

# iC-PNH Series

## PHASED ARRAY NONIUS ENCODERS



Rev F1, Page 1/15

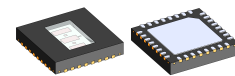
### FEATURES

- ◆ Compact, high resolution absolute encoder ICs for up to 24 bit singleturn resolution (with nonius interpolation)
- ◆ For code discs of  $\varnothing 26$  mm,  $\varnothing 33$  mm,  $\varnothing 39$  mm
- ◆ Monolithic 3-channel *HD Phased Array* with excellent signal matching
- ◆ Moderate track pitch for reduced cross talk
- ◆ Ultra low dark currents for operation up to high temperature
- ◆ Low noise amplifiers with high transimpedance gain
- ◆ Enhanced EMI tolerance by low impedance differential, short-circuit-proof, analog sine/cosine outputs
- ◆ Embedded sector detection by 2 digital tracks (2-bit Gray code)
- ◆ Low power consumption from single 4.1 to 5.5V supply
- ◆ Operational temperature range of  $-40^{\circ}\text{C}$  to  $+125^{\circ}\text{C}$
- ◆ Space saving optoQFN package (RoHS compliant)
- ◆ Evaluation kits with LED and code disc available for sampling

### APPLICATIONS

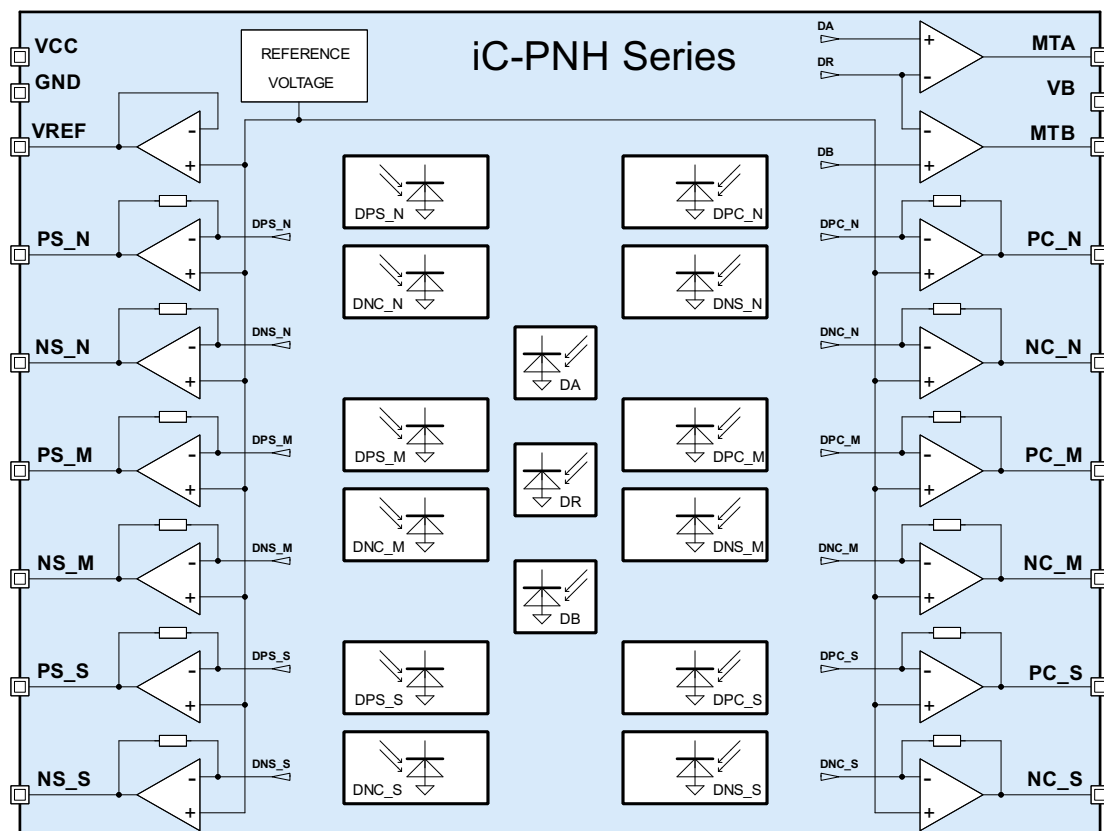
- ◆ Absolute position encoders
- ◆ AC servo feedback

### PACKAGES



32-pin optoQFN  
5 mm x 5 mm x 0.9 mm  
RoHS compliant

### BLOCK DIAGRAM



### DESCRIPTION

The iC-PNH device series represents advanced optical encoder ICs featuring monolithically integrated photosensors arranged as an *HD Phased Array*, providing excellent signal fidelity at relaxed alignment tolerances.

Its precision sine/cosine output signals allow for a high-resolution interpolation by subsequent devices: depending on the iC-PNH version, a singleturn position can be resolved with up to 24 bit utilizing the 3-channel nonius interpolation of iC-MN.

The typical application of iC-PNH devices are absolute position encoders for motion control and drive applications.

iC-PNH scans 5 tracks in total, whereof 3 analog tracks feature phased-arrays of multiple photosensors each per track, generating positive and negative going sine signals, as well as positive and negative going cosine signals. An excellent matching and common mode behavior of the differential signal paths is obtained by a paired amplifier design. Due to a typical transimpedance gain of 1 M $\Omega$ , the output signal level reaches a few hundred millivolts already at low light conditions.

Additional 2 digital tracks are implemented for sector detection, to separate a repeated nonius scale. For

instance, the standard code discs made for iC-PNH feature two nonius scales per turn and provide a 2-bit Gray code to distinguish this.

Sector detection can be used already at low supply voltages from 1.8V up; the power consumption is low unless other sections are biased. Full operation requires a single-sided supply of 4.1V to 5.5V.

#### **iC-PNH26xx Series**

Optical radius 11.0 mm, code disc  $\varnothing$  26.0 mm;  
iC-PNH2612: 512 CPR (2x 256/255/240 CPR)  
iC-PNH2624: 1024 CPR (2x 512/510/480 CPR)  
iC-PNH2628: 128 CPR (2x 64/63/56 CPR)

#### **iC-PNH33xx Series**

Optical radius 14.5 mm, code disc  $\varnothing$  33.2 mm;  
iC-PNH3312: 512 CPR (2x 256/255/240 CPR)

iC-PNH3348 **Encoder blue**<sup>®</sup>: 2048 CPR  
(2x 1023/1024/992 CPR)

A separated datasheet is available for iC-PNH **Encoder blue**<sup>®</sup> series devices.

