

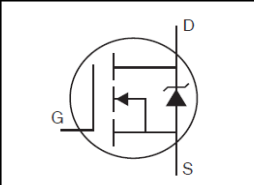
Features

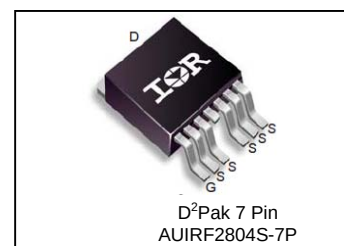
- Advanced Process Technology
- Ultra Low On-Resistance
- 175°C Operating Temperature
- Fast Switching
- Repetitive Avalanche Allowed up to T_{jmax}
- Lead-Free, RoHS Compliant
- Automotive Qualified *

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.

HEXFET® Power MOSFET

	V_{DS}	40V
	$R_{DS(on)}$ max.	1.6mΩ
	I_D (Silicon Limited)	320A①
	I_D (Package Limited)	240A



G	D	S
Gate	Drain	Source

Base Part Number	Package Type	Standard Pack		Complete Part Number
		Form	Quantity	
AUIRF2804S-7P	D²Pak-7PIN	Tube	50	AUIRF2804S-7P
		Tape and Reel Left	800	AUIRF2804S-7TRL

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} @ 10V (Silicon Limited)	320①	A
I_D @ $T_C = 100^\circ\text{C}$	Continuous Drain Current, V_{GS} @ 10V (Silicon Limited)	230	
I_D @ $T_C = 25^\circ\text{C}$	Continuous Drain Current, V_{GS} @ 10V (Package Limited)	240	
I_{DM}	Pulsed Drain Current ②	1360	
P_D @ $T_C = 25^\circ\text{C}$	Maximum Power Dissipation	330	W
	Linear Derating Factor	2.2	W/°C
V_{GS}	Gate-to-Source Voltage	± 20	V
E_{AS}	Single Pulse Avalanche Energy (Thermally Limited) ③	630	mJ
E_{AS} (tested)	Single Pulse Avalanche Energy Tested Value ⑦	1050	
I_{AR}	Avalanche Current ②	See Fig.12a,12b,15,16	A
E_{AR}	Repetitive Avalanche Energy ⑥		mJ
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 ⑨	—	0.50	°C/W
$R_{\theta CS}$	Case-to-Sink, Flat, Greased Surface	0.50	—	
$R_{\theta JA}$	Junction-to-Ambient	—	62	
$R_{\theta JA}$	Junction-to-Ambient (PCB Mount, steady state) ⑧	—	40	

HEXFET® is a registered trademark of Infineon.

*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	40	—	—	V	V _{GS} = 0V, I _D = 250μA
ΔV _{(BR)DSS} /ΔT _J	Breakdown Voltage Temp. Coefficient	—	0.028	—	V/°C	Reference to 25°C, I _D = 1.0mA
R _{DS(on)} SMD	Static Drain-to-Source On-Resistance	—	1.2	1.6	mΩ	V _{GS} = 10V, I _D = 160A ④
V _{GS(th)}	Gate Threshold Voltage	2.0	—	4.0	V	V _{DS} = V _{GS} , I _D = 250μA
g _{fs}	Forward Transconductance	220	—	—	S	V _{DS} = 10V, I _D = 160A
I _{DSS}	Drain-to-Source Leakage Current	—	—	20	μA	V _{DS} = 40V, V _{GS} = 0V
		—	—	250	μA	V _{DS} = 40V, V _{GS} = 0V, T _J = 125°C
I _{GSS}	Gate-to-Source Forward Leakage	—	—	200	nA	V _{GS} = 20V
	Gate-to-Source Reverse Leakage	—	—	-200	nA	V _{GS} = -20V

