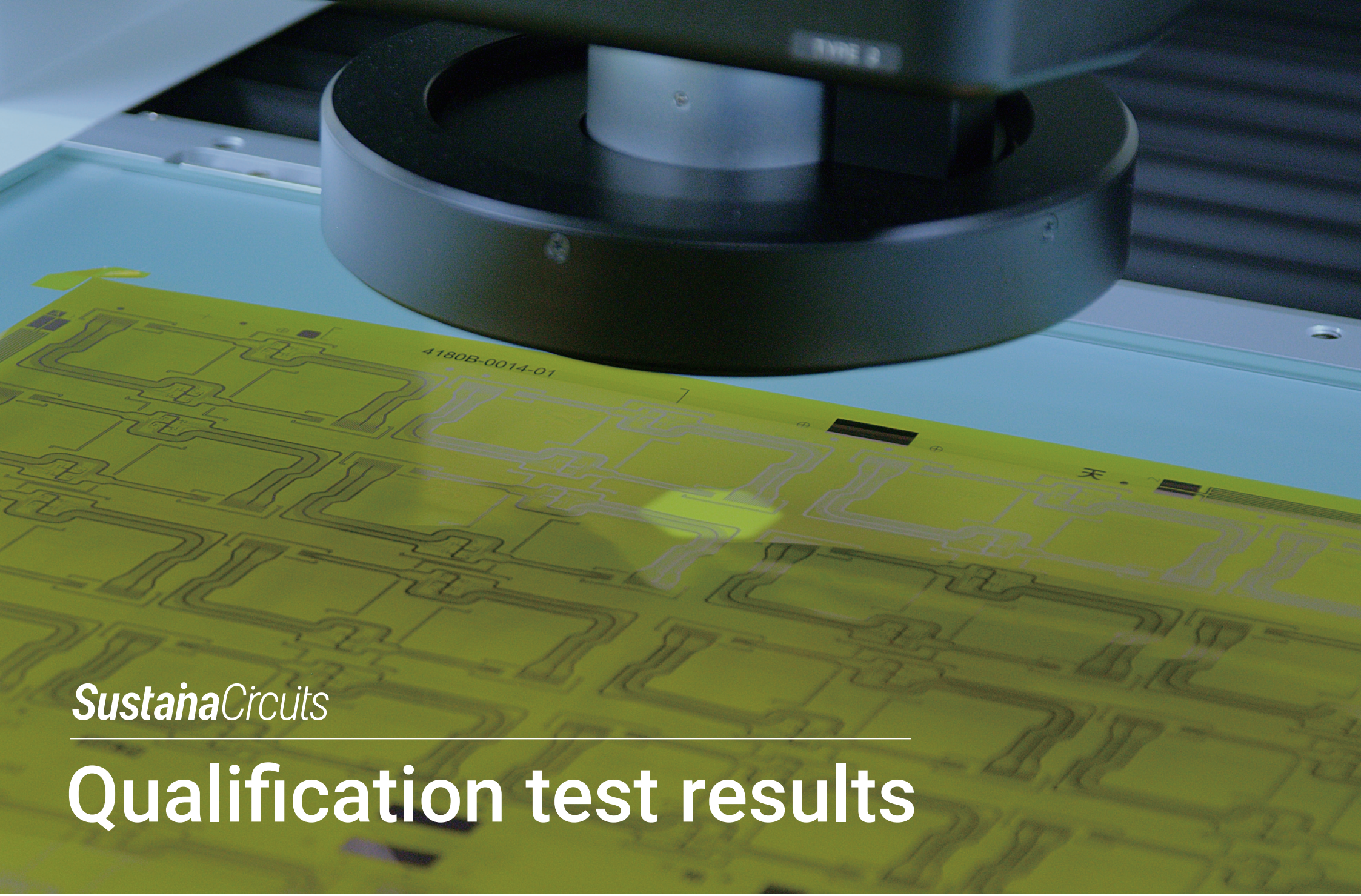


SustainaCircuits

Qualification test results

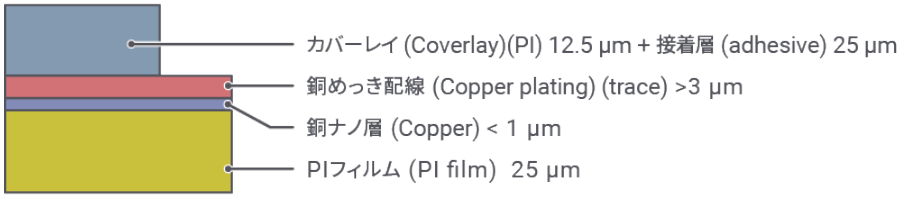
Elephantech

01. Specimen

SustanaCircuits

Each test was evaluated using the following specimen.

