

(2020.11.04 Revised)

Comparison Evaluation of Operational Amplifier

オペアンプ比較試験結果報告 Vol.1



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A vertical column of white circuit board patterns is positioned on the left side of the slide, extending from the top to the bottom.

I. Introduction

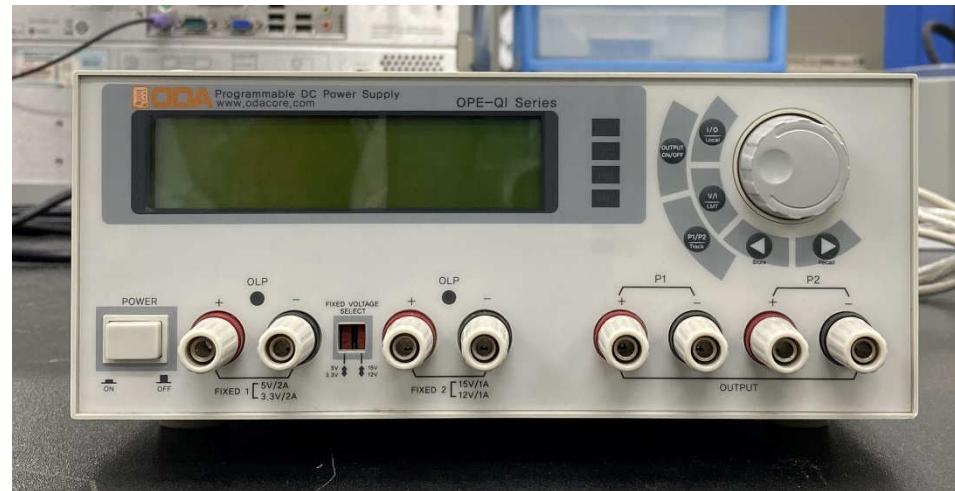


Introduction

- **Specimen:** Operational Amplifier (OP AMP)
- **Test:**
 - Electrical property measurements
 - X-ray analyses
 - SEM analyses
 - Environmental tests
- **Test term:** 2020. 08. 11 ~ 2020. 10. 19
- **Test environment:** (25±5) °C, Below 75% room humidity
- **Test apparatuses:**
 - DC power supply (OPE-QI Series, ODA, Korea)
 - 3-Phase power analyzer (43B, Fluke, USA)
 - X-ray (XTV160, Nikon, United Kingdom)
 - 3D digital optical microscope (KH-8700, Hirox, Japan)
 - Focused ion beam (Quanta 3D DualBeam, FEI, Netherland)
 - Small sized three-stage layered climate chamber (SXLN403, ETAC, Japan)
 - Thermal shock chamber (DS-890-2, Daewon sci, Korea)
- **Etc:** Blind test
- **Contact:** Lee, Ju Ho ☎ +82-31-789-7282 / leeduho@keti.re.kr

Introduction

- **Test apparatuses:**
 - DC power supply (OPE-Q1 Series, ODA, Korea)



Introduction

- **Test apparatuses:**
 - 3-Phase power analyzer (43B, Fluke, USA)



Introduction

- **Test apparatuses:**
 - X-ray (XTV160, Nikon, United Kingdom)



Introduction

- **Test apparatuses:**
 - 3D digital optical microscope (KH-8700, Hirox, Japan)



Introduction

- **Test apparatuses:**

- Focused ion beam (Quanta 3D DualBeam, FEI, Netherland)



Introduction

- **Test apparatuses:**

- Small sized three-stage layered climate chamber (SXN403, ETAC, Japan)

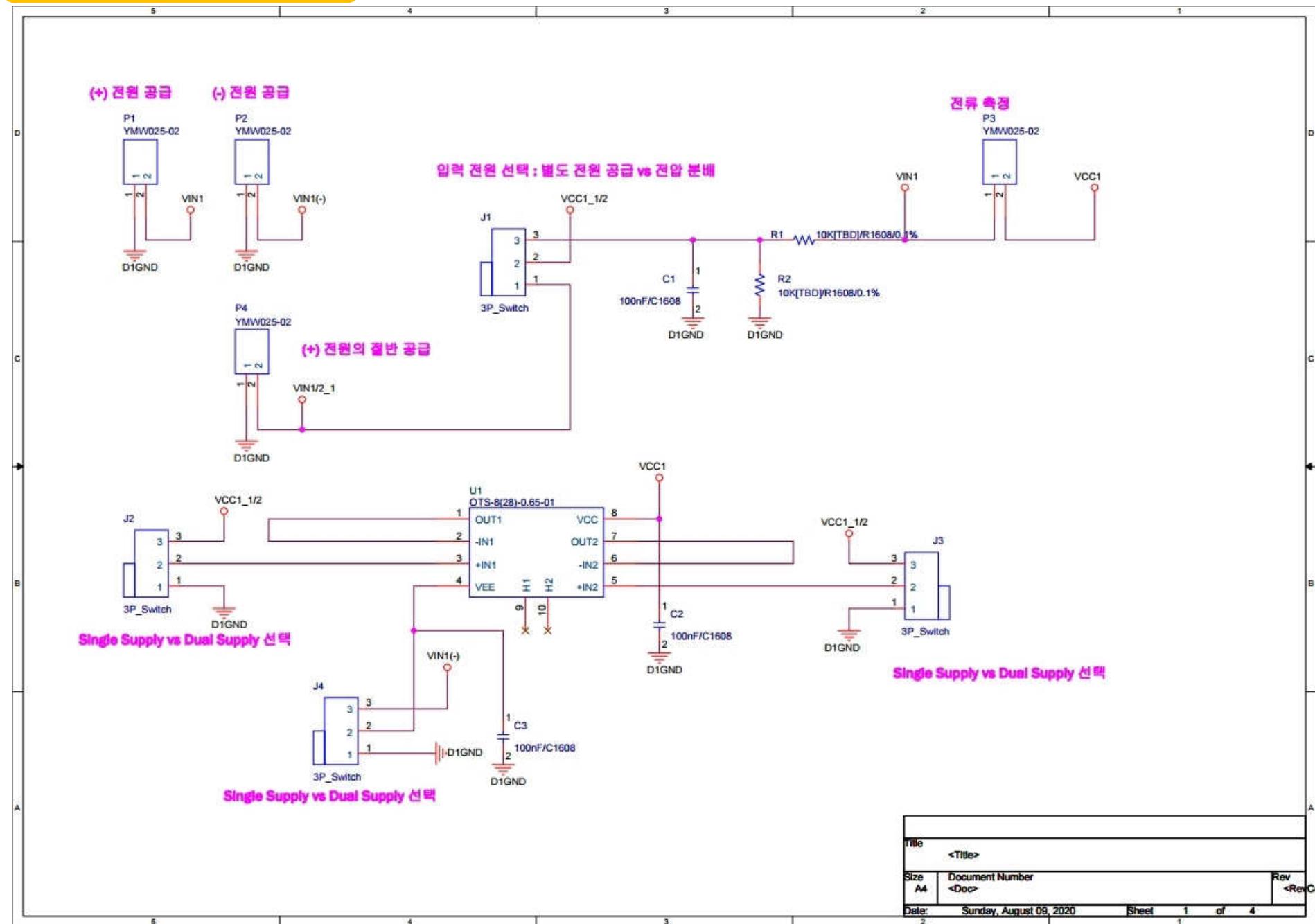


Introduction

- **Test apparatuses:**
 - Thermal shock chamber (DS-890-2, Daewon sci, Korea)



