

**Features**

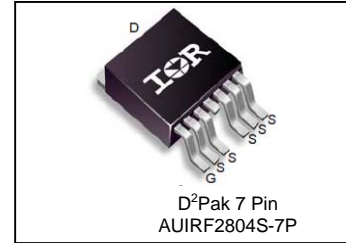
- Advanced Process Technology
- Ultra Low On-Resistance
- 175°C Operating Temperature
- Fast Switching
- Repetitive Avalanche Allowed up to Tjmax
- Lead-Free, RoHS Compliant
- Automotive Qualified \*

HEXFET® Power MOSFET

	<b>V<sub>DSS</sub></b>	<b>40V</b>
	<b>R<sub>DS(on)</sub> max.</b>	<b>1.6mΩ</b>
	<b>I<sub>D</sub> (Silicon Limited)</b>	<b>320AⓄ</b>
	<b>I<sub>D</sub> (Package Limited)</b>	<b>240A</b>

**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		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 (TA) is 25°C, unless otherwise specified.

Symbol	Parameter	Max.	Units
I <sub>D</sub> @ T <sub>C</sub> = 25°C	Continuous Drain Current, V <sub>GS</sub> @ 10V (Silicon Limited)	320Ⓞ	A
I <sub>D</sub> @ T <sub>C</sub> = 100°C	Continuous Drain Current, V <sub>GS</sub> @ 10V (Silicon Limited)	230	
I <sub>D</sub> @ T <sub>C</sub> = 25°C	Continuous Drain Current, V <sub>GS</sub> @ 10V (Package Limited)	240	
I <sub>DM</sub>	Pulsed Drain Current ②	1360	
P <sub>D</sub> @ T <sub>C</sub> = 25°C	Maximum Power Dissipation	330	W
	Linear Derating Factor	2.2	W/°C
V <sub>GS</sub>	Gate-to-Source Voltage	± 20	V
E <sub>AS</sub>	Single Pulse Avalanche Energy (Thermally Limited) ③	630	mJ
E <sub>AS (tested)</sub>	Single Pulse Avalanche Energy Tested Value ⑦	1050	
I <sub>AR</sub>	Avalanche Current ②	See Fig.12a,12b,15,16	A
E <sub>AR</sub>	Repetitive Avalanche Energy ⑥		mJ
T <sub>J</sub>	Operating Junction and	-55 to + 175	°C
T <sub>STG</sub>	Storage Temperature Range		
	Soldering Temperature, for 10 seconds (1.6mm from case)	300	

**Thermal Resistance**

Symbol	Parameter	Typ.	Max.	Units
R <sub>θJC</sub>	Junction-to-Case ⑧	—	0.50	°C/W
R <sub>θCS</sub>	Case-to-Sink, Flat, Greased Surface	0.50	—	
R <sub>θJA</sub>	Junction-to-Ambient	—	62	
R <sub>θJA</sub>	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](http://www.infineon.com)

**Static Electrical Characteristics @ T<sub>J</sub> = 25°C (unless otherwise specified)**

Symbol	Parameter	Min.	Typ.	Max.	Units	Conditions
V <sub>(BR)DSS</sub>	Drain-to-Source Breakdown Voltage	40	—	—	V	V <sub>GS</sub> = 0V, I <sub>D</sub> = 250μA
ΔV <sub>(BR)DSS</sub> /ΔT <sub>J</sub>	Breakdown Voltage Temp. Coefficient	—	0.028	—	V/°C	Reference to 25°C, I <sub>D</sub> = 1.0mA
R <sub>DS(on)</sub> SMD	Static Drain-to-Source On-Resistance	—	1.2	1.6	mΩ	V <sub>GS</sub> = 10V, I <sub>D</sub> = 160A ④
V <sub>GS(th)</sub>	Gate Threshold Voltage	2.0	—	4.0	V	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250μA
g <sub>fs</sub>	Forward Transconductance	220	—	—	S	V <sub>DS</sub> = 10V, I <sub>D</sub> = 160A
I <sub>DSS</sub>	Drain-to-Source Leakage Current	—	—	20	μA	V <sub>DS</sub> = 40V, V <sub>GS</sub> = 0V
		—	—	250		V <sub>DS</sub> = 40V, V <sub>GS</sub> = 0V, T <sub>J</sub> = 125°C
I <sub>GSS</sub>	Gate-to-Source Forward Leakage	—	—	200	nA	V <sub>GS</sub> = 20V
	Gate-to-Source Reverse Leakage	—	—	-200		V <sub>GS</sub> = -20V

