

Project Description

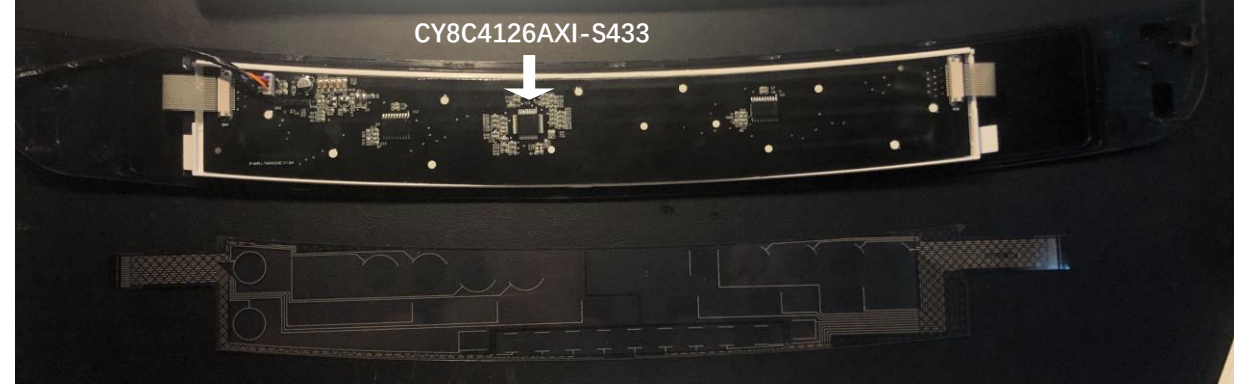
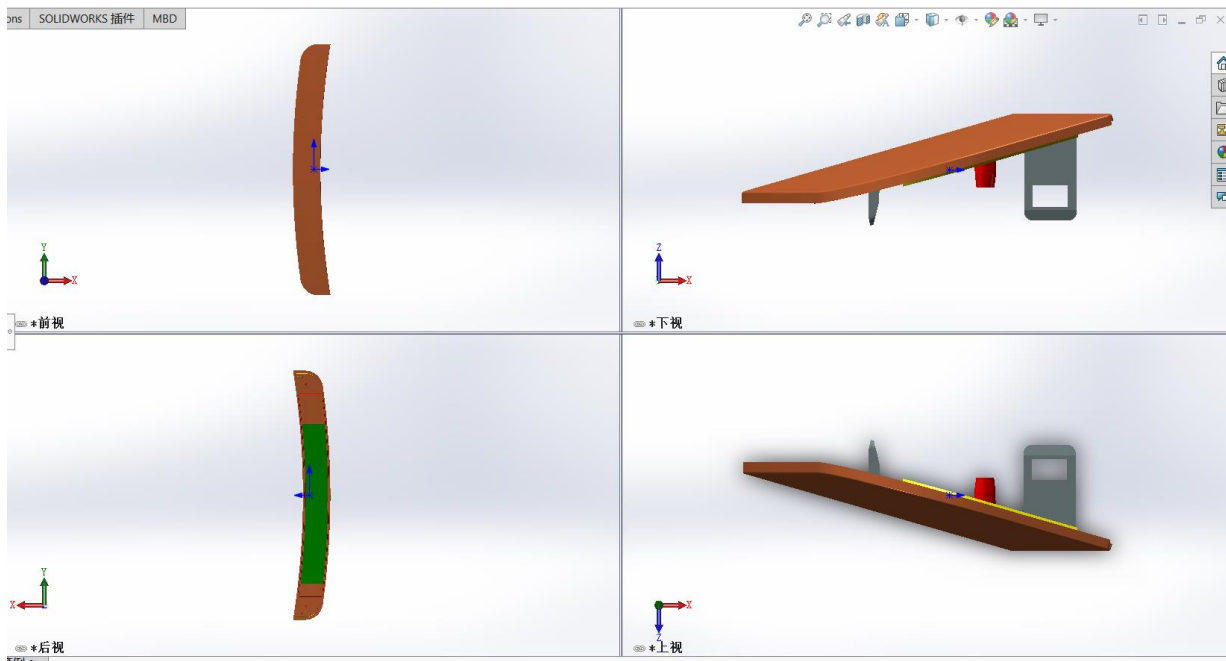
EndUser used Psoc4 MCU to control on washer touch panel(28 Touch-Keys & LED), touch sensing film is mainly of ITO material

Project Status: under massive production

We aim to step into this enduser's vendor pool via supplying them the touch sensing film, a FPCB which is mainly made of new & front-end material: PEDOT

PEDOT & ITO has their own characteristics, which means we need doing Cypress Psoc4 sensor tuning by ourselves, to demonstrate that :

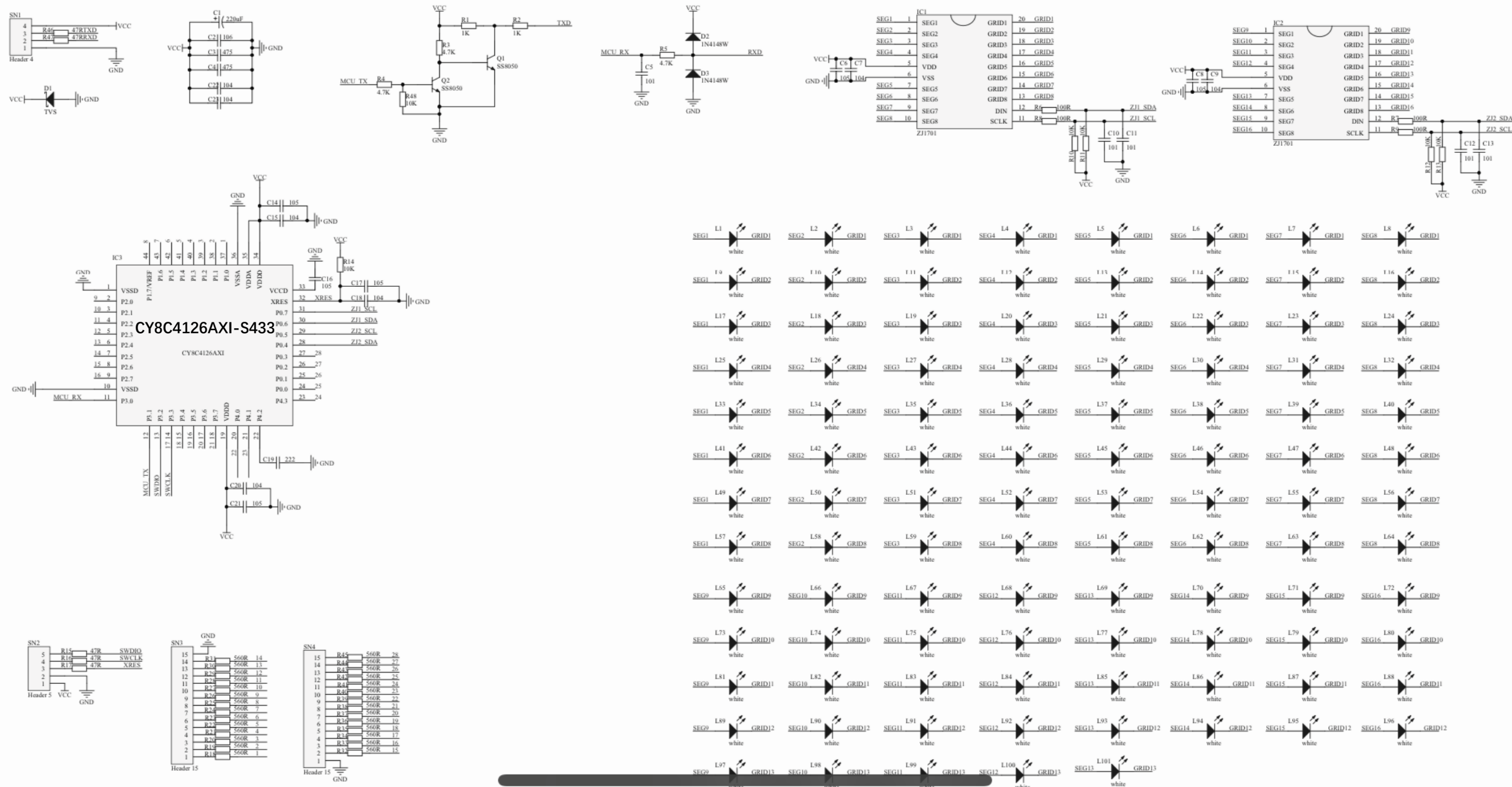
- ITO film's sensitivity & PEDOT film's sensitivity can be adjusted via parameter tuning.
- There will be a way to make two different kinds of films to compatible in a same set of sensor tuner parameters.



Touch Sensing Film:

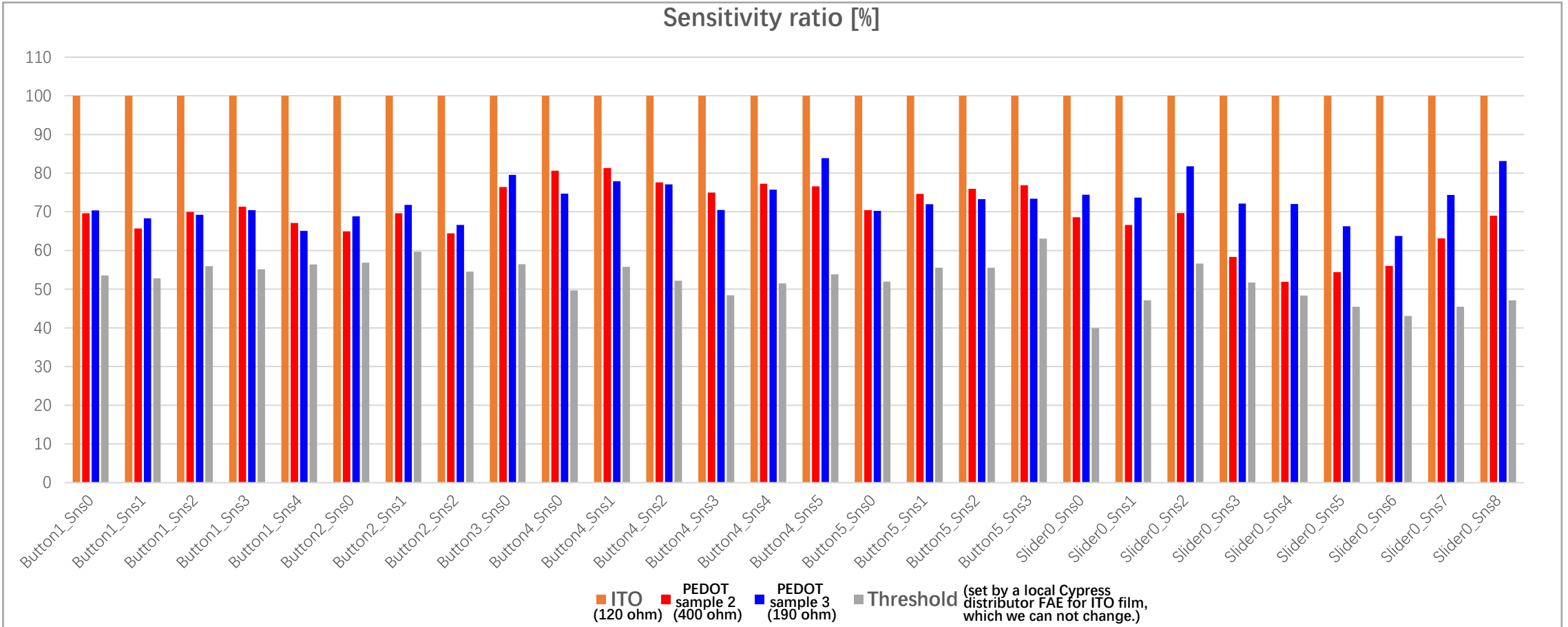
- sample1: ITO sheet resistance 120ohm
- sample2: PEDOT sheet resistance 400ohm
- sample3: PEDOT sheet resistance 190ohm

Schematic Diagram



Project Obstacles

After 1st round sampling, if we don't change any setting in the original sensor tuner parameters in Psoc4 Creator, our PEDOT doesn't fit well with a set of source code which has been customizedly tuned for ITO film via a local Cypress distributor FAE. PEDOT only can run out 70% sensitivity if comparing to ITO's sensitivity. We think this is because PEDOT has a totally different layout structure and material characteristics with ITO. Pls see below graph in details:



We're not approachable to get more supports from that local Cypress distributor to evaluate on our PEDOT film's advantages and disadvantages.