Circuit diagram

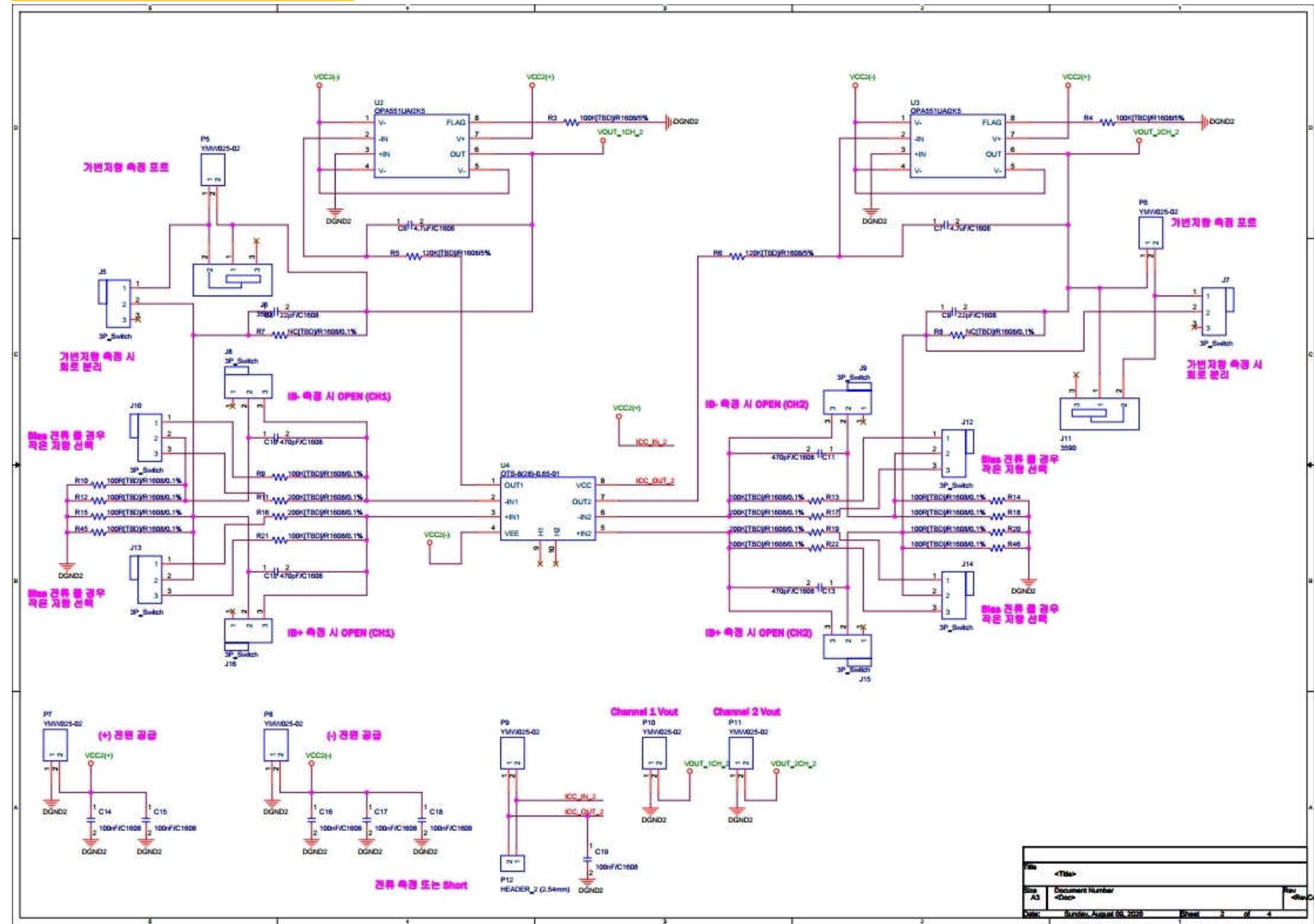


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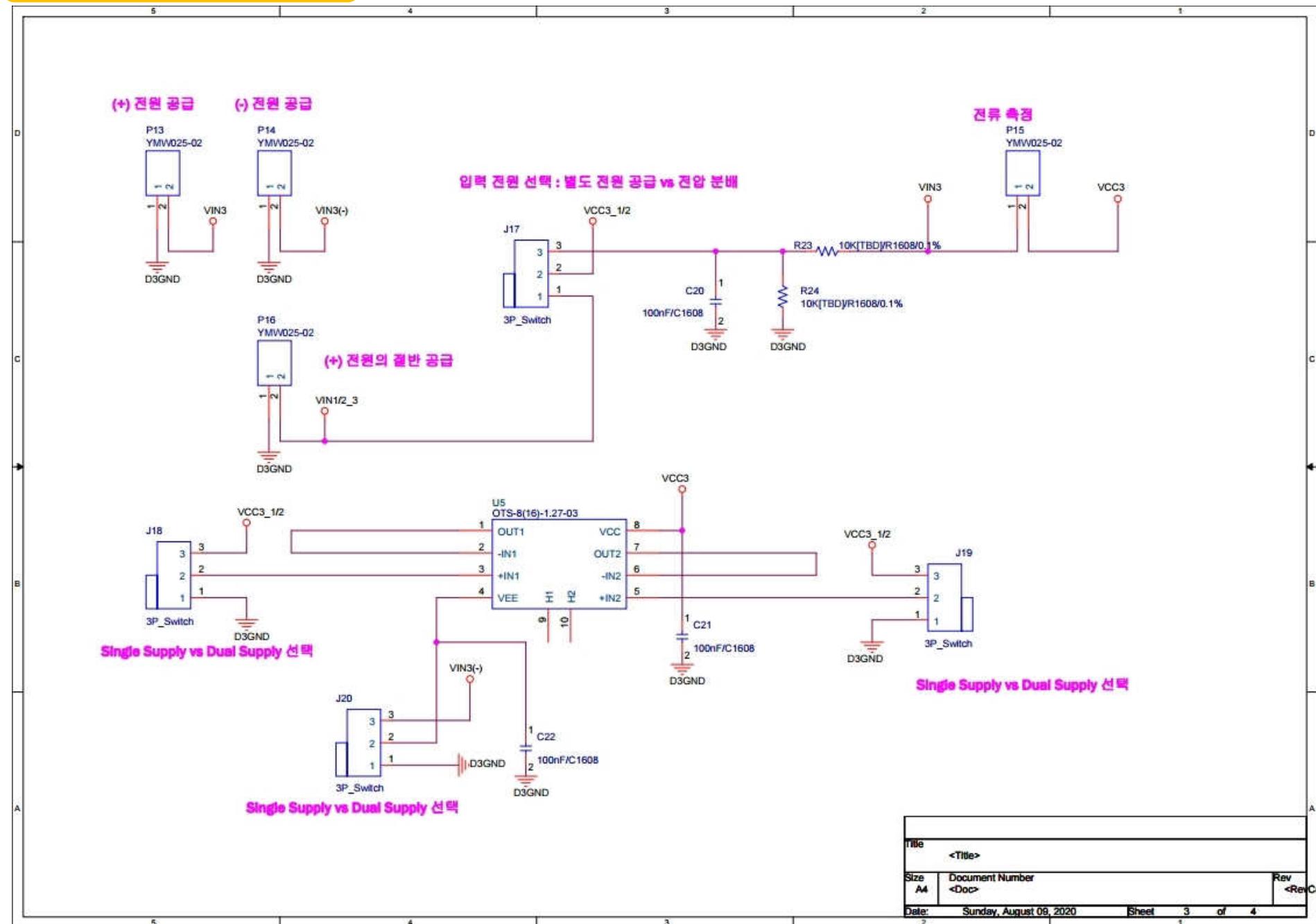
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Date: Sunday, August 09, 2020 Sheet 1 of 4

Circuit diagram

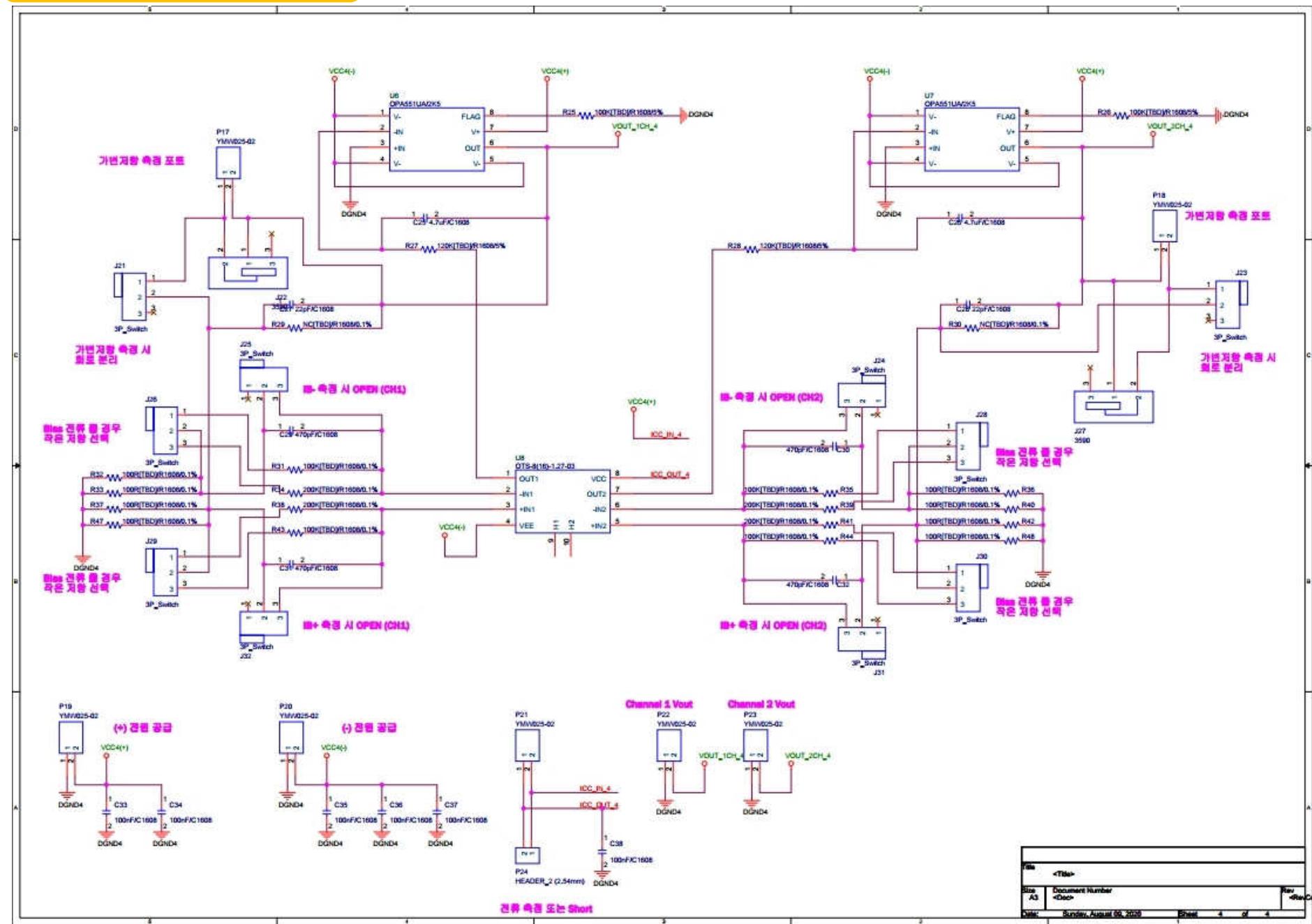


Circuit diagram

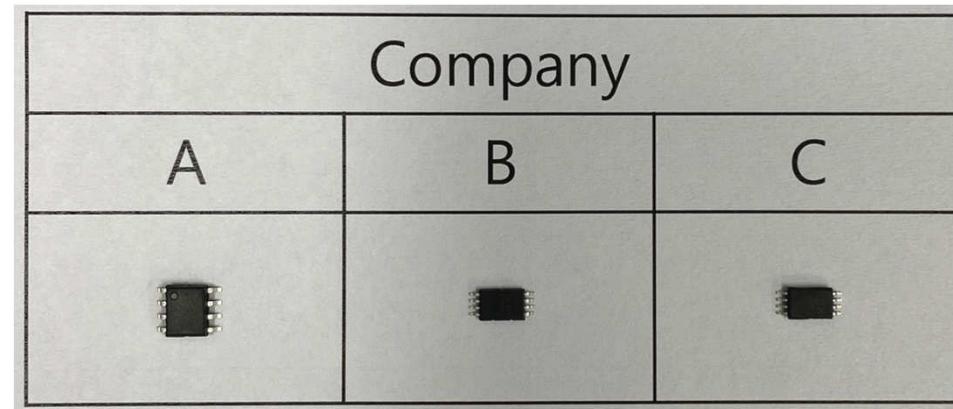


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Date: Sunday, August 09, 2020	Rev: <Rev>
Sheet 3	of 4

