

# Encoder IC PR5301-XX

## Sensor IC for Incremental Optical Encoders for resolutions of 50, 150 or 300 lpi

PR5301 is a sensor IC with A and B channel digital output.

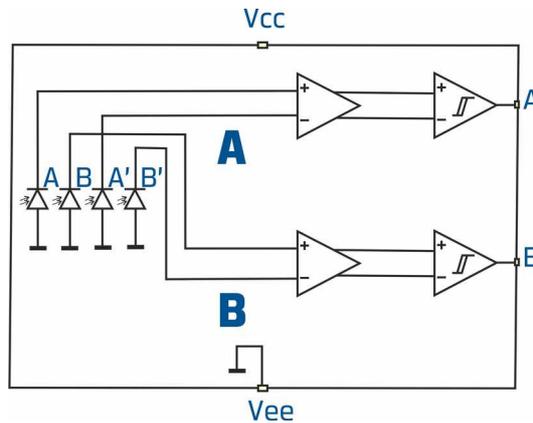
It comes in a small DFN package for easy use in linear or rotary encoders.

- PR5301-050 for 50 lpi resolution
- PR5301-150 for 150 lpi resolution
- PR5301-300 for 300 lpi resolution

### FEATURES

- fixed resolutions of 50, 150 or 300 lpi
- small DFN package
- A and B channel digital output
- photodiodes with antireflective coating
- high sensitivity for low LED current
- best for red or near-infrared light

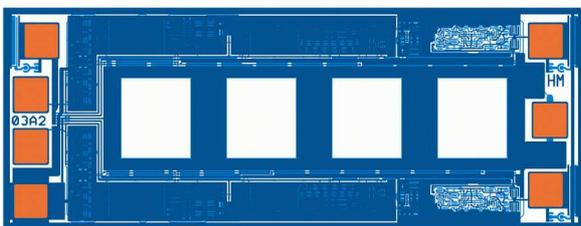
### BLOCK DIAGRAM



### PACKAGES

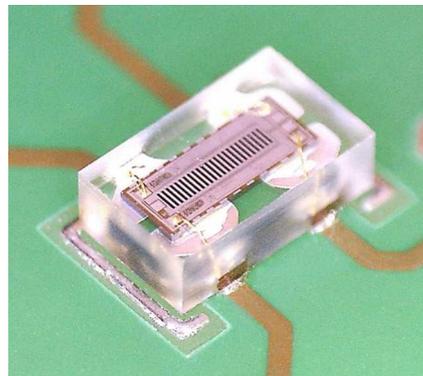
The PR5301 is offered as bare die or in a tiny optical DFN package.

a) IC as bare die – PR5301-XX-BD



Encoder ICs can be delivered as bare dies (2,225 µm x 910 µm) on tested and inked wafers, or singulated dies on adhesive film

b) In optical DFN package - PR5301-XX-TM



PR5301-300-TM in ODFN-4L 1.8x2.9 package.

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## Electrical Characteristics

### ABSOLUTE MAXIMUM RATINGS

| Parameter   |              | Min  | Typ | Max                  | Units |
|---|--------------|------|-----|----------------------|-------|
| V <sub>CC</sub> (supply voltage)                    |              | -0.3 |     | 14                   | V     |
| V <sub>PIN</sub> (voltage @ other pins)             |              | -0.3 |     | V <sub>CC</sub> +0.3 | V     |
| Operating Temperature                               | PR5301-BD    | -40  |     | 85                   | °C    |
|   | PR5301-TM    | -40  |     | 85                   | °C    |
| Storage Temperature Range                           | PR5301-BD    | -55  |     | 125                  | °C    |
|   | PR5301-TM    | -40  |     | 100                  | °C    |
| T <sub>J</sub> (Junction Temperature)               | PR5201-BD/OC | -40  |     | 85                   | °C    |
|   | PR5201-CB/TM | -40  |     | 85                   | °C    |
| Electrostatic Discharge (ESD) Protection @ all pins |              | 4    |     |                      | kV    |

