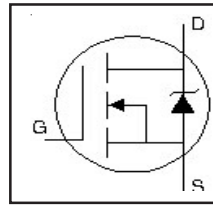


# AUIRLI2505

## 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 T<sub>jmax</sub>
- Lead-Free, RoHS Compliant
- Automotive Qualified\*



HEXFET® Power MOSFET

<b>V<sub>(BR)DSS</sub></b>	<b>55V</b>
<b>R<sub>DS(on)</sub> max.</b>	<b>8.0mΩ</b>
<b>I<sub>D</sub></b>	<b>58A</b>

## 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.



<b>G</b>	<b>D</b>	<b>S</b>
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<sub>A</sub>) is 25°C, unless otherwise specified.

	Parameter	Max.	Units
I <sub>D</sub> @ T <sub>C</sub> = 25°C	Continuous Drain Current, V <sub>GS</sub> @ 10V	58	A
I <sub>D</sub> @ T <sub>C</sub> = 100°C	Continuous Drain Current, V <sub>GS</sub> @ 10V	41	
I <sub>DM</sub>	Pulsed Drain Current ①⑥	360	
P <sub>D</sub> @ T <sub>C</sub> = 25°C	Power Dissipation	63	W
	Linear Derating Factor	0.42	W/°C
V <sub>GS</sub>	Gate-to-Source Voltage	± 16	V
E <sub>AS</sub>	Single Pulse Avalanche Energy (Thermally Limited)②⑥	500	mJ
I <sub>AR</sub>	Avalanche Current ①⑥	54	A
E <sub>AR</sub>	Repetitive Avalanche Energy ③	6.3	mJ
dv/dt	Peak Diode Recovery dv/dt ③⑥	5.0	V/ns
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	
	Mounting Torque, 6-32 or M3 screw	10 lbf•in (1.1N•m)	

## Thermal Resistance

	Parameter	Typ.	Max.	Units
R <sub>θJC</sub>	Junction-to-Case ⑦	—	2.4	°C/W
R <sub>θJA</sub>	Junction-to-Ambient	—	65	

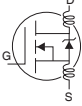
HEXFET® is a registered trademark of International Rectifier.

\*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	—	0.035	—	V/°C	Reference to $25^\circ\text{C}, I_D = 1mA$ 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	$V_{DS} = V_{GS}, I_D = 250\mu A$
$g_{fs}$	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		$V_{DS} = 44V, V_{GS} = 0V, T_J = 150^\circ\text{C}$
$I_{GSS}$	Gate-to-Source Forward Leakage	—	—	100	nA	$V_{GS} = 16V$
	Gate-to-Source Reverse Leakage	—	—	-100		$V_{GS} = -16V$

### Dynamic Electrical Characteristics @ $T_J = 25^\circ\text{C}$ (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	—		$R_G = 1.3\Omega, V_{GS} = 5.0V$
$t_f$	Fall Time	—	84	—		$R_D = 0.50\Omega$ , See Fig. 10 ④⑥
$L_D$	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	—	5000	—	pF	$V_{GS} = 0V$
$C_{oss}$	Output Capacitance	—	1100	—		$V_{DS} = 25V$
$C_{riss}$	Reverse Transfer Capacitance	—	390	—		$f = 1.0MHz$ , See Fig. 5 ⑥
C	Drain to Sink Capacitance	—	12	—		$f = 1.0MHz$

### Diode Characteristics

	Parameter	Min.	Typ.	Max.	Units	Conditions
$I_S$	Continuous Source Current (Body Diode)	—	—	58	A	MOSFET symbol showing the integral reverse p-n junction diode.
$I_{SM}$	Pulsed Source Current (Body Diode) ①	—	—	360		
$V_{SD}$	Diode Forward Voltage	—	—	1.3	V	$T_J = 25^\circ\text{C}, I_S = 31A, V_{GS} = 0V$ ④
$t_{rr}$	Reverse Recovery Time	—	140	210	ns	$T_J = 25^\circ\text{C}, I_F = 54A$
$Q_{rr}$	Reverse Recovery Charge	—	650	970	nC	$di/dt = 100A/\mu s$ ④⑥
$t_{on}$	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. ( See fig. 11 )
- ②  $V_{DD} = 25V$ , starting  $T_J = 25^\circ\text{C}$ ,  $L = 240\mu H$   
 $R_G = 25\Omega, I_{AS} = 54A$ . (See Figure 12)
- ③  $I_{SD} \leq 54A$ ,  $di/dt \leq 230A/\mu s$ ,  $V_{DD} \leq V_{(BR)DSS}$ ,  
 $T_J \leq 175^\circ\text{C}$ .