Circuit diagram



Specimens



Sample	Power supply Voltages, V_{CC} (V)		Input differential voltage range, V_{IDR} (V)	Input common mode voltage range, V_{ICR} (V)	Output short circuit duration	Junction temperature, T_J (°C)	Storage temperature, T_{stg} (°C)	Input current, per pin, I_{IN} (mA)
	Single	Split						
A	32	± 16	32	-0.3~32	Continuous	150	-55~125	50
B	36	± 18	36	-0.3~36	Continuous	150	-65~150	unknown
C	36	± 18	36	-0.3~36	Continuous	150	-55~150	-10

A: IK Semicon

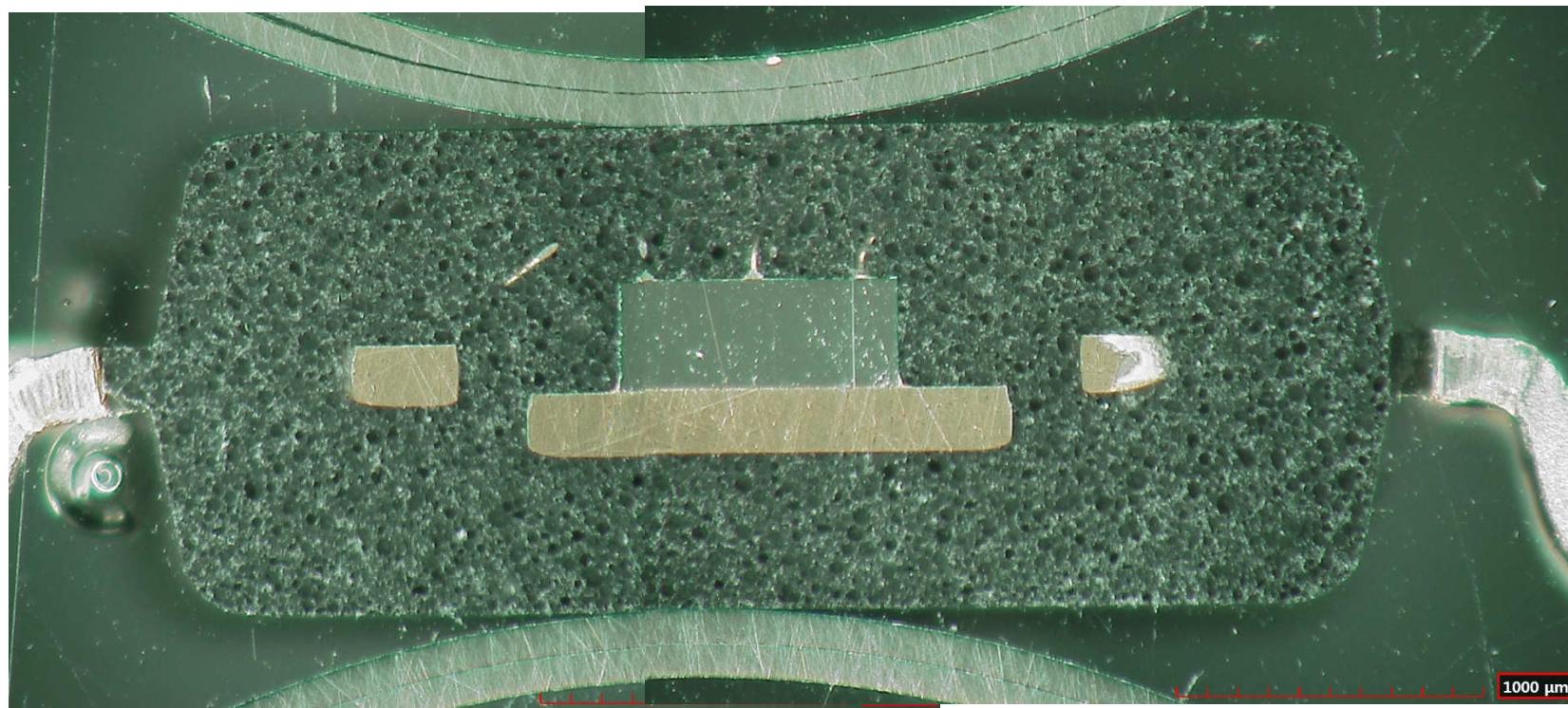
B: Diodes Corporated

C: ROHM

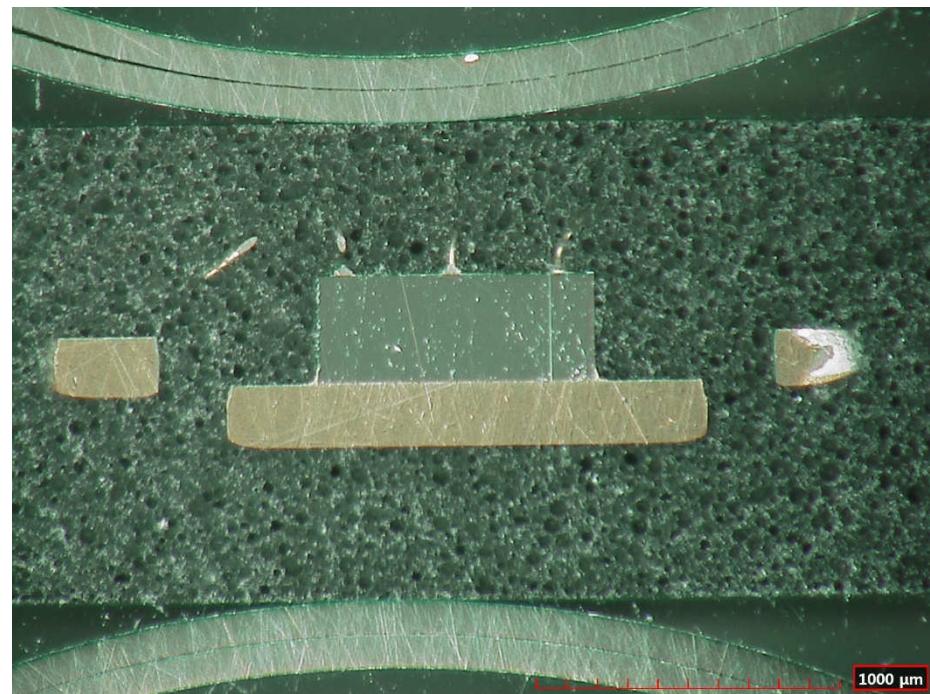
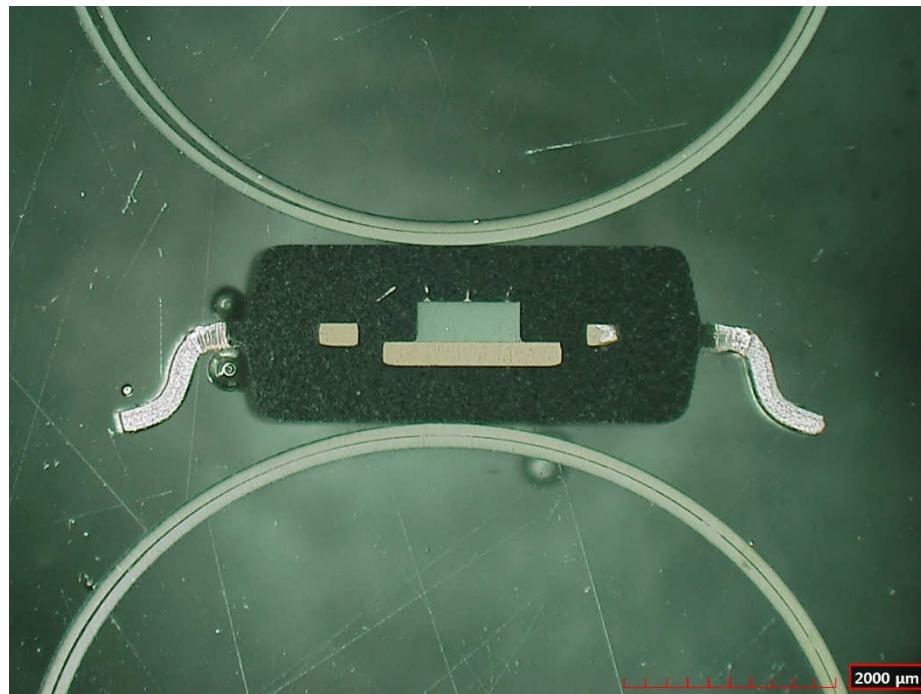
II. Optical microscope analyses (内部断面観察)



