COMMON PARTS/MATERIALS, SPACE USE, APPLICATION DATA SHEET FOR

Part Description	RESISTORS, CHIP, FIXED, METAL FILM
Part Number and Type	JAXA 2050/J401-1005 JAXA 2050/J401-1608 JAXA 2050/J401-2012 JAXA 2050/J401-3216 JAXA 2050/J401-3225
Applicable Specification	JAXA-QTS-2050D JAXA-QTS-2050/J401

October 2020

Prepared and Established by SANADA KOA Corporation

Issued by Japan Aerospace Exploration Agency

This document is the English version of JAXA QTS/ADS which was originally written and authorized in Japanese and carefully translated into English for international users. If any question arises as to the context or detailed description, it is strongly recommended to verify against the latest official Japanese version.

The release date of the English version of this specification: February 1, 2022

Revision Log		
Rev.	Date	Description
NC	24 Nov. 2010	Original.
A	8 Jul. 2011	Updated the result of characteristic test under various operating conditions with the requalification test performed. Updated the failure rate of qualified parts according to the increase of load life test samples.
B	23 Aug. 2019	1. Updated the following test results in accordance with the requalification test performed. ・ Updated the test results of dielectric withstanding voltage, insulation resistance, and resistance-temperature characteristics for paragraph 4.1 Electrical Characteristics. ・ Updated the test results of Adhesion, board bending, resistance to board exposure, resistance to soldering heat, solderability, random vibration, shock, thermal shock [II], moisture resistance, resistance to solvents, and stability for paragraph 4.2 Mechanical and thermal characteristics. ・ Updated the test results of short-time overload and low-temperature operation for paragraph 5 Characteristics under various operating conditions. 2. Added the result of the acceleration test performed in life test during requalification test. ・ Added the calculation condition and test results for paragraph 5 Characteristics under various operating conditions. 3. Updated the failure rate field data ・ Updated paragraph 6.1.2 Failure Rate Field Data of General-Purpose Parts (Reference) to the current value. 4. Changed the company name from Tama Electric Co., Ltd. to SANADA KOA Corporation. ・ Cover sheet: Prepared and Established by SANADA KOA Corporation ・ Paragraph 9: Manufacturer 5. P12: Corrected errors on the military specification number.
C	12 Oct. 2020	1. Updated the following test results due to the requalification test except for omitted tests for styles 1005 and 1608. ・ Paragraph 4.1 Electrical characteristics: Updated the test results for dielectric withstanding voltage and insulation resistance. ・ Paragraph 4.2 Mechanical and thermal characteristics: Updated the test results for board bending, resistance to soldering heat, solderability, thermal shock (II), moisture resistance, resistance to solvents, and stability. ・ Paragraph 5 Characteristic under various operating conditions: Updated the test results for short-time overload and low temperature operation. 2. Clarified paragraph 8 NOTES: Clarified the description due to occurrence of peeled external electrode caused by the mishandling of the parts.

Contents

COMMON PARTS/MATERIALS,
SPACE USE,
APPLICATION DATA SHEET FOR

1. GENERAL

1.1 Scope

This Application Data Sheet provides additional detailed information necessary for designing or selecting products not contained in JAXA QML. Relevant information not covered in this document shall also be considered. Users are responsible for all aspects pertaining to selection and use of the product(s) specified in this document.

1.2 Applicable Documents

JAXA -QTS-2050D	Resistors, High Reliability, Space Use, General Specification For
JAXA -QTS-2050/J401	Resistors, Chip, Fixed, Metal Film, High Reliability, Space Use, Detail Specification For

2. SUMMARY OF PRODUCT

2.1 Externals, Dimensions, Mass and Photograph

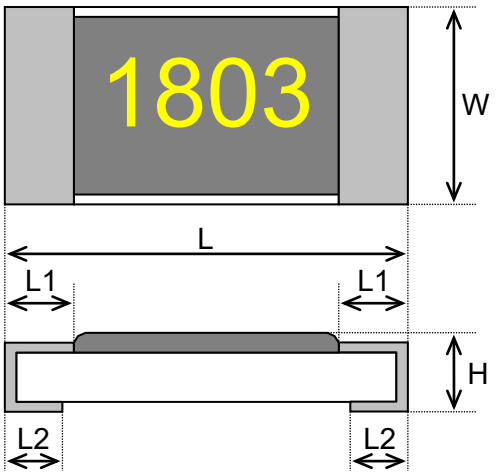
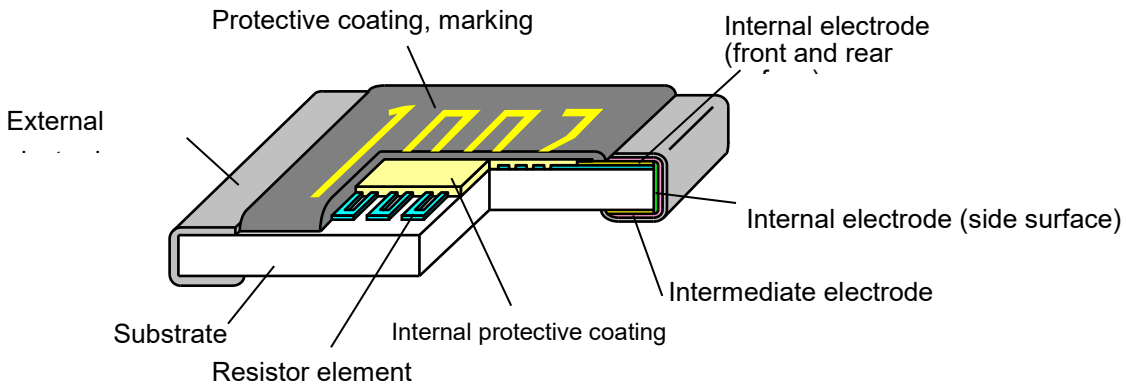


Photo: JAXA2050/J401-3216 type

Part name	Dimension [mm]					Mass (typ.value) [mg]
	L	W	H	L1	L2	
2050/J401-1005	1.0±0.1	0.5±0.05	0.35±0.05	0.2±0.1	0.25±0.1	0.68
2050/J401-1608	1.6±0.2	0.8±0.1	0.45±0.1	0.3±0.1	0.3±0.1	2.14
2050/J401-2012	2.0±0.2	1.25±0.2	0.5±0.1	0.4±0.2	0.3±0.1	4.54
2050/J401-3216	$3.2\pm^{0.2}_{0.3}$	1.6±0.2	0.6±0.1	0.5±0.3	0.4±0.2	9.14
2050/J401-3225	$3.2\pm^{0.2}_{0.3}$	2.5±0.2	0.6±0.1	0.5±0.3	0.4±0.2	14.5

2.2 Construction



Element	Main constituent
Substrate	96% alumina (Al_2O_3)
Internal electrode (front and rear surface)	Chromium, nickel, copper type (Cr, Ni, Cu)
Internal electrode (side surface)	Nickel chromium type (NiCr)
Resistor element	Nickel chromium type (NiCr)
Internal protective coating	Inorganic type
Protective coating, marking	Epoxy type
Intermediate electrode	Nickel plating (Ni)
External electrode	Solder plating (Sn90-Pb10)

3. USAGE

3.1 Absolute Maximum Ratings

Item	2050/J401 -1005	2050/J401 -1608	2050/J401 -2012	2050/J401 -3216	2050/J401 -3225
Operating temperature range (°C)	-55 to +125				
Rated ambient temperature (°C)	85				
Nominal resistance range (Ω)	10 to 510k (see Appended Table)(2)				
Critical resistance (Ω)	76.8k	—	100k	180k	160k
Maximum operating voltage (V)	50	75	100	150	200
Maximum overload voltage (V)	75	150	200	300	400
Rated power (W)(1)	0.032	0.05	0.10	0.125	0.25

Notes: (1) If the temperature exceeds rated ambient temperature, load power shall be derated in accordance with the derating curve in Figure 1.

(2) The range of nominal resistance differs according to the style, resistance tolerance and resistance-temperature characteristics.

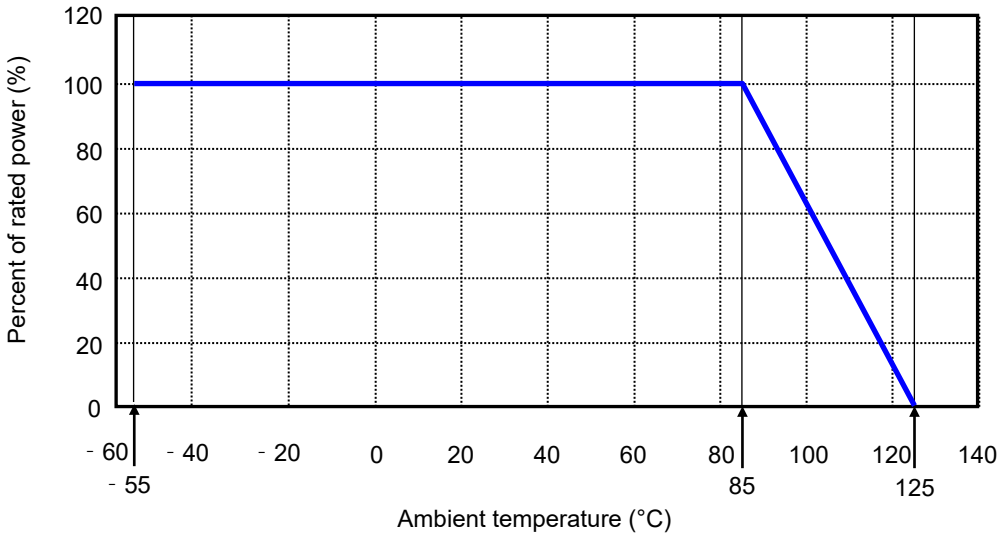


Figure 1. Derating Curve

3.2 Recommended Operating Conditions

It is recommended to operate the resistors at 50% or less of the rated power specified in the derating curve shown in Figure 1.

3.3 Notes for Circuit Design

If the rated calculated voltage exceeds the maximum operating voltage, the maximum operating voltage shall be used as the rated voltage.

$$E = \sqrt{P \times R}$$

E: Rated voltage (V)
P: Rated power (W)
R: Nominal resistance (Ω)

3.4 Recommended Mounting Method

Solder: Sn/Pb eutectic solder (melting-point temperature: 183˚C)
Flux: Less corrosive rosin flux (when applied)

Mounting method	Soldering conditions
Reflow	Preheating: 150°C, 60 sec max. Soldering: 240±5°C, 6 sec max. Frequency: 2 times max.
Flow	Soldering: 260±10°C, 10 sec max. Frequency: 1 times only
Hand soldering	Soldering: 350±10°C, 3 sec max. Soldering iron shall be 20W max or temperature controllable.

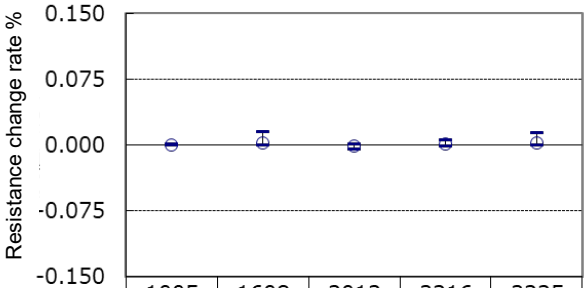
3.5 Cleansing

Cleansing shall be performed by immersing the resistor in alcohols (non-chlorinated) solvents for a maximum of 5 minutes.

