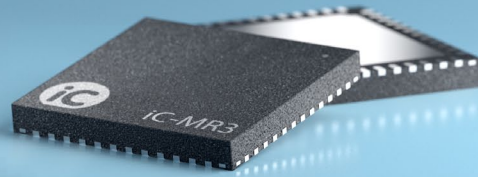


iC-MR3

13-Bit S&H Sin/Cos Interpolator with 2.5V/5V Controller Interfaces



Description

iC-MR3 combines high-precision analog signal-conditioning with 1 Vpp line drivers for sine/cosine signals and a fast, high-resolution sampling sine-to-digital converter. An absolute data interface (ADI) presets period counting, whereas multiturn and singleturn offset values can adjust the final position data. iC-MR3 features a parallel 8-bit and a serial 4-pin SPI microcontroller interface. Alternatively, the serial I/O interface can function as a sensor interface either in BiSS C protocol (up to 10MHz, bidirectional) or in SSI protocol (up to 4MHz). A 12-bit ADC can evaluate an external temperature sensor; monitoring a motor's temperature is supported by configurable alarms. The device aims at high-resolution position encoders and safety-oriented applications.

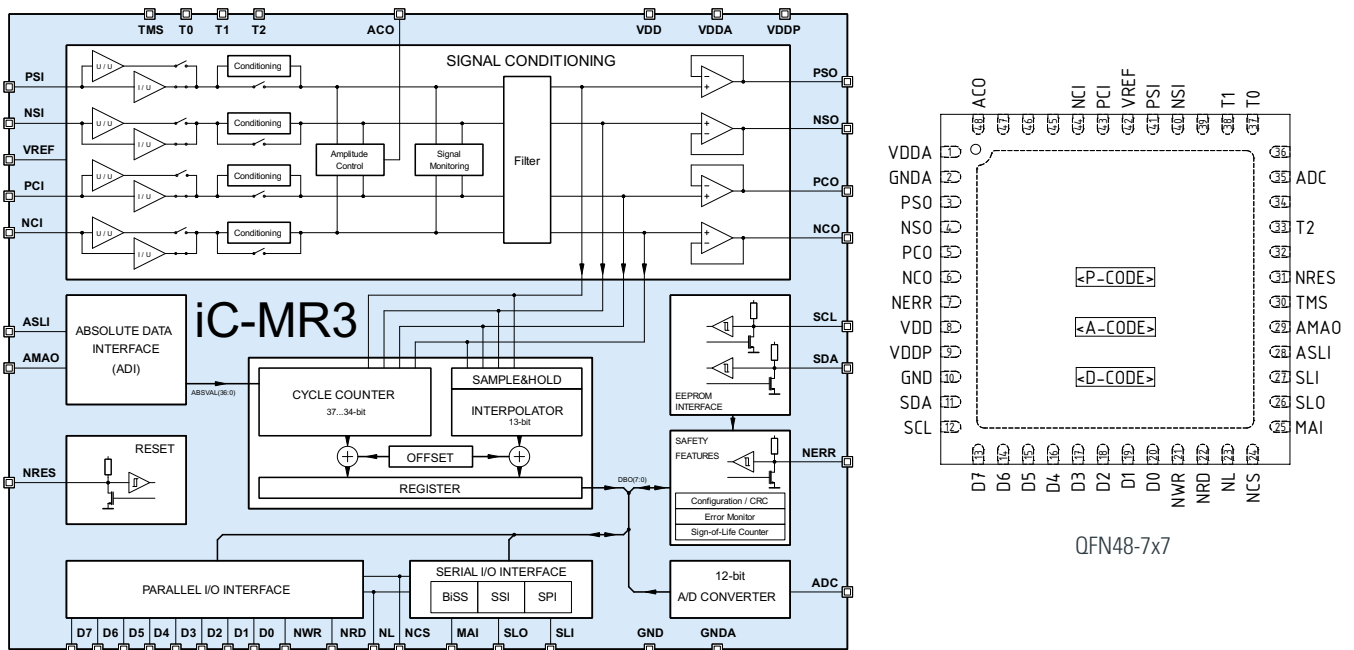
Applications

- Fast position decoding for safety-oriented encoder systems
- Motor feedback systems

Features

- Triggered 13-bit sine-to-digital conversion within 2 μs
- PGA inputs for differential and single-ended signals of up to 500 kHz
- Variable input resistance for current/voltage conversion
- Signal conditioning for offset, amplitude, and phase
- Input signal stabilization through LED or MR bridge current control
- 8-bit parallel and serial I/O interfaces (BiSS, SSI, and SPI) with separate low-voltage supply
- Absolute data interface (BiSS/SSI) for initialization
- Position data of up to 50 bit with adjustable ST/MT data length
- Position data preset using ST/MT offset registers
- 12-bit A/D converter for temperature sensing
- Special functions for safety applications (signal monitoring, sign-of-life counter, and extended CRC)
- Current-limited, diff. 1 Vpp sin/cos outputs to 100 Ω
- Device configuration through I/O interfaces or I²C EEPROM
- Single-sided 5V operation from -40 to +125 °C