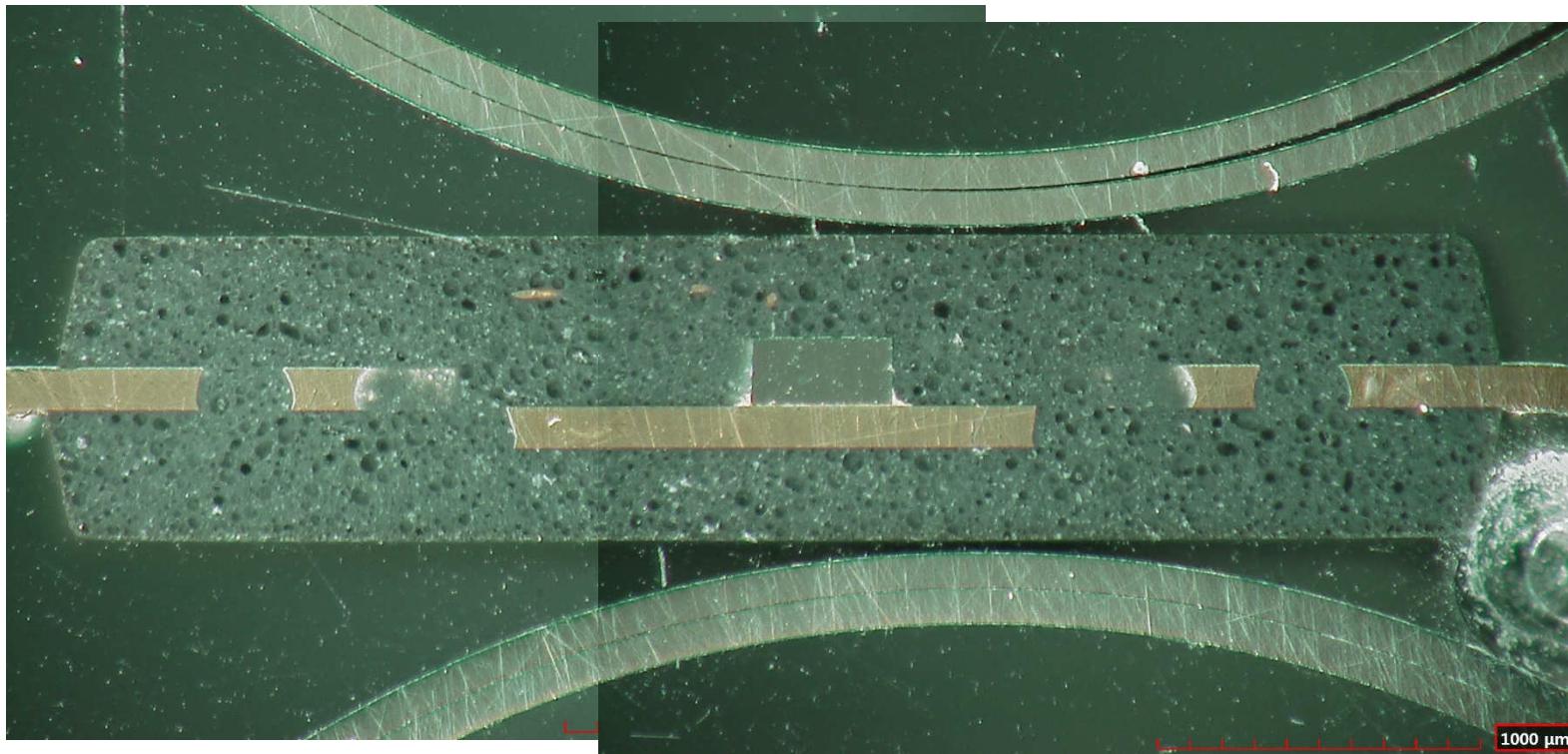
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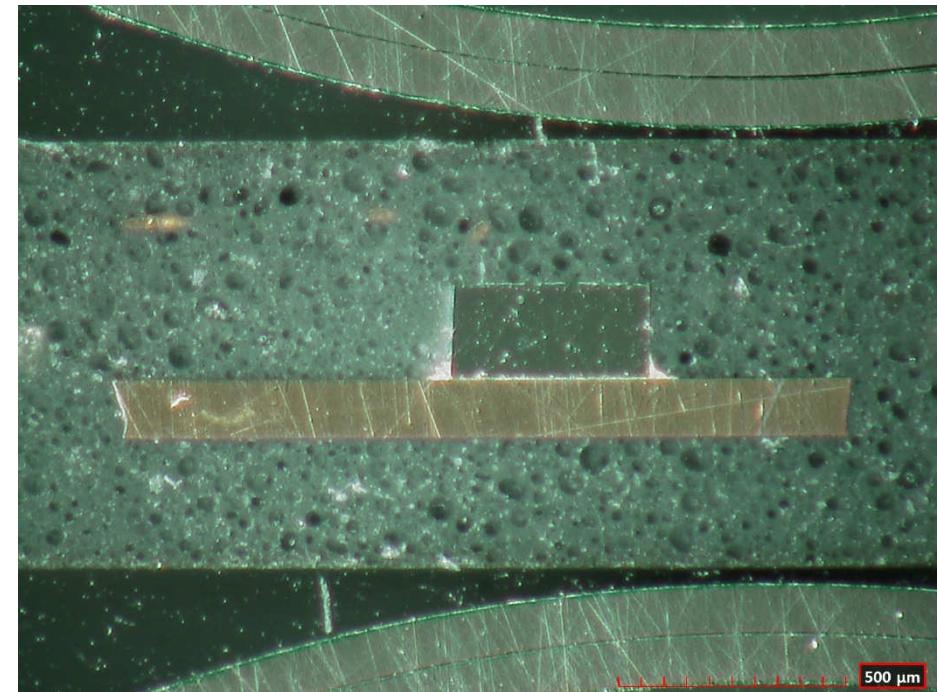
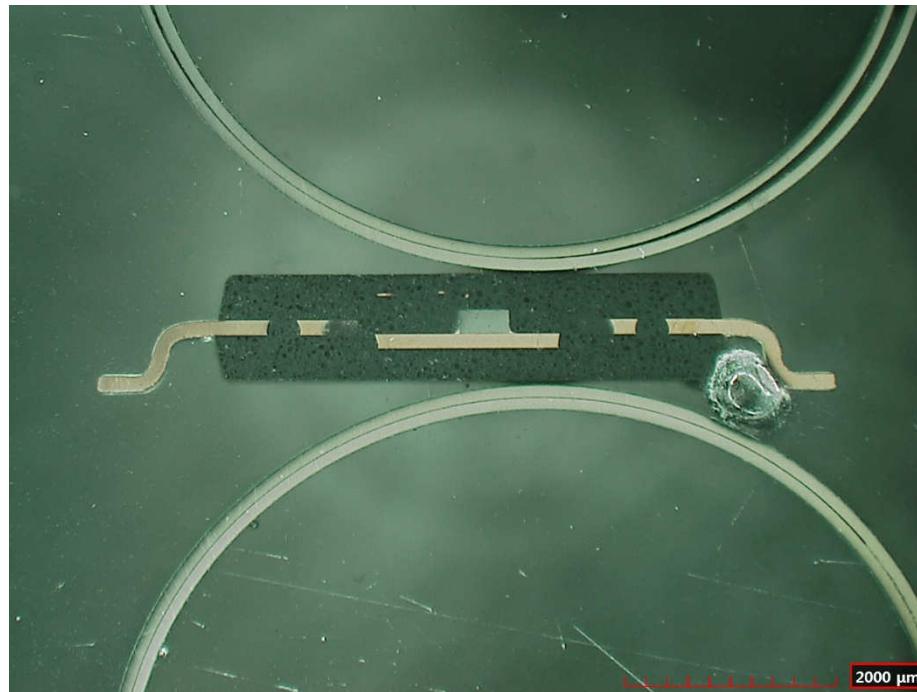
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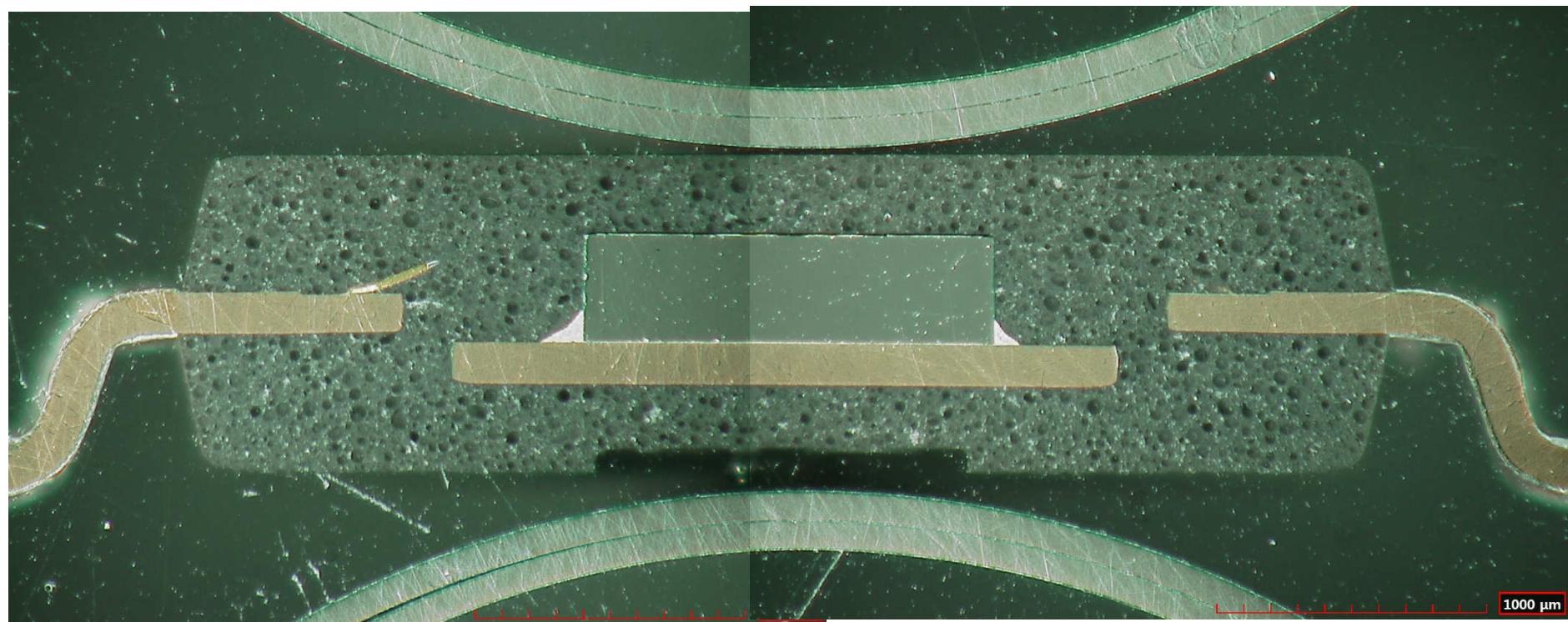
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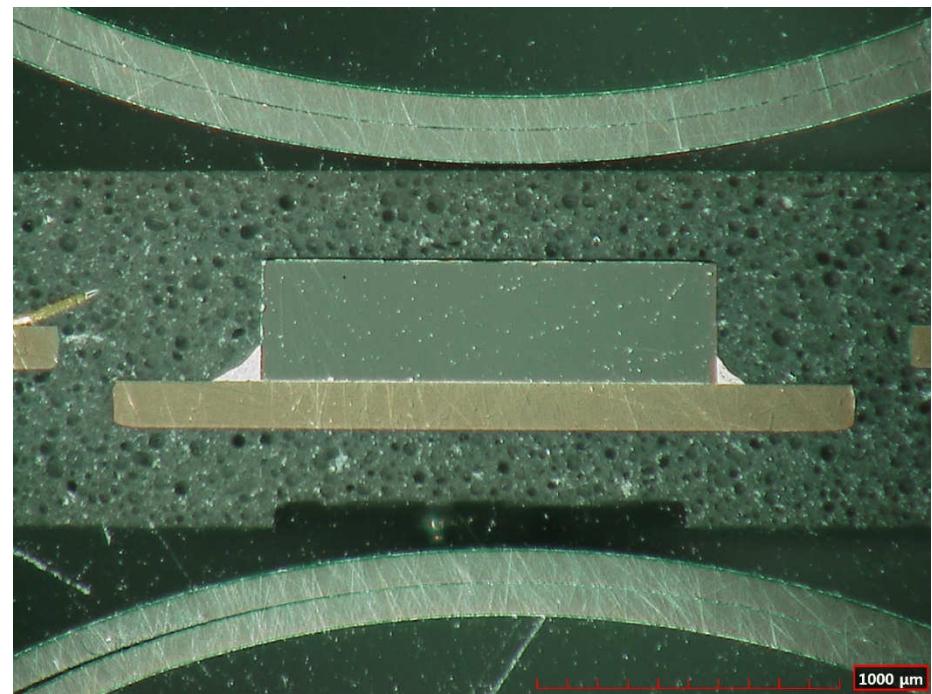
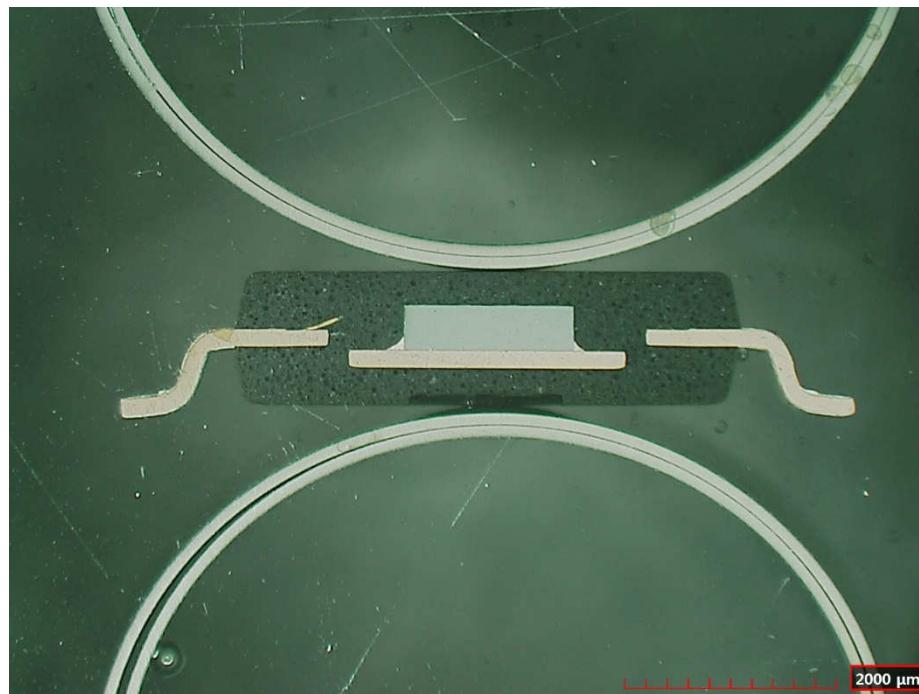
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C社