So, we tried our own efforts to start tuning via reading Cypress's tuner guidelines.

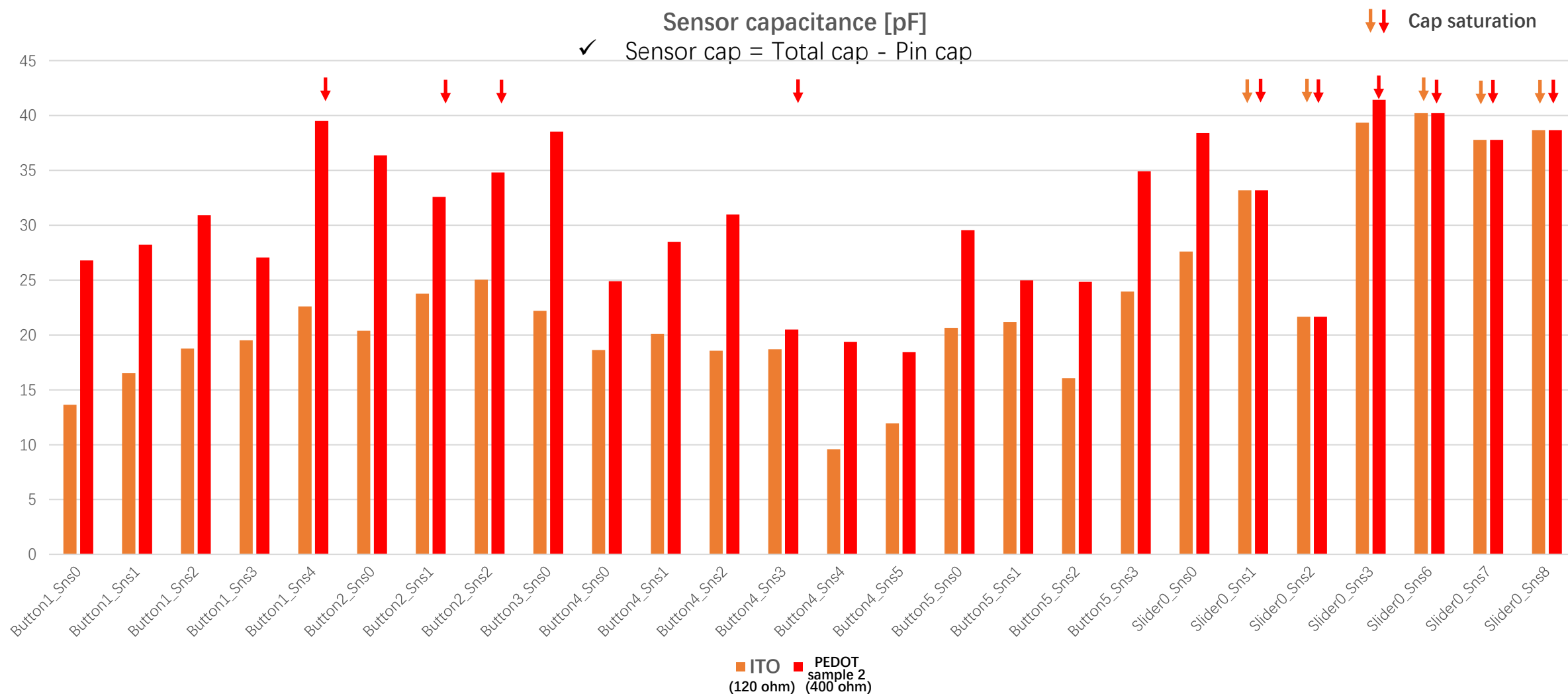
Now we'd like to know deeper on the parameters that we have adjusted, will have any other side-effects that we should better be pre-noticed.

Before we deliver our PEDOT sample to our enduser customer, we'd like to verify on some important stuffs such as whether we did a correct tuning trial, whether we well understood CapSense function, whether we considered tuning factors with multi-aspects.

[After checking next several pages' details, Pls help advise what will be the sides effects for our newly set tuning parameters.](#)

How to move away the obstacles that we met —— try on tuning by ourselves

Before tuning, we did a test to see how will be ITO's compensation capacitance value and PEDOT's.
Based on below test result, we try to find out which tuning parameter can be suitable for both ITO and PEDOT.



Now we start tuning

Firstly, we checked 3 film samples' parameter data via CapSense' auto calculation tool.

the parameter data we collected via auto calculation

sample 1(ITO): 120ohm					sample 3(PEDOT): 190ohm					sample 3(PEDOT): 400ohm							
Button	modulator IDAC	GAIN IDAC	Compensation IDAC	Scan Resolution	Button	modulator IDAC	GAIN IDAC	Compensation IDAC	Scan Resolution	Button	modulator IDAC	GAIN IDAC	Compensation IDAC	Scan Resolution			
1-0	39	2400	30	13	1-0	48	2400	37	13	1-0	49	2400	36	13			
1-1			29		1-1			37		1-1			37				
1-2			34		1-2			40		1-2			40				
1-3			34		1-3			36		1-3			37				
1-4	41		40	14	1-4	50		49	14	1-4	51		49	14			
2-0			34		2-0			45		2-0			45				
2-1			41		2-1			51		2-1			52				
2-2			37		2-2			44		2-2			43				
3-0	38		38	14	3-0	47		48	14	3-0	48		48	14			
4-0			23		4-0			26		4-0			27				
4-1			40		4-1			46		4-1			47				
4-2			25		4-2			33		4-2			33				
4-3	40		24	13	4-3	46		31	13	4-3	46		31	13			
4-4			14		4-4			20		4-4			21				
4-5			16		4-5			19		4-5			18				
5-0			31		5-0			34		5-0			36				
5-1	32		30	14	5-1	42		28	14	5-1	41		29	14			
5-2			25		5-2			28		5-2			29				
5-3			32		5-3			42		5-3			41				
s0			31		s0			33		s0			32				
s1	53		46	15	s1	69		54	15	s1	72		50	15			
s2			46		s2			57		s2			57				
s3			44		s3			60		s3			53				
s4			51		s4			70		s4			73				
s5			54		s5			57		s5			62				
s6			41		s6			68		s6			59				
s7			39		s7			54		s7			49				
s8			43		s8			49		s8			47				

We took all test results as reference, and did our tuning trial as below:

Our Tuning Trial

tuning 14 00 Parameter				
Button	modulator IDAC	GAIN IDAC	Compensation IDAC	Scan Resolution
1-0	65	2400	45	14
1-1			45	
1-2			45	
1-3			45	
1-4			45	
2-0	75		40	15
2-1			40	
2-2			40	
3-0	75		40	15
4-0	80		15	14
4-1			30	
4-2			30	
4-3			30	
4-4			15	
4-5	15			
5-0	67		36	15
5-1			29	
5-2			29	
5-3			41	
s0	90		40	16
s1			45	
s2			45	
s3			45	
s4			75	
s5			45	
s6			45	
s7			45	
s8	40			

Tuning Summaries:

1. Scan Resolution ↑
2. Modulator IDAC & Compensation IDAC has been newly set, meanwhile here can reduce the disadvantages caught by high scan resolution.

UART setting data for existing ITO

Configure 'UART1' ? X

Name:

Configuration **UART Basic** UART Advanced UART Pins Built-in

Mode:

Direction:

Baud rate (bps): Actual baud rate (bps): 9615

Data bits:

Parity:

Stop bits:

Oversampling:

☐ Clock from terminal

☐ Median filter

☐ Retry on NACK

☐ Inverting RX

☐ Enable wakeup from Deep Sleep Mode

☐ Low power receiving

Datasheet OK Apply Cancel

Our trial on UART setting for ITO & PEDOT to let
2 films compatible to a same set of parameters

Configure 'UART1' ? X

Name:

Configuration **UART Basic** UART Advanced UART Pins Built-in

Mode:

Direction:

Baud rate (bps): Actual baud rate (bps): 9615

Data bits:

Parity:

Stop bits:

Oversampling:

☐ Clock from terminal

☐ Median filter

☐ Retry on NACK

☐ Inverting RX

☐ Enable wakeup from Deep Sleep Mode

☐ Low power receiving

Datasheet OK Apply Cancel

HERE NO CHANGE

UART setting data for existing ITO

Configure 'UART1' ? X

Name: UART1

Configuration UART Basic **UART Advanced** UART Pins Built-in

Buffers size
RX buffer size: 17
TX buffer size: 16
☒ Byte mode

Interrupt
☐ None
☒ Internal
☐ External

DMA
☐ RX output
☐ TX output

Interrupt sources
☐ UART done
☐ TX FIFO not full
☐ TX FIFO empty
☐ TX FIFO overflow
☐ TX FIFO underflow
☐ TX lost arbitration
☐ TX NACK
☐ TX FIFO level
☒ RX FIFO not empty
☐ RX FIFO full
☐ RX FIFO overflow
☐ RX FIFO underflow
☐ RX frame error
☐ RX parity error
☐ RX FIFO level
☐ Break detected Break width: 11

FIFO levels

Datasheet OK Apply Cancel

Our trial on UART setting for ITO & PEDOT to let 2 films compatible to a same set of parameters

Configure 'UART1' ? X

Name: UART1

Configuration UART Basic **UART Advanced** UART Pins Built-in

Buffers size
RX buffer size: 17
TX buffer size: 16
☒ Byte mode

Interrupt
☐ None
☒ Internal
☐ External

DMA
☐ RX output
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Interrupt sources
☐ UART done
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☐ TX lost arbitration
☐ TX NACK
☐ TX FIFO level
☒ RX FIFO not empty
☐ RX FIFO full
☐ RX FIFO overflow
☐ RX FIFO underflow
☐ RX frame error
☐ RX parity error
☐ RX FIFO level
☐ Break detected Break width: 11

FIFO levels

Datasheet OK Apply Cancel

HERE NO CHANGE

UART setting data for existing ITO

Configure 'UART1' ? X

Name:

Configuration | UART Basic | UART Advanced | UART Pins | **Built-in** < >

Information		
Component Major Version	4	
Component Minor Version	0	

Settings		
Disable	<input type="checkbox"/>	<i>f(x)</i>
Suppress API Generation	<input type="checkbox"/>	<i>f(x)</i>
User Comments	<i>f(x)</i>	

Datasheet OK Apply Cancel

Our trial on UART setting for ITO & PEDOT to let
2 films compatible to a same set of parameters

Configure 'UART1' ? X

Name:

Configuration | UART Basic | UART Advanced | UART Pins | **Built-in** < >

Information		
Component Major Version	4	
Component Minor Version	0	

Settings		
Disable	<input type="checkbox"/>	<i>f(x)</i>
Suppress API Generation	<input type="checkbox"/>	<i>f(x)</i>
User Comments	<i>f(x)</i>	

Datasheet OK Apply Cancel

HERE NO CHANGE

CapSense parameter setting for existing ITO

Configure 'CapSense'

Load configuration Save configuration Export Register Map

Name: CapSense

Basic Advanced Built-in

General CSD Settings CSX Settings Widget Details Scan Order

Regular widget raw count filter
tune
☒ Enable IIR filter (First order)
IIR filter raw count coefficient: 20
☒ Enable median filter (3-sample)
☐ Enable average filter (4-sample)

Proximity widget raw count filter
tune
☐ Enable IIR filter (First order)
IIR filter raw count coefficient: 128
☐ Enable median filter (3-sample)
☐ Enable average filter (4-sample)

