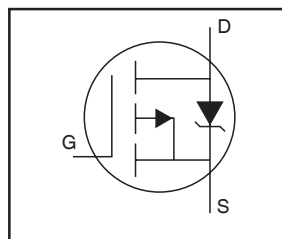


Features

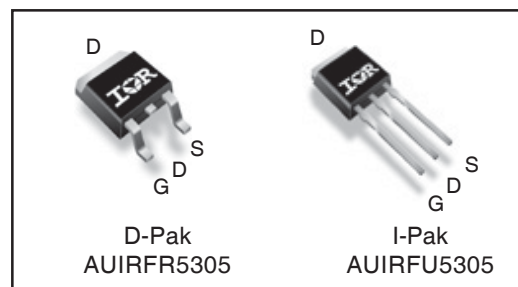
- Advanced Planar Technology
- Low On-Resistance
- Dynamic dV/dt Rating
- 175°C Operating Temperature
- Fast Switching
- Fully Avalanche Rated
- Repetitive Avalanche Allowed up to T_{jmax}
- Lead-Free, RoHS Compliant
- Automotive Qualified *

Description

Specifically designed for Automotive applications, this Cellular Planar design of HEXFET® Power MOSFETs utilizes the latest processing techniques to achieve low on-resistance per silicon area. This benefit combined with the fast switching speed and ruggedized device design that HEXFET power MOSFETs are well known for, provides the designer with an extremely efficient and reliable device for use in Automotive and a wide variety of other applications.



$V_{(BR)DSS}$	-55V
$R_{DS(on)}$ max.	0.065Ω
I_D	-31A



G	D	S
Gate	Drain	Source

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.

Absolute Maximum Ratings

	Parameter	Max.	Units
I_D @ $T_C = 25^\circ\text{C}$	Continuous Drain Current, V_{GS} @ -10V	-31	A
I_D @ $T_C = 100^\circ\text{C}$	Continuous Drain Current, V_{GS} @ -10V	-22	
I_{DM}	Pulsed Drain Current ①⑥	-110	
P_D @ $T_C = 25^\circ\text{C}$	Power Dissipation	110	W
	Linear Derating Factor	0.71	W/°C
V_{GS}	Gate-to-Source Voltage	± 20	V
E_{AS}	Single Pulse Avalanche Energy (Thermally limited) ②⑥	280	mJ
I_{AR}	Avalanche Current ①⑥	-16	A
E_{AR}	Repetitive Avalanche Energy ①	11	mJ
dv/dt	Peak Diode Recovery dv/dt ③⑥	-5.0	V/ns
T_J	Operating Junction and	-55 to + 175	°C
T_{STG}	Storage Temperature Range		
	Soldering Temperature, for 10 seconds	300 (1.6mm from case)	

Thermal Resistance

	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case	—	1.4	°C/W
$R_{\theta JA}$	Junction-to-Ambient (PCB mount) **	—	50	
$R_{\theta JA}$	Junction-to-Ambient ***	—	110	

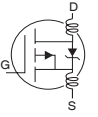
HEXFET® is a registered trademark of International Rectifier.

*Qualification standards can be found at <http://www.irf.com/>

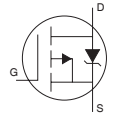
Static Electrical Characteristics @ $T_J = 25^\circ\text{C}$ (unless otherwise specified)

	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(BR)DSS}$	Drain-to-Source Breakdown Voltage	-55	—	—	V	$V_{GS} = 0V, I_D = -250\mu A$
$\Delta V_{(BR)DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	—	-0.034	—	V/ $^\circ\text{C}$	Reference to 25°C , $I_D = -1\text{mA}$
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	—	—	0.065	Ω	$V_{GS} = -10V, I_D = -16A$ ④
$V_{GS(th)}$	Gate Threshold Voltage	-2.0	—	-4.0	V	$V_{DS} = V_{GS}, I_D = -250\mu A$
g_{fs}	Forward Transconductance	8.0	—	—	S	$V_{DS} = -25V, I_D = -16A$ ⑥
I_{DSS}	Drain-to-Source Leakage Current	—	—	-25	μA	$V_{DS} = -55V, V_{GS} = 0V$
		—	—	-250		$V_{DS} = -44V, V_{GS} = 0V, T_J = 150^\circ\text{C}$
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)

	Parameter	Min.	Typ.	Max.	Units	Conditions
Q_g	Total Gate Charge	—	—	63	nC	$I_D = -16A$ $V_{DS} = -44V$ $V_{GS} = -10V$ See Fig.6 and 13 ④⑥
Q_{gs}	Gate-to-Source Charge	—	—	13		
Q_{gd}	Gate-to-Drain ("Miller") Charge	—	—	29		
$t_{d(on)}$	Turn-On Delay Time	—	14	—	ns	$V_{DD} = -28V$ $I_D = -16A$ $R_G = 6.8\Omega$ $R_D = 1.6\Omega$ See Fig.10④⑥
t_r	Rise Time	—	66	—		
$t_{d(off)}$	Turn-Off Delay Time	—	39	—		
t_f	Fall Time	—	63	—		
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	—	1200	—	pF	$V_{GS} = 0V$ $V_{DS} = -25V$ $f = 1.0\text{MHz}$, see Fig.5 ⑥
C_{oss}	Output Capacitance	—	520	—		
C_{rss}	Reverse Transfer Capacitance	—	250	—		