P-Flex® PIの標準層構成
(Standard layer composition)



理論総厚 (Total theoretical thickness): 66 µm

補強板付きの場合の層構成
(Layer composition including options)

(for 300 µm thick FPC connector)

理論総厚 (Total theoretical thickness): 331 µm

導体表面から補強板まで 293 µm(The thickness from the conductor surface to the stiffener is 293 µm.)

02. Results of insulation resistance of surface layer

SustanaCircuits

1.Applicable standard
JIS C 5016 7.5

2.Test condition
Overview of insulation resistance measurement

Applied voltage : 500V(DC)
Applied time : 60 sec
Gap width : 1.0 mm

3.Test results
In this test, a voltage of 500V (DC) was applied to Elephantech's P-Flex® PI test specimens for 60 seconds.
After the test, no mechanical damage, flashover (surface discharge), sparkover (airborne discharge), breakdown (dielectric breakdown), or other abnormalities were observed in the test specimens.

Sample No.	After the test [MΩ]
#1	>2099
#2	>2099
#3	>2099

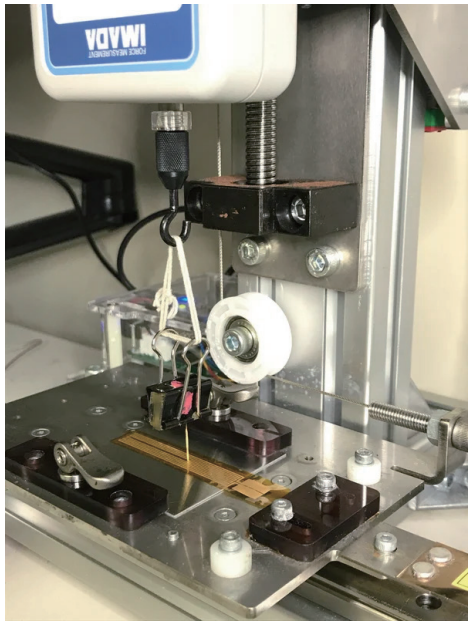
03. Peel Strength of Conductor test

SustanaCircuits

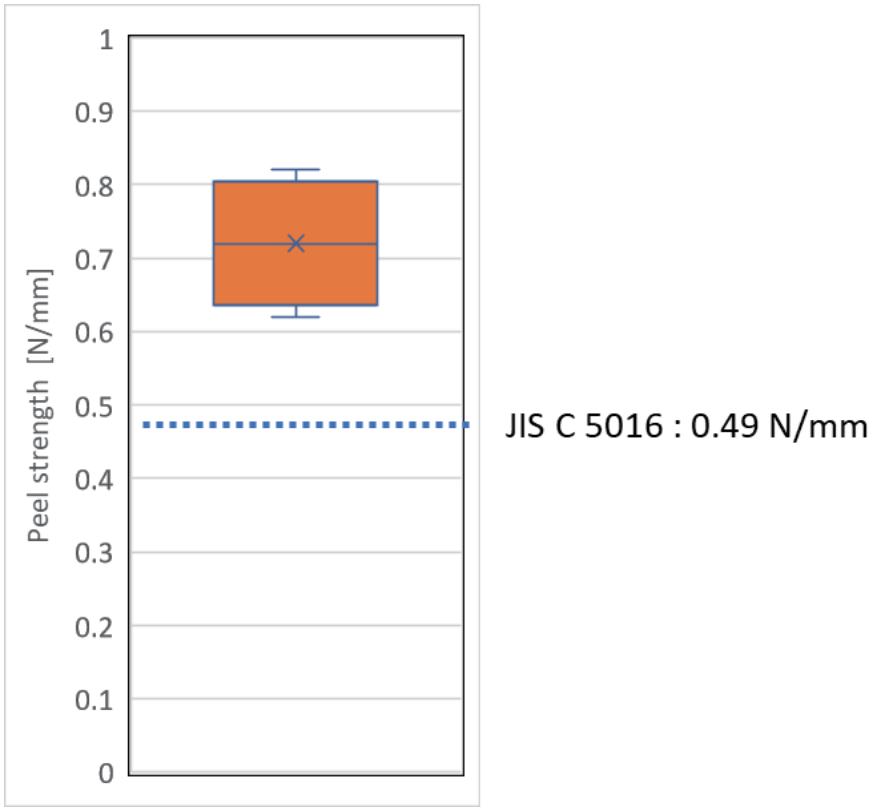
Tested according to the conditions specified in JIS C5016 8.1. Sufficient peel strength was confirmed.

