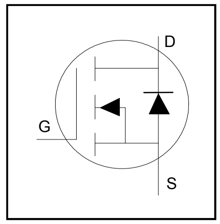
AUTOMOTIVE GRADE

AUIRFS4127

HEXFET® Power MOSFET

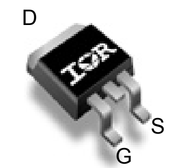
Features
- Advanced Process Technology
- Ultra Low On-Resistance
- 175°C Operating Temperature
- Fast Switching
- Repetitive Avalanche Allowed up to Tjmax
- Lead-Free, RoHS Compliant
- Automotive Qualified *



V_{DSS}		200V
$R_{DS(on)}$	typ.	18.6mΩ
	max	22mΩ
I_D		72A

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.



D^2Pak
AUIRFS4127

G	D	S
Gate	Drain	Source

Base part number	Package Type	Standard Pack		Orderable Part Number
		Form	Quantity	
AUIRFS4127	D^2-Pak	Tube	50	AUIRFS4127
		Tape and Reel Left	800	AUIRFS4127TRL

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.

	Parameter	Max.	Units
I_D @ T_C = 25°C	Continuous Drain Current, V_{GS} @ 10V	72	A
I_D @ T_C = 100°C	Continuous Drain Current, V_{GS} @ 10V	51	
I_{DM}	Pulsed Drain Current ①	300	
P_D @T_C = 25°C	Power Dissipation	375	W
	Linear Derating Factor	2.5	W/°C
V_{GS}	Gate-to-Source Voltage	± 20	V
dv/dt	Peak Diode Recovery ③	57	V/ns
E_{AS}	Single Pulse Avalanche Energy (Thermally limited) ②	250	mJ
I_{AR}	Avalanche Current ①	See Fig. 14, 15, 22a, 22b	A
E_{AR}	Repetitive Avalanche Energy ④		mJ
T_J T_{STG}	Operating Junction and Storage Temperature Range	-55 to + 175	°C
	Soldering Temperature for 10 seconds	300(1.6mm from case)	

Thermal Resistance

Symbol	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case ⑧⑨	——	0.4	°C/W
$R_{\theta JA}$	Junction-to-Ambient ⑦	——	40	

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*Qualification standards can be found at www.infineon.com

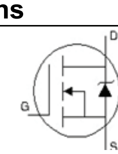
Static Electrical Characteristics @ T_J = 25°C (unless otherwise specified)

Symbol	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(BR)DSS}$	Drain-to-Source Breakdown Voltage	200	——	——	V	V_{GS} = 0V, I_D = 250μA
$\Delta V_{(BR)DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	——	0.23	——	V/°C	Reference to 25°C, I_D = 5mA①
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	——	18.6	22	mΩ	V_{GS} = 10V, I_D = 44A ④
$V_{GS(th)}$	Gate Threshold Voltage	3.0	——	5.0	V	V_{DS} = V_{GS}, I_D = 250μA
gfs	Forward Trans conductance	79	——	——	S	V_{DS} = 50V, I_D = 44A
I_{DSS}	Drain-to-Source Leakage Current	——	——	20	μA	V_{DS} = 200V, V_{GS} = 0V
		——	——	250		V_{DS} = 200V, V_{GS} = 0V, T_J = 125°C
I_{GSS}	Gate-to-Source Forward Leakage	——	——	100	nA	V_{GS} = 20V
	Gate-to-Source Reverse Leakage	——	——	-100		V_{GS} = -20V
R_G	Internal Gate Resistance	——	3.0	——	Ω	

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

Symbol	Parameter	Min.	Typ.	Max.	Units	Conditions
Q_g	Total Gate Charge	——	100	150	nC	I_D = 44A
Q_{gs}	Gate-to-Source Charge	——	30	——		V_{DS} = 100V
Q_{gd}	Gate-to-Drain ("Miller") Charge	——	31	——		V_{GS} = 10V ④
Q_{sync}	Total Gate Charge Sync. (Q_g - Q_{gd})	——	69	——		
$t_{d(on)}$	Turn-On Delay Time	——	17	——	ns	V_{DD} = 130V
t_r	Rise Time	——	18	——		I_D = 44A
$t_{d(off)}$	Turn-Off Delay Time	——	56	——		R_G = 2.7Ω
t_f	Fall Time	——	22	——		V_{GS} = 10V ④
C_{iss}	Input Capacitance	——	5380	——	pF	V_{GS} = 0V
C_{oss}	Output Capacitance	——	410	——		V_{DS} = 50V
C_{rss}	Reverse Transfer Capacitance	——	86	——		f = 1.0 MHz (See Fig. 5)
C_{oss} eff. (ER)	Effective Output Capacitance (Energy Related)	——	360	——		V_{GS} = 0V, V_{DS} = 0V to 160V ⑥
C_{oss} eff. (TR)	Effective Output Capacitance (Time Related)	——	590	——		V_{GS} = 0V, V_{DS} = 0V to 160V ⑤

Diode Characteristics

Symbol	Parameter	Min.	Typ.	Max.	Units	Conditions	
I_S	Continuous Source Current (Body Diode)	——	——	72	A	MOSFET symbol showing the integral reverse p-n junction diode. 	
I_{SM}	Pulsed Source Current (Body Diode) ①	——	——	300			
V_{SD}	Diode Forward Voltage	——	——	1.3	V	T_J = 25°C, I_S = 44A, V_{GS} = 0V ④	
t_{rr}	Reverse Recovery Time	——	136	——	ns	T_J = 25°C	V_R = 100V,
		——	139	——		T_J = 125°C	I_F = 44A
Q_{rr}	Reverse Recovery Charge	——	458	——	nC	T_J = 25°C	di/dt = 100A/μs④
		——	688	——		T_J = 125°C	
I_{RRM}	Reverse Recovery Current	——	8.3	——	A	T_J = 25°C	

