Basic Approach of JAXA Parts Program Related to Passive Parts

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Japan Aerospace Exploration Agency

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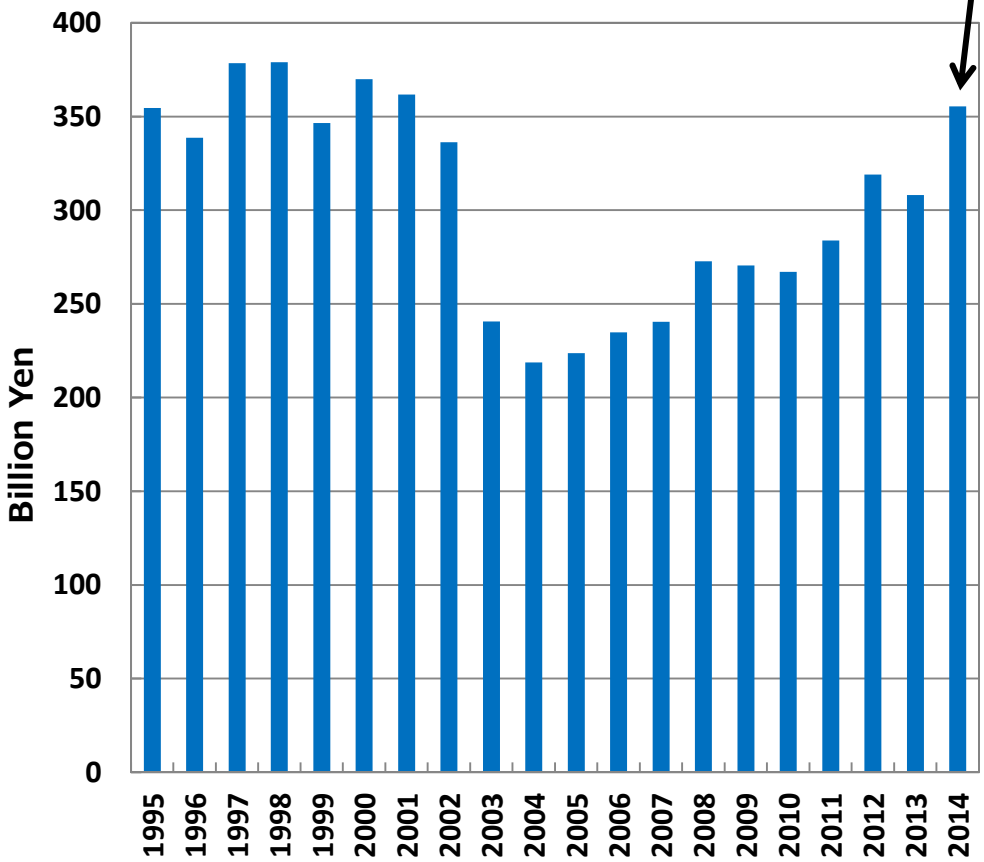
- Current Situation of Space Market in Japan
- New Basic Plan on Space Policy in Japan and JAXA's approach
- JAXA Qualified Parts
- Future Development of Passive Parts

Market of Space Industry in Japan

3 Billion€ in 2014 (1 € =120 Yen)

Sales of space equipment in Japan



(2015 Space Industry Databook by Society of Japanese Aerospace Companies)

