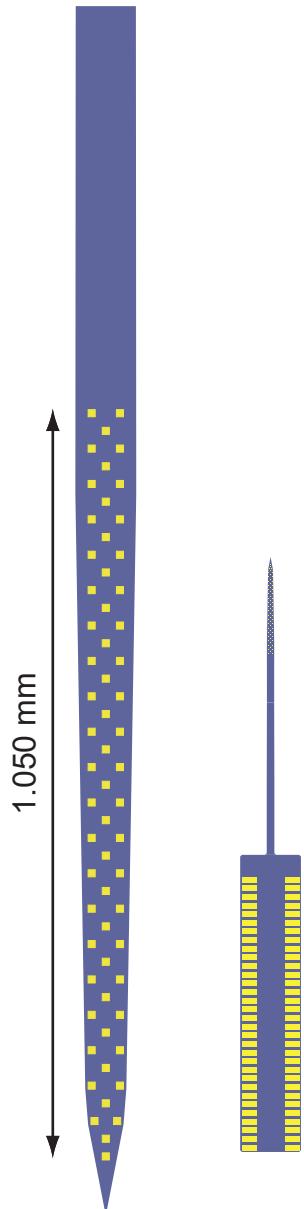
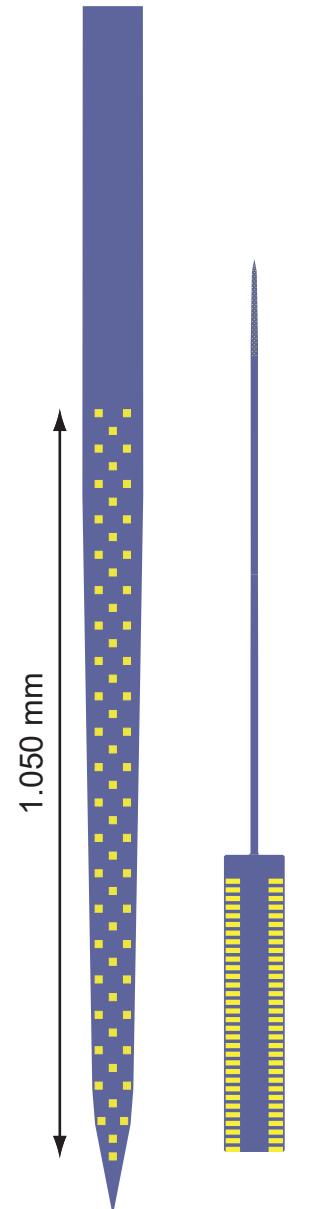


### 64D Short



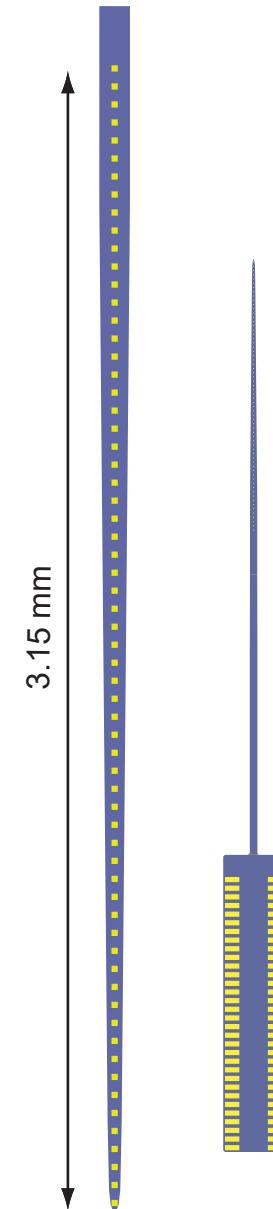
Total of 64 electrodes on 1 prong  
25  $\mu\text{m}$  vertical spacing  
20  $\mu\text{m}$  horizontal spacing  
Prong dimensions:  
 $L \times w \times t = 3.5 \text{ mm} \times 85 \mu\text{m} \times 23 \mu\text{m}$   
Tip angle: 22°

### 64D Sharp



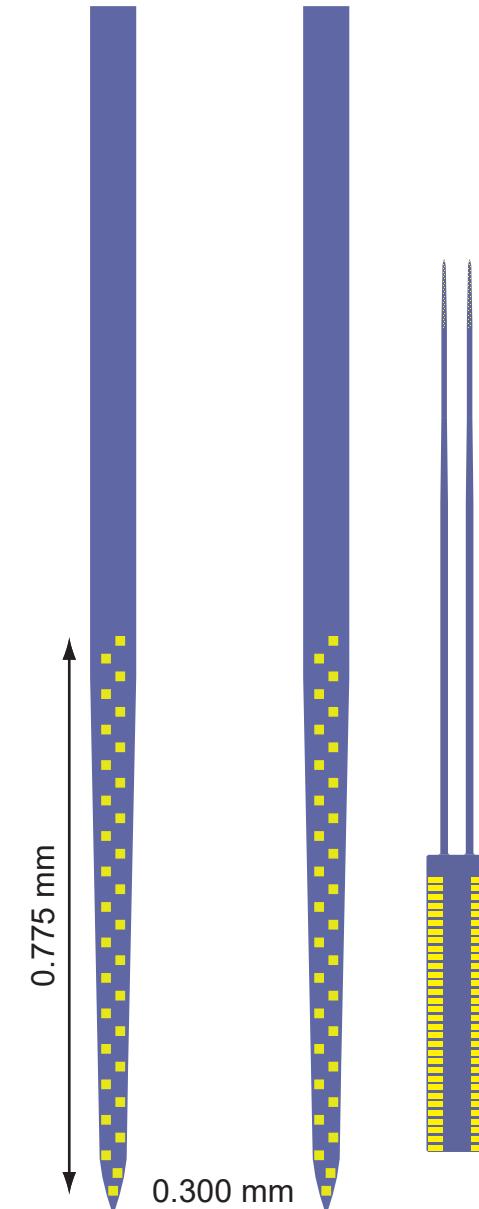
Total of 64 electrodes on 1 prong  
25  $\mu\text{m}$  vertical spacing  
20  $\mu\text{m}$  horizontal spacing  
Prong dimensions:  
 $L \times w \times t = 7 \text{ mm} \times 85 \mu\text{m} \times 23 \mu\text{m}$   
Tip angle: 22°

### 64E



Total of 64 electrodes on 1 prong  
50  $\mu\text{m}$  vertical spacing  
Prong dimensions:  
 $L \times w \times t = 7 \text{ mm} \times 85 \mu\text{m} \times 23 \mu\text{m}$   
Tip angle: 39°

### 64F



Total of 64 electrodes on 2 prongs  
25  $\mu\text{m}$  vertical spacing  
20  $\mu\text{m}$  horizontal spacing  
Prong dimensions:  
 $L \times w \times t = 7 \text{ mm} \times 65 \mu\text{m} \times 23 \mu\text{m}$   
Tip angle: 35°

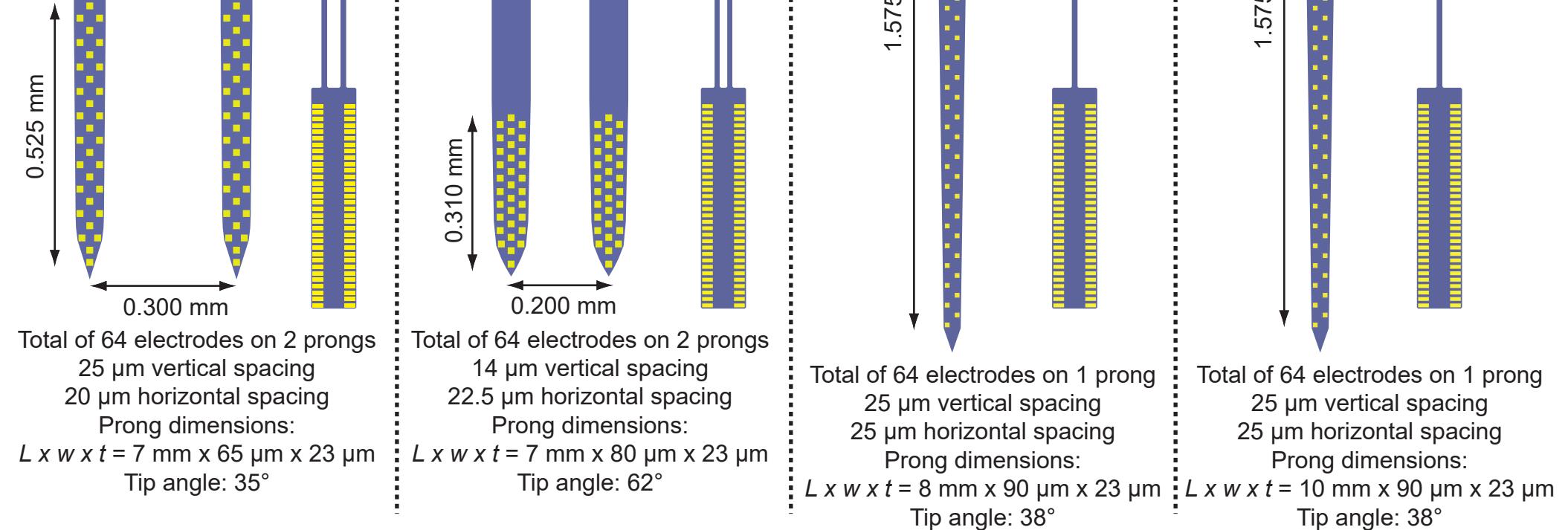
All recording sites have dimensions 10  $\mu\text{m} \times 10 \mu\text{m}$ .

