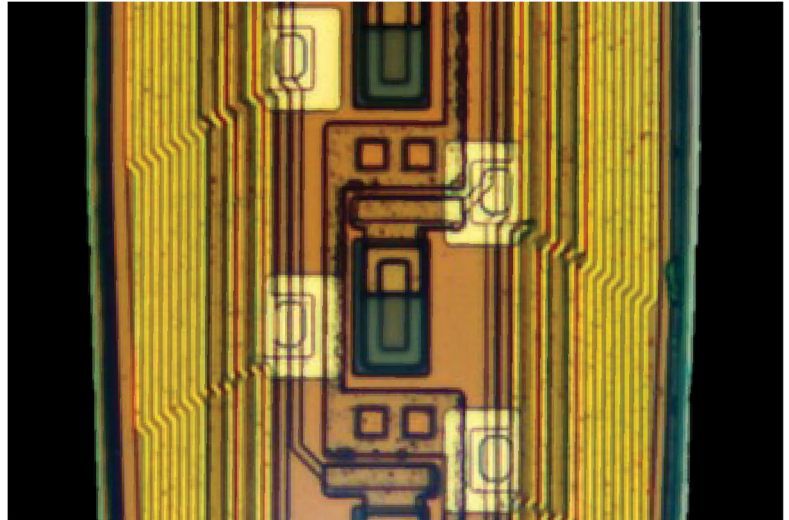


HectoSTAR Optoelectrode Datasheet



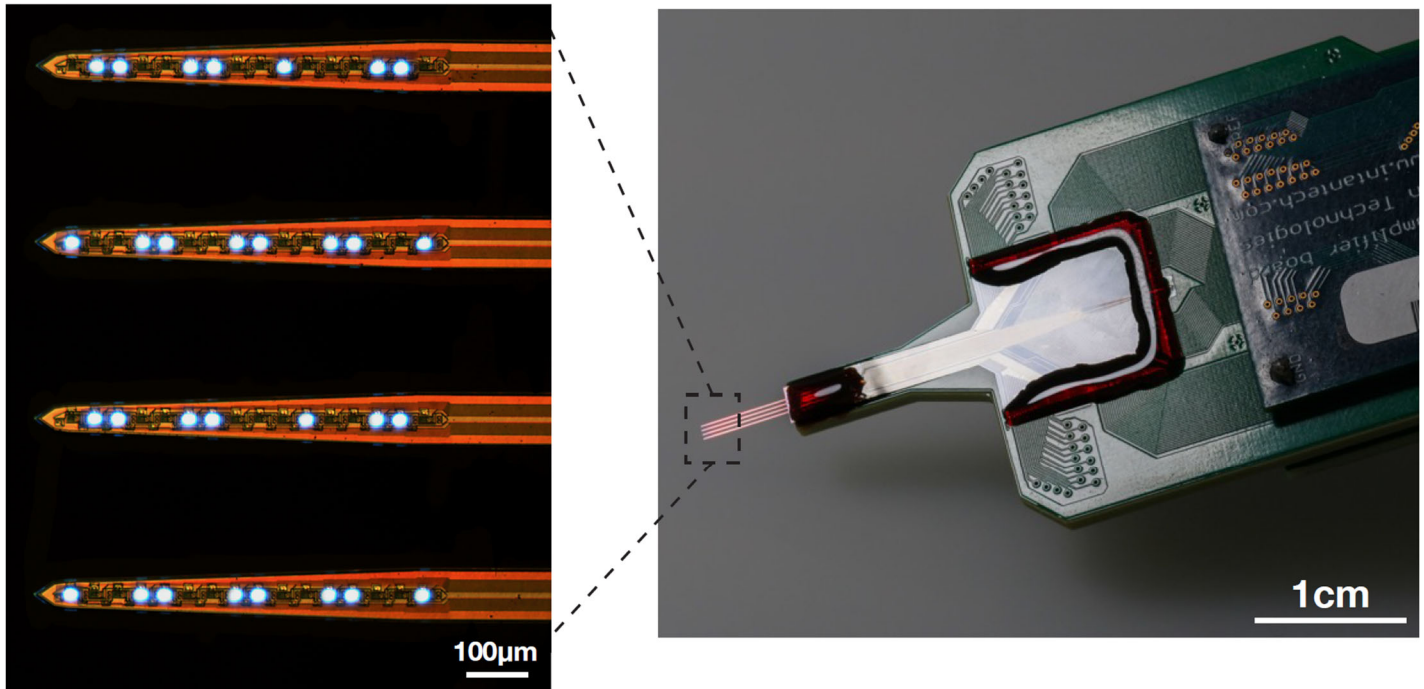
Features

- 32/64 μ LEDs, 8 x 17 μ m each, 16/32 per shank
 - Emission Peak λ = 465 nm and FWHM = 40 nm
 - Typical irradiance of 33 mW/mm² (@ max operating current of 100 μ A)
- 64/128 recording channels, 32/64 per shank
 - Electrode impedance of 1-2 M Ω at 1 kHz
 - Noise floor $\leq$ 7 μ V_{rms} using an Intan 128 CH Amplifier Board
- Custom stimulation output patterns with a 1 μ A resolution @ 20kHz update rate for up to 12 seconds of repeatable duration.
- 6 mm shank length, < 20g total weight
- Please direct questions or concerns to info@neurolighttech.com

Description

NeuroLight Technologies (NLT) provides blue (465nm) μ LED optoelectrodes for head-fixed behaving animal studies. NLT's probes use monolithically-integrated microLEDs for high spatiotemporal optical stimulation. These probes incorporate 64 μ LEDs and 128 recording sites in 2 and 4-shank configurations, and 32 μ LEDs and 64 recording sites in a single shank configuration.

