International Rectifier

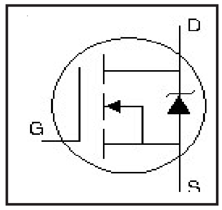
AUTOMOTIVE GRADE

AUIRLI2505

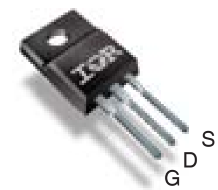
HEXFET® Power MOSFET

Features

- Advanced Planar Technology
- Logic-Level Gate Drive
- Low On-Resistance
- Dynamic dv/dt Rating
- 175°C Operating Temperature
- Fast Switching
- Fully Avalanche Rated
- Repetitive Avalanche Allowed up to Tjmax
- Lead-Free, RoHS Compliant
- Automotive Qualified*



$V_{(BR)DSS}$	55V
$R_{DS(on)}$ max.	8.0mΩ
I_D	58A



TO-220AB Full-Pak
AUIRLI2505

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°C	Continuous Drain Current, V_{GS} @ 10V	58	A
I_D @ T_C = 100°C	Continuous Drain Current, V_{GS} @ 10V	41	
I_{DM}	Pulsed Drain Current ①⑥	360	
P_D @T_C = 25°C	Power Dissipation	63	W
	Linear Derating Factor	0.42	W/°C
V_{GS}	Gate-to-Source Voltage	± 16	V
E_{AS}	Single Pulse Avalanche Energy (Thermally Limited)②⑥	500	mJ
I_{AR}	Avalanche Current ①⑥	54	A
E_{AR}	Repetitive Avalanche Energy ③	6.3	mJ
dv/dt	Peak Diode Recovery dv/dt ③⑥	5.0	V/ns
T_J T_{STG}	Operating Junction and Storage Temperature Range	-55 to + 175	°C
	Soldering Temperature, for 10 seconds (1.6mm from case)	300	
	Mounting Torque, 6-32 or M3 screw	10 lbf•in (1.1N•m)	

Thermal Resistance

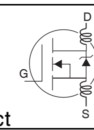
	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case ⑦	–––	2.4	°C/W
$R_{\theta JA}$	Junction-to-Ambient	–––	65	

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

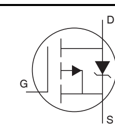
Static Electrical Characteristics @ T_J = 25°C (unless otherwise specified)

	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(BR)DSS}$	Drain-to-Source Breakdown Voltage	55	–––	–––	V	V_{GS} = 0V, I_D = 250μA
$\Delta V_{(BR)DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	–––	0.035	–––	V/°C	Reference to 25°C, I_D = 1mA ⑥
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	–––	–––	8.0	mΩ	V_{GS} = 10V, I_D = 31A ④
		–––	–––	10		V_{GS} = 5.0V, I_D = 31A ④
		–––	–––	13		V_{GS} = 4.0V, I_D = 26A ④
$V_{GS(th)}$	Gate Threshold Voltage	1.0	–––	2.0	V	V_{DS} = V_{GS}, I_D = 250μA
gfs	Forward Transconductance	59	–––	–––	S	V_{DS} = 25V, I_D = 54A 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°C
I_{GSS}	Gate-to-Source Forward Leakage	–––	–––	100	nA	V_{GS} = 16V
	Gate-to-Source Reverse Leakage	–––	–––	-100		V_{GS} = -16V