**Dynamic Electrical Characteristics @ T<sub>J</sub> = 25°C (unless otherwise specified)**

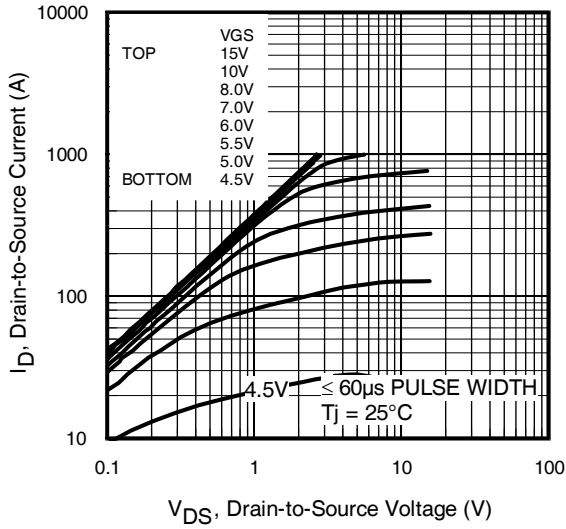
Symbol	Parameter	Min.	Typ.	Max.	Units	Conditions
Q <sub>g</sub>	Total Gate Charge	—	170	260	nC	I <sub>D</sub> = 160A V <sub>DS</sub> = 32V V <sub>GS</sub> = 10V ④
Q <sub>gs</sub>	Gate-to-Source Charge	—	63	—		
Q <sub>gd</sub>	Gate-to-Drain ("Miller") Charge	—	71	—		
t <sub>d(on)</sub>	Turn-On Delay Time	—	17	—	ns	V <sub>DD</sub> = 20V I <sub>D</sub> = 160A R <sub>G</sub> = 2.6Ω V <sub>GS</sub> = 10V ④
t <sub>r</sub>	Rise Time	—	150	—		
t <sub>d(off)</sub>	Turn-Off Delay Time	—	110	—		
t <sub>f</sub>	Fall Time	—	100	—		
L <sub>D</sub>	Internal Drain Inductance	—	4.5	—	nH	Between lead, 6mm (0.25in.) from package and center of die contact
L <sub>S</sub>	Internal Source Inductance	—	7.5	—		
C <sub>iss</sub>	Input Capacitance	—	6930	—	pF	V <sub>GS</sub> = 0V V <sub>DS</sub> = 25V f = 1.0 MHz, See Fig. 5
C <sub>oss</sub>	Output Capacitance	—	1750	—		
C <sub>rss</sub>	Reverse Transfer Capacitance	—	970	—		
C <sub>oss</sub>	Output Capacitance	—	5740	—		
C <sub>oss</sub>	Output Capacitance	—	1570	—		
C <sub>oss eff.</sub>	Effective Output Capacitance ④	—	2340	—		

**Diode Characteristics**

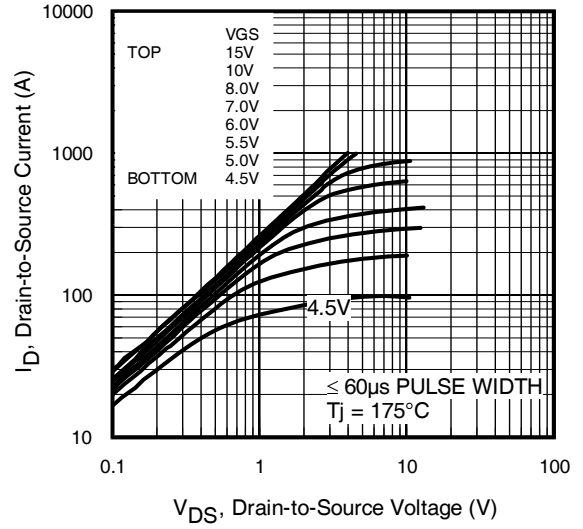
Symbol	Parameter	Min.	Typ.	Max.	Units	Conditions
I <sub>S</sub>	Continuous Source Current (Body Diode)	—	—	320①	A	MOSFET symbol showing the integral reverse p-n junction diode.
I <sub>SM</sub>	Pulsed Source Current (Body Diode) ②	—	—	1360		
V <sub>SD</sub>	Diode Forward Voltage	—	—	1.3	V	T <sub>J</sub> = 25°C, I <sub>S</sub> = 160A, V <sub>GS</sub> = 0V ④
t <sub>rr</sub>	Reverse Recovery Time	—	43	65	ns	T <sub>J</sub> = 25°C, I <sub>F</sub> = 160A, V <sub>DD</sub> = 20V
Q <sub>rr</sub>	Reverse Recovery Charge	—	48	72	nC	di/dt = 100A/μs ④
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:**