Diode Characteristics

	Parameter	Min.	Typ.	Max.	Units	Conditions
I_S	Continuous Source Current (Body Diode)	—	—	-31	A	MOSFET symbol showing the integral reverse p-n junction diode. 
I_{SM}	Pulsed Source Current (Body Diode) ①	—	—	-110		
V_{SD}	Diode Forward Voltage	—	—	-1.3	V	$T_J = 25^\circ\text{C}, I_S = -16A, V_{GS} = 0V$ ④
t_{rr}	Reverse Recovery Time	—	71	110	ns	$T_J = 25^\circ\text{C}, I_F = -16A$
Q_{rr}	Reverse Recovery Charge	—	170	250	nC	$di/dt = 100A/\mu s$ ④⑥

① Repetitive rating; pulse width limited by max. junction temperature. (See Fig. 11)

② $V_{DD} = -25V$, starting $T_J = 25^\circ\text{C}$, $L = 2.1\text{mH}$
 $R_G = 25\Omega$, $I_{AS} = -16A$. (See Figure 12)

③ $I_{SD} \leq -16A$, $di/dt \leq -280A/\mu s$, $V_{DD} \leq V_{(BR)DSS}$,
 $T_J \leq 175^\circ\text{C}$

* *When mounted on 1" square PCB (FR-4 or G-10 Material).

For recommended footprint and soldering techniques refer to application note #AN-994.

*** Uses typical socket mount.

④ Pulse width $\leq 300\mu s$; duty cycle $\leq 2\%$.

⑤ This is applied for I-PAK, L_S of D-PAK is measured between lead and center of die contact.

⑥ Uses IRF5305 data and test conditions.

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.	
Moisture Sensitivity Level		D PAK	MSL1
		I-PAK	N/A
ESD	Machine Model	Class M2 (200V) (per AEC-Q101-002)	
	Human Body Model	Class H1B (1000V) (per AEC-Q101-001)	
	Charged Device Model	Class C5 (1125V) (per AEC-Q101-005)	
RoHS Compliant		Yes	

[†] Qualification standards can be found at International Rectifier's web site: <http://www.irf.com/>

^{††} Exceptions to AEC-Q101 requirements are noted in the qualification report.