Baseline IIR filter settings
Regular widget baseline coefficient: 20
Proximity widget baseline coefficient: 1

☐ Enable sensor auto-reset
☐ Enable self-test library
☐ Enable multi-frequency scan

Datasheet OK Apply Cancel

Our trial on parameter setting for ITO & PEDOT to let 2 films compatible to a same set of parameters

Configure 'CapSense'

Load configuration Save configuration Export Register Map

Name: CapSense

Basic Advanced Built-in

General CSD Settings CSX Settings Widget Details Scan Order

Regular widget raw count filter
tune
☒ Enable IIR filter (First order)
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☒ Enable median filter (3-sample)
☐ Enable average filter (4-sample)

Proximity widget raw count filter
tune
☐ Enable IIR filter (First order)
IIR filter raw count coefficient: 128
☐ Enable median filter (3-sample)
☐ Enable average filter (4-sample)

Baseline IIR filter settings
Regular widget baseline coefficient: 20
Proximity widget baseline coefficient: 1

☐ Enable sensor auto-reset
☐ Enable self-test library
☐ Enable multi-frequency scan

Datasheet OK Apply Cancel

HERE NO CHANGE

CapSense parameter setting for existing ITO

Configure 'CapSense' ? X

Load configuration Save configuration Export Register Map

Name: CapSense

Basic Advanced Built-in

General CSD Settings CSX Settings Widget Details Scan Order

Scan settings

Modulator clock frequency (24000

Actual frequency (kHz): 24000

Sense clock source: Auto

☐ Enable shield electrode

Enable the shield electrode for reliable operation in the presence of water droplets

☐ Enable common sense clock

Sense clock frequency (kHz) Set per widget

Actual frequency (kHz): N/A

Inactive sensor connection: Ground

IDAC sensing configuration: IDAC sourcing

☒ Enable IDAC auto-calibration

☒ Enable compensation IDAC

Datasheet OK Apply Cancel

Our trial on parameter setting for ITO & PEDOT to let 2 films compatible to a same set of parameters

Configure 'CapSense' ? X

Load configuration Save configuration Export Register Map

Name: CapSense

Basic Advanced Built-in

General CSD Settings CSX Settings Widget Details Scan Order

Scan settings

Modulator clock frequency (24000

Actual frequency (kHz): 24000

Sense clock source: Auto

☐ Enable shield electrode

Enable the shield electrode for reliable operation in the presence of water droplets

☐ Enable common sense clock

Sense clock frequency (kHz) Set per widget

Actual frequency (kHz): N/A

Inactive sensor connection: Ground

IDAC sensing configuration: IDAC sourcing

☐ Enable IDAC auto-calibration

☒ Enable compensation IDAC

Datasheet OK Apply Cancel

1 CHANGE

CapSense parameter setting for existing ITO

Configure 'CapSense' ? x

Load configuration Save configuration Export Register Map

Name: CapSense

Basic **Advanced** Built-in

General CSD Settings CSX Settings Widget Details Scan Order

i The CSX Settings tab is available only when the CSX sensing mode is selected in the Basic tab.

Scan settings

Modulator clock frequency (24000)

Actual frequency (kHz): N/A

Tx clock source: Auto

☐ Enable common Tx clock

Tx clock frequency (kHz) Set per widget

Actual frequency (kHz): N/A

Number of reported fingers: N/A if no touchpad

☒ Enable IDAC auto-calibration

Datasheet OK Apply Cancel

Our trial on parameter setting for ITO & PEDOT to let 2 films compatible to a same set of parameters

Configure 'CapSense' x

Load configuration Save configuration Export Register Map

Name: CapSense

Basic **Advanced** Built-in

General CSD Settings CSX Settings Widget Details Scan Order

i The CSX Settings tab is available only when the CSX sensing mode is selected in the Basic tab.

Scan settings

Modulator clock frequency (24000)

Actual frequency (kHz): N/A

Tx clock source: Auto

☐ Enable common Tx clock

Tx clock frequency (kHz) Set per widget

Actual frequency (kHz): N/A

Inactive electrode connecti: Ground

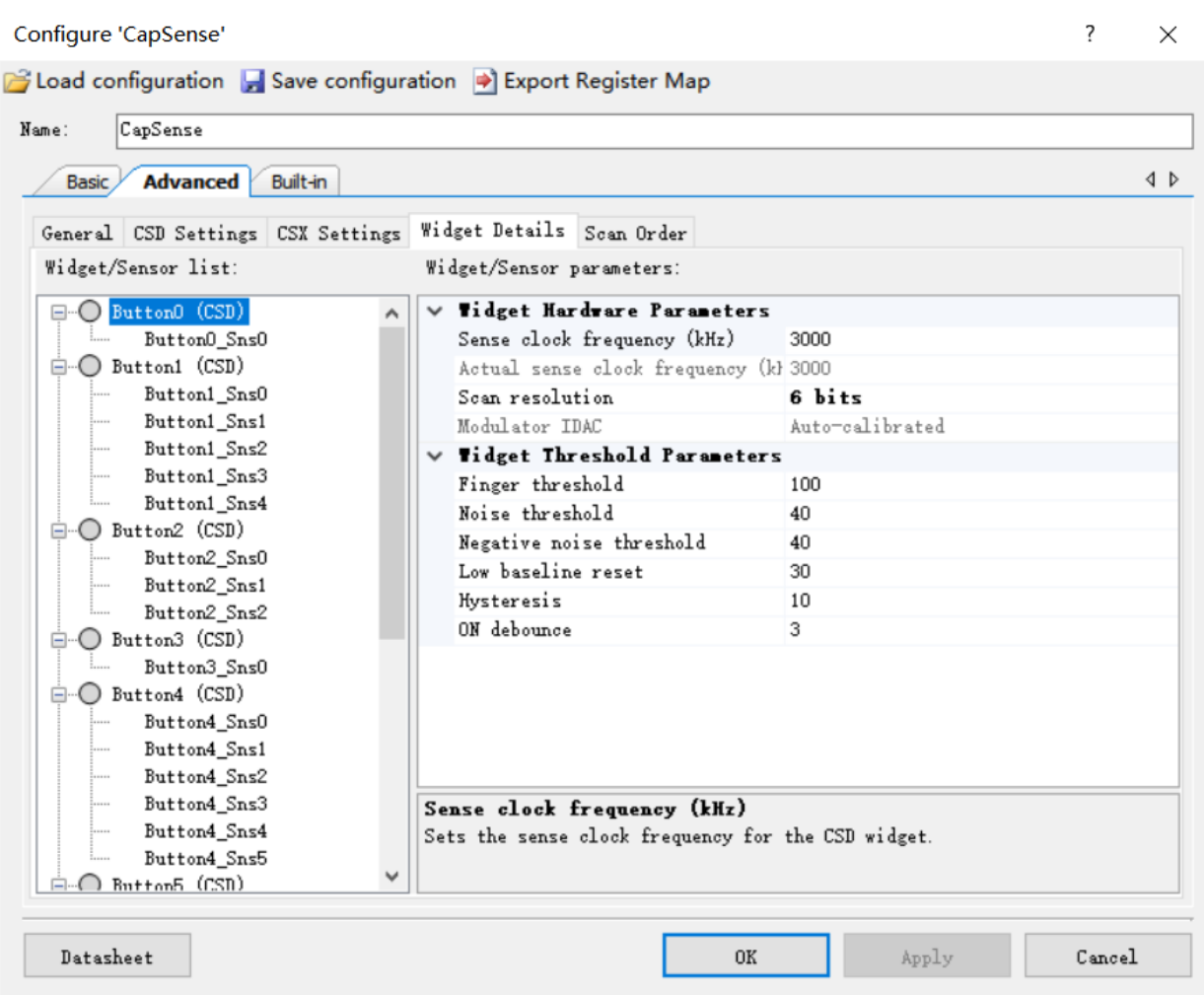
Number of reported fingers: N/A if no touchpad

☒ Enable IDAC auto-calibration

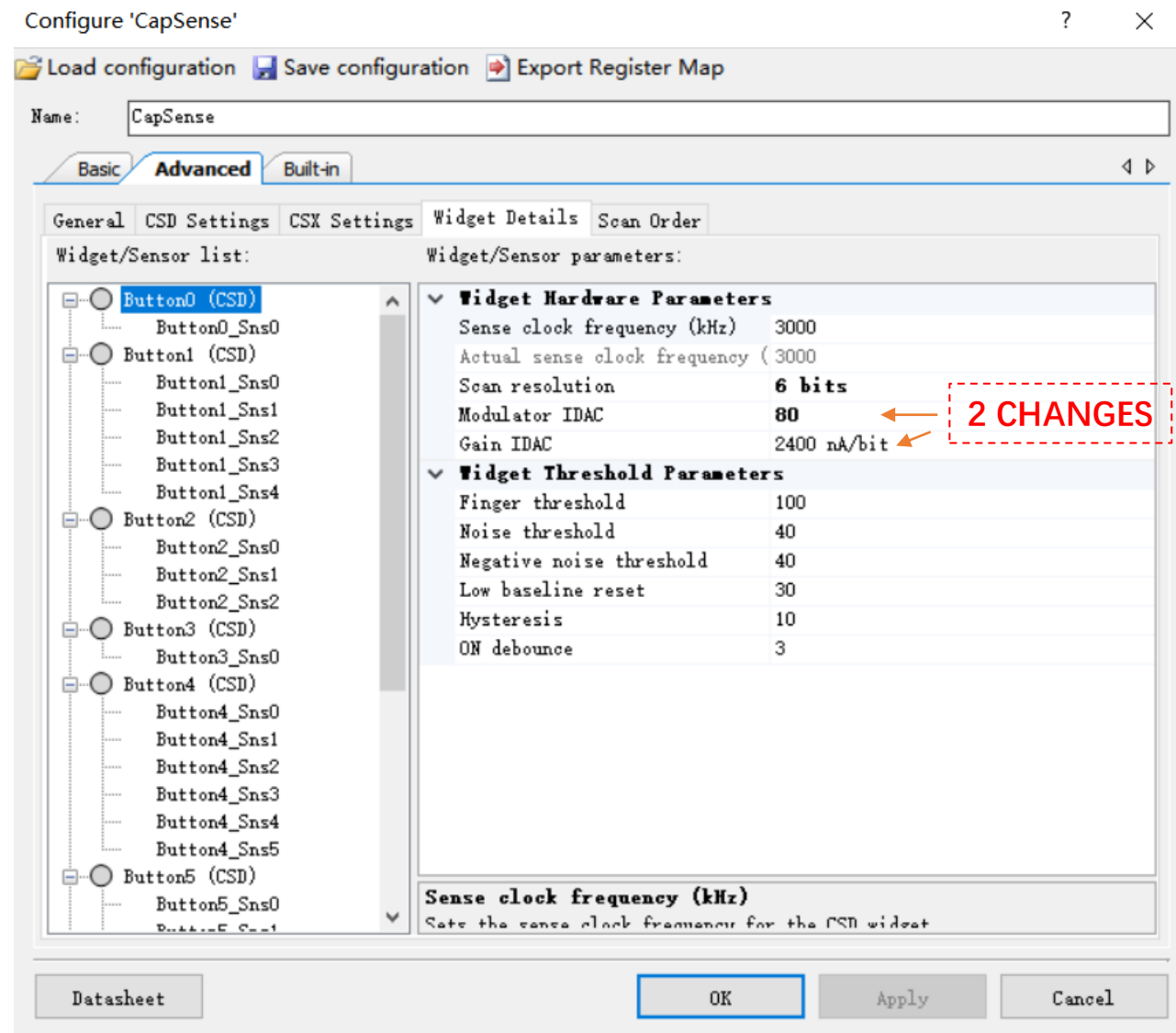
Datasheet OK Apply Cancel

HERE NO CHANGE ?