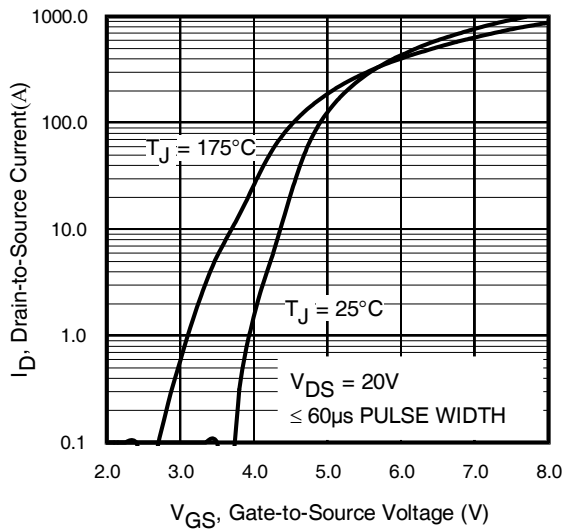
- ① Calculated continuous current based on maximum allowable junction temperature. Package limitation current is 240A. Note that current limitations arising from heating of the device leads may occur with some lead mounting arrangements. (Refer to AN-1140)
- ② Repetitive rating; pulse width limited by max. junction temperature. (See fig. 11).
- ③ Limited by T<sub>Jmax</sub>, starting T<sub>J</sub> = 25°C, L=0.049mH, R<sub>G</sub> = 25Ω, I<sub>AS</sub> = 160A, V<sub>GS</sub> = 10V. Part not recommended for use above this value.
- ④ Pulse width ≤ 1.0ms; duty cycle ≤ 2%.
- ⑤ C<sub>oss eff.</sub> is a fixed capacitance that gives the same charging time as C<sub>oss</sub> while V<sub>DS</sub> is rising from 0 to 80% V<sub>DSS</sub>.
- ⑥ Limited by T<sub>Jmax</sub>, see Fig.12a, 12b, 15, 16 for typical repetitive avalanche performance.
- ⑦ This value determined from sample failure population, starting T<sub>J</sub> = 25°C, L = 0.049mH, R<sub>G</sub> = 25Ω, I<sub>AS</sub> = 160A, V<sub>GS</sub> = 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<sub>θ</sub> is measured at T<sub>J</sub> of approximately 90°C.



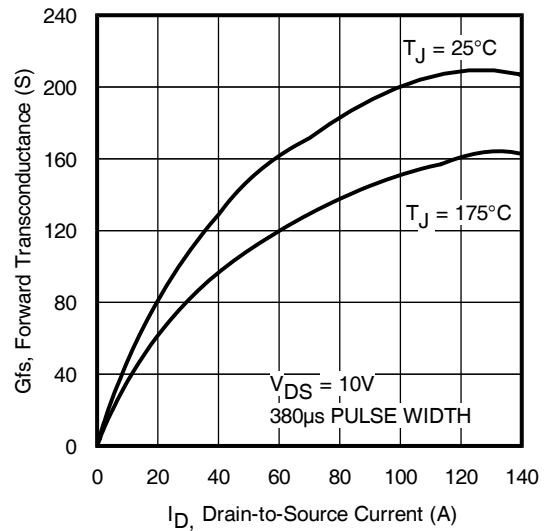
**Fig. 1** Typical Output Characteristics



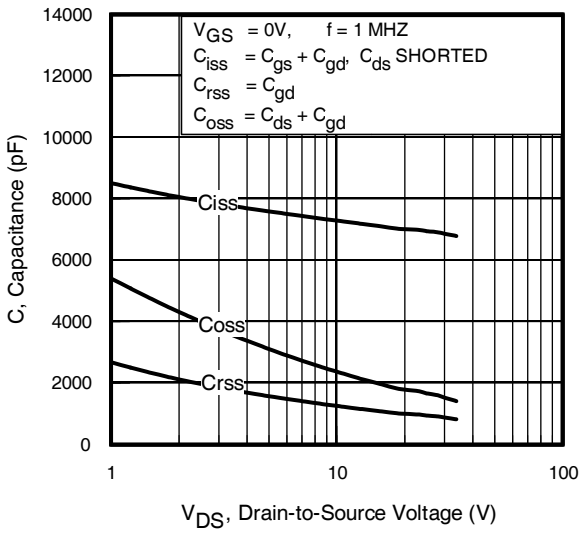
**Fig. 2** Typical Output Characteristics



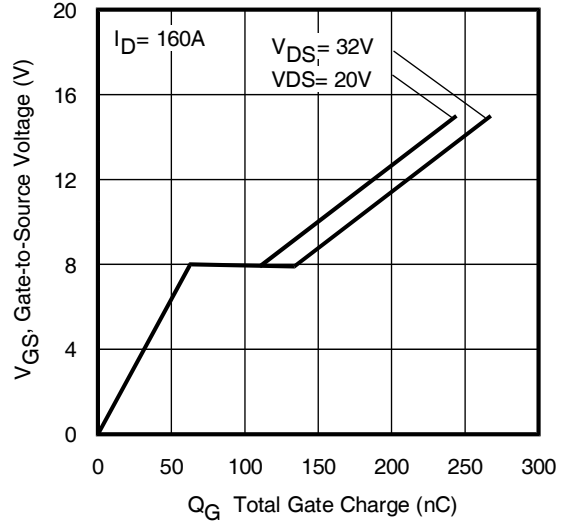
**Fig. 3** Typical Transfer Characteristics



