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7 February 2025

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

Prepared and Established by
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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	20 July 2007	Original
A	21 Jan. 2009	Refer JAXA-QTS-2050/E201H (Rev. A).
B	1 July 2011	Refer JAXA-QTS-2050/E201H (Rev. B).
C	16 Apr. 2012	Refer JAXA-QTS-2050/E201H (Rev. C).
D	1 Feb. 2013	Refer JAXA-QTS-2050/E201H (Rev. D).
E	14 Feb. 2013	Refer JAXA-QTS-2050/E201H (Rev. E).
F	7 Nov. 2013	Refer JAXA-QTS-2050/E201H (Rev. F).
G	28 Jun. 2019	Refer JAXA-QTS-2050/E201H (Rev. G).
H	28 Sep. 2020	Reflected S3SU-1901 (Rev. NC and Rev. 1), issued by TATEYAMA KAGAKU DEVICE TECHNOLOGY CO., LTD.
J	7 Feb. 2025	Reflected S3SU-1901 (Rev. 2), issued by TATEYAMA KAGAKU DEVICE TECHNOLOGY CO., LTD.
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Revision Log

Rev.	Date	Description
NC	11 Dec. 2019	1. Original in accordance with JAXA-QTS-2050/E201 (Rev. G) to assign internal document number. 2. Changed the following item. (1) Table 8. Qualification Test Changed note (4) as follows in compliance with general specification: From: For Dimensional inspection, the number of samples and the quantity of allowable defects shall be 5 and 0 respectively. To: For Dimensional inspection, JIS Z 9015-1 “Special Inspection Level S-4”, AQL 1.0% shall be applied.
1	7 Aug. 2020	Changed the following items. 1. Table 2-1. Ratings (Resistor) (1) Changed the paragraph number for resistance-temperature characteristics from E.3.6.3 to 3.1.1(1). (2) Added “Note (1): Indicates the paragraph number in this specification.” (3) Added the following characteristic values for L and K to the column for resistance-temperature characteristics. (a) L: ±200ppm/°C (b) K: ±100ppm/°C 2. Table 3. Performance Due to the addition of resistance-temperature characteristics in paragraph 3.1.1, changed the following paragraph number of JAXA-QTS-2050 requirements. (1) Resistance to soldering heat: From 3.1.1 to 3.1.2 (2) Exposure to high temperature: From 3.1.2 to 3.1.3. (3) Humidity (steady state): From 3.1.3 to 3.1.4. (4) Thermal shock: From 3.1.4 to 3.1.5. (5) Load life in humidity: From 3.1.5 to 3.1.6. 3. Added paragraph 3.1.1, “Resistance-Temperature Characteristics”. 4. Due to the addition of resistance-temperature characteristics in paragraphs 3.1.1 and 4.4.1, changed the following paragraph number and reference paragraph number. (1) Resistance to soldering heat (a) Paragraph number: From 3.1.1 to 3.1.2 (b) Reference paragraph number: From 4.4.1 to 4.4.2 (2) Exposure to high temperature (a) Paragraph number: From 3.1.2 to 3.1.3 (b) Reference paragraph number: From 4.4.2 to 4.4.3 (3) Humidity (steady state) (a) Paragraph number: From 3.1.3 to 3.1.4 (b) Reference paragraph number: From 4.4.3 to 4.4.4 (4) Thermal shock (a) Paragraph number: From 3.1.4 to 3.1.5 (b) Reference paragraph number: From 4.4.4 to 4.4.5 (5) Load life in humidity (a) Paragraph number: From 3.1.5 to 3.1.6 (b) Reference paragraph number: From 4.4.5 to 4.4.6 5. Table 7. In-Process Inspection Changed the following paragraph number and reference paragraph number. (1) Thermal shock (a) Paragraph number: From 3.1.4 to 3.1.5 (b) Reference paragraph number: From 4.4.4 to 4.4.5 (2) Exposure to high temperature (a) Paragraph number: From 3.1.2 to 3.1.3 (b) Reference paragraph number: From 4.4.2 to 4.4.3

Revision Log

Rev.	Date	Description
		6. Table 8. Qualification Test Changed the following paragraph number and reference paragraph number. (1) III-1. Resistance-temperature characteristics (a) Paragraph number: From E.3.6.3 to 3.1.1 (b) Reference paragraph number: From E.4.4.5.3 to 4.4.1 (2) IV-1. Resistance to soldering heat (a) Paragraph number: From 3.1.1 to 3.1.2 (b) Reference paragraph number: From 4.4.1 to 4.4.2 (3) XII-1. Exposure to high temperature (a) Paragraph number: From 3.1.2 to 3.1.3 (b) Reference paragraph number: From 4.4.2 to 4.4.3 (4) XIII-1. Humidity (steady state) (a) Paragraph number: From 3.1.3 to 3.1.4 (b) Reference paragraph number: From 4.4.4 to 4.4.4 (5) XIV-1. Thermal shock (a) Paragraph number: From 3.1.4 to 3.1.5 (b) Reference paragraph number: From 4.4.4 to 4.4.5 (6) XV-1. Load life in humidity: From 3.1.5 to 3.1.6. (a) Paragraph number: From 3.1.5 to 3.1.6 (b) Reference paragraph number: From 4.4.5 to 4.4.6 7. Table 9. Quality Conformance Inspection (Group A) Changed the following paragraph number and reference paragraph number. (1) A3-1-1, “Resistance to soldering heat” (a) Paragraph number: From 3.1.1 to 3.1.2 (b) Reference paragraph number: From 4.4.1 to 4.4.2 8. Table 10. Quality Conformance Inspection (Group B) Changed the following paragraph number and reference paragraph number. (1) B1-6-1, “Load life in humidity” (a) Paragraph number: From 3.1.5 to 3.1.6 (b) Reference paragraph number: From 4.4.5 to 4.4.6 (2) B3-1-2, “Resistance-temperature characteristics” (a) Paragraph number: From E.3.6.3 to 3.1.1 (b) Reference paragraph number: From E.4.4.5.3 to 4.4.1 9. Paragraph 4.4.1, “Resistance-Temperature Characteristics” Added test temperature condition to clarify. 10. Due to the addition of resistance-temperature characteristics in paragraph 4.4.1, changed the following paragraph number. (1) Resistance to soldering heat Paragraph number: From 4.4.1 to 4.4.2 (2) Exposure to high temperature Paragraph number: From 4.4.2 to 4.4.3 (3) Humidity (steady state) Paragraph number: From 4.4.3 to 4.4.4 (4) Thermal shock Paragraph number: From 4.4.4 to 4.4.5 (5) Load life in humidity Paragraph number: From 4.4.5 to 4.4.6 11. Paragraph 4.4.2, item d), “Post-test inspection” Due to the addition of resistance-temperature characteristics in paragraph 3.1.1, changed reference paragraph number.