64G

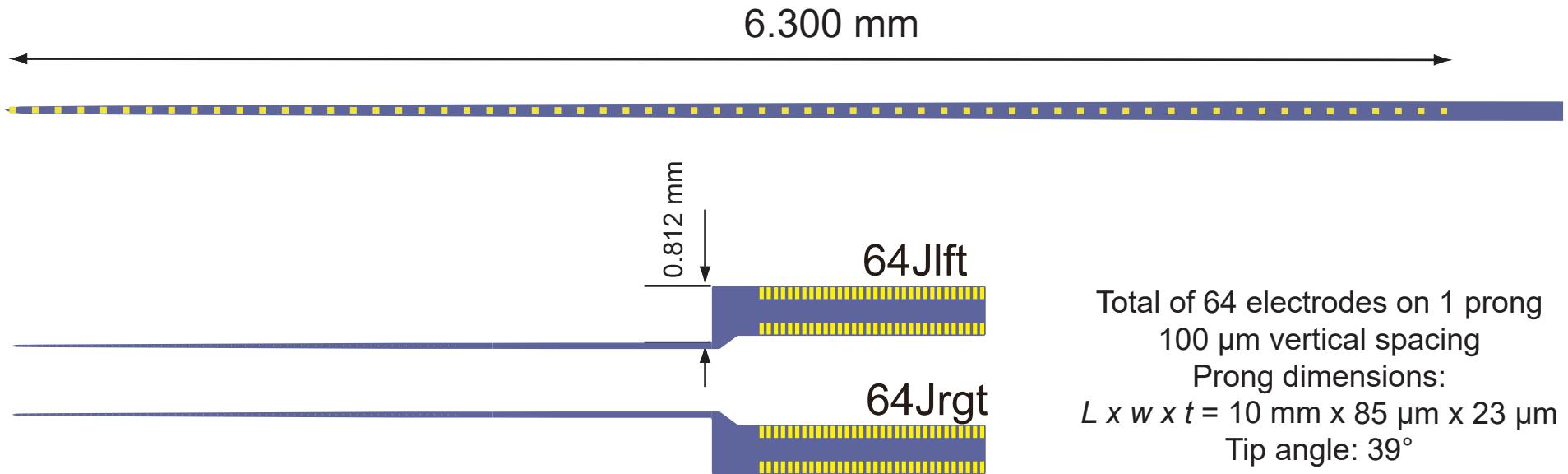
64H

64M

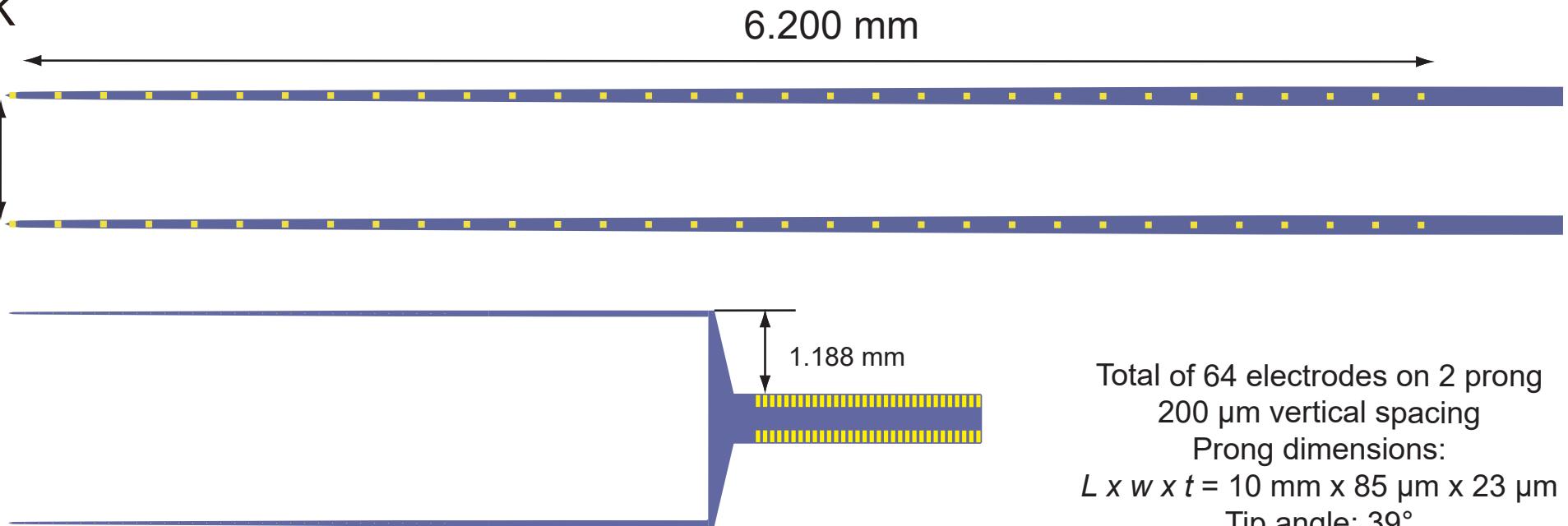
64ML



# 64Jlft and 64Jrgt

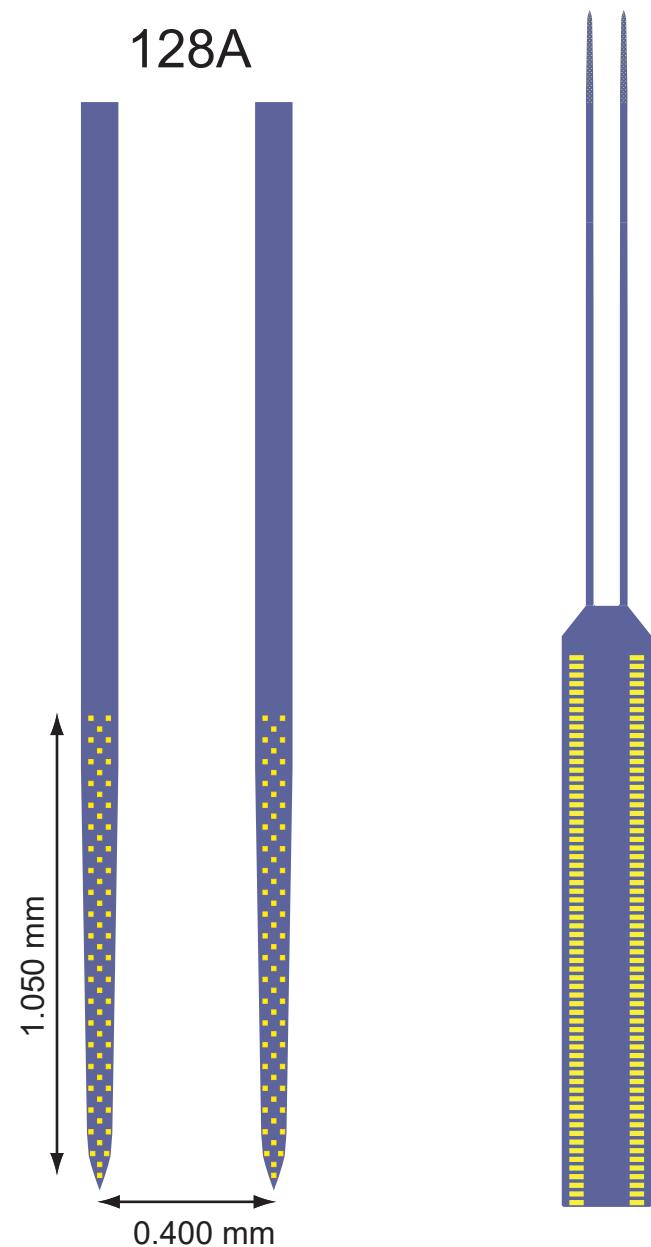


# 64K



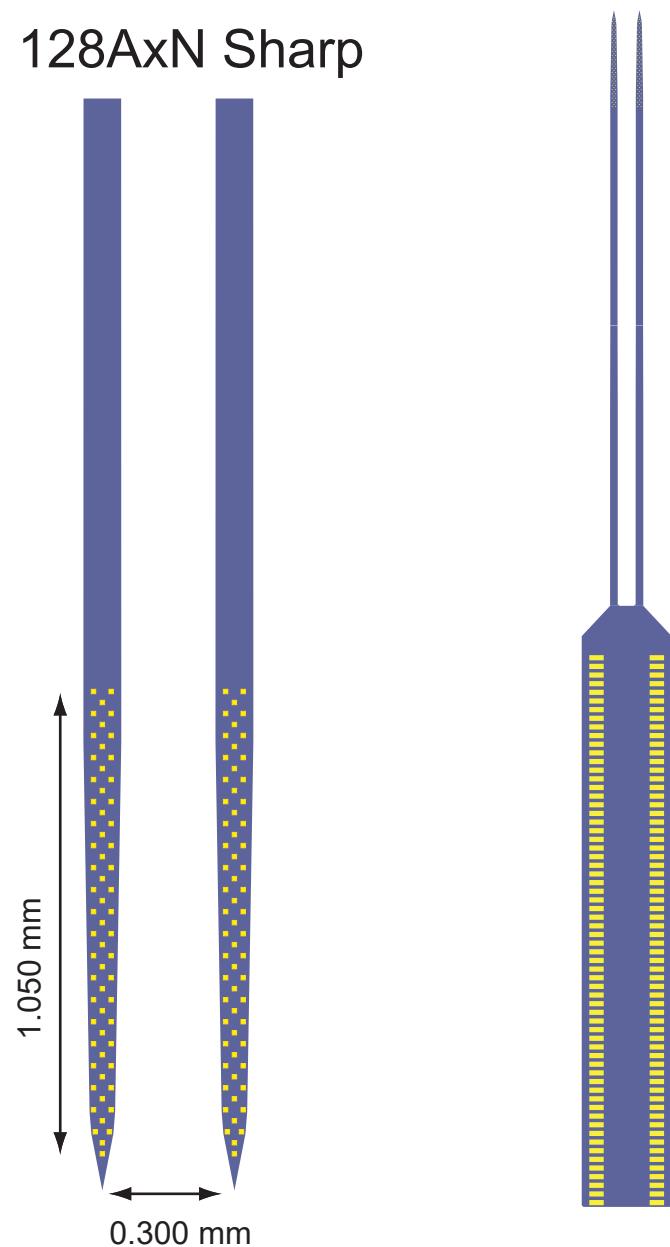
All recording sites have dimensions 10  $\mu\text{m} \times 10 \mu\text{m}$ .

128A



Total of 128 electrodes on 2 prongs  
25  $\mu\text{m}$  vertical spacing  
20  $\mu\text{m}$  horizontal spacing  
Prong dimensions:  
 $L \times w \times t = 7 \text{ mm} \times 86 \mu\text{m} \times 23 \mu\text{m}$   
Tip angle: 39°