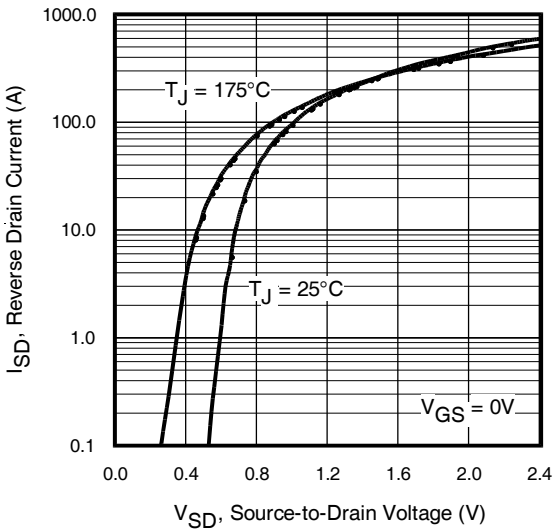
**Fig. 4** Typical Forward Trans conductance vs. Drain Current



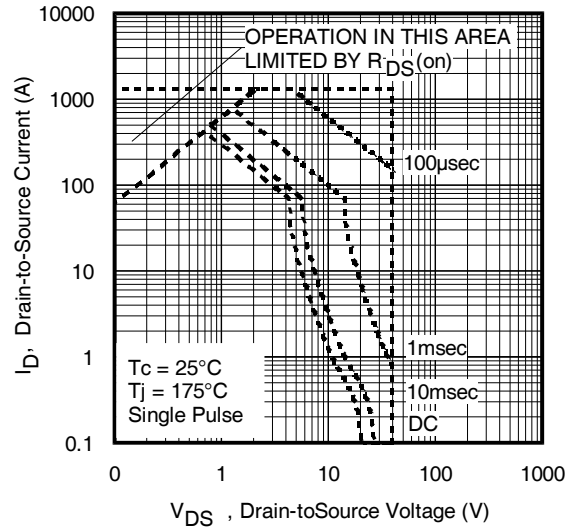
**Fig 5.** Typical Capacitance vs. Drain-to-Source Voltage



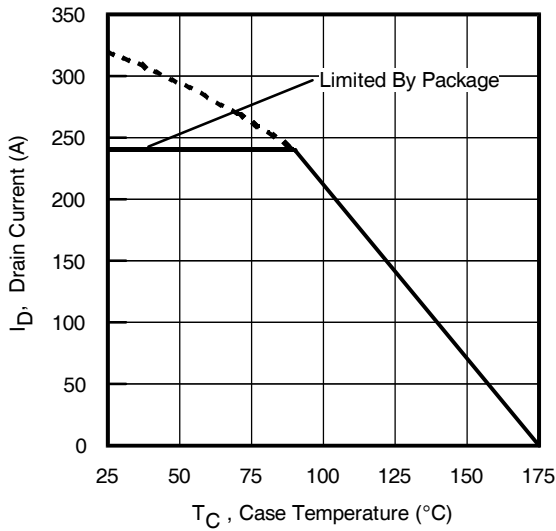
**Fig 6.** Typical Gate Charge vs. Gate-to-Source Voltage



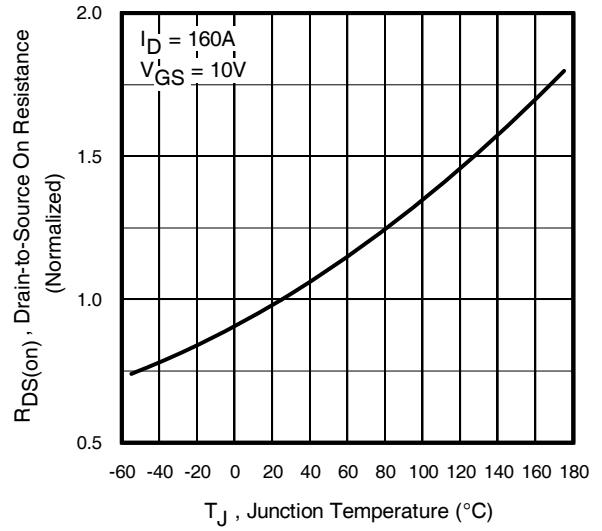
**Fig. 7** Typical Source-to-Drain Diode Forward Voltage