1.Applicable standard
JIS C 5016 8.1

2.Test condition
The conductor is peeled 90° to the surface from which the conductor is removed. The peeling speed is approximately 50 mm/minute.



3.Test results
Peel Strength : 0.63-0.84(n=4)



04. Results of resistance to flexural fatigue test

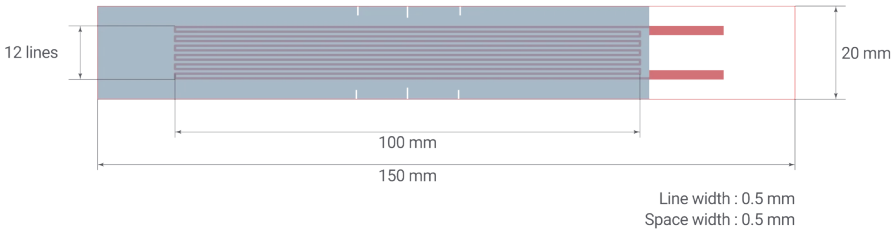
SustanaCircuits

1.Applicable standard

JIS C 5016 8.6

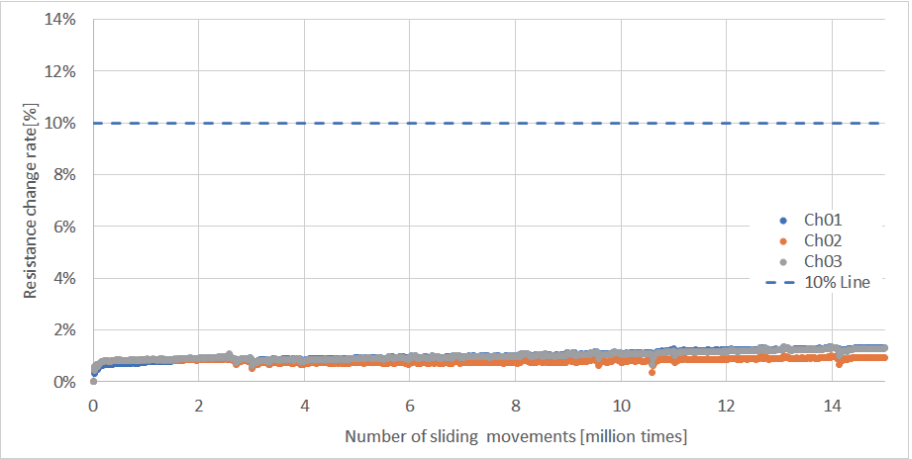
2.Test condition

Flexing rate：5Hz(300rpm)
Flexing radius (r)：5mm
Sliding distance (l)：22mm
Wiring pattern Line/Space=0.5mm/0.5mm



3.Test results

Resistance to flexural fatigue test was conducted in accordance with JIS C5016 8.6. , and data up to 16 million cycles was obtained(n=3).