### OPERATING CHARACTERISTICS

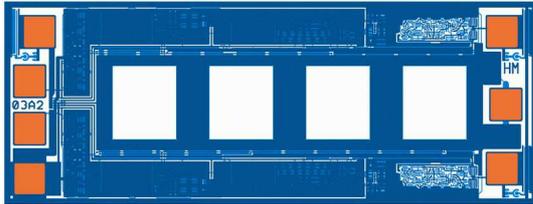
V<sub>CC</sub> = 5 V, T<sub>J</sub> = -40...85°C (unless otherwise noted)

| Symbol  | Parameter                  | Conditions                                  | Min                  | Typ | Max | Units |
|---|----------------------------|---|----------------------|-----|-----|-------|
| V <sub>CC</sub>                               | Supply voltage             |   | 3                    |     | 6   | V     |
| I <sub>CC</sub>                               | Supply current (no load)   | digital outputs LO                          | 0.4                  |     | 1.5 | mA    |
|   |                            | digital outputs HI                          | 0.4                  |     | 1.5 | mA    |
| <b>Digital outputs A, B, Z, C4, RL, Alarm</b> |                            |   |                      |     |     |       |
| f <sub>OUT</sub>                              | Output frequency           | A, B  |                      |     | 300 | kHz   |
| V <sub>SAT(Lo)</sub>                          | Saturation voltage LO      | I = 1.3 mA                                  |                      |     | 0.3 | V     |
| I <sub>SC(Lo)</sub>                           | Short-circuit current LO   | V = V <sub>CC</sub>                         | 1.8                  |     | 26  | mA    |
| V <sub>SAT(Hi)</sub>                          | Saturation voltage HI      | I = 1.3 mA                                  | V <sub>CC</sub> -1.2 |     |     | V     |
| I <sub>SC(Hi)</sub>                           | Short-circuit current HI   | V = 0 V                                     | -28                  |     | -2  | mA    |
| <b>Photosensors</b>                           |                            |   |                      |     |     |       |
| λ <sub>ar</sub>                               | Spectral application range | Se(λ <sub>ar</sub> )=0.25*λ <sub>peak</sub> | 500                  |     | 950 | nm    |
| λ <sub>peak</sub>                             | Peak sensitivity           |   |                      | 800 |     | nm    |

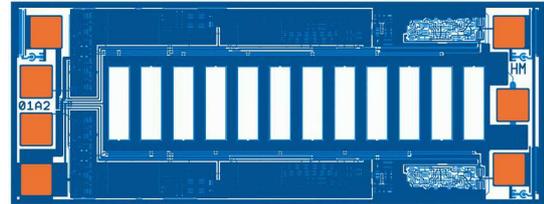
Test pins are used for chip test only. Their use is not further described in this document.

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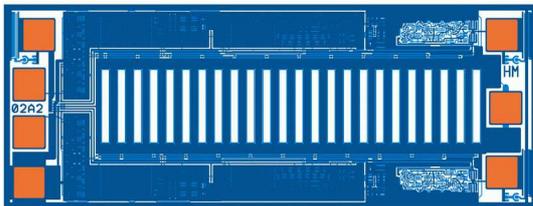
## Photodiodes – Resolution and Size



**PR5301-050** for 50 lpi resolution  
The width of a photodiode for 50 dpi is 254  $\mu\text{m}$  with a pitch of 381  $\mu\text{m}$ .



**PR5301-150** for 150 lpi resolution  
The width of a photodiode for 150 dpi is 84.7  $\mu\text{m}$  with a pitch of 127  $\mu\text{m}$ .

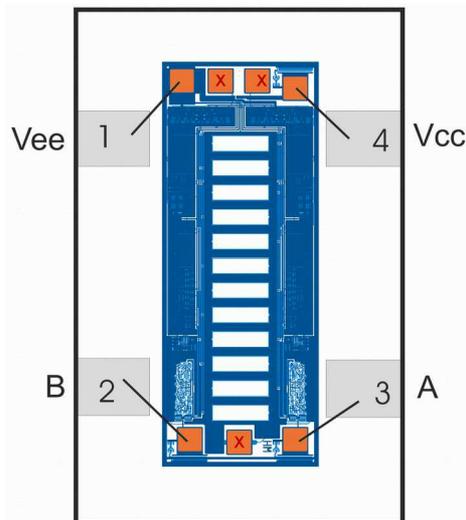


**PR5301-300** for 300 lpi resolution  
The width of a photodiode for 150 dpi is 42.3  $\mu\text{m}$  with a pitch of 63.5  $\mu\text{m}$ .

