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15 July 2020

FUSES, SUBMINIATURE, CURRENT-LIMITING, HIGH RELIABILITY, SPACE USE, DETAIL SPECIFICATION FOR

Prepared and Established by
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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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Revision Log		
Rev.	Date	Description
NC	7 June 2011	Original
A	15 March 2012	1) Cover sheet: Changed the corporate name from TATEYAMA KAGAKU IND. Co., LTD. to TATEYAMA KAGAKU DEVICE TECHNOLOGY CO., LTD. due to the name change. 2) Paragraph 1.3, Table 2: Corrected the nominal resistance of JAXA2210/101-A72V1.5AL from 97.0 – 163mΩ to 70.0 – 163mΩ.
B	21 April 2014	Paragraph 4.3.1 Added a paragraph Clarified the configuration of inspection lot for quality conformance inspection. Paragraphs 4.2 and 4.3 Specified the test circuit for overload interrupt.
C	31 Jan. 2019	Cover: Changed corporate name. Table 4 Modified the mass due to the change of resin materials. Style J1: 0.43 to 0.47 → 0.46 to 0.50 Style J2: 1.95 to 2.15 → 2.00 to 2.20 Paragraph 4.4.1: Specified the handling of products stored for a long time at manufacturer's site.
D	15 July 2020	Table 2 Added a note for operating temperature range (^{5}) Case temperature range to ensure pre-arcing. Clarification of substituting the in-process inspection results Table 6 Added notes (^{3}) and (^{4}) for X-ray inspection of qualification test. (^{3}) This test item can be performed prior to Group I inspection. (^{4}) The test result of in-process inspection may be used. Table 7 Added note (^{4}) for X-ray inspection of qualify conformance inspection (Group A) (^{4}) The result of in-process inspection performed at the end of manufacture process may be used. Paragraph 4.5 Changes to test and inspection Specified that the test result of X-ray inspection during in-process inspection may be used for X-ray inspection (Group A1-1) in Group A inspection.
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Contents

FUSES, SUBMINIATURE, CURRENT-LIMITING, HIGH RELIABILITY, SPACE USE, DETAIL SPECIFICATION FOR

1. GENERAL

1.1 Scope

This specification establishes the detailed requirements for JAXA-QTS-2210, the high reliability, subminiature, current-limiting fuses (hereinafter referred to as "fuses") to be used for electronic equipment installed on spacecrafts such as satellites.

1.2 Part Number

The part numbers for the fuses covered in this specification shall be assigned as the following example. Refer to Table 1 for details.

Example:

JAXA(1) 2210/101 - A 72V 1A L

Characteristic | Rated voltage | Rated current | Terminal structure

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

Table 1. Part Number

Item	Applicable paragraph of JAXA-QTS-2210	Specification
Characteristic	1.4.1	A: Fast acting
Rated voltage	1.4.2	72V, 126V
Rated current	1.4.3	1A, 1.5A, 2A, 3A, 5A, 7.5A, 10A, 15A
Terminal structure	1.4.4	L: Tough pitch copper, solder finish of 1.52µm thickness or more

1.3 Ratings

The ratings are shown in Table 2.

Table 2. Ratings

Part number	Rating			Pre-arcing time (m sec)(3)			Operating temperature range (5)	Rated breaking capacity	Style (4)
	Voltage (V)	Current(1) (A)	Nominal resistance (2) (mΩ)	Test current 250%	Test current 400%	Test current 600%			
JAXA 2210/101-A72V1AL	72	1.0	110-220	10.0-300	1.00-15.0	0.15-3.00	-55˚C to +125˚C	1,000A	J1
JAXA 2210/101-A72V1.5AL	72	1.5	70.0-163						
JAXA 2210/101-A72V2AL	72	2.0	45.0-75.0						
JAXA 2210/101-A72V3AL	72	3.0	20.0-43.8						
JAXA 2210/101-A72V5AL	72	5.0	12.0-22.5						
JAXA 2210/101-A72V7.5AL	72	7.5	8.20-13.8						
JAXA 2210/101-A72V10AL	72	10.0	6.30-10.7						J2
JAXA 2210/101-A72V15AL	72	15.0	4.00-7.00						
JAXA 2210/101-A126V1AL	126	1.0	90.0-270	10.0-300	0.75-15.0	0.10-3.00			
JAXA 2210/101-A126V3AL	126	3.0	20.0-95.0						
JAXA 2210/101-A126V5AL	126	5.0	12.0-40.0						