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Rev.	Date	Description
2	7 Feb. 2025	1. Revised after the issuance of JAXA-QTS-2050/E201 (Rev. H) to assign internal document number. 2. Changed the following items after the issuance of JAXA-QTS-2050/E201 (Rev. H). (1) Added mass-related information to the following table and paragraph. (a) Table 3. Performance (b) Table 8. Qualification Test (c) Table 9. Quality Conformance Inspection (Group A) (d) Paragraph 4.6, “Changes of Tests and Inspections” (2) Table 9. Quality Conformance Inspection (Group A) For mass, added note (6). (3) Added “Resistance to solvents” test requirements in this specification. (a) Added paragraphs 3.1.7, “Resistance to Solvents” and 4.4.7, “Resistance to Solvents”. (b) Changed the following requirements paragraph number and test methods paragraph number for resistance to solvents of Table 8. Qualification Test and Table 10. Quality Conformance Inspection (Group B). • Requirements paragraph number: From E.3.8.5 to 3.1.7 • Test methods paragraph number: From E.4.4.7.5 to 4.4.7 (4) Changed the magnification for external visual inspection from 10-fold to 10-fold or higher. (5) Table 8. Qualification Test Deleted group VII, order 2, “Shock” and group VII, order 1, “Random vibration”. (6) Table 11. Quality Conformance Inspection (Group C) Deleted group C1, order 1, item 1, “Shock” and group C1, order 2, item 1, “Random vibration”. 3. Due to the materials’ change, the following changes have been made. (1) Table 3. Performance (a) Changed the following items of “Materials”. • Changed “Lead borosilicate glass” to “Protective film 1: Glass-based, Protective film 2 and marking: resin-based” for materials of protective film and marking. • Changed “Silver-Palladium thick film” to “Silver-Palladium thick film, Silver thick film (back side)” for materials of internal electrode. • Added end-face electrode and “Silver-resin thick film” for materials of internal electrode. (b) Added following items. • Added “Adhesion” as an item of “Mechanical Performance”. • Added “Application of pulse” as an item of “Electrical Performance”. • Added “Resistance” as an item of “Electrical Performance”. • Added “Resistance-temperature characteristics” as an item of “Electrical Performance”. • Added “Solderability” as an item of “Mechanical Performance”. (2) Changed “Figure 2. Construction” to accompany materials’ change. (3) Table 6. Dimensions and Mass Updated the mass of each style. (4) Table 9. Quality Conformance Inspection (Group A) Added “Note (7): Tests and inspections shall be as specified in paragraph 4.6 of this specification”. (5) Table 10. Quality Conformance Inspection (Group B) Added “Note (3): Tests and inspections shall be as specified in paragraph 4.6 of this specification”.
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Contents

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

1. GENERAL

1.1 Scope

This specification establishes the detailed requirements for JAXA-QTS-2050 appendix E, the space use, high reliability, film chip fixed resistors (hereinafter referred to as "resistors") CRK16H, 10H, 8H, 4H and 2H types.

1.2 Part Number

The part numbers for the resistors covered in this specification shall be classified as specified in Table 1 and assigned as the following example:

(Example) JAXA([1]) CRK16H (Style) K (Characteristic) 103 (Nominal resistance) F (Resistance tolerance) R (Electrode Structure)

Note([1]): "JAXA" indicates that the common part for space use and may be abbreviated to "J."

Table 1. Part Numbers

Item	JAXA-QTS-2050 Applicable provisions	Description
Style	E.1.3.1	CRK16H, CRK10H, CRK8H, CRK4H, CRK2H
Characteristic	E.1.3.2	K (±100ppm/°C for −55 to +125°C) L (±200ppm/°C for −55 to +125°C) Not applicable for jumper resistors
Nominal resistance	E.1.3.3	(e.g.) 1002···10kΩ (The first 3 digits are significant figures and the last digit specifies the number of zeros to follow. When nominal resistance after the decimal point is needed, the letter “R” shall be substituted to represent the decimal point and succeeding digits of the group represent significant figures.) 103···10kΩ (The first 2 digits are significant figures and the last digit specifies the number of zeros to follow. When nominal resistance after the decimal point is needed, the letter “R” shall be substituted to represent the decimal point and succeeding digits of the group represent significant figures.) R00···Jumper resistor The marking of resistance on parts are as shown in Table 4.
Resistance tolerance	E.1.3.4	F (±1.0%), G (±2.0%), J (±5.0%) Not applicable for jumper resistors
Electrode structure	E.1.3.5	R: Double-sided solder plated electrode

1.3 Ratings

The ratings are shown in Tables 2-1 and 2-2.