For all versions:

- Die size: 2,225  $\mu\text{m}$  x 910  $\mu\text{m}$  (measured between centres of scribe lane)
- A/B photodiodes track width: 280  $\mu\text{m}$
- Pad window: 120  $\mu\text{m}$  x 120  $\mu\text{m}$

## PIN DESCRIPTION



Left: ODFN-4L 1.8x2.9 package (top view)

| Pin No | Pin Name | Pin Function Description |
|--------|----------|--------------------------|
| 1      | Vee      | negative supply voltage  |
| 2      | B        | B channel digital output |
| 3      | A        | B channel digital output |
| 4      | Vcc      | positive supply voltage  |

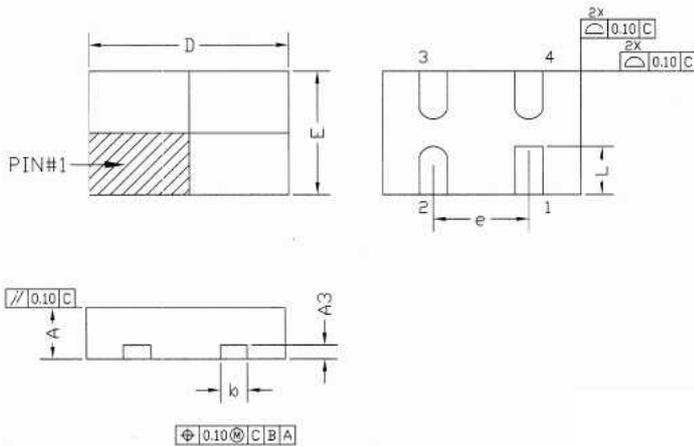
Test pins are for chip test only and not described in this document.

Chip centre may be offset by up to 250  $\mu\text{m}$  from package centre in any direction.

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## PR5301-XX-TM - Package Dimensions

### ODFN-4L-1.8x2.9 PACKAGE



| SYM | MILLIMETERS |      |      | INCHES     |       |       |
|-----|-------------|------|------|------------|-------|-------|
|     | MIN         | NOM  | MAX  | MIN        | NOM   | MAX   |
| A   | 0.85        | 0.90 | 0.95 | 0.033      | 0.035 | 0.037 |
| A3  | 0.20 REF.   |      |      | 0.008 REF. |       |       |
| b   | 0.35        | 0.40 | 0.45 | 0.014      | 0.016 | 0.018 |
| D   | 2.80        | 2.90 | 3.00 | 0.110      | 0.114 | 0.118 |
| E   | 1.70        | 1.80 | 1.90 | 0.066      | 0.070 | 0.074 |
| e   | 1.40 BSC    |      |      | 0.055 BSC  |       |       |
| L   | 0.60        | 0.70 | 0.80 | 0.023      | 0.027 | 0.031 |

#### NOTES:

1. CONTROLLING DIMENSION IN MM.
2. PACKAGE DIMENSION DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS, BURRS OR METAL SMEARING.
3. COPLANARITY APPLIES TO THE EXPOSED PAD AS WELL AS THE EXPOSED TERMINALS.  
MAXIMUM COPLANARITY SHALL BE 0.003 [0.08].
4. WARPAGE SHALL NOT EXCEED 0.004 [0.10].

A lead-free solder profile with a peak temperature of 260°C or less, according to J-STD-020 should be followed.

Samples shipped without moisture barrier bag must be dry-baked according to JEDEC guidelines before soldering. Manual soldering may

not be possible or must be done with utmost care.

Direct infrared heating should be avoided; pure convection heating is recommended. There is no experience with gas phase soldering.

### PRELIMINARY DATASHEET - DATA MAY CHANGE WITHOUT NOTICE

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2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

#### PREMA Semiconductor GmbH

Robert-Bosch-Str. 6

55129 Mainz Germany

Phone: +49-6131-5062-0

Fax: +49-6131-5062-220

Email: [prema@prema.com](mailto:prema@prema.com) Web site: [www.prema.com](http://www.prema.com)