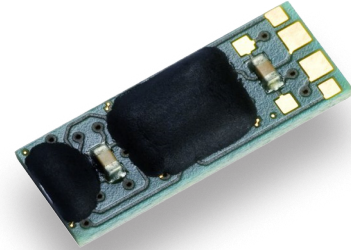# EBI7901CAx-DA-UF

Incremental Sensor Module

The sensor module EBI7901CAx-DA-UF contains an AMR (Anisotropic MagnetoResistive) FixPitch sensor and an interpolation-IC with a resolution up to 80 flanks per magnetic pole.

The AL798 AMR sensor with PurePitch layout is designed for a magnetic scale with 1 mm magnetic pole pitch.

The combination of the magnetic scale and the electronic module delivers two 90 degree phase shifted rectangular signals A and B (see Fig. 1).

Different preconfigured sensor modules are available (see page 6).

Product Overview

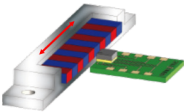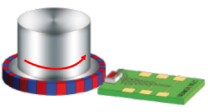| Article	Description
EBI7901CAx-DA-UF	Incremental module for 1 mm pitch with programmable resolution

For order information see page 6.

Quick Reference Guide

Symbol	Parameter	Min.	Typ.	Max.	Unit
V_{CC}	Supply voltage	4.5	5.0	5.5	V
I_C	Current consumption	-	8.0	-	mA
A	Resolution (flank to flank)[1), 2)]	250	-	12.5	µm
F	Flanks per mm [2)]	4	-	80	-
T_{amb}	Ambient temperature	-40	-	+100	°C

[1)]   Correlates to the preconfigured number of flanks per mm.

[2)]   Different resolutions are available, see page 6 for more information.

Measurement Setup

Depiction	Configuration	Application
	Linear magnetic scale with fixed pole length (pitch); sensors mounted perpendicularly to the magnetic track on the scale.	Incremental length measurement.
	Magnetic pole ring with fixed pitch; sensor mounted on substrate radially to the pole ring; sensor surface in plane with the pole ring.	Incremental angle measurement at the shaft circumference.

Features

–   A/B output signal (TTL)

–   PurePitch AMR sensor

–   Temperature range from -40 °C to +100 °C

Advantages

–   Small size

–   Fast signal processing

Applications

Incremental encoder for linear or rotary movements in various industrial applications, for example:

–   Motor integrated encoder

–   Motor feedback system

–   Micro positioning systems

ESD

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Absolute Maximum Ratings Values

In accordance with the absolute maximum rating system (IEC60134).

Symbol	Parameter	Min.	Max.	Unit
V_{CC}	Supply voltage	-0.3	+6.0	V
T_{amb}	Ambient temperature	-40	+100	°C
T_{stg}	Storage temperature	-40	+125	°C

Stresses beyond those listed under "absolute maximum ratings" may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

Electrical Data

T_{amb} = 25 °C; H_{ext} = 20 kA/m; V_{CC} = 5 V; unless otherwise specified.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V_{CC}	Supply voltage		4.5	5.0	5.5	V
I_C	Current consumption	No load	-	8.0	-	mA
F	Flanks per mm [2]		4	-	80	-
A	Resolution (flank to flank) [1] [2]		250	-	12.5	µm
Hys	Hysteresis	Based on pitch	-0.1	-	0.1	%
T_{amb}	Ambient temperature		-40	-	+100	°C

[1] Correlates to the preconfigured number of flanks per mm.

[2] Different resolutions are available, see page 6 for more information.

Operational Data

T_{amb} = 25 °C; H_{ext} = 20 kA/m; V_{CC} = 5V; unless otherwise specified.

