iC-PN Series, iC-LSHC
Phased Array Nonius Encoders

Description

This series of optical encoder iCs features monolithically integrated photosensors arranged as a differential scanning photosensor array (iC-LSHC) or phased array (iC-PN Series). A high photocurrent gain equal to 1 MΩ transimpedance generates output signals of several hundred millivolts at low illumination levels.

Absolute singleturn encoders that use a Nonius scale are the target application of the iC-PN series, available in various models to cater for smaller and larger code disc diameters. The device's 3-track, phased-array scanning generates both positive and negative sine and cosine signals with excellent matching and common mode behavior.
The unstructured photosensor array iC-LSHC also makes customization easy; a clear glass lid permits the external application of various code patterns. As an option, a reticle designed to match the required optical radius and the CPR count can be included in the IC's package.

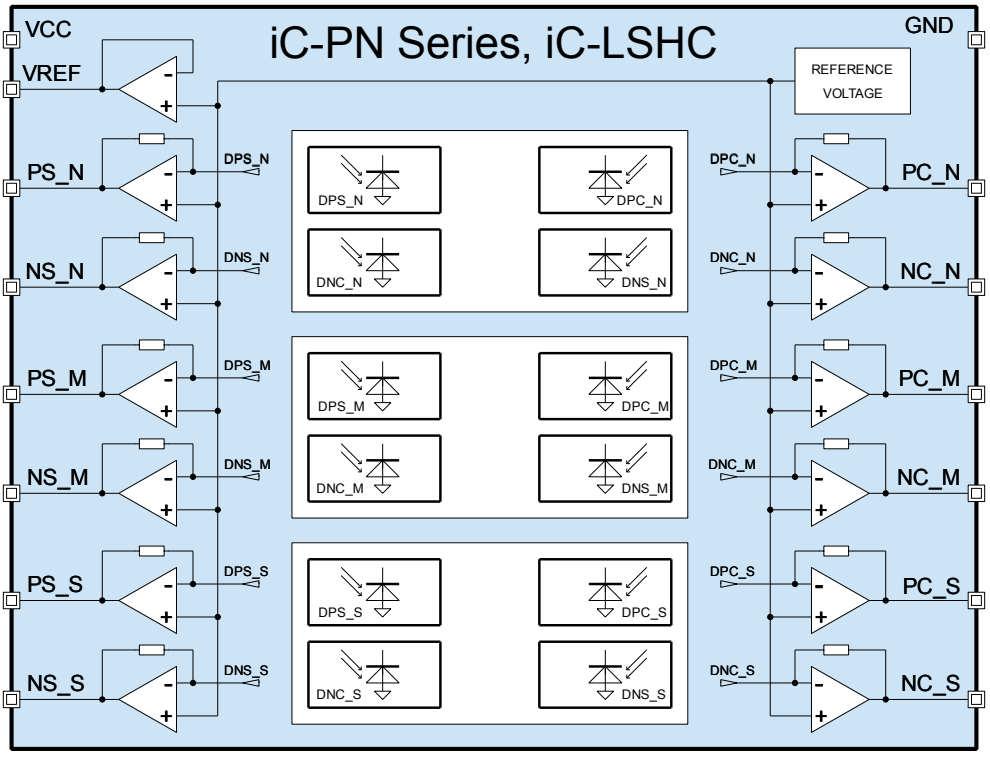
Features

- Monolithic array / phased array with excellent signal matching
- Compact array size eases illumination by a collimated LED
- Moderate track pitch for reduced crosstalk
- Ultra low dark currents for operation at high temperatures
- Low-noise photocurrent amplifiers with a high transimpedance gain
- Short-circuit-proof differential voltage outputs
- Enhanced EMI tolerance due to low output impedance
- Single 5 V supply, low power consumption
- Operational temperature range of -40 °C to +110 °C (+125 °C)
- Space-saving, RoHS compliant optoBGA and optoQFN packages
- Code discs available, customization on request

Applications

- Absolute linear and rotary position encoders

Block Diagram



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Key Specifications

General	
Supply Voltage	+4.1 V ... +5.5 V
Supply Current	typ. 9.5 mA, 15 mA max.
ESD Susceptibility	2 kV (HBM 100 pF, 1.5 kΩ)
Operational Temperature	-40 °C to +110 °C (+125 °C optional)
Package (RoHS compliant)	15-pin optoBGA (6.2 x 5.2 x 1.7 mm) 32-pin optoQFN (5.0 x 5.0 x 0.9 mm)

