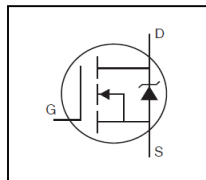


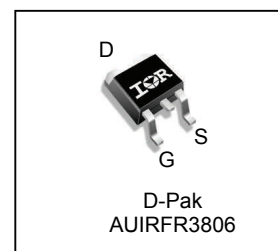
Features

- 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}		60V
$R_{DS(on)}$	typ. max.	12.6mΩ 15.8mΩ
I_D		43A


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.

G	D	S
Gate	Drain	Source

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

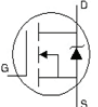
Static @ $T_J = 25^\circ\text{C}$ (unless otherwise specified)

	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°C , $I_D = 5mA$ ①
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	—	12.6	15.8	m Ω	$V_{GS} = 10V, I_D = 25A$ 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	—	Ω	
I_{DSS}	Drain-to-Source Leakage Current	—	—	20	μA	$V_{DS} = 60V, V_{GS} = 0V$
		—	—	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	$I_D = 25A$ $V_{DS} = 30V$ $V_{GS} = 10V$ 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	$V_{DD} = 39V$ $I_D = 25A$ $R_G = 20\Omega$ $V_{GS} = 10V$ 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	$V_{GS} = 0V$ $V_{DS} = 50V$ $f = 1.0MHz$ $V_{GS} = 0V, V_{DS} = 0V$ to 48V ⑥ $V_{GS} = 0V, V_{DS} = 0V$ 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_S	Continuous Source Current (Body Diode)	—	—	43	A	MOSFET symbol showing the integral reverse p-n junction diode. 
I_{SM}	Pulsed Source Current (Body Diode) ①	—	—	170		
V_{SD}	Diode Forward Voltage	—	—	1.3	V	$T_J = 25^\circ\text{C}, I_S = 25A, V_{GS} = 0V$ ④
t_{rr}	Reverse Recovery Time	—	22	33	ns	$T_J = 25^\circ\text{C}$ $T_J = 125^\circ\text{C}$ $V_R = 51V,$
Q_{rr}	Reverse Recovery Charge	—	17	26		
		—	24	36	nC	$T_J = 25^\circ\text{C}$ $I_F = 25A$ $T_J = 125^\circ\text{C}$ $di/dt = 100A/\mu s$ ④
		—	1.4	—	A	$T_J = 25^\circ\text{C}$
t_{on}	Forward Turn-On Time	Intrinsic turn-on time is negligible (turn-on is dominated by $L_S + L_D$)				

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_θ is measured at T_J approximately 90°C .

