

Higher reliability in a smaller package

3D Silicon Capacitors

High stability and reliability capacitors

Low profile capacitors - 100 μm thick

*High/extreme temperature capacitors - **up to 250°C***

Wire-bondable vertical capacitors - including high/extreme temperature & low profile

Wire-bondable embedded capacitors - including high/extreme temperature & low profile

Ultra broadband **surface mounted** & embedded capacitors - **up to 100 GHz+**

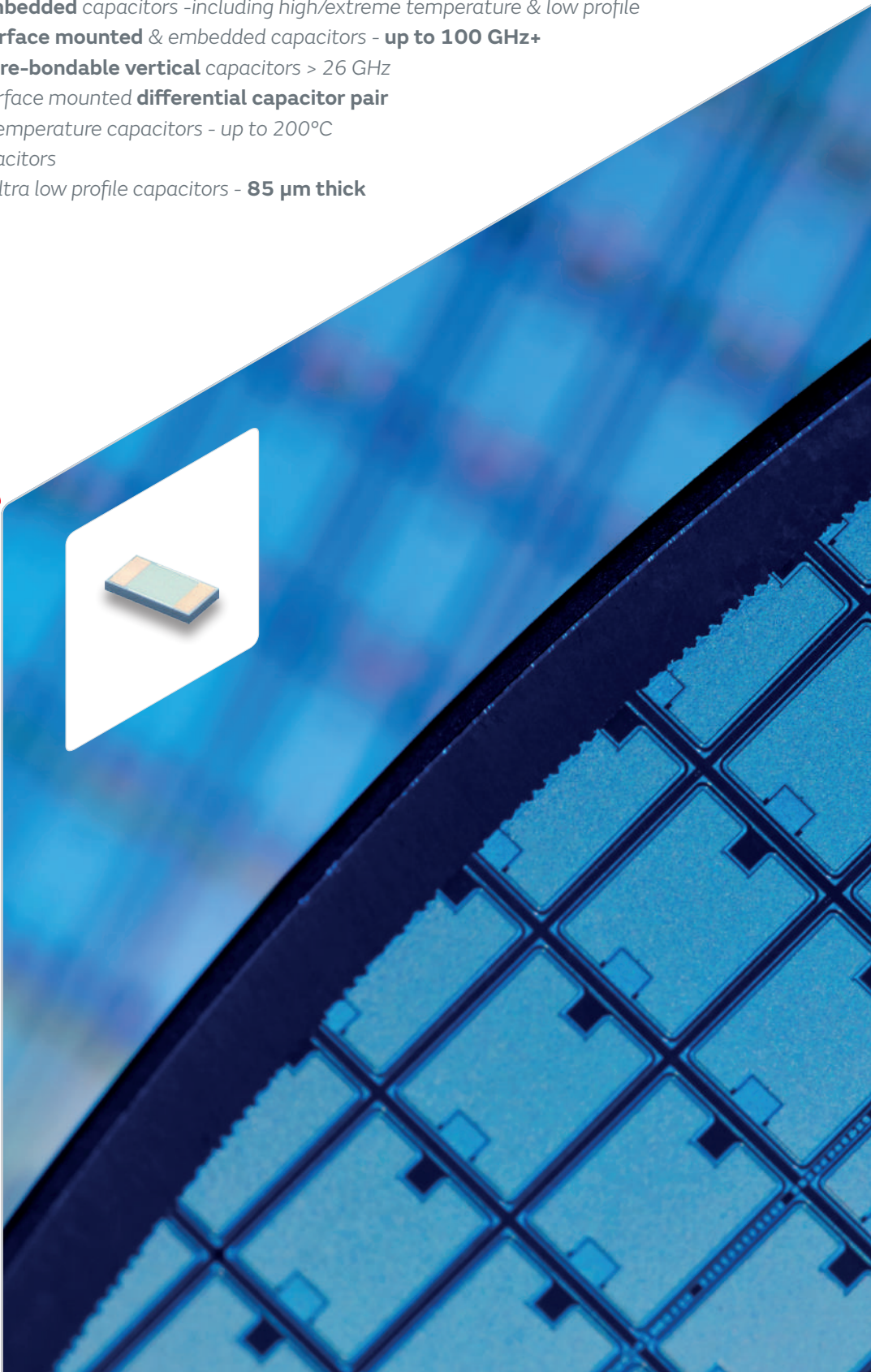
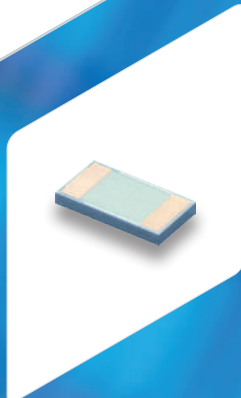
Ultra large-band **wire-bondable vertical** capacitors > 26 GHz

Ultra broadband surface mounted **differential capacitor pair**

Automotive high temperature capacitors - up to 200°C

Medical grade capacitors

Ultra low ESL and ultra low profile capacitors - **85 μm thick**

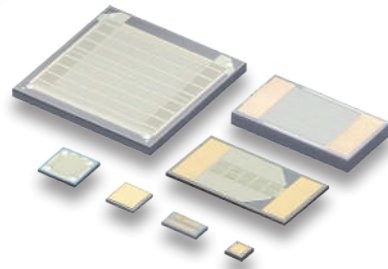


A microscopic view of a silicon wafer showing a grid pattern of capacitors. The wafer is blue and has a dark, curved edge. The capacitors are arranged in a regular grid. A red diamond shape is visible in the bottom right corner.

Murata silicon capacitors

The best choice for all demanding applications

Murata high-density silicon capacitors have been developed with a semiconductor MOS process and are using the third dimension to substantially increase the capacitor surface and thus its capacitance without increasing the capacitor footprint. Murata silicon technology is based on a monolithic structure embedded in a monocrystalline substrate (single MIM and multi MIM - Metal Insulator Metal).

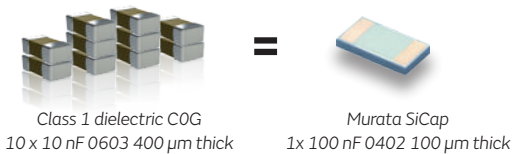


Murata's portfolio includes silicon capacitors from pF to few μ F

Higher performance in a smaller package

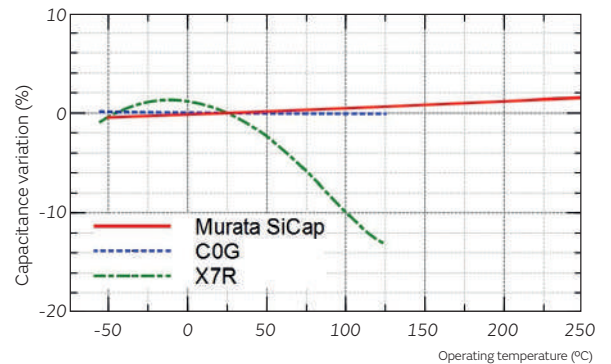
This advanced 3D topology gives a developed area equivalent to 80 ceramic layers in an amazing 100 μ m thickness (lower value on request) of active capacitance area. Thanks to a very linear and low dispersive dielectric, miniaturization, capacitance value and electrical performances are optimized.

