

# Si8931/32 Data Sheet

# Isolated Amplifier for Voltage Measurement

The Si8931/32 is a galvanically isolated analog amplifier optimized for voltage sensing. Its 2.5 V input range is ideal for isolated voltage sensing applications. The output is a differential analog signal (Si8931) or single-ended signal (Si8932) that is proportional to the input voltage.

The Si8931/32 provides excellent linearity with low offset and gain drift to ensure that accuracy is maintained over the entire operating temperature range. Exceptionally high common-mode transient immunity means that the Si8931/32 delivers accurate measurements even in the presence of high-power switching as is found in motor drive systems and inverters.

The Si8931/32 isolated voltage sensing amplifier utilizes Skyworks' proprietary isolation technology. It supports up to 5.0 kVrms withstand voltage per UL1577. This technology enables higher performance, reduced variation with temperature and age, tighter part-to-part matching, and longer lifetimes compared to other isolation technologies.

# Applications:

- · Industrial, HEV and renewable energy inverters
- · AC, Brushless, and DC motor controls and drives
- · Variable speed motor control in consumer white goods
- · Isolated switch mode and UPS power supplies
- · General industrial data acquisition and sensor interface
- · Automotive onboard chargers, battery management systems, and charging stations

# Safety Approvals:

- UL 1577 recognized
- Up to 5000 Vrms for 1 minute
- · CSA approval
  - · IEC 62368-1 (reinforced insulation)
- · VDE certification conformity
  - EN62368-1 (reinforced insulation)
  - Pending IEC60747-17 (basic/reinforced insulation)
- · CQC certification approval
  - GB4943.1-2011

#### Si8931 Si8932 VDDA **VDDB** VDDA VDDB **CMOS** Isolation Isolation OSC OSC VIN VIN AO AOP PWM PWM PWM PWM CMOS GNDB NC NC AON Transmitter Transmitter Receiver Receiver GNDA GNDB GNDA GNDB

#### KEY FEATURES

- 0 to 2.5 V nominal input voltage
- Low signal delay: 1 µs
- Typical input offset: 0.16 mV
- Typical gain error: ±0.06%
- Excellent drift specifications
   0.75 μV/°C offset drift
  - 6 ppm/°C typical gain drift
- Typical nonlinearity: 0.01%
- Typical SNR: 76 dB
- High common-mode transient immunity: 75 kV/µs
- Auomotive-grade OPNs
   AIAG-compliant PPAP documentation support
- IMDS and CAMDS listing support
- Compact packages
  - · 8-pin wide body stretched SOIC

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- · 8-pin narrow body SOIC
- -40 to 125 °C

# 1. Ordering Guide

Ordering Part Automotive		Ordering Options					
Number <sup>1, 2, 3</sup>	Ordering Part Number <sup>1, 2, 3, 4</sup>	Input Range	Isolation Rating	Output	Package Type		
Si8931D-IS4	Si8931D-AS4	0 to 2.5 V nominal	5.0 kVrms	Differential	WB Stretched SOIC-8		
Si8931B-IS	Si8931B-AS	0 to 2.5 V nominal	2.5 kVrms	Differential	NB SOIC-8		
Si8932D-IS4	Si8932D-AS4	0 to 2.5 V nominal	5.0 kVrms	Single-ended	WB Stretched SOIC-8		
Si8932B-IS	Si8932B-AS	0 to 2.5 V nominal	2.5 kVrms	Single-ended	NB SOIC-8		

Note:

1. All packages are RoHS-compliant.

2. "Si" and "SI" are used interchangeably.

3. AEC-Q100 pending qualification.

4. Automotive-Grade devices ("-A" suffix) are identical in construction materials, topside marking, and electrical parameters to their Industrial Grade ("-I suffix") version counterparts. Automotive-Grade products are produced utilizing full automotive process flows and additional statistical process controls throughout the manufacturing flow. The Automotive-Grade part number is included on shipping labels.

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Si8931/32 Data Sheet • System Overview

# 2. System Overview

The input to the Si8931/32 is designed for 0 to 2.5 V nominal input.

The Si8931/32 modulates the analog signal in a unique way for transmission across the semiconductor based isolation barrier. The input signal is first converted to a pulse-width modulated digital signal. On the other side of the isolation barrier, the signal is demodulated to faithfully reproduce the analog signal. This solution provides exceptional signal bandwidth and accuracy. The Si8931 provides a differential voltage output while the Si8932 provides a single-ended voltage output.

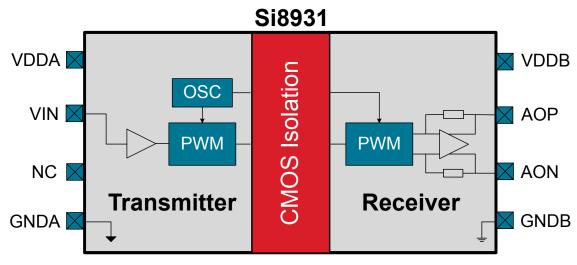


Figure 2.1. Si8931 Functional Block Diagram

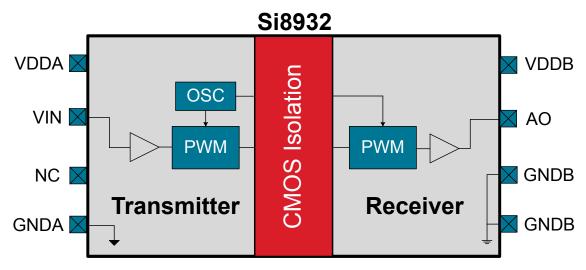


Figure 2.2. Si8932 Functional Block Diagram

# 2.1 Fail-Safe and Low-Power Modes

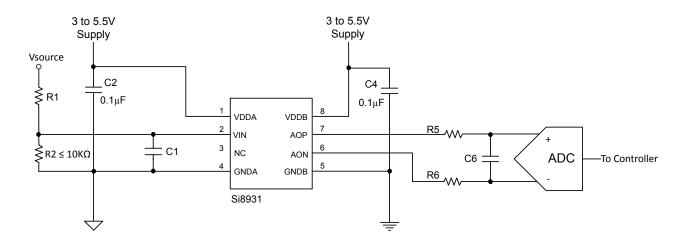
The Si8931/32 implements a fail-safe output when the high-side supply voltage VDDA goes away. This is important for safe operation in systems with high safety requirements. The fail-safe output is nominally 2.8 V (Si8932) or -2.8 V (Si8931) which can be differentiated from the maximum clipping output voltage of 2.6 V to simplify diagnostics on the system level.

