



## General description

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

This product is a single 22nF capacitor in 0402 package size. Other capacitance values and other package size are available as a single die or capacitor array; please feel free to contact us.

WBSC/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 Ti (0.1  $\mu\text{m}$ )/Ni (0.3 $\mu\text{m}$ )/Au (0.2 $\mu\text{m}$ ) and the top electrode is in gold. Other top finishings such as Aluminum are available on request.

## Key features

- Full compatible Monolithic ceramic capacitors for replacement
- 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 0.25mm (standard), but lower thickness is possible (i.e 0.10mm) on request.
- Small size 1.0 x 0.5 mm (0402 format)
- Break down voltage : 30V
- 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 0402 footprint
- Applicable for standard wire bonding assembly (ball and wedge)

## Key applications

- Any demanding applications, such as medical, aerospace, automotive industrial...
- Supply decoupling / filtering of active device
- High reliability applications
- Battery operated devices
- High temperature applications
- High volumetric efficiency (i.e. *capacitance per unit volume*)

## Functional diagram

The next figure provides implementation set-up diagram.

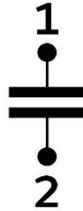


Figure 1 Block Diagram

## Electrical performances

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
C	Capacitance value	@+25°C	-	22	-	nF
$\Delta C_P$	Capacitance tolerance <sup>(1)</sup>	@+25°C	-15	-	+15	%
T <sub>OP</sub>	Operating temperature		-55	20	150	°C
T <sub>STG</sub>	Storage temperature <sup>(2)</sup>		-70	-	165	°C
$\Delta C_T$	Capacitance temperature variation	-55 °C to 150 °C	-	70	-	ppm/K
RV <sub>DC</sub>	Rated voltage <sup>(3)</sup>		-	-	16 <sup>(4)</sup> 14.7 <sup>(5)</sup>	V <sub>DC</sub>
BV	Break down voltage	@+25°C	30	-	-	V
$\Delta C_{RVDC}$	Capacitance voltage variation	From 0 V to RV <sub>DC</sub> , @+25°C	-	-	0.02	%/V <sub>DC</sub>
IR	Insulation resistor	@RV <sub>DC</sub> , +25°C, 120s	-	10	-	GΩ
ESL	Equivalent Serial Inductance <sup>(6)</sup>	@+25°C, SRF shunt mode	-	3	-	pH
ESD	HBM stress <sup>(7)</sup>	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) Measured  
(7) please refer to application note 'ESD Challenge in 3D Murata Integrated Passive technology'

For extended frequency range (up to 26GHz), see Ultra large band Wire bonding vertical Silicon Capacitor (UWSC).