Notes:

① Repetitive rating; pulse width limited by max. junction temperature.
② Limited by T_{Jmax}, starting T_J = 25°C, L = 0.26mH, R_G = 25Ω, I_{AS} = 44A, V_{GS} =10V. Part not recommended for use above this value.
③ $I_{SD} \leq$ 44A, di/dt $\leq$ 760A/μs, $V_{DD} \leq V_{(BR)DSS}$, $T_J \leq$ 175°C.
④ Pulse width $\leq$ 400μs; 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.
⑨ $R_{\theta JC}$ value shown is at time zero.

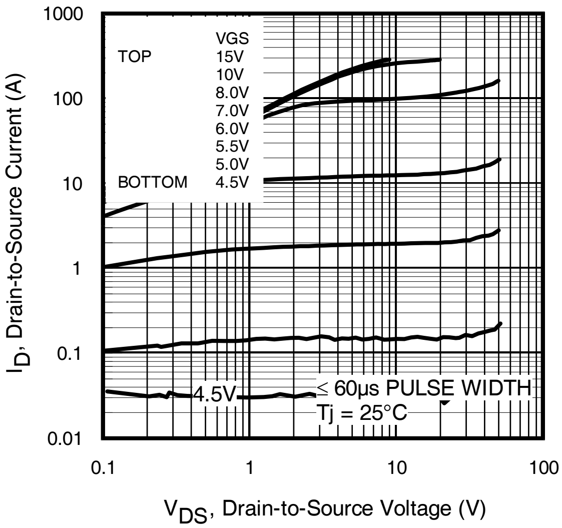


Fig 1. Typical Output Characteristics

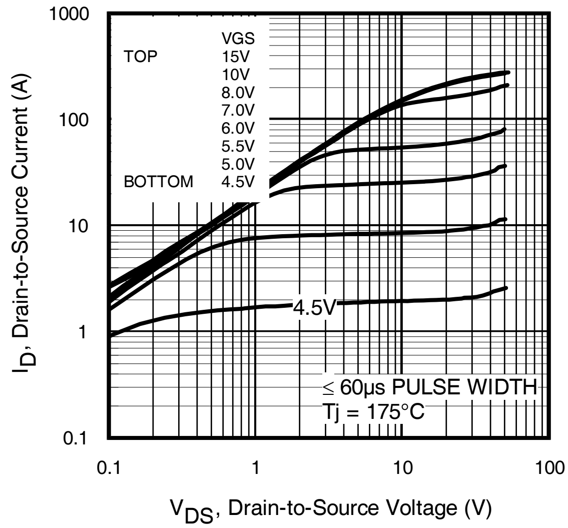


