Analog-to-Digital Converters (ADCs)

Microchip offers several families of analog-to-digital converters (ADCs). High performance combined with low-cost and low-power consumption make these ADCs ideal for portable instrumentation, embedded control and data acquisition applications.

Product Summary

The **MCP3XXX** series SAR ADCs have 10, 12 and 12-bit plus sign resolutions with sampling rates up to 200 ksps. Communication with the device is accomplished with a simple serial interface using the SPI or I²C™ protocols. These ADCs come with excellent linearity where DNL and INL are less than ±1 LSB. The low-current consumption and small packages make these ADCs ideal for process control, data acquisition and portable instrumentation applications.

The **MCP3550/1/3** devices are 2.7V to 5.5V low-power, 22-bit delta-sigma Analog-to-Digital Converters (ADCs). The devices offer output noise as low as 2.5 µVRMS, with a total unadjusted error of less than 10 ppm. The family exhibits 6 ppm max. Integral Non-Linearity (INL) error, 3 µV offset error and 2 ppm full-scale error. The MCP3550/1/3 devices provide high accuracy and low noise performance for applications where sensor measurements (such as pressure, temperature and humidity) are performed. With the internal oscillator and high oversampling rate, minimal external components are required for high-accuracy applications.

The **TC500** series dual slope ADCs have a high resolution of up to 17 bits plus the sign bit with fully differential inputs. These ADCs have serial interface.

The BCD and binary ADCs have 3½ digit, 4½ digit and 15-bit resolutions. The overrange and underrange detection features make it useful for applications in data acquisition, display systems, and portable instrumentation.

The display ADCs feature 3½ to 4½ digit resolution with direct LCD or LED drives for display in digital meters, portable instrumentation and analog measurement applications.

Features for Selected Products

- Up to 22-bit resolution
- Low-power consumption
- Up to 200 ksps sampling rate
- Differential or single-ended input configurations
- DNL and INL < ±1LSB
- Overrange and underrange detection
- Low battery detection
- On-chip voltage reference
- Auto-ranging

Related Application Notes

AN246   Driving the Analog Inputs of a SAR A/D Converter

AN681   Reading and Using Fast Fourier Transforms (FFT)

AN688   Layout Tips for 12-Bit A/D Converter Application

AN693   Understanding A/D Converter Performance Specifications

AN695   Interfacing Pressure Sensors to Microchip's Analog Peripherals

AN699   Anti-Aliasing Analog Filters for Data Acquisition Systems

AN702   Interfacing Microchip MCP3201 A/D Converter to 8051-Based Microcontroller

AN703   Using the MCP320X 12-Bit Serial A/D Converter with Microchip PIC® Microcontroller Devices

AN704   Interfacing Microchip's MCP3201 Analog/Digital (A/D) Converter to MC68HC11E9-Based Microcontroller

AN719   Interfacing Microchip's MCP3201 Analog-to-Digital Converter to the PIC® Microcontroller

AN842   Differential ADC Biasing Techniques, Tips and Tricks

AN845   Communicating with The MCP3221 Using PIC® Microcontrollers

AN1007   Designing with the MCP3551 Delta-Sigma ADC

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Additional Information

- Microchip's web site: www.microchip.com
- *Product Selector Guide*, DS00148
- *Stand-Alone Analog and Interface Solutions*, DS21060
- *Microchip's Technical Library CD-ROM*, DS00161
- *Analog & Interface Families Data Book 2002*, DS00207

Related Tools

- FilterLab® Software
- MXDEV® Analog Evaluation System available at: www.microchip.com

Successive Approximation Register (SAR) A/D Converters

Product	Res. (Bits)	Sample Rate	# Channels	Interface	Input Range	Supply Current (µA)	INL (ppm)	Packages
MCP3001/2/4/8	10	200 ksps	1/2/4/8 SE	SPI	2.7-5.5V	400-520	±1	8P, SO, ST, 14P, SO, ST, 16P, SO
MCP3201	10	22 ksps	1 SE	I²C™	2.7-5.5V	175-250	±1	5OT
MCP3201/2/4/8	12	100 ksps	1/2/4/8 SE	SPI	2.7-5.5V	400-550	±1	8P, SO, ST, 14P, SO, ST, 16P, SO
MCP3221	12	22 ksps	1 SE	I²C	2.7-5.5V	110	±1	5OT
MCP3301/2/4	13	100 ksps	1/2/4 Diff	SPI	2.7-5.5V	200-400	±1	8P, SO, MS, 14P, SO, ST, 16P, SO