Block Diagram



iC-MR3

13-Bit S&H Sin/Cos Interpolator

Key Specifications

Sin/Cos Inputs and Conditioning

Max. Input Frequency	500 kHz
Input Signal Amplitude	Differential 20 mV to 1 V (up to 4 V using divider) Single-ended 40 mV to 2 V (rail-to-rail using divider)
Input Offset Error	300 μ V max.
Input Resistance	High impedance (typ. 20 k Ω using divider) Typ. 1.6 to 4.6 k Ω (current mode)
Input Current Range	\pm 4.3 to \pm 625 μ A (current mode)
Input Gain	x2 to x100 (up to x25 using divider)
Gain Ratio Calibration	40 to 250% (sine to cosine), in steps of 0.09%
Offset Calibration	Range \pm 300% (steps of 0.3%), up to \pm 3600% (steps of 3.6%)
Calibration Ref.	0.25V, 0.5V, VDC, 5% V (ACO)
Phase Calibration	Up to \pm 10.4° (sine to cosine), in steps of 0.02°

1 Vpp Sin/Cos Outputs

Diff. Amplitude	Typ. 500 mV (to 100 Ω pin-to-pin)
Short-Circuit Current	Typ. 20 mA, 40 mA max.
Output Offset Error	Typ. \pm 200 μ V

Signal Level Control

Control Modes	Sin/cos square, sum, square & sum, hysteresis
Operating Range	Up to 50 mA (short-circuit-proof), Vs 1.2V max.
Control Alarm	At 3% and 90% of range limits

Sine-to-Digital Conversion

Resolution	13 bit per input cycle
Conversion Rate	Typ. 2 μ s with cyclic readout
Accuracy (INL)	Typ. 0.13° per input cycle

12-bit A/D Converter

Input Voltage Range	0 to 2.5V
16-bit Temperature Value	Resolution 0.5 mV (12 bit), adjustable offset and slope
Temperature Monitoring	Adjustable min./max. alarm thresholds
Conversion Rate	1.1 ms

Data I/O Interfaces

I/O Interfaces	BiSS (10 MHz), SSI (4 MHz), SPI (10 MHz), I ² C master to serial EEPROM (140 kHz)
Position Data Length	Up to 50 bit (incl. up to 26 bit ST data)
Absolute Data Interface	BiSS (7.5 MHz, 1.875 MHz) or SSI (940 kHz, 235 kHz)
ADI Format	MT data: 0, 8, 12, 16, 24 bit ST data: 0 to 24 bit, Sync 0 to 3 bit

Other Operational Data

Main Supply Voltage	5V \pm 10%, typ. 33 mA
Digi. I/O Supply Voltage	2.5 to 5.5 V, typ. 1 mA
Operational Temperature	-40 to +125 °C
Package	QFN48-7x7 (7 mm x 7 mm)
Device Configuration	From serial I ² C EEPROM or MCU

Pin Functions

Name	Function
VDDA	5V Supply Voltage, analog
GNDA	Ground, analog
PSO	Sine Output
NSO	Sine Output, inverted
PCO	Cosine Output
NCO	Cosine Output, inverted
NERR	Error Signal, input/indication output*
VDD	5V Supply Voltage, digital
VDDP	2.5 to 5V I/O Supply Voltage, digital
GND	Ground, digital
SDA, SCL	EEPROM Interface, I ² C
D7 to D0	Parallel Interface, data line / Status Output
NWR, NRD	Parallel Interface, write/read signal*
NL	Parallel/Serial Interface, Data Acquisition Trigger Input
NCS (NCS)	Parallel/Serial Interface, chip select*
MAI (SCLK)	Serial Interface, clock input
SLO (MISO)	Serial Interface, data output
SLI (MOSI)	Serial Interface, data input
ASLI	Absolute Data Interface, data input
AMA0	Absolute Data Interface, clock output
TMS	Test Mode Selection Input
NRES	Reset Signal, input/indication output*
T0 to T2	Test Pin
ADC	12-bit ADC Input, temperature sensor
NSI	Sine Input, inverted
PSI	Sine Input
VREF	Reference Voltage, input/output
PCI	Cosine Input
NCI	Cosine Input, inverted
ACO	Amplitude Control Output, high-side current source

*) Pin is low active.

Safety Functions

Signal Monitoring	By Lissajous figure monitoring
Status Byte	Configuration completed, error, warning, bus occupied, write lock CFG/EDS, ADI data valid, position data valid
Error/Warning Masking	External system, ADI reading, conversion, configuration, temperature, amplitude, control
Configuration Check	On startup & command
Error Simulation	On set/reset commands
Position Data CRC	6 bit, 16 bit
Sign-of-Life Counter	6 bit (BiSS), 8 bit (SPI, PAR)