



**THE DATASHEET OF  
AUIRS21271STR**



#### Features

- Floating channel designed for bootstrap operation
- Fully operational to +600 V
- Tolerant to negative transient voltage – dV/dt immune
- Application-specific gate drive range:  
Motor Drive: 12 V to 20 V (AUIRS2127/AUIRS2128)  
Automotive: 9 V to 20 V (AUIRS21271/AUIRS21281)
- Undervoltage lockout
- Desaturation Over Current Protection
- 3.3 V, 5 V, and 15 V input logic compatible
- FAULT lead indicates shutdown has occurred
- Output in phase with input (AUIRS2127/AUIRS21271)
- Output out of phase with input (AUIRS2128/AUIRS21281)
- Lead-free, RoHS compliant
- Automotive qualified\*

#### Typical Applications

- Fork Lift motor drives
- hydraulic pumps
- IGBT drive with Desaturation Detection
- General purpose three phase inverters

#### Product Summary

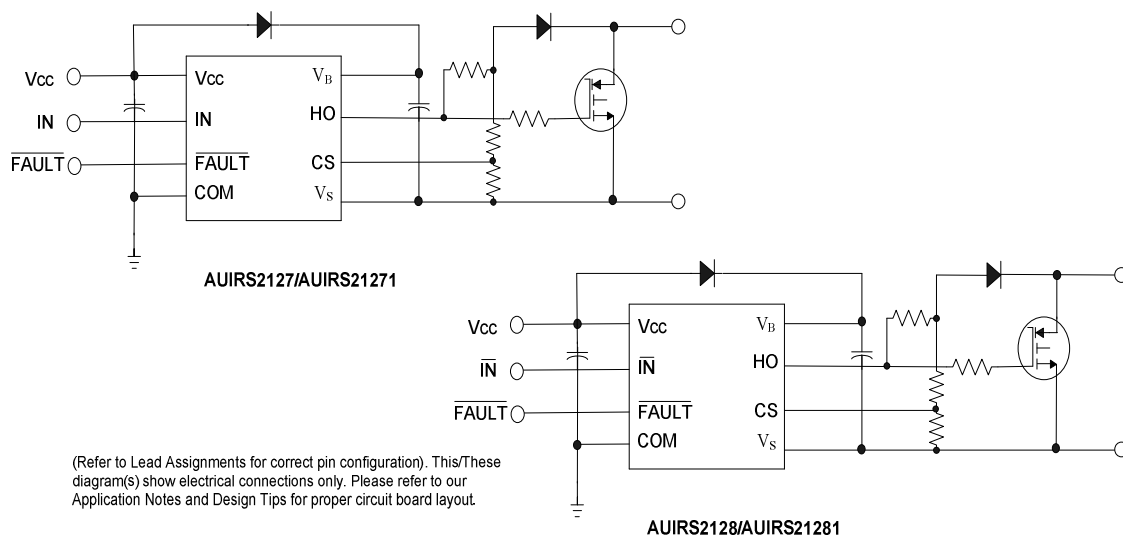
Topology		Single
$V_{\text{OFFSET}}$		$\leq 600 \text{ V}$
$V_{\text{OUT}}$	AUIRS212(7,8)	12 V – 20 V
	AUIRS212(71,81)	8.4 V – 20 V
$I_{\text{O+}} \& I_{\text{O-}}$ (typical)		290 mA & 600 mA
$t_{\text{ON}} \& t_{\text{OFF}}$ (typical)		200 ns & 175 ns

#### Package Options



8-Lead SOIC

#### Typical Connection Diagram



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## Description

The AUIRS2127S/AUIRS2128S/AUIRS21271S/AUIRS21281S 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 or LSTTL outputs, down to 3.3 V. The protection circuitry detects over-current in the driven power transistor and terminates the gate drive voltage. An open drain FAULT signal is provided to indicate that an over-current shutdown has occurred. The output drivers feature a high pulse current buffer stage designed for minimum cross-conduction. 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 <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>		SOIC8	MSL3 <sup>†††</sup> 260°C (per IPC/JEDEC J-STD-020)
<b>ESD</b>	Machine Model	Class M2 (Pass +/-150V) (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 <sup>††††</sup> (per AEC-Q100-004)	
<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.

†††† FAULT pin not stressed.

## Absolute Maximum Ratings

Absolute maximum ratings indicate sustained limits beyond which permanent damage to the device may occur. These are stress ratings only, functional operation of the device at these or any other condition beyond those indicated in the “Recommended Operating Condition” is not implied. Exposure to absolute maximum-rated conditions for extended periods may affect device reliability. All voltage parameters are absolute voltages referenced to COM unless otherwise stated in the table. The thermal resistance and power dissipation ratings are measured under board mounted and still air conditions.

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	$V_{CC} + 0.3$	
$V_{FLT}$	FAULT output voltage	-0.3	$V_{CC} + 0.3$	
$V_{CS}$	Current sense voltage	$V_S - 0.3$	$V_B + 0.3$	
$dV_S/dt$	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	$^\circ\text{C}/\text{W}$
$T_J$	Junction temperature	—	150	$^\circ\text{C}$
$T_S$	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 differentials.

Symbol	Definition	Min.	Max.	Units	
$V_B$	High-side floating supply voltage	(AUIRS2127/AUIRS2128)	$V_S + 12$	$V_S + 20$	V
		(AUIRS21271/AUIRS21281)	$V_S + 9$	$V_S + 20$	
$V_S$	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	$V_{CC}$		
$V_{FLT}$	FAULT output voltage	0	$V_{CC}$		
$V_{CS}$	Current sense voltage	$V_S$	$V_S + 5$		
$T_A$	Ambient temperature	-40	125	$^\circ\text{C}$	

† Logic operational for  $V_S$  of -5 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  $V_{\text{S}}$ .

Symbol	Definition		Min	Typ	Max	Units	Test Conditions
$V_{\text{IH}}$	Logic "1" input voltage	(AUIRS2127/AUIRS21271)	2.5	—	—	V	$V_{\text{CC}} = 10 \text{ V to } 20 \text{ V}$
	Logic "0" input voltage	(AUIRS2128/AUIRS21281)					
$V_{\text{IL}}$	Logic "0" input voltage	(AUIRS2127/AUIRS21271)	—	—	0.8		
	Logic "1" input voltage	(AUIRS2128/AUIRS21281)					
$V_{\text{CSTH+}}$	CS input positive going threshold	(AUIRS2127/AUIRS2128)	180	250	320	mV	
		(AUIRS21271/AUIRS21281)	1.5	1.8	2.1	V	
$V_{\text{OH}}$	High level output voltage, $V_{\text{BIAS}} - V_{\text{O}}$		—	0.05	0.2	V	$I_{\text{O}} = 2 \text{ mA}$
$V_{\text{OL}}$	Low level output voltage, $V_{\text{O}}$		—	0.02	0.1	V	
$I_{\text{LK}}$	Offset supply leakage current		—	—	50	$\mu\text{A}$	$V_{\text{B}} = V_{\text{S}} = 600 \text{ V}$
$I_{\text{QBS}}$	Quiescent $V_{\text{BS}}$ supply current		—	300	925		$V_{\text{IN}} = 0 \text{ V or } 5 \text{ V}$
$I_{\text{QCC}}$	Quiescent $V_{\text{CC}}$ supply current		—	60	130		$V_{\text{IN}} = 5 \text{ V}$
$I_{\text{IN+}}$	Logic "1" input bias current		—	7.0	15		$V_{\text{IN}} = 0 \text{ V}$
$I_{\text{IN-}}$	Logic "0" input bias current		—	—	5.0		$V_{\text{CS}} = 3 \text{ V}$
$I_{\text{CS+}}$	"High" CS bias current		—	—	5.0		$V_{\text{CS}} = 0 \text{ V}$
$I_{\text{CS-}}$	"High" CS bias current		—	—	5.0		
$V_{\text{BSUV+}}$	$V_{\text{BS}}$ supply undervoltage positive going threshold	(AUIRS2127/AUIRS2128)	8.8	10.3	11.8		V
		(AUIRS21271/AUIRS21281)	6.3	7.2	8.2		
$V_{\text{BSUV-}}$	$V_{\text{BS}}$ supply undervoltage negative going threshold	(AUIRS2127/AUIRS2128)	7.5	9.0	10.6		
		(AUIRS21271/AUIRS21281)	6.0	6.8	7.7		
$I_{\text{O+}}$	Output high short circuit pulsed current <sup>(†)</sup>		200	290	—	mA	$V_{\text{O}} = 0 \text{ V}, V_{\text{IN}} = 5 \text{ V}$ $\text{PW} \leq 10 \mu\text{s}$
$I_{\text{O-}}$	Output low short circuit pulsed current <sup>(†)</sup>		420	600	—		$V_{\text{O}} = 15 \text{ V}, V_{\text{IN}} = 0 \text{ V}$ $\text{PW} \leq 10 \mu\text{s}$
$R_{\text{on, FLT}}$	FAULT – low on resistance		—	125	—	$\Omega$	