Sales of manufacturing industries of space equipment

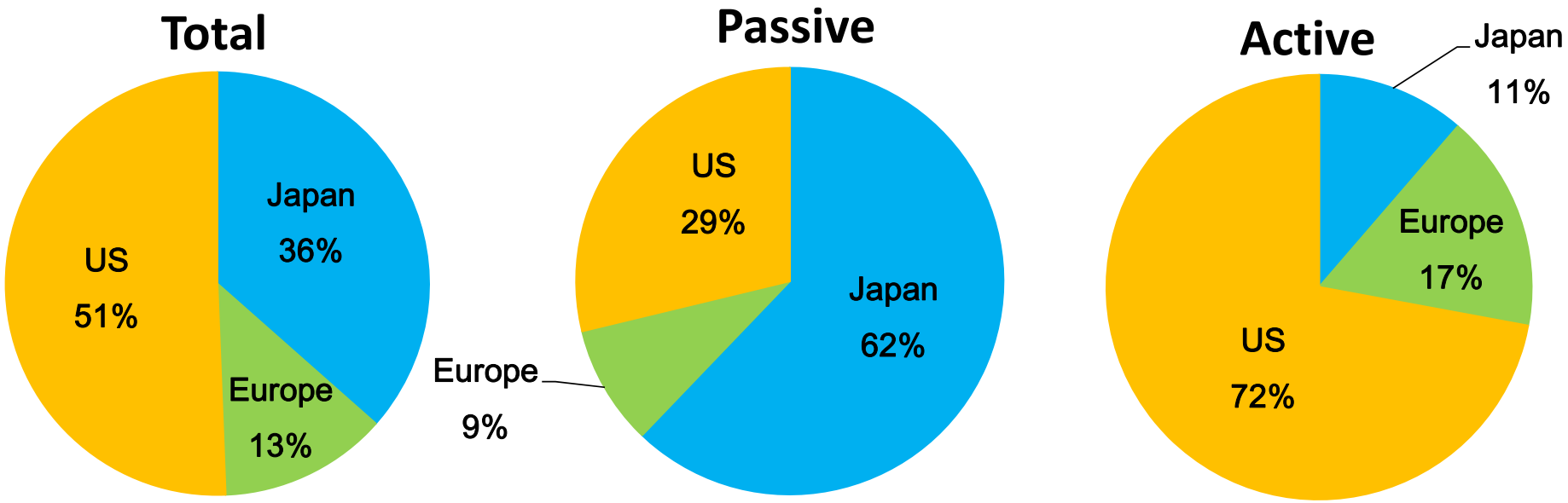
- **Total: 355 Billion Yen (3 B€)**
- **EEE parts for Japanese satellites (estimated): 25 Billion Yen (210 M€)**
- **Qualified EEE parts for Japanese satellites (estimated): 4 Billion Yen (33 M€)**

<1€ = 120 Yen>

Sales of manufacturing industries of space equipment is on the rise, however their market size is small compared to space market in Europe / the US, and markets for other industries

Parts used in JAXA projects

While most of active parts are imported, around 60 % of passive parts come from domestic manufacturers



Calculated in terms of part type

No change in those rates has been observed for 5 years

New Basic Plan on Space Policy in Japan

The New "Basic Plan for Space Policy" was determined on Jan. 9, 2015

- **Reflection of the new national security policy**
- **Establishment of the long-term and concrete public investment plan for the next 10 years, foreseeing the coming 20 years**

1 Environmental awareness surrounding space policy

-In considering our space policy how has the environment been changed?

2 Goals of Japan's space policy

-Ensuring space security

-Promoting use of space in civil area

-Maintaining and strengthening industrial and science / technology basis

3 Basic stance for fostering space policy

-Prioritizing realization of outcomes from use of space (exit strategy)

-Setting flexible targets rather than fixed rigid targets

4 Concrete approach to accomplish the goals

New Basic Plan on Space Policy
-- 4 Concrete approach

I Ensuring space security

- Quasi-Zenith Satellite System (QZSS)
- Space Situational Awareness (SSA)
- X-band Satellite-Based Communication Network
- Information Gathering Satellite
- Responsive Small Satellites
- Advanced optical & radar satellites etc.

II Promoting use of space in civil area

- Geostationary meteorological satellites HIMAWARI
- GOSAT, environmental observation satellites
- QZSS
- Advanced optical & radar satellites
- Automation, unmanned and labor saving operations through GNSS and geospatial information
- Creation of new industries using satellite remote sensing data as big data etc.

