

To Future

Confidential
for Future only

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***Power Choke Coils
Metal Composite
QA7-181001F***

***Adding manufacturing site
Batam factory, Indonesia***

(ETQP5M_ _ _ Y_M , ETQP5M_ _ _ Y_K, ETQP_M_ _ _ Y_C)

August. 29th, 2018
Tajima Factory, Japan
Device Solutions Business Division
Automotive & Industrial Systems Company
Panasonic Corporation

Increase of production flexibility with dual location to avoid supply chain risk of demand increase and emergency issue(e.g. earthquake).

Product of Batam factory is equivalent quality to Japan.

We add production location at Batam factory Indonesia as 2nd manufacturing site of Power choke coil (PCC).

Before: Tajima factory (Japan)

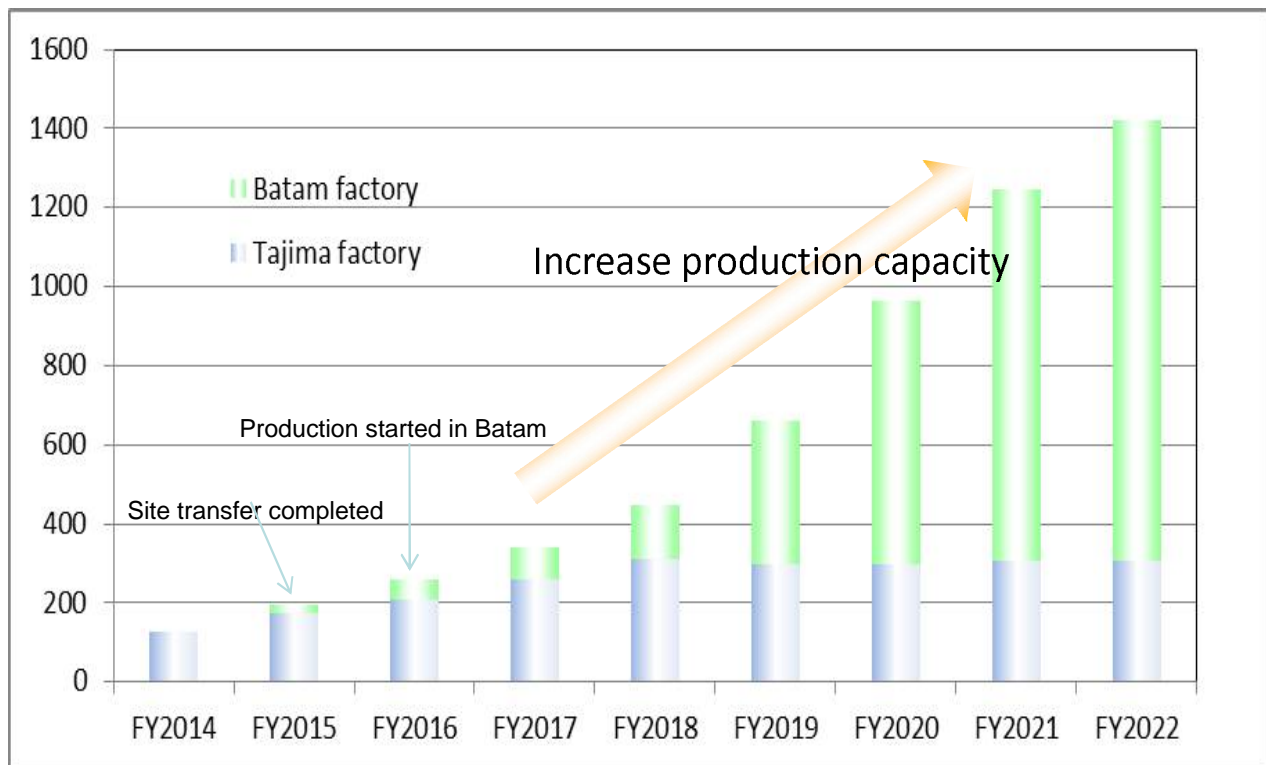
After : Tajima factory (Japan) and **Batam factory (Indonesia)**

Production of automotive PCC in Batam

Site transfer completed in 2014.

We will increase production capacity to respond to increasing demand.

