

July 17<sup>th</sup>, 2018

Dear Valued Customer,

[Notice] Change of Assembly factory for QFP (Quad Flat Package)

First of all, we would like to take this opportunity to thank you for the excellent business relationship between the two companies and we look forward to a successful ongoing partnership in the future.

Our limited assembly capacity causes some delivery problems in recent high demand situations. To improve such situations, we'd like to change our assembly process for some QFP(Quad Flat Package) products to our contracted assembly factory having more capacity. We have enough experiences to utilize the factory, so we judged to keep the same quality level with the current. The detail information is referred to the attached documents. We appreciate your understanding and cooperation.

1. Change of Assembly factory

Current location: Singapore Epson Industrial Pte Ltd. (SEP)

New location: Advanced Semiconductor Engineering, Inc. Chung-Li (ASECL)

2. Material and Specification change

There is no specification change in your operation, though mold resin, lead frame and thickness of IC chip are changed to follow the contracted factory's standard. The detail information is referred to the attached documents.

3. Objective parts :

Please refer to the attached documents.

4. Schedule :

The products assembled in the contracted factory will be shipped after December 2018 onwards. Concrete schedule will be defined by order volume and WIP status, and it will be informed by our sales representatives.

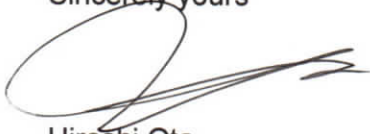
5. Last order information:

Effective last order date: 26<sup>th</sup> December, 2018

Last shipment date: 30<sup>th</sup> June, 2019

\*It's appreciated to receive your requests or inquiries about this change by 28<sup>th</sup> September, 2018.

Sincerely yours



Hiroshi Ota

General Manager of IC Sales Department

Device Sales & Marketing Department

SEIKO EPSON CORPORATION

# Package Product Assembly Plant & Material Change

Model;

S1C17W\*\*F series / S1C8F626F series

Package;

QFP15-100pin (P-LQFP100-1414-0.50)

TQFP15-128pin (P-TQFP128-1414-0.40)

QFP21-176pin (P-LQFP176-2424-0.50)

QFP21-216pin (P-LQFP216-2424-0.40)

SEIKO EPSON CORPORATION  
Microdevices Operations Division

Confidential

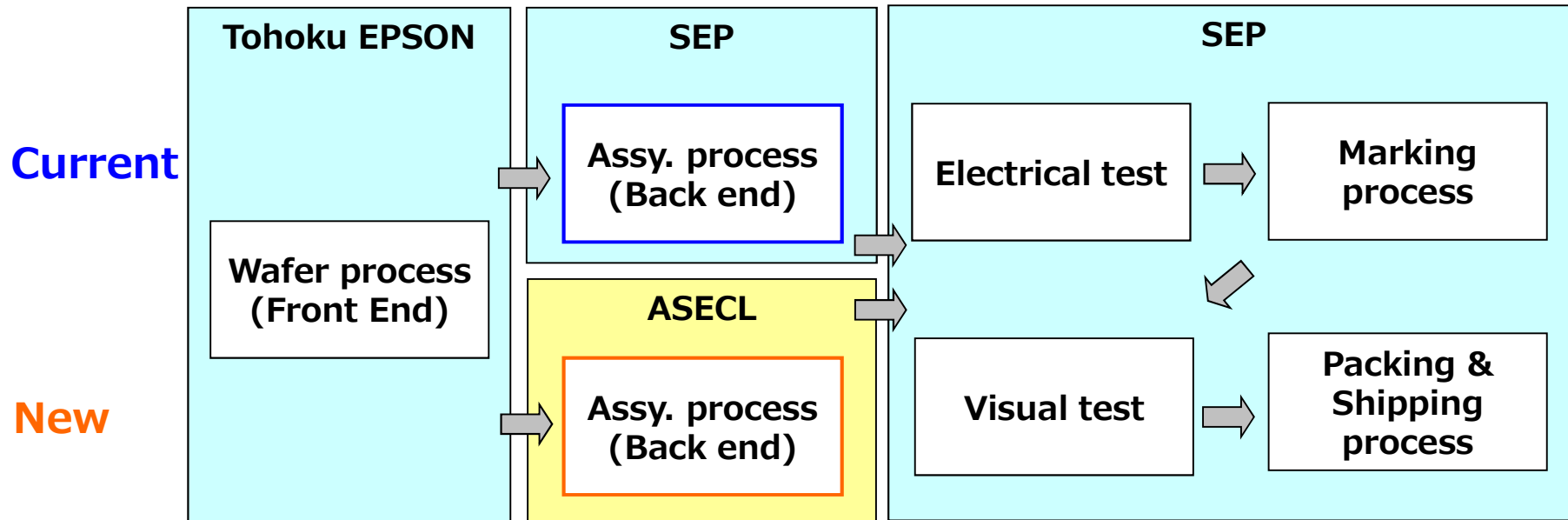
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# Description of Change : Production Site / Flow



- Assembly process (plant) change  
Wafer process, Test process, Marking process,  
Shipping process: no change

SEP : Singapore Epson Industrial Pte Ltd.  
ASECL : Advanced Semiconductor Engineering, Inc. Chung-Li

# Description of Change : Changing points

P-LQFP type package ; QFP15-100pin, QFP21-176pin, QFP21-216pin

Item	Current	New	Changing point	Reason
Lead frame	Cu frame	Cu frame	Dimension	Take standard lead-frame at subcontractor
Mold Compound	CV8000series Flammability: UL-94 V-0 Halogen free	EME-G600series Flammability: UL-94 V-0 Halogen free	Material	Take standard mold compound at subcontractor
IC Chip Thickness	400um	300um	Thickness	Take standard thickness and process condition at subcontractor

- These are their standard materials of our subcontractor.
- Our subcontractor has produced over 1000Mpcs in this condition as their standard since 2009.