Class-leading miniaturization

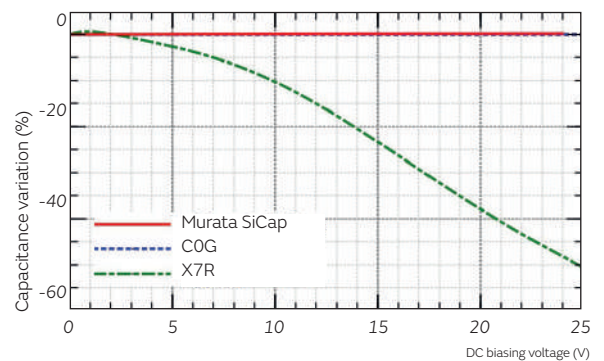


10 times reliability of MLCCs

Coming from the same DNA as the semiconductor MOS process, Murata silicon capacitors have a default mode fully modeled with proven consistent data and offer therefore predictable and exceptional reliable performances. Our SiCap technology features high reliability - up to 10 times better than alternative capacitor technologies - mainly obtained thanks to the oxide generated during the high temperature curing. Furthermore, all electrical tests are completed at the end of the production steps which avoids early failures.



Capacitance variation vs temperature (for SiCap and MLCC technologies)



Capacitance variation vs DC biasing voltage @ BV 30 (for SiCap and MLCC technologies)

Murata Integrated Passive Solutions is located in Caen, France. The site includes an R&D center and a wafer foundry certified ISO 9001 / 14001, IATF 16949 for the automotive market as well as ISO 13485 for medical devices.

Murata silicon capacitors meet the toughest requirements

Murata silicon capacitors are the best choice for all demanding applications in medical, automotive, communication, industrial and high-reliability markets such as downhole and aerospace.

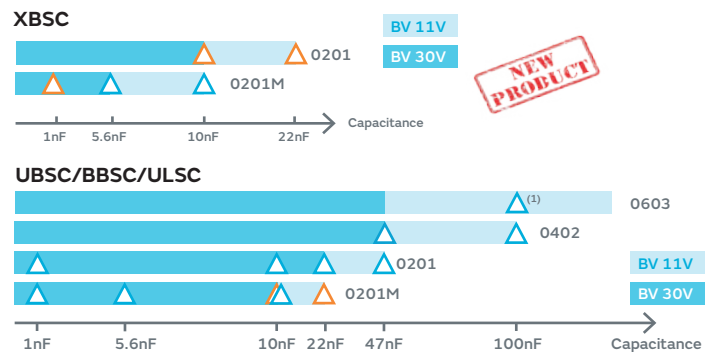
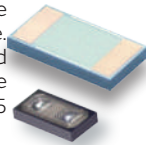
	Operating Frequency (°C)						Max. temp.				Thickness				Assembly			Application								
	10 GHz	20 GHz	40 GHz	60 GHz+	100 GHz+		125°C	150°C	200°C	250°C	85 µm	100 µm	250 µm	400 µm	Solder mounting	Wire-bonding / embedded	Wire-bonding vertical	Automotive	Broadband	High-Rel	RF Power	Medical	RFID	Signal Integrity	All applications	
XBSC								X			X				X				X							
UBSC								X			X		X		X				X							
BBSC								X			X		X		X				X							
ULSC								X			X		X		X				X							
UBDC								X			X		X		X				X							
UBEC								X			X		X		X				X							
BBEC								X			X		X		X				X							
ULEC								X			X		X		X				X							
UWSC								X			X		X		X				X		X					
WBSC								X			X		X		X			X	X							
WTSC									X		X		X		X			X	X		X					
WXSC									X		X		X		X			X	X		X					
WLSC								X			X		X		X			X	X		X					
HSSC								X			X		X		X			X	X		X					X
LPSC								X			X		X		X			X	X		X		X			X
HTSC									X				X		X			X	X		X					
XTSC									X				X		X			X	X		X					
EMSC								X			X		X		X			X	X		X					X
ETSC									X			X		X				X	X		X					
EXSC									X			X		X				X	X		X					
ATSC									X			X		X				X	X		X					
UESL									X						X			X	X		X				X	
MGSC								X			X				X			X	X		X					X

(*) Please refer to specification of each part number to get max operating frequency

Ultra broadband surface mounted Si capacitors up to 100 GHz+

(XBSC 100 GHz+, UBSC 60 GHz+, BBSC 40 GHz, ULSC 20 GHz)

The XBSC/UBSC/BBSC/ULSC capacitors target **optical communication systems** (ROSA/TOSA, SONET and all optoelectronics) as well as **high speed data systems**. These ultra broadband capacitors are optimized for DC blocking, feedback, coupling and bypass applications in ultra broadband applications. They offer low insertion loss, low reflection and unique phase stability, from 16 kHz(****) to 100 GHz+ for the XBSC, up to 60 GHz+ for the UBSC, up to 40 GHz for BBSC and up to 20 GHz for the ULSC. They provide very high capacitance stability over temperature (60 ppm/K) and voltage. They are fully compatible with high speed automated pick-and-place manufacturing operations and are available with ENIG termination and with SAC305 prebump for 0201M case size.



Key features

- Ultra broadband performance up to 110 GHz.
- Resonance free allowing ultra low group delay variation.
- Ultra low insertion loss thanks to an excellent impedance matching in transmission mode.
- Low ESL and low ESR in bypass grounding mode.
- High stability of capacitance value over temperature, voltage and aging.
- High reliability.

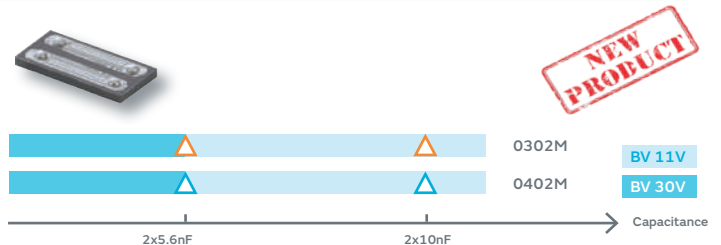
Finishing and packaging

- Lead-free nickel/solder coating compatible with automatic soldering technologies: reflow and manual. Other top finishings available on request (ex: lead-free bumping - SAC305 type6, or thick copper).
- Tape & reel, waffle pack, film frame carrier delivery.

Parameter	Value
Capacitance range	1 nF to 100 nF(*)
Capacitance tolerances	±15%(*)
Operating temperature range	-55°C to 150°C
Storage temperature range	-70°C to 165°C(**)
Temperature coefficient	+60 ppm/K
Breakdown Voltage (BV)	11 VDC / 30 VDC / 100 VDC
Capacitance variation versus RVDC	0.1%/V (from 0 to RVDC)
Insertion loss (IL) up to 67 GHz	<0.4 dB (***)
Return loss (RL) up to 67 GHz	>20 dB (***)
Equivalent Series Inductance (ESL)	Typ. 100 pH(***) @ SRF
Equivalent Series Resistance (ESR)	Typ. 300 mΩ(***)
Insulation resistance	100GΩ @ RVDC @ 25°C t>120s for 100nF
Ageing	Negligible, < 0.001% / 1000h
Reliability	FIT<0.017 parts / billions hours
Capacitor thickness	400 μm or 100 μm

Ultra Broadband surface mounted differential Si capacitor pairs (UBDC 60 GHz+)

Ultra broadband smart products have been developed to keep pace with evolving **optical communication market** requirements and customers' feedbacks. With an on-going miniaturization and improved performances of optoelectronics circuitries, Murata offers some smart solutions by integrating differential capacitor pairs...into a single silicon passive device. This unique integration based on ultra deep trench MOS Silicon offers unique performances with low insertion loss, low reflection and phase stability up to 67 GHz. These capacitors are fully compatible with high speed automated pick-and-place manufacturing operations and are available with SAC305 pre-bump.