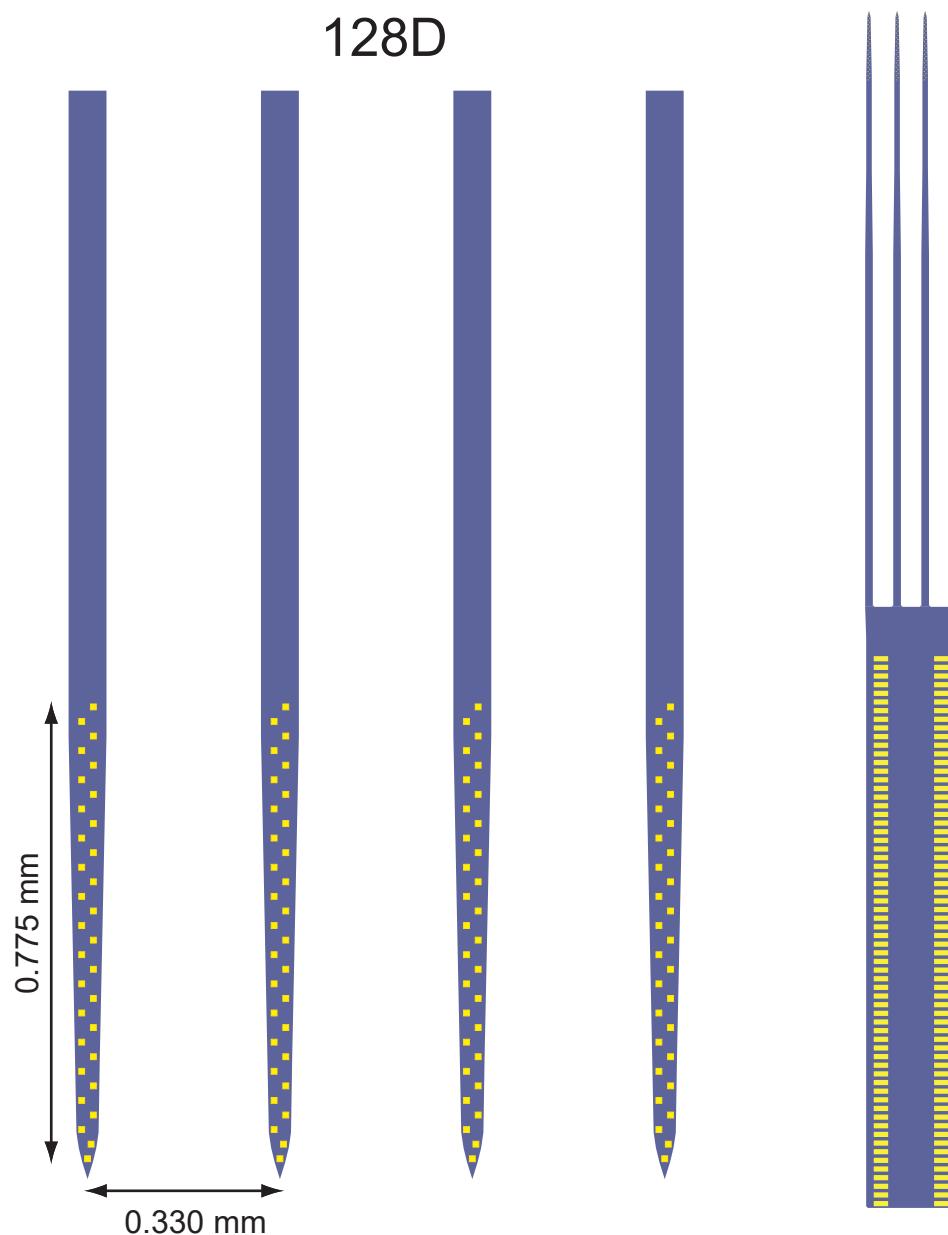
128AxN Sharp



Total of 128 electrodes on 2 prongs  
25  $\mu\text{m}$  vertical spacing  
20  $\mu\text{m}$  horizontal spacing  
Prong dimensions:  
 $L \times w \times t = 7 \text{ mm} \times 85 \mu\text{m} \times 23 \mu\text{m}$   
Tip angle: 22°

All recording sites have dimensions 10  $\mu\text{m} \times 10 \mu\text{m}$ .

# 128D



Total of 128 electrodes on 4 prongs

25  $\mu\text{m}$  vertical spacing

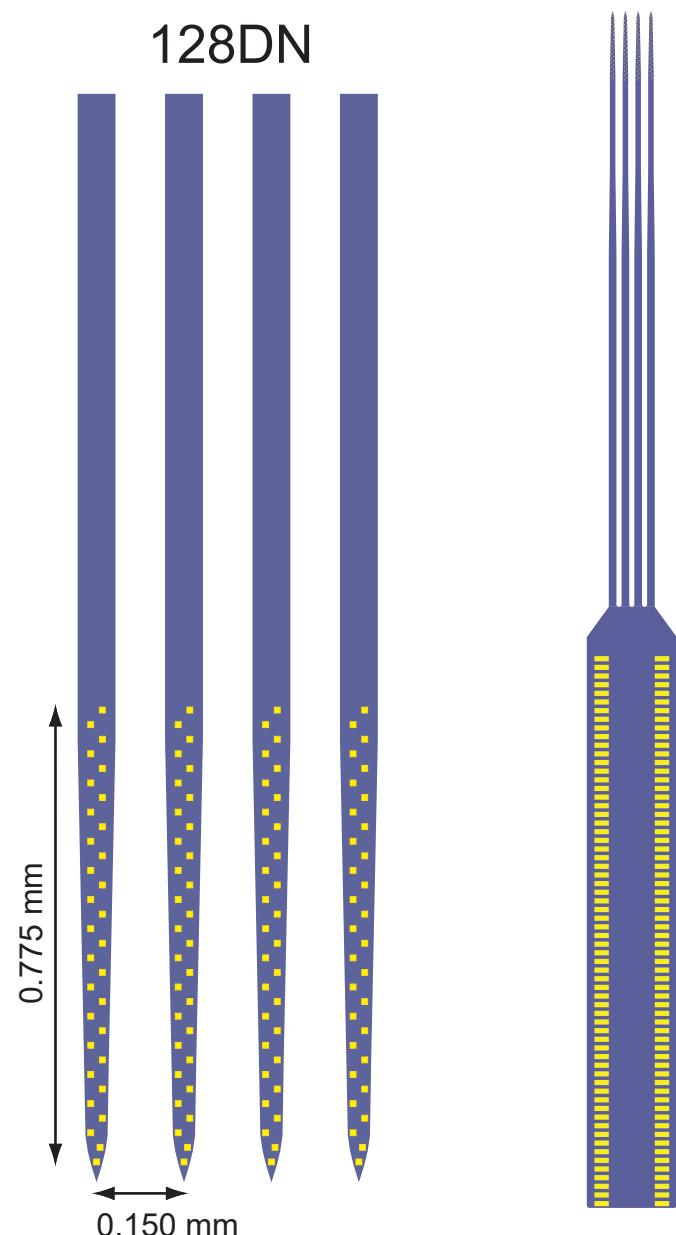
20  $\mu\text{m}$  horizontal spacing

Prong dimensions:

$L \times w \times t = 7 \text{ mm} \times 65 \mu\text{m} \times 23 \mu\text{m}$

Tip angle: 35°

# 128DN



Total of 128 electrodes on 4 prongs

25  $\mu\text{m}$  vertical spacing

20  $\mu\text{m}$  horizontal spacing

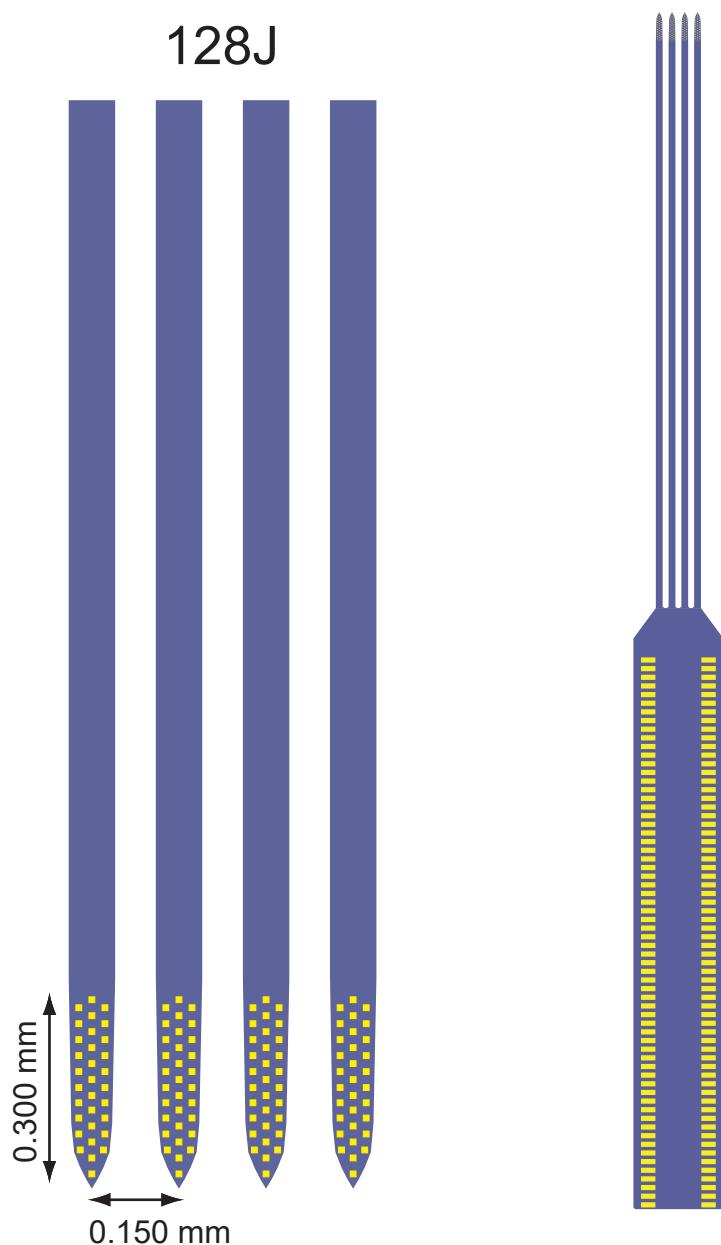
Prong dimensions:

$L \times w \times t = 7 \text{ mm} \times 65 \mu\text{m} \times 23 \mu\text{m}$

Tip angle: 35°

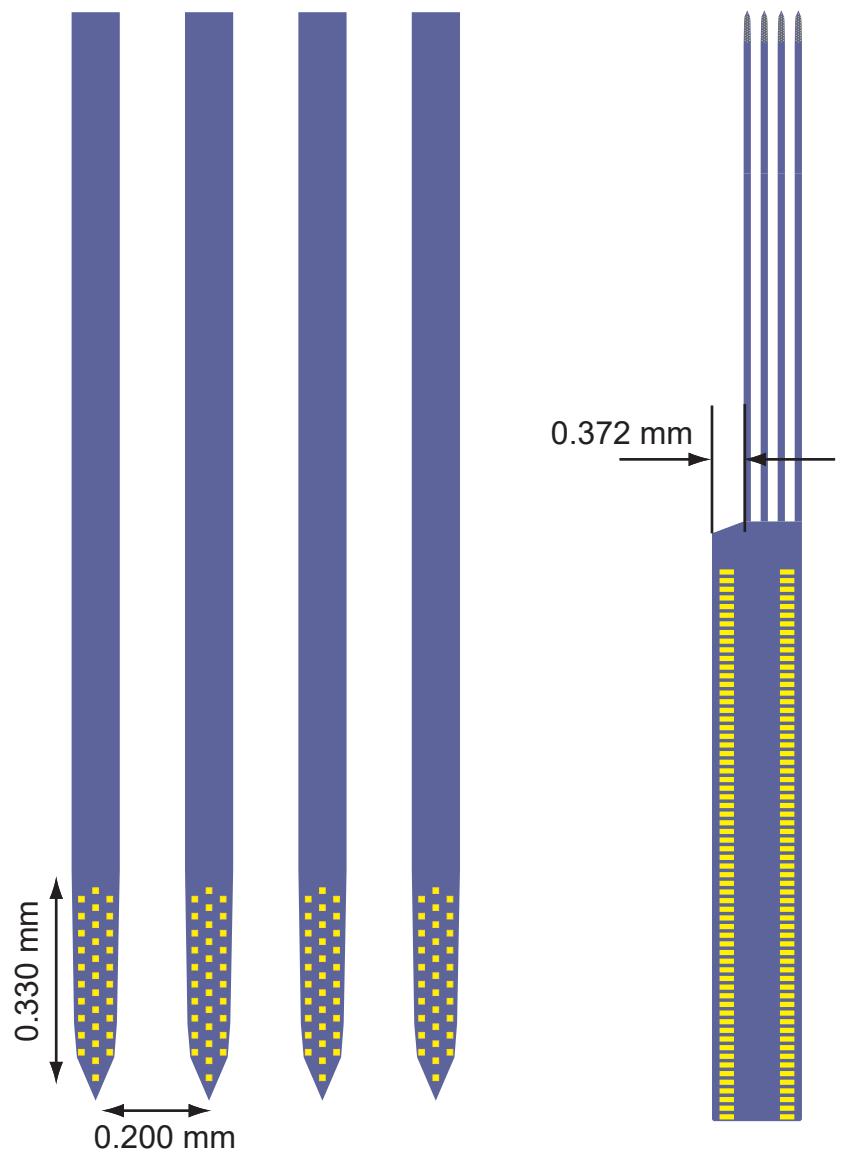
All recording sites have dimensions 10  $\mu\text{m} \times 10 \mu\text{m}$ .

128J



Total of 128 electrodes on 4 prongs  
13.75  $\mu\text{m}$  vertical spacing  
22.5  $\mu\text{m}$  horizontal spacing  
Prong dimensions:  
 $L \times w \times t = 7 \text{ mm} \times 80 \mu\text{m} \times 23 \mu\text{m}$   
Tip angle: 62°

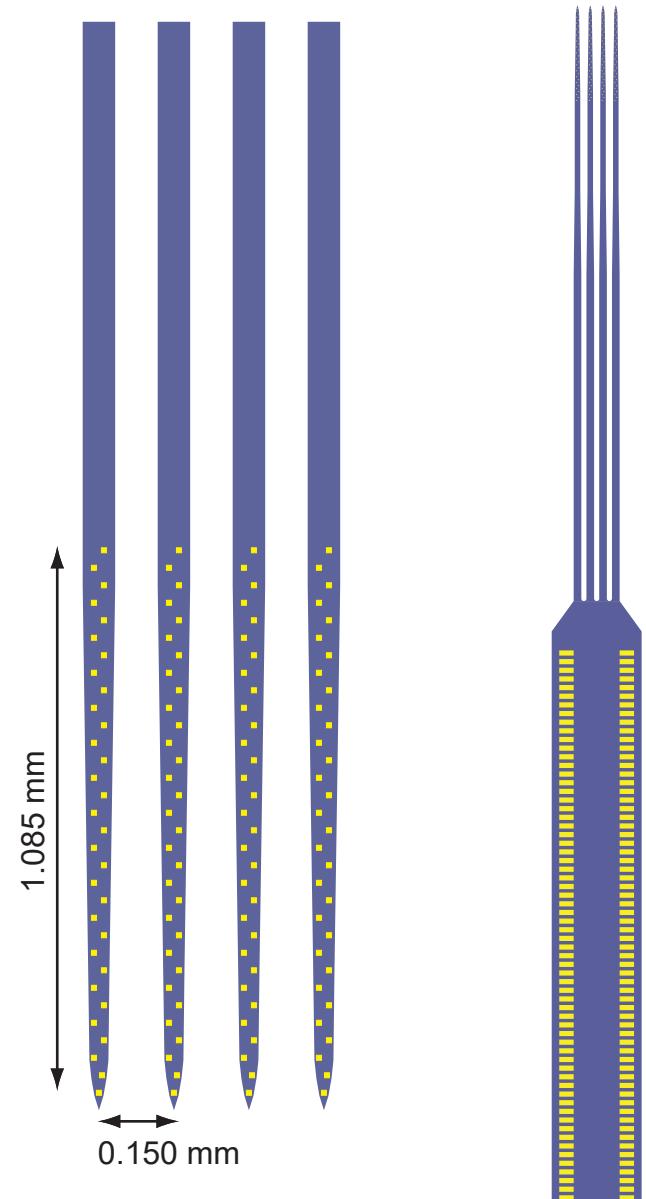
128K



Total of 128 electrodes on 4 prongs  
15  $\mu\text{m}$  vertical spacing  
25  $\mu\text{m}$  horizontal spacing  
Prong dimensions:  
 $L \times w \times t = 6 \text{ mm} \times 85 \mu\text{m} \times 23 \mu\text{m}$   
Tip angle: 47°

All recording sites have dimensions 10  $\mu\text{m} \times 10 \mu\text{m}$ .