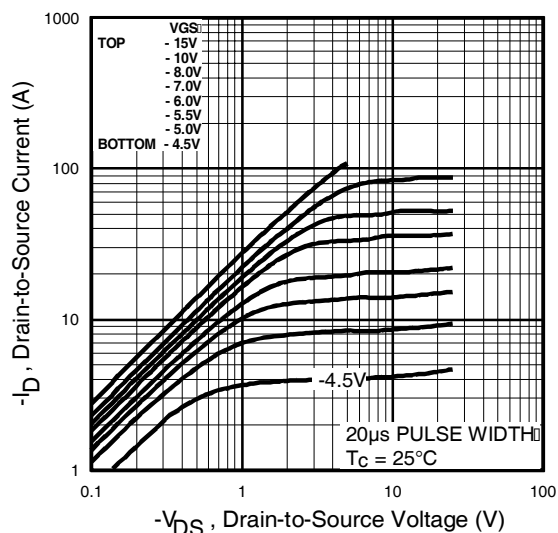


Fig 1. Typical Output Characteristics

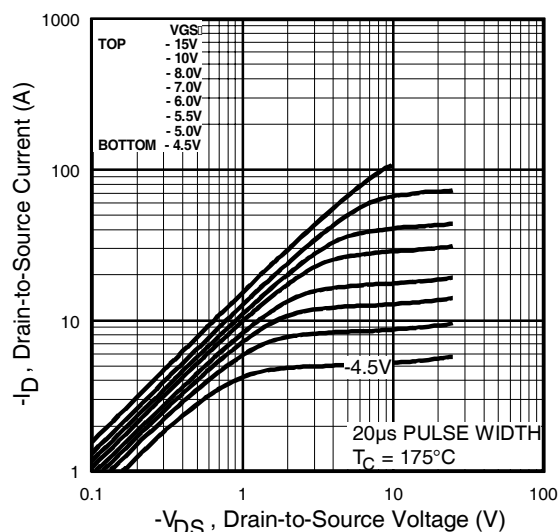


Fig 2. Typical Output Characteristics

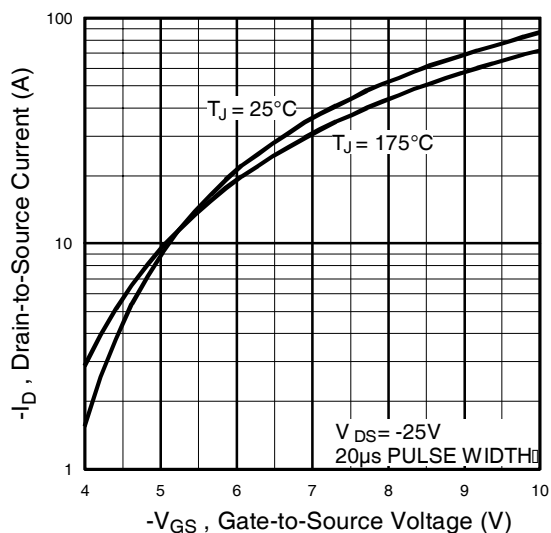


Fig 3. Typical Transfer Characteristics

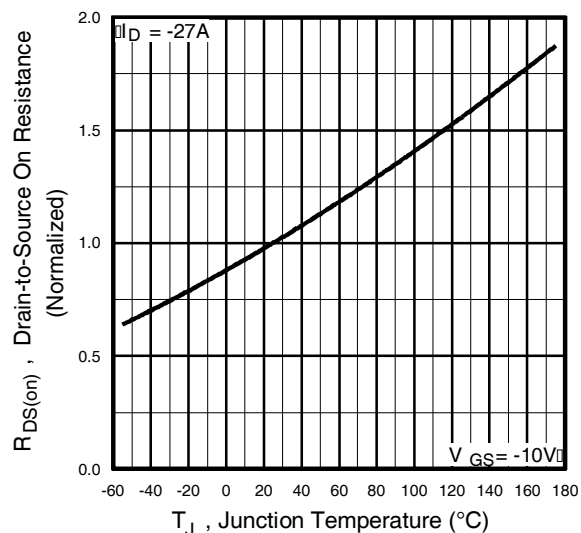


Fig 4. Normalized On-Resistance Vs. Temperature

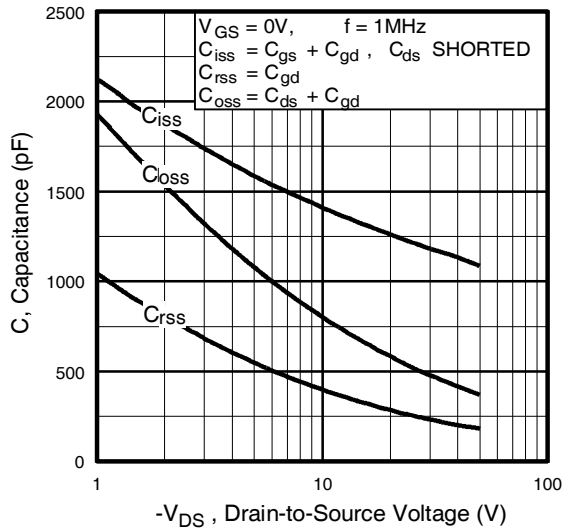


Fig 5. Typical Capacitance Vs. Drain-to-Source Voltage

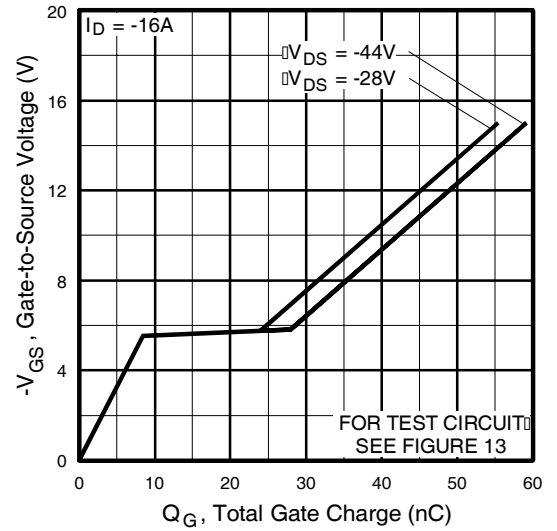