(†) Guaranteed by design

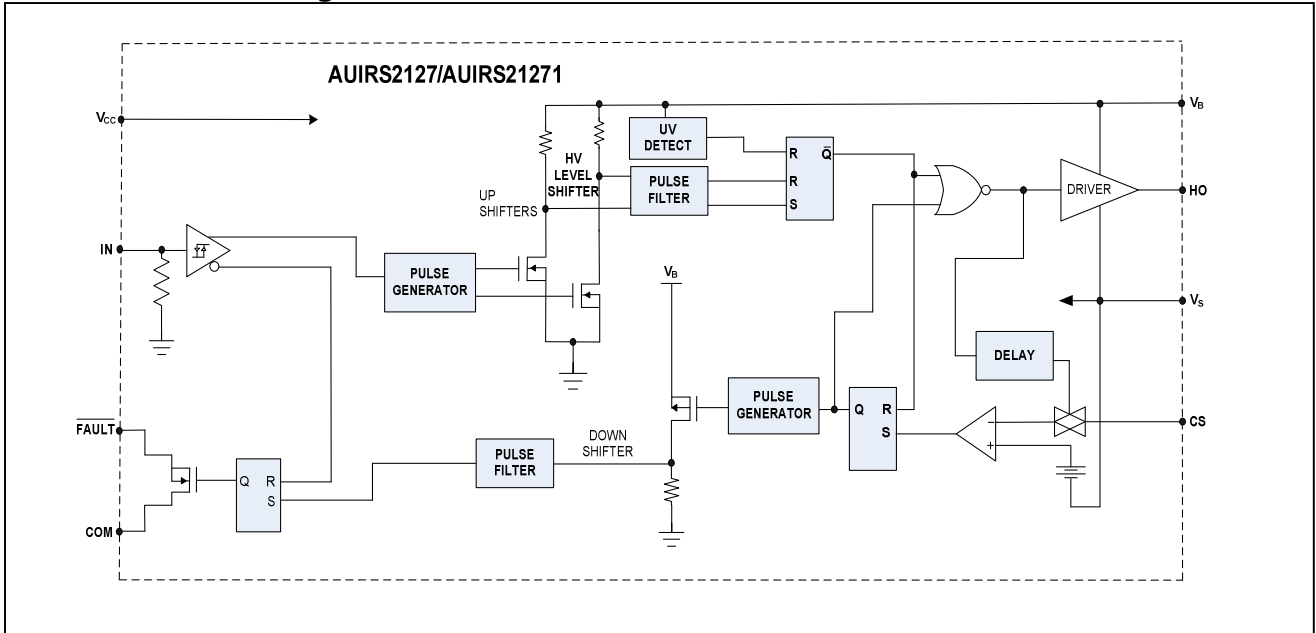
## Dynamic Electrical Characteristic

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  $V_{\text{BIAS}} (V_{\text{CC}}, V_{\text{BS}}) = 15 \text{ V}$ ,  $C_{\text{L}} = 1000 \text{ pF}$ .

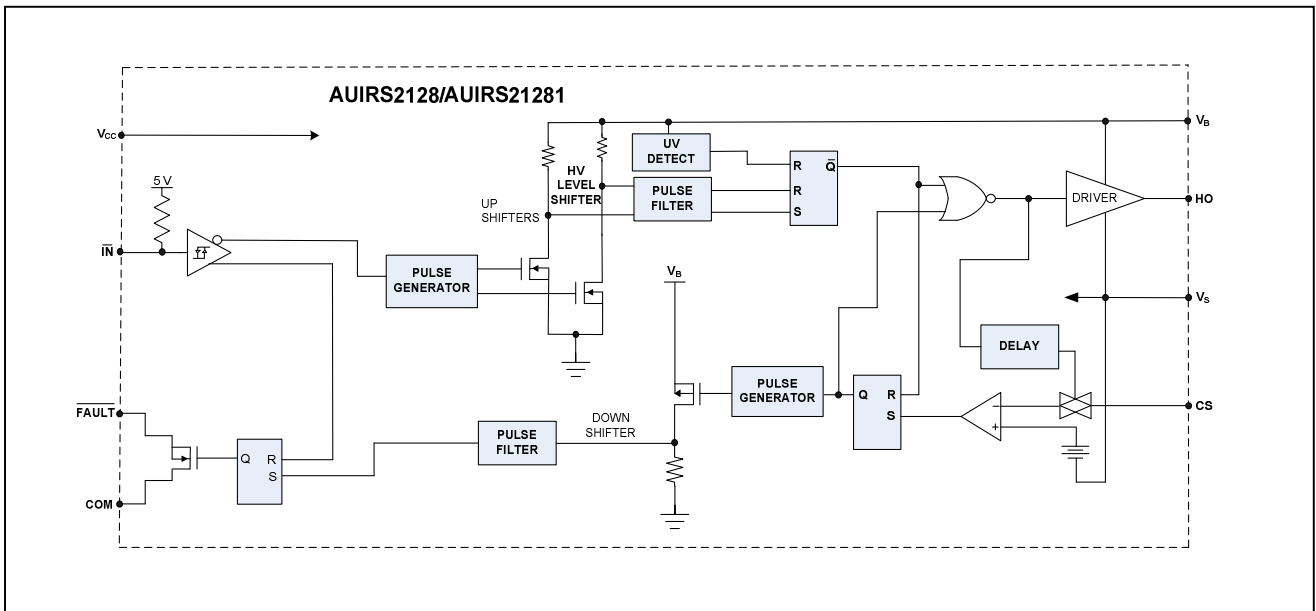
Symbol	Definition	Min	Typ	Max	Units	Test Conditions
$t_{\text{on}}$	Turn-on propagation delay	—	200	275	ns	$V_{\text{S}} = 0 \text{ V}$
$t_{\text{off}}$	Turn-off propagation delay	—	175	275		$V_{\text{S}} = 600 \text{ V}$
$t_{\text{r}}$	Turn-on rise time	—	80	130		
$t_{\text{f}}$	Turn-off fall time	—	40	65		
$t_{\text{bl}}$	Start-up blanking time	475	750	985		
$t_{\text{CS}}$	CS shutdown propagation delay	—	65	360		
$t_{\text{fit}}$	CS to FAULT pull-up propagation delay	—	270	510		

Note: Please refer to figures in Parameter Temperature Trends section

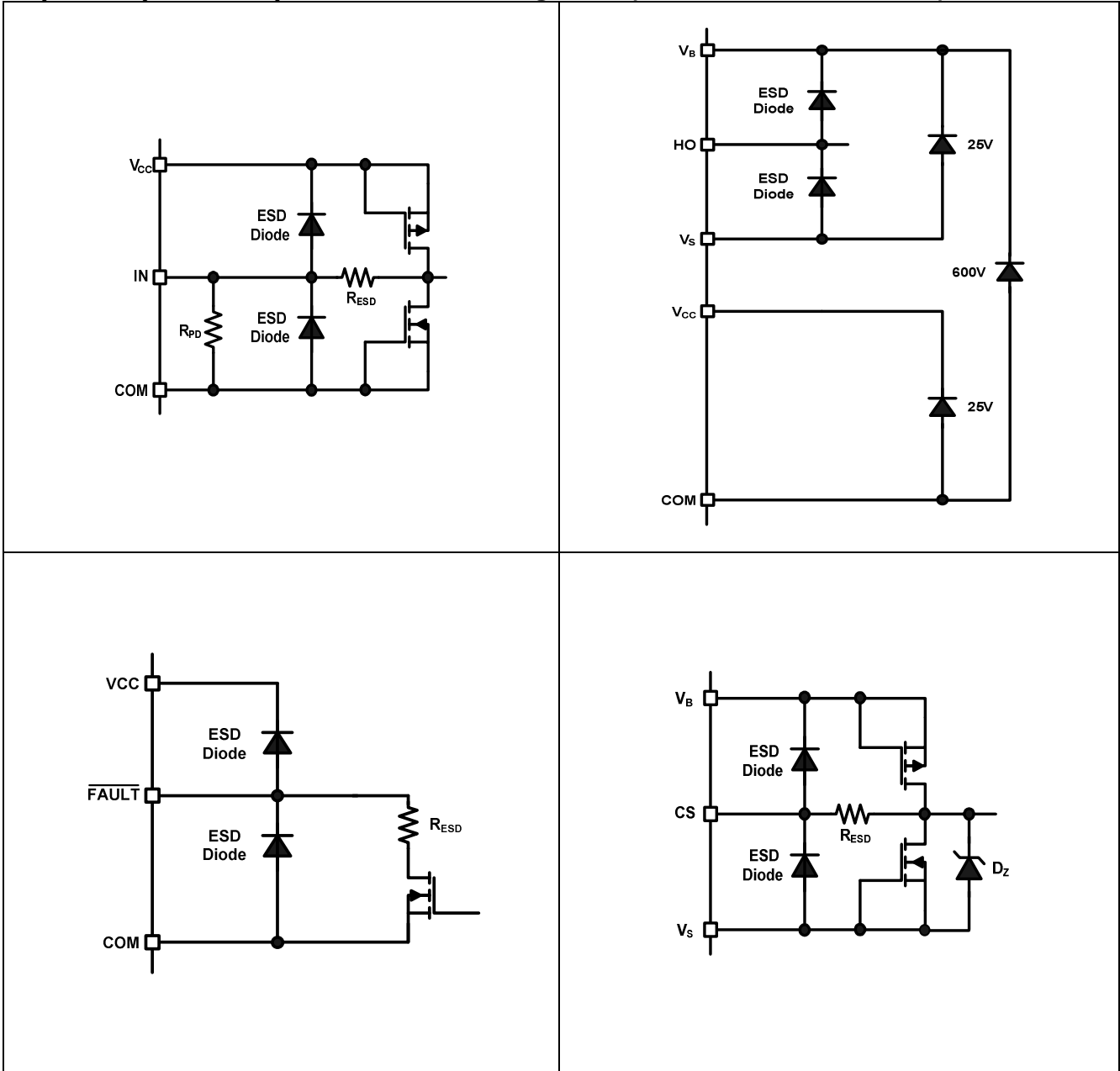
**Functional Block Diagram: AUIRS2127/AUIRS21271**



