

### Features

- Floating channel designed for bootstrap operation
- Fully operational to +600 V
- Tolerant to negative transient voltage, dV/dt immune
- Gate drive supply range from 10V to 20V
- Undervoltage lockout for both channels
- 3.3V and 5V input logic compatible
- Matched propagation delay for both channels
- Lower di/dt gate driver for better noise immunity
- Output source/sink current capability of 1.9A/2.3A typical
- Leadfree, RoHS compliant
- Automotive qualified\*

### Typical Applications

- Piezo injection
- Electric Power Steering
- Fan and compressor
- Starter/alternator

### Product Summary

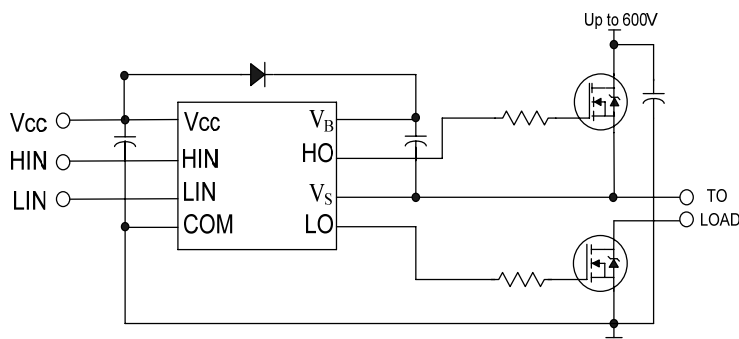
Topology	High and Low Side Driver
$V_{\text{OFFSET}}$	$\leq 600\text{V}$
$V_{\text{OUT}}$	10V – 20V
$I_{\text{o+}}$ & $I_{\text{o-}}$ (typical)	1.9A & 2.3A
$t_{\text{on}}$ & $t_{\text{off}}$ (typical)	135ns

### Package Options



8 - Lead SOIC  
AUIRS21811S

### Typical Connection Diagram



**AUIRS21811S**

(Refer to Lead Assignments for correct pin configuration). This/These diagram(s) show electrical connections only. Please refer to our Application Notes and Design Tips for proper circuit board layout.

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**Description**

The AUIRS21811S is a high voltage, high speed power MOSFET and IGBT driver with independent high and low side referenced output channels. Proprietary HVIC and latch immune CMOS technologies enable ruggedized monolithic construction. The logic input is compatible with standard CMOS or LSTTL output, down to 3.3 V logic. The output drivers feature a high pulse current buffer stage. The floating channel can be used to drive an N-channel power MOSFET or IGBT in the high-side configuration which operates up to 600V.

**Feature Comparison: AUIRS21811/AUIRS2181/AUIRS2183/AUIRS2184**

Part	Input Logic	Cross-Conduction Prevention logic	Dead-Time	Ground Pins	Ton/Toff (typical)
21811	HIN/LIN	No	none	COM	135/135 ns
2181	HIN/LIN	No	none	COM	160/200 ns
21814				V <sub>SS</sub> /COM	
2183	HIN/LIN	Yes	Internal 500ns	COM	180/220 ns
21834			Programmable 0.4 – 5 us	V <sub>SS</sub> /COM	
2184	IN/SD	Yes	Internal 500ns	COM	600/230 ns
21844			Programmable 0.4 – 5 us	V <sub>SS</sub> /COM	

**Qualification Information<sup>†</sup>**

<b>Qualification Level</b>		Automotive (per AEC-Q100 <sup>††</sup> )
		Comments: This family of ICs has passed an Automotive qualification. IR's Industrial and Consumer qualification level is granted by extension of the higher Automotive level.
<b>Moisture Sensitivity Level</b>		MSL3 <sup>†††</sup> 260°C (per IPC/JEDEC J-STD-020)
<b>ESD</b>	Machine Model	Class M3 (Pass +/-250V) (per AEC-Q100-003)
	Human Body Model	Class H2 (Pass +/-2500V) (per AEC-Q100-002)
	Charged Device Model	Class C5 (Pass +/-1250V) (per AEC-Q100-011)
<b>RoHS Compliant</b>		Yes

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

†† Exceptions to AEC-Q100 requirements are noted in the qualification report.

††† Higher MSL ratings may be available for the specific package types listed here. Please contact your International Rectifier sales representative for further information.

### Absolute Maximum Ratings

Absolute Maximum Ratings indicate sustained limits beyond which damage to the device may occur. All voltage parameters are absolute voltages referenced to COM lead. 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 "Recommended Operating Conditions" 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.

Symbol	Definition	Min	Max	Units
$V_B$	High side floating absolute voltage	-0.3	620	V
$V_S$	High side floating supply offset voltage	$V_B - 25$	$V_B + 0.3$	
$V_{HO}$	High side floating output voltage	$V_S - 0.3$	$V_B + 0.3$	
$V_{CC}$	Low side and logic fixed supply voltage	-0.3	20	
$V_{LO}$	Low side output voltage	-0.3	$V_{CC} + 0.3$	
$V_{IN}$	Logic input voltage (HIN & LIN)	COM - 0.3	$V_{CC} + 0.3$	
$dV_S/dt$	Allowable offset supply voltage transient	—	50	V/ns
$P_D$	Package power dissipation @ $T_A \leq 25^\circ\text{C}$	—	0.625	W
$R_{thJA}$	Thermal resistance, junction to ambient	—	200	°C/W
$T_J$	Junction temperature	—	150	°C
$T_S$	Storage temperature	-50	150	
$T_L$	Lead temperature (soldering, 10 seconds)	—	300	

### Recommended Operating Conditions

The Input/Output logic timing diagram is shown in Figure 1. For proper operation the device should be used within the recommended conditions.  $V_S$  and offset rating are tested with all supplies biased at 15V differential.