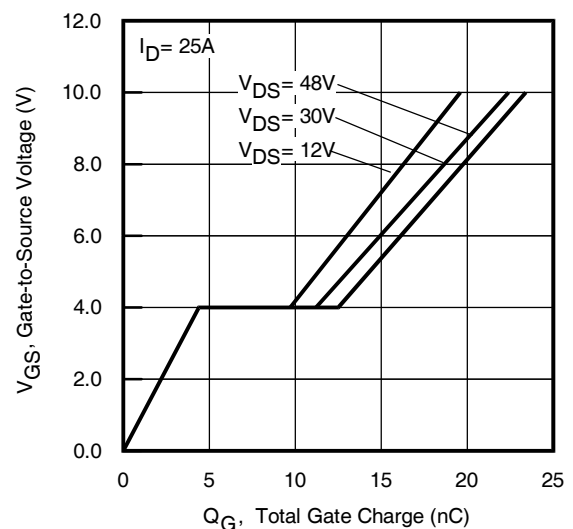
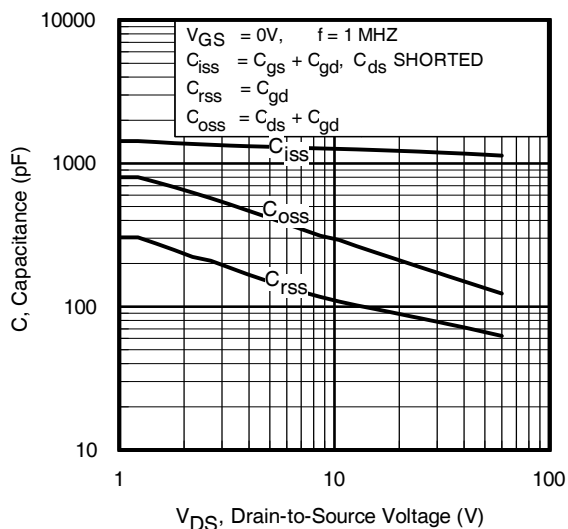
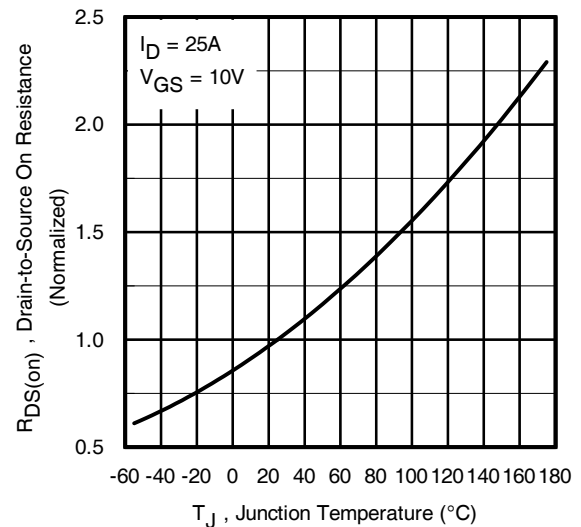
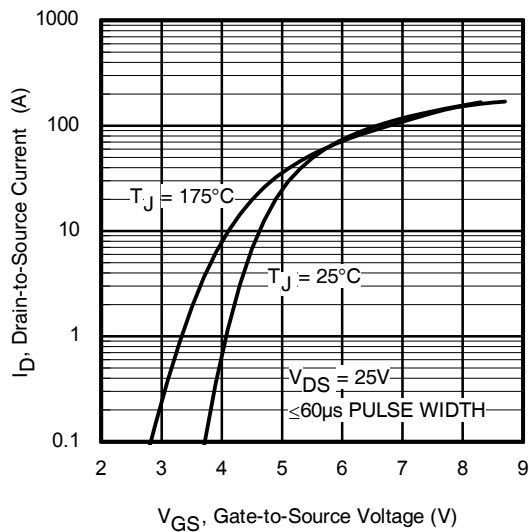
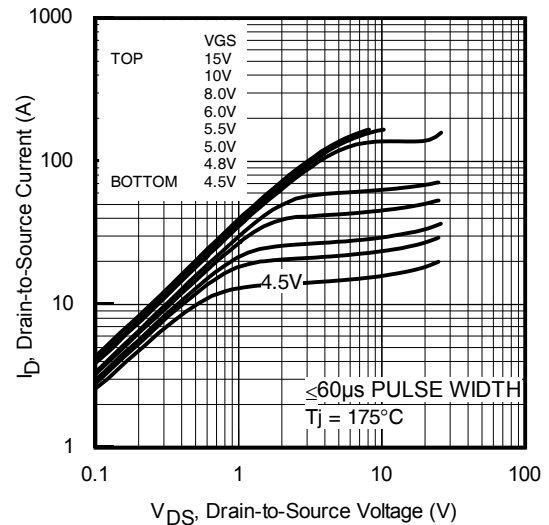
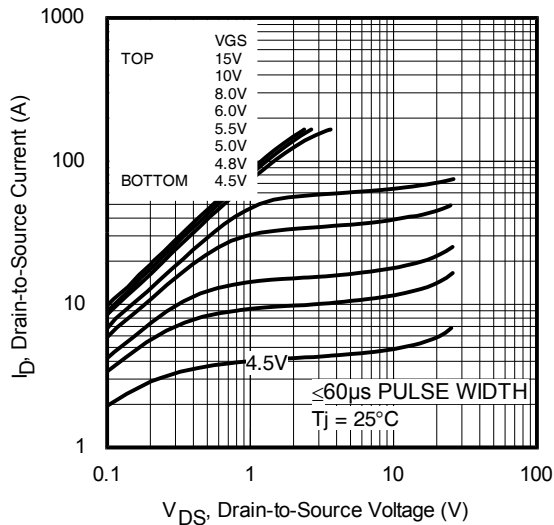
