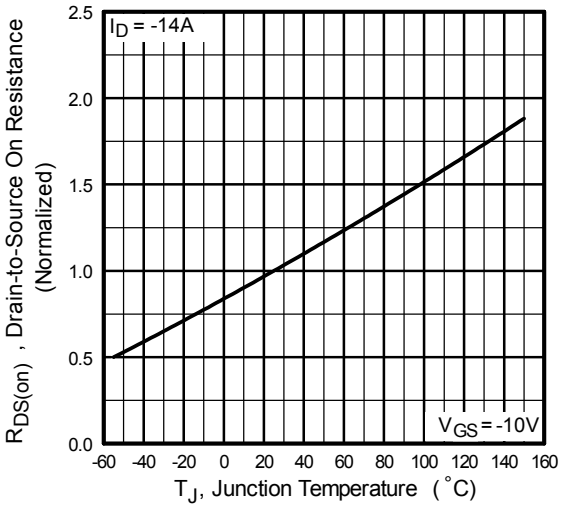



**Fig. 4** Normalized On-Resistance Vs. Temperature

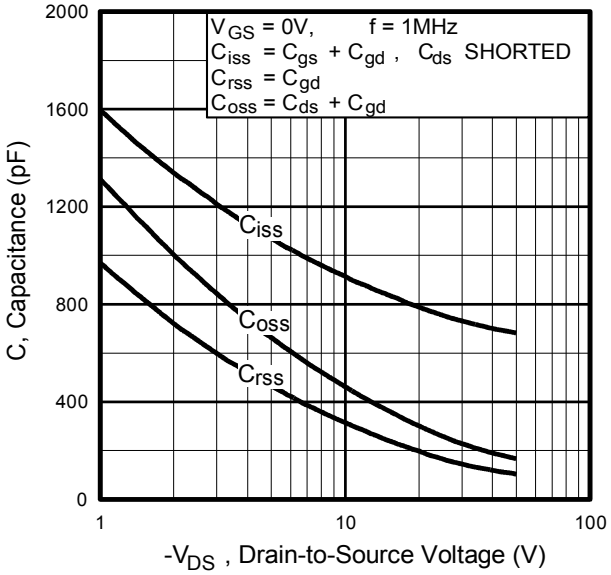



**Fig 5.** Typical Capacitance vs. Drain-to-Source Voltage

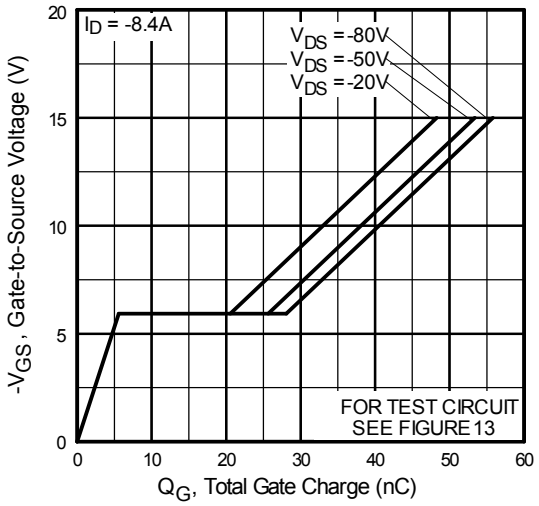



**Fig 6.** Typical Gate Charge vs. Gate-to-Source Voltage

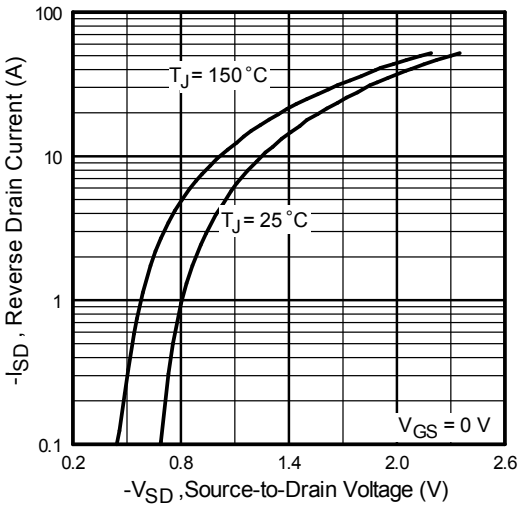