4. CHARACTERISTICS UNDER NORMAL OPERATING CONDITIONS

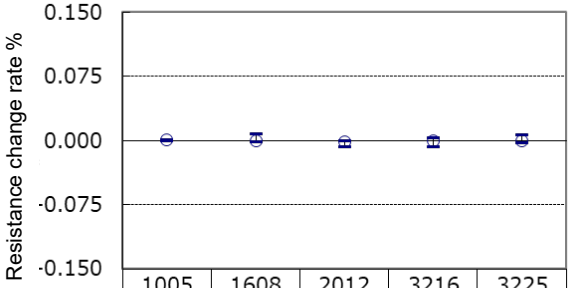
4.1 Electrical Characteristics

Dielectric withstanding voltage
(atmospheric pressure) n=10
A.C. 150Vrms-60sec
Limit: ± (0.15%+0.01Ω)



	1005	1608	2012	3216	3225
– MAX.	0.001	0.015	0.001	0.006	0.014
– MIN.	0.000	0.000	-0.005	-0.001	0.000
○ AVE	0.000	0.002	-0.001	0.001	0.002

Dielectric withstanding voltage
(reduced pressure) n=10
A.C. 75Vrms-60sec
Limit: ± (0.15%+0.01Ω)

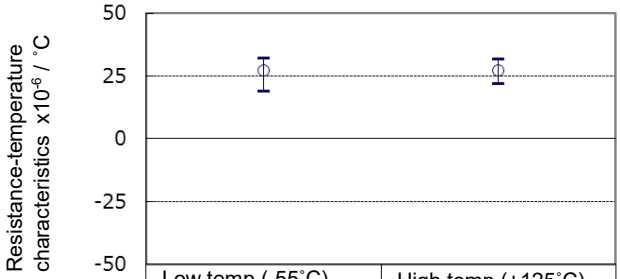


	1005	1608	2012	3216	3225
– MAX.	0.001	0.008	0.000	0.003	0.006
– MIN.	0.000	-0.002	-0.007	-0.008	-0.003
○ AVE	0.001	0.000	-0.002	-0.001	0.000

Insulation resistance n=10
Condition: D.C. 100V-60sec
Limit: 10^3MΩ min.

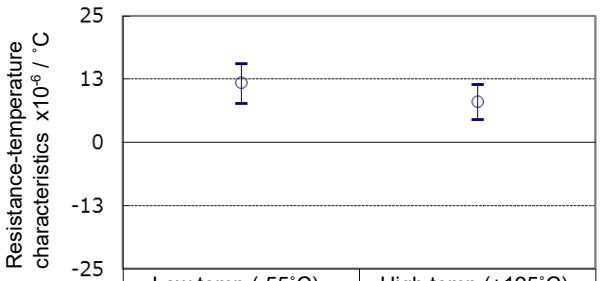
Style	Result
J2050/J401-1005	More than 10GΩ for all samples
J2050/J401-1608	More than 10GΩ for all samples
J2050/J401-2012	More than 10GΩ for all samples
J2050/J401-3216	More than 10GΩ for all samples
J2050/J401-3225	More than 10GΩ for all samples

Resistance-temperature characteristics n=10
Condition: -55˚C/25˚C/125˚C
Limit: ±50x10^{-6}/˚C
J2050/J401-1005H10R0D



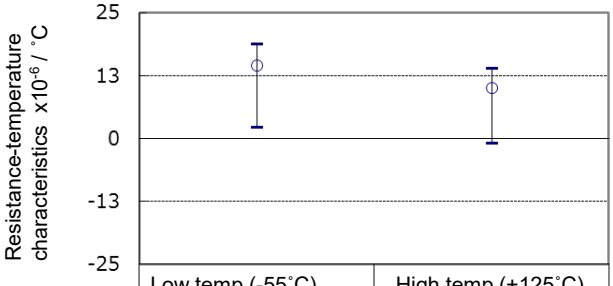
	Low temp (-55˚C)	High temp (+125˚C)
– MAX.	32.14	31.72
– MIN.	18.91	21.77
○ AVE	27.06	27.21

Resistance-temperature characteristics n=10
Condition: -55˚C/25˚C/125˚C
Limit: ±25x10^{-6}/˚C
J2050/J401-1005E7682B



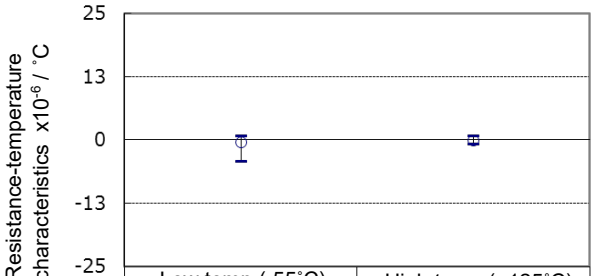
	Low temp (-55˚C)	High temp (+125˚C)
– MAX.	15.53	11.52
– MIN.	7.73	4.58
○ AVE	11.78	8.10

Resistance-temperature characteristics n=10
Condition: -55˚C/25˚C/125˚C
Limit: ±25x10^{-6}/˚C
J2050/J401-1005E1003B



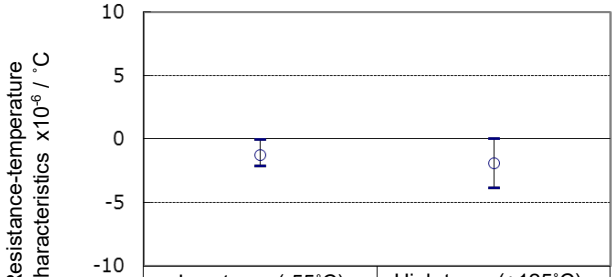
	Low temp (-55˚C)	High temp (+125˚C)
– MAX.	18.76	13.97
– MIN.	2.28	-0.89
○ AVE	14.45	9.93

Resistance-temperature characteristics n=10
Condition: -55˚C/25˚C/125˚C
Limit: ±25x10^{-6}/˚C
J2050/J401-1005E51R0D



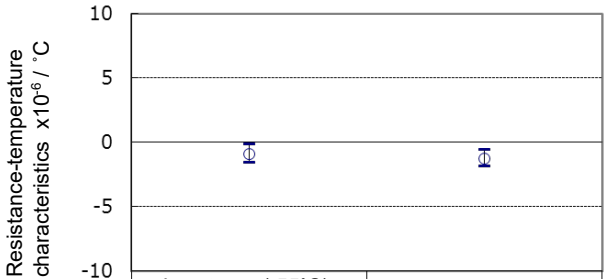
	Low temp (-55˚C)	High temp (+125˚C)
– MAX.	0.76	0.72
– MIN.	-4.24	-0.83
○ AVE	-0.43	-0.07

Resistance-temperature characteristics n=10
Condition: -55˚C/25˚C/125˚C
Limit: ±10x10^{-6}/˚C
J2050/J401-1005Y1000B



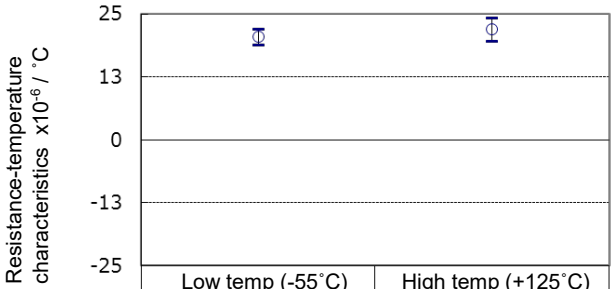
	Low temp (-55˚C)	High temp (+125˚C)
– MAX.	-0.04	0.04
– MIN.	-2.11	-3.82
○ AVE	-1.23	-1.90

Resistance-temperature characteristics n=10
Condition: -55˚C/25˚C/125˚C
Limit: ±10x10^{-6}/˚C
J2050/J401-1005Y1002B



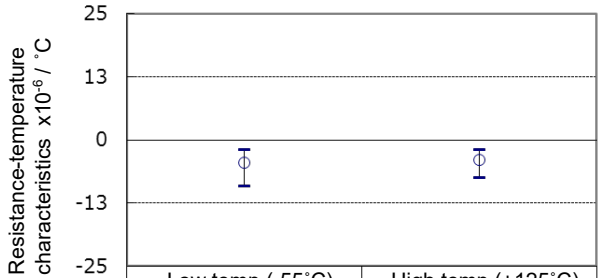
	Low temp (-55˚C)	High temp (+125˚C)
– MAX.	-0.13	-0.57
– MIN.	-1.55	-1.87
○ AVE	-0.91	-1.31

Resistance-temperature characteristics n=15
Condition: -55˚C/25˚C/125˚C
Limit: ±25x10^{-6}/˚C
J2050/J401-1608E10R0D



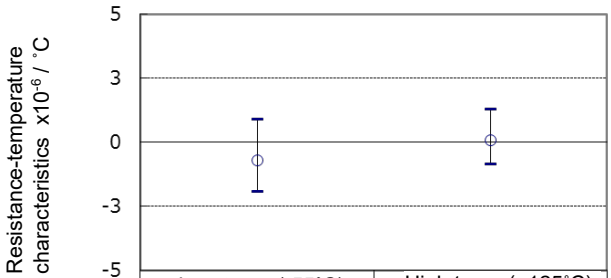
	Low temp (-55˚C)	High temp (+125˚C)
– MAX.	22.01	24.13
– MIN.	18.83	19.63
○ AVE	20.56	22.01

Resistance-temperature characteristics n=15
Condition: -55˚C/25˚C/125˚C
Limit: ±25x10^{-6}/˚C
J2050/J401-1608E5902B



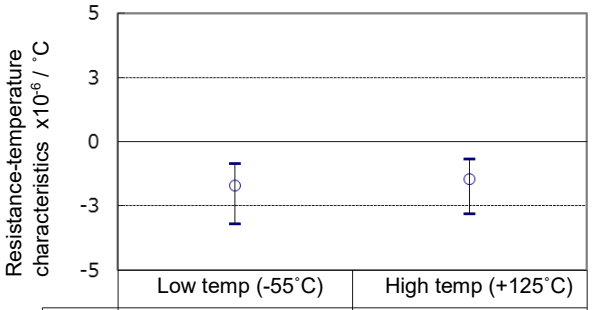
	Low temp (-55˚C)	High temp (+125˚C)
– MAX.	-2.02	-1.86
– MIN.	-9.22	-7.40
○ AVE	-4.44	-4.05

Resistance-temperature characteristics n=10
Condition: -55˚C/25˚C/125˚C
Limit: ±5x10^{-6}/˚C
J2050/J401-1608A1000B



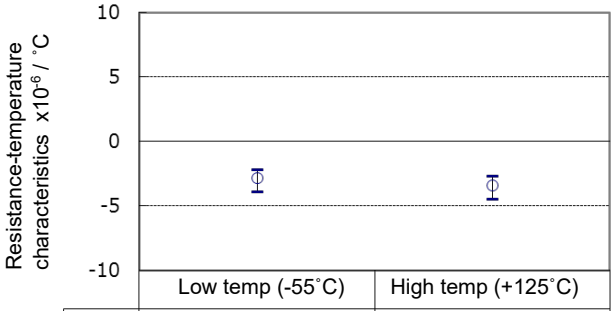
	Low temp (-55˚C)	High temp (+125˚C)
– MAX.	0.89	1.28
– MIN.	-1.92	-0.85
○ AVE	-0.69	0.09

Resistance-temperature characteristics n=10
Condition: -55˚C/25˚C/125˚C
Limit: ±5x10^{-6}/˚C
J2050/J401-1608A4702B



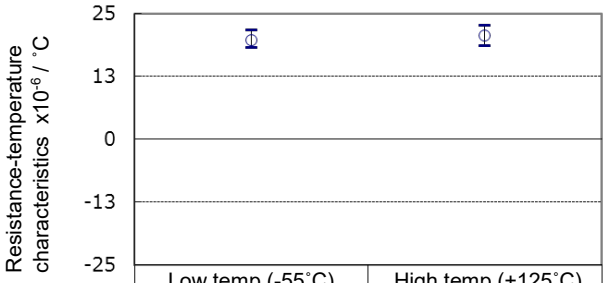
	Low temp (-55˚C)	High temp (+125˚C)
– MAX.	-0.85	-0.69
– MIN.	-3.20	-2.80
○ AVE	-1.72	-1.47

Resistance-temperature characteristics n=10
Condition: -55˚C/25˚C/125˚C
Limit: ±10x10^{-6}/˚C
J2050/J401-1608Y5902B



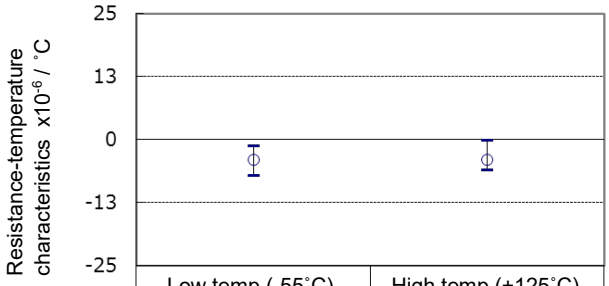
	Low temp (-55˚C)	High temp (+125˚C)
– MAX.	-2.20	-2.73
– MIN.	-3.94	-4.47
○ AVE	-2.82	-3.38

Resistance-temperature characteristics n=15
Condition: -55˚C/25˚C/125˚C
Limit: ±25x10^{-6}/˚C
J2050/J401-2012E10R0D



