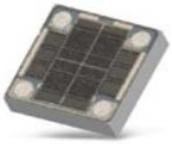
UBEC/BBEC/ULEC 100µm & 400µm - Assembly by Wirebonding

Rev. 1.3

General description

This document describes the attachment techniques recommended by Murata* for their capacitors on the customer substrates. This document is non-exhaustive. Customers with specific attachment requirements or attachment scenarios that are not covered by this document should contact Murata.



Handling precautions and storage

Silicon die must always be handled in a clean room environment (usually class 1000 (ISO 6)) but the assembled devices don't need to be handled in such an environment as the product is already well packed. The remaining quantities have to be repacked immediately after any process step, in the same conditions as before the opening (ESD bag + N2).

Store the capacitors in the manufacturer's package in the following conditions without a rapid thermal change in an indoor room:

- Temperature: -10 to 40 degree C
- Humidity: 30 to 70%RH

Avoid storing the capacitors in the following conditions:

(a) Ambient air containing corrosive gas. (Chlorine, Hydrogen sulfide, Ammonia, Sulfuric acid, Nitric oxide, etc.)
(b) Ambient air containing volatile or combustible gas
(c) In environments with a high concentration of airborne particles
(d) In liquid (water, oil, chemical solution, organic solvents, etc.)
(e) In direct sunlight
(f) In freezing environments

To avoid contamination and damage like scratches and cracks, our recommendations are:

- Never handle the die with the bare hands
- Avoid touching the active face
- Do not store or transport die outside protective bags, tubes, boxes, sawing tape
- Work only in ESD environments
- Use plastic tweezers or a soft vacuum tool to remove the silicon die from the packing.

Standard packing is tape & reel for die size larger than 0201 but silicon capacitors can be provided within waffle pack, gelpak or sawing frame. Please contact the Murata sales contact for drawing and references (mis@murata.com).

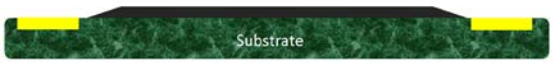
*Murata Integrated Passive Solutions

Pad Finishing

- Gold finishing (1.5 µm), recommended for gold wire bonding
- Aluminum finishing (3µm thickness - Al/Si/Cu: 98.96 %/1 %/0.04 %) is recommended for aluminum wire bonding
- Other finishes are available upon request (gold, copper …)

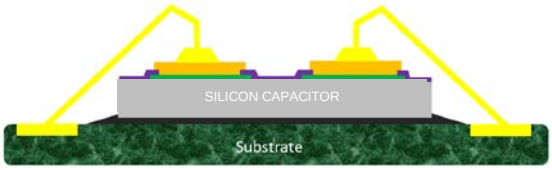
Process Flow with Glue

Step A - Glue application



Step B - Pick and place/bonding
Step C - Curing

Step D - Wire bonding



Recommendations concerning the Glue for Die Attachment

Using electrical conductive glue could result in capacitor leakage in case of glue overflow on die front side chipping. Special care must be taken when using, for example, thermally conductive glues. For information, Murata often uses the following non-conductive glue:

Technology: Bismaleimide resin
Cure: Heat Cure

TYPICAL PROPERTIES OF UNCURED MATERIAL

Specific Gravity @ 25 °C	1.37
Viscosity @ 25 °C, cps	10,000
Thixotropic Index (Speed 0.5/speed 0.5)	5
Pot Life @ 25 °C, hours	12
Ionic Contaminants, ppm:	
Na+, K+	<20
Cl-, F-	<20
Flash Point - See MSDS	

TYPICAL PROPERTIES OF CURED MATERIAL

Physical Properties:	
Glass Transition Temperature (Tg) °C	-30
Coefficient of Thermal Expansion ppm/°C:	
Below Tg, ppm/°C	80
Above Tg, ppm/°C	150
DMA modulus @ 25°C,GPa	0.3

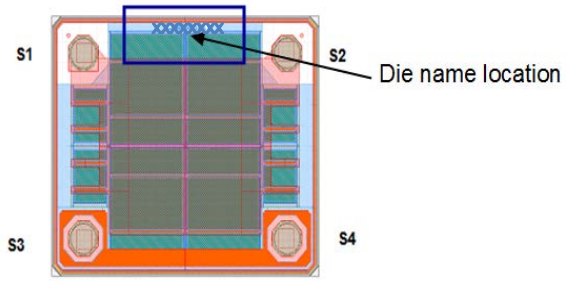
TYPICAL PERFORMANCE OF CURED MATERIAL

Die Shear Strength:
1 mil BLT, 300x300 mil die
Average kgf @25°C on Ceramic
>100 Average kgf @275°C on Ceramic 15

Special care must be taken when using, for example, thermally conductive glues.