Device	Output Voltage (VDDA Normal)	Output Voltage (VDDA Removed)
Si8931	~ ±2.6 V	~ –2.8 V
Si8932	0 to ~2.6 V	~ +2.8 V

In addition to the fail-safe output, when a loss of VDDA supply occurs, the part will automatically move into a lower power mode that reduces IDDB current to approximately 1 mA. The controller side continues to monitor high-side communications to determine when VDDA supply returns. When the supply voltage is returned, normal operation begins in approximately 250 µs. Similarly, a loss of VDDB supply will reduce IDDA current to approximately 1 mA.

# 3. Voltage Sense Application

A typical isolated voltage sensing application circuit is shown below. In this example, a high voltage is divided down to produce a voltage (VIN) within the optimum input signal range of the Si8931/32. Numerous alternative inputs configurations are possible with the flexibility of a high impedance input isolator. The Si8931 senses the single-ended input voltage and reproduces it as a differential (or single-ended with the Si8932) output voltage across the galvanic isolation barrier. The Si8931 differential outputs (AOP, AON) can be routed directly to a differential ADC as shown below. The Si8932 senses the single-ended input voltage and reproduces it as a single-ended output voltage across the galvanic isolation barrier. The single-ended input voltage and reproduces it as a single-ended output voltage across the galvanic isolation barrier. The single-ended output voltage and reproduces it as a single-ended output voltage across the galvanic isolation barrier. The single-ended output voltage and reproduces it as a single-ended output voltage across the galvanic isolation barrier. The single-ended output can be routed directly to a standard ADC (not shown). If the voltage sensed is > 2.5 V, a simple voltage divider consisting of R1 and R2 can be used to scale down any voltage to fit the input range of the Si8931/32. R2 < 10 k $\Omega$  is recommended for best performance.





The amplifier bandwidth of the Si8931/32 is approximately 600 kHz. For applications where input filtering is required, a passive, differential RC low-pass filter can be placed at the input pin. Consider the source resistance of the signal measured (or the parallel combination of R1 and R2 if using a voltage divider) as it should be included in the filter calculation. Capacitor C1 should be sized to make a band limiting filter at the desired frequency.

C4, the local bypass capacitor for the B-side of Si8931/32, should be placed closed to VDDB supply pin with its return close to GNDB. The output signal at AOP and AON is differential with unity gain and common mode of 1.4 V. The outputs are sampled by a differential input ADC. Depending on the sample rate of the ADC, an anti-aliasing filter may be required. A simple anti-aliasing filter can be made from the passive components, R5, C6, and R6. The characteristics of this filter are dictated by the input topology and sampling frequency of the ADC. However, to ensure the Si8931/32 outputs are not overloaded, R5 = R6 > 5 k $\Omega$  and C6 can be calculated by the following equation:

$$C6 = \frac{1}{2 \times \pi \times (R5 + R6) \times f_{3dB}}$$

# 4. Electrical Specifications

# Table 4.1. Electrical Specifications

T<sub>A</sub> = -40 to +125 °C; typical specs at 25 °C with VDDA = VDDB = 5 V unless specified differently under Test Condition

Param	ieter	Symbol	Test Condition	Min	Тур	Мах	Units
Input Side Su	oply Voltage	VDDA		3.0		5.5	V
Input Supply Current	Si8931/32	IDDA	VDDA = 3.3 V	3.5	4.7	5.7	mA
Output Side Su	pply Voltage	VDDB		3.0		5.5	V
Output Supply	Si8931	IDDB	VDDB = 3.3 V	2.6	3.5	4.5	mA
Current	Si8932	IDDB	VDDB = 3.3 V	2.6	4.3	5	mA
Amplifier B	andwidth				600		kHz
Amplifier Input				-			
Specified Input R		VIN		0.25		2.25	V
Maximum Inp before C		VIN			2.5		V
Input Refer	red Offset	VOS	T <sub>A</sub> = 25 °C, VIN = 0.25 V	-1	±0.16	1	mV
Input Offset Drift		VOST		-25	±0.75	25	µV/°C
Input Impedance		RIN			500		MΩ
Amplifier Output				_	1	I	
Full-scale	Output				2.5		Vpk
Gai	n				1		
Gain E	Error		T <sub>A</sub> = 25 °C	-0.25	±0.06	0.25	%
Coin Error Drift	Si8931			-40	6	20	ppm/°C
Gain Error Drift	Si8932			-30	-5	30	ppm/°C
Output Common Mode Voltage	Si8931	(VAOP + VAON)/2		1.34	1.39	1.44	V
	Si8931		T <sub>A</sub> = 25 °C	-0.04	0.01	0.04	%
Nonlinearity	Si8932		T <sub>A</sub> = 25 °C	-0.05	0.01	0.05	%
Nonlinearity Drift			T <sub>A</sub> = 25 °C	-5		5	ppm/°C
Signal-to-Noise	Si8931	SNR	100 kHz bandwidth	73	77		dB
Ratio	Si8932	SNR	100 kHz bandwidth	72	76		dB
Total Harmonic	Si8931	THD	F <sub>IN</sub> = 1 kHz		-80	-70	dB
Distortion	Si8932	THD	F <sub>IN</sub> = 1 kHz		-80	-66	dB