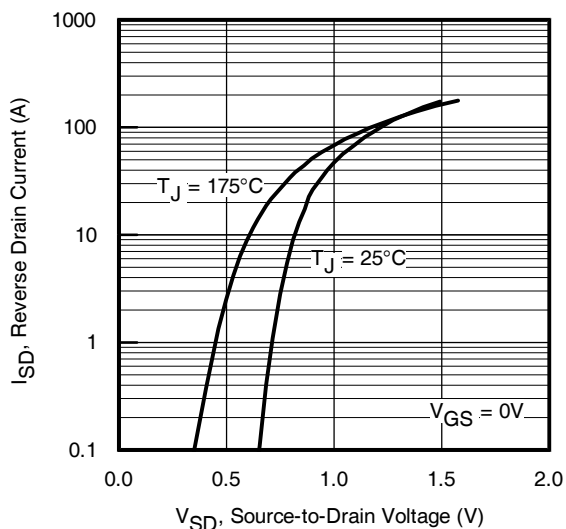
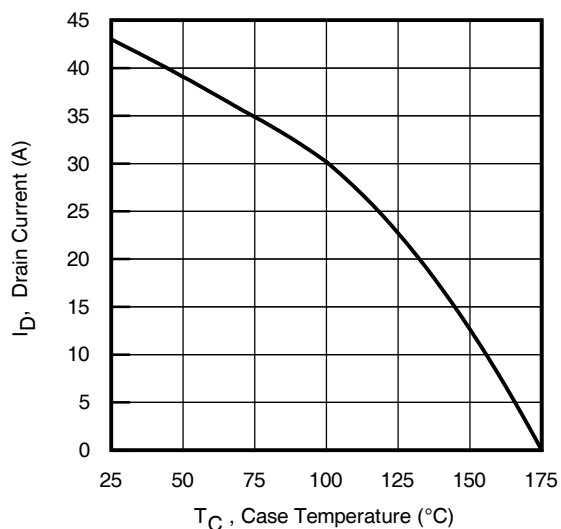
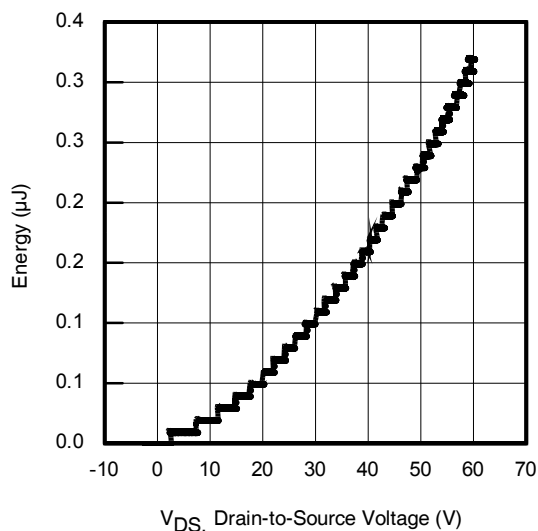
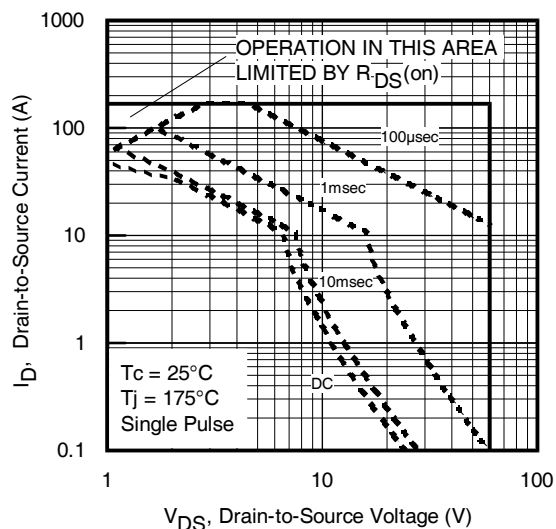
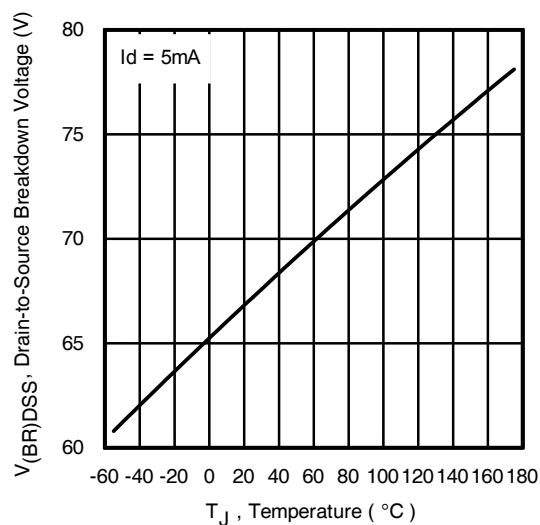
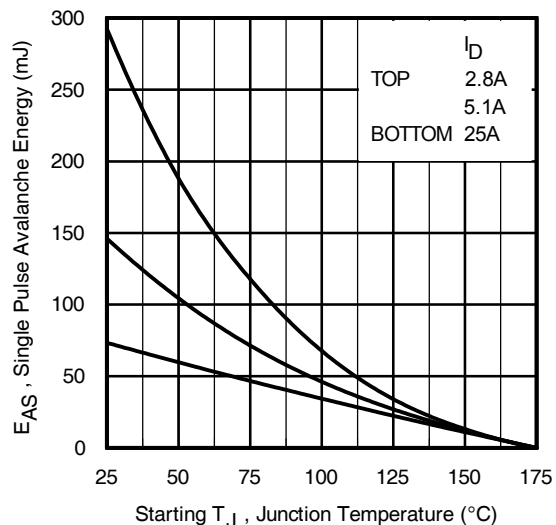