# Description of Change : Changing points

P-TQFP type package ; TQFP15-128pin

Item	Current	New	Changing point	Reason
Lead frame	Cu frame	Cu frame	Dimension	Take standard lead-frame at subcontractor
Mold Compound	CV8000series Flammability: UL-94 V-0 Halogen free	EME-G600series Flammability: UL-94 V-0 Halogen free	Material	Take standard mold compound at subcontractor
IC Chip Thickness	300um	178um	Thickness	Take standard thickness and process condition at subcontractor

- These are their standard materials of our subcontractor.
- Our subcontractor has produced over 1000Mpcs in this condition as their standard since 2009.

## Verification : Verification Results of Changing points /Concerns

Item	Changing points	Concerns	Verification item	Result
Lead frame	Dimension	Dimensions /Tolerance	Dimensions data	Pass
		Lead strength	Lead strength test	Pass
		Solderbility	Solderbility test	Pass
Mold Compound	Material	Reliability	Reliability test	Pass
IC Chip Thickness	Thickness	Reliability	Reliability test	Pass

• We evaluated each verification items. Any problem was not found in our evaluation.



# Verification : Reliability Test Results of EC parts

Test Item	Test Condition	Sample size	Test Duration	Failure Count	Judge ment
High Temp with Bias Test	125°C, Absolute Maximum Rating Voltage	135	1,000 H	0	Pass
High Temp and High Humidity with Bias Test	85°C, 85%RH, Absolute Maximum Rating Voltage	135	1,000 H	0	Pass
High Temp storage Test	Ta=150°C	45	1,000 H	0	Pass
Temp cycle Test	-65°C~150°C each more than 10 minute	45	200 cyc.	0	Pass
Pressure cooker Test	Ta=121°C, 100% 2.0E5 Pa	45	200 H	0	Pass
Resistance to soldering heat Test	Pre-Conditioning → Reflow 265°C	45	3 Times	0	Pass
Lead strength (Pull)	Tension 2.5N, 30sec	22	1 Time	0	Pass
Lead strength (Bending)	Bend 30°	22	2 Times	0	Pass
Solderability1	Steam aging 4h → Solder dipping 245°C, 5sec	22	1 Time	0	Pass
Solderability2	150°C,16h → Solder dipping 245°C, 5sec	22	1 Time	0	Pass

• We judged that the Engineering change had no problem, based on the test result performed in the same condition as our current parts.

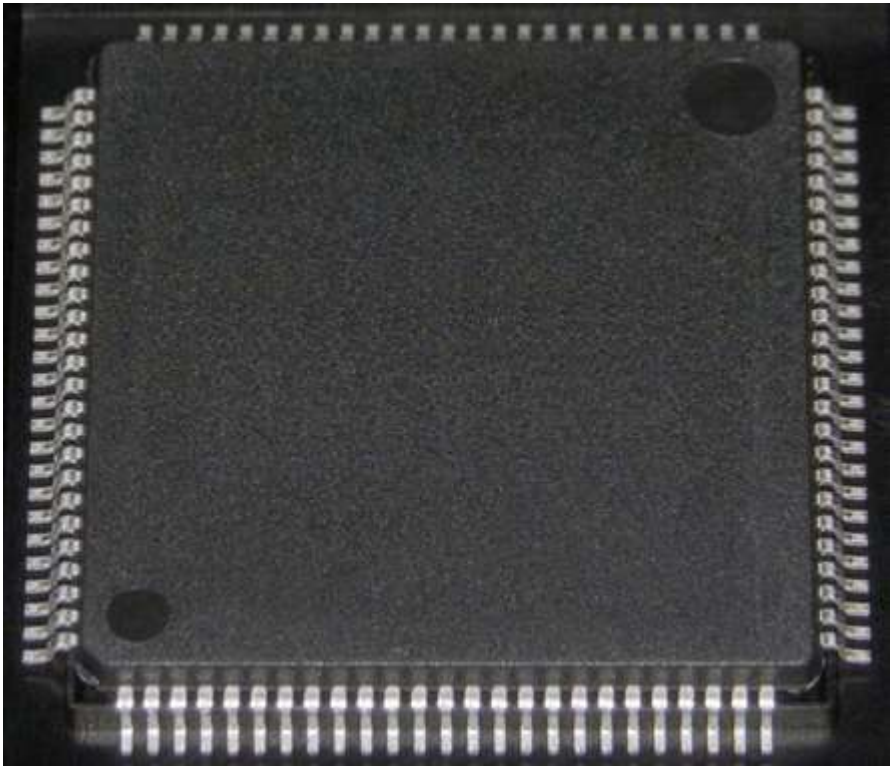
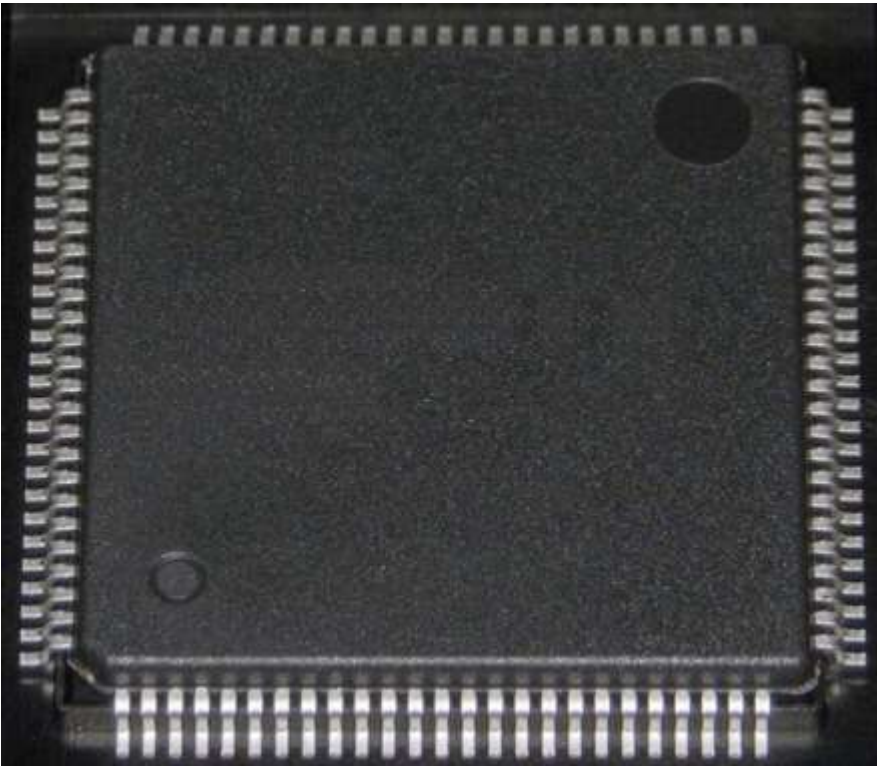
# Verification : List of Product Comparisons