2. APPLICABLE DOCUMENTS

2.1 Applicable Documents

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

2.2 Reference Documents

The reference documents are as specified in paragraph E.2.2 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

Table 2-1. Ratings (Resistor)

Item	Paragraph	Description				
		CRK16H	CRK10H	CRK8H	CRK4H	CRK2H
Operating temperature range(°C)	E.3.5.2	-55 to +125				
Rated ambient temperature(°C)	−	70				
Derating curve	E.3.5.4	Refer to Figure 1				
Nominal resistance range (Ω)	E.3.5.1	1.0 to 10M				
Critical resistance (Ω)	−	24k	180k	160k	120k	75k
Rated voltage (V)	E.3.5.5	Rated voltage = $\sqrt{\ }$ (Rated power x resistance) If the value exceeds maximum operating voltage, the maximum operating voltage shall be the rated voltage.				
Maximum operating voltage (V)	−	50	150	200		
Maximum overload voltage (V)	−	100	300	400		
Rated power (W)	E.3.5.3	0.10	0.125	0.25	0.33	0.50
Resistance-temperature characteristic	3.1.1 ([1])	L±200ppm/°C (1.0 to 9.76Ω), K±100ppm/°C (10 to 10MΩ)				

Note ([1]) This number indicates the paragraph number of this specification.

Table 2-2. Ratings (Jumper resistor)

Item	Paragraph	Description				
		CRK16H	CRK10H	CRK8H	CRK4H	CRK2H
Operating temperature range(°C)	E.3.5.2	-55 to +125				
Rated ambient temperature(°C)	−	70				
Derating curve	E.3.5.4	Refer to Figure 1				
Nominal resistance range (Ω)	E.3.5.1	50m as a maximum				
Rated current (A)	E.3.5.6	1.0	1.5	2.0		
Maximum overload current (A)	−	2.0	3.0	4.0		

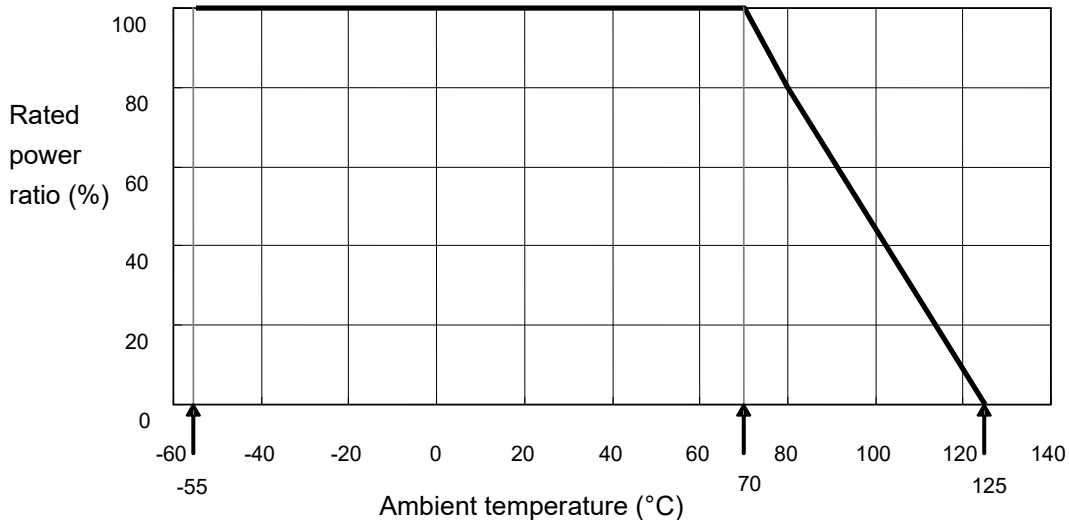


Figure 1. Derating Curve

3. REQUIREMENTS

The requirements are as specified in paragraph E.3, appendix E of JAXA-QTS-2050 and as provided below.

3.1 Performance

The performances are shown in table 3.