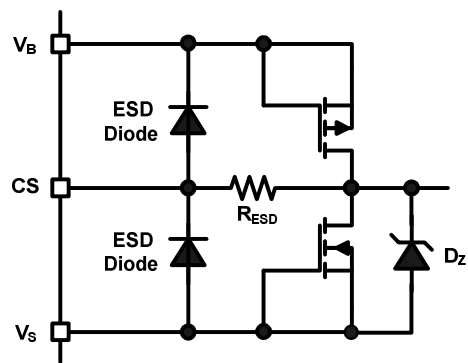
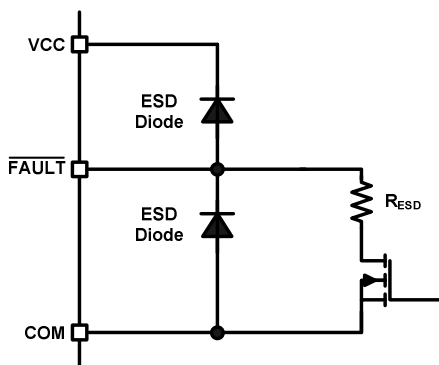
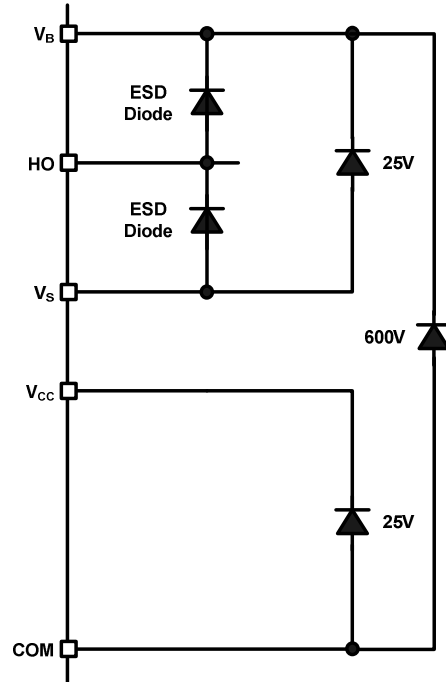
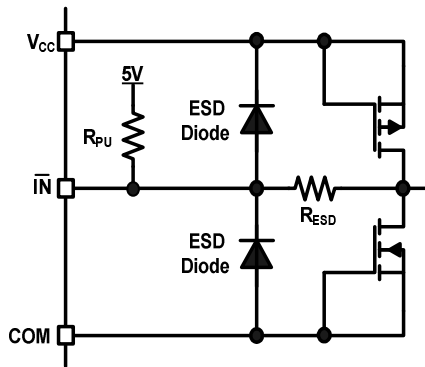
**Functional Block Diagram: AUIRS2128/AUIRS21281**



**Input/Output Pin Equivalent Circuit Diagrams: (AUIRS2127/AUIRS21271)**



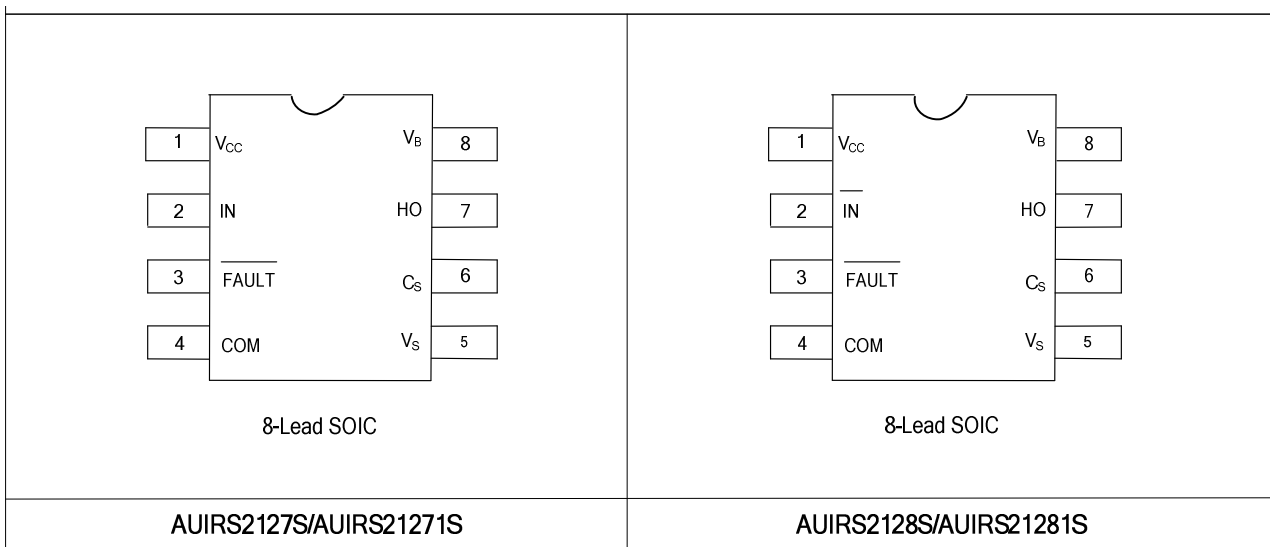
**Input/Output Pin Equivalent Circuit Diagrams: (AUIRS2128/AUIRS21281)**



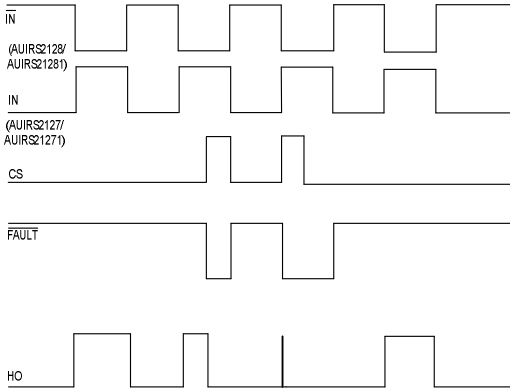
## Lead Definitions

PIN	Symbol	Description
1	$V_{CC}$	Low-side and gate drive supply
2	$\overline{IN}$ IN	Logic input for gate driver output (HO), in phase with HO (AUIRS2127/AUIRS21271) Logic input for gate driver output (HO), out of phase with HO (AUIRS2128/AUIRS21281)
3	$\overline{FAULT}$	Indicates over-current shutdown has occurred, negative logic
4	COM	Logic ground
5	$V_S$	High-side floating supply return
6	$C_S$	Current sense input to current sense comparator
7	HO	High-side gate drive output
8	$V_B$	High-side floating supply

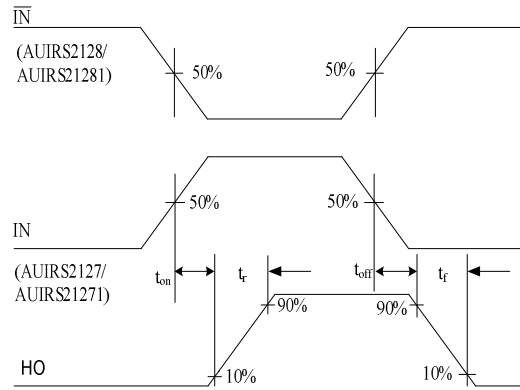
## Lead Assignments



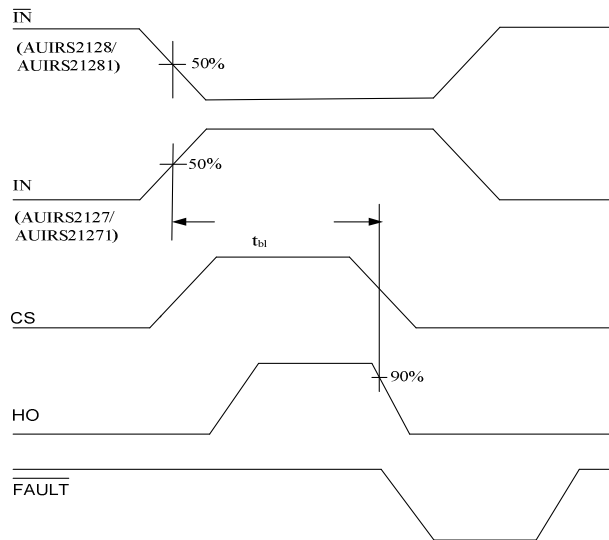
**Application Information and Additional Details**



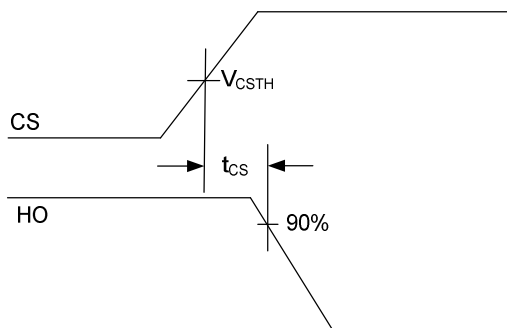
**Figure 1: Input/Output Timing Diagram**



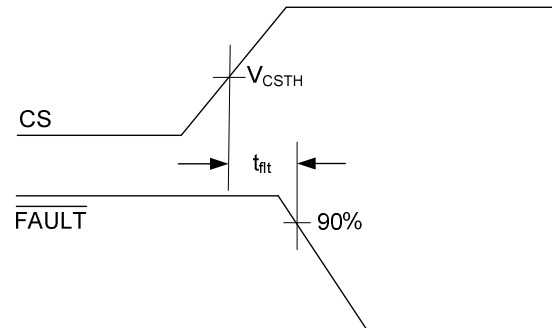
**Figure 2: Switching Time Waveform Definition**



**Figure 3: Start-Up Blanking Time Waveform Definitions**



**Figure 4: CS Shutdown Waveform Definitions**



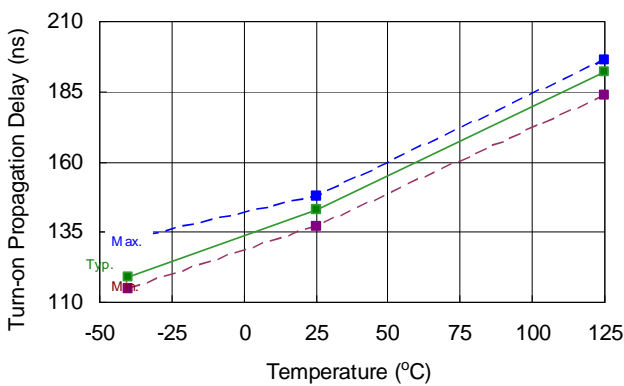
**Figure 5: CS to FAULT Waveform Definitions**

**Parameter Temperature Trends**

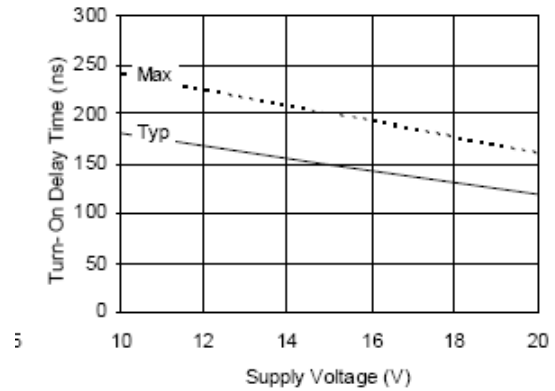
Figures 6-33 provide information on the experimental performance of the AUIRS212(7, 71, 8, 81)S HVIC. The line plotted in each figure is generated from actual lab data.