Fig 5. Typical Capacitance vs. Drain-to-Source Voltage

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

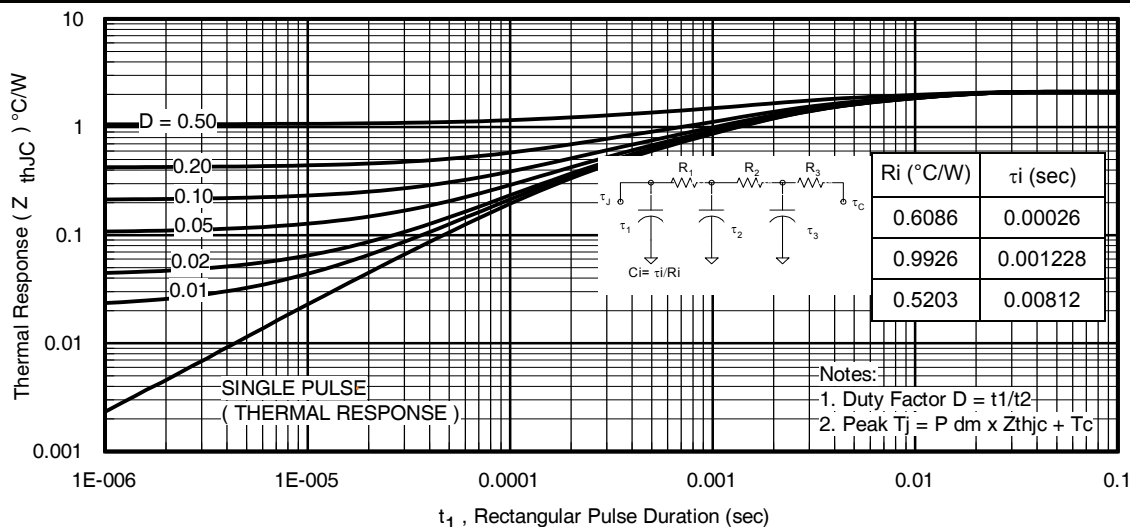


Fig 13. Maximum Effective Transient Thermal Impedance, Junction-to-Case

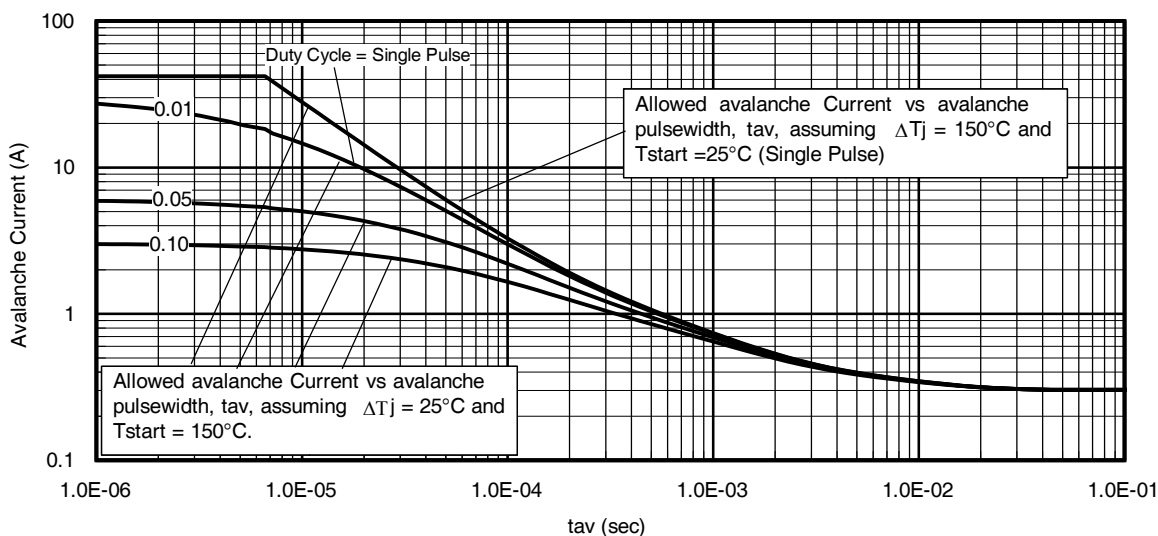
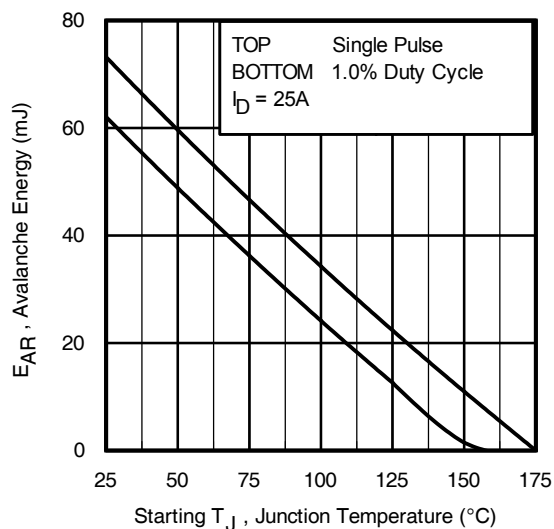