Electrophysiological recordings can be performed with either Intan or Plexon®'s 128 channel headstages. Precise control of individual μ LEDs is achieved with NLT's stimulation module, allowing for arbitrary waveform stimulation patterns at an update rate of 20 kHz and a step resolution of 1 μ A.



Probe Types

NLT provides three different probe configurations. Four and dual shank configurations contain 64 μ LEDs and 128 recording sites, and the single shank configuration contains 32 μ LEDs and 64 recording sites. Technical details for each configuration are shown in Table 1 below. Figures 1-3 show a graphical representation of each probe type and the pitch between the electrodes and μ LEDs.

Configuration	1-Shank	2-Shank	4-Shank
Shank Length	6mm	6mm	6mm
Recording Sites	64	128	128
Recording Pitch	40 μ m	40 μ m	40 μ m
μ LEDs	32	64	64
Emission Peak	465nm	465nm	465nm
Irradiance	33mW/mm ²	33mW/mm ²	33mW/mm ²
μ LED Pitch	40 μ m	40 μ m	40 μ m
Shank Pitch	N/A	300 μ m	300 μ m
Coverage (HxW)	1300 μ m	1300 μ m x 300 μ m	700 μ m x 900 μ m

Table 1: Probe Configuration Technical Details

Warning: devices are not ESD protected

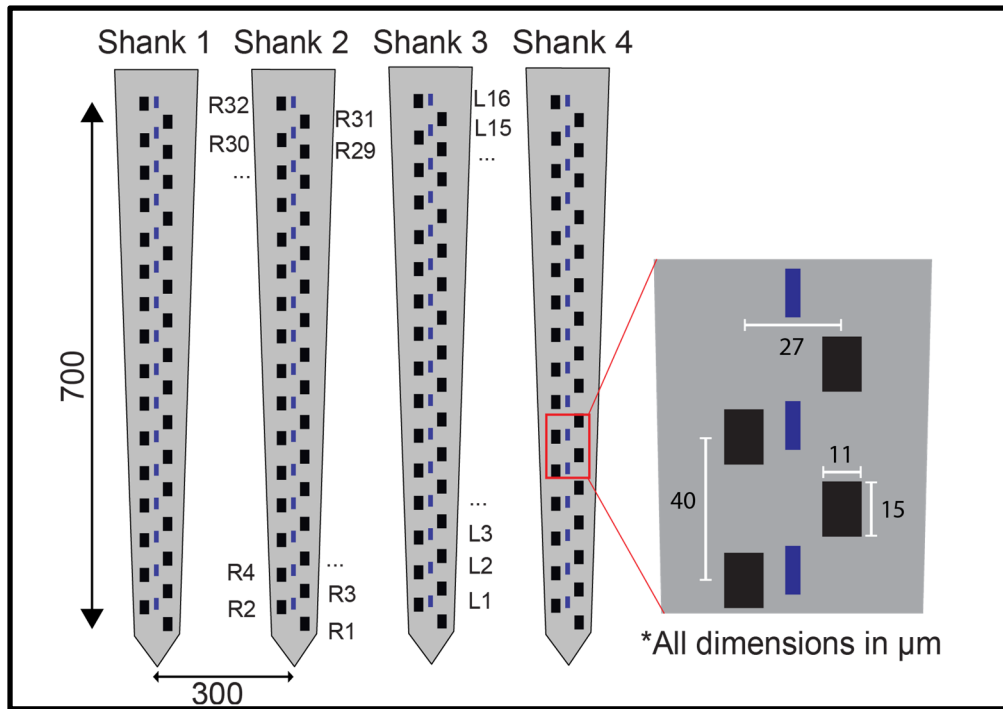


Figure 1: 4-Shank Configuration and Site Pitch (All Probes)

