## FUJITSU SEMICONDUCTOR LIMITED

Nomura Fudosan Shin-yokohama Bldg. 10-23, Shin-yokohama 2-Chome,
Kohoku-ku Yokohama Kanagawa 222-0033, Japan
Tel: +81-45-415-5858
*http://jp.fujitsu.com/fsl/en/*

*For further information please contact:*

**North and South America**
FUJITSU SEMICONDUCTOR AMERICA, INC.
1250 E. Arques Avenue, M/S 333
Sunnyvale, CA 94085-5401, U.S.A.
Tel: +1-408-737-5600 Fax: +1-408-737-5999
*http://us.fujitsu.com/micro/*

**Europe**
FUJITSU SEMICONDUCTOR EUROPE GmbH
Pittlerstrasse 47, 63225 Langen, Germany
Tel: +49-6103-690-0 Fax: +49-6103-690-122
*http://emea.fujitsu.com/semiconductor/*

**Korea**
FUJITSU SEMICONDUCTOR KOREA LTD.
206 Kosmo Tower Building, 1002 Daechi-Dong,
Gangnam-Gu, Seoul 135-280, Republic of Korea
Tel: +82-2-3484-7100 Fax: +82-2-3484-7111
*http://kr.fujitsu.com/fmk/*

**Asia Pacific**
FUJITSU SEMICONDUCTOR ASIA PTE. LTD.
151 Lorong Chuan,
#05-08 New Tech Park 556741 Singapore
Tel : +65-6281-0770 Fax : +65-6281-0220
*http://www.fujitsu.com/sg/services/micro/semiconductor/*

FUJITSU SEMICONDUCTOR SHANGHAI CO., LTD.
Rm. 3102, Bund Center, No.222 Yan An Road (E),
Shanghai 200002, China
Tel : +86-21-6146-3688 Fax : +86-21-6335-1605
*http://cn.fujitsu.com/fss/*

FUJITSU SEMICONDUCTOR PACIFIC ASIA LTD.
10/F., World Commerce Centre, 11 Canton Road,
Tsimshatsui, Kowloon, Hong Kong
Tel : +852-2377-0226 Fax : +852-2376-3269
*http://cn.fujitsu.com/fsp/*



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FUJITSU SEMICONDUCTOR

shaping tomorrow with you

# Providing New Technologies for the Near Future

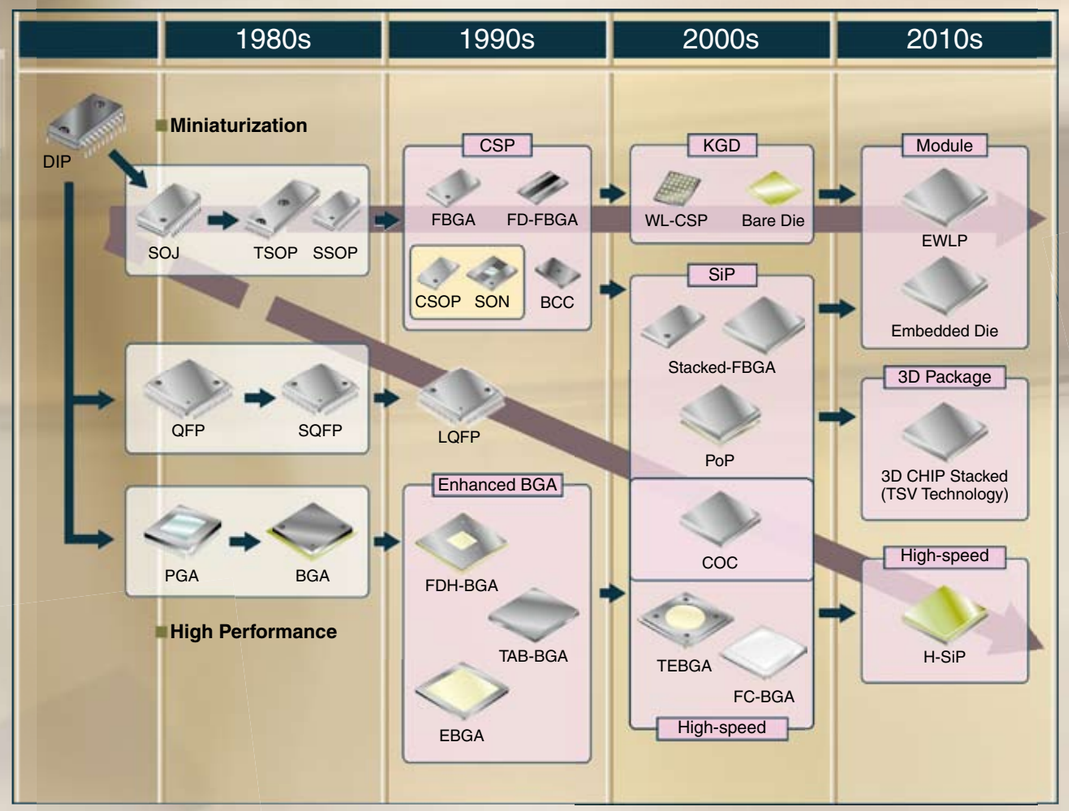
## Trends in Package Development

Electronic products have been in growing demand, such as personal computers, mobile phones and PDAs, and its technology innovation has constantly come along. The IC technology is supporting customers to meet market demands today and in the future.

Packaging solutions enable to reduce size and space requirements as a key technology. The packages such as CSP (Chip Size Package or Chip Scale Package) and BGA (Ball Grid Array) have supported high-density wiring technology and widely used in the market.

Miniaturization forced the use of new approaches in die packaging in order to achieve the smallest possible solutions. Leading the van of CSP, Fujitsu Semiconductor has launched the mass-production packages of SON which was impressed as the world's smallest level.

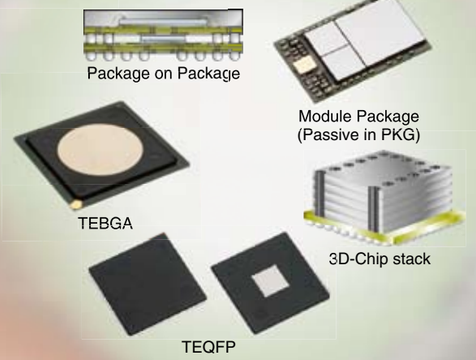
Fujitsu Semiconductor has a mass-production lineup of super compact packages such as FBGA (Fine Pitch BGA) and WL-CSP (Wafer Level CSP) and beyond. The high pin count packages, PBGA (Plastic BGA) and TEBGA (Thermal Enhanced BGA) have been mass-produced in order to fulfill the size and weight limitations, for example portable equipment.



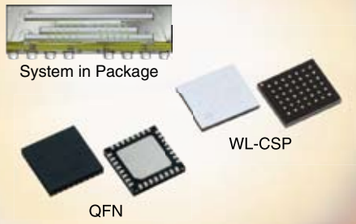

## Package Solutions

Fujitsu Semiconductor offers a wide range of packages to optimize applications in a way most suited for customers' requirements.