Fig 2. Typical Output Characteristics

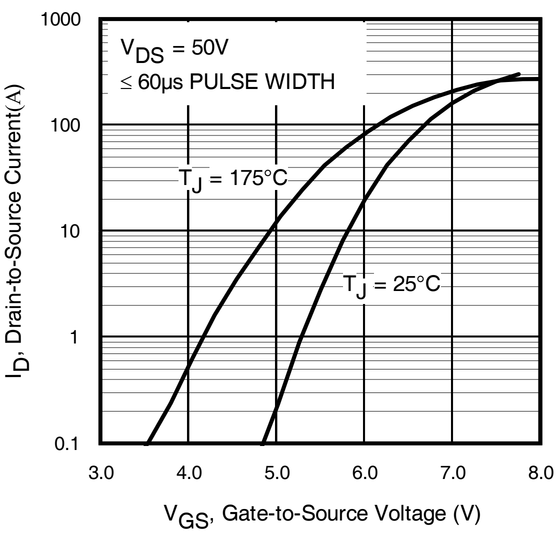


Fig 3. Typical Transfer Characteristics

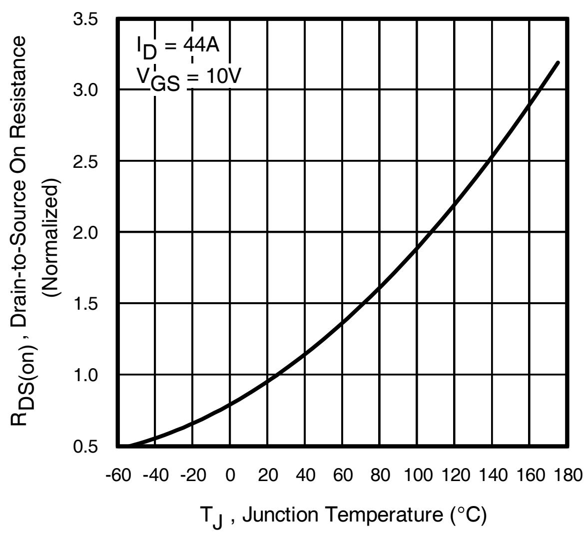


Fig 4. Normalized On-Resistance vs. Temperature

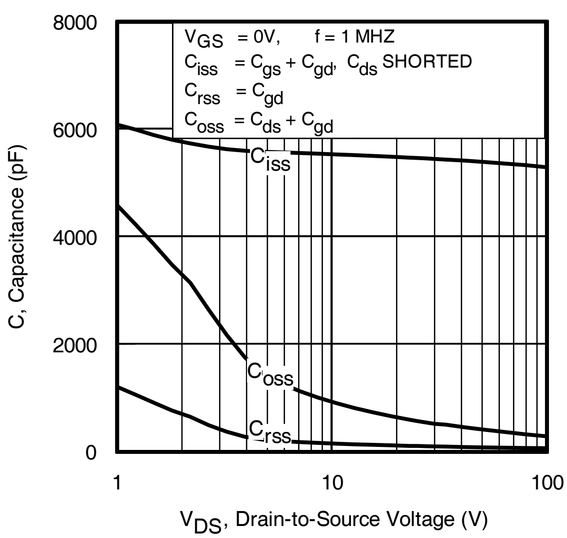


Fig 5. Typical Capacitance vs. Drain-to-Source Voltage

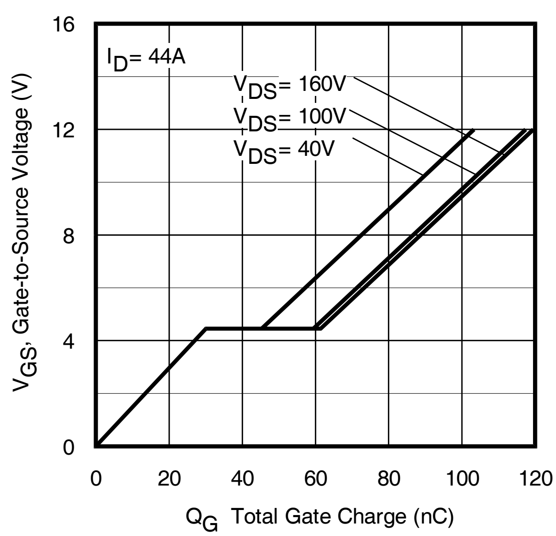


Fig 6. Typical Gate Charge vs. Gate-to-Source Voltage

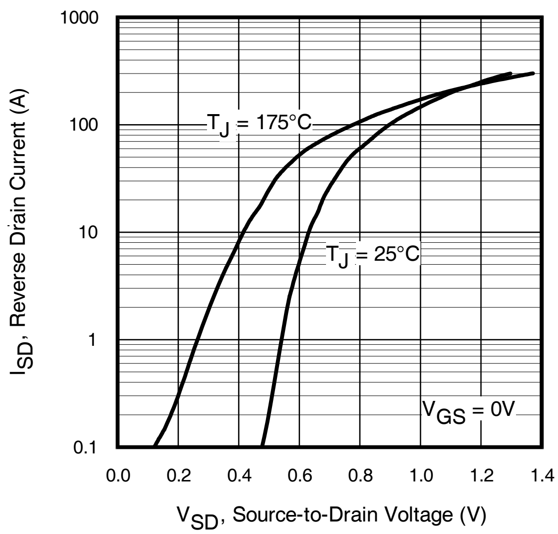


Fig 7. Typical Source-Drain Diode Forward Voltage

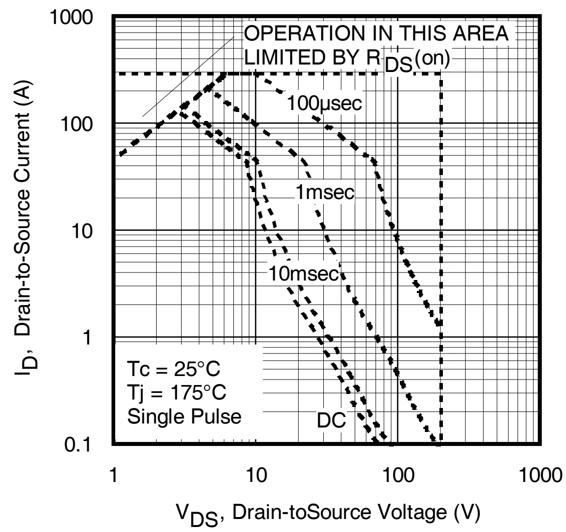


Fig 8. Maximum Safe Operating Area