GOSAT : Greenhouse Gases Observing Satellite
GNSS : Global Navigation Satellite System

III Maintaining and strengthening industrial and science / technology basis

- New-type core rocket and Epsilon rocket
- The government steadily takes steps according to the schedule
- To foster public-private efforts to achieve the cumulative market size of 5 trillion yen over 10 years
- Build organic cycles among science & technology, security and industrial promotion through R&D activities by JAXA, public and private institutions based on utilization needs on outer space
- Stable supply of key parts, new development of private demands, etc.

New Basic Plan on Space Policy
-- EEE parts-related descriptions

1. Environmental awareness surrounding space policy

-It is difficult to maintain domestic base of technology and production for space parts only by meeting the domestic demand for satellites

→ High dependence of key parts on overseas sources

4. Concrete approach

Maintaining and strengthening space industrial base in cooperation with private sectors

-To promote stable supply of key parts, entry of new companies into space business market, new development of demands from private sectors, and acquisition of overseas customers

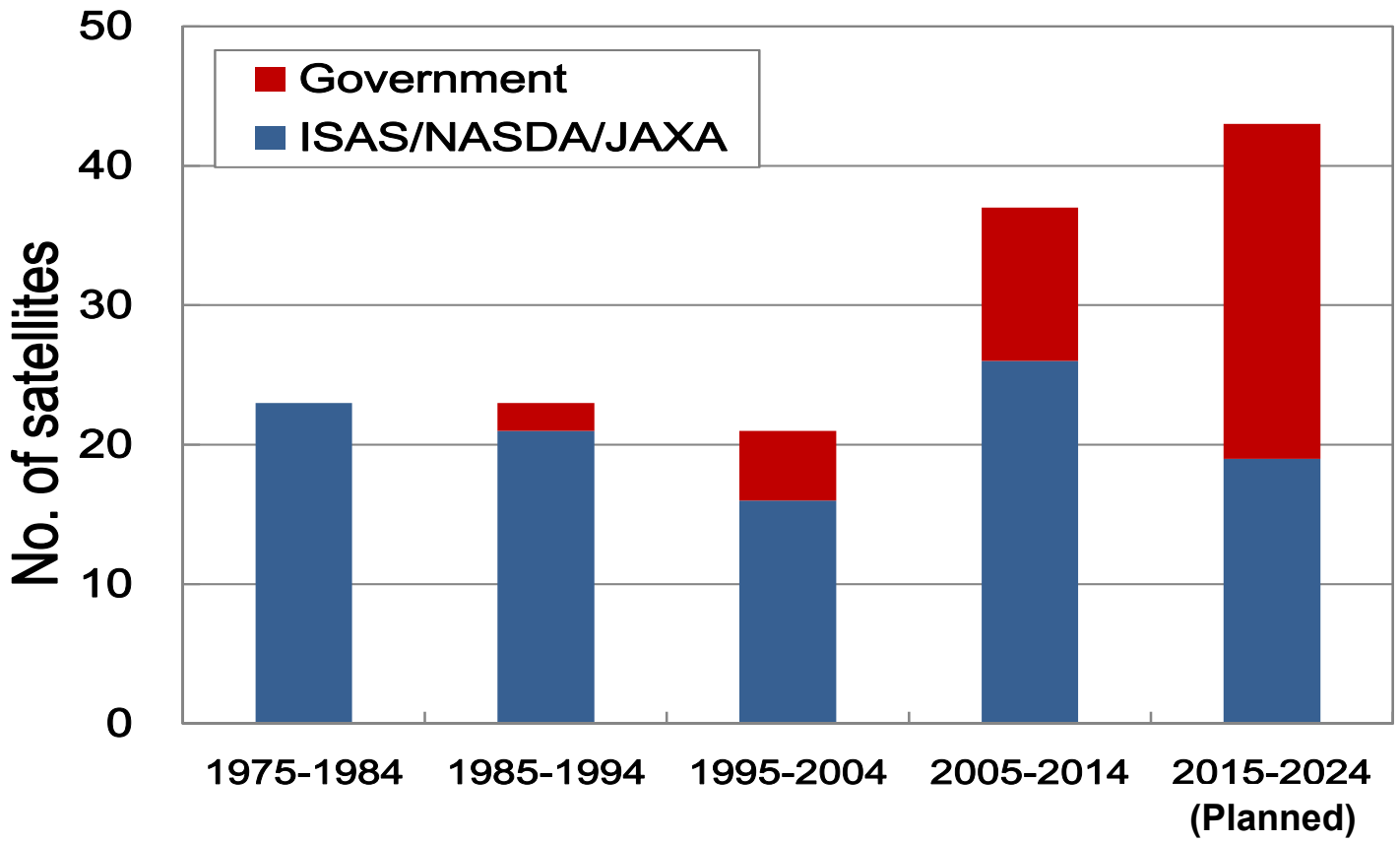
-To develop technological strategy on EEE parts, implement necessary measures based on the strategy, and reflect the strategy to related plans (Cabinet Office, MEXT, METI, and MLIT etc.)