#### **iC-PNH39xx Series**

Optical radius 17.5 mm, code disc  $\varnothing$  39.0 mm;  
iC-PNH3912: 512 CPR (2x 256/255/240 CPR)  
iC-PNH3948: 2048 CPR (2x 1024/1023/992 CPR)

Encoder blue is a trademark of iC-Haus GmbH.

# iC-PNH Series

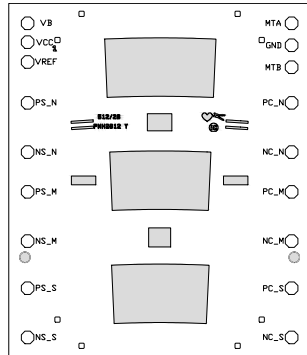
## PHASED ARRAY NONIUS ENCODERS



Rev F1, Page 3/15

### PACKAGING INFORMATION

#### PAD LAYOUT



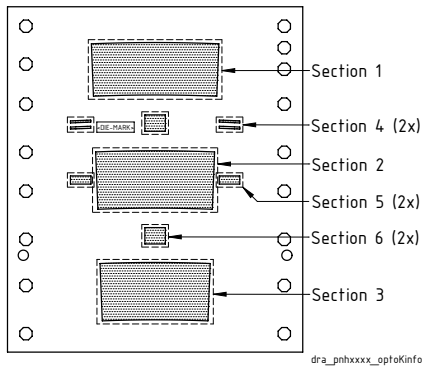
#### PAD FUNCTIONS

##### No. Name Function

Chip layout example.

Grey sections represent sensor layout areas; fill factors vary.

#### SENSOR LAYOUT



#### AOI CRITERIA

<Die Mark>	<Section>	<Area Class> <sup>1</sup>
iC PNH2612	1, 3	A25
	2	A16
	4, 5, 6	A40
iC PNH2624		see iC-PNH2612
iC PNH2628		see iC-PNH2612
iC PNH3312	1, 3	A25
	2	A16
	4, 5, 6	A40
iC PNH3912		see iC-PNH3312
iC PNH3948	1, 3	A25
	2	A16
	4, 5, 6	A40

<sup>1</sup> Inspection class for the optical inspection of detector areas. Refer to [Optical Selection Criteria](#) for further description.

# iC-PNH Series

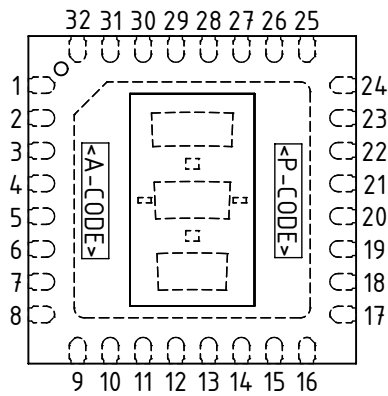
## PHASED ARRAY NONIUS ENCODERS



Rev F1, Page 4/15

### PIN CONFIGURATION

oQFN32-5x5 (5 mm x 5 mm)



### PIN FUNCTIONS

No.	Name	Function
1	VCC	+4.1..5.5 V Supply Voltage
2	VREF	Reference Voltage Output
3	PS_N	N-Track Sine +
4	NS_N	N-Track Sine -
5	PS_M	M-Track Sine +
6	NS_M	M-Track Sine -
7	PS_S	S-Track Sine +
8	NS_S	S-Track Sine -
9..16	n.c. <sup>1</sup>	
17	NC_S	S-Track Cosine -
18	PC_S	S-Track Cosine +
19	NC_M	M-Track Cosine -
20	PC_M	M-Track Cosine +
21	NC_N	N-Track Cosine -
22	PC_N	N-Track Cosine +
23	MTB	Digital Output B
24	GND	Ground
25	MTA	Digital Output A
26..31	n.c. <sup>1</sup>	
32	VB <sup>2</sup>	+1.8..5.5 V Auxiliary Supply Voltage
	BP <sup>3</sup>	Backside paddle

IC top marking: <P-CODE> = product code, <A-CODE> = assembly code (subject to changes);

<sup>1</sup> Pin numbers marked n.c. are not connected.

