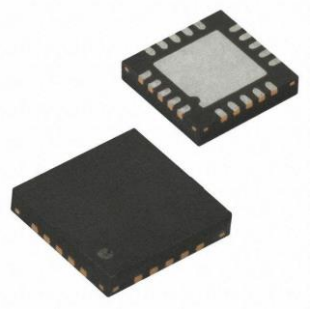
16bit, 4/8-Channel, 250kSPS, SAR ADC

PRODUCT DESCRIPTION

The MS5182N/MS5189N is a 4/8-channel, 16bit, charge redistribution successive approximation analog-to-digital converter respectively. It uses single power supply. The MS5182N/MS5189N integrates a no missing 16-bit SAR ADC, a low crosstalk multiplexer, an internal low-drift reference voltage source (optional 2.5V or 4.096V), a temperature sensor, an optional single-pole filter, and a sequencer that is useful when multiple channels are sequentially sampled.

The MS5182N/MS5189N uses SPI interface to configure registers and read converted data. SPI interface uses a separate power supply (VIO).

The MS5182N/MS5189N is available in QFN20 package and operating temperature ranges from -40°C to +125°C.



QFN20

FEATURES

- No Missing Resolution: 16bit
- Integrated Multiplexer: 4 (MS5182N), 8 (MS5189N)
- Optional Input Configurations: Unipolar and Bipolar Inputs, Single-ended and Differential Inputs
- INL (@External Reference 2.048V): +0.4LSB (Typical), ±1.5LSB (Maximum)
- Dynamic Range: 93.8dB
- SINAD (@External Reference 2.048V): 92.5dB (20kHz), THD: -100dB (20kHz)
- Analog Input Range: 0 to V_{REF} (V_{REF} up to V_{DD})
- Multiple References: Internal 2.5V or 4.096V, External
- Internal Temperature Sensor
- Channel Sequencer
- Single Power Supply : 2.3V to 5.5V
  Logical Power Supply: 1.8V to 5.5V
- Serial Interface: Compatible with SPI, MICROWIRE, QSPI and DSP
- Standby Current: 50nA

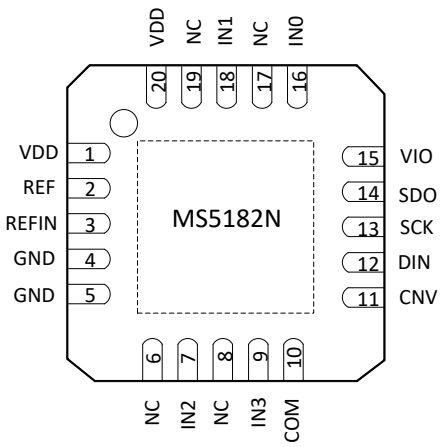
APPLICATIONS

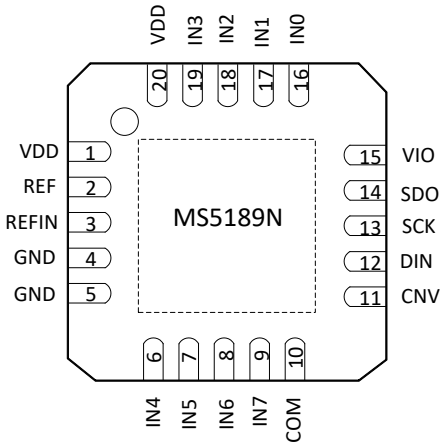
- Multichannel System Monitoring
- Battery-powered Equipment
- Medical Devices: ECG, EKG
- Mobile Communication: GPS
- Power Line Monitoring
- Data Acquisition
- Seismic Data Acquisition System
- Instrumentation
- Process Control

