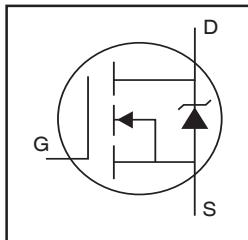
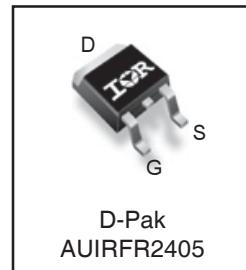


AUIRFR2405

HEXFET® Power MOSFET



V_{(BR)DSS}	55V
R_{DS(on)} typ.	11.8mΩ
max	16mΩ
I_D (Silicon Limited)	56A^⑥
I_D (Package Limited)	30A



G	D	S
Gate	Drain	Source

Description

Specifically designed for Automotive applications, this Stripe 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.

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.

	Parameter	Max.	Units
I _D @ T _C = 25°C	Continuous Drain Current, V _{GS} @ 10V (Silicon Limited)	56 ^⑥	A
I _D @ T _C = 100°C	Continuous Drain Current, V _{GS} @ 10V (Silicon Limited)	40 ^⑥	
I _D @ T _C = 25°C	Continuous Drain Current, V _{GS} @ 10V (Package Limited)	30	
I _{DM}	Pulsed Drain Current ①	220	
P _D @ T _C = 25°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) ②	130	mJ
I _{AR}	Avalanche Current ①	34	A
E _{AR}	Repetitive Avalanche Energy ①	11	mJ
dv/dt	Peak Diode Recovery dv/dt ③	5.0	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)		

Thermal Resistance

	Parameter	Typ.	Max.	Units
R _{θJC}	Junction-to-Case ④	—	1.4	°C/W
R _{θJA}	Junction-to-Ambient (PCB Mount) ⑦	—	50	
R _{θJA}	Junction-to-Ambient	—	110	

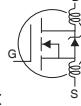
HEXFET® is a registered trademark of International Rectifier.

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

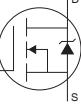
Static Electrical Characteristics @ $T_J = 25^\circ\text{C}$ (unless otherwise specified)

	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(\text{BR})\text{DSS}}$	Drain-to-Source Breakdown Voltage	55	—	—	V	$V_{\text{GS}} = 0\text{V}$, $I_D = 250\mu\text{A}$
$\Delta V_{(\text{BR})\text{DSS}/\Delta T_J}$	Breakdown Voltage Temp. Coefficient	—	0.052	—	V/ $^\circ\text{C}$	Reference to 25°C , $I_D = 1\text{mA}$
$R_{\text{DS}(\text{on})}$	Static Drain-to-Source On-Resistance	—	11.8	16	$\text{m}\Omega$	$V_{\text{GS}} = 10\text{V}$, $I_D = 34\text{A}$ ④
$V_{\text{GS}(\text{th})}$	Gate Threshold Voltage	2.0	—	4.0	V	$V_{\text{DS}} = V_{\text{GS}}$, $I_D = 250\mu\text{A}$
g_{fs}	Forward Transconductance	30	—	—	S	$V_{\text{DS}} = 25\text{V}$, $I_D = 34\text{A}$ ④
I_{DSS}	Drain-to-Source Leakage Current	—	—	20	μA	$V_{\text{DS}} = 55\text{V}$, $V_{\text{GS}} = 0\text{V}$
		—	—	250		$V_{\text{DS}} = 44\text{V}$, $V_{\text{GS}} = 0\text{V}$, $T_J = 150^\circ\text{C}$
I_{GSS}	Gate-to-Source Forward Leakage	—	—	200	nA	$V_{\text{GS}} = 20\text{V}$
	Gate-to-Source Reverse Leakage	—	—	-200		$V_{\text{GS}} = -20\text{V}$