Key features

- Ultra broadband performance up to 67 GHz.
- Resonance free allowing ultra low group delay variation.
- Ultra low insertion loss thanks to an excellent impedance matching in transmission mode for UBB differential capacitor pair (100Ω differential(**))
- Low ESL and low ESR in bypass grounding mode for UBB matched termination.
- High stability of capacitance value over temperature, voltage and aging. High reliability.
- Straight forward assembly process.

Finishing and packaging

- Lead-free nickel/solder coating compatible with automatic soldering technologies (reflow and manual).
- Tape and reel, film frame carrier delivery.

Parameter	Value
Capacitance range	5.6 nF to 10 nF(*)
Capacitance tolerances	±15%(*)
Operating temperature range	-55 to 150 °C
Storage temperature range	- 70 to 165 °C(**)
Temperature coefficient	+60 ppm/K
Breakdown Voltage (BV)	11 V, 30 V
Capacitance variation versus RVDC	0.1 %/V (from 0 V to RVDC)
Insertion loss (IL) up to 60 GHz	<0.9 dB
Return loss (RL) up to 60 GHz	>12 dB
Capacitance insulation resistance	10 GΩ @ RVDC, @ 25°C, t>120s, for 10nF
Ageing	Negligible, < 0.001% / 1000h
Reliability	FIT<0.017 parts / billions hours
Capacitor thickness	100 μm

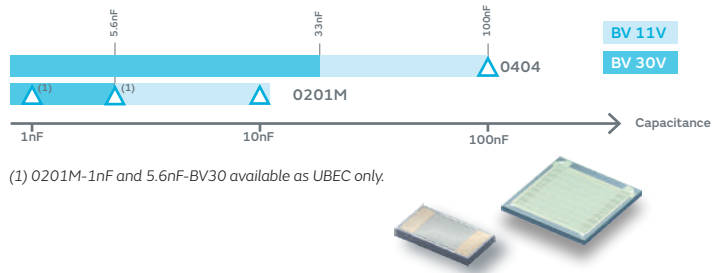
(*) Other values on request (**) w/o packing (***) e.g. 10 nF/0201M/BV 11V (****) Cut-off frequency at -3 dB according to the capacitance value (ex: 100 nF in this case)

△ Available parts. For other values, contact your Murata sales representative.
 ▲ Under development.

Ultra broadband wire-bondable embedded Si capacitors up to 60 GHz+

(UBEC 60 GHz+, BBEC 40 GHz, ULEC 20 GHz)

The UBEC/BBEC/ULEC capacitors target **optical communication systems** (ROSA/TOSA, SONET and all optoelectronics) as well as **high speed data systems** or products. The UBEC/BBEC/ULEC are optimized for DC decoupling and bypass applications. They offer high rejection up to 60 GHz+ for the UBEC, up to 40 GHz for the BBEC and up to 20 GHz for the ULEC. The UBEC/BBEC/ULEC capacitors also provide very high capacitance stability over temperature (+60 ppm/K) and voltage. These capacitors are compatible with standard wire bonding assembly (ball and wedge) and embedding.



Parameter	Value
Capacitance range	1 nF to 100 nF(*)
Capacitance tolerances	± 15%(*)
Operating temperature range	-55°C to 150°C
Storage temperature range	-70°C to 165°C(**)
Temperature coefficient	+60 ppm/K
Breakdown Voltage (BV)	11 VDC or 30 VDC(*)
Capacitance variation versus RVDC	0.1%/V (from 0 to RVDC)
Insertion loss (IL) up to 60 GHz+	<0.4 dB(***)
Return loss (RL) up to 60 GHz+	>20 dB(***)
Equivalent Series Inductance (ESL)	Typ. 100 pH(***) @ SRF
Equivalent Series Resistance (ESR)	Typ. 300 mΩ(***)
Insulation resistance	100GΩ @ RVDC @ 25°C t>120s for 100nF
Ageing	Negligible, < 0.001% / 1000h
Reliability	FIT<0.017 parts / billions hours
Capacitor thickness	100 μm

Key features

- Ultra broadband performance up to 67 GHz.
- Resonance free allowing ultra group delay variation.
- Ultra low insertion loss thanks to an excellent impedance matching in transmission mode.
- Low Esl and low ESR in bypass grounding mode.
- High stability of capacitance value over temperature, voltage and aging.
- High reliability.

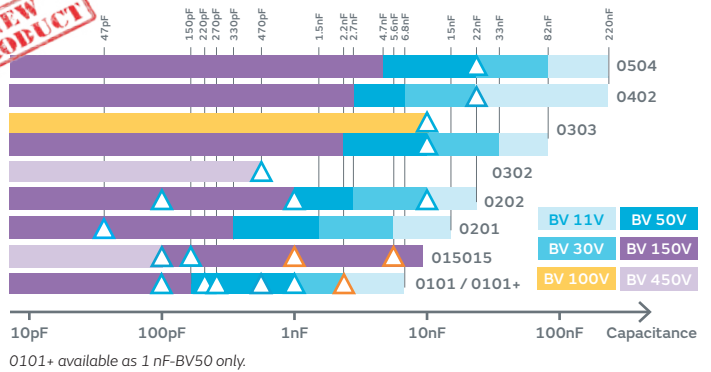
Finishing and packaging

- Can be directly mounted on the PCB using die bonding and wire bonding(s). Capacitors with top electrodes in Aluminum. Other top finishings available on request (eg: Gold - TiWAu). Compatible with standard wire bonding assembly (ball and wedge) and embedding.
- Tape & reel (except for 0201M), waffle pack, film frame carrier delivery.

Ultra large-band wire bondable vertical Si capacitors up to 26 GHz+ (UWSC)

The UWSC capacitors target **optical communication systems** (ROSA/TOSA, SONET and all optoelectronics) as well as **high speed data systems** or products. The UWSC are optimized for DC decoupling and bypass applications. They offer high rejection at > 26 GHz. The UWSC capacitors also provide very high capacitance stability over temperature (+60 ppm/K) and voltage. These capacitors are compatible with standard wire bonding assembly (ball and wedge). The bottom electrode is in Ti/Ni/Au and the top electrode is in Gold (TiWAu).

NEW PRODUCT



Parameter	Value
Capacitance range	47 pF to 22 nF(*)
Capacitance tolerances	± 15%(*)
Operating temperature range	-55 °C to 150 °C
Storage temperature range	- 70 °C to 165 °C(**)
Temperature coefficient	+60 ppm/K
Breakdown Voltage (BV)	11 V, 30 V, 50 V, 100 V, 150 V, 450 V(*)
Capacitance variation versus RVDC	0.02 %/V (from 0 V to RVDC)
Equivalent Series Inductance (ESL)	Typ 6 pH (****) @ SRF
Equivalent Series Resistance (ESR)	Typ 14 mΩ (****)
Insulation resistance	10GΩ @ RVDC @ 25°C t>120s for 10nF
Ageing	Negligible, < 0.001% / 1000h
Reliability	FIT<0.017 parts / billions hours
Capacitor thickness	250 μm or 100 μm (*)

Key features

- Ultra large band performance higher than 26 GHz.
- Resonance free and phase stability.
- Unique capacitance value of 1 nF in 0101.
- High stability of capacitance value over temperature, voltage and aging.
- High reliability.
- Ultra low ESR and ESL.

