

### FEATURES

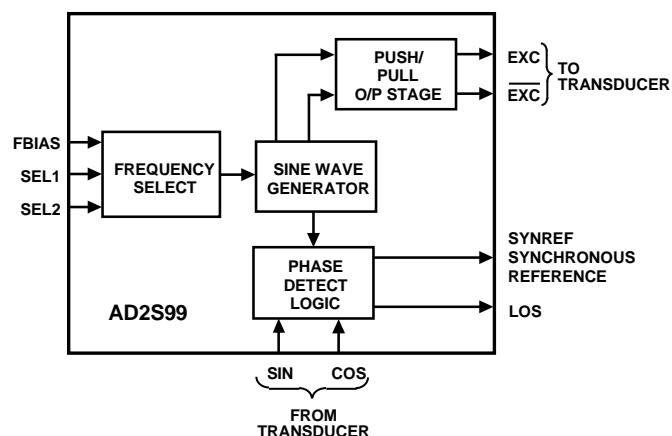
**Programmable Sinusoidal Oscillator**  
**Synthesized Synchronous Reference Output**  
**Programmable Output Frequency Range: 2 kHz–20 kHz**  
**“Loss-of-Signal” Indicator**  
**20-Pin PLCC Package**  
**Low Cost**

### APPLICATIONS

Excitation Source for:

**Resolvers**  
**Synchros**  
**LVDTs**  
**RVDTs**  
**Pressure Transducers**  
**Load Cells**  
**AC Bridges**

### FUNCTIONAL BLOCK DIAGRAM



### GENERAL DESCRIPTION

The AD2S99 programmable sinusoidal oscillator provides sine wave excitation for resolvers and a wide variety of ac transducers. The AD2S99 also provides a synchronous reference output signal (3 V p-p square wave) that is phase locked to its SIN and COS inputs. In an application, the SIN and COS inputs are connected to the transducer's secondary windings.

The synchronous reference output compensates for temperature and cabling dependent phase shifts and eliminates the need for external preset phase compensation circuits. The synchronous reference output can be used as a zero crossing reference for resolver-to-digital converters such as Analog Devices' AD2S80A, AD2S82A, AD2S83 and AD2S90.

The AD2S99 is packaged in a 20-pin PLCC and operates over  $-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$ .

### PRODUCT HIGHLIGHTS

#### Dynamic Phase Compensation

The AD2S99 dynamically compensates for any phase variation in a transducer by phase locking its synchronous reference output to the transducer's secondary windings.

#### Programmable Excitation Frequency

The excitation frequency is easily programmed to 2 kHz, 5 kHz, 10 kHz, or 20 kHz by using the frequency select pins. Intermediate frequencies are available by adding an external resistor.

#### Signal Loss Detection

The AD2S99 has the ability to detect if both the transducer secondary winding connections become disconnected from its SIN and COS inputs. The "LOS" output pin pulls high when a signal loss is detected.

#### Integration

The AD2S99 integrates the transducer excitation, synchronous reference, and loss of signal detection functions into a small, cost effective package.

### REV. B

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# AD2S99—SPECIFICATIONS ( $V_S = \pm 4.75\text{ V to } \pm 5.25\text{ V @ } -40^\circ\text{C to } +85^\circ\text{C unless otherwise noted}$ )