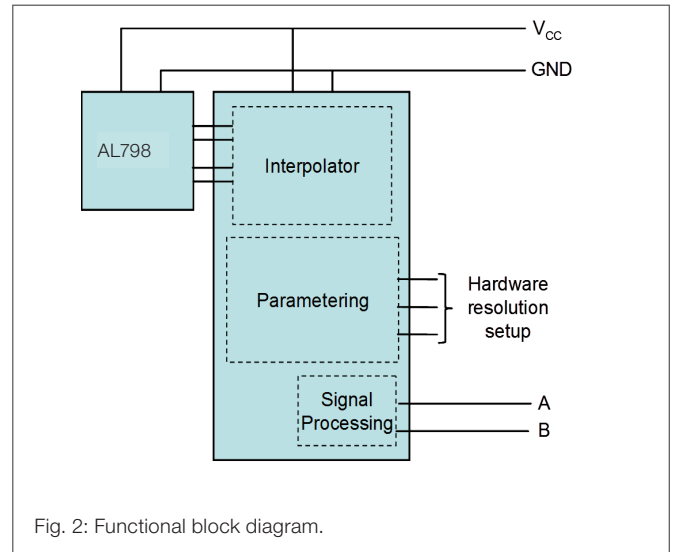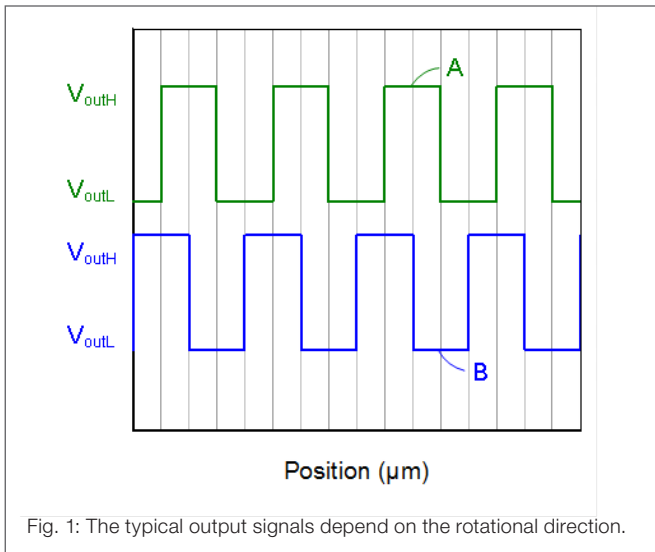| Article Description	Resolution Flanks per mm	Interpolation Factor IPF	Input Frequency [1]
EBI7901CAA-DA-UF	4	1	20 kHz
EBI7901CAC-DA-UF	16	4	20 kHz
EBI7901CAD-DA-UF	20	5	20 kHz
EBI7901CAE-DA-UF	32	8	20 kHz
EBI7901CAF-DA-UF	64	16	20 kHz
EBI7901CAG-DA-UF	80	20	10 kHz

[1] Maximum input frequency (see page 3 for more information) .

Mechanical Data

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
Δd	Working distance (scale surface ↔ sensor)	Depends on magnetic scale	-	300	-	µm

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Typical Performance Graphs

Fig. 1: The typical output signals depend on the rotational direction.

Fig. 2: Functional block diagram.

Input Frequency and Output Frequency of the Application

1. The input frequency depends on the number of poles and rotational speed respectively on the pole pitch and velocity.

a) pole ring

f_i - input frequency in Hz
n - number of poles (per revolution)
R - rotation speed in rpm

$$f_i = \frac{(n \times R)}{60}$$

Example: pole ring with 50 poles and rotating speed 1000 rpm

$$f_i = \frac{(50 \times 1000)}{60} = 833.3\,Hz$$

b) linear scale

f_i - input frequency in Hz
p - pole pitch in mm
v - velocity in m/s

$$f_i = \frac{v}{p} \times 1000$$

Example: linear scale with 1 mm pitch, velocity 2 meters per second

$$f_i = \frac{2}{1} \times 1000 = 2000\,Hz$$

2. The output frequency depends on the input frequency and the programmed resolution.

f_i - input frequency in Hz
f_o - output frequency in Hz
res - programmed resolution