Fig 14. Typical Avalanche Current Vs. Pulse width



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

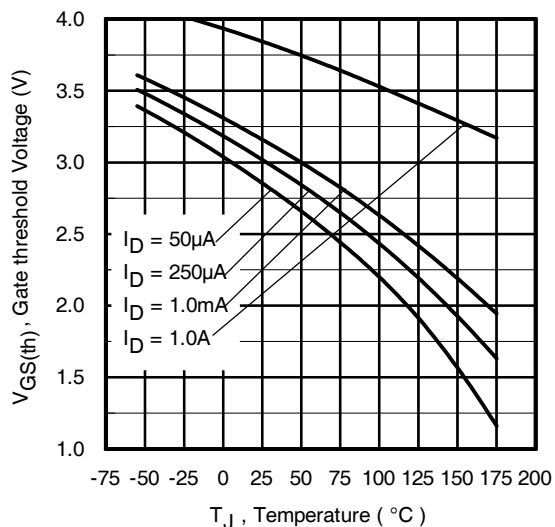
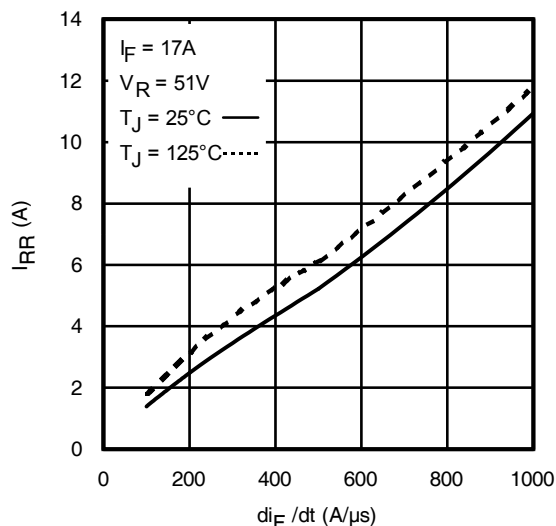
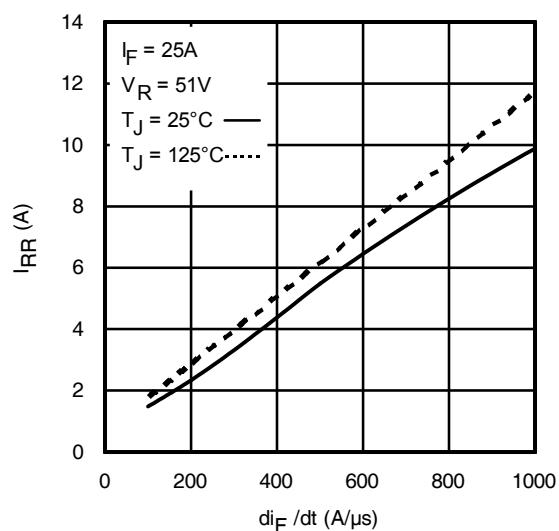
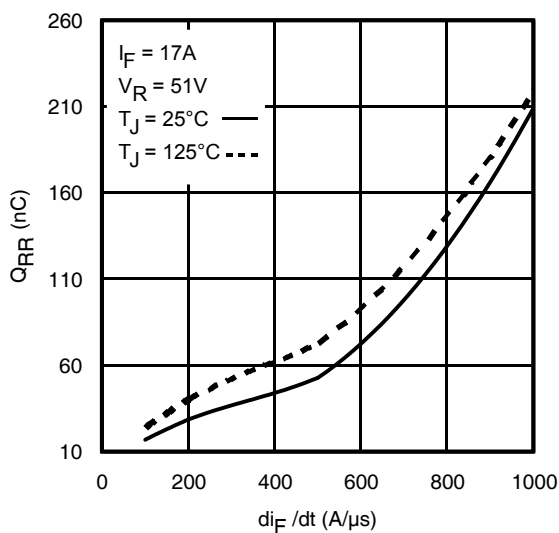
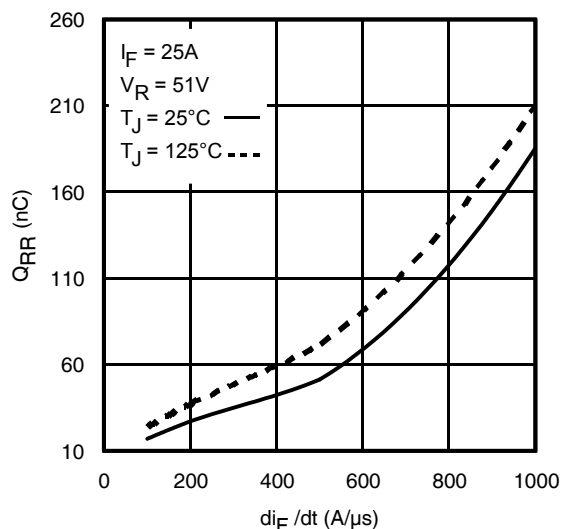
1. Avalanche failures assumption:
Purely a thermal phenomenon and failure occurs at a temperature far in excess of T_{jmax} . This is validated for every part type.
2. Safe operation in Avalanche is allowed as long as T_{jmax} is not exceeded.
3. Equation below based on circuit and waveforms shown in 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. ΔT = Allowable rise in junction temperature, not to exceed T_{jmax} (assumed as 25°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)

