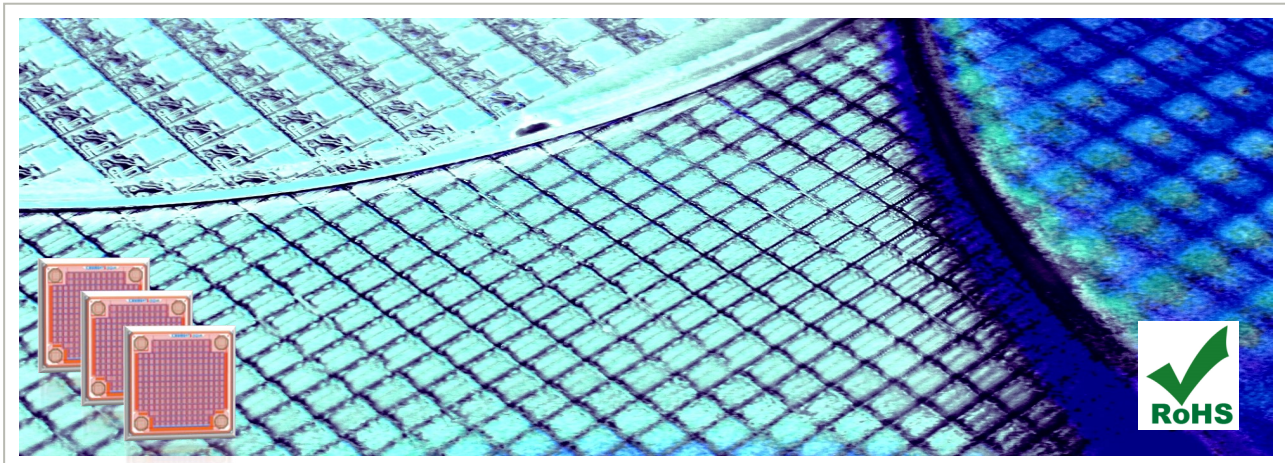




ATSC Automotive Grade Silicon Capacitors

Rev 1.1



Key Features

- Qualified according to AEC-Q100
- Ultra long life @ 200°C
- High stability of capacitance value:
 - ◆ Temperature $<\pm 1\%$ (-55°C to +200°C)
 - ◆ Voltage $<0.1\%$ /V
 - ◆ Negligible capacitance loss through ageing
- 16 V operating voltage
- Load dump
- 8 kV HBM ESD
- Suitable for high temperature leadframe mounting

Key Applications

- Harsh conditions sensors
- 200°C sensors
- Ignition sensors
- Oil pressure sensors
- Temperature sensors
- Motor management sensors
- Turbo charger sensors
- Hall effect sensors

The ATSC capacitors target **Under-the-Hood electronics** and all sensors exposed to harsh conditions in the automotive market segment. The deep trench MOS capacitors manufactured in **IPDiA ISO-TS 16949 certified facility**, combined with a unique Mosaic design and distributed trench capacitors drive to an unprecedented level of electrical performances. Thanks to the purity of the oxide cured at a temperature of 900°C during the manufacturing process, IPDiA is now offering a range of capacitors tested under **AEC-Q100 conditions up to 200°C** with a lifetime that has never been equaled.

The SiCap technology features **high reliability** - up to 10 times better than alternative capacitor technologies, coupled with **stability and low profile**. The ATSC capacitors offer **enhanced decoupling performances** compared with standard external SMD solutions, and can be integrated directly into the sensor.

Electrical Specifications

| | | Capacitance value | | | | | |
|------|--------|----------------------------------|---------------------|---------------------|---------------------|---------------------|---------------------------------|
| | | 10 | 15 | 22 | 33 | 47 | 68 |
| Unit | 10 pF | Contact IPDiA Sales | Contact IPDiA Sales | Contact IPDiA Sales | Contact IPDiA Sales | Contact IPDiA Sales | Contact IPDiA Sales |
| | 0.1 nF | 1nF/0202 935 174 72C 410 | Contact IPDiA Sales | Contact IPDiA Sales | Contact IPDiA Sales | Contact IPDiA Sales | Contact IPDiA Sales |
| | 1 nF | Contact IPDiA Sales | Contact IPDiA Sales | Contact IPDiA Sales | Contact IPDiA Sales | Contact IPDiA Sales | 47nF/0505 935 174 72H 547 |
| | 10 nF | 100nF/0605 935 174 72G 610 | Contact IPDiA Sales | Contact IPDiA Sales | Contact IPDiA Sales | Contact IPDiA Sales | Contact IPDiA Sales |
| | 0.1 μF | Contact IPDiA Sales | Contact IPDiA Sales | Contact IPDiA Sales | Contact IPDiA Sales | Contact IPDiA Sales | Contact IPDiA Sales |

