



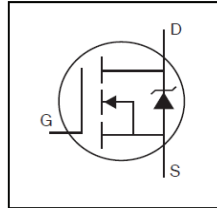
# THE DATASHEET OF AUIRL1404STRL



**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 \*

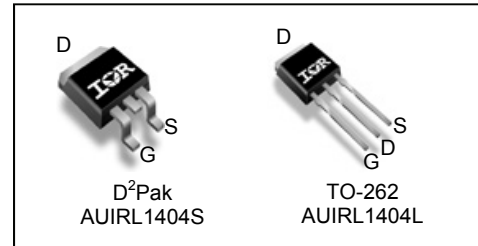
HEXFET® Power MOSFET



<b>V<sub>DSS</sub></b>	<b>40V</b>
<b>R<sub>DS(on)</sub> max.</b>	<b>4.0mΩ</b>
<b>I<sub>D</sub></b>	<b>160A<sup>Ⓞ</sup></b>

**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.



<b>G</b>	<b>D</b>	<b>S</b>
Gate	Drain	Source

Base part number	Package Type	Standard Pack		Orderable Part Number
		Form	Quantity	
AUIRL1404L	TO-262	Tube	50	AUIRL1404L
AUIRL1404S	D²-Pak	Tube	50	AUIRL1404S
		Tape and Reel Left	800	AUIRL1404STRL

**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 (TA) is 25°C, unless otherwise specified.

Symbol	Parameter	Max.	Units
I <sub>D</sub> @ T <sub>C</sub> = 25°C	Continuous Drain Current, V <sub>GS</sub> @ 10V	160 <sup>Ⓞ</sup>	A
I <sub>D</sub> @ T <sub>C</sub> = 100°C	Continuous Drain Current, V <sub>GS</sub> @ 10V	110 <sup>Ⓞ</sup>	
I <sub>DM</sub>	Pulsed Drain Current <sup>①</sup>	640	
P <sub>D</sub> @ T <sub>A</sub> = 25°C	Maximum Power Dissipation	3.8	W
P <sub>D</sub> @ T <sub>C</sub> = 25°C	Maximum Power Dissipation	200	
	Linear Derating Factor	1.3	W/°C
V <sub>GS</sub>	Gate-to-Source Voltage	± 20	V
E <sub>AS</sub>	Single Pulse Avalanche Energy (Thermally Limited) <sup>②</sup>	520	mJ
I <sub>AR</sub>	Avalanche Current <sup>①</sup>	95	A
E <sub>AR</sub>	Repetitive Avalanche Energy <sup>①</sup>	20	mJ
dv/dt	Peak Diode Recovery <sup>③</sup>	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	

**Thermal Resistance**

Symbol	Parameter	Typ.	Max.	Units
R <sub>θJC</sub>	Junction-to-Case	—	0.75	°C/W
R <sub>θCS</sub>	Case-to-Sink, Flat, Greased Surface	0.50	—	
R <sub>θJA</sub>	Junction-to-Ambient (PCB Mount), D² Pak <sup>Ⓞ</sup>	—	40	

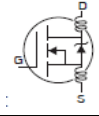
HEXFET® is a registered trademark of Infineon.

\*Qualification standards can be found at [www.infineon.com](http://www.infineon.com)

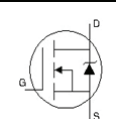
**Static @  $T_J = 25^\circ\text{C}$  (unless otherwise specified)**

	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(BR)DSS}$	Drain-to-Source Breakdown Voltage	40	—	—	V	$V_{GS} = 0V, I_D = 250\mu A$
$\Delta V_{(BR)DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	—	0.038	—	V/ $^\circ\text{C}$	Reference to $25^\circ\text{C}, I_D = 1\text{mA}$
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	—	—	4.0	m $\Omega$	$V_{GS} = 10V, I_D = 95A$ ④
		—	—	5.9		$V_{GS} = 4.3V, I_D = 40A$ ④
$V_{GS(th)}$	Gate Threshold Voltage	1.0	—	3.0	V	$V_{DS} = V_{GS}, I_D = 250\mu A$
gfs	Forward Trans conductance	93	—	—	S	$V_{DS} = 25V, I_D = 95A$
$I_{DSS}$	Drain-to-Source Leakage Current	—	—	20	$\mu A$	$V_{DS} = 40V, V_{GS} = 0V$
		—	—	250		$V_{DS} = 32V, V_{GS} = 0V, T_J = 150^\circ\text{C}$
$I_{GSS}$	Gate-to-Source Forward Leakage	—	—	200	nA	$V_{GS} = 20V$
	Gate-to-Source Reverse Leakage	—	—	-200		$V_{GS} = -20V$

