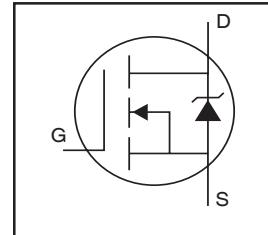


AUIRL3705N

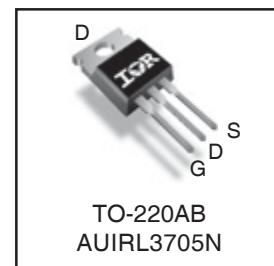
Features

- Advanced Planar Technology
- Logic-Level Gate Drive
- 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 *

HEXFET® Power MOSFET



$V_{(BR)DSS}$	55V
$R_{DS(on)}$ max.	0.01Ω
I_D	89A ^⑤



G	D	S
Gate	Drain	Source

Description

Specifically designed for Automotive applications, this Cellular 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 @ $T_C = 25^\circ\text{C}$	Continuous Drain Current, V_{GS} @ 10V	89 ^⑤	A
I_D @ $T_C = 100^\circ\text{C}$	Continuous Drain Current, V_{GS} @ 10V	63	
I_{DM}	Pulsed Drain Current ①	310	
P_D @ $T_C = 25^\circ\text{C}$	Power Dissipation	170	
	Linear Derating Factor	101	W/°C
V_{GS}	Gate-to-Source Voltage	±16	V
E_{AS}	Single Pulse Avalanche Energy ②	340	mJ
I_{AR}	Avalanche Current ①	46	A
E_{AR}	Repetitive Avalanche Energy ①	17	mJ
dv/dt	Peak Diode Recovery dv/dt ③	5.0	V/ns
T_J	Operating Junction and Storage Temperature Range	-55 to +175	°C
T_{STG}	Soldering Temperature, for 10 seconds	300 (1.6mm from case)	
	Mounting Torque, 6-32 or M3 screw	10 lbf•in (1.1N•m)	

Thermal Resistance

	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case	—	0.90	°C/W
$R_{\theta CS}$	Case-to-Sink, Flat, Greased Surface	0.50	—	
$R_{\theta JA}$	Junction-to-Ambient	—	62	

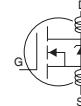
HEXFET® is a registered trademark of International Rectifier.

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

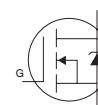
Static Electrical Characteristics @ $T_J = 25^\circ\text{C}$ (unless otherwise specified)

	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(\text{BR})\text{DSS}}$	Drain-to-Source Breakdown Voltage	55	—	—	V	$V_{GS} = 0\text{V}$, $I_D = 250\mu\text{A}$
$\Delta V_{(\text{BR})\text{DSS}}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	—	0.056	—	V/ $^\circ\text{C}$	Reference to 25°C , $I_D = 1\text{mA}$
$R_{DS(\text{on})}$	Static Drain-to-Source On-Resistance	—	—	0.010	Ω	$V_{GS} = 10\text{V}$, $I_D = 46\text{A}$ ④
		—	—	0.012		$V_{GS} = 5.0\text{V}$, $I_D = 46\text{A}$ ④
		—	—	0.018		$V_{GS} = 4.0\text{V}$, $I_D = 39\text{A}$ ④
$V_{GS(\text{th})}$	Gate Threshold Voltage	1.0	—	2.0	V	$V_{DS} = V_{GS}$, $I_D = 250\mu\text{A}$
g_{fs}	Forward Transconductance	50	—	—	S	$V_{DS} = 25\text{V}$, $I_D = 46\text{A}$ ⑤
I_{DSS}	Drain-to-Source Leakage Current	—	—	25	μA	$V_{DS} = 55\text{V}$, $V_{GS} = 0\text{V}$
		—	—	250		$V_{DS} = 44\text{V}$, $V_{GS} = 0\text{V}$, $T_J = 150^\circ\text{C}$
I_{GSS}	Gate-to-Source Forward Leakage	—	—	100	nA	$V_{GS} = 16\text{V}$
	Gate-to-Source Reverse Leakage	—	—	-100		$V_{GS} = -16\text{V}$

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

Q_g	Total Gate Charge	—	—	98	nC	$I_D = 46\text{A}$ $V_{DS} = 44\text{V}$ $V_{GS} = 5.0\text{V}$, See Fig 6 and 13 ④
Q_{gs}	Gate-to-Source Charge	—	—	19		
Q_{gd}	Gate-to-Drain ("Miller") Charge	—	—	49		
$t_{d(on)}$	Turn-On Delay Time	—	12	—	ns	$V_{DD} = 28\text{V}$ $I_D = 46\text{A}$
t_r	Rise Time	—	140	—		$R_G = 1.8\Omega$, $V_{GS} = 5.0\text{V}$
$t_{d(off)}$	Turn-Off Delay Time	—	37	—		$R_D = 0.59\Omega$, See Fig.10 ④
t_f	Fall Time	—	78	—		
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	—	3600	—	pF	$V_{GS} = 0\text{V}$
C_{oss}	Output Capacitance	—	870	—		$V_{DS} = 25\text{V}$
C_{rss}	Reverse Transfer Capacitance	—	320	—		$f = 1.0\text{MHz}$, See Fig.5