Volume
(Mil-pcs/year)



Approval part number in Batam factory

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Power Choke Coils for Automotive

	ETQP5M__Y_M	ETQP5M__Y_M	ETQP_M__Y_C	
μH	□7	□8	□10	
0.33				ETQP5MR33YLC
0.68				ETQP5MR68YLC
1				ETQP5M1R0YLC
1.5			ETQP5M1R5YFC	ETQP6M1R5YLC
2				ETQP5M2R0YLC
2.2				
2.5		ETQP5M2R5YFK	ETQP5M2R5YFC	ETQP6M2R5YLC
3.3			ETQP5M3R3YFC	ETQP6M3R3YLC
4.7	ETQP5M4R7YFM		ETQP5M4R7YFC	ETQP6M4R7YLC
6.8	ETQP5M6R8YFM			
10	ETQP5M100YFM	ETQP5M100YFK	ETQP5M100YFC	
15		ETQP5M150YFK		
22	ETQP5M220YFM	ETQP5M220YFK	ETQP5M220YFC	
33	ETQP5M330YFM		ETQP5M330YFC	
47	ETQP5M470YFM	ETQP5M470YFK	ETQP5M470YFC	
68			ETQP5M680YFC	
100	ETQP5M101YGM	ETQP5M101YGK	ETQP5M101YGC	

Power Choke Coil for Automotive

Panasonic

Production part number in Batam factory

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Delivery part number (August 23, 2018)

Size	μH	Location		Customer P/N	Panasonic P/N
□7	4.7	-	USA	ETQ-P5M4R7YFM	ETQP5M4R7YFM
	6.8	Europe	-	ETQ-P5M6R8YFM	ETQP5M6R8YFM
	10	Europe	-	ETQ-P5M100YFM	ETQP5M100YFM
	33	Europe	-	ETQ-P5M330YFM	ETQP5M330YFM
	47	-	USA	ETQ-P5M470YFM	ETQP5M470YFM
□8	2.5	-	USA	ETQ-P5M2R5YFK	ETQP5M2R5YFK
	10	-	USA	ETQ-P5M100YFK	ETQP5M100YFK
	22	Europe	USA	ETQ-P5M220YFK	ETQP5M220YFK
	47	-	USA	ETQ-P5M470YFK	ETQP5M470YFK
	100	Europe	-	ETQ-P5M101YGK	ETQP5M101YGK
□10	1.5	-	USA	ETQ-P5M1R5YFC	ETQP5M1R5YFC
	2.5	-	USA	ETQ-P5M2R5YFC	ETQP5M2R5YFC
	3.3	Europe	USA	ETQ-P5M3R3YFC	ETQP5M3R3YFC
	4.7	Europe	USA	ETQ-P5M4R7YFC	ETQP5M4R7YFC
	10	Europe	USA	ETQ-P5M100YFC	ETQP5M100YFC
	22	Europe	-	ETQ-P5M220YFC	ETQP5M220YFC
	33	-	USA	ETQ-P5M330YFC	ETQP5M330YFC
	100	-	USA	ETQ-P5M101YGC	ETQP5M101YGC
	0.68	-	USA	ETQ-P5MR68YLC	ETQP5MR68YLC
	1.0	-	USA	ETQ-P5M1R0YLC	ETQP5M1R0YLC
	2.5	-	USA	ETQ-P6M2R5YLC	ETQP6M2R5YLC
	3.3	-	USA	ETQ-P6M3R3YLC	ETQP6M3R3YLC