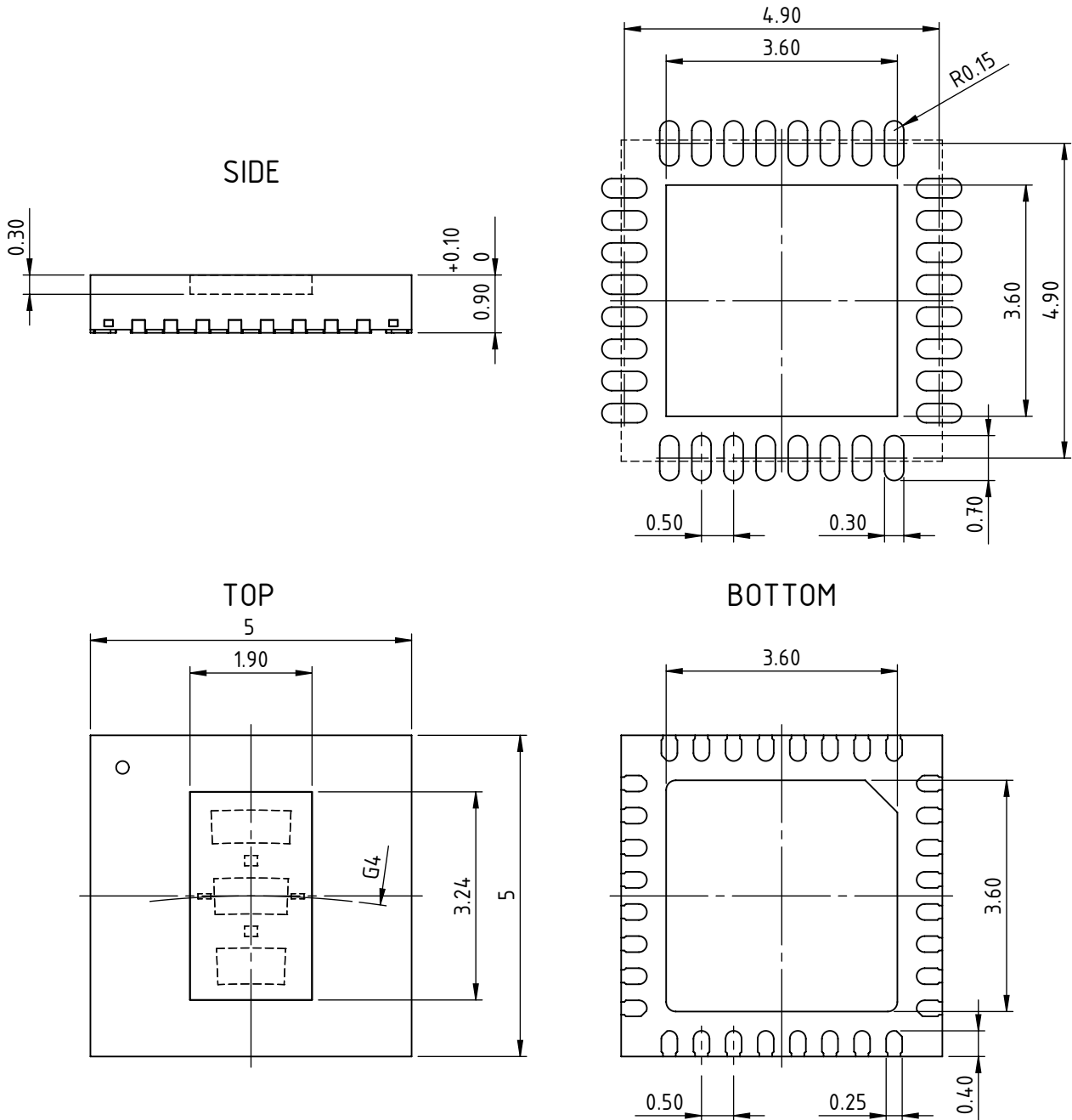
<sup>2</sup> If there is no auxiliary supply available, connect pin 32 either to VCC or GND (for chip release Y, and X).  
For chip release Z1, do not wire pin 32 or connect pin 32 to GND.

<sup>3</sup> Connecting the backside paddle is recommended by a single link to GND. A current flow across the paddle is not permissible.

### PACKAGE DIMENSIONS

Drawing valid for chip release Z1, and Y.

### RECOMMENDED PCB-FOOTPRINT

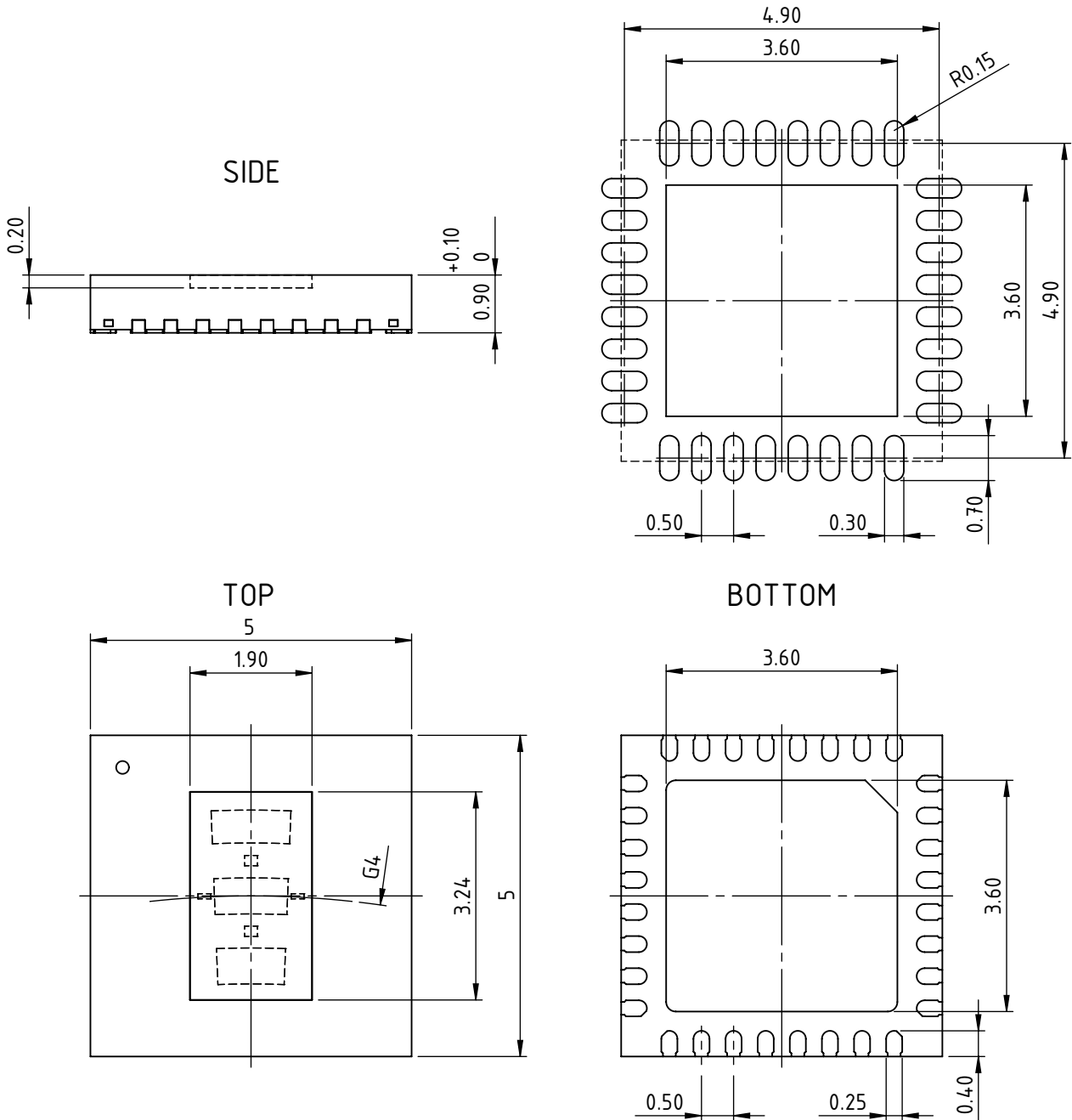


All dimensions given in mm. General Tolerances of form and position according to JEDEC MO-220.  
 Positional tolerance of sensor pattern:  $\pm 70\mu\text{m}$  /  $\pm 1^\circ$  (with respect to center of backside pad).  
 $G4$ : radius of chip center (refer to the relevant encoder disc and code description).  
 Maximum molding excess  $+20\mu\text{m}$  /  $-75\mu\text{m}$  versus surface of glass. Small pits in the mold surface, which may occasionally appear due to the manufacturing process, are cosmetic in nature and do not affect reliability.