**Digital AV**
- High density, high function, high performance -



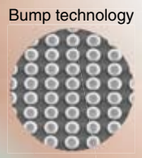

**Mobile**
- Super compact, light, thin -

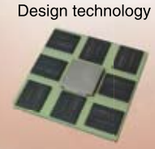




**Cutting-edge technologies**
**Lower cost by integrated design**
**Environmental considerations**

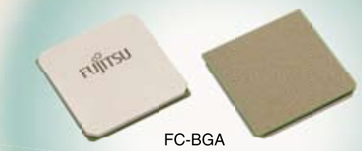
**Key technologies**





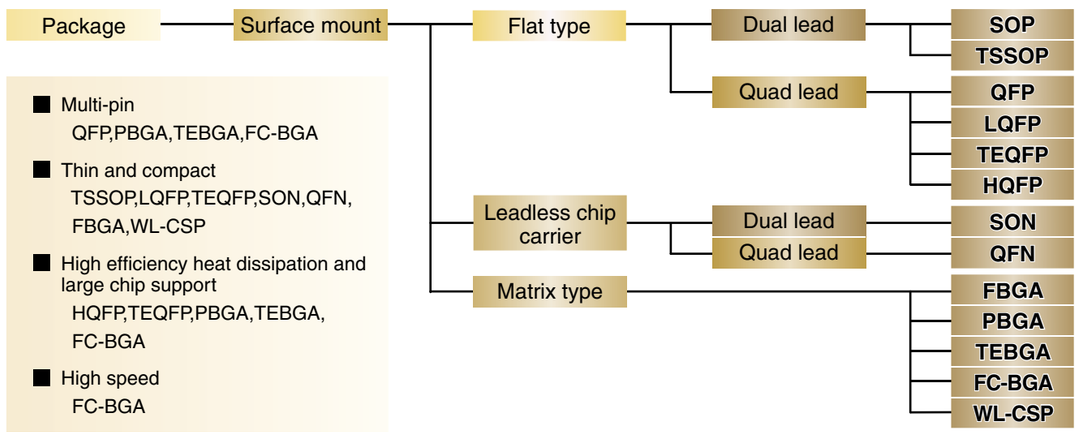
**Key technologies**




**High-end**
- Ultra high speed, high efficiency heat dissipation -

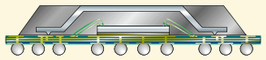
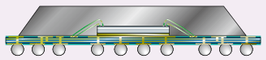
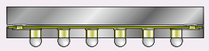
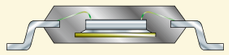

**Automotive**
- High reliability, high heat resistance -

## Package Line-up




- Multi-pin
  QFP,PBGA,TEBGA,FC-BGA
- Thin and compact
  TSSOP,LQFP,TEQFP,SON,QFN, FBGA,WL-CSP
- High efficiency heat dissipation and large chip support
  HQFP,TEQFP,PBGA,TEBGA, FC-BGA
- High speed
  FC-BGA

## Package Overview

| | Package type | Package structure | Pin count | I/O frequency (GHz) | Heat resistance Θja(°C /W) (0m/s) | Application |
|---|---|---|---|---|---|---|
| High-end | FC-CBGA |  | 450~2116 | ~5 | 7~ | Routers, Servers, Workstations, Backbone transmission devices |
| | FC-PBGA (AlSiC-LID) |  | 450~2116 | ~2.5 | 7~ | |
| | FC-PBGA (Cu-LID) |  | 450~1156 | ~2.5 | 9~ | Routers, Personal computers, Graphics, Digital TVs, Set top boxes, Printers |
| | TEBGA |  | 256~1156 | ~1.6 | 13~ | |
| | PBGA |  | 256~1156 | ~1.6 | 15~ | |
| Consumer appliances | FBGA |  | 66~906 | ~1 | 17~60 | Personal computers, Mobile phones, Digital video cameras, Digital still cameras, PDAs |
| | SON QFN |  | 6~68 | ~1.5 | 20~40 | Mobile phones, Digital video cameras, Digital still cameras, PDAs |
| | WL-CSP |  | 42~309 | ~2.5 | 25~60 | Mobile phones, Digital video cameras, Digital still cameras, PDAs |
| | QFP LQFP |  | 48~304 | ~2.5 | 15~100 | Personal computers, Digital TV, Set top boxes, Printers |
| | TEQFP |  | 48~256 | ~2.5 | 15~35 | Personal computers, Digital TV, Set top boxes |

# SOP (Small Outline L-Leaded Package)
# TSSOP (Thin Shrink Small Outline Package)

### Features

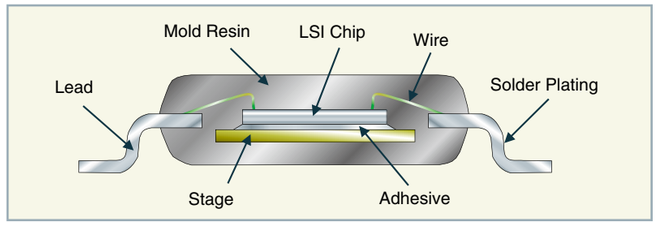
- Superior cost performance with a mature technology.
- High reliability in mounting the package on printed circuit boards.
- Thin and compact.

### SOP and TSSOP Package external view

SOP

TSSOP

### SOP and TSSOP Package cross section




### SOP and TSSOP Package line-up

| Package type | Package size (mm) | | Mounting height (mm) | Pin count | | |
|---|---|---|---|---|---|---|
| | X | Y | | Pin pitch 1.27mm | Pin pitch 0.65mm | Pin pitch 0.50mm |
| SOP | 5.3 | 5.24 | 2.10 Max. | 8 | – | – |
| | 7.5 | 12.7 | 2.65 Max. | 20 | – | – |
| TSSOP | 4.4 | 3.1 | 1.20 Max. | – | 8 | – |
| | 4.4 | 4.96 | | – | 14/16 | – |
| | 4.4 | 6.5 | | – | 20 | 24 |
| | 4.4 | 7.8 | | – | 24 | 30 |
| | 4.4 | 9.7 | | – | 28 | – |

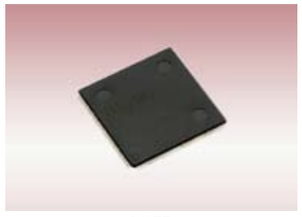
Please contact us for information on other packages.

# QFP (Quad Flat Package)
# LQFP (Low Profile Quad Flat Package)
# TEQFP (Thermally Enhanced QFP)
# HQFP (QFP with Heat Sink)

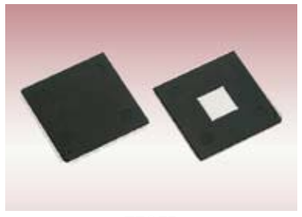
## Features

- Equipped with outer leads at the four corners of the package.
- Superior cost performance with a mature technology.
- High reliability in mounting the package on printed circuit boards.
- TEQFP and HQFP can be mounted with a chip with high heat emission because of their high efficiency in heat dissipation.