# Si8931/32 Data Sheet • Electrical Specifications

Parameter		Test Condition	Min	Тур	Мах	Units
		VDDA at DC		-100		dB
		VDDA at 100 mV and 10 kHz ripple		-100		dB
ejection Ratio	PSRR	VDDB at DC		-100	)	dB
		VDDB at 100 mV and 10 kHz ripple		-100		dB
Dutput Resistive Si8931		Between AON and AOP	5			kΩ
Si8932	RLOAD	Between AO and GND	5			kΩ
Output Capacitive Load		Each pin to ground			100	pF
					I	1
Delay	t <sub>PD</sub>	50% to 50%		1		μs
Rise Time		10% to 90%		1.6		μs
Common-Mode Transient Immunity <sup>1</sup>		VIN = GNDA, VCM = 1500 V	50	75		kV/µs
	Rejection Ratio Si8931 Si8932 acitive Load Delay Time de Transient	Rejection Ratio     PSRR       Si8931     RLOAD       Si8932     CLOAD       acitive Load     CLOAD       Delay     tpD       Time     t <sub>R</sub> de Transient     CMTI	Rejection RatioPSRRVDDA at DCPSRRVDDA at 100 mV and 10 kHz rippleVDDB at DCVDDB at DCVDDB at 100 mV and 10 kHz rippleSi8931RLOADSi8932Between AON and AOPacitive LoadCLOADEach pin to groundDelay $t_{PD}$ 50% to 50%Time $t_R$ 10% to 90%de TransientCMTI	Rejection RatioPSRR $VDDA at DC$ PSRRVDDA at 100 mV and 10 kHz rippleVDDB at DCVDDB at DCVDDB at 100 mV and 10 kHz rippleSi8931RLOADBetween AON and AOPSi8932CLOADEach pin to groundDelaytPD50% to 50%TimetR10% to 90%de TransientCMTIVIN = GNDA, 50	Rejection RatioPSRR $VDDA at DC$ -100PSRR $VDDA at 100 mV and 10 kHz ripple$ -100VDDB at DC-100VDDB at 100 mV and 10 kHz ripple-100Si8931RLOADBetween AON and AOP5Si8932CLOADEach pin to ground5Delay $t_{PD}$ 50% to 50%1Time $t_R$ 10% to 90%1.6de TransientCMTIVIN = GNDA,50	Rejection RatioVDDA at DC-100PSRR $VDDA at 100 \text{ mV and 10} \\ \text{KHz ripple}$ -100VDDB at DC-100VDDB at 100 mV and 10 \\ \text{KHz ripple}-100Si8931RLOADBetween AON and AOP5Si8932RLOADEach pin to ground5DelaytPD50% to 50%1TimetR10% to 90%1.6de TransientCMTIVIN = GNDA,50

1. An analog CMTI failure is defined as an output error of more than 100 mV persisting for at least 1  $\mu$ s.

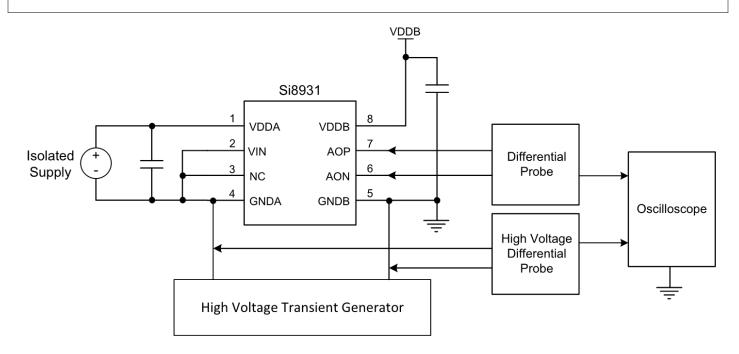


Figure 4.1. Common-Mode Transient Immunity Characterization Circuit

Parameter	Symbol	Test Condition	Characteristic	Unit
Safety Temperature	T <sub>S</sub>		150	°C
		$\theta_{JA} = 90 \text{ °C/W}$		
		VDD = 5.5 V	050	
		T <sub>J</sub> = 150 °C	253	
		T <sub>A</sub> = 25 °C		
Safety Input Current (WB Stretched SOIC-8)	IS	$\theta_{JA} = 90 \ ^{\circ}C/W$		
	VDD = 3.6 V T <sub>J</sub> = 150 °C 386			
			386	mA
		T <sub>A</sub> = 25 °C		
		θ <sub>JA</sub> = 112 °C/W	203	mA
		VDD = 5.5 V		
		T <sub>J</sub> = 150 °C		
		T <sub>A</sub> = 25 °C		
Safety Input Current (NB SOIC-8)	۱ <sub>S</sub>	θ <sub>JA</sub> = 112 °C/W		+
		VDD = 3.6 V		
		T <sub>J</sub> = 150 °C	310	mA
		T <sub>A</sub> = 25 °C		
		$\theta_{JA} = 90 \ ^{\circ}C/W$		
Safety Input Power (WB Stretched SOIC-8)	P <sub>S</sub>	T <sub>J</sub> = 150 °C	1389	mW
		T <sub>A</sub> = 25 °C		
		θ <sub>JA</sub> = 112 °C/W		
Safety Input Power (NB SOIC-8)	Ps	T <sub>J</sub> = 150 °C	1116	mW
		T <sub>A</sub> = 25 °C		
Note:		1		

# Table 4.2. IEC 60747-17 Safety Limiting Values<sup>1</sup>

#### Note:

1. Maximum value allowed in the event of a failure. Refer to the thermal derating curves below.

# Table 4.3. Thermal Characteristics

Parameter	Symbol	WB Stretched SOIC-8	NB SOIC-8	Unit
IC Junction-to-Air Thermal Resistance	$\theta_{JA}$	90	112	°C/W

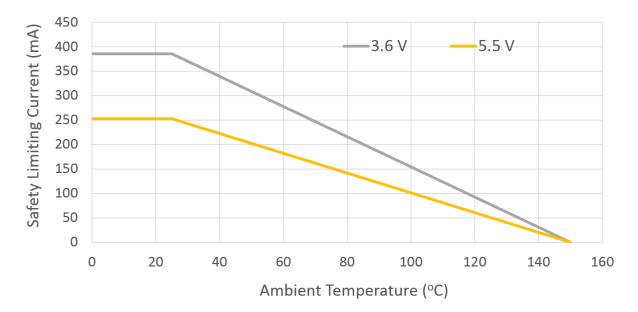


Figure 4.2. WB Stretched SOIC-8 Thermal Derating Curve for Safety Limiting Current

