

CLC952 12-bit, 41MSPS Monolithic A/D Converter

General Description

The CLC952 is a complete monolithic 12-bit 41MSPS analog-todigital converter system. Fabricated from a 0.8µm BiCMOS process, the CLC952's on-chip features include a very linear wideband track-and-hold, bandgap voltage reference and a proprietary 12-bit multi-stage quantizer. The CLC952 has been designed for wideband digital communications receivers and features a 72dBc spurious-free dynamic range (SFDR) and 64dB signal-to-noise ratio (SNR).

The CLC952 operates from a standard ±5V power supply and features excellent noise isolation with its >60dB power-supply rejection ratio (PSRR). All digital control functions and output registers are TTL compatible. The CLC952AC operates over the commercial temperature range (0°C to 70°C), and the CLC952AJ operates over the industrial temperature range (-40°C to 85°C) version. The CLC952 is available in a 28-pin SSOP that provides an extremely small footprint for reduced board space. National Semiconductor thoroughly tests each part to verify full compliance with guaranteed specifications.

Features

- 41MSPS
- Wide dynamic range SFDR: 72dBc SNR: 64dB
- Low power dissipation: 660mW
- Ground centered, DC-coupled analog input
- Excellent PSRR: >60dB
- Very small package: 28-pin SSOP
- Low cost

Applications

- Cellular base-stations
- Digital communications
- Infrared/CCD imaging
- IF sampling
- Electro-optics
- Instrumentation
- Medical imaging
- High definition video



CLC952 Electrical Characteristics (Vcc = +5V, VEE = -5V, 40.96MSPS; unless specified)							
PARAMETERS	CONDITIONS	TEMP		RATINGS		UNITS	NOTES
		Note 4	MIN	TYP	MAX		
DYNAMIC PERFORMANCE small-signal bandwidth large-signal bandwidth slew rate overvoltage recovery time effective aperture delay aperture jitter	V _{in} = 1/4FS V _{in} = FS V _{in} = 1.5FS (0.01%)	+25°C +25°C +25°C +25°C +25°C +25°C +25°C		185 180 357 5 1.6 4		MHz MHz V/μs ns ns ps(rms)	
NOISE AND DISTORTION (40.96MSP	S)						
signal-to-noise ratio (w/o harmonics) 2.0MHz	FS FS	+25°C Full	60	64 61		dB dB	1
9.67MHz	FS FS	+25°C Full	60	64 61		dB dB	1
19.5MHz	FS FS	+25°C Full	60	62 60		dB dB	1
spurious-free dynamic range	FS-1dB	±25°C	64	72		dBc	1
9.67MHz 19.5MHz	FS-1dB FS-1dB FS-1dB FS-1dB FS-1dB	Full +25°C Full +25°C	61 60	71 69 68 67		dBc dBc dBc dBc dBc dBc	1
intermodulation distortion	FS-1dB	Full		66		dBc	
19.49MHz (f ₁), 19.9MHz (f ₂)	FS-7dB	+25°C		75		dBFS	
differential non-linearity integral non-linearity bipolar offset error bipolar offset error bipolar gain error bipolar gain error	DC; FS DC; FS	+25°C +25°C +25°C Full +25°C Full		1.4 3.0 5.1 -4.5	25.0 15.0	LSB LSB mV mV %FS %FS	3
ANALOG INPUT AND PERFORMANC	Æ						
analog input resistance analog input capacitance		+25°C +25°C		500 2		Ω pF	
DIGITAL INPUTS input voltage	logic LOW logic HIGH logic LOW	Full Full Full	2.0	0	0.8	V V	1,3 1,3 1,3
output voltage	logic HIGH logic LOW logic HIGH	Full Full Full	2.4	4.0	25 0.8	μA V V	1,3 1,3 1,3 1,3
TIMING maximum conversion rate minimum conversion rate pulse width high pulse width low pipeline delay output propagation delay	~	Full Full Full Full Full +25°C	10.5	3.0 12.2 12.2 15	40.96 15 1.0	MSPS MSPS ns ns clk cycle ns	1,3 3 3 3 3 3
POWER REQUIREMENTS +5V supply current +5V supply current -5V supply current -5V supply current nominal power dissipation V _{EE} power supply rejection ratio V _{CC} power supply rejection ratio	41MSPS 41MSPS 41MSPS 41MSPS 41MSPS 41MSPS	+25°C Full +25°C Full +25°C +25°C +25°C		54 78 660 72 60	70 70 100 100	mA mA mA mW dB dB	1 3 1 3