## QFP Package external view

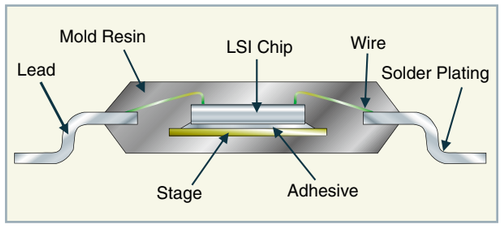


LQFP

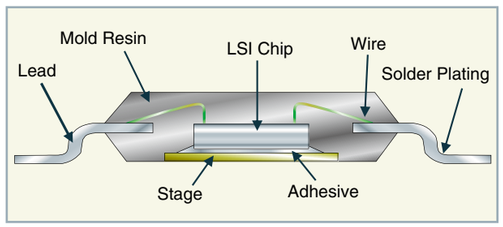


TEQFP

## QFP and LQFP Package cross section




## TEQFP Package cross section




## QFP Packages line-up

| Package type | Package size (mm) | | Mounting height (mm) | Pin count | | |
|---|---|---|---|---|---|---|
| | X | Y | | Pin pitch 0.65mm | Pin pitch 0.50mm | Pin pitch 0.40mm |
| QFP | 14.0 | 20.0 | 3.35 Max. | 100 | – | – |
| | 28.0 | 28.0 | 3.95 Max. | – | 208 | – |
| | | | 4.03 Max. | – | – | 256 |
| | 32.0 | 32.0 | | – | 240 | – |
| LQFP TEQFP | 7.0 | 7.0 | 1.70 Max. | – | 48 | 64 |
| | 10.0 | 10.0 | | 52 | 64 | – |
| | 12.0 | 12.0 | | 64 | 80 | – |
| | 14.0 | 14.0 | | – | 100 | – |
| | 16.0 | 16.0 | | – | 120 | 144 |
| | 20.0 | 20.0 | | – | 144 | – |
| | 24.0 | 24.0 | | – | 176 | 216 |
| | 28.0 | 28.0 | | – | 208 | 256 |
| HQFP | 28.0 | 28.0 | 3.95 Max. | – | 208 | – |
| | | | 4.03 Max. | – | – | 256 |
| | 32.0 | 32.0 | | – | 240 | 296 |
| | 40.0 | 40.0 | 4.10 Max. | – | 304 | – |

Please contact us for information on other packages.

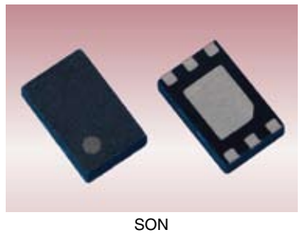


# SON (Small Outline Non-leaded Package)
# QFN (Quad Flat Non-Leaded Package)

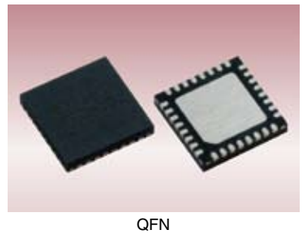
## Features

- Thin and compact.
- Better cost performance compared to BGA.

## Package external view

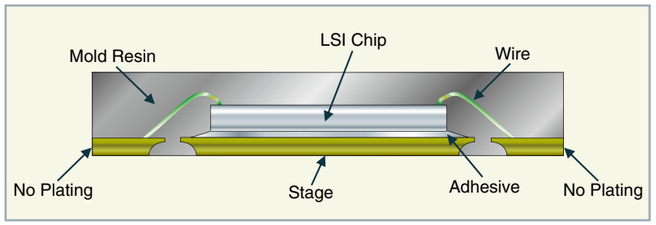


SON



QFN

## Package cross section




## SON Package line-up

| Package size (mm) | | Mounting height (mm) | Pin count | | |
|---|---|---|---|---|---|
| X | Y | | Pin pitch 0.65mm | Pin pitch 0.50mm | Pin pitch 0.40mm |
| 1.80 | 2.85 | 0.80 Max. | 6 | – | – |
| 2.0 | 2.0 | | – | 8 | – |
| 3.0 | 3.0 | | – | 10 | – |

## QFN Package line-up

| Package size (mm) | | Mounting height (mm) | Pin count | | |
|---|---|---|---|---|---|
| X | Y | | Pin pitch 0.65mm | Pin pitch 0.50mm | Pin pitch 0.40mm |
| 2.5 | 3.5 | 0.80 Max. | – | – | 24 |
| 3.0 | 3.0 | | – | 16 | 20 |
| 4.0 | 4.0 | | 16 | 16/20/24 | 28 |
| 5.0 | 5.0 | | – | 28/32 | 40 |
| 6.0 | 6.0 | | – | 40 | 48 |
| 7.0 | 7.0 | | – | 48 | 56 |
| 8.0 | 8.0 | | – | – | 68 |
| 9.0 | 9.0 | | – | 64 | – |

Please contact us for information on other packages.

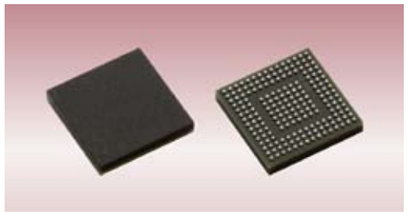
# FBGA
**(Fine pitch Ball Grid Array)**

## Features

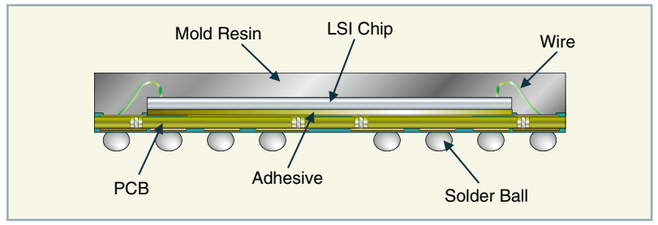
Low profile and multi-pin support, suitable for portable devices such as mobile phones and DSCs.

- Fine pitch (pin pitch from 0.4mm) and thin.
- Superior electrical characteristics and reliability.
- Plentiful line-up and customization support.

## FBGA Package external view



## FBGA Package cross section




## FBGA Package line-up

Pin pitch : 0.50mm (Less than 500pin)

| Package code | Pin count | | Package size (mm) | | Pin arrangement |
|---|---|---|---|---|---|
| | Total | number of TBs* included | X | Y | |
| BGA-66P-M01 | 66 | 9 | 5.0 | 5.0 | 2 rows |
| BGA-82P-M01 | 82 | 9 | 6.0 | 6.0 | 2 rows |
| BGA-96P-M04 | 96 | 0 | 6.0 | 6.0 | 3 rows |
| BGA-100P-M03 | 100 | 0 | 7.0 | 7.0 | 2 + (1) + 1 rows |
| BGA-112P-M05 | 112 | 0 | 7.0 | 7.0 | 3 rows (With nonexistent pins) |
| BGA-130P-M02 | 130 | 9 | 7.0 | 7.0 | 3 rows |
| BGA-144P-M09 | 144 | 0 | 7.0 | 7.0 | 4 rows |
| BGA-168P-M03 | 168 | 25 | 9.0 | 9.0 | 3 rows (With nonexistent pins) |
| BGA-208P-M01 | 208 | 0 | 9.0 | 9.0 | 4 rows |
| BGA-232P-M01 | 232 | 0 | 12.0 | 12.0 | 2 + (1) + 2 rows |
| BGA-240P-M02 | 289 | 49 | 10.0 | 10.0 | 4 rows |
| BGA-240P-M03 | 240 | 0 | 10.0 | 10.0 | 4 rows |
| BGA-289P-M01 | 289 | 25 | 10.0 | 10.0 | 3 + (1) + 2 rows |
| BGA-304P-M05 | 304 | 0 | 13.0 | 13.0 | 2 + (1) + 2 rows |
| BGA-304P-M07 | 304 | 0 | 12.0 | 12.0 | 4 rows |
| BGA-337P-M02 | 428 | 81 | 13.0 | 13.0 | 4 rows |
| BGA-345P-Mxx | 345 | 25 | 12.0 | 12.0 | 2 + (1) + 2 + (1) + 1 rows |
| BGA-385P-M01 | 434 | 49 | 13.0 | 13.0 | 3 + (1) + 2 rows |
| BGA-385P-M02 | 385 | 81 | 13.0 | 13.0 | 2 + (2) + 2 rows |
| BGA-385P-M03 | 385 | 81 | 12.0 | 12.0 | 4 rows |
| BGA-400P-M04 | 481 | 81 | 15.0 | 15.0 | 4 rows |