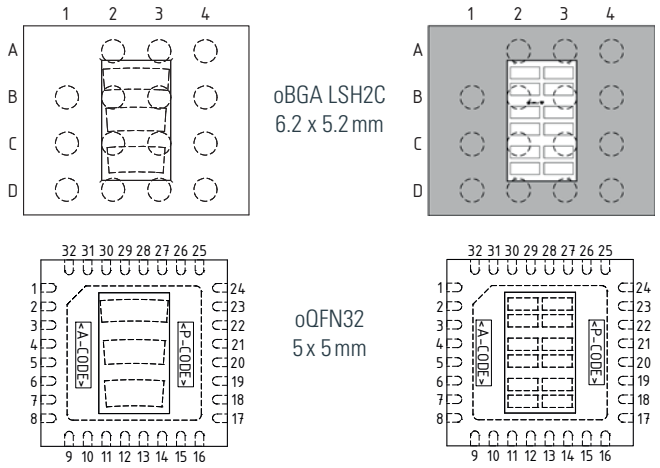
Photosensors	
Spectral Application Range	400 nm to 950 nm (sensitivity to 25%)
Peak Sensitivity Wavelength	λpk 680 nm
Spectral Sensitivity	typ. 0.5 A/W at λpk
Effective Area per Photodiode	0.26 mm² (iC-LSHC), typ. 0.1 mm² (iC-PN Series)
Required Irradiance iC-LSHC iC-PN Series	at λ = 850 nm typ. 2.5 mW/cm² typ. 6 ... 16 mW/cm²

Photocurrent Amplifiers	
Operating Range	up to 1120 nA photocurrent
Photo Sensitivity	typ. 0.1 V/µW at λ = 850 nm
Transimpedance Gain	typ. 1 MΩ
Gain Matching	+/– 0.2%
Cut-off Frequency (-3 dB)	typ. 400 kHz

Reference Voltage Output	
Output Voltage	typ. 770 mV (to 1.6 mA from high-side)

Signal Outputs	
Recommended Signal Level	typ. 250 mVpk
Maximum Signal Level	2.0 V max. above ground
Dark Voltage	typ. 770 mV
Short-Circuit Current	typ. 480 µA sink, typ. 420 µA source
Power-On Settling Time	100 µs max.

Pin Configuration



Pin Functions

oQFN	oBGA	Function
1	A2	+4.1 V ... +5.5 V Supply Voltage
2	A3	Reference Voltage Output
3	B1	N-Track Sine +
4	B2	N-Track Sine –
5	C1	M-Track Sine +
6	C2	M-Track Sine –
7	D1	S-Track Sine +
8	D2	S-Track Sine –
17	D3	S-Track Cosine –
18	D4	S-Track Cosine +
19	C3	M-Track Cosine –
20	C4	M-Track Cosine +
21	B3	N-Track Cosine –
22	B4	N-Track Cosine +
24	A4	Ground

Device Overview

	iC-PN1864 iC-PN1856	iC-PN2656 iC-PN2612 iC-PN2624	iC-PN3356 iC-PN3312 iC-PN3324	iC-PN3924	iC-LSHC
Cycles per Revolution Singleturn Resolution with iC-MN	64, 256 19 bit, 21 bit	256, 512, 1024 21 bit, 22 bit, 23 bit	256, 512, 1024 21 bit, 22 bit, 23 bit	1024 23 bit	freely selectable
Code Discs (glass) *prefix LSHC	*16S 18-64N *15S 18-256N	*4S 26-256N *11S 26-512N *1S 26-1024N	*13S 33-256N *9S 33-512N *10S 33-1024N	*12S 39-1024N	
Diameter	Ø 18.0 mm	Ø 26.0 mm	Ø 33.0 mm	Ø 39.0 mm	
Optical Center Radius (code begin / end)	6.905 mm 5.3/8.4 mm	10.905 mm 9.3/12.5 mm	14.5 mm 12.9/16.1 mm	17.5 mm 15.9/19.1 mm	
Bore hole	Ø 3.0 mm	Ø 11.6 mm	Ø 18.0 mm	Ø 13.0 mm	

Recommended collimated LEDs: iC-TL85, iC-SD85 and iC-TL46 (blue). Custom designs available on request (charges apply).

Am Kuemmerling 18 · D-55294 Bodenheim, Germany · Phone: +49 (6135) 9292-300 · Fax: +49 (6135) 9292-192 · www.ichaus.com