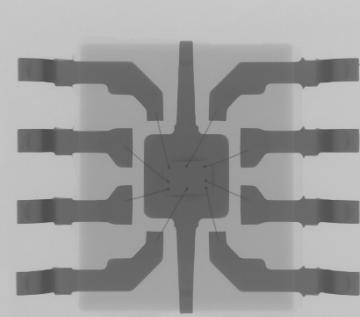
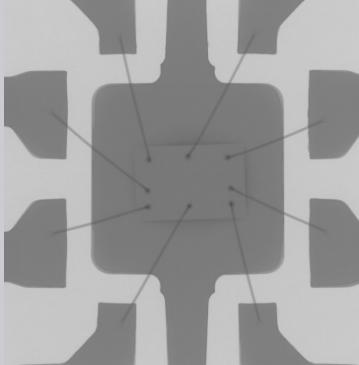
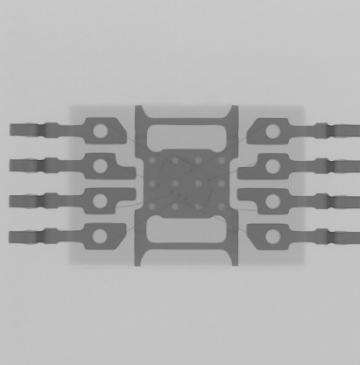
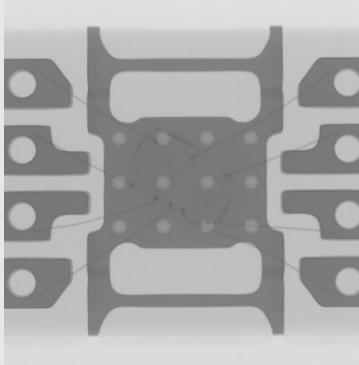
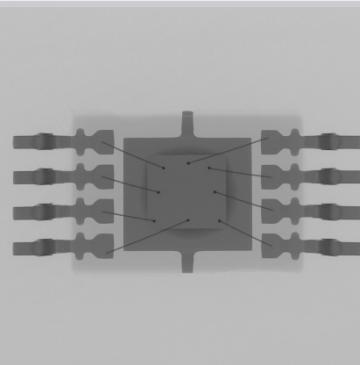
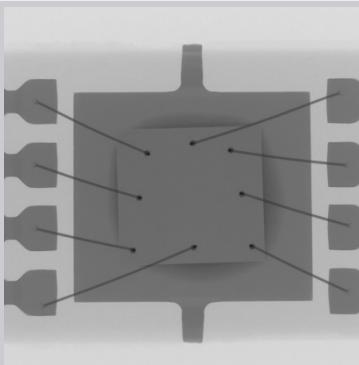
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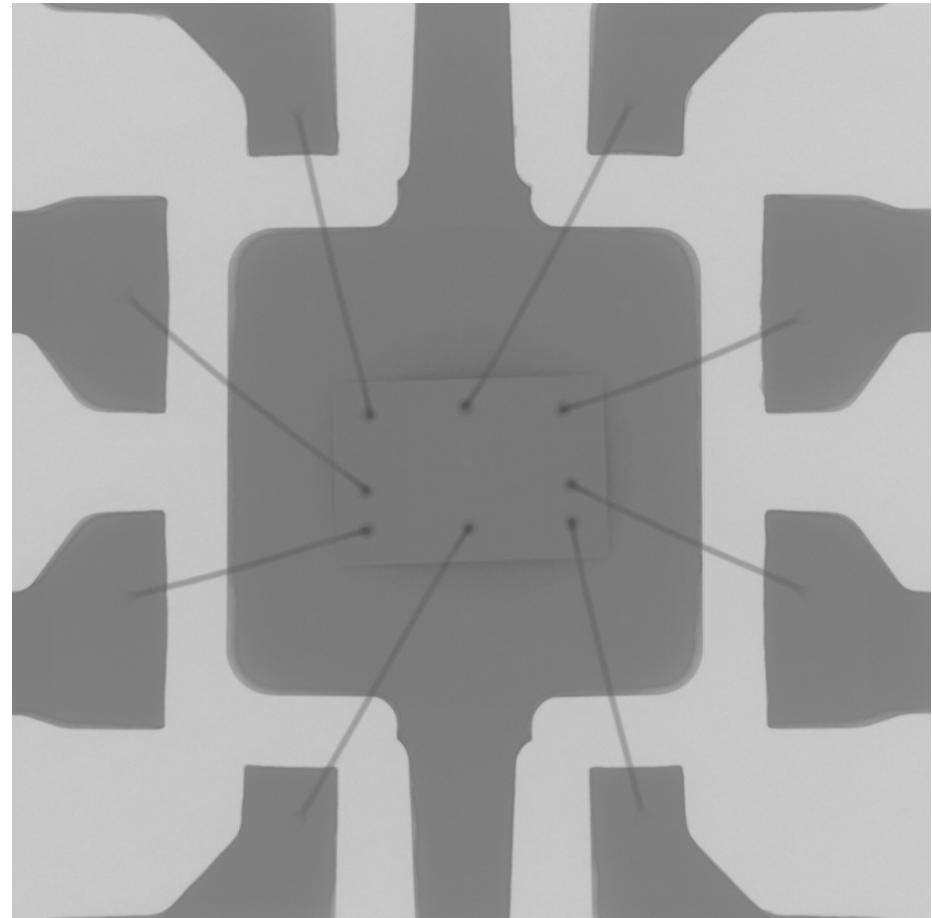
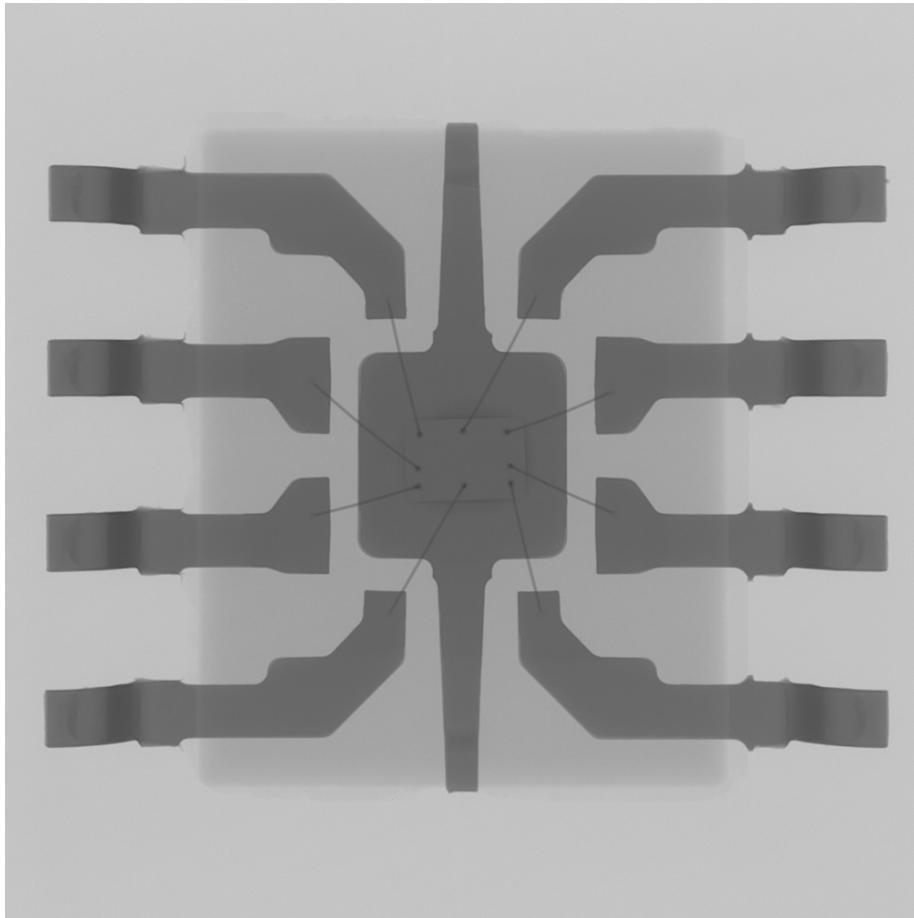
III. X-ray analyses