- To conduct R&D of high performance and low cost EEE parts for space use

- To establish an environment to realize timely in-orbit demonstration of key parts with low cost using small / ultrasmall satellites (MEXT and MLIT)

METI : Ministry of Economy, Trade and Industry
MEXT : Ministry of Education, Culture, Sports, Science and Technology
MLIT : Ministry of Land, Infrastructure, Transport and Tourism

Launch of Japanese satellites



- Total number of Japanese satellites is on the rise
- Government satellites are the great contributors of the increase
- JAXA qualified parts are also used for government satellites

Basic Approach of JAXA Parts Program

In line with the New Basic Plan on Space Policy, basic approach of JAXA parts program has been revised

[Tactics #0] Drawing up "ALL-JAPAN" policy on space parts

--- From "ALL-JAXA policy" to "ALL-JAPAN" policy

[Tactics #1] R&D of space parts and peripheral technologies

--- Acquisition of domestic sources of key parts and technologies

[Tactics #2] Promoting the use of domestic space qualified parts

--- Qualification of parts for space use and their stable supply

[Tactics #3] Wise use of overseas parts

--- Information-gathering on quality / lead time of overseas parts, second source etc.

[Tactics #4] Cooperation with overseas partners

--- Improvement of independence from ITAR

--- Increase of overseas awareness of JAXA qualified parts

[Tactics #5] Using domestic COTS

--- Development of an environment to facilitate using COTS in space

Cooperation with overseas partners

Considering Japanese satellites are heavily depend on overseas parts, cooperation with overseas partners is very important (Tactics #3 and #4), especially with ESA

- **Information gathering**

  Technology trends, change in MIL/ESCC specs, availability and quality issues of overseas parts, etc.

- **Seeking new part sources**

  Adoption of ESCC parts

- **Comparison of test specifications for parts qualification / parts application**

