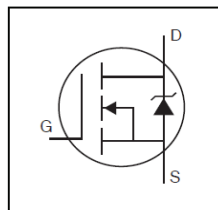


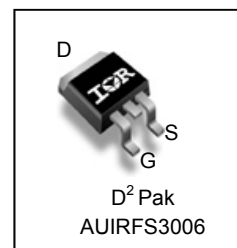
Features

- Advanced Process Technology
- Ultra Low On-Resistance
- Enhanced dV/dT and dI/dT capability
- 175°C Operating Temperature
- Fast Switching
- Repetitive Avalanche Allowed up to T_{jmax}
- Lead-Free, RoHS Compliant
- Automotive Qualified *



HEXFET® Power MOSFET

V_{DS}	60V
$R_{DS(on)}$ typ.	2.0mΩ
max.	2.5mΩ
I_D (Silicon Limited)	270A ①
I_D (Package Limited)	195A



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	
AUIRFS3006	D ² -Pak	Tube	50	AUIRFS3006
		Tape and Reel Left	800	AUIRFS3006TRL

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 (T_A) is 25°C, unless otherwise specified.

Symbol	Parameter	Max.	Units
$I_D @ T_C = 25^\circ\text{C}$	Continuous Drain Current, $V_{GS} @ 10\text{V}$ (Silicon Limited)	270①	A
$I_D @ T_C = 100^\circ\text{C}$	Continuous Drain Current, $V_{GS} @ 10\text{V}$ (Silicon Limited)	191①	
$I_D @ T_C = 25^\circ\text{C}$	Continuous Drain Current, $V_{GS} @ 10\text{V}$ (Package Limited)	195	
I_{DM}	Pulsed Drain Current ②	1080	
$P_D @ T_C = 25^\circ\text{C}$	Maximum Power Dissipation	375	W
	Linear Derating Factor	2.5	W/°C
V_{GS}	Gate-to-Source Voltage	± 20	V
E_{AS}	Single Pulse Avalanche Energy (Thermally Limited) ③	320	mJ
I_{AR}	Avalanche Current ②	See Fig.14,15, 22a, 22b	A
E_{AR}	Repetitive Avalanche Energy ②		mJ
dv/dt	Peak Diode Recovery ④	10	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)	300	

Thermal Resistance

Symbol	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case ⑨⑩	—	0.40	°C/W
$R_{\theta JA}$	Junction-to-Ambient (PCB Mount), D ² Pak®	—	40	

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	—	0.07	—	V/ $^\circ\text{C}$	Reference to 25°C , $I_D = 5mA$ ②
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	—	2.0	2.5	m Ω	$V_{GS} = 10V, I_D = 170A$ ⑤
$V_{GS(th)}$	Gate Threshold Voltage	2.0	—	4.0	V	$V_{DS} = V_{GS}, I_D = 250\mu A$
g_{fs}	Forward Trans conductance	280	—	—	S	$V_{DS} = 25V, I_D = 170A$
R_G	Internal Gate Resistance	—	2.0	—	Ω	
I_{DSS}	Drain-to-Source Leakage Current	—	—	20	μA	$V_{DS} = 60V, V_{GS} = 0V$
		—	—	250		$V_{DS} = 60V, V_{GS} = 0V, T_J = 125^\circ\text{C}$
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)