A large number of individual samples were tested at three temperatures (-40 °C, 25 °C, and 125 °C) in order to generate the experimental curves. 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 curve were determined by calculating the averaged experimental value of the parameter (for a given temperature).

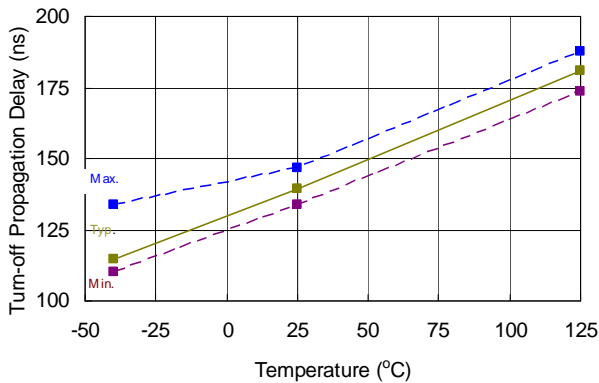
A different set of individual samples was used to generate curves of parameter trends vs. supply voltage.



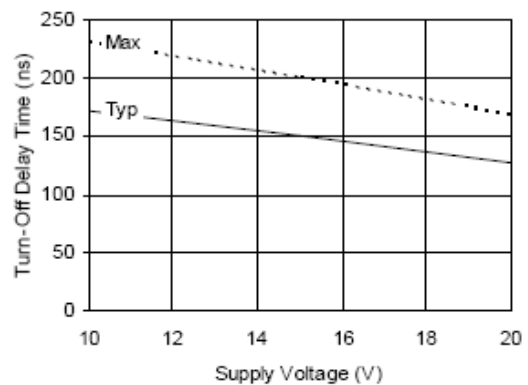
**Figure 6A. Turn-On Propagation Delay vs. Temperature**



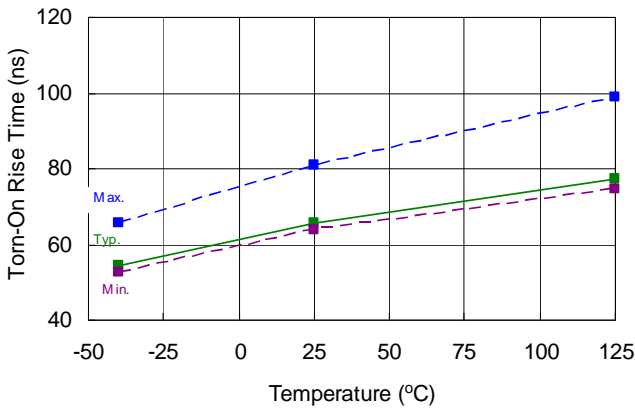
**Figure 6B. Turn-On Propagation Delay vs. Supply Voltage**



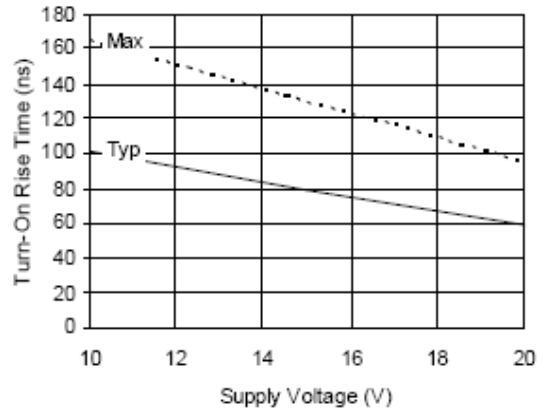
**Figure 7A. Turn-Off Propagation Delay vs. Temperature**



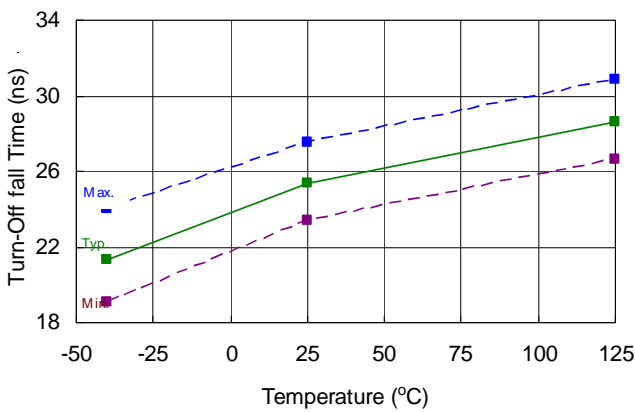
**Figure 7B. Turn-Off Propagation Delay vs. Supply Voltage**



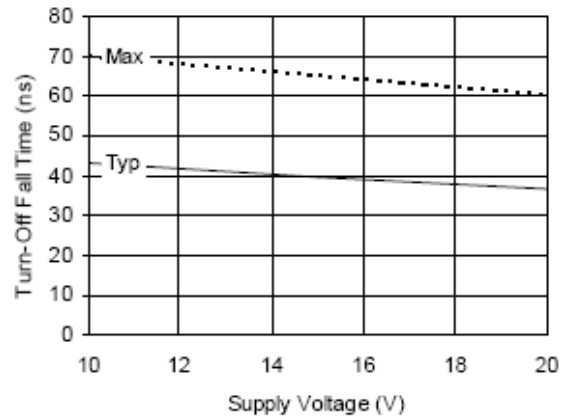
**Figure 8A. Turn-On rise time vs. Temperature**



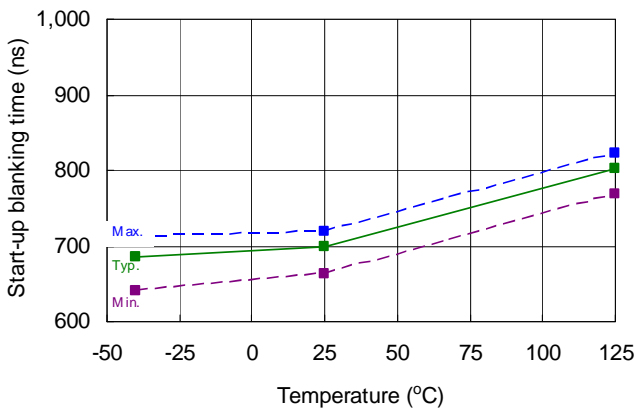
**Figure 8B. Turn-On rise time vs. Voltage**



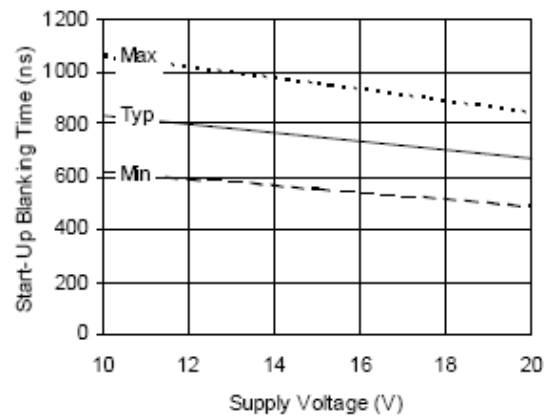
**Figure 9A. Turn-Off fall time vs. Temperature**