### PACKAGE DIMENSIONS

Drawing valid for chip release X.

### RECOMMENDED PCB-FOOTPRINT



All dimensions given in mm. General Tolerances of form and position according to JEDEC MO-220.  
 Positional tolerance of sensor pattern:  $\pm 70\mu\text{m}$  /  $\pm 1^\circ$  (with respect to center of backside pad).  
 G4: radius of chip center (refer to the relevant encoder disc and code description).  
 Maximum molding excess  $+20\mu\text{m}$  /  $-75\mu\text{m}$  versus surface of glass. Small pits in the mold surface, which may occasionally appear due to the manufacturing process, are cosmetic in nature and do not affect reliability.

# iC-PNH Series

## PHASED ARRAY NONIUS ENCODERS



Rev F1, Page 7/15

### ABSOLUTE MAXIMUM RATINGS

These ratings do not imply operating conditions; functional operation is not guaranteed. Beyond these ratings device damage may occur.

Item No.	Symbol	Parameter	Conditions	Limits		Unit
				Min.	Max.	
G001	VCC	Voltage at VCC, VB		-0.3	6	V
G002	I(VCC)	Current in VCC, VB		-20	20	mA
G003	V()	Pin Voltage, all signal outputs		-0.3	VCC + 0.3	V
G004	I()	Pin Current, all signal outputs		-20	20	mA
G005	Vd()	ESD Susceptibility, all pins	HBM, 100 pF discharged through 1.5 kΩ		2	kV
G006	Tj	Junction Temperature		-40	150	°C
G007	Ts	Chip Storage Temperature		-40	150	°C

### THERMAL DATA

Operating conditions: VCC = 4.1...5.5 V

Item No.	Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
T01	Ta	Operating Ambient Temperature Range		-40		125	°C
T02	Ts	Storage Temperature Range		-40		125	°C
T03	Tpk	Soldering Peak Temperature	tpk < 20 s, convection reflow tpk < 20 s, vapor phase soldering  MSL 5A (max. floor life 24 h at 30 °C and 60 % RH); Refer to <a href="#">Handling and Soldering Conditions</a> for details.			245 230	°C °C

All voltages are referenced to ground unless otherwise stated.

All currents flowing into the device pins are positive; all currents flowing out of the device pins are negative.

# iC-PNH Series

## PHASED ARRAY NONIUS ENCODERS



Rev F1, Page 8/15

### ELECTRICAL CHARACTERISTICS

Operating conditions: VCC = 4.1...5.5 V, VB = 0 V, Tj = -40...125 °C, unless otherwise stated

Item No.	Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
<b>Total Device</b>							
001	VCC	Permissible VCC Supply Voltage	regular operation	4.1		5.5	V
002	I(VCC)	VCC Supply Current	no load, Vout() < Vout()mx		9.5	15	mA
003	Vc()hi	Clamp-Voltage hi at all pins	I() = 4 mA			11	V
004	Vc()lo	Clamp-Voltage lo at all pins	I() = -4 mA	-1.2		-0.3	V
<b>Photosensors</b>							
101	$\lambda_{ar}$	Spectral Application Range	$Se(\lambda_{ar}) = 0.25 \times S(\lambda_{pk})$	400		950	nm
102	$S(\lambda)$	Spectral Sensitivity	$\lambda_{LED} = 460 \text{ nm}$ $\lambda_{LED} = 740 \text{ nm}$ $\lambda_{LED} = 850 \text{ nm}$		0.25 0.5 0.35		A/W A/W A/W
103	$\lambda_{pk}$	Peak Sensitivity Wavelength			680		nm
<b>Photocurrent Amplifiers</b>							
201	Iph()	Permissible Photocurrent Operating Range		0		1120	nA
202	$\eta()$ r	Photo Sensitivity (light-to-voltage conversion ratio)	$\lambda_{LED} = 740 \text{ nm}$		0.3		V/ $\mu$ W
203	Z()	Equivalent Transimpedance Gain	$Z = Vout() / Iph()$	0.7	1.0	1.4	M $\Omega$
204	TCz	Temperature Coefficient of Transimpedance Gain			-0.12		%/ $^{\circ}$ C
205	$\Delta Z()$ pn	Transimpedance Gain Matching	P.. channel vs. corresponding N.. channel	-0.2		0.2	%
206	$\Delta Vout()$ pn	Signal Matching	no illumination; any output vs. any output P.. output vs. corresponding N.. output	-35 -2.5		35 2.5	mV mV
207	fc()hi	Cut-off Frequency (-3 dB)			400		kHz
208	VNoise()	RMS Output Noise	illuminated to 500 mV signal level above dark level, 500 kHz band width		0.5		mV
<b>Signal Outputs</b>							
301	Vout()mx	Permissible Max. Output Voltage	refer to Figure 1	2.0			V
302	Iout()mx	Permissible Max. Load Current		-100		250	$\mu$ A
303	Vout()d	Dark Signal Level	no illumination, I() $\leq$ 50 $\mu$ A	575	770	1000	mV
304	Isc()hi	Short-Circuit Current hi	load current to ground	100	420	1300	$\mu$ A
305	Isc()lo	Short-Circuit Current lo	load current to IC	250	480	700	$\mu$ A
306	Ri()	Internal Output Resistance	f = 1 kHz	70	110	180	$\Omega$
307	ton()	Power-On Settling Time	VCC = 0 V $\rightarrow$ 5 V			100	$\mu$ s
<b>Reference Voltage VREF</b>							
401	VREF	Reference Voltage	I(VREF) = -100...+300 $\mu$ A	575	770	1000	mV
402	dVout()	Load Balancing	I(VREF) = -100...+300 $\mu$ A	-10		+10	mV
403	Isc()hi	Short-Circuit Current hi	load current to ground	200	420	2000	$\mu$ A
404	Isc()lo	Short-Circuit Current lo	load current to IC	0.5	4.5	10	mA
<b>Digital Outputs MTA, MTB and Auxiliary Supply VB (chip release Y, and X)</b>							
601	VB	Auxiliary Supply VB for MTA/MTB Operation	VCC < 0.5 V, or as #001 with 100 $\mu$ s ahead	1.8		5.5	V
602	I(VB)	Supply Current in VB	VCC = 1.8 ... +5.5 V, MTA, MTB not loaded			300	$\mu$ A
603	I(VB)cyc	Averaged Supply Current in VB	VCC = 0 V, VB on-cycle 15 $\mu$ s, illuminated for 3 $\mu$ s, MTA, MTB not loaded			80	$\mu$ A
604	ton(VB)	VB Power-Up Settling Time for MTA/MTB Operation	VB = 0 V $\rightarrow$ 1.8 V, without illumination; refer to Figure 4			10	$\mu$ s
605	ton(VCC)	VCC Power-Up Settling Time for MTA/MTB Operation	VB = 0 V, without illumination; refer to Figure 3			100	$\mu$ s
606	toff(VCC)	VCC Power-Down Delay Time for MTA/MTB Operation	Validity delay after VCC < 0.5 V; refer to Figure 5			40	$\mu$ s