*TB : Thermal Ball

## FBGA Package line-up

Pin pitch : 0.50mm (500pin or more)

| Package code | Pin count | | Package size (mm) | | Pin arrangement |
|---|---|---|---|---|---|
| | Total | number of TBs* included | X | Y | |
| BGA-506P-Mxx | 506 | 81 | 14.0 | 14.0 | 3 + (1) + 2 rows |
| BGA-562P-M03 | 562 | 81 | 14.0 | 14.0 | 3 + (1) + 3 rows |
| BGA-586P-Mxx | 586 | 121 | 15.0 | 15.0 | 3 + (1) + 2 rows |
| BGA-586P-M04 | 586 | 49 | 15.0 | 15.0 | 4 + (1) + 2 rows |
| BGA-610P-M01 | 610 | 121 | 16.0 | 16.0 | 3 + (2) + 2 rows |
| BGA-650P-M03 | 650 | 169 | 15.0 | 15.0 | 5 rows |
| BGA-753P-Mxx | 753 | 169 | 18.0 | 18.0 | 3 + (1) + 2 rows |
| BGA-770P-M01 | 770 | 121 | 16.0 | 16.0 | 4 + (1) + 3 rows |
| BGA-842P-Mxx | 842 | 169 | 18.0 | 18.0 | 3 + (1) + 2 rows |
| BGA-906P-Mxx | 906 | 169 | 18.0 | 18.0 | 3 + (1) + 2 + (1) + 2 rows |

*TB : Thermal Ball

Pin pitch : 0.65mm

| Package code | Pin count | | Package size (mm) | | Pin arrangement |
|---|---|---|---|---|---|
| | Total | number of TBs* included | X | Y | |
| BGA-176P-M05 | 176 | 0 | 11.0 | 11.0 | 4 rows |
| BGA-204P-M01 | 204 | 0 | 11.0 | 11.0 | 3 + (1) + 2 rows |
| BGA-240P-M07 | 240 | 0 | 13.0 | 13.0 | 4 rows |
| BGA-252P-M01 | 252 | 0 | 13.0 | 13.0 | 5 rows (With nonexistent pins) |
| BGA-280P-M03 | 280 | 0 | 13.0 | 13.0 | 5 rows |
| BGA-360P-M05 | 441 | 81 | 16.0 | 16.0 | 5 rows |
| BGA-385P-M04 | 385 | 25 | 16.0 | 16.0 | 5 rows |

*TB : Thermal Ball

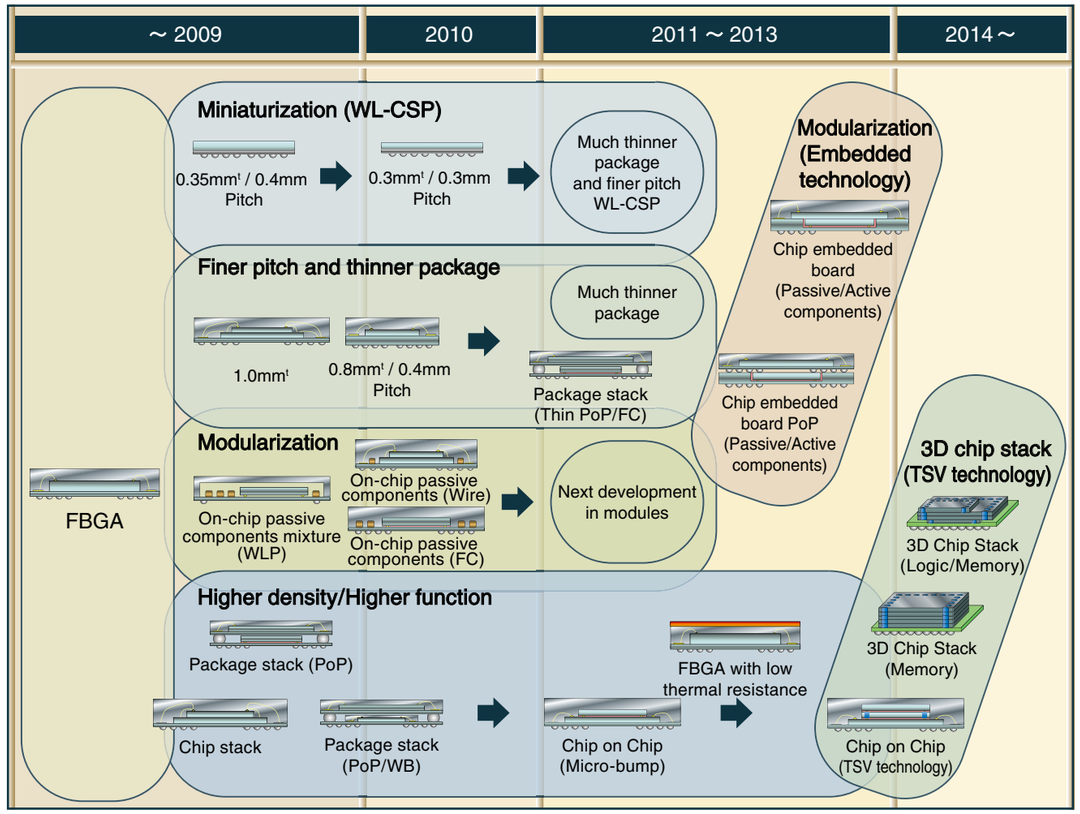
Pin pitch : 0.80mm

| Package code | Pin count | | Package size (mm) | | Pin arrangement |
|---|---|---|---|---|---|
| | Total | number of TBs* included | X | Y | |
| BGA-112P-M04 | 112 | 0 | 10.0 | 10.0 | 4 rows |
| BGA-144P-M06 | 144 | 0 | 12.0 | 12.0 | 4 rows |
| BGA-144P-M07 | 144 | 0 | 12.0 | 12.0 | 4 rows (With nonexistent pins) |
| BGA-176P-M04 | 176 | 0 | 12.0 | 12.0 | 5 rows (With nonexistent pins) |
| BGA-188P-M01 | 188 | 0 | 15.0 | 15.0 | 4 rows (With nonexistent pins) |
| BGA-192P-M06 | 192 | – | 12.0 | 12.0 | Full Matrix (With nonexistent pins) |
| BGA-224P-M06 | 224 | 0 | 16.0 | 16.0 | 4 rows |
| BGA-224P-M08 | 260 | 36 | 16.0 | 16.0 | 4 rows |
| BGA-224P-M09 | 288 | 64 | 16.0 | 16.0 | 4 rows |
| BGA-240P-M06 | 240 | 0 | 15.0 | 15.0 | 5 rows |
| BGA-256P-M17 | 256 | 49 | 18.0 | 18.0 | 2 + (1) + 2 rows |
| BGA-272P-M06 | 321 | 49 | 18.0 | 18.0 | 4 rows |
| BGA-272P-M08 | 272 | 0 | 18.0 | 18.0 | 4 rows |
| BGA-320P-M05 | 369 | 49 | 18.0 | 18.0 | 5 rows |
| BGA-441P-M01 | 441 | – | 18.0 | 18.0 | Full Matrix |

Please contact us for information on other pin arrangements.