Table 3. Performance

Item		JAXA-QTS-2050 Requirements	Performance	
			Resistor	Jumper resistor
Materials		E.3.2	As specified in appendix E of JAXA-QTS-2050	
	Base substance	E.3.2.1	Alumina 96% as a minimum	
	Resistor element	E.3.2.3	Ruthenium oxide thick film	Silver-Palladium thick film
	Protective film and marking	E.3.2.4	Protective film 1: Glass-based, Protective film 2 and marking: Resin-based	
	Internal electrodes	E.3.2.2	Silver-Palladium thick film, Silver thick film (back side)	
	End-face electrode	E.3.2.2	Silver-resin thick film	
	Intermediate electrodes	E.3.2.2	Nickel plated	
	External electrodes	E.3.2.2	Solder plated (Sn90Pb10)	
Externals, Dimensions, mass and Marking		E.3.3	As specified in appendix E of JAXA-QTS-2050	
	Externals and markings	E.3.3.1	As specified in Figure 2, Tables 4 and 5.	
	Construction, dimensions and mass	E.3.3.2	As specified in Figure 2 and Table 6.	
Workmanship		E.3.4	As specified in appendix E of JAXA-QTS-2050	
Electrical performance		E.3.6	As specified in appendix E of JAXA-QTS-2050	
	Application of Pulse	E.3.6.1	There shall be no evidence of arcing, insulation breakdown, or mechanical damage	
	Resistance	E.3.6.2	The resistance shall be within the specified tolerance.	
	Resistance-Temperature Characteristics	E.3.6.3	The resistance-temperature characteristics shall be within the specified tolerance.	
	Dielectric Withstanding Voltage (Barometric pressure)	E.3.6.4	Allowable resistance change ± (0.25% + 0.01Ω)	Resistance: 50mΩ as a maximum
	Insulation Resistance	E.3.6.5	1,000MΩ as a minimum	
	Short-Time Overload	E.3.6.6	Allowable resistance change: ± (0.5% + 0.01Ω)	Resistance: 50mΩ as a maximum
Mechanical performance		E.3.7	As specified in appendix E of JAXA-QTS-2050	
	Solderability	E.3.7.1	A minimum of 95% of the terminal surface shall be evenly covered with new solder.	
	Adhesion	E.3.7.2	There shall be no mechanical damage.	
	Board bending	E.3.7.3	Allowable resistance change: ± (1.0% + 0.01Ω)	Resistance: 50mΩ as a maximum
	Resistance to Bonding Exposure	E.3.7.4	Allowable resistance change: ± (0.25% + 0.01Ω)	Resistance: 50mΩ as a maximum
	Resistance to soldering heat	3.1.2(1)	Allowable resistance change: ± (0.5% + 0.01Ω)	Resistance: 50mΩ as a maximum
Environmental performance		E.3.8	As specified in appendix E of JAXA-QTS-2050	
	Thermal Shock [II]	E.3.8.3	Allowable resistance change: ± (0.25% + 0.01Ω)	Resistance: 50mΩ as a maximum
	Moisture Resistance	E.3.8.4	Allowable resistance change: ± (0.5% + 0.01Ω)	Resistance: 50mΩ as a maximum
	Resistance to Solvents	3.1.7 (1)	As specified in appendix E of JAXA-QTS-2050	
	Low Temperature operation	E.3.8.6	Allowable resistance change: ± (0.25% + 0.01Ω)	Resistance: 50mΩ as a maximum
	Stability	E.3.8.7	Allowable resistance change: ± (0.5% + 0.01Ω)	Resistance: 50mΩ as a maximum
			Resistance change of Dielectric Withstanding Voltage: ± (0.25% + 0.01Ω)	Resistance: 50mΩ as a maximum
			Insulation Resistance: 1,000MΩ minimum	
	Exposure to high temperature	3.1.3(1)	Allowable resistance change: ± (0.25% + 0.01Ω)	Resistance: 50mΩ as a maximum
	Humidity (steady state)	3.1.4(1)	Allowable resistance change: ± (0.5% + 0.01Ω)	Resistance: 50mΩ as a maximum
	Thermal Shock [I]	3.1.5(1)	Allowable resistance change: ± (0.25% + 0.01Ω)	Resistance: 50mΩ as a maximum
Durability performance		E.3.9	As specified in appendix E of JAXA-QTS-2050	
	Life	E.3.9.1	Allowable resistance change: ± (1.5% + 0.01Ω)	Resistance: 50mΩ as a maximum
	Load life in humidity	3.1.6(1)	Allowable resistance change: ± (1.5% + 0.01Ω)	Resistance: 50mΩ as a maximum

Note: (1) This number indicates the paragraph number of this specification.

Table 4. Marking

Resistance tolerance	G(±2.0%) J(±5.0%)	F(±1.0%) [3]	
Nominal resistance sequence	E24	E24	E96
Number of digits marked[3]	3	3 or 4	4
Example of marking [1] [2] [3]	"103"	"103" or "1002"	"1002"

Notes: [1] The marking for jumper resistors shall be “R00.”

[2] E96 series of CRK16H shall not be marked.

[3] E24 series of F level parts are expressed in 4 digits unless otherwise indicated in the documents such as purchase order to mark in 3 digits.

Table 5. Nominal Resistance

Standard resistor value: E24 series							
10	11	12	13	15	16	18	20
22	24	27	30	33	36	39	43
47	51	56	62	68	75	82	91
Standard resistor value: E96 series							
100	102	105	107	110	113	115	118
121	124	127	130	133	137	140	143
147	150	154	158	162	165	169	174
178	182	187	191	196	200	205	210
215	221	226	232	237	243	249	255
261	267	274	280	287	294	301	309
316	324	332	340	348	357	365	374
383	392	402	412	422	432	442	453
464	475	487	499	511	523	536	549
562	576	590	604	619	634	649	665
681	698	715	732	750	768	787	806
825	845	866	887	909	931	953	976

