Wire Bondable Vertical SiCap WLSC 015015 4.7nF BV11

Rev. 2.02

General description

WLSC Capacitors targets power supplies decoupling and filtering of active devices. They are based on PICS Integrated Passive technology.

This product is a single 4.7nF capacitor in 015015 package size [0.381 x 0.381 mm]. Other capacitance values and other package size are available as a single die or capacitor array; please feel free to contact us.

WLSC capacitors are directly mounted on the PCB application using die bonding and wire bonding processes. Standard FR4 PCB can be used. The bottom electrode is in TiNiAu and the top electrode is in TiWAu. Other top finishings such as Aluminum are available on request.

Key features

- Compatible with MLCC footprint
- Ultra-high stability of capacitance value:
  - Temperature 70ppm/K (-55 °C to +150 °C)
  - Voltage <-0.02%/Volt
  - Negligible capacitance loss through ageing
- Low profile 0.1mm
- Small size 0.381 x 0.381 mm (015015 format)
- Break down voltage: 11V
- Low leakage current
- High reliability
- High operating temperature (up to 150 °C)
- Compatible with high temperature cycling during manufacturing operations (exceeding 300 °C)
- Compatible with EIA 015015 footprint
- Applicable for standard wire bonding assembly (ball and wedge)

Key applications

- Any demanding applications, such as medical, aerospace…
- Supply decoupling / filtering of active device
- High reliability applications
- Devices with battery operations
- High temperature applications
- High volumetric efficiency *(i.e. capacitance per unit volume)*

Functional diagram

The next figure provides implementation set-up diagram.

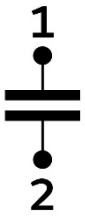


Figure 1 Block Diagram

Electrical performances

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
C	Capacitance value	@+25°C	-	4.7	-	nF
ΔC_P	Capacitance tolerance (1)	@+25°C	-15	-	+15	%
T_{OP}	Operating temperature		-55	20	150	°C
T_{STG}	Storage temperature (2)		-70	-	165	°C
ΔC_T	Capacitance temperature variation	-55 °C to 150 °C	-	70	-	ppm/K
RV_{DC}	Rated voltage (3)		-	-	3.8(4) 3.4(5)	V_{DC}
BV	Break down voltage	@+25°C	11	-	-	V
ΔC_{RVDC}	Capacitance voltage variation	From 0 V to RV_{DC}, @+25°C	-	-	-0.02	$\%/V_{DC}$
Fc-3dB	Cut-off frequency at 3dB(6)	@+25°C, transmission mode	-	339	399	kHz
IR	Insulation resistor	@RV_{DC}, +25°C, 120s	-	10	-	GΩ
ESL	Equivalent Serial Inductance (6)	@+25°C, SRF shunt mode	-	8	-	pH
ESD	HBM stress (7)	JS-001-2017	2	-	-	kV

Table 1 - Electrical performances

(1): other tolerance available upon request
(2): without packaging
(3): Lifetime is voltage and temperature dependent, please refer to application note 'Lifetime of 3D capacitors'
(4): 10 years of intrinsic life time prediction at 100°C continuous operation
(5): 10 years of intrinsic life time prediction at 150°C continuous operation
(6): Simulated
(7): please refer to application note 'ESD Challenge in 3D Murata Integrated Passive technology'

Impedance characteristic of 4.7nF WLSC in Shunt mode

Graph will be completed after end of characterisation

Figure 2 - 4.7nF WLSC simulation results (Impedance characteristic versus Frequency in shunt mode)