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

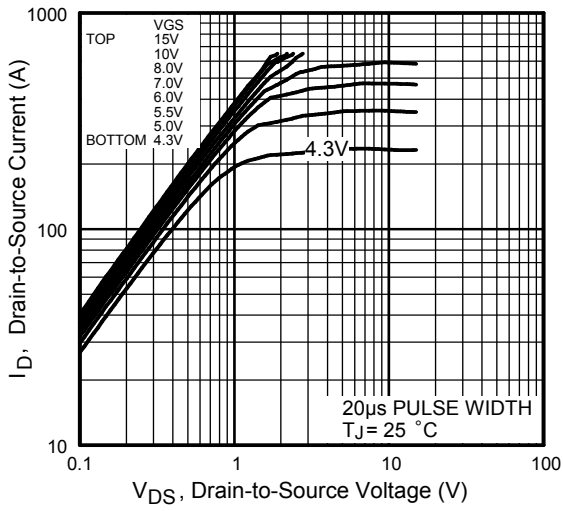
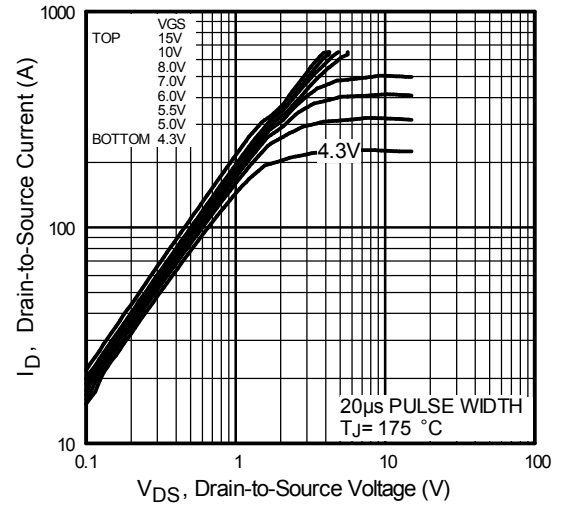
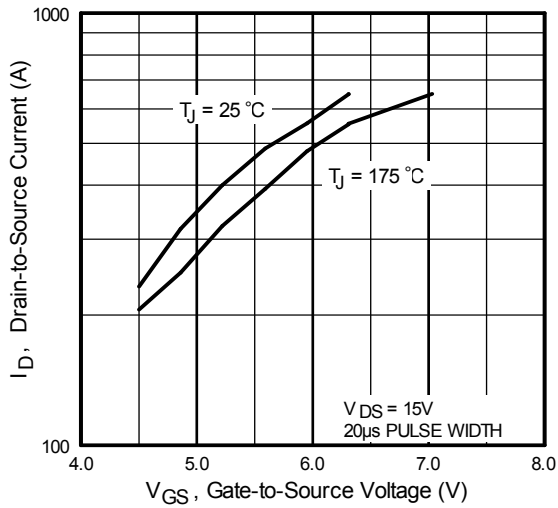
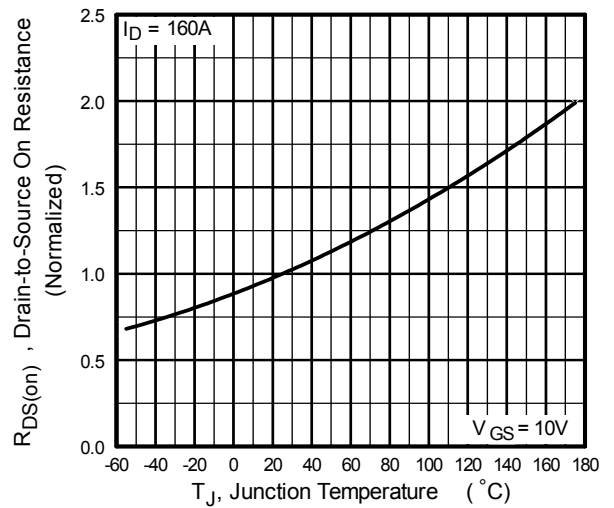
$Q_g$	Total Gate Charge	—	—	140	nC	$I_D = 95A$ $V_{DS} = 32V$ $V_{GS} = 5.0V$ , See Fig. 6 ④
$Q_{gs}$	Gate-to-Source Charge	—	—	48		
$Q_{gd}$	Gate-to-Drain Charge	—	—	60		
$t_{d(on)}$	Turn-On Delay Time	—	18	—	ns	$V_{DD} = 20V$ $I_D = 95A$ $R_G = 2.5\Omega, V_{GS} = 4.5V$ $R_D = 0.25\Omega$ ④
$t_r$	Rise Time	—	270	—		
$t_{d(off)}$	Turn-Off Delay Time	—	38	—		
$t_f$	Fall Time	—	130	—		
$L_D$	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	—	6600	—	pF	$V_{GS} = 0V$ $V_{DS} = 25V$ $f = 1.0\text{MHz}$ , See Fig. 5
$C_{oss}$	Output Capacitance	—	1700	—		
$C_{rss}$	Reverse Transfer Capacitance	—	350	—		
$C_{oss}$	Output Capacitance	—	6700	—		
$C_{oss}$	Output Capacitance	—	1500	—		
$C_{oss\text{ eff.}}$	Effective Output Capacitance	—	1500	—		