Diode Characteristics

	Parameter	Min.	Typ.	Max.	Units	Conditions
I_S	Continuous Source Current (Body Diode)	—	—	89 ⑤	A	MOSFET symbol showing the integral reverse p-n junction diode.
I_{SM}	Pulsed Source Current (Body Diode) ①	—	—	310		
V_{SD}	Diode Forward Voltage	—	—	1.3		$T_J = 25^\circ\text{C}$, $I_S = 46\text{A}$, $V_{GS} = 0\text{V}$ ④
t_{rr}	Reverse Recovery Time	—	94	140	ns	$T_J = 25^\circ\text{C}$, $I_F = 46\text{A}$
Q_{rr}	Reverse Recovery Charge	—	290	440	nC	$dI/dt = 100\text{A}/\mu\text{s}$ ④
t_{on}	Forward Turn-On Time	Intrinsic turn-on time is negligible (turn-on is dominated by $LS+LD$)				

Notes:

- ① Repetitive rating; pulse width limited by max. junction temperature. (See fig. 11).
- ② $V_{DD} = 25\text{V}$, starting $T_J = 25^\circ\text{C}$, $L = 320\mu\text{H}$, $R_G = 25\Omega$, $I_{AS} = 46\text{A}$. (See Figure 12)
- ③ $I_{SD} \leq 46\text{A}$, $di/dt \leq 250\text{A}/\mu\text{s}$, $V_{DD} \leq V_{(\text{BR})\text{DSS}}$, $T_J \leq 175^\circ\text{C}$
- ④ Pulse width $\leq 300\mu\text{s}$; duty cycle $\leq 2\%$.
- ⑤ Calculated continuous current based on maximum allowable junction temperature. for recommended current-handling of the package refer to Design tip # 93-4

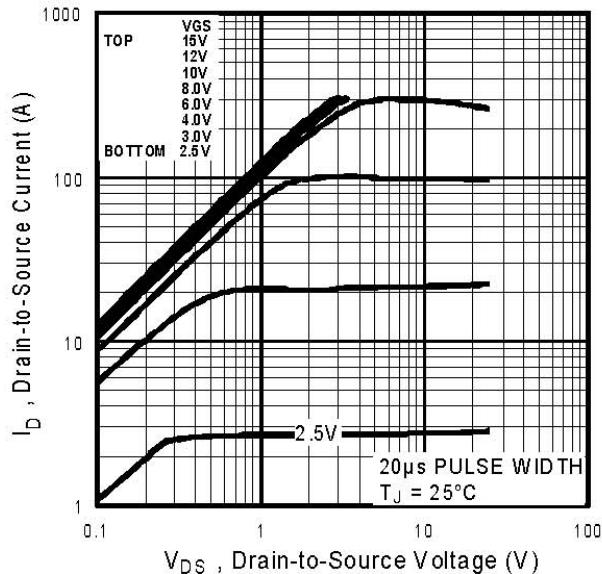
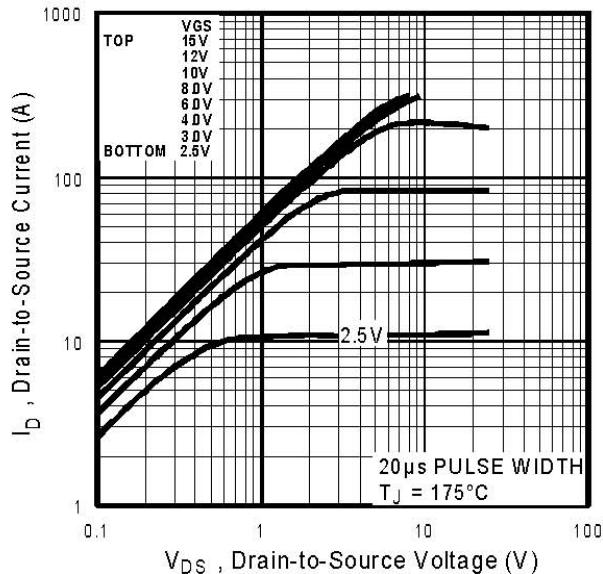
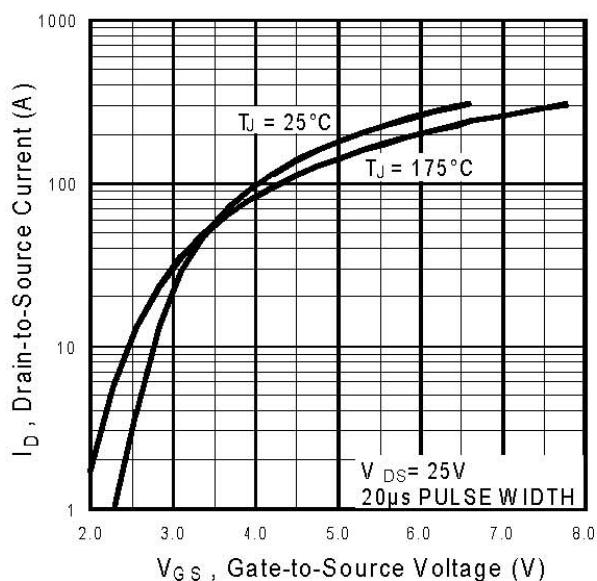
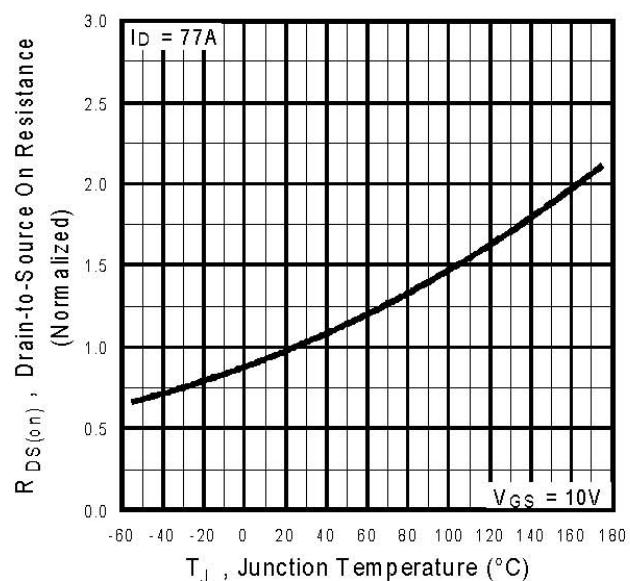
Qualification Information[†]