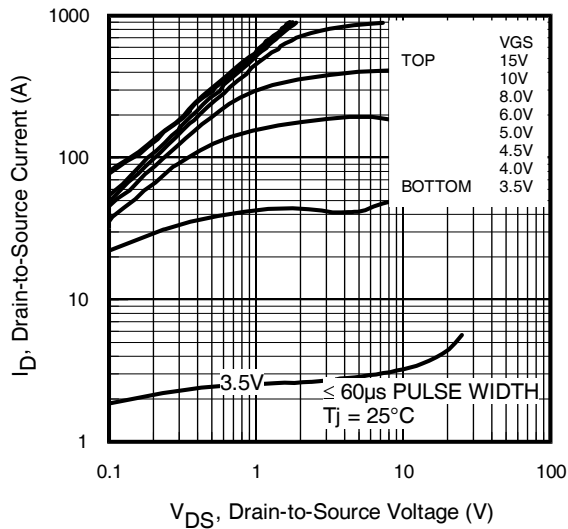
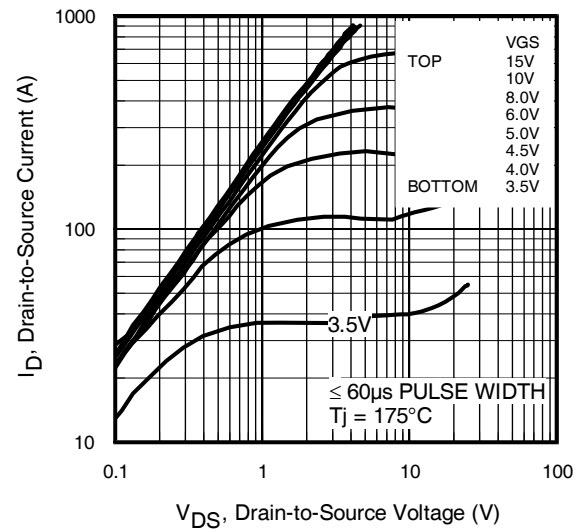
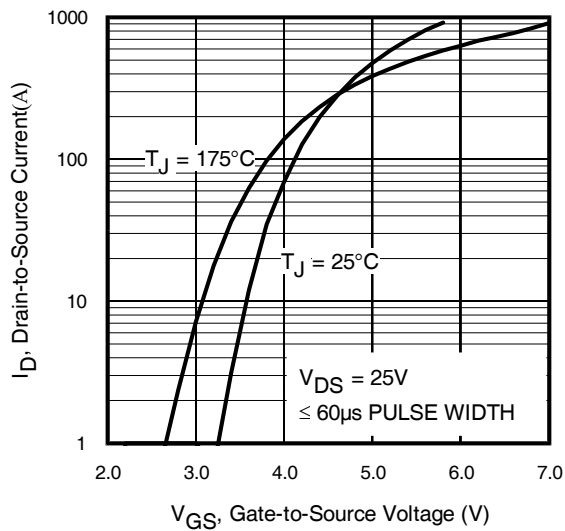
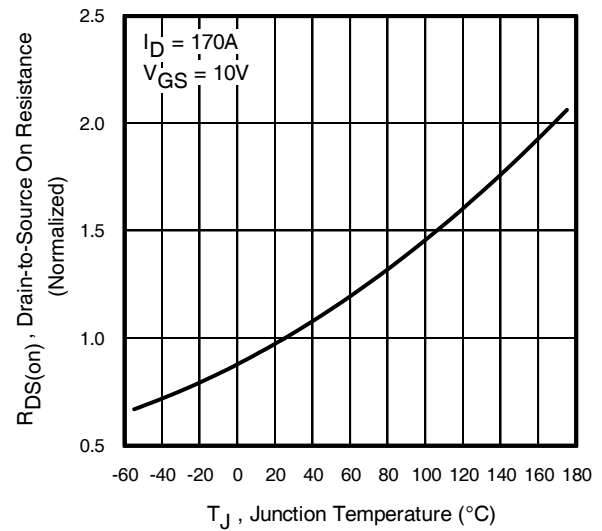
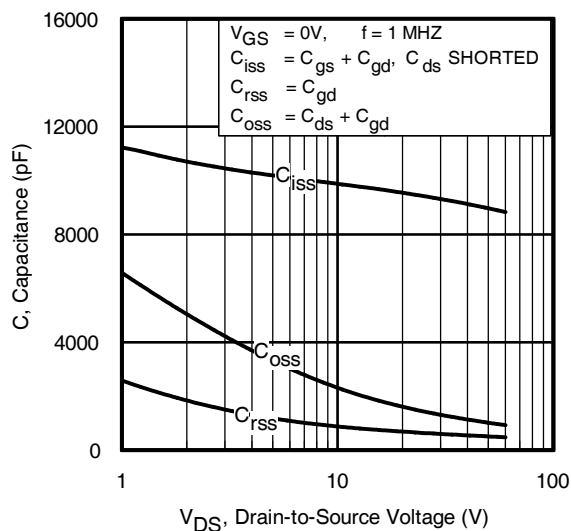
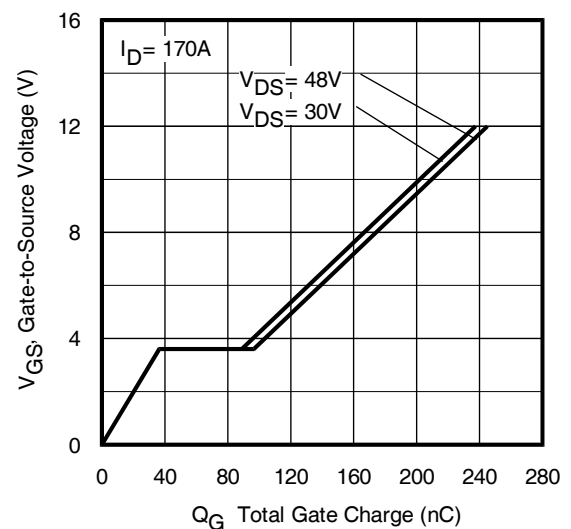
Q_g	Total Gate Charge	—	200	300	nC	$I_D = 170A$ $V_{DS} = 30V$ $V_{GS} = 10V$ ⑤
Q_{gs}	Gate-to-Source Charge	—	37	—		
Q_{gd}	Gate-to-Drain Charge	—	60	—		
Q_{sync}	Total Gate Charge Sync. ($Q_g - Q_{gd}$)	—	140	—		
$t_{d(on)}$	Turn-On Delay Time	—	16	—	ns	$V_{DD} = 39V$ $I_D = 170A$ $R_G = 2.7\Omega$ $V_{GS} = 10V$ ⑤
t_r	Rise Time	—	182	—		
$t_{d(off)}$	Turn-Off Delay Time	—	118	—		
t_f	Fall Time	—	189	—		
C_{iss}	Input Capacitance	—	8970	—	pF	$V_{GS} = 0V$ $V_{DS} = 50V$ $f = 1.0MHz$, See Fig. 5
C_{oss}	Output Capacitance	—	1020	—		
C_{rss}	Reverse Transfer Capacitance	—	534	—		
$C_{oss \text{ eff. (ER)}}$	Effective Output Capacitance (Energy Related)	—	1480	—		$V_{GS} = 0V, V_{DS} = 0V \text{ to } 48V$ ⑦
$C_{oss \text{ eff. (TR)}}$	Effective Output Capacitance (Time Related)	—	1920	—		$V_{GS} = 0V, V_{DS} = 0V \text{ to } 48V$ ⑧