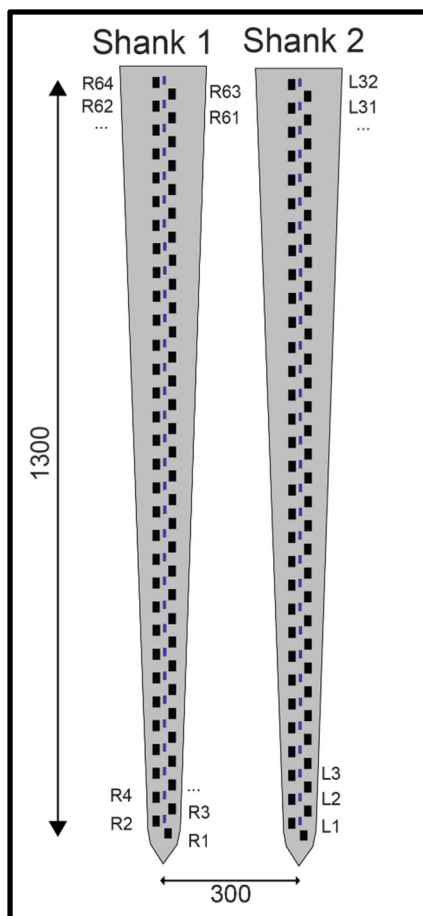


Figure 2: 2-Shank Configuration

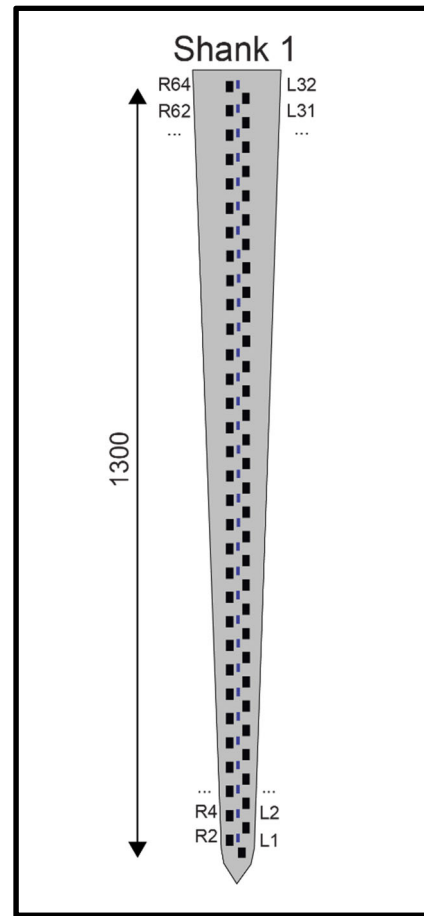


Figure 3: 1-Shank Configuration

Warning: devices are not ESD protected

Typical System Configuration

The HectoSTAR optoelectrodes are controlled using a single FPGA interface board that allows for connection to an Intan 128 channel headstage for neural recordings and an NLT stimulation module. The stimulation module enables the independent control of individual μ LEDs with an update rate of 20kHz at a step resolution of 1uA. Control software is currently implemented in an Open-Ephys plugin. Curating stimulation patterns can be customized using a MATLAB GUI and users can select waveform types and their associated parameters. Stimulation files are then uploaded to the FPGA and can be triggered via the user or through external TTL inputs. Figure 4 shows the block diagram of the system and Figures 5 and 6 show the actual system and the stimulation module, respectively.