**Figure 9B. Turn-Off fall time vs. Voltage**



**Figure 10A. Star-up blanking time vs. Temperature**



**Figure 10B. Start-up blanking time vs. Voltage**

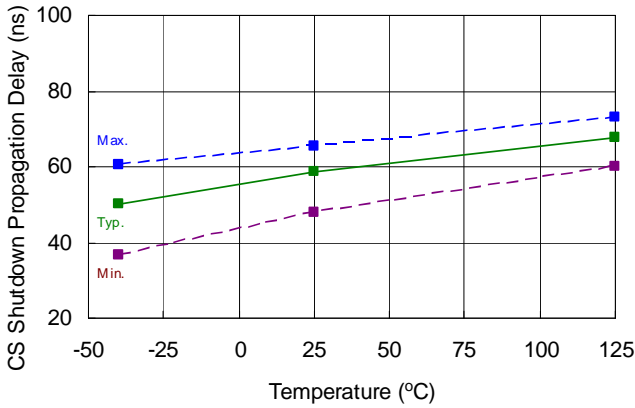


Figure 11A. CS Shutdown Prop. delay vs. Temperature

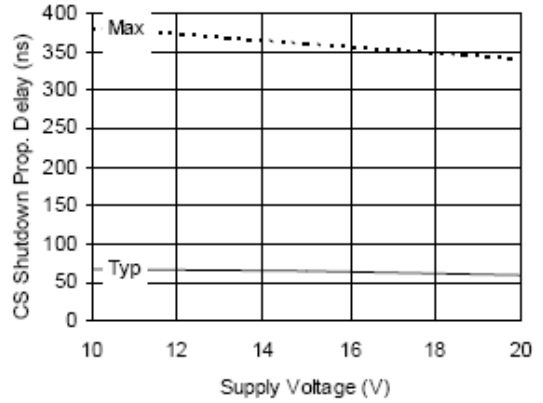


Figure 11B. CS Shutdown Prop. delay vs. Voltage

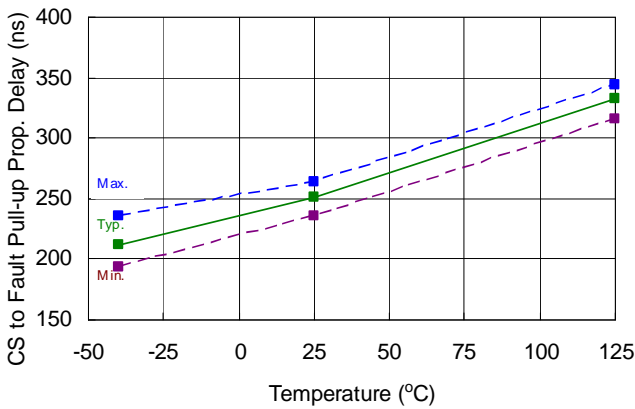


Figure 12A. CS to Fault pull-up Prop. delay vs. Temperature

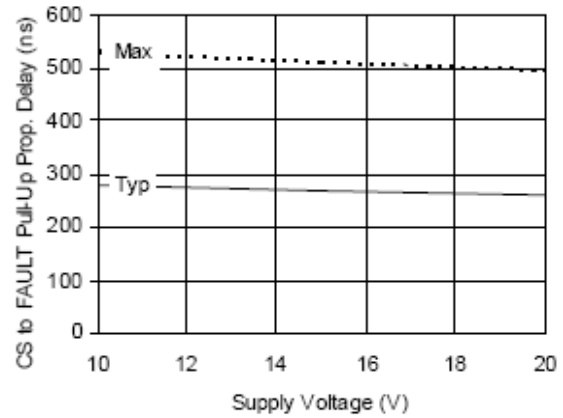


Figure 12B. CS to Fault Prop. delay vs. Voltage

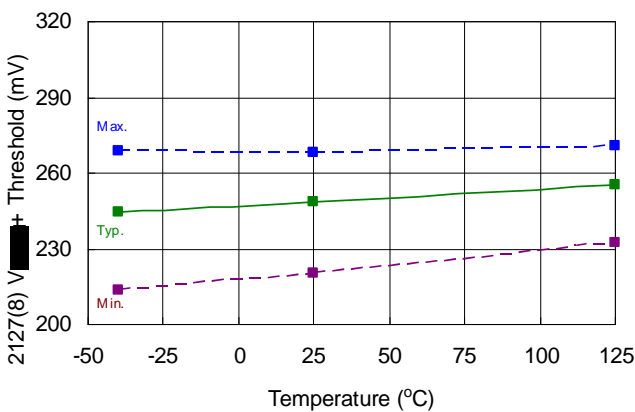


Figure 13A. 2127(8)  $V_{CSTH+}$  threshold voltage vs. Temperature

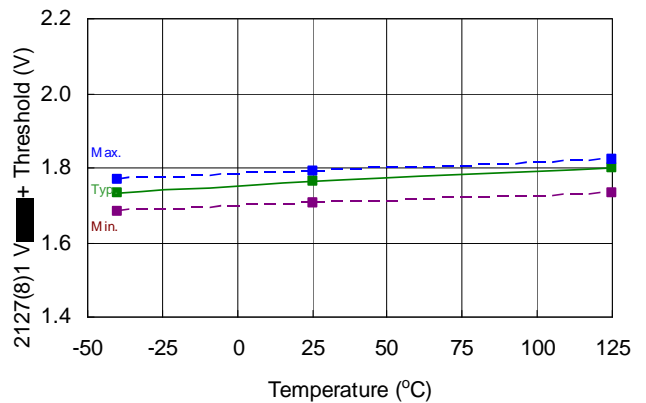


Figure 13B. 2127(8)1  $V_{CSTH+}$  threshold voltage vs. Temperature

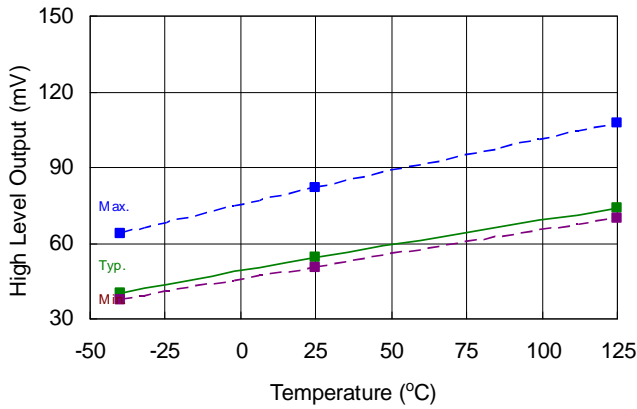


Figure 14A. High level output (I<sub>o</sub> = 2mA) vs. Temperature

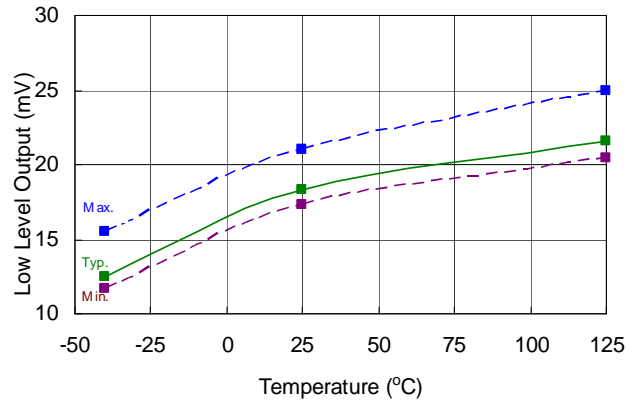