Use of Conductive Glue

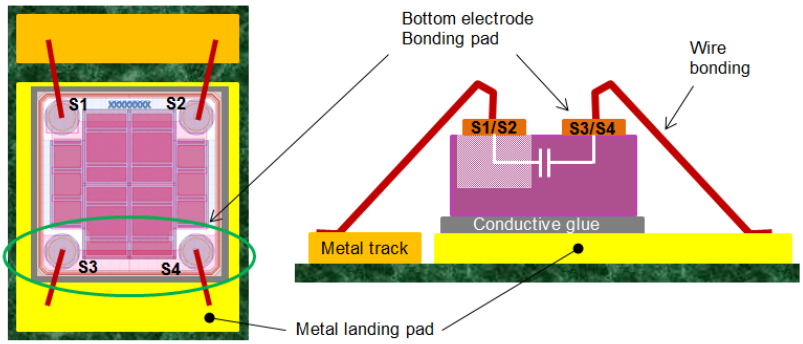
In case of 4 pads:



Pin #	Symbol	Description
1, 2	Signal 1	Signal 1
3, 4	Signal 2	Signal 2

Pin description

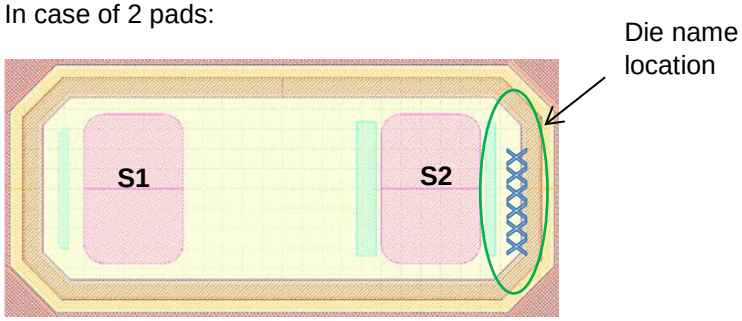
Murata recommends using non conductive glue but if conductive glue is used, the bottom electrode has to be connected to the landing metal pad of the substrate (S3 and S4 pads)*.



	Decoupling	Transmission
Conductive Glue	✓	Not recommended
Non Conductive Glue	✓	Not recommended

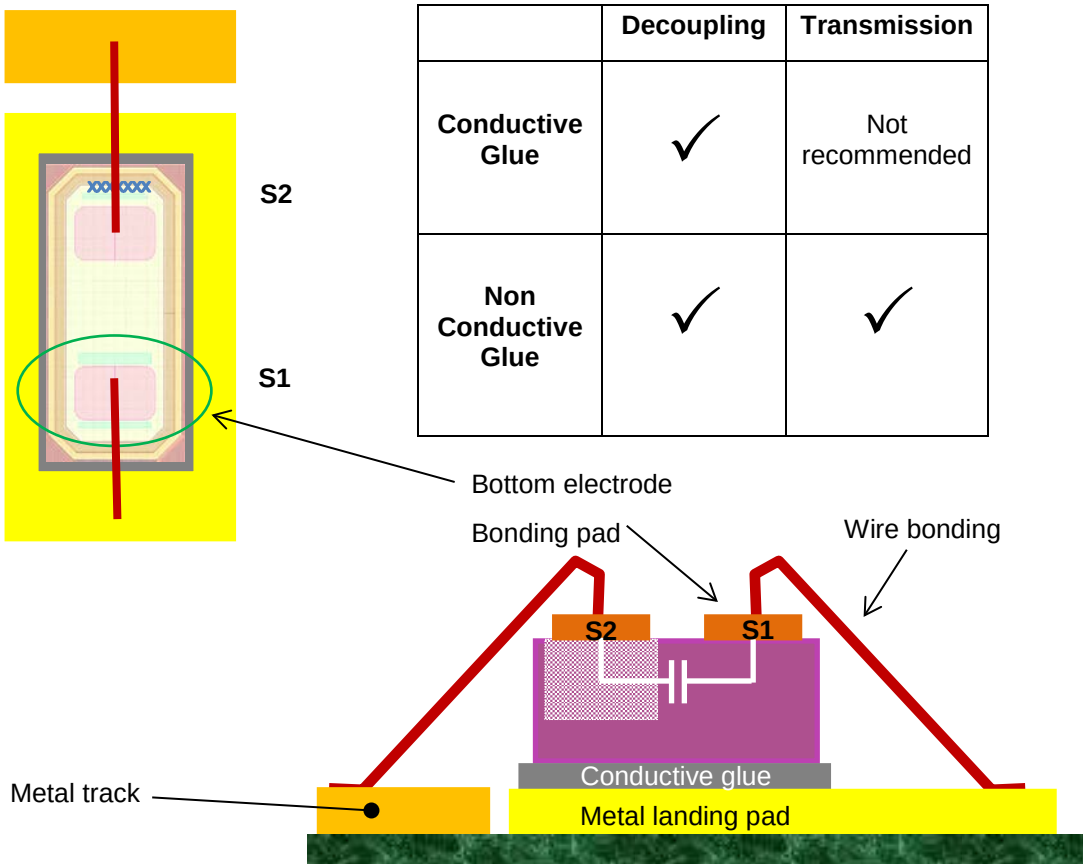
* Except for the 0202 BV30 10nF: Please contact Murata for more information