Notes: (1) Loads shall be derated when the case temperature exceeds +25˚C.

(2) Resistance at 25˚C.

(3) The maximum pre-arcing time at -55˚C with 250% loads shall be as specified below.
1.0A: 10 sec., 1.5A: 10 sec., 2.0A: 10 sec., 3.0A or more: 5 sec.

(4) Refer to Figure 2 and Table 4.

(5) Case temperature range to ensure pre-arcing.

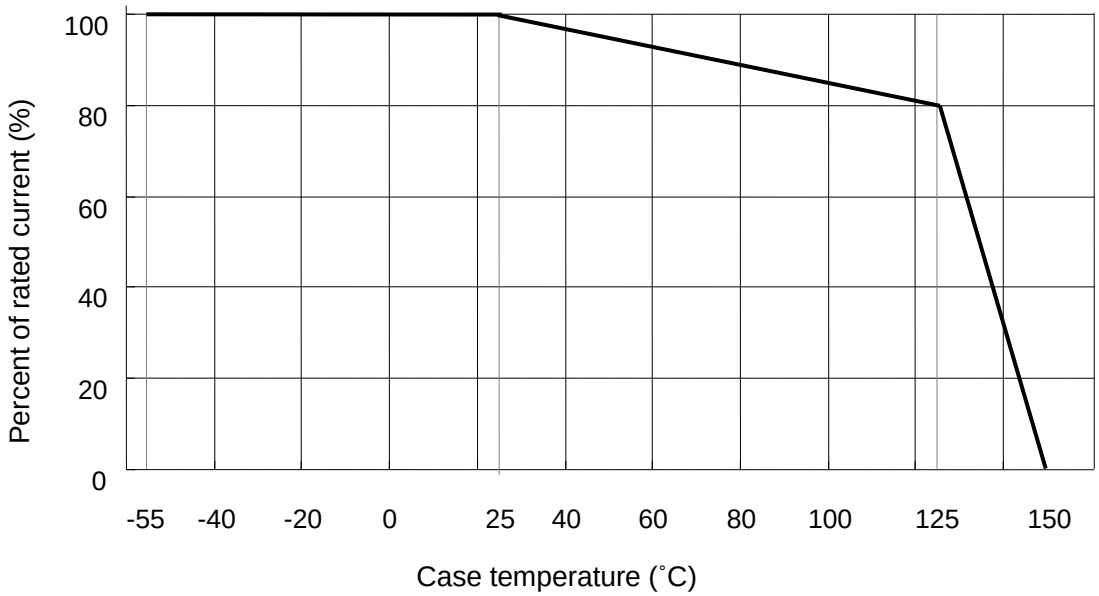


Figure 1. Derating Curve

2. APPLICABLE DOCUMENTS

The applicable documents shall be as specified in paragraph 2.1 of JAXA-QTS-2210.

3. REQUIREMENTS

The requirements shall be as follows and as specified in section 3 of JAXA-QTS-2210.

3.1 Performance

The performances are shown in Table 3.