Figure 14B. Low level output (I<sub>o</sub> = 2mA) vs. Temperature

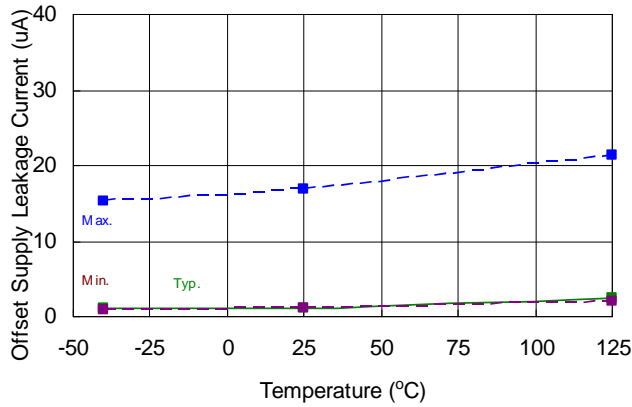


Figure 15A. Offset supply leakage current vs. Temperature

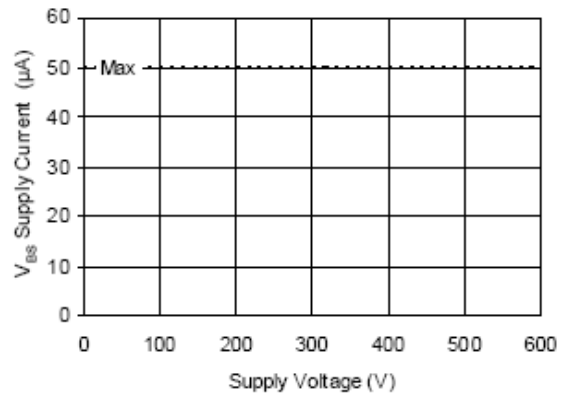


Figure 15B. High-side floating well offset supply leakage current vs. Voltage

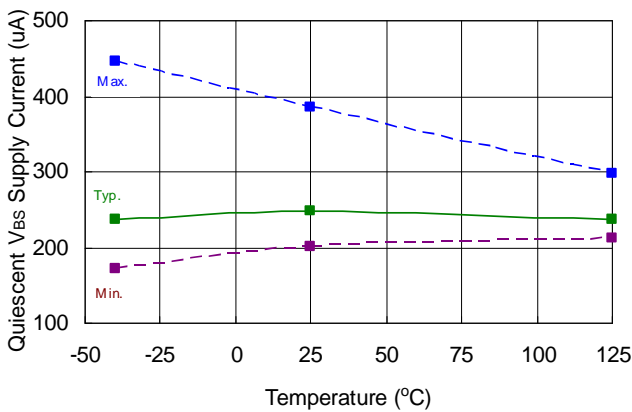


Figure 16A. V<sub>BS</sub> supply current vs. Temperature

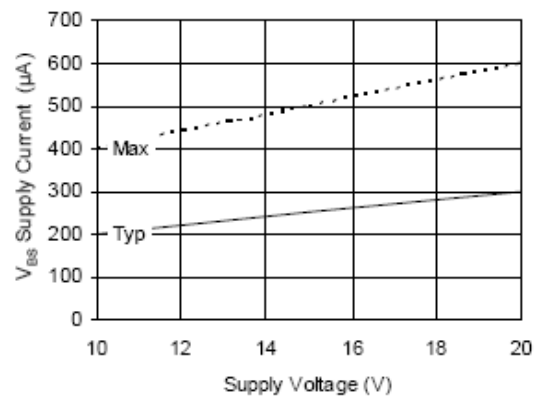
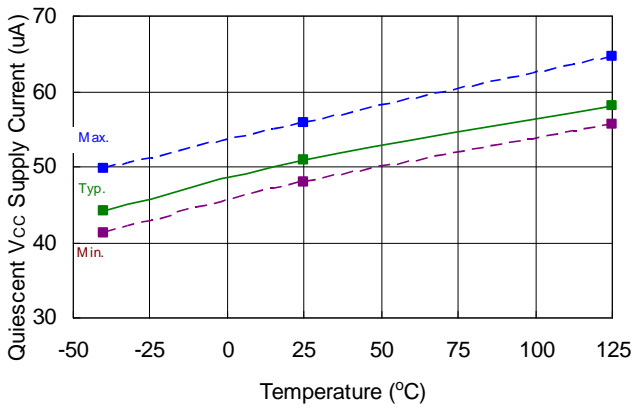
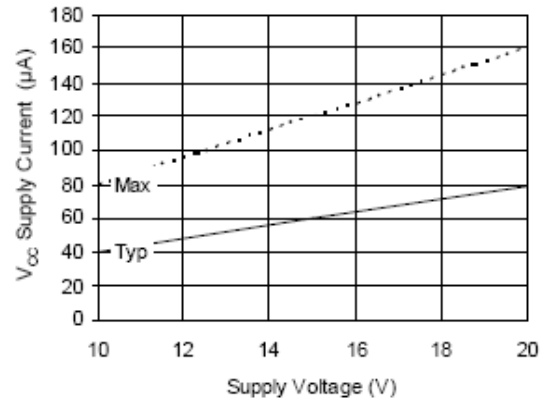


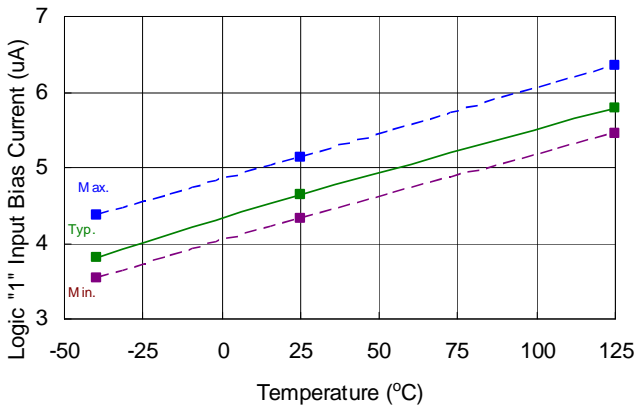
Figure 16B. V<sub>BS</sub> supply current vs. Voltage



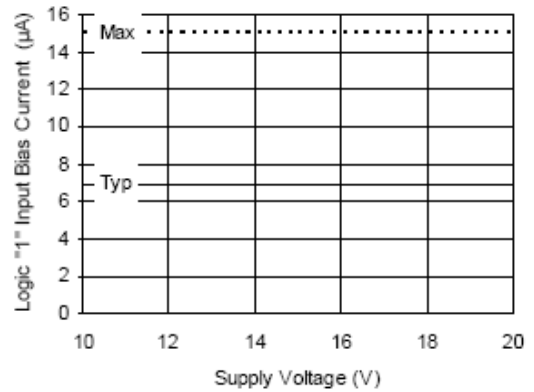
**Figure 17A. V<sub>CC</sub> supply current vs. Temperature**



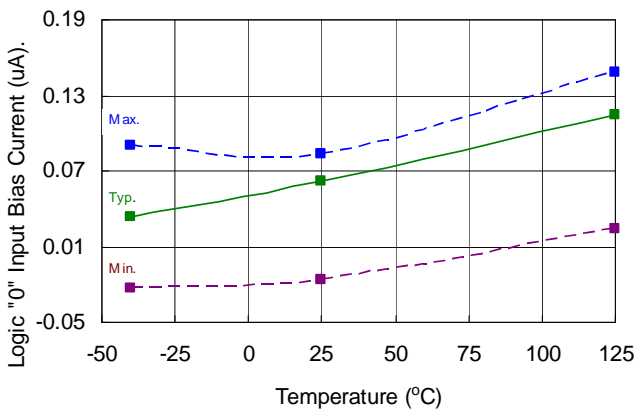
**Figure 17B. V<sub>CC</sub> supply current vs. Voltage**



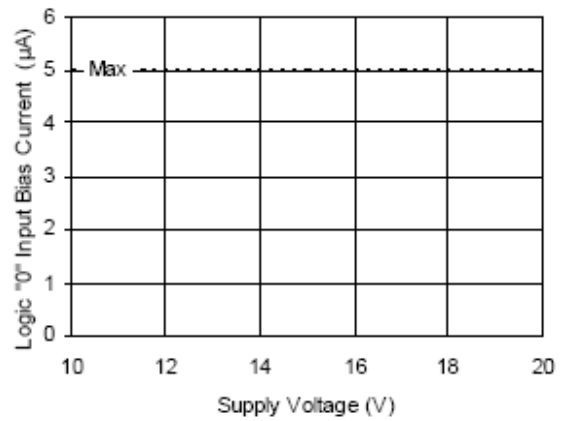
**Figure 18A. Logic "1" input bias current vs. Temperature**