# iC-PNH Series

## PHASED ARRAY NONIUS ENCODERS



Rev F1, Page 9/15

### ELECTRICAL CHARACTERISTICS

Operating conditions: VCC = 4.1...5.5 V, VB = 0 V, Tj = -40...125 °C, unless otherwise stated

Item No.	Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
607	Vs()hi	Saturation Voltage hi at MTA, MTB	VB = 0 V, Vs()hi = VCC - V(), I() = -130 µA VB as #601, Vs()hi = VB - V(), I() = -130 µA			0.4 0.4	V V
608	Vs()lo	Saturation Voltage lo at MTA, MTB	VB = 0 V or as #601; I() = 200 µA			0.4	V
609	ton_LED	Recommended Illumination Time	VB = 0 V or as #601; Gray-code scanning by DA, DB, sensors: Iph(DA, DB) = 100...260 nA, Iph(DR) = 180 nA See Figure 2 and note on verification.	3			µs
610	tp1()	Output Validity at MTA, MTB	VB = 0 V or as #601; see Figure 6; output stable for readout after LED on			3	µs
611	tp2()	Output Validity at MTA, MTB	VB = 0 V or as #601; see Figure 6; output stable for readout after LED off	1			µs
612	Vout()max	Maximum Output Voltage at MTA, MTB	VB = 0 V VB as #601			VCC VB	V V
<b>Device Specific: iC-PNH2612 (chip release Y)</b>							
V101	Aph()	Radiant Sensitive Area	sensors of N/M/S tracks sensors of MTA, MTB tracks		0.076 0.03		mm <sup>2</sup> mm <sup>2</sup>
V102	E()mxr	Irradiance For Max. Signal Level	λ <sub>LED</sub> = 740 nm, Vout() not saturated		2.9		mW/ cm <sup>2</sup>
<b>Device Specific: iC-PNH2624 (chip release Z, Y)</b>							
V201	Aph()	Radiant Sensitive Area	sensors of N/M/S tracks sensors of MTA, MTB tracks		0.067 0.03		mm <sup>2</sup> mm <sup>2</sup>
V202	E()mxr	Irradiance For Max. Signal Level	λ <sub>LED</sub> = 740 nm, Vout() not saturated		3.3		mW/ cm <sup>2</sup>
<b>Device Specific: iC-PNH2624 (chip release X)</b>							
V2X01	Aph()	Radiant Sensitive Area	sensors of N/M/S tracks sensors of MTA, MTB tracks		0.058 0.03		mm <sup>2</sup> mm <sup>2</sup>
V2X02	E()mxr	Irradiance For Max. Signal Level	λ <sub>LED</sub> = 740 nm, Vout() not saturated		3.8		mW/ cm <sup>2</sup>
<b>Device Specific: iC-PNH2628 (chip release Y)</b>							
V301	Aph()	Radiant Sensitive Area	sensors of N/M/S tracks sensors of MTA, MTB tracks		0.052 0.03		mm <sup>2</sup> mm <sup>2</sup>
V302	E()mxr	Irradiance For Max. Signal Level	λ <sub>LED</sub> = 740 nm, Vout() not saturated		4.2		mW/ cm <sup>2</sup>
<b>Device Specific: iC-PNH3312 (chip release Y)</b>							
V401	Aph()	Radiant Sensitive Area	sensors of N/M/S tracks sensors of MTA, MTB tracks		0.10 0.03		mm <sup>2</sup> mm <sup>2</sup>
V402	E()mxr	Irradiance For Max. Signal Level	λ <sub>LED</sub> = 740 nm, Vout() not saturated		2.2		mW/ cm <sup>2</sup>
<b>Device Specific: iC-PNH3912 (chip release Y)</b>							
V501	Aph()	Radiant Sensitive Area	sensors of N/M/S tracks sensors of MTA, MTB tracks		0.064 0.029		mm <sup>2</sup> mm <sup>2</sup>
V502	E()mxr	Irradiance For Max. Signal Level	λ <sub>LED</sub> = 740 nm, Vout() not saturated		3.5		mW/ cm <sup>2</sup>
<b>Device Specific: iC-PNH3948 (chip release Y)</b>							
V601	Aph()	Radiant Sensitive Area	sensors of N/M/S tracks sensors of MTA, MTB tracks		0.060 0.029		mm <sup>2</sup> mm <sup>2</sup>
V602	E()mxr	Irradiance For Max. Signal Level	λ <sub>LED</sub> = 740 nm, Vout() not saturated		3.7		mW/ cm <sup>2</sup>

### ELECTRICAL CHARACTERISTICS

Operating conditions:  $V_{CC} = 4.1...5.5\text{ V}$ ,  $V_B = 0\text{ V}$ ,  $T_j = -40...125\text{ }^\circ\text{C}$ , unless otherwise stated