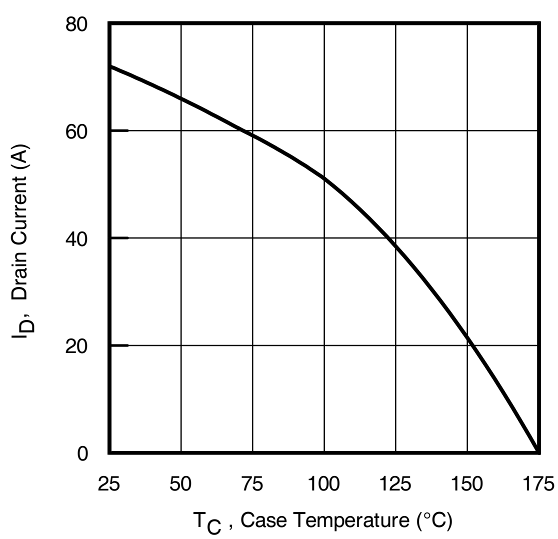


Fig 9. Maximum Drain Current vs. Case Temperature

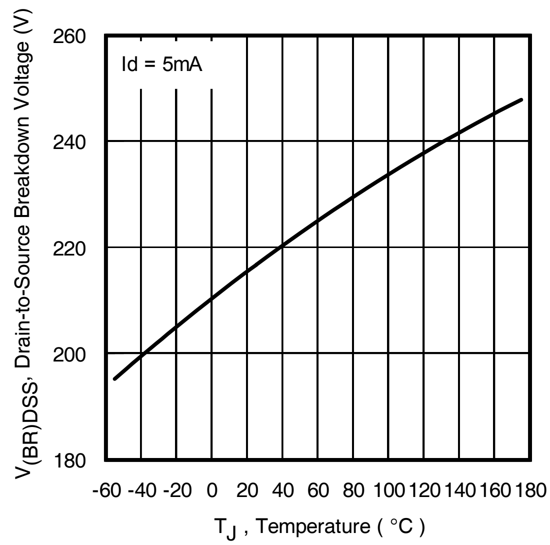


Fig 10. Drain-to-Source Breakdown Voltage

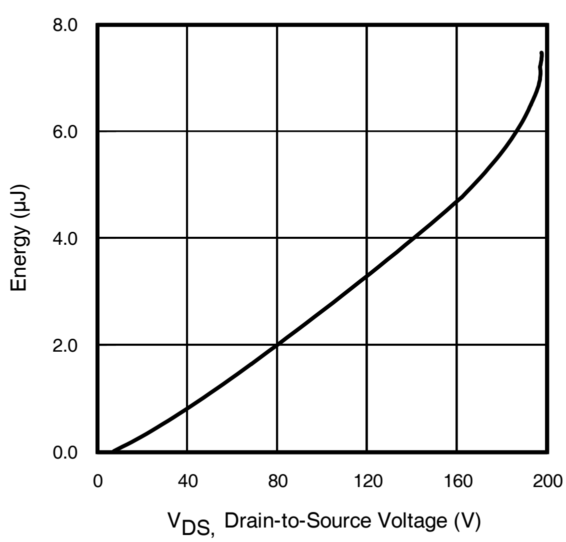


Fig 11. Typical C_{oss} Stored Energy

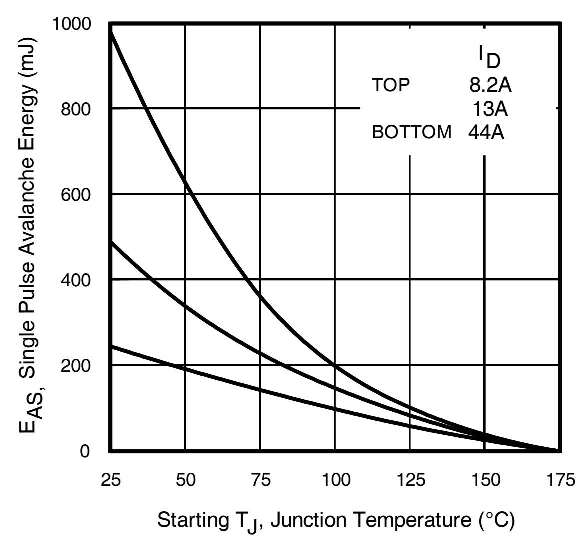


Fig 12. Maximum Avalanche Energy vs. Drain Current

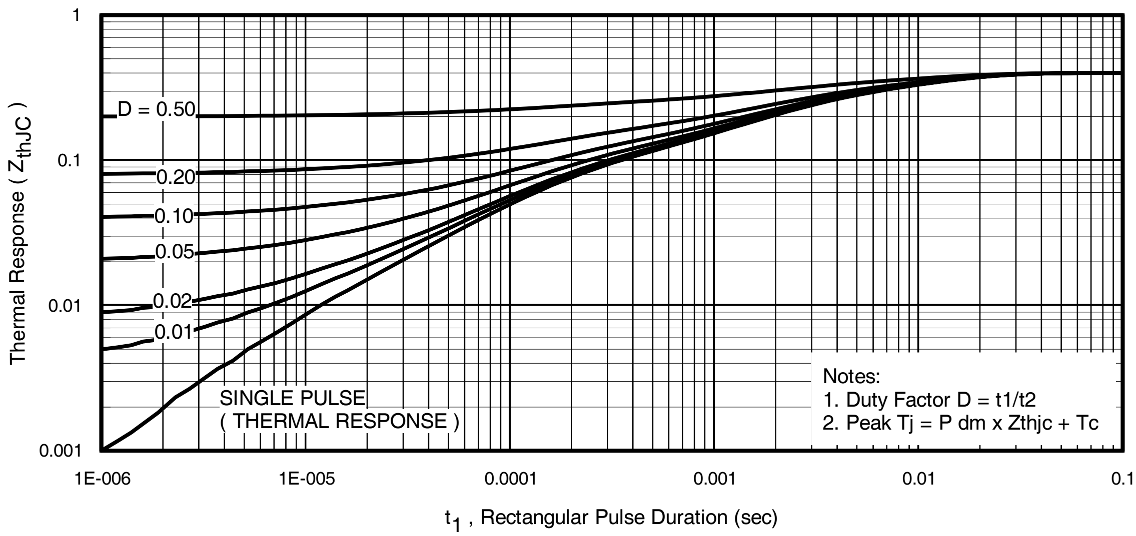


Fig 13. Maximum Effective Transient Thermal Impedance, Junction-to-Case

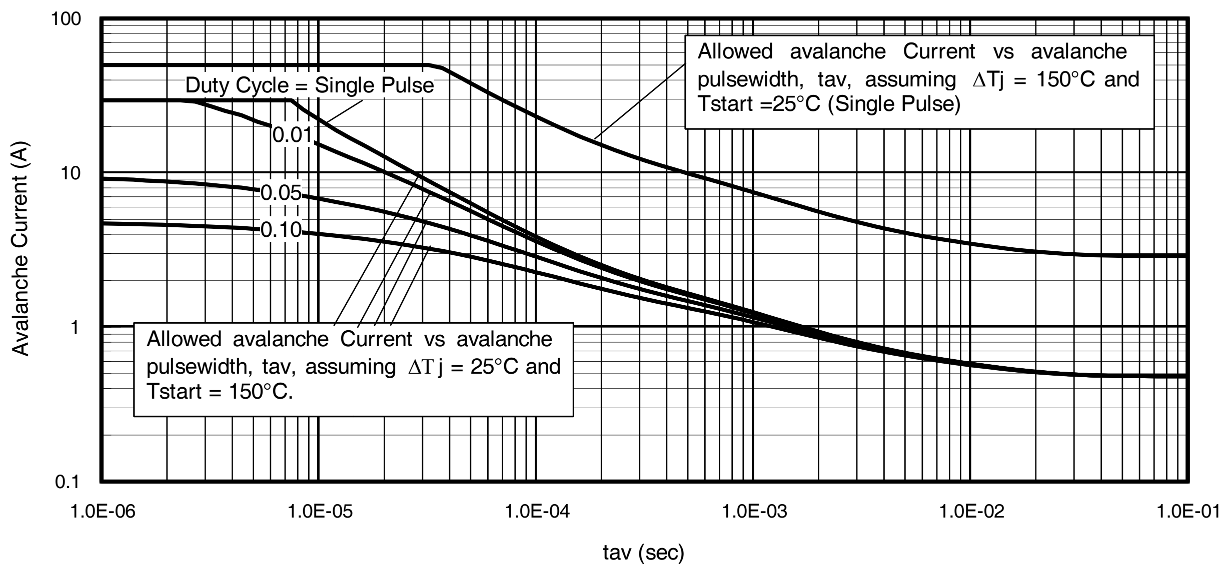


Fig 14. Avalanche Current vs. Pulse Width

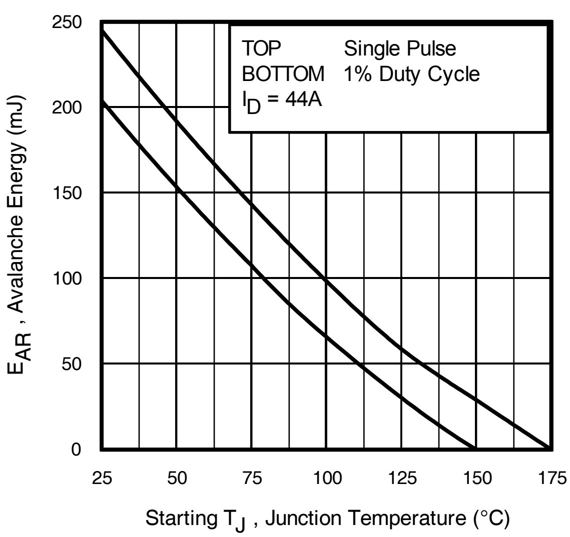


Fig 15. Maximum Avalanche Energy vs. Temperature

Notes on Repetitive Avalanche Curves , Figures 14, 15:
(For further info, see AN-1005 at www.irf.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 asT_{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 14, 15).
t_{av} = Average time in avalanche.
D = Duty cycle in avalanche = tav ·f
$Z_{thJC}(D, t_{av})$ = Transient thermal resistance, see Figures 14)
PD (ave) = 1/2 ($1.3 \cdot BV \cdot I_{av}$) = $\Delta T / Z_{thJC}$
$I_{av} = 2\Delta T / [1.3 \cdot BV \cdot Z_{th}]$
$E_{AS\ (AR)} = P_{D\ (ave)} \cdot t_{av}$