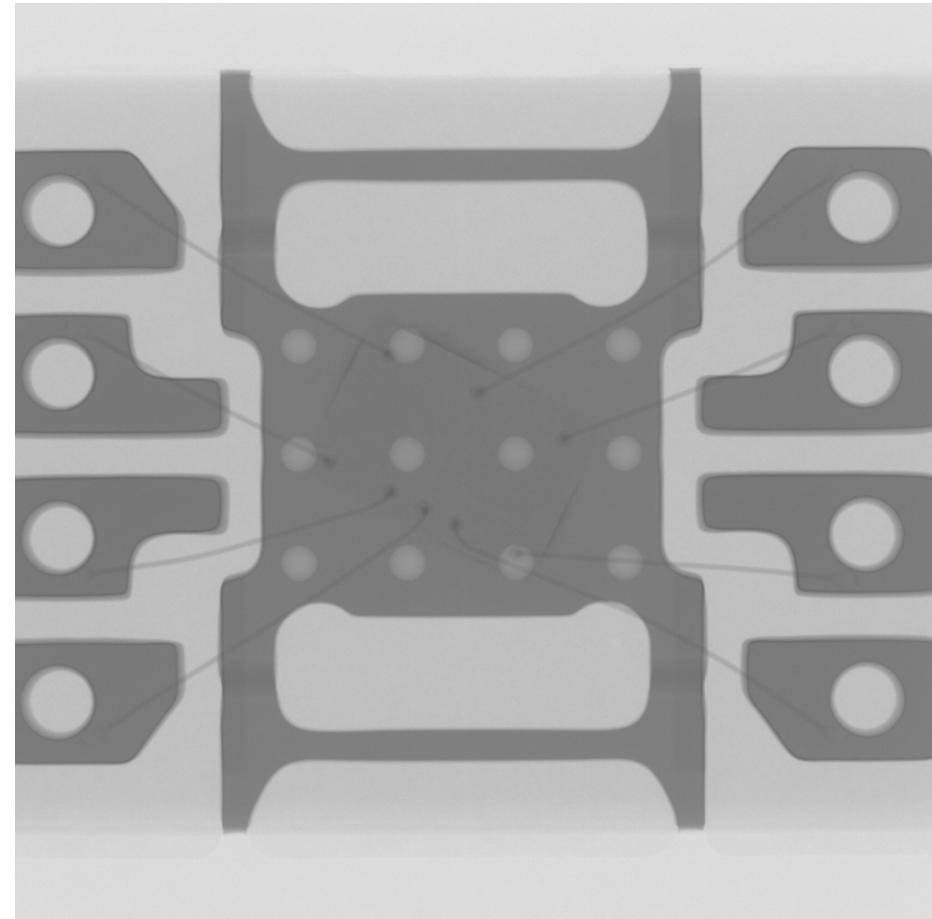
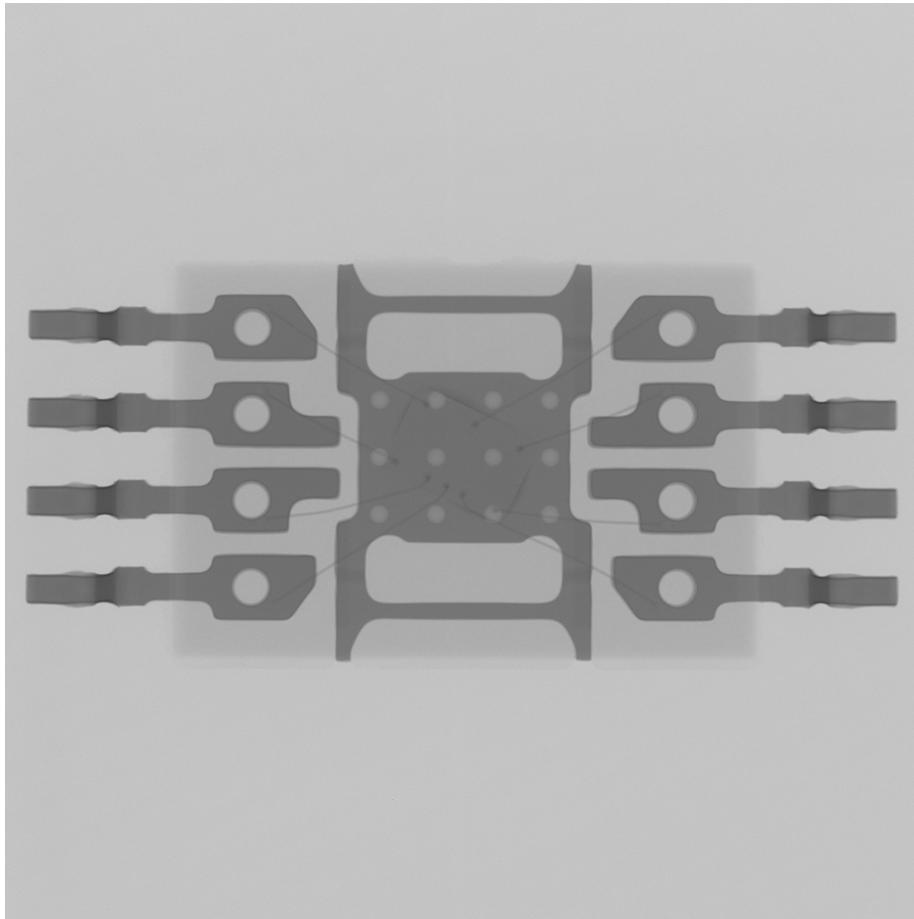
A/B/C社

