

iC-RZ Series

Optical Twin-Scan Encoder IC with Safety Channel

Description

The iC-RZ Series is an advanced absolute optical encoder IC series for functional safety applications. It provides two autonomous channels, each scanning a serial pseudo-random code (PRC) track on the disc. The control channel (CC) and the safety channel (SC) both utilize high-definition phased-array photosensors to read an additional incremental track of 1024 CPR. This generates sine/cosine signals which are used to increase the resolution via the integrated flash interpolator. Additionally, a sin/cos signal of 1024 or 2048 CPR can be output for use by an external interpolation IC for even higher resolutions.

Both CC and SC provide a BiSS slave interface which is compatible with the BiSS Safety protocol and an SSI master multitrack interface for connection of external multitrack devices. The SC can also be configured for an SSI or SPI interface.

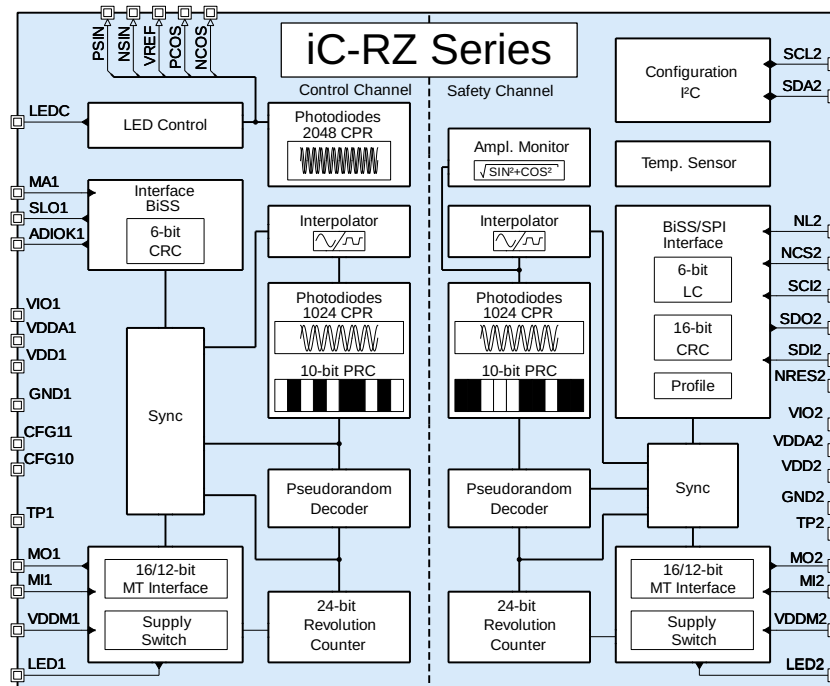
Applications

- Absolute position encoders for functional safety
- Singleturn and multitrack encoders for motor feedback
- High-resolution encoders (up to 24 bit using iC-MR3)

Features

- Robust and compact EncoderBlue® for a 10-bit PRC disc of $\varnothing 26.5\text{ mm}$, 42.8mm
- Autonomous double-scanning with control (CC) and safety (SC) channels
- Resolution of 15 bits (CC and SC) using flash interpolators evaluating an incremental track of 1024 CPR
- Pin-configured control channel (CC) with MT interface (SSI) and serial data output (BiSS)
- Flexible safety channel (SC) with CRC-monitored setup, OEM and user data, signal monitoring, temperature sensing, MT interface (SSI), and serial data output (BiSS, SSI, SPI)
- Compatible with BiSS Safety protocol
- Configuration (SC) via interface or external I²C EEPROM
- Separated channel supplies (5V)
- 3.3V-compatible I/O ports
- Signal stabilization by on-chip or off-chip LED current control
- Differential sin/cos signals with 1024 or 2048 CPR
- Incremental index pulse generation (optional from CC)
- Operational temperature -40 to $+125^\circ\text{C}$

Block Diagram



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Key Specifications

General

Main Supply Voltages	CC: 5V ±10%, typ. 15 mA SC: 5V ±10%, typ. 10 mA
I/O Port Supply Voltage	2.4 to 5.5V
LED Current Control (LEDC)	up to 50 mA
Operating Speed	up to 12000 rpm
Operational Temperature	-40 to +125°C
Package (RoHS compliant)	38-pin optoQFN 7.0 mm × 5.0 mm, thickness 1.0 mm