Min/max ratings are based on product characterization and simulation. Individual parameters are tested as noted. Outgoing quality levels are determined from tested parameters.

Notes

- These parameters are 100% tested at 25°C.
 Typical specifications are the mean values of the distributions of deliverable converters tested to date.
- 3) Min/max data over temperature is based on the 5 sigma limit for deliverable converters tested to date.

4) Full temperature range is 0°C to +70°C for AC, -40°C to +85°C for AJ.

Absolute Maximum Ratings

positive supply voltage (V _{CC})	-0.5V to +6V
negative supply voltage (V _{EE})	+0.5V to -6V
differential voltage between any two grounds	<200mV
analog input voltage range	V_{EE} to V_{CC}
digital input voltage range	-0.5V to +V _{CC}
output short circuit duration (one-pin to ground)	infinite
junction temperature	175°C
storage temperature range	-65°C to 150°C
lead solder duration (+300°C)	10sec

Note: Absolute maximum ratings are limiting values, to be applied individually, and beyond which the serviceability of the circuit may be impaired. Functional operability under any of these conditions is not necessarily implied. Exposure to maximum ratings for extended periods may affect device reliability.

Recommended Operating Conditions

nositive supply voltage (Vac)	+5\/ +5%
negative supply voltage (VCC)	-5\/ +5%
	-3V ±3/8
differential voltage between any two grounds	<10mV
analog input voltage range	±0.5V
operating temperature range (AC)	0°C to +70°C
operating temperature range (AJ)	-40°C to +85°C

Package Thermal Resistance θ_{JC} Package θ_{JA} 80°C/W

28-pin SSOP

32°C/W

Reliability Information

Transistor count

3000

Ordering Information			
Model	Temperature Range	Description	
CLC952ACMSA CLC952AJMSA CLC952PCASM	0°C to +70°C -40°C to +85°C	28-pin SSOP (commercial part) 28-pin SSOP (industrial part) Fully loaded evaluation board with CLC952 ready for test.	
El (D	Analog Input NCODE Digital Dutputs N-2 $t_{OD} = 15ns ty$	N+1 N+2 N+1 N+2 N+2 N+2 N+2 N+2 N+2 N+2 N+2 N+2 N+2	

CLC952 Timing Diagram

CLC952 Typical Performance Characteristics (VCC = +5V, VEE = -5V)



Single Tone Output Spectrum 40.96MSPS

 $A_{IN} = 4.99MHz$

16

30.72MSPS

 $A_{IN} = 0.39 MHz$

12

40.96MSPS

0

-10

15

20

12

8

CLC952 Typical Performance Characteristics (v_{cc} = +5v, v_{EE} = -5v)

















CLC952 Typical Performance Characteristics (V_{CC} = +5V, V_{EE} = -5V)



Physical Dimensions



Symbol	Min	Max	Notes
А	1.73	2.00	
A1	0.00	0.21	
A2	1.65	1.85	
b	0.20	0.40	
b1	0.20	0.33	
С	0.10	0.22	
c1	0.10	0.18	
D	10.07	10.33	2
E	7.50	7.90	
E1	5.20	5.38	2
е	0.65 BSC		
L	0.52	0.95	
L1	1.25 REF		
R1	0.09		

Notes:

1. All dimensions are in millimeters

2. Dimensions D and E1 do not include mold protrusion. Allowable protrusion is 0.20mm per side.

CLC952 Pin Definitions



AGND (Pi	ns 1, 6, 13	B) Analog	circuit ground.
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Customer Design Applications Support

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