  Comparison of generic specifications between ESCC and JAXA qualification

JAXA qualified parts -- part type breakdown

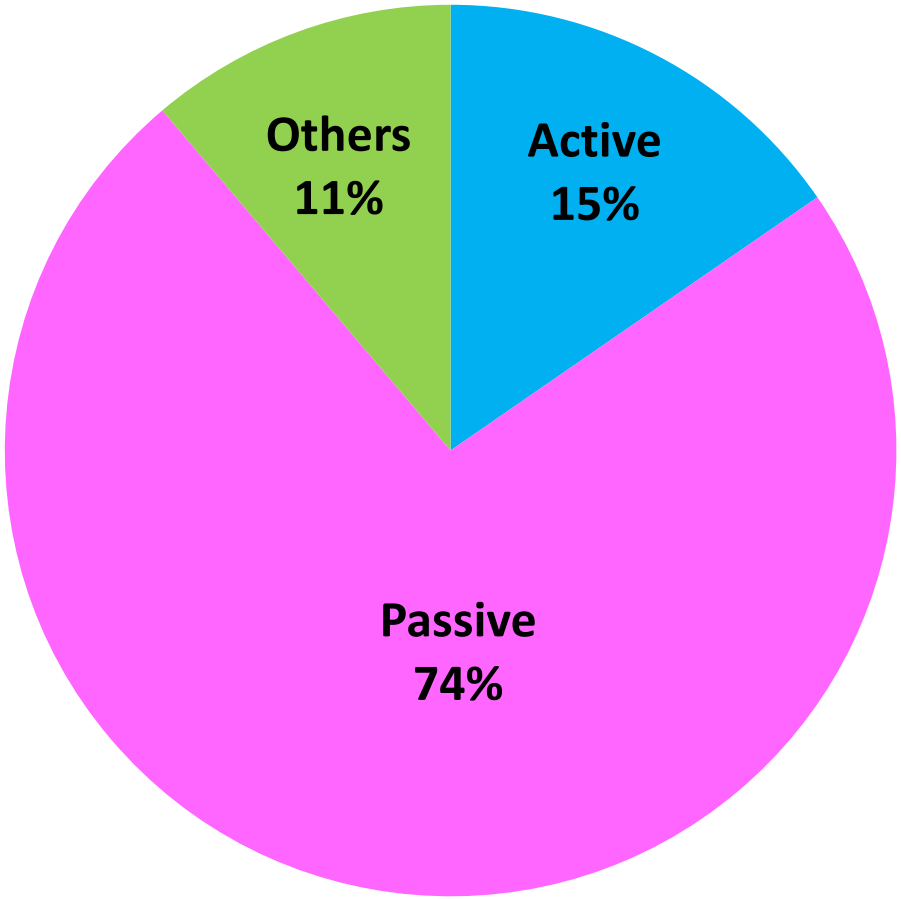
- No. of qualified parts
  143 (passive : 105)
- No. of detail specs
  83 (passive : 55)
- No. of qualified manufacturers
  25 (passive : 15)

These figures are quite stable for 5 years

10 part types are listed in EPPL (passive : 7)

- Fuses (SMD and Leaded)
- Thermistors
- Pt temperature sensors
- Chip thin film resistors
- Ta capacitor (Matsuo Electric)
- Differential transmission cables (Junkosha)
- Point-of-Load DC/DC converters
- Power MOSFETs (N-ch and P-ch)