# 128M



Total of 128 electrodes on 4 prongs

35  $\mu\text{m}$  vertical spacing

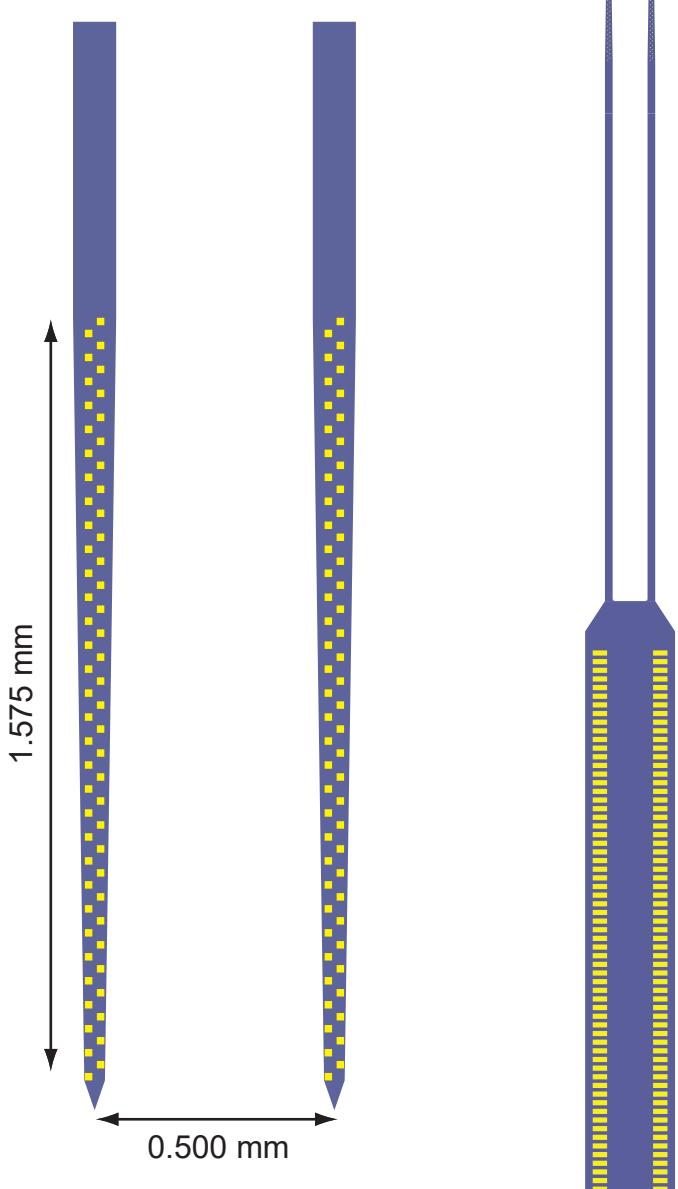
20  $\mu\text{m}$  horizontal spacing

Prong dimensions:

$L \times w \times t = 7 \text{ mm} \times 65 \mu\text{m} \times 23 \mu\text{m}$

Tip angle: 35°

# 128P



Total of 128 electrodes on 2 prongs

25  $\mu\text{m}$  vertical spacing

25  $\mu\text{m}$  horizontal spacing

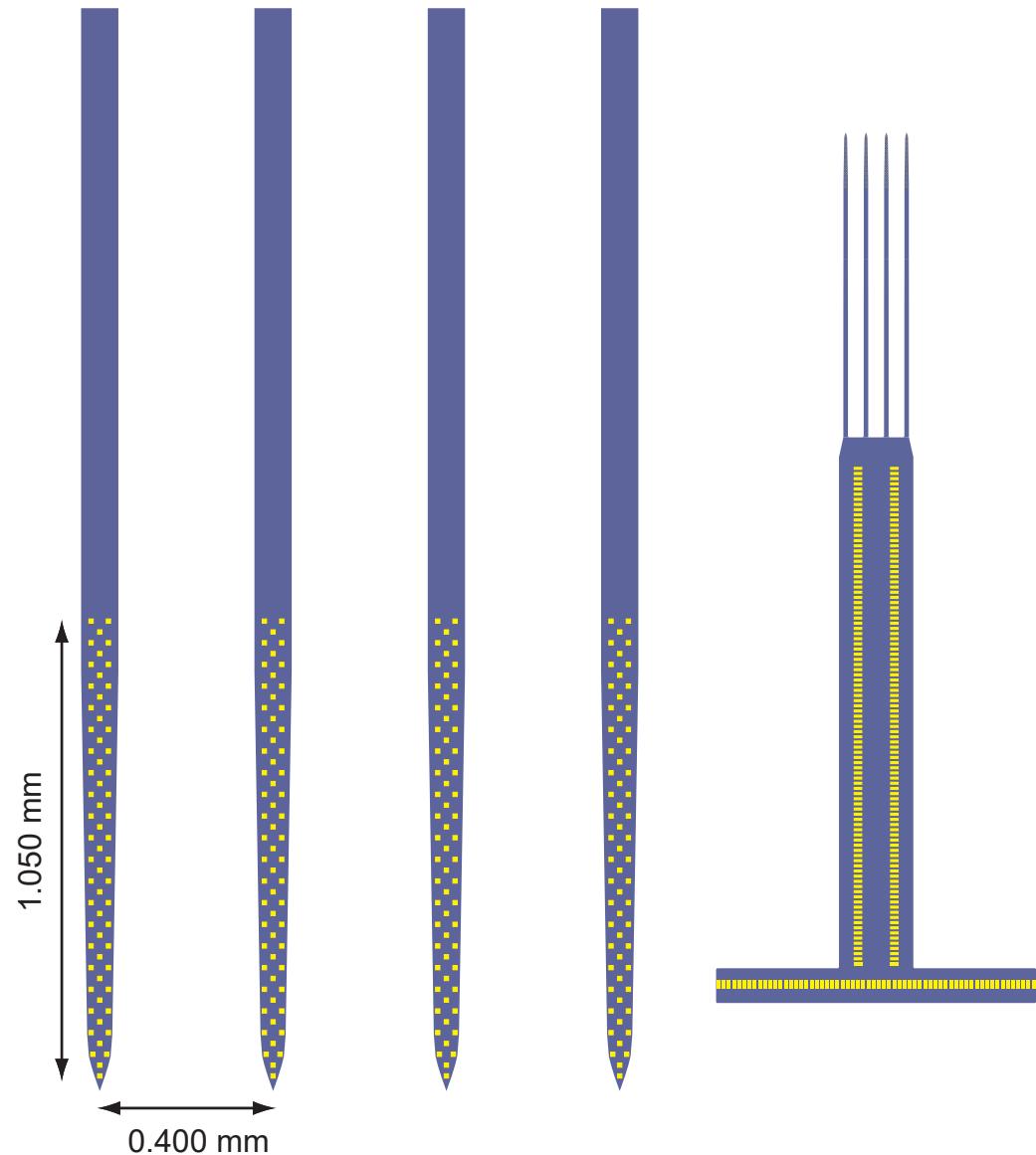
Prong dimensions:

$L \times w \times t = 8 \text{ mm} \times 90 \mu\text{m} \times 23 \mu\text{m}$

Tip angle: 38°

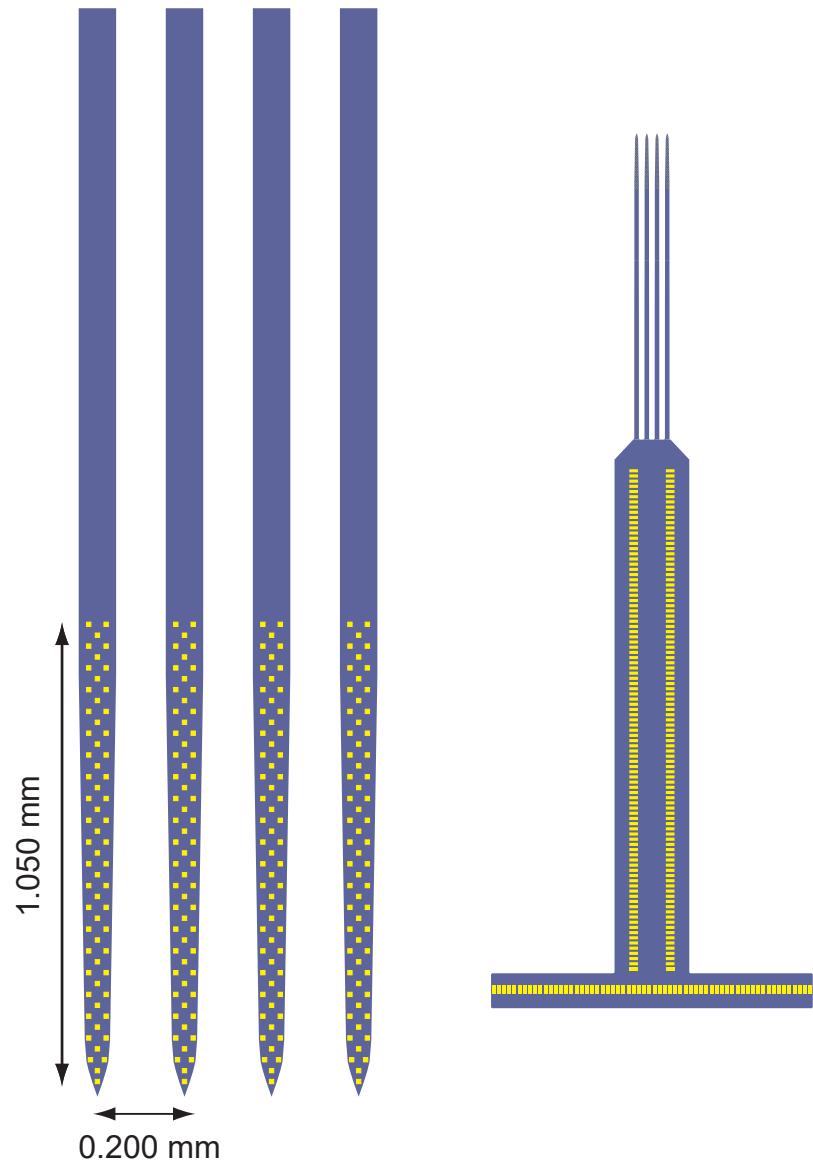
All recording sites have dimensions 10  $\mu\text{m}$  x 10  $\mu\text{m}$ .