Specimen	X-ray analyses		
A			
B			
C			

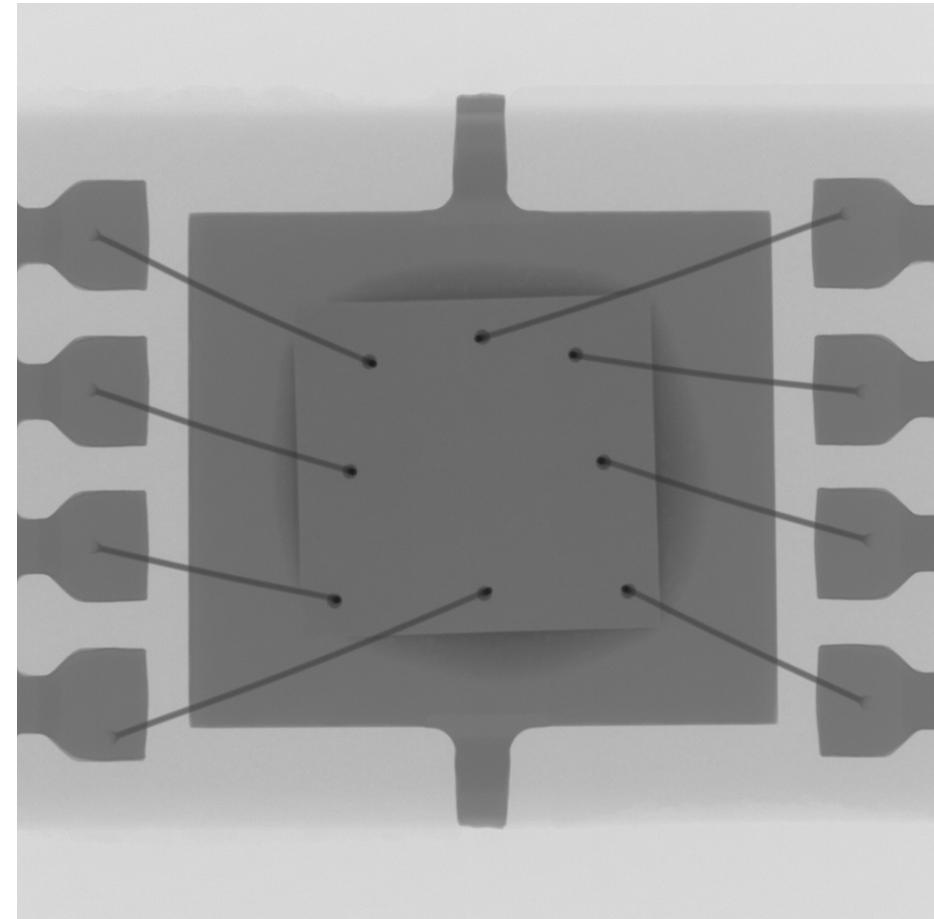
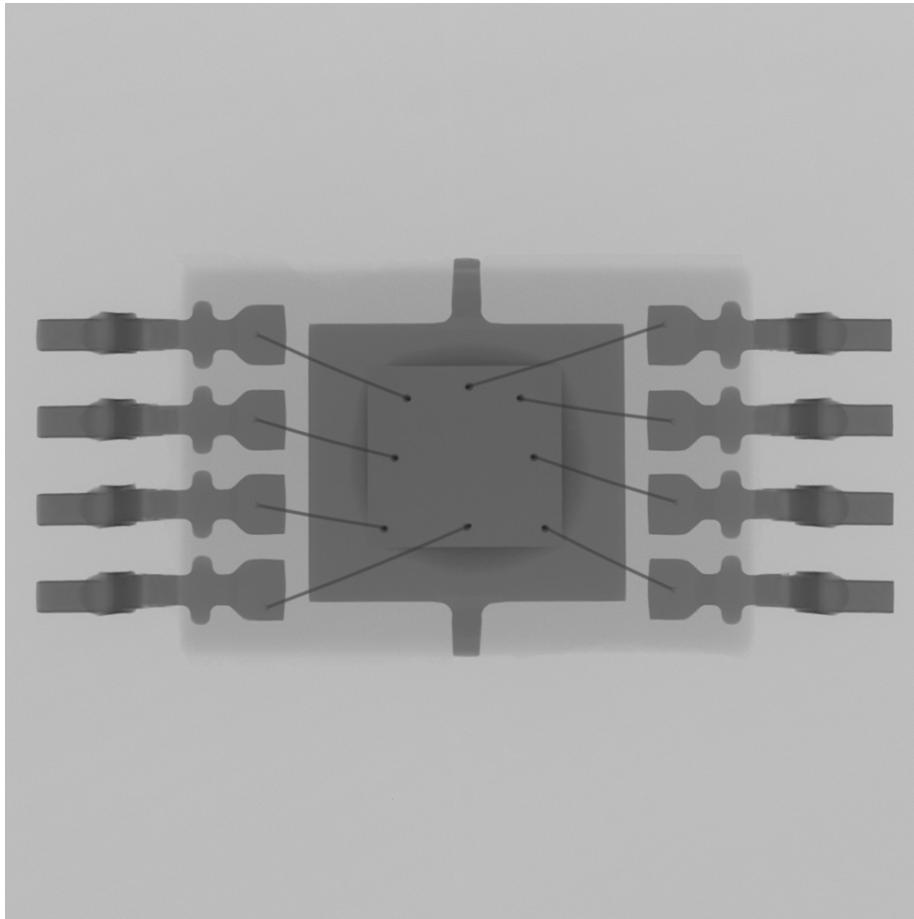
A社



B社



C社



III. SEM analyses

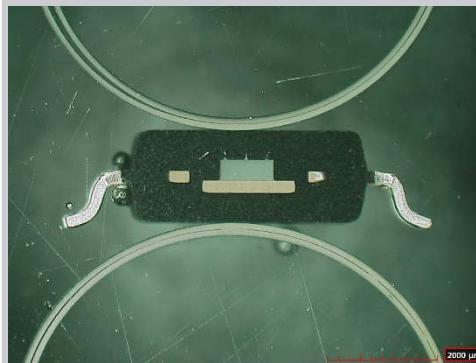


A/B/C社

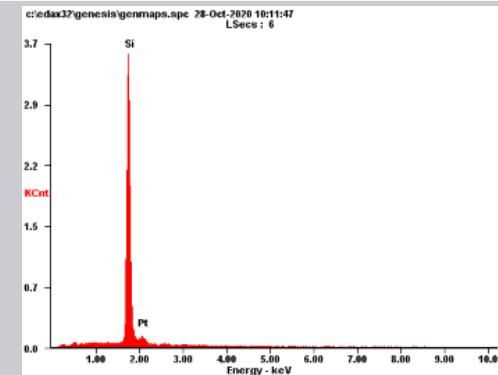
Specimen

SEM analyses

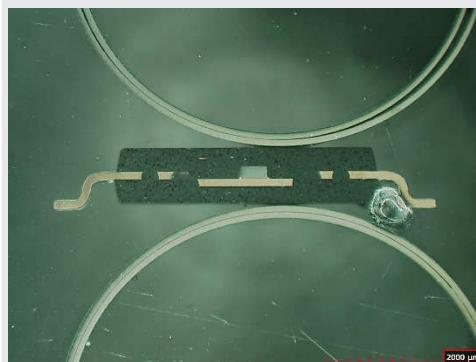
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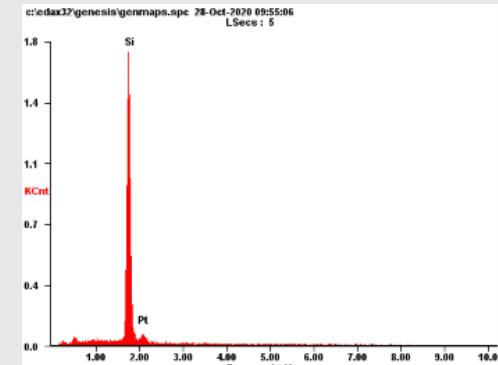
Element	Wt%	At%
Si	85.16	97.55
Pt	14.84	02.45



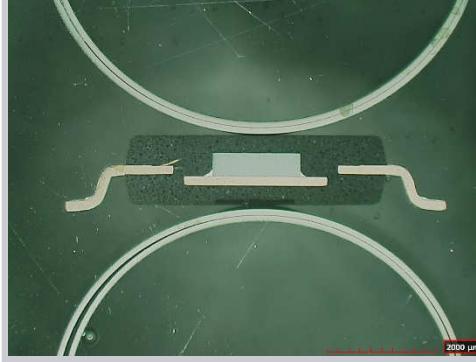
B



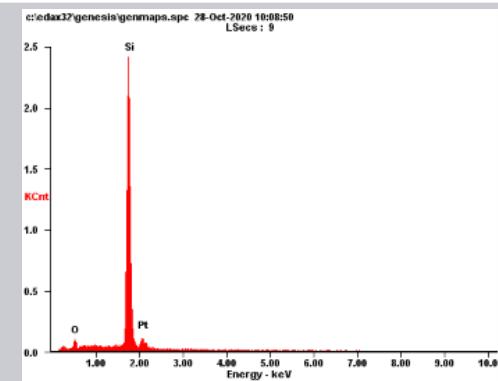
Element	Wt%	At%
Si	84.31	97.39
Pt	15.69	02.61