As of Sep.1 2016



Total : 143 types

Others: PCBs, materials, solar cells

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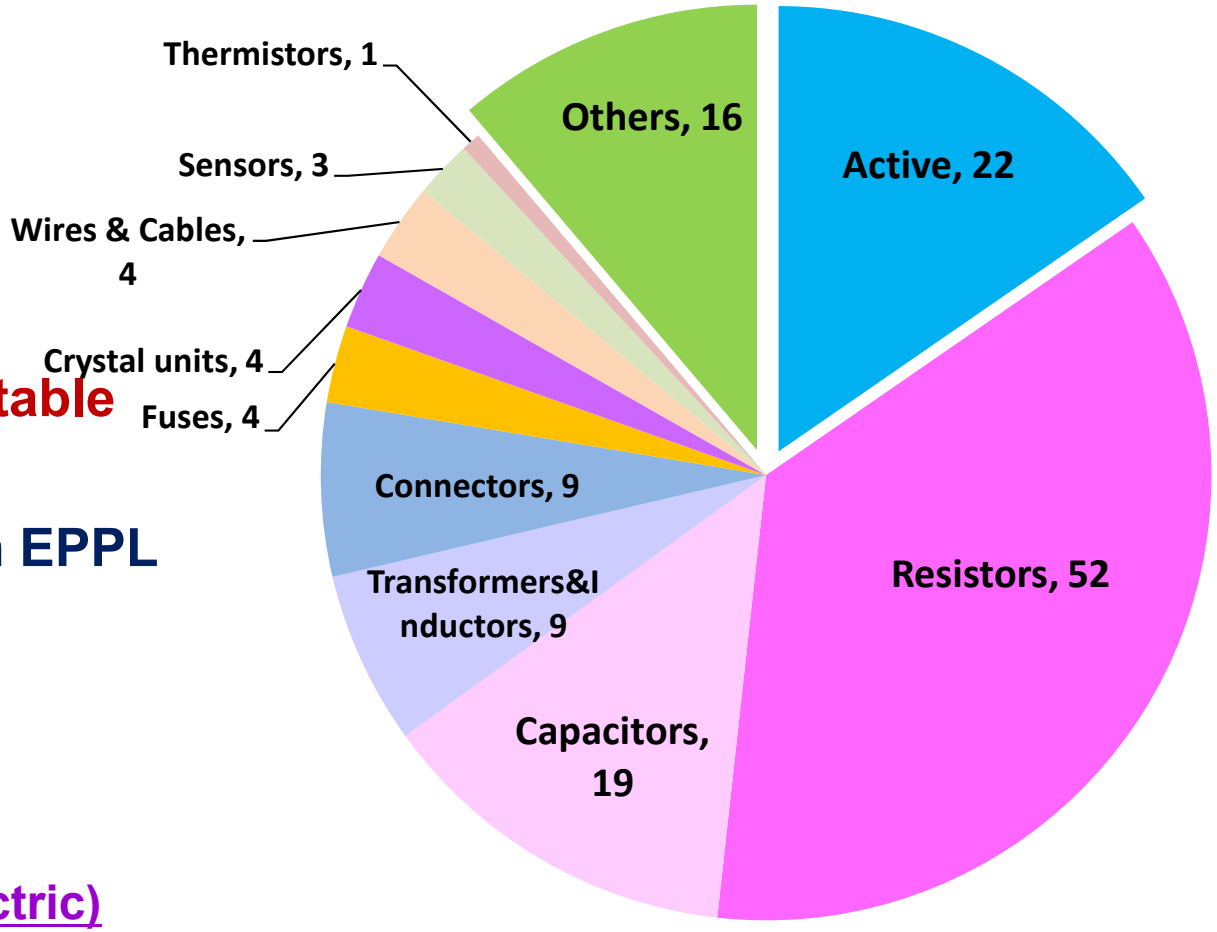

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JAXA qualified parts (passive) -- Lineup

Comp. family	Description	Detail spec.	Manufacturer
Capacitors	Mica	4	Soshin Electric
	MLCC	3	Murata
	Chip, Solid, Electrolytic, Tantalum EPPL	1	Matsuo Electric
Resistors	Chip, Thick Film	3	Tateyama Kagaku
			Hokuriku Electric
	Wire-Wound (Power Type)	3	Seiden Techno
			Sanada KOA
	Film	4	Sanada KOA
	Networks, Film	1	Sanada KOA
	Chip, Thin Film EPPL	1	Sanada KOA
Thermistors	Chip, Negative Temperature Coefficient EPPL	1	Tateyama Kagaku
Fuses	Subminiature, Current-Limiting EPPL	2	Tateyama Kagaku
Temp. Sensors	Platinum EPPL	3	MHI*
Osc. Crystals	Quartz Crystal Units	4	Nihon Dempa Kogyo
Transformers and Inductors	Power	3	Tamura
	Others	6	Tamura
Wires and Cables	Fluoroplastic, Polyimide Insulated Wires	4	Hitachi Metals
	Differential Transmission Cables EPPL	2	Junkosha
Connectors	Rectangular, Miniature	2	JAE**
			Nihon Maruko
	Rectangular, Miniature, High Density	2	JAE**
			Nihon Maruko
	Rectangular, Microminiature	1	Nihon Maruko
	Rectangular Miniature Mixed	1	Nihon Maruko
	Coaxial, RF	3	Waka Manufacturing

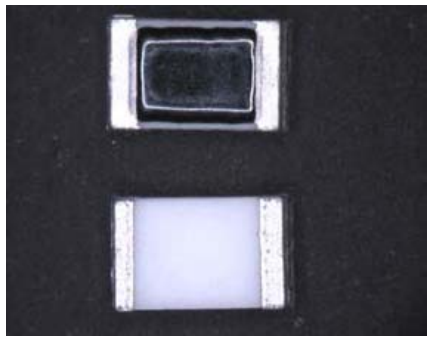
* MHI=Mitsubishi Heavy Industries ** JAE=Japan Aviation Electronics Industry

