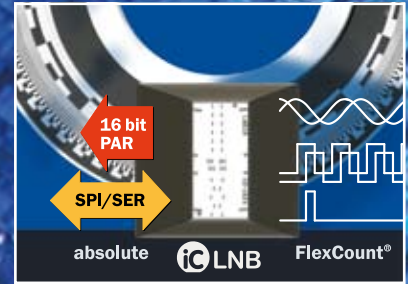


iC-LNB

18-BIT OPTICAL ENCODER WITH SPI AND SERIAL/PARALLEL OUTPUTS



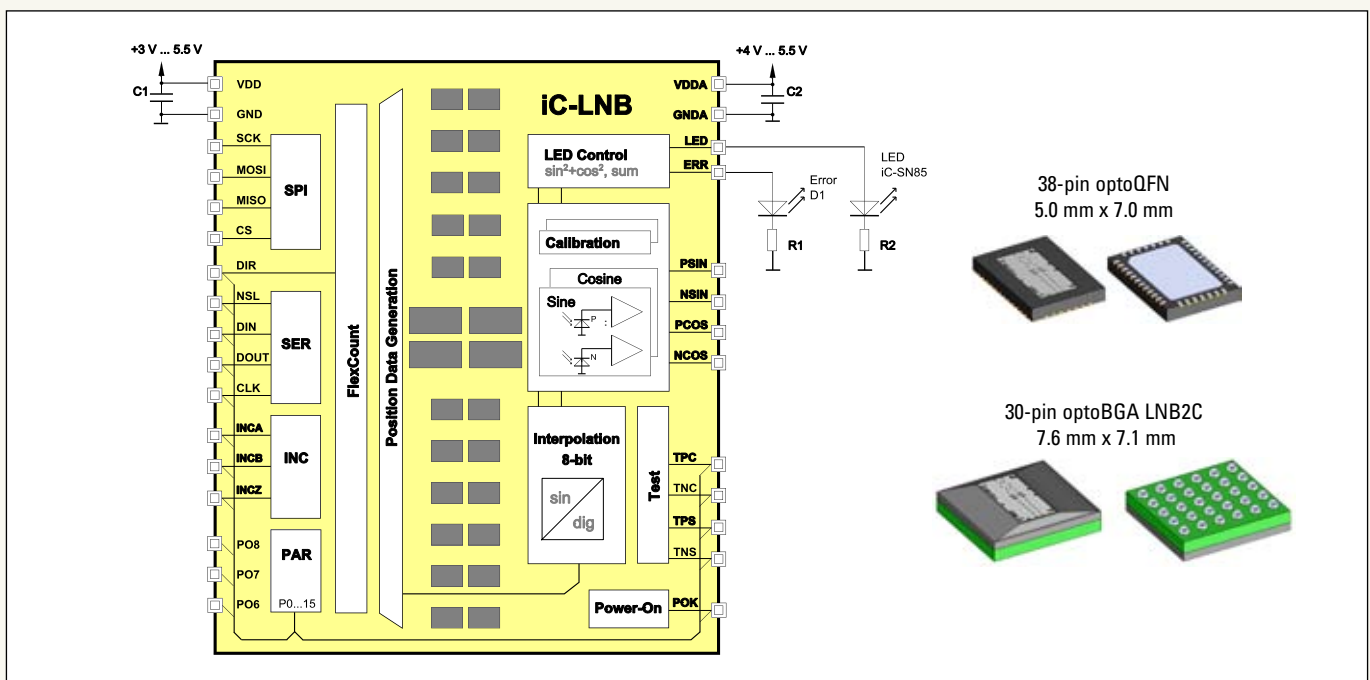
iC-LNB is an optoelectronic encoder IC for absolute linear and angle measuring systems, such as glass scales and encoders. Photodiodes, amplifiers, and comparators, the entire signal conditioning unit, and interfaces for position data output have been monolithically integrated into the device.

Applications

- Absolute and incremental position sensors
- Linear scales and rotary encoders
- Motion control

Features

- System-on-chip design for excellent reliability
- Very compact array size
- Leading/trailing sampling of 10 binary tracks pitched at 400 μm
- Analog sine/cosine scanning with enlarged photodiodes and signal conditioning
- Differential sine/cosine outputs with 1024 CPR and 500 mVpk
- Absolute resolution of up to 18 bits by fast 8-bit vector-tracking interpolation
- Unique FlexCount[®] circuit: freely selectable resolution for absolute and incremental data
- Incremental quadrature outputs with 1 to 16,384 CPR and programmable index signal
- Scalable shift-register for 12 to 18 bits and 1 μs cycles at 16 MHz clock frequency
- Parallel data output of 16 bits in Gray code
- Permanent RAM monitoring by parity bits
- LED illumination control (mean or sin/cos square) by 50 mA high-side current source
- Alarm indication for configuration and illumination error (end of life)
- Undervoltage detection
- 3.3 V-compatible SPI and I/O ports for configuration and data
- 4 V to 5.5 V single supply operation
- Operating temperature range of $-40\text{ }^{\circ}\text{C}$ to $110\text{ }^{\circ}\text{C}$
- Small outline, optoBGA and optoQFN packages for SMT
- Available accessories: LED and code discs (1024 CPR)



An integrated LED current control with a driver stage allows a transmitting LED to be directly connected (e.g. iC-SN85). The optical receive power is kept constant by the control unit, regardless of temperature and aging effects. The receive power setpoint can be programmed. Should the LED current control exit its operating range, this is indicated at the error message output (end-of-life alarm at pin ERR).

