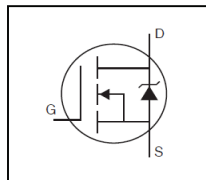


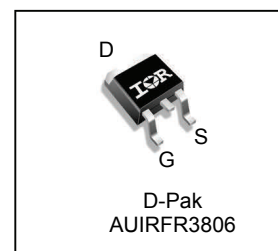
**Features**

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



HEXFET® Power MOSFET

|              |              |                                |
|--------------|--------------|--------------------------------|
| $V_{DS}$     |              | <b>60V</b>                     |
| $R_{DS(on)}$ | typ.<br>max. | <b>12.6mΩ</b><br><b>15.8mΩ</b> |
| $I_D$        |              | <b>43A</b>                     |



|          |          |          |
|----------|----------|----------|
| <b>G</b> | <b>D</b> | <b>S</b> |
| 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 |                       |
| AUIRFR3806       | D-Pak        | Tube               | 75       | AUIRFR3806            |
|                  |              | Tape and Reel Left | 3000     | AUIRFR3806TRL         |

**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 |
|---------------------------------|---------------------------------------------------------|--------------|-------|
| $I_D @ T_C = 25^\circ\text{C}$  | Continuous Drain Current, $V_{GS} @ 10\text{V}$         | 43           | A     |
| $I_D @ T_C = 100^\circ\text{C}$ | Continuous Drain Current, $V_{GS} @ 10\text{V}$         | 31           |       |
| $I_{DM}$                        | Pulsed Drain Current ①                                  | 170          |       |
| $P_D @ T_C = 25^\circ\text{C}$  | Maximum Power Dissipation                               | 71           | W     |
|                                 | Linear Derating Factor                                  | 0.47         | W/°C  |
| $V_{GS}$                        | Gate-to-Source Voltage                                  | ± 20         | V     |
| $E_{AS}$                        | Single Pulse Avalanche Energy (Thermally Limited) ②     | 73           | mJ    |
| $I_{AR}$                        | Avalanche Current ①                                     | 25           | A     |
| $E_{AR}$                        | Repetitive Avalanche Energy ①                           | 7.1          | mJ    |
| dv/dt                           | Peak Diode Recovery dv/dt③                              | 24           | V/ns  |
| $T_J$                           | Operating Junction and                                  | -55 to + 175 | °C    |
| $T_{STG}$                       | Storage Temperature Range                               |              |       |
|                                 | Soldering Temperature, for 10 seconds (1.6mm from case) |              |       |

**Thermal Resistance**

| Symbol          | Parameter                          | Typ. | Max. | Units |
|-----------------|------------------------------------|------|------|-------|
| $R_{\theta JC}$ | Junction-to-Case ⑧                 | —    | 2.12 | °C/W  |
| $R_{\theta JA}$ | Junction-to-Ambient ( PCB Mount) ② | —    | 50   |       |
| $R_{\theta JA}$ | Junction-to-Ambient ②              | —    | 110  |       |

HEXFET® is a registered trademark of Infineon.

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

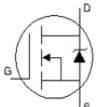
**Static @  $T_J = 25^\circ\text{C}$  (unless otherwise specified)**

|                                 | Parameter                            | Min. | Typ.  | Max. | Units               | Conditions                                           |
|---------------------------------|--------------------------------------|------|-------|------|---------------------|------------------------------------------------------|
| $V_{(BR)DSS}$                   | Drain-to-Source Breakdown Voltage    | 60   | —     | —    | V                   | $V_{GS} = 0V, I_D = 250\mu A$                        |
| $\Delta V_{(BR)DSS}/\Delta T_J$ | Breakdown Voltage Temp. Coefficient  | —    | 0.075 | —    | V/ $^\circ\text{C}$ | Reference to $25^\circ\text{C}$ , $I_D = 5mA$ ①      |
| $R_{DS(on)}$                    | Static Drain-to-Source On-Resistance | —    | 12.6  | 15.8 | m $\Omega$          | $V_{GS} = 10V, I_D = 25A$ ④                          |
| $V_{GS(th)}$                    | Gate Threshold Voltage               | 2.0  | —     | 4.0  | V                   | $V_{DS} = V_{GS}, I_D = 50\mu A$                     |
| $g_{fs}$                        | Forward Trans conductance            | 41   | —     | —    | S                   | $V_{DS} = 10V, I_D = 25A$                            |
| $R_{G(Int)}$                    | Internal Gate Resistance             | —    | 0.79  | —    | $\Omega$            |                                                      |
| $I_{DSS}$                       | Drain-to-Source Leakage Current      | —    | —     | 20   | $\mu A$             | $V_{DS} = 60V, V_{GS} = 0V$                          |
|                                 |                                      | —    | —     | 250  |                     | $V_{DS} = 48V, V_{GS} = 0V, T_J = 125^\circ\text{C}$ |
| $I_{GSS}$                       | Gate-to-Source Forward Leakage       | —    | —     | 100  | nA                  | $V_{GS} = 20V$                                       |
|                                 | Gate-to-Source Reverse Leakage       | —    | —     | -100 |                     | $V_{GS} = -20V$                                      |