Schematic of 4.7nF WLSC in Shunt mode

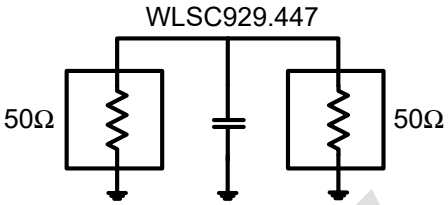


Figure 3 - 4.7nF WLSC measurement schematic

Example of 015015 mounted

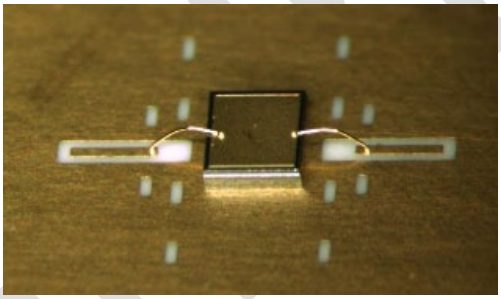


Figure 4 – micro picture of 015015 WLSC mounted

Pinning definition

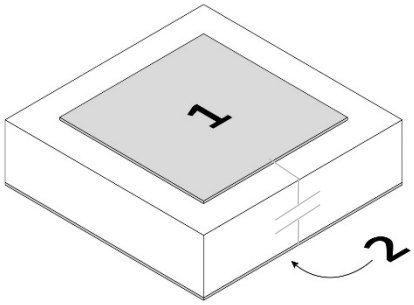


Figure 5 Pinning definition

pin #	Symbol	Coordinates X / Y
1	Signal	0.0 / 0.0
2	GND	Backside

Table 2 - Pining description. Reference (0,0) located at the centre of the die.

Ordering Information for WLSC929.447

Type number	Package		
	Packaging	Finishing	Description
935146929447-F1T	6” FFC(1)	Au(2)	WLSC 4.7nF/015015 – 1 bondpad – 0.381 x 0.381mm x 0.10mm(3)
935146929447-F2T	8” FFC(1)	Au(2)	WLSC 4.7nF/015015 – 1 bondpad – 0.381 x 0.381mm x 0.10mm(3)
935146929447-E1T	6” Grip ring(1)	Au(2)	WLSC 4.7nF/015015 – 1 bondpad – 0.381 x 0.381mm x 0.10mm(3)
935146929447-W0T	Waffle pack 400units	Au(2)	WLSC 4.7nF/015015 – 1 bondpad – 0.381 x 0.381mm x 0.10mm(3)
935146929447-T3T 	T&R 1000units(4)	Au(2)	WLSC 4.7nF/015015 – 1 bondpad – 0.381 x 0.381mm x 0.10mm(3)

(1) Other film frame carrier are possible on request
(2) Au = TiWAu (0.3µm) / Au (3µm)
(3) Refer to Figure 9
(4) missing capacitors can reach 0.5%

Table 3 - Packaging and ordering information

Product Name	Die Name	Description
WLSC929.447	WU015015447	WLSC 4.7nF/015015/BV11 – 1 bondpad – 0.381 x 0.381mm x 0.10mm

Table 4 - Die information

Pad Metallization

This wire bondable capacitor is delivered as standard with the bottom electrode in TiNiAu (Ti (0.1 µm)/Ni (0.3µm)/Au (0.2µm)) and top electrode in TiWAu (TiWAu (0.3µm) / Au (3µm))

Other Metallization, such as thick Gold or Aluminum top pads are possible on request.

Silicon dies are not sensitive to humidity, please refer to applications notes 'Assembly Notes' section 'Handling precautions and storage'.

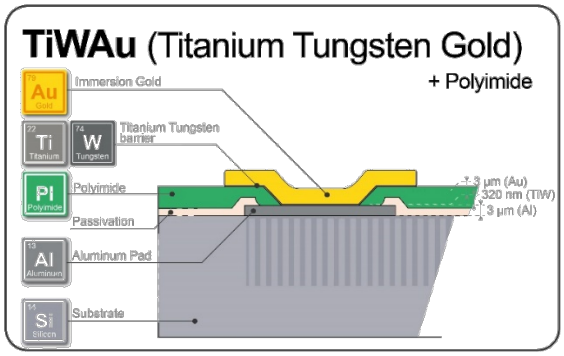


Figure 6 – Top electrode description

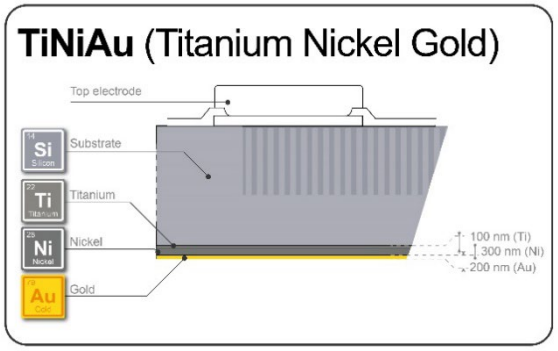


Figure 7 – Bottom electrode description

Material regulation

This product is RoHS compliant at the time of publication. For further information about regulation compliancy, please ask your sales representative.

Package outline

The product is delivered as a bare silicon die.