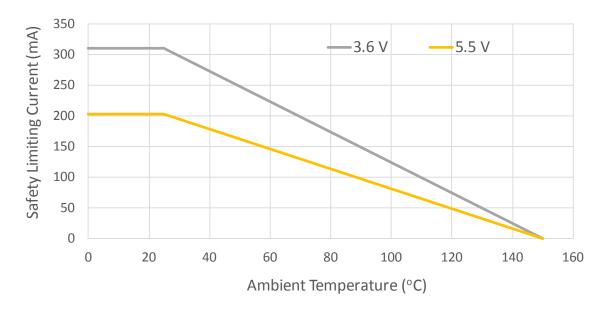


Figure 4.3. NB SOIC-8 Thermal Derating Curve for Safety Limiting Current

# Table 4.4. Absolute Maximum Ratings<sup>1</sup>

Parameter	Symbol	Min	Мах	Unit
Storage Temperature	T <sub>STG</sub>	-65	150	°C
Ambient Temperature Under Bias	T <sub>A</sub>	-40	125	°C
Junction Temperature	TJ	_	150	°C
Supply Voltage	VDDA, VDDB	-0.5	6.0	V
Input Voltage respect to GNDA	VIN	-0.5	VDDA + 0.5	V
Output Sink or Source Current	I <sub>O</sub>	_	5	mA
Total Power Dissipation	PT	_	212	mW
Lead Solder Termperature (10 s)		_	260	°C
Human Body Model ESD Rating		6000	_	V
Capacitive Discharge Model ESD Rating		2000	_	V
	1			1

# Note:

1. Permanent device damage may occur if the absolute maximum ratings are exceeded. Functional operation should be restricted to conditions as specified in the operational sections of the data sheet.

# 4.1 Regulatory Information

# Table 4.5. Regulatory Information<sup>1, 2</sup>

CSA

The Si8931/32 is certified under CSA. For more details, see Master Contract File 232873.

62368-1: Up to 600 V<sub>RMS</sub> reinforced insulation working voltage; up to 1000 V<sub>RMS</sub> basic insulation working voltage.

# VDE

The Si8931/32 is pending certification under VDE. For more details, see File 5028467.

IEC60747-17: Up to 2121 V<sub>peak</sub> for reinforced insulation working voltage.

EN62368-1: Up to 600 V<sub>RMS</sub> reinforced insulation working voltage; up to 1000 V<sub>RMS</sub> basic insulation working voltage.

UL

The Si8931/32 is certified under UL1577 component recognition program. For more details, see File E257455.

Rated up to 5000  $V_{\text{RMS}}$  isolation voltage for basic protection.

# CQC

The Si8931/32 is certified under GB4943.1-2011.

Rated up to 250  $V_{RMS}$  reinforced insulation working voltage at 5000 meters.

# Note:

1. Regulatory Certifications apply to 5 kV<sub>RMS</sub> rated devices which are production tested to 6.0 kV<sub>RMS</sub> for 1 sec.

2. Regulatory Certifications apply to 2.5 kVRMS rated devices which are production tested to 3.0 kVRMS for 1 sec.

# Table 4.6. Insulation and Safety-Related Specifications

			Value			
Parameter	Symbol Test Condition		WB Stretched SOIC-8	NB SOIC-8	Unit	
Nominal External Air Gap (Clearance)	CLR		8.0	4.0	mm	
Nominal External Tracking (Creepage)	CRP		8.0	4.0	mm	
Minimum Internal Gap (Internal Clearance)	DTI		36	36	μm	
Tracking Resistance	PTI or CTI	IEC60112	600	600	V	
Erosion Depth	ED		0.04	0.04	mm	
Resistance (Input-Output) <sup>1</sup>	R <sub>IO</sub>		10 <sup>12</sup>	10 <sup>12</sup>	Ω	
Capacitance (Input-Output) <sup>1</sup>	C <sub>IO</sub>	f = 1 MHz	1	1	pF	

Note:

1. To determine resistance and capacitance, the Si8931/32 is converted into a two-terminal device. Pins 1–4 are shorted together to form the first terminal, and pins 5–8 are shorted together to form the second terminal. The parameters are then measured between these two terminals.

# Table 4.7. IEC 60664-1 Ratings

			ication
Parameter	Test Conditions	WB Stretched SOIC-8	NB SOIC-8
Basic Isolation Group	Material Group	I	I
Installation	Rated Mains Voltages $\leq$ 150 V <sub>RMS</sub>	I-IV	I-IV
Installation Classification	Rated Mains Voltages ≤ 300 V <sub>RMS</sub>	I-IV	I-IV
	Rated Mains Voltages ≤ 600 V <sub>RMS</sub>	I-IV	1-111

# Table 4.8. IEC 60747-17 Insulation Characteristics<sup>1</sup>

			Characte	eristic	
Parameter	Symbol	Test Condition	WB Stretched SOIC-8	NB SOIC-8	Unit
Maximum Working Insulation Voltage	V <sub>IORM</sub>		1500	1500	V <sub>RMS</sub>
Maximum Repetitive Isolation Voltage	V <sub>IORM</sub>		2121	2121	V <sub>peak</sub>
Input to Output Test Voltage	V <sub>PR</sub>	Method b1 (V <sub>IORM</sub> x 1.875 = V <sub>PR</sub> , 100% Production Test, t <sub>m</sub> = 1 sec, Partial Discharge < 5 pC)	3976	3976	V <sub>peak</sub>
Maximum Transient Isola- tion Overvoltage	V <sub>IOTM</sub>	t = 60 sec	8000	4000	V <sub>peak</sub>
Maximum Surge Isolation Voltage	V <sub>IOSM</sub>	Test voltage is $\ge$ 1.3 x V <sub>IMP</sub> , mini- mum 10000 V <sub>peak</sub> and 1.2 µs/50 µs	10400	10400	V <sub>peak</sub>
Maximum Impulse Voltage	V <sub>IMP</sub>		8000	5656	V <sub>peak</sub>
Pollution Degree		DIN VDE 0110	2	2	
Insulation Resistance	R <sub>S</sub>	T <sub>AMB</sub> = T <sub>S</sub> , V <sub>IO</sub> = 500 V	>10 <sup>9</sup>	>10 <sup>9</sup>	Ω

# Note:

1. This isolator is suitable for reinforced electrical isolation only within the safety limit data. Maintenance of the safety data is ensured by protective circuits. The Si8931/32 provides a climate classification of 40/125/21.