# 256AS



Total of 256 electrodes on 4 prongs  
25  $\mu\text{m}$  vertical spacing  
20  $\mu\text{m}$  horizontal spacing  
Prong dimensions:  
 $L \times w \times t = 6 \text{ mm} \times 86 \mu\text{m} \times 23 \mu\text{m}$   
Tip angle: 39°

# 256ANS



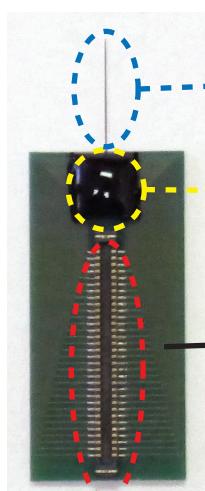
Total of 256 electrodes on 4 prongs  
25  $\mu\text{m}$  vertical spacing  
20  $\mu\text{m}$  horizontal spacing  
Prong dimensions:  
 $L \times w \times t = 6 \text{ mm} \times 86 \mu\text{m} \times 23 \mu\text{m}$   
Tip angle: 39°

All recording sites have dimensions 10  $\mu\text{m} \times 10 \mu\text{m}$ .

# Assembly and packaging of UCLA silicon microprobes

64 channel  
package

(2 cm x 1 cm, 0.3 g)



silicon  
microprobe

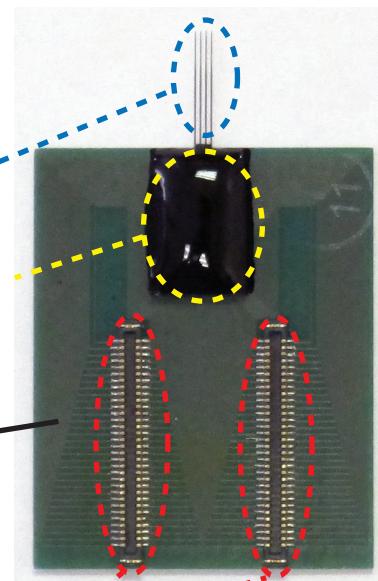
encapsulation  
epoxy

printed circuit  
board (PCB)

Molex Slimstack  
connector

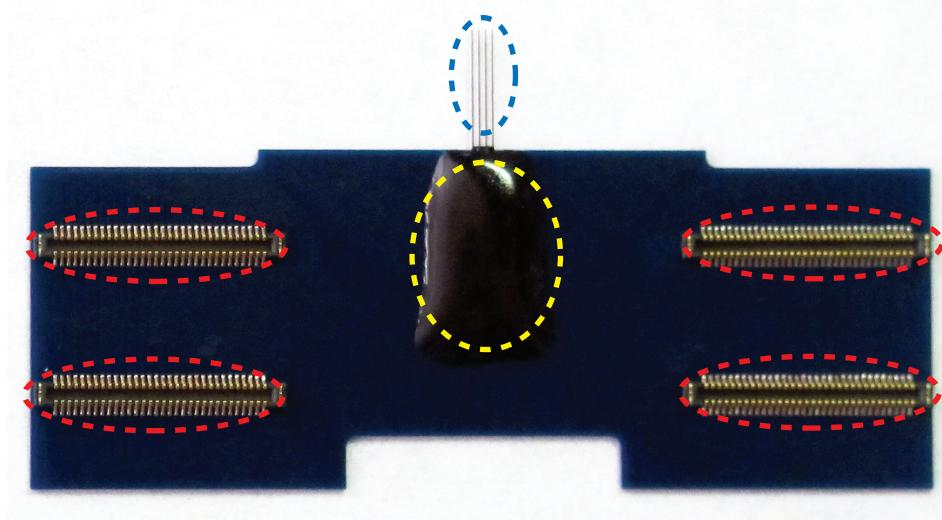
128 channel  
package

(2.6 cm x 2.1 cm, 0.7 g)



256 channel  
package

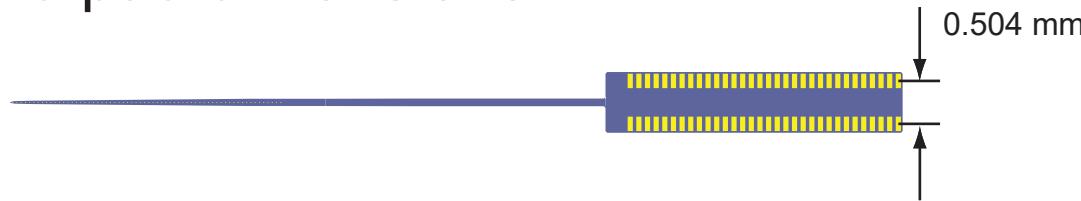
(2.1 cm x 5.4 cm, 1.3 g)



2 cm

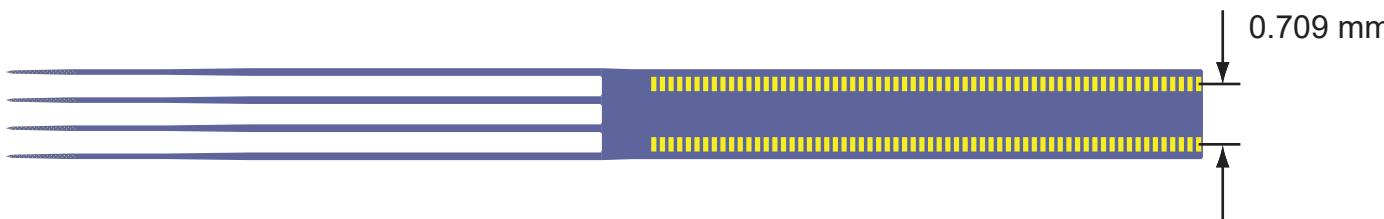
- The Molex Slimstack connector is a 64-contact fine pitch connector (Molex # 5024306410).
- By default the connector is attached to the front side of the PCB (pictured above). However, if attaching an optical fiber there is an option to attach the connector to the back side to prevent blocking access to the fiber.
- By default the encapsulation epoxy is added to protect the bonded wires connecting the microprobe to the PCB. However, if attaching an optical fiber the epoxy should be added after fiber attachment.
- In terms of compatible hardware, *Intan Technologies* manufactures a head stage that directly plugs into our 64, 128, and 256 channel microprobe packages.