Symbol	Definition	Min	Max	Units
$V_B$	High side floating supply absolute voltage	$V_S + 10$	$V_S + 20$	V
$V_S$	High side floating supply offset voltage	†	600	
$V_{HO}$	High side floating output voltage	$V_S$	$V_B$	
$V_{CC}$	Low side and logic fixed supply voltage	10	20	
$V_{LO}$	Low side output voltage	0	$V_{CC}$	
$V_{IN}$	Logic input voltage (HIN & LIN)	COM	$V_{CC}$	
$T_A$	Ambient temperature	-40	125	°C

† Logic operational for  $V_S$  of -5V to +600V. Logic state held for  $V_S$  of -5V to  $-V_{BS}$ . (Please refer to Figure 4 for more details).

### Dynamic Electrical Characteristics

Unless otherwise noted, these specifications apply for an operating junction temperature range of  $-40^{\circ}\text{C} \leq T_j \leq 125^{\circ}\text{C}$  with bias conditions of  $V_{CC} = V_{BS} = 15\text{V}$ ,  $V_S = \text{COM}$ ,  $C_L = 1000\text{pF}$ .

Symbol	Definition	Min	Typ	Max	Units	Test Conditions
$t_{on}$	Turn-on propagation delay	—	135	230	ns	$V_S = 0\text{V}$
$t_{off}$	Turn-off propagation delay	—	135	230		$V_S = 0\text{V}$ or $600\text{V}$
MT	Delay matching, HO & LO turn-on/off	—	—	35		
$t_r$	Turn-on rise time	—	—	60		$V_S = 0\text{V}$
$t_f$	Turn-off fall time	—	—	35		$V_S = 0\text{V}$

### Static Electrical Characteristics

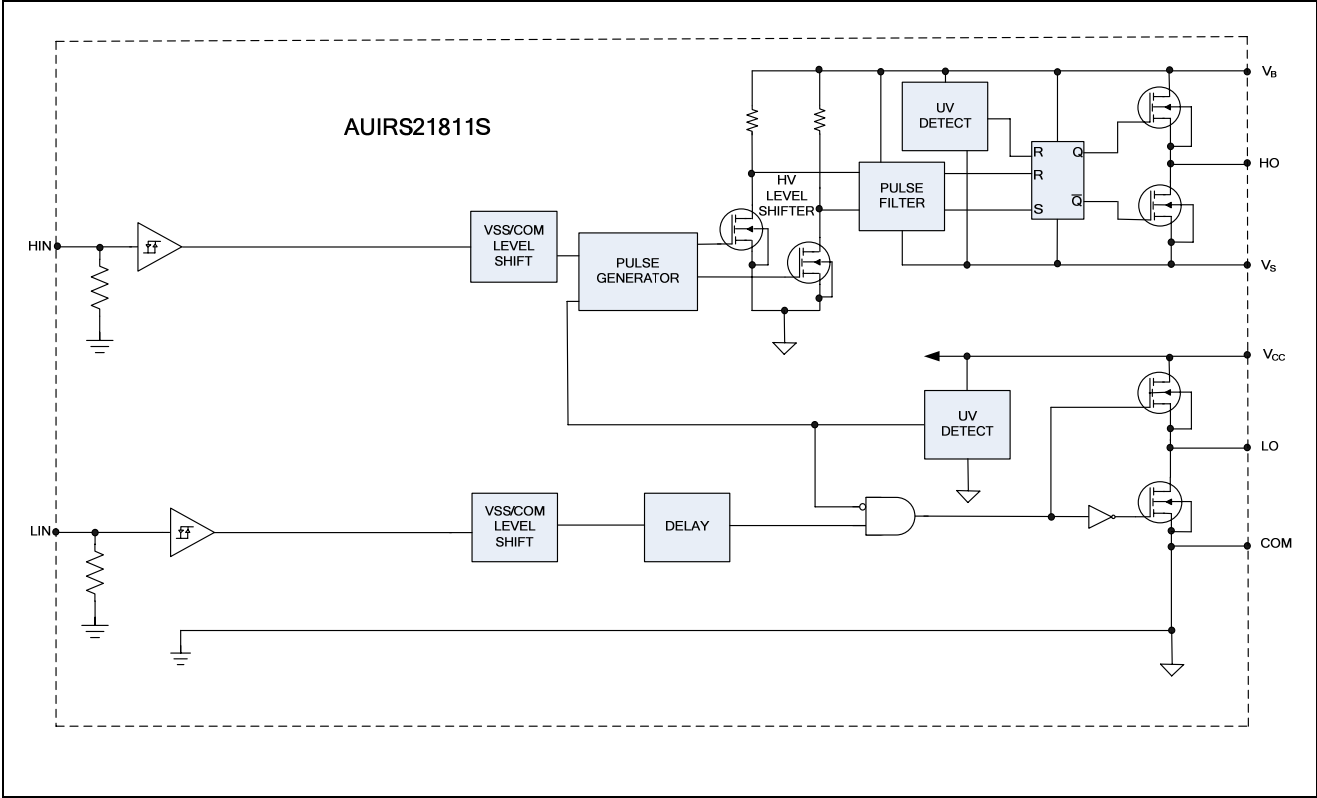
Unless otherwise noted, these specifications apply for an operating junction temperature range of  $-40^{\circ}\text{C} \leq T_j \leq 125^{\circ}\text{C}$  with bias conditions of  $V_{CC} = V_{BS} = 15\text{V}$  and  $V_S = \text{COM}$ . The  $V_{IN}$  and  $I_{IN}$  parameters are referenced to  $V_{SS}/\text{COM}$  and are applicable to the respective input leads: HIN and LIN. The  $V_O$  and  $I_O$  parameters are referenced to  $V_S/\text{COM}$  and are applicable to the respective output leads: HO and LO.