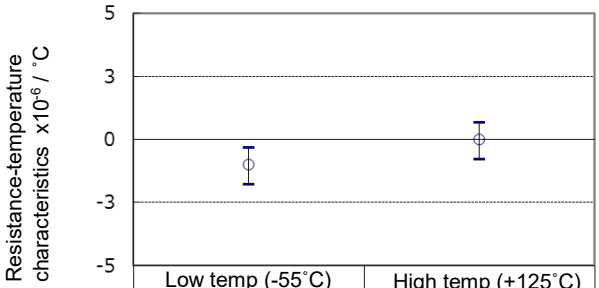
	Low temp (-55˚C)	High temp (+125˚C)
– MAX.	21.84	22.69
– MIN.	18.20	18.70
○ AVE	19.77	20.65

Resistance-temperature characteristics n=15
Condition: -55˚C/25˚C/125˚C
Limit: ±25x10^{-6}/˚C
J2050/J401-2012E1003B



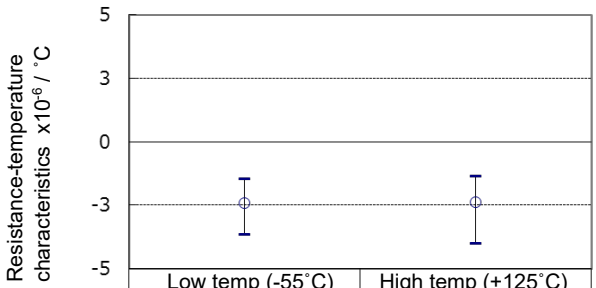
	Low temp (-55˚C)	High temp (+125˚C)
– MAX.	-1.19	-0.22
– MIN.	-7.16	-6.08
○ AVE	-4.07	-3.91

Resistance-temperature characteristics n=15
Condition: -55˚C/25˚C/125˚C
Limit: ±5x10^{-6}/˚C
J2050/J401-2012A1000B



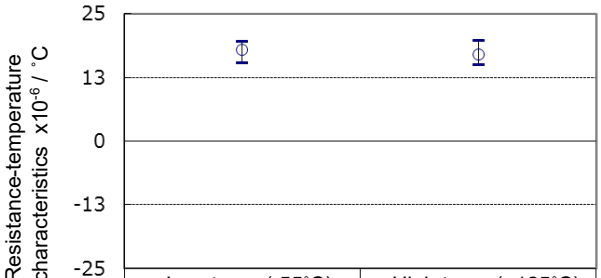
	Low temp (-55˚C)	High temp (+125˚C)
– MAX.	-0.320	0.690
– MIN.	-1.772	-0.790
○ AVE	-1.001	0.016

Resistance-temperature characteristics n=15
Condition: -55˚C/25˚C/125˚C
Limit: ±5x10^{-6}/˚C
J2050/J401-2012A1003B



	Low temp (-55˚C)	High temp (+125˚C)
– MAX.	-1.463	-1.349
– MIN.	-3.653	-4.003
○ AVE	-2.420	-2.386

Resistance-temperature characteristics n=10
Condition: -55˚C/25˚C/125˚C
Limit: ±25x10^{-6}/˚C
J2050/J401-3216E10R0D



	Low temp (-55˚C)	High temp (+125˚C)
– MAX.	19.54	19.83
– MIN.	15.45	14.99
○ AVE	17.97	16.94

Resistance-temperature characteristics n=10
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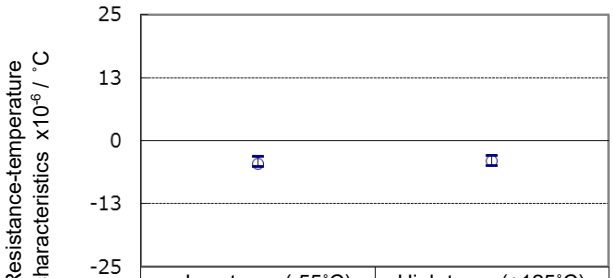
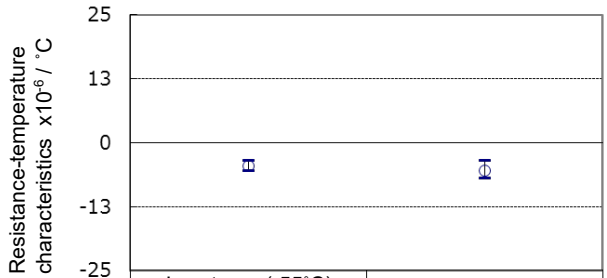
Limit: ±25x10^{-6}/˚C
J2050/J401-3216E1803B



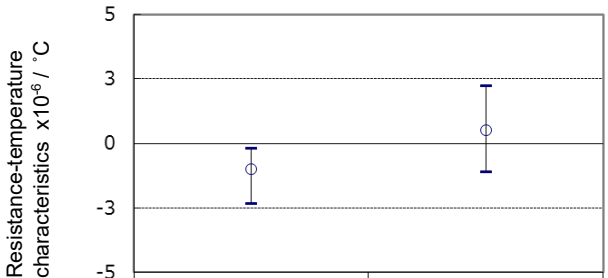
	Low temp (-55˚C)	High temp (+125˚C)
– MAX.	-3.14	-2.93
– MIN.	-5.19	-4.92
○ AVE	-4.57	-4.02

Resistance-temperature characteristics n=10
Condition: -55˚C/25˚C/125˚C
Limit: ±25x10^{-6}/˚C
J2050/J401-3216E3003B



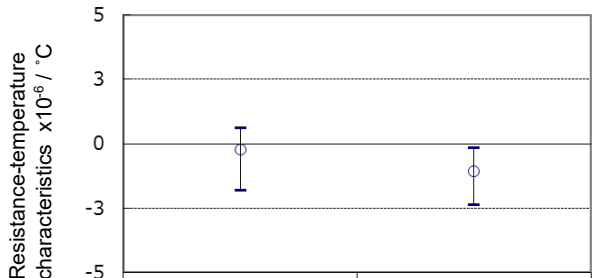
	Low temp (-55˚C)	High temp (+125˚C)
– MAX.	-3.49	-3.46
– MIN.	-5.54	-6.92
○ AVE	-4.61	-5.49

Resistance-temperature characteristics n=15
Condition: -55˚C/25˚C/125˚C
Limit: ±5x10^{-6}/˚C
J2050/J401-3216A1000B



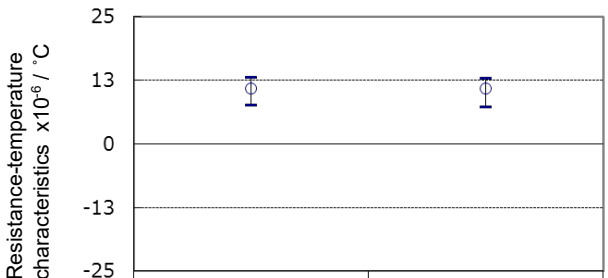
	Low temp (-55˚C)	High temp (+125˚C)
– MAX.	-0.184	2.249
– MIN.	-2.351	-1.118
○ AVE	-0.999	0.526

Resistance-temperature characteristics n=15
Condition: -55˚C/25˚C/125˚C
Limit: ±5x10^{-6}/˚C
J2050/J401-3216A3003B



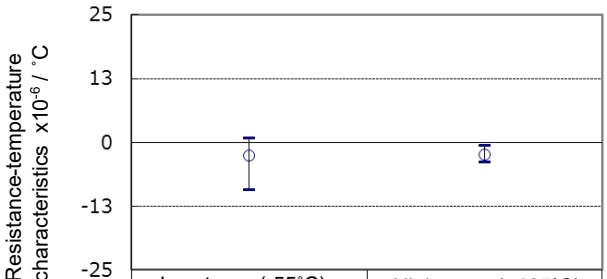
	Low temp (-55˚C)	High temp (+125˚C)
– MAX.	0.604	-0.141
– MIN.	-1.807	-2.356
○ AVE	-0.228	-1.056

Resistance-temperature characteristics n=10
Condition: -55˚C/25˚C/125˚C
Limit: ±25x10^{-6}/˚C
J2050/J401-3225E10R0D



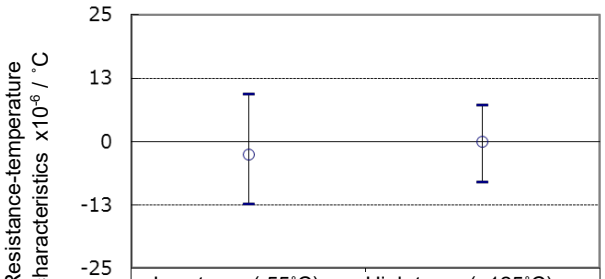
	Low temp (-55˚C)	High temp (+125˚C)
– MAX.	13.08	12.83
– MIN.	7.68	7.30
○ AVE	10.88	10.82

Resistance-temperature characteristics n=10
Condition: -55˚C/25˚C/125˚C
Limit: ±25x10^{-6}/˚C
J2050/J401-3225E1603B



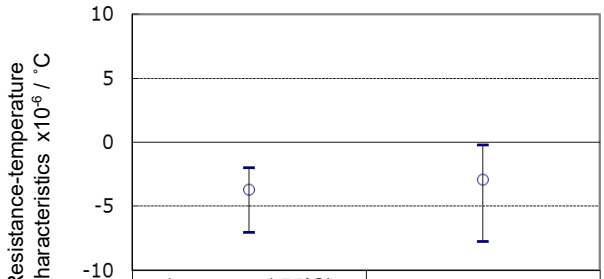
	Low temp (-55˚C)	High temp (+125˚C)
– MAX.	0.89	-0.64
– MIN.	-9.26	-3.83
○ AVE	-2.62	-2.43

Resistance-temperature characteristics n=10
Condition: -55˚C/25˚C/125˚C
Limit: ±25x10^{-6}/˚C
J2050/J401-3225E5103B



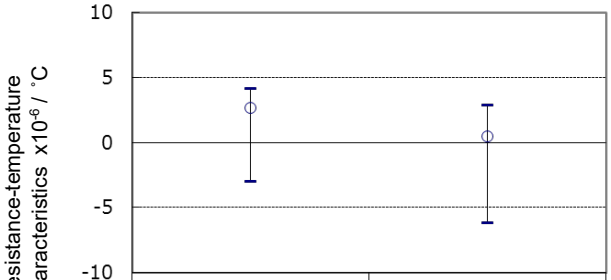
	Low temp (-55˚C)	High temp (+125˚C)
– MAX.	9.41	7.14
– MIN.	-12.40	-8.00
○ AVE	-2.59	-0.12

Resistance-temperature characteristics n=15
Condition: -55˚C/25˚C/125˚C
Limit: ±10x10^{-6}/˚C
J2050/J401-3225Y1000B



	Low temp (-55˚C)	High temp (+125˚C)
– MAX.	-2.003	-0.220
– MIN.	-7.066	-7.730
○ AVE	-3.677	-2.939

Resistance-temperature characteristics n=15
Condition: -55˚C/25˚C/125˚C
Limit: ±10x10^{-6}/˚C
J2050/J401-3225Y5103B



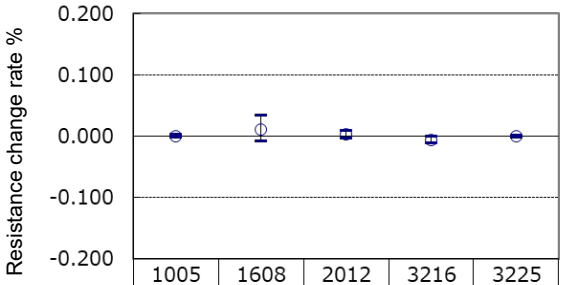
	Low temp (-55˚C)	High temp (+125˚C)
– MAX.	4.191	2.888
– MIN.	-3.020	-6.170
○ AVE	2.656	0.506

4.2 Mechanical and Thermal Characteristics

Adhesion n=10
Condition: 5N-10sec
Acceptance criteria: There shall be no damage.