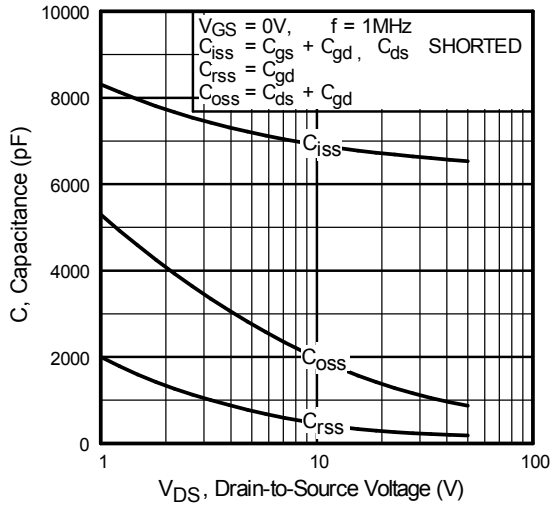
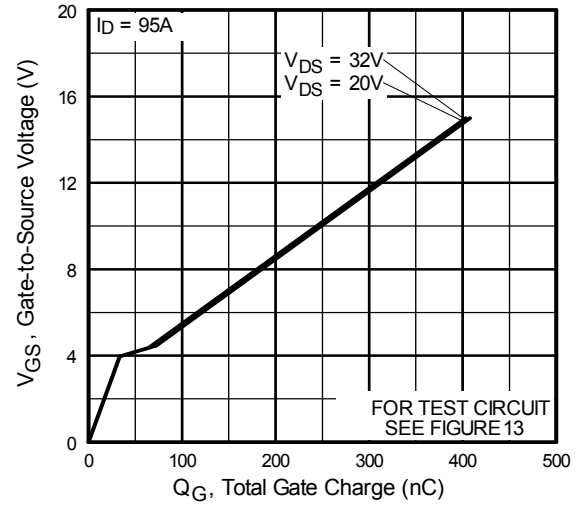
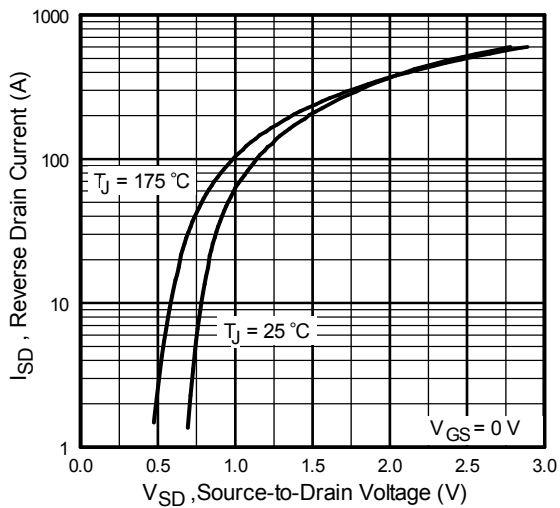
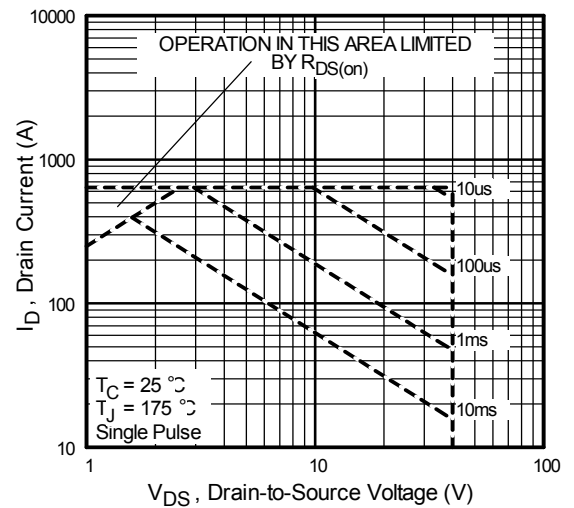
**Diode Characteristics**