$$f_0 = f_i \times \frac{res}{4}$$

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Pinning

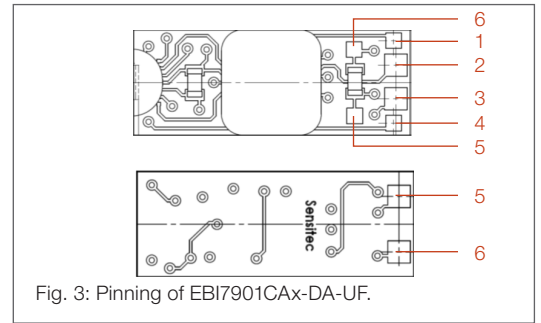| Pad	Symbol	Parameter
1	V_{01}	Output voltage bridge 1
2	A	Output signal A
3	B	Output signal B
4	V_{02}	Output voltage bridge 2
5	GND	Ground
6	V_{CC}	Supply voltage

Fig. 3: Pinning of EBI7901CAx-DA-UF.

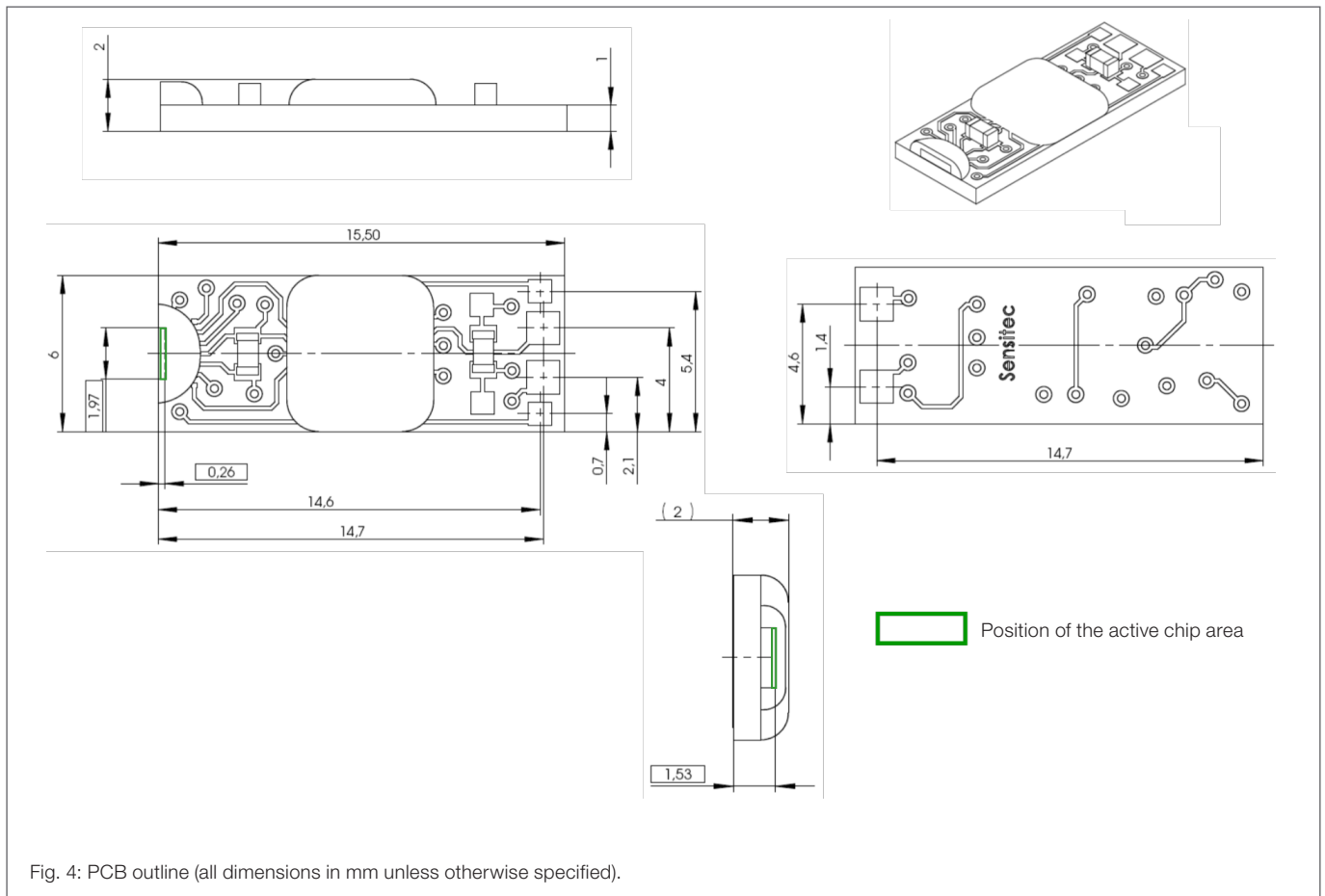**Note:** Do not connect a load to the pads 1 and 4 during operation.