Diode Characteristics

	Parameter	Min.	Typ.	Max.	Units	Conditions
I_S	Continuous Source Current (Body Diode)	—	—	270 ①	A	MOSFET symbol showing the integral reverse p-n junction diode. 
I_{SM}	Pulsed Source Current (Body Diode) ②	—	—	1080		
V_{SD}	Diode Forward Voltage	—	—	1.3	V	$T_J = 25^\circ\text{C}, I_S = 170A, V_{GS} = 0V$ ⑤
t_{rr}	Reverse Recovery Time	—	44	—	ns	$T_J = 25^\circ\text{C}$
		—	48	—		$T_J = 125^\circ\text{C}$
Q_{rr}	Reverse Recovery Charge	—	63	—	nC	$T_J = 25^\circ\text{C}$
		—	77	—		$T_J = 125^\circ\text{C}$
I_{RRM}	Reverse Recovery Current	—	2.4	—	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 Calculated continuous current based on maximum allowable junction temperature. Bond wire current limit is 195A. Note that current limitations arising from heating of the device leads may occur with some lead mounting arrangements.
- ② Repetitive rating; pulse width limited by max. junction temperature.
- ③ Limited by T_{Jmax} , starting $T_J = 25^\circ\text{C}$, $L = 0.022mH$, $R_G = 25\Omega$, $I_{AS} = 170A$, $V_{GS} = 10V$. Part not recommended for use above this value.
- ④ $I_{SD} \leq 170A$, $di/dt \leq 1360A/\mu s$, $V_{DD} \leq V_{(BR)DSS}$, $T_J \leq 175^\circ\text{C}$.
- ⑤ Pulse width $\leq 400\mu s$; duty cycle $\leq 2\%$.
- ⑥ $C_{oss \text{ eff. (TR)}}$ is a fixed capacitance that gives the same charging time as C_{oss} while V_{DS} is rising from 0 to 80% V_{DSS} .
- ⑦ $C_{oss \text{ eff. (ER)}}$ is a fixed capacitance that gives the same energy as C_{oss} while V_{DS} is rising from 0 to 80% V_{DSS} .
- ⑧ When mounted on 1" square PCB (FR-4 or G-10 Material). For recommended footprint and soldering techniques refer to application note #AN-994
- ⑨ R_θ is measured at T_J approximately 90°C .
- ⑩ $R_{\theta JC}$ value shown is at time zero