Table 3. Performance

Item		Requirements paragraph of JAXA-QTS-2210	Performance
Materials		3.3	As specified in Table 5.
Design and construction		3.4	As specified in Figure 3.
Externals, dimensions and marking		3.5	
	Externals and markings	3.5.1	As specified in JAXA-QTS-2210. Marking shall be as shown in Figure 4.
	Dimensions and weight	3.5.2	As specified in Figure 2 and Table 4.
Workmanship		3.6	As specified in JAXA-QTS-2210.
Electrical performance		3.8	
	Burn-in	3.8.1	Allowable voltage drop change: within ±10%
	Resistance	3.8.2	As specified in Table 2.
	Current-carrying capacity	3.8.3	5.0A or less: +85˚C max. 7.5A or more: +120˚C max.
	Dielectric withstanding voltage	3.8.4	Resistance after test: As specified in Table 2.
	Overload interrupt	3.8.5	Pre-arcing time: As specified in Table 2.
	Short circuit interrupt	3.8.6	As specified in JAXA-QTS-2210.
	Insulation resistance	3.8.7	As specified in JAXA-QTS-2210.
	Resistance-temperature coefficient	3.8.8	+3500±700ppm/˚C
Mechanical performance		3.9	
	Terminal strength	3.9.1	Allowable resistance change: within ±10%
	Solderability	3.9.2	As specified in JAXA-QTS-2210.
	Resistance to soldering heat	3.9.3	Allowable resistance change: within ±10%
Environmental performance		3.10	
	High-frequency vibration	3.10.1.1	Allowable resistance change: within ±10%
	Random vibration	3.10.1.2	Allowable resistance change: within ±10%
	Shock	3.10.2	Allowable resistance change: within ±10%
	Thermal shock[I]	3.10.3.1	As specified in JAXA-QTS-2210.
	Thermal shock[II]	3.10.3.2	Allowable resistance change: within ±10%
	Salt spray (corrosion)	3.10.4	Allowable resistance change: within ±10%
	Moisture resistance	3.10.5	Allowable resistance change: within ±15%
	Low-temperature operation	3.10.6	Allowable resistance change: within ±10%
	Thermal vacuum	3.10.7	Pre-arcing time: As specified in Table 2. Allowable resistance change: within ±10%
	Resistance to solvents	3.10.8	Not applicable as this fuse apply laser marking.
Durability		3.11	
	Steady-State life	3.11.1	Allowable resistance change: within ±10%

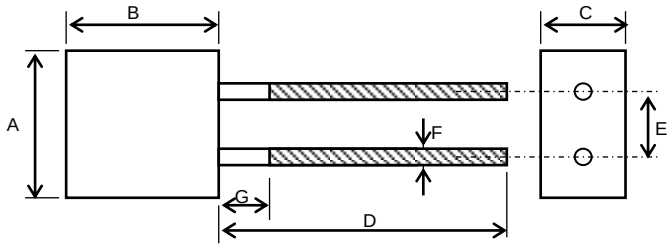


Figure 2. Dimensional Drawing

Table 4. Dimension and Weight

Style	Dimension (mm)							Weight (g) (typ.)
	A	B	C	D (min.)	E	F(1)	G (max.)(2)	
J1	$7.00^{+0.1}_{-0.3}$	$5.40^{+0.1}_{-0.3}$	$3.50^{+0.1}_{-0.3}$	40.0	4.00±0.05	0.60±0.05	5.00	0.46 to 0.50
J2	$9.00^{+0.1}_{-0.3}$	$9.30^{+0.1}_{-0.3}$	$5.00^{+0.1}_{-0.3}$	57.0	5.00±0.05	1.20±0.1	5.00	2.00 to 2.20

Notes: (1) Dimensions after solder coating.
(2) Length of uncoated part of the lead from fuse body.