Position Acquisition

Singleturn Resolution	CC, SC: 15 bits (per 360°)
Multiturn Resolution	CC, SC: 0, 12/16 (ext. sensor), 24 bits (counted)

Temperature Sensor

Resolution	1° C/LSB, range -64 to +191°C
Monitoring	by adjustable high/low warning thresholds

Interfaces and Protocols

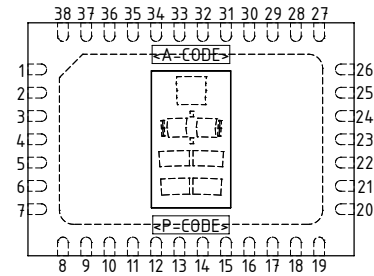
	CC	SC	Description
SPI		•	4-wire, 10 MHz for position data and configuration
BiSS C	• ¹	• ²	bidirectional, up to 10 MHz
SSI		• ³	unidirectional, approx. 500 kHz, binary
Multiturn	•	•	SSI master, 100 kHz, data frame 0/12/16 bits, sync bits, 1 error bit (default); 24-bit internal counter
I ² C		•	for configuration from EEPROM

¹ Data frame of 0/12/16/24 bits MT, 16/24 bits ST, error/warning bit, 6-bit CRC

² Data frame of 0/12/16/24 bits MT, 9 to 16 bits ST, error/warning bit, 6-bit sign-of-life counter, 16-bit CRC

³ Data frame of 0/12/16/24 bits MT, 9 to 16 bits ST

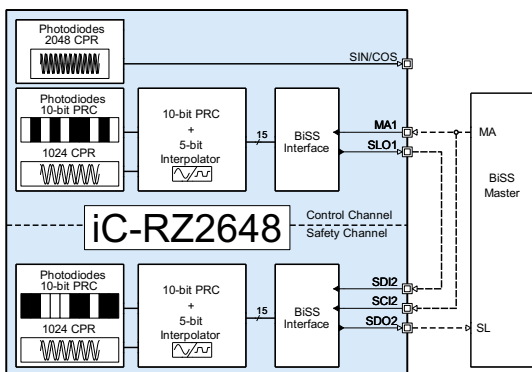
Pin Configuration oQFN38-7×5



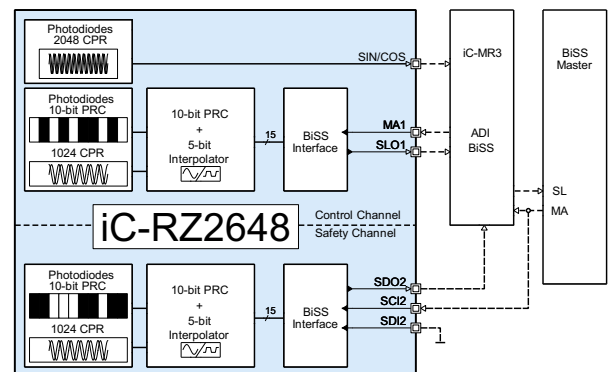
Pin Functions

Name	Function
PSIN, NSIN, PCOS, NCOS	Diff. Sin/Cos Signals (2048 CPR)
VREF	Reference Voltage Output (to iC-MR3)
LEDC, LED1, LED2	LED Control Outputs
VIOx	I/O Supply Voltages
MA1, SLO1	BiSS Interface (CC): clock and data
ADIOK1	ADI Status Output (CC)
SCL2, SDA2	I ² C Interface (SC): clock and data
NL2, NCS2, SCI2, SDO2, SDI2	BiSS/SPI Interface (SC): latch, chip select, clock in, data out, data in
NRES2	Reset Status Input/Output (SC)
MO1, MI1, MO2, MI2	MT Interface (CC, SC): clock and data MO2: Alignment Signal (SC) in test mode
VDDMx	MT Supply Voltage Inputs
VDDAx	Analog Supply Voltage Inputs
VDDx	Digital Supply Voltage Inputs
CFG1/1, CFG1/0	Configuration Inputs (CC)
GND x, TPx	Ground Pins, Test Pins

Application Examples



15-bit Dual-Channel Safety Encoder



24-bit Singleturn Encoder with Safety Channel