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

	Parameter	Min.	Typ.	Max.	Units	Conditions
Q_g	Total Gate Charge	–––	–––	130	nC	I_D = 54A
Q_{gs}	Gate-to-Source Charge	–––	–––	25		V_{DS} = 44V
Q_{gd}	Gate-to-Drain ("Miller") Charge	–––	–––	67		V_{GS} = 5.0V, See Fig. 6&13 ④⑥
$t_{d(on)}$	Turn-On Delay Time	–––	12	–––	ns	V_{DD} = 28V
t_r	Rise Time	–––	160	–––		I_D = 54A
$t_{d(off)}$	Turn-Off Delay Time	–––	43	–––		R_G = 1.3Ω, V_{GS} = 5.0V
t_f	Fall Time	–––	84	–––		R_D = 0.50Ω, See Fig. 10 ④⑥
L_D	Internal Drain Inductance	–––	4.5	–––	nH	Between lead, 6mm (0.25in.) 
L_S	Internal Source Inductance	–––	7.5	–––		from package and center of die contact
C_{iss}	Input Capacitance	–––	5000	–––	pF	V_{GS} = 0V
C_{oss}	Output Capacitance	–––	1100	–––		V_{DS} = 25V
C_{rss}	Reverse Transfer Capacitance	–––	390	–––		ƒ = 1.0MHz, See Fig. 5 ⑥
C	Drain to Sink Capacitance	–––	12	–––		ƒ = 1.0MHz

Diode Characteristics

	Parameter	Min.	Typ.	Max.	Units	Conditions
I_S	Continuous Source Current (Body Diode)	–––	–––	58	A	MOSFET symbol showing the 
I_{SM}	Pulsed Source Current (Body Diode) ①	–––	–––	360		integral reverse p-n junction diode.
V_{SD}	Diode Forward Voltage	–––	–––	1.3	V	T_J = 25°C, I_S = 31A, V_{GS} = 0V ④
t_{rr}	Reverse Recovery Time	–––	140	210	ns	T_J = 25°C, I_F = 54A
Q_{rr}	Reverse Recovery Charge	–––	650	970	nC	di/dt = 100A/μs ④⑥
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} = 25V, starting T_J = 25°C, L = 240μH R_G = 25Ω, I_{AS} = 54A. (See Figure 12)

③ $I_{SD} \leq$ 54A, di/dt ≤ 230A/μs, $V_{DD} \leq V_{(BR)DSS}$, $T_J \leq$ 175°C.

④ Pulse width ≤ 300μs; duty cycle ≤ 2%.

⑤ t=60s, ƒ=60Hz

⑥ Uses IRL2505 data and test conditions.

⑦ R_θ is measured at Tj at approximately 90°C.

Qualification Information[†]

<table>
<tr><td colspan="2" rowspan="2">Qualification Level</td><td colspan="2">Automotive
(per AEC-Q101)</td></tr>
<tr><td colspan="2">Comments: This part number(s) passed Automotive qualification. IR’s Industrial and Consumer qualification level is granted by extension of the higher Automotive level.</td></tr>
<tr><td colspan="2">Moisture Sensitivity Level</td><td>TO-220 Fullpak</td><td>N/A</td></tr>
<tr><td rowspan="3">ESD</td><td>Machine Model</td><td colspan="2">Class M4 (+/- 800V)[††]
AEC-Q101-002</td></tr>
<tr><td>Human Body Model</td><td colspan="2">Class H1C (+/- 2000V)[††]
AEC-Q101-001</td></tr>
<tr><td>Charged Device Model</td><td colspan="2">Class C5 (+/- 2000V)[††]
AEC-Q101-005</td></tr>
<tr><td colspan="2">RoHS Compliant</td><td colspan="2">Yes</td></tr>
</table>

† Qualification standards can be found at International Rectifier’s web site: http//www.irf.com/

†† Highest passing voltage.

