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Superseding
JAXA-QTS-2050/J401
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5 December 2023

RESISTORS, CHIP, FIXED, METAL FILM, HIGH RELIABILITY, SPACE USE, DETAIL SPECIFICATION FOR

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.

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Record of revisions		
Rev.	Date	Description
NC	19 Nov. 2010	Original
A	5 Dec. 2023	Reflected the change of document by SANADA KOA Corporation. Document No: P-CEBA-0216 (Rev. A)
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Revision history		
Rev.	Date	Description
NC	19 Nov. 2010	Original
A	5 Dec. 2023	1. Changed the name of the corporations on the cover page. (1) Changed the corporate name of "Prepared and Established" from "Tama Electric Industry Co., Ltd" to "SANADA KOA Corporation". (2) Changed the name of "Issued" from "Japan Aerospace Exploration Agency, Independent Administrative Agency" to "Japan Aerospace Exploration Agency, National Research and Development Agency". (For Japanese version only.) 2. Incorporated the changes of JAXA-QTS-2050G dated on 21 February 2023 (1) Reflected the requirement of "Resistance to soldering heat" moved from the detail specifications to appendix J of JAXA-QTS-2050. ・ Deleted the paragraphs 3.1.1 and 4.4.1 from the table of contents. ・ Deleted the paragraphs 3.1.1 and 4.4.1 from the main body. ・ Changed the requirement paragraph number in Table 4 (from 3.1.1 to J.3.8.5) ・ Changed the requirement paragraph number in Table 9 (from 3.1.1 to J.3.8.5) ・ Changed the test method paragraph number in Table 9 (4.4.1 to J.4.4.6.5) ・ Added "Resistance to soldering heat" to order 1 of subgroup 1 of group 1 in Table 11 (Moisture resistance has been moved to order 2 of subgroup 1 of group 1 in Table 11). (2) Reflected the change of item name from "External, dimensions and marking" to "Externals, dimensions, mass and marking." ・ Revised the item name from "External, dimensions and marking" to "Externals, dimensions, mass and marking" in Table 4, Table 9, and Table 10. ・ Added note (3) consisted of “To be conducted prior to group B inspection, inspection shall be performed only at the time of group A inspection.” in Table 10. (3) Reflected that the reduced pressure of dielectric withstanding voltage applied only to qualification test. ・ Revised the item name from "Dielectric withstanding voltage" to "Dielectric withstanding voltage (atmospheric pressure)" in Table 10. Revised the test method paragraph number referred to dielectric withstanding voltage (at sea level) in Table 10 (from J.4.4.5.4 to J.4.4.5.4.1). (4) Deleted the requirements of "Shock" and "Random vibration". ・ Deleted those items from environmental performances in Table 4. ・ Changed the test items in order 2 of group VII and order 1 of group VIII in Table 9. ・ Changed the test items in order 1 of subgroup 1 of group C1, and order 1 of subgroup 2 of group C1 in Table 12.

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Revision history		
Rev.	Date	Description
		(5) Aligned the requirements for AQL specified in Table 9 (qualification test) and Table 10 (quality conformance inspection (group A)) regarding the sample size of weight inspection. ・ Added note (4) in Table 10. 3. Corrected errors (1) Revised the item name from "External" to "External inspection" in Table 8. (2) Revised the requirement paragraph number of "Solderability" in Table 10 (from J.3.7.1.2 to J.3.8.1). (3) Revised the test method paragraph number of "Solderability" in Table 10 (from J.4.4.6.1.2 to J.4.4.6.1). (4) Revised the requirement paragraph number for "Adhesion" in Table 10 (from 3.7.2 to J.3.8.2).

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RESISTORS, CHIP, FIXED, METAL FILM,
HIGH RELIABILITY, SPACE USE,
DETAIL SPECIFICATION FOR

1. GENERAL

1.1 Scope

This specification establishes the detailed requirements for JAXA-QTS-2050 appendix J, the space use, high reliability, metal film fixed chip resistors (hereinafter referred to as "resistors") 1005, 1608, 2012, 3216 and 3225 types.

1.2 Part Number

The part shall be indicated as follows. Refer to Table 1 for details.

Example:

JAXA[(1)] 2050/J 401 – 1608 A 1002 B B Z

401	1608	A	1002	B	B	Z
Designation number	Style	Characteristic	Nominal resistance	Resistance tolerance	Terminal structure	Screening option

Note: “JAXA” indicates that the part is for space use and may be abbreviated “J.”

