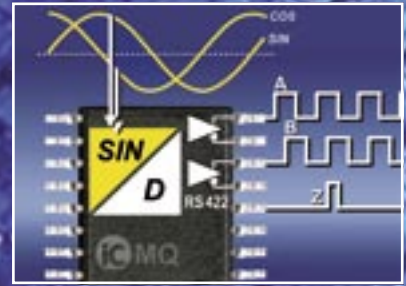


iC-MQ

PROGRAMMABLE 9-BIT SIN/COS INTERPOLATION IC WITH RS422 DRIVER



Interpolator iC-MQ is a non-linear A/D converter which, by applying a count-safe vector principle, digitizes sine/cosine sensor signals with selectable resolution and hysteresis. The angle value is output incrementally via differential RS422 drivers as an encoder quadrature signal with an index pulse. The minimum phase distance can be preselected, thus generating fail-safe counter signals and enhancing the noise immunity of the sensor system.

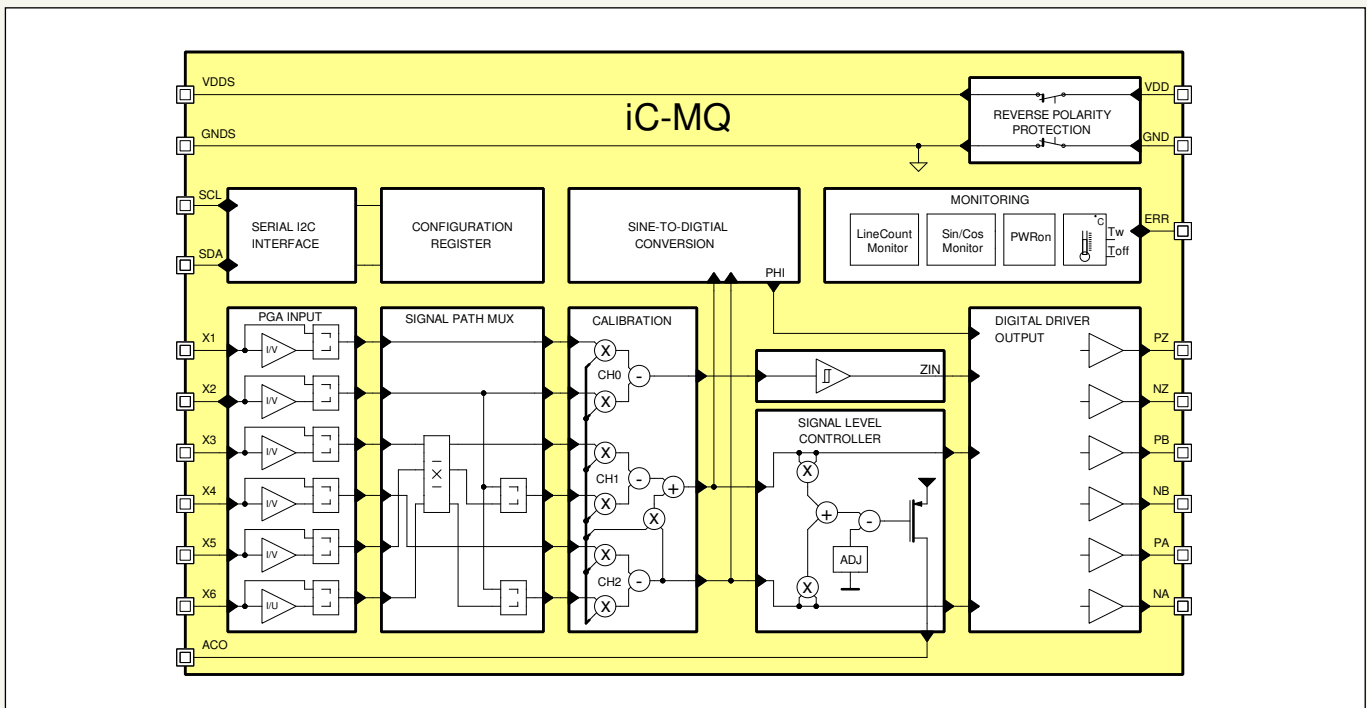
The integrated signal conditioning unit allows signal amplitudes and offset voltages to be calibrated and also a phase error between the sine and cosine signals to be corrected.

Applications

- Optical and magnetic position sensors
- Rotary encoders
- Linear encoders

Features

- Latency-free sine-to-digital conversion to 400 angle steps
- 200 kHz input freq. for x1 to x5 interpolation (10 kHz for x100)
- Flexible pin assignment due to signal path multiplexers
- PGA inputs for differential and single-ended signals
- Variable input resistance for current/voltage conversion
- Signal conditioning for offset, amplitude and phase
- Controlled 50 mA current source for LED or MR sensor supply
- Fault-tolerant RS422 50 mA sink/source outputs
- Preselectable minimum phase distance for spike-proof counter stimulus
- Zero signal conditioning and electronic index generation
- Signal and operation monitoring with configurable alarm output, output shutdown and error storage
- I²C multimaster interface for in-circuit calibration and parameters (EEPROM)
- Adjustable overtemperature alarm and shutdown
- Supply from 4.3 to 5.5 V, operation from -25 (-40) to +100 °C
- Reverse polarity protection including the sub-system