| Parameters | Value |
|------------------------------------|---|
| Capacitance range | 1 nF to 100 nF ^(*) |
| Capacitance tolerance | ±15 % |
| Operating temperature range | -55 to 200 °C |
| Storage temperature | -70 to 215 °C |
| Temperature coefficient | ±1 %, from -55 to +200°C |
| Breakdown Voltage (BV) | 30 |
| Capacitance variation versus RVDC | 0.1 %/V (from 0 V to RVDC) |
| Equivalent Series Inductance (ESL) | Typ 500 pH |
| Equivalent Series Resistance (ESR) | Typ 0.1 Ω |
| Insulation resistance | 50 GΩ min @ RVDC, 25°C 20 GΩ min @ RVDC, 200°C |
| Aging | Negligible, < 0.001 % / 10 000h |
| Reliability | FIT<0.017 parts / billion hours |
| Capacitor height | 250 μm typ ^(*) |

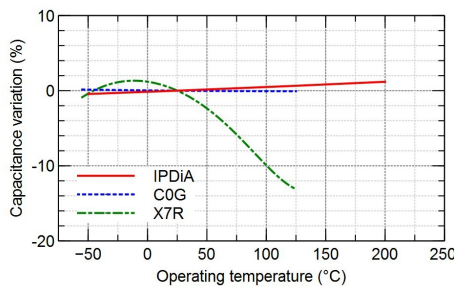


Fig.1: Capacitance variation vs temperature (for ATSC and MLCC technologies)

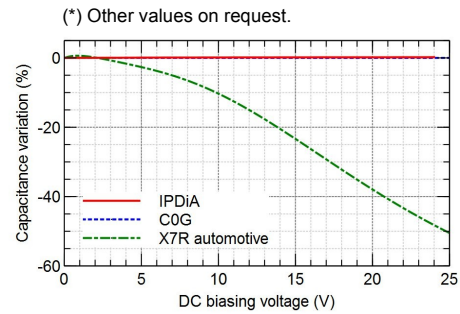
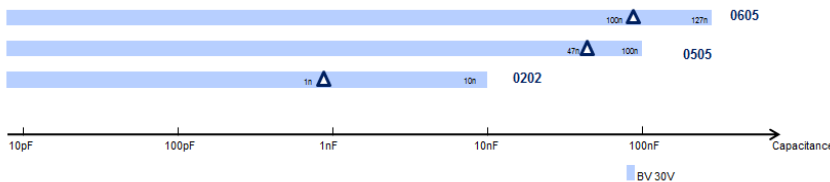


Fig.2: Capacitance variation vs DC biasing voltage (for ATSC and MLCC technologies)

(*) Other values on request.

ATSC Capacitance Range

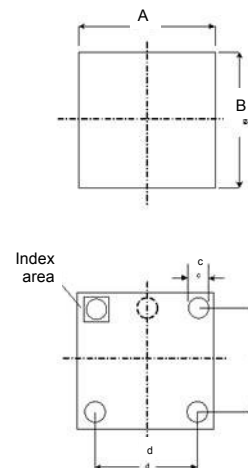


△ Available parts – see table above
For other values, contact your IPDiA sales representative

Termination and Outline

Pad finishing in Aluminum (3μm thickness +/-10%)
Applicable for high temperature wirebonding and other mountings

| Typ. | | 0202 | 0505 | 0605 |
|------------|---|------------|------------|------------|
| Comp. size | A | 0.58 ±0.05 | 1.25 ±0.05 | 1.50 ±0.05 |
| | B | 0.58 ±0.05 | 1.25 ±0.05 | 1.25 ±0.05 |
| | c | 0.15 | 0.15 | 0.15 |
| | d | 0.3 | 0.96 | 1.16 |
| | e | 0.3 | 0.96 | 0.89 |



Packaging

Tape and reel, waffle pack or wafer delivery.