Table 1. Part Number

Item	Applicable provision of JAXA-QTS-2050	Description
Style	J.1.3.1	1005, 1608, 2012, 3216, 3225
Characteristics	J.1.3.2	A: ±5 (x 10^{-6}/°C) for -55°C to +125°C Y: ±10 (x 10^{-6}/°C) for -55°C to +125°C E: ±25 (x 10^{-6}/°C) for -55°C to +125°C H: ±50 (x 10^{-6}/°C) for -55°C to +125°C
Nominal resistance	J.1.3.3	(e.g.) 1002⋯10kΩ (identified by 4-digit number)
Resistance tolerance	J.1.3.4	B: (±0.1%), D: (±0.5%), F: (±1.0%)
Electrode structure	J.1.3.5	B: Solder plating over the underlying metal barrier (Sn-Pb alloy containing 3wt% or more Pb)
Screening options	J.1.3.6	A: Power conditioning A (85°C, rated voltage, 168H) B: Power conditioning B (85°C, rated power x 1.5, 100H) Z: Not applicable

1.3 Ratings

Ratings shall be as specified in Table 2.

Table 2. Ratings

Item	Requirement paragraph of JAXA-QTS-2050	Description				
		1005	1608	2012	3216	3225
Operating temperature range (°C)	J.3.6	-55 to +125				
Rated ambient temperature (°C)	J.3.6	85				
Derating curve	J.3.6	As specified in Figure 1.				
Nominal resistance range (Ω)	-	As specified in Table 3.				
Critical resistance (Ω)	-	76.8k	-	100k	180k	160k
Rated voltage (V)	J.3.6	Rated voltage = $\sqrt{}$(rated power x resistance) If the calculated value exceeds maximum operating voltage, the maximum operating voltage shall be regarded as rated voltage.				
Maximum operating voltage (V)	-	50	75	100	150	200
Maximum overload voltage (V)	-	75	150	200	300	400
Rated power (W)	J.3.6	0.032	0.05	0.10	0.125	0.25
Resistance temperature characteristics	J.1.3.2	As specified in Table 3.				

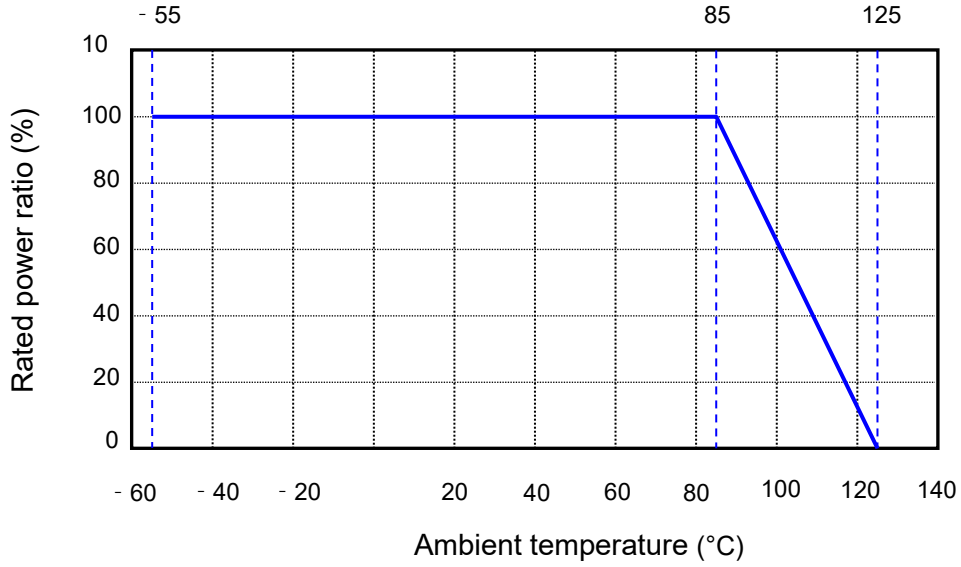

Figure 1. Derating Curve

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Table 3. Range of Nominal Resistance and Resistance – Temperature Characteristics

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

2. APPLICABLE DOCUMENTS

2.1 Applicable Documents

The applicable documents shall be as specified in paragraph 2.1 of JAXA-QTS-2050.