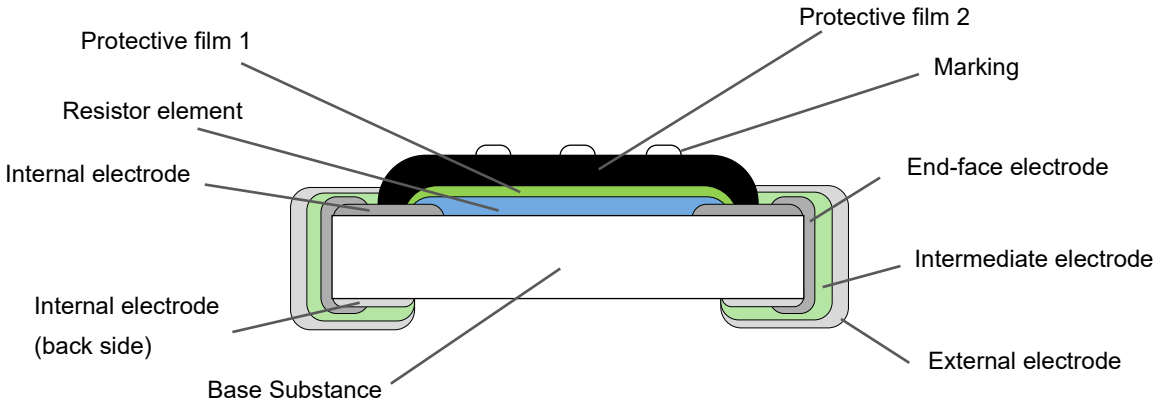
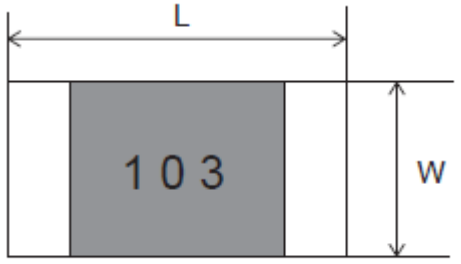
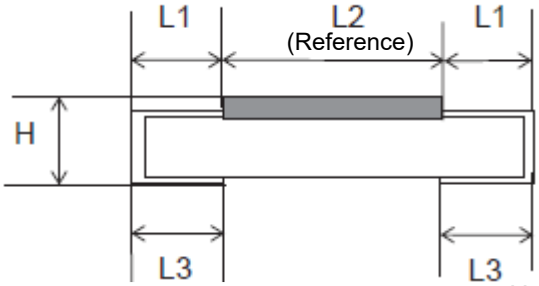


Figure 2. Construction

Table 6. Dimensions and Mass





Unit: mm

Style	L	W	H	L1	L2 (Reference)	L3	Mass (mg) (Reference)
CRK16H	1.6±0.15	0.80±0.15	0.45±0.1	0.3±0.20	1.0	0.3±0.2	2.1
CRK10H	2.0±0.20	1.25±0.20	0.50±0.1	0.4±0.20	1.3	0.4±0.2	4.9
CRK 8H	3.2±0.20	1.60±0.20	0.60±0.1	0.5±0.25	2.2	0.5±0.3	9.1
CRK 4H	3.2±0.20	2.60±0.20	0.60±0.1	0.5±0.20	2.0	0.5±0.3	14.9
CRK 2H	5.0±0.20	2.50±0.20	0.60±0.1	0.6±0.20	3.8	0.5±0.3	23.3

3.1.1 Resistance-Temperature Characteristic

The resistance-temperature characteristic shall be in accordance with E.3.6.3, appendix E of JAXA-QTS-2050 and as follows.

When tested in accordance with paragraph 4.4.1, the resistor shall meet the following requirements.

a) Resistance-Temperature Characteristic
Resistance-temperature characteristic shall be within the value specified in table E-3, appendix E of JAXA-QTS-2050.
However, this does not apply to jumper resistors.

3.1.2 Resistance to Soldering Heat

When tested in accordance with paragraph 4.4.2, the resistor shall meet the following requirements.

a) Externals
There shall not be any evidence of mechanical damages or flaking, or exposure of the internal electrodes. The electrode corrosion shall be less than 50% of the external electrode length.

b) Resistance change: As specified in Table 3.

3.1.3 Exposure to High Temperature

When tested in accordance with paragraph 4.4.3, the resistor shall meet the following requirements.

a) Externals: There shall not be any mechanical damage.

b) Resistance change: As specified in Table 3.

3.1.4 Humidity (Steady State)

When tested in accordance with paragraph 4.4.4, the resistor shall meet the following requirements.

a) Externals: There shall not be any mechanical damage.

b) Resistance change: As specified in Table 3.

3.1.5 Thermal Shock

When tested in accordance with paragraph 4.4.5, the resistor shall meet the following requirements.

a) Externals: There shall not be any mechanical damage.

b) Resistance change: As specified in Table 3.

3.1.6 Load Life in Humidity

When tested in accordance with paragraph 4.4.6, the resistor shall meet the following requirements

a) Externals: There shall not be any mechanical damage.

b) Resistance change: As specified in Table 3.

3.1.7 Resistance to Solvents

When tested in accordance with paragraph 4.4.7, the marking shall remain legible.

4. QUALITY ASSURANCE PROVISIONS

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

4.1 In-Process Inspection

The in-process inspection shall be performed in accordance with paragraph E.4.1, appendix E of JAXA-QTS-2050. The inspection specified in Table 7 shall be performed for each production lot.

Table 7. In-Process Inspection

Inspection			JAXA-QTS-2050		Pass/Fail criteria	
No.	Order	Item	Requirement paragraph	Test method paragraph	Sample size	Number of defectives allowed
1	1	DPA	E.3.4.1	E.4.4.4.1	10	0
2	1	Thermal shock	3.1.5 (1)	4.4.5 (1)	PDA 5%	
	2	Exposure to high temperature	3.1.3 (1)	4.4.3 (1)		
	3	Resistance	E.3.6.2	E.4.4.5.2		
3	1	External visual	E.3.3	E.4.4.3.2	100%	Not applicable

Note: (1) This number indicates the paragraph number of this specification.