#### 4.2 Typical Operating Characteristics

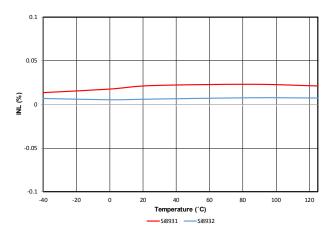


Figure 4.4. Nonlinearity (%) vs. Temperature (°C)

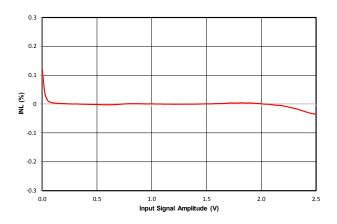


Figure 4.6. Si8931 Nonlinearity (%) vs. Input Signal Amplitude (mV)

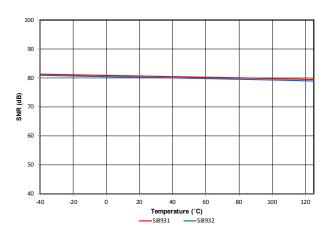


Figure 4.8. Signal-to-Noise Ratio (dB) vs. Temperature (°C)

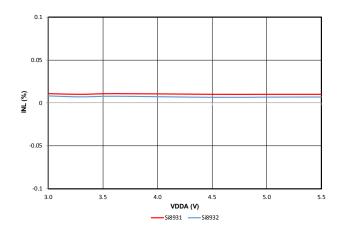


Figure 4.5. Nonlinearity (%) vs. VDDA Supply (V)

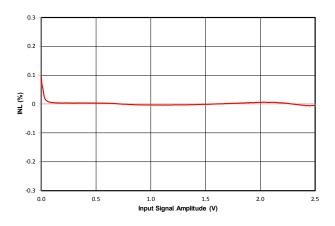


Figure 4.7. Si8932 Nonlinearity (%) vs. Input Signal Amplitude (mV)

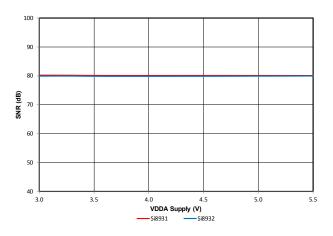


Figure 4.9. Signal-to-Noise Ratio (dB) vs. VDDA Supply (V)

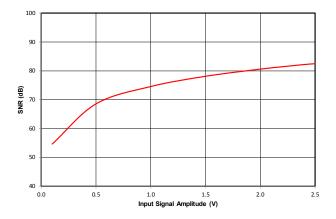


Figure 4.10. Si8931 Signal-to-Noise Ratio (dB) vs. Input Signal Amplitude (V)

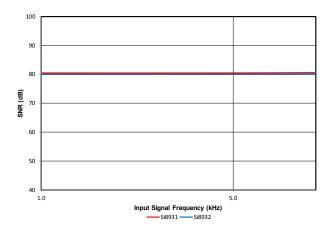


Figure 4.12. Signal-to-Noise Ratio (dB) vs. Input Signal Frequency (kHz)

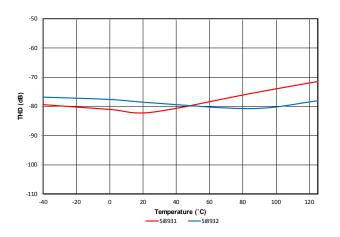


Figure 4.14. Total Harmonic Distortion (dB) vs. Temperature (°C)

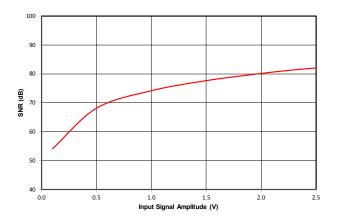


Figure 4.11. Si8932 Signal-to-Noise Ratio (dB) vs. Input Signal Amplitude (V)

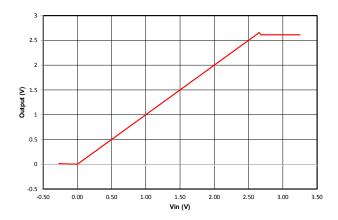


Figure 4.13. Output Voltage (V) vs. Input Voltage (V)

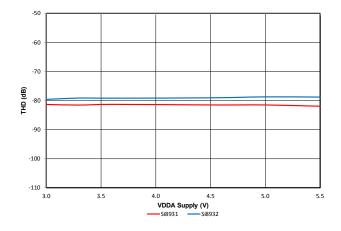


Figure 4.15. Total Harmonic Distortion (dB) vs. VDDA Supply (V)

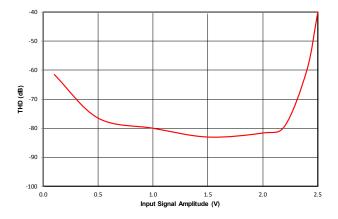


Figure 4.16. Si8931 Total Harmonic Distortion (dB) vs. Input Signal Amplitude (V)

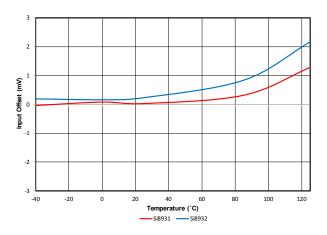


Figure 4.18. Input Offset (mV) vs. Temperature (°C)

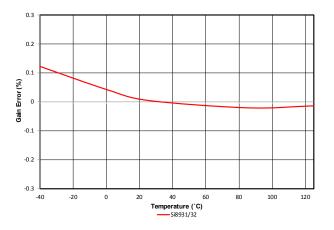


Figure 4.20. Gain Error (%) vs. Temperature (°C)