Parameter	Min	Typ	Max	Units	Test Conditions
FREQUENCY OUTPUT RANGE					SEL1 SEL2
2 kHz		2000		Hz	$V_{SS}$ $V_{SS}$
5 kHz		5000		Hz	$V_{SS}$ GND
10 kHz		10000		Hz	GND $V_{SS}$
20 kHz		20000		Hz	GND GND
ACCURACY					
Frequency			$\pm 10$	%	AP Grade @ +25°C
			$\pm 20$	%	AP Grade -40°C to +85°C
			$\pm 5$	%	BP Grade @ +25°C
			$\pm 10$	%	BP Grade -40°C to +85°C
Amplitude		$\pm 3$	$\pm 10$	%	AP Grade @ +25°C
			$\pm 20$	%	AP Grade -40°C to +85°C
		$\pm 3$	$\pm 5$	%	BP Grade @ +25°C
			$\pm 10$	%	BP Grade -40°C to +85°C
Power Supply Rejection Ratio		0.002		V p-p/V	Output Variation as Function of Change in Power Supply Voltage
ANALOG OUTPUTS					
Amplitude					
EXC, $\overline{\text{EXC}}$		2		V rms	EXC to GND, $\overline{\text{EXC}}$ to GND
SYNREF		$\pm 3$		V p-p	Square Wave
SYNREF OFFSET			$\pm 200$	mV	
Current Drive Capability					
EXC, $\overline{\text{EXC}}$ $V_S = \pm 5\text{ V}$			8	mA rms	$R_{LOAD} = 500\ \Omega$ $\overline{\text{EXC}}$ to EXC
Capacitive Drive			1000	pF	$C_{LOAD} = 1000\text{ pF}$
Total Harmonic Distortion					
EXC, $\overline{\text{EXC}}$			-25	dB	
ANALOG INPUTS SIN, COS					
Amplitude	1.8	2.0	2.2	V rms	
Phase Lock Range	-45		+45	Degrees	
Additional Phase Delay			$\pm 10$	Degrees	AP Grade
			$\pm 10$	Degrees	BP Grade
FREQUENCY SELECT INPUTS					
SEL1, SEL2 <sup>1</sup>	$V_{SS}$		AGND	V dc	
LOS OUTPUT					
Output Low Voltage			0.7	V dc	$I_{OL} = 400\ \mu\text{A}$
Output High Voltage		$V_{DD}$		V dc	50 k $\Omega$ Pull Up to $V_{DD}$ (Open Drain Output)
SIN, COS LOS Threshold	0.5	0.6	0.8	V rms	
POWER SUPPLIES					
$V_{DD}$	+4.75		+5.25	V dc	
$V_{SS}$	-4.75		-5.25	V dc	
Quiescent Current $I_{DD}$ , $I_{SS}$		$\pm 8$	$\pm 15$	mA	No Load
TEMPERATURE RANGE					
Operating	-40		+85	°C	
Storage	-65		+150	°C	

## NOTES

<sup>1</sup>Frequency select pins SEL1 and SEL2 must be connected to appropriate voltage levels before power is applied.

Specifications subject to change without notice.

# AD2S99

## ABSOLUTE MAXIMUM RATINGS\*

V <sub>DD</sub> .....	+7 V
V <sub>SS</sub> .....	-7 V
Operating Temperature .....	-40°C to +85°C
Storage Temperature .....	-65°C to +150°C
Analog Input Voltages (SIN and COS) .....	V <sub>SS</sub> - 0.3 V
.....	to V <sub>DD</sub> + 0.3 V
Frequency Select (SEL1, SEL2) .....	V <sub>SS</sub> - 0.4 V
.....	to AGND + 0.4 V

\*Stresses above those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational section of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

## RECOMMENDED OPERATING CONDITIONS

Power Supply Voltage (V <sub>DD</sub> to V <sub>SS</sub> ) .....	±4.75 V to ±5.25 V
Analog Input Voltage (SIN and COS) .....	2 V rms ±10%
Frequency Select (SEL1 and SEL2) .....	V <sub>SS</sub> to AGND
Operating Temperature Range .....	-40°C to +85°C

## ORDERING GUIDE

Model	Temperature Range	Package Option*
AD2S99AP	-40°C to +85°C	P-20A
AD2S99BP	-40°C to +85°C	P-20A

\*P = PLCC.