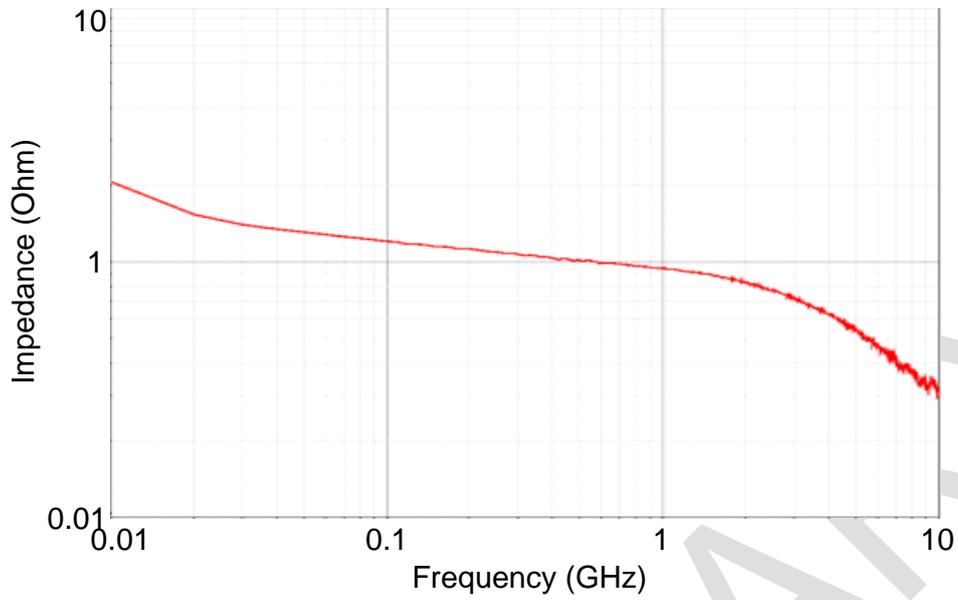


Figure 2 Impedance characteristic versus Frequency in shunt mode

**Schematic of 22nF WBSC in Shunt mode**

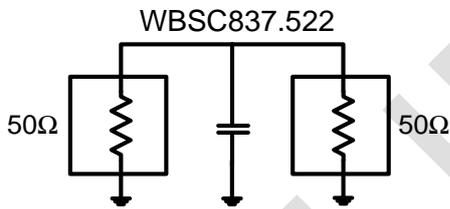


Figure 3 - 22nF WBSC measurement schematic

**Example of mounted 0202**

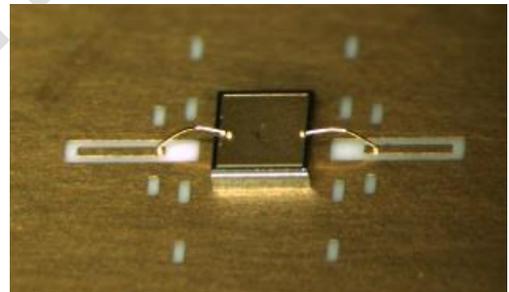


Figure 4 – micro picture of mounted 0202 WBSC



**Pinning definition**

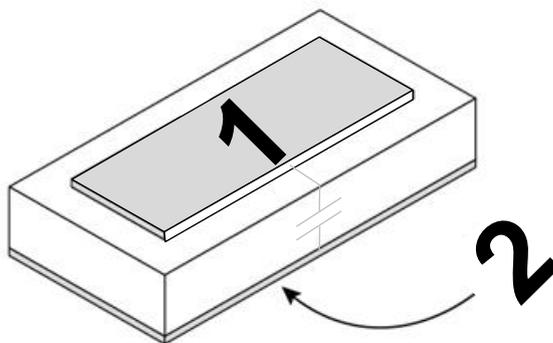


Figure 5 Pinning definition

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

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

**Ordering Information**

Regardless of packaging, Murata Integrated Passive Devices delivers products with AQL level II (0.65).