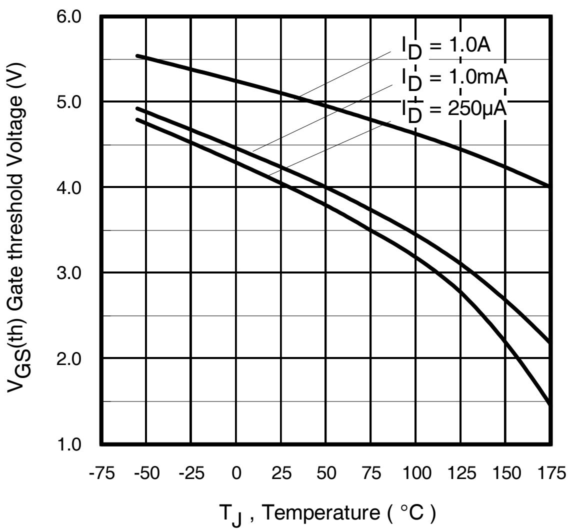


Fig 16. Threshold Voltage vs. Temperature

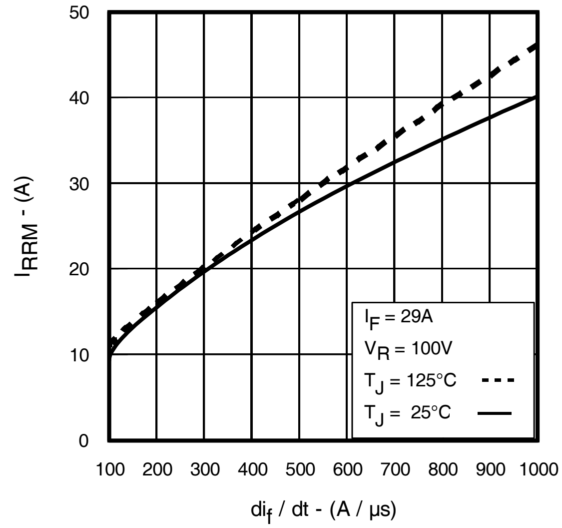


Fig 17. Typical Recovery Current vs. dif/dt

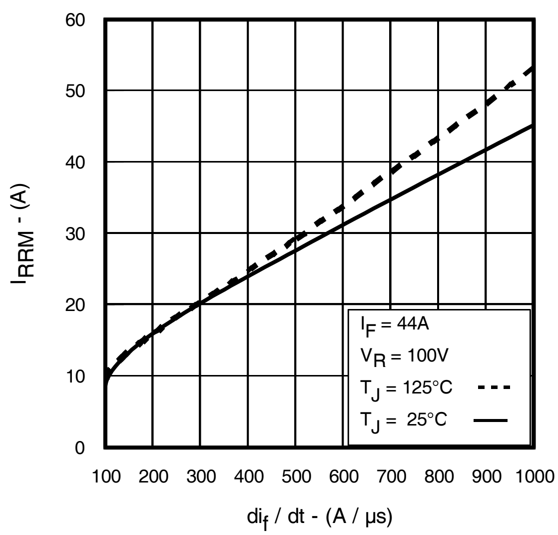


Fig 18. Typical Recovery Current vs. dif/dt

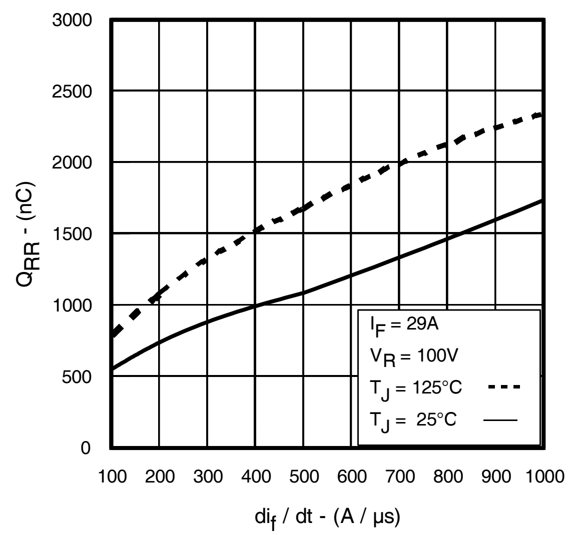


Fig 19. Typical Stored Charge vs. dif/dt

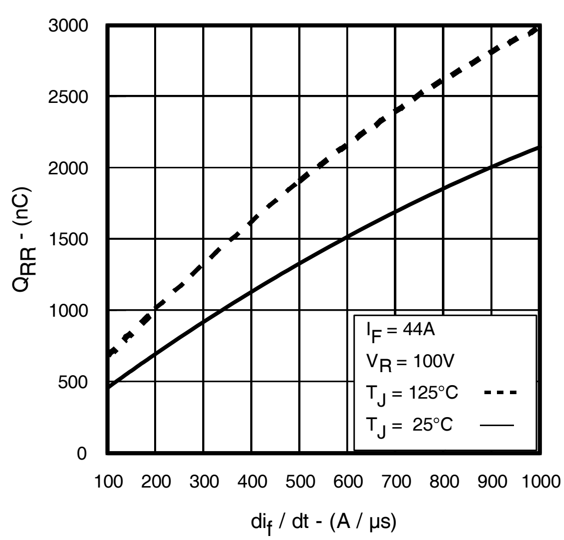


Fig 20. Typical Stored Charge vs. dif/dt

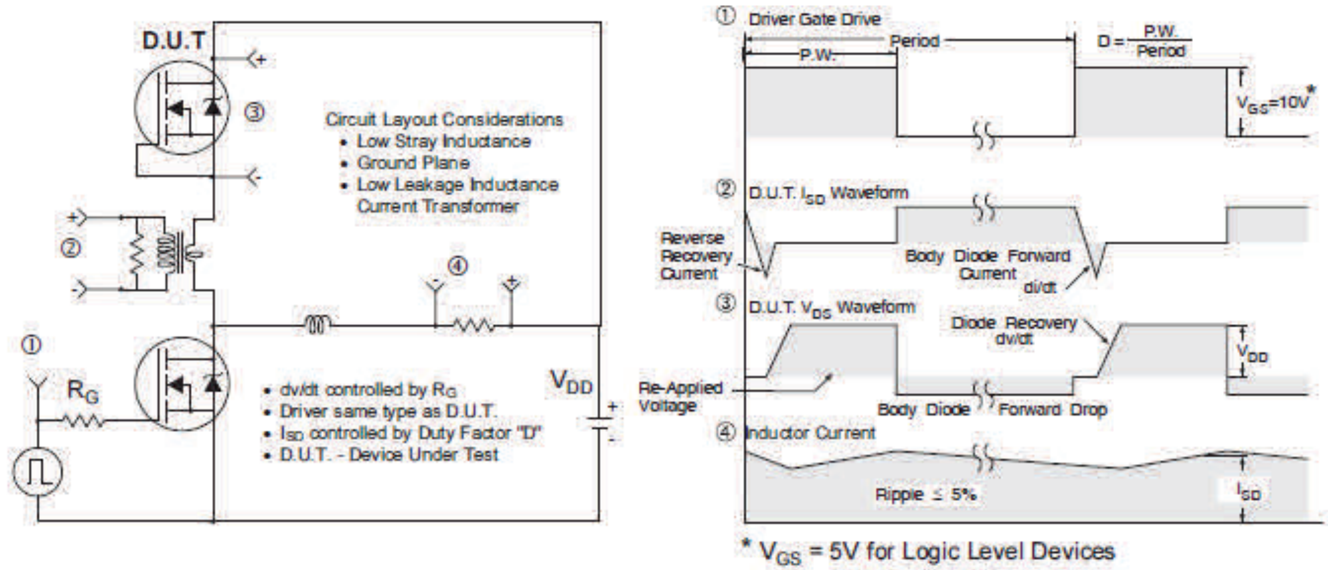


Fig 21. Peak Diode Recovery dv/dt Test Circuit for N-Channel HEXFET® Power MOSFETs