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

	Parameter	Min.	Typ.	Max.	Units	Conditions
Q_g	Total Gate Charge	—	70	110	nC	$I_D = 34\text{A}$
Q_{gs}	Gate-to-Source Charge	—	16	23		$V_{\text{DS}} = 44\text{V}$
Q_{gd}	Gate-to-Drain ("Miller") Charge	—	19	29		$V_{\text{GS}} = 10\text{V}$ ④
$t_{\text{d}(\text{on})}$	Turn-On Delay Time	—	15	—	ns	$V_{\text{DD}} = 28\text{V}$
t_r	Rise Time	—	130	—		$I_D = 34\text{A}$
$t_{\text{d}(\text{off})}$	Turn-Off Delay Time	—	55	—		$R_G = 6.8\Omega$
t_f	Fall Time	—	78	—		$R_D = 10\Omega$ 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	—	2430	—	pF	$V_{\text{GS}} = 0\text{V}$
C_{oss}	Output Capacitance	—	470	—		$V_{\text{DS}} = 25\text{V}$
C_{rss}	Reverse Transfer Capacitance	—	100	—		$f = 1.0\text{MHz}$, See Fig. 5
C_{oss}	Output Capacitance	—	2040	—		$V_{\text{GS}} = 0\text{V}$, $V_{\text{DS}} = 1.0\text{V}$, $f = 1.0\text{MHz}$
C_{oss}	Output Capacitance	—	350	—		$V_{\text{GS}} = 0\text{V}$, $V_{\text{DS}} = 44\text{V}$, $f = 1.0\text{MHz}$
$C_{\text{oss eff.}}$	Effective Output Capacitance ⑤	—	350	—		$V_{\text{GS}} = 0\text{V}$, $V_{\text{DS}} = 0\text{V}$ to 44V

Diode Characteristics

	Parameter	Min.	Typ.	Max.	Units	Conditions
I_S	Continuous Source Current (Body Diode)	—	—	56⑥	A	MOSFET symbol showing the integral reverse p-n junction diode.
I_{SM}	Pulsed Source Current (Body Diode) ①	—	—	220		
V_{SD}	Diode Forward Voltage	—	—	1.3	V	$T_J = 25^\circ\text{C}$, $I_S = 34\text{A}$, $V_{\text{GS}} = 0\text{V}$ ④
t_{rr}	Reverse Recovery Time	—	62	93	ns	$T_J = 25^\circ\text{C}$, $I_F = 34\text{A}$
Q_{rr}	Reverse Recovery Charge	—	170	260	nC	$\text{di}/\text{dt} = 100\text{A}/\mu\text{s}$ ④
t_{on}	Forward Turn-On Time	Intrinsic turn-on time is negligible (turn-on is dominated by L_S+L_D)				

Notes:

- ① Repetitive rating; pulse width limited by max. junction temperature.
- ② Starting $T_J = 25^\circ\text{C}$, $L = 0.22\text{mH}$
 $R_G = 25\Omega$, $I_{AS} = 34\text{A}$.
- ③ $I_{SD} \leq 34\text{A}$, $\text{di}/\text{dt} \leq 190\text{A}/\mu\text{s}$, $V_{\text{DD}} \leq V_{(\text{BR})\text{DSS}}$,
 $T_J \leq 175^\circ\text{C}$.
- ④ Pulse width $\leq 300\mu\text{s}$; duty cycle $\leq 2\%$.
- ⑤ $C_{\text{oss eff.}}$ 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 Calculated continuous current based on maximum allowable junction temperature. Package limitation current is 30A.
- 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 of approximately 90°C .

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
ESD	Machine Model	Class M4 (+/- 500V) ^{†††} AEC-Q101-002	
	Human Body Model	Class H1C (+/- 2000V) ^{†††} AEC-Q101-001	
	Charged Device Model	Class C5 (+/- 2000V) ^{†††} AEC-Q101-005	
RoHS Compliant		Yes	

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

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

^{†††} Highest passing voltage.