Symbol	Definition	Min	Typ	Max	Units	Test Conditions
$V_{IH}$	Logic "1" input voltage	2.5	—	—	V	$V_{CC} = 10\text{V}$ to $20\text{V}$
$V_{IL}$	Logic "0" input voltage	—	—	0.8		$I_O = 0\text{mA}$
$V_{OH}$	High level output voltage, $V_{BIAS} - V_O$	—	—	1.4		$I_O = 20\text{mA}$
$V_{OL}$	Low level output voltage, $V_O$	—	—	0.2		
$I_{LK}$	Offset supply leakage current	—	—	50	$\mu\text{A}$	$V_B = V_S = 600\text{V}$
$I_{QBS}$	Quiescent $V_{BS}$ supply current	25	80	200		$V_{IN} = 0\text{V}$ or $5\text{V}$
$I_{QCC}$	Quiescent $V_{CC}$ supply current	55	130	260		
$I_{IN+}$	Logic "1" input bias current	—	25	60		$V_{IN} = 5\text{V}$
$I_{IN-}$	Logic "0" input bias current	—	—	1.0		$V_{IN} = 0\text{V}$
$V_{CCUV+}$ $V_{BSUV+}$	$V_{CC}$ and $V_{BS}$ supply undervoltage positive going threshold	8.0	8.9	9.8	V	
$V_{CCUV-}$ $V_{BSUV-}$	$V_{CC}$ and $V_{BS}$ supply undervoltage negative going threshold	7.4	8.2	9.0		
$V_{CCUVH}$ $V_{BSUVH}$	$V_{CC}$ and $V_{BS}$ supply undervoltage Hysteresis	0.3	0.7	—		
$I_{O25+}^{(†)}$	Output high short circuit pulsed current	1.4	1.9	—	A	$V_O = 0\text{V}$ , $PW \leq 10\mu\text{s}$ , $T_J = 25^{\circ}\text{C}$
$I_{O25-}^{(†)}$	Output low short circuit pulsed current	1.8	2.3	—		$V_O = 15\text{V}$ , $PW \leq 10\mu\text{s}$ , $T_J = 25^{\circ}\text{C}$
$I_{O+}^{(†)(††)}$	Output high short circuit pulsed current	1.2	—	—		$V_O = 0\text{V}$ , $PW \leq 10\mu\text{s}$
$I_{O-}^{(†)(††)}$	Output low short circuit pulsed current	1.5	—	—		$V_O = 15\text{V}$ , $PW \leq 10\mu\text{s}$