PRODUCT SPECIFICATION

Part Number	Package	Marking
MS5182N	QFN20	MS5182
MS5189N	QFN20	MS5189

PIN CONFIGURATION



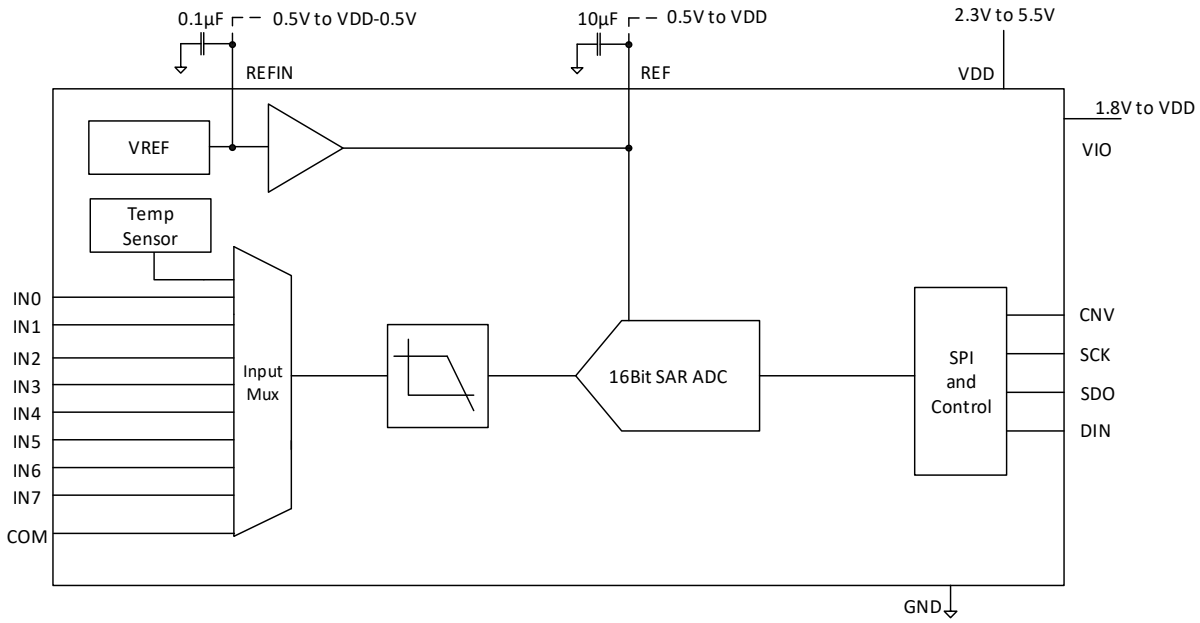


PIN DESCRIPTION

Pin	Name		Type	Description
	MS5182N	MS5189N		
1,20	VDD	VDD	-	Power Supply. Nominal value is from 2.3V to 5.5V when using external reference and decoupled with 10μF and 100nF capacitors. Minimum 3.0V when using internal reference source 2.5V; Minimum 4.5V when using internal reference source 4.096V
2	REF	REF	I/O	Reference Voltage Input/Output. A 10μF decoupling capacitor is required. This pin can output 2.5V or 4.096V reference voltage when enabling internal reference source. When the internal reference source is disabled and the internal buffer is enabled, the REFIN external reference voltage is output to the REF pin through the buffer.
3	REFIN	REFIN	I/O	Internal Reference Output/Voltage Buffer Input Pin. When an internal reference source is used, the internal output is unbuffered reference voltage and a 0.1μF decoupling capacitor is required. When the internal reference voltage buffer is enabled, a reference source from 0.5V to (VDD-0.5V) can be applied and buffered to the REF pin.
4	GND	GND	-	Ground
5	GND	GND	-	Ground
6	NC	IN4	I	MS5182N: Not Connection MS5189N: Analog Input Channel 4