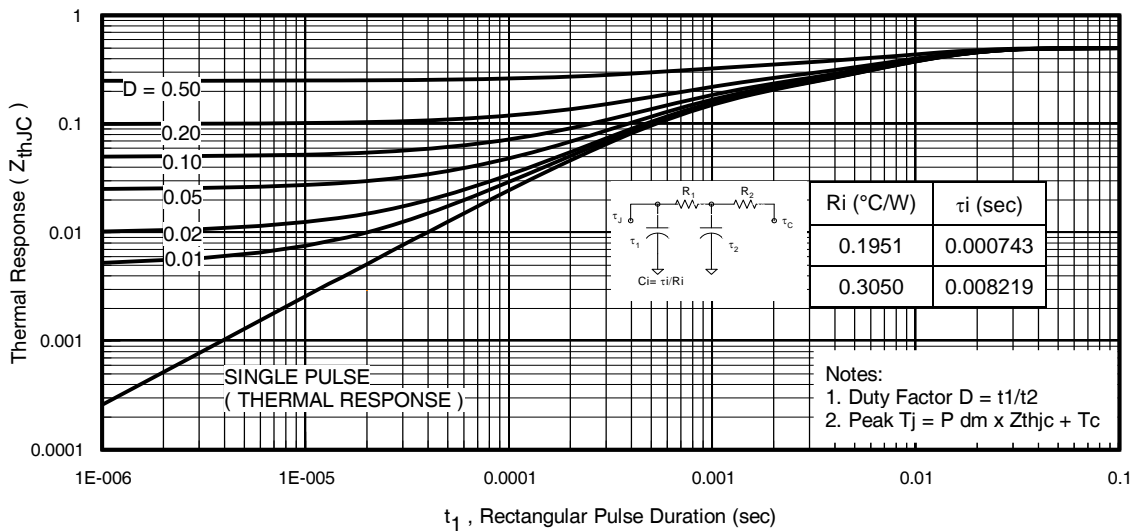
**Fig 8.** Maximum Safe Operating Area



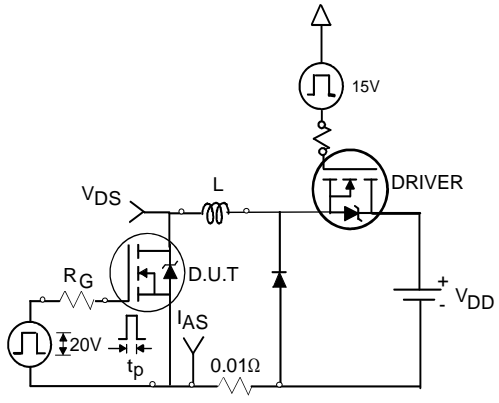
**Fig 9.** Maximum Drain Current vs. Case Temperature



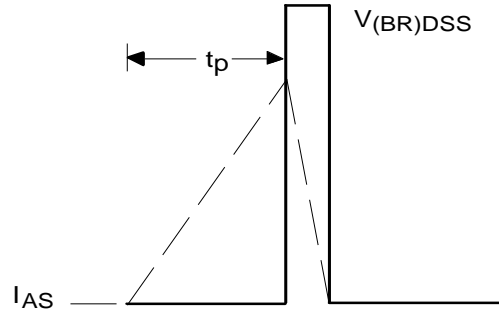
**Fig 10.** Normalized On-Resistance vs. Temperature



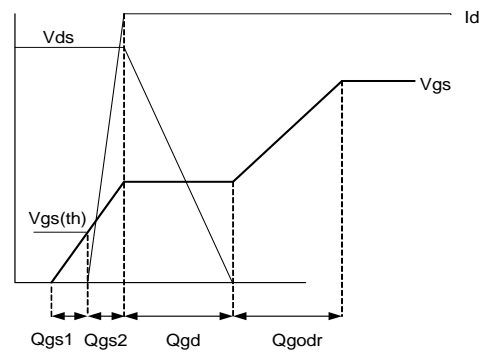
**Fig 11.** Maximum Effective Transient Thermal Impedance, Junction-to-Case



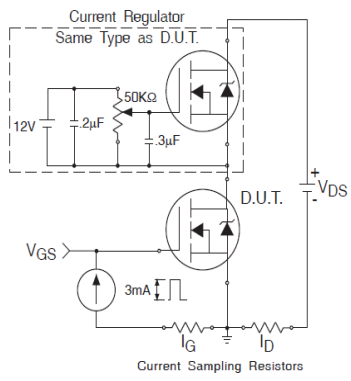
**Fig 12a.** Unclamped Inductive Test Circuit



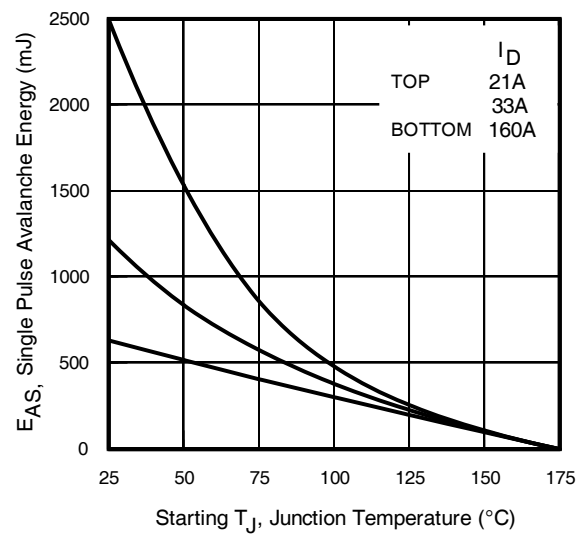
**Fig 12b.** Unclamped Inductive Waveforms