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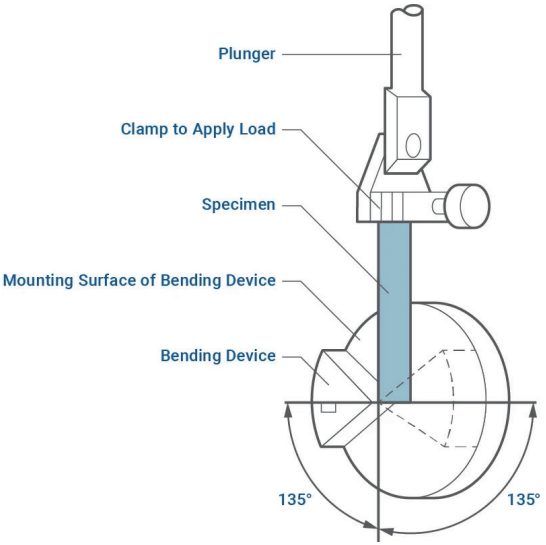
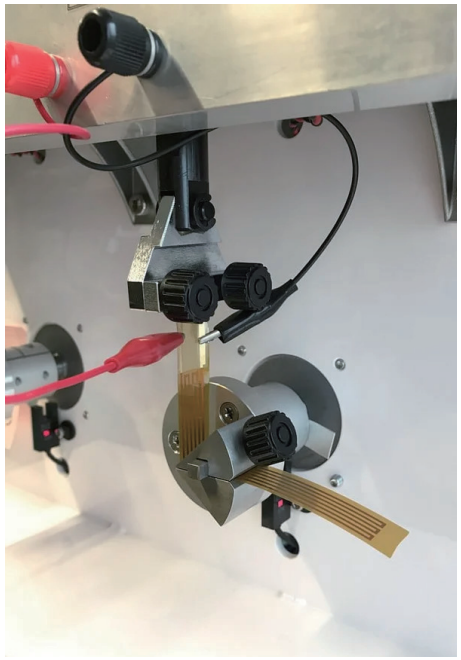
05. Resistance to bending test

SustanaCircuits

1.Applicable standard
JIS C 5016 8.7

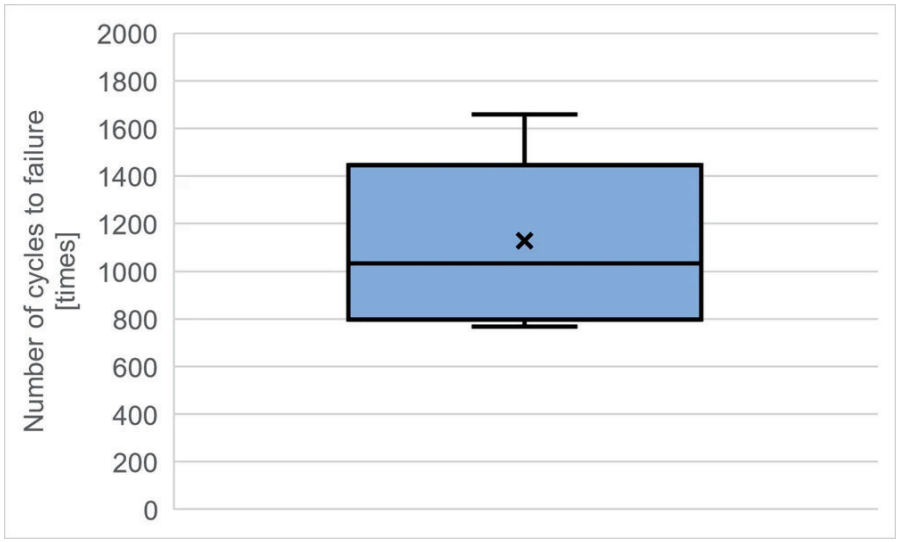
2.Test procedure





(1) Bending conditions
• Rate : 175rpm
• Angle : ±135°
• Load : 4.9N
• Bending radius : 0.38mm
(2) Continuous measurement of conductor resistance (disconnection determined when resistance exceeds 100Ω)
(3) Number of samples : 10p

3.Test results
Number of cycles to failure: 767~1,659times(n=10)



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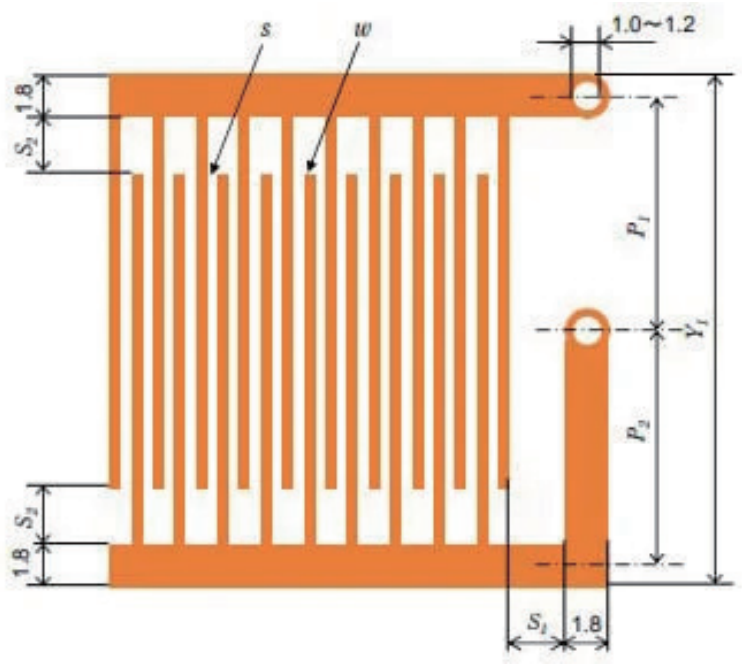
06. Migration test