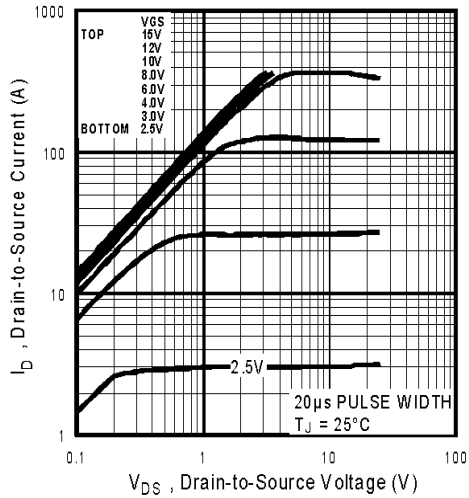
- ④ Pulse width  $\leq 300\mu s$ ; duty cycle  $\leq 2\%$ .
- ⑤  $t = 60s$ ,  $f = 60Hz$
- ⑥ Uses IRL2505 data and test conditions.
- ⑦  $R_\theta$  is measured at  $T_J$  at approximately  $90^\circ\text{C}$ .

**Qualification Information†**

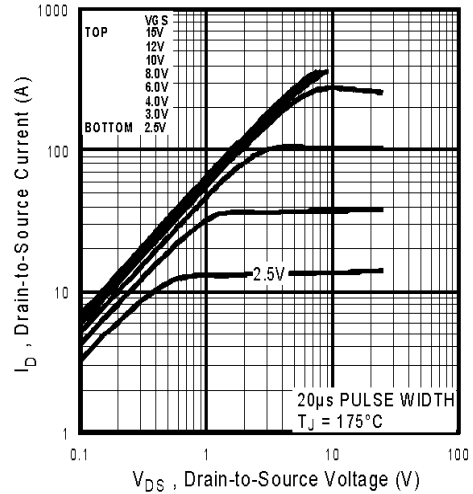
<b>Qualification Level</b>		Automotive (per AEC-Q101)	
		Comments: This part number(s) passed Automotive qualification. IR's Industrial and Consumer qualification level is granted by extension of the higher Automotive level.	
<b>Moisture Sensitivity Level</b>		TO-220 Fullpak	N/A
<b>ESD</b>	Machine Model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

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

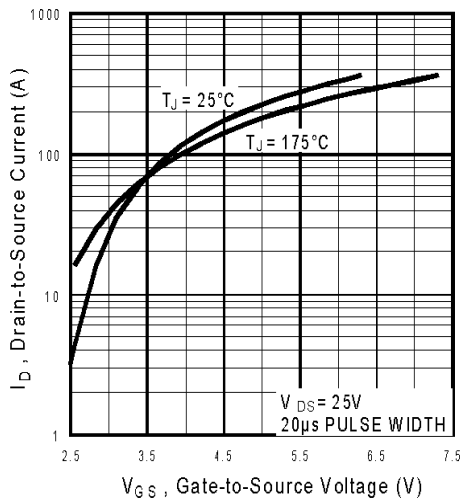
†† Highest passing voltage.



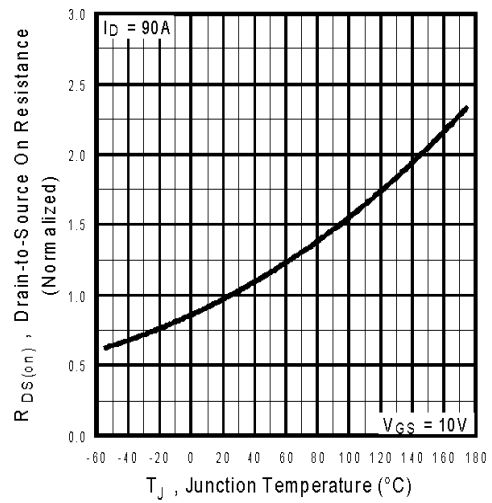
**Fig 1.** Typical Output Characteristics