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

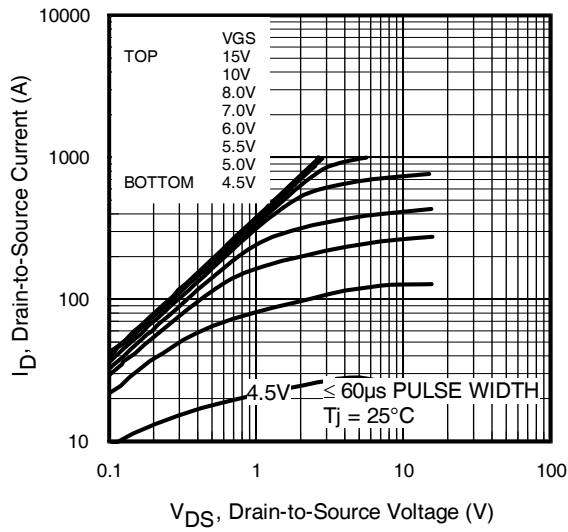
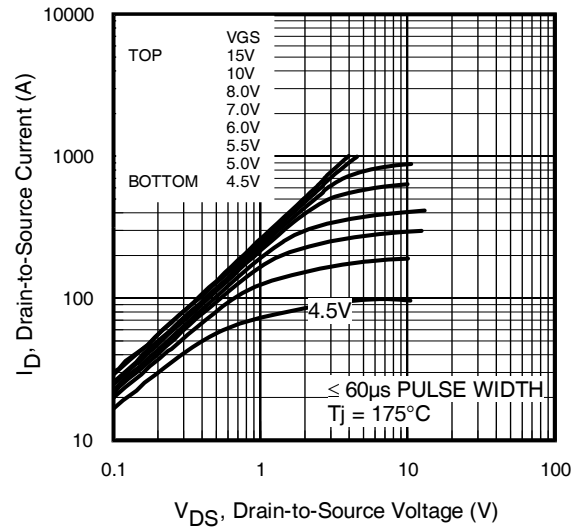
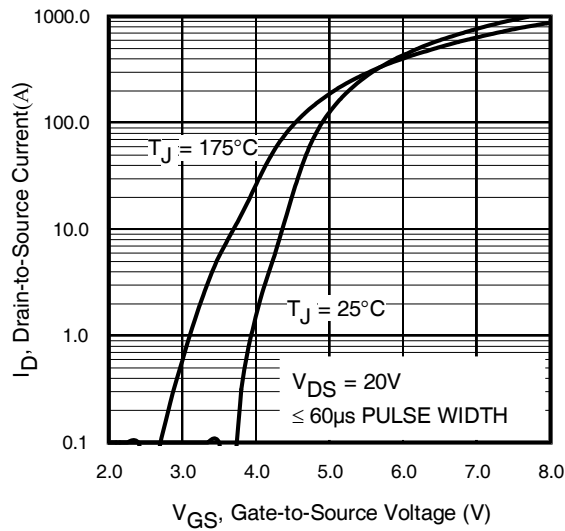
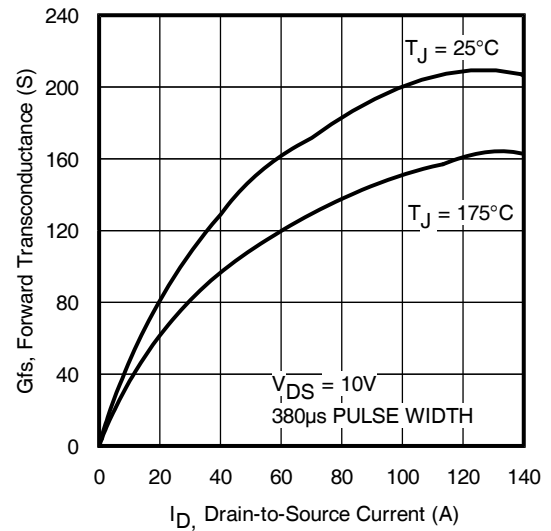
Symbol	Parameter	Min.	Typ.	Max.	Units	Conditions
Q _g	Total Gate Charge	—	170	260	nC	I _D = 160A
Q _{gs}	Gate-to-Source Charge	—	63	—		V _{DS} = 32V
Q _{gd}	Gate-to-Drain ("Miller") Charge	—	71	—		V _{GS} = 10V ④
t _{d(on)}	Turn-On Delay Time	—	17	—	ns	V _{DD} = 20V
t _r	Rise Time	—	150	—		I _D = 160A
t _{d(off)}	Turn-Off Delay Time	—	110	—		R _G = 2.6Ω
t _f	Fall Time	—	100	—		V _{GS} = 10V ④
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	—	6930	—	pF	V _{GS} = 0V
C _{oss}	Output Capacitance	—	1750	—		V _{DS} = 25V
C _{rss}	Reverse Transfer Capacitance	—	970	—		f = 1.0 MHz, See Fig. 5
C _{oss}	Output Capacitance	—	5740	—		V _{GS} = 0V, V _{DS} = 1.0V, f = 1.0MHz
C _{oss}	Output Capacitance	—	1570	—		V _{GS} = 0V, V _{DS} = 32V, f = 1.0MHz
C _{oss eff.}	Effective Output Capacitance ④	—	2340	—		V _{GS} = 0V, V _{DS} = 0V to 32V

Diode Characteristics

Symbol	Parameter	Min.	Typ.	Max.	Units	Conditions
I _S	Continuous Source Current (Body Diode)	—	—	320①	A	MOSFET symbol showing the integral reverse p-n junction diode.
I _{SM}	Pulsed Source Current (Body Diode) ②	—	—	1360		
V _{SD}	Diode Forward Voltage	—	—	1.3	V	T _J = 25°C, I _S = 160A, V _{GS} = 0V ④
t _{rr}	Reverse Recovery Time	—	43	65	ns	T _J = 25°C, I _F = 160A, V _{DD} = 20V
Q _{rr}	Reverse Recovery Charge	—	48	72	nC	di/dt = 100A/μs ④
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. Package limitation current is 240A. Note that current limitations arising from heating of the device leads may occur with some lead mounting arrangements. (Refer to AN-1140)
- ② Repetitive rating; pulse width limited by max. junction temperature. (See fig. 11).
- ③ Limited by T_{Jmax}, starting T_J = 25°C, L = 0.049mH, R_G = 25Ω, I_{AS} = 160A, V_{GS} = 10V. Part not recommended for use above this value.
- ④ Pulse width ≤ 1.0ms; duty cycle ≤ 2%.
- ⑤ C_{oss eff.} 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 Limited by T_{Jmax}, see Fig.12a, 12b, 15, 16 for typical repetitive avalanche performance.
- ⑦ This value determined from sample failure population, starting T_J = 25°C, L = 0.049mH, R_G = 25Ω, I_{AS} = 160A, V_{GS} = 10V.
- ⑧ This is applied to D2Pak, 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 of approximately 90°C.