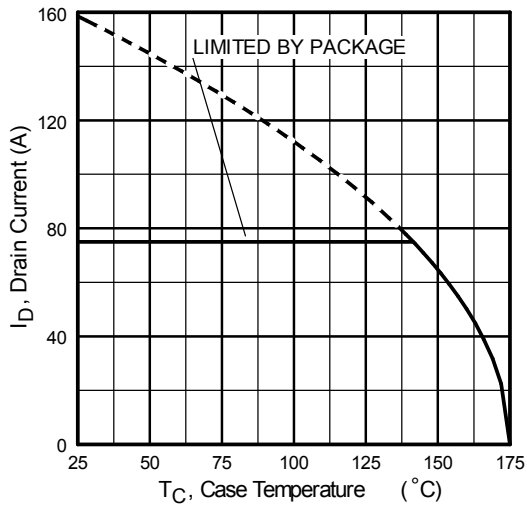
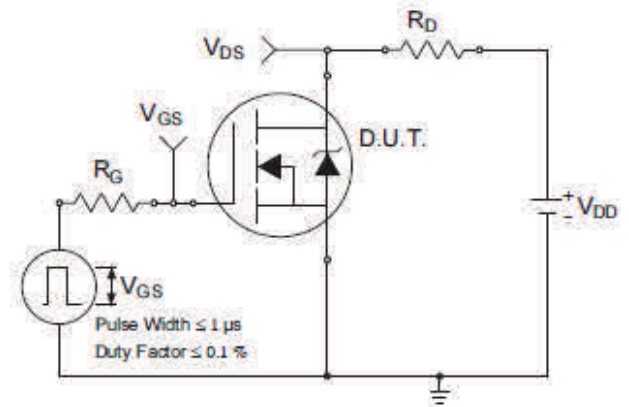
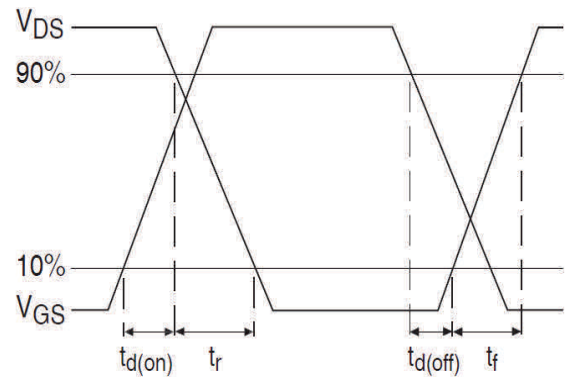
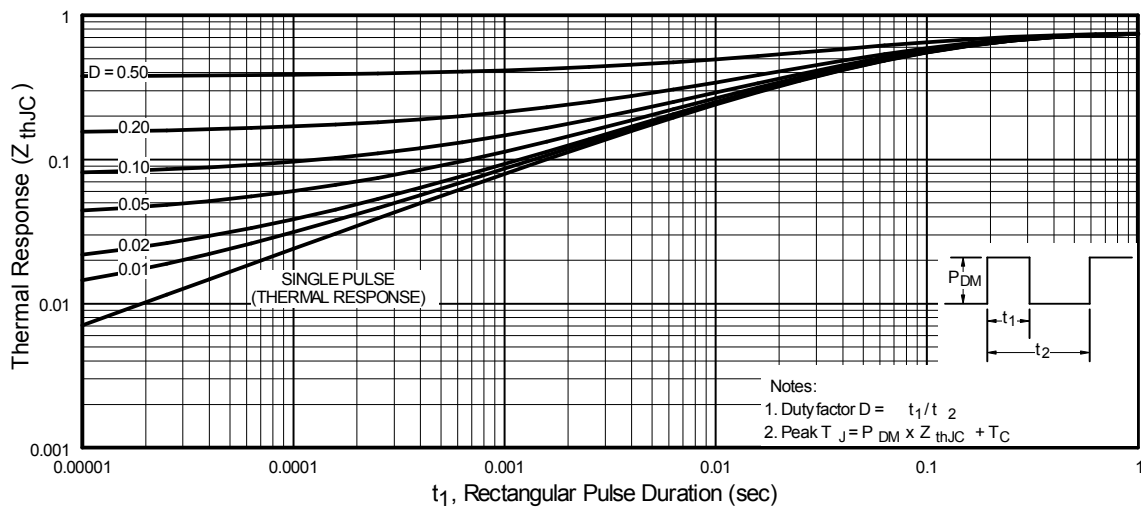
	Parameter	Min.	Typ.	Max.	Units	Conditions
$I_S$	Continuous Source Current (Body Diode)	—	—	160	A	MOSFET symbol showing the integral reverse p-n junction diode. 
$I_{SM}$	Pulsed Source Current (Body Diode) ①	—	—	640		
$V_{SD}$	Diode Forward Voltage	—	—	1.3	V	$T_J = 25^\circ\text{C}, I_S = 95A, V_{GS} = 0V$ ④
$t_{rr}$	Reverse Recovery Time	—	63	94	ns	$T_J = 25^\circ\text{C}, I_F = 95A$
$Q_{rr}$	Reverse Recovery Charge	—	170	250	nC	$di/dt = 100A/\mu s$ ④
$t_{on}$	Forward Turn-On Time	Intrinsic turn-on time is negligible (turn-on is dominated by $L_S + L_D$ )				