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	3L-TO-220	N/A
ESD	Machine Model	Class M4(+/- 800V) ^{†††} (per AEC-Q101-002)
	Human Body Model	Class H1C(+/- 2000V) ^{†††} (per AEC-Q101-001)
	Charged Device Model	Class C5(+/- 2000V) ^{†††} (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.

^{†††} 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

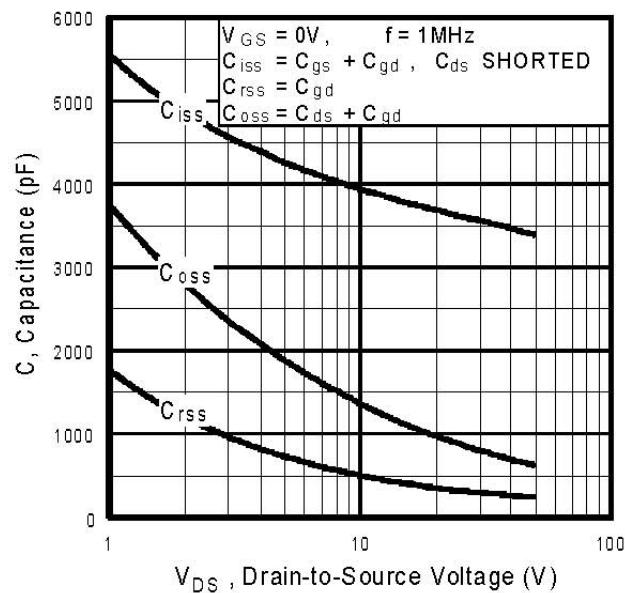


Fig 5. Typical Capacitance Vs.
Drain-to-Source Voltage

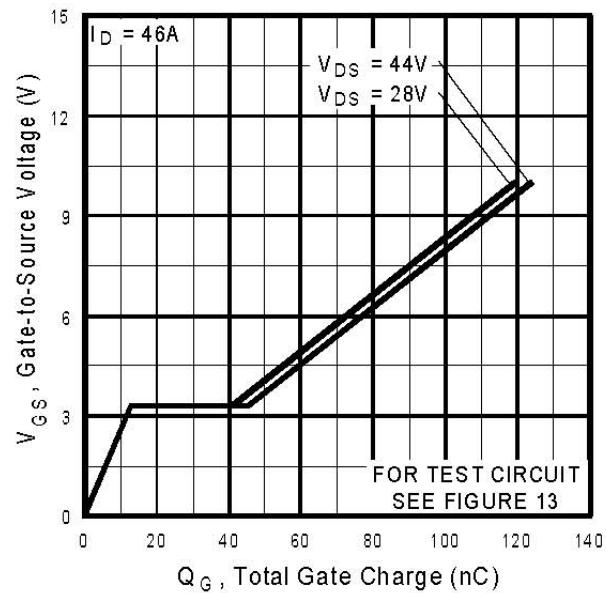


Fig 6. Typical Gate Charge Vs.
Gate-to-Source Voltage

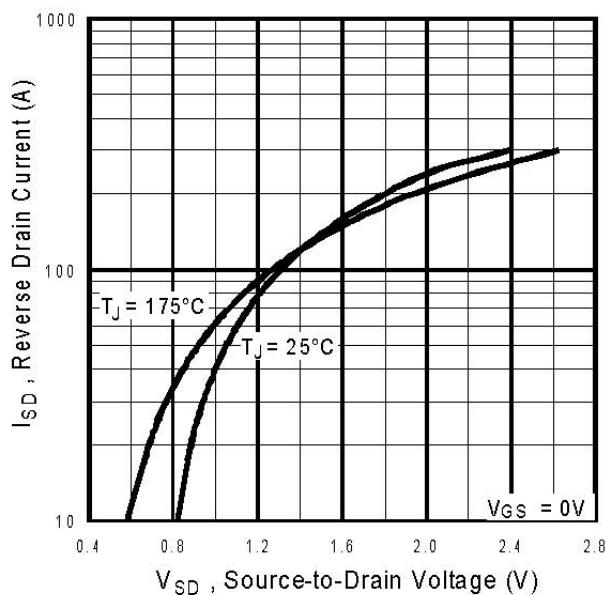


Fig 7. Typical Source-Drain Diode
Forward Voltage

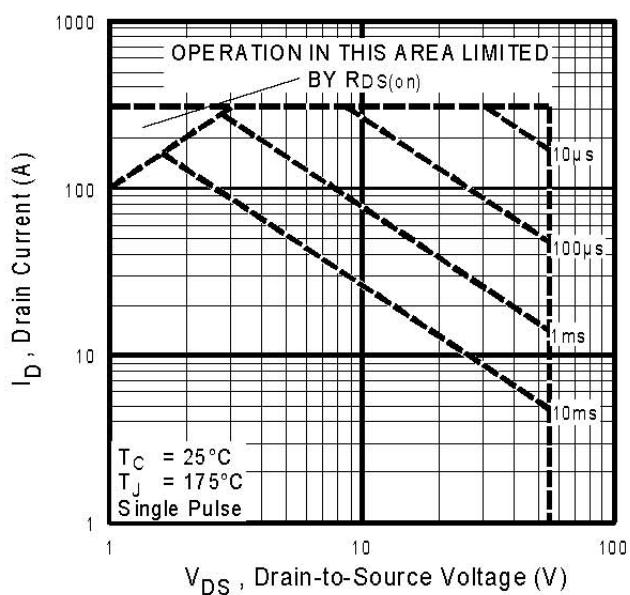


Fig 8. Maximum Safe Operating Area