# Wirebond pad dimensions

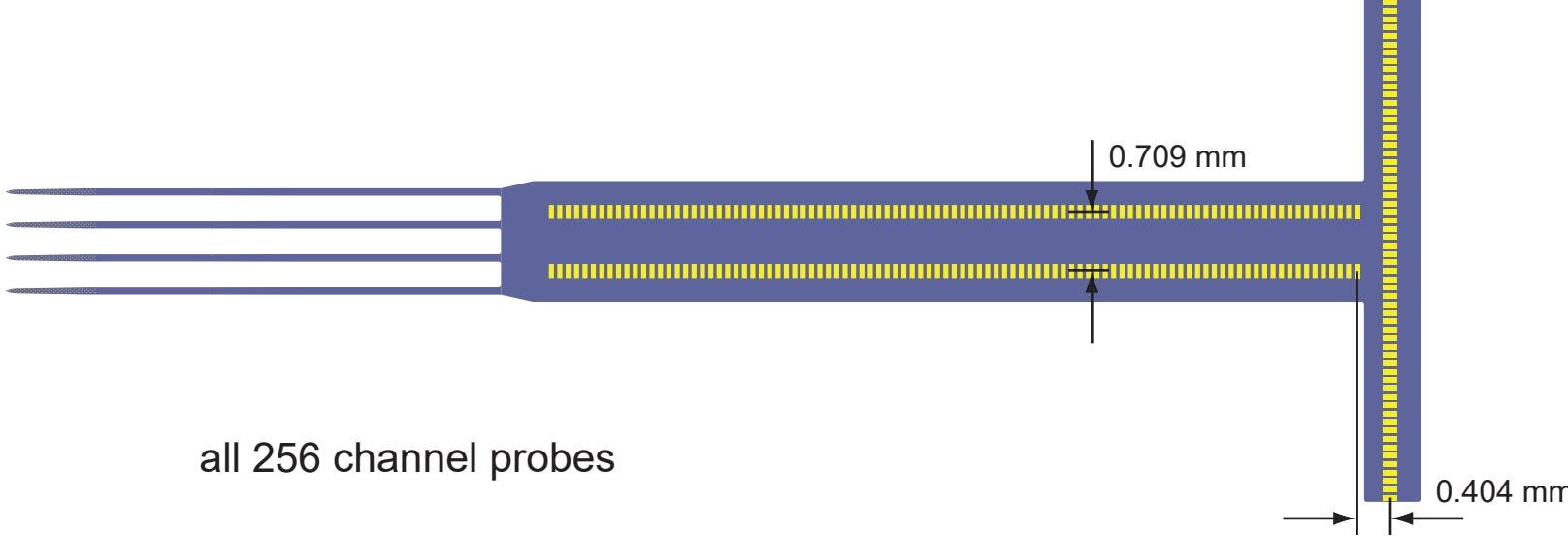


Pad size: 169  $\mu\text{m}$  x 61  $\mu\text{m}$   
Pitch: 102  $\mu\text{m}$

all 64 channel probes

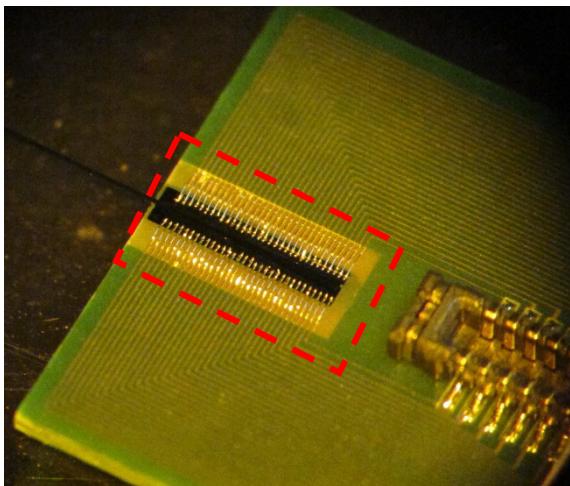


all 128 channel probes

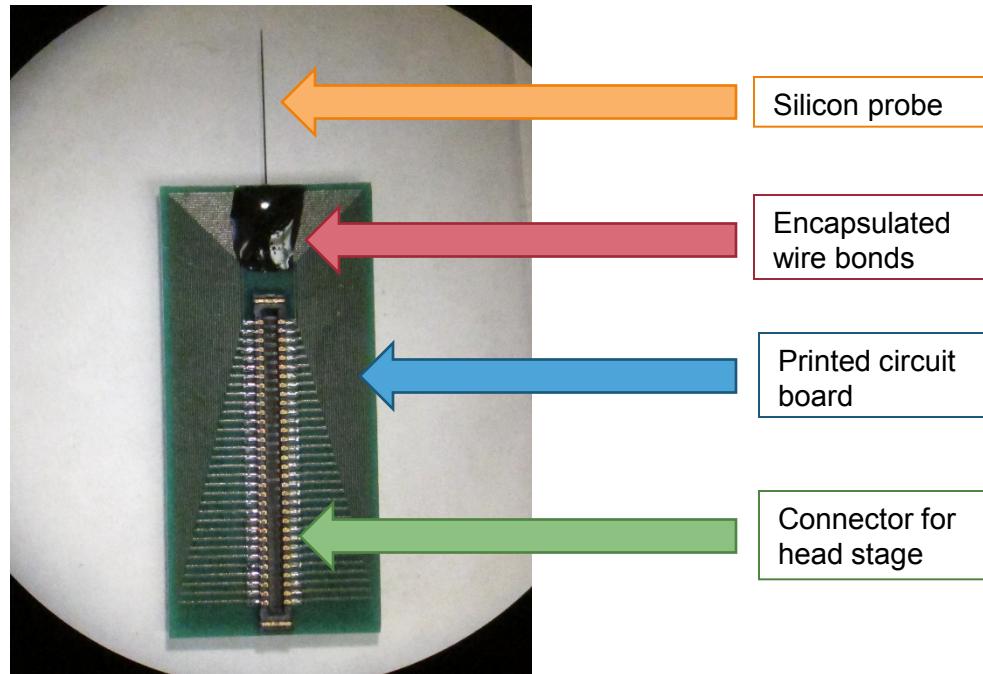


all 256 channel probes

# How to encapsulate the wire bonds with epoxy



The wire bonds (inside the dashed red rectangle) are very fragile. They will break if touched, so they should be encapsulated with epoxy before the probe is used.

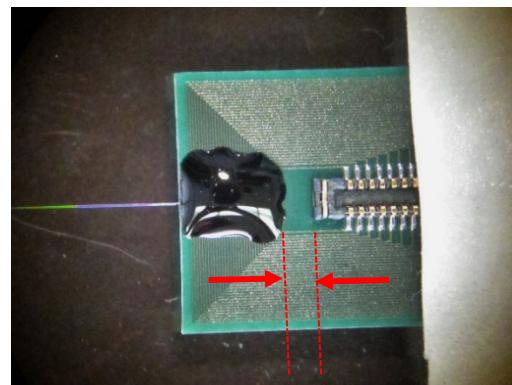
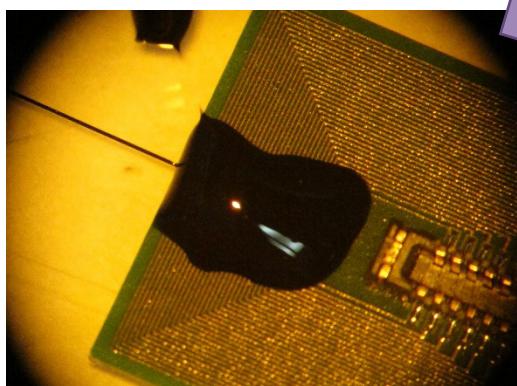
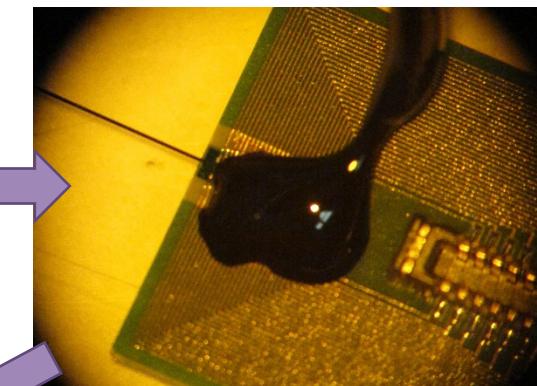
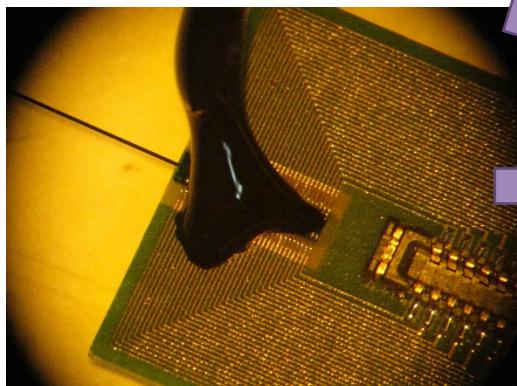
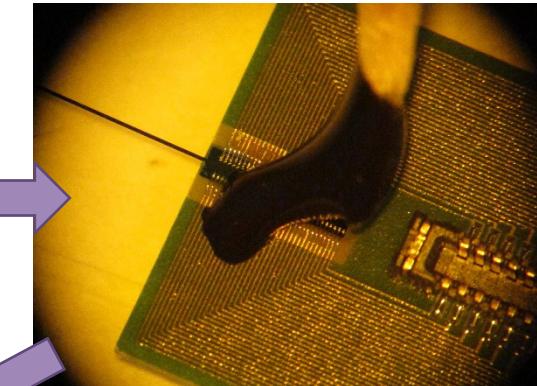
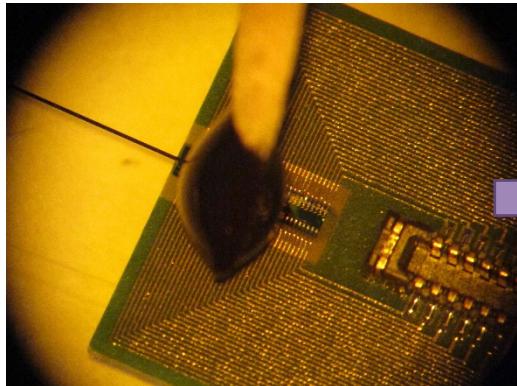