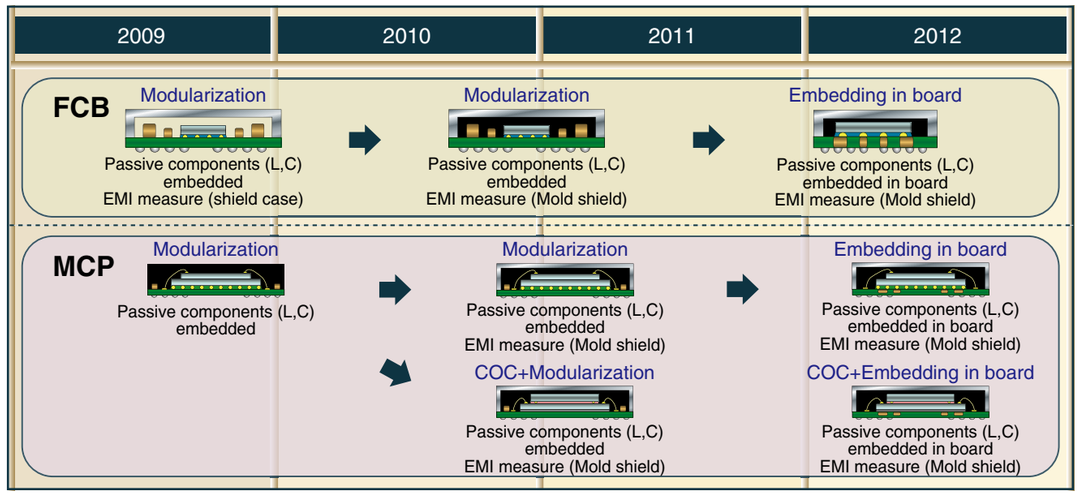
*TB : Thermal Ball

## CSP Road map




Fujitsu Semiconductor will provide the most suitable SiP to the customer's requirements with our extensive implementation technologies. Please contact us for any requests.

## Module package road map

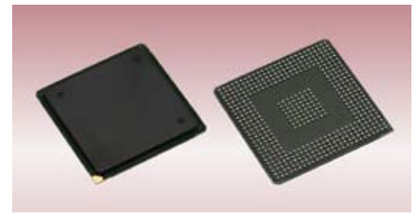



# PBGA
**(Plastic Ball Grid Array)**

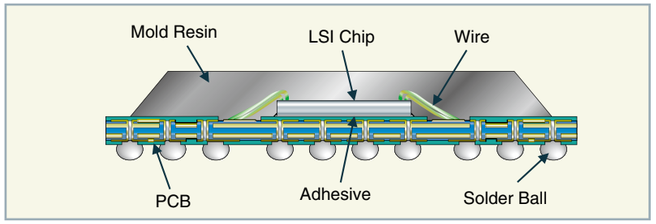
## Features

- Sealed with plastic resin to achieve high cost performance.
- Superior support for multi-pin.
- Package sizes at 27mmSQ, 31mmSQ, and 35mmSQ are available.

## PBGA Package external view



## PBGA Package cross section




## PBGA Package line-up

| Package code | Pin count | | Package size (mm) | | Pin arrangement | Pin pitch (mm) |
|---|---|---|---|---|---|---|
| | Total | number of TBs* included | X | Y | | |
| BGA-256P-M24 | 256 | – | 17.0 | 17.0 | Full Matrix | 1.00 |
| BGA-256P-M27 | 256 | 0 | 27.0 | 27.0 | 4 rows | 1.27 |
| BGA-320P-M06 | 320 | 64 | 27.0 | 27.0 | 4 rows | 1.27 |
| BGA-321P-M02 | 321 | – | 19.0 | 19.0 | Full Matrix (With nonexistent pins) | 1.00 |
| BGA-353P-M02 | 353 | 49 | 31.0 | 31.0 | 4 rows | 1.27 |
| BGA-416P-M05 | 416 | 64 | 27.0 | 27.0 | 4 rows | 1.00 |
| BGA-416P-M09 | 416 | 64 | 35.0 | 35.0 | 4 rows | 1.27 |
| BGA-480P-M14 | 480 | 64 | 27.0 | 27.0 | 5 rows | 1.00 |
| BGA-484P-M07 | 484 | 64 | 27.0 | 27.0 | 5 rows | 1.00 |
| BGA-484P-M11 | 484 | 64 | 35.0 | 35.0 | 5 rows | 1.27 |
| BGA-493P-M01 | 493 | 64 | 27.0 | 27.0 | 3 + (2) + 3 rows (With nonexistent pins) | 1.00 |
| BGA-496P-M02 | 496 | 144 | 27.0 | 27.0 | 4 rows | 1.00 |
| BGA-544P-M04 | 544 | 64 | 27.0 | 27.0 | 6 rows | 1.00 |
| BGA-564P-M01 | 564 | 64 | 31.0 | 31.0 | 5 rows | 1.00 |
| BGA-676P-M06 | 676 | – | 27.0 | 27.0 | Full Matrix | 1.00 |
| BGA-676P-M14 | 676 | 100 | 35.0 | 35.0 | 5 rows | 1.00 |
| BGA-868P-M03 | 868 | 196 | 35.0 | 35.0 | 6 rows | 1.00 |
| BGA-900P-M14 | 900 | – | 31.0 | 31.0 | Full Matrix | 1.00 |

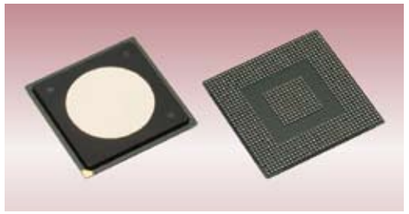
Please contact us for information on other pin arrangements.

*TB : Thermal Ball

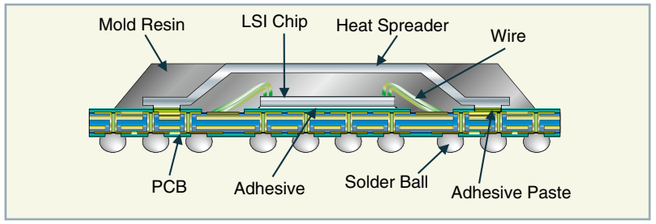
# TEBGA
**(Thermally Enhanced Ball Grid Array)**

## Features
- Superior thermal characteristics.
- Superior support for multi-pin.
- Package sizes at 27mmSQ and 35mmSQ are available.

## TEBGA Package external view



## TEBGA Package cross section




## TEBGA Package line-up

| Package code | Pin count | | Package size (mm) | | Pin arrangement | Pin pitch (mm) |
|---|---|---|---|---|---|---|
| | Total | number of TBs* included | X | Y | | |
| BGA-320P-Mxx | 320 | 64 | 27.0 | 27.0 | 4 rows | 1.27 |
| BGA-416P-Mxx | 416 | 64 | 27.0 | 27.0 | 4 rows | 1.00 |
| BGA-416P-M06 | 416 | 64 | 35.0 | 35.0 | 4 rows | 1.27 |
| BGA-480P-Mxx | 480 | 64 | 27.0 | 27.0 | 5 rows | 1.00 |
| BGA-484P-M09 | 484 | 64 | 27.0 | 27.0 | 5 rows | 1.00 |
| BGA-484P-M08 | 484 | 64 | 35.0 | 35.0 | 5 rows | 1.27 |
| BGA-520P-Mxx | 520 | 100 | 35.0 | 35.0 | 5 rows | 1.27 |
| BGA-543P-M01 | 543 | 64 | 27.0 | 27.0 | 6 rows | 1.00 |
| BGA-544P-M02 | 544 | 64 | 27.0 | 27.0 | 6 rows | 1.00 |
| BGA-676P-M10 | 676 | – | 27.0 | 27.0 | Full Matrix | 1.00 |
| BGA-676P-M12 | 676 | 100 | 35.0 | 35.0 | 5 rows | 1.00 |
| BGA-770P-Mxx | 772 | 100 | 35.0 | 35.0 | 6 rows | 1.00 |
| BGA-808P-M01 | 808 | 144 | 35.0 | 35.0 | 5+2 rows (With nonexistent pins) | 1.00 |
| BGA-868P-M01 | 868 | 196 | 35.0 | 35.0 | 6 rows | 1.00 |
| BGA-900P-M08 | 900 | 144 | 35.0 | 35.0 | 7 rows | 1.00 |
| BGA-1156P-M11 | 1156 | – | 35.0 | 35.0 | Full Matrix | 1.00 |

Please contact us for information on other pin arrangements.