Item	Contents	Page
Comparison of Appearance	Package Appearance (Our general product)	P9
	QFP15-100pin QFP21-176pin	P10
Comparison of External dimension	Measurement points of dimension (drawing)	P11
	Measurement result of external dimension	
	QFP15-100pin	P12
	TQFP15-128pin	P13
	QFP21-176pin	P14
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Comparison of Lead frame	X-ray photo (Our general product)	
	QFP15-100pin	P16
	QFP21-176pin	P17

•Comparison data and photo are shown on each page.  
As a typical photo, we explain with our general products.

# Verification : Comparison of Appearance


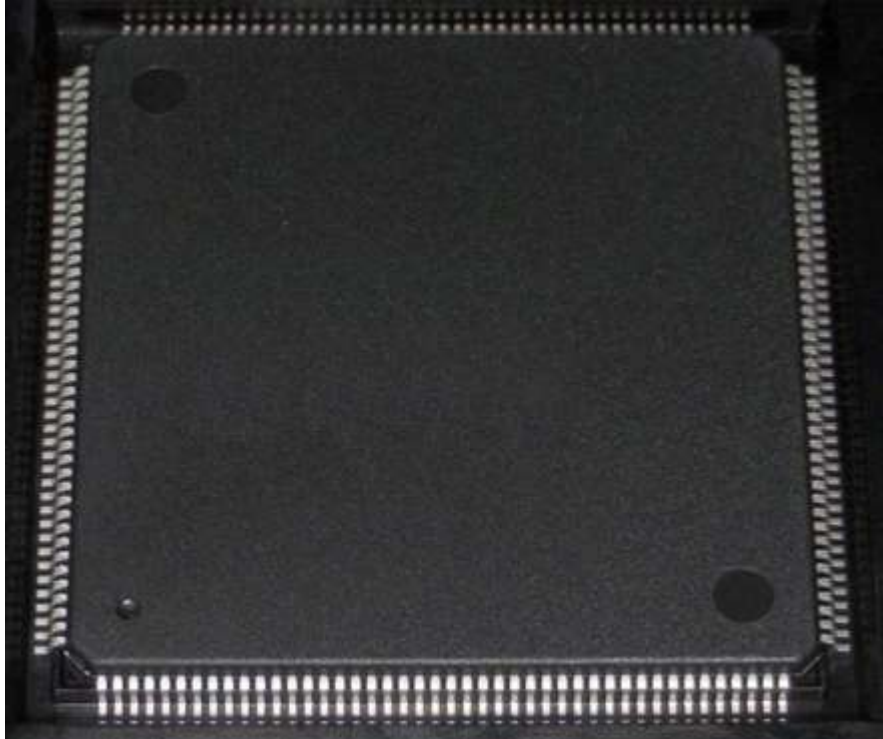
P-LQFP100-1414-0.50 (QFP15-100pin)

Current (Singapore EPSON)	New (ASECL)
 A photograph of a square, black integrated circuit (IC) chip with 100 pins. The chip is shown from a top-down perspective. It has a central square area with a circular index mark in the top-right corner. The pins are arranged in four rows along the perimeter of the chip.	 A photograph of a square, black integrated circuit (IC) chip, identical in appearance to the one in the left image. It has a central square area with a circular index mark in the top-right corner. The pins are arranged in four rows along the perimeter of the chip.

- Though external appearance is different at Index mark, there are no change of external dimension and its tolerance.
- The product marking is no change of a font style and a marking design.