Finishing and packaging

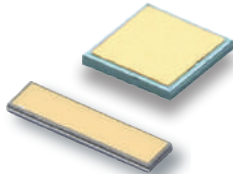
- Can be directly mounted on the PCB using die bonding and wire bonding(s). Bottom electrode in Ti/Ni/Au and top electrode in Gold (TiWAu). Other top finishings available on request (ex: Aluminum). Compatible with standard wire bonding assembly (ball and wedge).
- Tape and reel (up to 0202 case size included), waffle pack, film frame carrier delivery.

(*) Other values on request (**) w/o packing (***) e.g. 10 nF/0201M/BV 11V

▲ Available parts. For other values, contact your Murata sales representative.
 ▲ Under development.

Wire-bondable vertical Si capacitors up to 250°C (WBSC, WTSC, WXSC)

The Wire Bonding vertical Silicon Capacitors target RF High Power applications for **wireless communication, radar, lidar and data broadcasting systems**. They are suitable for DC decoupling, matching network, and harmonic / noise filtering functions. They offer ultra high stability of capacitance value with temperature, voltage, and aging. The Wire Bonding vertical range is available up to +150°C (WBSC), up to +200°C (WTSC) and up to +250°C (WXSC).

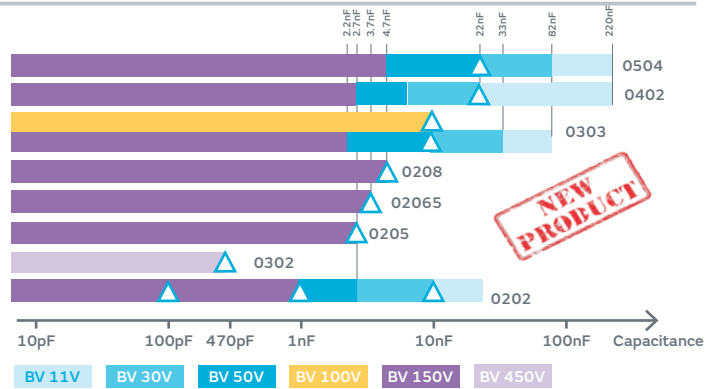


Key features

- Low profile 250 µm.
- Low leakage current.
- High stability (temperature and voltage).
- Negligible capacitance loss through aging.

Finishing and packaging

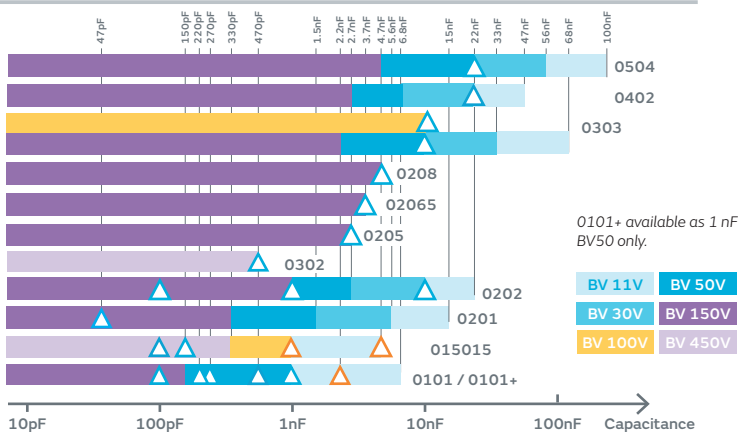
- Can be directly mounted on the PCB using die bonding and wire bonding(s). Bottom electrode is in Ti/Ni/Au and top electrode in Gold (TiWAu) for WBSC and in Aluminum for WTSC/WXSC. Other top finishings available on request. Compatible with standard wire bonding assembly (ball and wedge).
- Tape & reel (up to 0202 case size included), waffle pack, film frame carrier delivery.



Parameter	Value
Capacitance range	100 pF to 22 nF(*)
Capacitance tolerances	±15 % (*)
Operating temperature range	-55 °C to 250°C for WXSC
Storage temperature range	-70°C to 265°C(**) for WXSC
Temperature coefficient	+60 ppm/K
Breakdown Voltage (BV)	11 V, 30 V, 50 V, 100 V, 150 V, 450 V(*)
Capacitance variation versus RVDC	0.02%/V (from 0 to RVDC)
Equivalent Series Inductance (ESL)	Typ. 50 pH @ SRF
Equivalent Series Resistance (ESR)	Typ. 50 mΩ
Insulation resistance	10GΩ @ RVDC @ 25°C t>120s for 10nF
Ageing	Negligible, < 0.001% / 1000h
Reliability	FIT<0.017 parts / billions hours
Capacitor thickness	250 µm

Wire-bondable vertical low-profile Si capacitors down to 100 µm (WLSC)

The WLSC low profile capacitors target **RF High Power applications** with height and volume constraints and can address **wireless communication, radar and data broadcasting systems**. The WLSC are suitable for DC decoupling, matching network, and harmonic / noise filtering functions. The unique technology of integrated passive devices in silicon developed by Murata can solve most of the problems encountered in demanding applications. These Si capacitors in ultra-deep trenches have been developed with a semiconductor process which enables the integration of high capacitance density from 1.55 nF/mm² to 250 nF/mm² (with a breakdown voltage of respectively 450 V to 11 V).



Parameter	Value
Capacitance range	47 pF to 22 nF(*)
Capacitance tolerances	±15 % (*)
Operating temperature range	-55 °C to 150°C (*)
Storage temperature range	-70°C to 165°C(**)
Temperature coefficient	+60 ppm/K
Breakdown Voltage (BV)	11 V, 30 V, 50 V, 100 V, 150 V, 450 V(*)
Capacitance variation versus RVDC	0.02%/V (from 0 to RVDC)
Equivalent Series Inductance (ESL)	Typ 50 pH @ SRF
Equivalent Series Resistance (ESR)	Max 50 mΩ
Insulation resistance	10GΩ @ RVDC @ 25°C t>120s for 10nF
Ageing	Negligible, < 0.001% / 1000h
Reliability	FIT<0.017 parts / billions hours
Capacitor thickness	100 µm(*)

Key features

- Ultra low profile 100 µm.
- Low leakage current.
- High stability (temperature and voltage).
- Negligible capacitance loss through aging.

Finishing and packaging

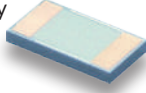
- Can be directly mounted on the PCB using die bonding and wire bonding(s). Bottom electrode in Ti/Ni/Au and top electrode in Gold (TiWAu). Other top finishings available on request (ex: Aluminum). Compatible with standard wire bonding assembly (ball and wedge).
- Tape & reel (up to 0202 case size included), waffle pack, film frame carrier delivery.

(*) Other values on request (**) w/o packing
 (***) e.g. 10 nF/0303/BV 50V

▲ Available parts. For other values, contact your Murata sales representative.
 ▲ Under development.

High stability & reliability Si capacitors (JEDEC/EIA compatible) (HSSC)

Murata High Stability Silicon Capacitors avoid the need to oversize the capacitor value for **sensitive capacitive circuitry** and offer a higher DC voltage stability. The IPD technology developed by Murata provides outstanding capacitor stability over the full operating voltage & temperature ranges. The very high and stable insulation resistance of silicon capacitors can improve **battery lifetime** up to 30% in mobile applications.