**Dynamic Electrical Characteristics @  $T_J = 25^\circ\text{C}$  (unless otherwise specified)**

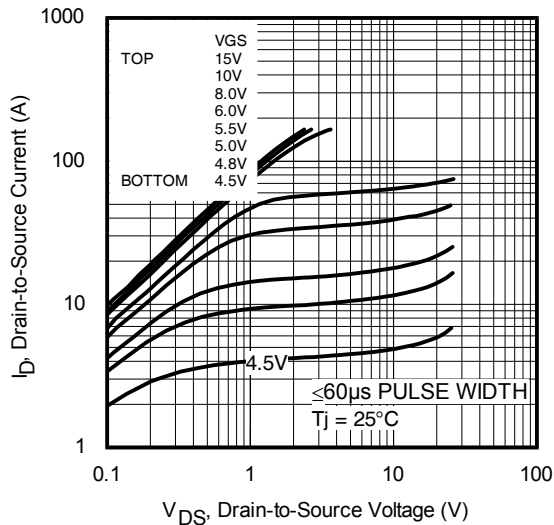
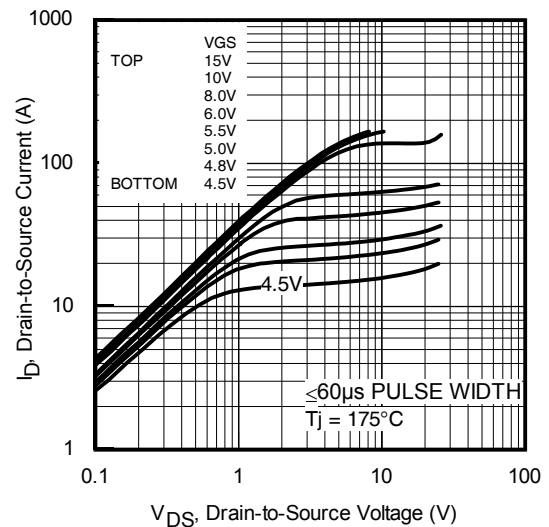
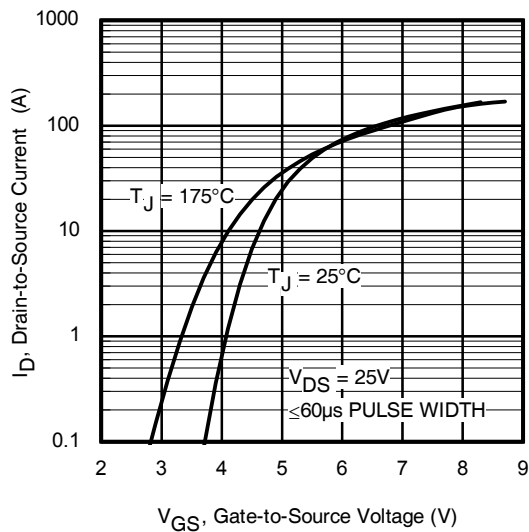
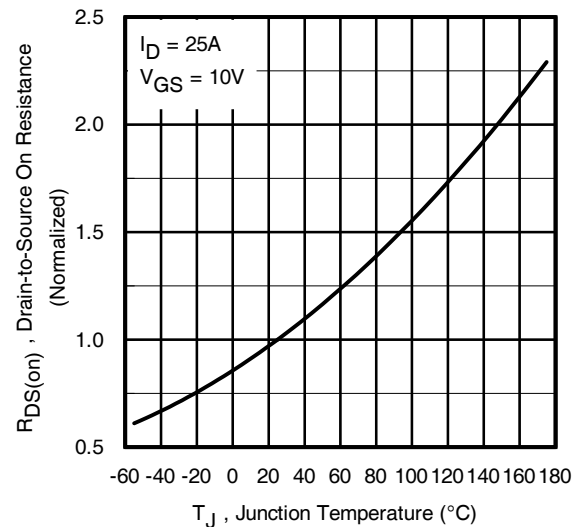
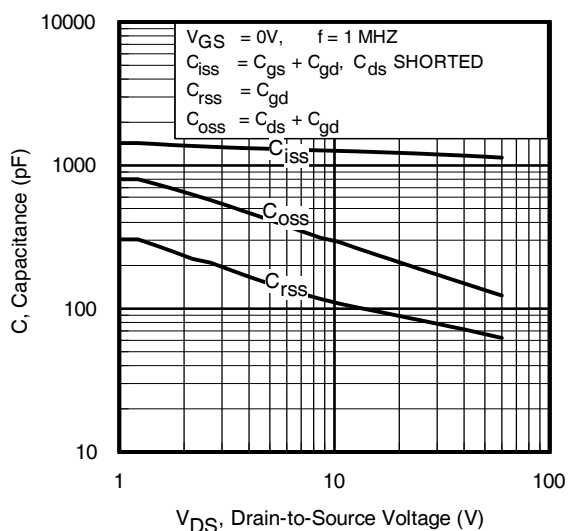
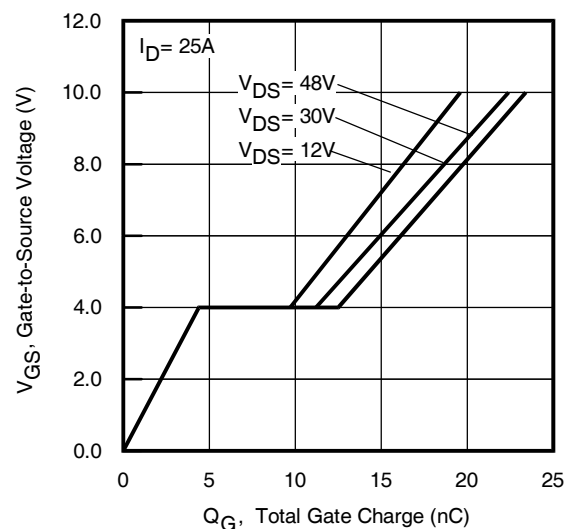
|                      |                                               |   |      |    |    |                                                                                                                               |
|----------------------|-----------------------------------------------|---|------|----|----|-------------------------------------------------------------------------------------------------------------------------------|
| $Q_g$                | Total Gate Charge                             | — | 22   | 30 | nC | $I_D = 25A$<br>$V_{DS} = 30V$<br>$V_{GS} = 10V$ ④                                                                             |
| $Q_{gs}$             | Gate-to-Source Charge                         | — | 5.0  | —  |    |                                                                                                                               |
| $Q_{gd}$             | Gate-to-Drain Charge                          | — | 6.3  | —  |    |                                                                                                                               |
| $Q_{sync}$           | Total Gate Charge Sync. ( $Q_g - Q_{gd}$ )    | — | 28.3 | —  |    |                                                                                                                               |
| $t_{d(on)}$          | Turn-On Delay Time                            | — | 6.3  | —  | ns | $V_{DD} = 39V$<br>$I_D = 25A$<br>$R_G = 20\Omega$<br>$V_{GS} = 10V$ ④                                                         |
| $t_r$                | Rise Time                                     | — | 40   | —  |    |                                                                                                                               |
| $t_{d(off)}$         | Turn-Off Delay Time                           | — | 49   | —  |    |                                                                                                                               |
| $t_f$                | Fall Time                                     | — | 47   | —  |    |                                                                                                                               |
| $C_{iss}$            | Input Capacitance                             | — | 1150 | —  | pF | $V_{GS} = 0V$<br>$V_{DS} = 50V$<br>$f = 1.0MHz$<br>$V_{GS} = 0V, V_{DS} = 0V$ to 48V ⑥<br>$V_{GS} = 0V, V_{DS} = 0V$ to 48V ⑤ |
| $C_{oss}$            | Output Capacitance                            | — | 130  | —  |    |                                                                                                                               |
| $C_{rss}$            | Reverse Transfer Capacitance                  | — | 67   | —  |    |                                                                                                                               |
| $C_{oss\ eff. (ER)}$ | Effective Output Capacitance (Energy Related) | — | 190  | —  |    |                                                                                                                               |
| $C_{oss\ eff. (TR)}$ | Effective Output Capacitance (Time Related)   | — | 230  | —  |    |                                                                                                                               |