**Fig. 7** Typical Source-to-Drain Diode Forward Voltage

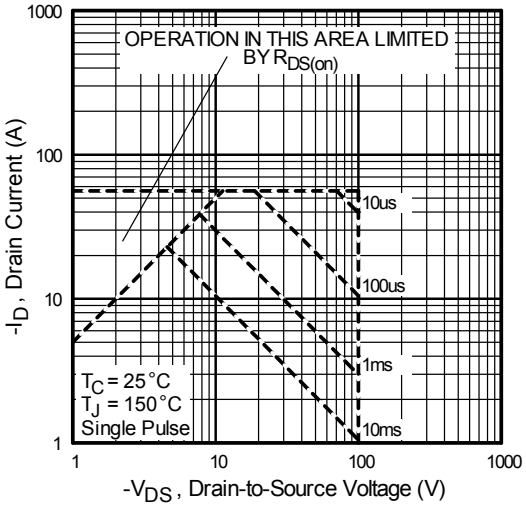



**Fig 8.** Maximum Safe Operating Area

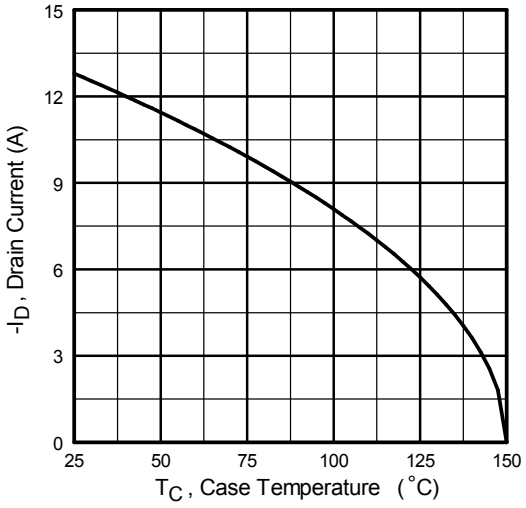



**Fig 9.** Maximum Drain Current Vs. Case Temperature

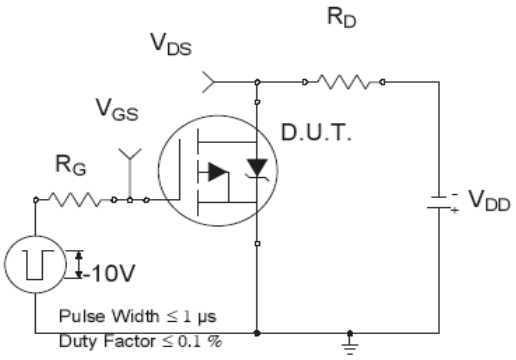



**Fig 10a.** Switching Time Test Circuit

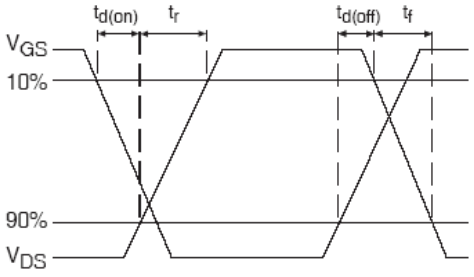