Japan Tajima Factory vs Indonesia Batam factory 6

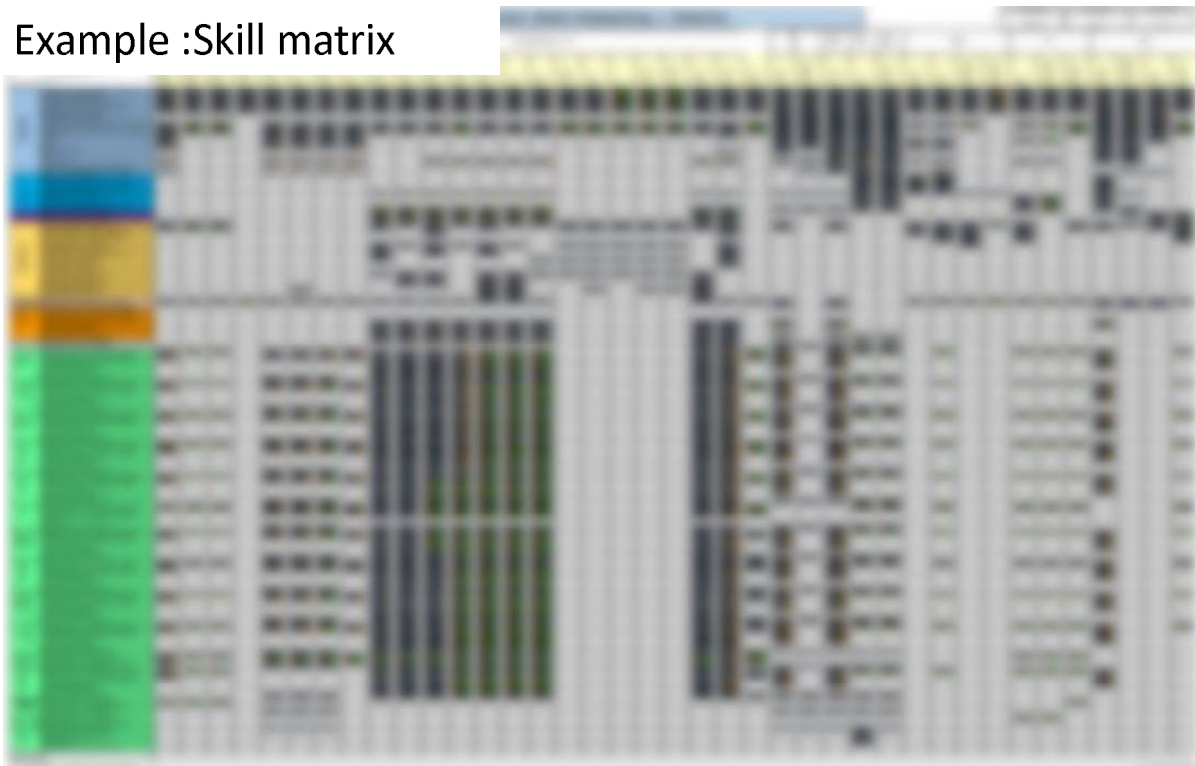
No	Item	Japan Tajima Factory	Indonesia Batam Factory	Comment
1	Operator	Japan Tajima Factory Operator	Indonesia Batam Factory Operator	Educated and trained
2	Production equipment	Same with Japan Tajima Factory		---
3	Measurement equipment	Same type with Japan Tajima Factory		---
4	Product Constituent Material	Same grade with Japan Tajima Factory		---
5	Packaging material	Standard packaging material Of Japan Tajima Factory	Standard packaging material Of Indonesia Batam Factory	Verified
6	Standard document language	Japanese	Indonesian/English	---
7	Control Plan	Same with Japan Tajima Factory		---
8	Traceability	Same with Japan Tajima Factory		---

Operator Education

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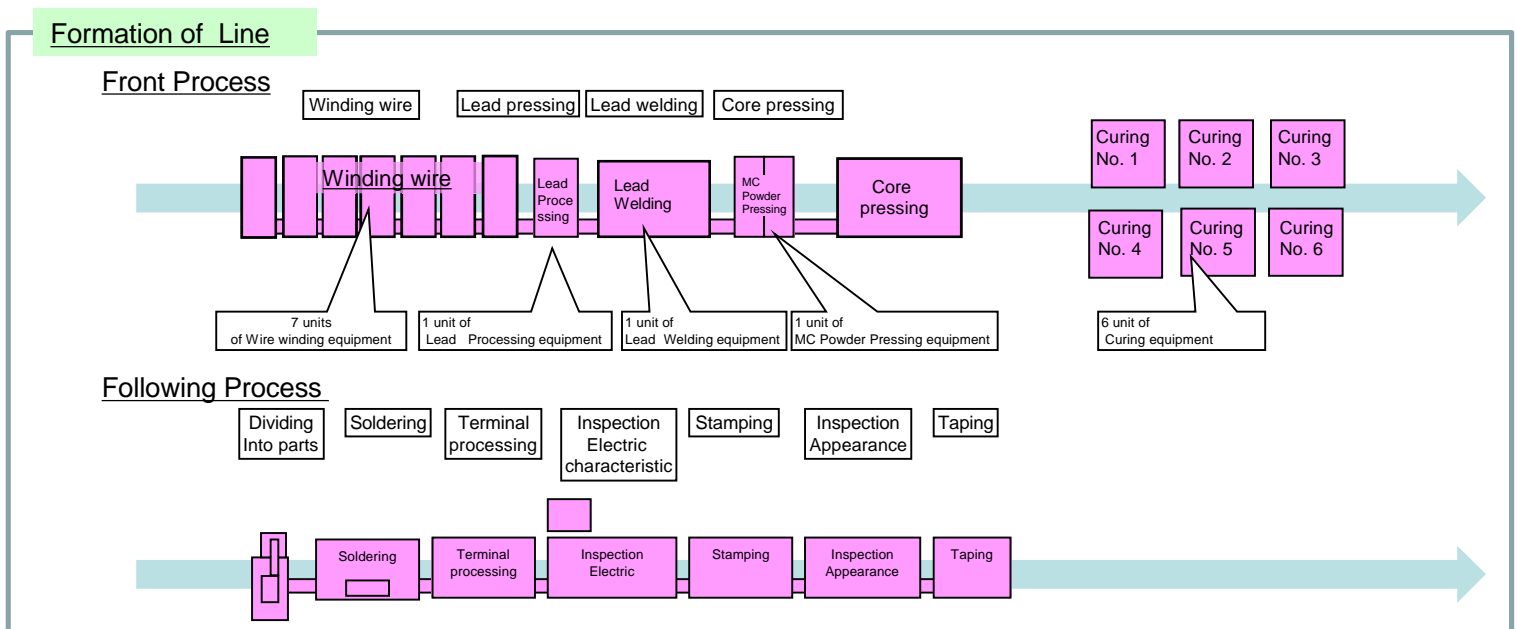
We educated operators and have skills
Batam's educational system is the same as Tajima.
Trainers who trained and has skills in Tajima in 2014 educate Batam members.