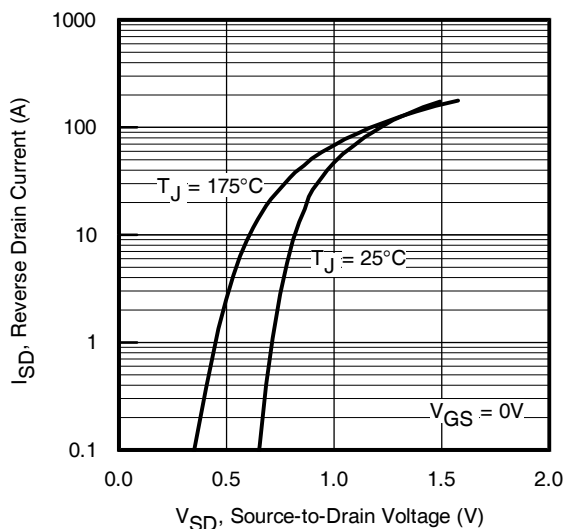
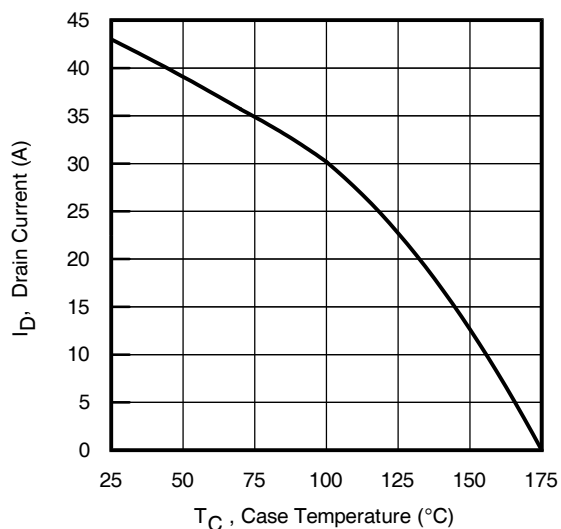
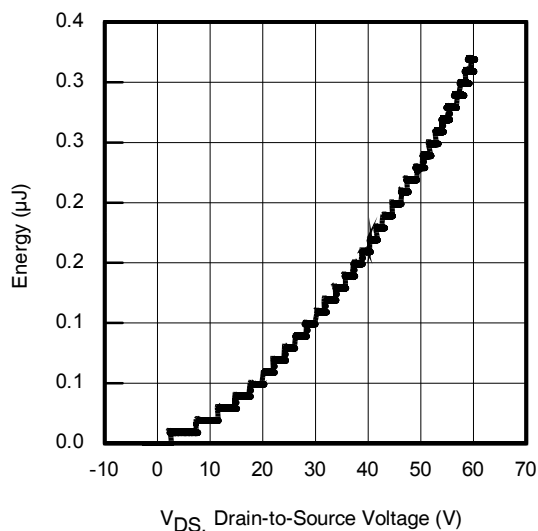
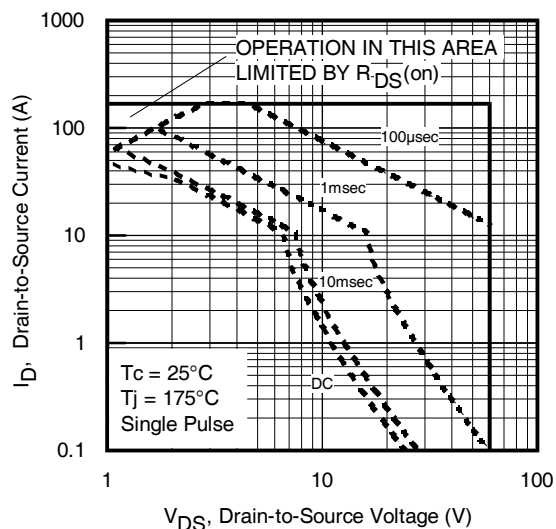
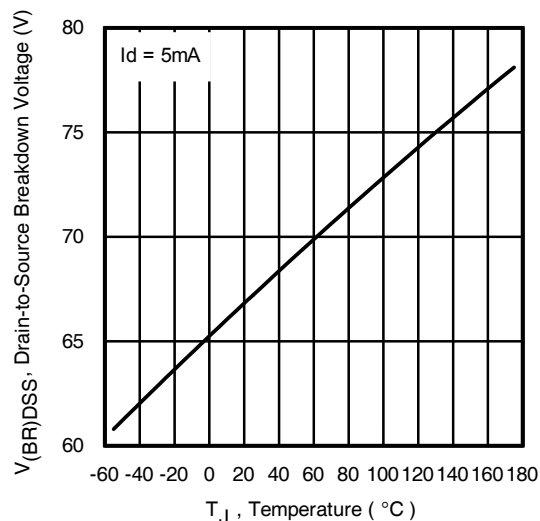
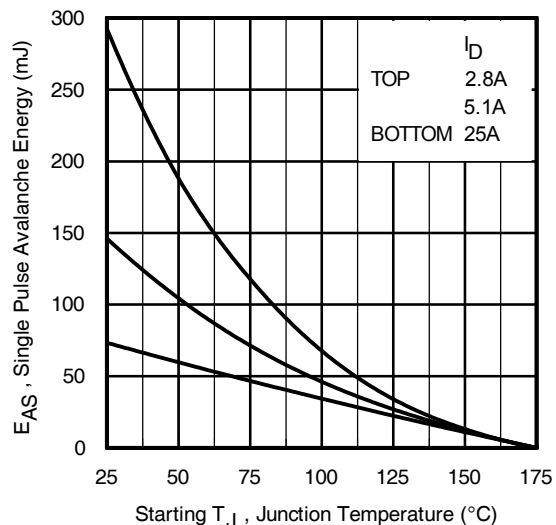
**Diode Characteristics**