SustanaCircuits

1.Applicable standard
JPCA-ET04

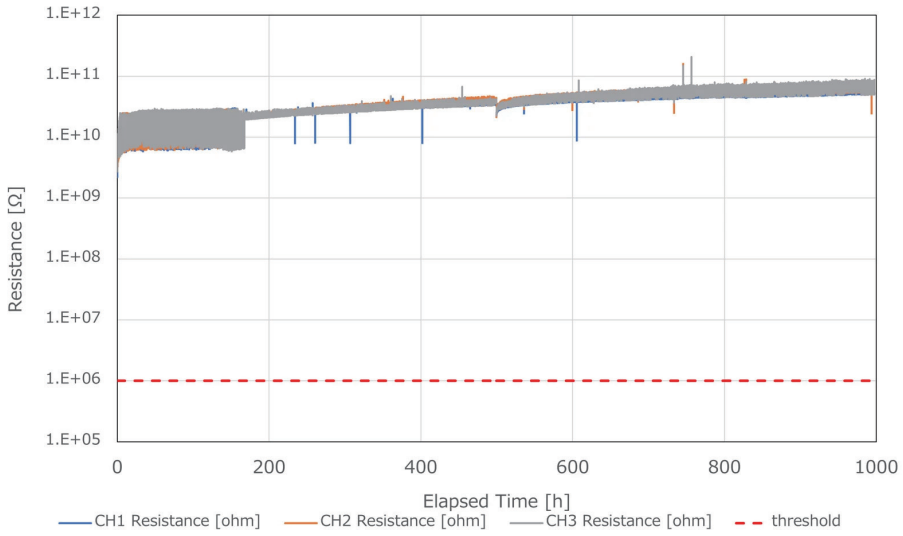
2.Test condition



(1) Environmental conditions: 85°C, 85%RH
a) Applied voltage: 100 VDC.
b) Testing time : 1000H
c)Number of samples : 3p

(2) Sample shape : JPCA 6.4.5-4 compliant
w/s=0.20mm/0.20mm
S1=S2=1.35mm
P1=5.0mm P2=3.8mm
Y1=10.6mm

3.Test results
No migration occurs. (n=3)



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07. Chemical resistance test

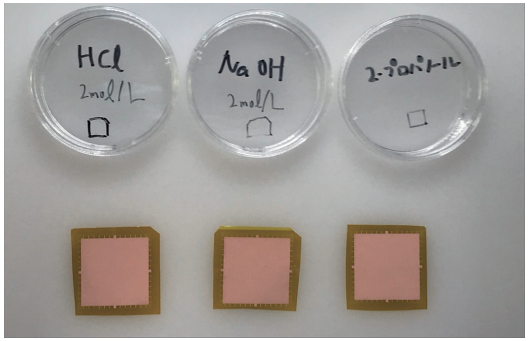
1.Applicable standard

JIS C 5016
"Test Methods for Flexible Printed Wiring Boards" 10.5
"Resistance to Chemicals"

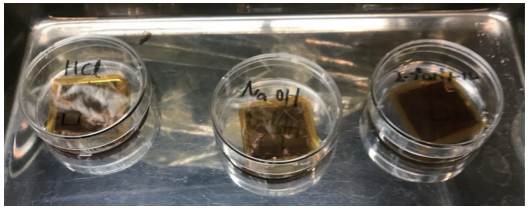
2.Test condition

In this chemical resistance test, the test specimens were immersed in 2 mol/L hydrochloric acid solution, 2 mol/L sodium hydroxide solution, and 2-propanol as alcohol for 5 minutes ± 30 seconds, and then their appearance was checked. The test specimens did not show any abnormalities in appearance after immersion in acid, alkali and alcohol for 5 minutes.