Example :Skill matrix






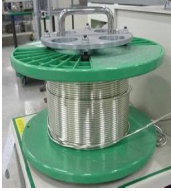
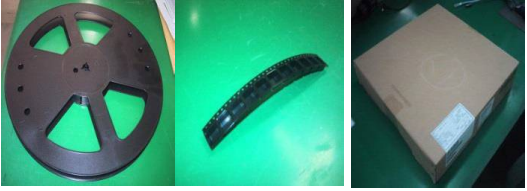
◇Summary of production lines

Equipment are the same as in Japan,
there are no change of equipment.



Product Constituent Material / Packaging material

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	Copper wire	Metal composite	Terminal	Solder	Packaging materials
					

Batam	The same material grade as Japan	Standard packaging material Of I Batam Factory
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Change of material supplier(Packing Case)

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- Packing case material (for all products)
 - We confirmed specifications and packaged tested.
 - We confirmed that there was no problem in performance.

		Packaging vibration test	Packaging drop test
Packaging appearance	Carrier tape deformation	No problem	No problem
Electrical characteristics	Degradation of characteristics	No problem	No problem
Product appearance	Chipping, terminal deformation etc.	No problem	No problem



We verified according to internal standards.
Validation results were approved.

Standard document

Standard documents were written in Indonesian.
The items written in the standard document are the same as in Japan

The image shows a screenshot of a Japanese Standard Operating Procedure (SOP) document for MC Power Choke Coils. The document is titled "作業指図書" (Operation Instruction) and includes sections for "Before operation", "Operation Procedure", "Finished products inspection", and "Points for attention". Red arrows point from English labels to the corresponding sections in the document.

Before operation

Operation Procedure

Finished products inspection

Points for attention

The document also includes a header section with the following information:

- Product: MC Power Choke Coils
- Model No.: ETQP5M**
- Process Name: Winding (No. 18 Line)
- Version: 1.0

The document is divided into several sections, including "Sebelum Pengerjaan" (Before Operation), "Prosedur" (Procedure), "Pemeriksaan Finish Product" (Finished Product Inspection), and "Poin Perhatian" (Points for Attention). The "Prosedur" section contains a table with columns for "No.", "Keterangan", and "Gambar". The "Pemeriksaan Finish Product" section contains a table with columns for "No.", "Keterangan", and "Gambar". The "Poin Perhatian" section contains a table with columns for "No.", "Keterangan", and "Gambar".

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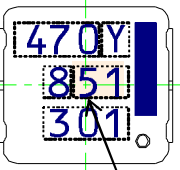
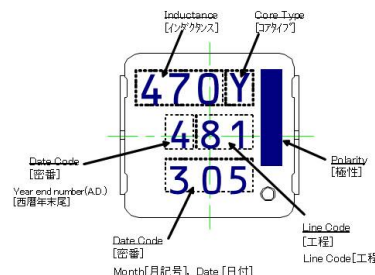
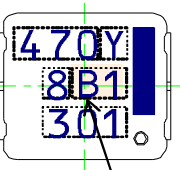
Tajima factory

Batam factory

[illegible]

Traceability of a power choke coil

Traceability is the same as Japan, there is no change of Traceability.
Production site is identified by line code.