Dimensions

Position of the active chip area

Fig. 4: PCB outline (all dimensions in mm unless otherwise specified).

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Detailed Pin Description

Pad	Symbol	Parameter	Description	Additional information
1	V_{01}	Output voltage bridge 1	Amplified sensor signal sine	Do not connect a load to the pad during operation.
2	A	Output signal A	Rectangular TTL-Signal for quad-count	See page 3, Fig. 1 for signal and phase relationship. A change of the direction changes the phase between A and B.
3	B	Output signal B	Rectangular TTL-Signal for-quad-count	
4	V_{02}	Output voltage bridge 2	Amplified sensor signal cosine	Do not connect a load to the pad during operation.
5	GND	Ground	Ground	
6	V_{CC}	Supply voltage	Supply voltage	Typically 5 V (4.5 V to 5.5 V)

Application Information to connect the Module

In this case the module has a programmed resolution of 20 flanks. This corresponds to a resolution of 50 µm.
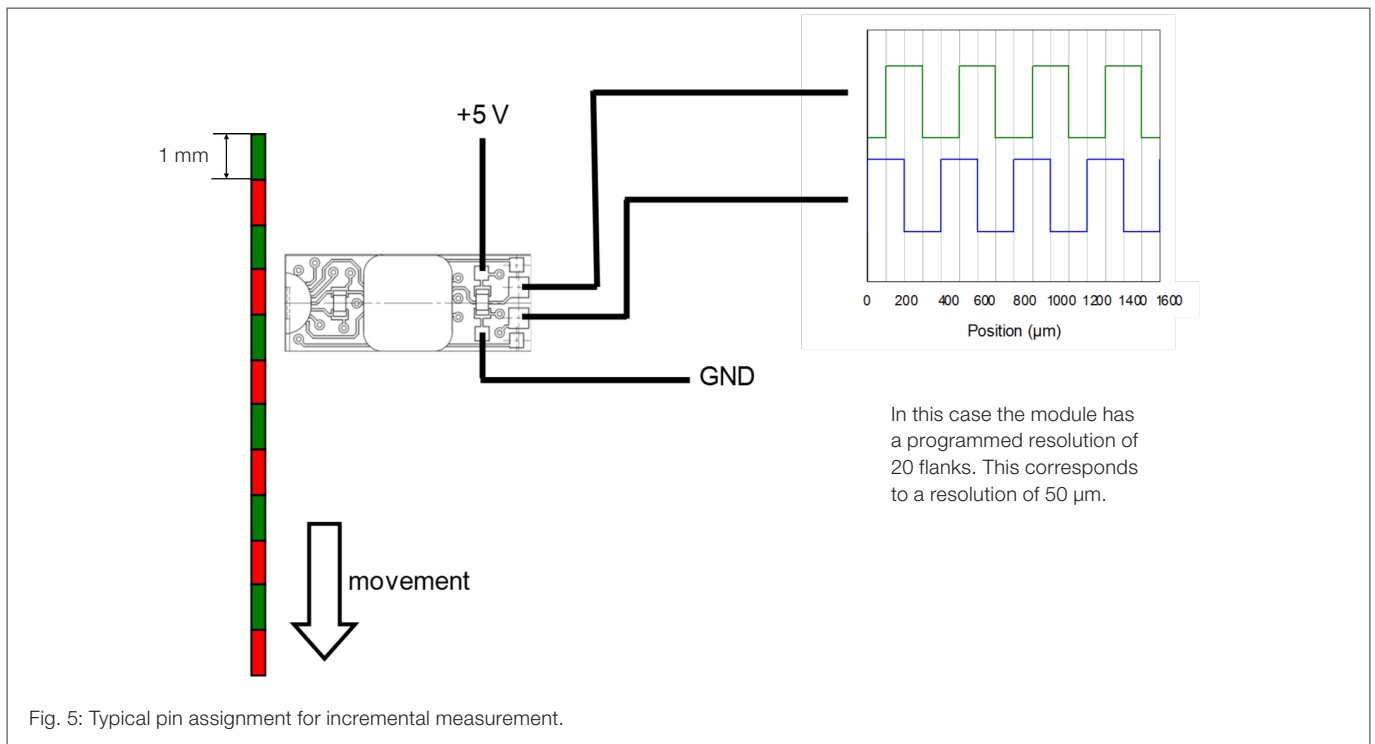
Fig. 5: Typical pin assignment for incremental measurement.