# Verification : Comparison of Appearance

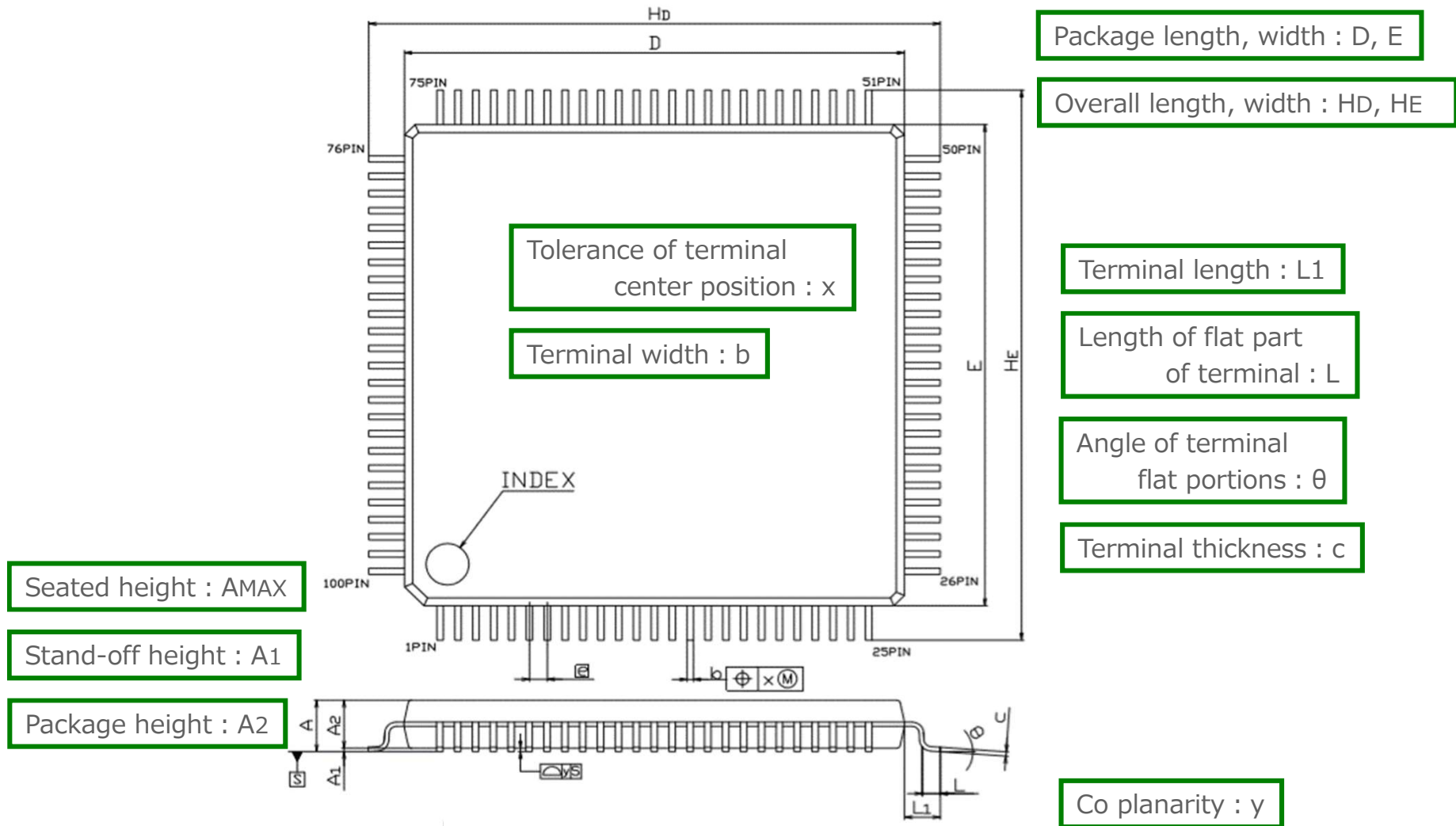
P-LQFP176-2424-0.50 (QFP21-176pin)

Current (Singapore EPSON)	New (ASECL)
 A photograph of a P-LQFP176-2424-0.50 chip from Singapore EPSON. The chip is square with 176 pins. It features a large circular index mark at the top center and two smaller circular marks at the bottom left. The ejector pins are located at the bottom edge.	 A photograph of a P-LQFP176-2424-0.50 chip from ASECL. The chip is square with 176 pins. It features a large circular index mark at the top left and a smaller circular mark at the bottom right. The ejector pins are located at the bottom edge.

- The difference in appearance is as follows.  
Index mark shape / Ejector pin location and size  
There are no change of external dimension and its tolerance.
- The product marking is no change of a font style and a marking design.

# Verification : External Dimension

Comparison of each dimension before / after the change.



Refer; P-LQFP100-1414-0.50 (QFP15-100pin)

# Verification : Measurement Results of External Dimension

P-LQFP100-1414-0.50 (QFP15-100pin)

Unit (mm)

Item / Spec.		Current (Singapore EPSON)		New (ASECL)	
		Average	Cpk	Average	Cpk
E	14±0.1	14.020	6.92	14.011	5.78
D	14±0.1	14.021	2.34	14.010	9.79
HE	16±0.4	15.976	4.82	15.976	17.76
HD	16±0.4	15.993	8.01	15.993	11.61
AMAX	Max 1.7	1.548	7.59	1.523	7.33
A1	0.1±0.1	0.110	3.63	0.106	2.73
A2	1.4±0.1	1.399	3.72	1.390	4.71
b	0.17~0.27	0.187	2.65	0.194	4.63
c	0.09~0.2	0.143	6.96	0.143	15.06
θ	0~10°	7.262	10.15	7.022	3.52
L	0.3~0.75	0.582	7.97	0.567	8.48
L1	1±0.2	0.984	19.97	0.990	4.79
x	Max 0.08	0.001	9.49	0.003	17.97
y	Max 0.08	0.035	5.68	0.025	2.87

•Judged no problem, because measurement data of each dimension shows over Cpk1.67.

# Verification : Measurement Results of External Dimension

P-TQFP128-1414-0.40 (TQFP15-128pin)

Unit (mm)

Item / Spec.		Current (Singapore EPSON)		New (ASECL)	
		Average	Cpk	Average	Cpk
E	14±0.1	14.033	3.54	13.988	3.32
D	14±0.1	14.032	5.54	13.983	3.88
HE	16±0.4	16.004	30.62	16.008	22.56
HD	16±0.4	16.007	15.10	16.004	37.91
AMAX	Max 1.2	1.181	10.97	1.147	11.82
A1	0.1±0.1	0.101	5.41	0.071	2.40
A2	1.0±0.1	1.007	11.83	1.003	6.89
b	0.13~0.23	0.168	2.90	0.167	2.37
c	0.09~0.2	0.140	10.74	0.142	11.88
θ	0~10°	4.6°	3.29	3.4°	2.49
L	0.3~0.75	0.500	2.82	0.501	3.58
L1	1±0.2	0.990	5.23	1.008	3.83
x	Max 0.08	0.007	4.17	0.002	17.13
y	Max 0.08	0.026	2.63	0.027	2.09

•Judged no problem, because measurement data of each dimension shows over Cpk1.67.