In case of 2 pads:



Pin #	Symbol	Description
1	Signal 1	Signal 1
2	Signal 2	Signal 2

Murata recommends using non conductive glue but if conductive glue is used, the bottom electrode has to be connected to the landing metal pad of the substrate.



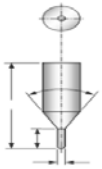
	Decoupling	Transmission
Conductive Glue	✓	Not recommended
Non Conductive Glue	✓	✓

Glue Application Tools

The glue can be dispensed with stamping, air pressure valve, auger or jetting method. The choice will depend on the die size.

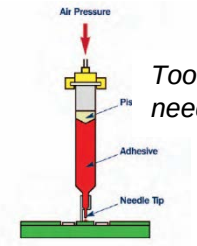
Silicon Capacitor Type	Capacitor size (µm²)	Recommended glue dispensing process	Recommended pattern
E0202	580 x 580	Stamping/jetting	DOT
E0302	850 x 580	Stamping/time pressure valve/jetting	DOT
E0404	1000 x 1000	Stamping/auger/time pressure valve	DOT
0201M	600 x 300	Stamping/jetting	DOT

Stamping:



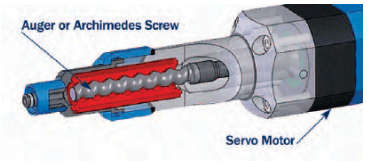
The tool is mounted on the bonding head. It is plunged into a dipping cavity filled with glue and pressed on the bonding position before capacitor bonding.

Air pressure valve:



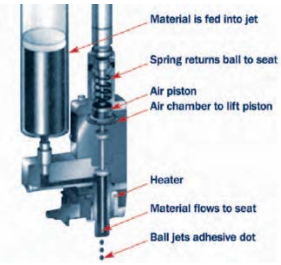
Tool used: needle

Auger:



Tool used: needle

Jetting:



Tool used: nozzle

Die Picking

The most common approach is with automatic equipment using vision inspection to correct die placement after picking and before placement. Manual picking can also be carried out. Use of a rubber or Torlon® tip is strongly recommended for the die picking. A metal tip could damage the capacitor.

Die Bonding

If automatic equipment is used, it is best to use the same tool as for picking. The placement force will depend on the die size. A minimum placement force is required in order to cover all the die back side with glue. Too much force can damage the die.

Recommended forces with recommended glue:

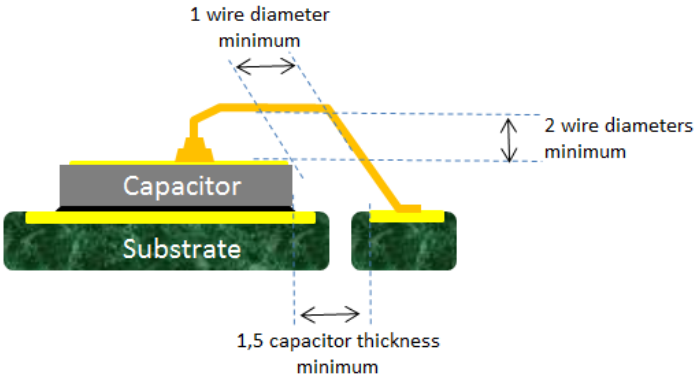
Silicon Capacitor Type	Capacitor size (µm²)	Placement force (grams)
E0202	580 x 580	100
E0302	850 x 580	200
E0404	1000 x 1000	250
0201M	600 x 300	100
E0202	580 x 580	100