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

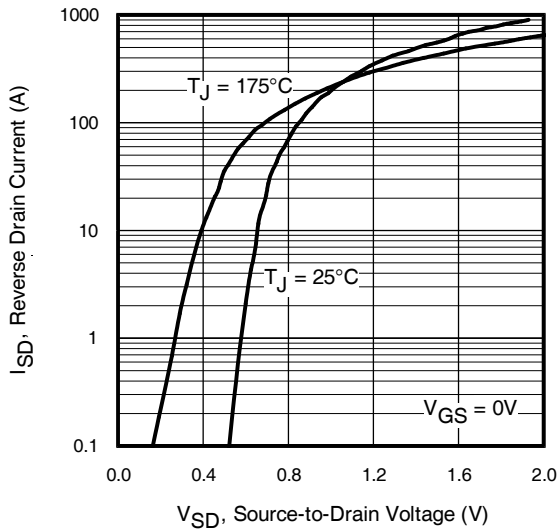


Fig. 7 Typical Source-to-Drain Diode Forward Voltage

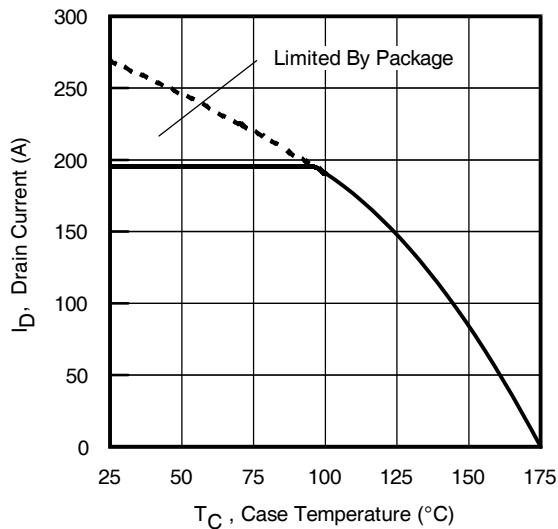


Fig 9. Maximum Drain Current vs. Case Temperature

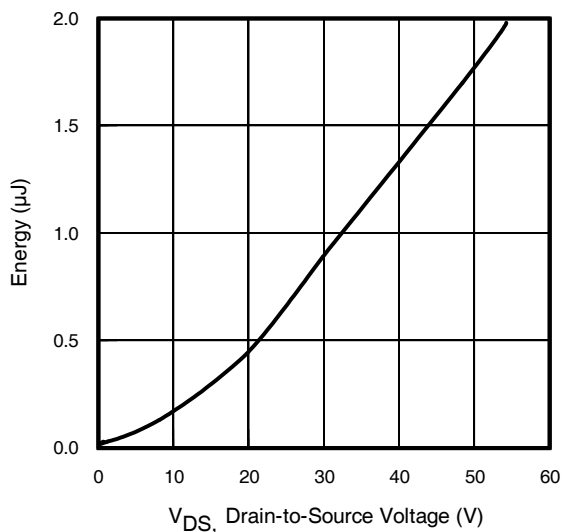


Fig 11. Typical C_{oss} Stored Energy

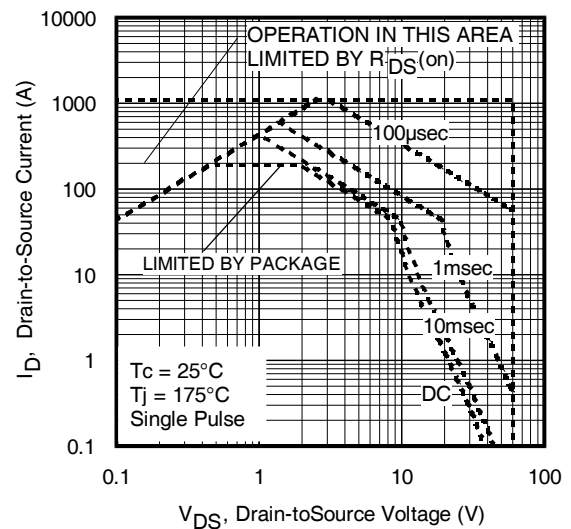


Fig 8. Maximum Safe Operating Area