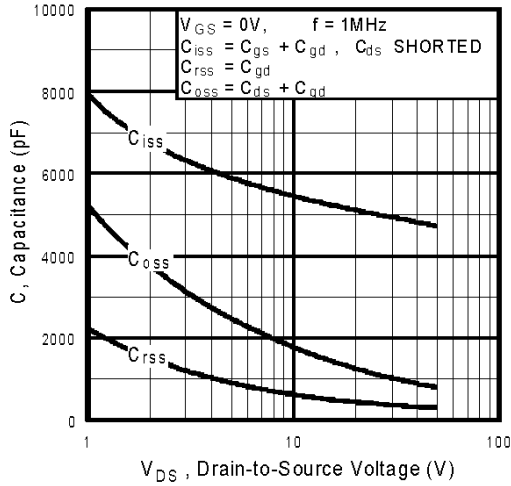
**Fig 2.** Typical Output Characteristics



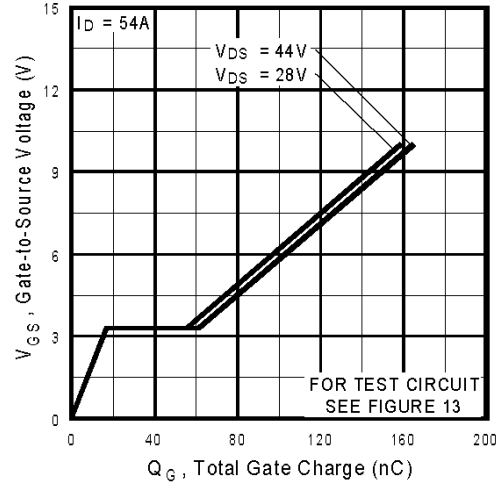
**Fig 3.** Typical Transfer Characteristics



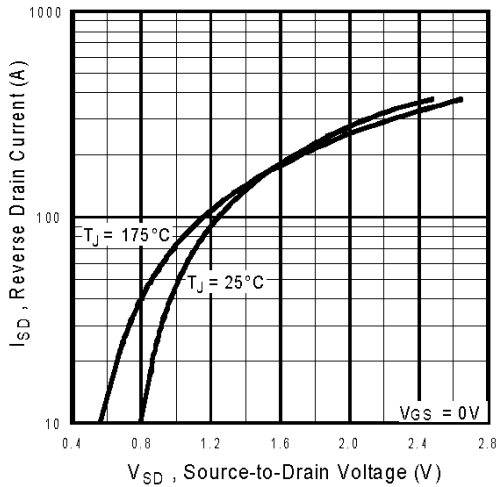
**Fig 4.** Normalized On-Resistance Vs. Temperature



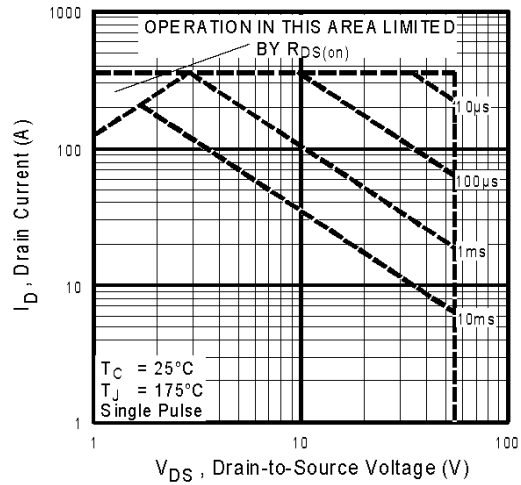
**Fig 5.** Typical Capacitance Vs. Drain-to-Source Voltage