	Example of product marking	Line Code			Note
		Single digit	Double digit	Examples	
Tajima Japan	 <p>Line Code [工程表示]</p>	<u>Line No.</u> 5:5 th line	<u>Process code</u> Single figure number	51 52 53 ...	
Batam Indonesia	 <p>Line Code [工程表示]</p>	<u>Line No.</u> B:11 th line	<u>Process code</u> Single figure number	B1 B2 B3 ...	<div> <p>■ Inductance[インダクタンス]: 47uH→“470”</p> <p>■ Core Type[コアタイプ]: “Y”</p> <p>■ Date Code[密番表示]:</p> <p>① Year end number(A.D.)[西暦年末尾] “0”=A.D.2010, “1”=A.D.2011, etc.</p> <p>② Month[月記号] “1”=Jan., “2”=Feb., “O”=Oct., etc.</p> <p>③ Date [日付]: “1”~“31”</p> <p>■ Line Code[工程表示]</p> </div>

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Batam



Reliability test item and parts number selection

Batam's products are produced with the same materials and equipment as in Japan. Since design guarantee is possible, reliability verification is unnecessary. However, we verified the following items to confirm that there are no site differences.

• Verification part number

Size Max / Wire diameter min

ETQP5M101YGC(100μH)

• Verification items

- Line evaluation
- Electrical Characteristics
- Dimension
- Reliability test
 - High temperature exposure
 - Temperature cycling
 - Moisture resistance
 - Humidity Bias

		ETQP5M _ _ Y_M	ETQP5M _ _ Y_M	ETQP _ M _ _ Y_C
		Small size		Large size
Copper wire diameter	μH	□7	□8	□10
Large	0.33			ETQP5MR33YLC
	0.68			ETQP5MR68YLC
	1			ETQP5M1R0YLC
	1.5			ETQP6M1R5YLC
	2			ETQP5M2R0YLC
	2.5		ETQP5M2R5YFK	ETQP5M2R5YLC
	1.5			ETQP5M1R5YFC
	2.5			ETQP6M2R5YFC
	3.3			ETQP5M3R3YLC
				ETQP6M3R3YFC
	4.7	ETQP5M4R7YFM		ETQP5M4R7YLC
				ETQP6M4R7YFC
	6.8	ETQP5M6R8YFM		
	10	ETQP5M100YFM	ETQP5M100YFK	ETQP5M100YFC
	15		ETQP5M150YFK	
	22	ETQP5M220YFM	ETQP5M220YFK	ETQP5M220YFC
	33	ETQP5M330YFM		ETQP5M330YFC
Small	47	ETQP5M470YFM	ETQP5M470YFK	ETQP5M470YFC
	68			ETQP5M680YFC
	100	ETQP5M101YGM	ETQP5M101YGK	ETQP5M101YGC

Evaluation result (Production machine evaluation)