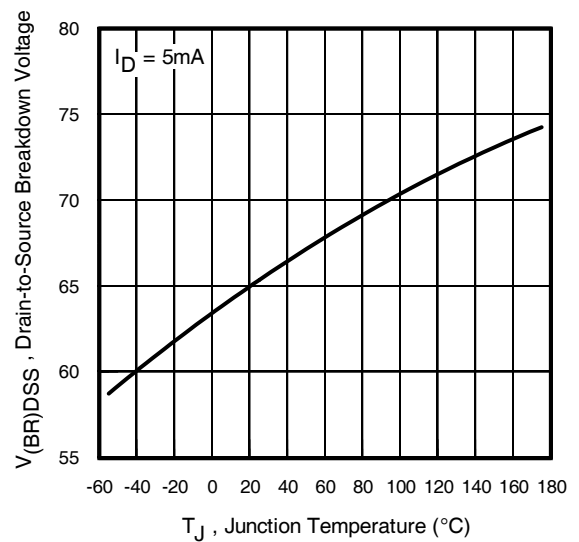


Fig 10. Drain-to-Source Breakdown Voltage

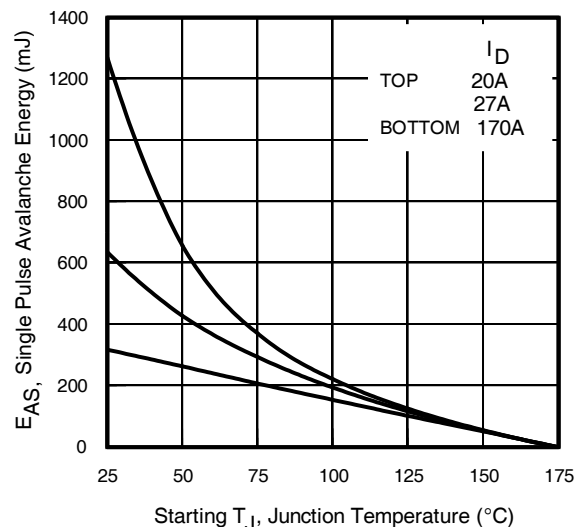


Fig 12. Maximum Avalanche Energy vs. Drain Current

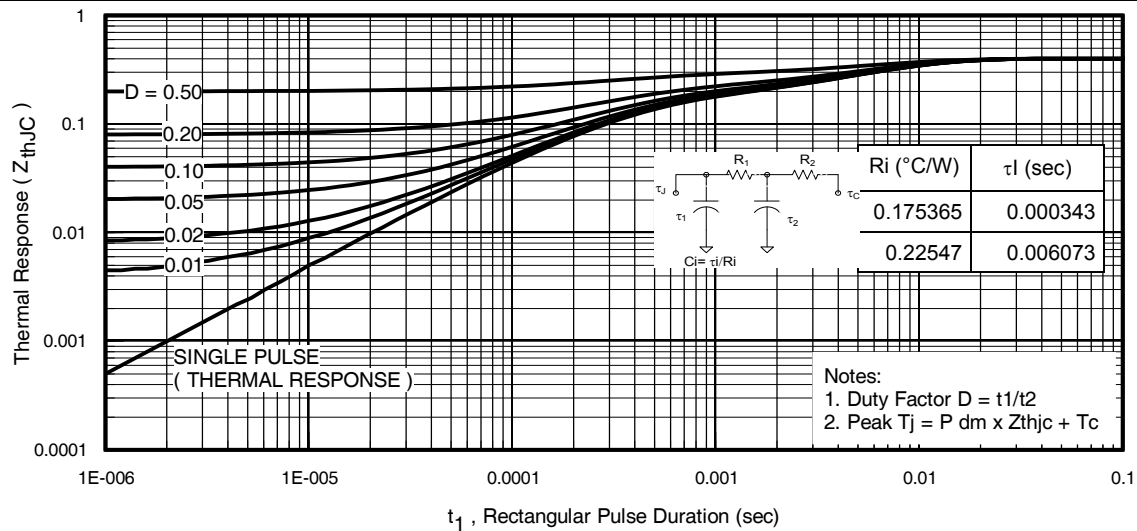


Fig 13. Maximum Effective Transient Thermal Impedance, Junction-to-Case

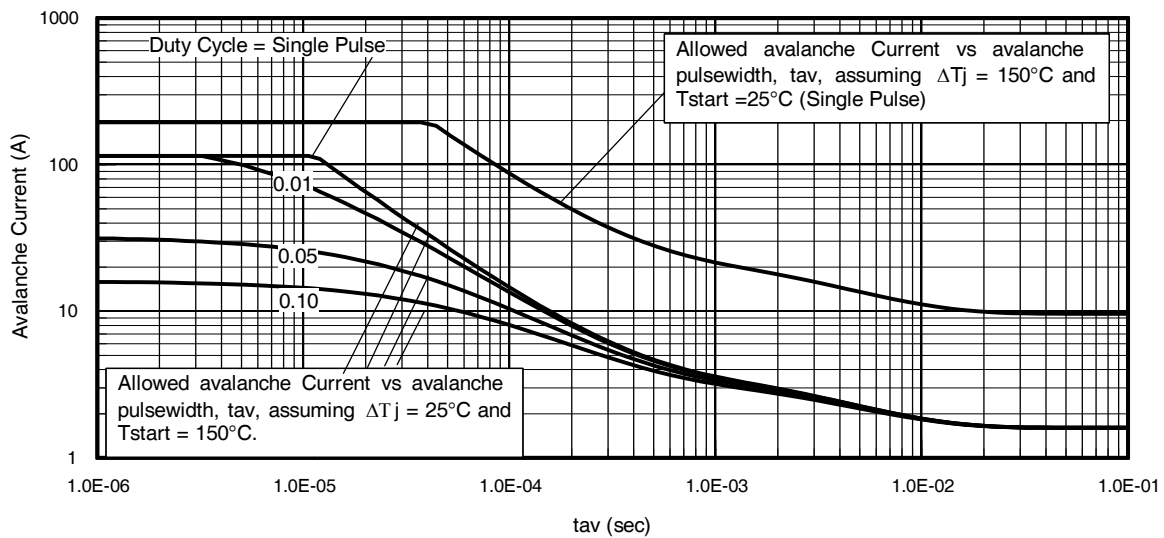
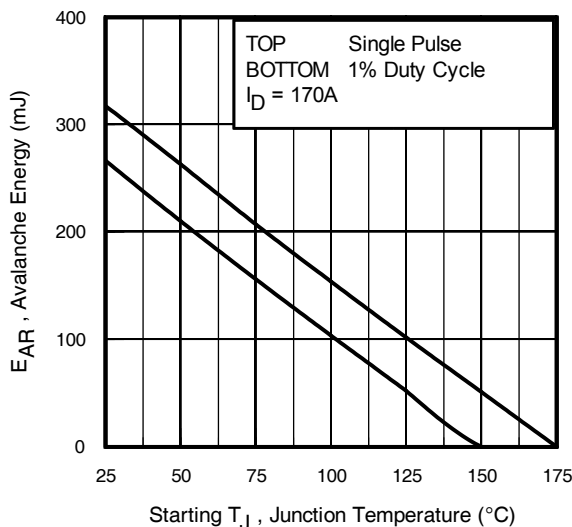


