## FEATURES

- **12-Bit SAR ADC**
- **125kSPS sampling rate**
- **Single supply single channel**
- **Low power dissipation 1.9mW**
- **Shutdown feature**
- **Flexible serial interface**
- **Supply voltage of 2.7V to 5.5V**
- **Temperature range: –40°C to +85°C**
- **8-lead TSSOP**

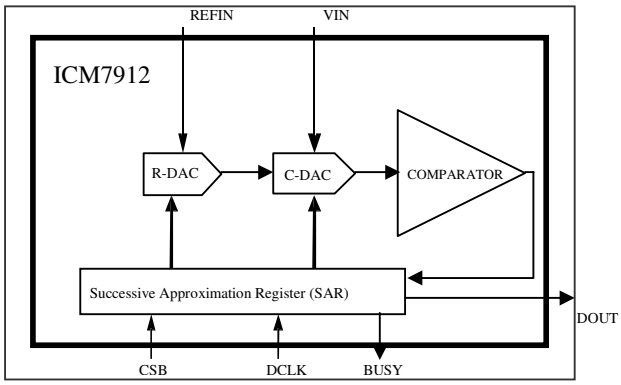
## APPLICATIONS

- PDA's
- Touch screen monitors
- Hand held devices
- Instrumentation and control systems
- Data Acquisition Systems
- Automotive

## OVERVIEW

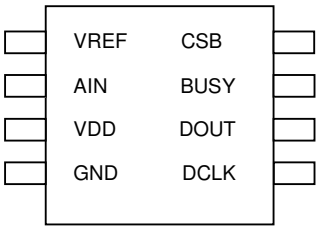
The ICM7912 is a 12-bit 125kSPS through put rate Analog-to-Digital Converter with a unipolar, single-ended input. It has successive approximation register (SAR) architecture and can sample the analog input. It has a flexible serial interface.

## BLOCK DIAGRAM



## PACKAGE

**8-Pin TSSOP**




## PIN DESCRIPTION

| Pin No | Symbol | Description |
|---|---|---|
| 1 | VREF | Reference input |
| 2 | AIN | Analog Input |
| 3 | VDD | Power Supply Input. Range is from 2.7V to 5.5V |
| 4 | GND | Ground |
| 5 | DCLK | External CLK Input |
| 6 | DOUT | Serial Data output, clocked out on falling edge of CLK |
| 7 | BUSY | BUSY output |
| 8 | CSB | Chip Select input Active Low. Initiates conversion and enables serial data. |

## ABSOLUTE MAXIMUM RATING

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $V_{DD}$ | Supply Voltage | -0.3 to 6.0 | V |
| $I_{IN}$ | Input Current | +/- 100.0 | mA |
| $V_{IN\_}$ | Digital Input Voltage | -0.3 to 6.0 | V |
| $V_{IN\_REF}$ | Reference Input Voltage | -0.3 to 6.0 | V |
| $T_{STG}$ | Storage Temperature | -65 to +150 | °C |
| $T_{SOL}$ | Soldering Temperature | 300 | °C |

**Note**: Stress greater than 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 sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.

## ORDERING INFORMATION

| Part | Temperature Range | Package |
|---|---|---|
| ICM7912 | -40°C to 85°C | 8-Pin TSSOP |

## DC ELECTRICAL CHARACTERISTICS

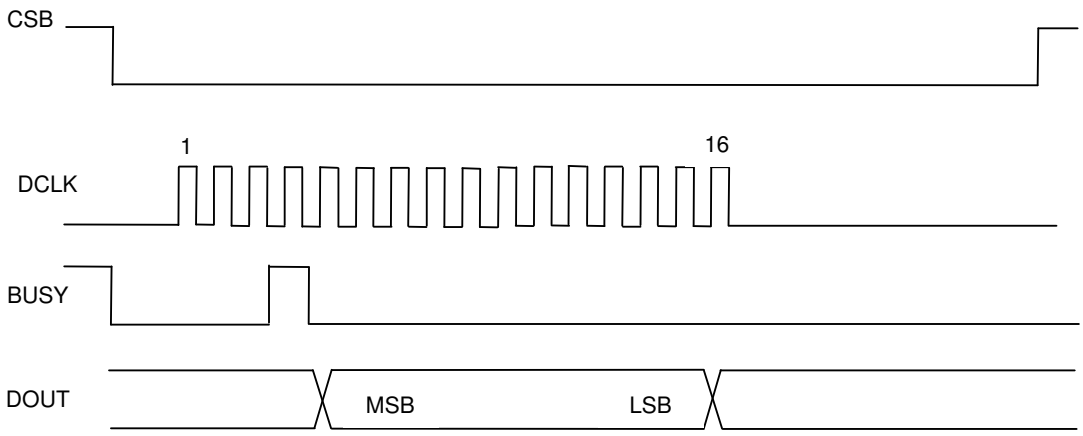
(VDD= 3.5V, Maximum Sample Rate, REF= 2.5V; all specifications $T_{MIN}$ to $T_{MAX}$ unless otherwise noted)