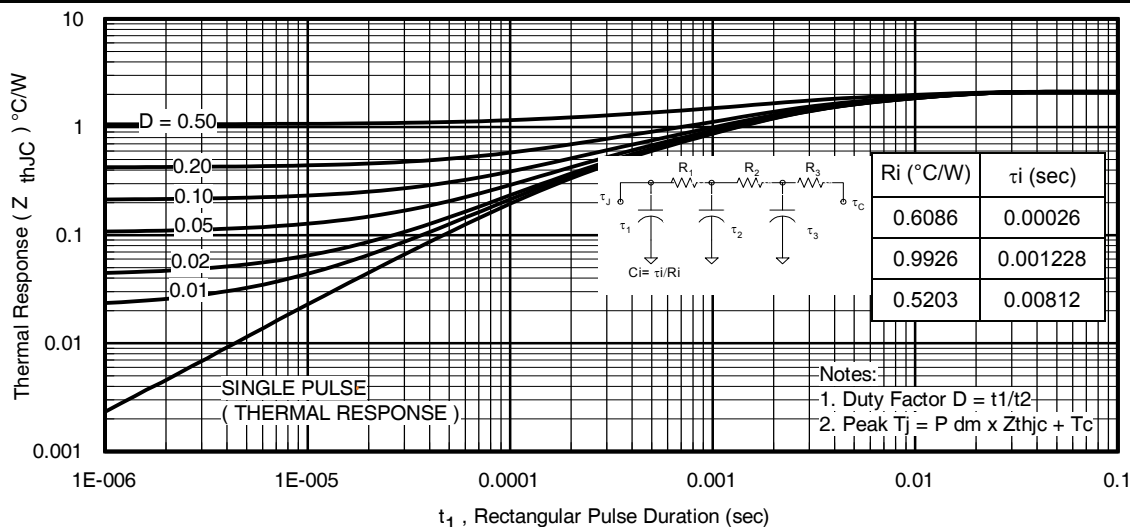
|                 | Parameter                              | Min.                                                                                           | Typ. | Max. | Units | Conditions                                                                                                                                           |
|-----------------|----------------------------------------|------------------------------------------------------------------------------------------------|------|------|-------|------------------------------------------------------------------------------------------------------------------------------------------------------|
| I <sub>S</sub>  | Continuous Source Current (Body Diode) | —                                                                                              | —    | 43   | A     | MOSFET symbol showing the integral reverse p-n junction diode.  |
| I <sub>SM</sub> | Pulsed Source Current (Body Diode) ①   | —                                                                                              | —    | 170  |       |                                                                                                                                                      |
| V <sub>SD</sub> | Diode Forward Voltage                  | —                                                                                              | —    | 1.3  | V     | T <sub>J</sub> = 25°C, I <sub>S</sub> = 25A, V <sub>GS</sub> = 0V ④                                                                                  |
| t <sub>rr</sub> | Reverse Recovery Time                  | —                                                                                              | 22   | 33   | ns    | T <sub>J</sub> = 25°C                                                                                                                                |
|                 |                                        | —                                                                                              | 26   | 39   |       | T <sub>J</sub> = 125°C V <sub>R</sub> = 51V,                                                                                                         |
| Q <sub>rr</sub> | Reverse Recovery Charge                | —                                                                                              | 17   | 26   | nC    | T <sub>J</sub> = 25°C I <sub>F</sub> = 25A                                                                                                           |
|                 |                                        | —                                                                                              | 24   | 36   |       | T <sub>J</sub> = 125°C di/dt = 100A/μs ④                                                                                                             |
|                 |                                        | —                                                                                              | 1.4  | —    | A     | T <sub>J</sub> = 25°C                                                                                                                                |
| 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:**