4.2 Qualification Test

The qualification test shall be performed in accordance with paragraph E.4.2, appendix E of JAXA-QTS-2050. Specifically, the test items specified in Table 8 shall be performed.

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Table 8. Qualification Test

Test			JAXA-QTS-2050		Pass/Fail criteria	
Group	Order	Item	Requirements paragraph	Test method paragraph	Sample size (3)	Number of defective allowed
I	1	Application of Pulse	E.3.6.1	E.4.4.5.1	100%	0
	2	Resistance	E.3.6.2	E.4.4.5.2		
IA	1	Externals, Dimensions, Mass and Marking	E.3.3	E.4.4.3	100% (4)	0
IB	1	DPA	E.3.4.1	E.4.4.4.1	2 highest resistance 2 lowest resistance } 4	0
II	1	Dielectric Withstanding Voltage (Barometric pressure)	E.3.6.4	E.4.4.5.4.1	10 any resistance	0
	2	Insulation Resistance	E.3.6.5	E.4.4.5.5		
III	1	Resistance-Temperature Characteristic	3.1.1 (1)	4.4.1 (1)	10 highest. resistance 10 critical resistance 10 lowest. resistance } 30	0
	2	Low Temperature operation	E.3.8.6	E.4.4.7.6		
	3	Short-Time Overload	E.3.6.6	E.4.4.5.6		
IV	1	Resistance to soldering heat	3.1.2 (1)	4.4.2 (1)	10 highest. resistance 10 critical resistance 10 lowest. resistance } 30	0
	2	Moisture Resistance	E.3.8.4	E.4.4.7.4		
V	1	Life	E.3.9.1	E.4.4.8.1	77 highest. resistance 77 critical resistance 77 lowest. resistance } 231	0
VI	1	Stability	E.3.8.7	E.4.4.7.7	10 highest. resistance 10 critical resistance 10 lowest. resistance } 30	0
VII	1	Resistance to Bonding Exposure	E.3.7.4	E.4.4.6.4	10 any resistance	0
	2	(Deleted)	-	-		
	3	Thermal Shock [II]	E.3.8.3	E.4.4.7.3		
VIII	1	(Deleted)	-	-	10 any resistance	0
IX	1	Solderability	E.3.7.1.2	E.4.4.6.1.2	10 any resistance	0
	2	Resistance to Solvents	3.1.7 (1)	4.4.7 (1)		
X	1	Adhesion	E.3.7.2	E.4.4.6.2	10 any resistance	0
XI	1	Board bending	E.3.7.3	E.4.4.6.3	10 any resistance	0
XII	1	Exposure to high temperature	3.1.3 (1)	4.4.3 (1)	10 highest. resistance 10 critical resistance 10 lowest. resistance } 30	0
XIII	1	Humidity (steady state)	3.1.4 (1)	4.4.4 (1)	10 highest. resistance 10 critical resistance 10 lowest. resistance } 30	0
XIV	1	Thermal shock	3.1.5 (1)	4.4.5 (1)	10 highest. resistance 10 critical resistance 10 lowest. resistance } 30	0
XV	1	Load life in humidity	3.1.6 (1)	4.4.6 (1)	77 highest. resistance 77 critical resistance 77 lowest. resistance } 231	0
–	1	Materials	E.3.2	—	(2)	

Notes: (1) This number indicates the paragraph number of this specification.
(2) Submit data which proves that the materials satisfy the design specification.
(3) For jumper resistors, n is10 for every test items except for groups I, IA and IB.
(4) For Dimensional and mass inspection, JIS Z 9015-1 “Special Inspection Level S-4”, AQL 1.0% shall be applied.

4.3 Qualification Conformance Inspection

The qualification conformance inspection shall be performed in accordance with paragraph E.4.3, appendix E of JAXA-QTS-2050. Specifically, the inspection items specified in Tables 9, 10 and 11 shall be performed.

Table 9. Qualify Conformance Inspection (Group A)

Inspection				JAXA-QTS-2050		Pass/Fail criteria	
Group	Sub-group	Order	Item	Requirements Paragraph	Method Paragraph	Sample size	Number of defective allowed
A1	1	1	Application of Pulse (5) (7)	E.3.6.1	E.4.4.5.1	100%	0
		2	Resistance (5) (7)	E.3.6.2	E.4.4.5.2		
	2	1	Externals, Dimensions, Mass (6) and Marking (7)	E.3.3	E.4.4.3.2	AQL (2) 2.5%	
		2	DPA (3)	E.3.4.1	E.4.4.4.1	4	0
A2	2	1	Solderability	E.3.7.1.2	E.4.4.6.1.2	10	0
A3	1	1	Resistance to soldering heat	3.1.2 (1)	4.4.2 (1)	10	
	2	1	Board bending (4)	E.3.7.3	E.4.4.6.3	10	

Notes: (1) This number indicates the paragraph number of this specification.
(2) For the sampling method, use “General inspection level II” of JIS Z 9015-1 attachment table 1. For the inspection of dimensions, the sample size and quantity of allowable defects shall be 5 and 0, respectively.
(3) This test can be omitted if DPA is performed in in-process inspection.
(4) This test can be omitted if the group B test will be performed continuously.
(5) This test can be substituted by the data from In-process inspection (Thermal shock, Exposure to high temperature and Resistance) as specified in No. 2 of Table 7.
(6) When performing group B quality conformance inspection, mass shall be measured only during the group A quality conformance inspection performed prior to the group B quality conformance inspection.
(7) Tests and inspections shall be as specified in paragraph 4.6 of this specification.