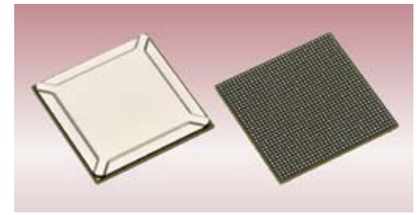
*TB : Thermal Ball

# FC-BGA
**(Flip Chip Ball Grid Array)**

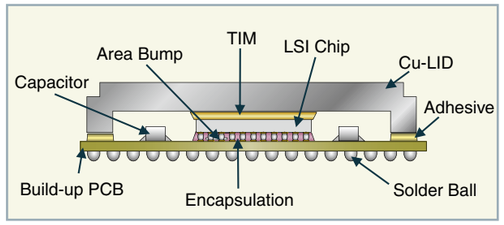
## Features
Superior electrical and thermal performance thanks to the flip chip bonding technology.
Wide support from consumer to high-end applications including servers.

- Support for ultra multi-pin by arranging the chip electrode over an area.
- Good dissipation of heat produced from the high electric consumption chip by deployment of a heat spreader.
- Capable of reduction of waveform distortion and high speed transmission (GHz level) for high frequencies.
- Fully customizable according to the customer's requirements.

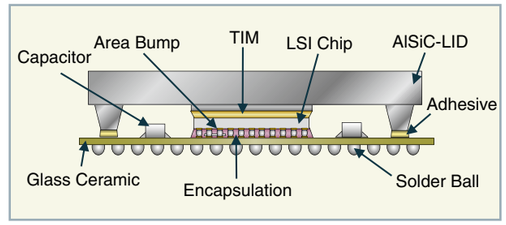
## FC-BGA Package external view



## FC-PBGA Package cross section




## FC-CBGA Package cross section




## FC-BGA Package line-up
FC-PBGA

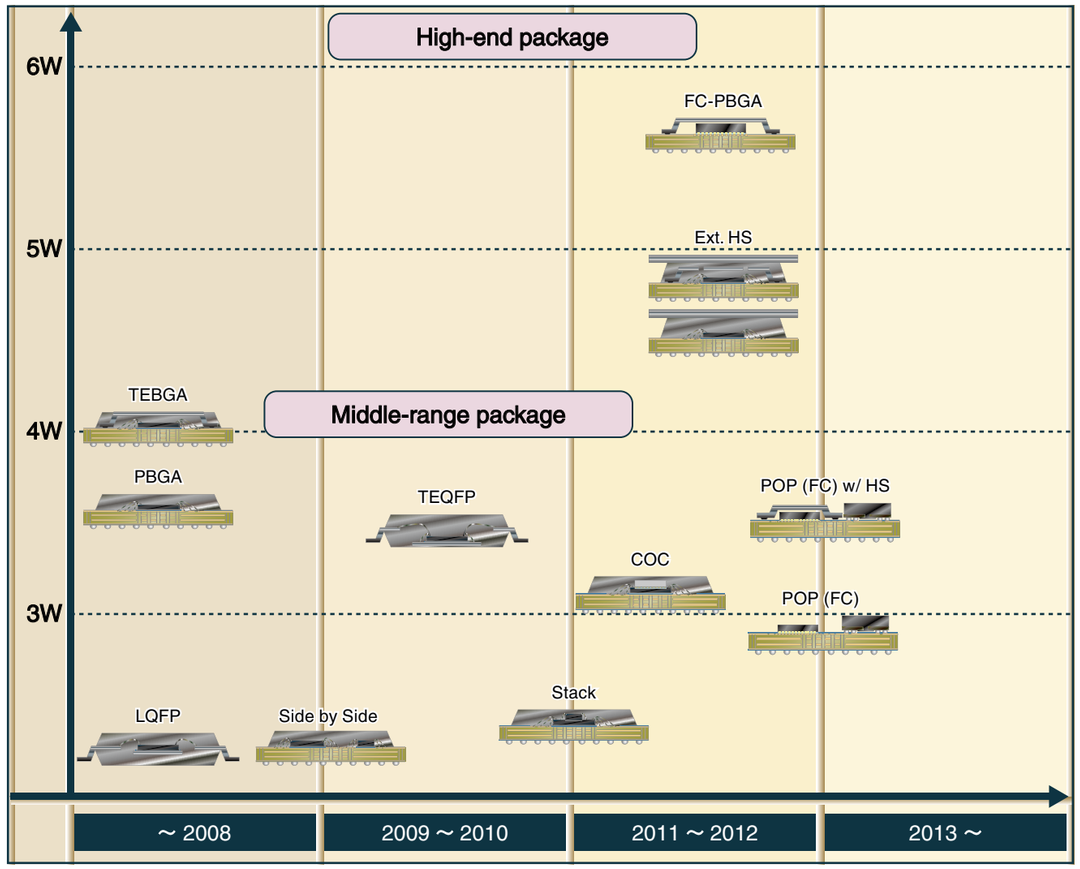
| Pin count | Package size (mm) | | Pin arrangement | Ball matrix | Pin pitch (mm) |
|---|---|---|---|---|---|
| | X | Y | | | |
| BGA484 | 23.0 | 23.0 | Full Matrix | 22 × 22 | 1.00 |
| BGA592 | 21.0 | 21.0 | Full Matrix (With nonexistent pins) | 25 × 25 | 0.80 |
| BGA625 | 17.0 | 17.0 | Full Matrix | 25 × 25 | 0.65 |
| BGA625 | 27.0 | 27.0 | Full Matrix | 25 × 25 | 1.00 |
| BGA729 | 29.0 | 29.0 | Full Matrix | 27 × 27 | 1.00 |
| BGA900 | 31.0 | 31.0 | Full Matrix | 30 × 30 | 1.00 |
| BGA1020 | 33.0 | 33.0 | Full Matrix | 32 × 32 | 1.00 |
| BGA1156 | 35.0 | 35.0 | Full Matrix | 34 × 34 | 1.00 |
| BGA1206 | 37.5 | 37.5 | Full Matrix (With nonexistent pins) | 36 × 36 | 1.00 |
| BGA1396 | 37.5 | 37.5 | Full Matrix | 37 × 37 | 1.00 |
| BGA1681 | 42.5 | 42.5 | Full Matrix | 41 × 41 | 1.00 |

FC-CBGA

| Pin count | Package size (mm) | | Pin arrangement | Ball matrix | Pin pitch (mm) |
|---|---|---|---|---|---|
| | X | Y | | | |
| BGA625 | 27.0 | 27.0 | Full Matrix | 25 × 25 | 1.00 |
| BGA625 | 33.0 | 33.0 | Full Matrix | 25 × 25 | 1.27 |
| BGA729 | 35.0 | 35.0 | Full Matrix | 27 × 27 | 1.27 |
| BGA900 | 31.0 | 31.0 | Full Matrix | 30 × 30 | 1.00 |
| BGA900 | 40.0 | 40.0 | Full Matrix | 30 × 30 | 1.27 |
| BGA1089 | 42.5 | 42.5 | Full Matrix | 33 × 33 | 1.27 |
| BGA1156 | 35.0 | 35.0 | Full Matrix | 34 × 34 | 1.00 |
| BGA1225 | 45.0 | 45.0 | Full Matrix | 35 × 35 | 1.27 |
| BGA1369 | 37.5 | 37.5 | Full Matrix | 37 × 37 | 1.00 |
| BGA1681 | 42.5 | 42.5 | Full Matrix | 41 × 41 | 1.00 |
| BGA2116 | 47.5 | 47.5 | Full Matrix | 46 × 46 | 1.00 |

Please contact us for information on other pin arrangements.