Type number (15NC)	Package		
	Packaging	Finishing	Description
935 142 837 522-F1T	6" FFC <sup>(1)</sup>	Au <sup>(2)</sup>	22nF/0402 – 1 bondpad – 1.00 x 0.50mm x 0.25mm <sup>(3)</sup>
935 142 837 522-F2T	8" FFC <sup>(1)</sup>	Au <sup>(2)</sup>	22nF/0402 – 1 bondpad – 1.00 x 0.50mm x 0.25mm <sup>(3)</sup>
935 142 837 522-E1T	6" Grip Ring <sup>(1)</sup>	Au <sup>(2)</sup>	22nF/0402 – 1 bondpad – 1.00 x 0.50mm x 0.25mm <sup>(3)</sup>
935 142 837 522-T3T	T&R 1Kunits <sup>(4)</sup>	Au <sup>(2)</sup>	22nF/0402 – 1 bondpad – 1.00 x 0.50mm x 0.25mm <sup>(3)</sup>
935 142 837 522-W0T	Waffle pack 400units	Au <sup>(2)</sup>	22nF/0402 – 1 bondpad – 1.00 x 0.50mm x 0.25mm <sup>(3)</sup>
935 146 837 522-F1T	6" FFC <sup>(1)</sup>	Au <sup>(2)</sup>	22nF/0402 – 1 bondpad – 1.00 x 0.50mm x 0.10mm <sup>(3)</sup>
935 146 837 522-F2T	8" FFC <sup>(1)</sup>	Au <sup>(2)</sup>	22nF/0402 – 1 bondpad – 1.00 x 0.50mm x 0.10mm <sup>(3)</sup>
935 146 837 522-E1T	6" Grip Ring <sup>(1)</sup>	Au <sup>(2)</sup>	22nF/0402 – 1 bondpad – 1.00 x 0.50mm x 0.10mm <sup>(3)</sup>
935 146 837 522-T3T	T&R 1Kunits <sup>(4)</sup>	Au <sup>(2)</sup>	22nF/0402 – 1 bondpad – 1.00 x 0.50mm x 0.10mm <sup>(3)</sup>
935 146 837 522-W0T	Waffle pack 400units	Au <sup>(2)</sup>	22nF/0402 – 1 bondpad – 1.00 x 0.50mm x 0.10mm <sup>(3)</sup>

- (1) Other film frame carrier are possible on request
- (2) Au = TiW (0.3µm) / Au (3µm)
- (3) Refer to Figure 7
- (4) missing capacitors can reach 0.5%

Table 3 - Packaging and ordering information



Product Name	Die Name	Description
WBSC837.522	WR0402522	WBSC 22nF/0402/BV30 – 1 bondpad – 1.00 x 0.50mm x 0.25mm
WLSC837.522	WR0402522	WBSC 22nF/0402/BV30 – 1 bondpad – 1.00 x 0.50mm x 0.10mm

Table 4 - Die information

### Pad Metallization

The wire bondable Silicon Capacitor is delivered as standard with the bottom electrode in TiNiAu and top electrode in TiWAu.

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'.

### 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.

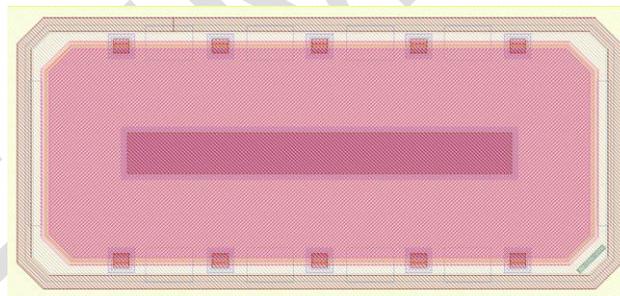


Figure 6 – Layout view



L (mm)	W (mm)	T (mm)	a (mm)	b (mm)
1.00 ±0.03	0.50 ±0.03	0.25 or 0.10 ±0.015	0.818	0.318