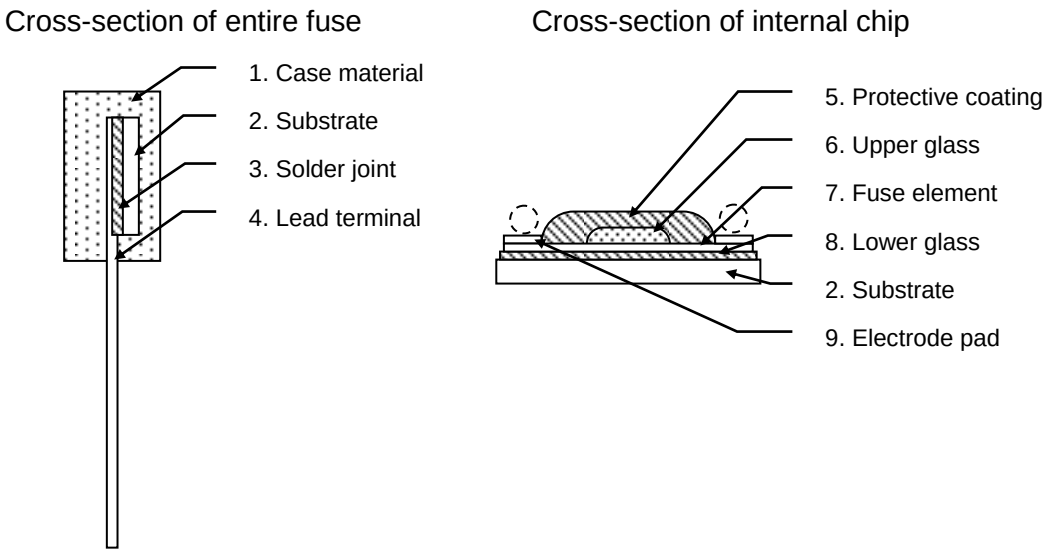


Figure 3. Construction

Table 5. Materials

Construction	Material
1. Case material	PPS resin
2. Substrate	Alumina 96% Thickness: J1) 0.500mm, J2) 0.635mm
3. Solder joint	Solder: Sn 8% / Ag 2% / Pb 90%
4. Lead terminal	Core: C1100W (Cu 99.9%) Ni plating 3µm / Gold plating 0.5µm / Solder coat finish (Sn 63% / Pb 37%)
5. Protective coating	Low-melting-point glass
6. Upper glass	Low-melting-point glass
7. Fuse element	Gold-based thick film conductive material
8. Lower glass	Low-melting-point glass
9. Electrode pad	Ni

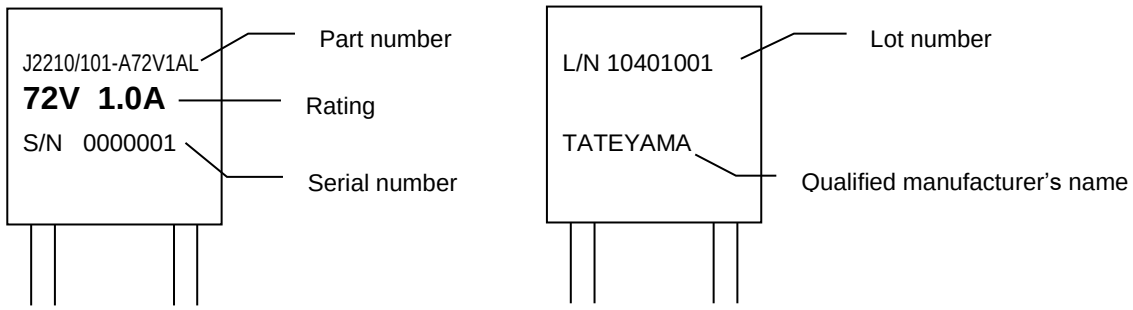


Figure 4. Markings

4. QUALITY ASSURANCE PROVISIONS

4.1 In-Process Inspection

The in-process inspection shall be performed in accordance with paragraph 4.3 of JAXA-QTS-2210.

4.2 Qualification Test

The qualification test shall be performed in accordance with paragraph 4.4 of JAXA-QTS-2210 and as specified in Table 6.

