iC-MUE

Magnetic Off-Axis Absolute Position Encoder



Description

The iC-MUE is a magnetic Hall off-axis absolute encoder System-on-Chip (SoC) for rotary or linear position sensing and motor feedback. Absolute position information is obtained using the dual-track Nonius principle. Decimal Nonius combinations are supported for arbitrary magnetic scale sizes ≥ 20 mm. Differential scanning suppresses external magnetic interference fields and ensures robust position feedback.

The on-chip interpolator resolves 21 bits angle resolution from a common Ø 44 mm magnetic scale (32 pole pairs). Auto-adjustment and digital angle correction (eccentricity compensation and LUT linearization) ensure reliable and best possible measurement results after end-of-line assembly as well as in-field installation of the encoder system. Automatic gain control keeps the Hall sensor signals at the optimal operating point.

The BiSS, SSI and SPI interfaces allow seamless integration into industrial or embedded environments. Programmable FlexCount® ABZ output resolution and UVW signals for motors of 1 to 32 pole pairs easily adapt the encoder to any motor feedback application. The integrated Absolute Data Interface (ADI) is compatible with established iC-Haus multiturn sensor solutions.

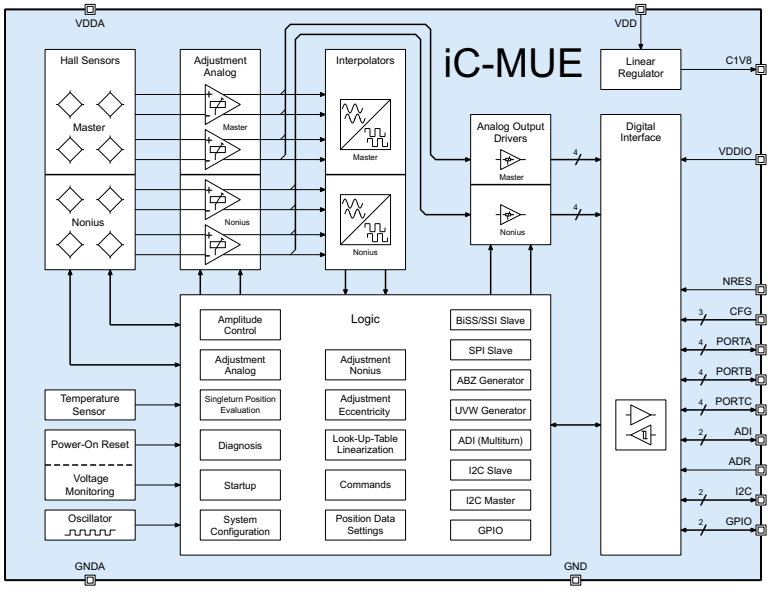
Features

- Decimal Nonius engine for arbitrary magnetic scale sizes
- 21 bits angle resolution with Ø 44 mm code disc (32 pole pairs)
- Hall sensors optimized for 2.00 mm pole width (Master track)
- Auto-adjustment triggered by pin or command
- Eccentricity compensation and LUT for increased accuracy
- Differential scanning for external magnetic field suppression
- BiSS/SSI and SPI serial interfaces for simultaneous use
- I²C master/slave interface for configuration and diagnostic data
- FlexCount® for programmable ABZ output resolution
- UVW commutation signals for motors of 1 to 32 pole pairs
- Safety-ready differential Sin/Cos outputs
- Absolute data interface for multiturn sensors
- Extensive self-diagnosis and user-defined alarms
- Internal temperature sensor
- Extension of scanning diameter and length with second iC-MUE
- 2.5 V, 3.3 V, and 5.0 V compatible I/O ports
- 3.0 V to 5.5 V operation within –40°C to 125°C

Applications

- Hollow-shaft rotary encoders
- Linear position sensors
- Motor feedback systems
- Modular kit encoders