# Verification : Measurement Results of External Dimension

P-LQFP176-2424-0.50 (QFP21-176pin)

Unit (mm)

Item / Spec.		Current (Singapore EPSON)		New (ASECL)	
		Average	Cpk	Average	Cpk
E	24±0.1	24.014	2.40	23.999	2.03
D	24±0.1	24.016	4.80	23.993	1.79
HE	26±0.4	26.018	7.71	26.017	6.90
HD	26±0.4	26.020	7.76	26.019	8.44
AMAX	Max 1.7	1.556	3.40	1.560	3.84
A1	0.1±0.1	0.090	10.05	0.093	3.56
A2	1.4±0.1	1.419	4.86	1.397	7.62
b	0.17~0.27	0.199	2.73	0.208	5.56
c	0.09~0.2	0.149	10.96	0.141	29.51
θ	0~10°	5.3°	1.85	4.6°	2.01
L	0.3~0.75	0.557	3.23	0.521	3.52
L1	1±0.2	1.004	2.31	1.012	2.31
x	Max 0.08	0.004	8.17	0.002	15.10
y	Max 0.08	0.026	3.74	0.026	9.22

•Judged no problem, because measurement data of each dimension shows over Cpk1.67.



# Verification : Measurement Results of External Dimension

P-LQFP216-2424-0.40 (QFP21-216pin)

Unit (mm)

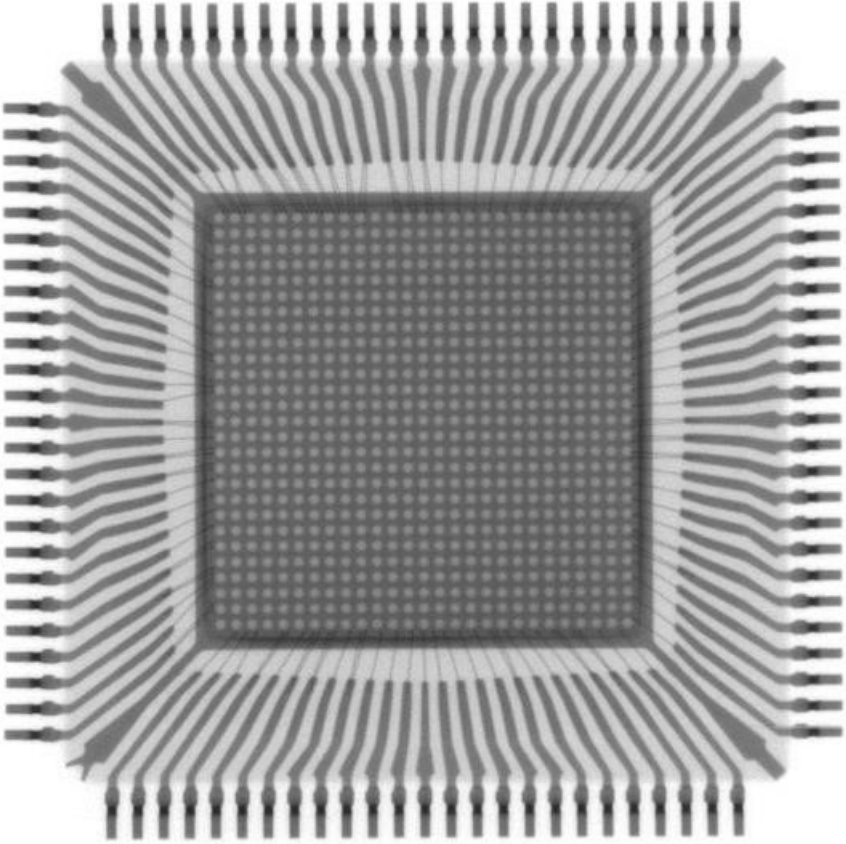
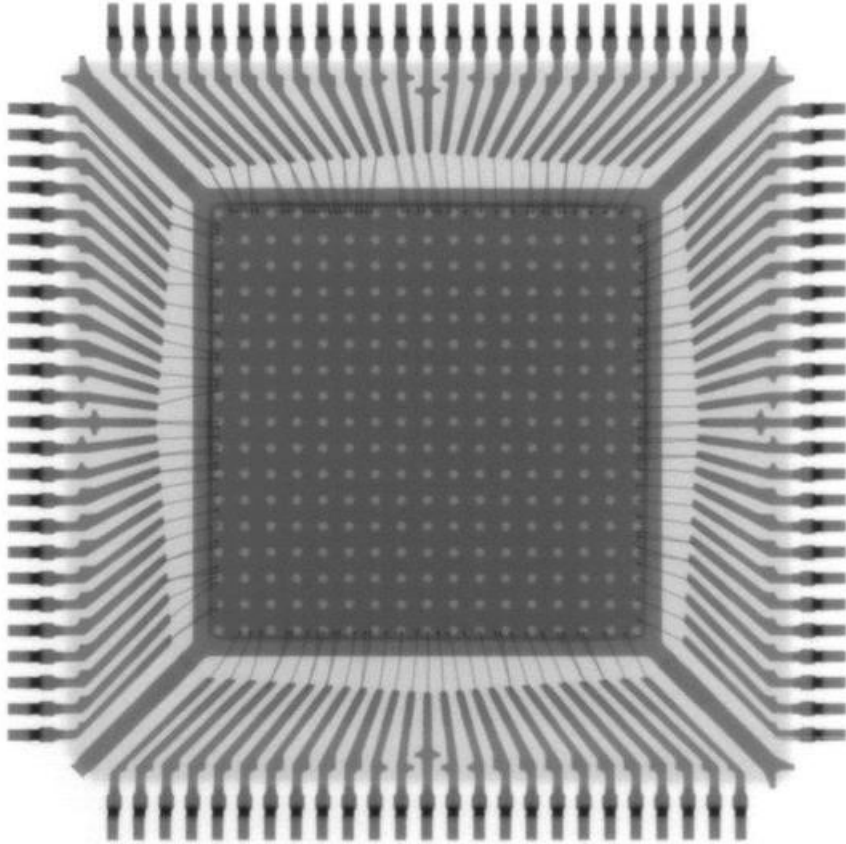
Item / Spec.		Current (Singapore EPSON)		New (ASECL)	
		Average	Cpk	Average	Cpk
E	24±0.1	23.996	3.48	23.976	3.46
D	24±0.1	23.995	4.03	23.975	3.52
HE	26±0.4	26.042	33.42	26.000	24.53
HD	26±0.4	26.044	24.15	26.007	16.06
AMAX	Max 1.7	1.540	4.35	1.567	5.09
A1	0.1±0.1	0.090	4.68	0.094	11.28
A2	1.4±0.1	1.416	17.67	1.396	13.38
b	0.13~0.27	0.163	2.93	0.171	4.02
c	0.09~0.2	0.146	6.58	0.141	18.95
θ	0~10°	6.1°	2.51	4.9°	1.92
L	0.3~0.7	0.624	2.97	0.526	2.63
L1	1±0.2	1.048	7.49	1.013	2.32
x	Max 0.08	0.006	6.35	0.004	9.18
y	Max 0.08	0.022	6.42	0.034	3.91