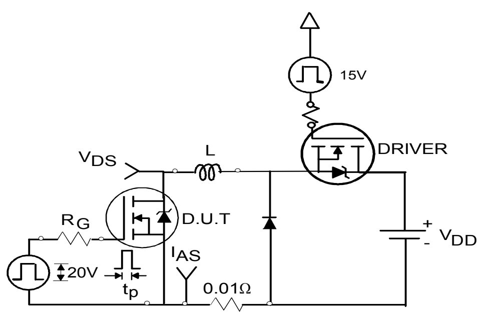


Fig 22a. Unclamped Inductive Test Circuit

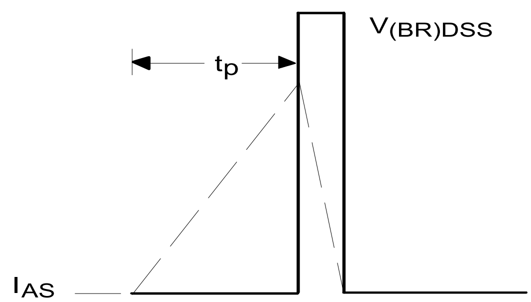


Fig 22b. Unclamped Inductive Waveforms

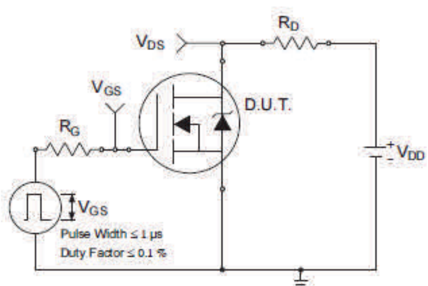


Fig 23a. Switching Time Test Circuit

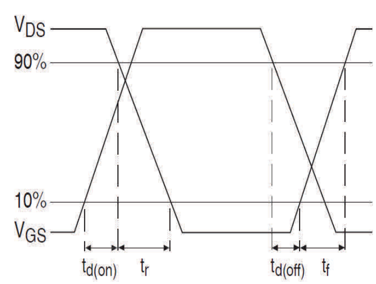


Fig 23b. Switching Time Waveforms

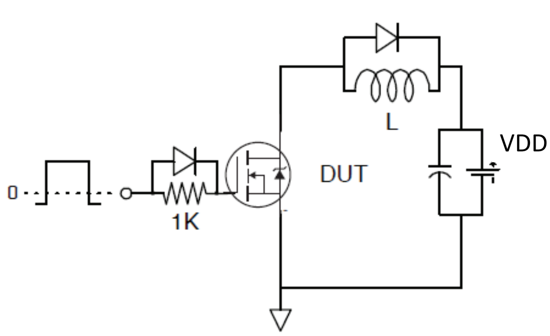


Fig 24a. Gate Charge Test Circuit

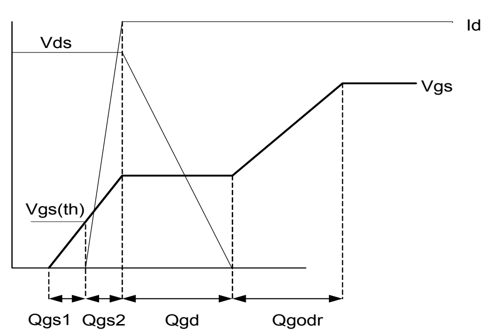
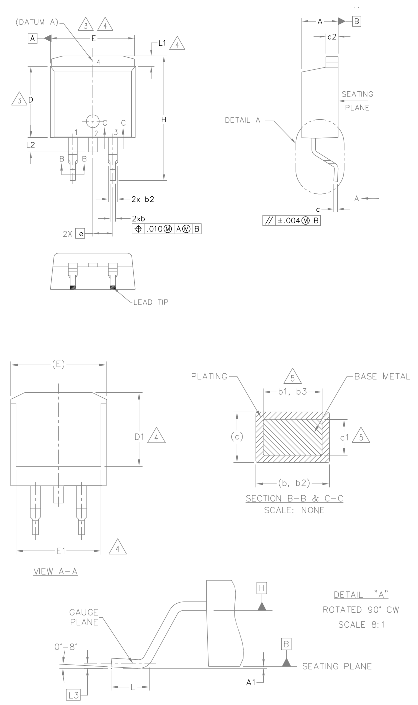