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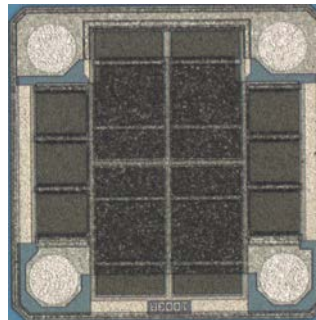
For more information, please visit: <http://www.ipdia.com>
To contact us, email to: sales@ipdia.com



Date of release: June 30, 2015
Document identifier: CL

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IPDiA Silicon capacitor A type

Introduction

This document describes the attachment techniques recommended by IPDiA for their high temperature silicon 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 IPDiA.

Handling Precautions and Storage

Silicon dies must always be handled in a clean room environment (usually class 1000 (ISO 6)) but the assembled devices do not need to be handled in this type of environment since the product is already well packed. The remaining quantities must be repacked immediately after any process step, under the same conditions as before opening (ESD bag + N2).

Store the capacitors in the manufacturer's package under the following conditions, with no rapid temperature change in an indoor room:

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

Avoid storing the capacitors under 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 such as scratches and cracks, we recommend the following:

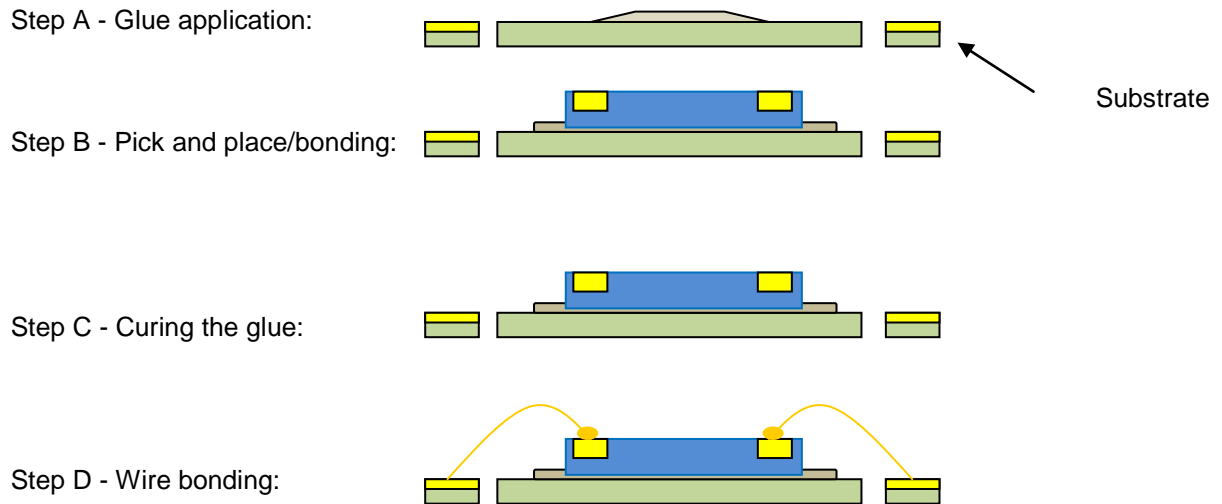
- Never handle the die with the bare hands
- Avoid touching the active face
- Do not store or transport die outside protective bags, tubes, boxes, sawing tape
- Work only in ESD environments
- Use plastic tweezers or a soft vacuum tool to remove the silicon die from the packing.

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

Pad Finishing

- TiCuNiAu electroplating: Ti(0.2 µm)/Cu(3.4 µm)/Ni(3 µm)/Au(1.5 µm)
- 3 µm aluminium (Al/Si/Cu: 98.96 %/1 %/0.04 %) (finishing recommended for aluminium wire bonding)
- Other finishes are available upon request

Process Flow



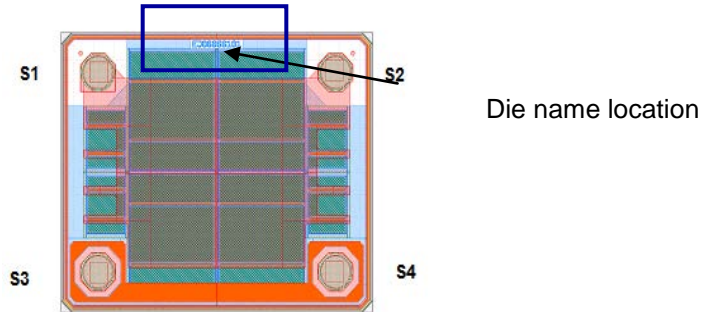
Recommendations concerning the Glue for Die Attachment

For high temperature application, the glue will be filled with conductive material. Using an electrical conductive glue could result in capacitor leakage in case of glue overflow on die front side chipping, the glue volume must be carefully adjusted. Some IPDiA high temperature capacitors have already been assembled with the following type of glue:

MATERIAL CHARACTERISTICS: *To be used as a guide only, not as a specification. Data below is not guaranteed. Different batches, conditions and applications yield differing results; Cure condition: 150°C/1 hour*
 * denotes test on lot acceptance basis

| PHYSICAL PROPERTIES: | | | |
|---|---|--------------------------------|-------------------|
| *Color (before cure): | White | Weight Loss: | |
| *Consistency: | Highly viscous paste | @ 200°C: | 0.48 % |
| *Viscosity (23°C): | | @ 250°C: | 0.71 % |
| @ 1 rpm: | 300,000 - 400,000 cPs | @ 300°C: | 1.22 % |
| Thixotropic Index: | N/A | Operating Temp: | |
| *Glass Transition Temp: | ≥ 90 °C (Dynamic Cure 20—200°C/5SO 25 Min, Ramp -10—200°C @ 20°C/Mm) | Continuous: | - 55°C to + 200°C |
| Coefficient of Thermal Expansion (CTE): | | Intermittent: | - 55°C to + 300°C |
| Below Tg: | 16 x 10 ⁻⁶ in/in°C | Storage Modulus @ 23°C: | 641,860 psi |
| Above Tg: | 68 x 10 ⁻⁶ in/in°C | Ion Content: | |
| Shore D Hardness: | 84 | CF: | 177 ppm |
| Lap Shear @ 23°C: | 1,522 psi | NH ₄ ⁺ : | 87 ppm |
| Die Shear @ 23°C: | ≥ 10 Kg / 3,400 psi | Na ⁺ : | 24 ppm |
| Degradation Temp: | 350 °C | K ⁺ : | 13 ppm |
| | | *Particle Size: | ≤ 20 microns |
| ELECTRICAL AND THERMAL PROPERTIES: | | | |
| Thermal Conductivity: | 0.45 W/mK | Dielectric Constant (1kHz): | 4.9 |
| Volume Resistivity @ 23°C: | > 6 x 10 ⁹ Ohm-cm | Dissipation Factor (1kHz): | 0.0041 |
| OPTICAL PROPERTIES @ 23°C: | | | |
| Spectral Transmission: | N/A | Index of Refraction: | N/A |

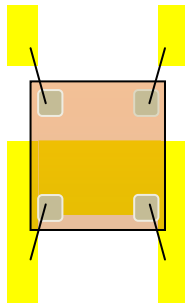
Use of Conductive Glue - Substrate Design



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

Pin description

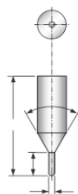
If conductive glue is used on the backside of the silicon cap, it is strongly recommended not to connect the backside to the electrical signal. If the backside is connected to the electrical signal, this signal will be exactly the same as pads 3-4.



Glue Application Tools

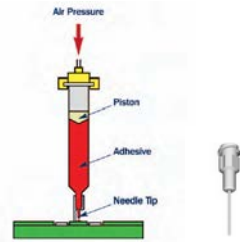
The glue can be dispensed with stamping, air pressure valve, auger or jetting method. The choice will depend on the die size.

Stamping:

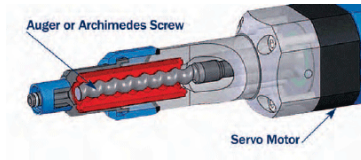


The tool is mounted on the bonding head. It is plunged into a dipping cavity filled with glue and pressed on the bonding position before capacitor bonding.

Air pressure valve:

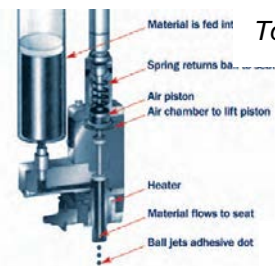


Auger:



Tool used: needle

Jetting:



Tool used: needle

Tool used: nozzle

| Silicon Capacitor Type | Capacitor size (µm ²) | Capacitor thickness | Recommended glue dispensing process | Recommended pattern |
|------------------------|-----------------------------------|---------------------|--------------------------------------|---------------------|
| E0202 | 580 x 580 | 100 µm minimum | Stamping/jetting | DOT |
| E0302 | 850 x 580 | | Stamping/time pressure valve/jetting | DOT |
| E0404 | 1000 x 1000 | | Stamping/auger/time pressure valve | DOT |
| E0505 | 1250 x 1250 | | Stamping/auger/time pressure valve | DOT/CROSS |
| E0605 | 1520 x 1250 | | Stamping/auger/time pressure valve | DOT/CROSS |
| E1208 | 3000 x 2000 | | auger | CROSS |
| E1612 | 4000 x 3000 | | auger | CROSS |
| E1616 | 4000 x 4000 | | auger | CROSS |
| E2016 | 5000 x 4000 | | | |

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. A minimum picking force (about 100 grams) is recommended.