Pin	Name		Type	Description
	MS5182N	MS5189N		
7	IN2	IN5	I	MS5182N: Analog Input Channel 2 MS5189N: Analog Input Channel 5
8	NC	IN6	I	MS5182N: Not Connection MS5189N: Analog Input Channel 6
9	IN3	IN7	I	MS5182N: Analog Input Channel 3 MS5189N: Analog Input Channel 7
10	COM	COM	I	Common-mode Channel Input. All input channels (IN7~IN0) can be referenced to a common-mode point of 0V or V_{REF}/2V.
11	CNV	CNV	I	Conversion Input. CNV initiates the conversion on the rising edge. During the conversion, if CNV remains low, the busy indicator is enabled.
12	DIN	DIN	I	Data Input. Used to write to 14bit configuration register. The configuration register can be written during and after conversion.
13	SCK	SCK	I	Serial Data Clock Input.
14	SDO	SDO	O	Serial Data Output.
15	VIO	VIO	-	Input/Output Interface Digital Power Supply. The nominal power supply is same as the host interface (1.8V, 2.5V, 3V or 5V).
16	IN0	IN0	I	Analog Input Channel 0.
17	NC	IN1	I	MS5182N: Not Connection MS5189N: Analog Input Channel 1
18	IN1	IN2	I	MS5182N: Analog Input Channel 1 MS5189N: Analog Input Channel 2
19	NC	IN3	I	MS5182N: Not Connection MS5189N: Analog Input Channel 3
-	EPAD	EPAD	-	Thermal Pad, Recommend to connect to system ground

BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATINGS

Any exceeding absolute maximum rating application causes permanent damage to device. Because long-time absolute operation state affects device reliability. Absolute ratings just conclude from a series of extreme tests. It doesn't represent chip can operate normally in these extreme conditions.

Parameter	Symbol	Range	Unit
Power Supply	V_{DD}	-0.3 ~ +7.0	V
Analog Input Voltage	V_{IN}	-0.3 ~ V_{DD}+0.3	V
Reference Voltage	V_{REFIN}	-0.3 ~ V_{DD}+0.3	V
Digital Input Voltage		-0.3 ~ V_{IO}+0.3	V
Digital Output Voltage		-0.3 ~ V_{IO}+0.3	V
Input Current		10	mA
Operating Temperature	T_A	-40 ~ 125	°C
Storage Temperature Range	T_{STG}	-65 ~ 150	°C
Lead Temperature (10s)		260	°C
ESD(HBM)	V_{ESD}	±3000	V

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ELECTRICAL CHARACTERISTICS

V_{DD}=2.3V to 5.5V, V_{IO}=1.8V to V_{DD}, Reference Voltage (V_{REF}) = V_{DD}, T_A=-40°C to +85°C.