3.Initial condition

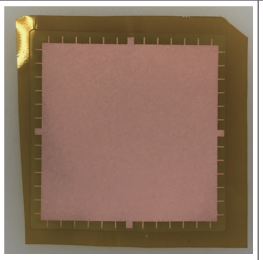
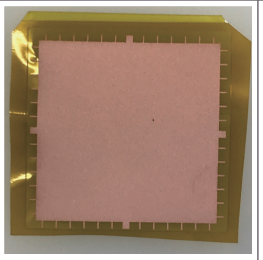
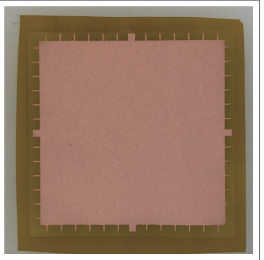
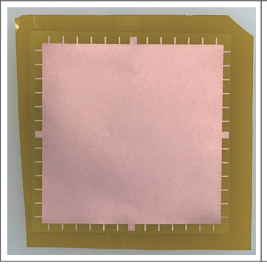
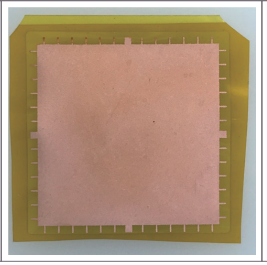
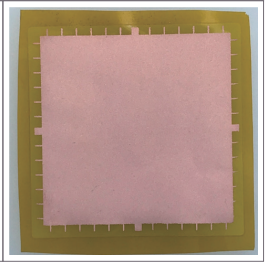


4.Testing condition



5.Test results

No floating, swollen, wrinkled, cracked, broken plating or peeling pad on conductor.

	Acid (Hydrochloric acid)	Alkali (Aqueous solution of sodium hydroxide)	Alcohol (2-propanol)
Before			
After			

08. Results of Dry heat test

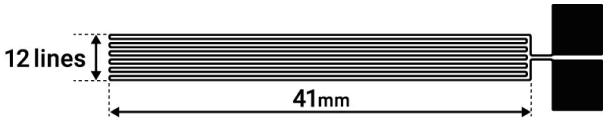
SustanaCircuits

1.Applicable standard
JIS C 60068-2-2

2.Test condition
150℃/1000H
2 Type specimens (resistance and insulation resistance)

3.Test results
- No remarkable rate of change in resistance.
- No floating, swollen, wrinkled, cracked, broken plating or peeling pad on conductor.

- Rate of change in resistance



Wiring pattern : w/s = 0.2mm / 0.2mm

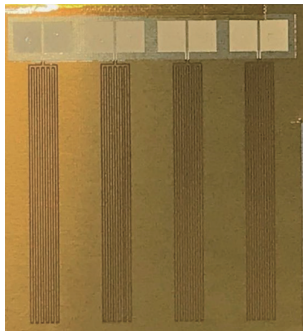
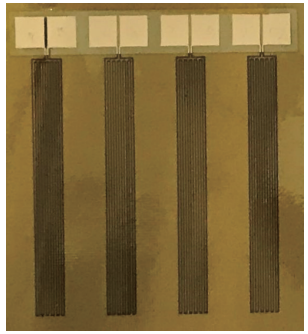
Before the test [MΩ]	After the test [MΩ]	Rate of change in resistance
3.37	3.41	1.25%
3.41	3.46	1.31%
3.06	3.09	1.10%
3.03	3.07	1.27%

- Insulation resistance

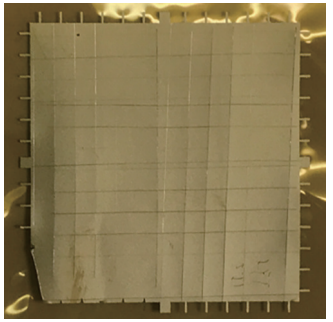
Wiring pattern space = 1.0mm

Before the test [MΩ]	After the test [MΩ]
>2099	>2099
>2099	>2099
>2099	>2099

- Appearance

Before the test	After the test
	

- Tape peeling test result



No peeling

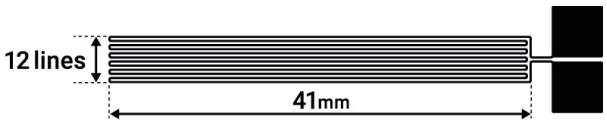
09. Results of Cold test

1.Applicable standard
JIS C 60068-2-1

2.Test condition
150℃/1000H
2 Type specimens (resistance and insulation resistance)

3.Test results
- No remarkable rate of change in resistance.
- No floating, swollen, wrinkled, cracked, broken plating or peeling pad on conductor.