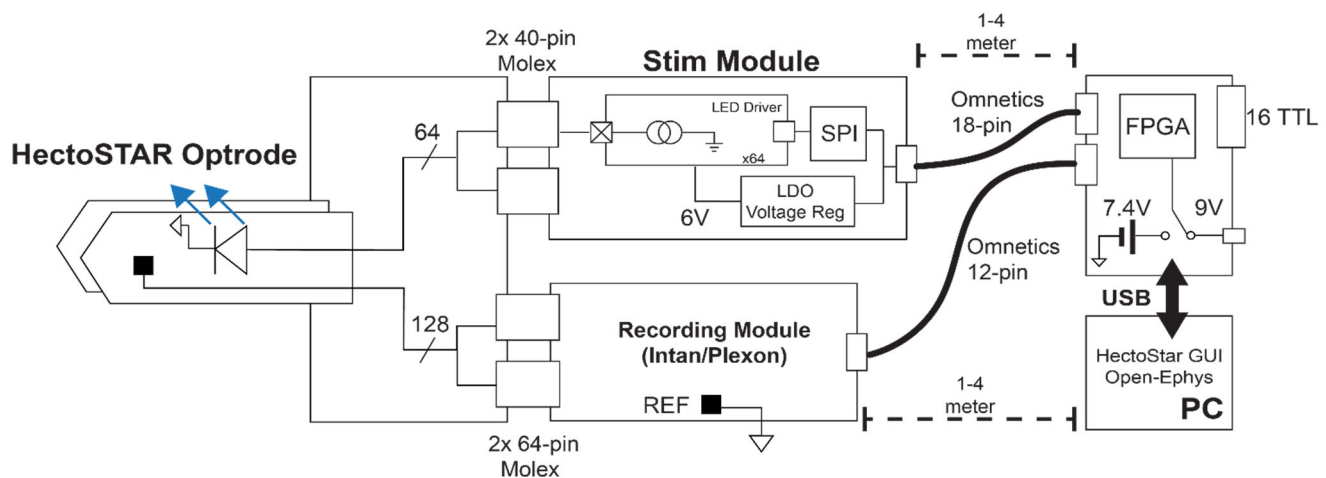


Figure 4: Block Diagram of Recording and Stimulation Control

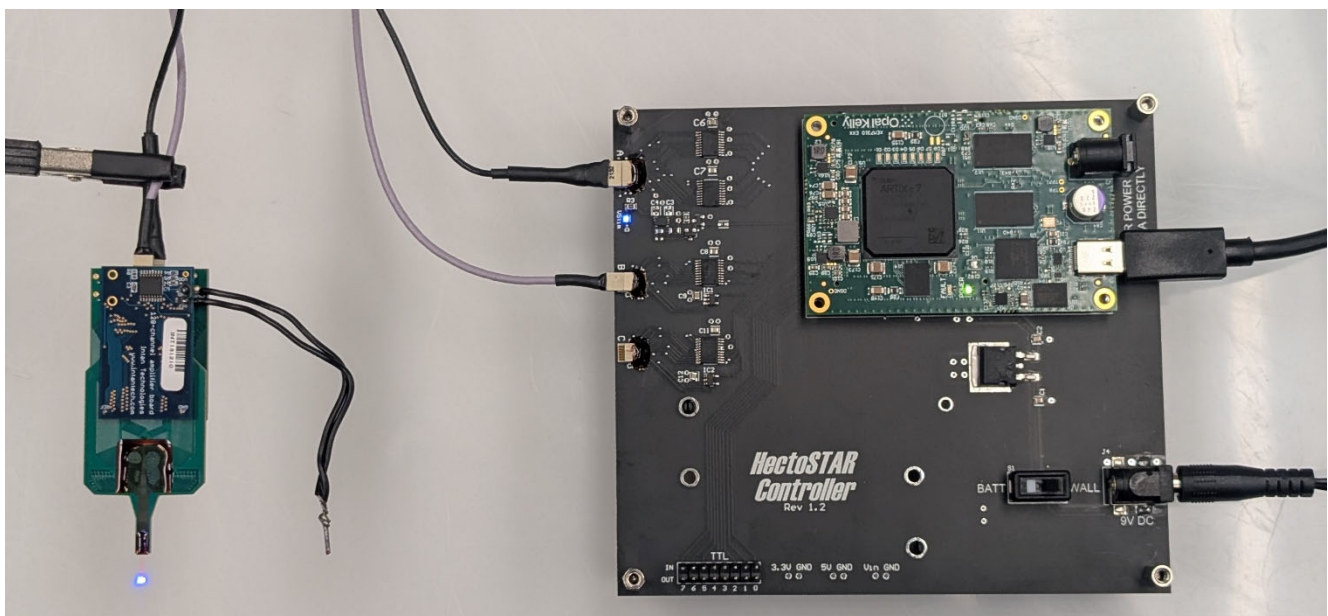


Figure 5: HectoSTAR Probe Module Connected with Intan Headstage on Top and Stimulation Module at Bottom (left), and FPGA Controller Hardware (Right)