Item No.	Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
<b>Device Specific: iC-PNH3948 (chip release X)</b>							
V6X01	Aph()	Radiant Sensitive Area	sensors of N/M/S tracks sensors of MTA, MTB tracks		0.055 0.029		mm <sup>2</sup> mm <sup>2</sup>
V6X02	E()mxr	Irradiance For Max. Signal Level	$\lambda_{LED} = 740\text{ nm}$ , $V_{out}()$ not saturated		4.0		mW/cm <sup>2</sup>

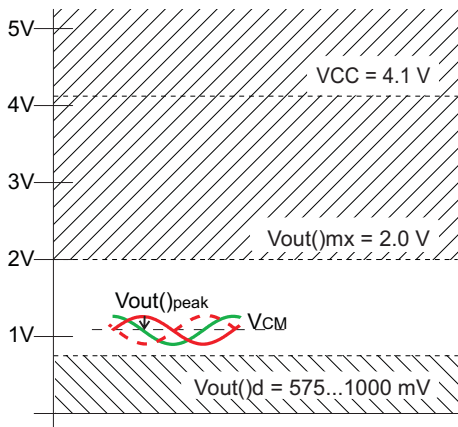


Figure 1: Permissible maximum output voltage range and example of typical output voltage.



Figure 2: Regular Gray code output at MTA (CH3, magenta) and MTB (CH4, green) during normal operation; shown with PS\_M (CH1, yellow) and PC\_M (CH2, blue).

**Note:** With a state of the art optical path and assembly of the encoder, the operating range for the signal output at MTA/MTB may be extended to 1/3 of the nominal illumination level (i.e. LED current at 33 %)

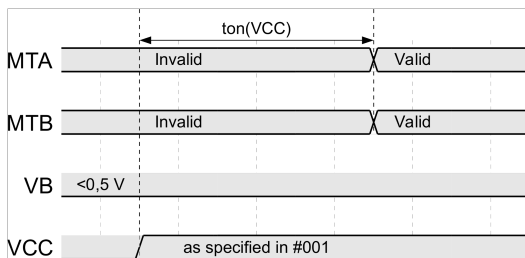


Figure 3: Outputs MTA and MTB operated from main supply VCC.

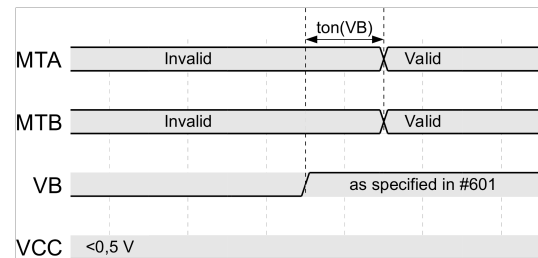


Figure 4: Outputs MTA and MTB operated from auxiliary supply VB.

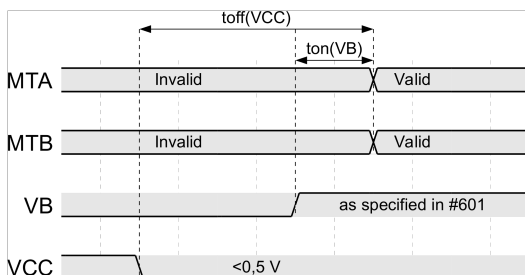


Figure 5: Intersection from main supply VCC to auxiliary supply VB.

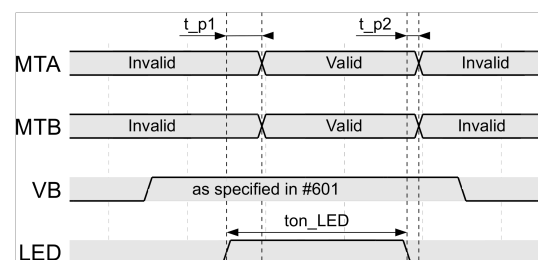


Figure 6: MTA and MTB output validity depending on LED flash.

### DEVICE OVERVIEW

Device	CPR Master	Code Disc P/O Code	Material	OR <sup>1</sup> [mm]	Code Radius begin / end [mm]	Resolution <sup>2</sup> [bit]	Error Tol. <sup>3</sup> [e°]
<b>∅ 26 H-Series</b>		(disc diameter 26.0 mm, bore hole 11.6 mm)					
iC-PNH2628	2x64	PNH6S 26-128	glass	10.905	9.4 / 12.4	21	± 19.6
iC-PNH2612	2x256	PNH3S 26-512	glass	10.905	9.4 / 12.4	23	± 9.8
iC-PNH2624	2x512	PNH9S 26-1024	glass	10.905	9.4 / 12.4	24	± 4.9
<b>∅ 33 H-Series</b>		(disc diameter 33.2 mm, bore hole 18.0 mm)					
iC-PNH3312	2x256	PNH2S 33-512	glass	14.5	13.0 / 16.0	23	± 9.8
iC-PNH3348 <sup>4</sup>	2x1024	PNH1S 33-2048	glass	14.5	13.0 / 16.0	25	± 4.9
<b>∅ 39 H-Series</b>		(disc diameter 39.0 mm, bore hole 18.0 mm)					
iC-PNH3912	2x256	PNH8S 39-512	glass	17.5	16.0 / 19.0	23	± 4.9
iC-PNH3948	2x1024	PNH4S 39-2048	glass	17.5	16.0 / 19.0	25	± 4.9

<sup>1</sup> Optical center radius.

<sup>2</sup> Angle resolution per single turn; interpolated by iC-MNF with 14 bit resolution.

<sup>3</sup> Permissible maximum track-to-track signal phase deviation in electrical degree per master signal cycle.

<sup>4</sup> **EncoderBlue®**. EncoderBlue is a trademark of iC-Haus GmbH.

Device availability on request.