- Rate of change in resistance



Wiring pattern : w/s = 0.2mm / 0.2mm

Before the test [MΩ]	After the test [MΩ]	Rate of change in resistance
3.76	3.74	-0.47%
3.45	3.45	-0.07%
4.01	4.00	-0.25%
3.74	3.74	-0.07%

- Insulation resistance

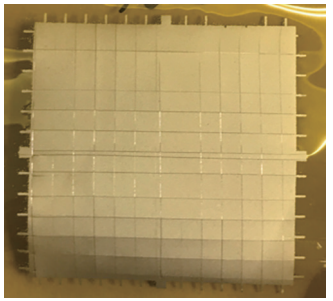
Wiring pattern space = 1.0mm

Before the test [MΩ]	After the test [MΩ]
>2099	>2099
>2099	>2099
>2099	>2099

- Appearance

Before the test	After the test
	

- Tape peeling test result



No peeling

10. Results of Thermal Shock (Low Temperature and High Temperature)

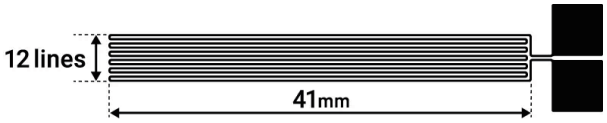
SustanaCircuits

1.Applicable standard
JIS C 5016 9.2

2.Test condition
Ta=-65℃(30min) ⇔ 125℃ (30min) × 100 cycle
2 Type specimens (resistance and insulation resistance)

3.Test results
- No remarkable rate of change in resistance.
- No floating, swollen, wrinkled, cracked, broken plating or peeling pad on conductor.

- Rate of change in resistance



Wiring pattern : w/s = 0.2mm / 0.2mm

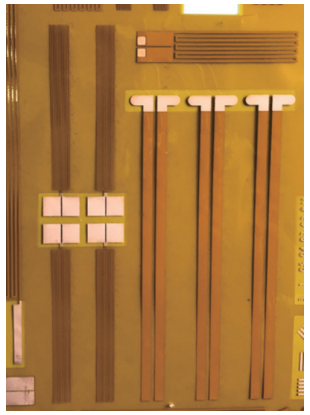
Before the test [MΩ]	After the test [MΩ]	Rate of change in resistance
3.29	3.29	0.11%
2.99	2.99	-0.08%
1.84	1.85	0.28%
1.71	1.70	0.59%

- Insulation resistance

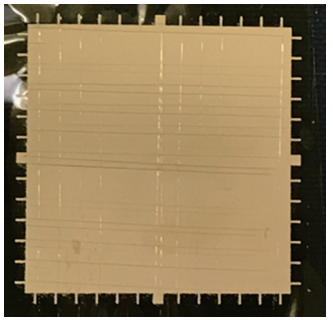
Wiring pattern space = 1.0mm

Before the test [MΩ]	After the test [MΩ]
>2099	>2099
>2099	>2099
>2099	>2099

- Appearance

Before the test	After the test
	

- Tape peeling test result



No peeling

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11.Results of Thermal Shock (Immersion, Hot Bath)

SustanaCircuits

1.Applicable standard

JIS C 5016 9.3

2.Test condition

Subject the specimen to the thermal shock of the cycles of the following table.

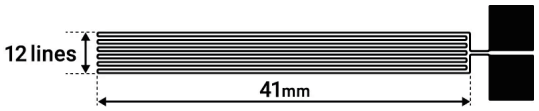
Step		Temperature ℃	Duration min	Immersing liquid
Cycle	1	260 +5-0	Three to five	Silicone oil
	2	20 ± 15	Within 15	(Transfer)
	3		20	2-propanol
	4		Within 15	(Transfer)

Appearance of Oil bath

3.Test result

- No remarkable rate of change in resistance.
- No floating, swollen, wrinkled, cracked, broken plating or peeling pad on conductor.

- Rate of change in resistance



Wiring pattern : w/s = 0.2mm / 0.2mm

Before the test [MΩ]	After the test [MΩ]	Rate of change in resistance
3.25	3.45	6.2%
3.22	3.42	6.2%
3.21	3.44	7.2%
3.15	3.45	9.5%

- Insulation resistance

Wiring pattern space = 1.0mm

Before the test [MΩ]	After the test [MΩ]
>2099	>2099
>2099	>2099
>2099	>2099

- Appearance

Before the test	After the test