2.2 Reference Documents

The reference documents shall be as specified in paragraph J.2.2 of JAXA-QTS-2050 and as follows.

a) JIS C 5201-1 Fixed resistors for use in electronic equipment Part 1: Generic specification.

b) JIS C 5201-8 Fixed resistors for use in electronic equipment Part 8: Sectional specification: Fixed chip resistors

3. REQUIREMENTS

The requirements shall be as specified in paragraph J.3 of JAXA-QTS-2050 and as follows.

3.1 Performances

The performances are shown in Table 4.

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Table 4. Performance

Item		Requirement paragraph of JAXA-QTS-2050	Performance
Materials		J.3.2	As specified in appendix J of JAXA-QTS-2050.
	Base substrate	J.3.2.1	Alumina 96% as a minimum.
	Resistive element	J.3.2.3	Nickel chromium thin metal film
	Internal protective coating	J.3.2.4	Inorganic type
	Protective coating, marking	J.3.2.4	Resin type (epoxy)
	Internal electrodes	J.3.2.2	Chromium, nickel, copper metal thin film (front surface and rear surface) Nickel chromium thin metal film (side surface)
	Intermediate electrodes	J.3.2.2	Nickel plated
	External electrodes	J.3.2.2	Solder plated (Sn90 Pb10)
Externals, dimensions, mass and marking		J.3.4	As specified in appendix J of JAXA-QTS-2050.
	Externals	J.3.4.1	As specified in appendix J of JAXA-QTS-2050.
	Dimensions and mass	J.3.4.2	As specified in Table 7.
	Markings	J.3.4.3	As specified in appendix J of JAXA-QTS-2050.
Workmanship		J.3.5	As specified in appendix J of JAXA-QTS-2050.
Electrical performance		J.3.7	As specified in appendix J of JAXA-QTS-2050.
	Application of pulse	J.3.7.1	There shall be no evidence of arcing, insulation breakdown or mechanical damage.
	Resistance	J.3.7.2	Within specified tolerance.
	Resistance-temperature characteristics	J.3.7.3	Within specified tolerance.
	Dielectric withstanding voltage	J.3.7.4	ΔR% ± (0.15% + 0.01Ω)
	Insulation resistance	J.3.7.5	10,000MΩ as a minimum
	Short-time overload	J.3.7.6	ΔR% ± (0.20% + 0.01Ω)
	Power conditioning	J.3.7.7	ΔR% ± (0.05% + 0.01Ω)
Mechanical performance		J.3.8	As specified in appendix J of JAXA-QTS-2050.
	Solderability	J.3.8.1	95% or more shall be covered with fresh solder.
	Adhesion	J.3.8.2	There shall be no damage on the resistor.
	Board Bending	J.3.8.3	ΔR% ± (0.20% + 0.01Ω)
	Resistance to bonding exposure	J.3.8.4	ΔR% ± (0.20% + 0.01Ω)
	Resistance to soldering heat	J.3.8.5	ΔR% ± (0.10% + 0.01Ω)
Environmental performance		J.3.9	As specified in appendix J of JAXA-QTS-2050.
	Deleted	-	-
	Deleted	-	-
	Thermal shock [I]	J.3.9.3.1	There shall be no mechanical damage on the resistor.
	Thermal shock [II]	J.3.9.3.2	ΔR% ± (0.50% + 0.01Ω)
	Moisture resistance	J.3.9.4	ΔR% ± (0.40% + 0.01Ω)
	Resistance to solvents	J.3.9.5	As specified in appendix J of JAXA-QTS-2050.
	Low temperature operation	J.3.9.6	ΔR% ± (0.15% + 0.01Ω)
	Stability	J.3.9.7	ΔR% ± (0.50% + 0.01Ω)
			ΔR% ± (0.15% + 0.01Ω) of dielectric withstanding voltage.
			Insulation Resistance: 10,000MΩ min.
Durability performance		J.3.10	As specified in appendix J of JAXA-QTS-2050.
	Life	J.3.10.1	ΔR% change rate: ± (0.50% + 0.01Ω)

Table 5. Marking

Resistance tolerance	B (±0.1%), D (±0.5%), F (±1.0%)			
Nominal resistance series	E24 series and E96 series			
Number of digits marked	Series	1005	1608	2012, 3216, 3225
	E24	Not marked	3	4
	E96		Not marked	
Display color	The display color differs in accordance with resistance-temperature characteristics as shown below. A (±5 x 10^{-6}/ ˚C) : Red Y (±10 x 10^{-6}/ ˚C) : Red E (±25 x 10^{-6}/ ˚C) : Yellow H (±50 x 10^{-6}/ ˚C) : Yellow			
Display example	3-digit: “103, 4-digit: “1002”			