Fig 14. Avalanche Current vs. Pulse width



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

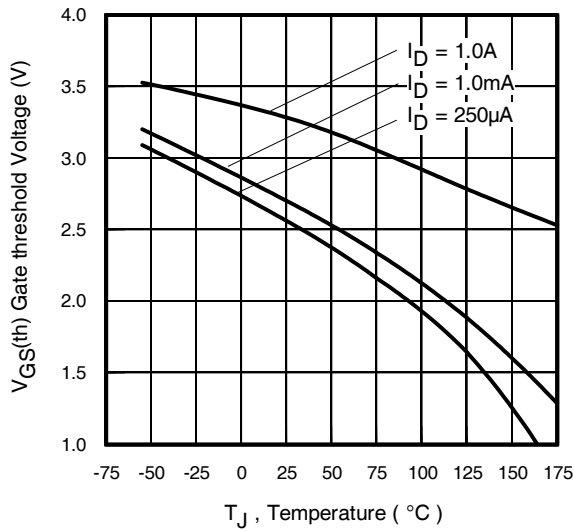
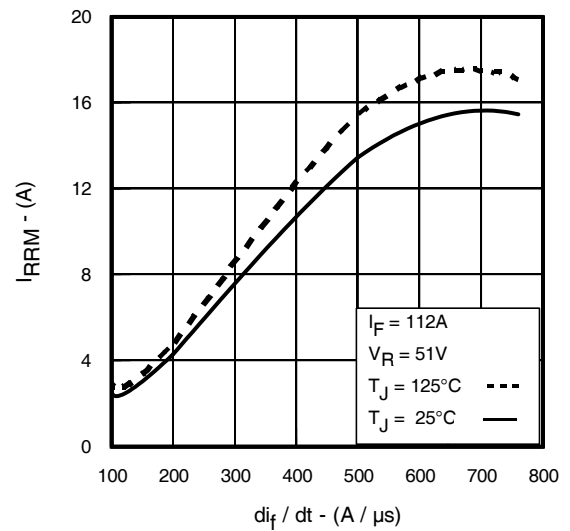
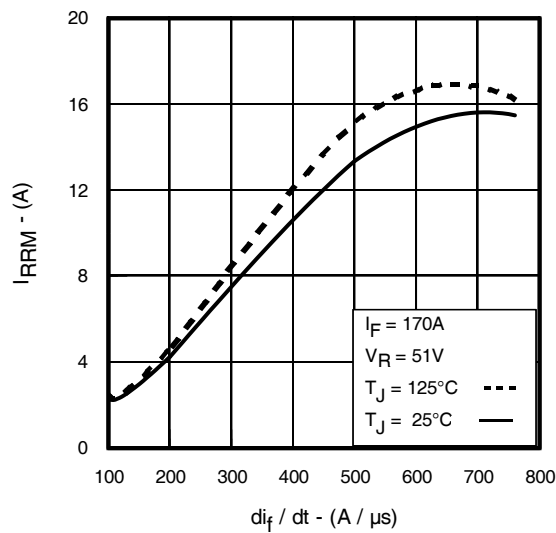
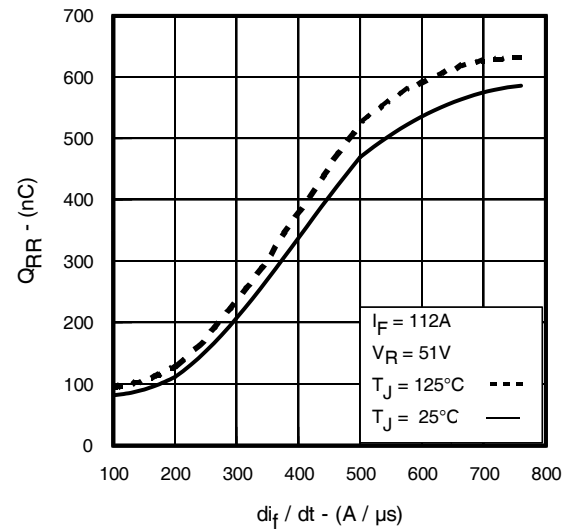
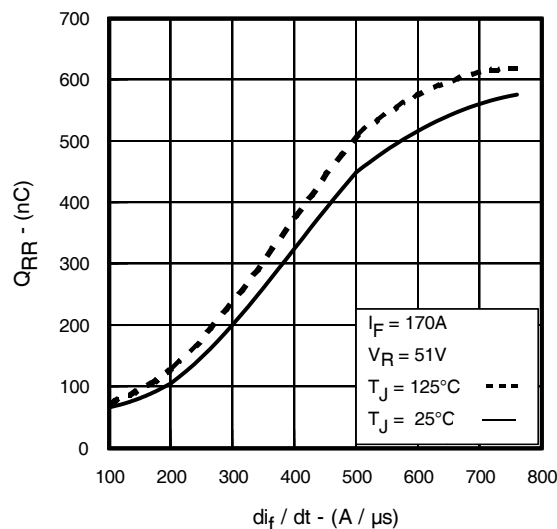
- Avalanche failures assumption:
Purely a thermal phenomenon and failure occurs at a temperature far in excess of T_{Jmax} . This is validated for every part type.
- Safe operation in Avalanche is allowed as long as T_{Jmax} is not exceeded.
- Equation below based on circuit and waveforms shown in Figures 22a, 22b.
- $P_{D(ave)}$ = Average power dissipation per single avalanche pulse.
- BV = Rated breakdown voltage (1.3 factor accounts for voltage increase during avalanche).
- I_{av} = Allowable avalanche current.
- ΔT = Allowable rise in junction temperature, not to exceed T_{Jmax} (assumed as $25^{\circ}C$ 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