Fig 6. Typical Gate Charge Vs. Gate-to-Source Voltage

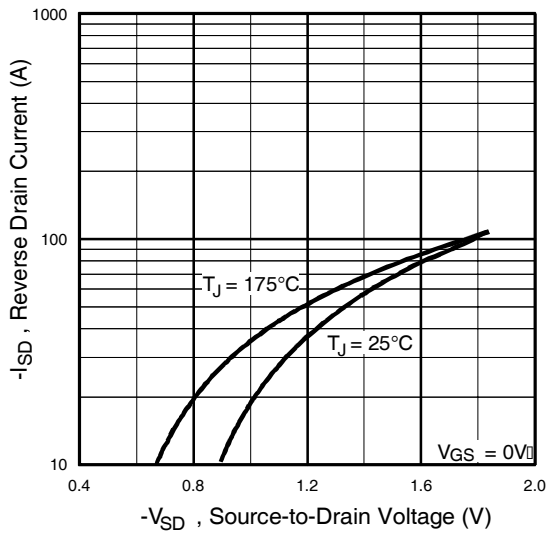


Fig 7. Typical Source-Drain Diode Forward Voltage

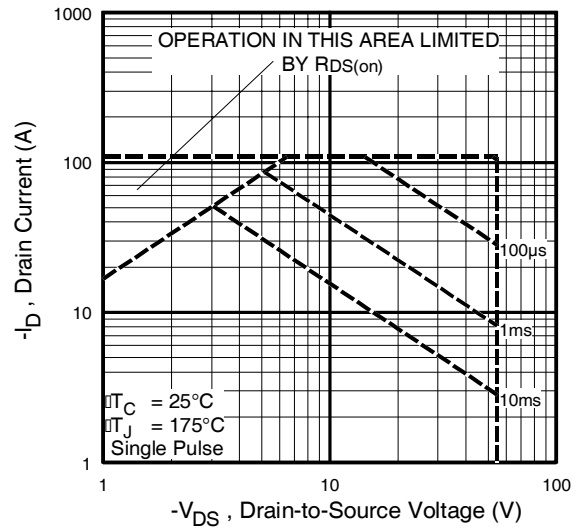


Fig 8. Maximum Safe Operating Area

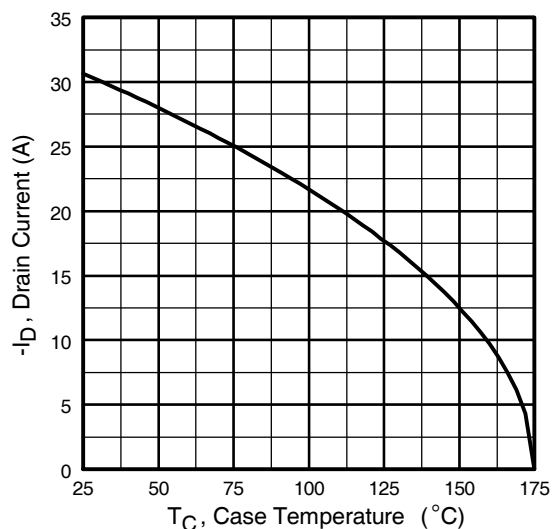


Fig 9. Maximum Drain Current Vs. Case Temperature

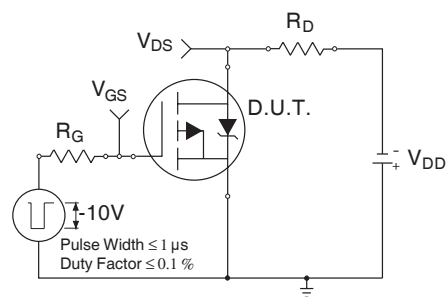


Fig 10a. Switching Time Test Circuit

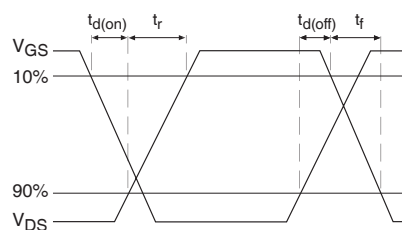


Fig 10b. Switching Time Waveforms

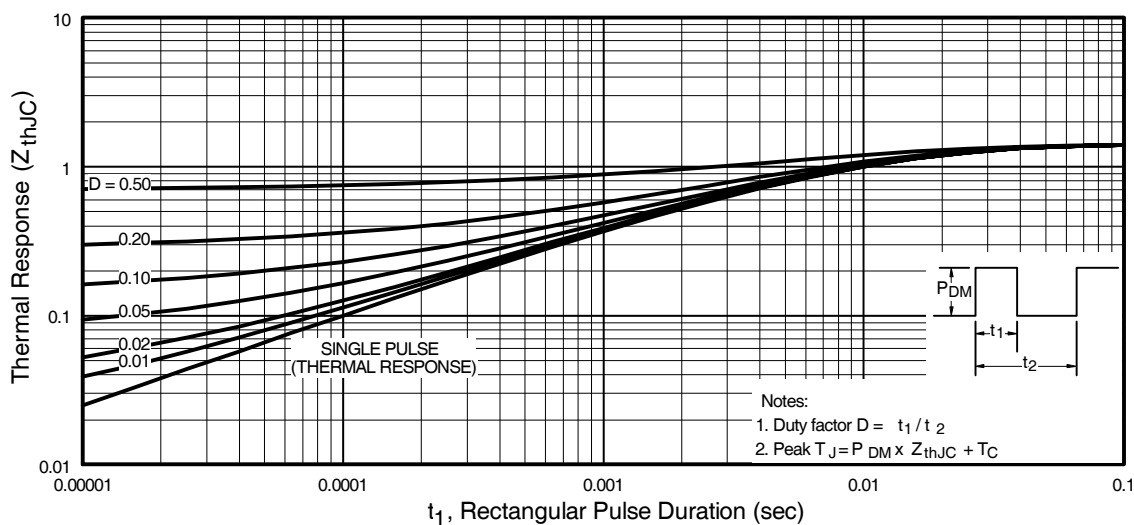