Warning: devices are not ESD protected

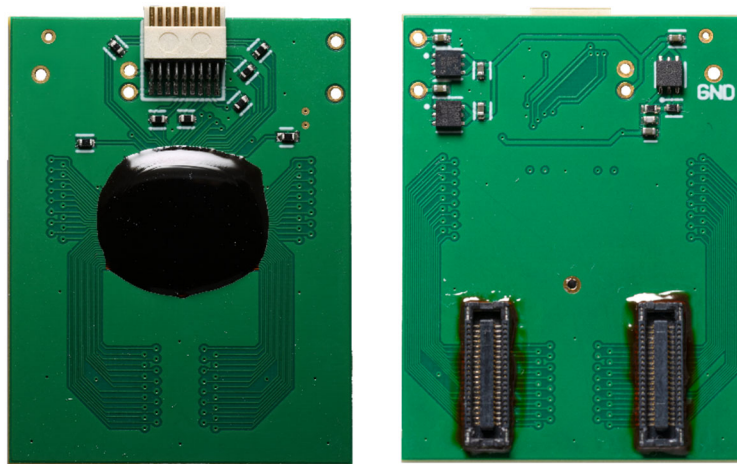
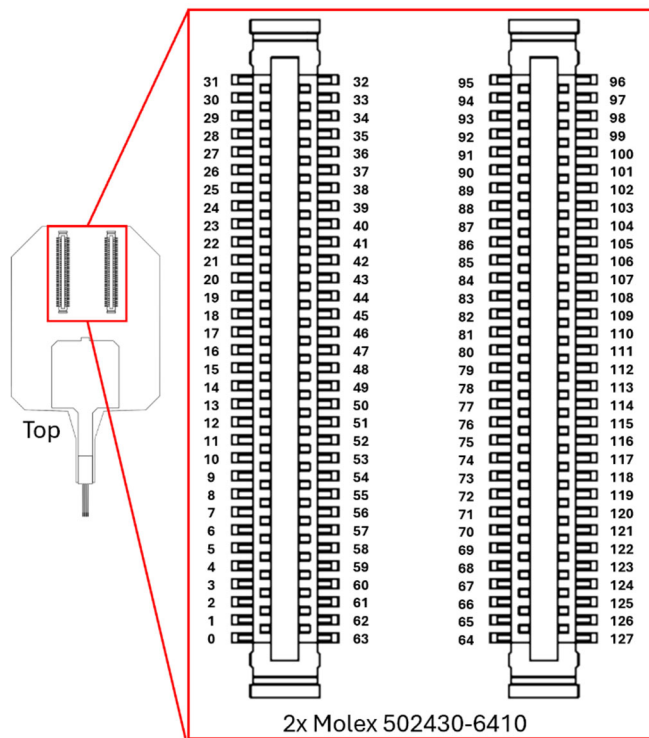


Figure 5: Stimulation Module Top View (left) and Bottom View (Right)

Connectors & Mapping

- Recording connector: 2x 64-pin Molex



Recording Site Pin Mapping (4 Shank)

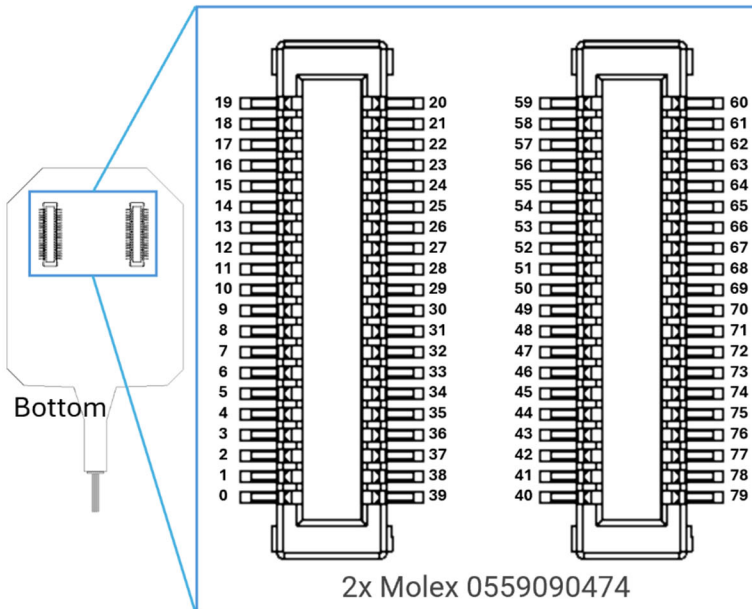
Pin #	Electrode #
0	S1R2
1	S1R4
2	S1R6
3	S1R8
4	S1R10
5	S1R12
6	S1R14
7	S1R16
8	S1R18
9	S1R20
10	S1R22
11	S1R24
12	S1R26
13	S1R28
14	S1R30
15	S1R32
16	S1R31
17	S1R29
18	S1R27
19	S1R25
20	S1R23
21	S1R21
22	S1R19
23	S1R17
24	S1R15
25	S1R13
26	S1R11
27	S1R9
28	S1R7
29	S1R5
30	S1R3
31	S1R1