## PIN DESIGNATIONS

Pin No.	Mnemonic	Description
1	SEL2	Frequency Select 2
2	SEL1	Frequency Select 1
3	FBIAS	External Frequency Adjust Pin
5	SIN	Resolver Output SIN
6 <sup>1</sup>	DGND	Digital Ground
7	COS	Resolver Output COS
10	SYNREF	Synthesized Reference Output
11	LOS	Indicates When Both the SIN and COS Are Below the Threshold.
12	V <sub>DD</sub>	Positive Power Supply
16 <sup>1</sup>	AGND	Analog Ground
17	EXC	Resolver Reference One
18	$\overline{\text{EXC}}$	Resolver Reference Two <sup>3</sup>
19 <sup>2</sup>	V <sub>SS</sub>	Negative Power Supply
20 <sup>2</sup>	V <sub>SS</sub>	Negative Power Supply

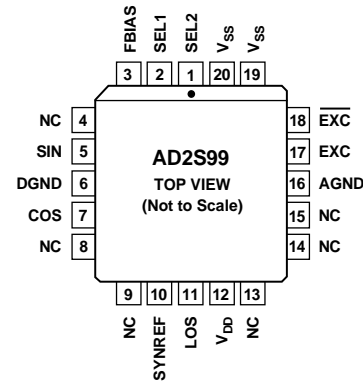
## NOTES

<sup>1</sup>Pins 6 and 16 must be connected together.

<sup>2</sup>Pins 19 and 20 must be connected together.

<sup>3</sup>Resolver Reference two ( $\overline{\text{EXC}}$ ) is 180° phase advanced with respect to Resolver Reference one (EXC).

## PIN CONFIGURATION



NC = NO CONNECT

## CAUTION

ESD (electrostatic discharge) sensitive device. Electrostatic charges as high as 4000 V readily accumulate on the human body and test equipment and can discharge without detection. Although the AD2S99 features proprietary ESD protection circuitry, permanent damage may occur on devices subjected to high energy electrostatic discharges. Therefore, proper ESD precautions are recommended to avoid performance degradation or loss of functionality.





## AD2S99/AD2S90 TYPICAL CONFIGURATION

Figure 3 shows a typical circuit configuration for the AD2S99 Oscillator and the AD2S90 Resolver-to-Digital Converter. The maximum level of the SIN and COS input signals to the AD2S90 should be 2 V rms  $\pm$  10%. All the analog ground signals should be star connected to the AD2S90 AGND pin. If shielded twisted pair cables are used for the resolver signals, the

shields should also be terminated at the AD2S90 AGND pin. The SYNREF output of the AD2S99 should be connected to the REF input pin of the AD2S90 via a 0.1  $\mu$ F capacitor with a 100 k $\Omega$  resistor to GND. This is to block out any dc offset in the SYNREF signal. For more detailed information please refer to the AD2S90 data sheet.