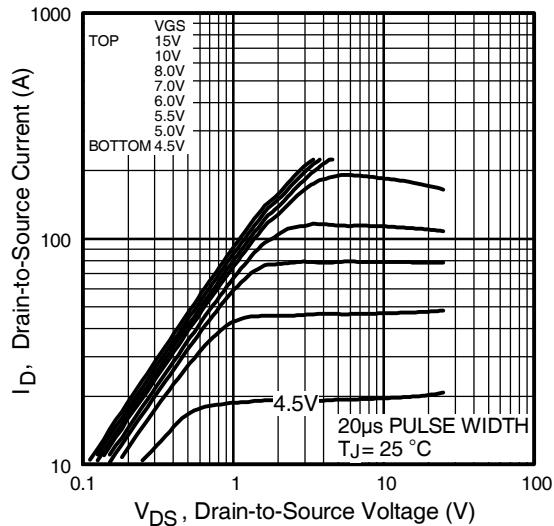


Fig 1. Typical Output Characteristics

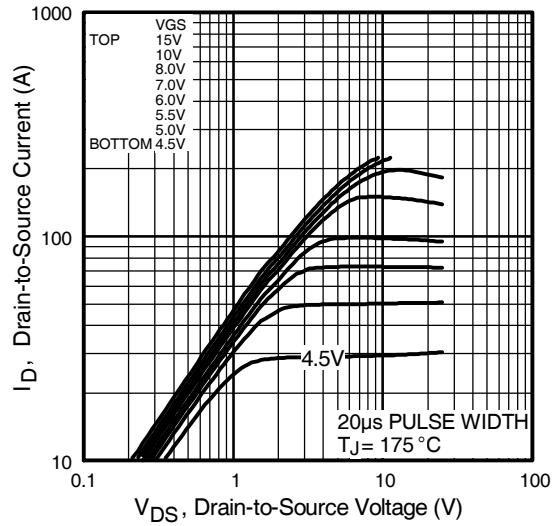


Fig 2. Typical Output Characteristics

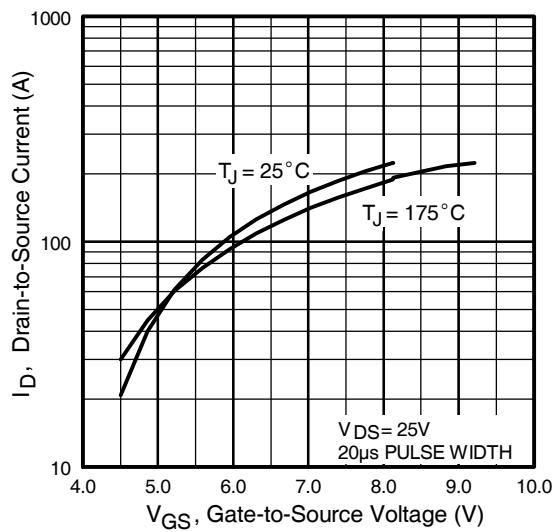


Fig 3. Typical Transfer Characteristics

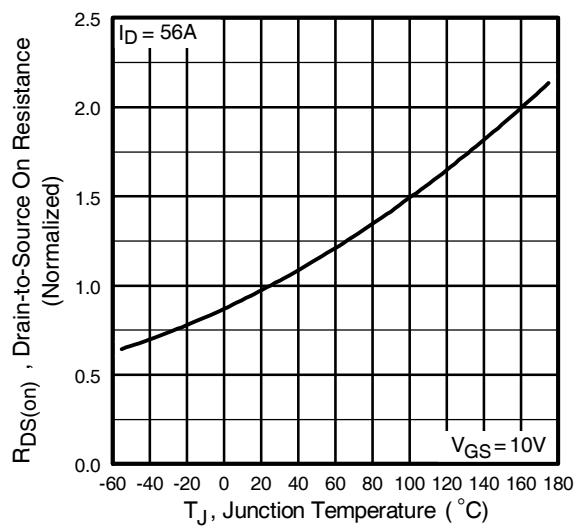


Fig 4. Normalized On-Resistance Vs. Temperature

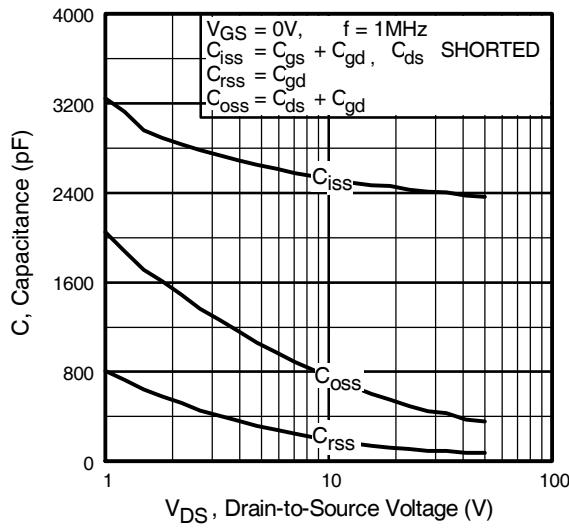


