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## **Axon-1N-1L Neural Probe Datasheet**

Optogenetic neural probe with up to 512 electrodes and 16k LEDs

Product Datasheet (Version 1.1)

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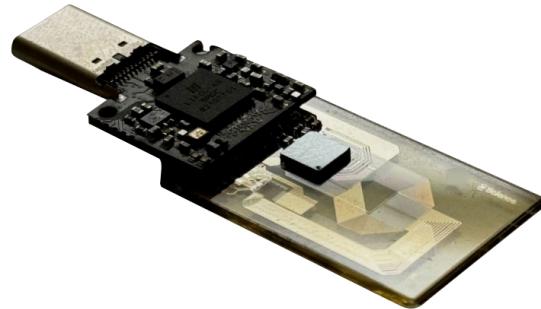
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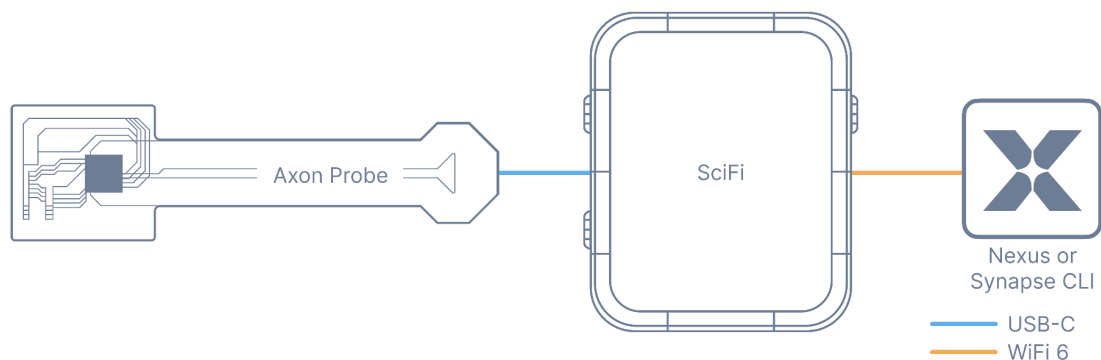
## Overview

The Axon-1N-1L family is a set of bidirectional neural probes designed for in-vitro and in-vivo applications featuring up to 512 titanium nitride (TiN) electrodes for recording and up to 16k gallium nitride (GaN) LEDs for optogenetic stimulation. Two Science ASICs provide the core functionality of the probe: the [NYX1-512™](#), a full-bandwidth 256-channel differential ADC; and the [LUX1-16K™](#), a 7-bit passive LED driver. Together, they enable closed-loop neural stimulation and recording for next generation neuroscience applications.



## Key Features

- Next-gen optogenetic probe design for closed-loop neural engineering
- Up to 512 TiN recording electrodes
- Up to 16k GaN LEDs for optogenetic stimulation
- 13 mm<sup>2</sup> active area
- On-chip amplification and analog-to-digital conversion
- Single ended and full-differential recording modes
- Small and scalable probe footprint
- Hardened device designed for long-term use



## Axon-1N-1L Characteristics

Recording characteristics	Recording channels	256 differential amplifiers
	Recording modes	Single-ended and differential recording
	Low-Pass Filter Corner	1.4 – 14 kHz
	High-Pass Filter Corner	3.8 – 460 Hz
	Gain	13 – 200 V/V
	Input referred noise	5.5 $\mu\text{V}_{\text{rms}}$ min.
	Bit depth	10 – 12 bits
	Sampling rate	4 – 32 kHz
	Input capacitance	6.8 pF
	Data throughput	Up to 130 Mb/s
Stimulation characteristics	Maximum frame rate	130 FPS
	Drive type	Passive, row raster scanning
	Brightness bit depth	7 bits

## Ordering Information

Example: Axon-1N-1L-512-TiN-529-530-TF-AAA		
Series	Recording chips	Stimulation chips
Axon	1N = 1 NYX1-512 chip	1L = 1 LUX1-16k chip