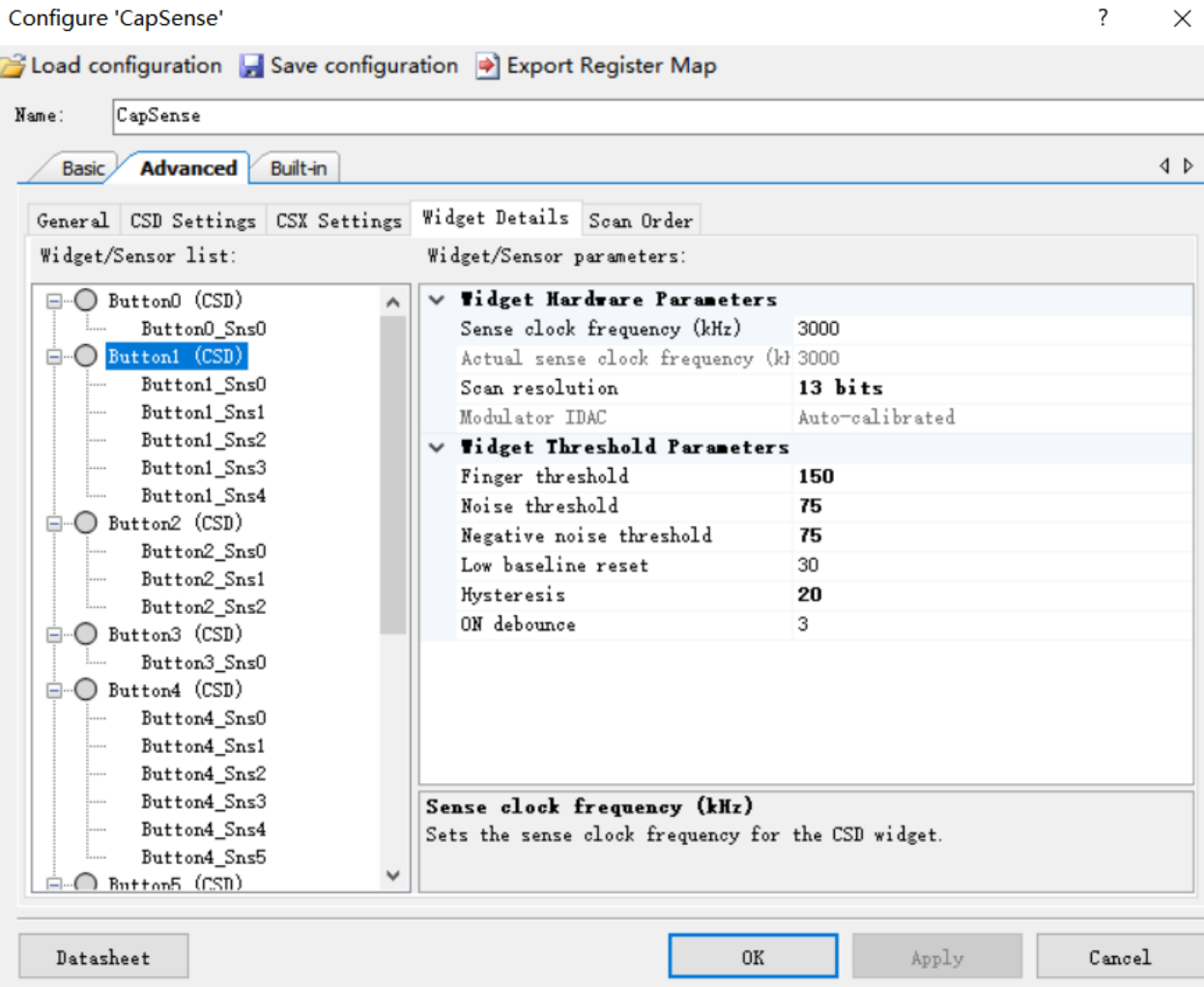
CapSense parameter setting for existing ITO



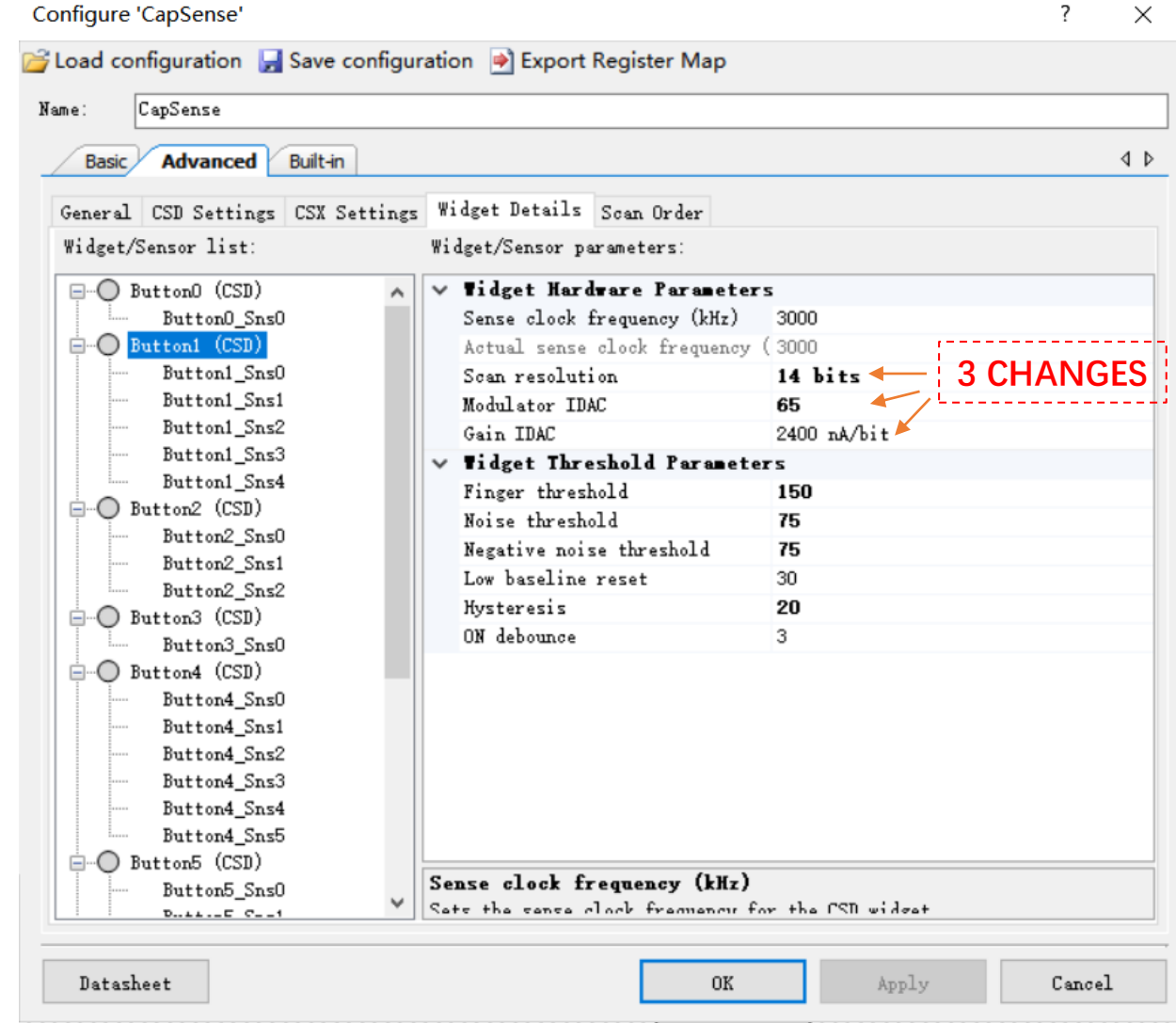
Our trial on parameter setting for ITO & PEDOT to let 2 films compatible to a same set of parameters



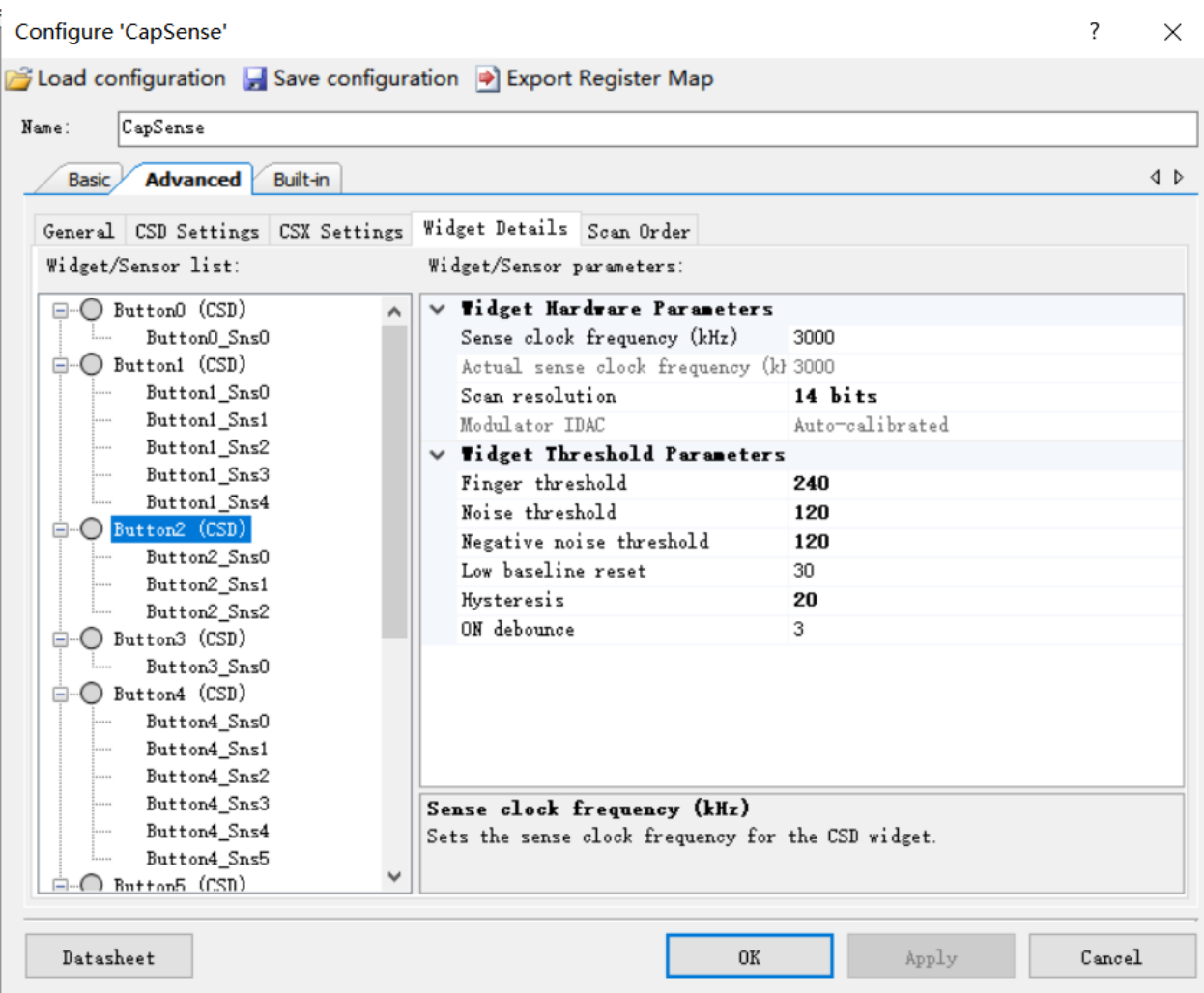
CapSense parameter setting for existing ITO