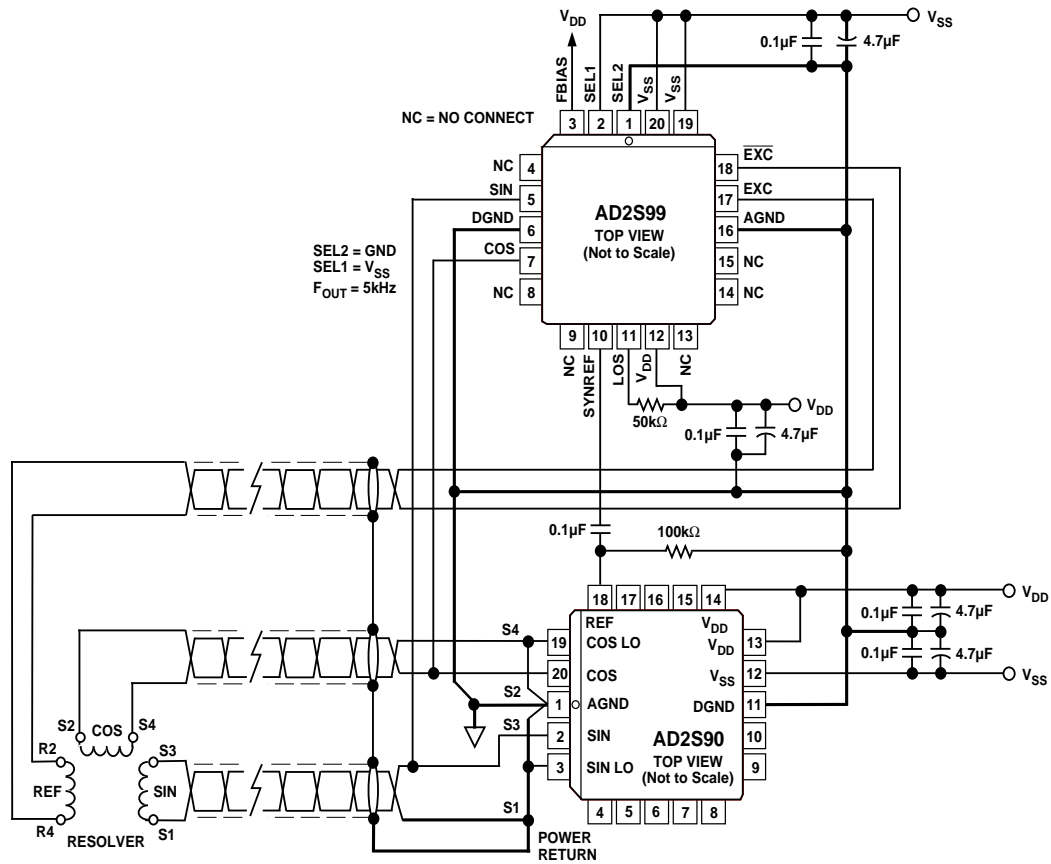


Figure 3. AD2S99 and AD2S90 Example Configuration

# AD2S99

## AD2S99/AD2S82A TYPICAL CONFIGURATION

Figure 4 shows a typical circuit configuration for the AD2S99 Oscillator and the AD2S82A Resolver-to-Digital Converter. The maximum level of the SIN and COS input signals to the AD2S82A should be 2 V rms  $\pm$ 10%. All the analog ground signals should be star connected to the AD2S82A AGND pin. If shielded twisted pair cables are used for the resolver signals, the shields should also be terminated at the AD2S82A AGND pin.

Coupling capacitor C3, and resistor to GND R3, between the SYNREF output of the AD2S99 and the REF input pin of the AD2S82A are optional. For additional information on selecting component values for the AD2S82A, please refer to the AD2S82A data sheet or the application note "Passive Component Selection and Dynamic Modeling for the AD2S80 Series Resolver-to-Digital Converters" (AN-266).