Table 5 - Dimensions and tolerances

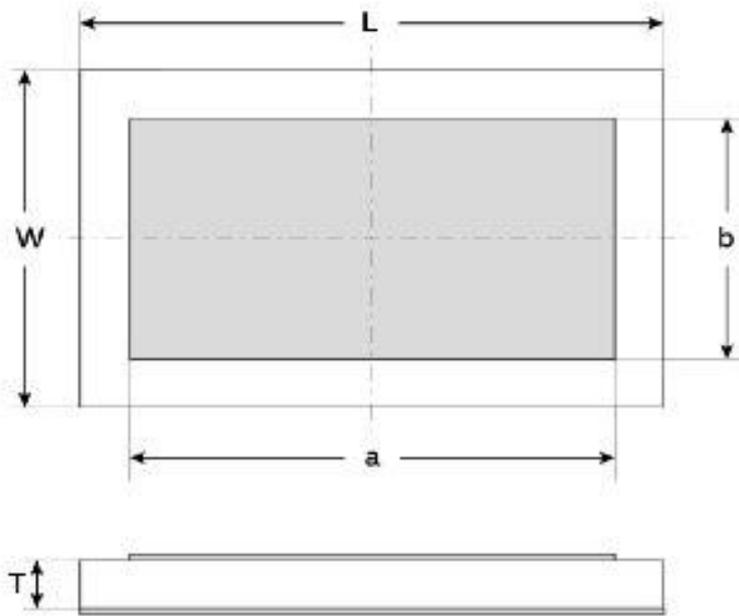


Figure 7 - Package outline 22nF Capacitor

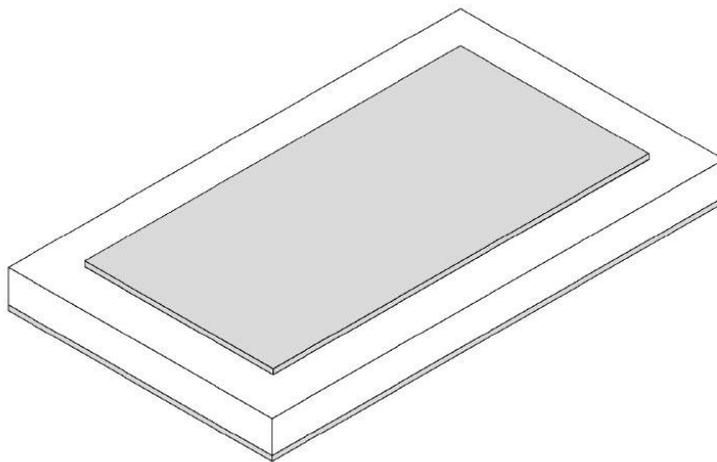


Figure 8 Package isometric view



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## Assembly

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WBSC/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 9 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'.

**Tape and Reel:** Dies are flipped in the tape cavity (bump down) with die ID located near the driving holes of the tape.

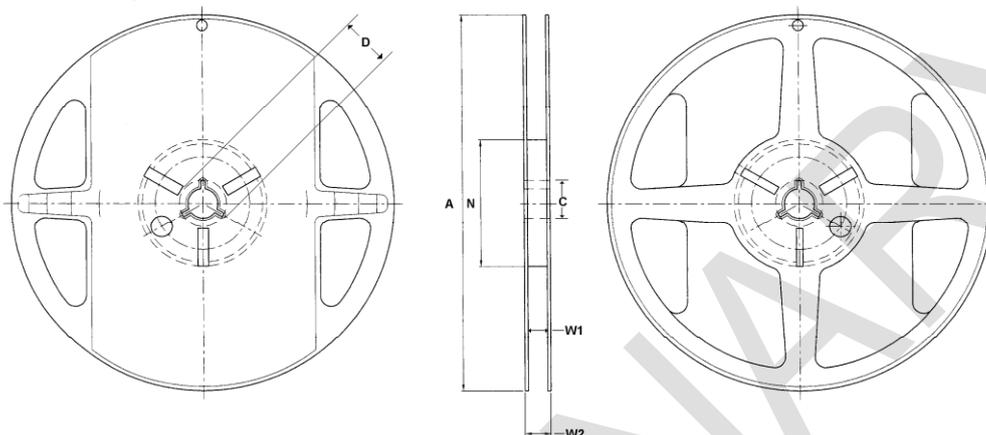


Figure 10 - Reel drawing

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)