Table 4: Device overview

### APPLICATION CIRCUITS

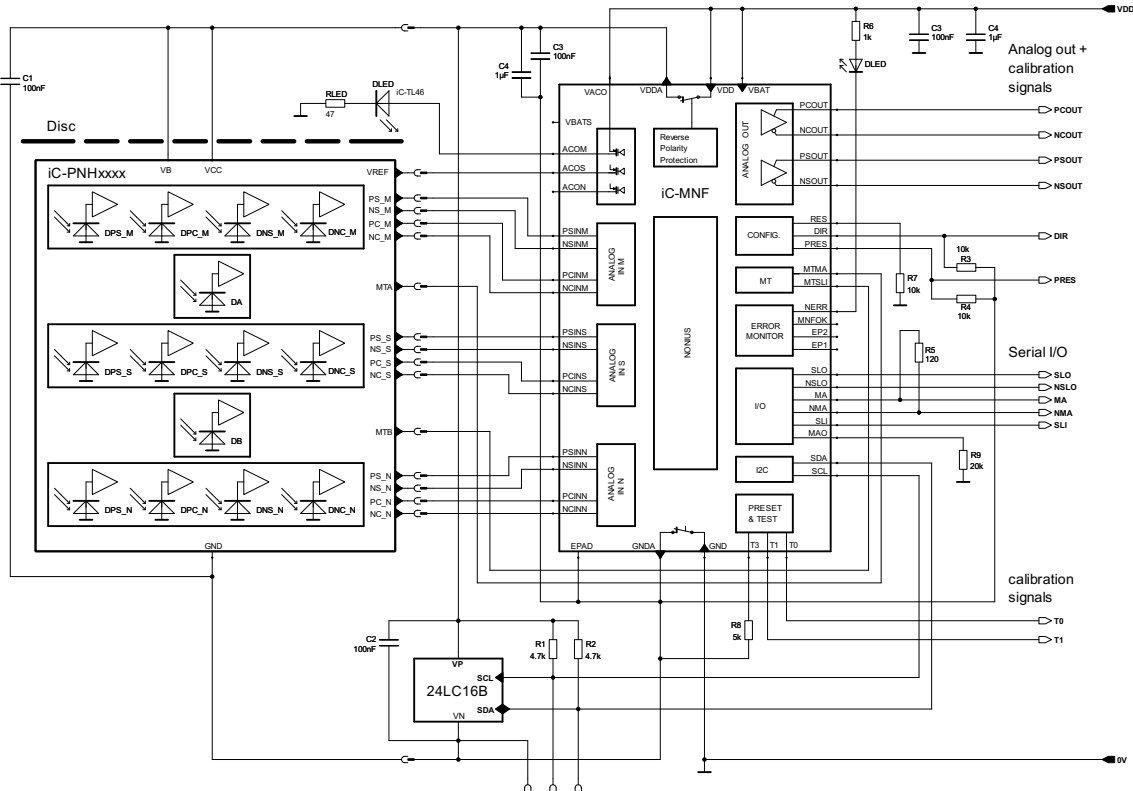


Figure 7: Application example of absolute encoder circuit.

### DESIGN REVIEW: Notes On Chip Functions

iC-PNHxxxx.		
No.	Function, Parameter/Code	Description and Application Hints
1		Refer to datasheet iC-PNH3348 release B1, 2014.

Table 5: Notes on chip functions regarding iC-PNH series chip release 0.

iC-PNHxxxx Z1		
No.	Function, Parameter/Code	Description and Application Hints
1	HD Phased Array	Chip release utilizes a high definition phased array layout.

Table 6: Notes on chip functions regarding iC-PNH series chip releases Z1.

iC-PNHxxxx Y, X		
No.	Function, Parameter/Code	Description and Application Hints
1	Supply VB	Auxiliary supply input VB connects to reserved pin 32. For recommendations on wiring, refer to footnotes on Page 4.
2	Outputs MTA and MTB	Refer to Elec. Char. for changes of specifications.
3	Package Dimensions	Chip release X: thickness of glass lid changed to 200 µm.

Table 7: Notes on chip functions regarding iC-PNH series chip release Y, and X.

# iC-PNH Series

## PHASED ARRAY NONIUS ENCODERS



Rev F1, Page 13/15

### REVISION HISTORY

Rel.	Rel. Date <sup>1</sup>	Chapter	Modification	Page
A1	2011-07-25	...	Initial release introducing iC-PNH3348.	all

Rel.	Rel. Date <sup>1</sup>	Chapter	Modification	Page
B1	2014-05-22	...	Refer to iC-PNH3348 datasheet release B1.	

Rel.	Rel. Date <sup>1</sup>	Chapter	Modification	Page
C1	2015-01-27	All	Introduction of iC-PNH series.	all

Rel.	Rel. Date <sup>1</sup>	Chapter	Modification	Page
C3	2016-01-18	...	Inclusion of chip release Y. iC-PNH3348 taken off to separated <a href="#">EncoderBlue®</a> datasheet.	various
		ELECTRICAL CHARACTERISTICS	Item 102: blue wavelenght supplemented Items 302: new entry Items 303, 401: min. limit, items 304, 403: max. limit Item 600ff: new block added for chip rel. Y	6, 7

Rel.	Rel. Date <sup>1</sup>	Chapter	Modification	Page
C4	2016-07-20	PACKAGING INFORMATION	VB pin name and footnote 2 on wiring	3
		ABSOLUTE MAXIMUM RATINGS	Item G001, G002: pin VB supplemented	5
		THERMAL DATA	OTR extended to 125 °C	5
		ELECTRICAL CHARACTERISTICS	Operating conditions: VB supplemented Items 003, 004: moved to 501, 502 Item 303: condition Item 608: conditions and limits	7
		APPLICATION CIRCUITS	Fig. 1, iC-PNHxxx symbol corrected	8

Rel.	Rel. Date <sup>1</sup>	Chapter	Modification	Page
D1	2017-11-08	DESCRIPTION	Device iC-PNH3912 added	2
		PACKAGING INFORMATION	Package drawing updated: minimum thickness 0.9 mm	3
		ELECTRICAL CHARACTERISTICS	Items 304, 403: max limits Item 608: min/max limits Item 609 added Items V501, V502 added for iC-PNH3912	8
		DEVICE OVERVIEW	Chapter supplemented	11
		ORDERING INFORMATION	Updated for iC-PNH3912 and codedisc	15

Rel.	Rel. Date <sup>1</sup>	Chapter	Modification	Page
D2	2018-01-17	PACKAGING INFORMATION	Footnote supplemented for chip rel. X	3
		ELECTRICAL CHARACTERISTICS	Block 6, V6: adaption of headline to include chip release X	8
		DESIGN REVIEW: Notes On Chip Functions	Supplemented for chip rel. X	12