Delta-Sigma A/D Converters

Product	Res. (Bits)	Sample Rate	# Channels	Interface	Supply Voltage Range	Typical Supply Current (µA)	INL (ppm)	Packages
MCP3550-50	22	13 sps	1 Diff	SPI	2.7-5.5V	120	2	8SO, MS
MCP3550-60	22	15 sps	1 Diff	SPI	2.7-5.5V	140	2	8SO, MS
MCP3551	22	14 sps	1 Diff	SPI	2.7-5.5V	120	2	8SO, MS
MCP3553	20	60 sps	1 Diff	SPI	2.7-5.5V	140	2	8SO, MS
MCP3421	18 to 12	4 to 240 sps	1 Diff	I²C	2.7-5.5V	150	10	6OT

Dual Slope A/D Converters

Product	Res. (Bits)	Sample Rate	# Channels	Interface	Input Range	Supply Voltage	Features	Packages
TC500/A	Up to 16/17	4 to 10 Conv./s	1	3-Wire	V_{SS} + 1.5V to V_{DD} − 1V	±4.5 to ±7.5V	Diff. inputs, program conv. time	16P, SO
TC510/514	Up to 17	4 to 10 Conv./s	1/4	3-Wire	V_{SS} + 1.5V to V_{DD} − 1V	+4.5 to +5.5V	Diff. inputs, program conv. time, charge pump (-V) output pin	24P, SO, 28P, SO
TC520A	–	–	–	Serial Port	–	+4.5 to +5.5V	Optional serial interface adapter for TC500/500A/510/514	14P, 16 SO
TC530/534	Up to 17	3 to 10 Conv./s	1/4	Serial Port	$2V_{SS}$ + 1.5V to V_{DD} − 1V	+4.5 to +5.5V	Diff. inputs, Program res./conv. time, charge pump (-V) output pin	28P, SO, 40P, 44PQ
TC7109/A	12 + sign	2 to 10 Conv./s	1	Parallel or Serial Port	V_{SS} + 1.5V to V_{DD} − 1V	±4.5 to ±5.5V	Differential inputs	40P, JW, 44L, 44PQ

Binary and BDC A/D Converters

Product	Description	Res.	Res. Counts	Interface	Input Range	Supply Voltage	Typ. Power	Features	Packages
TC835	BCD A/D	4½ digits	±20,000	MUXed BCD	V_{SS} + 1V to V_{DD} − 0.5V	±5V	8.5 mW	Upgrade to TC7135	28P, 44/64PQ
TC850	Binary A/D	15 bit	±32,768	8-bit parallel	V_{SS} + 1.5V to V_{DD} − 1V	±5V	20 mW	High speed (40 conv./s)	40P, JW, 44L
TC7135	BCD A/D	4½ digits	±20,000	MUXed BCD	V_{SS} + 1V to V_{DD} −1V	±5V	8.5 mW	For DMM, DPM, dataloggers	28P, L, 64PQ
TC14433/A	BCD A/D	3½ digits	±2,000	MUXed BCD	±199.9 mV to ±1.999V	±4.5 to ±8V	4 mW	For DMM, DPM,	24P, SO, JW, 28L

Display A/D Converters

Product	Display Type	Res.	Res. Counts	Supply Voltage	Power	Features	Packages
TC820	LCD	3¾	±4,000	9V	10 mW	DMM, freq counter & logic probe	40P, 44L, PQ
TC7106/A	LCD	3½ digits	±2,000	9V	10 mW	For DMM, DPM, datalogger	40P, JW, 44L, PQ
TC7107/A	LED	3½ digits	±2,000	±5V	10 mW	For DMM, DPM, datalogger	40P, JW, 44L, PQ
TC7116/A	LCD	3½ digits	±2,000	9V	10 mW	Hold function	40P, JW, 44L, PQ
TC7117/A	LED	3½ digits	±2,000	±5V	10 mW	Hold function	40P, JW, 44L, PQ
TC7126/A	LCD	3½ digits	±2,000	9V	0.5 mW	Low-power TC7106	40P, JW, 44L, PQ
TC7129	LCD	4½ digits	±20,000	9V	4.5 mW	Lowest noise ±3 µV sensitivity	40P, 44L, PQ

Package Key: **L** = PLCC   **MS** = MSOP   **P** = PDIP   **PQ** = 44-Pin & 64-Pin PQFP   **SO** = SOIC   **ST** = TSSOP   **OT** = SOT-23A   **JW** = CERDIP

www.microchip.com/analog

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