Table 6. Typical Nominal Resistance

E24 series	1.0	1.1	1.2	1.3	1.5	1.6	1.8	2.0	2.2	2.4	2.7	3.0
	3.3	3.6	3.9	4.3	4.7	5.1	5.6	6.2	6.8	7.5	8.2	9.1
E96 series	1.0	1.02	1.05	1.07	1.10	1.13	1.15	1.18	1.21	1.24	1.27	1.30
	1.33	1.37	1.40	1.43	1.47	1.50	1.54	1.58	1.62	1.65	1.69	1.74
	1.78	1.82	1.87	1.91	1.96	2.00	2.05	2.10	2.15	2.21	2.26	2.32
	2.37	2.43	2.49	2.55	2.61	2.67	2.74	2.80	2.87	2.94	3.01	3.09
	3.16	3.24	3.32	3.40	3.48	3.57	3.65	3.74	3.83	3.92	4.02	4.12
	4.22	4.32	4.42	4.53	4.64	4.75	4.87	4.99	5.11	5.23	5.36	5.49
	5.62	5.76	5.90	6.04	6.19	6.34	6.49	6.65	6.81	6.98	7.15	7.32
	7.50	7.68	7.87	8.06	8.25	8.45	8.66	8.87	9.09	9.31	9.53	9.76

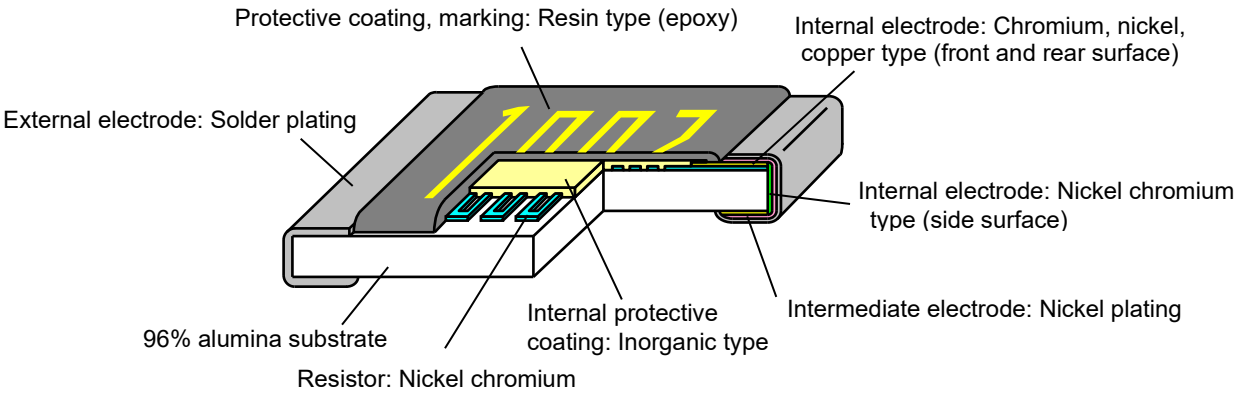

Figure 2. Construction

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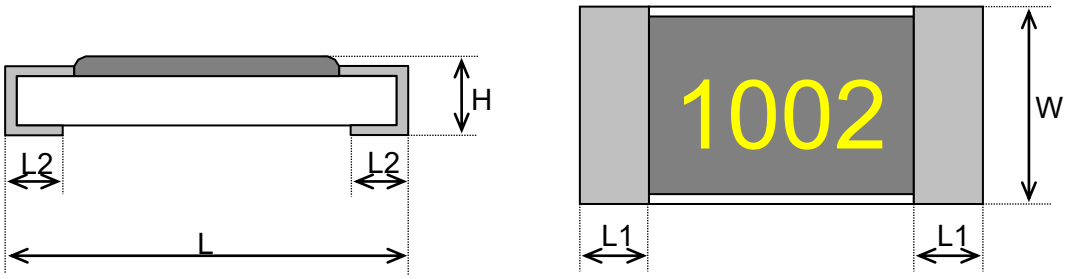
Table 7. Dimension and Mass



Style	L	W	H	L1	L2	Mass mg (ref.)
1005	1.0±0.1	0.5±0.05	0.35±0.05	0.2±0.1	0.25±0.1	0.68
1608	1.6±0.2	0.8±0.1	0.45±0.1	0.3±0.1	0.3±0.1	2.14
2012	2.0±0.2	1.25±0.2	0.5±0.1	0.4±0.2	0.3±0.2	4.54
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
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

4. QUALITY ASSURANCE PROVISIONS

The quality assurance provisions are as specified in paragraph J.4, appendix J of JAXA-QTS-2050 and as provided below.