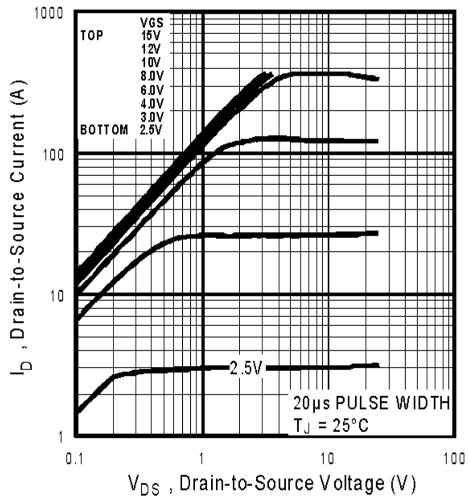


Fig 1. Typical Output Characteristics

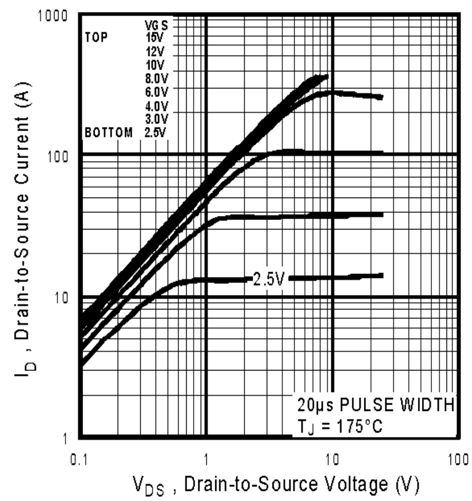


Fig 2. Typical Output Characteristics

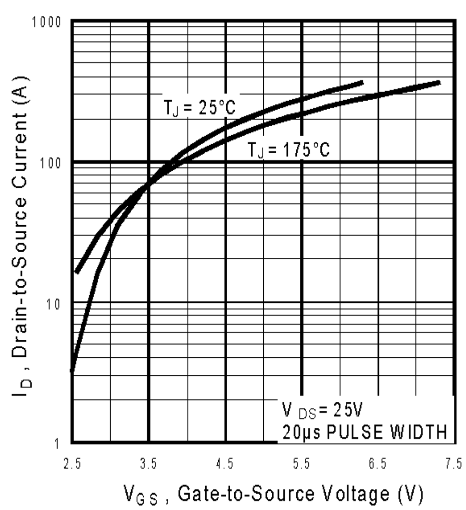


Fig 3. Typical Transfer Characteristics

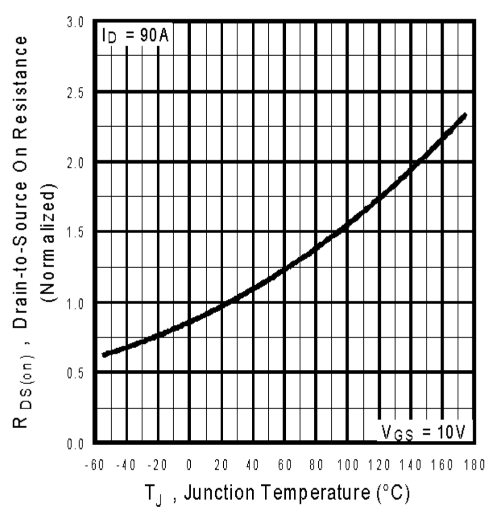


Fig 4. Normalized On-Resistance Vs. Temperature

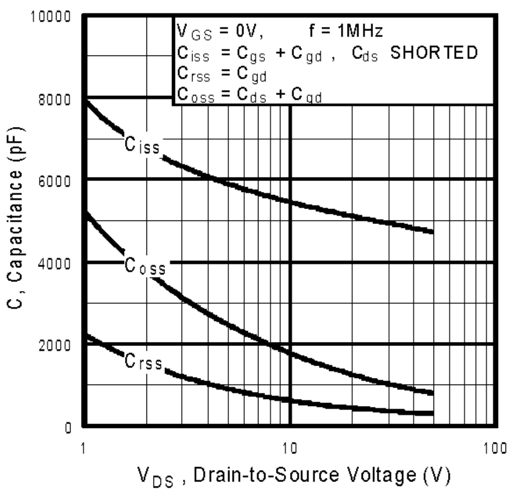


Fig 5. Typical Capacitance Vs. Drain-to-Source Voltage