**Fig 10b.** Switching Time Waveforms

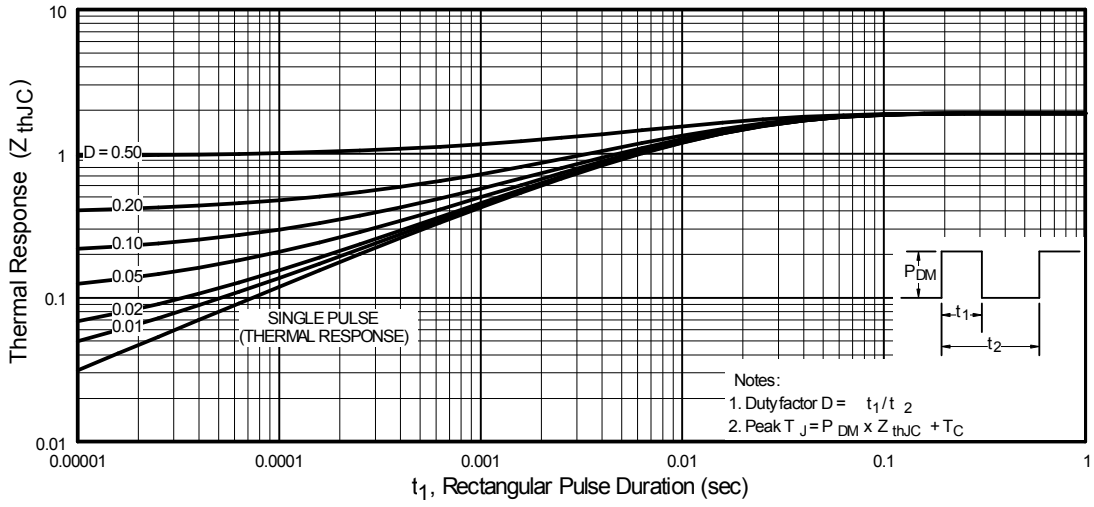



**Fig 11.** Maximum Effective Transient Thermal Impedance, Junction-to-Case

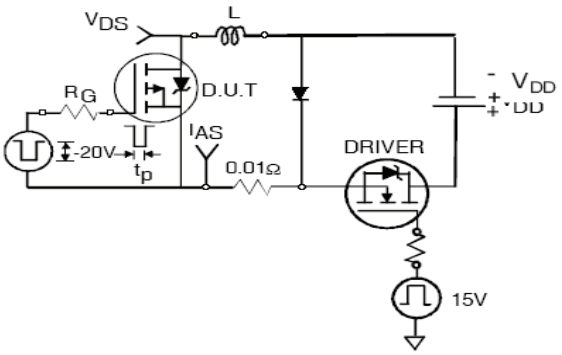



**Fig 12a.** Unclamped Inductive Test Circuit

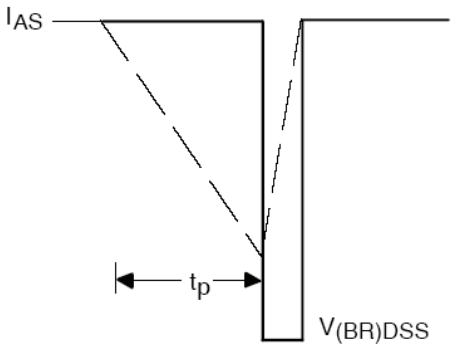