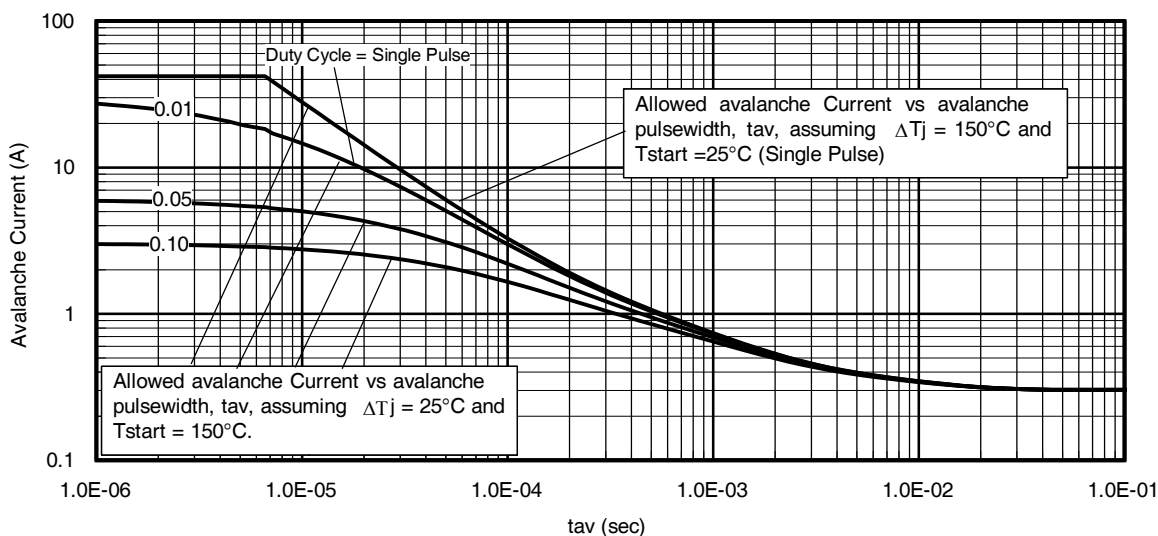
- ① Repetitive rating; pulse width limited by max. junction temperature.
- ② Limited by  $T_{Jmax}$ , starting  $T_J = 25^\circ\text{C}$ ,  $L = 0.23mH$ ,  $R_G = 25\Omega$ ,  $I_{AS} = 25A$ ,  $V_{GS} = 10V$ . Part not recommended for use above this value.
- ③  $I_{SD} \leq 25A$ ,  $di/dt \leq 1580A/\mu s$ ,  $V_{DD} \leq V_{(BR)DSS}$ ,  $T_J \leq 175^\circ\text{C}$ .
- ④ Pulse width  $\leq 400\mu s$ ; duty cycle  $\leq 2\%$ .
- ⑤  $C_{oss\ eff. (TR)}$  is a fixed capacitance that gives the same charging time as  $C_{oss}$  while  $V_{DS}$  is rising from 0 to 80%  $V_{DSS}$ .
- ⑥  $C_{oss\ eff. (ER)}$  is a fixed capacitance that gives the same energy as  $C_{oss}$  while  $V_{DS}$  is rising from 0 to 80%  $V_{DSS}$ .
- 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  $90^\circ\text{C}$ .


**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

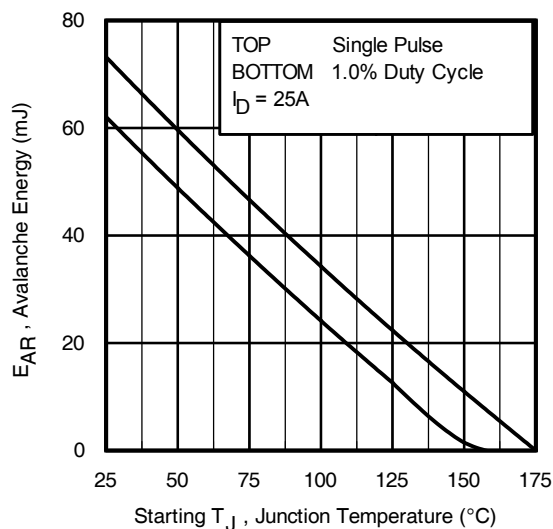

**Fig. 7** Typical Source-to-Drain Diode Forward Voltage

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

**Fig. 11** Typical Coss Stored Energy

**Fig. 8.** Maximum Safe Operating Area

**Fig. 10.** Drain-to-Source Breakdown Voltage

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



**Fig 13.** Maximum Effective Transient Thermal Impedance, Junction-to-Case



**Fig 14.** Typical Avalanche Current Vs. Pulse width



**Notes on Repetitive Avalanche Curves , Figures 14, 15:**  
 (For further info, see AN-1005 at [www.infineon.com](http://www.infineon.com))