Table 10. Qualify Conformance Inspection (Group B)

Test				JAXA-QTS-2050		Pass/Fail criteria	
Group	Sub-group	Order	Item	Requirements Paragraph	Method Paragraph	Sample size	Number of defective allowed
B1	1	1	Moisture resistance	E.3.8.4	E.4.4.7.4	10	0
	2	1	Life (1) (3)	E.3.9.1	E.4.4.8.1	10	
	3	1	Stability	E.3.8.7	E.4.4.7.7	10	
	4	1	Resistance to solvents	3.1.7 (2)	4.4.7 (2)	10	
	5	1	Board bending	E.3.7.3	E.4.4.6.3	10	
	6	1	Load life in humidity (1) (3)	3.1.6 (2)	4.4.6 (2)	10	
B2	1	1	Dielectric Withstanding Voltage (Barometric pressure) (3)	E.3.6.4	E.4.4.5.4.1	10	0
		2	Insulation Resistance (3)	E.3.6.5	E.4.4.5.5		
B3	1	1	Resistance to Bonding Exposure (3)	E.3.7.4	E.4.4.6.4	10	0
		2	Resistance-Temperature Characteristic (3)	3.1.1 (2)	4.4.1 (2)		
		3	Low temperature operation (3)	E.3.8.6	E.4.4.7.6		
		4	Short-Time Overload (3)	E.3.6.6	E.4.4.5.6		
	2	1	Adhesion (3)	E.3.7.2	E.4.4.6.2	10	0

Notes: (1) This item is not applicable to jumper resistors.
(2) This number indicates the paragraph number of this specification.
(3) Tests and inspections shall be as specified in paragraph 4.6 of this specification.

Table 11. Qualify Conformance Inspection (Group C)

Inspection				JAXA-QTS-2050		Pass/Fail criteria	
Group	Order	Item	Group	Requirements Paragraph	Method Paragraph	Sample size	Number of defective allowed
C1	1	1	(Deleted)	-	-	10	0
		2	Thermal shock [II]	E.3.8.3	E.4.4.7.3		
	2	1	(Deleted)	-	-	-	-

4.4 Test Method

The test method shall be in accordance with paragraph E.4.4, appendix E of JAXA-QTS-2050 and the following provisions.

4.4.1 Resistance-Temperature Characteristic

The resistance-temperature characteristic shall be tested in accordance with E.4.4.5.3, appendix E of JAXA-QTS-2050 and as follows.
For qualification test and quality conformance inspection, the following temperatures shall apply.

a) Reference temperature: 25°C
b) Test temperatures
 - Lowest temperature in the first series: -55°C
 - Highest temperature in the second series: +125°C
 The tolerance on each temperature in both series shall be within ±3°C.
 When transition (from the first series to the second series) is necessary, a lapse of time not to exceed 24 hours is permitted between the end of the first series and the start of the second series.

4.4.2 Resistance to Soldering Heat

The test shall be performed in accordance with method 210 of MIL-STD-202. The following conditions shall apply.

a) Pre-test measurements
 The measurement of resistor shall be performed as specified in paragraph E.4.4.5.2, appendix E of JAXA-QTS-2050.
b) Test condition: B
c) Post-test measurements
 After the test, leave the resistor at room temperature for an hour and measure the resistance as specified in paragraph E.4.4.5.2, appendix E of JAXA-QTS-2050.
d) Post-test inspection
 Inspect the external conditions using a 10x or higher magnifier to assure the product met the requirements specified in paragraph 3.1.2.

4.4.3 Exposure to High Temperature

The test shall be performed under the following conditions.

a) Test and inspection

1) In-process inspection

The product shall be exposed to high temperatures at 125±5°C without load for 100^{+4}_{0} hours.

2) Qualification test

The product shall be exposed to high temperatures at 150±5°C without load for 100^{+4}_{0} hours.

b) Measurement and inspection

The following electrical measurements and external visual inspection shall be performed before and after the test. For in-process inspection, the pre-test measurements and inspection are exempted.

1) Electrical measurements

The resistance shall be measured as specified in paragraph E.4.4.5.2, appendix E of JAXA-QTS-2050.

2) External visual

Inspect the external conditions using a 10x or higher magnifier for any evidence of mechanical damages.

4.4.4 Humidity (Steady State)

The test shall be performed in accordance with method 103 of MIL-STD-202. The following conditions shall apply.

a) Pre-test measurements

After the pretreatment, the resistance shall be measured as specified in paragraph E.4.4.5.2, appendix E of JAXA-QTS-2050.

b) Test

The product shall be exposed to the environments of 90 to 95%RH at 40±5°C without load for 2000 hours as a minimum.

c) Final Measurements

After the test, remove the resistor from the test chamber and dry it at the ambient conditions for 90±30 minutes. And measure the resistance as specified in paragraph E.4.4.5.2, appendix E of JAXA-QTS-2050.

d) External visual

After the final measurements, inspect the external conditions using a 10x or higher magnifier for any evidence of mechanical damages.

4.4.5 Thermal Shock

The test shall be performed in accordance with method 107 of MIL-STD-202. The following conditions shall apply.

a) Test conditions

1) In-process inspection: A. The temperature for step 3 shall be $+125^{+5}_{0}$ °C.

2) Qualification test: F-3

b) Measurements and inspections

The following electrical measurements and external visual inspection shall be performed before and after the test cycle. For in-process inspection, the post-test measurements and inspection are exempted.