Production machine evaluation

We check and judge the following items

Equipment	Evaluation item	Judgment criteria	Result(Batam)	Judgment	Remarks
Winding	Coil inner diameter	1.67 or more	Cpk 9.84 or more	OK	
	Coil height	1.67 or more	Cpk 5.61 or more	OK	
	Bonding strength	n=30/each machine r=0	r=0	OK	
	Coating peeling dimension	n=30/each machine r=0	r=0	OK	
	Lead position angle	n=30/each machine r=0	r=0	OK	
	Number of turns	n=30/each machine r=0	r=0	OK	
	Appearance (scratches, etc.)	n=30/each machine r=0	r=0	OK	
Lead Press Welding	Pinhole test	n=30/each machine r=0	r=0	OK	
	Lead cutting dimensions	1.67 or more	Cpk 4.17 or more	OK	
	Appearance (repelling, scratches)	n=30 r=0	r=0	OK	
	Pinhole test	n=30 r=0	r=0	OK	
	Joint strength	n=30 r=0	r=0	OK	
Core Forming Core Press Curing	Cutting debris scattering	n=5000	r=0	OK	
	I weight	1.67 or more	Cpk 2.98 or more	OK	
	I Height dimension	1.67 or more	Cpk 8.65 or more	OK	
	E weight	1.67 or more	Cpk 2.83 or more	OK	
	E Height dimension	1.67 or more	Cpk 6.55 or more	OK	
	E back thickness dimension	1.67 or more	Cpk 6.72 or more	OK	
	Core press dimensions	1.67 or more	Cpk 4.92	OK	
Cutting	After curing appearance	n=200 r=0	r=0	OK	
	Temperature profile	Within the standard range	Within the standard	OK	
Soldering	Appearance (cutting burr)	Burr dimension 0.1mm or less n=30 r=0	r=0	OK	
	Solder bath temp. distribution	Cpk 1.67 or more (320±10/-20℃)	Cpk 3.81 or more	OK	
Lead Forming Dimensional inspection	Appearance (solder condition)	n=50 r=0	r=0	OK	
	Height dimension	Cpk 1.67 or more	Cpk 1.92	OK	
	Stand-off dimension	Cpk 1.67 or more	Cpk 1.80 or more	OK	
	Coplanarity	Cpk 1.67 or more	Cpk 4.36	OK	
	Appearance (burr, chipping, etc.)	N=30 r=0	r=0	OK	
	Dimension measurement variation	5σ 0.005mm or less	Less than 0.005mm	OK	
	Dimension measurement correlation	r=0.90 or more	0.904 or more	OK	
Auto inspection system	Confirm defective automatic reject	To correctly reject the defective	Correctly reject	OK	
	Measurement variability L1	5σ 3% or less	0.07%	OK	
	Measurement variability IR	5σ 20% or less	3.79%	OK	
	Measurement variability DCR	5σ 1% or less	0.19%	OK	
	Measurement variability IMP	5σ 10% or less	8.01%	OK	
	Measurement variability L0	5σ 0.3% or less	0.01%	OK	
	Measurement variability Q	5σ 5% or less	0.45%	OK	
	measurements correlation L1	r=0.95 or more	0.9999	OK	
	measurements correlation DCR	r=0.95 or more	1.0000	OK	
	measurements correlation IMP	r=0.90 or more	0.9073	OK	
	measurements correlation L0	r=0.95 or more	1.0000	OK	
	measurements correlation Q	r=0.90 or more	0.9960	OK	
	Confirm defective automatic reject	To correctly reject the defective	Correctly reject	OK	
	Marking curing confirmation	That the ink is not transcribed	r=0	OK	
Appearance	Appearance (scratches, cracks, etc.)	n=100 r=0	r=0	OK	
Taping	Tape peel strength	10.2~100.2gf	32.1~69.1gf	OK	
	Iron temperature	Cpk 1.67 or more(55±5℃)	Cpk 6.31	OK	
	Appearance after taping	That there is no scratches, etc.	r=0	OK	

【Result】
pass

The evaluation items were determined for each process, it was determined by the data. The result is all the items has passed the request criteria.

Evaluation result (Production Verification)

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▪ Verification of Electrical characteristic

ETQP5M101YGC	Lot1 (n=100)	Lot2 (n=100)	Lot3 (n=100)	Lot4 (n=100)	Lot5 (n=100)	Lot6 (n=100)	Lot7 (n=100)	Lot8 (n=100)	Lot9 (n=100)	Lot10 (n=100)
Inductance Cpk	5.95	6.48	6.17	7.10	8.38	5.93	7.85	7.94	7.46	4.86
DC resistance Cpk	6.13	5.55	5.92	6.02	5.98	7.32	7.26	5.58	5.57	6.05

Summary :

Cpk of the electrical characteristic of all lines have 1.67 or more.

Comparison of Japan and Batam

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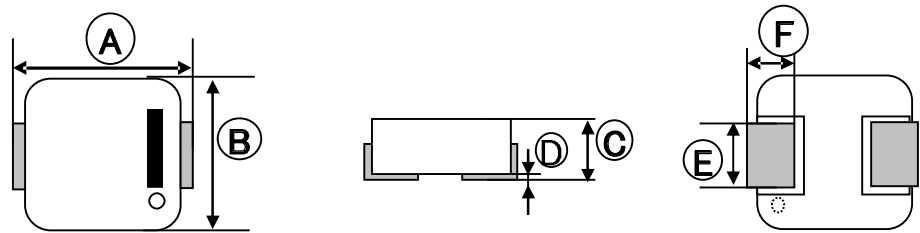
ETQP5M101YGC

Product characteristics of Japan and Batam are equivalent.