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SENSITEC
MAGNETORESISTIVE SENSORS

Order Code

EBI 7901 CAx - D A - U F

- Temperature and packaging
- Supply voltage and variant
- Sensor, output and resolution
- Module number
- Type of system
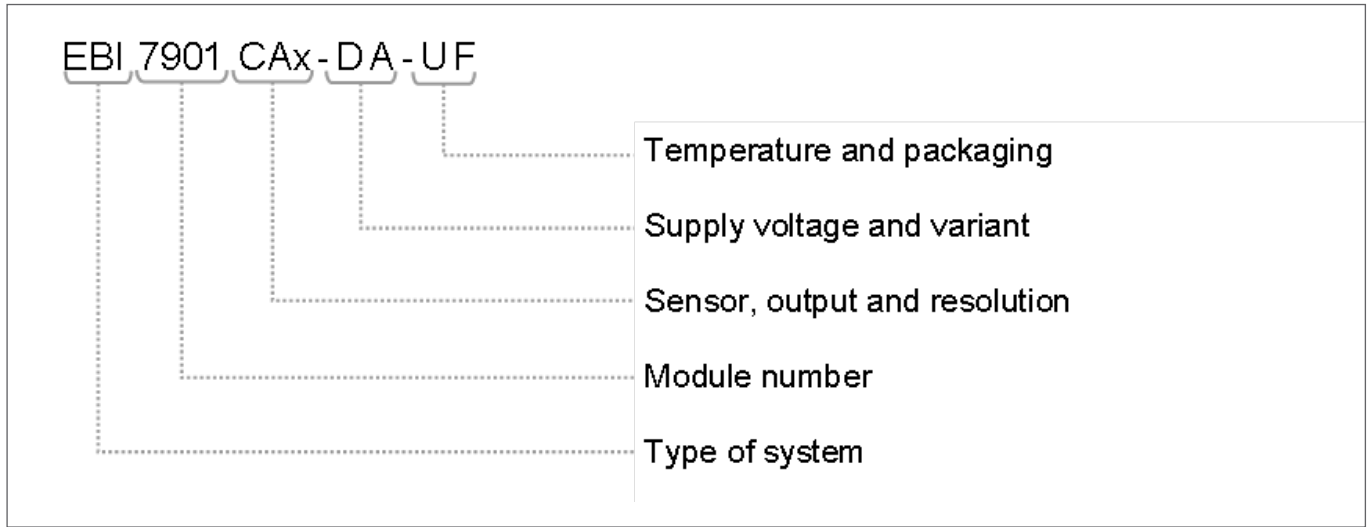
Product Overview - Standard Products
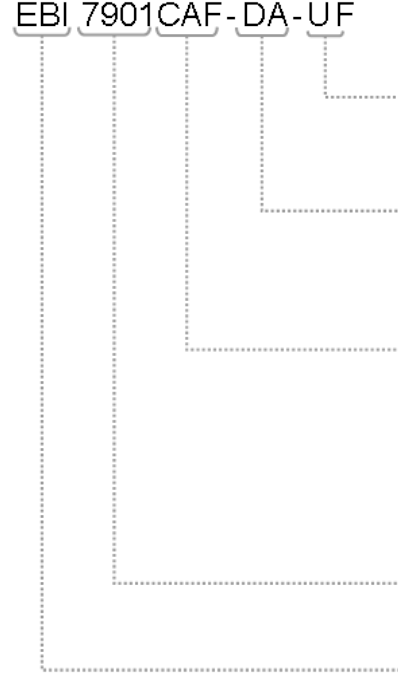
Resolution Flanks per pitch	Interpolation factor	Article description	Article number
4	1	EBI7901CAA-DA-UF	5112.2010.0
16	4	EBI7901CAC-DA-UF	5112.2012.0
32	8	EBI7901CAE-DA-UF	5112.2013.0
64	16	EBI7901CAF-DA-UF	5112.2014.0
80	20	EBI7901CAG-DA-UF	5112.2015.0