1) Electrical measurements

The resistance shall be measured as specified in paragraph E.4.4.5.2, appendix E of JAXA-QTS-2050.

2) External visual

Inspect the external conditions using a 10x or higher magnifier for any evidence of mechanical damages.

4.4.6 Load Life in Humidity

The test shall be performed in accordance with paragraph 4.24 of JIS C 5201-1.
The following conditions shall apply.

a) Pre-test measurements

After the pretreatment, the resistance shall be measured as specified in paragraph E.4.4.5.2, appendix E of JAXA-QTS-2050.

b) Test conditions

1) Qualification test: The product shall be exposed to the environments of 90 to 95%RH at 60±2°C for 2000 hours as a minimum with rated direct-current voltage applied intermittently, 90 minutes on and 30 minutes off.

2) Quality conformance inspection: The product shall be exposed to the environments of 90 to 95%RH at 60±2°C for 1000 hours as a minimum with rated direct-current voltage applied intermittently, 90 minutes on and 30 minutes off.

c) Final measurements

After the test, remove the resistor from the test chamber and dry it at the ambient conditions for 90±30 minutes. And measure the resistance as specified in paragraph E.4.4.5.2, appendix E of JAXA-QTS-2050.

d) External visual

After the final measurements, inspect the external conditions using a 10x or higher magnifier for any evidence of mechanical damages.

4.4.7 Resistance to Solvents

Resistors shall be tested in accordance with Test Method 215 of MIL-STD-202.
The following conditions shall apply.

a) Application area

Marked portion

b) Solvents to be used

1) 2-Propanol (isopropyl alcohol)

2) A mixture of 42 parts by volume of water, 1 part by volume of propylene glycol monomethyl ether, and 1 part by volume of monoethanolamine.

4.5 Long-Term Storage

Long-term storage shall be in accordance with paragraph E.4.5, appendix E of JAXA-QTS-2050 and as provided below.

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

The shipment of the resistors stored more than 24 months after qualify conformance inspection (group A) shall be in accordance with paragraph 4.7.1 of JAXA-QTS-2050.

4.5.2 Storage by Purchasers

The products shall be stored at room temperature (15 to 35°C) and at the normal humidity (25 to 85%RH) in a taping package or the package provided by the manufacturer. The product shall be stored in a clean place free of direct sunlight and hazardous gases such as chlorine and sulfur.

4.6 Changes of Tests and Inspections

The following items of qualify conformance inspection (groups A and B) specified in appendix E of JAXA-QTS-2050 have been changed in accordance with the decisions made by the Technology Review Board.

a) Group A inspection

1) Application of pulse and resistance value (group A1-1)
   These inspections shall not be performed because the infant mortalities can be removed through thermal shock, exposure to high temperature and resistance value at in-process inspections.
2) Externals, dimension, mass and marking (group A1-2)
   Because the products are manufactured under strict control and there are no defects attributed to the dimension in the past shipment, the inspection level of AQL 4.0% (General inspection level II) has been reduced to the sample size of 5 and the allowable defects of 0. For external and marking inspection, AQL has been changed from 4.0% (General inspection level II) to 2.5% (Special inspection level S-4).
3) Dielectric withstanding voltage and insulation resistance (group A1-3)
   Because the products are manufactured under strict control and there are no defects of protective film insulation in the past shipment, the inspection frequency is reduced. The test shall be performed as a group B inspection (n=10, Ac=0/Re=1) instead of a group A inspection (AQL 2.5%). For dielectric withstanding voltage, the test shall be performed in ambient atmospheric pressure.
4) Resistance to bonding exposure, resistance-temperature characteristic, low temperature operation and short-time overload (group A2-1)
   Because of good past manufacturing and inspection history, the inspection frequency is reduced. The test shall be performed as a group B inspection (n=10, Ac=0/Re=1) instead of a group A inspection (AQL 2.5%).
5) Adhesion (group A2-3)
   Because of good past manufacturing and inspection history, the inspection frequency is reduced. The test shall be performed as a group B inspection (n=10, Ac=0/Re=1) instead of a group A inspection (AQL 2.5%).

b) Group B inspection

1) Life (group B1-2) and Load life in humidity (group B1-6)

For jumper resistors, the materials used for resistor body are the same as the internal electrode materials, and resistors, materials, structures and manufacturing methods are identical except for the trimming is not performed for jumper resistor. For these reasons as well as the good manufacturing history, the resistor will be the designated sample and exempt from these tests.

5. PREPARATION FOR DELIVERY

Preparation for delivery shall be in accordance with paragraph E.5, appendix E of JAXA-QTS-2050 and as follows.

5.1 Packaging Types

The types of packages are as follows.

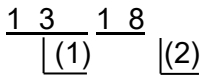
a) Bulk package
b) Chip tray package
c) Taping package

5.2 Marking on Package

The following items shall be marked on the package. In case the lack of space prohibits the marking, marking shall be applied to the documents attached to the product.

a) Lot date code

The completion date of group A inspection shall be marked as follows.
(Example)



(1) The first two digits shall correspond to the last two digits of the calendar year.
(2) The last two digits shall indicate the week of the calendar year. The first week shall be considered the week in which January 1st falls. The first day of the week shall be considered Sunday.

6. NOTE

Refer to the paragraph E.6, appendix E of JAXA-QTS-2050. To procure the resistors manufactured in accordance with this specification, the purchaser shall specify the type of packages (see paragraph 5) in the procurement specification or purchase order.