•Judged no problem, because measurement data of each dimension shows over Cpk1.67.

# Verification : Comparison of Lead frame (X-ray photo)

P-LQFP100-1414-0.50 (QFP15-100pin)

Reference our general product.

Current (Singapore EPSON)	New (ASECL)
	

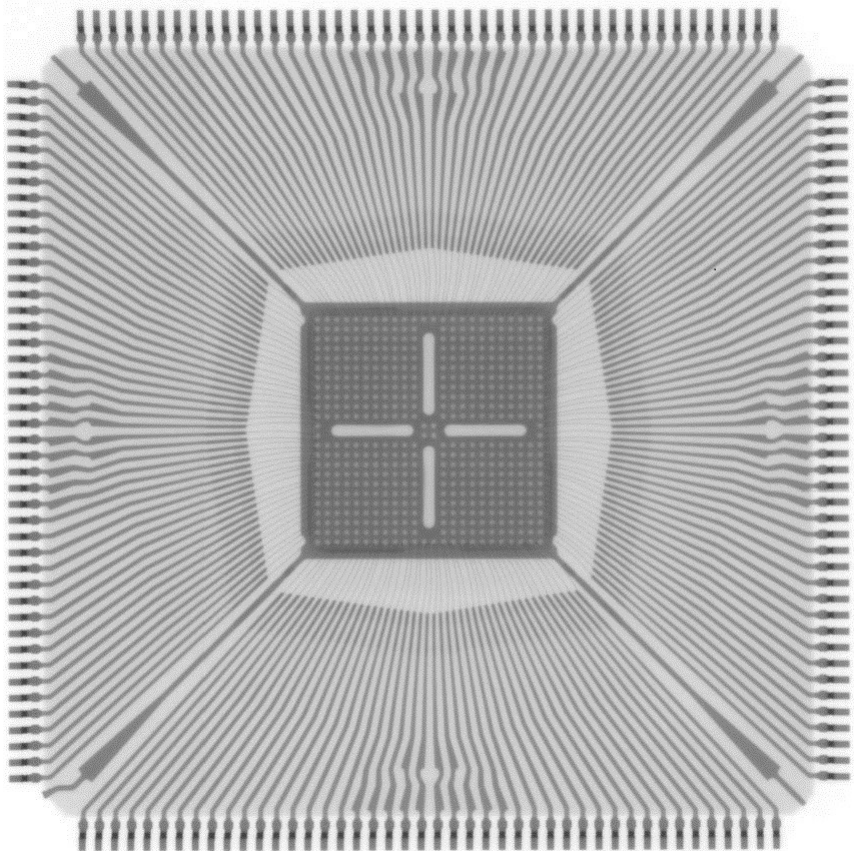
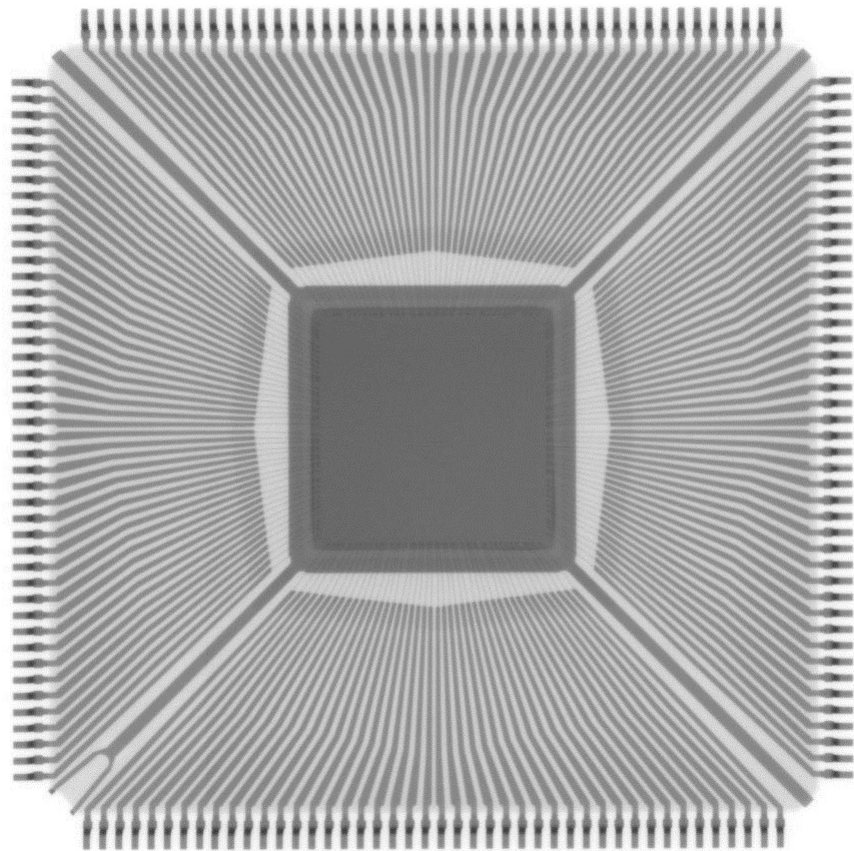
•Resistance to soldering heat (MSL) is same.