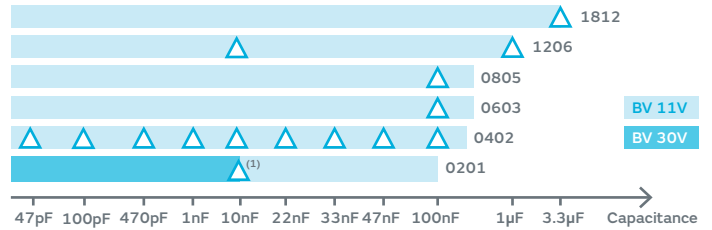


Key features

- Ultra high stability (temperature, voltage, aging).
- Low leakage current (high insulation resistance).
- Very low ESR and ESL.
- Negligible capacitance change with temperature variation.
- Low profile.

Finishing and packaging

- Lead-free NiAu finishing compatible with automatic soldering technologies (reflow and manual). Other terminations available on request.
- Wafers on foil, sawn and grinded. Tape & reel. Waffle Pack.



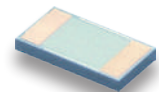
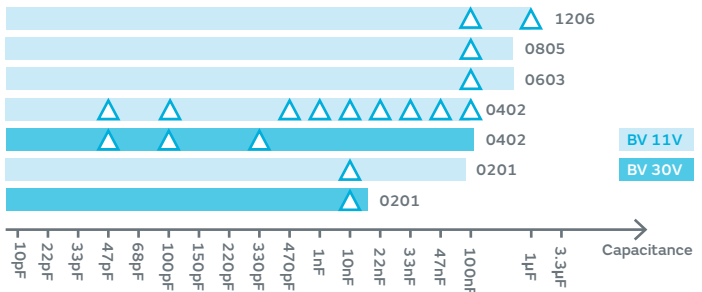
(1) 0201 - 10nF available in BV 11 and BV 30.

Parameter	Value
Capacitance range	47 pF to 3.3 µF(*)
Capacitance tolerances	±15%(*)
Operating temperature range	-55°C to 150°C
Storage temperature range	-70°C to 165°C(**)
Temperature coefficient	+60 ppm/K
Breakdown Voltage (BV)	11 VDC or 30 VDC
Capacitance variation versus RVDC	0.1%/V (from 0 to RVDC)
Insulation resistance	100 GΩ @ 3 V, @ 25°C, t>120s, for 100nF
Ageing	Negligible, < 0.001% / 1000h
Reliability	FIT<0.017 parts / billions hours

Low profile Si capacitors down to 100 µm (LPSC)

The LPSC target antenna matching, RF filtering and decoupling of active dies, in applications with height and volume constraints. They offer low profile (100 µm thin, 80 µm on request), with very high stability upon applied voltage, very low leakage current and high level of performances. These capacitors are dedicated to **Smart Card, RFID tags, medical**..where integration plays a key role. The LPSC product family is splitted into two series:

- LPSC range from 47 pF to 1 µF, suitable for embedded technologies, modules, system in package, when designers are looking for utmost decoupling behaviour;
- LPSC ESD Enhanced range from 47 pF up to 330 pF that works efficiently and durably in **RFID environments**. Thanks to the full modeling of the elementary cell, the ESD capabilities have been optimized up to 8 kV (see Key Features below). Furthermore, our RFID Silicon capacitor range has been fine tuned in order to reach SRF up to 3 GHz, hence allowing unique fine tuning of the antenna, from 13.56 MHz up to UHF (800/900 MHz) applications.



Key features

- Ultra low profile (100 µm, 80 µm on request).
- High Q.
- Voltage stability.
- High ESD capabilities (ESD enhanced series): >1 kV for 47 pF, >2 kV for 100 pF, >8 kV for 330 pF.
- Low leakage current down to 100 pA.
- Low ESL and low ESR.
- SRF > 1.2GHz for 100 pF.

Finishing and packaging

- Lead-free NiAu finishing compatible with wirebonding or automatic soldering technologies. Aluminum pads on request.
- Wafers on foil, sawn and grinded. Tape & reel. Waffle Pack.

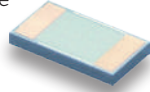
Parameter	Value
Capacitance range	47 pF to 1 µF(*)
Capacitance tolerances	±15 %(*)
Operating temperature range	-55°C to 150°C (*)
Storage temperature range	-70°C to 165°C (**)
Temperature coefficient	+60 ppm/K
Breakdown Voltage (BV)	11 VDC or 30 VDC
Capacitance variation versus RVDC	0.1%/V (from 0 to RVDC)
Insulation resistance	100 GΩ @ 3 V, @ 25°C, t>120s, for 100nF
Ageing	Negligible, < 0.001% / 1000h
Reliability	FIT<0.017 parts / billions hours
Capacitor thickness	100 µm(*)

(*) Other values on request (**) w/o packing

△ Available parts. For other values, contact your Murata sales representative.

Xtreme temperature Si capacitors up to 250°C (JEDEC/EIA compatible) (HTSC, XTSC)

Murata offers two JEDEC compatible capacitor ranges targeting applications in extreme conditions, like **Hi Rel applications**, the high temperature capacitors HTSC up to 200°C and the **xtreme temperature capacitors** XTSC up to 250°C. As an example of outstanding performance, the XTSC offer a 1 µF in 1206 with a temperature coefficient of +60 ppm/K over the full -55 °C/+250°C temperature range. Aging, stability of insulation resistance and capacitor value have been optimized to obtain the best product for Hi-Rel applications.

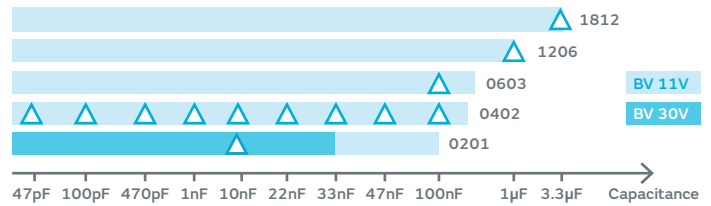


Key features

- Extended operating temperature range (up to 250°C) with low capacitance variation.
- High stability.
- High reliability.
- Low leakage current.
- Very low ESR and ESL.

Finishing and packaging

- Lead-free NiAu finishing compatible with wirebonding or leadframe soldering. Aluminum pads on request.
- Tape & reel, waffle pack or wafer delivery.

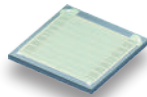


1812-3.3µF-BV11 available as HTSC only.

Parameter	Value
Capacitance range	47 pF to 3.3 µF(*)
Capacitance tolerances	±15%(*)
Operating temperature range	-55°C to 200°C for HTSC -55°C to 250°C for XTSC
Storage temperature range	-70°C to 215°C for HTSC(**) -70°C to 265°C for XTSC(**)
Temperature coefficient	+60 ppm/K
Breakdown Voltage (BV)	11 VDC or 30 VDC
Capacitance variation versus RVDC	0.1%/V (from 0 to RVDC)
Insulation resistance	100 GΩ @ 3 V, @ 25°C, t>120s, for 100nF
Ageing	Negligible, < 0.001% / 1000h
Reliability	FIT<0.017 parts / billions hours
Capacitor thickness	400 µm (*)

Wire-bondable or embedded low profile Si capacitors down to 100 µm (EMSC)

Murata Embedded Silicon Capacitors are designed to be compliant with the **embedding process for printed circuit board and laminates**. The EMSC can also be used with **wire bond technologies**. Thanks to the high robustness and performances of these silicon passive components, embedded processes are now reliable. The EMSC are available with a thickness of 100 µm (80 µm on request) and are the most appropriate solution for Chip On Board, Chip On Foil, Chip On Glass, Chip On Ceramic, flip chip and embedded applications.