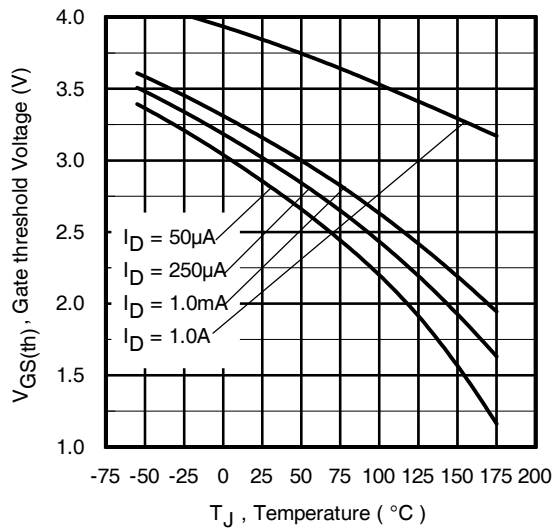
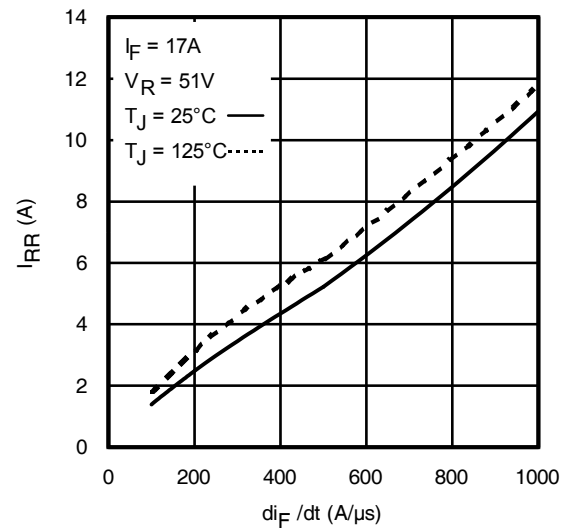
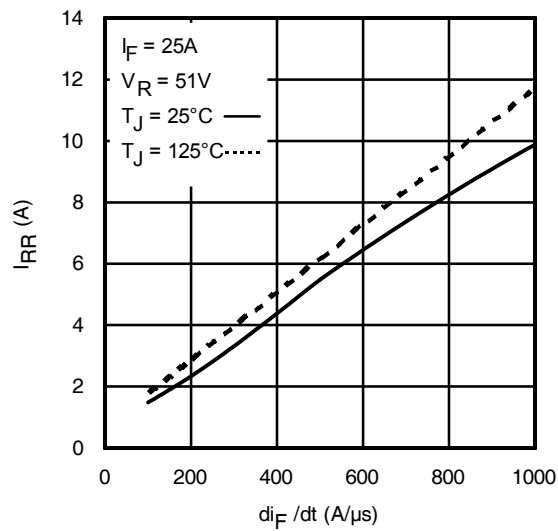
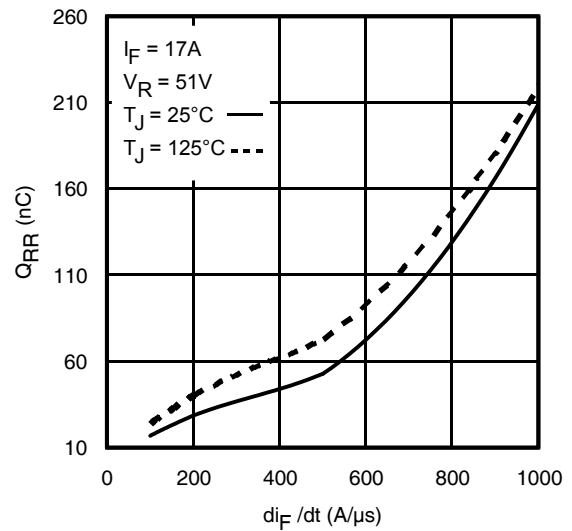
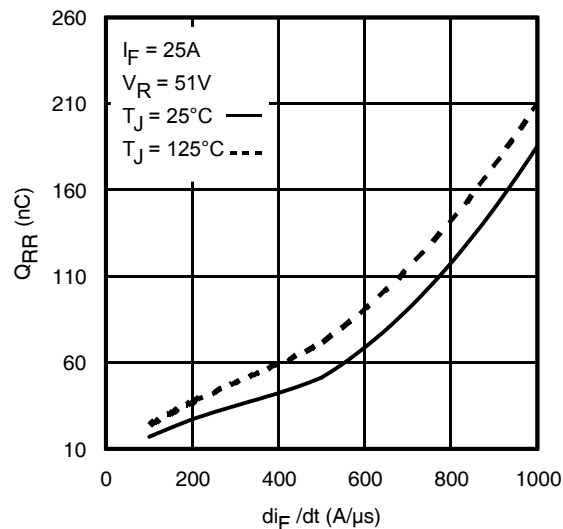
1. Avalanche failures assumption:  
Purely a thermal phenomenon and failure occurs at a temperature far in excess of  $T_{jmax}$ . This is validated for every part type.
2. Safe operation in Avalanche is allowed as long as  $T_{jmax}$  is not exceeded.
3. Equation below based on circuit and waveforms shown in Figures 22a, 22b.
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  $25^\circ\text{C}$  in Figure 13, 14).  
 $t_{av}$  = Average time in avalanche.  
 $D$  = Duty cycle in avalanche =  $t_{av} \cdot f$   
 $Z_{thJC}(D, t_{av})$  = Transient thermal resistance, see Figures 13)

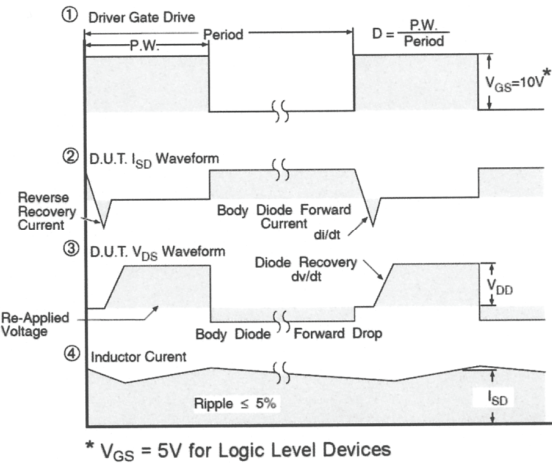
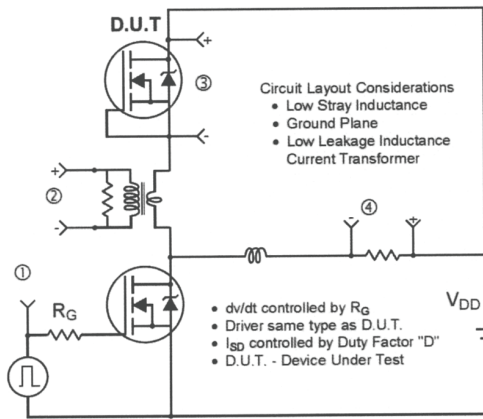
$$P_D(ave) = 1/2 (1.3 \cdot BV \cdot I_{av}) = \Delta T / Z_{thJC}$$