Figure 8 - Micro photography

A (mm)	Aw (mm)	c (mm)	d (mm)	e (mm)
0.381 ±0.02	0.381 ±0.02	0.10 ±0.015	0.295	0.295

Table 5 - Dimensions and tolerances

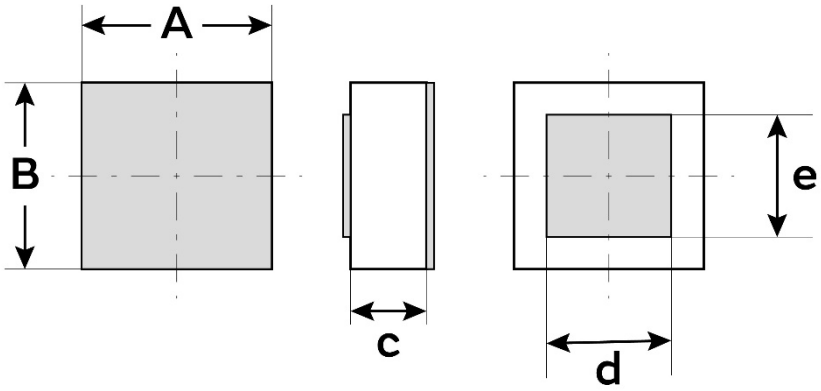


Figure 9 - Package outline drawing

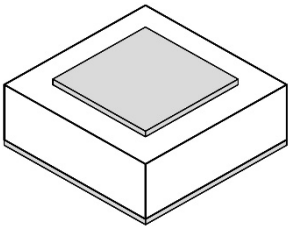


Figure 10 - Package isometric view

Assembly

WLSC capacitors are directly mounted on the PCB application using die bonding and wire bonding.

It is applicable for standard wire bonding assembly (ball and wedge).

For further information, please see our mounting application note.

The attachment techniques recommended by Murata 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 capacitors **please download the assembly instructions on https://www.murata.com/en-us/products/capacitor/siliconcapacitors and read them carefully.**

Figure 11 Scan this QR Code to access the Murata Silicon Capacitor web page

Packaging format

Please refer to application note ‘Products Storage Conditions and Shelf Life’.

Film Frame Carrier:

With UV curable dicing tape (UV performed).

Good dies are identified using the SINF electronic mapping format. No ink is added on wafer to label other dies.

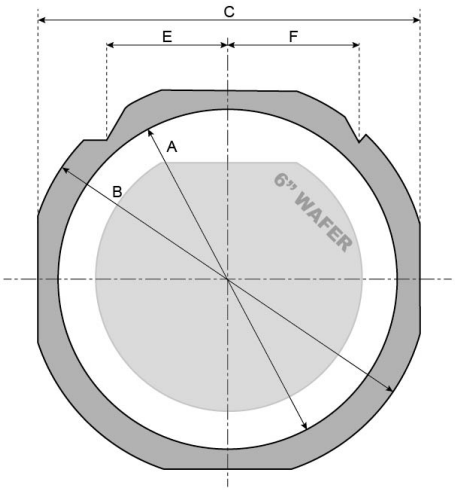


Figure 12 FF070 Frame with a 6" wafer

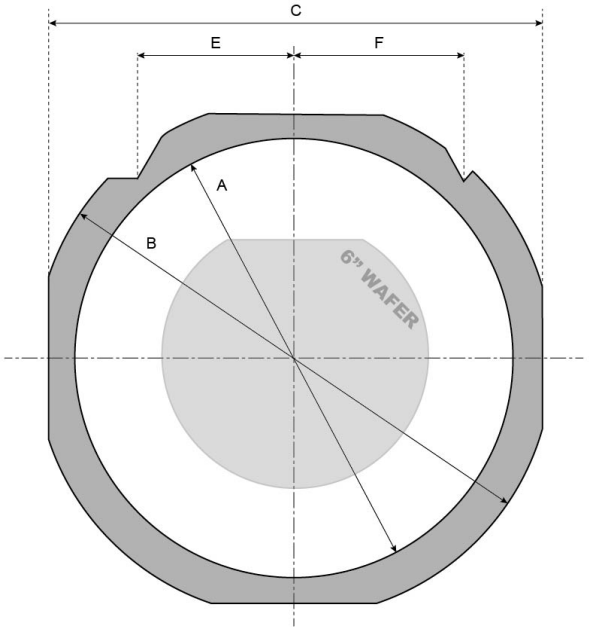


Figure 13 FF108 Frame with a 6" wafer

Frame Reference	Frame Style	Inside diameter A	Outside diameter B	Width C	Thickness	Pin location E	Pin location F
FF070 (1)	DTF-2-6-1	7.638”	8.976”	8.346”	0.048’’	2.370”	2.5’’
FF108 (1)	DTF-2-8-1	9.842”	11.653”	10.866”	0.048”	2.381”	2.5’’