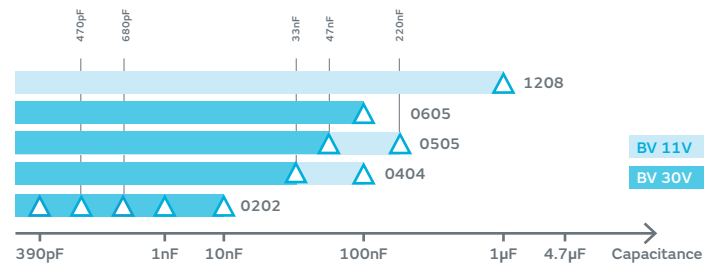


Key features

- Ultra Low profile 100 µm (80 µm on request).
- High stability (temperature, voltage and aging).
- Low ESL and ESR.
- Low leakage current.
- High reliability.

Finishing and packaging

- Pad finishing in Aluminum. Other finishing available such as copper, nickel or gold. Applicable for almost all embedded applications.
- Tape & reel, waffle pack or wafer delivery.



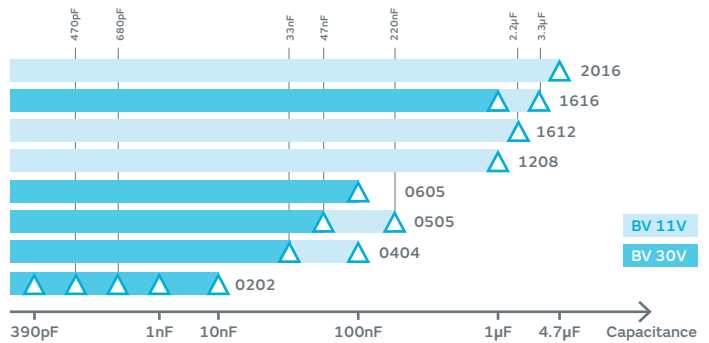
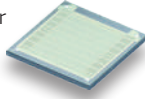
Parameter	Value
Capacitance range	390 pF to 1 µF
Capacitance tolerances	±15 %(*)
Operating temperature range	-55°C to 150°C
Storage temperature range	-70°C to 165°C(**)
Temperature coefficient	+60 ppm/K
Breakdown Voltage (BV)	11 VDC or 30 VDC
Capacitance variation versus RVDC	0.1%/V (from 0 to RVDC)
Insulation resistance	100 GΩ @ 3 V, @ 25°C, t>120s, for 100nF
Ageing	Negligible, < 0.001% / 1000h
Reliability	FIT<0.017 parts / billions hours
Capacitor thickness	100 µm(***)

(*) Other values on request (**) w/o packing (***) 80 µm thickness on request

△ Available parts. For other values, contact your Murata sales representative.

Extreme temp. wire-bondable Si capacitors up to 250°C (ETSC, EXSC)

The ETSC and EXSC series are designed to be compliant with **high temperature wire bond technologies** with Aluminum pads for Aluminum wedge bonding and gold pads on request for gold wire bonding. These capacitors feature low profile (250 µm), low leakage current and high operating temperature (ETSC up to 200°C/ EXSC up to 250°C) with high stability with temperature, voltage and negligible capacitance loss through aging. Applications include downhole industries, decoupling, filtering, charge pump, replacement of X8R and COG dielectrics, and high reliability applications, mainly for Multi-Chip Module assemblies.



Parameter	Value
Capacitance range	390 pF to 4.7 µF
Capacitance tolerances	±15 %(*)
Operating temperature range	-55°C to 200°C for ETSC -55°C to 250°C for EXSC
Storage temperature range	-70°C to 265°C(**) for EXSC
Temperature coefficient	+60 ppm/K
Breakdown Voltage (BV)	11 VDC or 30 VDC
Capacitance variation versus RVDC	0.1%/V (from 0 to RVDC)
Insulation resistance	100 GΩ @ 3 V, @ 25°C, t>120s, for 100nF
Ageing	Negligible, < 0.001% / 1000h
Reliability	FIT<0.017 parts / billions hours
Capacitor thickness	250 µm

Key features

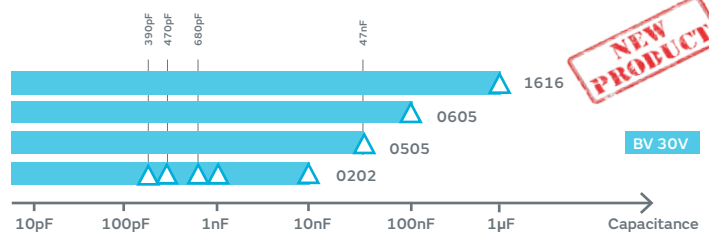
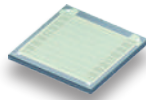
- Ultra High operating temperature
 - ETSC: up to 200°C
 - EXSC: up to 250°C
- Low profile (250 µm)
- High stability (temperature, voltage and aging)
- Low leakage current
- High reliability

Finishing and packaging

- Pad finishing in Aluminum. Other finishing available such as copper, nickel or gold.
- Tape & reel, waffle pack or wafer delivery.

Automotive high temperature Si capacitors up to 200°C (ATSC)

The ATSC capacitors target Under-the-Hood electronics and all sensors exposed to harsh conditions in the **automotive market** segment. These automotive grade capacitors are optimized for decoupling functions. They are manufactured in Murata IATF 16949 certified facility, under AEC-Q100 conditions up to 200°C.



Parameter	Value
Capacitance range	390 pF to 1 µF(*)
Capacitance tolerances	±15%(*)
Operating temperature range	-55 to 200 °C
Storage temperature range	- 70 to 215 °C(**)
Temperature coefficient	+80 ppm/K
Breakdown Voltage (BV)	30 VDC
Rated voltage	16 VDC
Capacitance variation versus RVDC	0.1 %/V (from 0 V to RVDC)
Insulation resistance	50 GΩ @ 10 V, @ 25°C, t>120s, for 100nF, or 15GΩ @15V for 100 nF
Ageing	Negligible, < 0.001% / 1000h
Reliability	FIT<0.017 parts / billions hours

Key features

- Qualified according to AEC-Q100.
- High stability of capacitance value over temperature, voltage and aging.
- 16 V operating voltage.
- Load dump.
- 8 kV HBM ESD.
- Suitable for high temperature leadframe mounting.

Finishing and packaging

- Pad finishing in Aluminum. Applicable for high temperature wirebonding and other mountings. Other finishings available such as nickel or gold.
- Tape and reel, waffle pack or wafer delivery.

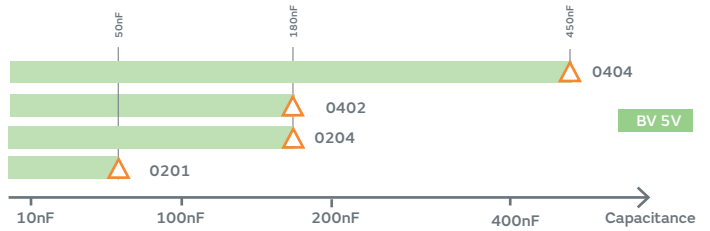
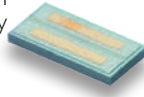
(*) Other values on request (**) w/o packing (***) value depends on products

△ Available parts. For other values, contact your Murata sales representative.