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

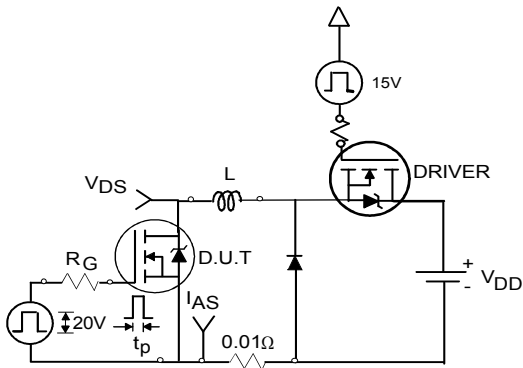
$$E_{AS(AR)} = P_D(ave) \cdot t_{av}$$

**Fig 15.** Maximum Avalanche Energy Vs. Temperature

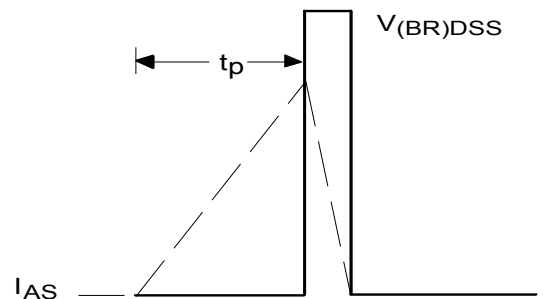

**Fig 16.** Threshold Voltage vs. Temperature

**Fig. 17 -** Typical Recovery Current vs.  $di_F/dt$ 

**Fig. 18 -** Typical Recovery Current vs.  $di_F/dt$ 

**Fig. 19 -** Typical Stored Charge vs.  $di_F/dt$ 

**Fig. 20 -** Typical Stored Charge vs.  $di_F/dt$



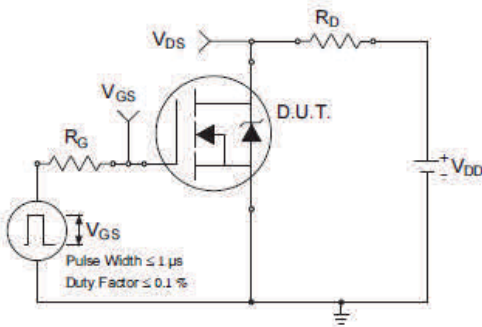
**Fig 20.** Peak Diode Recovery  $dv/dt$  Test Circuit for N-Channel HEXFET® Power MOSFETs



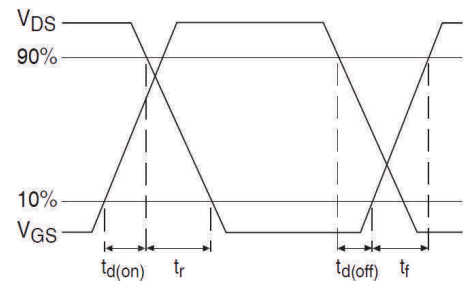
**Fig 21a.** Unclamped Inductive Test Circuit



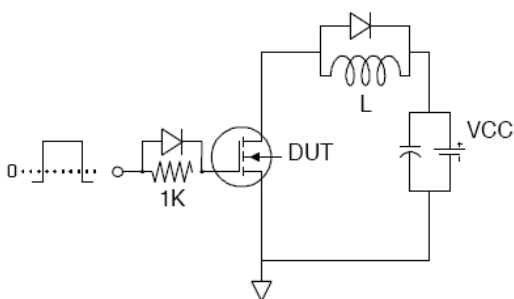
**Fig 21b.** Unclamped Inductive Waveforms



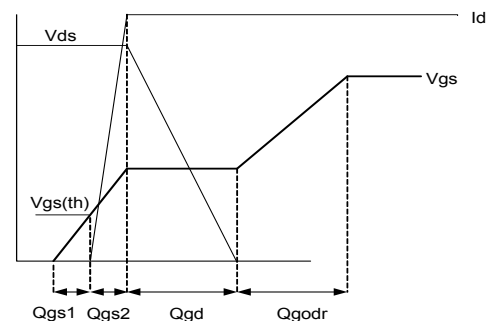
**Fig 22a.** Switching Time Test Circuit



**Fig 22b.** Switching Time Waveforms

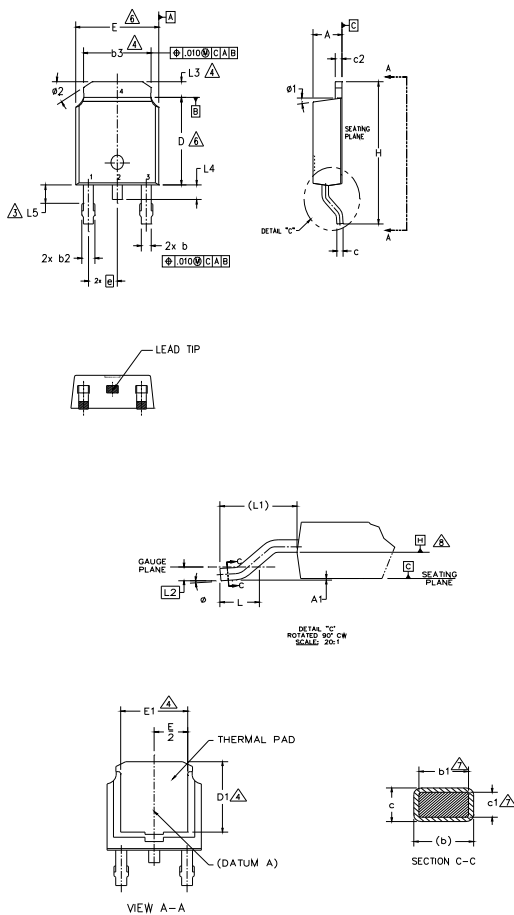


**Fig 23a.** Gate Charge Test Circuit



**Fig 23b.** Gate Charge Waveform

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



### NOTES:

- 1.- DIMENSIONING AND TOLERANCING PER ASME Y14.5M-1994
- 2.- DIMENSIONS 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