Product Overview - Special Products

Article description	Flanks per mm	Article number	Special feature
Currently not available	-	-	-

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Additional Information on Order Code

EBI 7901CAF - DA - UF

Temperature (U) and Packaging (F)
U: -40 °C...+100 °C. Operating temperature range.
F: ESD package. The primary shipping container for the module.

Supply voltage (D) and variant (A)
D: 5 V. Supply voltage of the module.
A: Standard. The data sheet describes the standard variant of the module.
All deviant variants are described separately.

Sensor (C), Output-Interface (A) and Resolution (F):
C: AL798, a 1 mm PurePitch sensor
averaging over two magnetic poles. Possible inaccuracies of the scale are
suppressed.
A digital interface with rectangular signals AB (TTL-level).
F: 64 flanks. The resolution is indicated in flanks per pitch (magnetic pole).

Module number (7901)
7901: Series 7900, module number 1

Type of system (EBI)
Electronic length and angle measurement
Measurement system including electronics (interpolator, amplifier or similar)
and equipped with a FixPitch / PurePitch sensor. Usable for angular and
length measurements.

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Special Design Features

◠ PerfectWave

Sensors with PerfectWave design provide the best signal quality, highest accuracy and optimal sensor linearity by filtering out higher harmonics in the signal. The linearity of the sensor is assured, even for weak magnetic field measurement.

◎ PurePitch

In PurePitch sensors the FixPitch principle is extended over several poles in order to increase accuracy still further. This arrangement reduces the influence of errors in the measurement scale and improves the immunity to interference fields.

♨ FixPitch

FixPitch sensors are adapted to the pole length (pitch) of the measurement scale. The linearity of the sensor is optimized and the influence of interference fields is minimized.

✖ FreePitch

FreePitch sensors are optimized so as to be independent of the pole length (pitch) of the measurement scale. FreePitch sensors are therefore particularly compact and come close to an idealized point-sensor.

◉ SmartFit

The sensor modules featuring SmartFit technologie offer additional comfort functions. One feature allows to re-parameterize a build-in sensor module (e. g. for changing the measurement resolution). Another feature is to indicate the operating status or error messages, to inform the user about the correct function or about operating disturbances. SmartFit technologie therefore offers comfort functions to make the sensor system safer, better and easier to use. Both functions are offered individually or in combination in SmartFit sensor modules.

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General Information

Product Status

Article	Status
EBI7901CAx-DA-UF	The product is in series production.
Note	The status of the product may have changed since this data sheet was published. The latest information is available on the internet at www.sensitec.com.

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Changelist

Version	Description of the Change	Date
EBI7901CAx.DSE.05	Disclaimer supplement	06/2022
EBI7901CAx.DSE.04	Change of corporate design (pp. 1-10)	01/2022
EBI7901CAx.DSE.00	Original (pp. 1-10)	07/2011

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