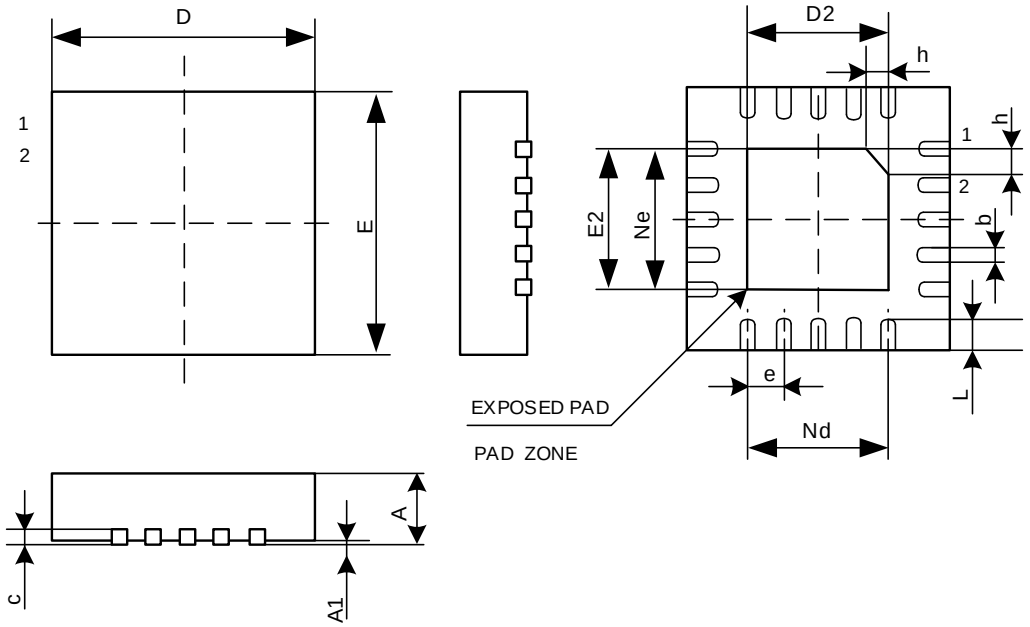
Parameter	Condition	Min	Typ	Max	Unit
Analog Input					
Analog Input Voltage	Unipolar mode	0		$+V_{REF}$	V
	Bipolar mode	$-V_{REF}/2$		$+V_{REF}/2$	
Absolute Input Voltage	Positive input, unipolar and bipolar modes	-0.1		V_{REF}+0.1	V
	Negative or COM input, unipolar mode	-0.1		+0.1	V
	Negative or COM input, bipolar mode	$V_{REF}/2$-0.1	$V_{REF}/2$	$V_{REF}/2$+0.1	V
Analog Input CMRR	f_{IN}=200kHz		68		dB
Leakage Current@25°C	Acquisition phase		1		nA
Conversion Rate					
Full Bandwidth	V_{DD}=4.5V to 5.5V	0		250	kSPS
	V_{DD}=2.3V to 4.5V	0		200	kSPS
1/4 Bandwidth	V_{DD}=4.5V to 5.5V	0		62.5	kSPS
	V_{DD}=2.3V to 4.5V	0		50	kSPS
Transient Response	Full-scale step, full bandwidth			2	µs
	Full-scale step, 1/4 bandwidth			12	µs
Accuracy					
No Missing Codes			16		Bits
INL	Reference voltage (V_{REF}) = 2.048V	-1.5	±0.4	+1.5	LSB
DNL	Reference voltage (V_{REF}) = 2.048V	-1	±0.25	+1	LSB
Transition Noise	V_{REF}=V_{DD}=5V		0.5		LSB
Gain Error		-8	±1	+8	LSB
Gain Error Match		-4	±0.5	+4	LSB
Gain Error Temperature Drift			±1		ppm/°C
Offset Error	V_{DD}=4.5V to 5.5V	-8	±1	+8	LSB
	V_{DD}=2.3V to 4.5V		±5		LSB
Offset Error Match		-4	±0.5	+4	LSB
Offset Error Temperature Drift			±1		ppm/°C
Power Supply Sensitivity	V_{DD}=5V±5%		±1.5		LSB

Parameter	Condition	Min	Typ	Max	Unit
AC Accuracy					
SNR	f_{IN}=20kHz,V_{REF}=5V	92.5	93.5		dB
	f_{IN}=20kHz, internal V_{REF}=4.096V	91	92.3		
SINAD	f_{IN}=20kHz, internal V_{REF}=2.5V	87.5	88.8		dB
	f_{IN}=20kHz, V_{REF}=5V	91	92.5		
	f_{IN}=20kHz, V_{REF}=5V, -60dB input		33.5		
	f_{IN}=20kHz, internal V_{REF}=4.096V	90	91		
THD	f_{IN}=20kHz		-100		dB
SFDR	f_{IN}=20kHz		110		dB
Crosstalk between Channels	f_{IN}=100kHz		-125		dB
Sampling Dynamics					
-3dB Input Bandwidth	Full bandwidth		1.6		MHz
	1/4 bandwidth		0.4		MHz
Aperture Delay	V_{DD}=5V		2.5		ns
Internal Reference Voltage					
REF Output Voltage	2.5V@25°C	2.490	2.500	2.510	V
	4.096V@25°C	4.086	4.096	4.106	V
REFIN Output Voltage	2.5V@25°C		1.2		V
	4.096V@25°C		2.3		V
REF Output Current			±300		μA
Temperature Drift			±10		ppm/°C
Voltage Regulation	V_{DD}=5V±5%		±15		ppm/V
Settling Time	C_{REF}=10μF		4		ms
External Reference Voltage					
Voltage Range	REF input	0.5		V_{DD}+0.3	V
	REFIN input	0.5		V_{DD}-0.5	V
Leakage Current	200kSPS,V_{REF}=5V		50		μA
Temperature Sensor					
Output Voltage	@25°C		183		mV
Temperature Sensitivity			1		mV/°C