	Inductance	DC Resistance	Insuration Resistance
Japan Line			
Batam Line			
Comparative evaluation	Equivalent level	Equivalent level	Equivalent level
Judgment	OK	OK	OK

Evaluation result
(Production Verification)

▪Verification of Dimension:ETQP5M101YGC



	Lot1 (n=100)	Lot2 (n=100)	Lot3 (n=100)	Lot4 (n=100)	Lot5 (n=100)	Lot6 (n=100)	Lot7 (n=100)	Lot8 (n=100)	Lot9 (n=100)	Lot10 (n=100)
Dimension A	5.78	6.07	7.72	7.28	6.52	7.33	6.01	6.11	6.73	5.64
Dimension B	19.55	20.93	16.00	14.81	17.33	16.70	16.84	17.04	16.79	16.68
Dimension C	5.27	4.94	5.07	5.69	4.74	5.51	4.76	4.85	5.04	4.81
Dimension D	2.22	1.97	2.17	2.76	1.95	1.88	1.76	2.16	1.98	1.79
Dimension E	4.48	4.81	4.71	4.18	4.24	4.73	4.65	4.32	4.24	4.78
Dimension F	4.04	5.17	4.45	3.83	3.94	3.54	4.39	4.62	4.54	3.55

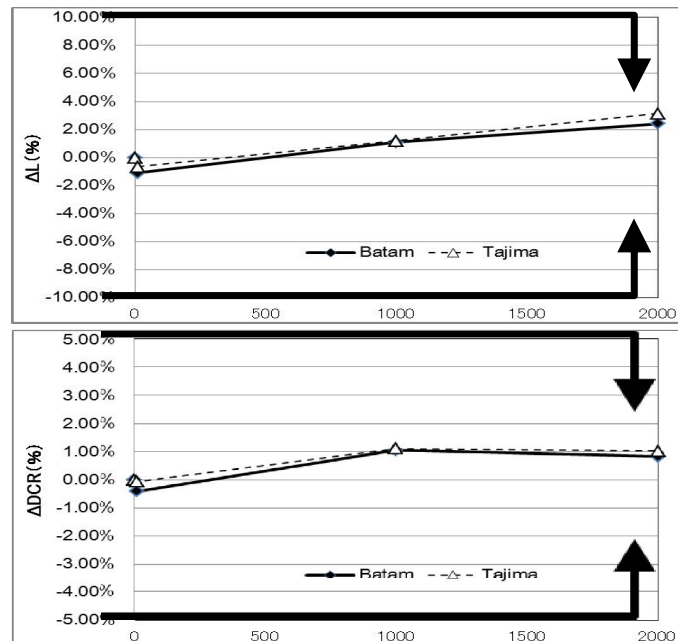
Summary :Cpk of the electrical characteristic of all lines have 1.67 or more.

Evaluation result (Reliability test)

Reliability test :High temperature Exposure: ETQP5M101YGC

Pre-Treatment : 85°C/85% 168h \Rightarrow Reflow 3times

Condition : 150 °C



Summary :

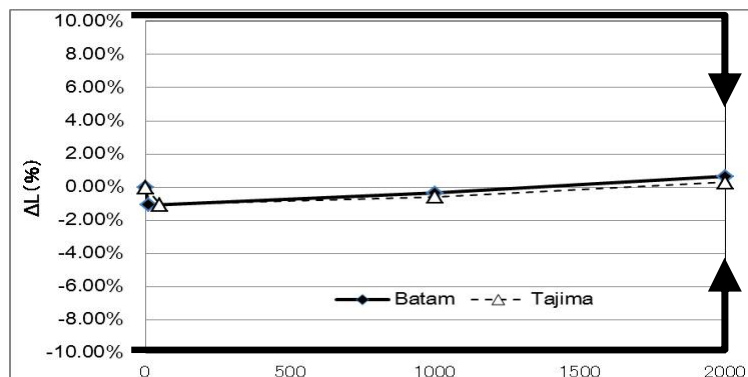
There is no difference in reliability test compared with Japan and Batam.

Evaluation result (Reliability test)

▪ Reliability test :Temperature cycling ETQP5M101YGC

Pre-Treatment : 85°C/85% 168h \Rightarrow Reflow 3times

Condition : '-40(10min.) - Room(2min.) - +150°C(10min.)