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Case

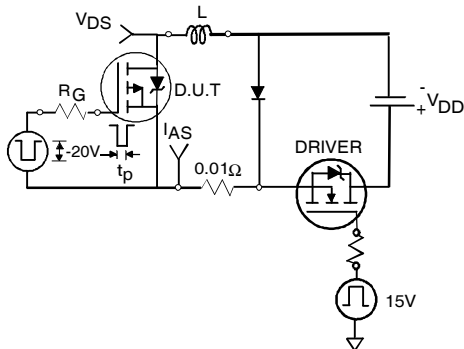


Fig 12a. Unclamped Inductive Test Circuit

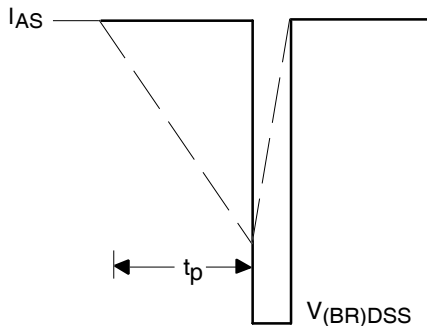


Fig 12b. Unclamped Inductive Waveforms

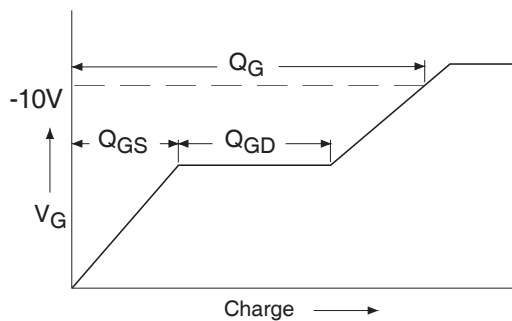


Fig 13a. Basic Gate Charge Waveform

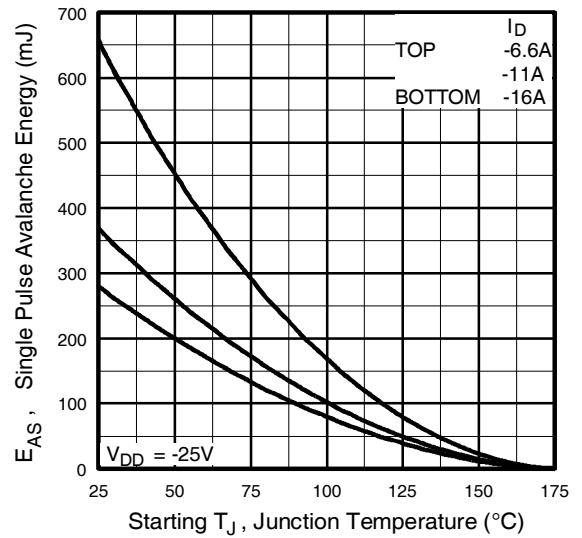


Fig 12c. Maximum Avalanche Energy Vs. Drain Current

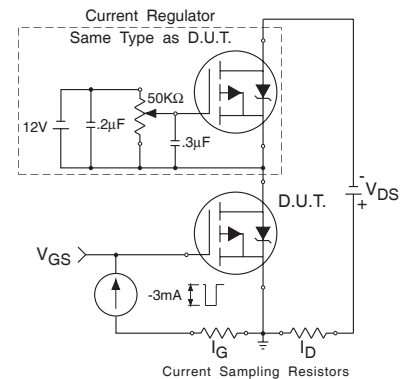
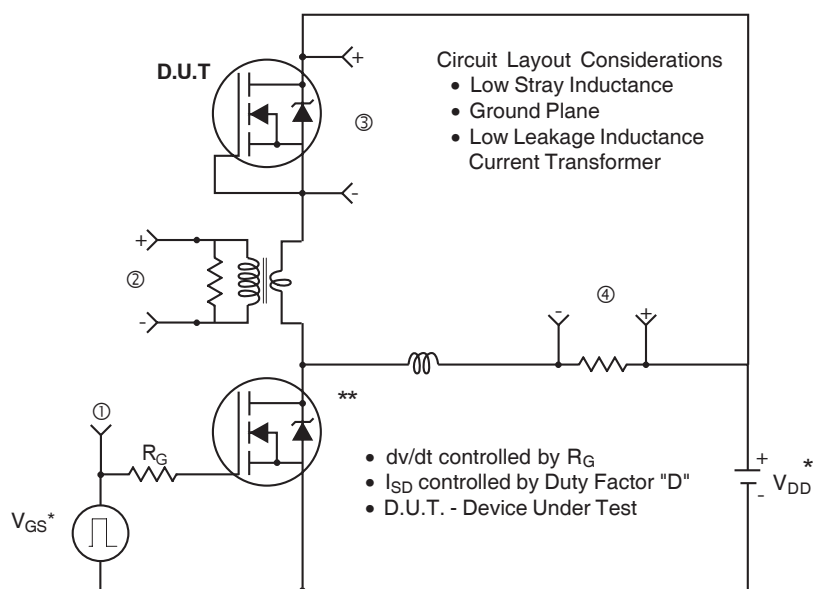