## Middle to High-end package road map

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Please contact us for any requests.

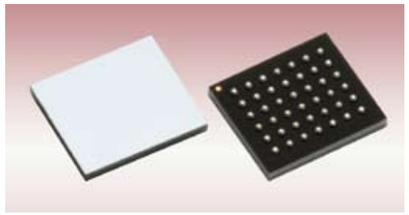
# WL-CSP
**(Wafer Level CSP)**

## Features

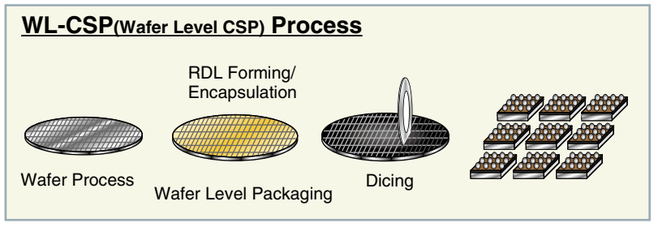
Ultra compact, ultra thin, multi-pin, and superior humidity and reflow resistance by wafer consistent assembly.
Also called as "Super CSP."

- Ultra compact, ultra thin, and light weight suitable for mobile devices and digital electric household appliances.
- JEDEC Moisture Sensitivity Level 1 clear.
- Support for pin pitch at less than or equal to 0.5mm contributing towards multi-pin.
- High speed transmission by reducing the wire length.
- Compliant with JEITA standards and fully customizable according to customer needs.

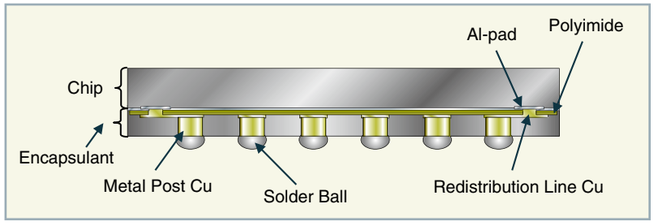
## WL-CSP External view



## WL-CSP Processes




## WL-CSP Package cross section



## Mass-production actual performance

| WL-CSP | WLP112 | WLP309 | WLP15 | WLP42 | WLP70-02 | WLP143 |
|---|---|---|---|---|---|---|
| Wafer Size | 200 mm | 200 mm | 200 mm | 300 mm | 300 mm | 300 mm |
| Package Size | 6.46 × 6.46 mm | 7.56 × 7.56 mm | 1.77 × 1.77 mm | 3.30 × 2.95 mm | 3.408 × 4.486 mm | 7.81 × 6.10 mm |
| Package Height | 0.6 mm Max | 0.8 mm Max | 0.64 mm Max | 0.50 mm Max | 0.35 mm Max | 0.55 mm Max |
| Chip Thickness | 390μm TYP | 520μm TYP | 390μm TYP | 300μm TYP | 220μm TYP | 350μm TYP |
| Encapsulant Thickness | 50μm TYP | 50μm TYP | 50μm TYP | 50μm TYP | 50μm TYP | 50μm TYP |
| Ball Pitch | 0.5 mm | 0.4 mm | 0.4 mm | 0.4 mm | 0.4 mm | 0.5 mm |
| Ball Height | 110μm TYP | 150μm TYP | 150μm TYP | 100μm TYP | 100μm TYP | 100μm TYP |

## Technology road map

| | | 2010 | 2011 | 2012 |
|---|---|---|---|---|
| WL-CSP Structure | Height（Min） | 0.25 mm | ← | ← |
| | Ball/Land pitch（Min） | 0.3 mm | ← | 0.25 mm |
| | Ball/Land dia.（Min） | 0.15 mm | ← | 0.13 mm |
| RDL Technology | Line/Space | 20μm / 15μm | ← | 15μm / 15μm |
| | Via/Land Pitch（Inline） | 50μm | ← | 40 μm |
| Others | Wafer size | 6 / 8 / 12 inch | ← | ← |
| | Scribe Width（Min） 6/8in | 90μm | ← | ← |
| | | 90μm（≦ 0.35-t） | ← | ← |
| | 12in | 100μm（> 0.35-t） | ← | ← |
| | Solder | Pb Free | ← | ← |
| | Mold resin | Halogen free | ← | ← |

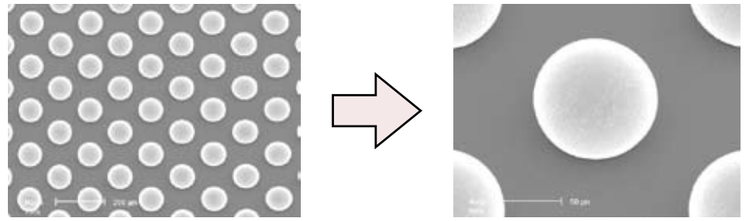
# Bump on Pad

## Features

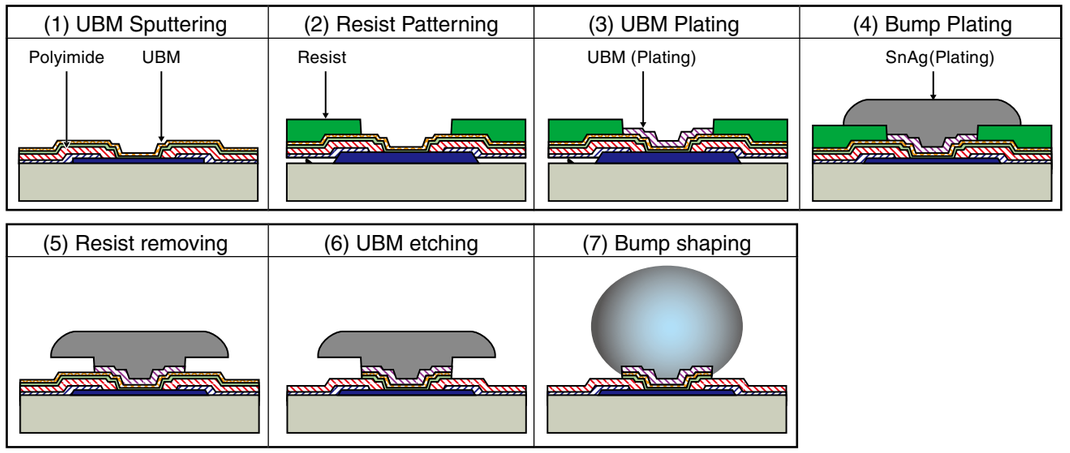
Wafer process and bumping in consolidated assembly.

- Technology supporting wide range of products from low-end applications such as mobile devices and digital electric household appliances to high-end applications such as servers.
- Promote multi-pin with min. 50μm AL pad pitch.
- Able to form wiring layer under a bump on demand.