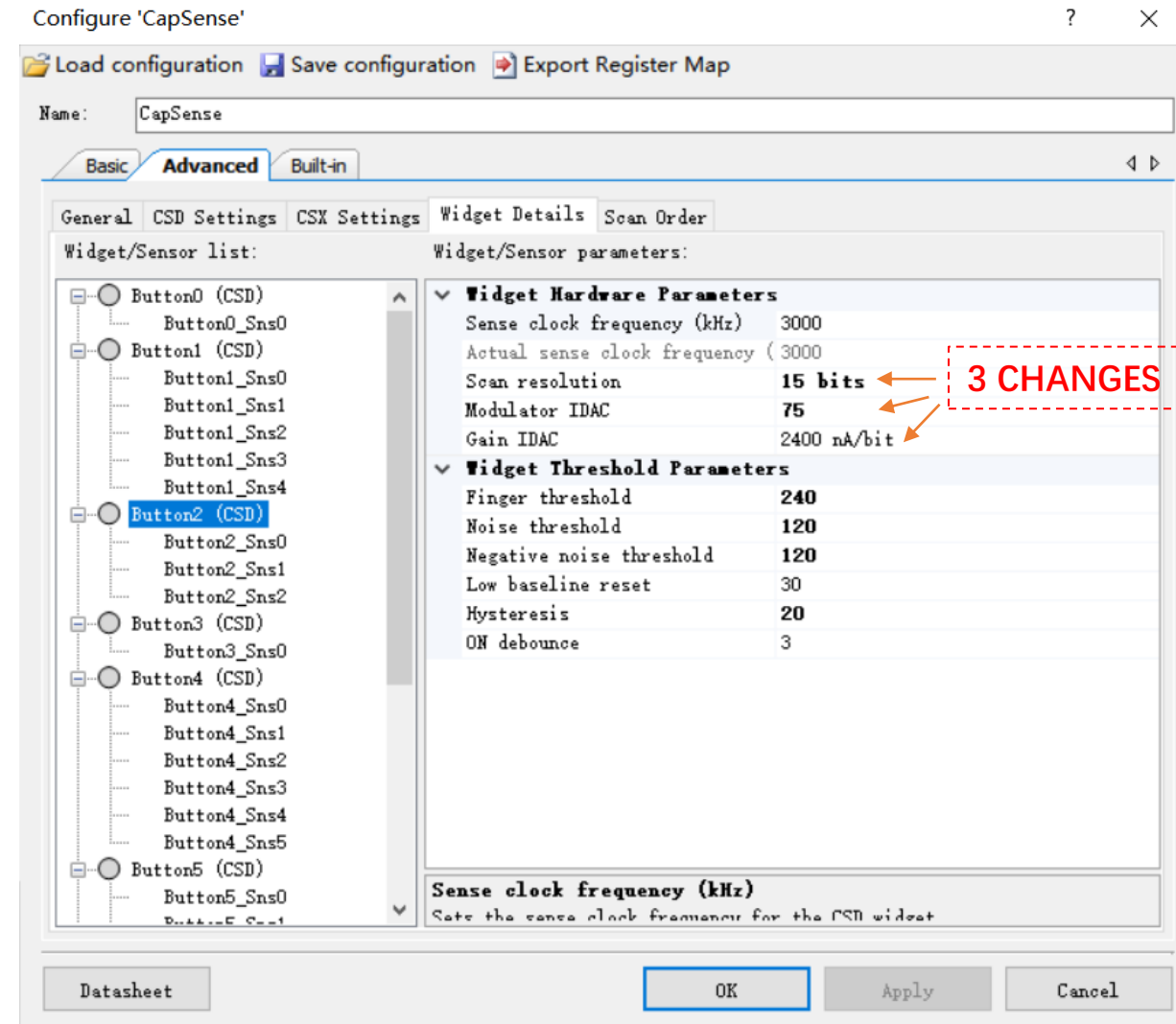
Our trial on parameter setting for ITO & PEDOT to let 2 films compatible to a same set of parameters



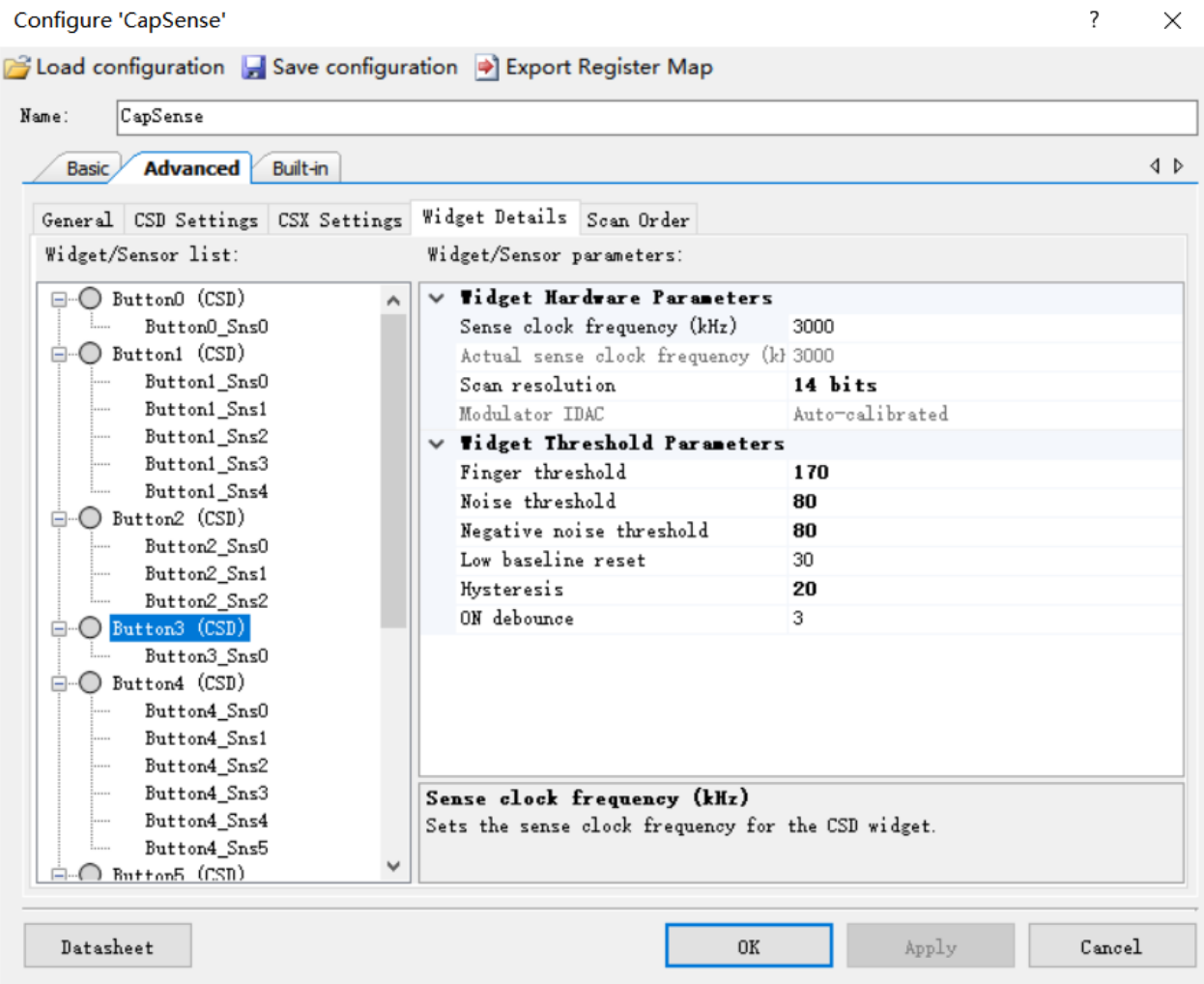
CapSense parameter setting for existing ITO



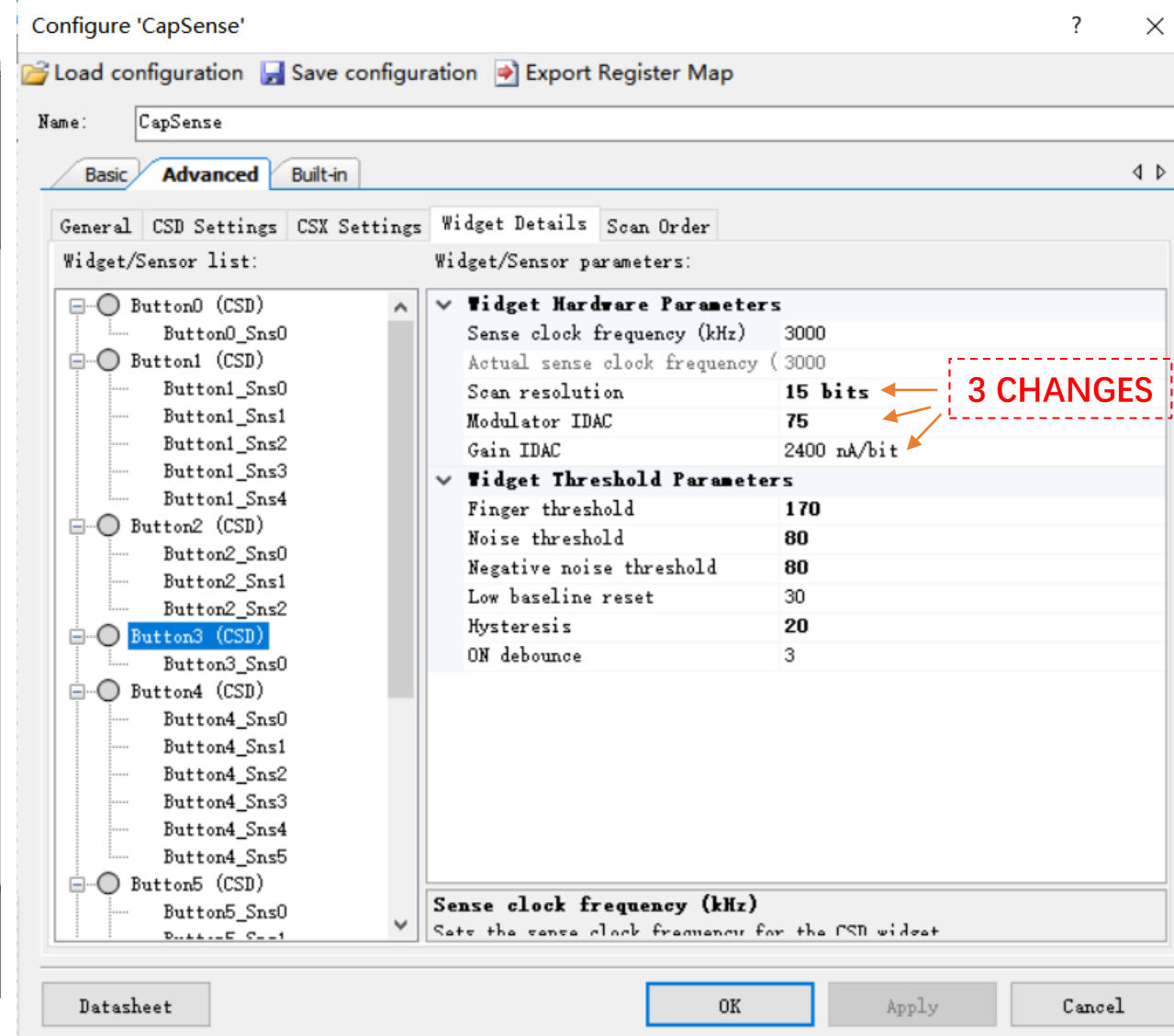
Our trial on parameter setting for ITO & PEDOT to let 2 films compatible to a same set of parameters