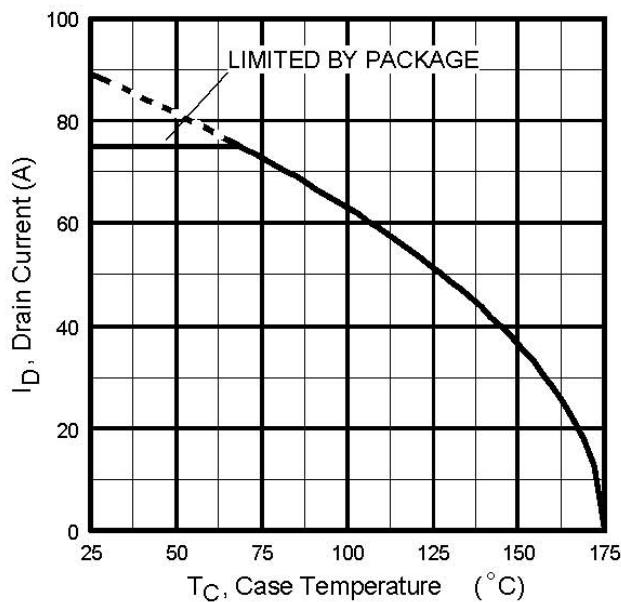


Fig 9. Maximum Drain Current Vs. Case Temperature

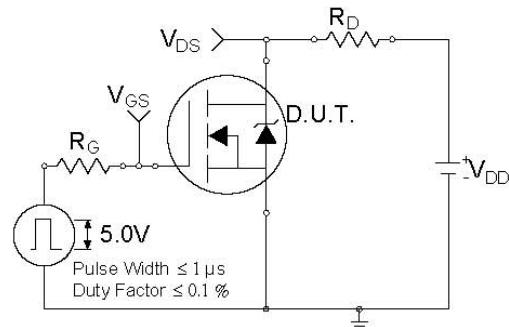


Fig 10a. Switching Time Test Circuit

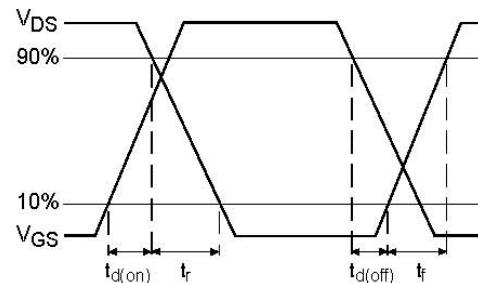


Fig 10b. Switching Time Waveforms

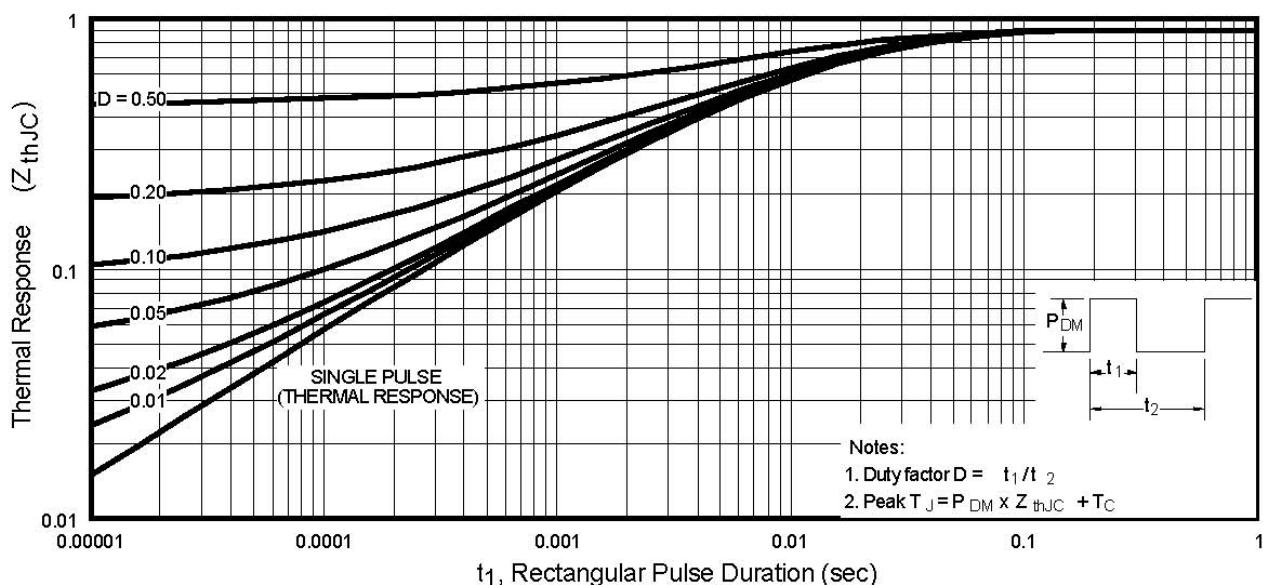


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Case