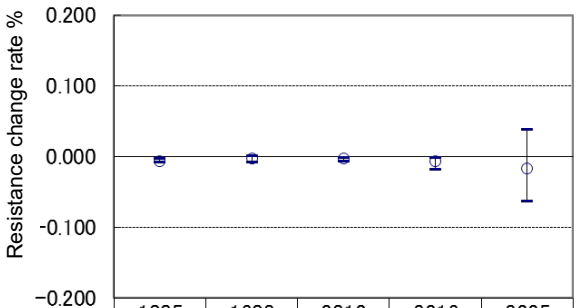
Style	Test result
J2050/J401-1005	No damage
J2050/J401-1608	No damage
J2050/J401-2012	No damage
J2050/J401-3216	No damage
J2050/J401-3225	No damage

Board bending n=10
Condition: Flexure 2mm
Limit: ± (0.20%+0.01Ω)



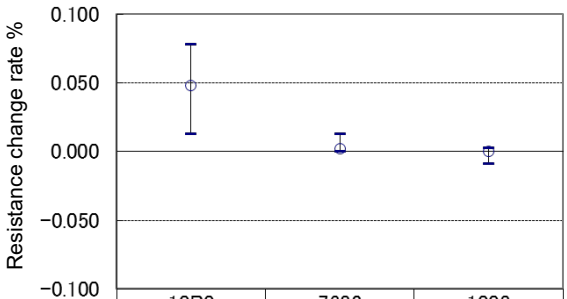
	1005	1608	2012	3216	3225
−MAX.	0.003	0.035	0.010	0.000	0.002
−MIN.	-0.001	-0.008	-0.003	-0.010	-0.002
○AVE	0.000	0.011	0.003	-0.006	0.000

Resistance to bonding exposure n=10
Condition: 260˚C-10sec→ left for 4 to 12hr
Limit: ± (0.20%+0.01Ω)



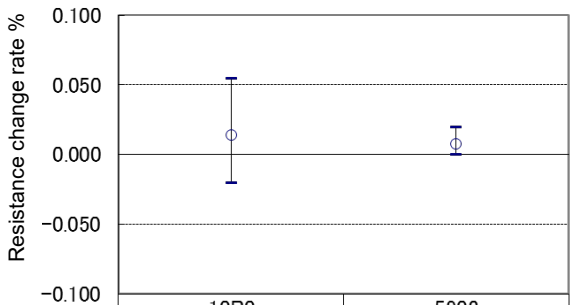
	1005	1608	2012	3216	3225
−MAX.	−0.003	0.002	−0.001	−0.001	0.038
−MIN.	−0.007	−0.007	−0.006	−0.018	−0.063
○AVE	−0.006	−0.003	−0.003	−0.006	−0.017

Resistance to soldering heat n=10
Condition: 260˚C-10sec
Limit: ± (0.10%+0.01Ω)
J2050/J401-1005



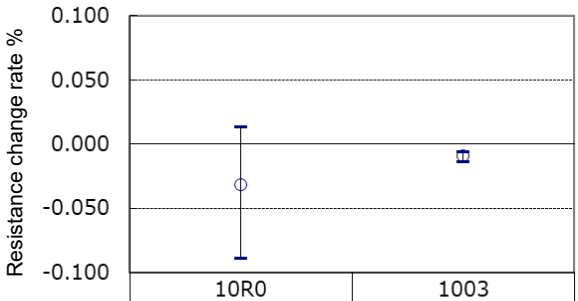
	10R0	7682	1003
−MAX.	0.078	0.013	0.003
−MIN.	0.013	0.000	−0.009
○AVE	0.048	0.002	0

Resistance to soldering heat n=15
Condition: 260˚C-10sec
Limit: ± (0.10%+0.01Ω)
J2050/J401-1608



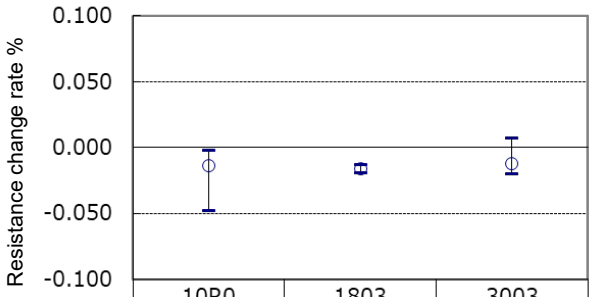
	10R0	5902
−MAX.	0.055	0.020
−MIN.	−0.020	0.000
○AVE	0.014	0.008

Resistance to soldering heat n=15
Condition: 260˚C-10sec
Limit: ± (0.10%+0.01Ω)
J2050/J401-2012



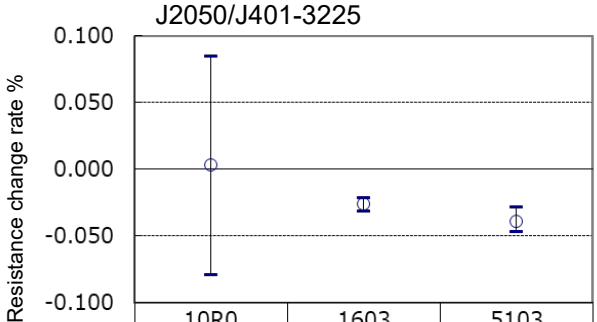
	10R0	1003
−MAX.	0.013	-0.006
−MIN.	-0.089	-0.014
○AVE	-0.032	-0.009

Resistance to soldering heat n=10
Condition: 260˚C-10sec
Limit: ± (0.10%+0.01Ω)
J2050/J401-3216



	10R0	1803	3003
– MAX.	-0.002	-0.013	0.007
– MIN.	-0.048	-0.019	-0.020
○ AVE	-0.014	-0.016	-0.012

Resistance to soldering heat n=10
Condition: 260˚C-10sec
Limit: ± (0.10%+0.01Ω)
J2050/J401-3225



	10R0	1603	5103
– MAX.	0.085	-0.021	-0.028
– MIN.	-0.079	-0.031	-0.047
○ AVE	0.003	-0.026	-0.039

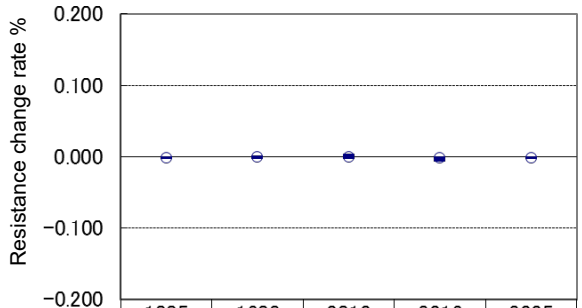
Solderability n=10
Condition: 245˚C-5sec
Acceptance criteria: 95% min.

	Test result
J2050/J401-1005	More than 95% for all samples
J2050/J401-1608	More than 95% for all samples
J2050/J401-2012	More than 95% for all samples
J2050/J401-3216	More than 95% for all samples
J2050/J401-3225	More than 95% for all samples

Random vibration n=10

Condition: 50 to 2000Hz, 334m/s^2,
3 min each for XYZ axes

Limit: ± (0.20%+0.01Ω)

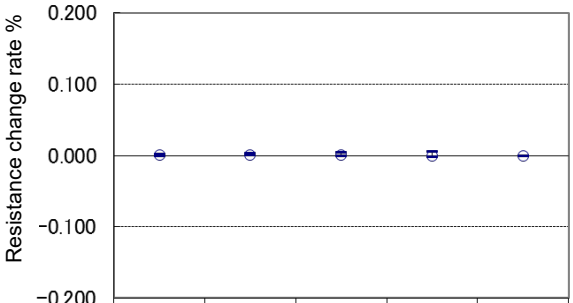


	1005	1608	2012	3216	3225
MAX.	−0.001	0.000	0.002	−0.001	−0.001
MIN.	−0.001	−0.001	−0.001	−0.005	−0.002
AVE	−0.001	0.000	0.000	−0.002	−0.002

Shock n=10

Condition: 980m/s^2, 6rms sawtooth wave
5 times each for XYZ axes

Limit: ± (0.20%+0.01Ω)



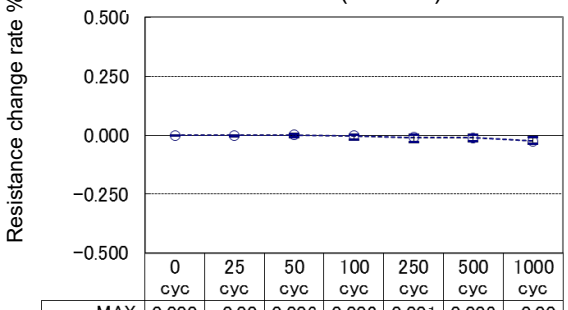
	1005	1608	2012	3216	3225
MAX.	0.002	0.003	0.004	0.006	0.000
MIN.	0.000	0.001	0.000	−0.002	−0.001
AVE	0.001	0.001	0.001	0.000	−0.001

Thermal shock [II] n=10

Condition: -30˚C(15min)/+25˚C(5min)/100˚C
(15min)/+25˚C(5min), 1000cycle

Limit: ± (0.50%+0.01Ω)

J2050/J401-1005 (76.8kΩ)



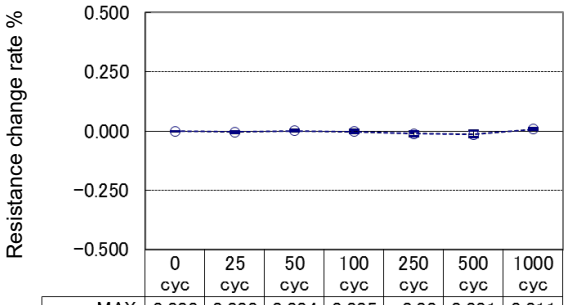
	0 cyc	25 cyc	50 cyc	100 cyc	250 cyc	500 cyc	1000 cyc
MAX.	0.000	−0.00	0.006	0.002	0.001	0.003	−0.00
MIN.	0.000	−0.00	−0.00	−0.01	−0.02	−0.02	−0.04
AVE	0.000	−0.00	0.001	−0.00	−0.01	−0.01	−0.03

Thermal shock [II] n=10

Condition: -30˚C(15min)/+25˚C(5min)/100˚C
(15min)/+25˚C(5min), 1000cycle

Limit: ± (0.50%+0.01Ω)

J2050/J401-1608 (59.0kΩ)



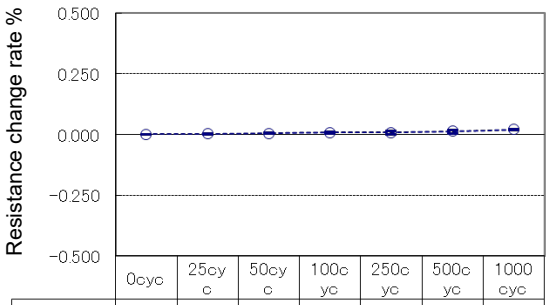
	0 cyc	25 cyc	50 cyc	100 cyc	250 cyc	500 cyc	1000 cyc
MAX.	0.000	0.000	0.004	0.005	−0.00	0.001	0.011
MIN.	0.000	−0.00	−0.00	−0.00	−0.02	−0.02	0.007
AVE	0.000	−0.00	0.002	−0.00	−0.01	−0.01	0.009

Thermal shock [II] n=10

Condition: -30˚C(15min)/+25˚C(5min)/100˚C
(15min)/+25˚C(5min), 1000cycle

Limit: ± (0.50%+0.01Ω)

J2050/J401-2012 (100kΩ)



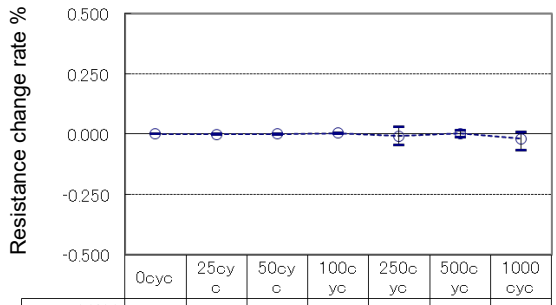
	0cyc	25cyc	50cyc	100cyc	250cyc	500cyc	1000 cyc
MAX.	0.000	0.004	0.006	0.010	0.013	0.019	0.023
MIN.	0.000	0.001	0.002	0.005	0.001	0.003	0.018
AVE	0.000	0.003	0.005	0.008	0.008	0.013	0.020

Thermal shock [II] n=10

Condition: -30˚C(15min)/+25˚C(5min)/100˚C
(15min)/+25˚C(5min), 1000cycle

Limit: ± (0.50%+0.01Ω)

J2050/J401-3216 (180kΩ)