* $V_{GS} = 5V$ for Logic Level Devices

Fig 21. Peak Diode Recovery dv/dt Test Circuit for N-Channel HEXFET® Power MOSFETs

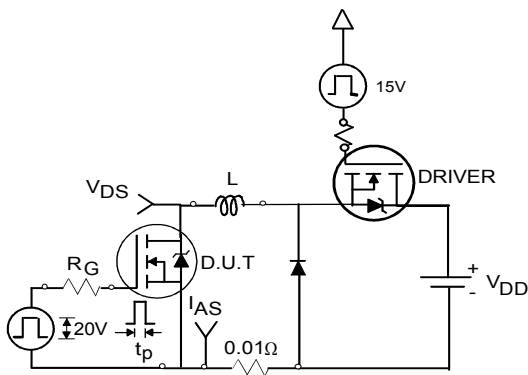


Fig 22a. Unclamped Inductive Test Circuit



Fig 22b. Unclamped Inductive Waveforms

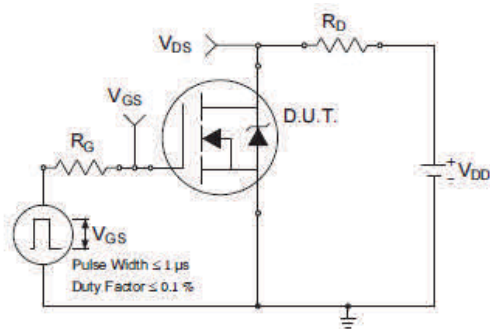


Fig 23a. Switching Time Test Circuit

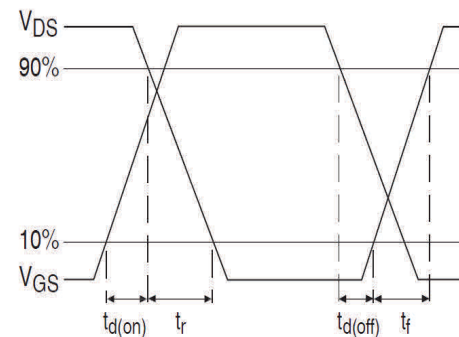


Fig 23b. Switching Time Waveforms



Fig 24a. Gate Charge Test Circuit

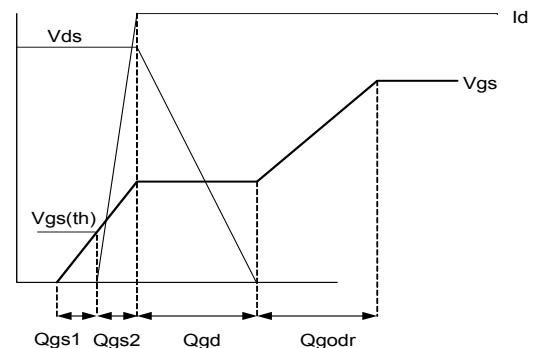


Fig 24b. Gate Charge Waveform

D²Pak (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 [0.005"] 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	5
A1	0.00	0.254	.000	.010	
b	0.51	0.99	.020	.039	
b1	0.51	0.89	.020	.035	
b2	1.14	1.78	.045	.070	
b3	1.14	1.73	.045	.068	5
c	0.38	0.74	.015	.029	5
c1	0.38	0.58	.015	.023	
c2	1.14	1.65	.045	.065	
D	8.38	9.65	.330	.380	
D1	6.86	—	.270	—	
E	9.65	10.67	.380	.420	3,4
E1	6.22	—	.245	—	4
e	2.54 BSC		.100 BSC		4
H	14.61	15.88	.575	.625	
L	1.78	2.79	.070	.110	
L1	—	1.68	—	.066	
L2	—	1.78	—	.070	
L3	0.25 BSC		.010 BSC		