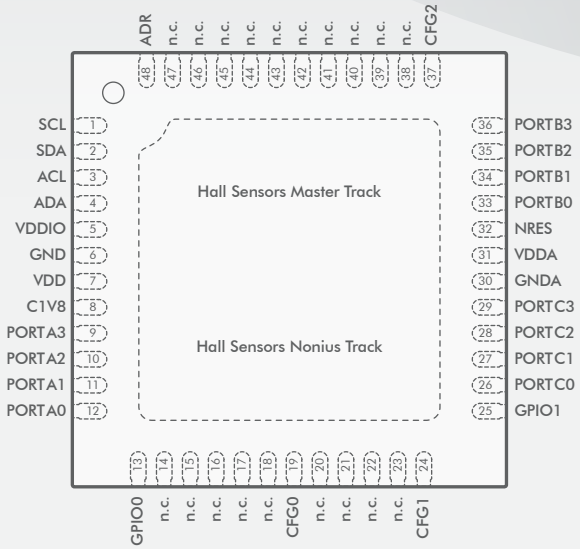
Block Diagram



Key Specifications

General	
Main Supply Voltage	3.0 V to 5.5 V, typ. 65 mA
I/O Supply Voltage	2.25 V to 5.5 V
Magnetic Scale	8 to 64 pole pairs dual-track Nonius, 3-track expandable, typ. air gap: 0.6 mm + 0.3 mm / – 0.2 mm
Operating Speed	Up to 12,000 RPM @ 32 pole pairs
Operating Temperature	–40 °C to +125 °C (ambient)
Package (RoHS compliant)	48-pin QFN 7.0 mm × 7.0 mm, thickness 0.9 mm
Position Acquisition	
Singleturn Resolution	Up to 22 bits (3-track up to 26 bits)
Multiturn Resolution	Up to 32 bits (internal revolution counter or external MT sensor)
Position Update Rate	Typ. 80 MHz
Noise-Free Resolution	Typ. 12 bits per pole pair, ±3 sigma
Absolute Accuracy	Typ. < 0.04° @ 32 pole pairs (calibrated, with LUT linearization)
Outputs and Interfaces	
Position Data Interfaces	BiSS (up to 10 MHz) or SSI (up to 4 MHz) SPI (up to 12 MHz) data protected by CRC (6 bits or 16 bits), optional sign-of-life counter, programmable error and warning bits
Quadrature Outputs	ABZ Generator (up to 18 MHz AB frequency) FlexCount® 1 to 2^{16} AB cycles (programmable)
Commutation Outputs	UVW Generator for 1 to 32 pole pair motors
Sin/Cos Outputs	Native CPR, safety-ready Analog output driver (amplitude 250 mV/6 mA or 1000 mV/1 mA)
Multiturn Interface	ADI master compatible with e.g.: iC-PVL battery-buffered counters, iC-MV gear scanners, Additional iC-MUE for 3-track systems
I²C Interface	I²C master & slave (Fast Mode), interface to external EEPROM and register read/write access

Pin Configuration QFN48-7×7



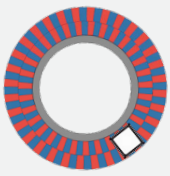
Pin Functions

Name	Function
PORTA0 … PORTA3	Interface Port A
PORTB0 … PORTB3	Interface Port B
PORTC0 … PORTC3	Interface Port C
CFG0 … CFG2	Port Configuration, input
ACL, ADA	Absolute Data Interface, master
SCL, SDA	I²C Interface, master / slave
ADR	I²C Address Configuration, input
GPIO0, GPIO1	General Purpose Input/Output
NRES	Reset, low active input
VDDA	+3.0 to 5.5 V Analog Supply Voltage, input
VDD	+3.0 to 5.5 V Digital Supply Voltage, input
VDDIO	+2.25 to 5.5 V I/O Supply Voltage, input
GNDA	Analog Ground
GND	Digital Ground
C1V8	Linear Regulator, external capacitor

Magnetic Scale Dimensions

Rotary Magnetic Scales	Axial	Radial
Outer Diameter [mm]	20 … 85	15 … 80
Inner Diameter [mm]	5 … 70	7 … 72

2 mm pole width, the exact values depend on the individual design of the magnetic scale.


AXIAL ROTARY


RADIAL ROTARY

Linear Magnetic Scales	2-track	3-track
Max. Absolute Measurement Length [mm]	256	4096


LINEAR

Am Kuemmerling 18 · D-55294 Bodenheim, Germany
Phone: +49 (6135) 9292-30 00 · Fax: +49 (6135) 9292-192
www.ichaus.com

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