Summary :

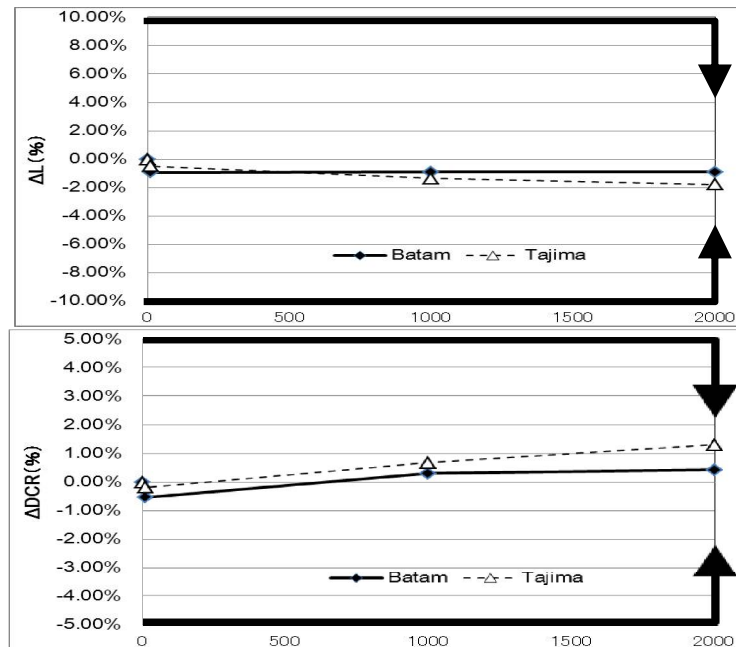
There is no difference in reliability test compared with Japan and Batam.

Evaluation result (Reliability test)

Reliability test : Moisture resistance ETQP5M101YGC

Pre-Treatment : 85°C/85% 168h ⇒ Reflow 3times

Condition : 85 °C85%RH



Summary :

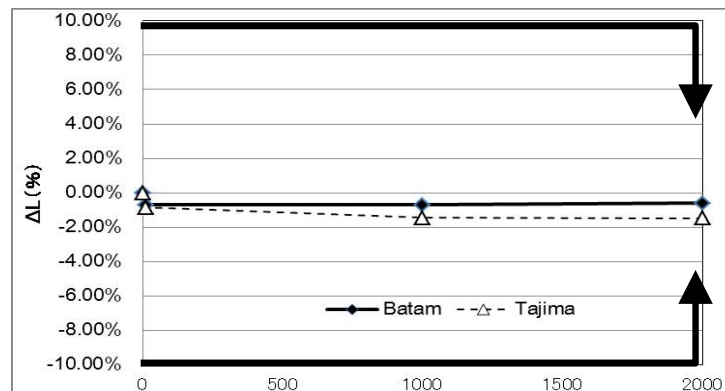
There is no difference in reliability test compared with Japan and Batam.

Evaluation result (Reliability test)

Reliability test : Humidity Bias ETQP5M101YGC

Pre-Treatment : 85°C/85% 168h \Rightarrow Reflow 3times

Condition : 85 °C85%RH DC 1.0A



Summary :

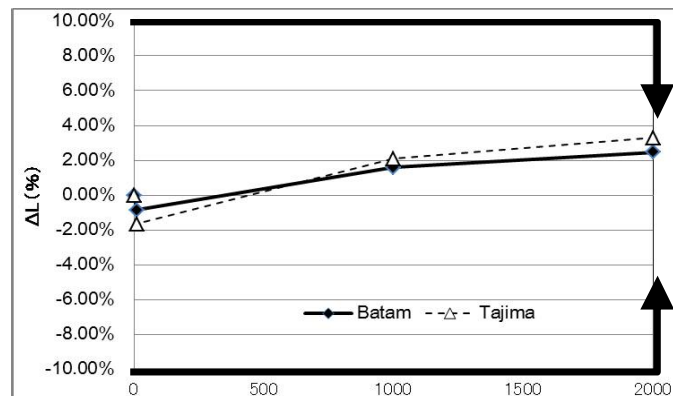
There is no difference in reliability test compared with Japan and Batam.

Evaluation result (Reliability test)

▪ Reliability test :High Temperature Operating Life ETQP5M101YGC

Pre-Treatment : 85°C/85% 168h \Rightarrow Reflow 3times

Condition : 150 °C DC1.0A



Summary :

There is no difference in reliability test compared with Japan and Batam.

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Batam's products are produced with the same materials and equipment as in Japan. We confirmed that there are no site differences and Batam's products is the same quality as Japan . Please approve of this PCN as soon as possible.