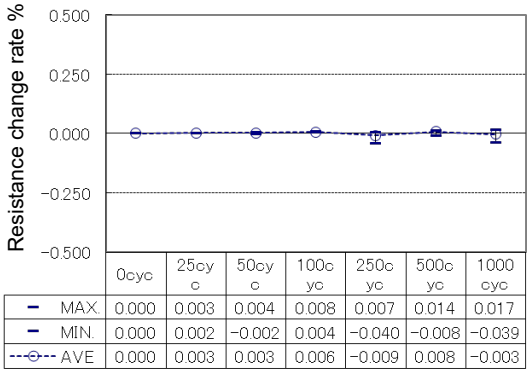
	0cyc	25cyc	50cyc	100cyc	250cyc	500cyc	1000 cyc
MAX.	0.000	0.000	0.003	0.007	0.029	0.015	0.010
MIN.	0.000	−0.003	−0.001	0.001	−0.046	−0.011	−0.066
AVE	0.000	−0.001	0.001	0.005	−0.008	0.002	−0.019

Thermal shock [II] n=10

Condition: -30˚C(15min)/+25˚C(5min)/100˚C (15min)/+25˚C(5min), 1000cycle

Limit: ± (0.50%+0.01Ω)

J2050/J401-3225 (160kΩ)



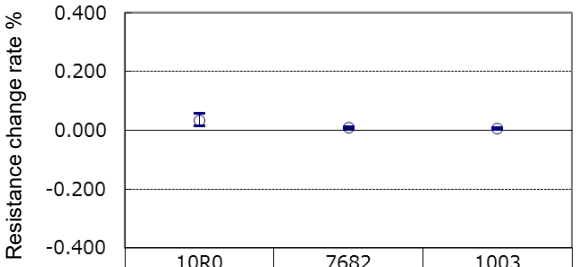
	0cyc	25cyc	50cyc	100cyc	250cyc	500cyc	1000cyc
MAX.	0.000	0.003	0.004	0.008	0.007	0.014	0.017
MIN.	0.000	0.002	-0.002	0.004	-0.040	-0.008	-0.039
AVE	0.000	0.003	0.003	0.006	-0.009	0.008	-0.003

Moisture resistance n=10

Condition: MIL-STD-202, Method 106(3)

Limit: ± (0.40%+0.01Ω)

J2050/J401-1005



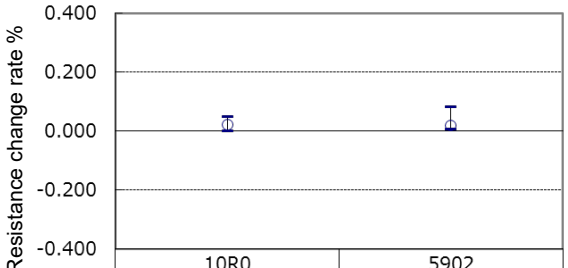
	10R0	7682	1003
MAX.	0.057	0.012	0.010
MIN.	0.015	0.005	0.002
AVE	0.033	0.009	0.006

Moisture resistance n=15

Condition: MIL-STD-202, Method 106(3)

Limit: ± (0.40%+0.01Ω)

J2050/J401-1608



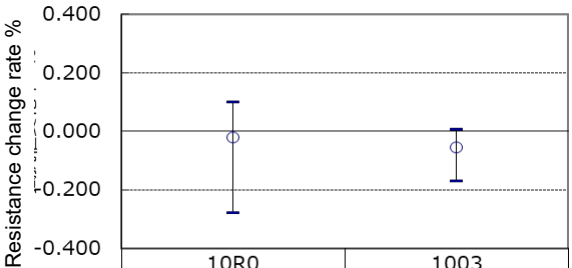
	10R0	5902
MAX.	0.048	0.082
MIN.	0.002	0.007
AVE	0.021	0.019

Moisture resistance n=15

Condition: MIL-STD-202, Method 106(3)

Limit: ± (0.40%+0.01Ω)

J2050/J401-2012



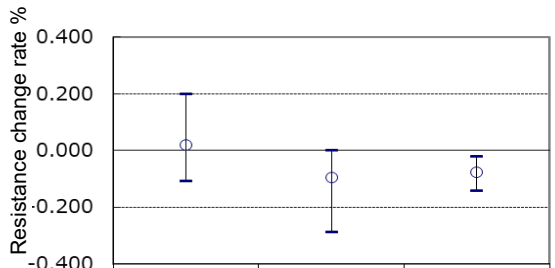
	10R0	1003
MAX.	0.100	0.006
MIN.	-0.279	-0.170
AVE	-0.021	-0.054

Moisture resistance n=10

Condition: MIL-STD-202, Method 106(3)

Limit: ± (0.40%+0.01Ω)

J2050/J401-3216



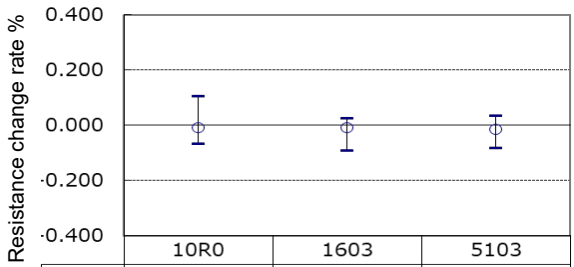
	10R0	1803	3003
MAX.	0.199	0.000	-0.020
MIN.	-0.107	-0.288	-0.143
AVE	0.018	-0.095	-0.076

Moisture resistance n=10

Condition: MIL-STD-202, Method 106(3)

Limit: ± (0.40%+0.01Ω)

J2050/J401-3225



	10R0	1603	5103
MAX.	0.105	0.026	0.035
MIN.	-0.068	-0.093	-0.082
AVE	-0.010	-0.010	-0.016

Note (3): The subcycle of step 7b and loading voltage are not applicable. The subcycle of step 7a applies the first 5 cycles.

Resistance to solvents n=10

Condition 1: 2-propanol

Condition 2: Water (42 parts by volume),
propylene glycol methyl ether (1 part),
monoethanolamine (1 part)

Acceptance criteria: There shall be no damage.
Marking shall be clearly legible.

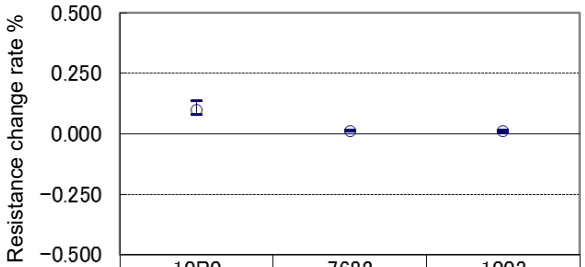
	Condition 1	Condition 2
J2050/J401-1005	No defect	No defect
J2050/J401-1608	No defect	No defect
J2050/J401-2012	No defect	No defect
J2050/J401-3216	No defect	No defect
J2050/J401-3225	No defect	No defect

Stability n=10

Condition: 125˚C-without load, 2000H

Limit: ± (0.50%+0.01Ω)

J2050/J401-1005



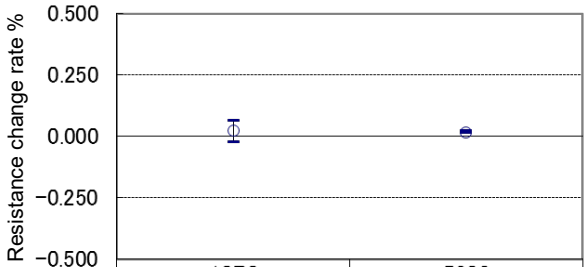
	10R0	7682	1003
− MAX.	0.136	0.016	0.014
− MIN.	0.082	0.010	0.008
○ AVE	0.100	0.013	0.012

Stability n=15

Condition: 125˚C-without load, 2000H

Limit: ± (0.50%+0.01Ω)

J2050/J401-1608



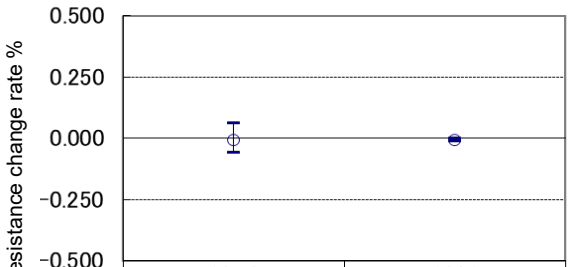
	10R0	5902
− MAX.	0.067	0.023
− MIN.	−0.023	0.015
○ AVE	0.022	0.018

Stability n=15

Condition: 125˚C-without load, 2000H

Limit: ± (0.50%+0.01Ω)

J2050/J401-2012



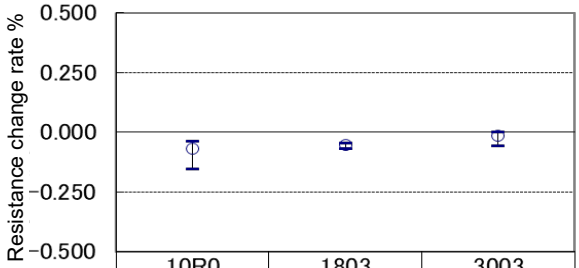
	10R0	1003
− MAX.	0.063	0.002
− MIN.	−0.057	−0.013
○ AVE	−0.009	−0.006

Stability n=10

Condition: 125˚C-without load, 2000H

Limit: ± (0.50%+0.01Ω)

J2050/J401-3216



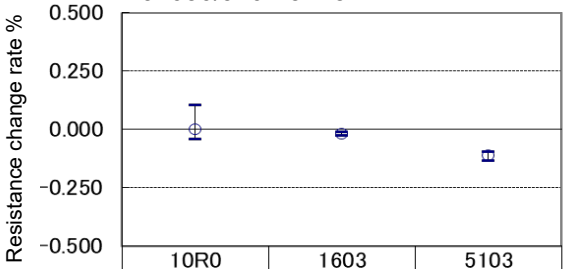
	10R0	1803	3003
− MAX.	−0.038	−0.045	0.000
− MIN.	−0.155	−0.068	−0.058
○ AVE	−0.068	−0.054	−0.015

Stability n=10

Condition: 125˚C-without load, 2000H

Limit: ± (0.50%+0.01Ω)

J2050/J401-3225



	10R0	1603	5103
− MAX.	0.106	−0.011	−0.096
− MIN.	−0.041	−0.027	−0.135
○ AVE	0.002	−0.018	−0.112

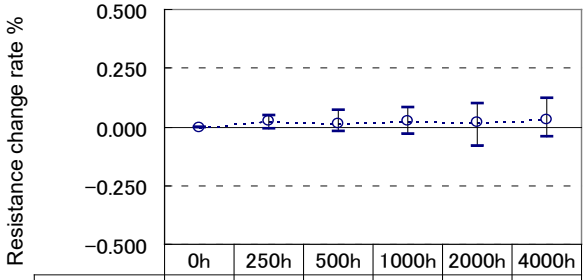
4.3 Outgassing

Outgassing test result of protective coating (epoxy type)

Item	Requirement	Measurement result (%)
Total Mass Loss (TML)	1.0% max.	0.368 to 0.410
Collectable Volatile Condensable Materials (CVCM)	0.1% max.	0.001 to 0.002
Water Vapor Regained (WVR)	-	0.215 to 0.230

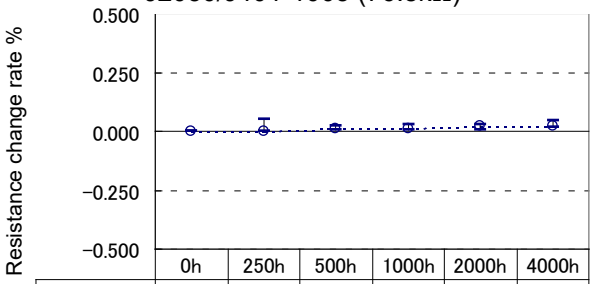
5. CHARACTERISTIC UNDER VARIOUS OPERATING CONDITIONS

Life n=77
Condition: 85˚C-rated voltage, 4000H
Limit: ± (0.50%+0.01Ω)
J2050/J401-1005 (10.0Ω)



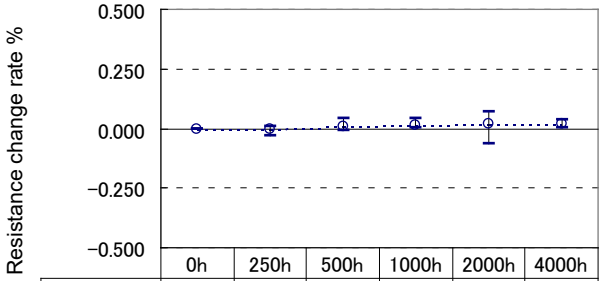
	0h	250h	500h	1000h	2000h	4000h
MAX.	0.000	0.050	0.070	0.080	0.100	0.12
MIN.	0.000	−0.010	−0.020	−0.030	−0.080	−0.04
AVE	0.000	0.023	0.015	0.028	0.019	0.03