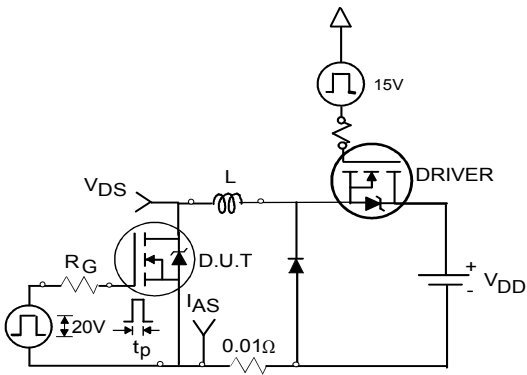
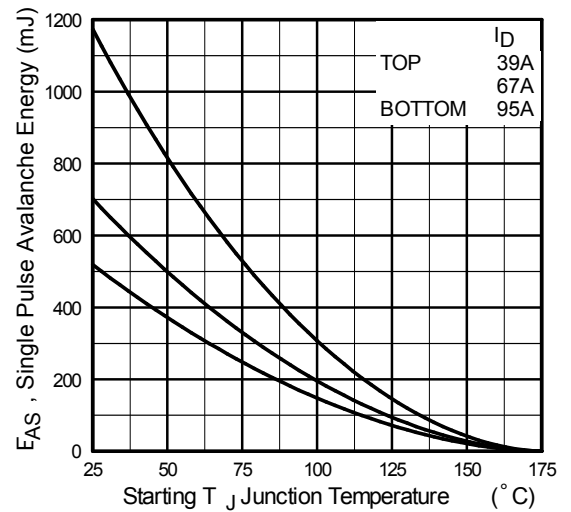
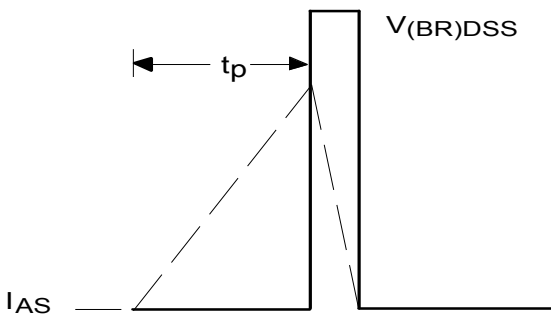
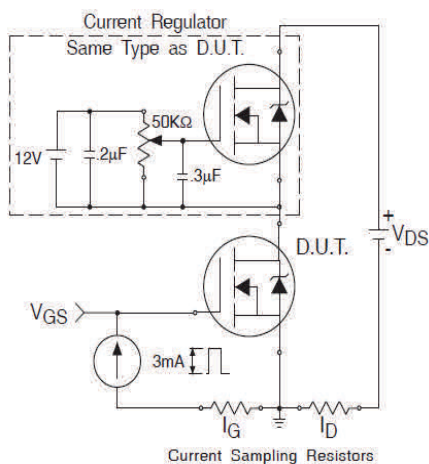
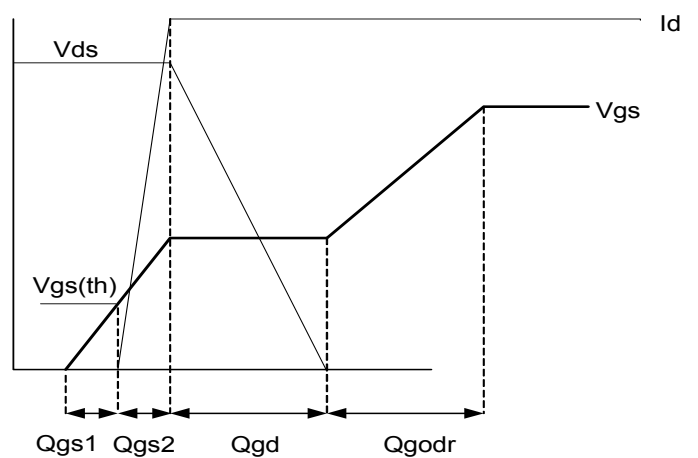
**Notes:**

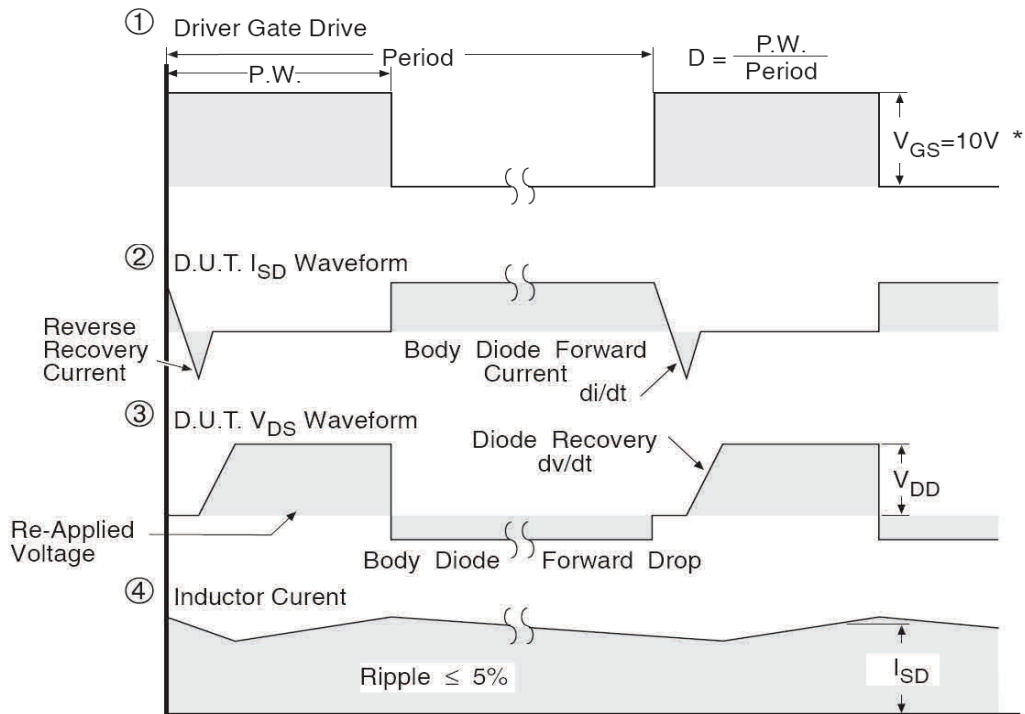
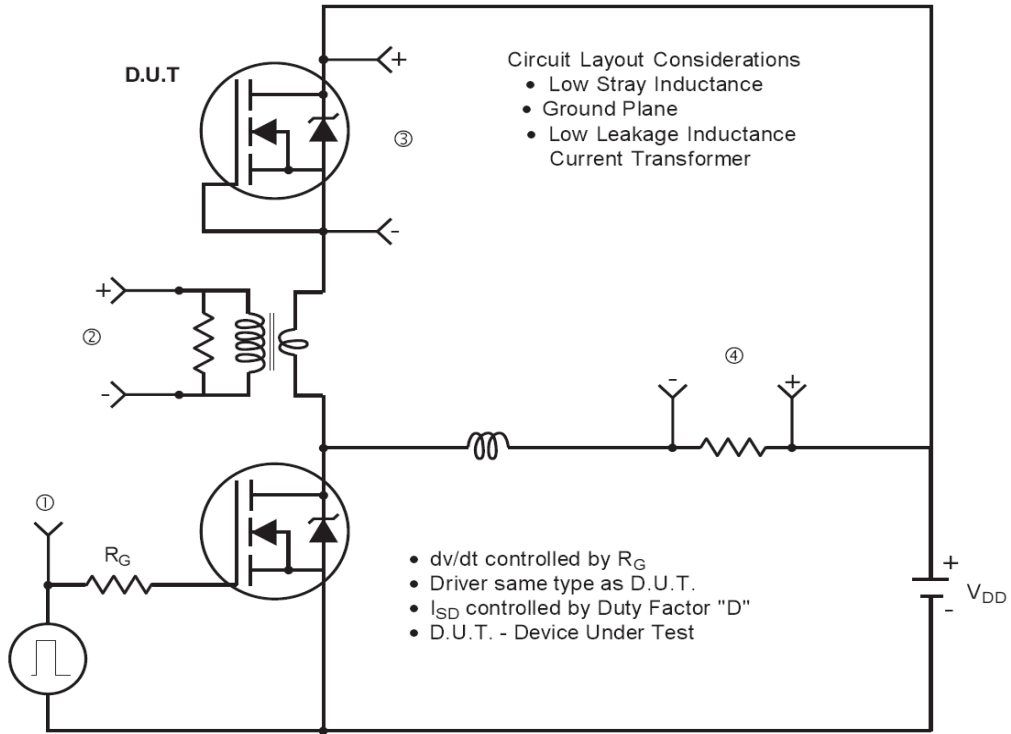
- ① Repetitive rating; pulse width limited by max. junction temperature. (See fig.11)
- ② Limited by  $T_{Jmax}$ , starting  $T_J = 25^\circ\text{C}$ ,  $L = 0.35\text{mH}$ ,  $R_G = 25\Omega$ ,  $I_{AS} = 95A$ ,  $V_{GS} = 10V$ . (See fig.12)
- ③  $I_{SD} \leq 95A$ ,  $di/dt \leq 160A/\mu s$ ,  $V_{DD} \leq V_{(BR)DSS}$ ,  $T_J \leq 175^\circ\text{C}$ .
- ④ Pulse width  $\leq 300\mu s$ ; duty cycle  $\leq 2\%$ .
- ⑤  $C_{oss\text{ eff.}}$  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; for recommended current-handling of the package refer to Design Tip # 93-4.
- ⑦ This is applied to D<sup>2</sup> Pak, When mounted on 1" square PCB (FR-4 or G-10 Material). For recommended footprint and soldering techniques refer to application note #AN-994