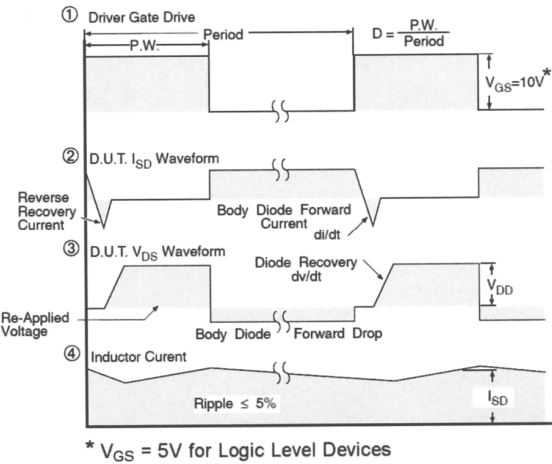
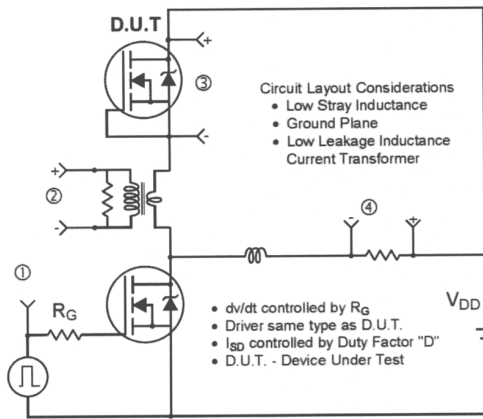
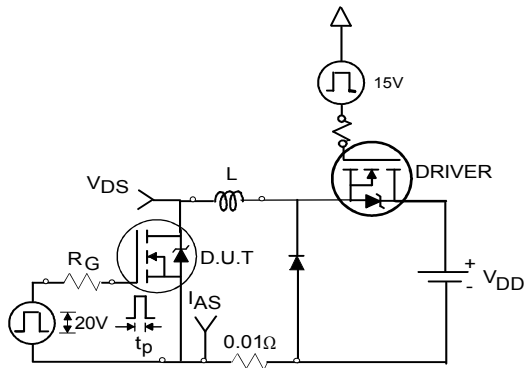
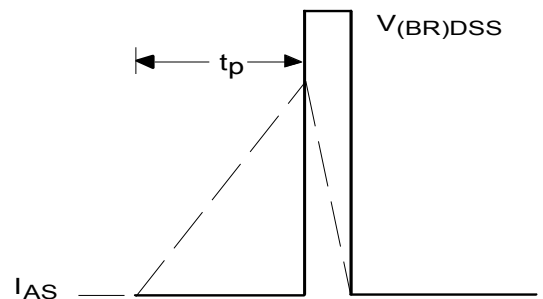
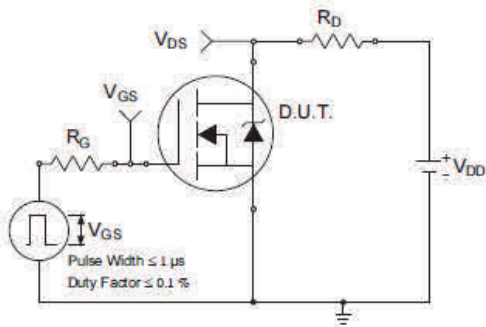
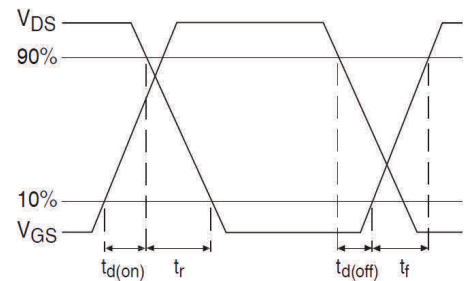
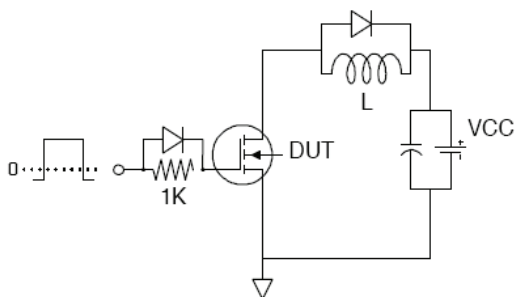
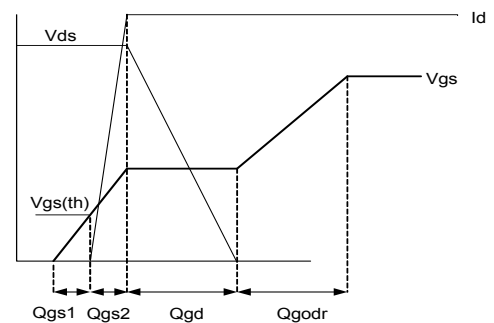
$$P_D(ave) = 1/2 (1.3 \cdot BV \cdot I_{av}) = \Delta T / Z_{thJC}$$