Life n=77
Condition: 85˚C- rated voltage, 4000H
Limit: ± (0.50%+0.01Ω)
J2050/J401-1005 (76.8kΩ)



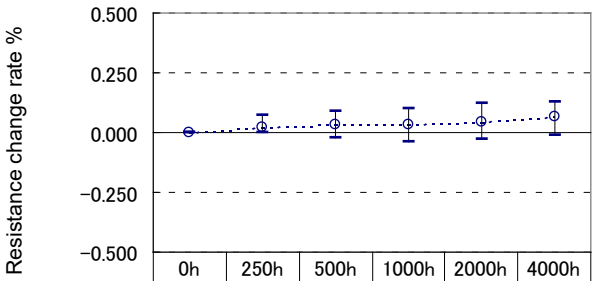
	0h	250h	500h	1000h	2000h	4000h
MAX.	0.000	0.050	0.022	0.026	0.030	0.044
MIN.	0.000	−0.001	0.005	0.007	0.008	0.016
AVE	0.000	0.002	0.011	0.014	0.022	0.022

Life n=77
Condition: 85˚C-rated voltage, 4000H
Limit: ± (0.50%+0.01Ω)
J2050/J401-1005 (100kΩ)



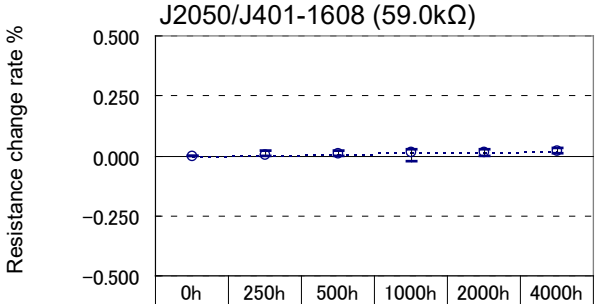
	0h	250h	500h	1000h	2000h	4000h
MAX.	0.000	0.007	0.040	0.044	0.069	0.037
MIN.	0.000	−0.029	−0.006	0.002	−0.064	0.002
AVE	0.000	0.000	0.011	0.014	0.022	0.021

Life n=116
Condition: 85˚C- rated voltage, 4000H
Limit: ± (0.50%+0.01Ω)
J2050/J401-1608 (10.0Ω)



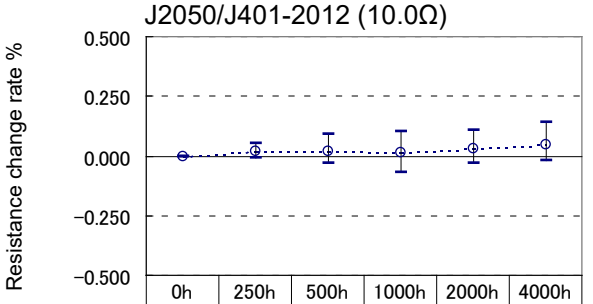
	0h	250h	500h	1000h	2000h	4000h
MAX.	0.000	0.070	0.090	0.100	0.120	0.130
MIN.	0.000	0.000	−0.020	−0.040	−0.030	−0.010
AVE	0.000	0.023	0.036	0.036	0.044	0.067

Life n=116
Condition: 85˚C-rated voltage, 4000H
Limit: ± (0.50%+0.01Ω)
J2050/J401-1608 (59.0kΩ)



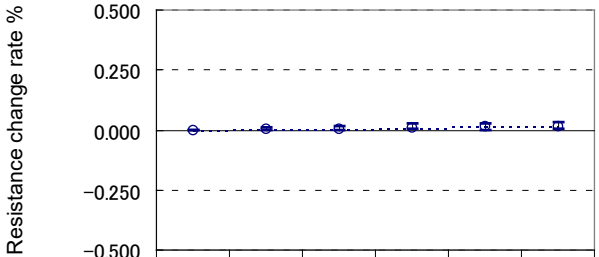
	0h	250h	500h	1000h	2000h	4000h
MAX.	0.000	0.017	0.017	0.024	0.027	0.031
MIN.	0.000	−0.003	−0.002	−0.027	−0.002	0.007
AVE	0.000	0.003	0.006	0.013	0.014	0.017

Life n=116
Condition: 85˚C- rated voltage, 4000H
Limit: ± (0.50%+0.01Ω)
J2050/J401-2012 (10.0Ω)



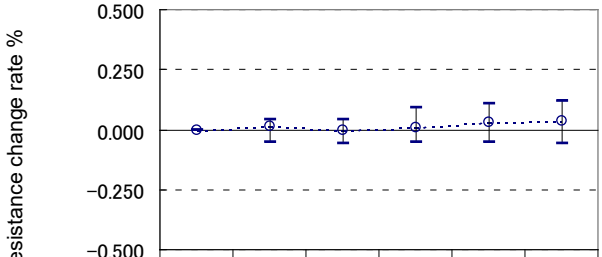
	0h	250h	500h	1000h	2000h	4000h
MAX.	0.000	0.050	0.090	0.100	0.110	0.140
MIN.	0.000	−0.010	−0.030	−0.070	−0.030	−0.020
AVE	0.000	0.017	0.019	0.012	0.029	0.048

Life n=116
Condition: 85˚C-rated voltage, 4000H
Limit: ± (0.50%+0.01Ω)
J2050/J401-2012 (100kΩ)



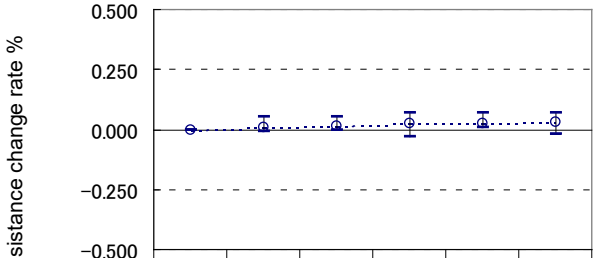
	0h	250h	500h	1000h	2000h	4000h
MAX.	0.000	0.011	0.014	0.023	0.024	0.028
MIN.	0.000	−0.001	−0.001	0.001	−0.003	0.002
AVE	0.000	0.002	0.005	0.011	0.013	0.016

Life n=77
Condition: 85˚C- rated voltage, 4000H
Limit: ± (0.50%+0.01Ω)
J2050/J401-3216 (10.0Ω)



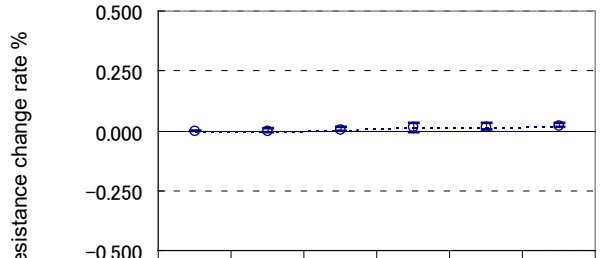
	0h	250h	500h	1000h	2000h	4000h
MAX.	0.000	0.040	0.040	0.090	0.110	0.120
MIN.	0.000	−0.050	−0.060	−0.050	−0.050	−0.060
AVE	0.000	0.013	0.000	0.010	0.028	0.036

Life n=77
Condition: 85˚C-rated voltage, 4000H
Limit: ± (0.50%+0.01Ω)
J2050/J401-3216 (180kΩ)



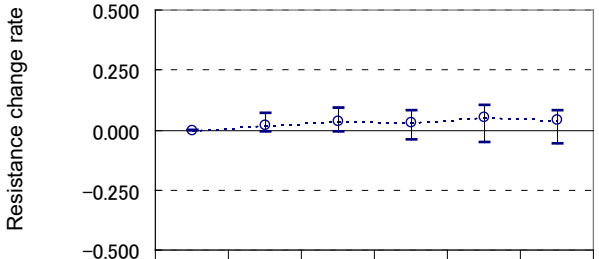
	0h	250h	500h	1000h	2000h	4000h
MAX.	0.000	0.050	0.050	0.067	0.067	0.067
MIN.	0.000	−0.006	0.000	−0.028	0.006	−0.017
AVE	0.000	0.007	0.016	0.025	0.026	0.029

Life n=77
Condition: 85˚C- rated voltage, 4000H
Limit: ± (0.50%+0.01Ω)
J2050/J401-3216 (300kΩ)



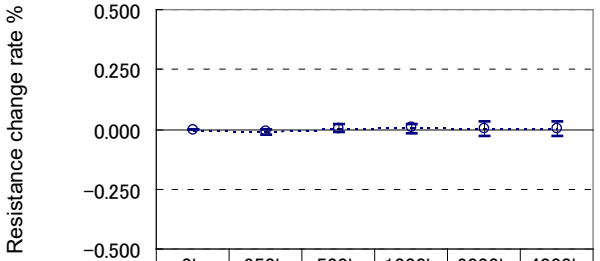
	0h	250h	500h	1000h	2000h	4000h
MAX.	0.000	0.007	0.013	0.033	0.030	0.030
MIN.	0.000	−0.007	0.000	−0.007	0.003	0.013
AVE	0.000	−0.002	0.005	0.014	0.014	0.018

Life n=77
Condition: 85˚C-rated voltage, 4000H
Limit: ± (0.50%+0.01Ω)
J2050/J401-3225 (10.0kΩ)



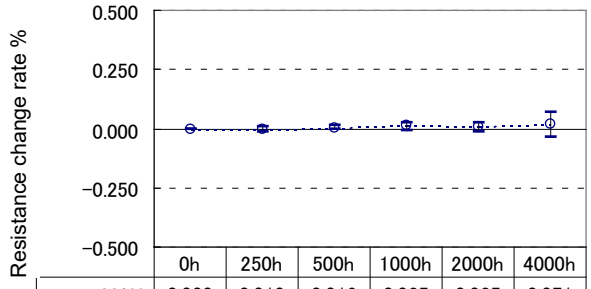
	0h	250h	500h	1000h	2000h	4000h
MAX.	0.000	0.070	0.090	0.080	0.100	0.080
MIN.	0.000	−0.010	−0.010	−0.040	−0.050	−0.060
AVE	0.000	0.017	0.034	0.032	0.052	0.041

Life n=77
Condition: 85˚C- rated voltage, 4000H
Limit: ± (0.50%+0.01Ω)
J2050/J401-3225 (160kΩ)



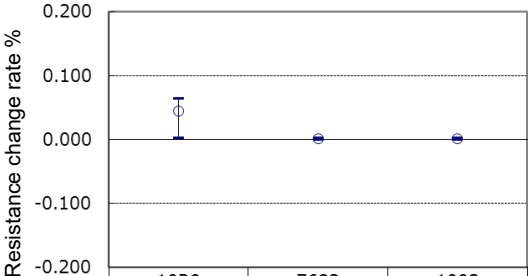
	0h	250h	500h	1000h	2000h	4000h
MAX.	0.000	0.000	0.019	0.019	0.031	0.031
MIN.	0.000	−0.025	−0.012	−0.019	−0.031	−0.031
AVE	0.000	−0.008	0.003	0.006	0.001	0.004

Life n=77
Condition: 85˚C-rated voltage, 4000H
Limit: ± (0.50%+0.01Ω)
J2050/J401-3225 (510kΩ)



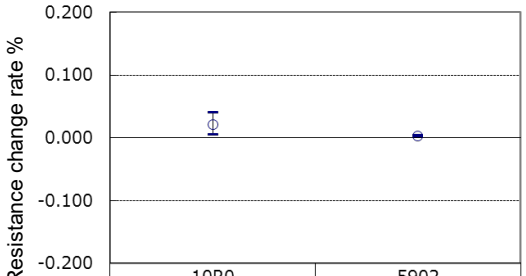
	0h	250h	500h	1000h	2000h	4000h
MAX.	0.000	0.010	0.016	0.025	0.025	0.071
MIN.	0.000	−0.012	0.000	−0.006	−0.016	−0.035
AVE	0.000	−0.002	0.005	0.014	0.010	0.018

Short-time overload n=10
Condition: Rated voltage x 2.5-5sec
Limit: ± (0.20%+0.01Ω)
J2050/J401-1005