**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-to-Drain Diode

**Fig 8.** Maximum Safe Operating Area

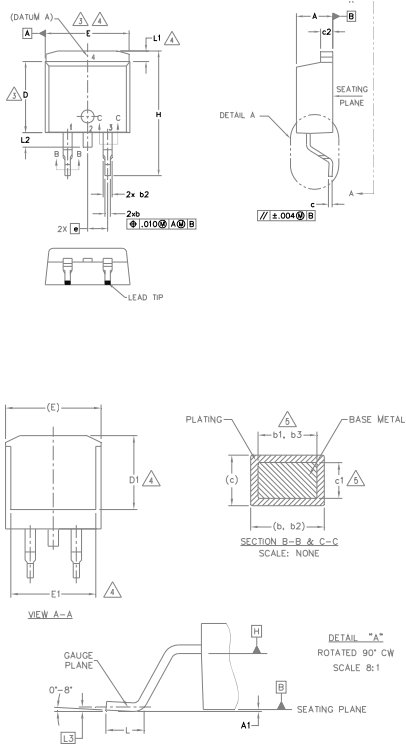

**Fig 9.** Maximum Drain Current vs. Case Temperature

**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 12c. Maximum Avalanche Energy vs. Drain Current**

**Fig 12b. Unclamped Inductive Waveforms**

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

**Fig 13b. Gate Charge Waveform**

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


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

**Fig 14.** Peak Diode Recovery  $dv/dt$  Test Circuit for N-Channel HEXFET® Power MOSFETs

**D<sup>2</sup>Pak (TO-263AB) Package Outline (Dimensions are shown in millimeters (inches))**


- NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M-1994
  2. DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES].
  3. DIMENSION D & E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED 0.127 [0.005"] PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTMOST EXTREMES OF THE PLASTIC BODY AT DATUM H.
  4. THERMAL PAD CONTOUR OPTIONAL WITHIN DIMENSION E, L1, D1 & E1.
  5. DIMENSION b1, b3 AND c1 APPLY TO BASE METAL ONLY.
  6. DATUM A & B TO BE DETERMINED AT DATUM PLANE H.
  7. CONTROLLING DIMENSION: INCH.
  8. OUTLINE CONFORMS TO JEDEC OUTLINE TO-263AB.

SYMBOL	DIMENSIONS				NOTES
	MILLIMETERS		INCHES		
	MIN.	MAX.	MIN.	MAX.	
A	4.06	4.83	.160	.190	
A1	0.00	0.254	.000	.010	
b	0.51	0.99	.020	.039	
b1	0.51	0.89	.020	.035	5
b2	1.14	1.78	.045	.070	
b3	1.14	1.73	.045	.068	5
c	0.38	0.74	.015	.029	
c1	0.38	0.58	.015	.023	5
c2	1.14	1.65	.045	.065	
D	8.38	9.65	.330	.380	3
D1	6.86	—	.270	—	4
E	9.65	10.67	.380	.420	3,4
E1	6.22	—	.245	—	4
e	2.54 BSC		.100 BSC		
H	14.61	15.88	.575	.625	
L	1.78	2.79	.070	.110	
L1	—	1.68	—	.066	4
L2	—	1.78	—	.070	
L3	0.25 BSC		.010 BSC		

**LEAD ASSIGNMENTS**
**DIODES**

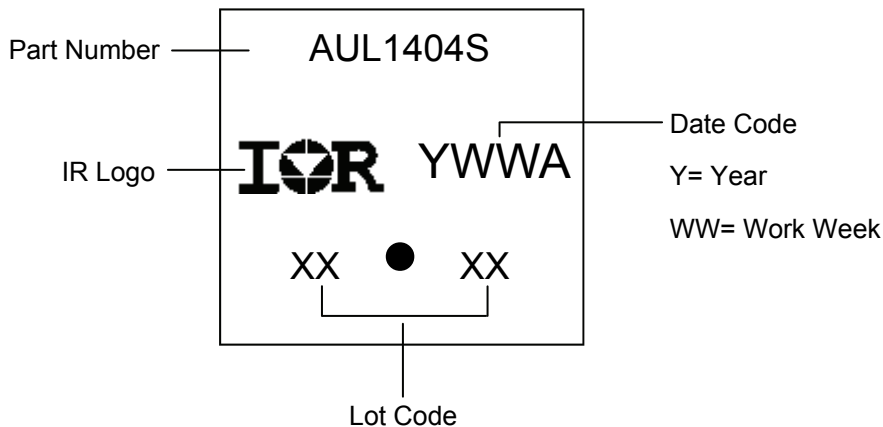
- 1.- ANODE (TWO DIE) / OPEN (ONE DIE)
- 2.- CATHODE
- 3.- ANODE

**HEXFET**

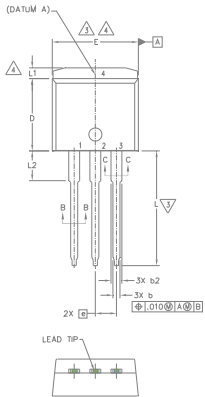
- 1.- GATE
- 2, 4.- DRAIN
- 3.- SOURCE

**IGBTs, CoPACK**

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

**D<sup>2</sup>Pak (TO-263AB) Part Marking Information**


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

**TO-262 Package Outline (Dimensions are shown in millimeters (inches))**

**NOTES:**

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M-1994
2. DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES].
3. DIMENSION D & E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED 0.127 [0.005"] PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTMOST EXTREMES OF THE PLASTIC BODY.
4. THERMAL PAD CONTOUR OPTIONAL WITHIN DIMENSION E, L1, D1 & E1.
5. DIMENSION b1 AND c1 APPLY TO BASE METAL ONLY.
6. CONTROLLING DIMENSION: INCH.
7. OUTLINE CONFORM TO JEDEC TO-262 EXCEPT A1(max.), b(min.) AND D1(min.) WHERE DIMENSIONS DERIVED THE ACTUAL PACKAGE OUTLINE.

**LEAD ASSIGNMENTS**
**IGBTs, CoPACK**

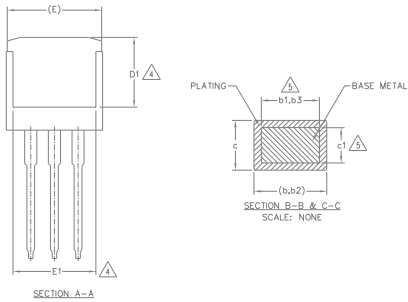
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- 3.- EMITTER
- 4.- COLLECTOR

**HEXFET**

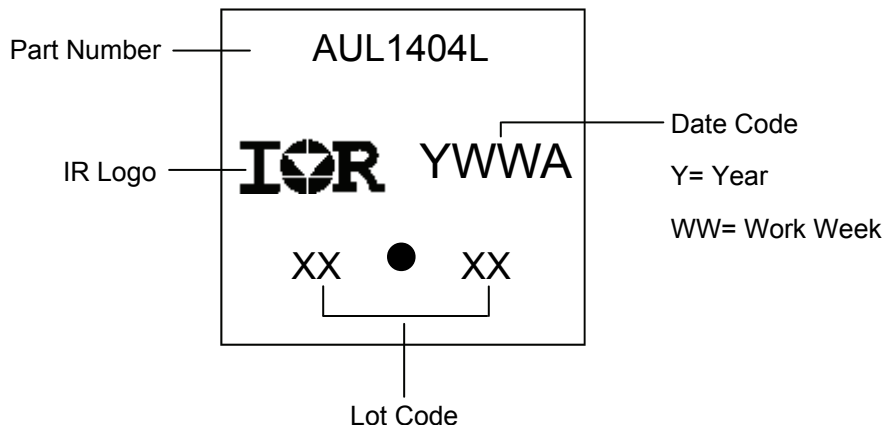
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- 2.- DRAIN
- 3.- SOURCE
- 4.- DRAIN