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:

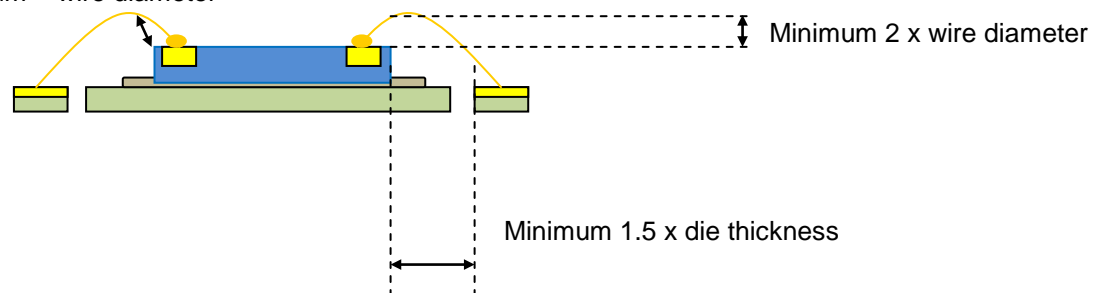
| Silicon Capacitor Type | Capacitor size (μm^2) | Capacitor thickness | Placement force (grams) |
|------------------------|------------------------------------|---------------------------|-------------------------|
| E0202 | 580 x 580 | 100 μm minimum | 100 |
| E0302 | 850 x 580 | | 200 |
| E0404 | 1000 x 1000 | | 250 |
| E0505 | 1250 x 1250 | | 250 |
| E0605 | 1520 x 1250 | | 300 |
| E1208 | 3000 x 2000 | | 300 |
| E1612 | 4000 x 3000 | | 400 |
| E1616 | 4000 x 4000 | | 450 |
| E2016 | 5000 x 4000 | | 500 |

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

Minimum = wire diameter

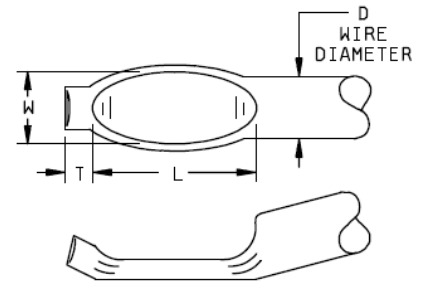


Ball bonding specifications

- 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.
- 80 % of the ball must be on the die pad metallization.

Wedge bonding specifications

- The wedge bond on die pad must be 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 aluminium wire diameter.
- The tool impression on wedge bond must cover the entire width of the wire.
- 80 % of the wedge (tail not included) must be on the die pad metallization.



Revision

| Version | Author | Date | Description |
|---------|------------|------------|--------------------------|
| 1.1 | Samuel YON | 15/06/2015 | Creation of the document |
| 1.2 | Samuel YON | 02/11/2015 | Amendment |
| | | | |
| | | | |
| | | | |
| | | | |

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[02013J3R0ABSTR](#) [02015J1R2ABSTR](#) [04021JR05Z4STR\500](#) [400Z0R1AT100T](#) [400Z0R1PT100T](#) [400Z100FT16T](#) [400Z150FT16T](#)
[400Z170FT16T](#) [400Z180FT16T](#) [400Z1R8QT25T](#) [400Z2R0QT25T](#) [400Z2R4QT25T](#) [400Z3R0AT25T](#) [400Z4R7AT25T](#) [400Z5R6BT25T](#)
[400Z8R2BT16T](#) [04023J4R6ABSTR](#) [02013J1R8PBSTR](#) [02015J0R9PBSTR](#) [02015J1R0PBSTR](#) [0201ZK8R2BBWTR](#) [04021JR65PBSTR](#)
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[04025J2R2QBWTR\500](#) [06035J2R2QBSTR](#) [06033J6R8BBSTR](#) [04023J5R6ABSTR](#) [100B300GT500XT](#) [100B1R0CT500XT](#)
[02015J2R0PBSTR\500](#) [100B470GT500XT](#) [700B271JT200XT](#) [100B5R1DT500XT](#) [100B0R6DT500XT](#) [100B160FT500XT](#)
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