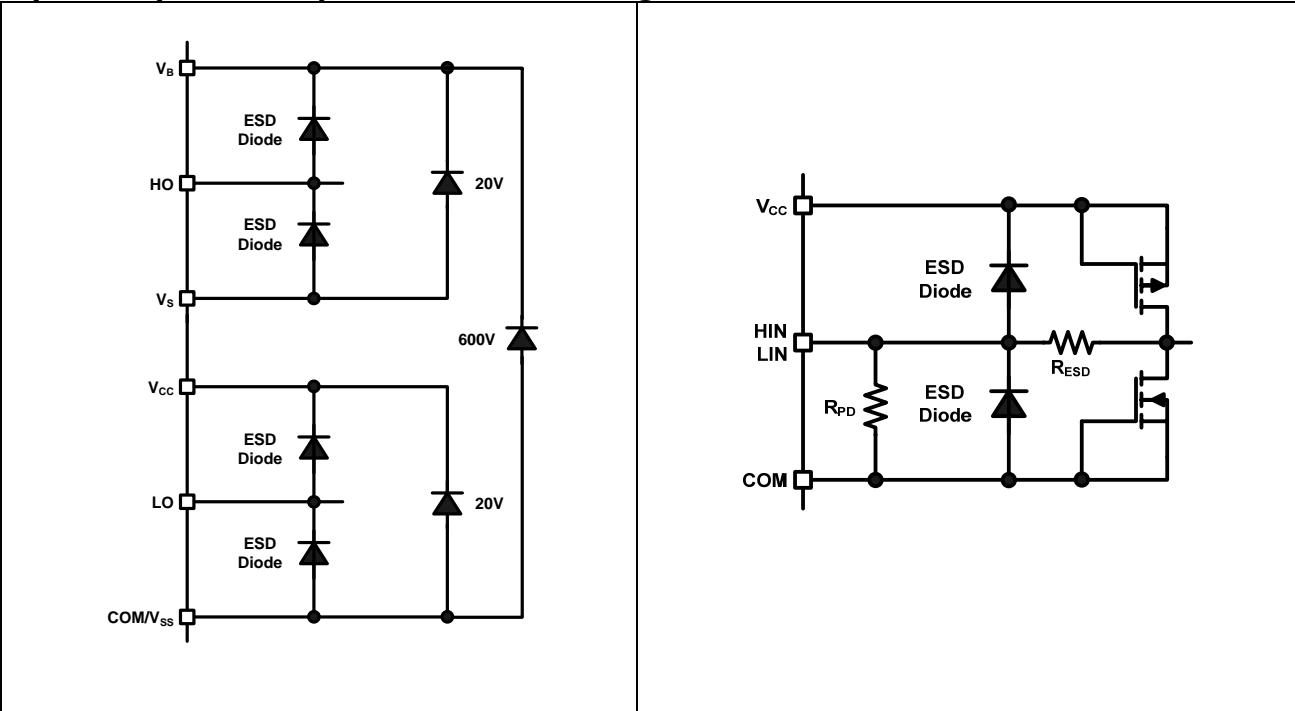
(†) Guaranteed by design

(††)  $I_{O+}$  and  $I_{O-}$  decrease with rising temperature

**Functional Block Diagrams**



**Input/Output Pin Equivalent Circuit Diagrams**

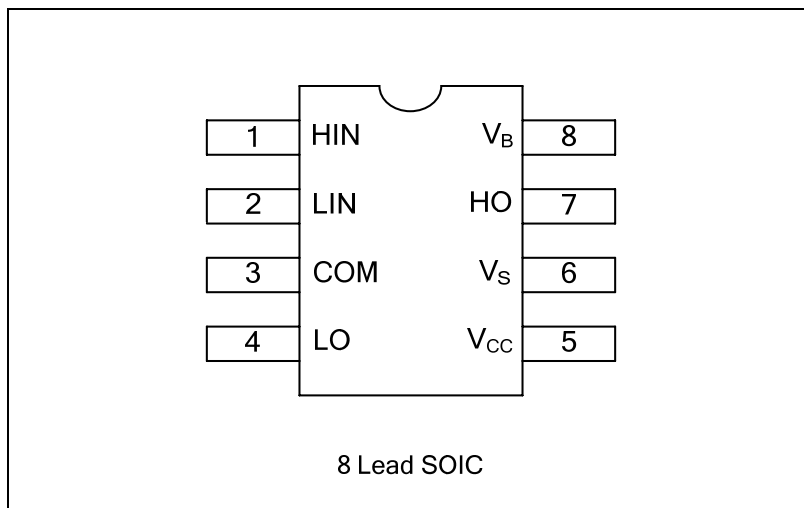




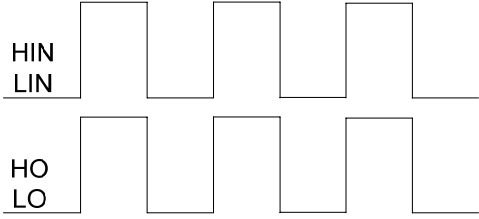
## Lead Definitions: AUIRS21811S

Pin#	Symbol	Description
1	HIN	Logic input for high-side driver output (HO), in phase
2	LIN	Logic input for low-side driver output (LO), in phase
3	COM	Low-side return
4	LO	Low-side gate drive output
5	V <sub>CC</sub>	Low-side and logic fixed supply
6	V <sub>S</sub>	High-side floating supply return
7	HO	High-side gate drive output
8	V <sub>B</sub>	High-side floating supply

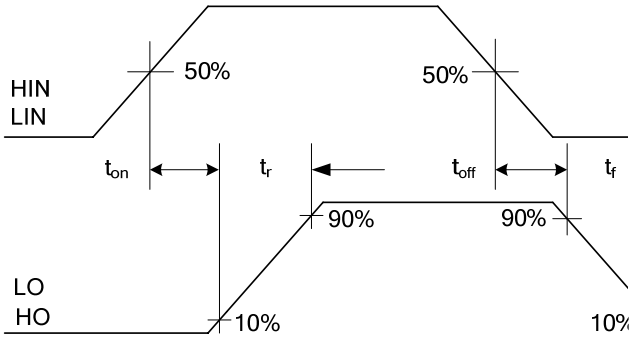
## Lead Assignments



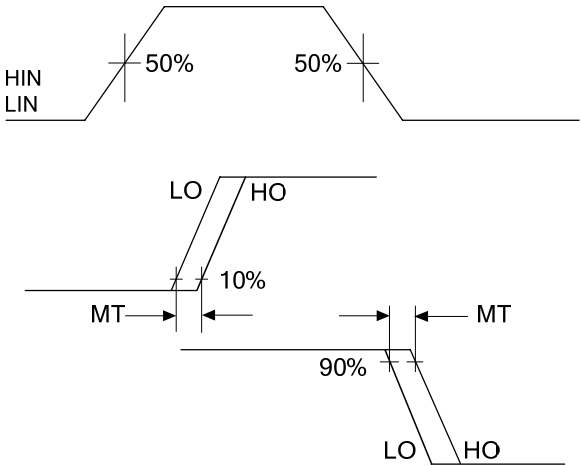
**Application Information and Additional Details**



**Figure 1. Input/Output Timing Diagram**



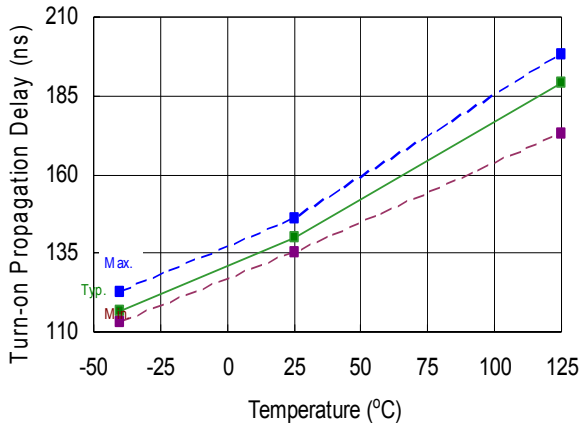
**Figure 2. Switching Time Waveform Definitions**



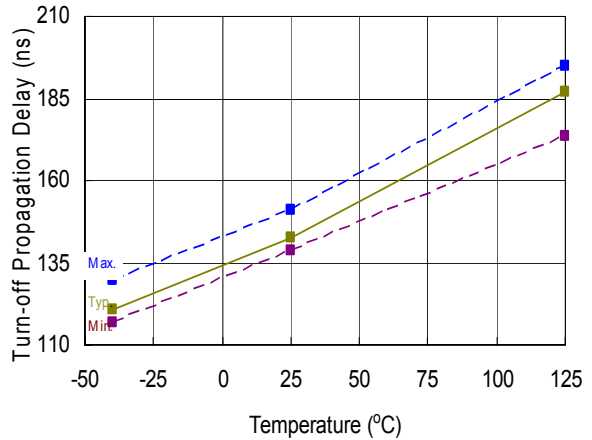
**Figure 3. Delay Matching Waveform Definitions**