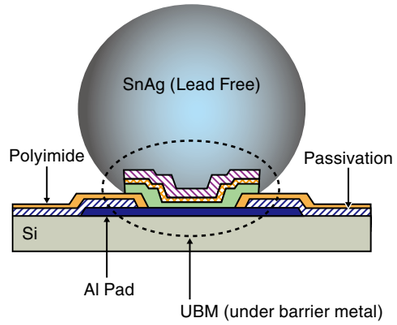
## Bump External view



## Manufacturing process

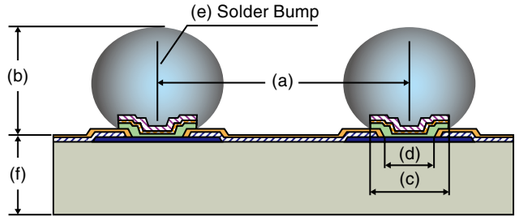



## Bump Cross section



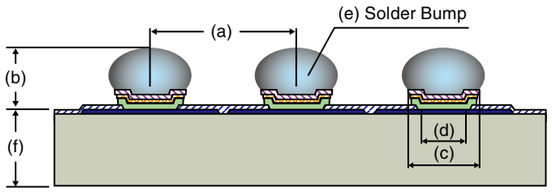
## Typical specification

| | | |
|---|---|---|
| (a) | Bump pitch | 176μm |
| (b) | Bump height | 85μm |
| (c) | UBM size | 80μm (typical) |
| (d) | Passivation opening size | 50μm (typical) |
| (e) | Bump material | SnAg (or PbSn) |
| (f) | Chip thickness (the thinnest case) | 200μm |




## Micro bump chip specification (example)

| | | |
|---|---|---|
| (a) | Bump pitch | 50μm |
| (b) | Bump height | 18μm |
| (c) | UBM size | 32μm (typical) |
| (d) | Passivation opening size | 17μm (typical) |
| (e) | Bump material | SnAg |
| (f) | Chip thickness (the thinnest case) | 150μm |




## Mass-production actual performance

| Wafer bumping | A | B | C |
|---|---|---|---|
| Purpose | High-end video | 1seg tuner | Image processing |
| Wafer size | 300 mm | 300 mm | 300 mm |
| Chip size | 9.52 × 14.44 mm | 2.90 × 2.90 mm | 5.10 × 4.50 mm |
| UBM size | 0.080 mm | 0.080 mm | 0.200 mm |
| Bump height | 0.085 mm | 0.085 mm | 0.100 mm |
| Bump pitch | 0.176 mm | 0.250 mm | 0.400 mm |
| Chip thickness | 0.550 mm | 0.185 mm | 0.450 mm |
| Bump material | SnAg | SnAg | SnAg |

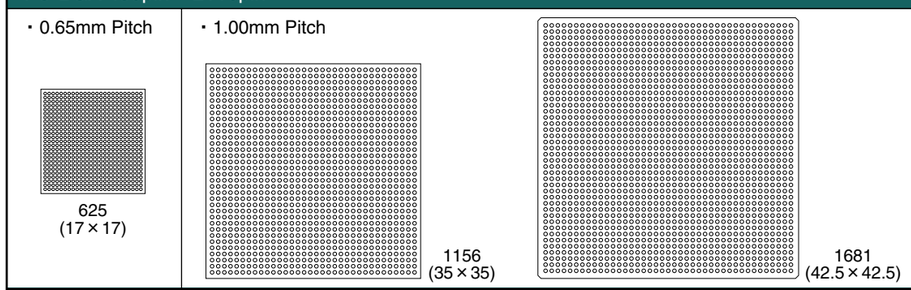
## Technology road map

| | ～ 2009 | ～ 2010 | ～ 2011 | 2012 ～ |
|---|---|---|---|---|
| Standard bump | Pitch 150μm(Min)<br>UBM 85μm(Max)<br>Height 80μm(Max) | | Pitch 130μm<br>UBM 85μm<br>Height 80μm | Pitch 100μm<br>UBM 70μm<br>Height 70μm |
| Micro bump | Pitch 50μm(Min)<br>UBM 30μm(Min)<br>Height 18μm(Max) | | Pitch 40/30μm<br>UBM 20μm<br>Height 18μm | |
| Bump package | UBM 200μm(Max)<br>Height 100μm(Max) | | | |
| Re-distribution layer bump | L&S 20/20μm(Min)<br>UBM 200μm(Max)<br>Height 100μm(Max) | L&S 15/20μm<br>UBM 200μm<br>Height 100μm | | L&S 10/15μm<br>UBM 200μm<br>Height 100μm |

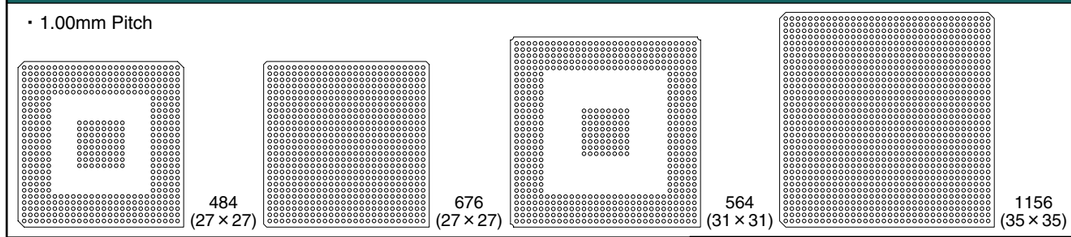
## Main package (Full scale: Size comparison)

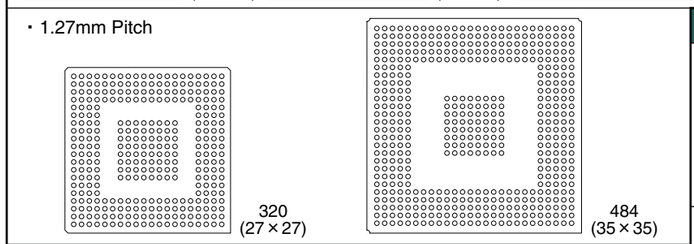
[Notation example]
625 : Pin count
(17 × 17) : Package size (unit:mm)

### FC-BGA 450pin ~ 2116pin

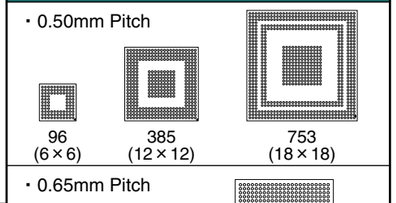



### PBGA 256pin ~ 1156pin

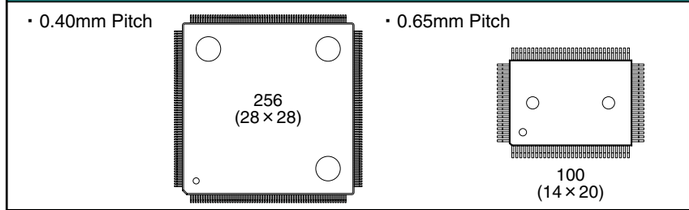


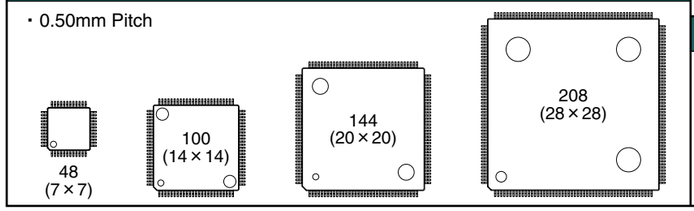

### FBGA 66pin ~ 906pin




### QFP 100pin ~ 256pin




### LQFP/TEQFP 48pin ~ 256pin




### QFN 16pin ~ 64pin