Fig. 1 Typical Output Characteristics

Fig. 2 Typical Output Characteristics

Fig. 3 Typical Transfer Characteristics

Fig. 4 Typical Forward Trans conductance vs. Drain Current

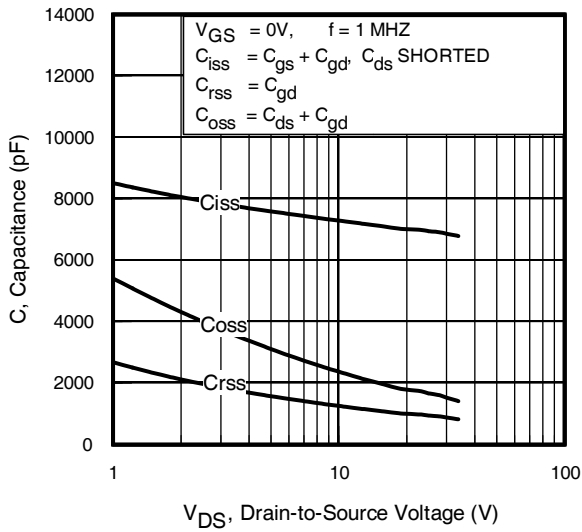


Fig 5. Typical Capacitance vs. Drain-to-Source Voltage

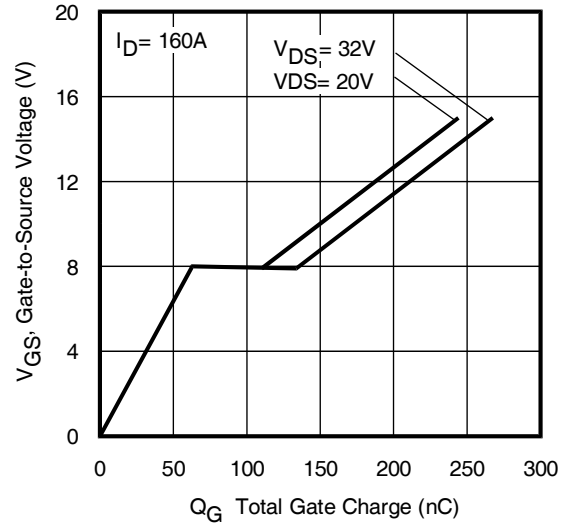


Fig 6. Typical Gate Charge vs. Gate-to-Source Voltage

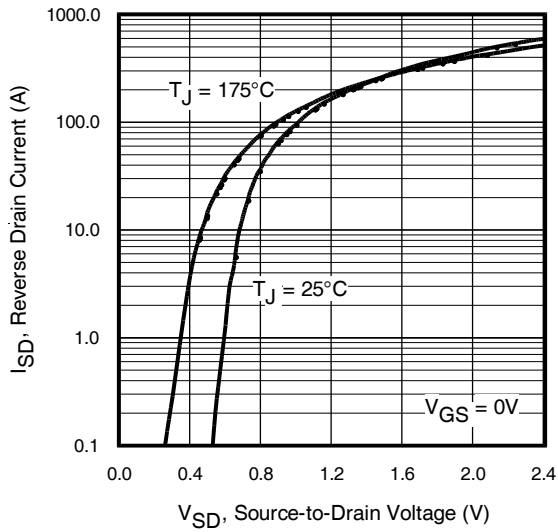


Fig. 7 Typical Source-to-Drain Diode Forward Voltage

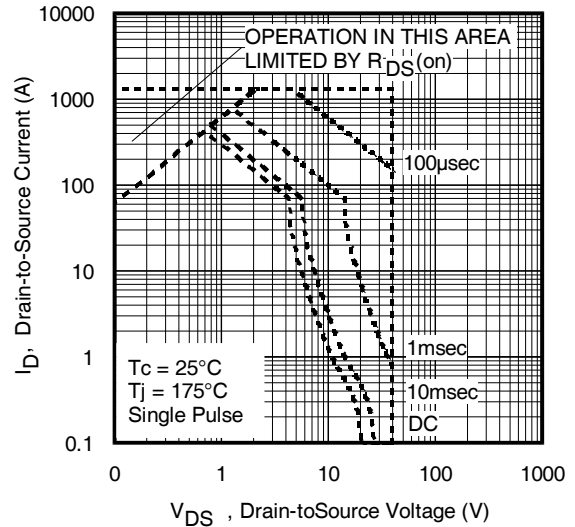


Fig 8. Maximum Safe Operating Area