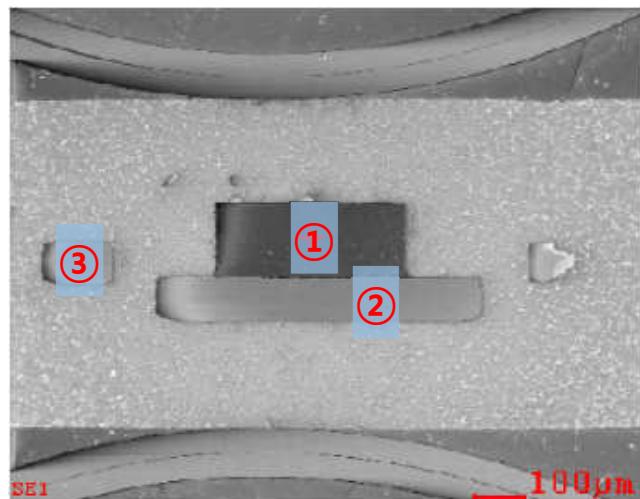


C

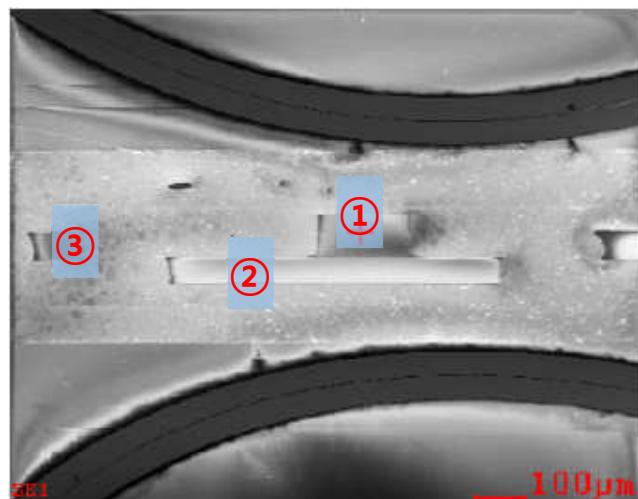


Element	Wt%	At%
O	05.38	10.22
Si	81.10	87.68
Pt	13.52	02.10

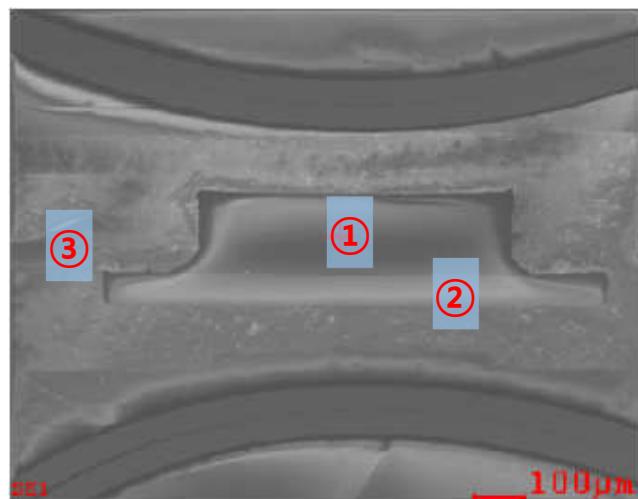




①	<table border="1"> <thead> <tr> <th>Element</th><th>Wt%</th><th>At%</th></tr> </thead> <tbody> <tr> <td>Si</td><td>85.16</td><td>97.55</td></tr> <tr> <td>Pt</td><td>14.84</td><td>02.45</td></tr> </tbody> </table>	Element	Wt%	At%	Si	85.16	97.55	Pt	14.84	02.45	<p>c:\edax32\genesis\genmaps.spc 28-Oct-2020 10:11:47 LSecs : 6</p> <p>Energy - keV</p>			
Element	Wt%	At%												
Si	85.16	97.55												
Pt	14.84	02.45												
<table border="1"> <thead> <tr> <th>Element</th><th>Wt%</th><th>At%</th></tr> </thead> <tbody> <tr> <td>O</td><td>02.36</td><td>09.51</td></tr> <tr> <td>Cu</td><td>85.03</td><td>86.32</td></tr> <tr> <td>Pt</td><td>12.61</td><td>04.17</td></tr> </tbody> </table>	Element	Wt%	At%	O	02.36	09.51	Cu	85.03	86.32	Pt	12.61	04.17	<p>c:\edax32\genesis\genmaps.spc 28-Oct-2020 05:42:15 LSecs : 8</p> <p>Energy - keV</p>	
Element	Wt%	At%												
O	02.36	09.51												
Cu	85.03	86.32												
Pt	12.61	04.17												
③	<table border="1"> <thead> <tr> <th>Element</th><th>Wt%</th><th>At%</th></tr> </thead> <tbody> <tr> <td>O</td><td>02.77</td><td>11.06</td></tr> <tr> <td>Cu</td><td>84.17</td><td>84.66</td></tr> <tr> <td>Pt</td><td>13.06</td><td>04.28</td></tr> </tbody> </table>	Element	Wt%	At%	O	02.77	11.06	Cu	84.17	84.66	Pt	13.06	04.28	<p>c:\edax32\genesis\genmaps.spc 28-Oct-2020 05:42:37 LSecs : 7</p> <p>Energy - keV</p>
Element	Wt%	At%												
O	02.77	11.06												
Cu	84.17	84.66												
Pt	13.06	04.28												



①	<table border="1"> <thead> <tr> <th>Element</th><th>Wt%</th><th>At%</th></tr> </thead> <tbody> <tr> <td>Si</td><td>84.31</td><td>97.39</td></tr> <tr> <td>Pt</td><td>15.69</td><td>02.61</td></tr> </tbody> </table>	Element	Wt%	At%	Si	84.31	97.39	Pt	15.69	02.61	<p>c:\edax32\genesis\genmaps.spc 28-Oct-2020 09:55:06 LSecs : 5</p> <p>EDX spectrum for region 1 showing peaks for Si and Pt. The x-axis is Energy - keV (1.00 to 10.0) and the y-axis is KCnt (0.0 to 1.8). The spectrum shows a very strong peak for Silicon (Si) at approximately 1.7 keV and a smaller peak for Platinum (Pt) at approximately 2.2 keV.</p>						
Element	Wt%	At%															
Si	84.31	97.39															
Pt	15.69	02.61															
②	<table border="1"> <thead> <tr> <th>Element</th><th>Wt%</th><th>At%</th></tr> </thead> <tbody> <tr> <td>O</td><td>02.21</td><td>09.00</td></tr> <tr> <td>Cu</td><td>84.47</td><td>86.55</td></tr> <tr> <td>Pt</td><td>13.32</td><td>04.44</td></tr> </tbody> </table>	Element	Wt%	At%	O	02.21	09.00	Cu	84.47	86.55	Pt	13.32	04.44	<p>c:\edax32\genesis\genmaps.spc 28-Oct-2020 09:55:28 LSecs : 9</p> <p>EDX spectrum for region 2 showing peaks for Cu, O, and Pt. The x-axis is Energy - keV (1.00 to 10.0) and the y-axis is KCnt (0.0 to 1.9). The spectrum shows a very strong peak for Copper (Cu) at approximately 1.0 keV, a medium peak for Oxygen (O) at approximately 1.2 keV, and a small peak for Platinum (Pt) at approximately 2.2 keV.</p>			
Element	Wt%	At%															
O	02.21	09.00															
Cu	84.47	86.55															
Pt	13.32	04.44															
③	<table border="1"> <thead> <tr> <th>Element</th><th>Wt%</th><th>At%</th></tr> </thead> <tbody> <tr> <td>C</td><td>06.33</td><td>25.13</td></tr> <tr> <td>O</td><td>04.74</td><td>14.12</td></tr> <tr> <td>Cu</td><td>77.00</td><td>57.83</td></tr> <tr> <td>Pt</td><td>11.94</td><td>02.92</td></tr> </tbody> </table>	Element	Wt%	At%	C	06.33	25.13	O	04.74	14.12	Cu	77.00	57.83	Pt	11.94	02.92	<p>c:\edax32\genesis\genmaps.spc 28-Oct-2020 09:55:50 LSecs : 13</p> <p>EDX spectrum for region 3 showing peaks for Cu, O, C, and Pt. The x-axis is Energy - keV (1.00 to 10.0) and the y-axis is KCnt (0.0 to 2.4). The spectrum shows a very strong peak for Copper (Cu) at approximately 1.0 keV, a medium peak for Oxygen (O) at approximately 1.2 keV, a small peak for Carbon (C) at approximately 1.5 keV, and a small peak for Platinum (Pt) at approximately 2.2 keV.</p>
Element	Wt%	At%															
C	06.33	25.13															
O	04.74	14.12															
Cu	77.00	57.83															
Pt	11.94	02.92															



①	<table border="1"> <thead> <tr> <th>Element</th><th>Wt%</th><th>At%</th></tr> </thead> <tbody> <tr> <td>O</td><td>05.38</td><td>10.22</td></tr> <tr> <td>Si</td><td>81.10</td><td>87.68</td></tr> </tbody> </table>	Element	Wt%	At%	O	05.38	10.22	Si	81.10	87.68	<p>c:\edax32\genesis\genmaps.spc 28-Oct-2020 10:08:50 LSecs : 9</p> <p>Si O Pt KCnt</p> <p>Energy - keV</p>					
Element	Wt%	At%														
O	05.38	10.22														
Si	81.10	87.68														
<table border="1"> <thead> <tr> <th>Element</th><th>Wt%</th><th>At%</th></tr> </thead> <tbody> <tr> <td>O</td><td>03.33</td><td>13.09</td></tr> <tr> <td>Cu</td><td>83.53</td><td>82.68</td></tr> </tbody> </table>	Element	Wt%	At%	O	03.33	13.09	Cu	83.53	82.68	<p>c:\edax32\genesis\genmaps.spc 28-Oct-2020 10:09:08 LSecs : 10</p> <p>Cu O Pt KCnt</p> <p>Energy - keV</p>						
Element	Wt%	At%														
O	03.33	13.09														
Cu	83.53	82.68														
<table border="1"> <thead> <tr> <th>Element</th><th>Wt%</th><th>At%</th></tr> </thead> <tbody> <tr> <td>C</td><td>07.90</td><td>28.98</td></tr> <tr> <td>O</td><td>06.22</td><td>17.12</td></tr> <tr> <td>Cu</td><td>73.81</td><td>51.18</td></tr> <tr> <td>Pt</td><td>12.08</td><td>02.73</td></tr> </tbody> </table>	Element	Wt%	At%	C	07.90	28.98	O	06.22	17.12	Cu	73.81	51.18	Pt	12.08	02.73	<p>c:\edax32\genesis\genmaps.spc 28-Oct-2020 10:09:34 LSecs : 13</p> <p>Cu O C Pt KCnt</p> <p>Energy - keV</p>
Element	Wt%	At%														
C	07.90	28.98														
O	06.22	17.12														
Cu	73.81	51.18														
Pt	12.08	02.73														