

**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 10 V to 20 V
- Undervoltage lockout
- CMOS Schmitt-triggered inputs with pull-down (AUIRS2117) or pull-up (AUIRS2118)
- Output in phase with input (AUIRS2117) or out of Phase with input (AUIRS2118)
- Leadfree, RoHS compliant
- Automotive qualified\*

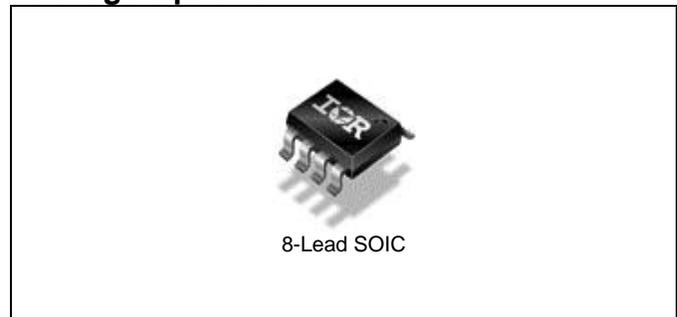
**Typical Applications**

- Direct/Piezo injection
- BLDC Motor Drive
- MOSFET and IGBT drivers

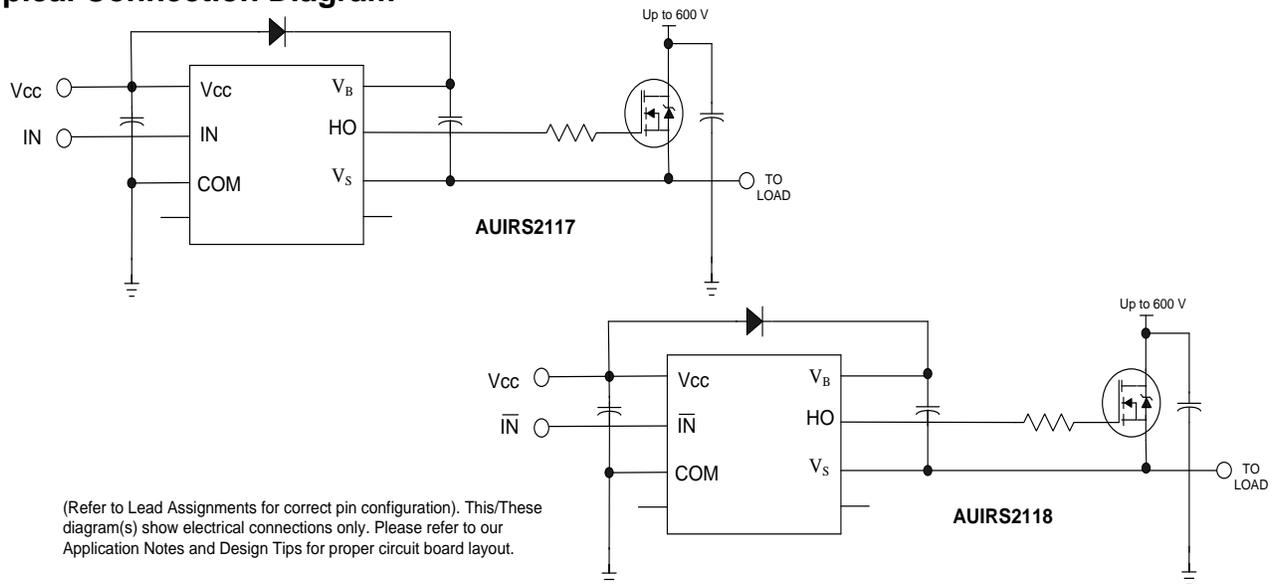
**Product Summary**

Topology	Single High Side
V <sub>OFFSET</sub>	≤ 600 V
V <sub>OUT</sub>	10 V – 20 V
I <sub>o+</sub> & I <sub>o-</sub> (typical)	290 mA & 600 mA
t <sub>ON</sub> & t <sub>OFF</sub> (typical)	140 ns & 140 ns

**Package Options**



**Typical Connection Diagram**



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### Description

The AUIRS2117S/AUIRS2118S are high voltage, high speed power MOSFET and IGBT drivers. Proprietary HVIC and latch immune CMOS technologies enable ruggedized monolithic construction. The logic input is compatible with standard CMOS outputs. 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 or low-side configuration which operates up to 600 V.

### Qualification Information<sup>†</sup>

<b>Qualification Level</b>		Automotive (per AEC-Q100)	
		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>		SOIC8N	MSL3 <sup>††</sup> 260°C (per IPC/JEDEC J-STD-020)
<b>ESD</b>	Machine Model	Class M2 (Pass +/-200V) (per AEC-Q100-003)	
	Human Body Model	Class H1B (Pass +/-1000V) (per AEC-Q100-002)	
	Charged Device Model	Class C4 (Pass +/-1000V) (per AEC-Q100-011)	
<b>IC Latch-Up Test</b>		Class II, Level A (per AEC-Q100-004)	
<b>RoHS Compliant</b>		Yes	

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

†† 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	625	V
$V_S$	High-side floating supply offset voltage	$V_B - 25$	$V_B + 0.3$	
$V_{HO}$	High-side floating output voltage	$V_S - 0.3$	$V_B + 0.3$	
$V_{CC}$	Logic supply voltage	-0.3	25	
$V_{IN}$	Logic input voltage	-0.3	$V_{CC} + 0.3$	
$dV_S/dt$	Allowable offset supply voltage transient (Fig. 2)	—	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	-55	150	
$T_L$	Lead temperature (soldering, 10 seconds)	—	300	

## Recommended Operating Conditions

The input/output logic timing diagram is shown in Fig. 1. For proper operation the device should be used within the recommended conditions. The  $V_S$  offset rating is tested with all supplies biased at 15 V 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	$V_S$	$V_B$	
$V_{CC}$	Logic supply voltage	10	20	
$V_{IN}$	Logic input voltage	0	$V_{CC}$	
$T_A$	Ambient temperature	-40	125	°C

† Logic operational for  $V_S$  of -5 V to +600 V. Logic state held for  $V_S$  of -5 V to  $-V_{BS}$ .  
(Please refer to the Design Tip DT97-3 for more details).

### 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  $V_{\text{BIAS}} (V_{\text{CC}}, V_{\text{BS}}) = 15 \text{ V}$ . The  $V_{\text{IL}}$ ,  $V_{\text{IH}}$  and  $I_{\text{IN}}$  parameters are referenced to COM. The  $V_{\text{O}}$  and  $I_{\text{O}}$  parameters are referenced to COM and are applicable to the respective output leads: HO.