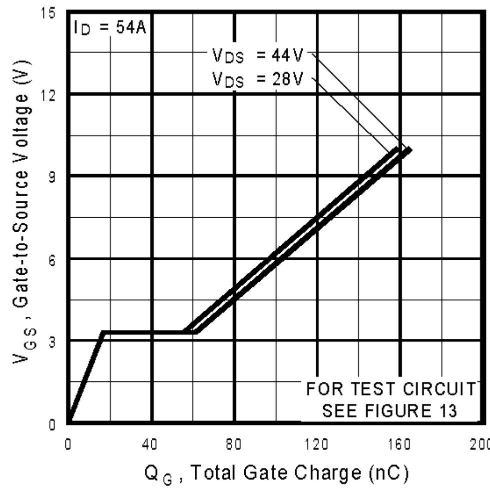


Fig 6. Typical Gate Charge Vs. Gate-to-Source Voltage

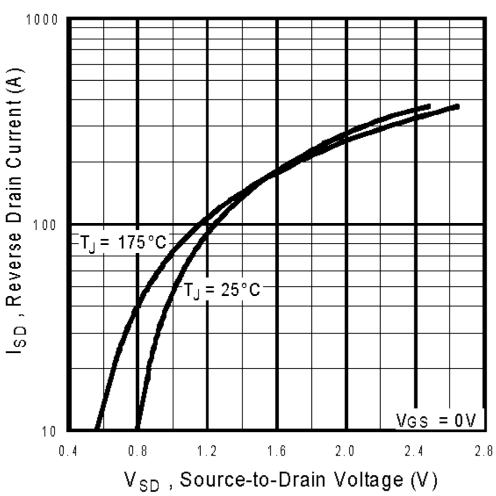


Fig 7. Typical Source-Drain Diode Forward Voltage

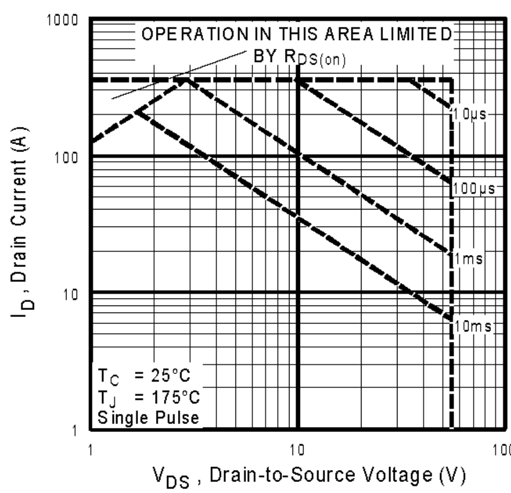


Fig 8. Maximum Safe Operating Area

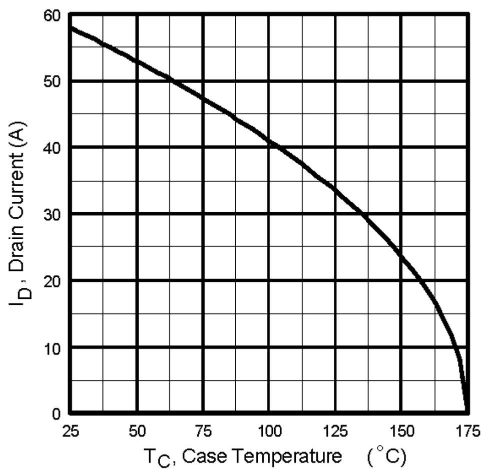


Fig 9. Maximum Drain Current Vs. Case Temperature

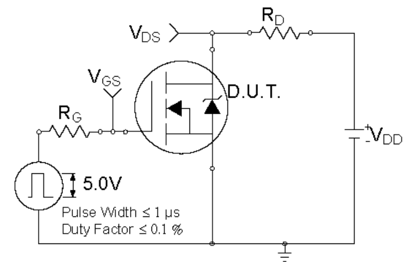