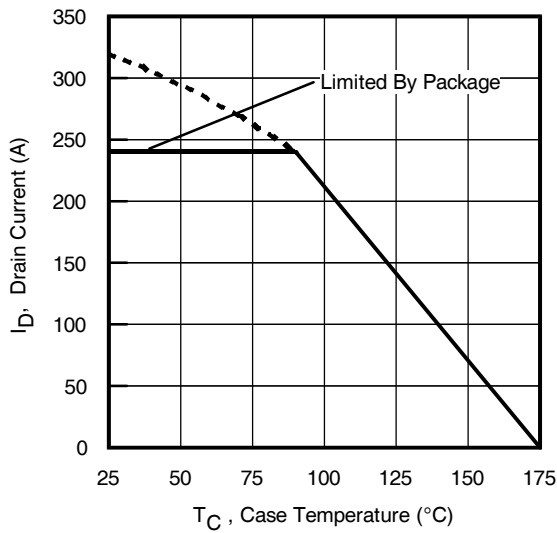


Fig 9. Maximum Drain Current vs. Case Temperature

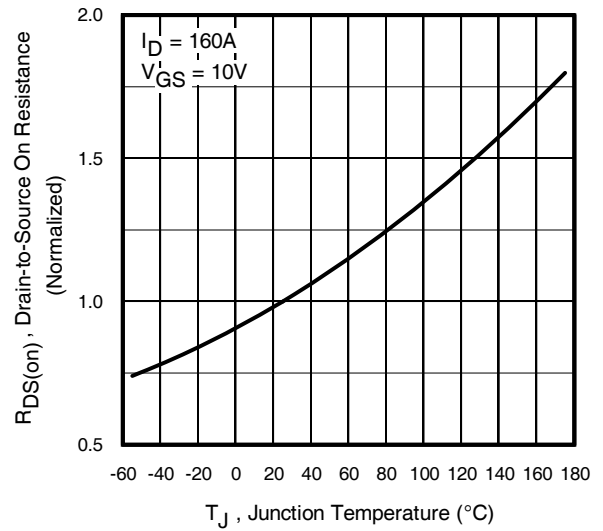


Fig 10. Normalized On-Resistance vs. Temperature

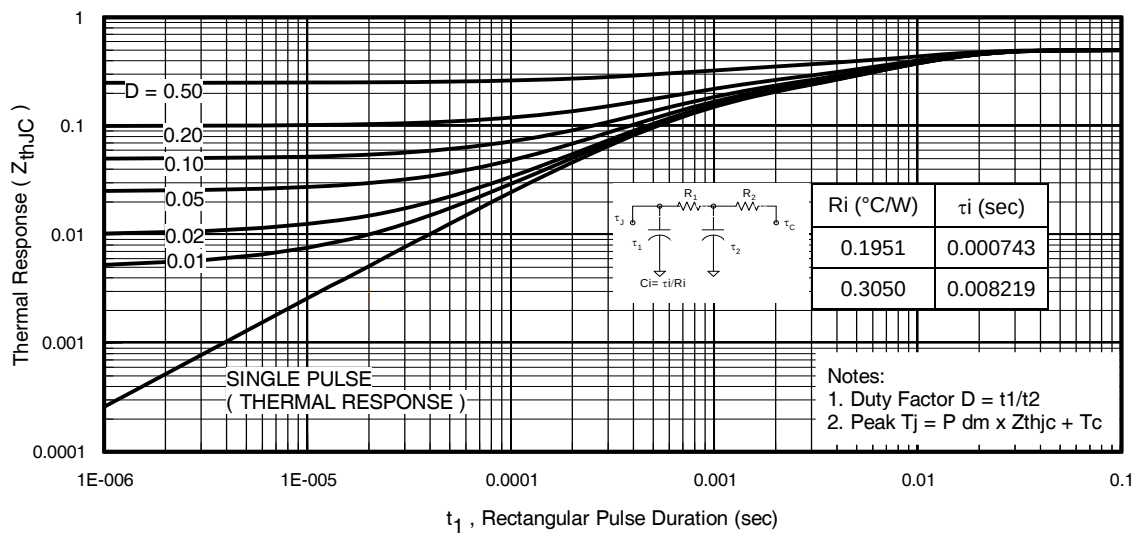


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Case

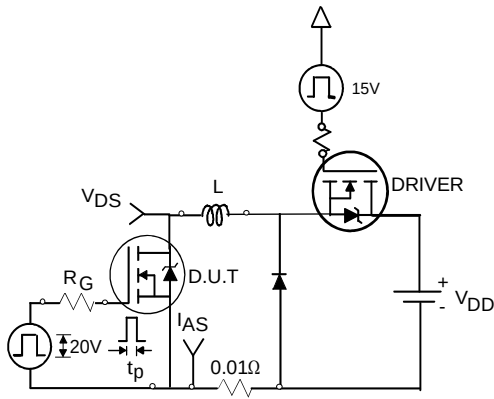


Fig 12a. Unclamped Inductive Test Circuit

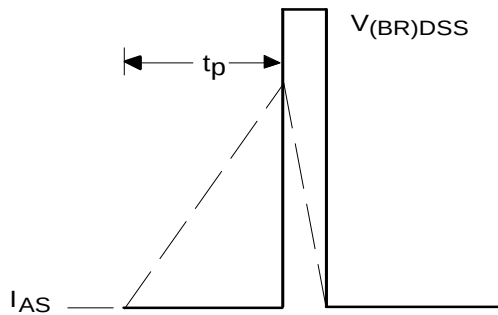


Fig 12b. Unclamped Inductive Waveforms

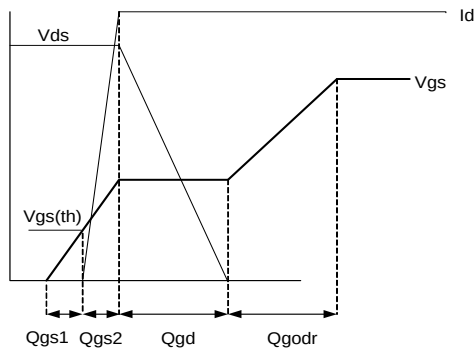


Fig 13a. Basic Gate Charge Waveform