4.1 In-Process Inspection

The in-process inspection shall be performed in accordance with paragraph J.4.1, appendix J of JAXA-QTS-2050. Specifically, inspection items specified in Table 8 shall be performed on each production lot.

4.2 Qualification Test

The qualification test shall be performed in accordance with paragraph J.4.2, appendix J of JAXA-QTS-2050 and as specified in Table 9.

Table 8. In-Process Inspection

Inspection			JAXA-QTS-2050		Pass/Fail (no. of pcs)	
No.	Order	Item	Requirement paragraph	Test method paragraph	No. of samples	No. of allowable defects
1	1	Application of pulse	J.3.7.1	J.4.4.5.1	All	Not applicable
2	1	Resistance	J.3.7.2	J.4.4.5.2	All	Not applicable
3	1	External inspection	J.3.4.1	J.4.4.3	All	Not applicable

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Table 9. Qualification Test

Test			JAXA-QTS-2050		Pass/Fail (no. of pcs)	
Group	Order	Item	Requirement paragraph	Test method paragraph	No. of samples	No. of allowable defects
I	1	Resistance	J.3.7.2	J.4.4.5.2	All(1)	0
	2	Externals, dimensions, mass and marking	J.3.4	J.4.4.3		
	3	DPA	J.3.5.1	J.4.4.4.1	2 max. resistance 2 min. resistance } 4	
II	1	Dielectric withstanding voltage	J.3.7.4	J.4.4.5.4	10 optional resistance	0
	2	Insulation resistance	J.3.7.5	J.4.4.5.5		
III	1	Resistance-temperature characteristics	J.3.7.3	J.4.4.5.3	10 max. resistance 10 critical resistance 10 min. resistance } 30	0
	2	Low temperature operation	J.3.9.6	J.4.4.7.6		
	3	Short-time overload	J.3.7.6	J.4.4.5.6		
IV	1	Resistance to soldering heat	J.3.8.5	J.4.4.6.5	10 max. resistance 10 critical resistance 10 min. resistance } 30	0
	2	Moisture resistance	J.3.9.4	J.4.4.7.4		
V	1	Life	J.3.10.1	J.4.4.8.1	77 max. resistance 77 critical resistance 77 min. resistance } 231	0
VI	1	Stability	J.3.9.7	J.4.4.7.7	10 max. resistance 10 critical resistance 10 min. resistance } 30	0
VII	1	Resistance to bonding exposure	J.3.8.4	J.4.4.6.4	10 optional resistance	0
	2	Deleted	-	-		
	3	Thermal shock [II]	J.3.9.3.2	J.4.4.7.3.2		
VIII	1	Deleted	-	-	-	-
IX	1	Solderability	J.3.8.1	J.4.4.6.1	10 optional resistance	0
	2	Resistance to solvents	J.3.9.5	J.4.4.7.5		
X	1	Adhesion	J.3.8.2	J.4.4.6.2	10 optional resistance	0
XI	1	Board Bending	J.3.8.3	J.4.4.6.3	10 optional resistance	0
-	1	Materials	J.3.2	-	(2)	

Notes:
(1) For dimensions and mass, “JIS Z 9015-1 Special Inspection Level S-4”, AQL 1.0% shall be applied.
(2) The data proving that the materials satisfy the design specification shall be submitted.

4.3 Quality Conformance Inspection

The quality conformance inspection shall be performed in accordance with paragraph J.4.3, appendix J of JAXA-QTS-2050. Specifically, inspection items specified in Tables 10, 11 and 12 shall be performed.