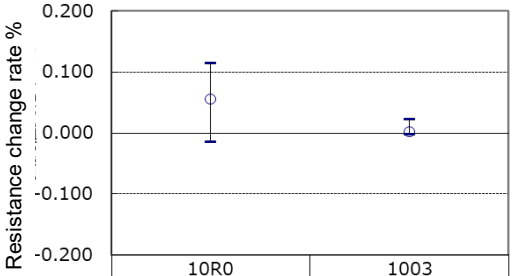
	10R0	7682	1003
MAX.	0.064	0.002	0.002
MIN.	0.002	0.000	0.000
AVE	0.045	0.001	0.001

Short-time overload n=15
Condition: Rated voltage x 2.5-5sec
Limit: ± (0.20%+0.01Ω)
J2050/J401-1608



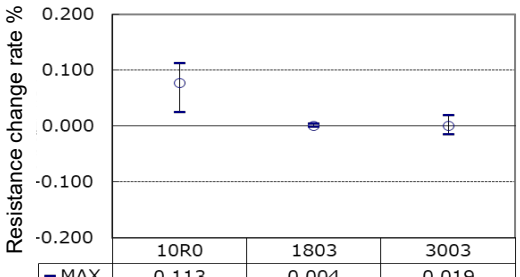
	10R0	5902
MAX.	0.041	0.004
MIN.	0.005	0.003
AVE	0.021	0.003

Short-time overload n=15
Condition: Rated voltage x 2.5-5sec
Limit: ± (0.20%+0.01Ω)
J2050/J401-2012



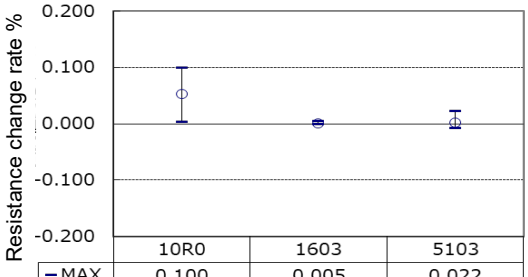
	10R0	1003
MAX.	0.114	0.022
MIN.	-0.014	-0.002
AVE	0.055	0.002

Short-time overload n=10
Condition: Rated voltage x 2.5-5sec
Limit: ± (0.20%+0.01Ω)
J2050/J401-3216



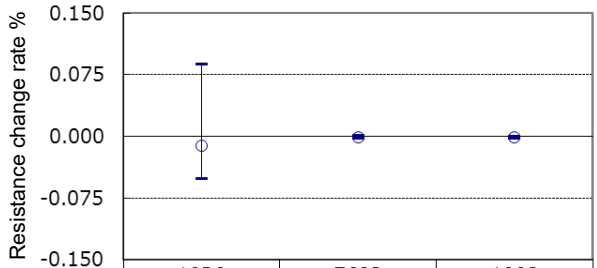
	10R0	1803	3003
MAX.	0.113	0.004	0.019
MIN.	0.025	-0.001	-0.014
AVE	0.077	0.001	0.000

Short-time overload n=10
Condition: Rated voltage x 2.5-5sec
Limit: ± (0.20%+0.01Ω)
J2050/J401-3225



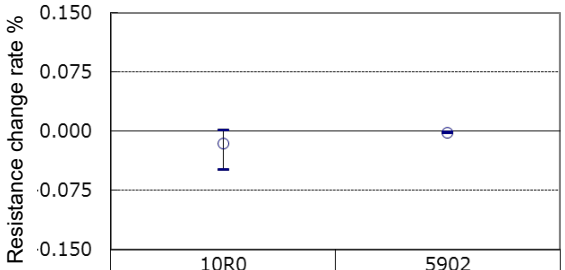
	10R0	1603	5103
MAX.	0.100	0.005	0.022
MIN.	0.003	-0.001	-0.008
AVE	0.053	0.001	0.002

Low-temperature operation n=10
Condition: -55˚C-1Hr→rated voltage for 45min
Limit: ± (0.15%+0.01Ω)
J2050/J401-1005



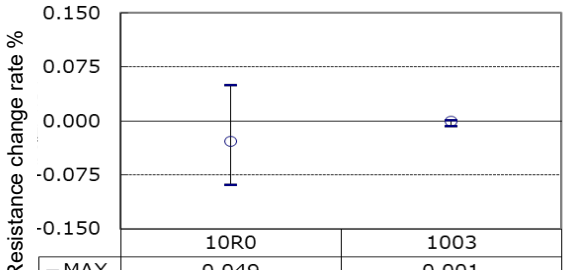
	10R0	7682	1003
– MAX.	0.088	0.001	0.000
– MIN.	-0.051	-0.002	-0.002
○ AVE	-0.011	-0.001	-0.001

Low-temperature operation n=15
Condition: -55˚C-1H→rated voltage for 45min
Limit: ± (0.15%+0.01Ω)
J2050/J401-1608



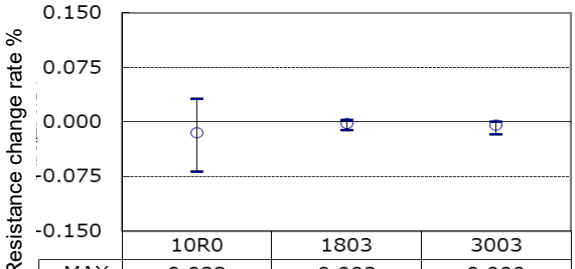
	10R0	5902
– MAX.	0.001	-0.001
– MIN.	-0.049	-0.002
○ AVE	-0.016	-0.002

Low-temperature operation n=15
Condition: -55˚C-1Hr→rated voltage for 45min
Limit: ± (0.15%+0.01Ω)
J2050/J401-2012



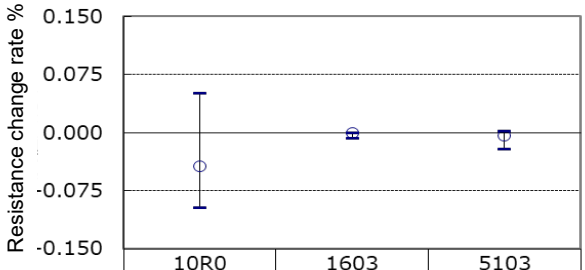
	10R0	1003
– MAX.	0.049	0.001
– MIN.	-0.089	-0.007
○ AVE	-0.028	-0.001

Low-temperature operation n=10
Condition: -55˚C-1Hr→rated voltage for 45min
Limit: ± (0.15%+0.01Ω)
J2050/J401-3216



	10R0	1803	3003
– MAX.	0.032	0.003	0.000
– MIN.	-0.068	-0.011	-0.017
○ AVE	-0.015	-0.002	-0.005

Low-temperature operation n=10
Condition: -55˚C-1Hr→rated voltage for 45min
Limit: ± (0.15%+0.01Ω)
J2050/J401-3225



	10R0	1603	5103
– MAX.	0.051	0.000	0.002
– MIN.	-0.097	-0.007	-0.021
○ AVE	-0.044	-0.001	-0.004

Accelerated life test

In this requalification test, life test was performed using acceleration test in which the life is accelerated by the ambient temperature. The calculation for acceleration factor and the test results are as follows:

(Calculation for acceleration factor due to temperature increase)
Based on the environment condition at 85 °C specified in paragraph J.3.10.1, Appendix J of JAXA-QTS-2050, the temperature acceleration factor for the environment at 125 °C calculated by using Arrhenius model was 12.26 and thus the testing duration calculated for 125°C was 326 hours while the testing duration for the above test method was 4000 hours.
Based on the above results, the actual requalification test was performed for 1000 hours.

Arrhenius equation

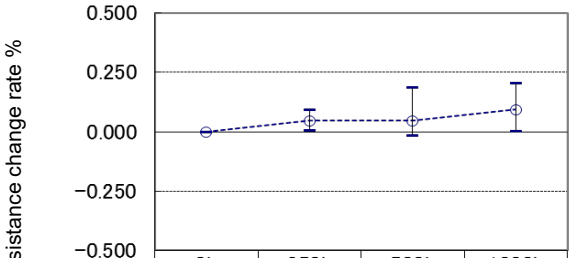
$$A_T = e^{\left[\left(\frac{EA}{k}\right) \times \left(\frac{1}{T1} - \frac{1}{T2}\right)\right]}$$

$$= \underline{12.26}$$

EA=Activation energy: 0.77
K=Boltzmann constant=8.617 x 10^{-5}eV/K
T1=Temperature at reference state (85°C)
T2=Temperature at test (125°C)
At=Temperature acceleration factor

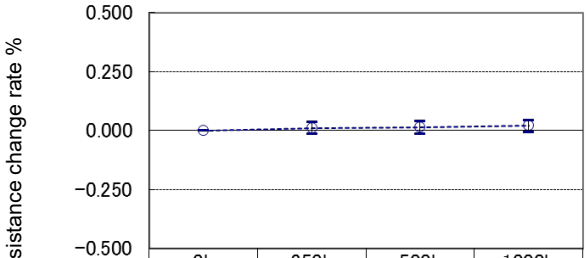
$e \fallingdotseq 2.72$

Life (Acceleration test) n=77
Condition: 125˚C-rated voltage, 1000H
Limit: ± (0.50%+0.01Ω)
J2050/J401-1005 (10.0Ω)



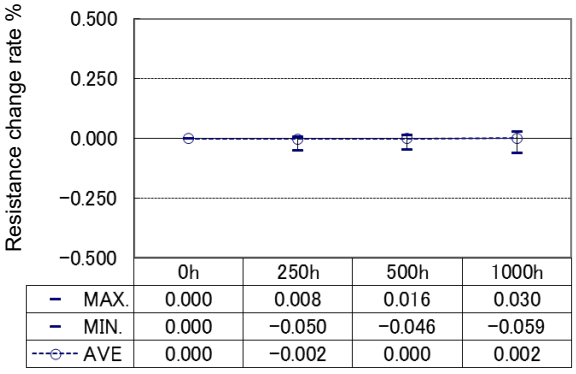
	0h	250h	500h	1000h
MAX.	0.000	0.091	0.187	0.203
MIN.	0.000	0.006	−0.015	0.003
AVE	0.000	0.047	0.046	0.093

Life (Acceleration test) n=77
Condition: 125˚C-rated voltage, 1000H
Limit: ± (0.50%+0.01Ω)
J2050/J401-1005 (76.8kΩ)



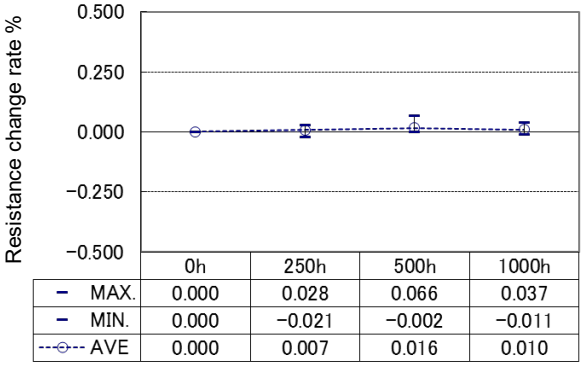
	0h	250h	500h	1000h
MAX.	0.000	0.036	0.039	0.046
MIN.	0.000	−0.014	−0.012	−0.006
AVE	0.000	0.011	0.015	0.021

Life (Acceleration test) n=77
Condition: 125˚C-rated voltage, 1000H
Limit: ± (0.50%+0.01Ω)
J2050/J401-1005 (100kΩ)



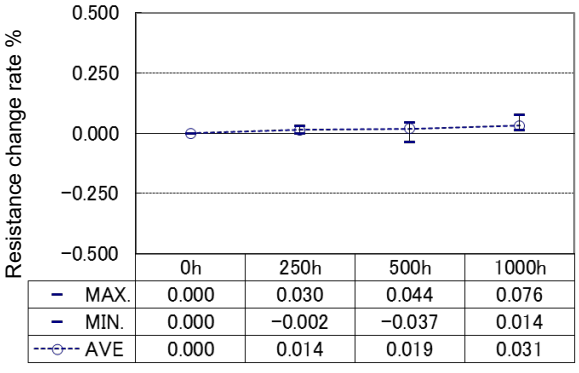
	0h	250h	500h	1000h
MAX.	0.000	0.008	0.016	0.030
MIN.	0.000	−0.050	−0.046	−0.059
AVE	0.000	−0.002	0.000	0.002