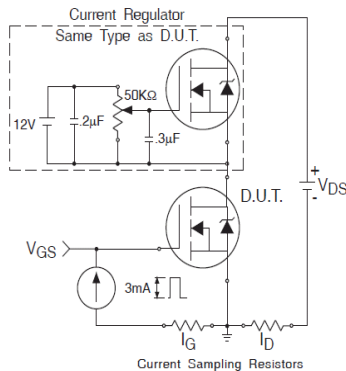


Fig 13b. Gate Charge Test Circuit

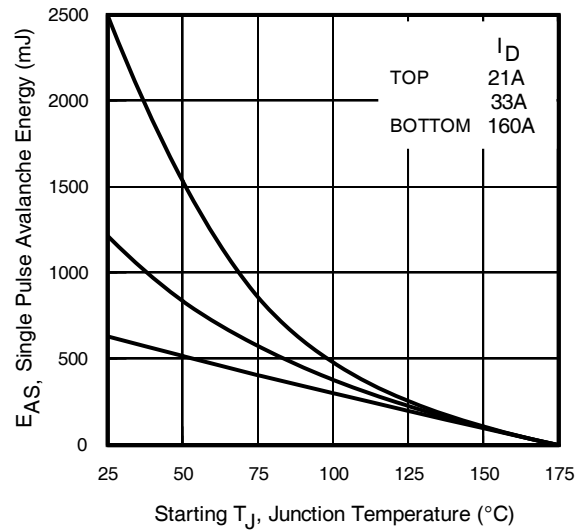


Fig 12c. Maximum Avalanche Energy vs. Drain Current

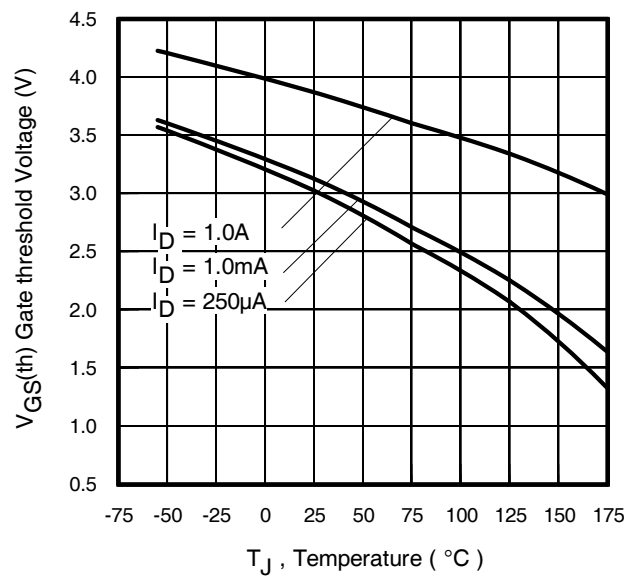


Fig 14. Threshold Voltage vs. Temperature

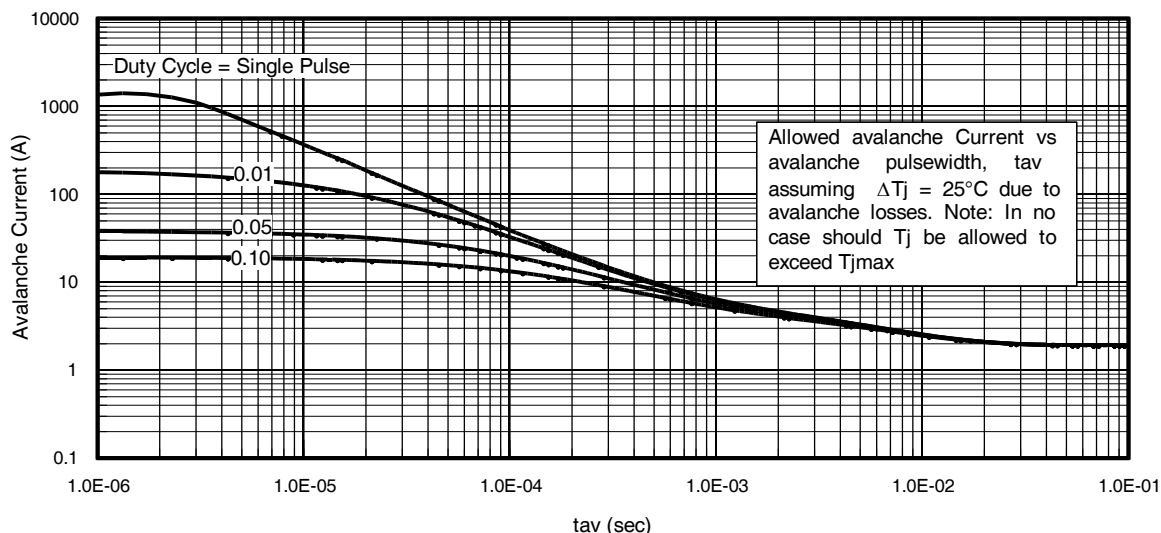


Fig 15. Typical Avalanche Current vs. Pulse width

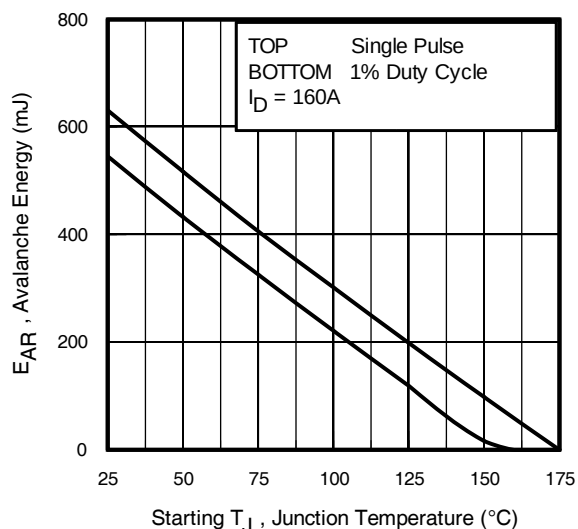


Fig 16. Maximum Avalanche Energy vs. Temperature

Notes on Repetitive Avalanche Curves , Figures 15, 16:
(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 as T_{jmax} is not exceeded.