The photocurrent offset and photocurrent amplitude of the analog sine/cosine signals can be calibrated. These calibrated voltage signals are lead out to pins PSIN, NSIN, PCOS, and NCOS and are used by the integrated 8-bit vector-tracking interpolation circuit.

iC-LNB synchronizes the interpolator and singleturn data to form a contiguous Gray-coded position data word. 16 parallel ports, a scalable shift-register, the SPI interface, as well as incremental A/B/Z signals are available for data output. By help of the unique FlexCount[®] circuit any angle resolution between 1 to 2¹⁶ angle steps per revolution can be preset for the incremental signals and the absolute position value.

After startup iC-LNB is configured using the SPI interface. To make connection to a 3.3 V microcontroller easier, all digital I/O ports, including the SPI, can be run on 3.3 V.

Key Specifications

General	
Supply Voltage	+4 V to +5.5 V, typ. 15 mA
I/O Port Supply Voltage	+3 V to +5.5 V
I/O Port Characteristics	CMOS/TTL compatible, ±2 mA @ 3.3 V, ±3.5 mA @ 5 V
LED Current Control	up to 50 mA
ESD Susceptibility	2 kV (HBM 100 pF, 1.5 kΩ)
Operational Temperature	-40 °C to +110 °C
Packages (RoHS compliant)	30-pin optoBGA LNB2C (7.6 x 7.1 x 1.8 mm) 38-pin optoQFN (5.0 x 7.0 x 0.9 mm)
Position Acquisition	
Singleturn Resolution	up to 18 bits / 360° @ sin/cos 1024 CPR
Absolute Angle Accuracy	±1 LSB @ 16 bits
Operating Speed	12,000 RPM @ 16 bits 6,000 RPM @ 17 bits 3,000 RPM @ 18 bits
Interpolation	
Sin/Cos Input Frequency	200 kHz @ 6 bits, 100 kHz @ 7 bits, 50 kHz @ 8 bits
Resolution	6 bits to 8 bits (absolute outputs)

FlexCount [®]	
Selectable resolution	1 to 16,384 CPR
Index Position	programmable, to all positions

Data Interfaces	
SPI	10 MHz, 3.3 V and 5 V, for configuration and position data
Serial Shift Register	up to 16 MHz, 12 bits to 18 bits
Parallel Outputs	up to 6.6 MHz, 16 bits
Incremental Outputs	A/B to 6.6 MHz, 90° or 180° Z index
Sin/Cos Outputs	500 mVpk (calibrated), up to 200 kHz, load 1 mA max.

Available Accessories	
LED	iC-SN85 BLCC SN1C
Code Disc	LNB1S 42-1024 (glass 1mm, OD Ø 42.0 mm, ID Ø 18.0 mm, optical radius 17.6 mm, 1024 ppr)

Pin Functions

Name	Function
VDD	+3 V to +5.5 V I/O Port Supply Voltage
GND	I/O Port Ground
VDDA	+4 V to +5.5 V Supply Voltage
GND A	Ground
SCK	SPI Clock Input
MOSI	SPI Data Input
MISO	SPI Data Output
CS	SPI Chip Select
DIR	Code Direction / Parallel Output Bit 13
NSL	Shift Register Load / Parallel Output Bit 12
DIN	Shift Register Data Input / Parallel Output Bit 11
DOUT	Shift Register Data Output / Parallel Output Bit 10
CLK	Shift Register Clock Input / Parallel Output Bit 9
P08	Parallel Output Bit 8
P07	Parallel Output Bit 7
P06	Parallel Output Bit 6
POK	Power OK Message / Parallel Output Bit 5
INCA	Incremental Output A / Parallel Output Bit 2
INCB	Incremental Output B / Parallel Output Bit 3
INCZ	Incremental Output Z / Parallel Output Bit 4
PSIN	Analog Voltage Output PSIN
NSIN	Analog Voltage Output NSIN
PCOS	Analog Voltage Output PCOS
NCOS	Analog Voltage Output NCOS
LED	LED Current Control (Highside Output)
ERR	Error Message Output
TPS	Test Input PSIN / Parallel Output Bit 1
TPC	Test Input PCOS / Parallel Output Bit 0
TNC	Test Input NCOS / Parallel Output Bit 15
TNS	Test Input NSIN / Parallel Output Bit 14

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