※ These are the pictures of Epson's general product for reference.

# Verification : Comparison of Lead frame (X-ray photo)

P-LQFP176-2424-0.50 (QFP21-176pin)

Reference our general product.

Current (Singapore EPSON)	New (ASECL)
	

•Resistance to soldering heat (MSL) is same.

※ These are the pictures of Epson's general product for reference.

# Summary of Verification Results

- Lead frame  
Material, External dimension : no change  
Lead strength and Solderability : equal to current parts
- Mold Compound Material  
Resistance to soldering heat, Reliability : equal to current parts  
Flammability (UL-94 V-0), Halogen Free compliance : no change
- IC Chip Thickness  
Change of IC chip thickness has no influence to IC chip itself.
- Conclusion  
We judged that there was no concern about new parts, because any problems were not found in our evaluation. We also refer to the fact that our subcontractor has produced over 1000Mpcs in this condition as their standard since 2009.

**-> You can take the EC parts in your production by current handling way without any adjustment.**

## Appendix : Outline of our subcontractor

### ASE Group Chung-Li (ASECL)

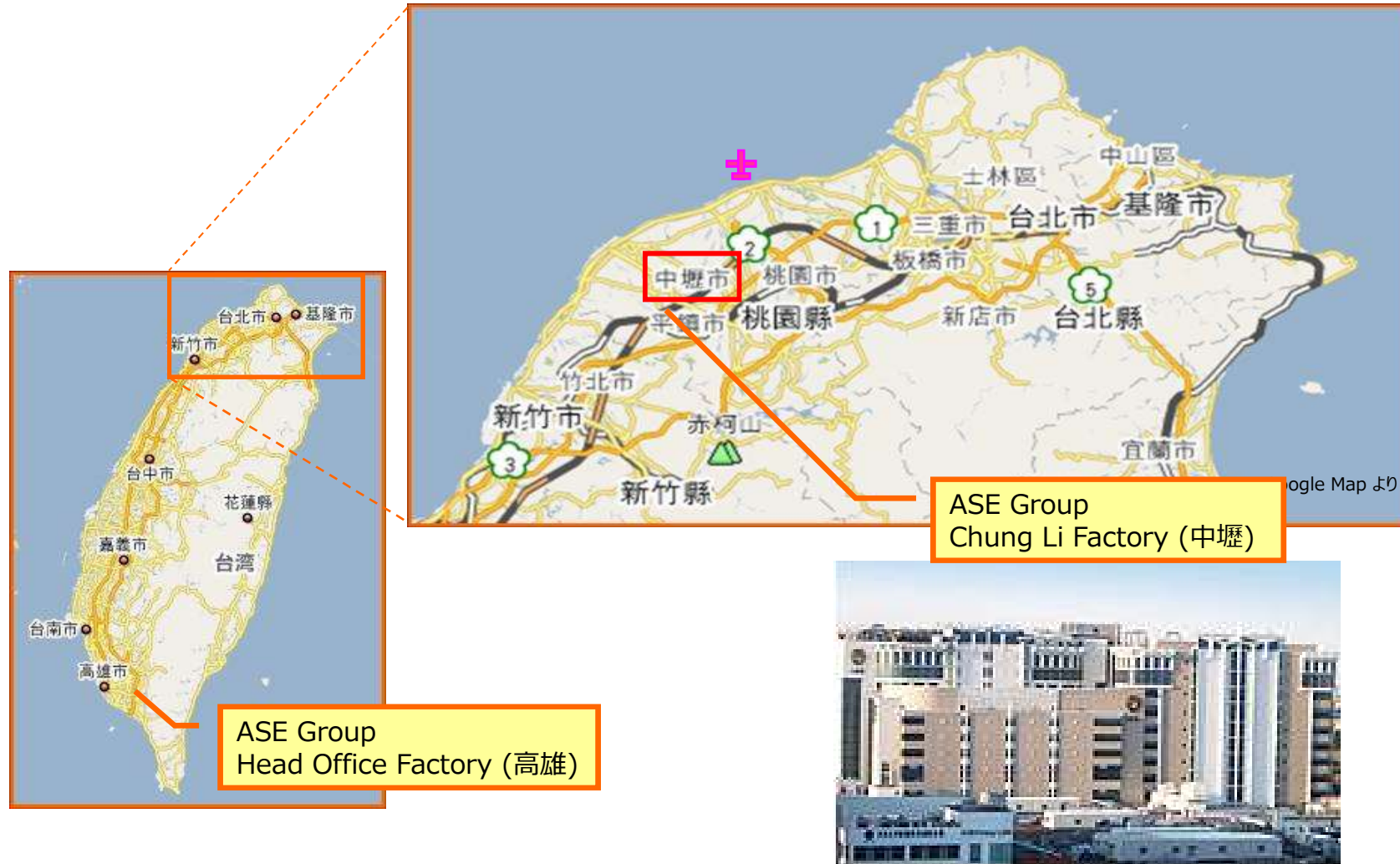
<http://www.asecl.aseglobal.com/>

(ASE; Advanced Semiconductor Engineering, Inc.)