Fig 5. Typical Capacitance Vs.
Drain-to-Source Voltage

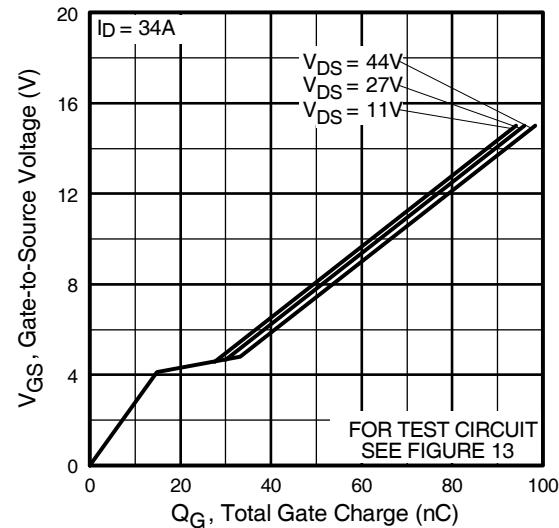


Fig 6. Typical Gate Charge Vs.
Gate-to-Source Voltage

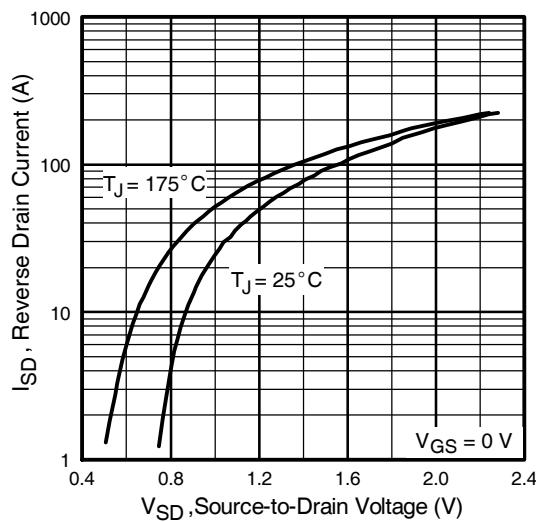


Fig 7. Typical Source-Drain Diode
Forward Voltage

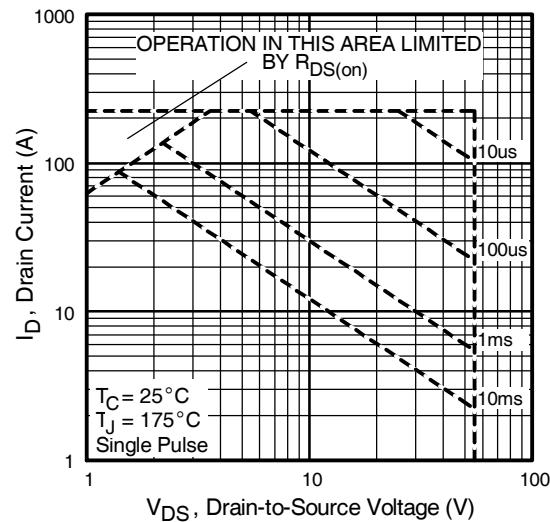


Fig 8. Maximum Safe Operating Area

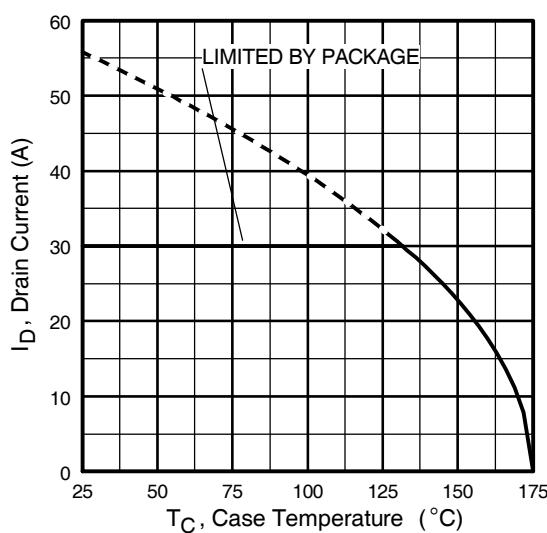