**Parameter Temperature Trends**

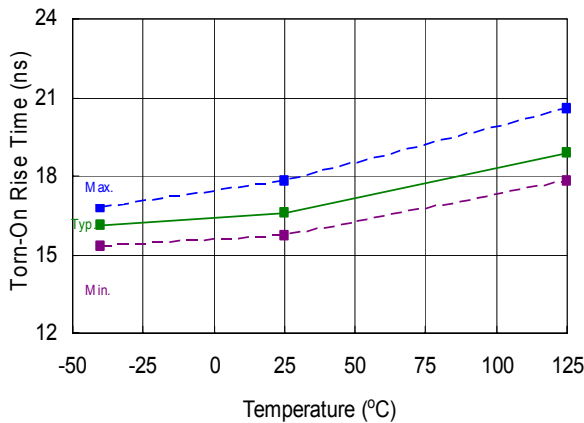
Figures 4-16 provide information on the experimental performance of the AUIRS21811S HVIC. The line plotted in each figure is generated from actual lab data. A large number of individual samples were tested at three temperatures (-40 °C, 25 °C, and 125 °C) in order to generate the curves. Each line in the graphs consist of three data points (one data point at each of the tested temperatures) that have been connected together to illustrate the understood trend. The individual data points on the curve were determined by calculating the averaged experimental value of the parameter (for a given temperature).



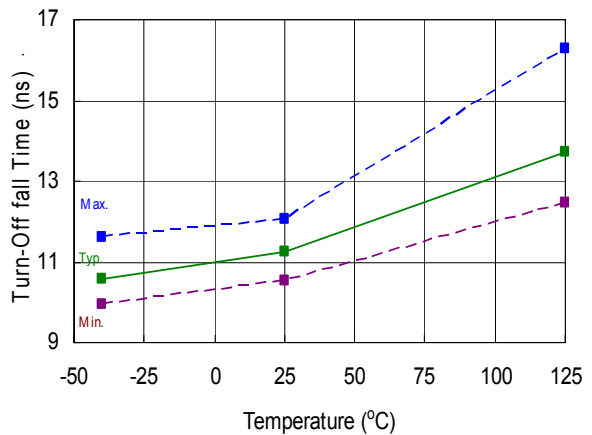
**Figure 4. Turn-On Propagation Delay vs. Temperature**



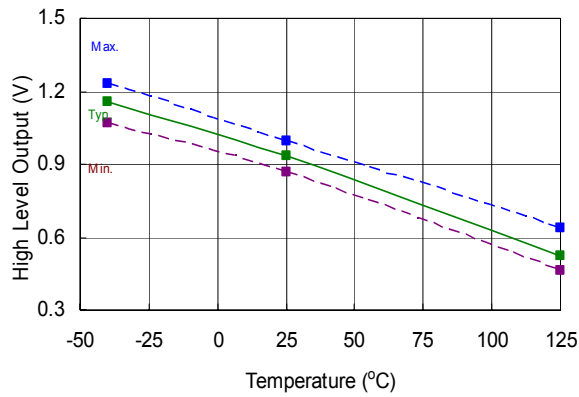
**Figure 5. Turn-Off Propagation Delay vs. Temperature**



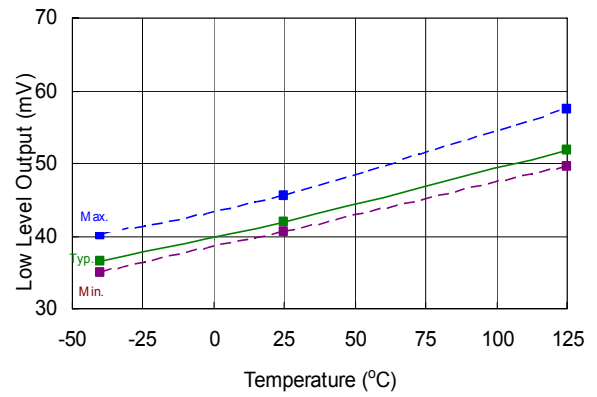
**Figure 6. Turn-On Rise Time vs. Temperature**



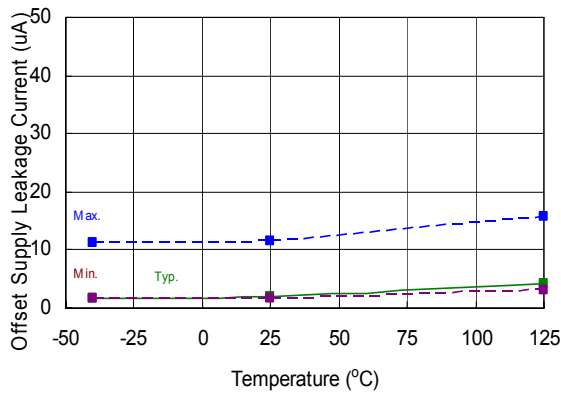
**Figure 7. Turn-Off Fall Time vs. Temperature**



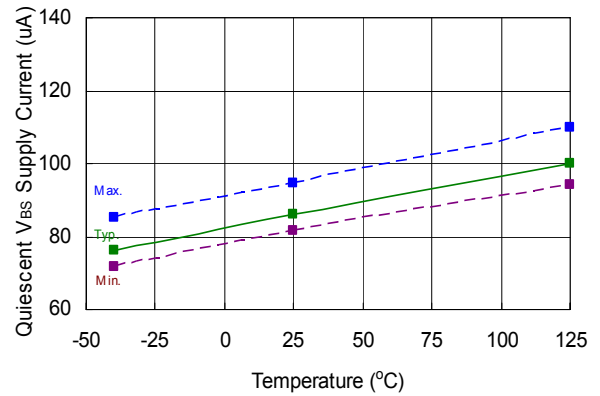
**Figure 8. High Level Output Voltage vs. Temperature (Io = 0 mA)**