LEAD ASSIGNMENTS

DIODES

- 1.- ANODE (TWO DIE) / OPEN (ONE DIE)
- 2.- CATHODE
- 3.- ANODE

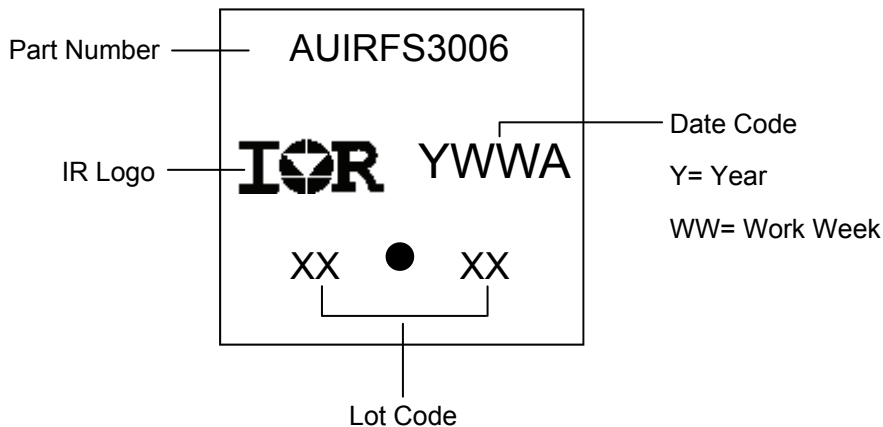
HEXFET

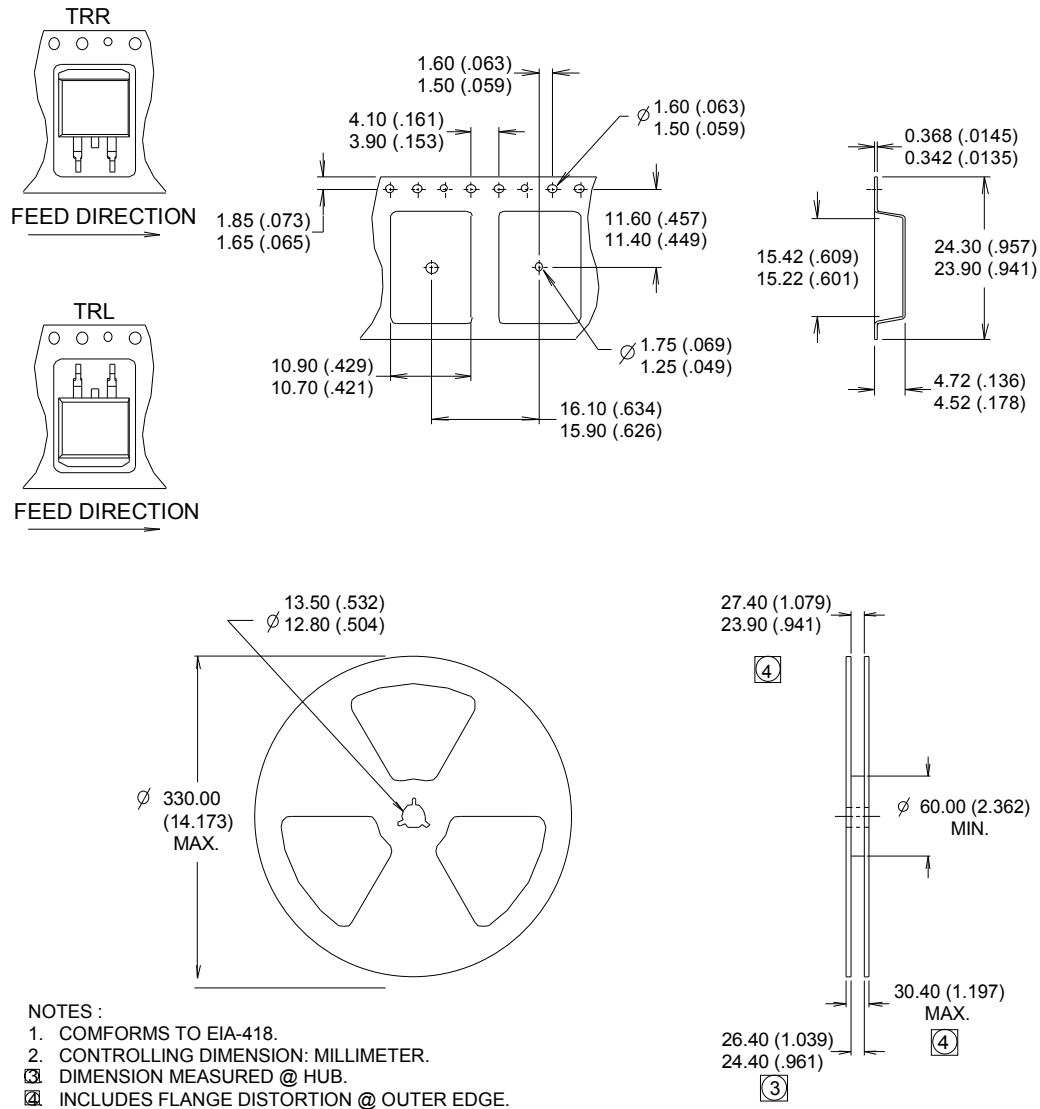
- 1.- GATE
- 2.- DRAIN
- 3.- SOURCE

IGBTs, CoPACK

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

D²Pak (TO-263AB) Part Marking Information



D²Pak (TO-263AB) Tape & Reel Information (Dimensions are shown in millimeters (inches))


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 B [†] AEC-Q101-002	
	Human Body Model	Class 2 [†] AEC-Q101-001	
	Charged Device Model	Class IV [†] AEC-Q101-005	
RoHS Compliant		Yes	

† Highest passing voltage.

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