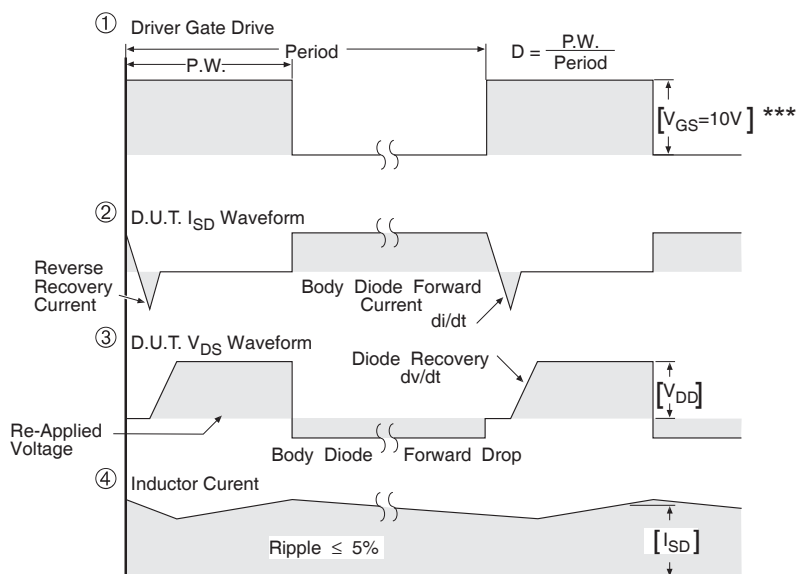
Fig 13b. Gate Charge Test Circuit

Peak Diode Recovery dv/dt Test Circuit



* Reverse Polarity for P-Channel

**** Use P-Channel Driver for P-Channel Measurements**

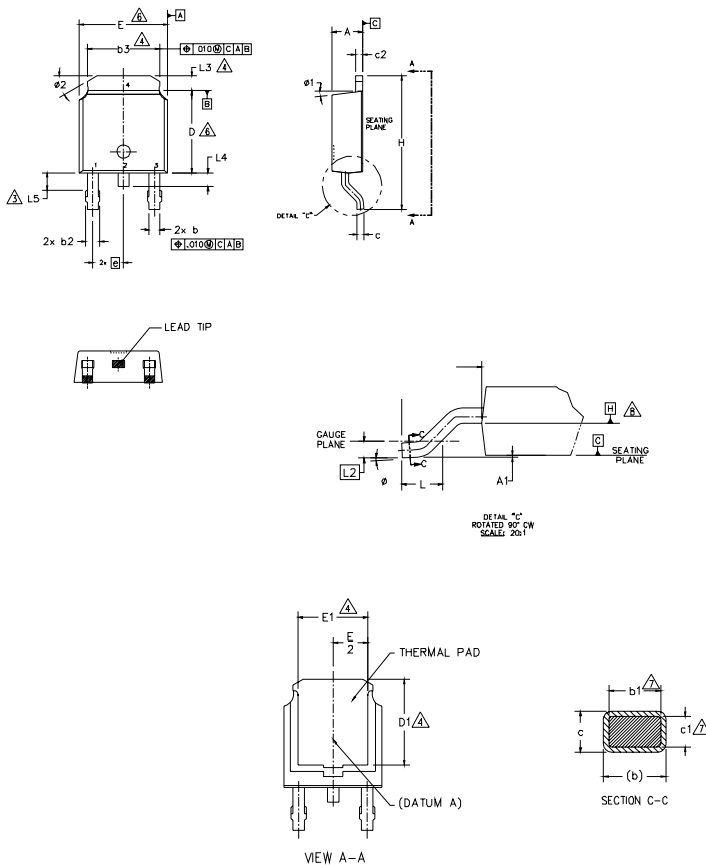


*** $V_{GS} = 5.0V$ for Logic Level and 3V Drive Devices

Fig 14. For P-Channel HEXFETS

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

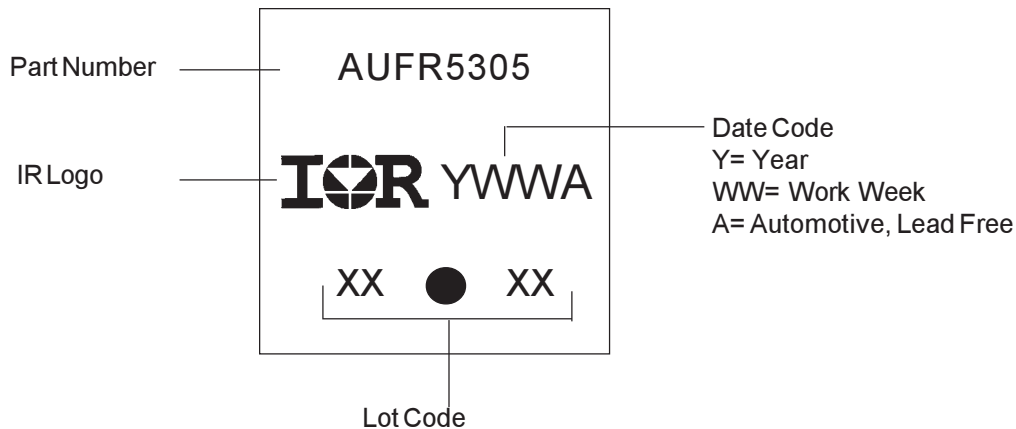
HEXFET

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

IGBT & CoPAK

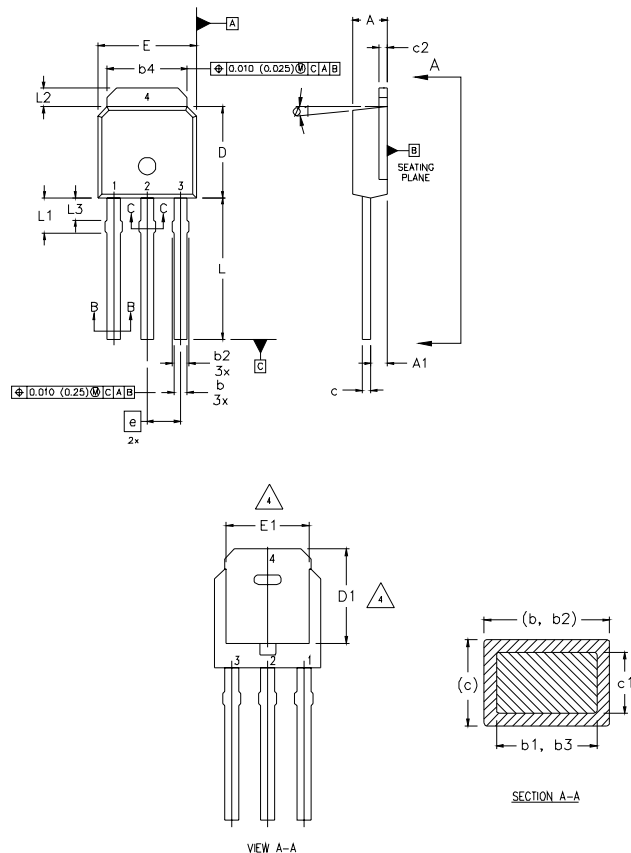
- 1.- GATE
- 2.- COLLECTOR
- 3.- EMITTER
- 4.- COLLECTOR

D-Pak (TO-252AA) Part Marking Information



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

I-Pak (TO-251AA) Package Outline (Dimensions are shown in millimeters (inches))



NOTES:

- 1 DIMENSIONING AND TOLERANCING PER ASME Y14.5 M- 1994.
- 2 DIMENSIONS ARE SHOWN IN MILLIMETERS (INCHES).
- 3 DIMENSION D & E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED 0.005" (0.127) PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY.
- 4 THERMAL PAD CONTOUR OPTION WITHIN DIMENSION b4, L2, E1 & D1.
- 5 LEAD DIMENSION UNCONTROLLED IN L3.
- 6 DIMENSION b1, b3 APPLY TO BASE METAL ONLY.
- 7 OUTLINE CONFORMS TO JEDEC OUTLINE TO-251AA.
- 8 CONTROLLING DIMENSION : INCHES.