Table 6. Qualification Test

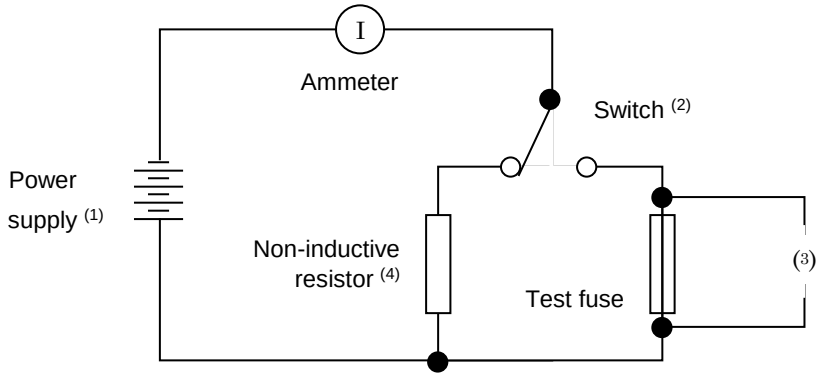
Test			JAXA-QTS-2210		Pass/Fail criteria	
Group	Order	Item	Requirements paragraph	Test method paragraph	No. of samples	No. of defectives allowed
I	1	Externals, dimension and marking	3.5	4.6.2	85	0
	2	Thermal shock [I]	3.10.3.1	4.6.6.3.1		
	3	Burn-in	3.8.1	4.6.4.1		
	4	Resistance	3.8.2	4.6.4.2		
	5	Current-carrying capacity	3.8.3	4.6.4.3		
	6	Dielectric withstanding voltage	3.8.4	4.6.4.4		
II	1	X-ray inspection(3)(4)	3.6.1	4.6.3.1	85	0
	2	DPA	3.6.2	4.6.3.2	3	0
III	1	Resistance-temperature coefficient	3.8.8	4.6.4.8	18	0
	2	Resistance to solvents	Not applicable			
	3	Terminal strength	3.9.1	4.6.5.1		
	4	Overload interrupt (-55˚C, +125˚C) (2)	3.8.5	4.6.4.5		
	5	Insulation resistance	3.8.7	4.6.4.7		
	6	Solderability	3.9.2	4.6.5.2		
IV	1	Low-temperature operation	3.10.6	4.6.6.6	18	0
	2	Steady-state life	3.11.1	4.6.7.1		
	3	Overload interrupt (+25˚C) (2)	3.8.5	4.6.4.5		
	4	Insulation resistance	3.8.7	4.6.4.7		
V	1	Thermal vacuum	3.10.7	4.6.6.7	8	0
VI	1	Short circuit interrupt	3.8.6	4.6.4.6	4	0
VII	1	Salt spray (corrosion)	3.10.4	4.6.6.4	4	0
	2	Overload interrupt (+25˚C) (600%)(2)	3.8.5	4.6.4.5		
	3	Insulation resistance	3.8.7	4.6.4.7		
VIII	1	Moisture resistance	3.10.5	4.6.6.5	12	0
	2	Resistance to soldering heat	3.9.3	4.6.5.3		
	3	High-frequency vibration	3.10.1.1	4.6.6.1.1		
	4	Random vibration	3.10.1.2	4.6.6.1.2		
	5	Shock	3.10.2	4.6.6.2		
	6	Current-carrying capacity	3.8.3	4.6.4.3		
	7	Overload interrupt (+25˚C) (2)	3.8.5	4.6.4.5		
	8	Insulation resistance	3.8.7	4.6.4.7		
IX	1	Thermal shock [II]	3.10.3.2	4.6.6.3.2	18	0
	2	Overload interrupt (+25˚C) (2)	3.8.5	4.6.4.5		
	3	Insulation resistance	3.8.7	4.6.4.7		
-	1	Materials	3.3	—	(1)	

Notes: (1) Documents shall be submitted to prove that the samples satisfy the design specification.

(2) The drawing of the test circuit for overload interrupt is shown in Figure 5.

(3) This test item may be performed prior to Group I inspection.

(4) The test result of in-process inspection may be used.



Notes:

(1) A battery, or power supply with which the impedance is less than 10% of the total impedance of the circuit shall be used.

(2) A switch for high current without a risk of contact bounce shall be used.