Fig 10a. Switching Time Test Circuit

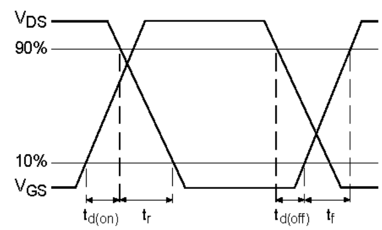


Fig 10b. Switching Time Waveforms

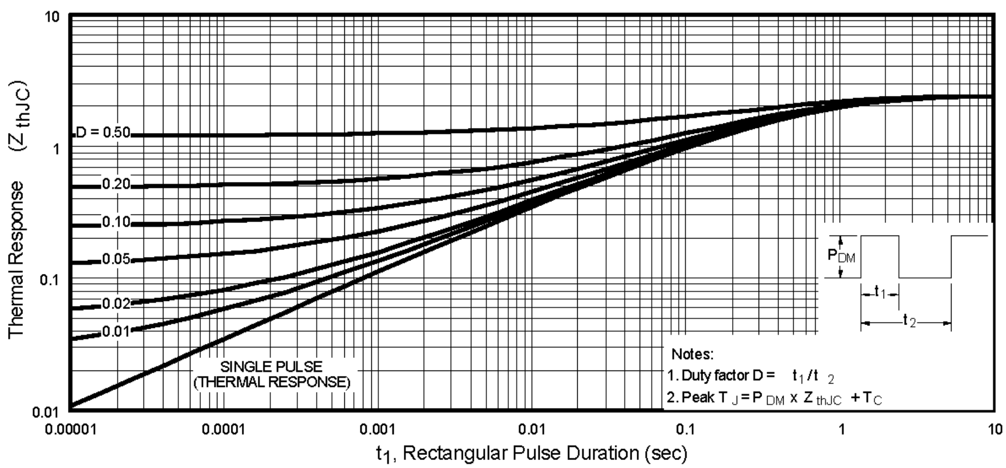


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Case

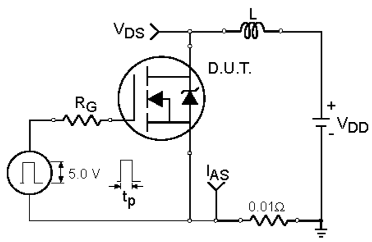


Fig 12a. Unclamped Inductive Test Circuit

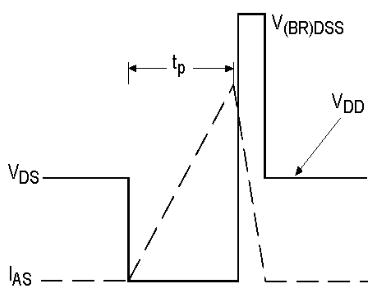


Fig 12b. Unclamped Inductive Waveforms