Fig 9. Maximum Drain Current Vs.
Case Temperature

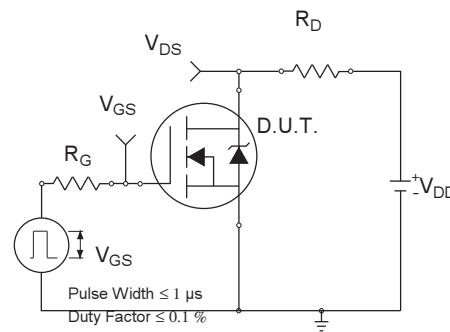


Fig 10a. Switching Time Test Circuit

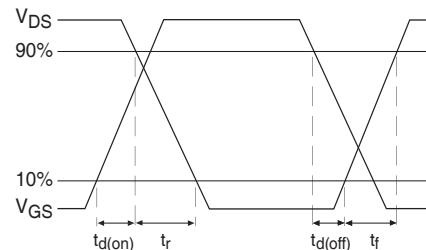


Fig 10b. Switching Time Waveforms

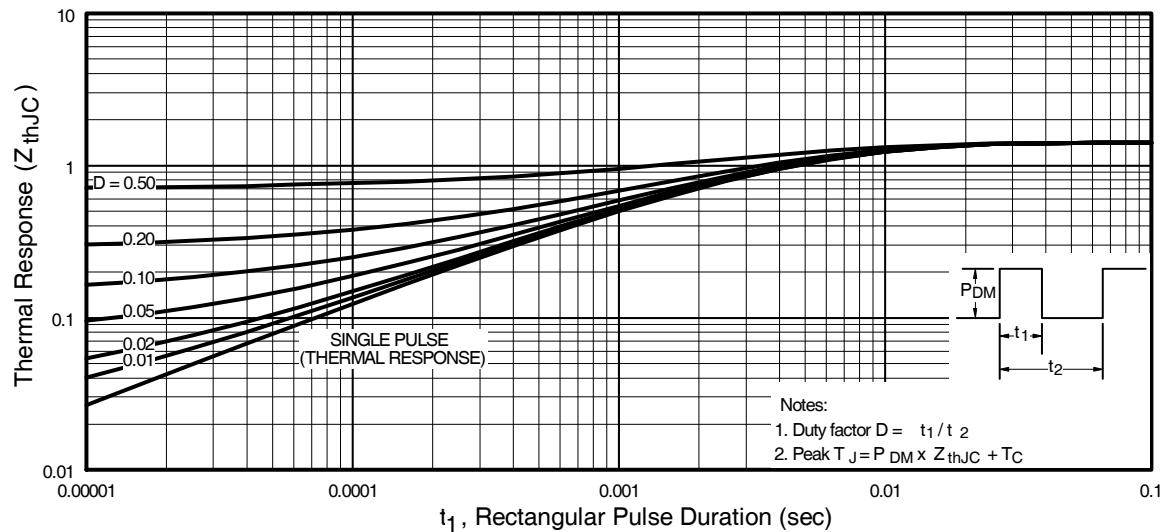


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Case

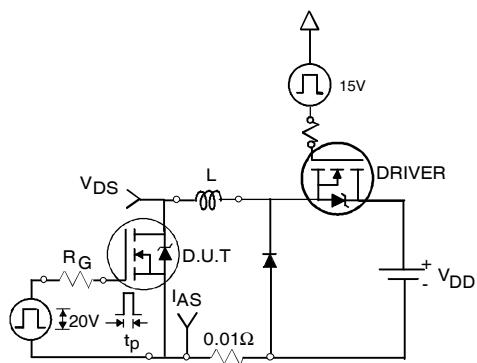


Fig 12a. Unclamped Inductive Test Circuit