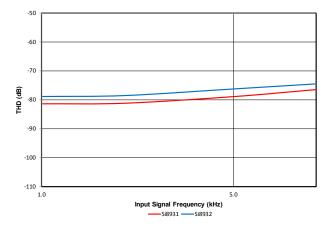


Figure 4.17. Total Harmonic Distortion (dB) vs. Input Signal Frequency (kHz)

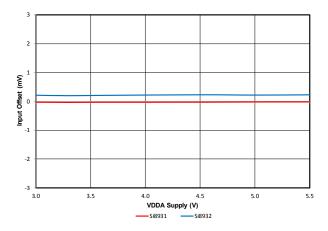


Figure 4.19. Input Offset (mV) vs. VDDA Supply (V)

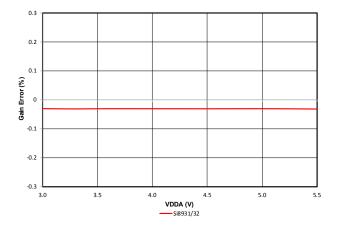


Figure 4.21. Gain Error (%) vs. VDDA Supply (V)

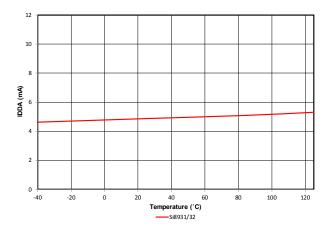


Figure 4.22. IDDA (mA) vs. Temperature (°C)

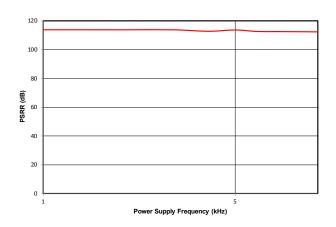


Figure 4.24. PSRR (dB) vs. Power Supply Frequency (kHz)

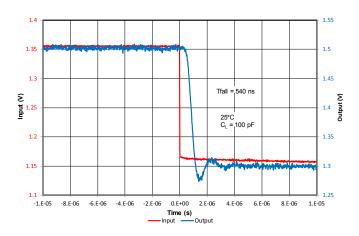


Figure 4.26. Si8931 High-to-Low Step Response

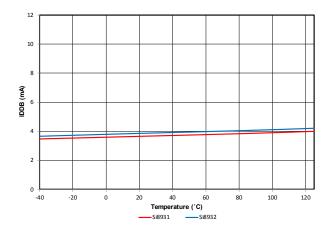


Figure 4.23. IDDB (mA) vs. Temperature (°C)

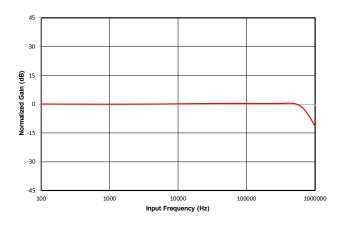


Figure 4.25. Amplifier Bandwidth

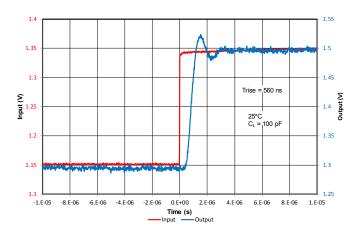


Figure 4.27. Si8931 Low-to-High Step Response

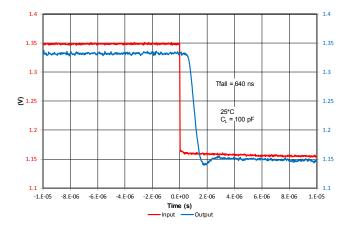


Figure 4.28. Si8932 High-to-Low Step Response

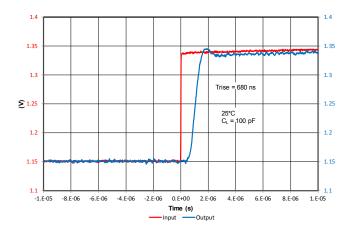
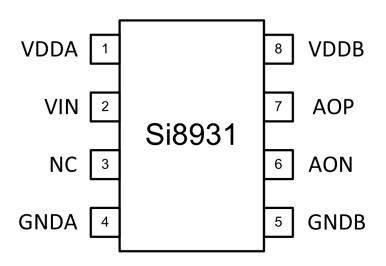


Figure 4.29. Si8932 Low-to-High Step Response

Si8931/32 Data Sheet • Pin Descriptions

# 5. Pin Descriptions

# 5.1 Si8931 Pin Descriptions





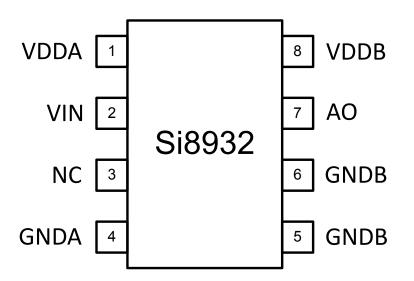
Name	Pin Number	Description
VDDA	1	Input side power supply
VIN	2	Voltage input
NC <sup>1</sup>	3	No Connect
GNDA	4	Input side ground
GNDB	5	Output side ground
AON	6	Analog output low
AOP	7	Analog output high
VDDB	8	Output side power supply

Note:

1. No Connect. These pins are not internally connected. To maximize CMTI performance, these pins should be connected to the ground plane.

Si8931/32 Data Sheet • Pin Descriptions

#### 5.2 Si8932 Pin Descriptions



# Table 5.2. Si8932 Pin Descriptions

Name	Pin Number	Description
VDDA	1	Input side power supply
VIN	2	Voltage input
NC <sup>1</sup>	3	No Connect
GNDA	4	Input side ground
GNDB	5	Output side ground
GNDB	6	Output side ground
AO	7	Analog output
VDDB	8	Output side power supply
Nut		

#### Note:

1. No Connect. These pins are not internally connected. To maximize CMTI performance, these pins should be connected to the ground plane.