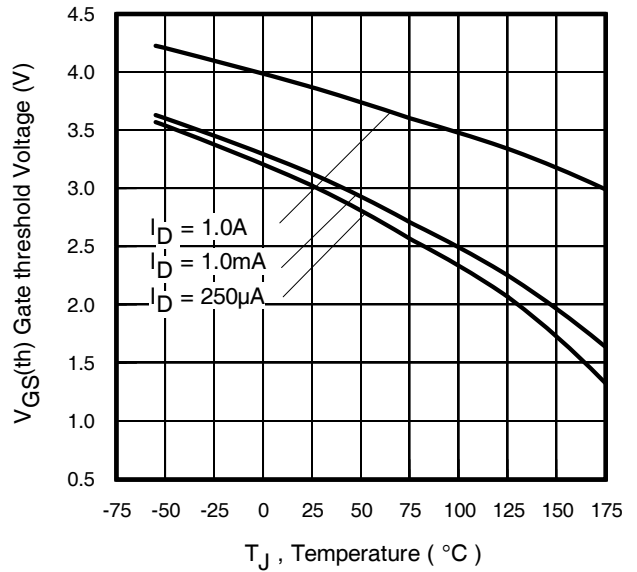
**Fig 13a.** Basic Gate Charge Waveform



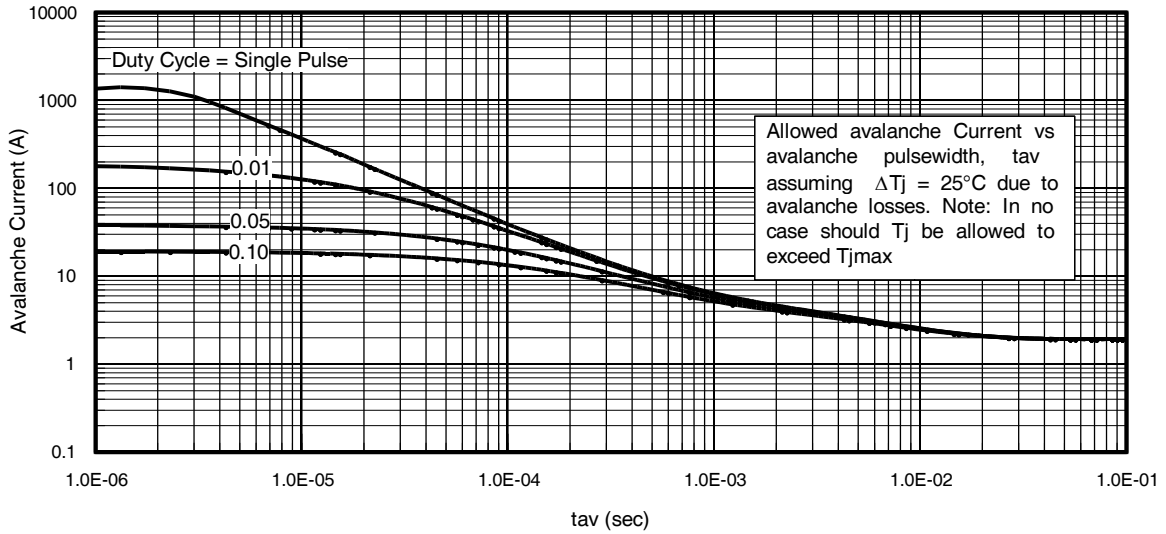
**Fig 13b.** Gate Charge Test Circuit



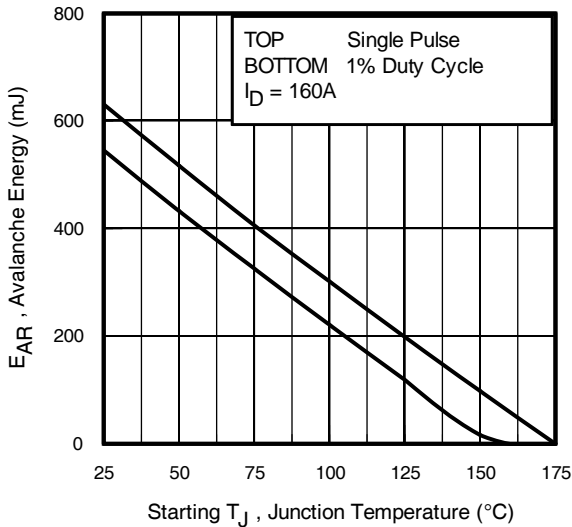
**Fig 12c.** Maximum Avalanche Energy vs. Drain Current