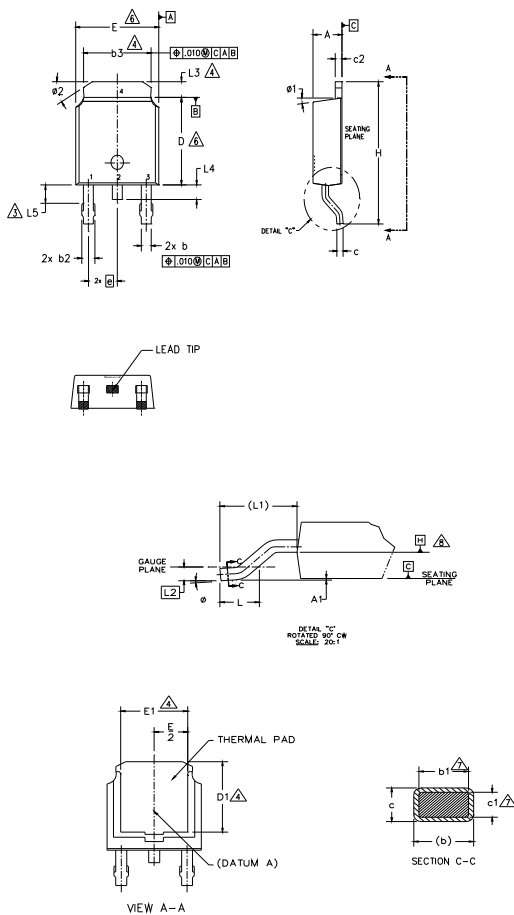
$$I_{av} = 2\Delta T / [1.3 \cdot BV \cdot Z_{thJC}]$$

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

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.

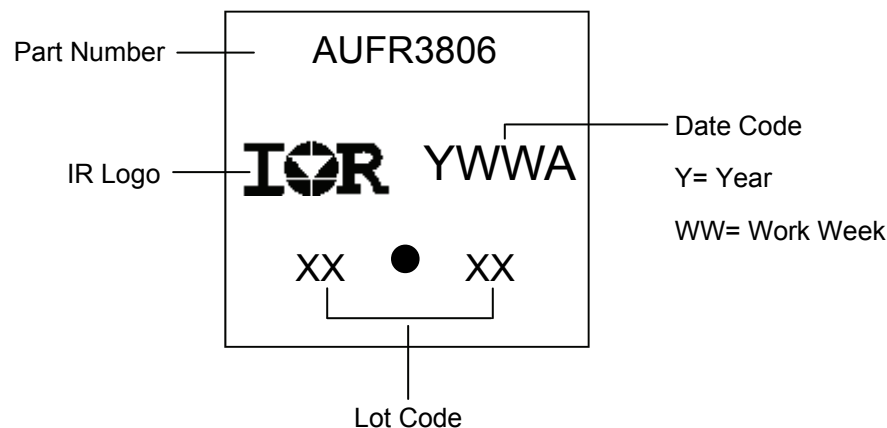
SYMBOL	DIMENSIONS				NOTES
	MILLIMETERS		INCHES		
	MIN.	MAX.	MIN.	MAX.	
A	2.18	2.39	.086	.094	
A1	—	0.13	—	.005	
b	0.64	0.89	.025	.035	
b1	0.65	0.79	.025	.031	7
b2	0.76	1.14	.030	.045	
b3	4.95	5.46	.195	.215	4
c	0.46	0.61	.018	.024	
c1	0.41	0.56	.016	.022	7
c2	0.46	0.89	.018	.035	
D	5.97	6.22	.235	.245	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