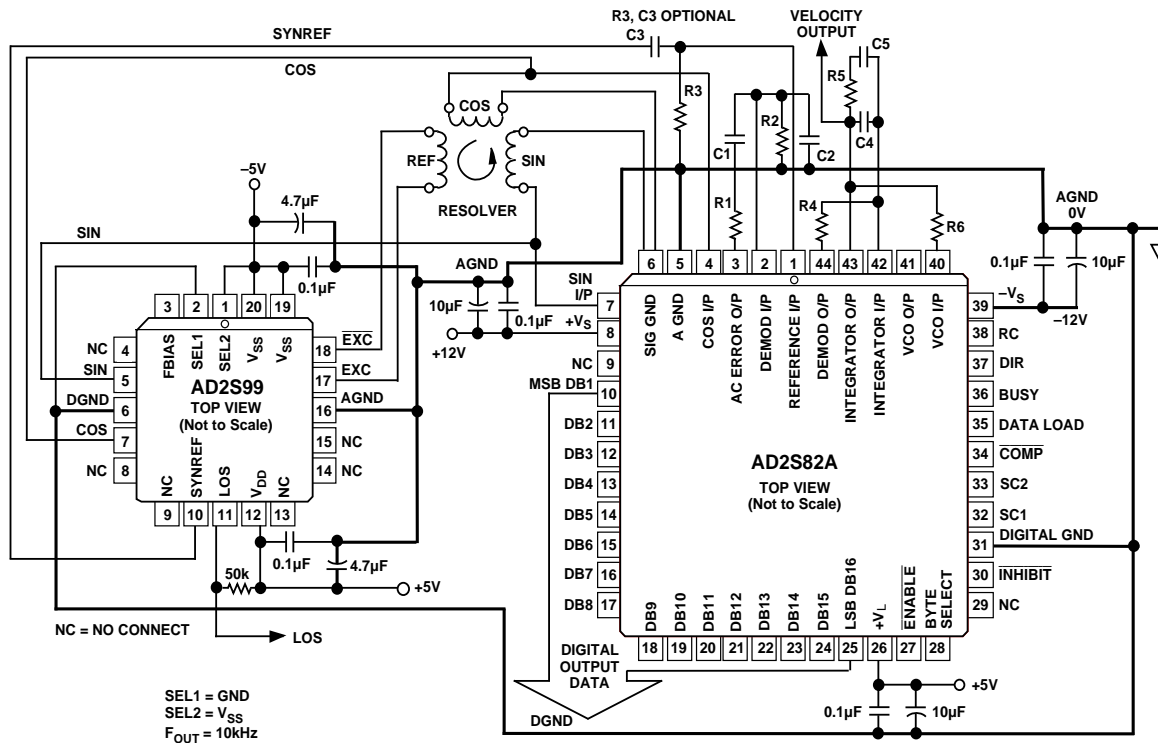


Figure 4. AD2S99 and AD2S82A Example Configuration

## AD2S99/AD2S93 TYPICAL CONFIGURATION

Figure 5 shows a typical circuit configuration for the AD2S99 Oscillator and the AD2S93 LVDT-to-Digital Converter. The maximum level of the A and B transducer input signals to the AD2S93 should be 1 V rms  $\pm$  20%. All the analog ground signals should be star connected to the AD2S93 AGND pin. If shielded twisted pair cables are used for the LVDT signals, the

shields should also be terminated at the AD2S93 AGND pin. The SYNREF output of the AD2S99 cannot be used as the REF input signal for the AD2S93. The zero crossing reference for the AD2S93 should be taken from the primary winding of the LVDT through a phase lead or lag network. The phase compensation network ensures that the REF input is phase coherent with the A and B input signals to the AD2S93.