**Fig 14.** Threshold Voltage vs. Temperature



**Fig 15.** Typical Avalanche Current vs. Pulse width



**Fig 16.** Maximum Avalanche Energy vs. Temperature

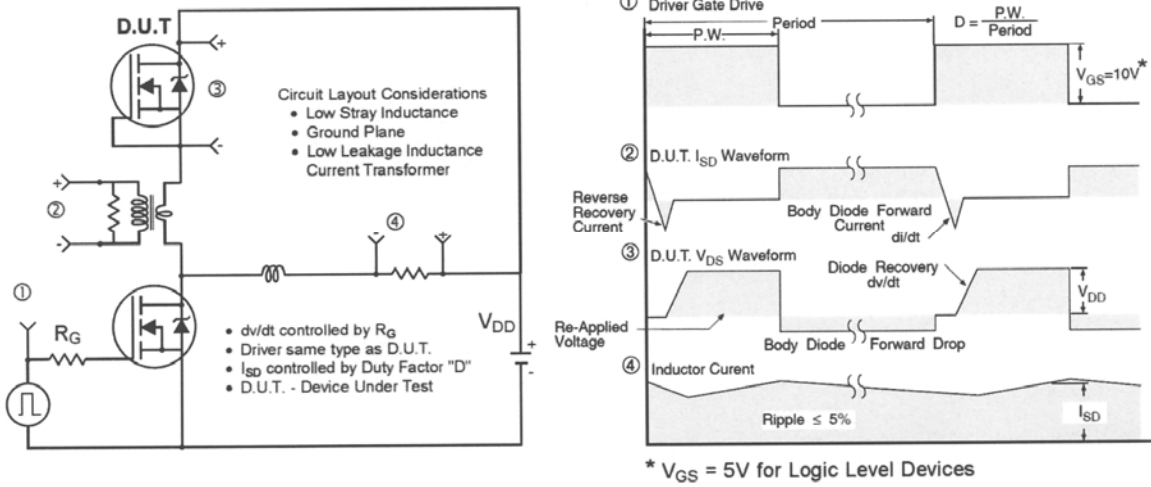
**Notes on Repetitive Avalanche Curves , Figures 15, 16:**  
**(For further info, see AN-1005 at www.irf.com)**

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.  $\Delta T$  = 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)

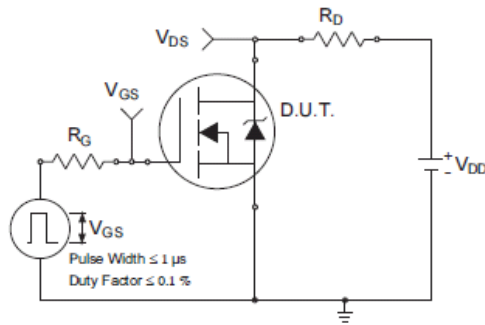
$$P_{D(ave)} = \frac{1}{2} (1.3 \cdot BV \cdot I_{av}) = \frac{\Delta T}{Z_{thJC}}$$

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

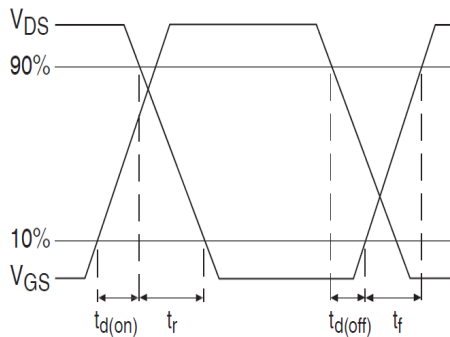
$$E_{AS(AR)} = P_{D(ave)} \cdot t_{av}$$



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



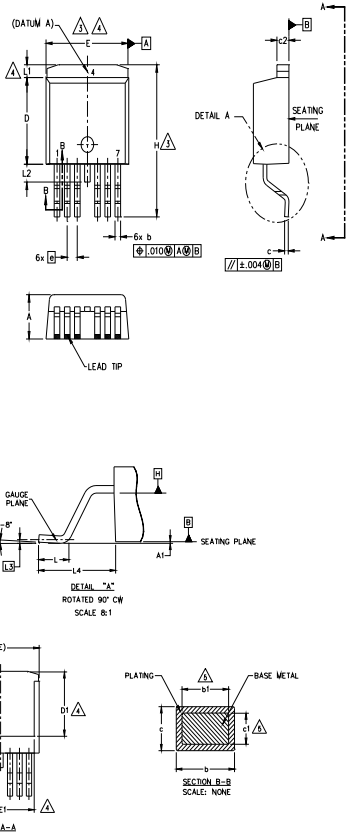
**Fig 18a. Switching Time Test Circuit**