Ultra low ESL and ultra low profile Si capacitors down to 85 μm (UESL)

NEW PRODUCT

The Ultra-low ESL (UESL) silicon capacitors target **power integrity and signal integrity for high-speed applications**. With an ultra-low ESL (Equivalent Series Inductance) and an excellent behavior in high frequencies, the UESL capacitors are the perfect match for power supply decoupling and bypass of high-speed digital IC. The UESL capacitors feature ultra-low thickness (85 μm and below) which enables advanced assembly with strong height restrictions (processor package, BGA land-side, package embedded...). The unique technology of integrated passive devices in silicon developed by Murata provides high stability over DC voltage and temperature.



Key features

- Ultra-low profile of 85 μm .
- Very low ESR and ESL.
- High stability.
- Low leakage current.

Finishing and packaging

- Lead-free NiAu finishing compatible with automatic soldering technologies (reflow and manual). Other terminations available upon request.
- Tape & reel or wafer delivery.

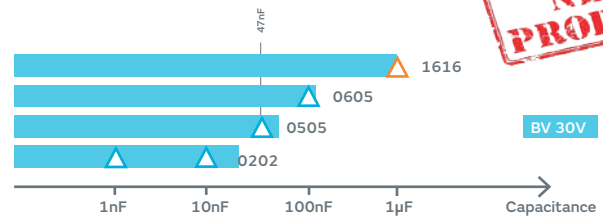
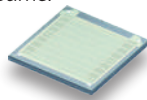
Parameter	Value
Capacitance range	50 nF to 450 nF(*)
Capacitance tolerances	$\pm 15\%$ (*)
Operating temperature range	-55 to 125 $^{\circ}\text{C}$
Storage temperature range	- 70 to 140 $^{\circ}\text{C}$ (**)
Temperature coefficient	+60 ppm/K
Breakdown Voltage (BV)	4.5 VDC
Capacitance variation versus RVDC	0.1 %/V (from 0 V to RVDC)
Equivalent Series Inductance (ESL)	Typ. 15 pH
Equivalent Series Resistance (ESR)	Typ. 30 m Ω to 120 m Ω (***)
Insulation resistance	100 G Ω @ 3 V, @ 25 $^{\circ}\text{C}$, t>120s, for 100 nF
Ageing	Negligible, < 0.001% / 1000h
Capacitor thickness	85 μm

Medical grade Si capacitors (MGSC)

The MGSC silicon capacitor range targets **high reliability medical applications** such as implantable devices (pacemaker, defibrillator...).

These capacitors are optimized in terms of reliability to avoid any burning test and to ensure that the initial failure rate is drastically lower than other ceramic types.

The very low leakage current enables to improve the performances of battery based applications and increase their lifetime.



NEW PRODUCT

Key features

- High reliability.
- Extreme low profile.
- High stability of capacitor value over voltage, temperature and aging.
- Die to die stacking.

Finishing and packaging

- Aluminum pads suitable for wirebonding assembly.
- Copper finishing option for embedded technology.
- Tape & reel. Other types of packagings on request (film frame carrier..).

Parameter	Value
Capacitance range	1nF to 1 μF (*)
Capacitance tolerances	$\pm 15\%$ (*)
Operating temperature range	-55 to 150 $^{\circ}\text{C}$
Storage temperature range	- 70 to 175 $^{\circ}\text{C}$ (**)
Temperature coefficient	+60 ppm/K
Recommended RVDC	12 V
Breakdown Voltage (BV)	30 VDC
Capacitance variation versus RVDC	0.1 %/V (from 0 V to RVDC)
Insulation resistance	50 G Ω @ 10 V, @ 25 $^{\circ}\text{C}$, t>120s, for 100nF
Ageing	Negligible, < 0.001% / 1000h
Reliability	FIT<0.017 parts / billions hours
Capacitor thickness	100 μm

(*) Other values on request

Available parts. For other values, contact your Murata sales representative.
 Under development.

Products handling, storage and shelf life indications

It is preferable to repack the remaining capacitors quantities after any process step, in the same conditions as before the opening (ESD bag + N₂). The assembly of capacitors has to be done one year maximum after the opening date.

Store the capacitors in a clean environment and in the manufacturer's package, without a rapid thermal change in an indoor room and with a temperature between -10 to 40 degree C.

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

1. Die must never be handled with bare hands
2. Avoid touching the active face
3. Do not store and transport die outside protective bags, boxes, sawn tape
4. Work only in ESD environments
5. Plastic tweezers or a soft vacuum tool are recommended 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).

The capacitors can be delivered in the following packaging: tape & reel, waffle pack, film frame carrier and raw wafer. Please contact Murata for drawing and references (mis@murata.com).

Packaging shelf life

Packaging	Recommendations
Raw wafer	6 years /8°C to 45°C, <30% RH or dried N ₂
Film frame carrier D175 Adwill	12 months 18-40°C / RH<60% (or dried N ₂) in the dark (UV performed)
Film frame carrier D510 Adwill	12 months 23 ± 5°C / 40%<RH<60% (or dried N ₂) in the dark (UV not performed)
Tape and reel	5 years 18-35°C / RH: 35-65% or dried N ₂
Waffle pack	5 years 18-35°C / RH: 35-65% or dried N ₂
Conductive bags	5 years

Assembly instructions

The attachment techniques recommended by Murata for silicon capacitors on the customer's substrates are fully detailed in specific documents available on our website. To assure the correct use and proper functioning of Murata Silicon capacitors **please download the assembly instructions on www.murata.com and read them carefully.**

		Title of the assembly note available on our website
HSSC	High stability and reliability capacitor	HSSC Capacitors 400 µm - Assembly by Soldering
LPSC	Low profile capacitor	LPSC Capacitors 100 µm - Assembly by Soldering
HTSC	High temperature capacitor	HTSC Capacitors 400 µm - Assembly by Soldering
XTSC	Extreme temperature capacitor	XTSC Capacitors 400 µm - Assembly by Soldering
EMSC	Wire-bondable & embedded low profile capacitor	EMSC Capacitors - Assembly by Wirebonding
XBSC	Extreme broadband surface mounted capacitor	XBSC / UBDC / UBSC / BBSC / ULSC Capacitors 100 µm & 400 µm - Assembly by Soldering
UBSC	Ultra broadband surface mounted capacitor	
BBSC	Broadband surface mounted capacitor	
ULSC	Ultra large band surface mounted capacitor	
UBDC	Ultra broadband surface mounted differential capacitors	
UBEC	Ultra broadband wire-bondable embedded capacitor	UBEC / BBEC / ULEC Capacitors 100 µm & 400 µm - Assembly by Wirebonding
BBEC	Broadband wire-bondable embedded capacitor	
ULEC	Ultra large band wire-bondable embedded capacitor	
UWSC	Ultra large band wire-bondable vertical capacitor	UWSC Capacitors 250 µm & 100 µm - Assembly by Wirebonding
WBSC	Wire-bondable vertical capacitor	WBSC / WTSC / WXSC Capacitors 250 µm / WLSC 100 µm - Assembly by Wirebonding
WTSC	High temperature wire-bondable vertical capacitor	
WXSC	Extreme temperature wire-bondable vertical capacitor	
WLSC	Wire-bondable vertical low profile capacitor	
ETSC	High temperature wire-bondable capacitor	ETSC / EXSC Capacitors 250 µm - Assembly by Wirebonding
EXSC	Extreme temperature wire-bondable capacitor	
ATSC	High temperature automotive capacitor	ATSC Capacitors 250 µm - Assembly by Wirebonding
UESL	Ultra low ESL and ultra low profile capacitor	UESL Capacitors 85 µm - Assembly by Soldering
MGSC	Wire-bondable & embedded low profile capacitor	MGSC Capacitors - Assembly by Wirebonding

Lifetime of silicon capacitors in Murata technologies

The 3D Murata technologies provide several passive components including High Density Capacitors. The lifetime of these 3D Silicon Capacitors has been determined using accelerated lifetime tests.