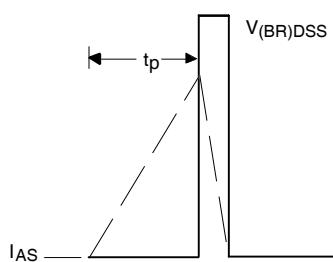


Fig 12b. Unclamped Inductive Waveforms

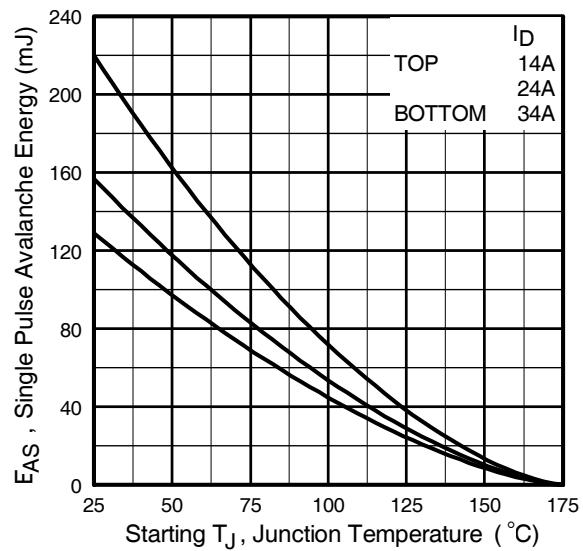


Fig 12c. Maximum Avalanche Energy Vs. Drain Current

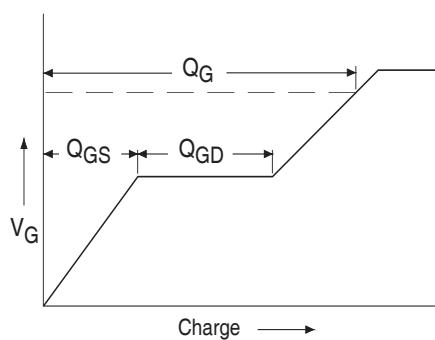


Fig 13a. Basic Gate Charge Waveform

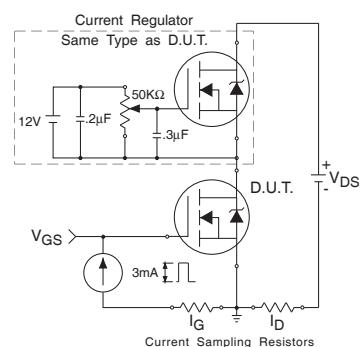
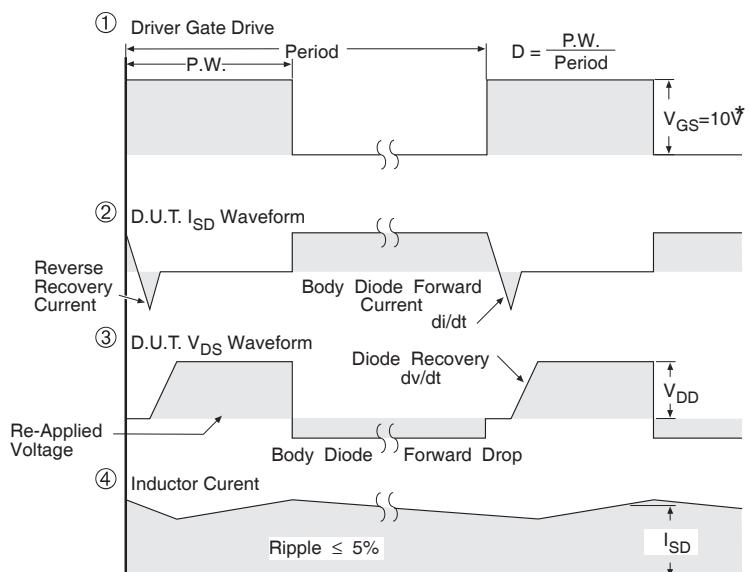
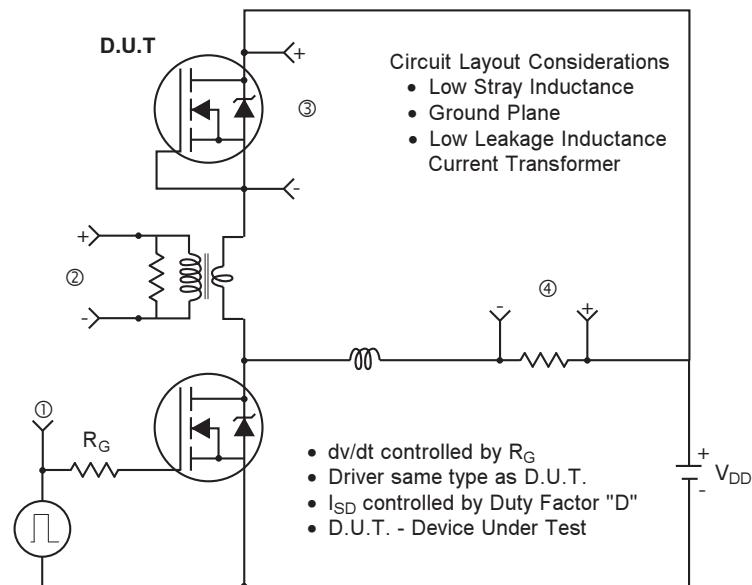