Parameter	Condition	Min	Typ	Max	Unit
Digital Input					
Input Low-level Voltage		-0.3		+0.3×V_{IO}	V
Input High-level Voltage		0.7×V_{IO}		V_{IO}+0.3	V
Input Low-level Current		-1		+1	μA
Input High-level Current		-1		+1	μA
Digital Output					
Output High-level Voltage	I_{SOURCE}=-500μA	V_{IO}-0.3			V
Output Low-level Voltage	I_{SINK}=+500μA			0.4	V
Output Short-circuit Current				80	mA
Power Supply					
VDD	Specified Performance	2.3		5.5	V
VIO	Specified Performance	1.8		V_{DD}+0.3	V
Standby Current	V_{DD}=V_{IO}=5V, 25°C		50		nA
Operating Current	V_{DD}=2.5V, 100kSPS		0.7		mA
	V_{DD}=2.5V, 200kSPS		1.4		
	V_{DD}=5V, 200kSPS		2.5	3	
	V_{DD}=5V, 200kSPS, internal reference source		3.2	4	

PACKAGE OUTLINE DIMENSIONS

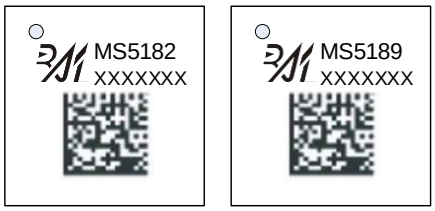
QFN20



Symbol	Dimensions in Millimeters		
	Min	Typ	Max
A	0.70	0.75	0.80
A1	-	0.02	0.05
b	0.18	0.25	0.30
c	0.18	0.20	0.25
D	3.90	4.00	4.10
D2	1.90	2.00	2.10
e	0.50BSC		
Ne	2.00BSC		
Nd	2.00BSC		
E	3.90	4.00	4.10
E2	1.90	2.00	2.10
L	0.35	0.40	0.45
h	0.25	0.30	0.35

MARKING and PACKAGING SPECIFICATION

1. Marking Drawing Description



Product Name: MS5182, MS5189

Product Code: XXXXXXX

2. Marking Drawing Demand

Laser printing, contents in the middle, font type Arial.

3. Packaging Specification

Package 1

Device	Package	Piece/Reel	Reel/Box	Piece/Box	Box/Carton	Piece/Carton
MS5182N	QFN20	1000	8	8000	4	32000
MS5189N	QFN20	1000	8	8000	4	32000

Package 2

Device	Package	Piece/Reel	Reel/Box	Piece/Box	Box/Carton	Piece/Carton
MS5182N	QFN20	3000	1	3000	8	24000
MS5189N	QFN20	3000	1	3000	8	24000

STATEMENT

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- The process of improving product is endless. And our company would sincerely provide more excellent product for customer.

MOS CIRCUIT OPERATION PRECAUTIONS

Static electricity can be generated in many places. The following precautions can be taken to effectively prevent the damage of MOS circuit caused by electrostatic discharge:

1. The operator shall ground through the anti-static wristband.
2. The equipment shell must be grounded.
3. The tools used in the assembly process must be grounded.
4. Must use conductor packaging or anti-static materials packaging or transportation.

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