| Symbol | Parameter | Test Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **DC PERFORMANCE** | | | | | | |
| | | | | | | |
| N | Resolution | (Note 1) | | 12 | | Bits |
| No Missing Codes | | (Note 1) | | 12 | | Bits |
| INL | Integral Nonlinearity | (Note 1) | | | 0.25 | % of FSR |
| GE | Gain Error | (Note 1) | | | 1 | % of FS |
| OE | Offset Error | (Note 1) | | | 30 | mV |
| **POWER REQUIREMENTS** | | | | | | |
| VDD | Supply Voltage | (Note 2) | 2.7 | | 5.5 | V |
| $I_{VDD}$ | Supply Current | (Note 1) | | 600 | | µA |
| $I_{SHTDOWN}$ | Supply Current | (Note 1) | | 40 | | µA |

| Symbol | Parameter | Test Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **LOGICINPUT/OUTPUT CHARACTERISTICS (VDD = 2.5V)** | | | | | | |
| VIH | | | 2.4 | | | V |
| VIL | | | | | 0.4 | V |
| VOH | IOH = 50 µA | (Note 1) | 2.4 | | | V |
| VOL | IOL = 50 µA | (Note 1) | | | 0.4 | V |
| **SWITCHING SPECIFICATIONS (CLK INPUT)** | | | | | | |
| Fsample | Maximum Conversion Rate | (Note 2) | | | 125 | kSPS |
| | Minimum Conversion Rate | (Note 2) | 0.5 | | | kSPS |
| TCLK | CLK Period | (Note 2) | 500 | | | ns |
| | Pulse-width High | (Note 2) | 250 | | | ns |
| | Pulse-width Low | (Note 2) | 250 | | | ns |
| $T_{Delay}$ | Data out Delay | (Note 2) | | 5 | | ns |
| | Wake-up Time | (Note 2) | | 20 | | ms |
| **REFERENCE** | | | | | | |
| $R_{IN}$ | Reference Input Resistance | (Note 1) | | 32 | | kΩ |
| | Reference Input Span | | | | VDD | V |
| $I_{REF}$ | Reference Input Current | | | 80 | | µA |

Note 1: 100 % Production Tested at 25 C; guaranteed by design and characterization testing for temperature range.
Note 2: Guaranteed by design& characterization testing.
Note 3: See Applications Information.
Note 4: 12 Monotonicity only guaranteed at REFIN MAX of VDD-1. Reference Input can swing to a higher value till VDD, with some degradation in DC performance and monotonicity could degrade to only 11 bits at high reference input.

## TIMING DIAGRAM




## DETAILED DESCRIPTION

The ICM7912 is a SAR architecture 12-Bit ADC. It operates on a 2.7V to 5.5V single supply and consumes about 600µA supply current when operating on a 2MHz external clock. The output throughput rate is a maximum of 125 kSPS when the DCLK is running at at the maximum frequency of 2MHz.

The ADC is composed of a high performance capacitive DAC and a comparator along with SAR control logic and resistor string segment. The reference input drives the resistor string directly and has an input resistance of around 32 kΩ.

The ICM7912 comes complete with a high performance CMOS sample and hold amplifier made up by the capacitive DAC.

There is shutdown capability which is active between conversions when CSB is high. The converter will shut down to under 40 µA of supply current.