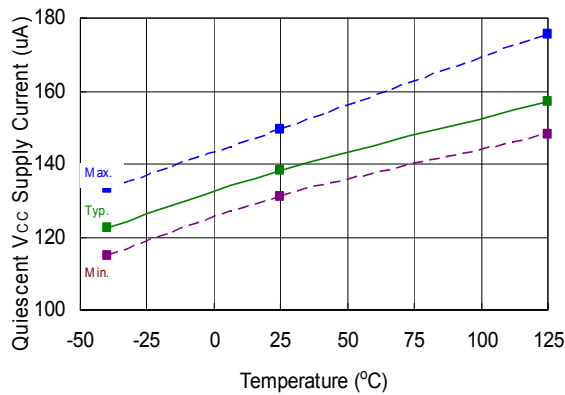
**Figure 9. Low Level Output vs. Temperature**



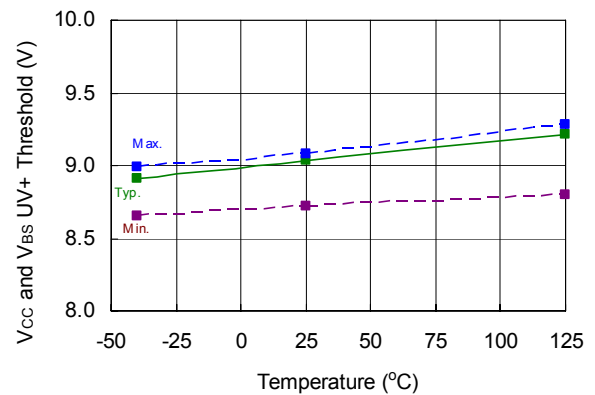
**Figure 10. Offset Supply Leakage Current vs. Temperature**



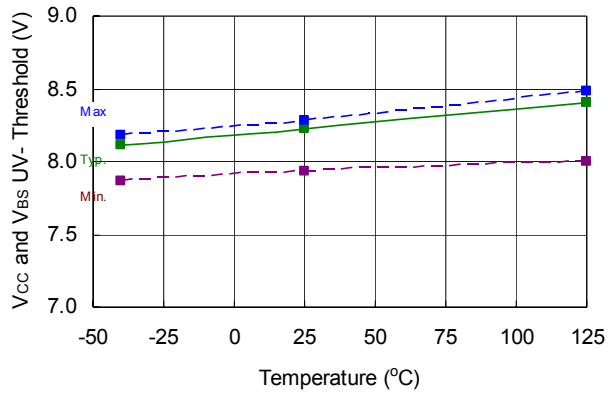
**Figure 11. VBS Supply Current vs. Temperature**



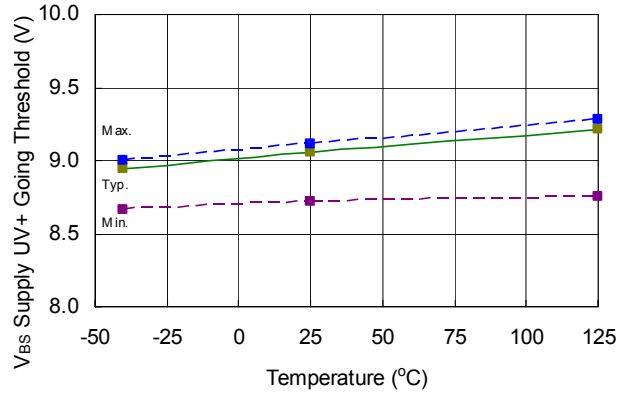
**Figure 12. VCC Supply Current vs. Temperature**



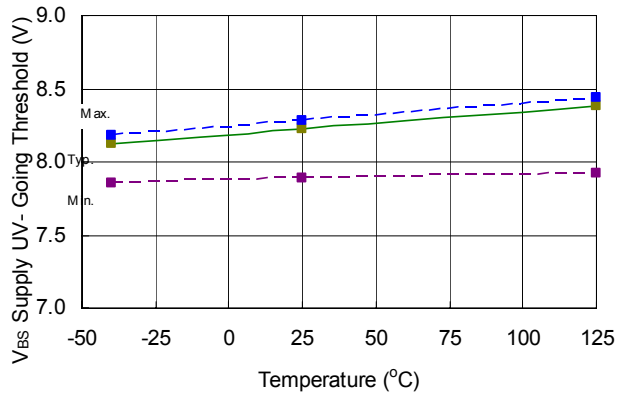
**Figure 13. VCC Undervoltage Threshold (+) vs. Temperature**