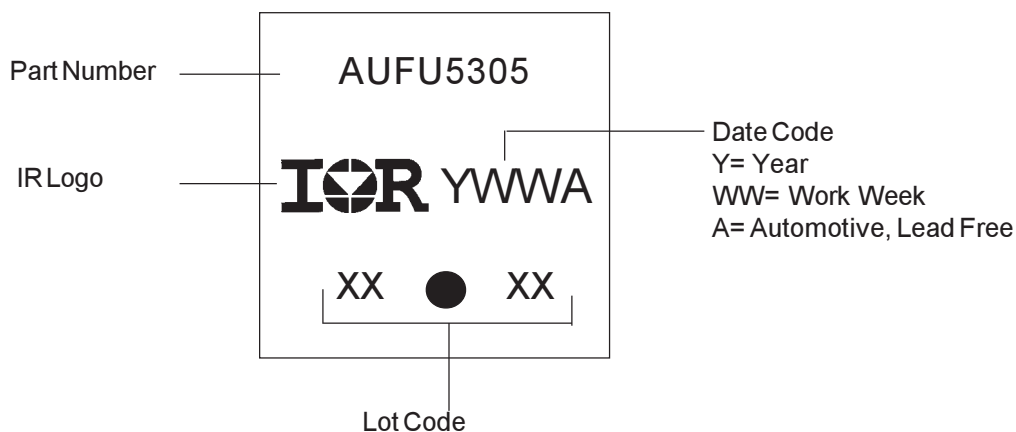
LEAD ASSIGNMENTS

HEXFET

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

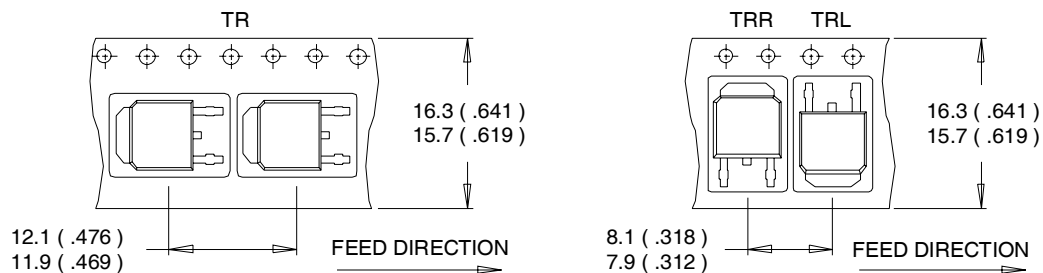
SYMBOL	DIMENSIONS				NOTES
	MILLIMETERS		INCHES		
	MIN.	MAX.	MIN.	MAX.	
A	2.18	2.39	0.086	.094	
A1	0.89	1.14	0.035	0.045	
b	0.64	0.89	0.025	0.035	
b1	0.64	0.79	0.025	0.031	4
b2	0.76	1.14	0.030	0.045	
b3	0.76	1.04	0.030	0.041	
b4	5.00	5.46	0.195	0.215	4
c	0.46	0.61	0.018	0.024	
c1	0.41	0.56	0.016	0.022	
c2	.046	0.86	0.018	0.035	
D	5.97	6.22	0.235	0.245	3, 4
D1	5.21	—	0.205	—	4
E	6.35	6.73	0.250	0.265	3, 4
E1	4.32	—	0.170	—	4
e	2.29		0.090 BSC		
L	8.89	9.60	0.350	0.380	
L1	1.91	2.29	0.075	0.090	
L2	0.89	1.27	0.035	0.050	4
L3	1.14	1.52	0.045	0.060	5
ø1	0°	15°	0°	15°	

I-Pak (TO-251AA) Part Marking Information



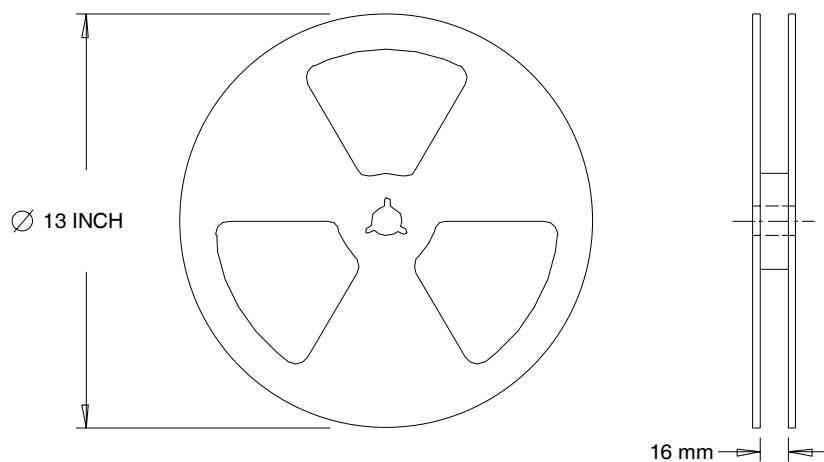
Note: For the most current drawing please refer to IR website at <http://www.irf.com/package/>

D-Pak (TO-252AA) Tape & Reel Information



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.

Ordering Information

Base part	Package Type	Standard Pack		Complete Part Number
		Form	Quantity	
AUIRFR5305	DPak	Tube	75	AUIRFR5305
		Tape and Reel	2000	AUIRFR5305TR
		Tape and Reel Left	3000	AUIRF5305TRL
		Tape and Reel Right	3000	AUIRF5305TRR
AUIRFU5305	IPak	Tube	75	AUIRFU5305

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IR warrants performance of its hardware products to the specifications applicable at the time of sale in accordance with IR’s standard warranty. Testing and other quality control techniques are used to the extent IR deems necessary to support this warranty. Except where mandated by government requirements, testing of all parameters of each product is not necessarily performed.

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For technical support, please contact IR’s Technical Assistance Center
<http://www.irf.com/technical-info/>

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