Pin #	Electrode #
32	S2R2
33	S2R4
34	S2R6
35	S2R8
36	S2R10
37	S2R12
38	S2R14
39	S2R16
40	S2R18
41	S2R20
42	S2R22
43	S2R24
44	S2R26
45	S2R28
46	S2R30
47	S2R32
48	S2R31
49	S2R29
50	S2R27
51	S2R25
52	S2R23
53	S2R21
54	S2R19
55	S2R17
56	S2R15
57	S2R13
58	S2R11
59	S2R9
60	S2R7
61	S2R5
62	S2R3
63	S2R1

Pin #	Electrode #
95	S3R2
94	S3R4
93	S3R6
92	S3R8
91	S3R10
90	S3R12
89	S3R14
88	S3R16
87	S3R18
86	S3R20
85	S3R22
84	S3R24
83	S3R26
82	S3R28
81	S3R30
80	S3R32
79	S3R31
78	S3R29
77	S3R27
76	S3R25
75	S3R23
74	S3R21
73	S3R19
72	S3R17
71	S3R15
70	S3R13
69	S3R11
68	S3R9
67	S3R7
66	S3R5
65	S3R3
64	S3R1

Pin #	Electrode #
96	S4R2
97	S4R4
98	S4R6
99	S4R8
100	S4R10
101	S4R12
102	S4R14
103	S4R16
104	S4R18
105	S4R20
106	S4R22
107	S4R24
108	S4R26
109	S4R28
110	S4R30
111	S4R32
112	S4R31
113	S4R29
114	S4R27
115	S4R25
116	S4R23
117	S4R21
118	S4R19
119	S4R17
120	S4R15
121	S4R13
122	S4R11
123	S4R9
124	S4R7
125	S4R5
126	S4R3
127	S4R1