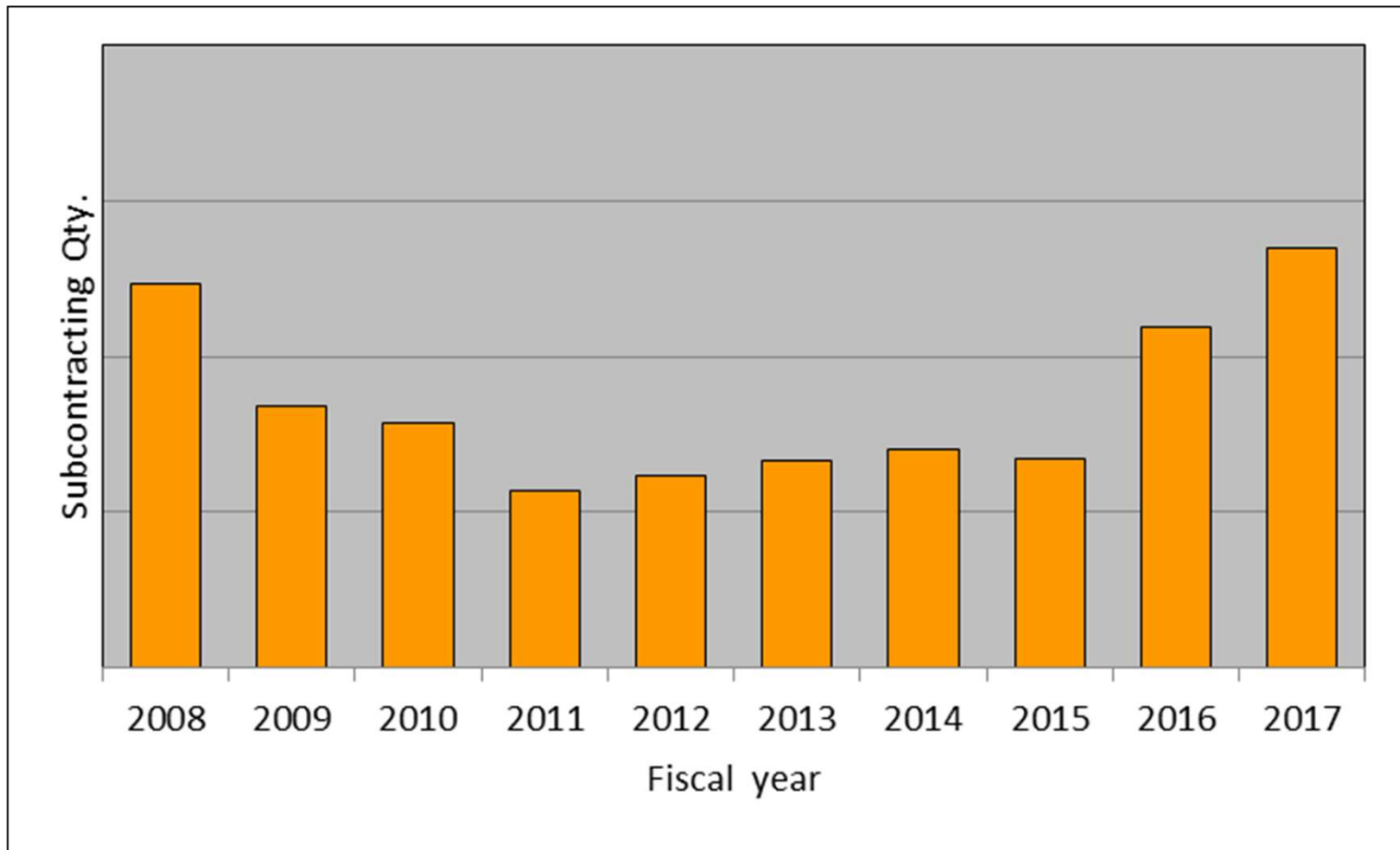
Address	550,Chung-Hwa Road Section 1 Chung-Li, 320, Taiwan, R.O.C		
Site area	6.4ha		
Business offerings	IC package Packaged IC test IC package material (Flip-chip package substrates)		
Quality systems	ISO9001:2015	August 2017	(Org. Jul. 2003)
	IATF16949:2016	August 2017	(Org. Jul. 2003)
	ISO1401:2016	November 2018	(Org. Nov. 2002)
	1999 M&A Plant by Motorola Inc. 2003 QFP production start 2004 BGA production start		
Other	W/W Number One OSAT(Outsourced Semiconductor Assembly & Test) company. Sales : ASE total NT\$240.4B (US\$7.9B) Packaging service NT\$126.2B (US\$4.2B) [2017 ASE IR Report]		

# Appendix : The subcontractor location

## <Location of ASECL>



# Appendix : Volume of Business for Epson



Epson started subcontracting production to ASECL from CY2003. The average of our volume of business was over 17Mpcs per year in the last ten years.

**EPSON**  
EXCEED YOUR VISION

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