3. Equation below based on circuit and waveforms shown in Figures 12a, 12b.
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 15, 16).
 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 11)

$$P_{D(ave)} = \frac{1}{2} (1.3 \cdot BV \cdot I_{av}) = \frac{\Delta T}{Z_{thJC}}$$

$$I_{av} = \frac{2 \Delta T}{1.3 \cdot BV \cdot Z_{thJC}}$$

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

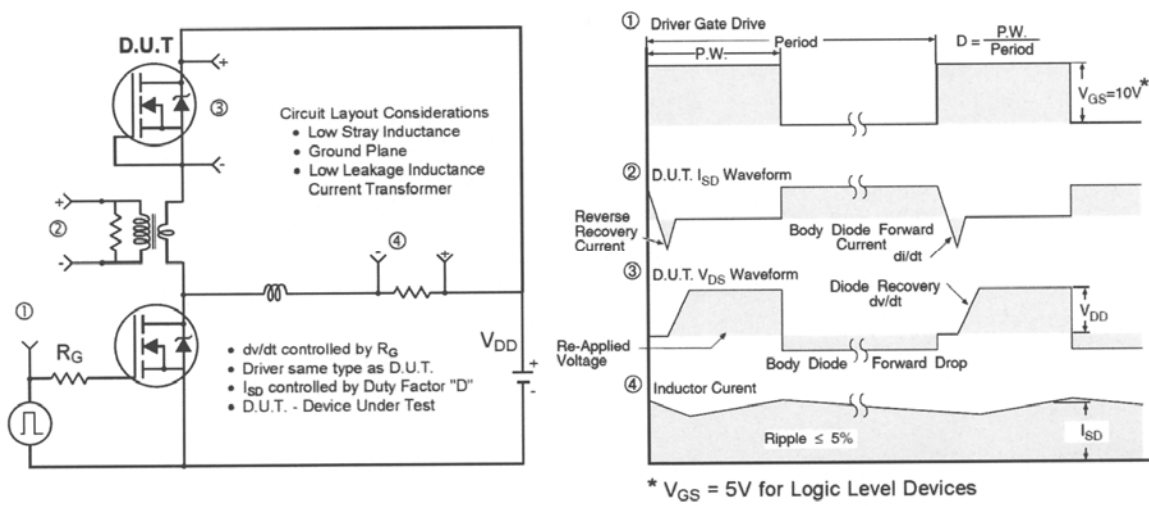


Fig 17. Peak Diode Recovery dv/dt Test Circuit for N-Channel HEXFET® Power MOSFETs