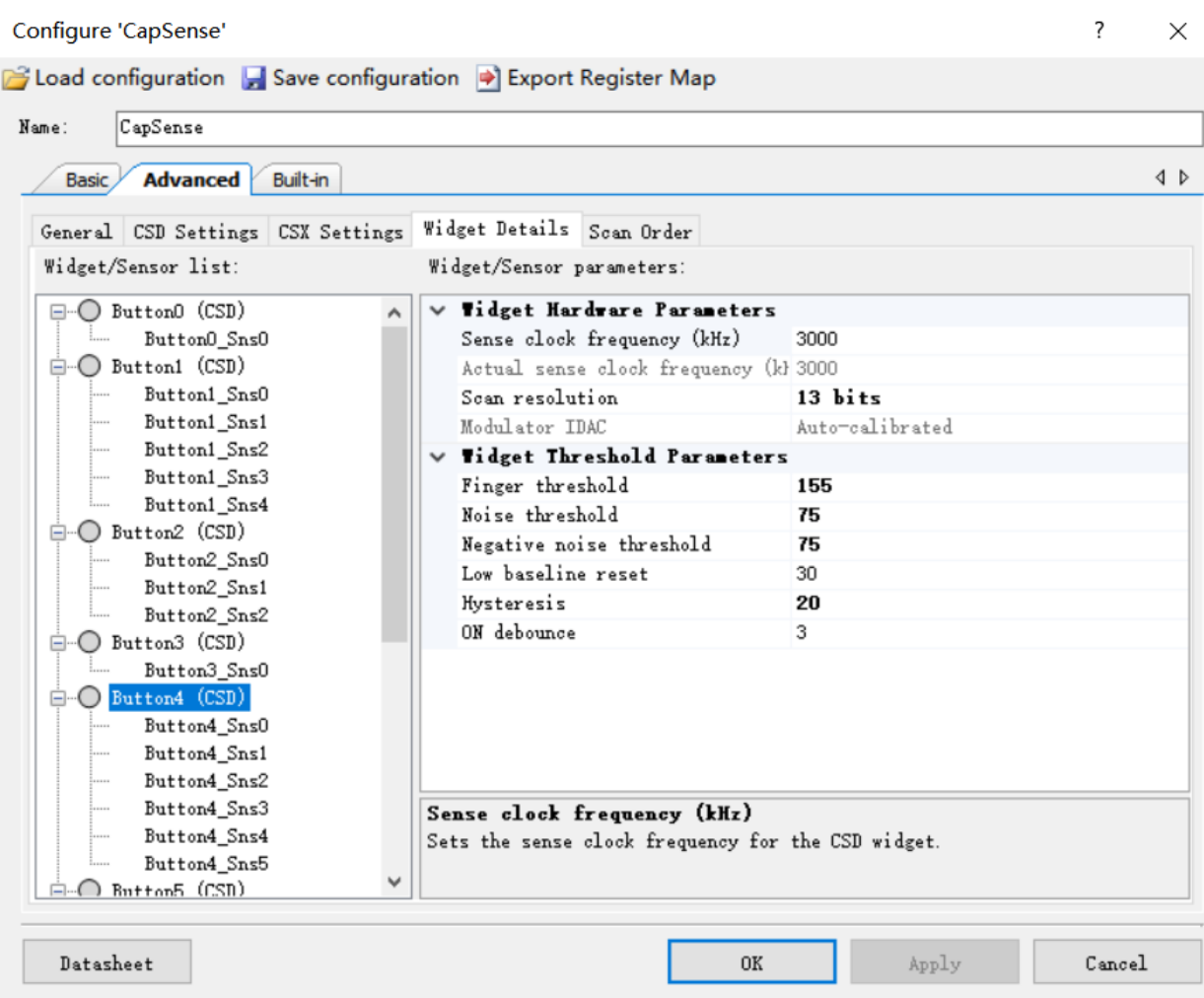
CapSense parameter setting for existing ITO



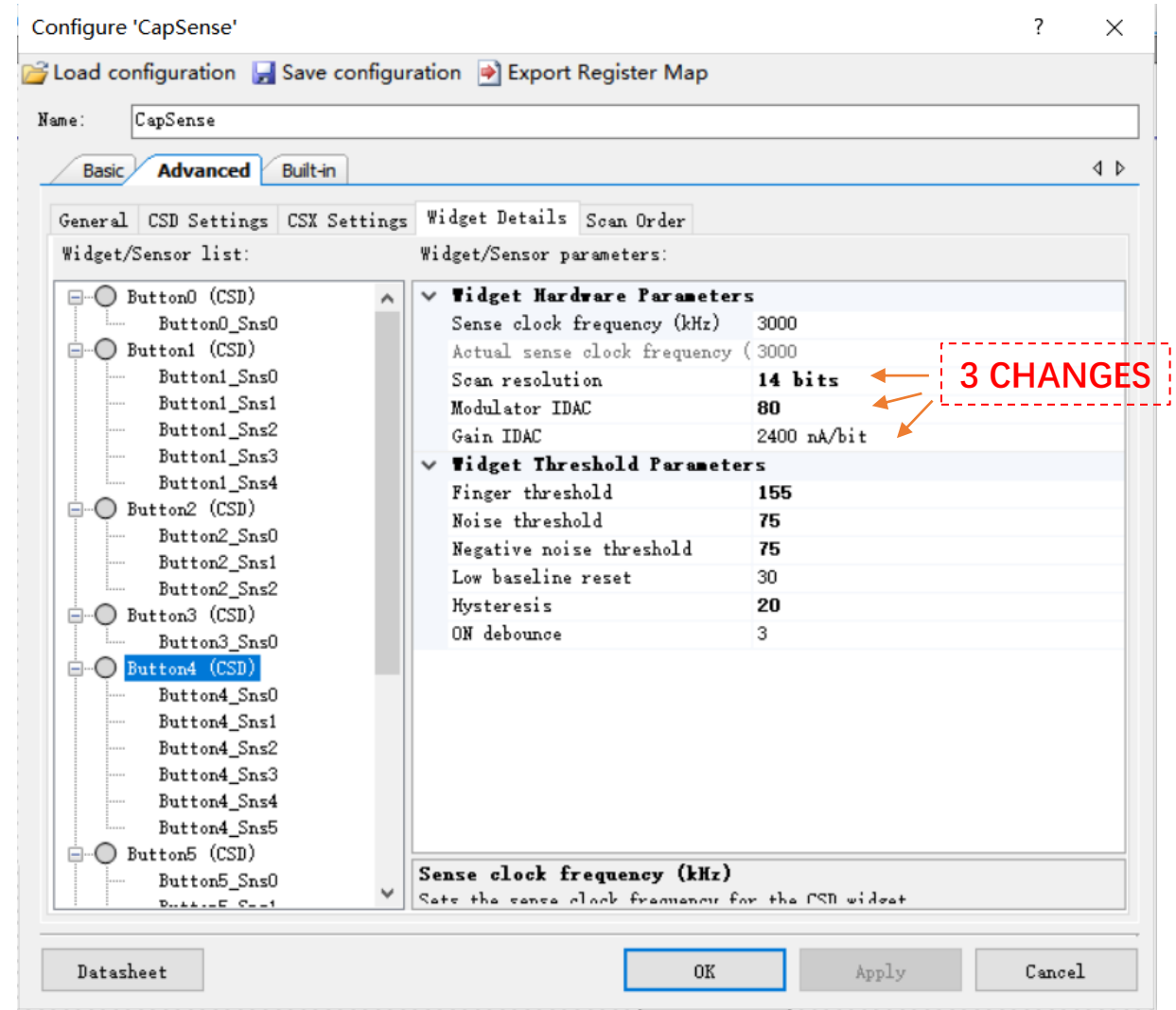
Our trial on parameter setting for ITO & PEDOT to let 2 films compatible to a same set of parameters



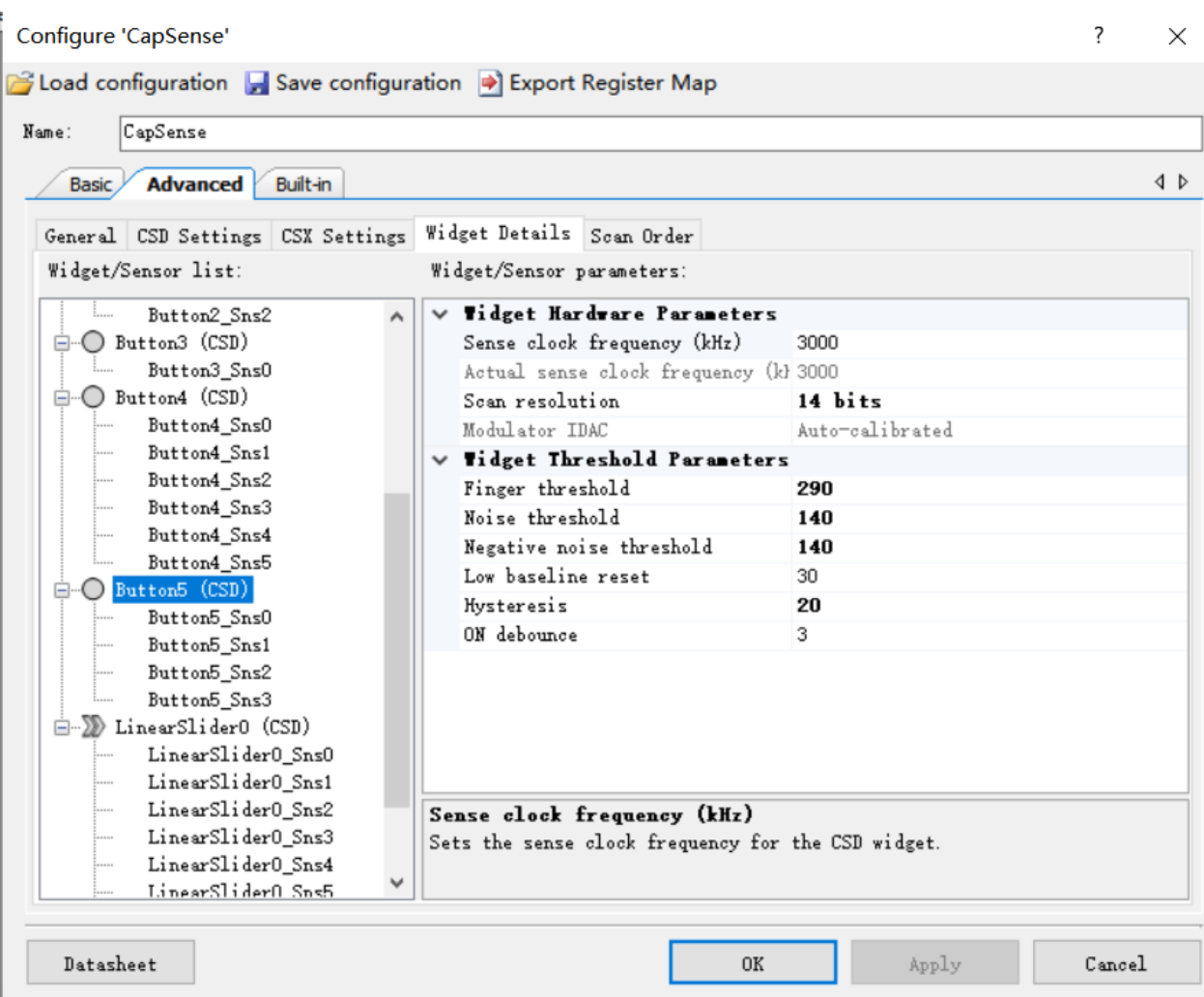
CapSense parameter setting for existing ITO