**Figure 14. V<sub>CC</sub> Undervoltage Threshold (-) vs. Temperature**

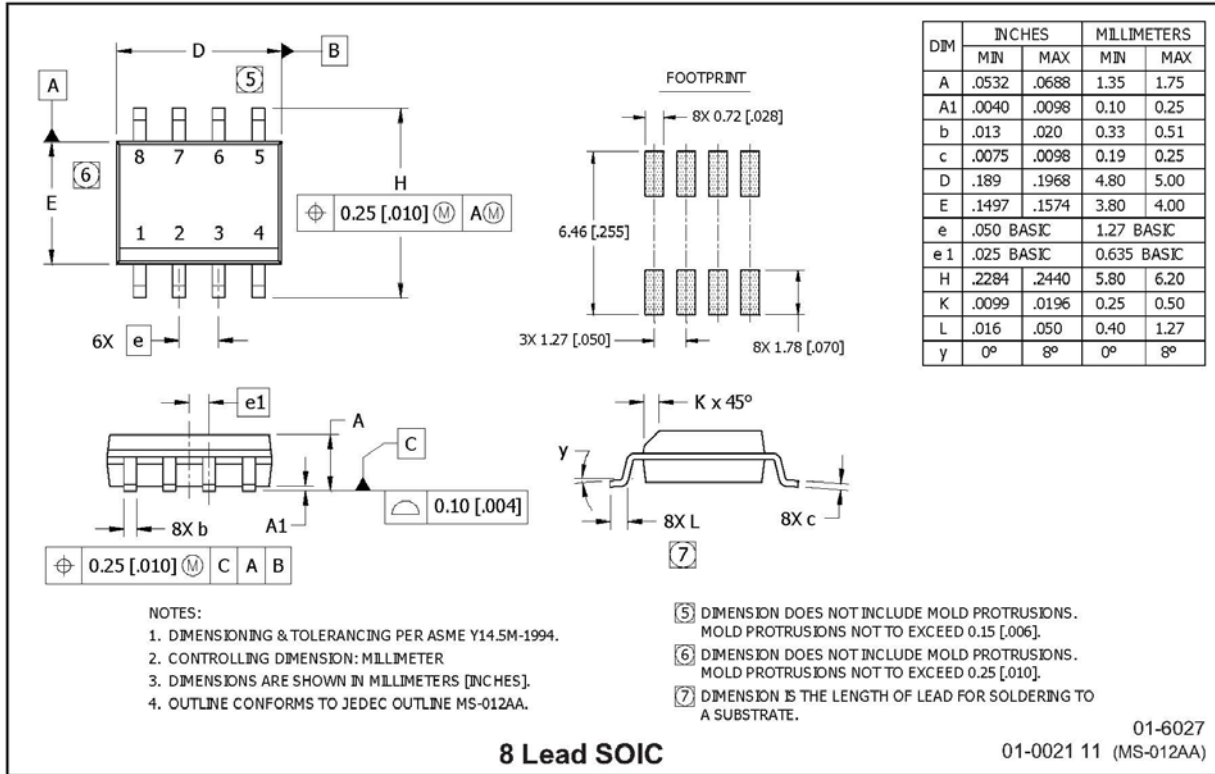


**Figure 15. V<sub>BS</sub> Undervoltage Threshold (+) vs. Temperature**

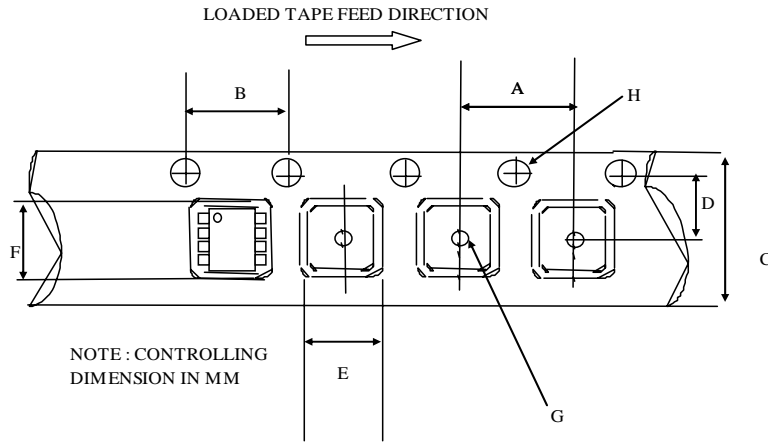


**Figure 16. V<sub>BS</sub> Undervoltage Threshold (-) vs. Temperature**

## Package Details: SOIC 8

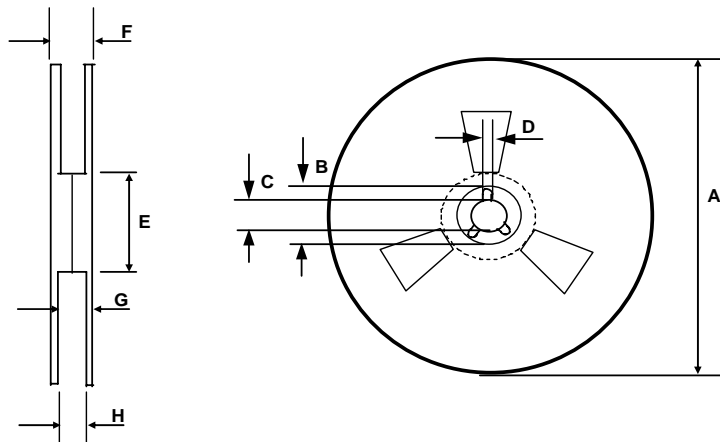


**Tape and Reel Details: SOIC8**



**CARRIER TAPE DIMENSION FOR 8SOICN**

Code	Metric		Imperial	
	Min	Max	Min	Max
A	7.90	8.10	0.311	0.318
B	3.90	4.10	0.153	0.161
C	11.70	12.30	0.46	0.484
D	5.45	5.55	0.214	0.218
E	6.30	6.50	0.248	0.255
F	5.10	5.30	0.200	0.208
G	1.50	n/a	0.059	n/a
H	1.50	1.60	0.059	0.062