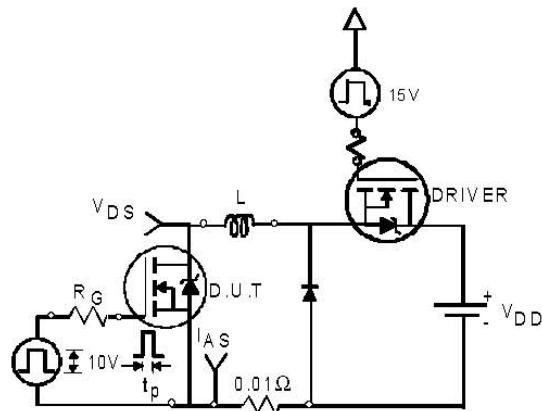


Fig 12a. Unclamped Inductive Test Circuit

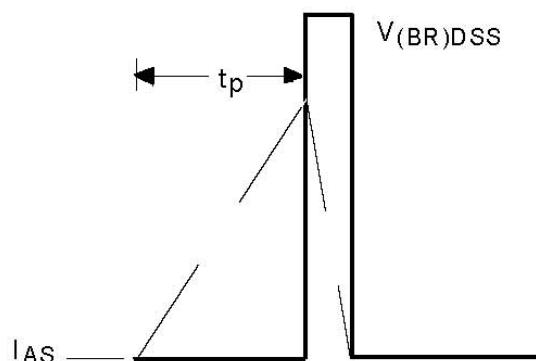


Fig 12b. Unclamped Inductive Waveforms

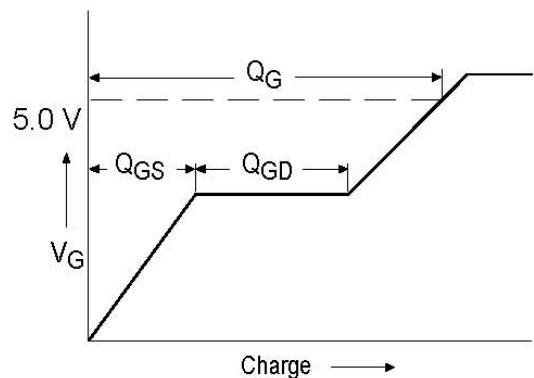


Fig 13a. Basic Gate Charge Waveform

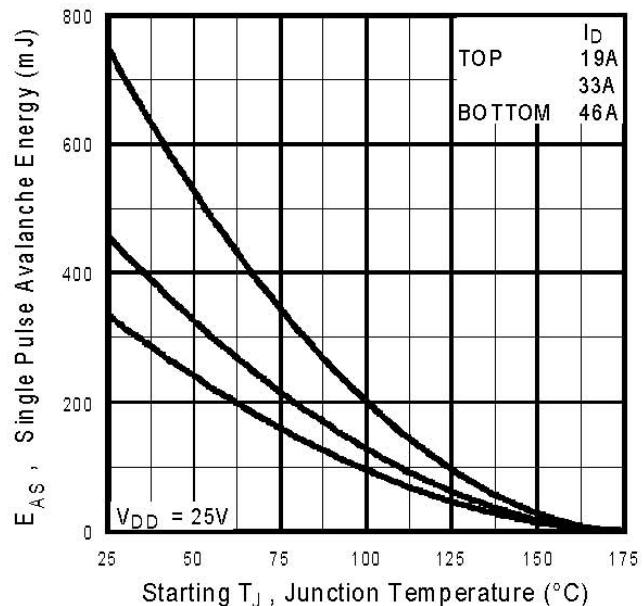


Fig 12c. Maximum Avalanche Energy Vs. Drain Current