### You will need:

1. Epoxy and plunger (Resinlab EP965 Black)
  - <http://www.resinlab.com/products/ep965-epoxy-encapsulant-black-50-ml-cartridge>
  - [http://www.grainger.com/product/WESTWARD-Epoxy-Applicator-Plungers-48H965?s\\_pp=false&picUrl=/static.grainger.com/rp/s/is/image/Grainger/48H965\\_AW02?\\$smthumb\\$](http://www.grainger.com/product/WESTWARD-Epoxy-Applicator-Plungers-48H965?s_pp=false&picUrl=/static.grainger.com/rp/s/is/image/Grainger/48H965_AW02?$smthumb$)
2. A small disposable weighing dish for mixing the epoxy
  - <https://www.fishersci.com/shop/products/fisherbrand-polystyrene-weighing-dishes-2/s67090a>
3. Wood applicator sticks for applying the epoxy
  - <https://www.fishersci.com/shop/products/fisherbrand-plain-tipped-applicators-3/23400112>

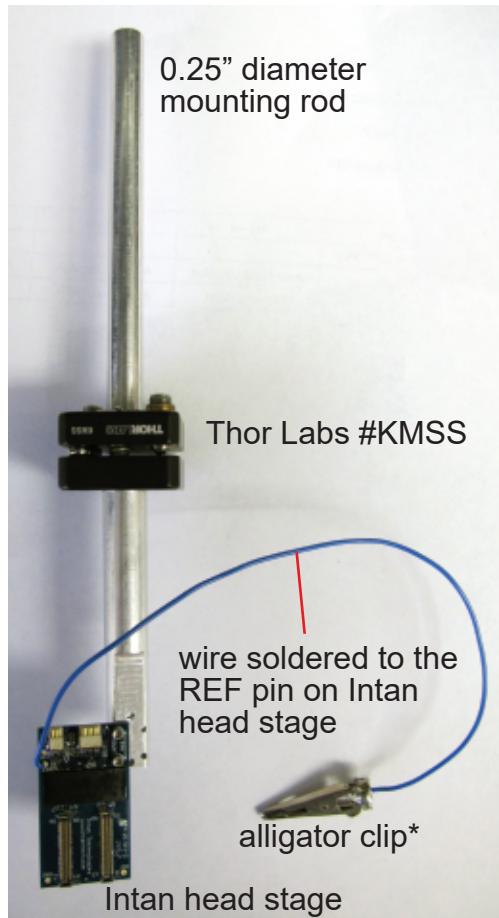


It is helpful to have a finer tip for the application, we break the sticks to get a pointed end. The EP965 epoxy is two parts that must be mixed together in a 1:1 ratio in order for it to cure properly. Mix it well, for a minute. Do not let it sit for more than 5 minutes before applying it. You want the epoxy to be less viscous, so it will drip off of the stick. The goal is to drop the epoxy onto the wire bonds and smear it over them without touching the wire bonds with the stick. NEVER touch the stick to the wire bonds, they WILL break. Cover the entire area of the wire bonds, being careful not to put epoxy too close to the connector as it will prevent the head stage from attaching. Cure overnight at room temperature (~16 hrs). It is NOT advisable to speed up curing time by increasing temperature because this will cause the epoxy to flow and cover a wider area than expected.

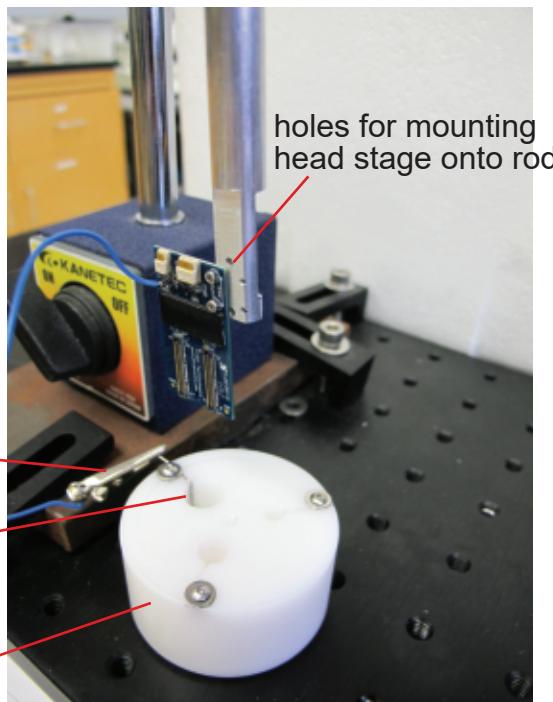
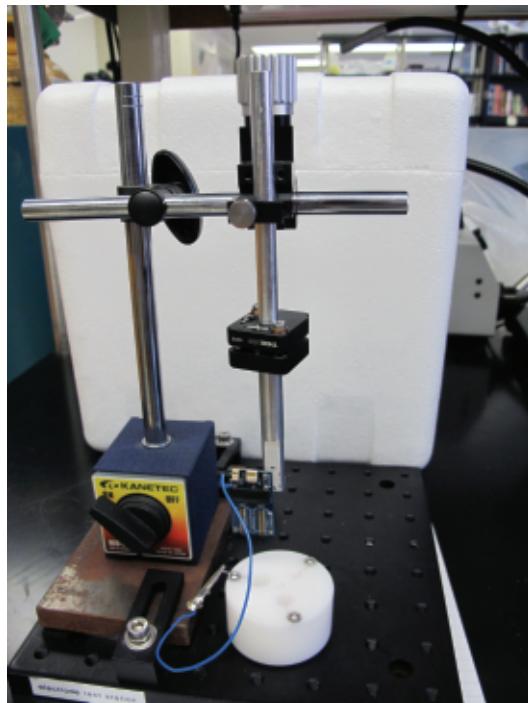


The edge of the epoxy should remain at least 1 mm from the edge of the connector, to prevent problems with plugging in the head stage.

# Electroplating and cleaning the recording sites



\*For electroplating: alligator clip is connected to the platinum wire in the gold solution



## Electroplating materials:

1. Non-cyanide gold solution (Sifco product # 80535500)
2. Platinum wire (WPI PTP201)
3. 128 ch electroplating system (Intan Technologies)
4. Probe holder and liquid well (machine shop & Thor Labs, pictured)

## Suggested electroplating settings:

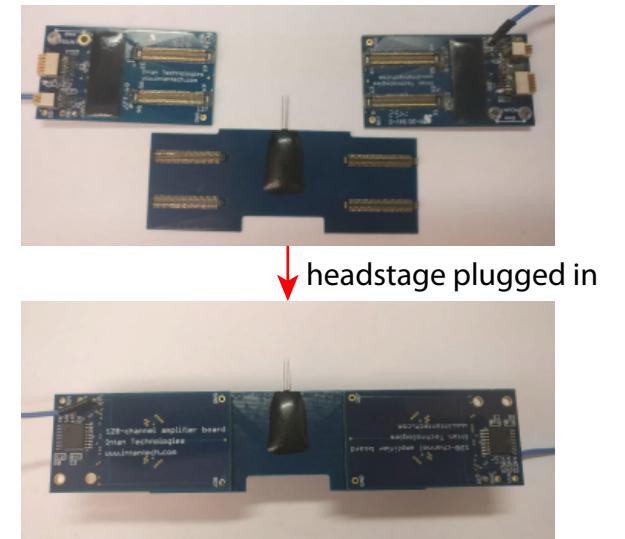
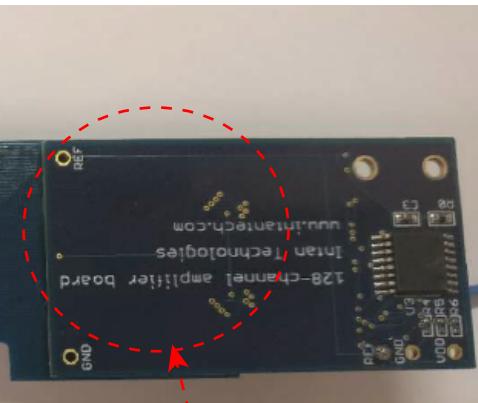
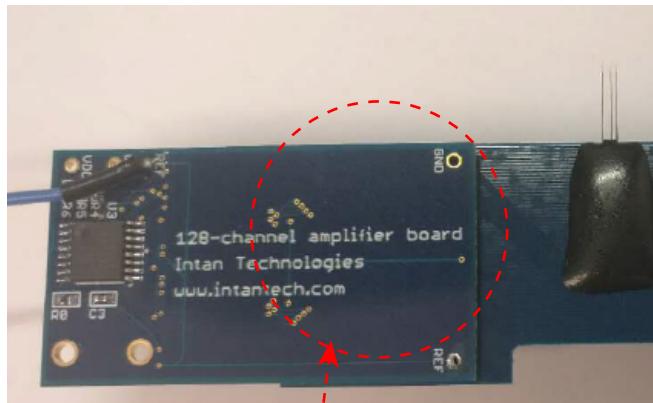
1. Connect the probe to the electroplating system as pictured.
2. Apply -2.2 to -2.5 V on the electrode in pulses of 1 to 5 s. Check impedance. Repeat until target impedance is reached. Recommended target impedance is 0.1 to 0.5 MΩ. Electrode is likely to be faulty if target impedance is not reached after 10 attempts.
3. Rinse probe in DI water.

## Suggested cleaning procedure:

1. Immerse probe in undiluted Trypsin solution (Thermo Fisher # 15090046) for at least 20 min.
2. Rinse probe in DI water.

# How to plug 2 Intan headstages into 256 channel silicon microprobes

## 1. Connectors on Top:



## 2. Connectors on Bottom:

