# iC-PR Series
## EncoderBlue goes reflective

## Description

The iC-PR series are advanced optical, reflective, lensless encoder iCs featuring integrated HD Phased Array photosensors and a blue LED. They provide high signal quality with relaxed alignment tolerances.
Differential digital ABZ outputs with or without interpolation or analog SIN/COS outputs with index are available. Typical applications are incremental encoders for motor control.
Blue-enhanced photosensors are adapted to the short wavelength of the embedded blue LED, and provide low-jitter outputs due to improved signal contrast. The unique assembly technology of the blue LED emitter and sensors results in low optical crosstalk.

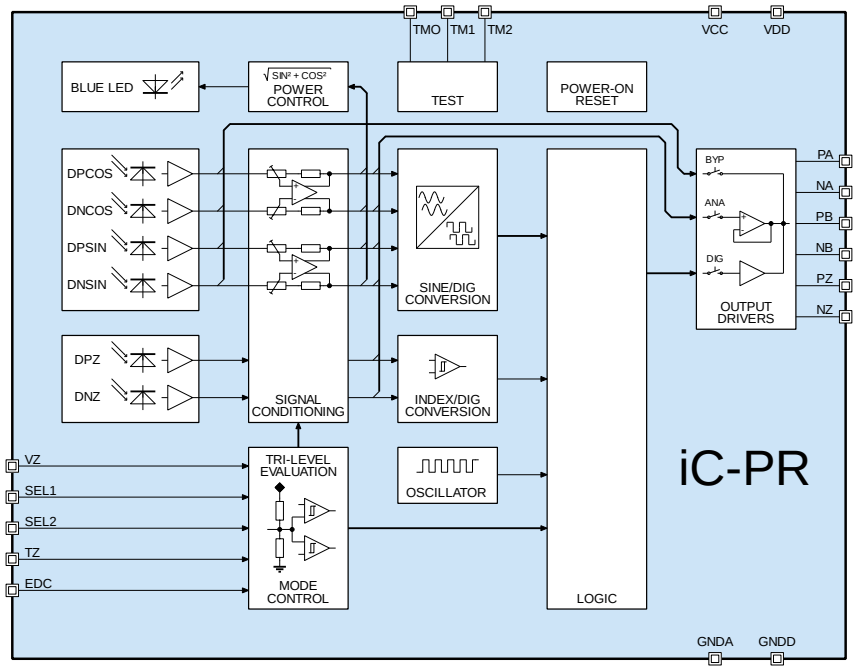
## Applications

- Incremental encoders
- Miniature motors and actuators
- X-Y and linear stages
- Factory automation robots
- Consumer robots

## Features

- Lensless reflective opto-encoder iCs, compact, high-resolution, incremental
- For reflective discs / scale of Ø 4, Ø 14, Ø 26 and Ø 43 mm and 256 µm grid
- Monolithic HD Phased Array with excellent signal matching
- Integrated blue LED with power control, EncoderBlue®
- Low-noise signal amplifiers with high EMI tolerance
- Pin-selectable modes of operation:
  Digital A/B/Z (x1, x2, x4, x8, x16 interpolated),
  analog COS/SIN with analog or digital Z
- Index gating: Ungated (1 T), B-gated (0.5 T), AB-gated (0.25 T)
- Pin-selectable minimal edge distance: 80 ns, 1 µs, 10 µs
- Complementary quadrature outputs PA, NA, PB and NB
- Complementary index outputs PZ and NZ
- Analog signal output for ease of alignment and resolution enhancement by external interpolation
- Operating temperature range of –40°C to +105°C
- Compact and lensless optoQFN mold package (4 mm x 4 mm x 0.9 mm)
- Evaluation kits on request

## Block Diagram



# iC-PR Series
# Reflective Opto Encoders

## Key Specifications

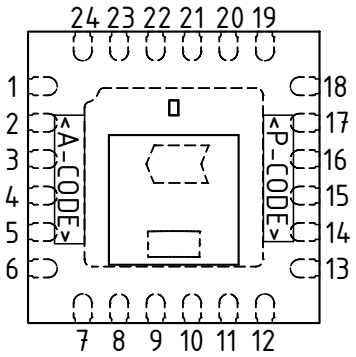
| General | |
|---|---|
| Supply Voltage | VCC: 4.5 V ... 5.5 V<br>VDD: 3.0 V ... 5.5 V |
| Supply Current | typ. 20 mA |
| ESD Susceptibility | CDM, HBM (JEDEC) |
| Operational Temperature | –40°C to +105°C |
| Package (RoHS compliant) | 24-pin optoQFN<br>(4.0 mm x 4.0 mm, thickness 0.9 mm) |

| Outputs | |
|---|---|
| Max. Output Frequency | 1.6 MHz min. |
| Saturation Voltage hi / lo | 0.4 V max. at +/–4 mA |
| AB Duty Cycle Variation | Mode DX 1: +/–5 %<br>Mode DX 2, DX 4, DX 8, DX 16: +/–10 % |
| Digital Hysteresis of Interpolator | typ. 5.6° (@ one cycle of sine / cosine) |
| Analog Output Signal | AAMP = single-ended ±250 mV<br>A250 = VCC / 2 ±250 mV<br>A500DZ = VCC / 2 ±500 mV |

**Operation Modes**

| SEL 1 | SEL 2 | Mode | Description |
|---|---|---|---|
| low | high | DX1 | digital A / B / Z (x1 interpolation) |
| high | low | DX2 | digital A / B / Z (x2 interpolation) |
| low | open | DX4 | digital A / B / Z (x4 interpolation) |
| high | high | DX8 | digital A / B / Z (x8 interpolation) |
| high | open | DX16 | digital A / B / Z (x16 interpolation) |
| open | low | A250 | analog COS / SIN / Z |
| open | high | AAMP | analog COS / SIN / Z |
| open | open | A500DZ | analog COS / SIN, digital Z (ungated) |

## Pin Configuration oQFN24-4x4




## Pin Functions

| No. | Name | Function |
|---|---|---|
| 1 | VDD | 3.0 V ... 5.5 V Digital Supply Voltage |
| 2 | SEL1 | Mode Selection Input 1 |
| 3 | SEL2 | Mode Selection Input 2 |
| 4 | TZ | Index Gating Control Input |
| 5 | PZ | Index Output Z+ |
| 6 | NZ | Index Output Z– |
| 13 | EDC | Edge Distance Control Input |
| 14 | NB | Incr. Output B–/Analog Sine– |
| 15 | PB | Incr. Output B+/Analog Sine+ |
| 16 | NA | Incr. Output A–/Analog Cos– |
| 17 | PA | Incr. Output A+/Analog Cos+ |
| 18 | GNDD | Digital Ground |
| 19 | GNDA | Analog Ground |
| 20 | TMO | Test Mode Output |
| 21 | TM2 | Test Mode Input 2 |
| 22 | TM1 | Test Mode Input 1 |
| 23 | VZ | Index Detection Control Input |
| 24 | VCC | 4.5 V ... 5.5 V Analog Supply Voltage |
| 7 ... 12 | n. c. | not connected |

## Device Overview

| Encoder | iC-PR256 | iC-PR0464 | iC-PR1456 | | iC-PR2656 | | iC-PR2604 | iC-PR4307 |
|---|---|---|---|---|---|---|---|---|
| Disc Size | linear | Ø 4 mm | Ø 14 mm | | Ø 26 mm | | Ø 26 mm | Ø 43 mm |
| Optical Radius | - | 1.625 mm | 4.65 mm | | 10.475 mm | | 10.475 mm | 19.223 mm |
| Native Resolution / CPR | 256 µm | 64 | 250 | 256 | 250 | 256 | 360 | 720 |
| DX2 (x2 interpolation) | 128 µm | 128 | 500 | 512 | 500 | 512 | 720 | 1440 |
| DX4 (x4 interpolation) | 64 µm | 256 | 1000 | 1024 | 1000 | 1024 | 1440 | 2880 |
| DX8 (x8 interpolation) | 32 µm | 512 | 2000 | 2048 | 2000 | 2048 | 2880 | 5760 |
| DX16 (x16 interpolation) | 16 µm | 1024 | 4000 | 4096 | 4000 | 4096 | 5760 | 11520 |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