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Table 10. Quality Conformance Inspection (Group A)

Inspection				JAXA-QTS-2050		Pass/Fail (no. of pcs)	
Group	Sub-group	Order	Item	Requirement paragraph	Test method paragraph	No. of samples	No. of allowable defects
A1	1	1	Thermal shock [I]	J.3.9.3.1	J.4.4.7.3.1	All	0
		2	Power conditioning(1)	J.3.7.7	J.4.4.5.7		
		3	Resistance	J.3.7.2	J.4.4.5.2		
	2	1	Externals, dimensions, mass (3) and marking	J.3.4	J.4.4.3	AQL(4) 4.0%	
		2	DPA	J.3.5.1	J.4.4.4.1	4	0
	3	1	Dielectric withstanding voltage (atmospheric pressure)	J.3.7.4	J.4.4.5.4.1	AQL(2) 2.5%	
		2	Insulation resistance	J.3.7.5	J.4.4.5.5		
A2	1	1	Resistance to bonding exposure	J.3.8.4	J.4.4.6.4	AQL(2) 2.5%	
		2	Resistance-temperature characteristic	J.3.7.3	J.4.4.5.3		
		3	Low temperature operation	J.3.9.6	J.4.4.7.6		
		4	Short-time overload	J.3.7.6	J.4.4.5.6		
	2	1	Solderability	J.3.8.1	J.4.4.6.1	AQL(2) 2.5%	
	3	1	Adhesion	J.3.8.2	J.4.4.6.2	AQL(2) 2.5%	

Notes:

(1) Power conditioning test shall be performed if required by order.

(2) For the sampling method, “General Inspection Level II” of JIS Z 9015-1 attachment table 1 shall be applied for order 1 of subgroup of 2 of group A1, and “Special Inspection Level S-4” shall be applied for subgroup 3 of group A1 and group A2.

(3) To be conducted prior to group B inspection, inspection shall be performed only at the time of group A inspection.

(4) In accordance with JIS Z 9015-1 attachment table 1, the sampling method shall be "Normal Inspection Level II" for order 1 of subgroup 2 of group A1, and judgment shall be made on the basis of an Acceptable Quality Level (AQL) of 4.0% or 10 pieces, whichever is greater.

Table 11. Quality Conformance Inspection (Group B)

Inspection				JAXA-QTS-2050		Pass/Fail (no. of pcs)	
Group	Sub-group	Order	Item	Requirement paragraph	Test method paragraph	No. of samples	No. of allowable defects
B1	1	1	Resistance to soldering heat	J.3.8.5	J.4.4.6.5	10	0
		2	Moisture resistance	J.3.9.4	J.4.4.7.4	10	0
	2	1	Life	J.3.10.1	J.4.4.8.1	10	0
	3	1	Stability	J.3.9.7	J.4.4.7.7	10	0
	4	1	Resistance to solvents	J.3.9.5	J.4.4.7.5	10	0
	5	1	Board bending	J.3.8.3	J.4.4.6.3	5	0

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Table 12. Quality Conformance Inspection (Group C)

Inspection				JAXA-QTS-2050		Pass/Fail (no. of pcs)	
Group	Sub-group	Order	Item	Requirement paragraph	Test method paragraph	No. of Samples	No. of allowable defects
C1	1	1	Deleted	-	-	10	0
		2	Thermal shock [II]	J.3.9.3.2	J.4.4.7.3.2		
	2	1	Deleted	-	-	-	-

4.4 Test Method

The test method shall be in accordance with paragraph J.4.3, appendix J of JAXA-QTS-2050.

4.5 Long-Term Storage

The long-term storage shall be in accordance with paragraph J.4.3, appendix J of JAXA-QTS-2050.

4.5.1 Disposition of Products Stored for a Long Time at Manufacturer's Site

When products have been stored at the manufacturer's site for 12 months or longer after the Group A inspection, the resistors shall be inspected as specified in paragraph 4.7.1 of JAXA-QTS-2050.

In addition, sampling inspection of solderability and resistance to bonding exposure shall be performed for each terminal structure in accordance with Table 10.

The re-inspection date shall be marked on the package.

If a sample is failed to the inspections of solderability and/or resistance to bonding exposure, the lot shall not be delivered.

4.5.2 Storage by Purchasers

Resistors shall be kept in taping package or delivery package and stored at room temperature (15 to 35˚C) and normal humidity (25 to 85%RH). The storage area shall be clean and free from the influence of direct sunlight and harmful gas such as chlorine and sulfur.

4.6 Changes of Test and Inspection

There shall be no changes from the quality conformance inspection defined in appendix J of JAXA-QTS-2050.

5. PREPARATION FOR DELIVERY

Preparation for delivery shall be in accordance with paragraph J.4.3, appendix J of JAXA-QTS-2050.

6. NOTE

Refer to the paragraph J.6, appendix J of JAXA-QTS-2050.