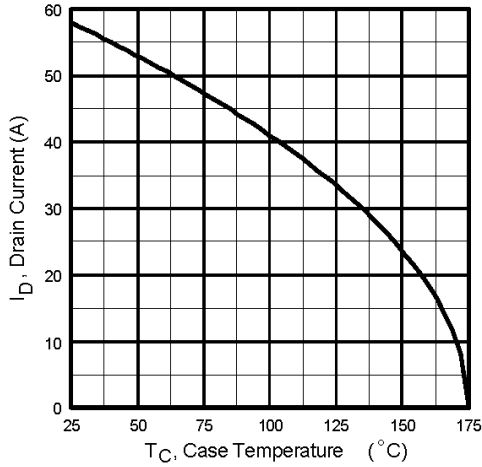
**Fig 6.** Typical Gate Charge Vs. Gate-to-Source Voltage



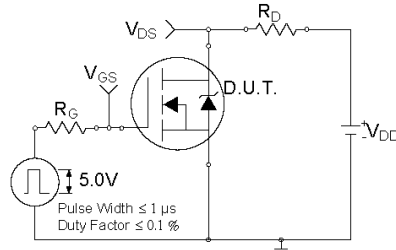
**Fig 7.** Typical Source-Drain Diode Forward Voltage



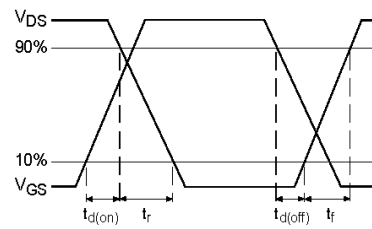
**Fig 8.** Maximum Safe Operating Area



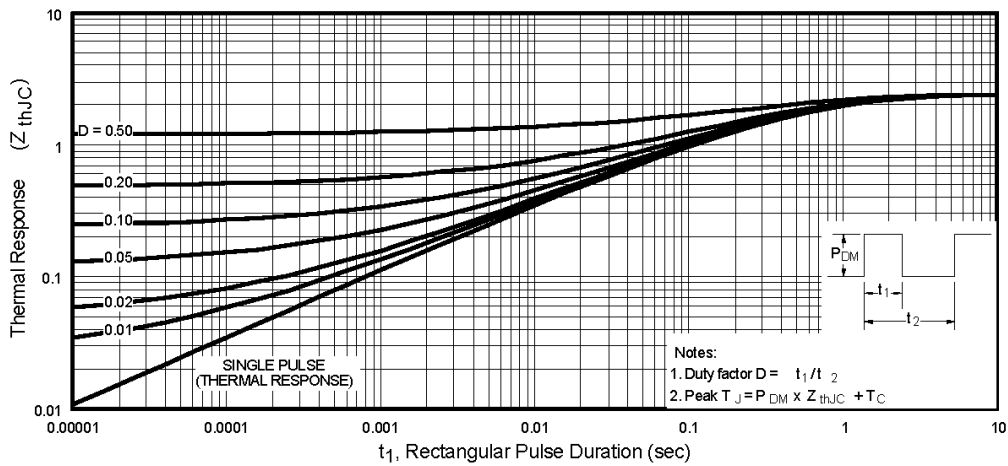
**Fig 9.** Maximum Drain Current Vs. Case Temperature



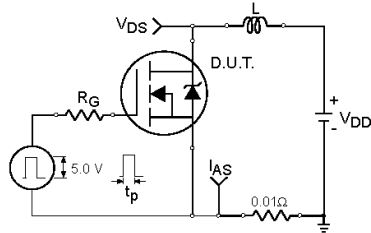
**Fig 10a.** Switching Time Test Circuit



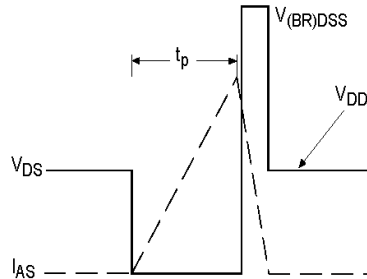
**Fig 10b.** Switching Time Waveforms



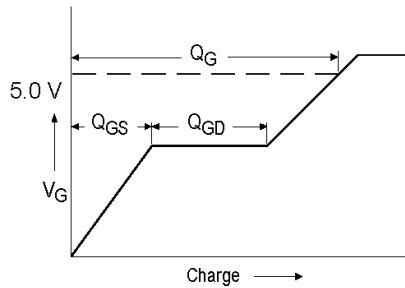
**Fig 11.** Maximum Effective Transient Thermal Impedance, Junction-to-Case