- LED Connector: 2x 40-pin Molex

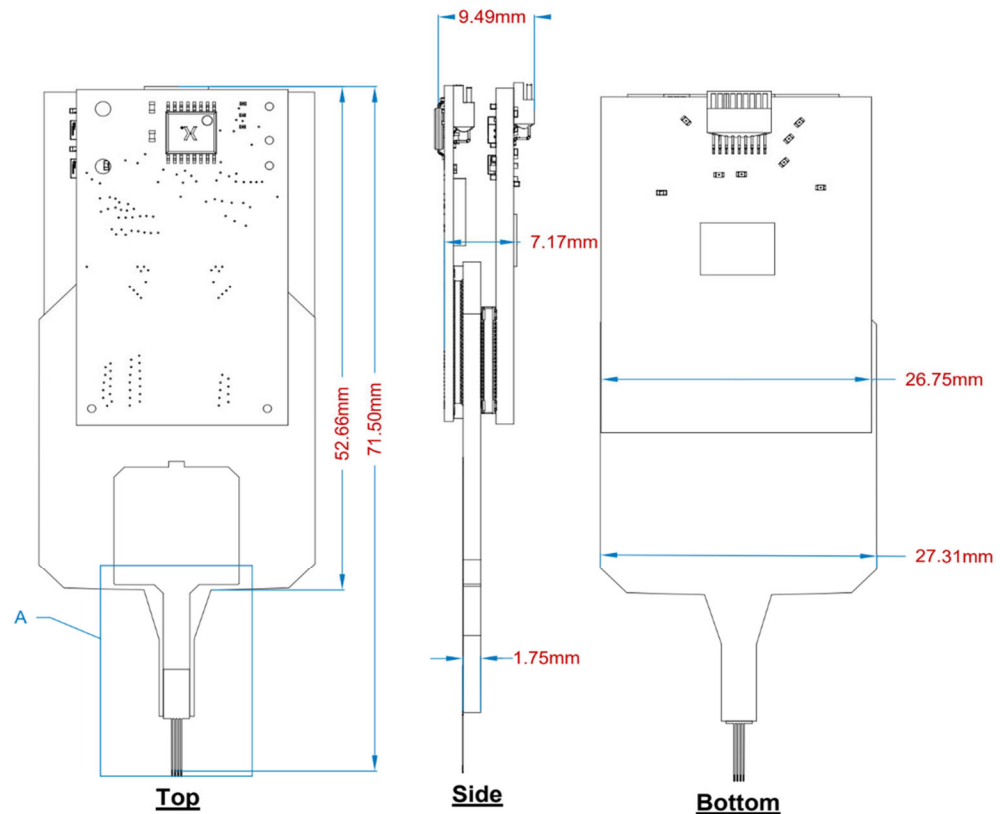


LED Pin Mapping (4 Shank)

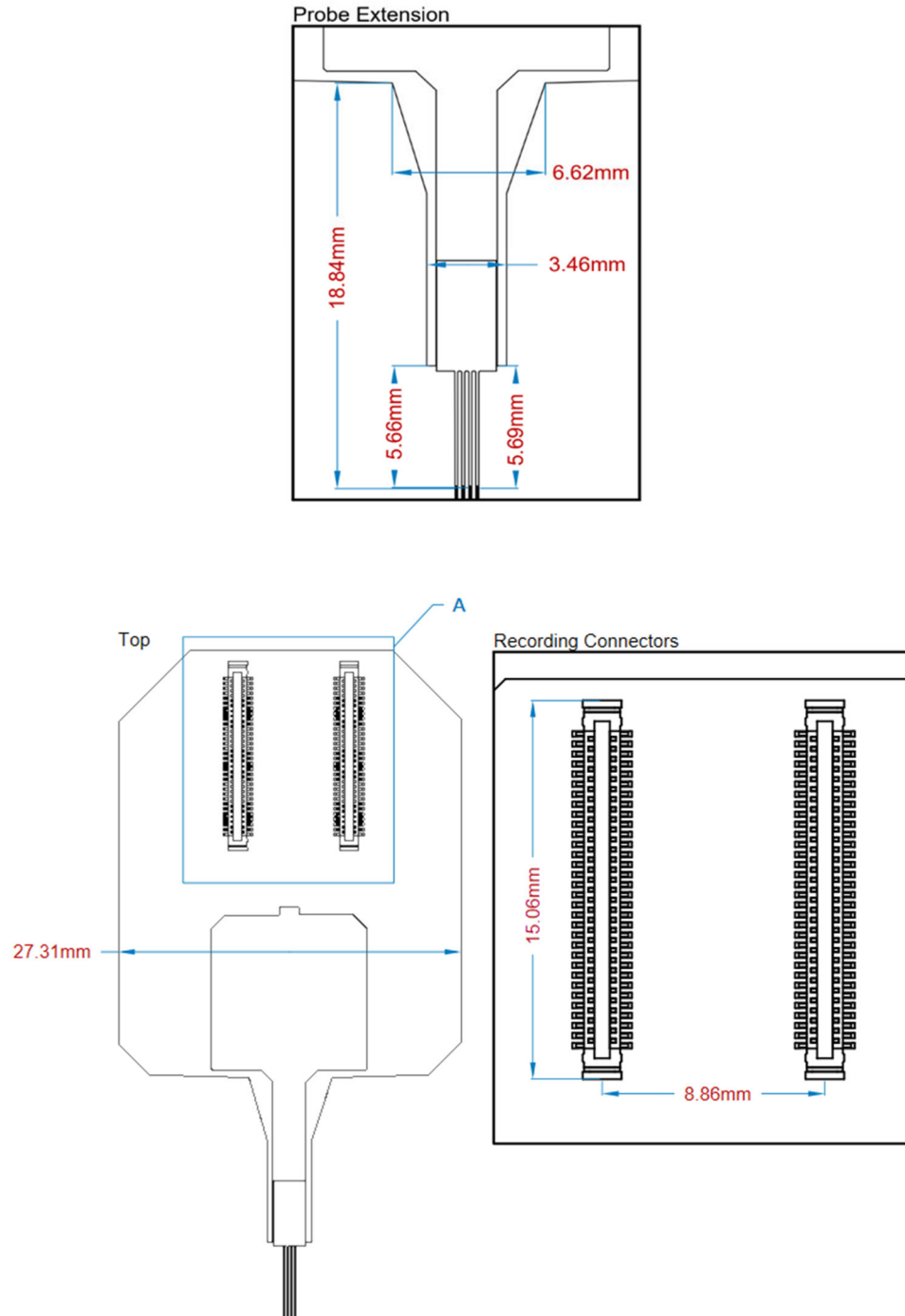
Pin #	LED#	Pin #	LED#	Pin #	LED#	Pin #	LED#
0	LED0	20	LED16	40	LED32	60	LED48
1	LED1	21	LED17	41	LED33	61	LED49
2	LED2	22	LED18	42	LED34	62	LED50
3	LED3	23	LED19	43	LED35	63	LED51
4	LED4	24	LED20	44	LED36	64	LED52
5	LED5	25	LED21	45	LED37	65	LED53
6	LED6	26	LED22	46	LED38	66	LED54
7	LED7	27	LED23	47	LED39	67	LED55
8	LED8	28	LED24	48	LED40	68	LED56
9	LED9	29	LED25	49	LED41	69	LED57
10	LED10	30	LED26	50	LED42	70	LED58
11	LED11	31	LED27	51	LED43	71	LED59
12	LED12	32	LED28	52	LED44	72	LED60
13	LED13	33	LED29	53	LED45	73	LED61
14	LED14	34	LED30	54	LED46	74	LED62
15	LED15	35	LED31	55	LED47	75	LED63
16	LGND	36	LGND	56	LGND	76	LGND
17	LGND	37	LGND	57	LGND	77	LGND
18	LGND	38	LGND	58	LGND	78	LGND
19	LGND	39	LGND	59	LGND	79	LGND