The Time-Dependent Dielectric Breakdown (TDDB) measurements are used to model the intrinsic behavior of the capacitor dielectric under elevated temperature and strong electric field. The acceleration factors for temperature and electric field are used to extrapolate the capacitor lifetime under typical operating conditions.

The Temperature Cycling (TMCL) tests are done to assess the endurance of non-hermetic packaged solid-state devices exposed to thermo-mechanical stress as a result of expansion and contraction by high and low temperature.

Lifetime of these capacitors depends on the applied voltage and operating temperature. Please refer to our application note 'Lifetime of 3D capacitors in Murata technologies' for more details.

General Information

Learn more about our Silicon Capacitors thanks to our Web portal:

www.murata.com and follow the sections

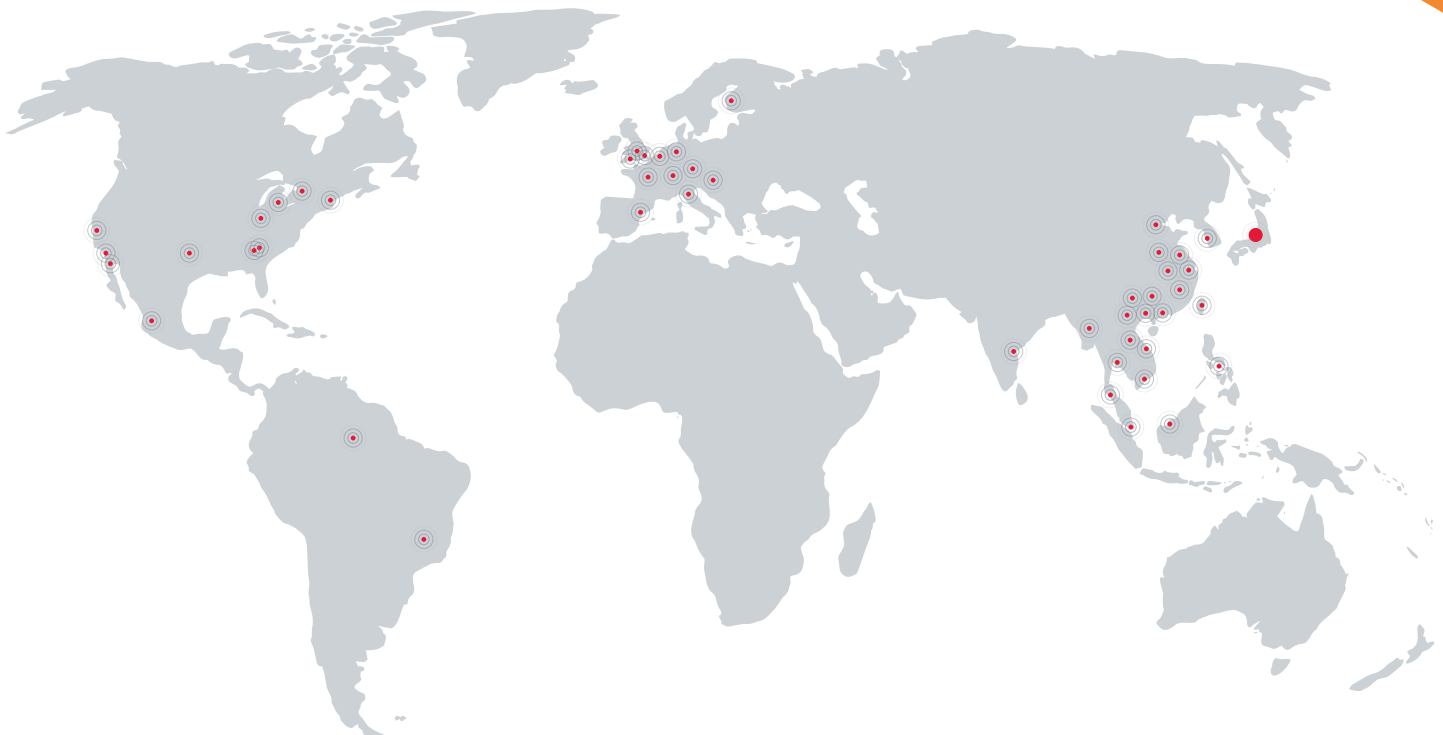
- ➔ Products
- ➔ Capacitor
- ➔ Silicon Capacitor





Global locations

For details please visit www.murata.com



⚠ Note

1 Export Control

For customers outside Japan:

No Murata products should be used or sold, through any channels, for use in the design, development, production, utilization, maintenance or operation of, or otherwise contribution to (1) any weapons (Weapons of Mass Destruction [nuclear, chemical or biological weapons or missiles] or conventional weapons) or (2) goods or systems specially designed or intended for military end-use or utilization by military end-users.

For customers in Japan:

For products which are controlled items subject to the "Foreign Exchange and Foreign Trade Law" of Japan, the export license specified by the law is required for export.

2 Please contact our sales representatives or product engineers before using the products in this catalog for the applications listed below, which require especially high reliability for the prevention of defects which might directly damage a third party's life, body or property, or when one of our products is intended for use in applications other than those specified in this catalog.

- ① Aircraft equipment
- ② Aerospace equipment
- ③ Undersea equipment
- ④ Power plant equipment
- ⑤ Medical equipment
- ⑥ Transportation equipment (vehicles, trains, ships, etc.)
- ⑦ Traffic signal equipment
- ⑧ Disaster prevention / crime prevention equipment
- ⑨ Data-processing equipment
- ⑩ Application of similar complexity and/or reliability requirements to the applications listed above

3 Product specifications in this catalog are as of March 2014. They are subject to change or our products in it may be discontinued without advance notice. Please check with our sales representatives or product engineers before ordering. If there are any questions, please contact our sales representatives or product engineers.

4 Please read rating and ⚠CAUTION (for storage, operating, rating, soldering, mounting and handling) in this catalog to prevent smoking and/or burning, etc.

5 This catalog has only typical specifications. Therefore, please approve our product specifications or transact the approval sheet for product specifications before ordering.

6 Please note that unless otherwise specified, we shall assume no responsibility whatsoever for any conflict or dispute that may occur in connection with the effect of our and/or a third party's intellectual property rights and other related rights in consideration of your use of our products and/or information described or contained in our catalogs. In this connection, no representation shall be made to the effect that any third parties are authorized to use the rights mentioned above under licenses without our consent.

7 No ozone depleting substances (ODS) under the Montreal Protocol are used in our manufacturing process.

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www.murata.com

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