Fig 13b. Gate Charge Test Circuit

Peak Diode Recovery dv/dt Test Circuit

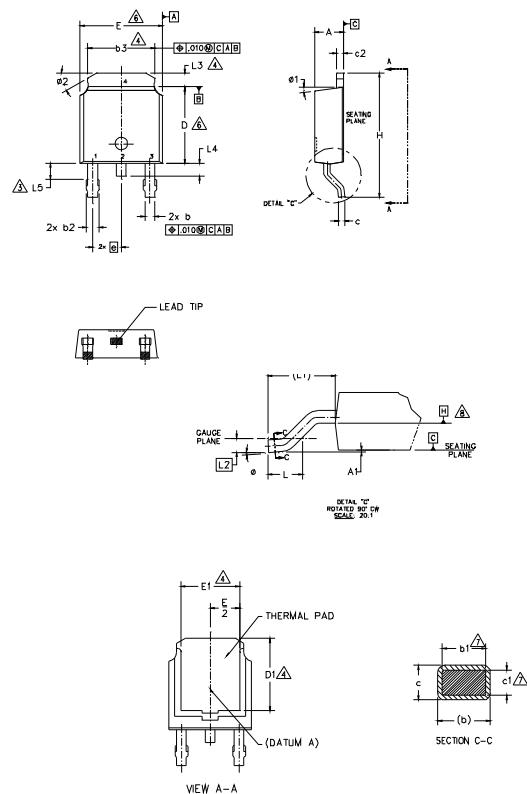


* $V_{GS} = 5V$ for Logic Level Devices

Fig 14. For N-Channel HEXFET® Power MOSFETs

D-Pak (TO-252AA) Package Outline

Dimensions are shown in millimeters (inches)



DIMENSIONS					
SYMBOL	MILLIMETERS		INCHES		NOTES
	MIN.	MAX.	MIN.	MAX.	
A	2.18	.239	.086	.094	
A1	—	.13	—	.005	
b	.64	.89	.025	.035	7
b1	.65	.79	.025	.031	
b2	.76	1.14	.030	.045	
b3	4.95	5.46	.195	.215	4
c	.46	.61	.018	.024	
c1	.41	.56	.016	.022	7
c2	.46	.89	.018	.035	
D	5.97	6.22	.235	.245	6
D1	5.21	—	.205	—	
E	6.35	6.73	.250	.265	6
E1	4.32	—	.170	—	
e	.229 BSC		.090 BSC		4
H	9.40	10.41	.370	.410	
L	1.40	1.78	.055	.070	
L1	2.74 BSC		.108 REF.		
L2	.051 BSC		.020 BSC		
L3	.89	1.27	.035	.050	4
L4	—	1.02	—	.040	
L5	1.14	1.52	.045	.060	3
o	0°	10°	0°	10°	
o1	0°	15°	0°	15°	
o2	25°	35°	25°	35°	