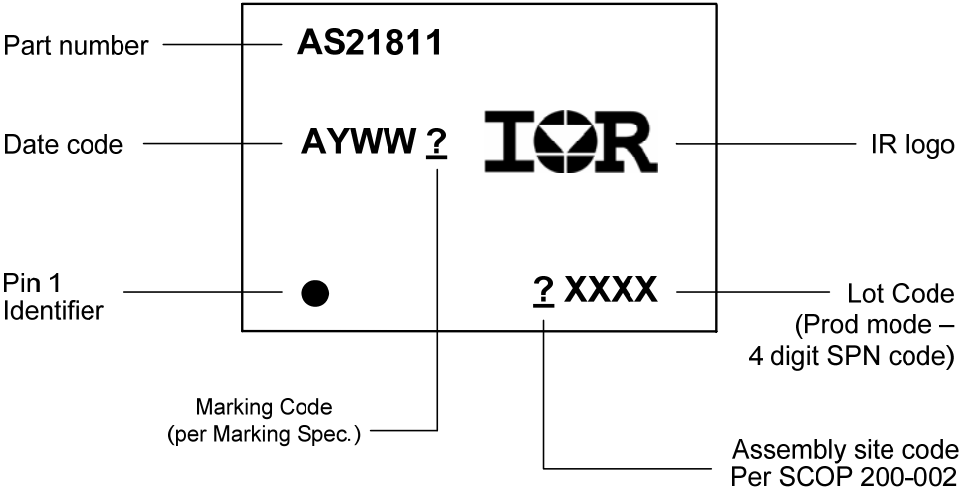


**REEL DIMENSIONS FOR 8SOICN**

Code	Metric		Imperial	
	Min	Max	Min	Max
A	329.60	330.25	12.976	13.001
B	20.95	21.45	0.824	0.844
C	12.80	13.20	0.503	0.519
D	1.95	2.45	0.767	0.096
E	98.00	102.00	3.858	4.015
F	n/a	18.40	n/a	0.724
G	14.50	17.10	0.570	0.673
H	12.40	14.40	0.488	0.566

**Part Marking Information**

**SOIC8:**





**Order Information**

Base Part Number	Package Type	Standard Pack		Complete Part Number
		Form	Quantity	
AUIRS21811	SOIC8N	Tube/Bulk	95	AUIRS21811S
		Tape and Reel	2500	AUIRS21811STR

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**WORLD HEADQUARTERS:**

233 Kansas St., El Segundo, California 90245  
Tel: (310) 252-7105

**Revision History**

<b>Date</b>	<b>Change by</b>	<b>Comment</b>
8/6/08	CIC	First draft: all changes wrt AUIRS2181(4)(S) datasheet Updated all references to IC name Changed references of ton/toff to reflect requested 120ns/120ns spec Updated expected I <sub>QBS</sub> and I <sub>QCC</sub> specs
9/8/08	CIC	Changed product summary topology to "Half-Bridge" Changed product summary I <sub>O+</sub> & I <sub>O-</sub> from typ values to min values Removed reference to deadtime in the product summary Removed typical applications section Removed references to other parts in feature comparison section Changed V <sub>IN</sub> from 2.7V min to 2.5V min Changed V <sub>OH</sub> from 1.2V max to 1.4V max Changed V <sub>OL</sub> from 0.1V max to 0.2V max Updated functional block diagrams Updated lead definitions and lead assignments, added device label for lead assignment Added typical application diagram section Added simplified block diagram section Added input/output pin equivalent diagrams Added in application info and additional details section Added in parameter temperature trend section
10/31/08	CIC	Changed VB max to 620V (align with rest of 20V clamp drivers spec)
2/24/09	CIC	Updated the qual table (showing "TBD" for ESD/LU ratings)
2/26/09	CIC	Removed IRS218114
3/10/09	CIC	Removed Simplified Block Diagram Removed Typical Application Diagram Removed Parameter Temp Trend Section Updated page number references
3/23/09	CIC	Changed I <sub>O</sub> +/- units to A from mA
5/20/09	CIC	Added ESD and LU ratings
6/9/09	APBU	Front page: "Logic and power ground +/- 5V offset" sentence erased (only one ground exists). Page 3: "designed for minimum driver cross-conduction" sentence erased. Page 5, 6, 8: V <sub>SS</sub> related sentences erased or modified (V <sub>SS</sub> does not exist).
7/17/09	CIC	Removed min spec on I <sub>O</sub> +/- parameters Changed typ ton/toff to 135ns
9/08/09	APBU	Added Typical Applications on front page, Extended Feature comparison table, added junction temperature range in Dynamic and Static electrical characteristic tables.
9/14/09	APBU	Added tri-temp plots, added ESD passing threshold voltage, corrected I <sub>O</sub> +/- & T <sub>on/off</sub> typical value on front page to be consistent with data in table
9/15/09	APBU	Corrected list of Typical Applications on front page
9/16/09	APBU	Dyn el. Char table: Max turn on and off prop. Delay changed from 180 ns to 210 ns, removed temperature range from Statics and Dynamic Electrical Characteristic tables
9/16/09	CIC	Change the year to 2009 in header Separated Marking info and order info in two pages
9/17/09	CIC	Fixed ESD passing thresholds
10/6/09	APBU	LU rating to "tbd", added SOA page, updated marking, updated table of content, added guaranteed by design note for I <sub>O</sub> +/- parameters, removed typ. t <sub>r</sub> /t <sub>f</sub> ,
10/08/09	APBU	Removed SOA page and updated table of content.
10/09/09	APBU	Changed Max turn on/off to 230ns to allow for tri-temp variations

1/6/2010	APBU	Removed Latch Up Rating from Qual Info page; updated ton/toff typical in comparison table for AUIRS2181(4)S to 160/200ns & for AUIRS2184(4)S to 600/230ns; modified disclaimer under Absolute Max. Rating; added Important Notice
2/24/10	APBU	Page 6: Added $I_{O25+}$ and $I_{O25-}$ specification and the note
05/07/10	APBU	Corrected topology to High and Low Side driver on front page.
28 July 2010	APBU	Clamp voltage changed from 25V to 20V in input output pin equivalent circuit diagram.