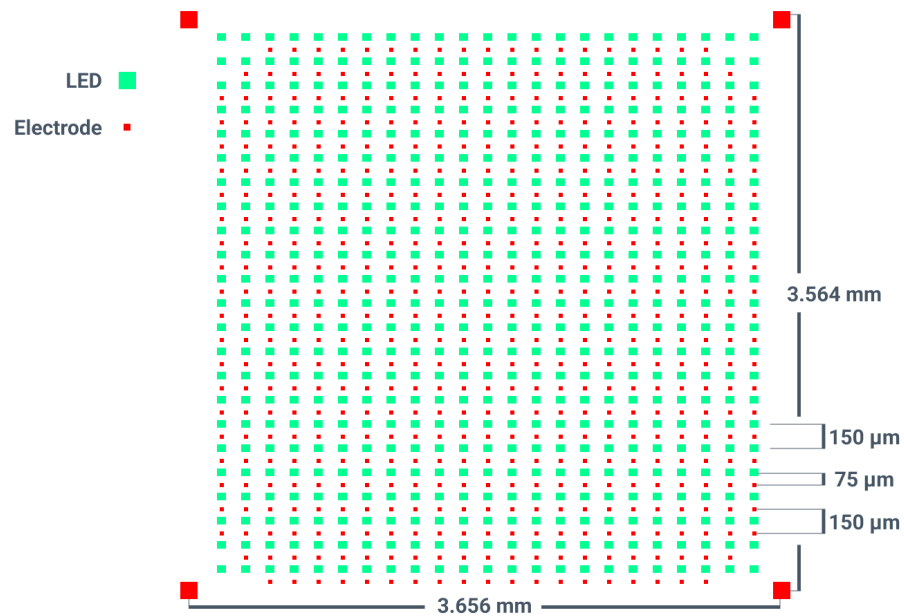
Example: Axon-1N-1L-512-TiN-529-530-TF-AAA					
Electrode Count	Electrode Material	LED Count	LED Wavelength (nm)	Format	Variant
0-512	TiN	0-16k	530	TF = Thin Film OS = On Substrate	AAA

## Axon-1N-1L-512-TiN-529-530-XX-AAA Probe Description

The Axon-1N-1L-512-TiN-529-530-XX-AAA probe enables a broad range of neuroscience experiments. The thin film variant is suitable for acute or chronic in-vivo  $\mu$ ECoG recordings, and the on-substrate variant is designed for in-vitro cell culture applications.

Probe characteristics	Probe dimensions	50 mm x 20 mm
	Well diameter	13 mm
	Power consumption	Less than 400 mW
Electrodes	Electrode sites	512
	Electrode layout	Square array covering 13 mm <sup>2</sup>
	Electrode material	Titanium Nitride (TiN)
	Electrode size	20 x 20 $\mu$ m
	Electrode impedance	Less than 80 k $\Omega$ @ 1 kHz
	Electrode pitch	150 $\mu$ m
LEDs	LED sites	529
	LED size	40 x 50 $\mu$ m <sup>2</sup>
	LED pitch	150 $\mu$ m
	LED layout	23 x 23 array covering 13 mm <sup>2</sup>
	Maximum simultaneous on LEDs	23
	LED material	Gallium Nitride (GaN)
	LED wavelength	530 nm
	LED irradiance	Less than 2.5 mW/mm <sup>2</sup> @ 10 $\mu$ m

There are 512 electrodes and 529 LEDs on this probe. The electrodes are patterned in a 23 x 23 square grid with no electrodes in the corners and a pitch of 150  $\mu$ m. The LEDs are arranged in a 23 x 23 square grid with a pitch of 150  $\mu$ m. The two grids are staggered, so the electrode-LED pitch is 75  $\mu$ m. The total active portion of the cell culture well measures 3.56 x 3.65 mm<sup>2</sup>. There are 4 reference electrodes, all shorted together, at the corners of the array to provide a spatially-average reference signal for single-ended measurements.



The probe consists of two pieces: an FR4 PCB containing control and power electronics; and a microfabricated glass substrate housing the stimulation and recording ASICs, as well as the active area. A glass well can be affixed to the substrate to create a chamber for cell culture.

## Hardware Requirements

To get started using an Axon-1N-1L Probe, you will need:

- A [SciFi wireless headstage](#).
- USB Type-C® data cable (USB3.2 gen 1x1 required)
- A WiFi network:
  - Capable of WiFi 5 (802.11ac) or later. To get best performance, use WiFi 6 (802.11ax 160MHz).
  - Supporting UDP multicast (if over the air streaming is desired).
- A PC with [synapsect!](#) software installed.

## Contact Information



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*This preliminary product datasheet may change without notice.*