LEAD ASSIGNMENTS

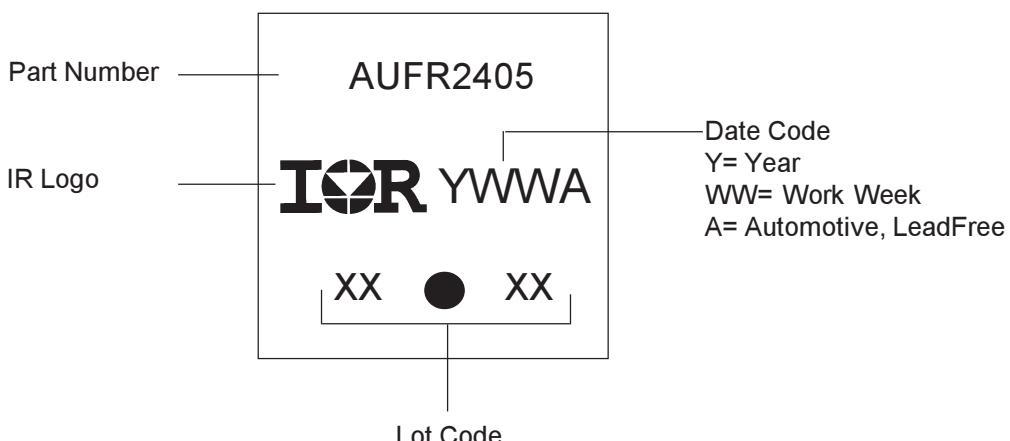
HEXFET

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

IGBT & CoPAK

1. GATE
2. COLLECTOR
3. Emitter
4. COLLECTOR

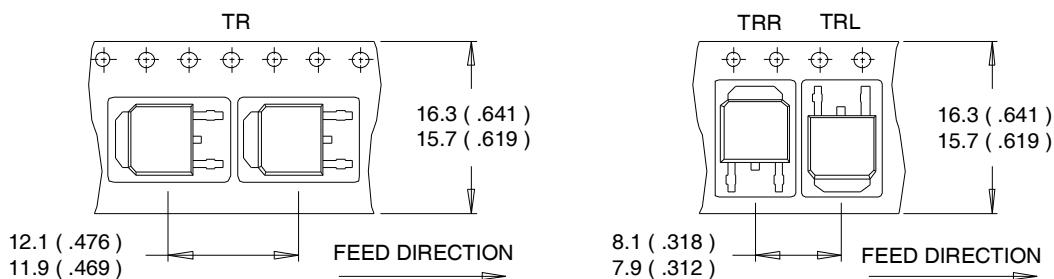
D-Pak Part Marking Information



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

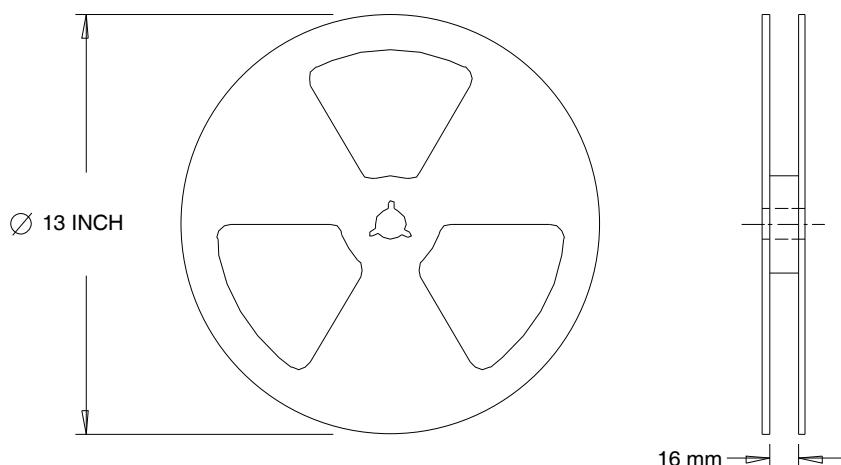
D-Pak (TO-252AA) Tape & Reel Information

Dimensions are shown in millimeters (inches)



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 number	Package Type	Standard Pack		Complete Part Number
		Form	Quantity	
AUIRFR2405	Dpak	Tube	75	AUIRFR2405
		Tape and Reel	2000	AUIRFR2405TR
		Tape and Reel Left	3000	AUIRFR2405TRL
		Tape and Reel Right	3000	AUIRFR2405TRR

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