Wire Bonding

Materials used and bonding conditions:

- Wire lead: diameter 20 to 25 microns, Au/Al wire
- Wire bonding temperature for gold wire bonding: 150 to 200 °C
- Wire bonding methods: Ball bonding or wedge bonding

Wire bonding specifications:

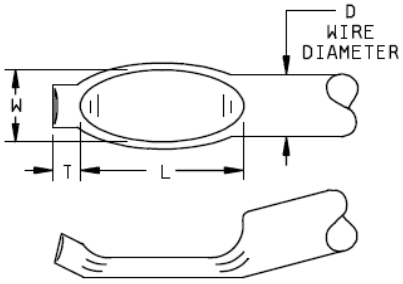


Ball bonding specifications:

- The gold ball diameter must be between 2 and 5 times the wire diameter.
- The wire exit must be completely within the periphery of the ball.
- 100 % of the ball must be on the die pad metallization.

Wedge bonding specifications:

- The wedge bond on die pad must between 1.2 and 3 times the gold wire diameter in width.
- The wedge bond must be between 1.5 and 6 times the gold wire diameter in length.
- The bond width must be between 1 and 3 times the aluminum wire diameter.
- The tool impression on wedge bond must cover the entire width of the wire.
- 100 % of the wedge (tail not included) must be on the die pad metallization.



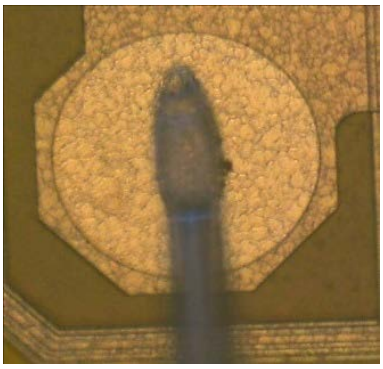
Wire Bonding Parameters

In case of 4 pads:

Wire bonding parameters will be adjusted in function of the tool and the wire references, as well as the type of equipment. These data are given to help our customers to define the parameters area.

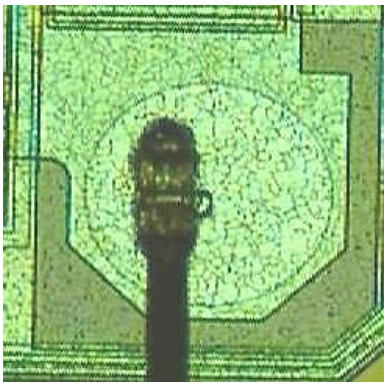
Wedge bonding with aluminum wire (25 µm):

Bonding process : Wedge Alu	
Bonder	BJ820
Bonding Tool	CCNOE-1/16-1"-45-C-2020-MP
Wire	AL1%Si-SR-25-1-4%-17-19gf-12AL (SPM)
US	20% (400-440 mW)
Force	17 cN
Bonding time	10 ms - 20 ms
Deformation	25 - 35%
Temperature	Ambiant



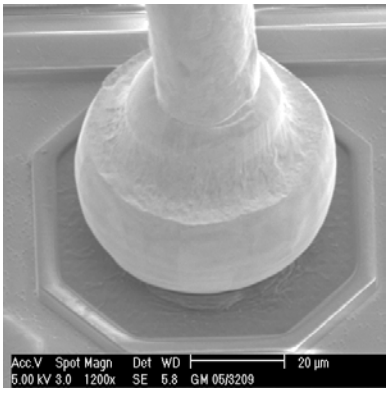
Wedge bonding with gold wire (25 µm):

Bonding process : Wedge /Gold wire	
Bonder	BJ820
Bonding Tool	FP45B-TI-2015-1.00-CGM
Wire	Heraeus Au AW14 (>17cN et 0,5-3%)
US	20 – 30% (420 -600 mW)
Force	20 – 30cN
Bonding time	20ms
Deformation	25 – 35%
Temperature	115°c



Ball bonding with gold wire (25 µm):

Ball bonding /Gold wire	
Bonder	5810 BONDTEC
Bonding Tool	UTS-38HG-AZM-1/16 16mm (SPT)
Wire	Heraeus HD2 (>7cN,2-6%)
US	215 – 230 mW
Force	30 – 40 g
Bonding time	24 ms
Temperature	125°c



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