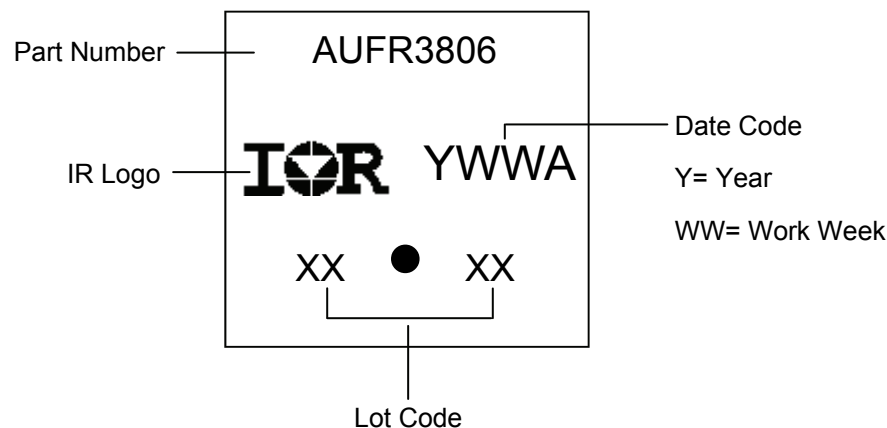
### HEXFET

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

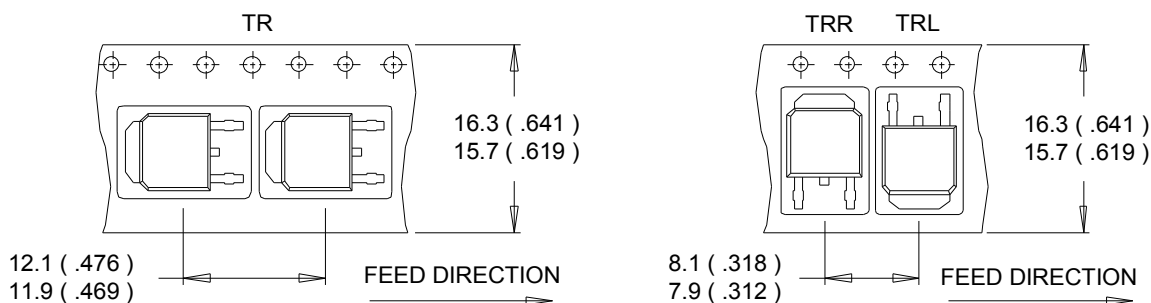
### IGBT & CoPAK

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

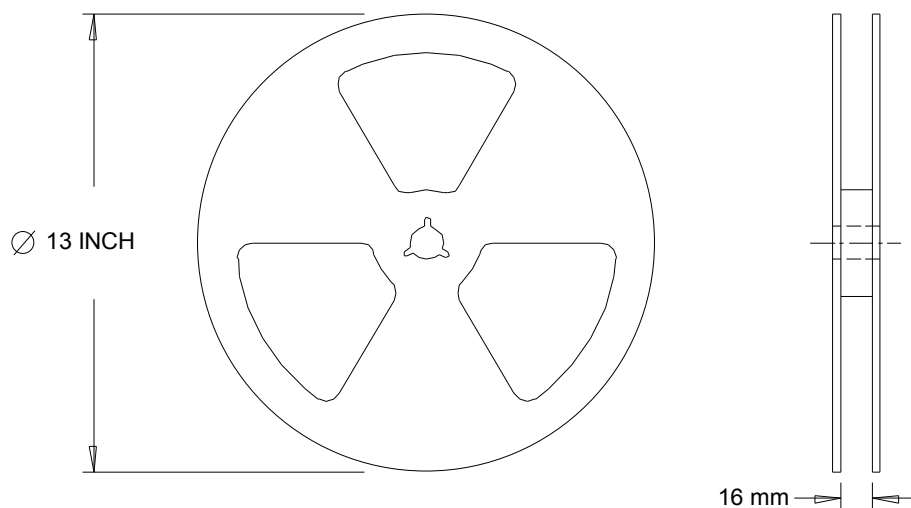
## D-Pak (TO-252AA) Part Marking Information



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**

|                                   |                      |                                                                                                                                                                               |      |
|-----------------------------------|----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|
| <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-Pak                                                                                                                                                                         | MSL1 |
| <b>ESD</b>                        | Machine Model        | Class M3 (+/- 250V) <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                                                                                                                             |      |
| <b>RoHS Compliant</b>             |                      | Yes                                                                                                                                                                           |      |

† Highest passing voltage.

**Revision History**

| Date       | Comments                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 11/23/2015 | <ul style="list-style-type: none"> <li>Updated datasheet with corporate template</li> <li>Corrected ordering table on page 1.</li> <li>Corrected typo on test condition Coss eff. <math>V_{DS}</math> from "60V" to "48V" on page 2.</li> <li>Updated typo on the fig.19 and fig.20, unit of y-axis from "A" to "nC" on page 6.</li> <li>Corrected typo from Rthcs to RthJA (PCB Mount) on page 1.</li> <li>Corrected typo RthJA from "62C/W" to "110C/W" on page 1.</li> </ul> |

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