JAXA qualified parts listed in EPPL

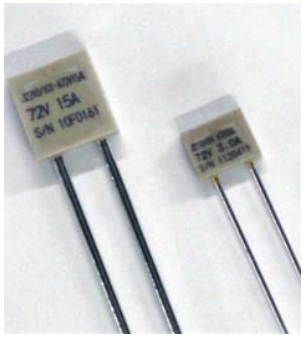
Chip Ta capacitor

Differential Transmission Cables

Pt temperature sensors



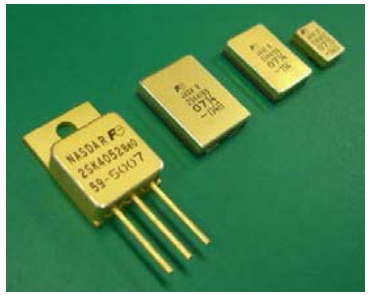
Chip thermistors



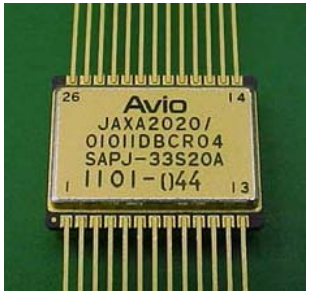
Leaded fuses

SMD fuses

Chip metal film resistors



Power MOSFETs (n-ch / p-ch)



POL DC/DC converters

JAXA qualified parts are displayed in the JAXA exhibition booth

For more information, visit our website!
https://eeepitnl.tksc.jaxa.jp/en/

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Roadmap for EEE parts

- Technology roadmap for EEE parts / technology is being developed for the coming 10 years to increase the export and to reduce import of equipment and parts
- It is aimed to strengthen the outcome and reduce dependency on overseas parts, by promoting commercial space business and by acquiring growing demand from overseas and commercial area
- More consideration will be given on entering into commercial market, not only aiming for using EEE parts for government / JAXA satellites

Development of passive parts in the near future

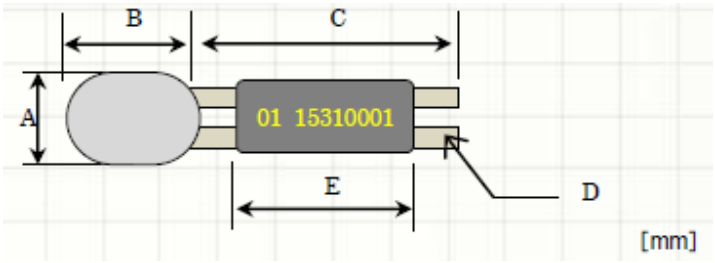
- Ensuring stable quality
- Downsizing and low loss for high performance and high power satellites

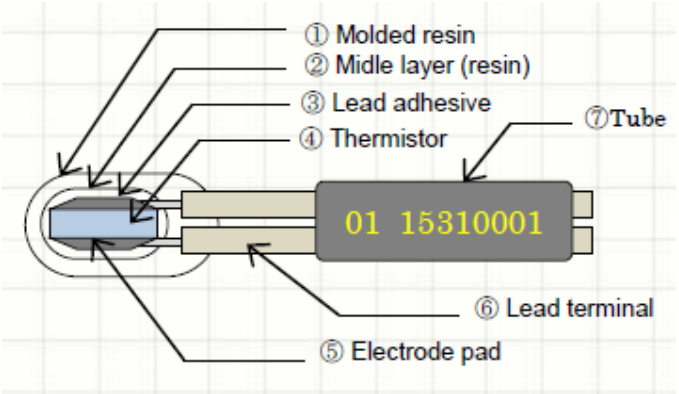
  - **Leaded thermistors** --- To be qualified in 4Q 2016
  - **Stacked capacitors** --- Targeting qualification in 3-4 years
  - **Leaded capacitors** --- Targeting qualification in 3-4 years
  - **RF cables / connectors**
    --- Targeting qualification in 2-3 years
  - **Chip resistors / capacitors in smaller size**
    --- Under consideration