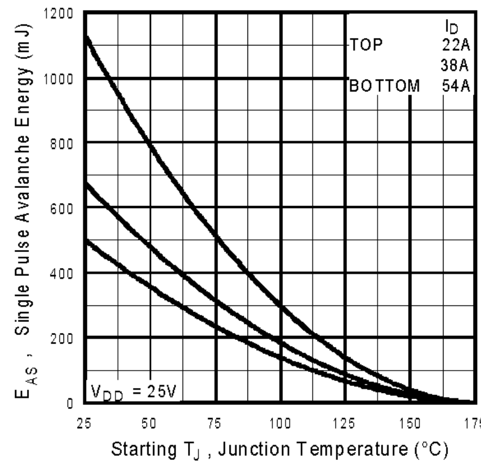


Fig 12c. Maximum Avalanche Energy
Vs. Drain Current

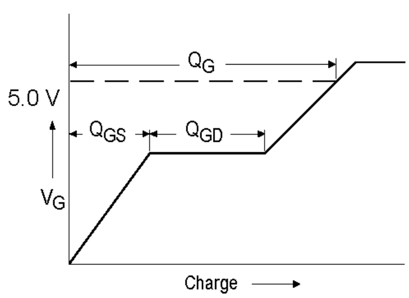


Fig 13a. Basic Gate Charge Waveform

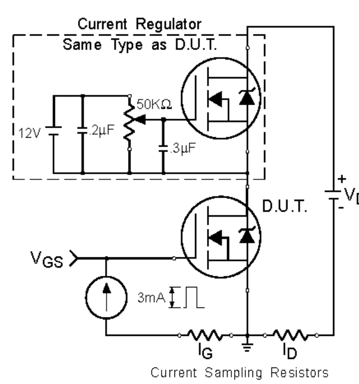
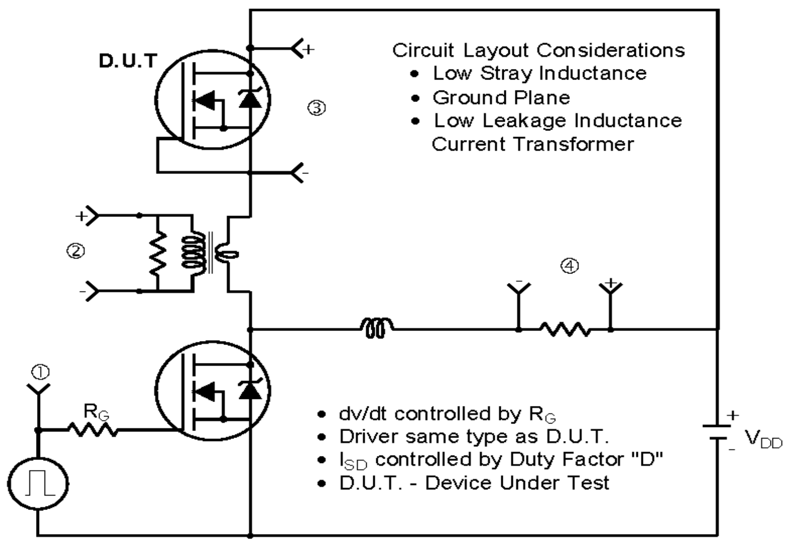


Fig 13b. Gate Charge Test Circuit

Peak Diode Recovery dv/dt Test Circuit



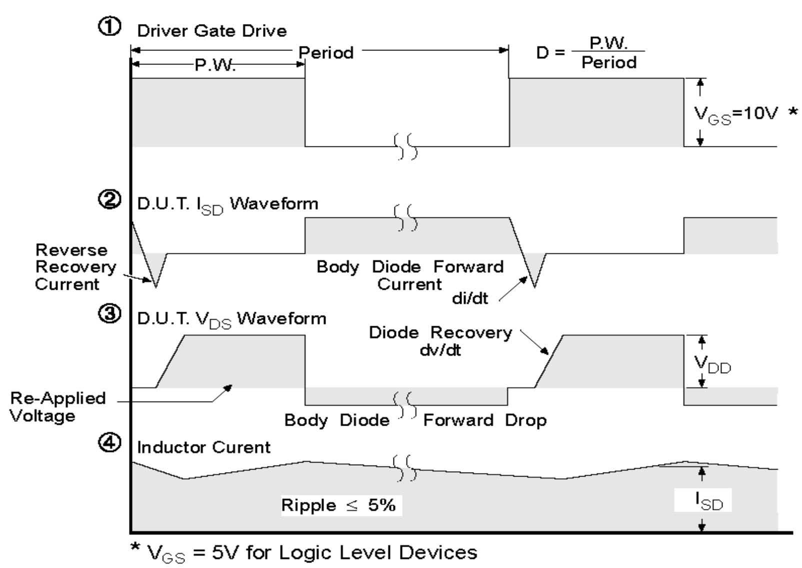
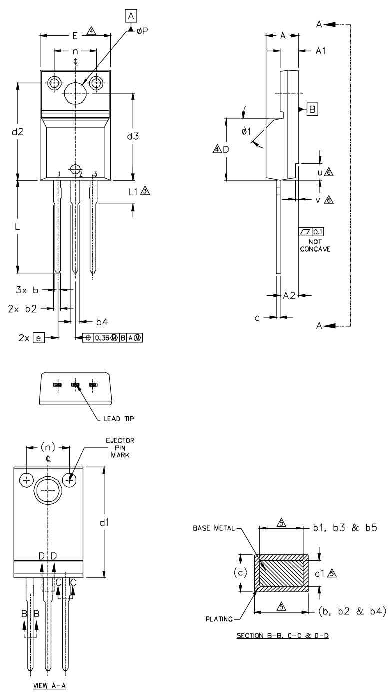