Fig 24b. Gate Charge Waveform

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 [.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		

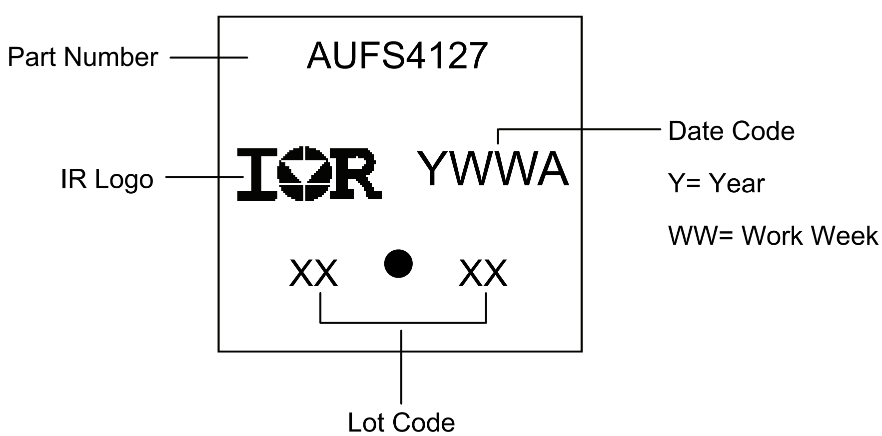
LEAD ASSIGNMENTS

DIODES
1.– ANODE (TWO DIE) / OPEN (ONE DIE)
2, 4.– CATHODE
3.– ANODE

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

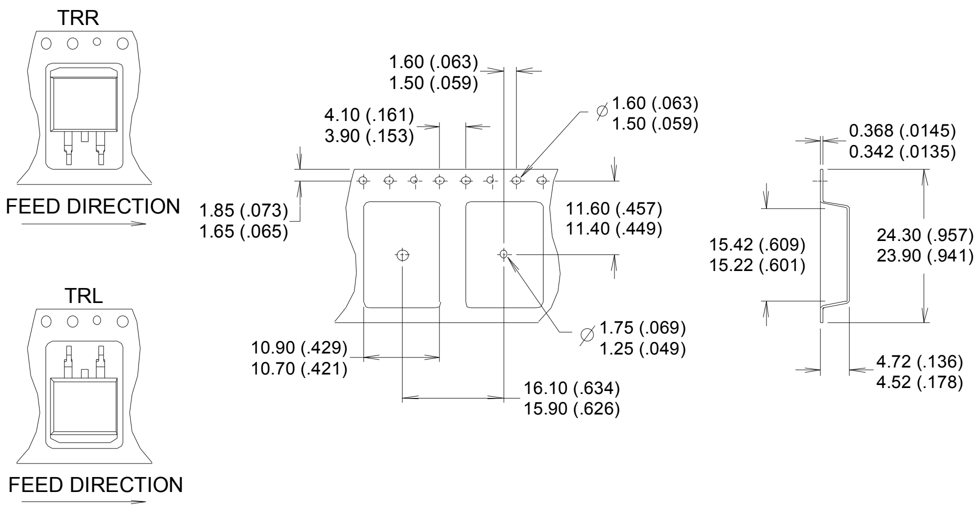
IGBTs, CoPACK
1.– GATE
2, 4.– COLLECTOR
3.– EMITTER

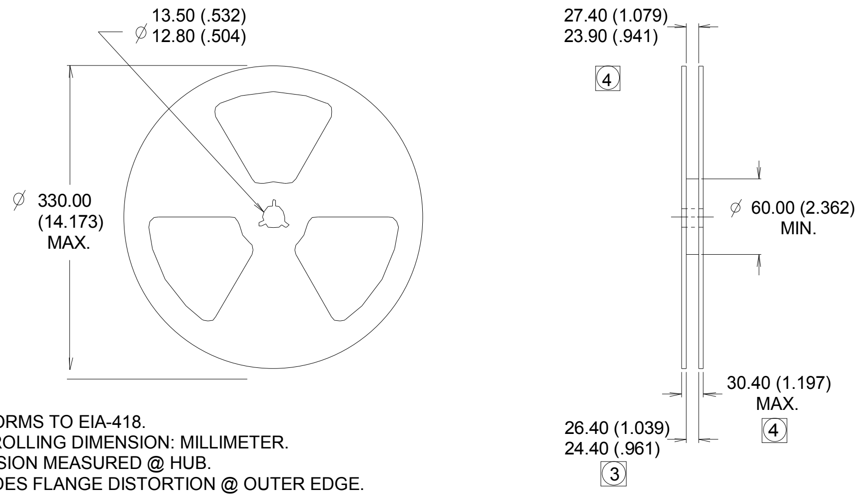
D²Pak (TO-263AB) Part Marking Information



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

D²Pak (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.

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^2-Pak	MSL1
ESD	Human Body Model	Class H2 (+/- 4000V)† AEC-Q101-001	
	Charged Device Model	Class C5 (+/- 2000V)† AEC-Q101-005	
RoHS Compliant		Yes	

† Highest passing voltage.

Revision History

Date	Comments
10/27/2015	• Updated datasheet with corporate template • Corrected ordering table on page 1.
03/28/2017	• Removed TO-262 Pak "AUIRFSL4127" this devices TO-262 Pak was never released and this part was erroneously added to the datasheet. –All pages

IMPORTANT NOTICE

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