**DIODES**

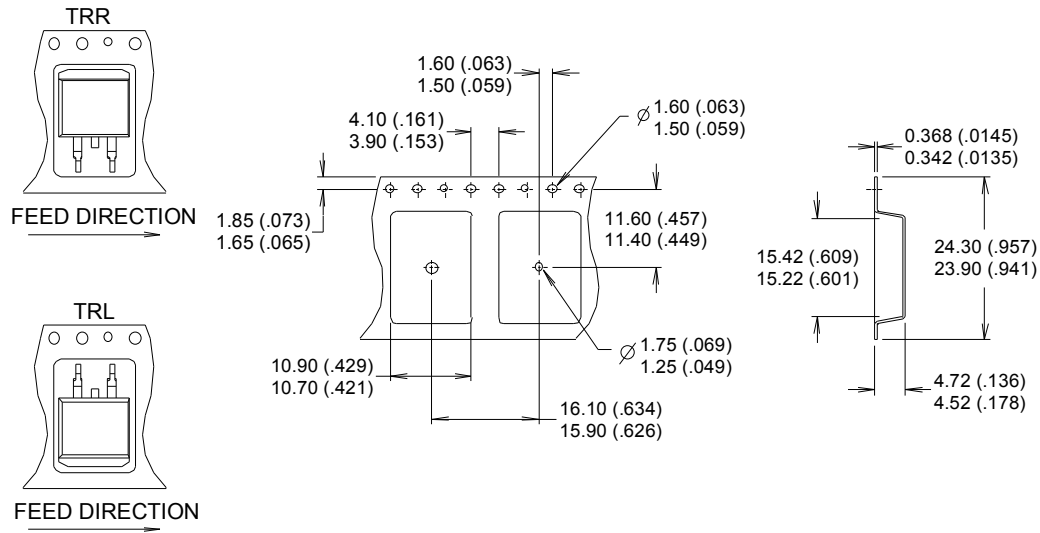
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- 2, 4.- CATHODE
- 3.- ANODE



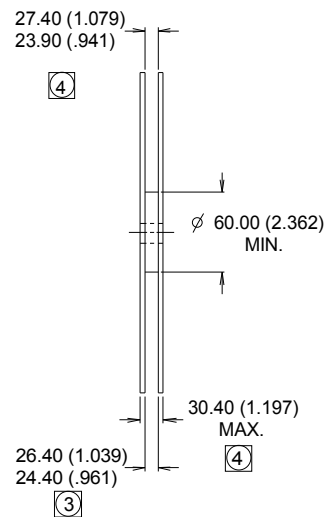
SYMBOL	DIMENSIONS				NOTES
	MILLIMETERS		INCHES		
	MIN.	MAX.	MIN.	MAX.	
A	4.06	4.83	.160	.190	
A1	2.03	3.02	.080	.119	
b	0.51	0.99	.020	.039	
b1	0.51	0.89	.020	.035	5
b2	1.14	1.78	.045	.070	
b3	1.14	1.73	.045	.068	5
c	0.38	0.74	.015	.029	
c1	0.38	0.58	.015	.023	5
c2	1.14	1.65	.045	.065	
D	8.38	9.65	.330	.380	3
D1	6.86	-	.270	-	4
E	9.65	10.67	.380	.420	3,4
E1	6.22	-	.245	-	4
e	2.54 BSC		.100 BSC		
L	13.46	14.10	.530	.555	
L1	-	1.65	-	.065	4
L2	3.56	3.71	.140	.146	

**TO-262 Part Marking Information**


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

**D<sup>2</sup>Pak (TO-263AB) Tape & Reel Information** (Dimensions are shown in millimeters (inches))


- NOTES :
1. COMFORMS TO EIA-418.
  2. CONTROLLING DIMENSION: MILLIMETER.
  - ③ DIMENSION MEASURED @ HUB.
  - ④ INCLUDES FLANGE DISTORTION @ OUTER EDGE.



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

**Qualification Information**

<b>Qualification Level</b>		Automotive (per AEC-Q101)	
		Comments: This part number(s) passed Automotive qualification. Infineon's Industrial and Consumer qualification level is granted by extension of the higher Automotive level.	
<b>Moisture Sensitivity Level</b>		D <sup>2</sup> -Pak	MSL1
		TO-262	
<b>ESD</b>	Machine Model	Class M4 (+/- 800V) <sup>†</sup> AEC-Q101-002	
	Human Body Model	Class H2 (+/- 4000V) <sup>†</sup> AEC-Q101-001	
	Charged Device Model	Class C5 (+/- 2000V) <sup>†</sup> AEC-Q101-005	
<b>RoHS Compliant</b>		Yes	

† Highest passing voltage.

**Revision History**

Date	Comments
10/27/2015	<ul style="list-style-type: none"> <li>Updated datasheet with corporate template</li> <li>Corrected ordering table on page 1.</li> </ul>

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- ✓ Cost Control Management
- ✓ Shortage Management
- ✓ Alternative Solution
- ✓ Excess Inventory Management