Leaded Thermistor

Item	Characteristics		
Nominal zero-power resistance	2200 (Ω)	5000(Ω)	10,000(Ω)
Nominal B value range	3750 (K)	3970 (K)	4150 (K)
B value tolerance	F=±1 (%)		
Operating / Storage temperature range	-55 to +150 degC		
Zero-power resistance tolerance	F=±1 (%) , J=±5 (%)		
Allowable operating power	10 (mW)		
Rated power @ 25 degC	310 (mW)		

- ✓ Compatible with S-311-P18 (GSFC spec) with wider temperature range
- ✓ To be qualified in 4Q 2016





Type	1800	1501	1102
A	Max. 2.8 mm		
B	4.0±1.5 mm		
C	80+15/-0 mm	500+15/-0 mm	1000+15/-0 mm
D	AWG28 (Outer Diameter 0.63~0.74mmΦ)		
E	10±1.0mm		

Summary

- Space market in Japan is on the rise but its size is small
- Although about 60% of passive parts are from domestic manufacturers, more than 60% of parts in total are imported
- New basic plan on space policy was determined, considering the current situation of space industry in Japan. The number of launches of Japanese satellites is expected to rise, especially on government satellites. Maintaining / strengthening space industrial base on EEE parts is a part of the policies
- In line with the new basic plan, JAXA revised a basic approach of JAXA parts program (from ALL-JAXA policy to ALL-Japan policy). While promoting usage of JAXA qualified parts, wise use of imported parts is considered with cooperation with overseas partners
- Roadmap on EEE parts is currently being developed. For passive parts, ensuring stable quality and downsizing / low loss are the keys

APPENDIX

Export control of JAXA qualified parts - (1/2)

"Law concerning JAXA" states that what JAXA do shall be in line with the peaceful use of outer space as stipulated by Article 2 of Basic Space Law of Japan. As long as parts are to be used for peaceful purposes, their export to overseas is subject only to export control in Japan, under the control of METI (Ministry of Economy, Trade and Industry)

<Legislation – Foreign Exchange and Foreign Trade Act>

- Japanese export control list complies with the international export control regimes such as NSG (nuclear), AG (biological and chemical), MTCR (missile) and WA (conventional weapons) control lists
- There are two controls -- List control and Catch-all control

  List control -> Applied to exports to all countries

  Catch-all control -> Applied to exports to;

  <WMD catch-all> countries other than 27 countries that have severe export control system (US, most European countries, Australia, etc.)

  <Military catch-all> countries and regions under UNSC Arms Embargos

NSG : Nuclear Supplier Group AG : Australia Group WA : Wassenaar Arrangement
MTCR : Missile Technology Control Regime WMD : Weapon of Mass Destruction

Reference (METI): http://www.meti.go.jp/policy/anpo/englishpage/overview.pdf

Export control of JAXA qualified parts - (2/2)

List control

- A wide range of dual-use items are listed, which are based on international export control regimes
- An export license is required for the export of a listed item
- Applied to exports to all countries

Catch-all control

- Exporters have to apply for an export license in cases where the item or technology is not on the control lists but could conceivably contribute to WMD proliferation programs (WMD Catch-all) or military end-use (Military Catch-all)
- Applied to exports to:
  <WMD> countries other than 27 countries (US, most European countries, Australia, etc.)
  <Military> countries and regions under UNSC Arms Embargos

- **Majority of JAXA qualified parts are NOT controlled items subject to the control list**
  -> Only review and approval are required for their export to 27 countries including most of European countries
- Information on intended use and end users (at the best of purchaser's knowledge) shall be provided for an approval or a license

Controlled items :
- EEPROM
- Solar cells
- Thermal control materials