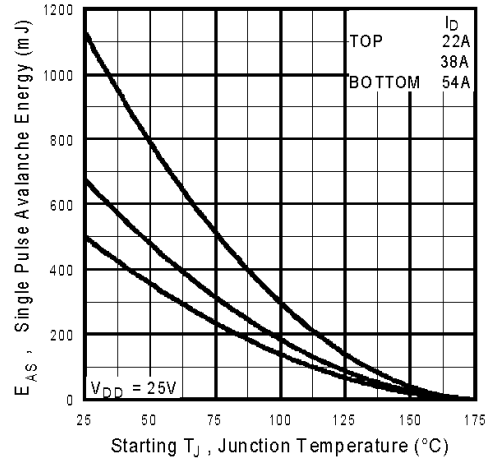
**Fig 12a.** Unclamped Inductive Test Circuit



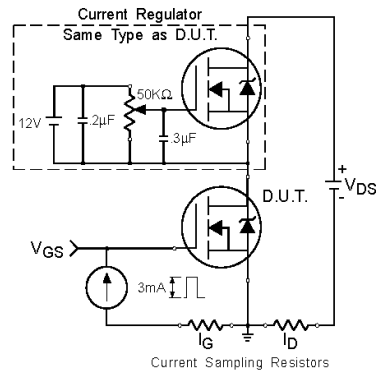
**Fig 12b.** Unclamped Inductive Waveforms



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

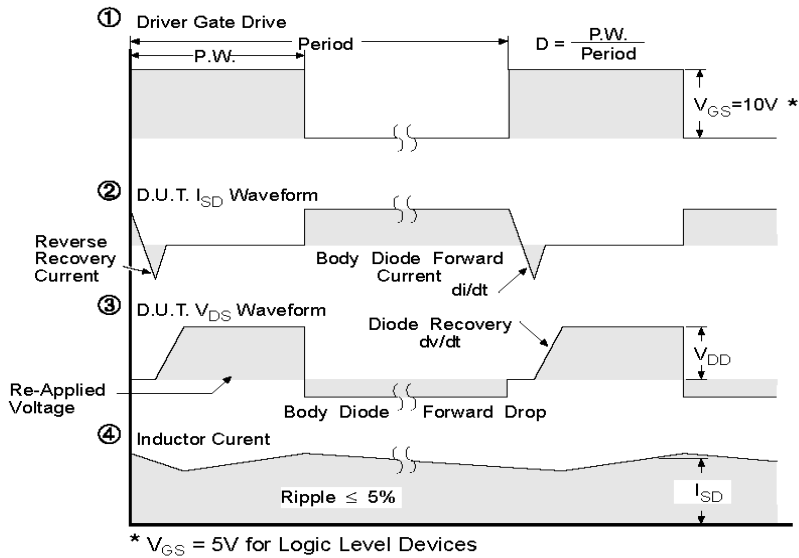
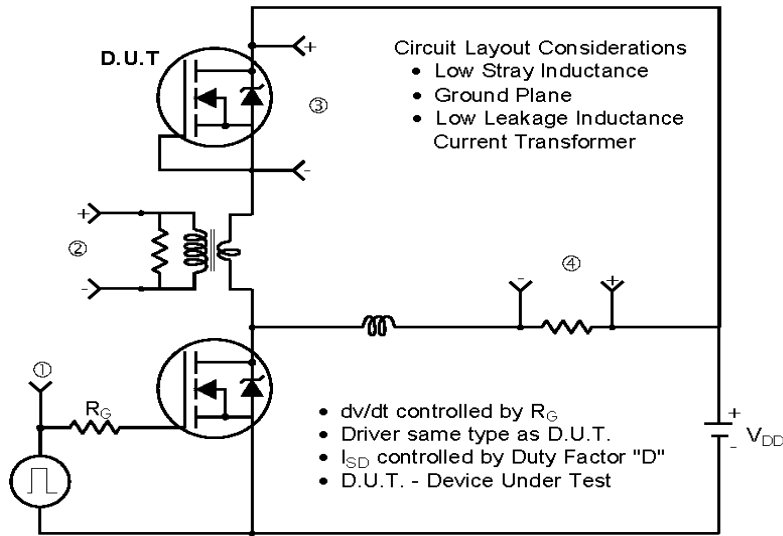