Life (Acceleration test) n=115
Condition: 125˚C-rated voltage, 1000H
Limit: ± (0.50%+0.01Ω)
J2050/J401-1608 (10.0Ω)



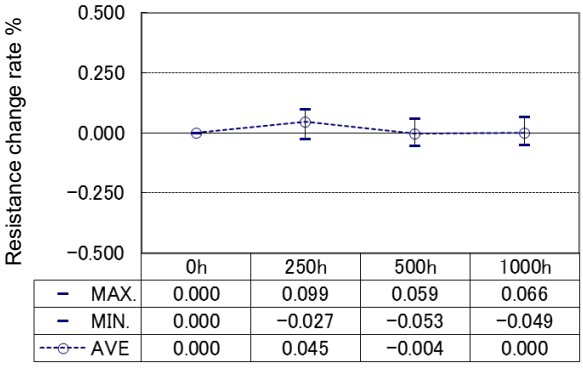
	0h	250h	500h	1000h
MAX.	0.000	0.028	0.066	0.037
MIN.	0.000	−0.021	−0.002	−0.011
AVE	0.000	0.007	0.016	0.010

Life (Acceleration test) n=116
Condition: 125˚C-rated voltage, 1000H
Limit: ± (0.50%+0.01Ω)
J2050/J401-1608 (59.0kΩ)



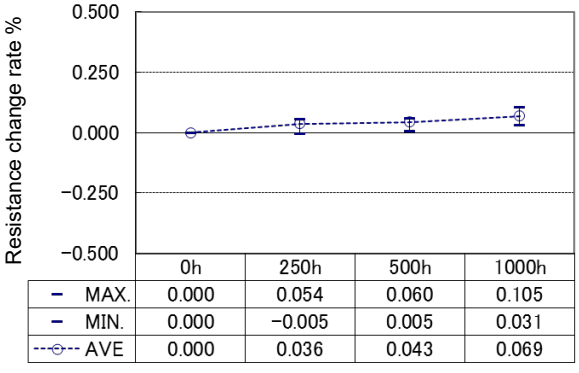
	0h	250h	500h	1000h
MAX.	0.000	0.030	0.044	0.076
MIN.	0.000	−0.002	−0.037	0.014
AVE	0.000	0.014	0.019	0.031

Life (Acceleration test) n=115
Condition: 125˚C-rated voltage, 1000H
Limit: ± (0.50%+0.01Ω)
J2050/J401-2012 (10.0Ω)



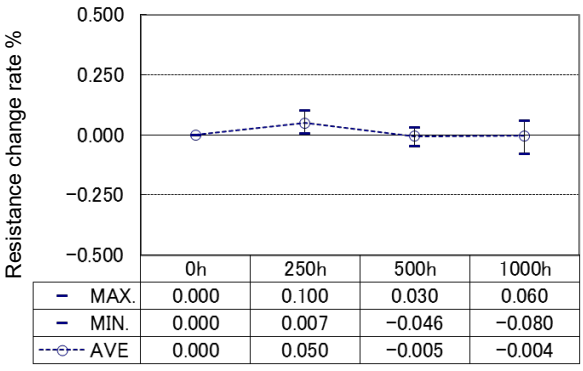
	0h	250h	500h	1000h
MAX.	0.000	0.099	0.059	0.066
MIN.	0.000	−0.027	−0.053	−0.049
AVE	0.000	0.045	−0.004	0.000

Life (Acceleration test) n=116
Condition: 125˚C-rated voltage, 1000H
Limit: ± (0.50%+0.01Ω)
J2050/J401-2012 (100kΩ)



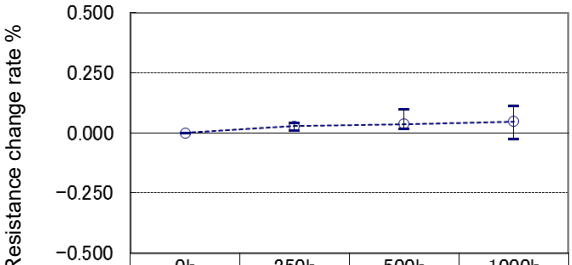
	0h	250h	500h	1000h
MAX.	0.000	0.054	0.060	0.105
MIN.	0.000	−0.005	0.005	0.031
AVE	0.000	0.036	0.043	0.069

Life (Acceleration test) n=77
Condition: 125˚C-rated voltage, 1000H
Limit: ± (0.50%+0.01Ω)
J2050/J401-3216 (10.0Ω)



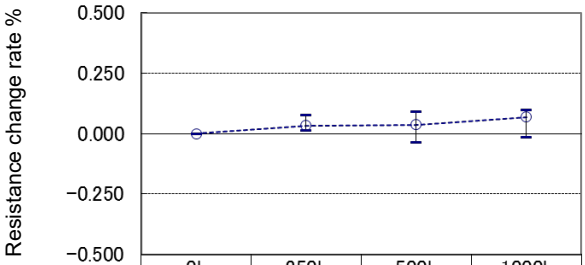
	0h	250h	500h	1000h
MAX.	0.000	0.100	0.030	0.060
MIN.	0.000	0.007	−0.046	−0.080
AVE	0.000	0.050	−0.005	−0.004

Life (Acceleration test) n=77
Condition: 125˚C-rated voltage, 1000H
Limit: ± (0.50%+0.01Ω)
J2050/J401-3216 (180kΩ)



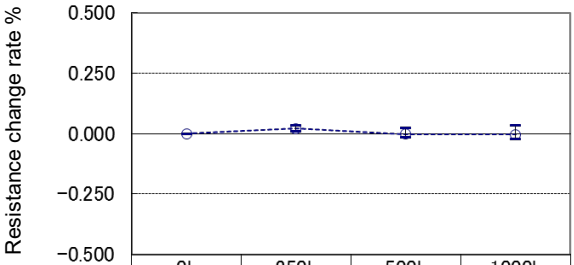
	0h	250h	500h	1000h
MAX.	0.000	0.040	0.099	0.113
MIN.	0.000	0.008	0.016	−0.026
AVE	0.000	0.028	0.037	0.047

Life (Acceleration test) n=77
Condition: 125˚C-rated voltage, 1000H
Limit: ± (0.50%+0.01Ω)
J2050/J401-3216 (300kΩ)



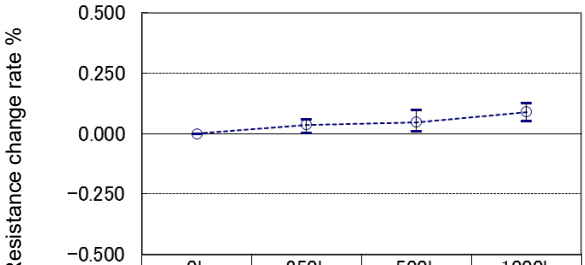
	0h	250h	500h	1000h
MAX.	0.000	0.076	0.091	0.097
MIN.	0.000	0.013	−0.036	−0.014
AVE	0.000	0.033	0.037	0.069

Life (Acceleration test) n=77
Condition: 125˚C-rated voltage, 1000H
Limit: ± (0.50%+0.01Ω)
J2050/J401-3225 (10.0Ω)



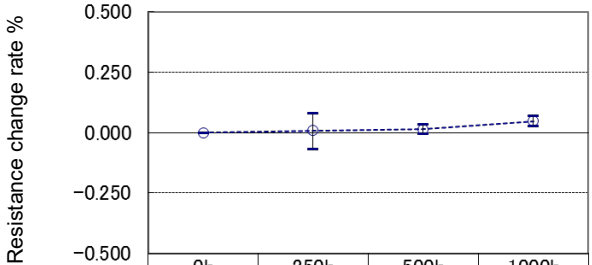
	0h	250h	500h	1000h
MAX.	0.000	0.033	0.022	0.035
MIN.	0.000	0.010	−0.015	−0.022
AVE	0.000	0.021	−0.002	−0.003

Life (Acceleration test) n=77
Condition: 125˚C-rated voltage, 1000H
Limit: ± (0.50%+0.01Ω)
J2050/J401-3225 (160kΩ)



	0h	250h	500h	1000h
MAX.	0.000	0.060	0.099	0.127
MIN.	0.000	0.002	0.009	0.052
AVE	0.000	0.037	0.048	0.089

Life (Acceleration test) n=77
Condition: 125˚C-rated voltage, 1000H
Limit: ± (0.50%+0.01Ω)
J2050/J401-3225 (510kΩ)



	0h	250h	500h	1000h
MAX.	0.000	0.080	0.034	0.068
MIN.	0.000	−0.070	−0.006	0.028
AVE	0.000	0.008	0.014	0.048

6. RELIABILITY

6.1 Failure Rate

6.1.1 Failure Rate of Qualified Parts

The failure rate of this product was calculated based on the whole data from life test (4000Hr) performed as a part of qualification test.

Part name	Average rate of change (1)	Failure rate (2)	Failure rate level (3)
J2050/J401-XXXX	0.03%	0.020%/1000h	P

(1) Average resistance change rate of 4,000 hour life test performed on 13 items (1157 samples in total).
(2) Failure rate (λ) = 0.917/total test time @reliability level :60% @85˚C
(3) Referenced to the failure rate specified in JIS C 5003.

6.1.2 Failure Rate Field Data of General-Purpose Parts (reference)

The filed failure rate of general-purpose resistor (RN73) which has identical structure and design to this product is as follows.

Part name	No. of failure	Total component hour (1)	Failure rare (2)
RN73 series	0	21.494×10^{12}	0.000043 fit

(1) Delivery record: Calculated from the total number of deliveries since 2005. Operating time was calculated on assumption that the product operated 4 hours per day and 23 days per month for 5 years.
(2) When the number of failure is 0, the failure rate is calculated by dividing 0.917 by total component hour in accordance with JIS C 5003.

6.2 Possible Failure Modes

Failure mode	Occurrence rate
Open-circuit and resistance increase	80%
Short-circuit and resistance decrease	20%

7. STORAGE CONDITIONS

Resistors shall be kept in delivery package for storage. Storage period shall be within 12 months at 5 to 35˚C/35 to 75%RH. Use caution to avoid dew condensation or exposure to harmful gas (hydrogen sulfide, nitrous acid gas, hydrogen chloride etc.) and dust as it may degrade the solderability of resistors.

8. NOTES

When heat-resistant masking tape is attached to and peeled off of the chip resistor, the upper electrode may detach. It is confirmed that the bonding strength of the tape adhesive increases

due to the heat during mounting the product in particular. Therefore, refrain from using heat-resistant masking tape, or if such tapes are needed to be used, use a method in which the tape adhesive does not come into direct contact with the product.
After mounting the product, the cleaning methods, which put stress on the product, such as brushing and high pressure shower should be avoided due to possible detachment of the upper electrode. However, if such cleaning methods are necessary, they should be evaluated prior to use.

9. OTHERS

The contact information on this data sheet is as follows:

Manufacturer: SANADA KOA Corporation
Address: 4-5 Yazaki-cho, Fuchu, Tokyo, 183-0025, Japan
Telephone: +81-42-364-8321
Fax: +81-42-366-0411

Appended Table: Nominal Resistance Range

Style	Temperature characteristics ($\times 10^{-6}$ / °C)	Nominal resistance range (Ω)		
		B (±0.1%)	D (±0.5%)	F (±1.0%)
1005	Y (±10)	100 to 10k	100 to 10k	100 to 10k
	E (±25)	100 to 100k	51 to 100k	51 to 100k
	H (±50)	100 to 100k	10 to 100k	10 to 100k
1608	A (±5)	100 to 47k	—	—
	Y (±10)	100 to 59k	100 to 59k	100 to 59k
	E (±25)	15 to 59k	10 to 59k	10 to 59k
	H (±50)	15 to 59k	10 to 59k	10 to 59k
2012	A (±5)	100 to 100k	—	—
	Y (±10)	100 to 100k	100 to 100k	100 to 100k
	E (±25)	15 to 100k	10 to 100k	10 to 100k
	H (±50)	15 to 100k	10 to 100k	10 to 100k
3216	A (±5)	100 to 300k	—	—
	Y (±10)	100 to 300k	100 to 300k	100 to 300k
	E (±25)	15 to 300k	10 to 300k	10 to 300k
	H (±50)	15 to 300k	10 to 300k	10 to 300k
3225	Y (±10)	100 to 510k	100 to 510k	100 to 510k
	E (±25)	15 to 510k	10 to 510k	10 to 510k
	H (±50)	15 to 510k	10 to 510k	10 to 510k