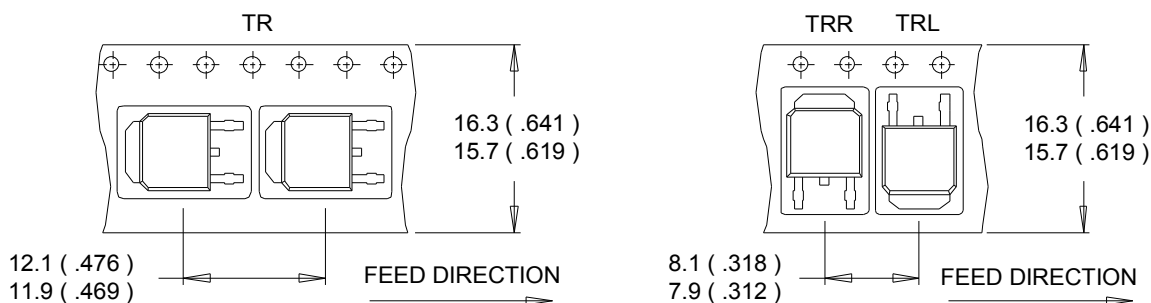
- 1.- GATE
- 2.- DRAIN
- 3.- SOURCE
- 4.- DRAIN

IGBT & CoPAK

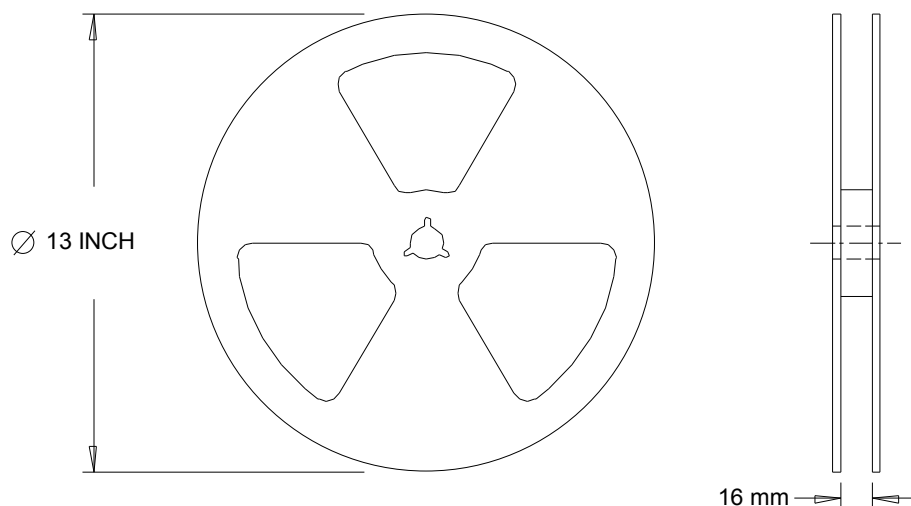
- 1.- GATE
- 2.- COLLECTOR
- 3.- EMITTER
- 4.- COLLECTOR

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

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 M3 (+/- 250V) [†] AEC-Q101-002	
	Human Body Model	Class H1A (+/- 500V) [†] AEC-Q101-001	
	Charged Device Model	Class C5 (+/- 2000V) [†] AEC-Q101-005	
RoHS Compliant		Yes	

† Highest passing voltage.

Revision History

Date	Comments
11/23/2015	- Updated datasheet with corporate template - Corrected ordering table on page 1. - Corrected typo on test condition Coss eff. V_{DS} from "60V" to "48V" on page 2. - Updated typo on the fig.19 and fig.20, unit of y-axis from "A" to "nC" on page 6. - Corrected typo from Rthcs to RthJA (PCB Mount) on page 1. - Corrected typo RthJA from "62C/W" to "110C/W" on page 1.

Published by

Infineon Technologies AG
81726 München, Germany

© Infineon Technologies AG 2015

All Rights Reserved.

IMPORTANT NOTICE

The information given in this document shall in no event be regarded as a guarantee of conditions or characteristics ("Beschaffenheitsgarantie"). With respect to any examples, hints or any typical values stated herein and/or any information regarding the application of the product, Infineon Technologies hereby disclaims any and all warranties and liabilities of any kind, including without limitation warranties of non-infringement of intellectual property rights of any third party.

In addition, any information given in this document is subject to customer's compliance with its obligations stated in this document and any applicable legal requirements, norms and standards concerning customer's products and any use of the product of Infineon Technologies in customer's applications.

The data contained in this document is exclusively intended for technically trained staff. It is the responsibility of customer's technical departments to evaluate the suitability of the product for the intended application and the completeness of the product information given in this document with respect to such application.

For further information on the product, technology, delivery terms and conditions and prices please contact your nearest Infineon Technologies office (www.infineon.com).

WARNINGS

Due to technical requirements products may contain dangerous substances. For information on the types in question please contact your nearest Infineon Technologies office.

Except as otherwise explicitly approved by Infineon Technologies in a written document signed by authorized representatives of Infineon Technologies, Infineon Technologies' products may not be used in any applications where a failure of the product or any consequences of the use thereof can reasonably be expected to result in personal injury.