(3) A oscillograph or an equivalent measuring circuit for recording current shall be used.

(4) The same resistance value as the test fuse shall be set in order to obtain prospective current.

Figure 5. Test Circuit for Overload Interrupt of Qualification Test

4.3 Quality Conformance Inspection

The quality conformance inspection shall be performed in accordance with paragraph 4.5 of JAXA-QTS-2210 and as specified in Tables 7, 8, and 9.

4.3.1 Sample

The inspection lot for quality conformance inspection shall consist of the following items.

a) Qualify conformance inspection (Group A)
   The samples with the identical characteristics and ratings under the identical production conditions shall be used.

b) Qualify conformance inspection (Group B and C)
   Sampling from the lot which passed the Group A inspection, Group B and C inspections shall be performed with the following combination .
   1) Characteristic A, Style J1, rated voltage 72V at any rated current between 1.0 to 7.5A
   2) Characteristic A, Style J2, rated voltage 72V at any rated current between 10.0 to 15.0A
   3) Characteristic A, Style J2, rated voltage 126V at any rated current between 1.0 to 5.0A

Table 7. Quality Conformance Inspection (Group A)

Test			JAXA-QTS-2210		Pass/Fail criteria	
Group	Order	Item	Requirements paragraph	Test method paragraph	No. of samples	No. of defectives allowed
A1	1	X-ray inspection(4)	3.6.1	4.6.3.1	100%	N/A
A2	1	Thermal shock [I]	3.10.3.1	4.6.6.3.1	100%	0
	2	Burn-in	3.8.1	4.6.4.1		
	3	Resistance	3.8.2	4.6.4.2		
A3	1	Externals, dimensions and marking	3.5	4.6.2	AQL(1) 1.0%	
A4	1	Current-carrying capacity (+25˚C)	3.8.3	4.6.4.3	21(2)	0
	2	Dielectric withstanding voltage	3.8.4	4.6.4.4		
	3	Overload interrupt (+25˚C) (3)	3.8.5	4.6.4.5		
	4	Insulation resistance	3.8.7	4.6.4.7		
A5	1	Terminal strength	3.9.1	4.6.5.1	4	0
	2	Solderability	3.9.2	4.6.5.2		
A6	1	DPA	3.6.2	4.6.3.2	3	0

Notes: (1) The acceptance quality level (AQL) is based on a single sampling plans for normal inspection, specified in JIS Z 9015-1, Attachment Table 2-A.

(2) Samples shall be selected from the both ends of truncated distribution based on the voltage drop after burn-in test.

(3) The drawing of the test circuit for overload interrupt is shown in Figure 6.

(4) The result of in-process inspection performed at the end of manufacture process may be used.

Table 8. Quality Conformance Inspection (Group B)