Table 6 - Frame dimensions (inches)

(1) or equivalent

Expander grip ring 6” diameter:

With UV curable dicing tape (UV performed)

Good dies are identified using the SINF electronic mapping format. No ink is added on wafer to label other dies.

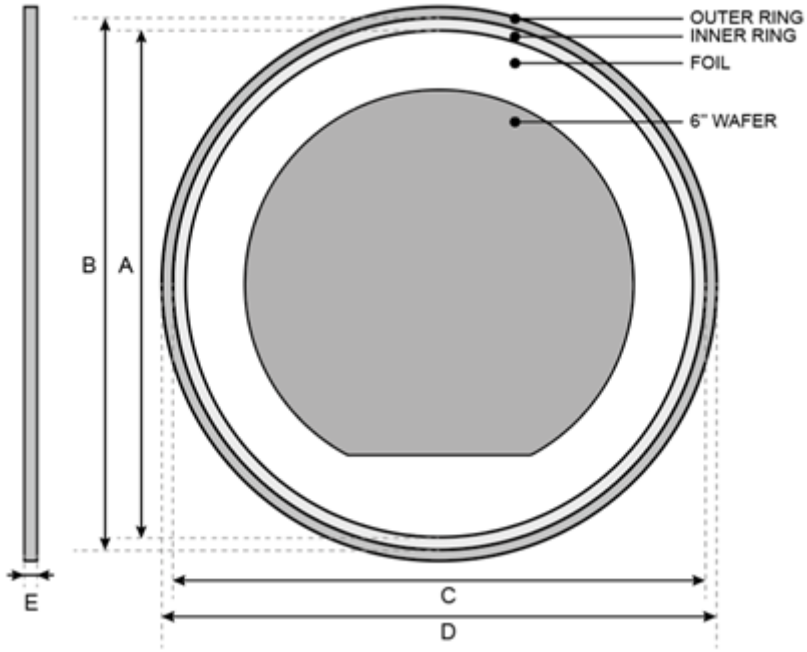


Figure 14 – Grip Ring drawing

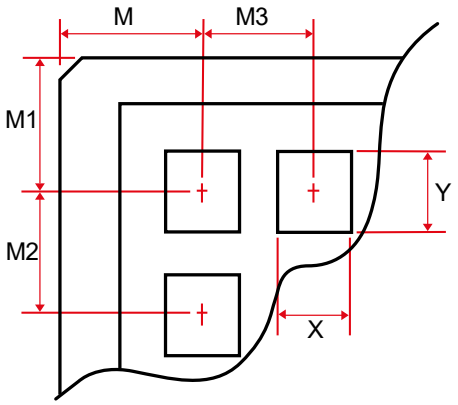
Grip Ring Style	A	B	C	D	E	Locator Notch
GRP-2620-6 (1)	7.670”	7.973”	7.975”	8.280”	0.236”	None

Table 7 - Frame dimensions (inches)

(1) or equivalent

Waffle pack:

Please refer to application note 'Waffle Pack Chip Carrier Handling & Opening Procedure'. Dies are not flipped in the waffle pack cavity (wire bond pad up).



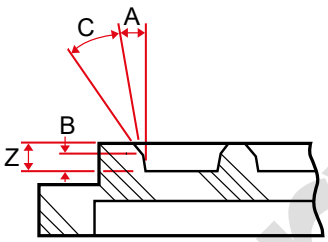


Table 8 - Waffle pack drawing

External dimensions	Max. capacity	Pocket length X	Pocket width Y	Pocket depth Z
2 inches	20 x 20	$0.48_{\pm 0.05}$	$0.48_{\pm 0.05}$	$0.28_{\pm 0.05}$

Table 9 - Waffle pack dimensions (mm)

M	M1	M2	M3	A
$4.60_{\pm 0.08}$	$4.60_{\pm 0.08}$	$2.18_{\pm 0.05}$	$2.18_{\pm 0.05}$	$7°\ _{\pm 1/2°}$

Table 10 - Waffle pack dimensions (mm)

Tape and Reel: Dies are not flipped in the tape cavity (wire bond pad up) with die ID located near the driving holes of the tape.