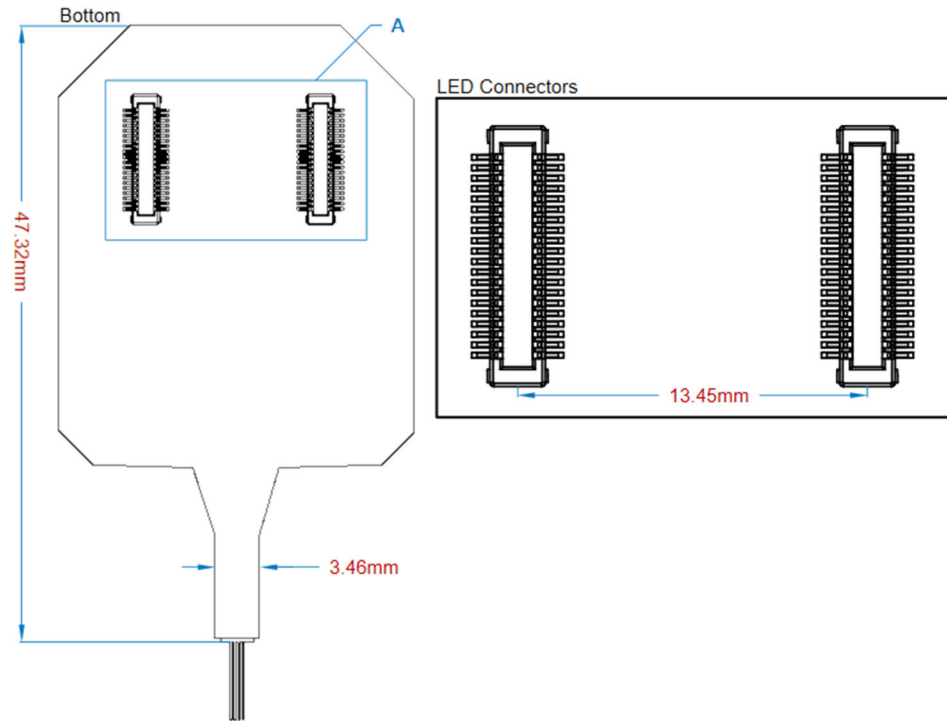
*This mapping does not currently reflect the physical shank location of the LEDs

Device Dimensions



Warning: devices are not ESD protected





Applications

- Optogenetic-control of local neural circuits in awake, head-fixed studies
- Square-wave excitation for precise timing control
- High-fidelity stimulation patterns, triggerable from external inputs. Up to 12 seconds of repeatable duration.