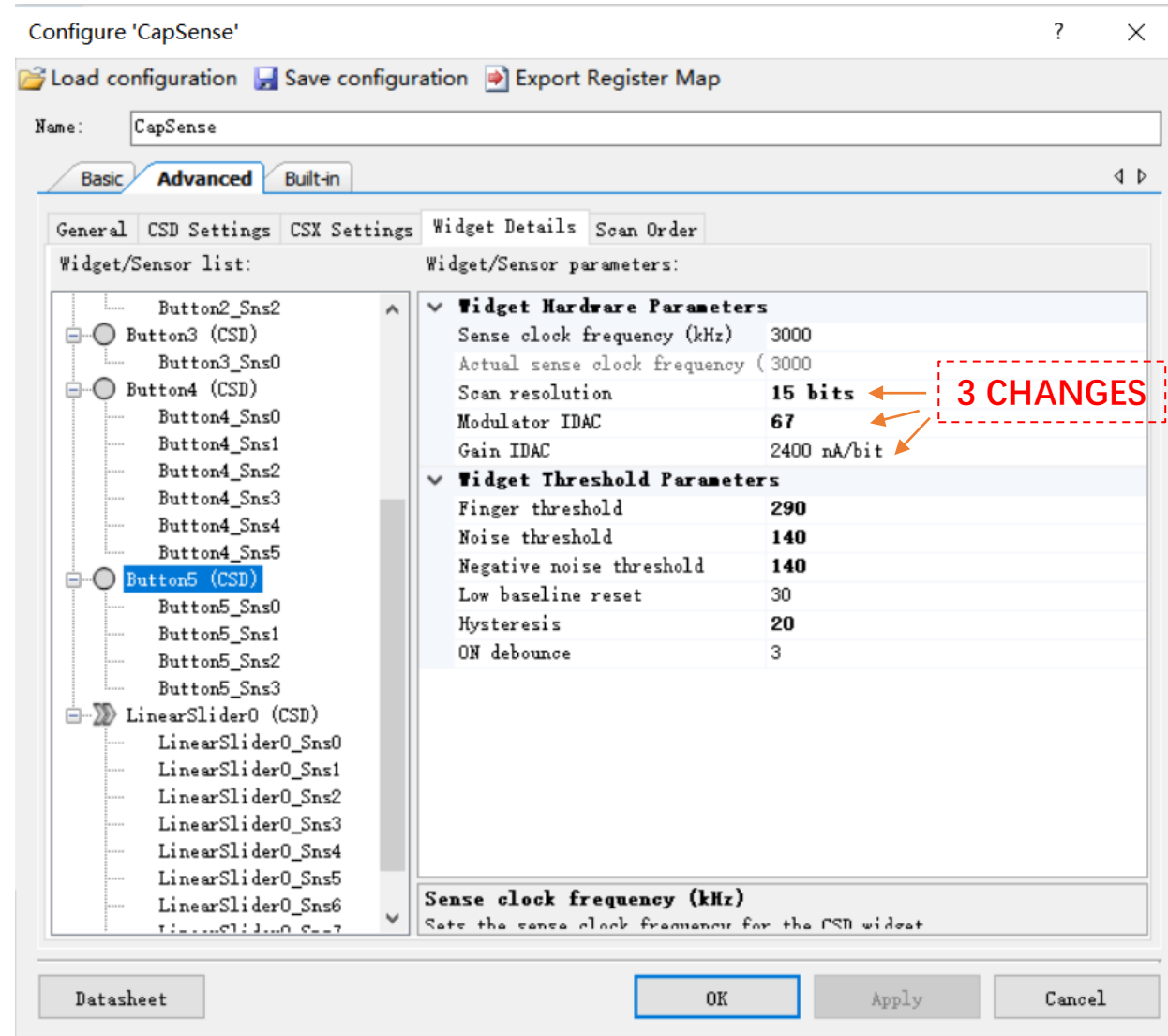
Our trial on parameter setting for ITO & PEDOT to let 2 films compatible to a same set of parameters



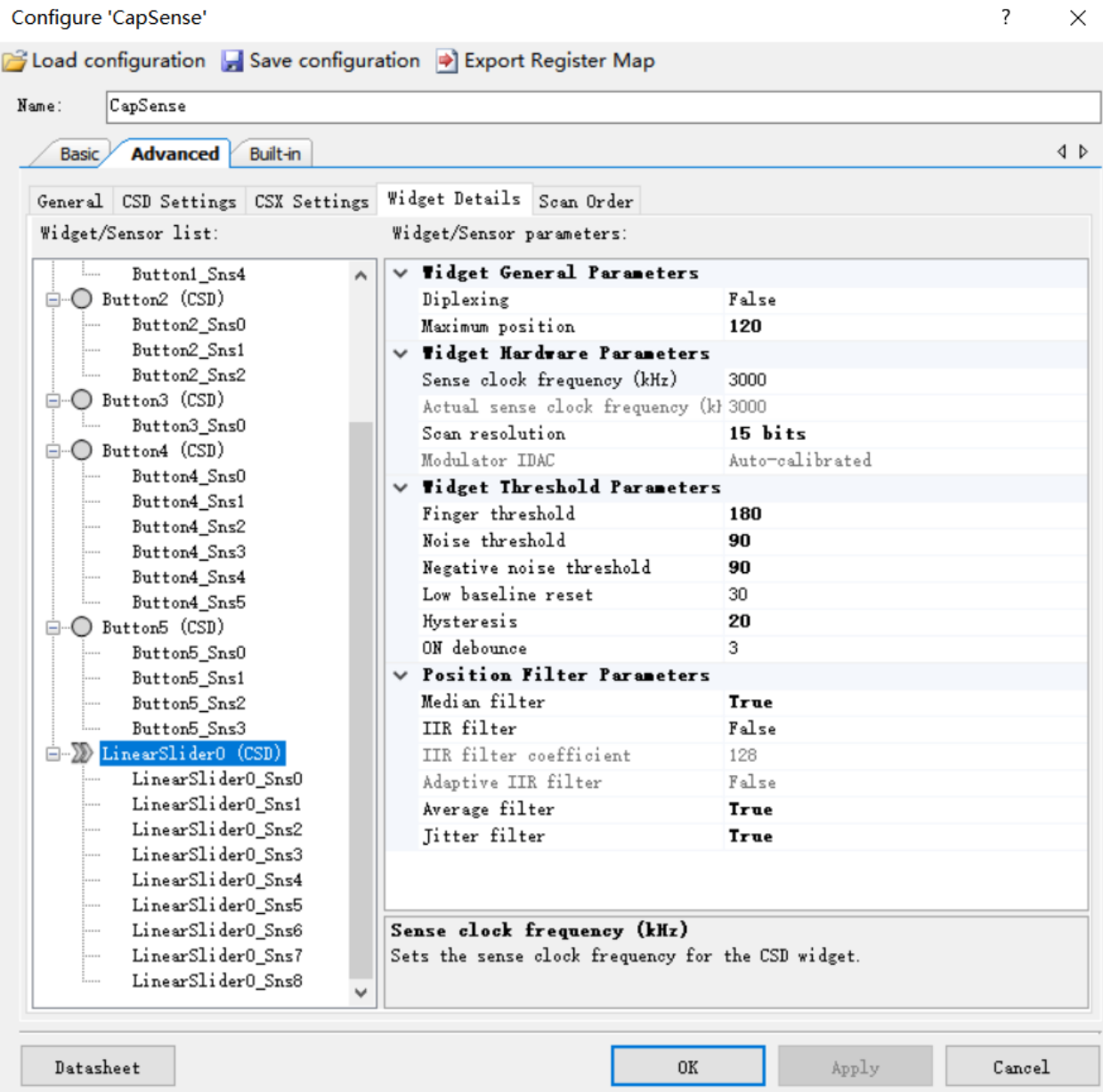
CapSense parameter setting for existing ITO



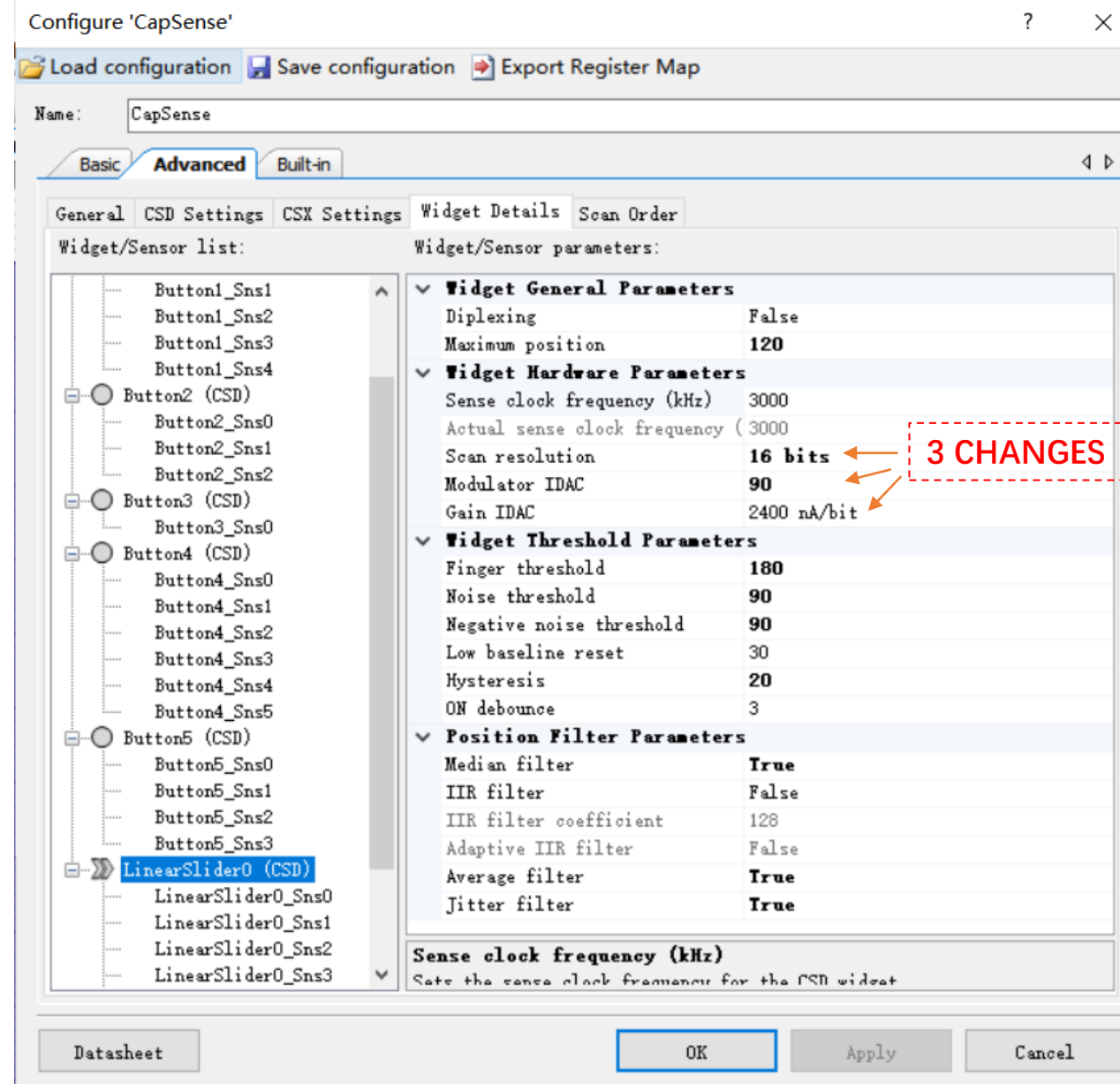
Our trial on parameter setting for ITO & PEDOT to let 2 films compatible to a same set of parameters



CapSense parameter setting for existing ITO



Our trial on parameter setting for ITO & PEDOT to let 2 films compatible to a same set of parameters



CapSense parameter setting for existing ITO

Configure 'CapSense'

Load configuration Save configuration Export Register Map

Name: CapSense

Basic Advanced Built-in

General CSD Settings CSX Settings Widget Details Scan Order

Scan slot	Sensor assignment	Sense clock (kHz)	Scan resolution (bits)	Slot scan time (μs)
0	Button0_Sns0	3000	6	3
1	Button1_Sns0	3000	13	341
2	Button1_Sns1	3000	13	341
3	Button1_Sns2	3000	13	341
4	Button1_Sns3	3000	13	341
5	Button1_Sns4	3000	13	341
6	Button2_Sns0	3000	14	683
7	Button2_Sns1	3000	14	683
8	Button2_Sns2	3000	14	683
9	Button3_Sns0	3000	14	683
10	Button4_Sns0	3000	13	341
11	Button4_Sns1	3000	13	341
12	Button4_Sns2	3000	13	341
13	Button4_Sns3	3000	13	341
14	Button4_Sns4	3000	13	341
15	Button4_Sns5	3000	13	341
16	Button5_Sns0	3000	14	683
17	Button5_Sns1	3000	14	683
18	Button5_Sns2	3000	14	683
19	Button5_Sns3	3000	14	683
20	LinearSlider0_Sns0	3000	15	1365
21	LinearSlider0_Sns1	3000	15	1365
22	LinearSlider0_Sns2	3000	15	1365
23	LinearSlider0_Sns3	3000	15	1365
24	LinearSlider0_Sns4	3000	15	1365
25	LinearSlider0_Sns5	3000	15	1365
26	LinearSlider0_Sns6	3000	15	1365
27	LinearSlider0_Sns7	3000	15	1365
28	LinearSlider0_Sns8	3000	15	1365

