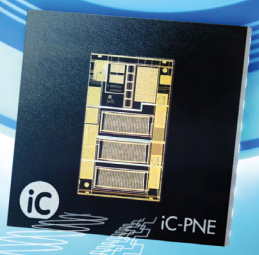
iC-PNE Series

Octal Nonius Phased Array Encoders



Description

This series of optical encoder iCs features monolithically integrated photosensors. Precision sine/cosine signals are output for a high-resolution interpolation by subsequent devices, such as iC-MNF, resolving a singleturn position with 23 bits and higher. Output amplitudes of several hundred millivolts are achieved at low illumination levels, saving LED current for durability.

As a typical Nonius scale for iC-PNE repeats 8 times per turn, 4 sector tracks are scanned digitally by additional photosensors. This section runs independently on a lower supply voltage with extremely low power consumption, allowing battery operation. The typical application of iC-PNE devices are absolute position encoders for motion control and drive applications.

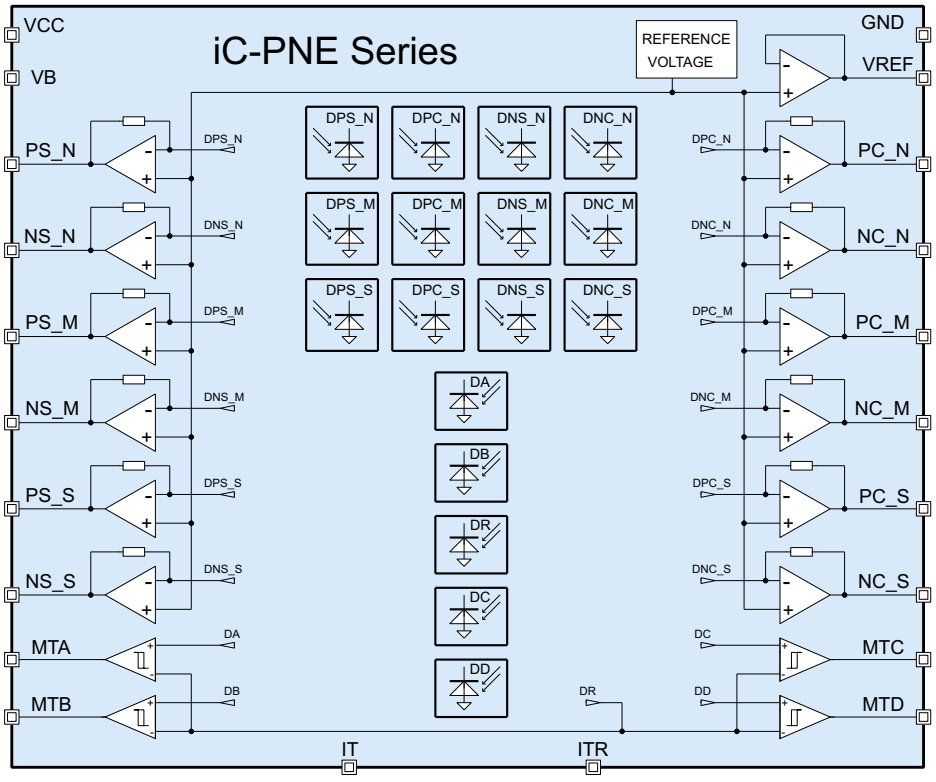
Applications

- Absolute position encoders
- AC servo feedback

Features

- For compact, high resolution absolute position encoders
- Monolithic 3-channel HD phased array with excellent signal matching
- Embedded octal sector detection by 4-bit Gray code scanning
- Moderate track pitch for reduced crosstalk
- Ultra-low dark currents for operation at high temperatures
- Low-noise photocurrent amplifiers with 1 MΩ transimpedance gain
- Enhanced EMI tolerance by low impedance differential, short-circuit-proof, analog sine/cosine outputs
- Operation from 4.1 V up, respectively 1.8 V for digital section
- Operational temperature range of –40 to +125 °C
- Space-saving, RoHS compliant optoQFN package
- Sampling with evaluation kit and code disc