**Fig 12b.** Unclamped Inductive Waveforms

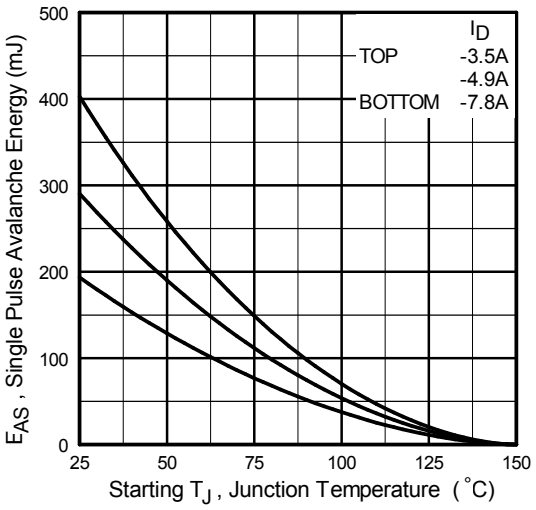



**Fig 12c.** Maximum Avalanche Energy vs. Drain Current

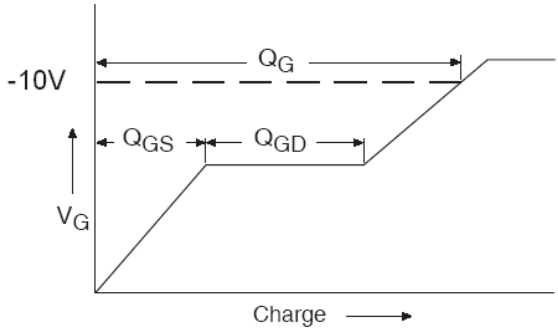



**Fig 13a.** Gate Charge Waveform

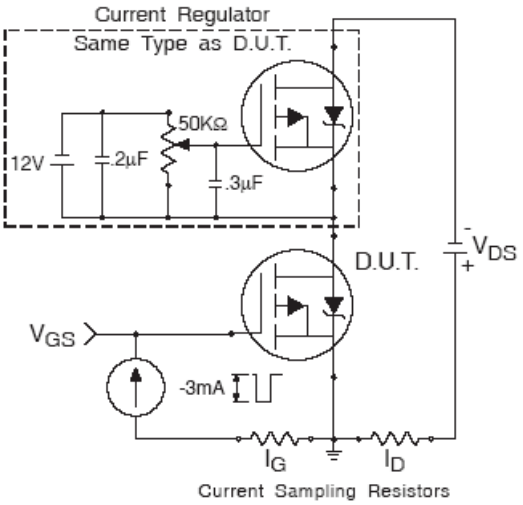



**Fig 13b.** Gate Charge Test Circuit

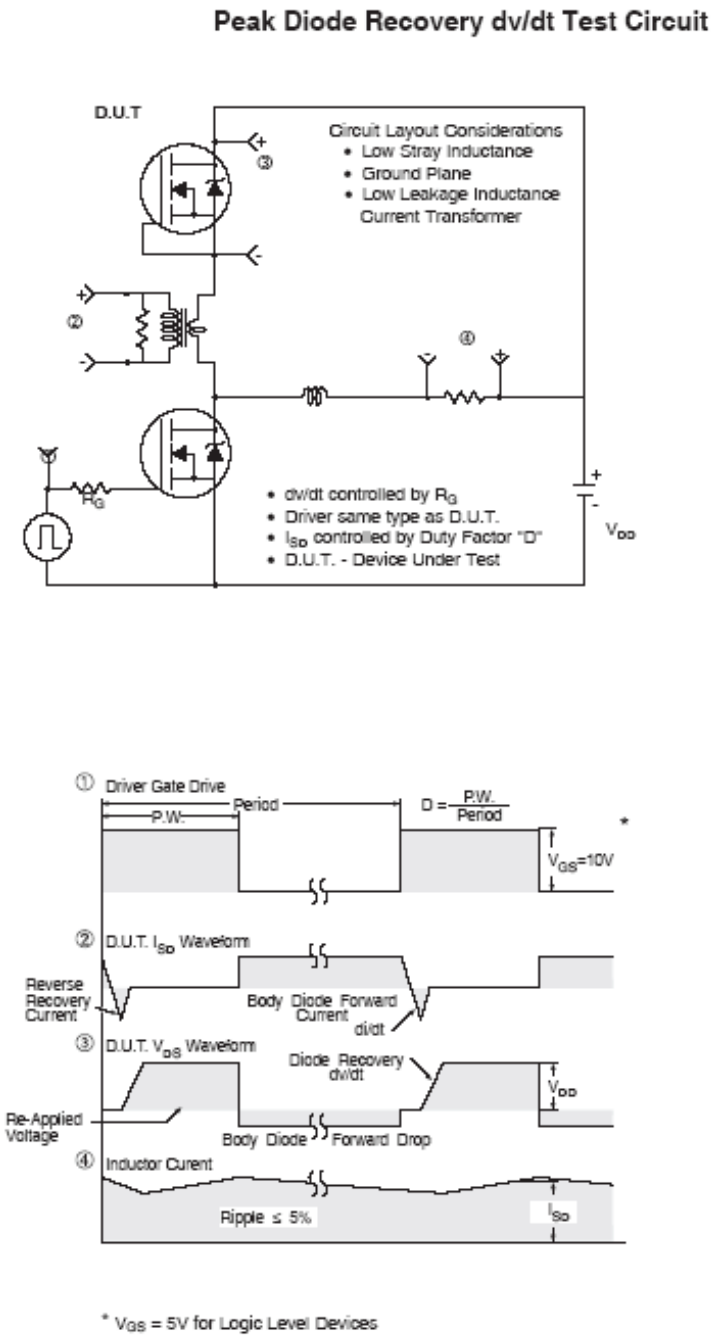
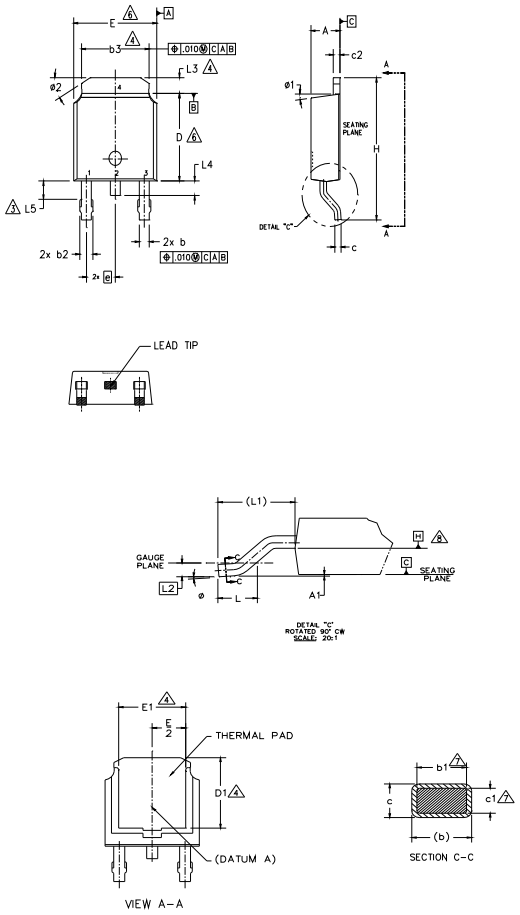