Total scan time: 22 ms

Datasheet OK Apply Cancel

Our trial on parameter setting for ITO & PEDOT to let 2 films compatible to a same set of parameters

Configure 'CapSense'

Load configuration Save configuration Export Register Map

Name: CapSense

Basic Advanced Built-in

General CSD Settings CSX Settings Widget Details Scan Order

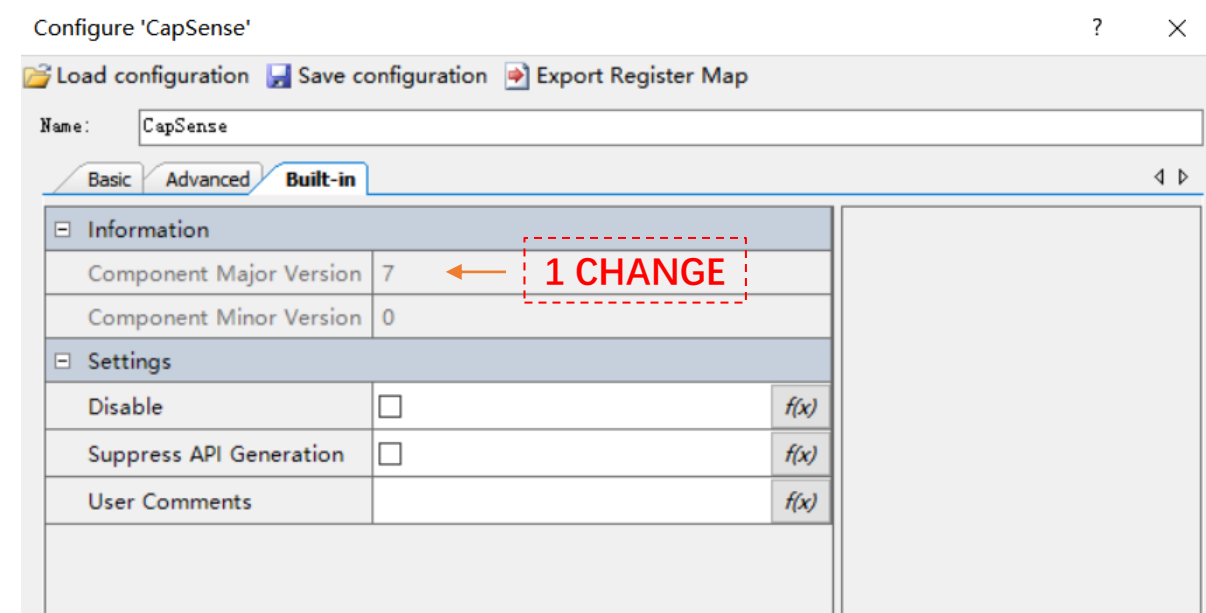
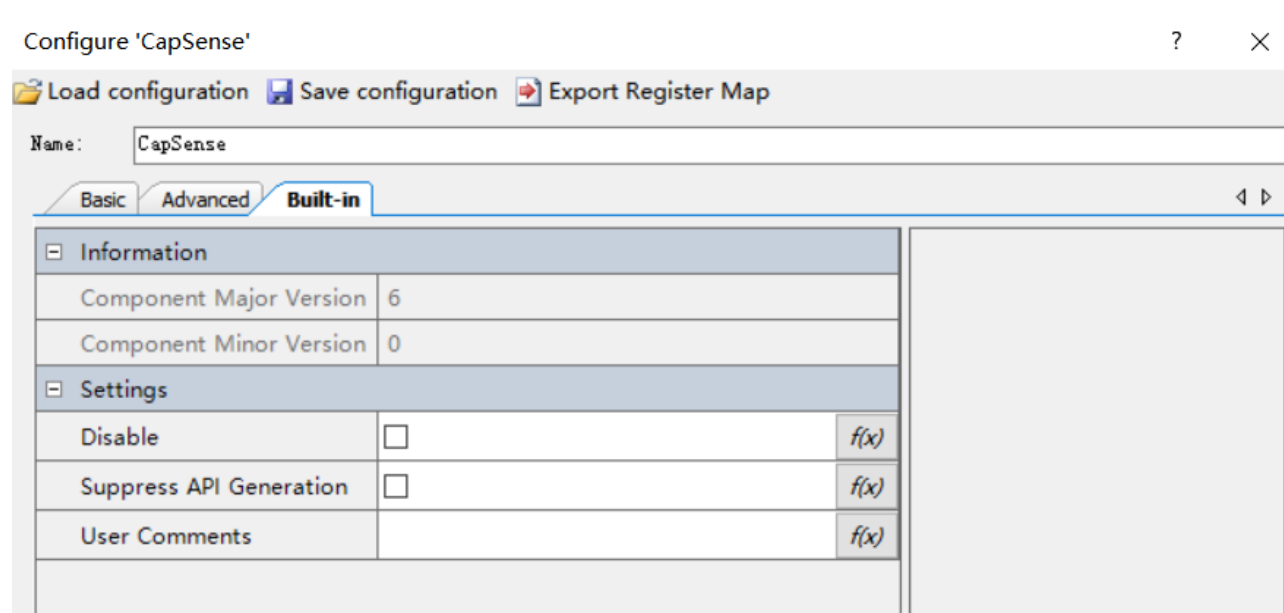
Scan slot	Sensor assignment	Sense clock (kHz)	Scan resolution (bits)	Slot scan time (μs)
0	Button0_Sns0	3000	6	3
1	Button1_Sns0	3000	14	683
2	Button1_Sns1	3000	14	683
3	Button1_Sns2	3000	14	683
4	Button1_Sns3	3000	14	683
5	Button1_Sns4	3000	14	683
6	Button2_Sns0	3000	15	1365
7	Button2_Sns1	3000	15	1365
8	Button2_Sns2	3000	15	1365
9	Button3_Sns0	3000	15	1365
10	Button4_Sns0	3000	14	683
11	Button4_Sns1	3000	14	683
12	Button4_Sns2	3000	14	683
13	Button4_Sns3	3000	14	683
14	Button4_Sns4	3000	14	683
15	Button4_Sns5	3000	14	683
16	Button5_Sns0	3000	15	1365
17	Button5_Sns1	3000	15	1365
18	Button5_Sns2	3000	15	1365
19	Button5_Sns3	3000	15	1365
20	LinearSlider0_Sns0	3000	16	2731
21	LinearSlider0_Sns1	3000	16	2731
22	LinearSlider0_Sns2	3000	16	2731
23	LinearSlider0_Sns3	3000	16	2731
24	LinearSlider0_Sns4	3000	16	2731
25	LinearSlider0_Sns5	3000	16	2731
26	LinearSlider0_Sns6	3000	16	2731
27	LinearSlider0_Sns7	3000	16	2731
28	LinearSlider0_Sns8	3000	16	2731

Total scan time: 43 ms

Datasheet OK Apply Cancel

CapSense parameter setting for existing ITO

Our trial on parameter setting for ITO & PEDOT to let 2 films compatible to a same set of parameters



This page was about the content that we sent out our first inquiry in last week, on what's the difference between PDL3.1.1 & PDL3.1.2 which had been posted on Cypress Developer Community.

and thanks so much for Motoo Tanaka's detailed reply which helped us clearly dig out lots of difference between CapSense6.0 & CapSense7.0.

but after updating PDL library version, we still didn't find a way out of dilemma at that time where we should make our PEDOT film well fit into the source code which had been customized for existing ITO film.

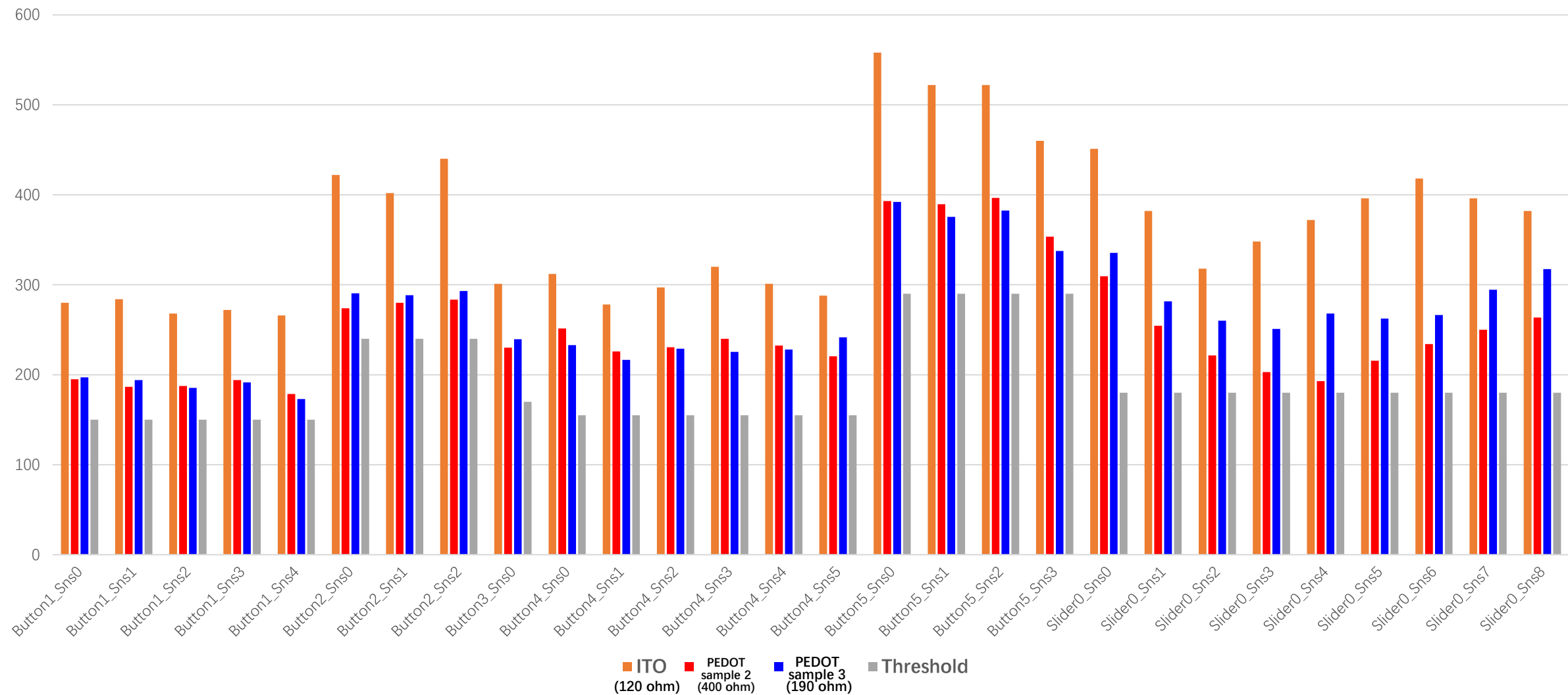
So, this week, we pluck up courage, and did parameter adjusting in CapSense sensor tuner by ourselves.

This is our first try, we'd like to get your advice on whether there is any side-effect that we neglected in all parameter adjusting, and any other tuning skills and aspects that we should consider into this project.

We need your sincere help and suggestions. Thanks so much!

Attachment

Before the Parameter Adjusting
PEDOT sample2 vs PEDOT sample vs ITO



After the Parameter Adjusting

PEDOT sample2 vs PEDOT sample vs ITO