**Figure 18B. Logic "1" input bias current vs. Voltage**



**Figure 19A. Logic "0" input bias current vs. Temperature**



**Figure 19B. Logic "0" input bias current vs. Voltage**

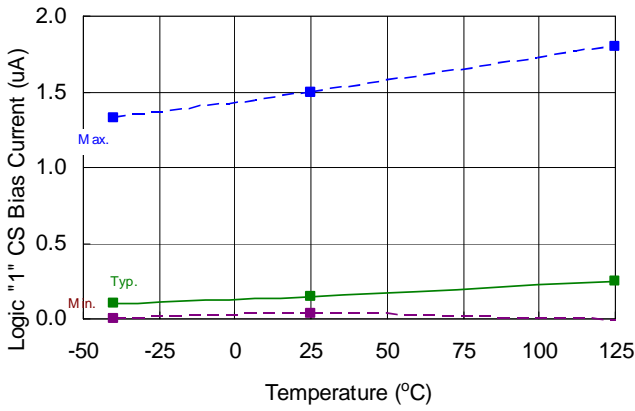


Figure 20A. Logic "1" CS bias current vs. Temperature

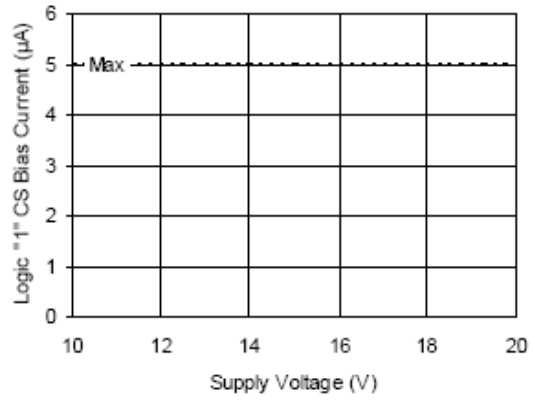


Figure 20B. Logic "1" CS bias current vs. Voltage

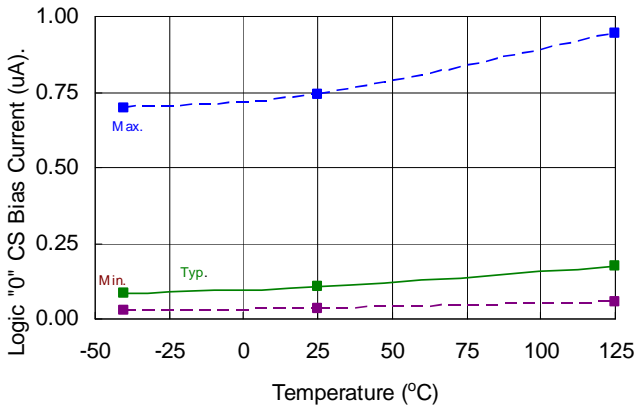


Figure 21A. Logic "0" CS bias current vs. Temperature

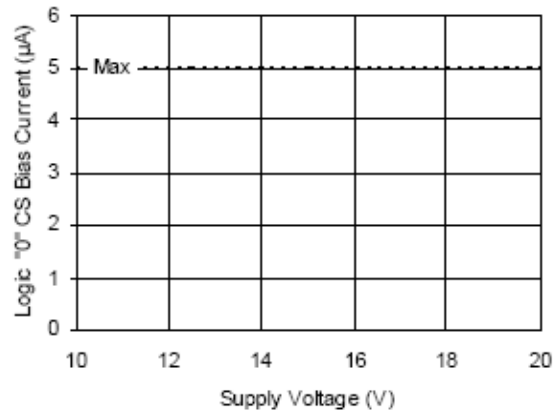


Figure 21B. Logic "0" CS bias current vs. Voltage

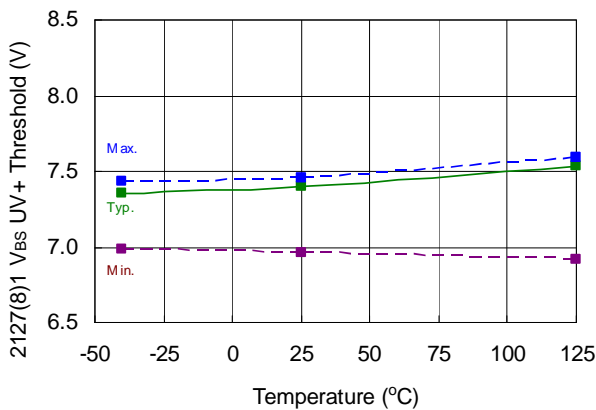


Figure 22A. 2127(8)1 V<sub>BS</sub> UV threshold + vs. Temperature

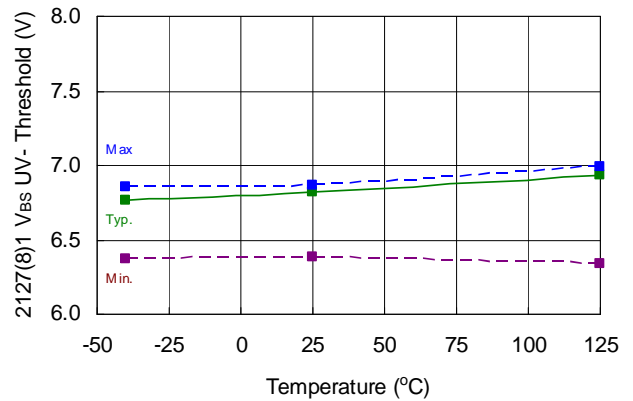


Figure 22B. 2127(8)1 V<sub>BS</sub> UV threshold - vs. Temperature

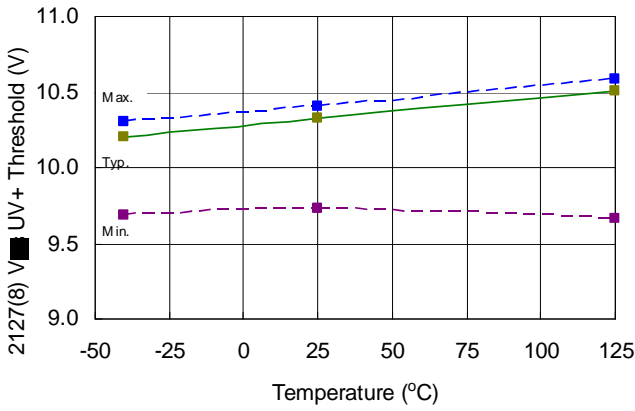


Figure 23A. 2127(8) V<sub>BS</sub> UV threshold + vs. Temperature

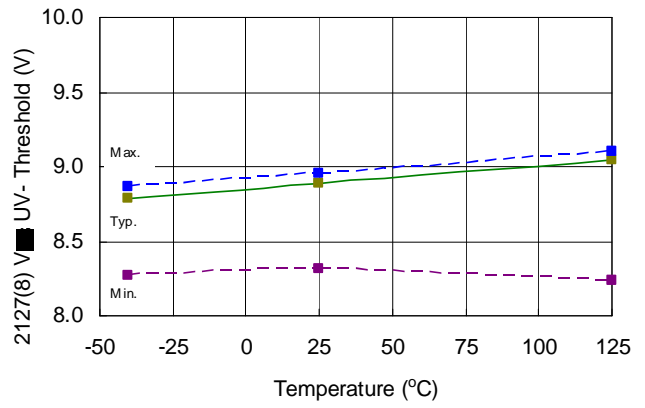


Figure 23B. 2127(8) V<sub>BS</sub> UV threshold - vs. Temperature

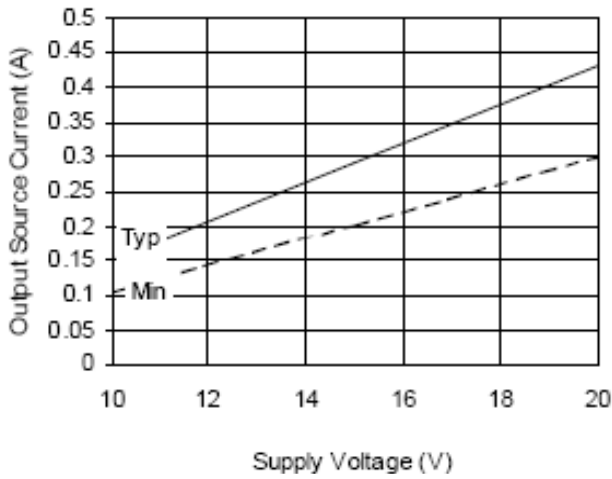


Figure 24. Output source current vs. Voltage

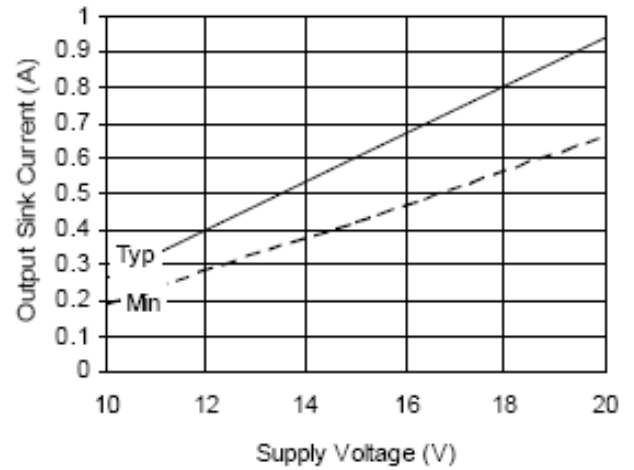
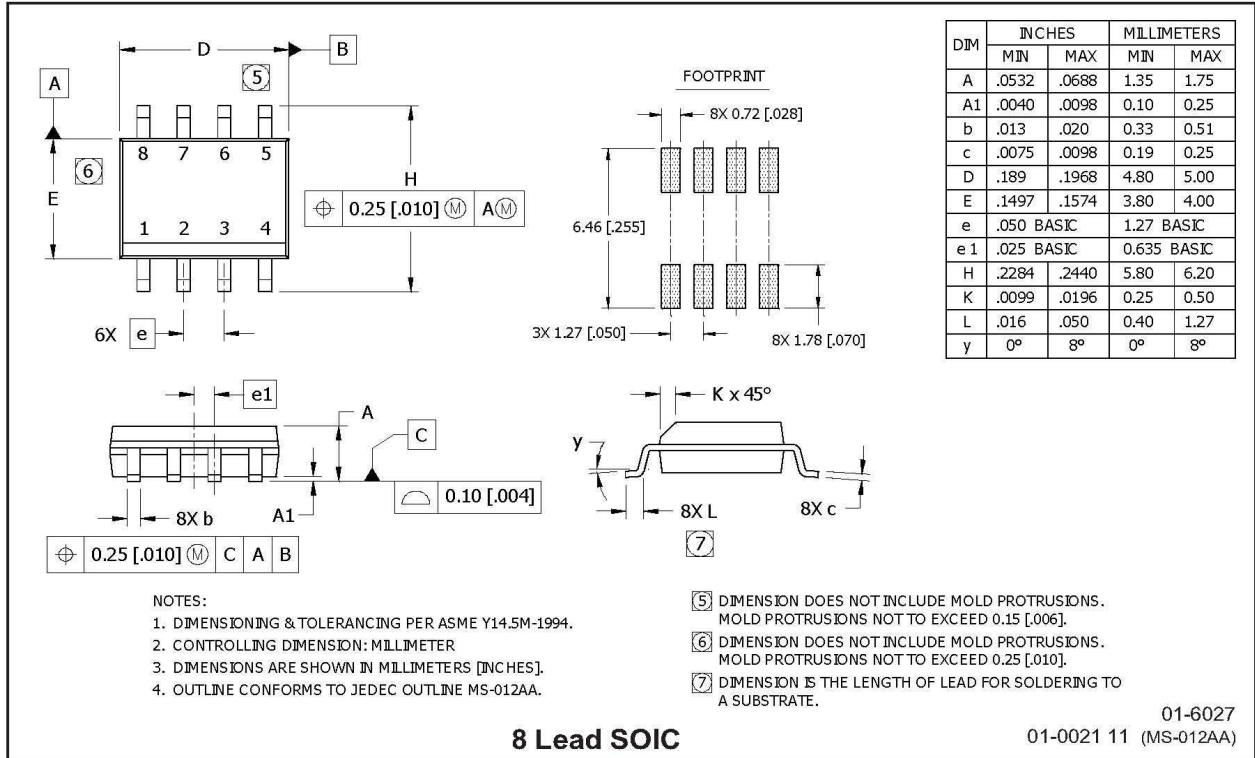
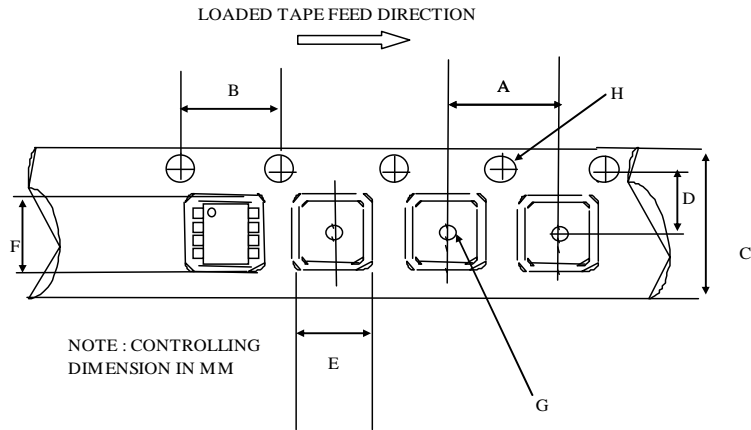