Fig 14. For N-Channel HEXFETS

TO-220AB Full-Pak Package Outline

Dimensions are shown in millimeters (inches)



SYMBOL	DIMENSIONS				NOTES
	MILLIMETERS		INCHES		
	MIN.	MAX.	MIN.	MAX.	
A	4.57	4.83	.180	.190	
A1	2.57	2.83	.101	.111	
A2	2.51	2.93	.099	.115	
b	0.61	0.94	.024	.037	
b1	0.61	0.89	.024	.035	5
b2	0.76	1.27	.030	.050	
b3	0.76	1.22	.030	.048	5
b4	1.02	1.52	.040	.060	
b5	1.02	1.47	.040	.058	5
c	0.33	0.63	.013	.025	
c1	0.33	0.58	.013	.023	5
D	8.66	9.80	.341	.386	4
d1	15.80	16.13	.622	.635	
d2	13.97	14.22	.550	.560	
d3	12.30	12.93	.484	.509	
E	9.63	10.75	.379	.423	4
e	2.54 BSC		.100 BSC		
L	13.20	13.72	.520	.540	
L1	3.37	3.67	.122	.145	3
n	6.05	6.60	.238	.260	
øP	3.05	3.45	.120	.136	
u	2.40	2.50	.094	.098	6
v	0.40	0.50	.016	.020	6
ø1	–	45°	–	45°	

NOTES:

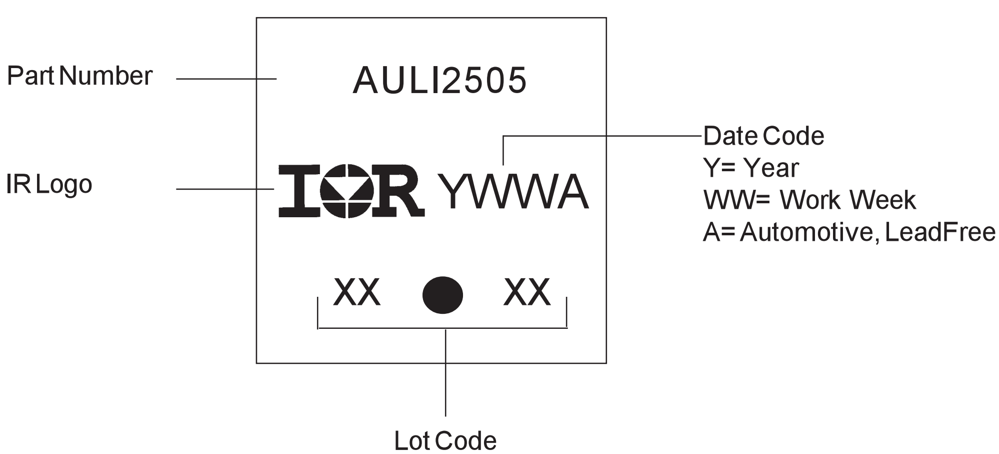
1.0 DIMENSIONING AND TOLERANCING AS PER ASME Y14.5 M– 1994.
2.0 DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES].
3.0 LEAD DIMENSION AND FINISH UNCONTROLLED IN L1.
4.0 DIMENSION D & E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED .005" (0.127) PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTER MOST EXTREMES OF THE PLASTIC BODY.
5.0 DIMENSION b1, b3, b5 & c1 APPLY TO BASE METAL ONLY.
6.0 STEP OPTIONAL ON PLASTIC BODY DEFINED BY DIMENSIONS u & v.
7.0 CONTROLLING DIMENSION : INCHES.

LEAD ASSIGNMENTS

HEXFET
1.– GATE
2.– DRAIN
3.– SOURCE

IGBTs, CoPACK
1.– GATE
2.– COLLECTOR
3.– EMITTER

TO-220AB Full-Pak Part Marking Information



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

Ordering Information

Base part number	Package Type	Standard Pack		Complete Part Number
		Form	Quantity	
AUIRLI2505	TO-220 Fullpak	Tube	50	AUIRLI2505

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http://www.irf.com/technical-info/

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