**Fig 14.** Peak Diode Recovery dv/dt Test Circuit for P-Channel HEXFET® Power MOSFETs

## D-Pak (TO-252AA) Package Outline (Dimensions are shown in millimeters (inches))




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

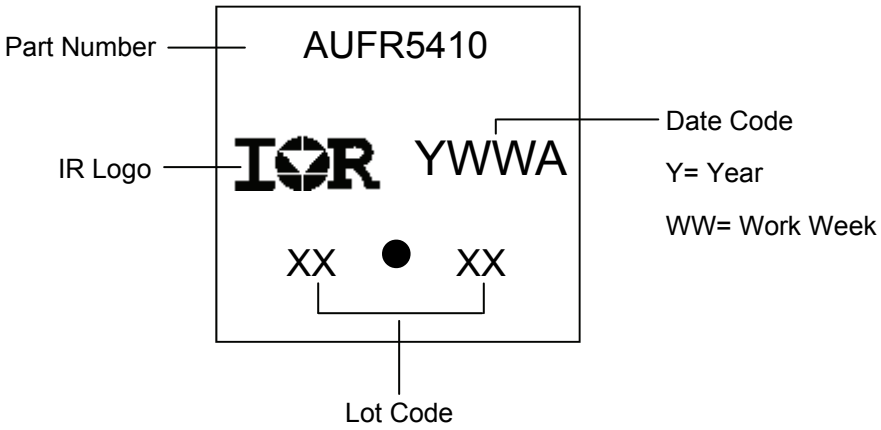
HEXFET

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

IGBT & CoPAK

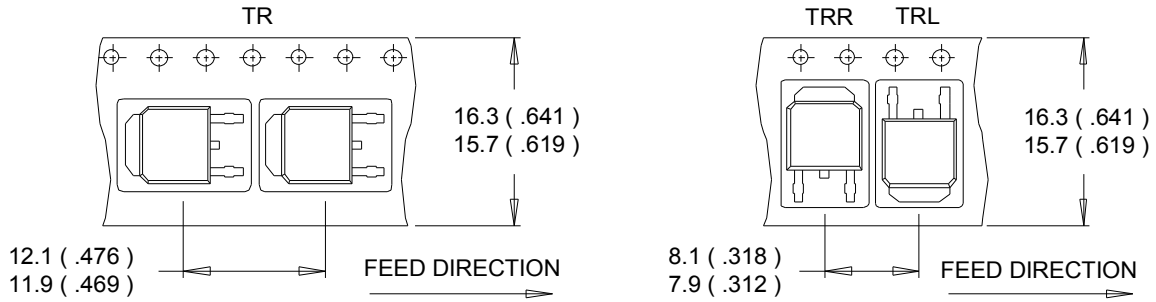
1.– GATE
2.– COLLECTOR
3.– EMITTER
4.– COLLECTOR

## D-Pak (TO-252AA) Part Marking Information

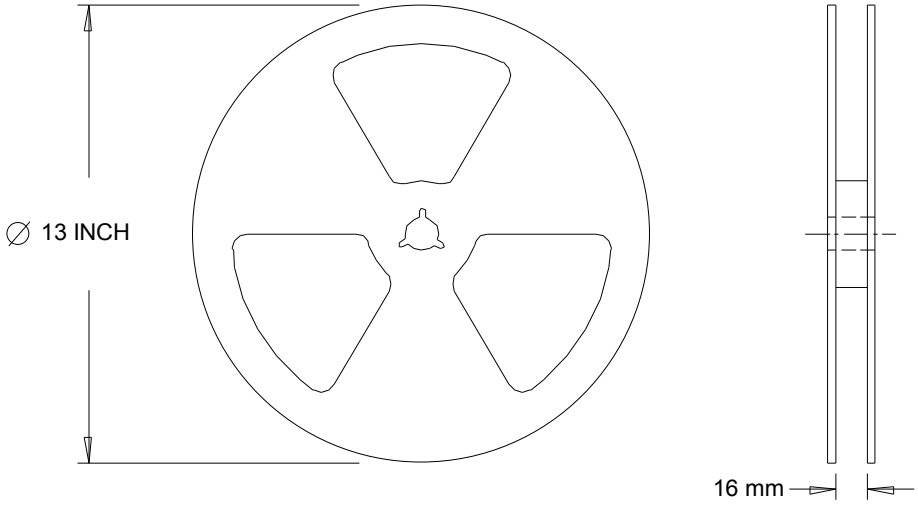



Note: For the most current drawing please refer to IR website at http://www.irf.com/package/

**D-Pak (TO-252AA) Tape & Reel Information** (Dimensions are shown in millimeters (inches))




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 (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 |
| **ESD** | Machine Model | Class M2 (+/- 200V)† 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 |
|---|---|
| 12/2/2015 | • Updated datasheet with corporate template<br>• Corrected ordering table on page 1. |

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