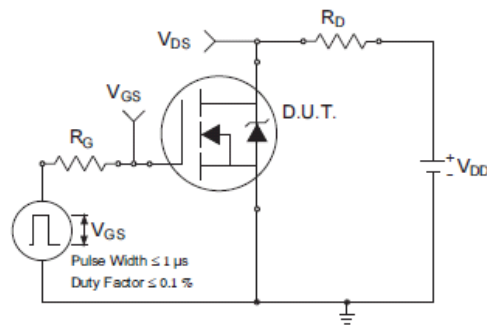


Fig 18a. Switching Time Test Circuit

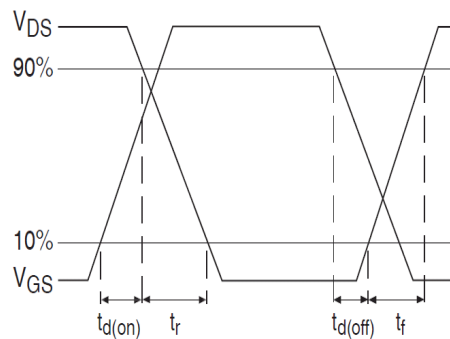
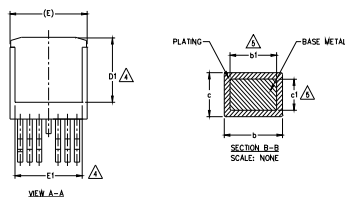
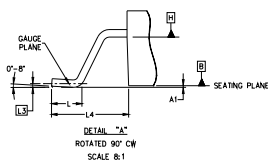
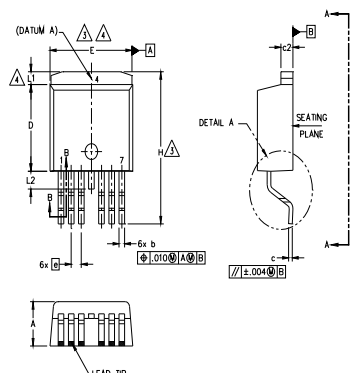


Fig 18b. Switching Time Waveforms

D²Pak - 7 Pin Package Outline

Dimensions are shown in millimeters (inches)

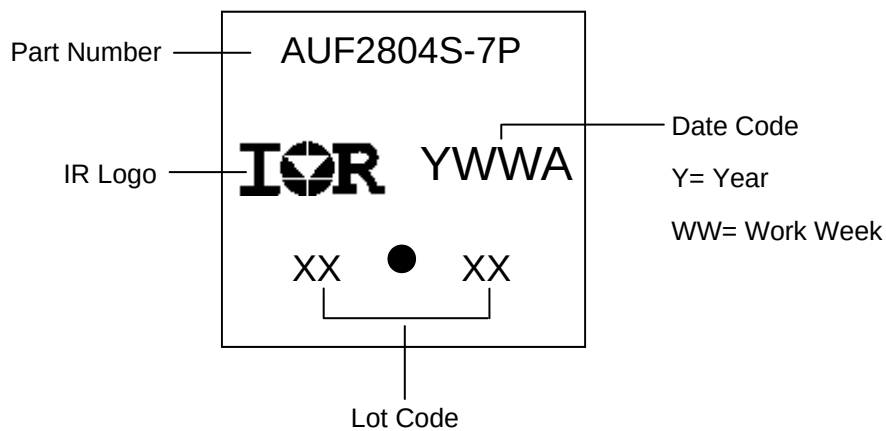


SYMBOL	DIMENSIONS				NOTES
	MILLIMETERS		INCHES		
	MIN.	MAX.	MIN.	MAX.	
A	4.06	4.83	.160	.190	5
A1	—	0.254	—	.010	
b	0.51	0.99	.020	.036	
b1	0.51	0.89	.020	.032	
c	0.38	0.74	.015	.029	
c1	0.38	0.58	.015	.023	5
c2	1.14	1.65	.045	.065	3
D	8.38	9.65	.330	.380	
D1	6.86	—	.270	—	4
E	9.65	10.67	.380	.420	3,4
E1	6.22	—	.245	—	4
e	1.27 BSC		.050 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		4
L4	4.78	5.28	.188	.208	

NOTES:

1. DIMENSIONING AND TOLERANCING AS 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 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-263CB.