## APPLICATIONS INFORMATION

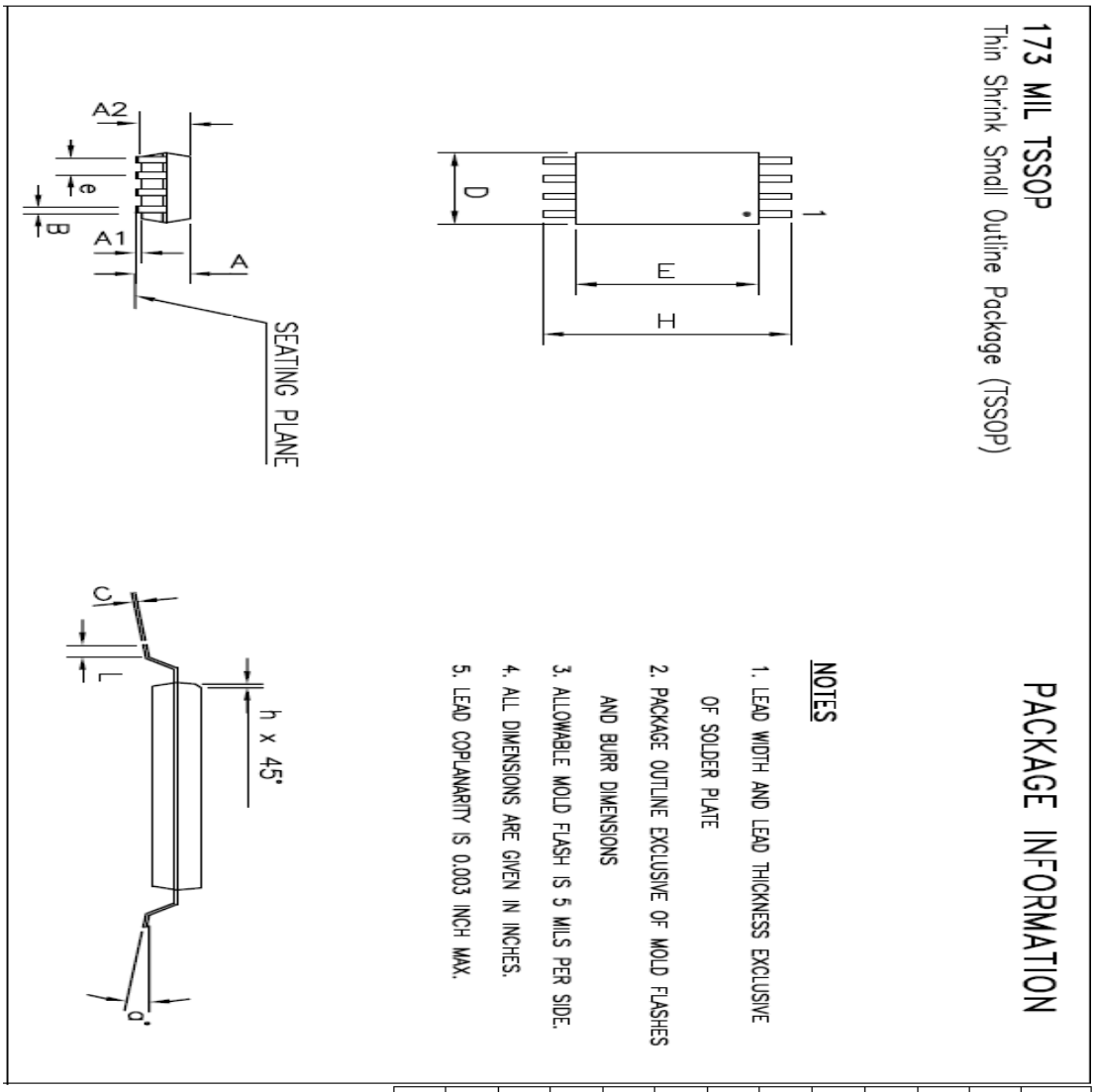
The IC7912 has a single ended analog input which can swing from GND to VDD. The reference input has a range from GND to VDD and can be tied to VDD for largest input range.

The ICM7912uses the DCLK as the external clock and this controls all the transfer of information to and from the ADC.

One complete conversion cycle of the ICM7912 will take 16 clock cycles. As CSB is pulled low the ADC powers up and initiates a sampling/conversion cycle. Data is clocked out MSB first on the falling edge of the DCLK input. The analog input is sampled on the first three clock pulses and then conversion process begins. The DOUT is available from the falling edge of the 4$^{th}$ DCLK pulse MSB first and the LSB is available on the falling edge of the 15$^{th}$ DCLK pulse. Since there is some propagation delay the DOUT should be sampled on the rising edge of the following clock pulse. So this implies the MSB can be safely sampled on the 5$^{th}$ DCLK rising edge and the LSB can be sampled on the 16$^{th}$ DCLK rising edge.

## PACKAGE INFORMATION

### 8 LEAD TSSOP STANDARD PACKAGE




| JEDEC# | MO-153AA | |
|---|---|---|
| TYPE | 08 LEAD | |
| SYMBOL | Min | Max |
| A | 0.034 | 0.047 |
| A1 | 0.002 | 0.006 |
| B | 0.007 | 0.012 |
| C | 0.004 | 0.008 |
| D | 0.114 | 0.122 |
| E | 0.169 | 0.177 |
| e | 0.0256 BSC | |
| H | 0.252 BSC | |
| L | 0.020 | 0.030 |
| α° | 0° | 8° |