**Fig 12c.** Maximum Avalanche Energy Vs. Drain Current



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

**Peak Diode Recovery dv/dt Test Circuit**

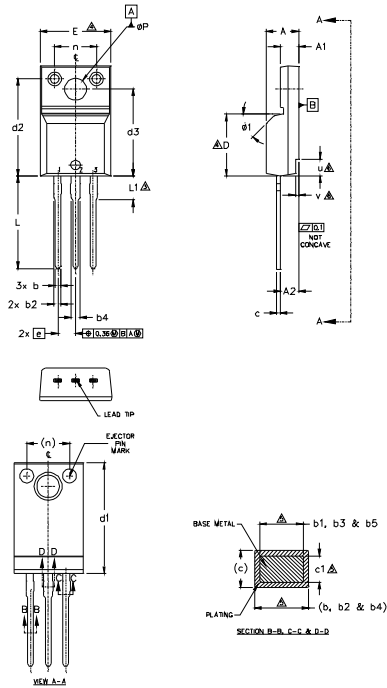


**Fig 14.** For N-Channel HEXFETS



## 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	NOTES: 1.0 DIMENSIONING AND TOLERANCING AS PER ASME Y14.5 M- 1994. 2.0 DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES]. LEAD DIMENSION AND FINISH UNCONTROLLED IN L1. 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. STEP OPTIONAL ON PLASTIC BODY DEFINED BY DIMENSIONS u & v. 7.0 CONTROLLING DIMENSION : INCHES.	
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		5
b3	0.76	1.22	.030	.048		
b4	1.02	1.52	.040	.060		5
b5	1.02	1.47	.040	.058		
c	0.33	0.63	.013	.025		5
c1	0.33	0.58	.013	.023		
D	8.86	9.80	.341	.386		4
d1	15.80	16.13	.622	.635		4
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	3	
L1	3.37	3.67	.122	.145		
n	6.05	6.60	.238	.260	6	
øP	3.05	3.45	.120	.136		
u	2.40	2.50	.094	.098	6	
v	0.40	0.50	.016	.020		
ø1	-	45°	-	45°		

NOTES:  
 1.0 DIMENSIONING AND TOLERANCING AS PER ASME Y14.5 M- 1994.  
 2.0 DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES].  
 LEAD DIMENSION AND FINISH UNCONTROLLED IN L1.  
 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.  
 STEP OPTIONAL ON PLASTIC BODY DEFINED BY DIMENSIONS u & v.  
 7.0 CONTROLLING DIMENSION : INCHES.

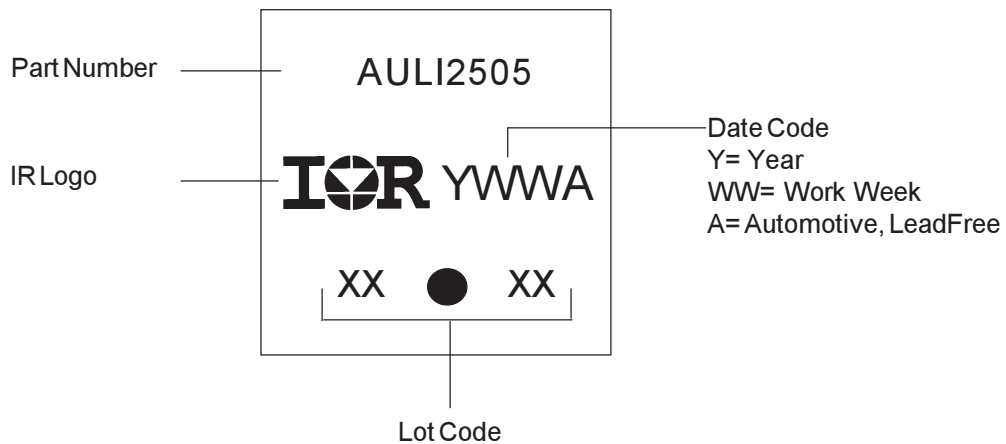
**LEAD ASSIGNMENTS**

- HEXCEL  
 1- GATE  
 2- DRAIN  
 3- SOURCE

**IRTELs CuPACK**

- 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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