Figure 25. Output sink current vs. Voltage

## Package Details: SOIC8

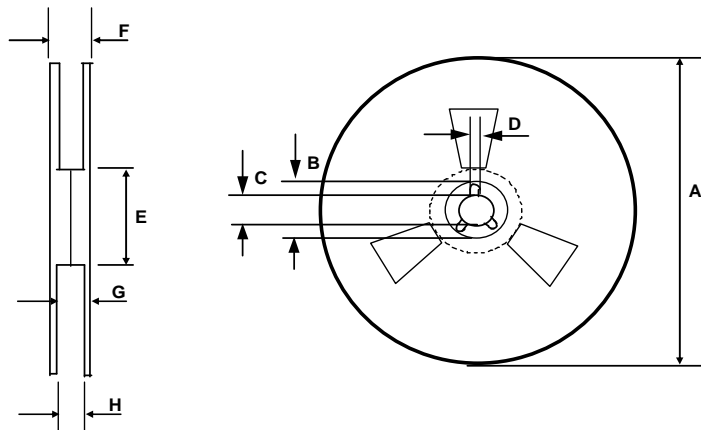


**Tape and Reel Details: SOIC8**



**CARRIER TAPE DIMENSION FOR 8SOICN**

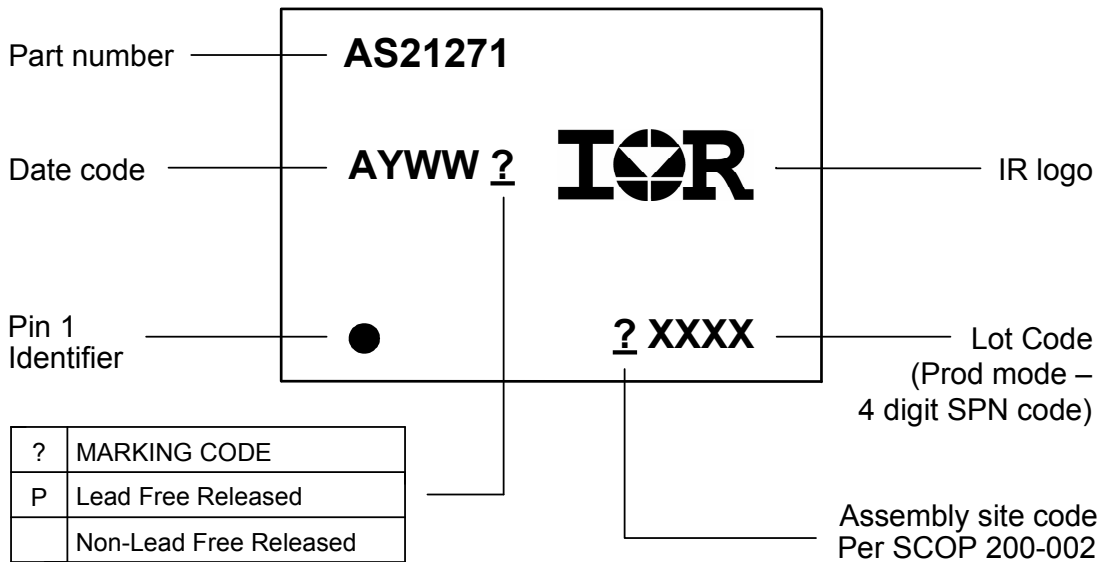
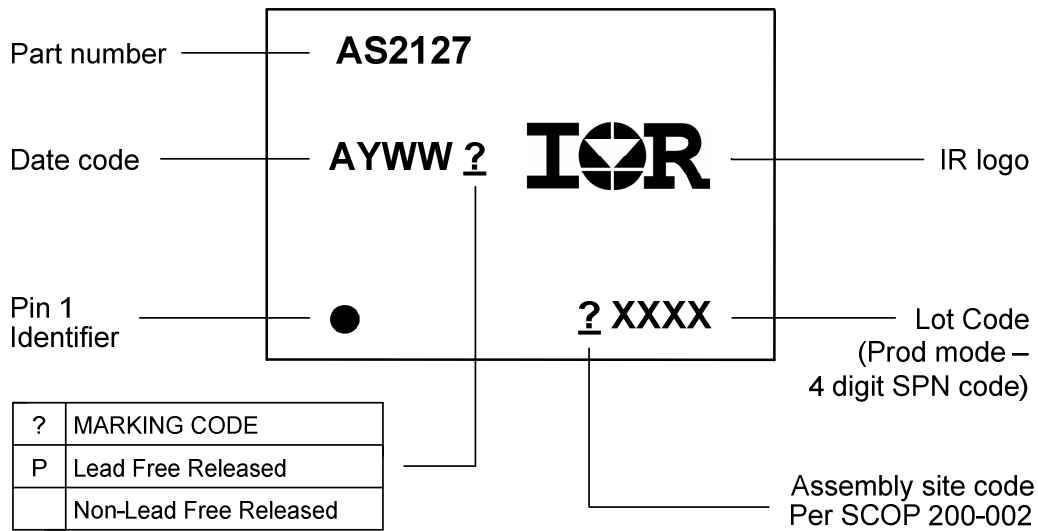
Code	Metric		Imperial	
	Min	Max	Min	Max
A	7.90	8.10	0.311	0.318
B	3.90	4.10	0.153	0.161
C	11.70	12.30	0.46	0.484
D	5.45	5.55	0.214	0.218
E	6.30	6.50	0.248	0.255
F	5.10	5.30	0.200	0.208
G	1.50	n/a	0.059	n/a
H	1.50	1.60	0.059	0.062

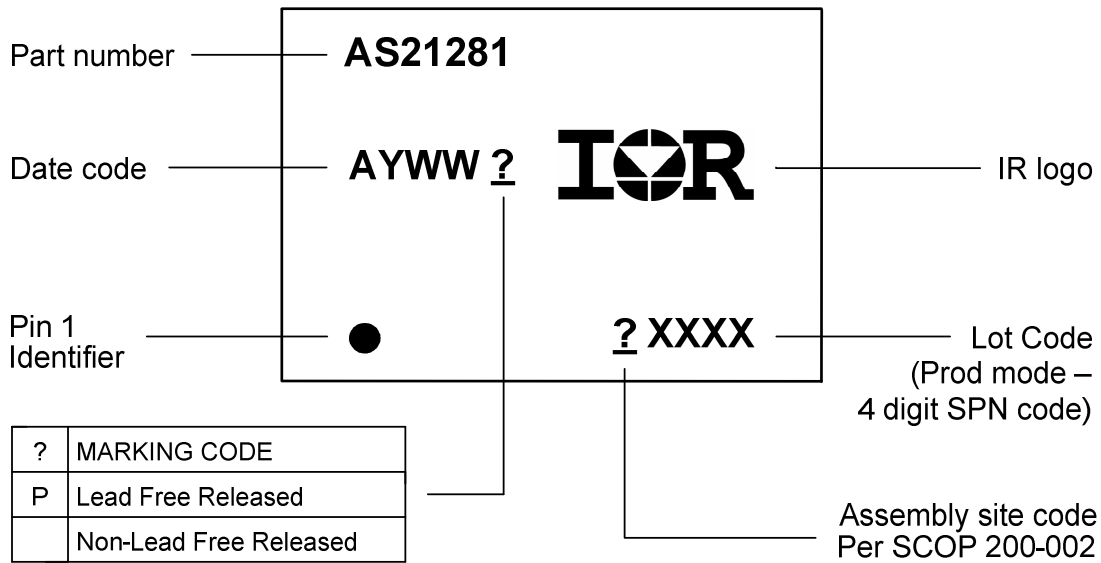
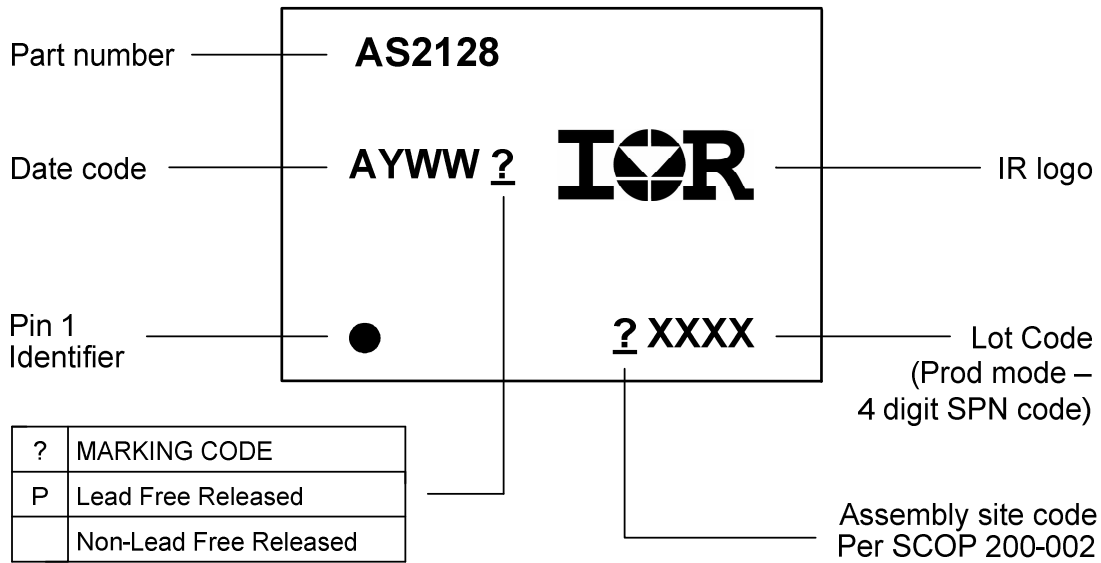


**REEL DIMENSIONS FOR 8SOICN**

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	
AUIRS2127S	SOIC8	Tube/Bulk	95	AUIRS2127S
		Tape and Reel	2500	AUIRS21271STR
AUIRS21271S	SOIC8	Tube/Bulk	95	AUIRS21271S
		Tape and Reel	2500	AUIRS21271STR
AUIRS2128S	SOIC8	Tube/Bulk	95	AUIRS2128S
		Tape and Reel	2500	AUIRS2128STR
AUIRS21281S	SOIC8	Tube/Bulk	95	AUIRS21281S
		Tape and Reel	2500	AUIRS21281STR

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