# 6. Packaging

# 6.1 Package Outline: 8-Pin Wide Body Stretched SOIC

The figure below illustrates the package details for the Si8931/32 in a 8-Pin Wide Body Stretched SOIC package. The table lists the values for the dimensions shown in the illustration.

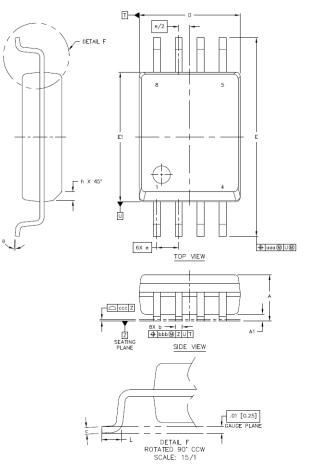


Figure 6.1. 8-Pin Wide Body Stretched SOIC Package

# Table 6.1. 8-Pin Wide Body Stretched SOIC Package Diagram Dimensions

Symbol	Millimeters		
Synbol	Min	Мах	
A	2.49	2.79	
A1	0.36	0.46	
b	0.30	0.51	
с	0.20	0.33	
D	5.74	5.94	
E	11.25	11.76	
E1	7.39	7.59	
e	1.27	BSC	
L	0.51	1.02	
h	0.25	0.76	

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# Si8931/32 Data Sheet • Packaging

Symbol	Millimeters		
	Min	Мах	
θ	0°	8°	
ааа	_	0.25	
bbb	_	0.25	
ccc		0.10	
Noto:			

#### Note:

1. All dimensions shown are in millimeters (mm) unless otherwise noted.

2. Dimensioning and Tolerancing per ANSI Y14.5M-1994.

3. Recommended reflow profile per JEDEC J-STD-020C specification for small body, lead-free components.

# 6.2 Package Outline: 8-Pin Narrow Body SOIC

The figure below illustrates the package details for the Si8931/32 in an 8-Pin Narrow Body SOIC package. The table lists the values for the dimensions shown in the illustration.

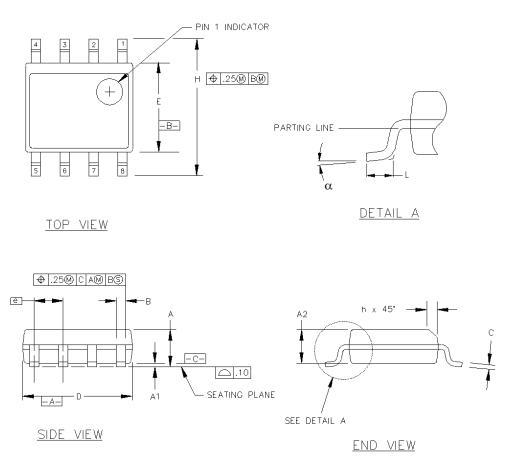


Figure 6.2. 8-Pin Narrow Body SOIC Package

# Table 6.2. 8-Pin Narrow Body SOIC Package Diagram Dimensions

Dimension	Min	Мах
A	1.35	1.75
A1	0.10	0.25
A2	1.40 REF	1.55 REF
В	0.33	0.51
С	0.19	0.25
D	4.80	5.00
E	3.80	4.00
e	1.27	BSC
Н	5.80	6.20
h	0.25	0.50
L	0.40	1.27
α	0°	8°

Dimension	Min	Мах			
Note:	Note:				
1. All dimensions shown are in millimeters (mm) unless otherwise noted.					
2. Dimensioning and Tolerancing per ANSI Y14.5M-1982.					
3. This drawing conforms to JEDEC Outline MS-012.					
4. Recommended card reflow profile is per the JEDEC/IPC J-STD-020B specification for Small Body Components.					

#### 6.3 Land Pattern: 8-Pin Wide Body Stretched SOIC

The figure below illustrates the recommended land pattern details for the Si8931/32 in a 8-Pin Wide Body Stretched SOIC package. The table lists the values for the dimensions shown in the illustration.

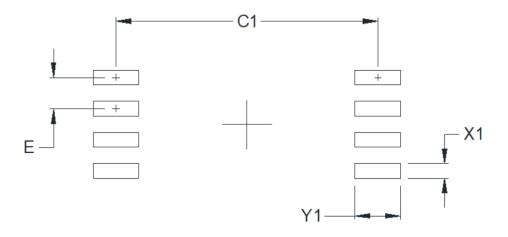


Figure 6.3. 8-Pin Wide Body Stretched SOIC Land Pattern

#### Table 6.3. 8-Pin Wide Body Stretched SOIC Land Pattern Dimensions<sup>1</sup>

Dimension	(mm)
C1	10.60
E	1.27
X1	0.60
Y1	1.85

# Note:

#### General

- 1. All dimensions shown are at Maximum Material Condition (MMC). Least Material Condition (LMC) is calculated based on a Fabrication Allowance of 0.05mm.
- 2. This Land Pattern Design is based on the IPC-7351 guidelines.

#### Solder Mask Design

1. All metal pads are to be non-solder mask defined (NSMD). Clearance between the solder mask and the metal pad is to be 60 µm minimum, all the way around the pad.

#### Stencil Design

- 1. A stainless steel, laser-cut and electro-polished stencil with trapezoidal walls should be used to assure good solder paste release.
- 2. The stencil thickness should be 0.125mm (5 mils).
- 3. The ratio of stencil aperture to land pad size should be 1:1 for all perimeter pins.

# **Card Assembly**

- 1. A No-Clean, Type-3 solder paste is recommended.
- 2. The recommended card reflow profile is per the JEDEC/IPC J-STD-020 specification for Small Body Components.

# 6.4 Land Pattern: 8-Pin Narrow Body SOIC

The figure below illustrates the recommended land pattern details for the Si8931/32 in an 8-Pin Narrow Body SOIC package. The table lists the values for the dimensions shown in the illustration.