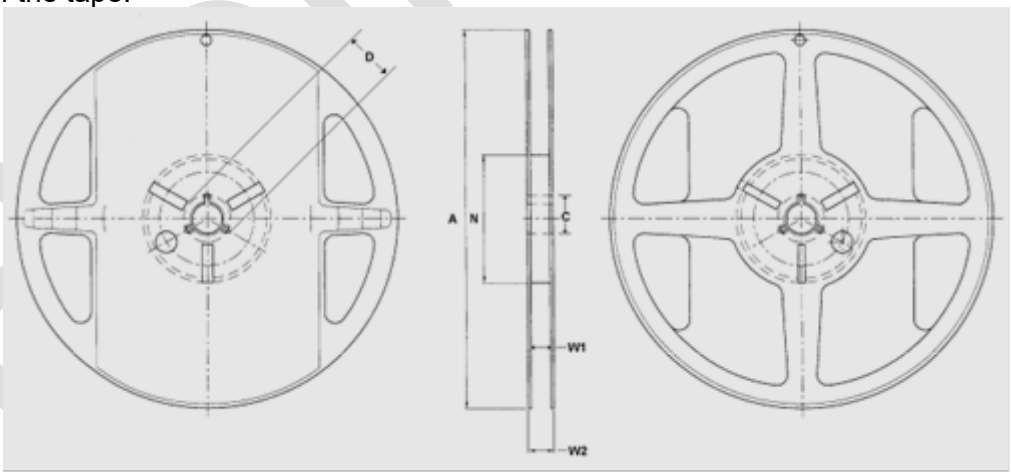


Figure 10 - Reel drawing

Tape Width	Diameter A	C	D	Hub N	W1	W2
8	178 (7 inches)	13.5	20.2	60	9	11.5

Table 6 – Reel dimensions (mm)

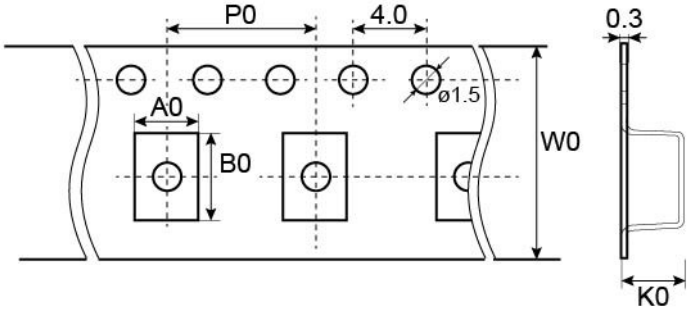


Figure 11 - Tape drawing

Cavity dimensions			Carrier tape width W0	Carrier tape pitch P0
Ao	Bo	Ko		
tbd	tbd	tbd	tdb mm	tbd mm

Table 7 - Tape dimensions (mm)

Definitions

Data sheet status

Objective specification: This data sheet contains target or goal specifications for product development.

Preliminary specification: This data sheet contains preliminary data; supplementary data may be published later.

Product specification: This data sheet contains final product specifications.

Limiting values

Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or any other conditions above those given in the Electrical performances sections of this specification is not implied. Exposure to limiting values for extended periods may affect device reliability.

Application information

Where application information is given, it is advisory and does not form part of the specification.

Revision history

Revision	Date	Description	Author.
Release 1.0	**2018 Dec 13th**	**Creation**	**OGA**
Release 1.03	**2020 Sept. 05th**	**General update**	**OGA**
Release 1.04	**2022 April. 14th**	**T&R information added**	**OGA**
Release 1.05	**2023 feb. 14th**	**Minor update**	**OGA**
Release 2.01	**2023 June 18th**	**Finishing cross section added and erratum in figure5** **New T&R packing** 	**OGA**
Release 2.02	**2025 Oct. 22th**	**Key applications have been updated according to the latest market requirement. Ordering information has been updated according to the latest product lineup and specification.**	**CGU, HFU**

Disclaimer / Life support applications

These products are not designed for use in life support appliances, devices, or systems where malfunction of these products can reasonably be expected to result in personal injury. Murata customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify Murata for any damages resulting from such improper use or sale.

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