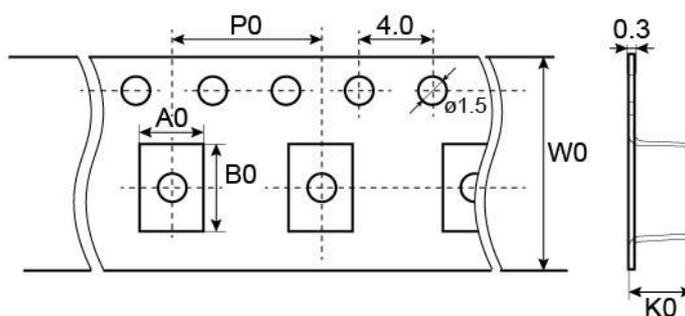


Figure 11 - Tape drawing

Die size [L x W x T]	Cavity dimensions			Carrier tape width W0	Carrier tape pitch P0
	Ao	Bo	Ko		
1.00 x 0.50 x 0.10	0.59	1.09	0.20	8	4
1.00 x 0.50 x 0.25	0.65	1.14	0.33	8	4

Table 7 - Tape dimensions (mm)



**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).

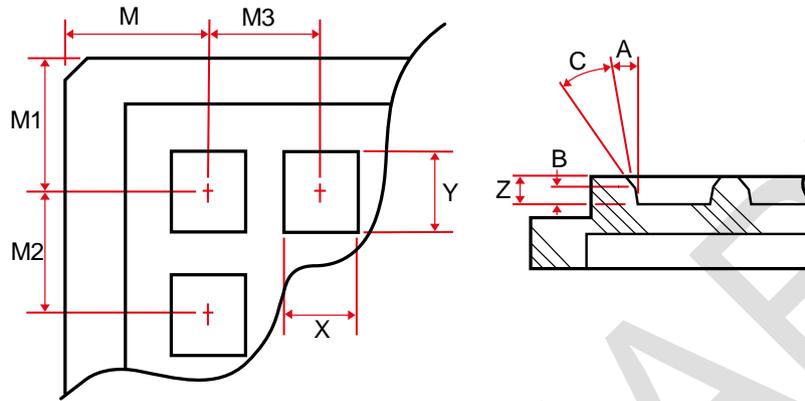


Table 8 - Waffle pack drawing

External dimensions	Max. capacity	Pocket length X	Pocket width Y	Pocket depth Z
2 inches	20 x 20	tbd	tbd	tbd

Table 9 - Waffle pack dimensions (mm) in 250µm thick product

M	M1	M2	M3	A
tbd	tbd	tbd	tbd	tbd

Table 10 - Waffle pack dimensions (mm) for 250µm thick product

External dimensions	Max. capacity	Pocket length X	Pocket width Y	Pocket depth Z
2 inches	20 x 20	tbd	tbd	tbd