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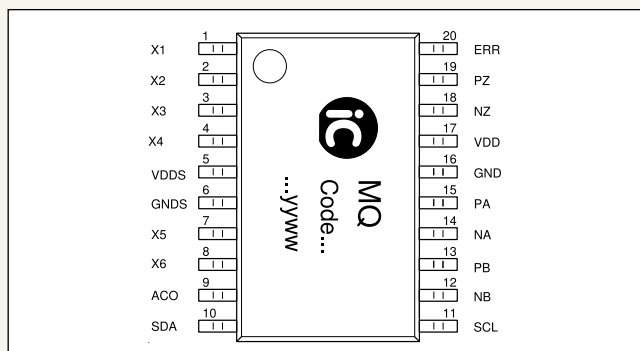
For the purpose of signal stabilization (to minimize the effects of temperature and aging), the conditioned signals are fed into the signal level controller which drives the transmitting LED of optical systems via the integrated 50 mA driver stage (output ACO). If MR sensors are connected this driver stage also powers the measuring bridges. If the control limits are reached this is signaled at alarm message output ERR (signal loss due to wire breakage, short circuiting, dirt or aging, for example).

iC-MQ is protected against a reversed power supply voltage; the integrated supply switch for loads of up to 20 mA extends this protection to cover the overall system. The device is configured via I²C, either from a microcontroller or an external EEPROM.

Pin Functions

No.	Name	Function
1	X1	Signal Input 1 (Index +)
2	X2	Signal Input 2 (Index -)
3	X3	Signal Input 3
4	X4	Signal Input 4
5	VDDS	Power Supply Output (secured)
6	GNDS	Power Supply Ground (secured)
7	X5	Signal Input 5
8	X6	Signal Input 6
9	ACO	Signal Level Controller, high-side current source output
10	SDA	Ser. Configuration Interface, data line
11	SCL	Ser. Configuration Interface, clock line
12	NB S4	Incremental Output B - / Test Signal Output
13	PB S3	Incremental Output B + / Test Signal Output
14	NA S2	Incremental Output A - / Test Signal Output
15	PA S1	Incremental Output A + / Test Signal Output
16	GND	Ground
17	VDD	+4.3 ... 5.5 V Pos. Supply Voltage
18	NZ S6	Incremental Output Z - / Test Signal Output
19	PZ S5	Incremental Output Z + / Test Signal Output
20	ERR	Error Message I/O / Test Mode Trigger Input

Pin Configuration TSSOP20 4.4 mm



Compatible Sensors

Photodiode arrays, AMR sensors, GMR sensors

Key Specifications

Inputs and Signal Conditioning	
Differential Input Signal Range	10 to 500 mVpp, 40 mVpp to 2 Vpp
Single-Ended Input Signal Range	20 mVpp to 1 Vpp, 80 mVpp to 4 Vpp
Input Current Range	+/- 10 µA to +/- 300 µA
Input Resistance	typ. 1.6 kΩ to 4.6 kΩ (I mode) typ. 20 kΩ or high impeded. (V mode)
Permissible Input Frequency	to 200 kHz (10 kHz @ IPF x100)
Input Gain Range	0.5x to 25x and 2x to 100x
Gain Ratio Calibration Range	40 % to 250 % (sine vs. cosine)
Gain Calibration Step	1.5 %
Offset Calibration Range (based on calibration reference)	to +/- 100 %, +/- 200 %, +/- 600 %, +/- 1200 %
Offset Calibration Step	0.8 %, 1.6 %, 4.8 %, 10 % and 3.2 % to 37.4 % for index channel
Phase Calibration Range	+/- 20 ° (sin vs. cos)
Phase Calibration Step	0.65 °

Sine-to-Digital Conversion	
Conversion Rate	typ. 5 MSPS
Interpolation Factors	x1, x2, x3, x4, x5, x6, x8, x10, x16, x20, x24, x25, x32, x48, x50, x96, x100
Angle Resolutions	4 to 400 steps/period
Angle Hysteresis	0.9° to 11.7°, ½ and 1 LSB
Absolute Angle Accuracy	1.8° max.
Relative Angle Accuracy	+/- 10 % edge vs. period
Angle Repeatability	typ. 0.1°

Incremental Outputs	
Drive Modes	push-pull, highside, lowside
Push-pull Drive Mode	RS422 to 100 Ω, +/- 50 mA
A/B Output Frequency	to 1.25 MHz
A/B Output Min. Phase Distance	200 ns to 1.6 µs
Z Index Position	adjustable to any angle step
Z Index Length	90°, 180°, 270°, 360°

Signal Level Controller	
Control Modes	constant current, sine square, sum
Operating Range	to 50 mA (short-circuit-proof), Vs 1.2 V max.
Control Alarm Thresholds	approx. 2 % and 100 % of range limit

Sub-System Power Switch	
Permissible Load Current	to 20 mA
Drop Out Voltage	150 mV per switch (@ 10 mA)

Other Operational Data	
Supply Voltage	single 4.3 to 5.5 V, 25 mA max.
Operational Temp. Range	-25 °C to +100 °C (ext. -40 °C)
Package	TSSOP20 4.4 mm or bare die
Device Configuration	external EEPROM, via I2C multi-master interface from microcontrollers
Monitoring and Alarms	lack of input signal (due to wire breakage, short-circuit, loss of magnet, etc.), excessive input signal level, signal level controller out of range, thermal overload, power up configuration error
Other Operational Modes	calibration and test modes

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