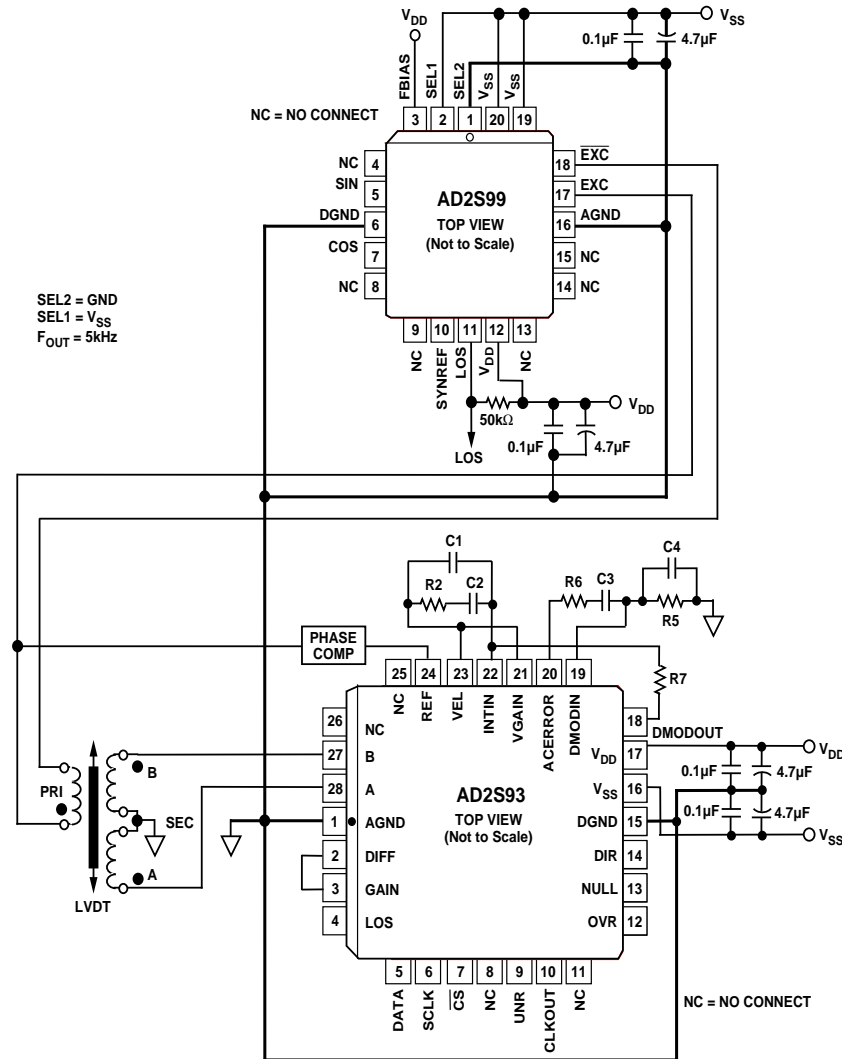


Figure 5. AD2S99 and AD2S93 Example Configuration

# AD2S99



Figure 6. Sample Buffer Configuration

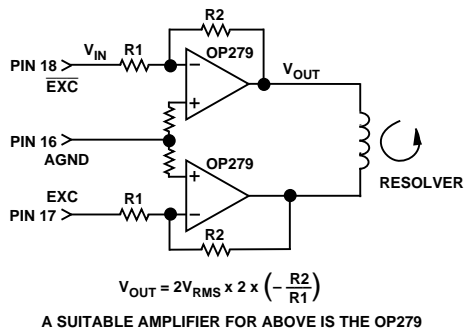
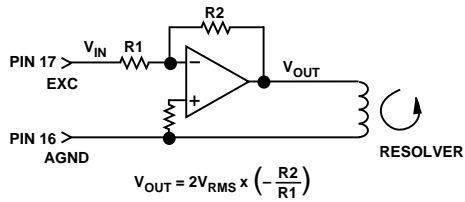
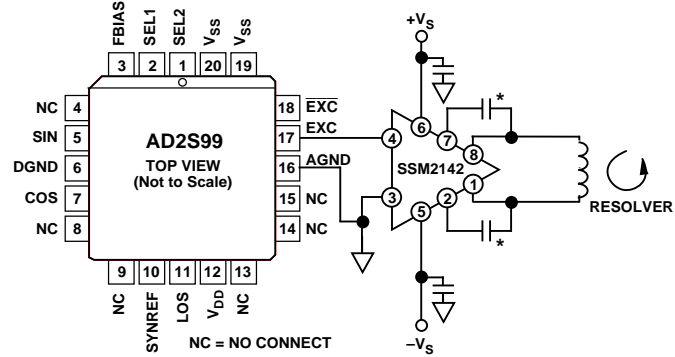


Figure 7. Sample Buffer Configurations



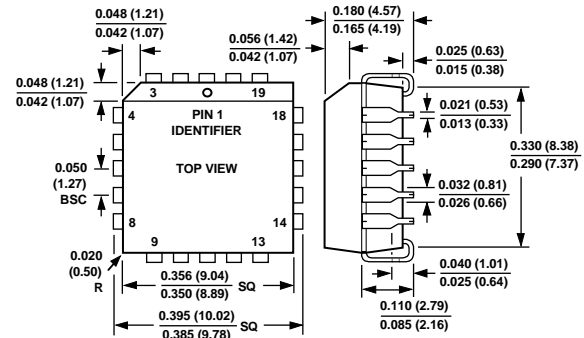
\*OPTIONAL; CONSULT APPROPRIATE ANALOG DEVICES DATA SHEET.

Figure 8. The SSM2142 as a Single Ended to Differential Driver

## OUTLINE DIMENSIONS

Dimensions shown in inches and (mm).

### PLCC (P-20A)



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