Table 11 - Waffle pack dimensions (mm) for 100µm thick product

M	M1	M2	M3	A
tbd	tbd	tbd	tbd	tbd

Table 12 - Waffle pack dimensions (mm) for 100µm thick product



**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.

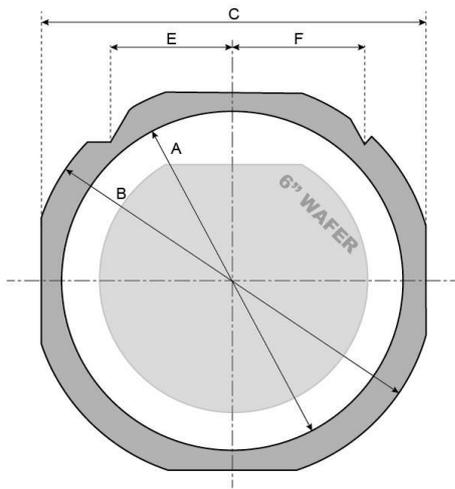


Figure 12 FF070 Frame with a 6" wafer

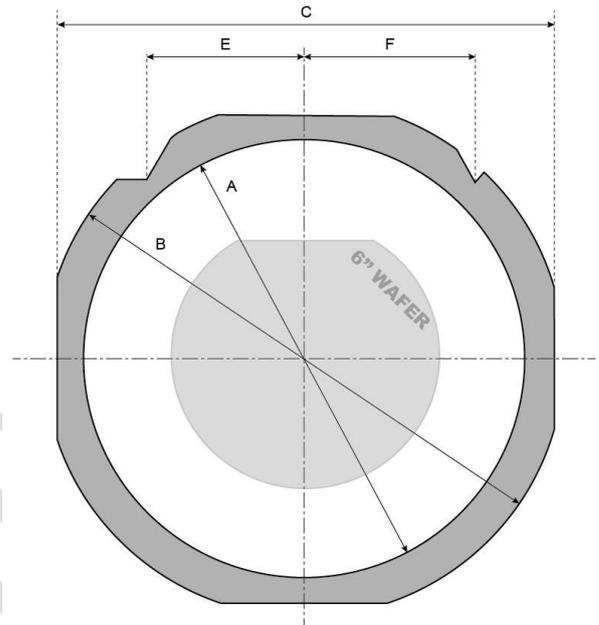


Figure 13 FF108 Frame with a 6" wafer

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 13 - Frame dimensions (inches)

(1) or equivalent



**Expander grip ring 6" diameter:**

With UV curable dicing tape (UV not performed)

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

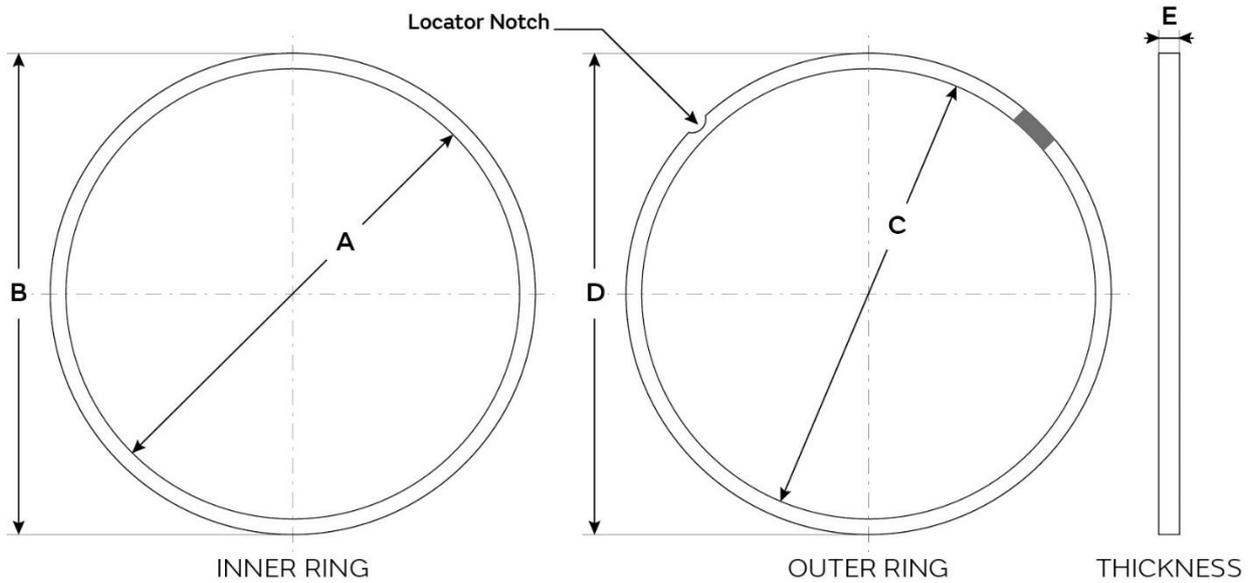


Figure 14 – Grip Ring drawing

Grip Ring Style	A	B	C	D	E	Locator Notch
GRP-2620-6 <sup>(1)</sup>	7.670"	7.973"	7.975"	8.280"	0.236"	None

Table 14 - Frame dimensions (inches)

(1) or equivalent



## 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
Rev 1.00	2010 August 13th	Creation	OGA
Rev 2.04	2020 Sept. 7th	General update	OGA

## Disclaimer / Life support applications

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