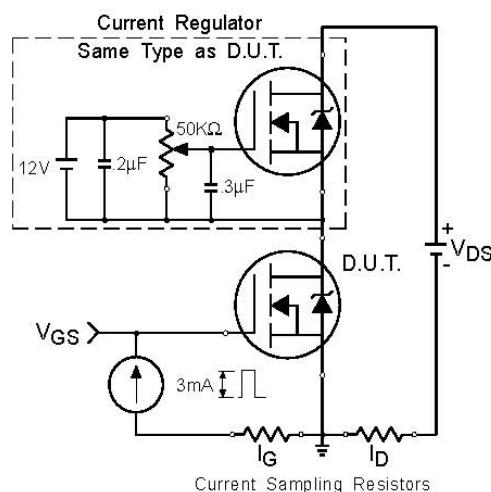
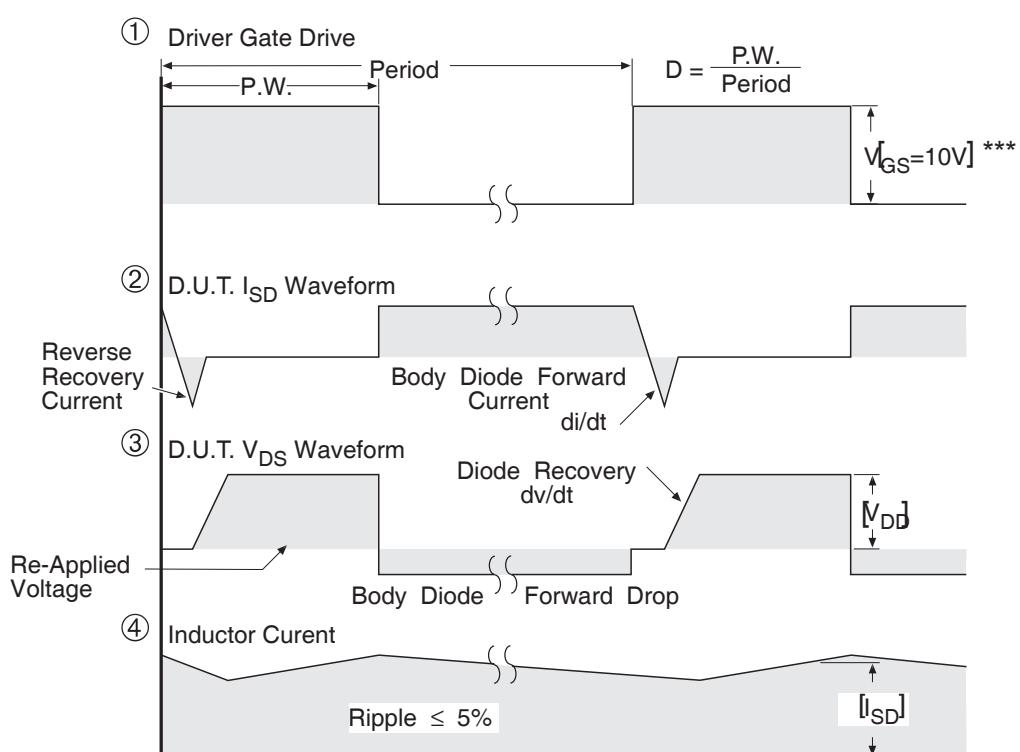
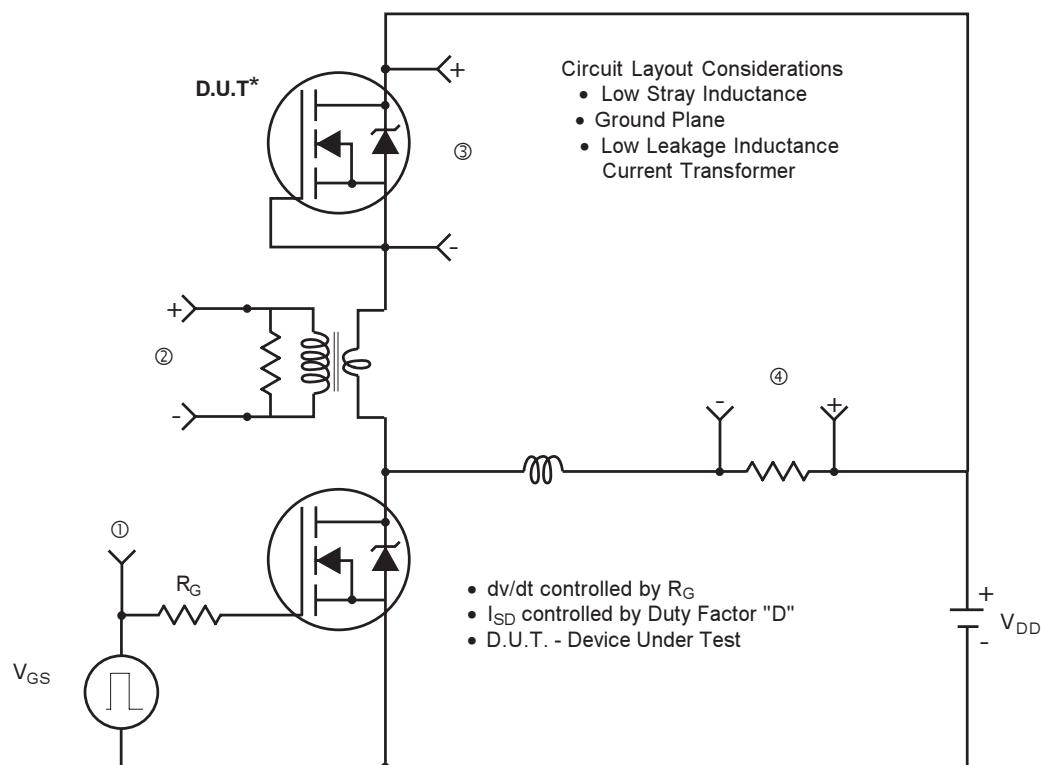


Fig 13b. Gate Charge Test Circuit

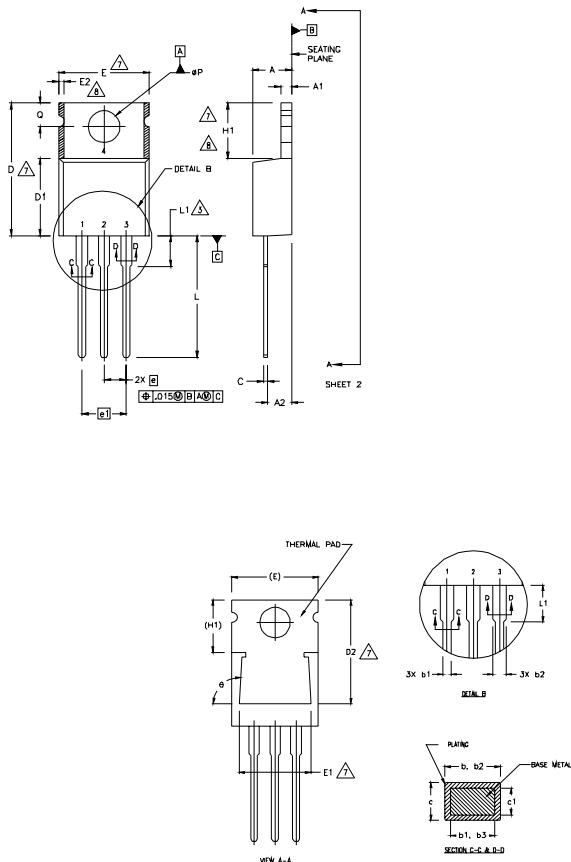
Peak Diode Recovery dv/dt Test Circuit



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

TO-220AB Package Outline

Dimensions are shown in millimeters (inches)