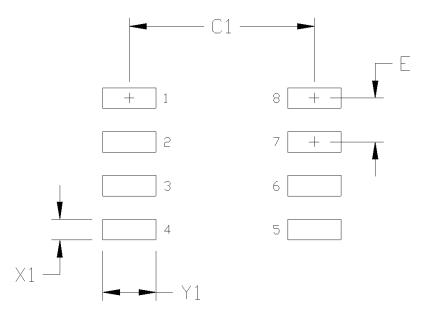


Figure 6.4. 8-Pin Narrow Body SOIC Land Pattern

Table 6.4.	8-Pin Narrow Body	SOIC Land Pattern	Dimensions
------------	-------------------	-------------------	------------

Symbol	mm
C1	5.40
E	1.27
X1	0.60
Y1	1.55
M . / .	

#### Note:

1. This Land Pattern Design is based on IPC-7351 pattern SOIC127P600X173-8N for Density Level B (Median Land Protrusion). 2. All feature sizes shown are at Maximum Material Condition (MMC) and a card fabrication tolerance of 0.05 mm is assumed.

# 6.5 Top Marking: 8-Pin Wide Body Stretched SOIC

The figure below illustrates the top markings for the Si8931/32 in a 8-Pin Wide Body Stretched SOIC package. The table explains the top marks shown in the illustration.

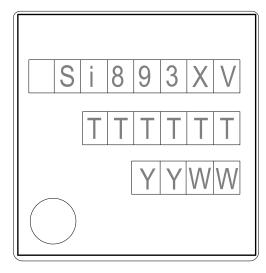


Figure 6.5. 8-Pin Wide Body Stretched SOIC Top Marking

Line 1 Marking:	Customer Part Number	Si893X X = Base part number • 1 = Differential output • 2 = Single-ended output V = Insulation rating: • D = 5.0 kVrms
Line 2 Marking:	TTTTTT = Mfg Code	Manufacturing Code from the Assembly Purchase Order form.
Line 3 Marking:	YY = Year WW = Work Week Circle = 43 mils Diameter Left-Justified	Assigned by the Assembly House. Corresponds to the year and work week of the mold date.

# 6.6 Top Marking: 8-Pin Narrow Body SOIC

The figure below illustrates the top markings for the Si8931/32 in an 8-Pin Narrow Body SOIC package. The table explains the top marks shown in the illustration.

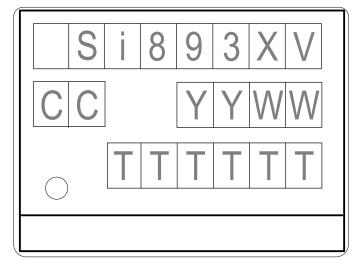


Figure 6.6. 8-Pin Narrow Body SOIC Top Marking

# Table 6.6. 8-Pin Narrow Body SOIC Top Marking Explanation

Line 1 Marking:	Customer Part Number	Si893X = Isolator Amplifier Series X = Base part number • 1 = Differential output • 2 = Single-ended output S = Input Range: • A = ±62.5 mV • B = ±250 mV V = Insulation rating: • B = 2.5 kVrms
	CC = Country of Origin ISO Code Ab- breviation	
Line 2 Marking:	YY = Year WW = Work Week	Assigned by the Assembly House. Corresponds to the year and work week of the mold date.
Line 3 Marking:	TTTTTT = Mfg Code Circle = 19.7 mils Diameter Left-Justified	Manufacturing Code from the Assembly Purchase Order form.

Si8931/32 Data Sheet • Revision History

# 7. Revision History

# Revision 206438A

December, 2022

· Updated decimal-based revision number to alphanumeric code.

# **Revision 0.9**

September, 2022

- · Updated Safety Approvals on front page.
- · Updated minimum supply currents in 4. Electrical Specifications.
- Updated 4.1 Regulatory Information.

# **Revision 0.8**

# May, 2021

- · Added Automotive OPNs to 1. Ordering Guide.
- Updated Figure 3.1 Voltage Sense Application on page 6.
- Updated Table 4.4 Absolute Maximum Ratings<sup>1</sup> on page 11.
- Added Surge Voltage parameter to Table 4.8 IEC 60747-17 Insulation Characteristics<sup>1</sup> on page 13.
- Changed "60 mm" to "60 μm" in Solder Mask Design note in Table 6.3 8-Pin Wide Body Stretched SOIC Land Pattern Dimensions<sup>1</sup> on page 25.

# Revision 0.7

December, 2019

- · Updated Applications and Key Features on front page.
- · Updated 4. Electrical Specifications after full characterization.
- Added section for Automotive Grade OPNs.
- Updated Table 4.6 Insulation and Safety-Related Specifications on page 12.
- Updated 6.6 Top Marking: 8-Pin Narrow Body SOIC.
- · Changed Si8932 Pin 6 from NC to GND.
- Numerous clarifications throughout.

# **Revision 0.5**

March, 2019

- · Updated specifications.
- · Added narrow body SOIC-8 package.

# **Revision 0.2**

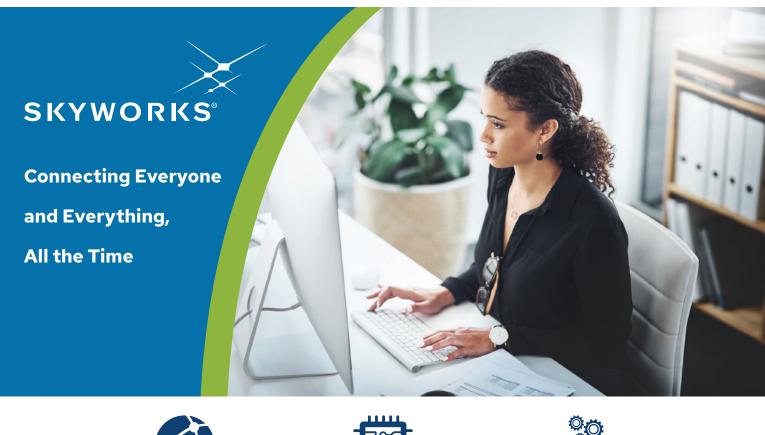
May, 2018

· Corrections and clarifications.

# **Revision 0.1**

January, 2018

• Initial draft.









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