**Fig 18b. Switching Time Waveforms**



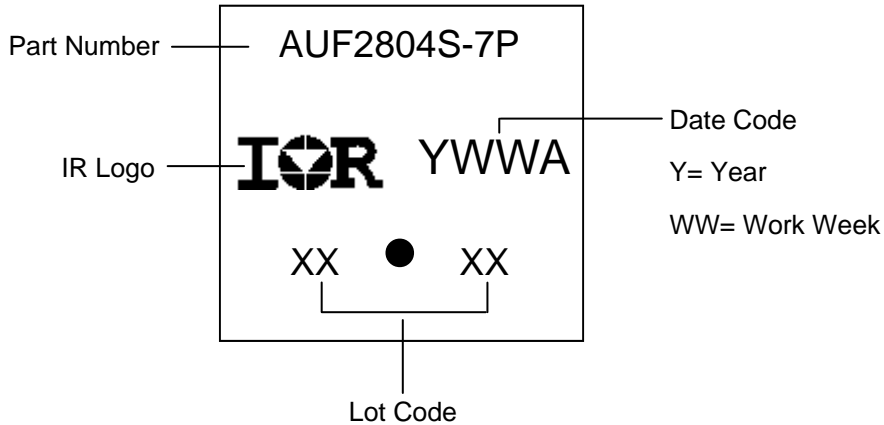
**D<sup>2</sup>Pak - 7 Pin Package Outline**  
 Dimensions are shown in millimeters (inches)



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		
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	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 [.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.

**D<sup>2</sup>Pak - 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

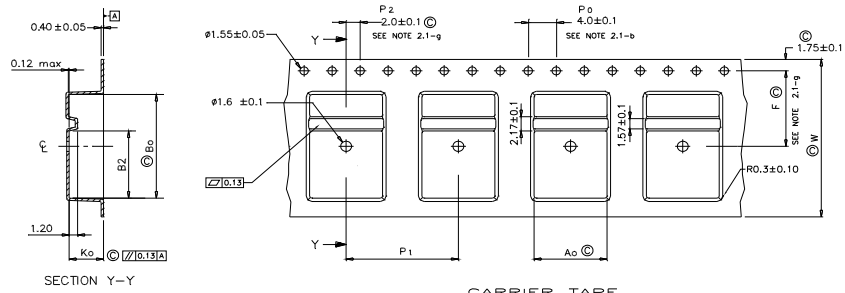
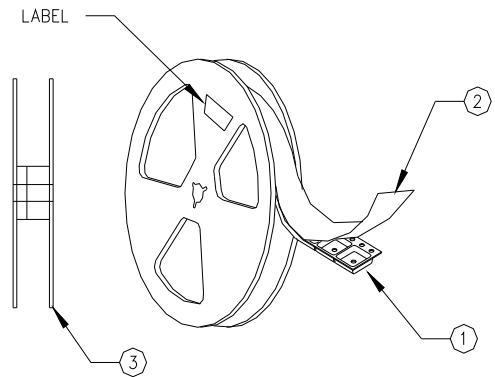
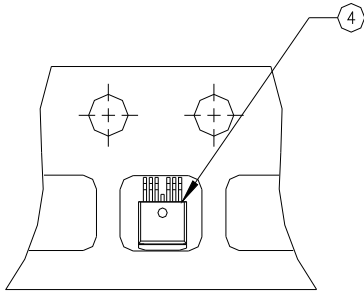
NOTES, TAPE & REEL, LABELLING:

1. TAPE AND REEL.

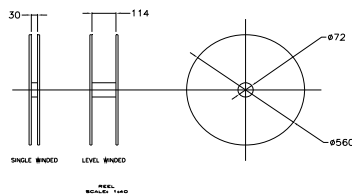
- 1.1 REEL SIZE 13 INCH DIAMETER.
- 1.2 EACH REEL CONTAINING 800 DEVICES.
- 1.3 THERE SHALL BE A MINIMUM OF 42 SEALED POCKETS CONTAINED IN THE LEADER AND A MINIMUM OF 15 SEALED POCKETS IN THE TRAILER.
- 1.4 PEEL STRENGTH MUST CONFORM TO THE SPEC. NO. 71-9667.
- 1.5 PART ORIENTATION SHALL BE AS SHOWN 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**

<b>Qualification Level</b>		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 <sup>2</sup> PAK 7 Pin	MSL1
<b>ESD</b>	Machine Model	Class M4 <sup>†</sup> (Per AEC-Q101-002)	
	Human Body Model	Class H3A <sup>†</sup> (per AEC-Q101-001)	
	Charged Device Model	Class C5 <sup>†</sup> (per AEC-Q101-005)	
<b>RoHS Compliant</b>		Yes	

† Highest passing voltage.

**Revision History**

Date	Comments
11/11/2015	<ul style="list-style-type: none"> <li>Updated datasheet with corporate template</li> <li>Corrected ordering table on page 1.</li> </ul>

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