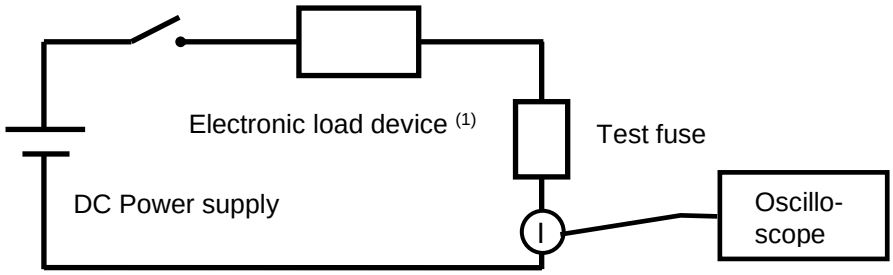
Test			JAXA-QTS-2210		Pass/fail criteria	
Group	Order	Item	Requirement paragraph	Test method paragraph	No. of samples	No. of defectives allowed
B1	1	Low temperature operation	3.10.6	4.6.6.6	12	0
	2	Steady-state life	3.11.1	4.6.7.1		
	3	Overload interrupt (+25°C) (1)	3.8.5	4.6.4.5		
	4	Insulation resistance	3.8.7	4.6.4.7		
B2	1	Short circuit Interrupt	3.8.6	4.6.4.6	4	0
B3	1	Resistance–temperature coefficient	3.8.8	4.6.4.8	6	0
	2	Terminal strength	3.9.1	4.6.5.1		
	3	Overload interrupt (+25°C) (600%)(1)	3.8.5	4.6.4.5		
	4	Insulation resistance	3.8.7	4.6.4.7		
	5	Resistance to solvents	Not applicable			
B4	1	Resistance to soldering heat	3.9.3	4.6.5.3	4	0
	2	High frequency vibration	3.10.1.1	4.6.6.1.1		
	3	Random vibration	3.10.1.2	4.6.6.1.2		
	4	Shock	3.10.2	4.6.6.2		
B5	1	Salt spray (corrosion)	3.10.4	4.6.6.4	4	0
	2	Overload interrupt (+25°C) (600%)(1)	3.8.5	4.6.4.5		
	3	Insulation resistance	3.8.7	4.6.4.7		
B6	1	Moisture resistance	3.10.5	4.6.6.5	4	0
	2	Current-carrying capacity	3.8.3	4.6.4.3		

(1) The drawing of the test circuit for overload interrupt is shown in Figure 6.

Table 9. Quality Conformance Inspection (Group C)

Test			JAXA-QTS-2210		Pass/fail criteria	
Group	Order	Item	Requirement paragraph	Test method paragraph	No. of samples	No. of defectives allowed
C1	1	Thermal vacuum	3.10.7	4.6.6.7	8	0
C2	1	Thermal shock [II]	3.10.3.2	4.6.6.3.2	18	0
	2	Overload interrupt (+25°C) (1)	3.8.5	4.6.4.5		
	3	Insulation resistance	3.8.7	4.6.4.7		

(1) The drawing of the test circuit for overload interrupt is shown in Figure 6.



(1) A specific constant test current shall be applied to the fuse using an electronic load device.

Figure 6. Test Circuit for Overload Interrupt of Quality Conformance Inspection

4.4 Long-Term Storage

Long-term storage shall be in accordance with paragraph 4.7 of JAXA-QTS-2210 and as specified below.

4.4.1 Handling of Products Stored for a Long Time at Manufacturer's Site

The fuses stored more than 24 months after Qualify Conformance Inspection (Group A) shall be inspected either 100 % or by sampling for the following test items in accordance with Tables 7 and 8, and only accepted products can be shipped. Sampling inspection shall be performed per production lot and the result of the inspection will be valid for 24 months.
The re-inspection date shall be printed on the package, storage box, or the certificate of the inspection attached to the products.

a) 100% inspection:
   1) Resistance (Group A2-3)
   2) Externals and markings (Group A3-1)

b) Sampling inspection:
   1) Current-carrying capacity (Group A4-1)
   2) Dielectric withstanding voltage (Group A4-2)
   3) Overload interrupt (Group A4-3)
   4) Insulation resistance (Group A4-4)
   5) Solderability (Group A5-2)
   6) Resistance to soldering heat (Group B4-1)

4.4.2 Storage by Purchasers

The products shall be stored at room temperature (15 to 30°C) and at the normal humidity (25 to 85%RH) in 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.

4.5 Changes of Test and Inspection

The following test item of quality conformance inspection specified in JAXA-QTS-2210 is changed.

a) Group A inspection

1) X-ray inspection (Group A1-1)

The test result of X-ray inspection during in-process inspection is used for X-ray inspection (Group A1-1) due to no items placing the stress on the sample after the X-ray inspection during in-process inspection. (See note ([4]) of Table 7)

5. PREPARATION FOR DELIVERY

Preparation for delivery shall be as specified in paragraph 5 of JAXA-QTS-2210.
The packaging form shall be as follows

a) Palette packaging

6. NOTES

Refer to the paragraph 6 of JAXA-QTS-2210.