Rel.	Rel. Date <sup>1</sup>	Chapter	Modification	Page
D3	2018-08-17	ELECTRICAL CHARACTERISTICS	Item 102: condition added, limits adapted Item 301: comment added, and Figure 1 added	8
		ORDERING INFORMATION	iC-PNH2624_X and codedisc PNH9S 26-1024 added	15

Rel.	Rel. Date <sup>1</sup>	Chapter	Modification	Page
E1	2019-05-24	PACKAGING INFORMATION	Package drawing added for chip release X	5
		ELECTRICAL CHARACTERISTICS	Items 605 to 609: update of conditions Item 601: update of condition Item 605 and 606: added as new item Figures 3, 4, 5, and 6 added on power-up timings	8ff

Rel.	Rel. Date <sup>1</sup>	Chapter	Modification	Page
E2	2020-03-02	PACKAGING INFORMATION	AOI criteria added	3

# iC-PNH Series

## PHASED ARRAY NONIUS ENCODERS



Rev F1, Page 14/15

Rel.	Rel. Date <sup>1</sup>	Chapter	Modification	Page
F1	2021-02-02	PACKAGING INFORMATION	Update of AOI criteria: hyperlink to customer information in footnote	3
		PACKAGE DIMENSIONS	Update of package drawings and footnote	5, 6
		THERMAL DATA	Item T03: hyperlink to customer information	7
		ELECTRICAL CHARACTERISTICS	V100ff: subtitles edited for chip release Sections V2X and V6X added (on chip release X) Figure 2 and note box added on verification of MTA/MTB output signals	10
		DEVICE OVERVIEW	Table 4 update for resolution of iC-MNF	11
		APPLICATION CIRCUITS	Figure 7 updated to iC-MNF	12
		ORDERING INFORMATION	Listing updated	15

iC-Haus expressly reserves the right to change its products, specifications and related supplements (together the Documents). A Datasheet Update Notification (DUN) gives details as to any amendments and additions made to the relevant Documents on our internet website [www.ichaus.com/DUN](http://www.ichaus.com/DUN) and is automatically generated and shall be sent to registered users by email.

Copying – even as an excerpt – is only permitted with iC-Haus' approval in writing and precise reference to source.

The data and predicted functionality is intended solely for the purpose of product description and shall represent the usual quality and behaviour of the product. In case the Documents contain obvious mistakes e.g. in writing or calculation, iC-Haus reserves the right to correct the Documents and no liability arises insofar that the Documents were from a third party view obviously not reliable. There shall be no claims based on defects as to quality and behaviour in cases of insignificant deviations from the Documents or in case of only minor impairment of usability.

No representations or warranties, either expressed or implied, of merchantability, fitness for a particular purpose or of any other nature are made hereunder with respect to information/specification resp. Documents or the products to which information refers and no guarantee with respect to compliance to the intended use is given. In particular, this also applies to the stated possible applications or areas of applications of the product.

iC-Haus products are not designed for and must not be used in connection with any applications where the failure of such products would reasonably be expected to result in significant personal injury or death (*Safety-Critical Applications*) without iC-Haus' specific written consent. Safety-Critical Applications include, without limitation, life support devices and systems. iC-Haus products are not designed nor intended for use in military or aerospace applications or environments or in automotive applications unless specifically designated for such use by iC-Haus.

iC-Haus conveys no patent, copyright, mask work right or other trade mark right to this product. iC-Haus assumes no liability for any patent and/or other trade mark rights of a third party resulting from processing or handling of the product and/or any other use of the product.

Software and its documentation is provided by iC-Haus GmbH or contributors "AS IS" and is subject to the ZVEI General Conditions for the Supply of Products and Services with iC-Haus amendments and the ZVEI Software clause with iC-Haus amendments ([www.ichaus.com/EULA](http://www.ichaus.com/EULA)).

<sup>1</sup> Release Date format: YYYY-MM-DD

# iC-PNH Series

## PHASED ARRAY NONIUS ENCODERS



Rev F1, Page 15/15

### ORDERING INFORMATION

Type	Package	Options	Order Designation
iC-PNHxxxx	32-pin optoQFN, 5 mm x 5 mm, thickness 0.9 mm RoHS compliant	xxxx = device version	iC-PNHxxxx oQFN32-5x5
Code Disc	Glass disc 1.0 mm	nn = design number aa = diameter cc...cccc = master track CPR  for iC-PNH3312 (2x 256 CPR) for iC-PNH2612 (2x 256 CPR) for iC-PNH3948 (2x 1024 CPR) for iC-PNH2624, chip rel. Z1, Y (2x 512 CPR) for iC-PNH2624, chip rel. X (2x 512 CPR) for iC-PNH2628 (2x 64 CPR) for iC-PNH3912 (2x 256 CPR)	PNHnnS aa-cccc  PNH2S 33-512 PNH3S 26-512 PNH4S 39-2048 PNH5S 26-1024  PNH9S 26-1024  PNH6S 26-128 PNH8S 39-512
Evaluation Kit	Kit with Scanner Module IC273 (61 mm x 64 mm), LED Module IC274 and Code Disc	xxxx = device version	iC-PNHxxxx EVAL IC273
Illumination	Infrared LED module (28 mm x 29 mm) Blue LED module (28 mm x 29 mm)	with iC-SD85 (850 nm)  with iC-TL46 (460 nm)	iC-SD85 EVAL IC274  iC-TL46 EVAL IC274
Mother Board	Adapter PCB (80 mm x 110 mm)	incl. ribbon cable	iC277 EVAL IC277
Adapter Board	Adapter PCB, connects IC273 to MN1D (41 mm x 41 mm)	incl. ribbon cable	iC306 EVAL IC306

Please send your purchase orders to our order handling team:

**Fax: +49 (0) 61 35 - 92 92 - 692**  
**E-Mail: [dispo@ichaus.com](mailto:dispo@ichaus.com)**

For technical support, information about prices and terms of delivery please contact:

**iC-Haus GmbH**  
**Am Kuemmerling 18**  
**D-55294 Bodenheim**  
**GERMANY**

**Tel.: +49 (0) 61 35 - 92 92 - 0**  
**Fax: +49 (0) 61 35 - 92 92 - 192**  
**Web: <http://www.ichaus.com>**  
**E-Mail: [sales@ichaus.com](mailto:sales@ichaus.com)**

**Appointed local distributors: [http://www.ichaus.com/sales\\_partners](http://www.ichaus.com/sales_partners)**