Block Diagram



iC-PNE Series
Octal Nonius Phased Array Encoders

Key Specifications

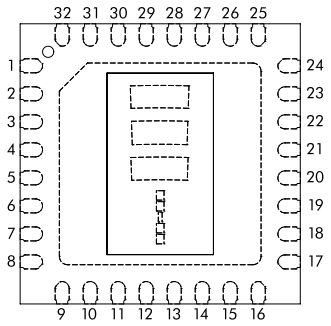
General	
Supply Voltage	+4.1 V ... +5.5 V, VB: +1.8 V ... +5.5 V
Supply Current	typ. 13 mA, 20 mA max. VB: 300 µA max.
ESD Susceptibility	2 kV (HBM 100 pF, 1.5 kΩ)
Operational Temperature	–40 °C to +125 °C
Package (RoHS compliant)	32-pin optoQFN (5.0 mm × 5.0 mm × thickness 0.9 mm)

Photosensors	
Spectral Application Range	400 nm to 950 nm (sensitivity to 25%)
Spectral Sensitivity	typ. 0.25 A/W at 460 nm, 0.35 A/W at 850 nm iC-PNE 3348 EncoderBlue®: typ. 0.25 A/W at λ_{LED} = 460 nm
Effective Area per Photodiode	typ. 0.06 mm², typ. 0.02 mm² for MTA ... MTD sensors
Required Irradiance	typ. 4 ... 8 mW/cm² (at λ_{LED})

Photocurrent Amplifiers	
Operating Range	up to 1120 nA photocurrent
Photo Sensitivity	typ. 0.2 to 0.3 V/µW (at λ_{LED})
Transimpedance Gain	typ. 1 MΩ
Gain Matching	+/– 0.2%
Cut-off Frequency (-3 dB)	typ. 400 kHz
Reference Output Voltage	typ. 900 mV

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	VB: 10 µs max., VCC: 100 µs max.

Pin Configuration oQFN32-5×5

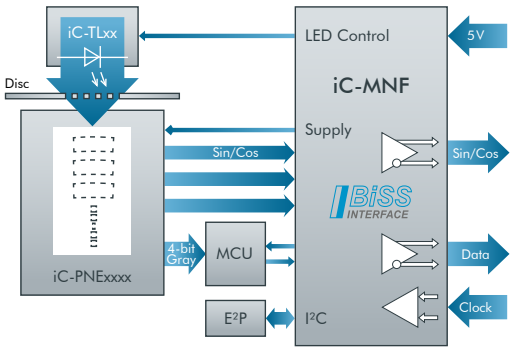


Pin Functions

No.	Name	Function
1	VCC	+4.1 V ... +5.5 V Supply Voltage
2	VREF	Reference Voltage Output
3, 4	PS_N, NS_N	N-Track Sine +, Sine –
5, 6	PS_M, NS_M	M-Track Sine +, Sine –
7, 8	PS_S, NS_S	S-Track Sine +, Sine –
9	MTD	Digital Output D
10, 15	ITR, IT	Test Input (factory use only)
11 ... 14	n. c.	not connected
16	MTC	Digital Output C
17, 18	NC_S, PC_S	S-Track Cosine–, Cosine +
19, 20	NC_M, PC_M	M-Track Cosine–, Cosine +
21, 22	NC_N, PC_N	N-Track Cosine–, Cosine +
23	MTB	Digital Output B
24	GND	Ground
25	MTA	Digital Output A
26 ... 31	n. c.	not connected
32	VB	+1.8 V to +5.5 V Digital Supply Voltage

Device Overview

	iC-PNE 2612 iC-PNE 2648	iC-PNE 3312 iC-PNE 3348	iC-PNE 3912 iC-PNE 3948
Singleturn Resolution with iC-MNF	23 bit, 25 bit	23 bit, 25 bit	23 bit, 25 bit
Cycles per Revolution	8×64, 8×256	8×64, 8×256	8×64, 8×256
Code Discs (glass)	PNE 01S 26-512 PNE 02S 26-2048	PNE 03S 33-512 PNE 04S 33-2048	PNE 05S 39-512 PNE 06S 39-2048
Diameter	Ø 26.0 mm	Ø 33.2 mm	Ø 39.0 mm
Optical Center Radius (code begin / end)	10.905 mm 9.5/12.4 mm	14.5 mm 13.1/16.0 mm	17.5 mm 16.1/19.0 mm
Bore hole	Ø 11.6 mm	Ø 18.0 mm	Ø 18.0 mm



Recommended collimated LEDs: iC-TL85, iC-SD85, and iC-TL46 (blue).
*) EncoderBlue is a trademark of iC-Haus GmbH (devices require LED iC-TL46).

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