NOTES

1 DIMENSIONING AND TOLERANCING PER ASME Y14.5 M- 1994.
2 DIMENSIONS ARE SHOWN IN INCHES [MILLIMETERS].
3 LEAD DIMENSION AND FINISH UNCONTROLLED IN L1.
4 DIMENSION D & E DO NOT INCLUDE MOLD FLASH. MOLD FLASH
SHALL NOT EXCEED .005" (0.127) PER SIDE. THESE DIMENSIONS ARE
MEASURED AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY.
5 DIMENSION B1 & C1 APPLY TO BASE METAL ONLY.
6 CONTROLLING DIMENSION : INCHES.
7 THERMAL PAD CONTOUR OPTIONAL WITHIN DIMENSIONS E,H1,D2 & E1
8 DIMENSION E2 X H1 DEFINE A ZONE WHERE STAMPING
AND SINGULATION IRREGULARITIES ARE ALLOWED.

LEAD ASSIGNMENTS

HEXFET

IGBTs, CoPACK

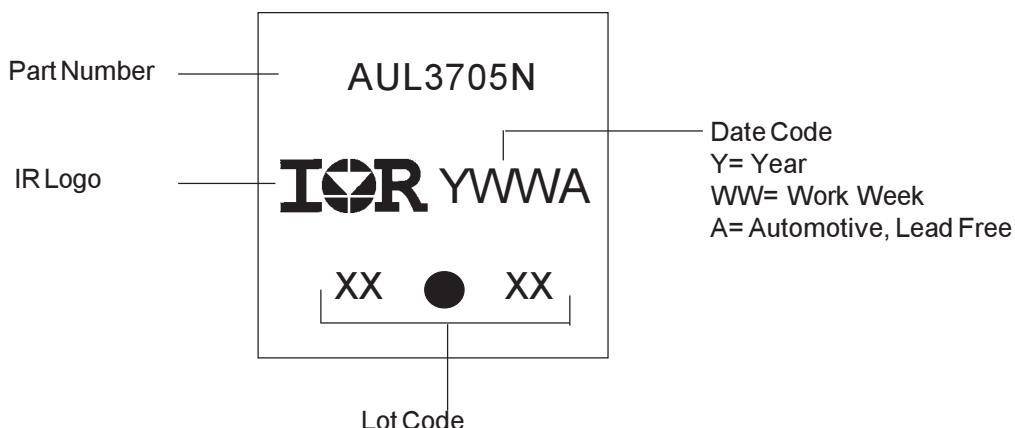
- 1.- GATE
- 2.- COLLECTOR
- 3.- Emitter

DIODES

1. - ANODE/OPEN
2. - CATHODE
3. - ANODE

SYMBOL	DIMENSIONS				NOTES	
	MILLIMETERS		INCHES			
	MIN.	MAX.	MIN.	MAX.		
A	3.56	4.82	.140	.190		
A1	0.51	1.40	.020	.055		
A2	2.04	2.92	.080	.115		
b	0.38	1.01	.015	.040		
b1	0.38	0.96	.015	.038	5	
b2	1.15	1.77	.045	.070		
b3	1.15	1.73	.045	.068		
c	0.36	0.61	.014	.024		
c1	0.36	0.56	.014	.022	5	
D	14.22	16.51	.560	.650	4	
D1	8.38	9.02	.330	.355		
D2	12.19	12.88	.480	.507	7	
E	9.66	10.66	.380	.420	4,7	
E1	8.38	8.89	.330	.350	7	
e	2.54 BSC		.100 BSC			
e1	5.08		.200 BSC			
H1	5.85	6.55	.230	.270	7,8	
L	12.70	14.73	.500	.580		
L1	—	6.35	—	.250	3	
ØP	3.54	4.08	.139	.161		
Q	2.54	3.42	.100	.135		
Ø	90°-93°		90°-93°			

TO-220AB Part Marking Information



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

Ordering Information

Base part	Package Type	Standard Pack		Complete Part Number
		Form	Quantity	
AUURL3705N	TO-220	Tube	50	AUURL3705N

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