D²Pak - 7 Pin Part Marking Information



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

D2Pak - 7 Pin Tape and Reel

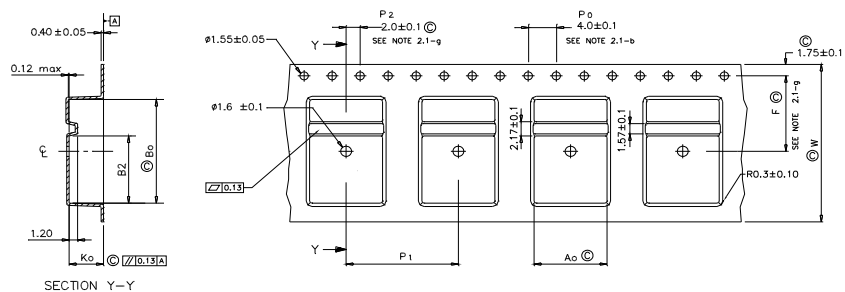
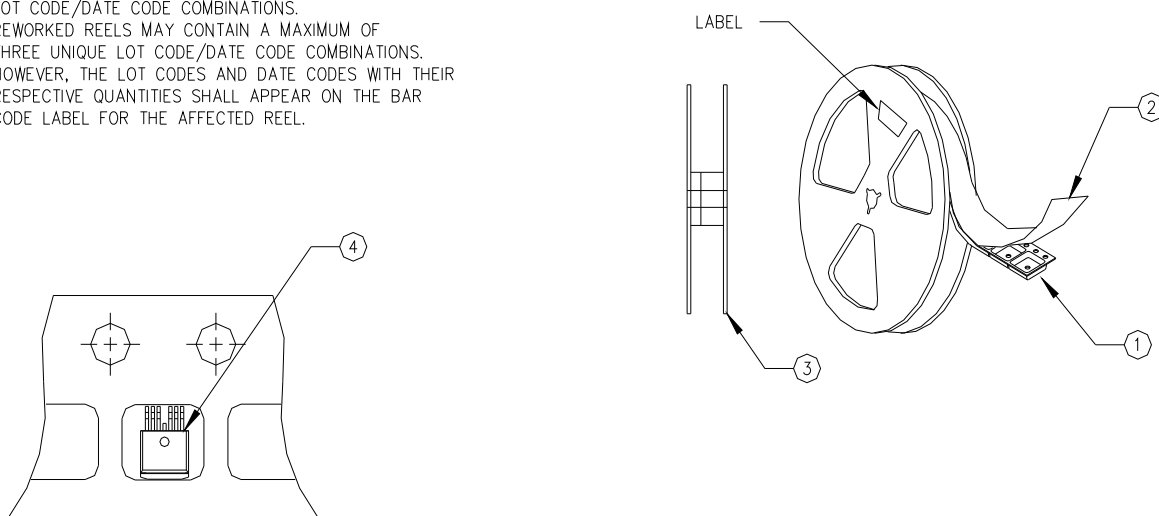
NOTES, TAPE & REEL, LABELLING:

1. TAPE AND REEL.

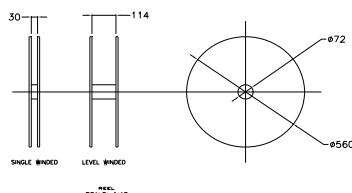
- 1.1 REEL SIZE 13 INCH DIAMETER.
- 1.2 EACH REEL CONTAINING 800 DEVICES.
- 1.3 THERE SHALL BE A MINIMUM OF 42 SEALED POCKETS CONTAINED IN THE LEADER AND A MINIMUM OF 15 SEALED POCKETS IN THE TRAILER.
- 1.4 PEEL STRENGTH MUST CONFORM TO THE SPEC. NO. 71-9667.
- 1.5 PART ORIENTATION SHALL BE AS SHOWN BELOW.
- 1.6 REEL MAY CONTAIN A MAXIMUM OF TWO UNIQUE LOT CODE/DATE CODE COMBINATIONS. REWORKED REELS MAY CONTAIN A MAXIMUM OF THREE UNIQUE LOT CODE/DATE CODE COMBINATIONS. HOWEVER, THE LOT CODES AND DATE CODES WITH THEIR RESPECTIVE QUANTITIES SHALL APPEAR ON THE BAR CODE LABEL FOR THE AFFECTED REEL.

2. LABELLING (REEL AND SHIPPING BAG).

- 2.1 CUST. PART NUMBER (BAR CODE): IRFXXXXSTRL-7P
- 2.2 CUST. PART NUMBER (TEXT CODE): IRFXXXXSTRL-7P
- 2.3 I.R. PART NUMBER: IRFXXXXSTRL-7P
- 2.4 QUANTITY:
- 2.5 VENDOR CODE: IR
- 2.6 LOT CODE:
- 2.7 DATE CODE:



Ao	10.80	+/- 0.1
Bo	16.00	+/- 0.1
B2	10.35	+/- 0.1
Ko	4.90	+/- 0.1
F	11.50	+/- 0.1
P1	16.00	+/- 0.1
W	24.00	+/- 0.1



LONG	UNITS
130	METERS/REEL

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. IR's Industrial and Consumer qualification level is granted by extension of the higher Automotive level.	
		D ² PAK 7 Pin	MSL1
ESD	Machine Model	Class M4 [†] (Per AEC-Q101-002)	
	Human Body Model	Class H3A [†] (per AEC-Q101-001)	
	Charged Device Model	Class C5 [†] (per AEC-Q101-005)	
RoHS Compliant		Yes	

† Highest passing voltage.

Revision History

Date	Comments
11/11/2015	- Updated datasheet with corporate template - Corrected ordering table on page 1.

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