Symbol	Definition	Min	Typ	Max	Units	Test Conditions		
$V_{\text{IH}}$	Logic "1" input voltage	AUIRS2117	9.5	—	—	V		
		AUIRS2118						
$V_{\text{IL}}$	Logic "0" input voltage	AUIRS2117	—	—	6.0		$I_{\text{O}} = 2 \text{ mA}$	
		AUIRS2118						
$V_{\text{OH}}$	High level output voltage, $V_{\text{BIAS}} - V_{\text{O}}$	—	0.05	0.2	V			
$V_{\text{OL}}$	Low level output voltage, $V_{\text{O}} \dagger$	—	0.02	0.2				
$I_{\text{LK}}$	Offset supply leakage current	—	—	50				$\mu\text{A}$
$I_{\text{QBS}}$	Quiescent $V_{\text{BS}}$ supply current	—	50	240				
$I_{\text{QCC}}$	Quiescent $V_{\text{CC}}$ supply current	—	70	340				
$I_{\text{IN}+}$	Logic "1" input bias current	AUIRS2117	—	20	40	$V_{\text{B}} = V_{\text{S}} = 600 \text{ V}$		
		AUIRS2118				$V_{\text{IN}} = 0 \text{ V or } V_{\text{CC}}$		
$I_{\text{IN}-}$	Logic "0" input bias current	AUIRS2117	—	—	5.0	$V_{\text{IN}} = 0 \text{ V}$		
		AUIRS2118				$V_{\text{IN}} = V_{\text{CC}}$		
$V_{\text{BSUV}+}$	$V_{\text{BS}}$ supply undervoltage positive going threshold	7.6	8.6	9.6	V			
$V_{\text{BSUV}-}$	$V_{\text{BS}}$ supply undervoltage negative going threshold	7.2	8.2	9.2				
$V_{\text{CCUV}+}$	$V_{\text{CC}}$ supply undervoltage positive going threshold	7.6	8.6	9.6				
$V_{\text{CCUV}-}$	$V_{\text{CC}}$ supply undervoltage negative going threshold	7.2	8.2	9.2				
$I_{\text{O}+}$	Output high short circuit pulsed current	200	290	—	mA	$V_{\text{O}} = 0 \text{ V}$ , $V_{\text{IN}} = \text{Logic "1"}$ $\text{PW} \leq 10 \mu\text{s}$		
$I_{\text{O}-}$	Output low short circuit pulsed current	420	600	—		$V_{\text{O}} = 15 \text{ V}$ , $V_{\text{IN}} = \text{Logic "0"}$ $\text{PW} \leq 10 \mu\text{s}$		

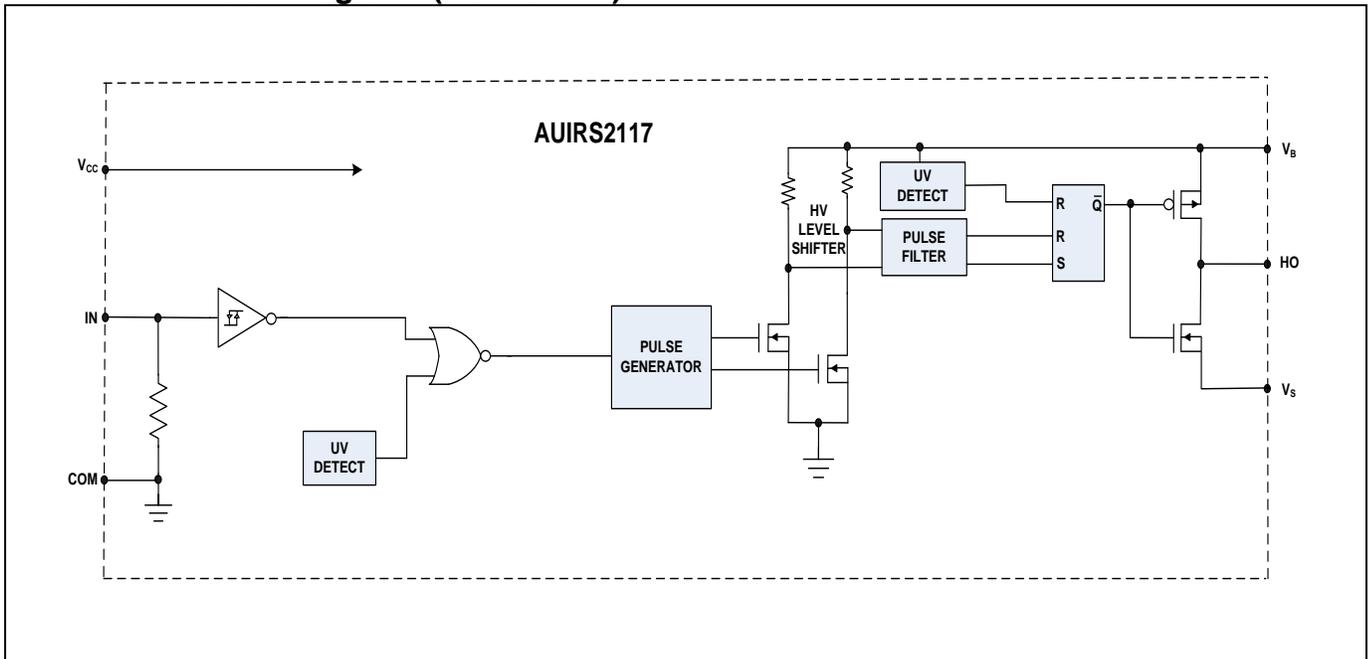
### Dynamic Electrical Characteristics

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  $V_{\text{BIAS}} (V_{\text{CC}}, V_{\text{BS}}) = 15 \text{ V}$ ,  $C_{\text{L}} = 1000 \text{ pF}$ . The dynamic electrical characteristics are measured using the test circuit shown in Fig. 3.

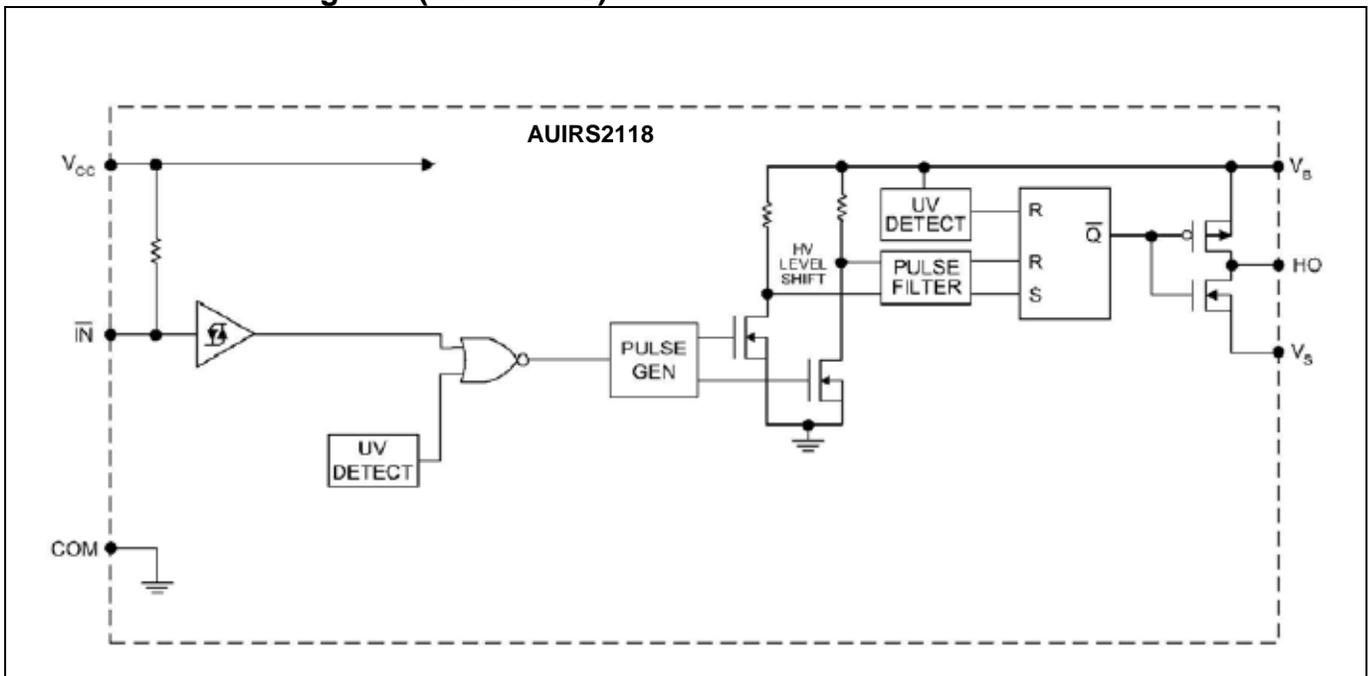
Symbol	Definition	Min	Typ	Max	Units	Test Conditions
$t_{\text{on}}$	Turn-on propagation delay	—	140	225	ns	$V_{\text{S}} = 0 \text{ V}$
$t_{\text{off}}$	Turn-off propagation delay	—	140	225		$V_{\text{S}} = 600 \text{ V}$
$t_{\text{r}}$	Turn-on rise time	—	75	130		
$t_{\text{f}}$	Turn-off fall time	—	25	65		

Note: Please refer to figures in Parameter Temperature Trends section

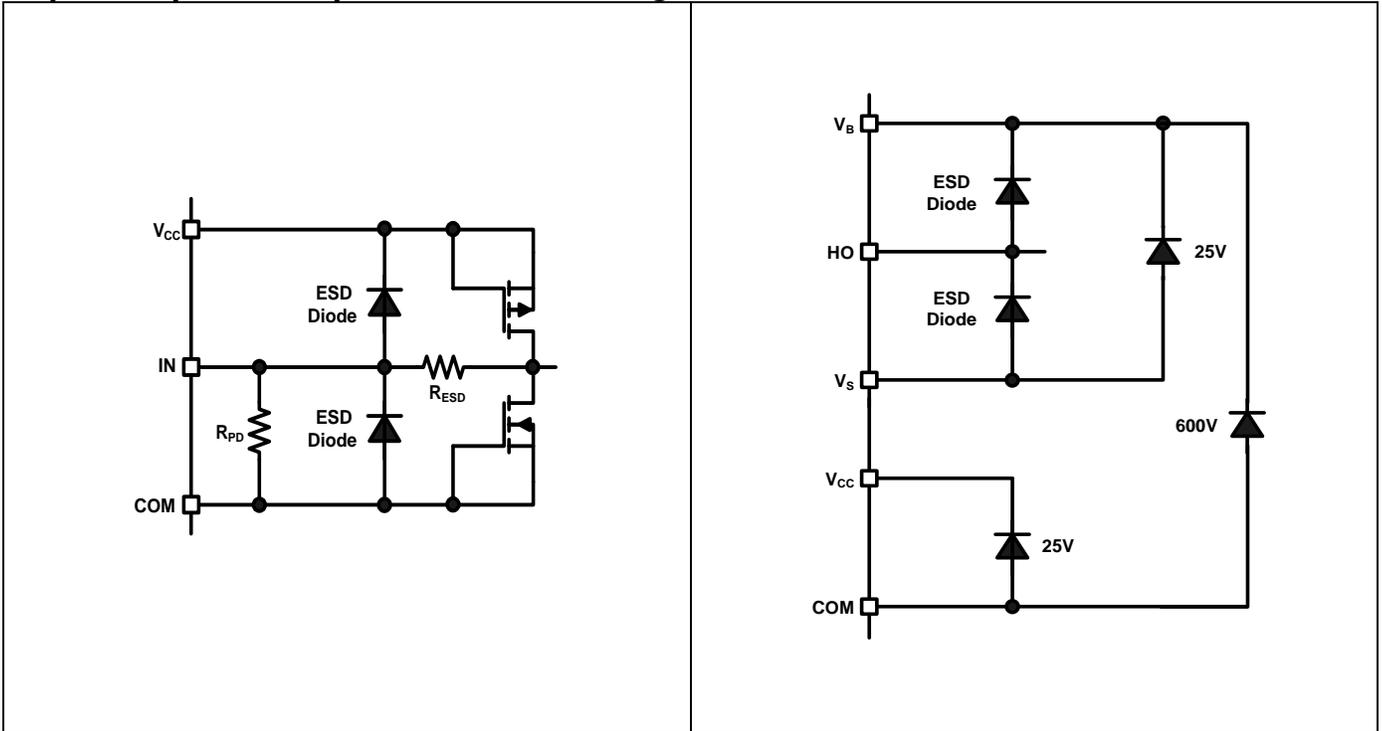
**Functional Block Diagram: (AUIRS2117)**



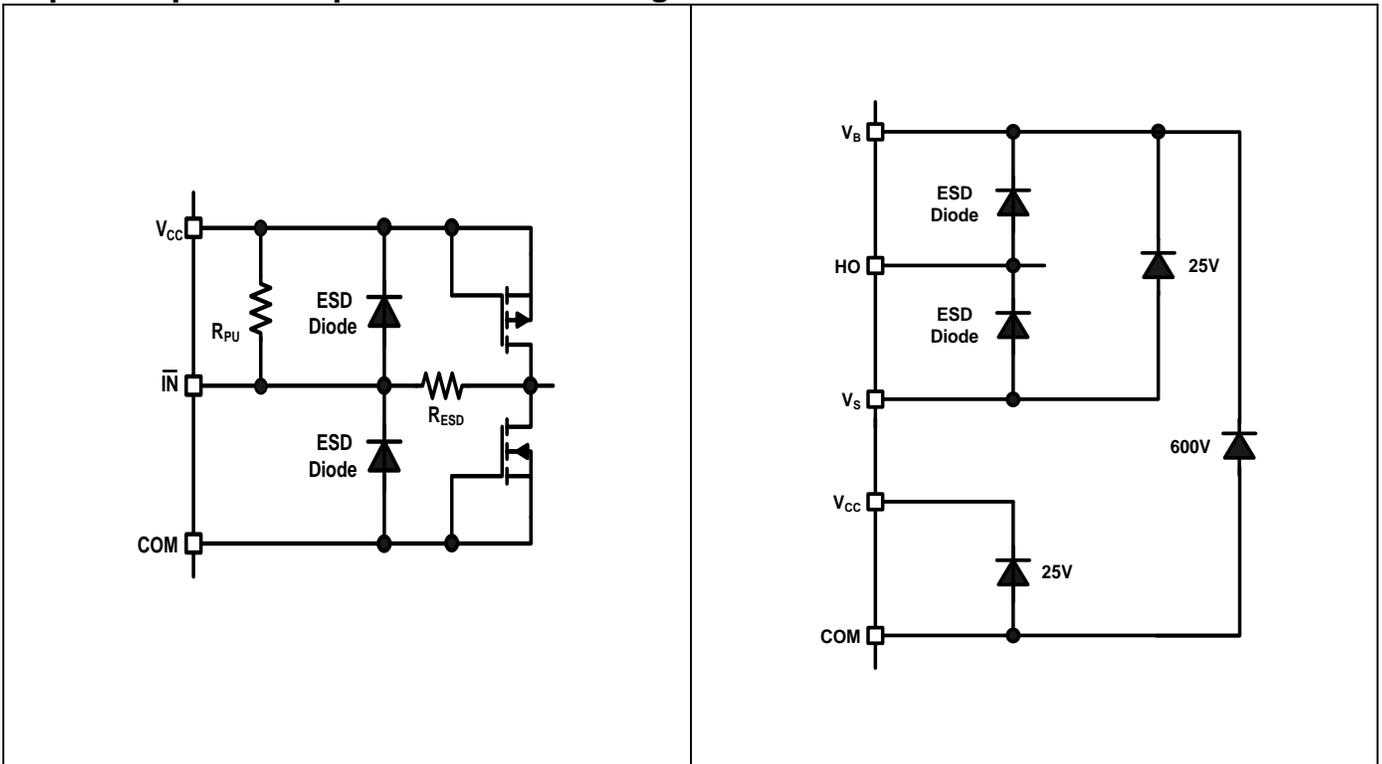
**Functional Block Diagram: (AUIRS2118)**



**Input/Output Pin Equivalent Circuit Diagrams: AUIRS2117S**



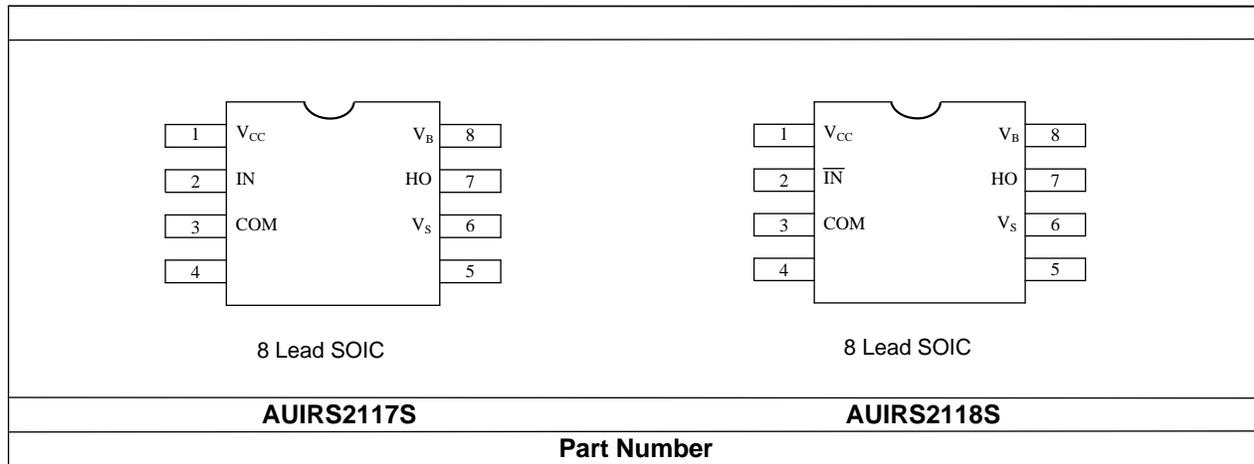
**Input/Output Pin Equivalent Circuit Diagrams: AUIRS2118S**



## Lead Definitions

PIN	Symbol	Description
1	$V_{CC}$	Low-side and logic fixed supply
2	$\overline{IN}$ $IN$	Logic input for gate driver output (HO), in phase with HO (AUIRS2117) Logic input for gate driver output (HO), out of phase with HO (AUIRS2118)
3	COM	Logic ground
4	NC	No Connection
5	NC	No Connection
6	$V_S$	High-side floating supply return
7	HO	High-side gate drive output
8	$V_B$	High-side floating supply

## Lead Assignments



## Application Information and Additional Details

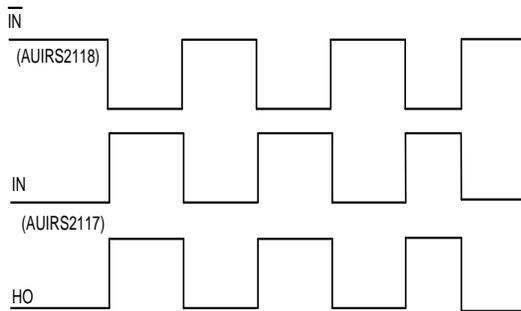


Figure 1: Input/Output Timing Diagram

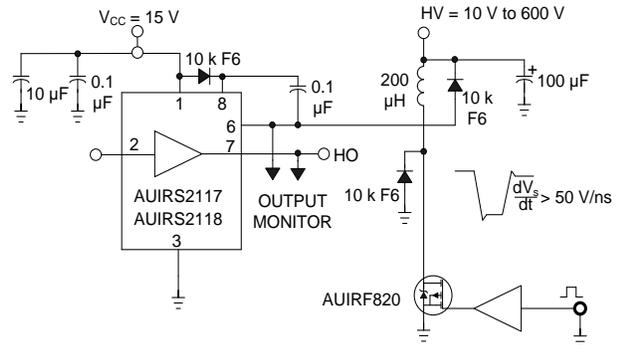


Figure 2: Floating Supply Voltage Transient Test Circuit

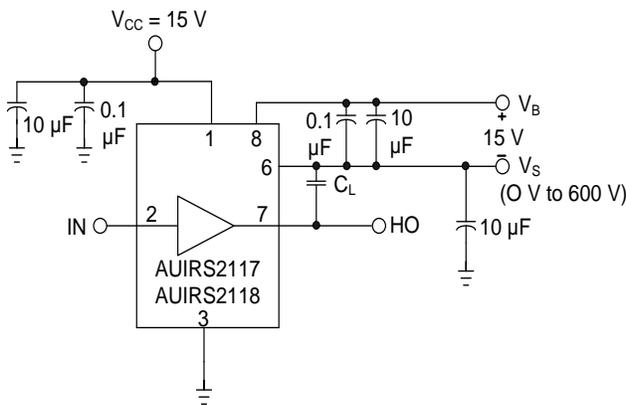


Figure 3: Switching Time Test Circuit

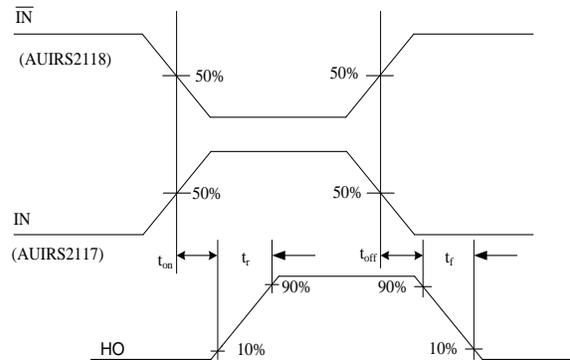
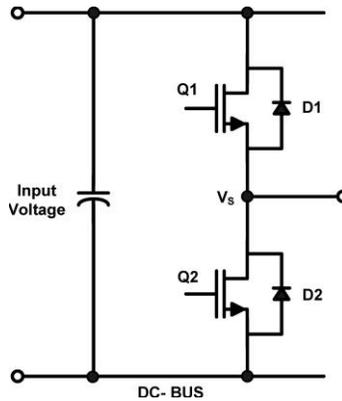


Figure 4: Switching Time Waveform Definition

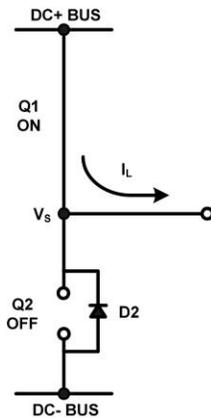
**Tolerant to Negative  $V_s$  Transients**

A common problem in today's high-power switching converters is the transient response of the switch node's voltage as the power switches transition on and off quickly while carrying a large current. A typical half bridge circuit is shown in Figure 5; here we define the power switches and diodes of the inverter.

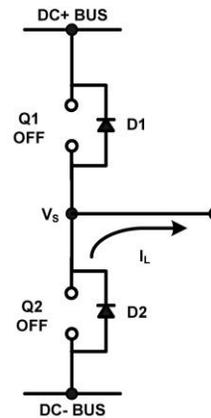
If the high-side switch (e.g., Q1 in Figures 6 and 7) switches off, while the current is flowing to a load, a current commutation occurs from high-side switch (Q1) to the diode (D2) in parallel with the low-side switch of the inverter. At the same instance, the voltage node  $V_s$  swings from the positive DC bus voltage to the negative DC bus voltage.



**Figure 5: Half Bridge Circuit**

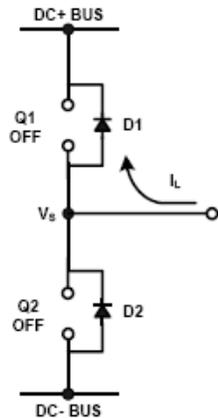


**Figure 6: Q1 conducting**

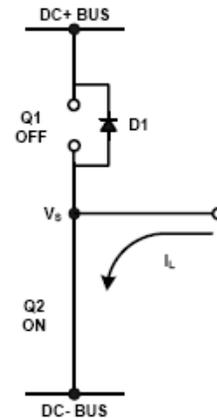


**Figure 7: D2 conducting**

Also when the current flows from the load back to the inverter (see Figures 8 and 9), and Q2 switches on, the current commutation occurs from D1 to Q2. At the same instance, the voltage node  $V_s$  swings from the positive DC bus voltage to the negative DC bus voltage.



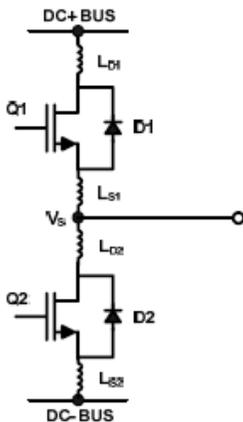
**Figure 8: D1 conducting**



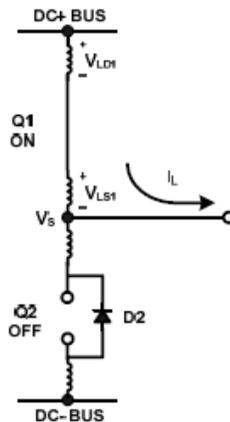
**Figure 9: Q2 conducting**

However, in a real inverter circuit, the  $V_s$  voltage swing does not stop at the level of the negative DC bus, rather it swings below the level of the negative DC bus. This undershoot voltage is called “negative  $V_s$  transient”.

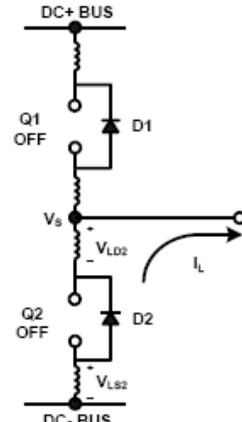
The circuit shown in Figure 10 depicts a half bridge circuit with parasitic elements shown; Figures 11 and 12 show a simplified illustration of the commutation of the current between Q1 and D2. The parasitic inductances in the power circuit from the die bonding to the PCB tracks are lumped together in  $L_D$  and  $L_S$  for each switch. When the high-side switch is on,  $V_s$  is below the DC+ voltage by the voltage drops associated with the power switch and the parasitic elements of the circuit. When the high-side power switch turns off, the load current can momentarily flow in the low-side freewheeling diode due to the inductive load connected to  $V_s$  (the load is not shown in these figures). This current flows from the DC- bus (which is connected to the COM pin of the HVIC) to the load and a negative voltage between  $V_s$  and the DC- Bus is induced (i.e., the COM pin of the HVIC is at a higher potential than the  $V_s$  pin).



**Figure 10: Parasitic Elements**



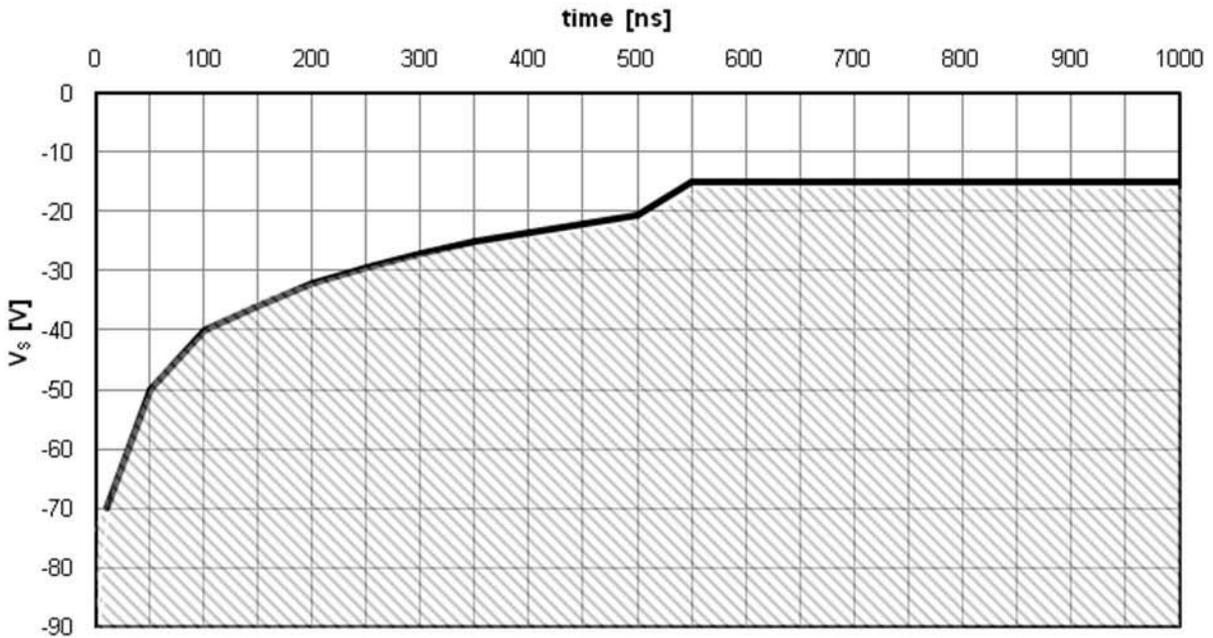
**Figure 11:  $V_s$  positive**



**Figure 12:  $V_s$  negative**

In a typical power circuit,  $dV/dt$  is typically designed to be in the range of 1-5 V/ns. The negative  $V_s$  transient voltage can exceed this range during some events such as short circuit and over-current shutdown, when  $di/dt$  is greater than in normal operation.

International Rectifier’s HVICs have been designed for the robustness required in many of today’s demanding applications. An indication of the AUIRS211(7,8)S’ robustness can be seen in Figure 13, where there is represented the IRS211(7,8)S Safe Operating Area at  $V_{BS}=15V$  based on repetitive negative  $V_s$  spikes. A negative  $V_s$  transient voltage falling in the grey area (outside SOA) may lead to IC permanent damage; viceversa unwanted functional anomalies or permanent damage to the IC do not appear if negative  $V_s$  transients fall inside SOA.



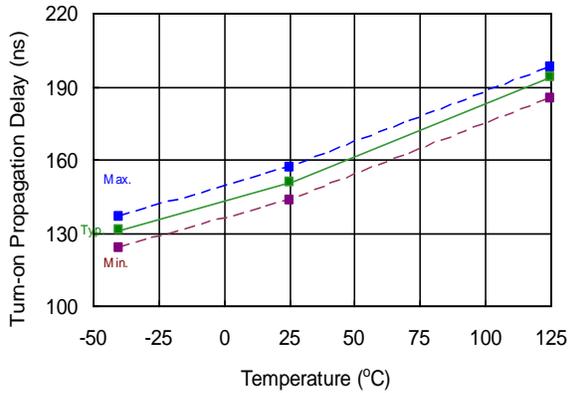
**Figure 13: Negative VS transient SOA for AUIRS2117(8)S @ VBS=15V**

Even though the AUIRS2117(8)S has shown the ability to handle these large negative Vs transient conditions, it is highly recommended that the circuit designer always limit the negative Vs transients as much as possible by careful PCB layout and component use.

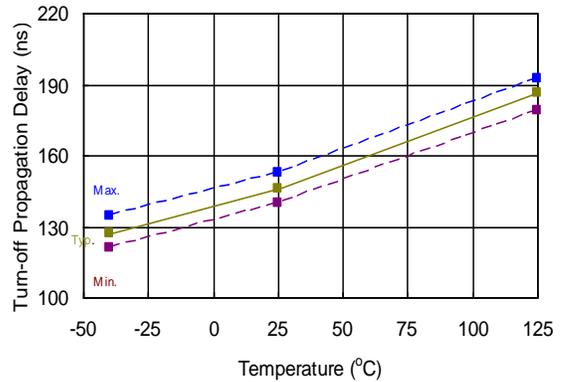
## Parameter Temperature Trends

Figures 14-28 provide information on the experimental performance of the AUIRS2117(8)S 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 experimental curve.

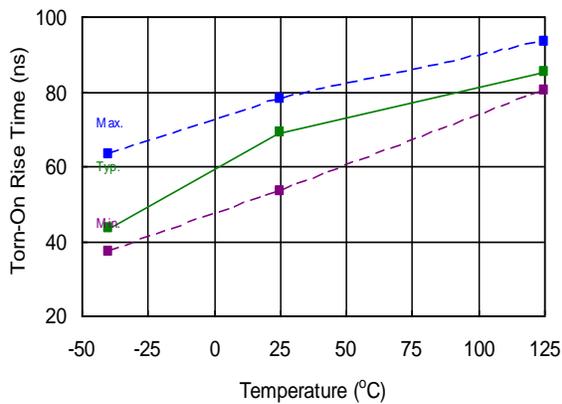
The line consists of three data points (one data point at each of the tested temperatures) that have been connected together to illustrate the understood trend. The individual data points on the Typ. curve were determined by calculating the averaged experimental value of the parameter (for a given temperature).



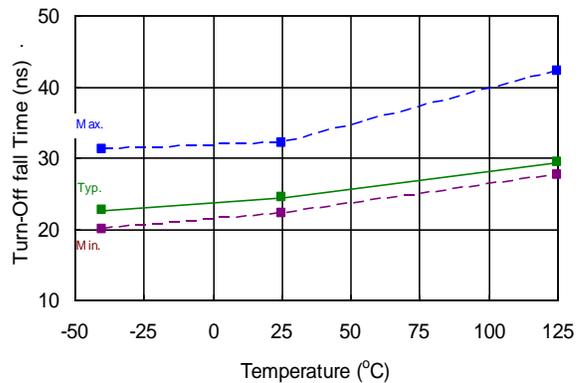
**Figure 14. Turn-On Time vs. Temperature**



**Figure 15. Turn-Off Time vs. Temperature**



**Figure 16. Turn-On Rise Time vs. Temperature**



**Figure 17. Turn-Off Fall Time vs. Temperature**

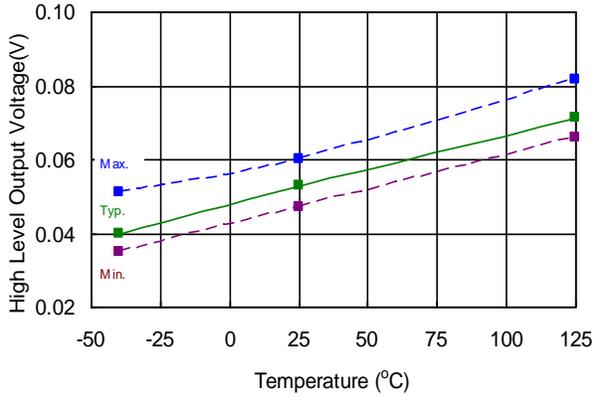


Figure 18. High Level Output Voltage vs. Temperature

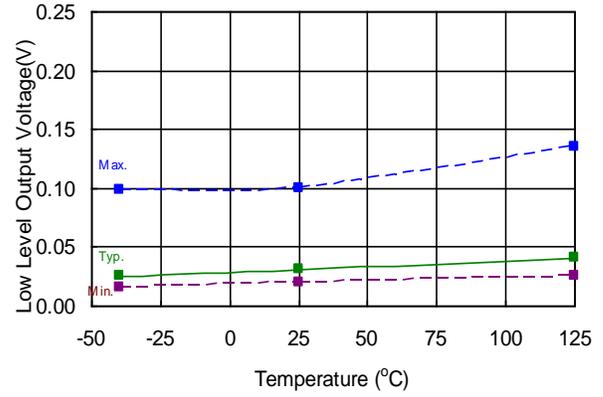


Figure 19. Low Level Output Voltage vs. Temperature

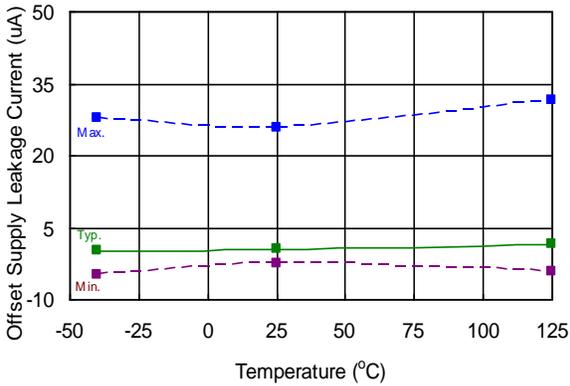


Figure 20. Offset Supply Leakage Current vs. Temperature

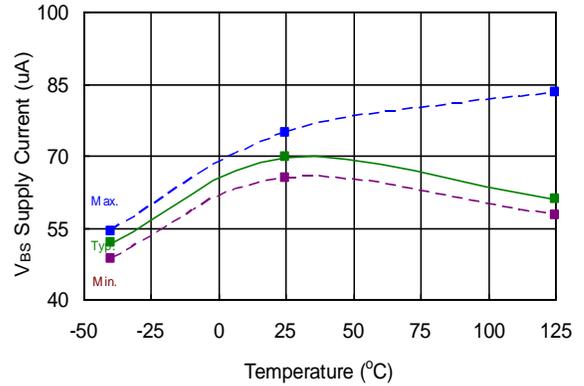


Figure 21. V<sub>BS</sub> Supply Current vs. Temperature

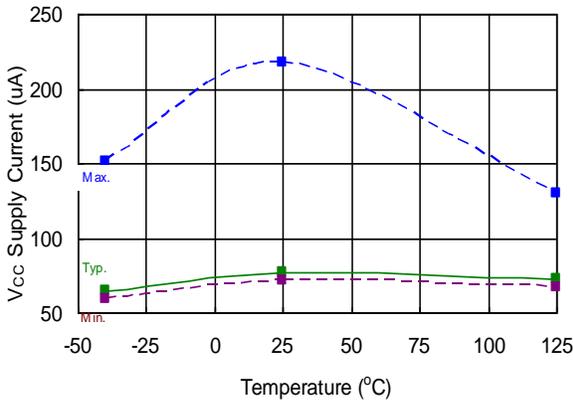


Figure 22. V<sub>CC</sub> Supply Current vs. Temperature

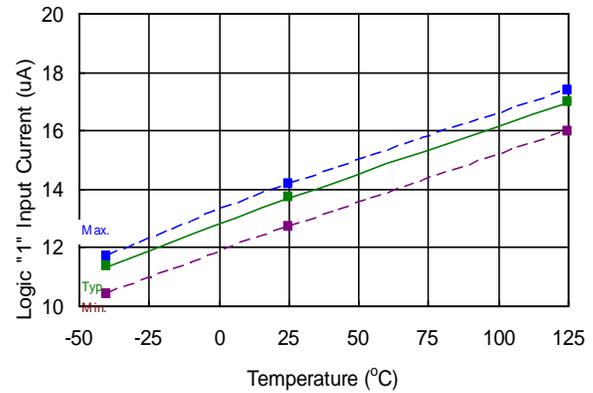
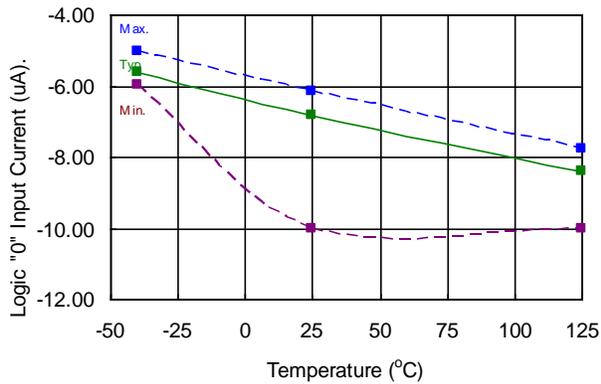
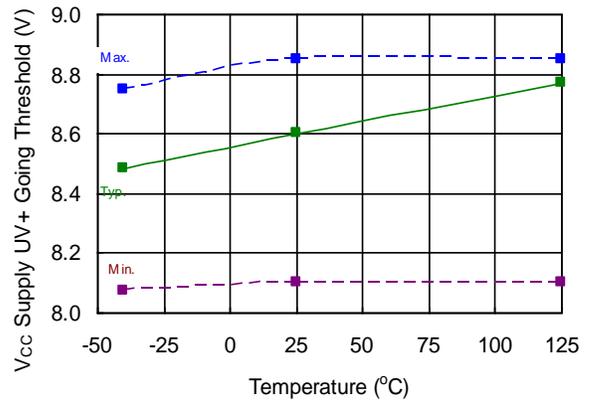


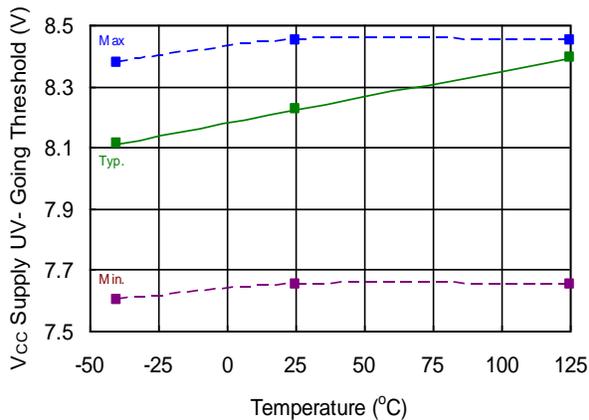
Figure 23. Logic "1" Input Current vs. Temperature



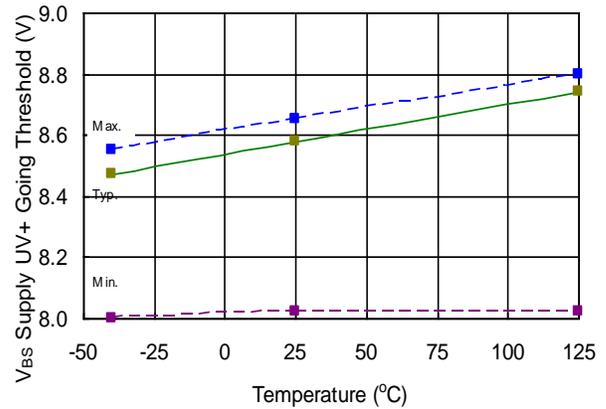
**Figure 24. Logic "0" (2118 "1") Input Current vs. Temperature**



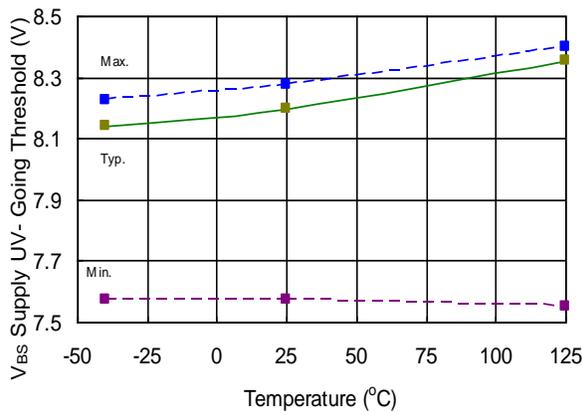
**Figure 25. V<sub>CC</sub> Undervoltage Threshold (+) vs. Temperature**



**Figure 26. V<sub>CC</sub> Undervoltage Threshold (-) vs. Temperature**

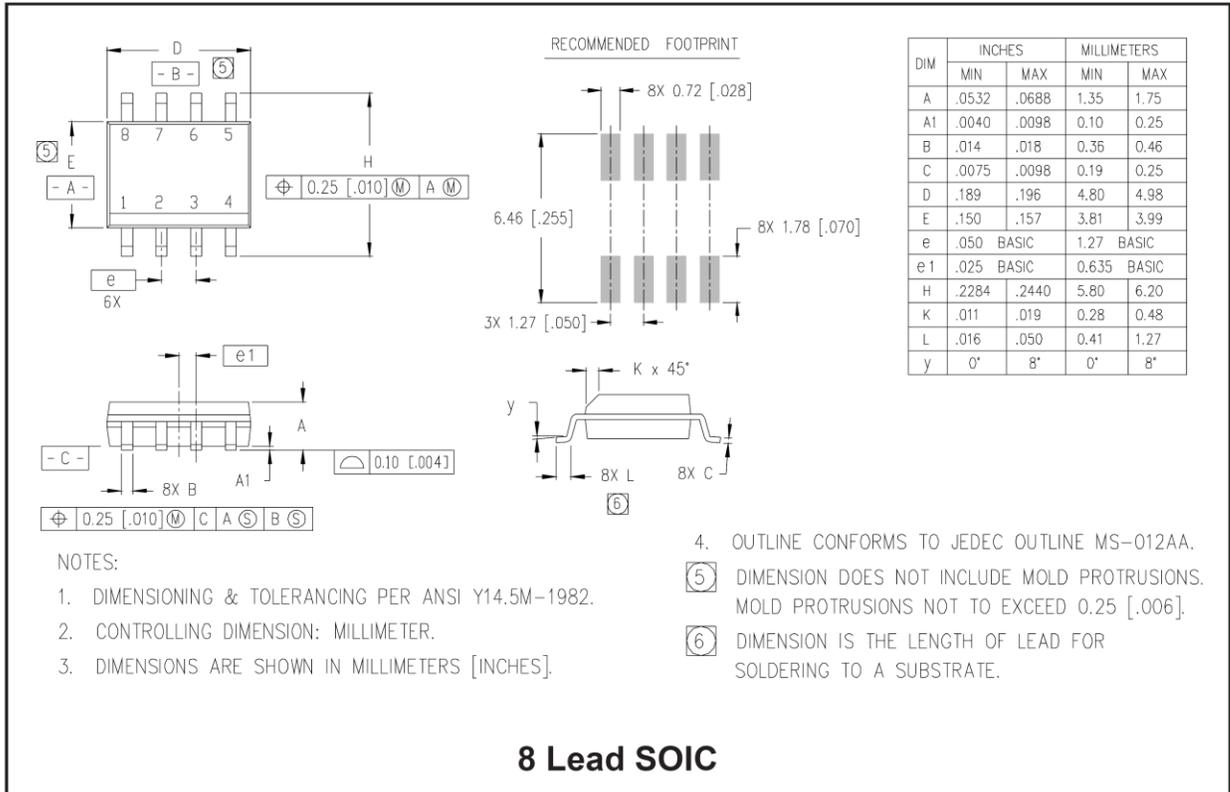


**Figure 27. V<sub>BS</sub> Undervoltage Threshold (+) vs. Temperature**

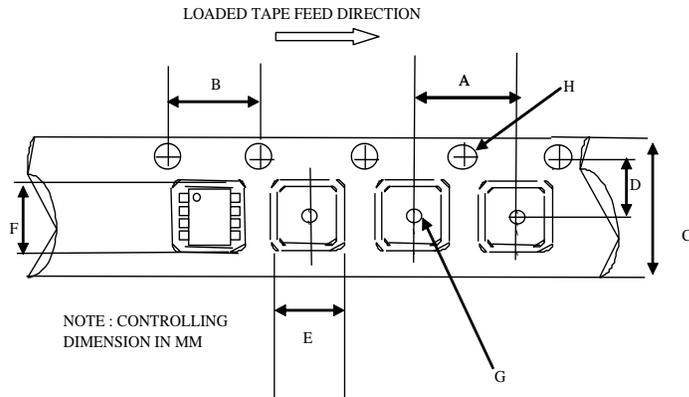


**Figure 28. V<sub>BS</sub> Undervoltage Threshold (-) vs. Temperature**

## Package Details: SOIC8

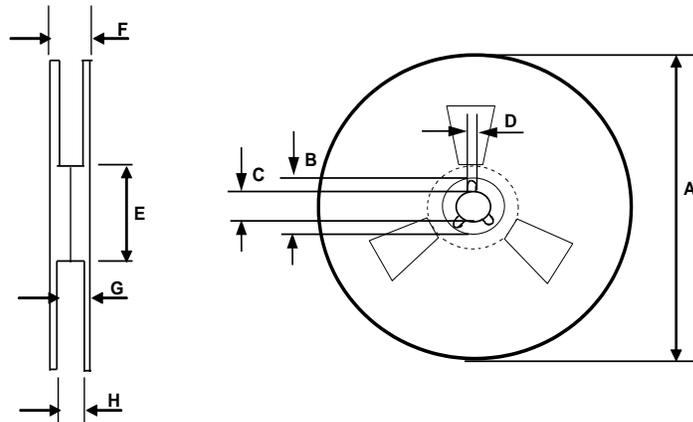


## Tape and Reel Details: SOIC8



CARRIER TAPE DIMENSION FOR 8SOICN

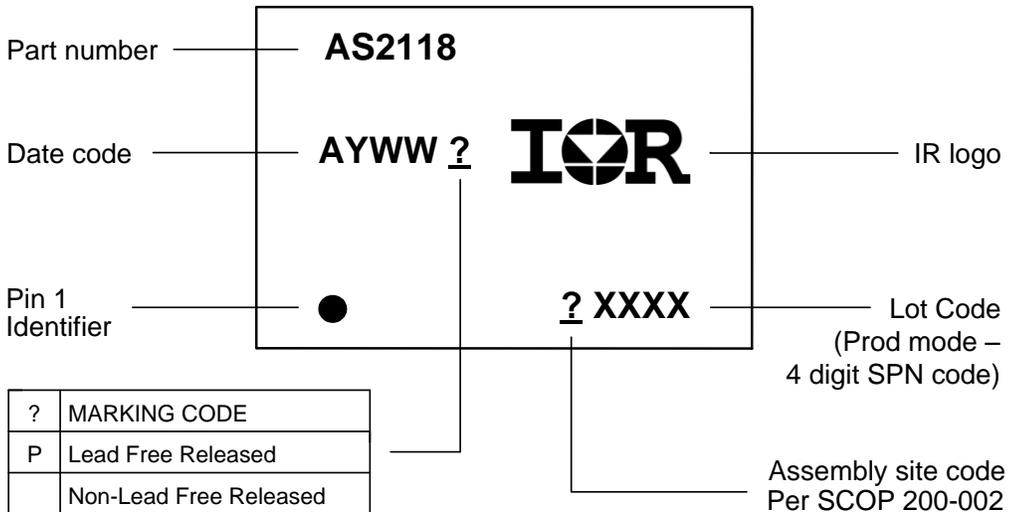
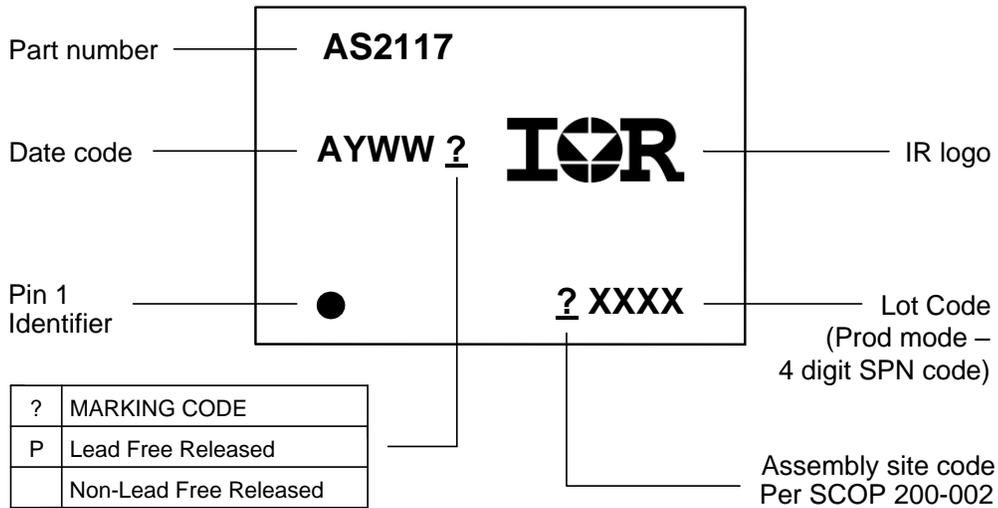
Code	Metric		Imperial	
	Min	Max	Min	Max
A	7.90	8.10	0.311	0.318
B	3.90	4.10	0.153	0.161
C	11.70	12.30	0.46	0.484
D	5.45	5.55	0.214	0.218
E	6.30	6.50	0.248	0.255
F	5.10	5.30	0.200	0.208
G	1.50	n/a	0.059	n/a
H	1.50	1.60	0.059	0.062



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**



**Ordering Information**

Base Part Number	Package Type	Standard Pack		Complete Part Number
		Form	Quantity	
AUIRS2117S	SOIC8	Tube/Bulk	95	AUIRS2117S
		Tape and Reel	2500	AUIRS2117STR
AUIRS2118S	SOIC8	Tube/Bulk	95	AIRS2118S
		Tape and Reel	2500	AUIRS2118STR

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**Revision History**

<b>Date</b>	<b>Comment</b>
MM/DD/YY	Original document
6/17/08	Converted the datasheet to the new format.
9/26/08	Reviewed and added missing graphs, inserted input/output Pin Equivalent Diagrams
02/10/09	Typ application section and other minor changes
08/03/09	Reviewed electrical spec, updated test temperature, qual info, package info I/O equivalent diagram page.
08/11/09	Reviewed electrical spec, updated test temperature and plots, add -VS note.
08/12/09	Updated figure numbers and page number table
8/14/09	Changed Ton/off typ to 150ns; Matched Toff delay to be same as Ton delay
9/23/09	Added ESD passing voltage; still need LU test result.
9/23/09	Added latch up test classification
10/16/09	Updated Voh and Vol graphs; changed Ton/off typ. 150 to 140, max. 200 to 225; Vol 0.1 to 0.2; Tf 35 to 25; IN- 5 to 1
10/27/09	Updated typ application section, Max Vs oper cond changed from 200V to 600V.
11/5/09	Removed parameter vs. voltage graphs.
12/8/09	Added Important Notice disclaimer, updated typ ton/off to 140nS & Max. to 225 nS, removed SOIC8 from P <sub>D</sub> description, updated VOL max to 0.2A, tf typical to 25nS.
2/2/2010	Corrected typical applications on front page from "BLCD" to "BLDC"; updated disclaimer under Abs. Max. Rating.
07/15/2014	Vin low limit corrected from 0.3 to -0.3V in Abs.Max.Ratings; Removed note II from AEC-Q100 (Page 3); Updated World Headquarters address (Page 20)

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