Ultra large band Wire bondable Silicon Capacitor UWSC 0202 10nF BV30

Rev. 3.00

General description

UWSC Capacitor targets Optical communication system such as ROSA/TOSA, SONET and all optoelectronics as well as High speed data system or products. The UWSC is suitable for DC decoupling and bypass applications in all broadband optoelectronics and High-speed data system. The unique technology of integrated passive device in silicon, developed by Murata Integrated Passive Solutions, offers unique performances with high rejection up to 26+ GHz. These Ultra large band Wire Bondable MOS vertical Silicon Capacitors (UWSC) have been developed in a semiconductor process, in order to combine ultra-deep trench MOS capacitors for high capacitance value of 10nF and MIM capacitors for low capacitance value of 10pF, both in a 0202-package size. Other capacitance values and other package size are available as a single capacitor or capacitor array; please feel free to contact us.

The UWSC capacitor provides very high stability of the capacitance over temperature, voltage variation as well as a very high reliability. UWSC capacitors have an extended operating temperature ranging from -55 to 150°C, with very low capacitance change over temperature (+70ppm/K).

UWSC 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

- Ultra large band performance to 26 GHz
- Resonance free
- Phase stability
- High rejection at 20 GHz
- Ultra-high stability of capacitance value:
  - Temperature 70ppm/K (-55 °C to +30 °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 0.5 x 0.5 mm (0202 format)
- Break down voltage : 30V
- Low leakage current < 70pA
- High reliability
- High operating temperature (up to 150 °C)
- Compatible with high temperature cycling during manufacturing operations (exceeding 300 °C)
- Compatible with EIA 0202 footprint
- Applicable for standard wire bonding assembly (ball and wedge)

Key applications

- ROSA/TOSA
- SONET
- High speed digital logic
- Microwave/millimetre system
- High volumetric efficiency (i.e. capacitance per unit volume
- Broadband test equipment

Functional diagram

The next figure provides implementation set-up diagram.

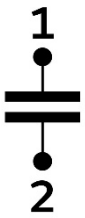

Figure 1 Block Diagram

Electrical performances

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
C	Capacitance value	@+25°C	-	10	-	nF
ΔC_P	Capacitance tolerance (1)	@+25°C	-15	-	+15	%
T_{OP}	Operating temperature		-55	-	150	°C
T_{STG}	Storage temperature (2)		-70	-	165	°C
ΔC_T	Capacitance temperature variation	-55 °C to 30 °C	-	70	-	ppm/K
RV_{DC}	Rated voltage (3)		-	10	16(4) 13.6(5)	V_{DC}
BV	Break down voltage	@+25°C	30	-	-	V
ΔC_{RVDC}	Capacitance voltage variation	From 0 V to RV_{DC}, @+25°C	-	-	0.02	$\%/V_{DC}$
IR	Insulation resistor	@RV_{DC}, +25°C, 120s	10	-	-	GΩ
ESL	Equivalent Serial Inductance	@ SRF, +25°C	-	3	-	pH
ESD	HBM stress (6)	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): please refer to application note 'ESD Challenge in 3D Murata Integrated Passive technology'

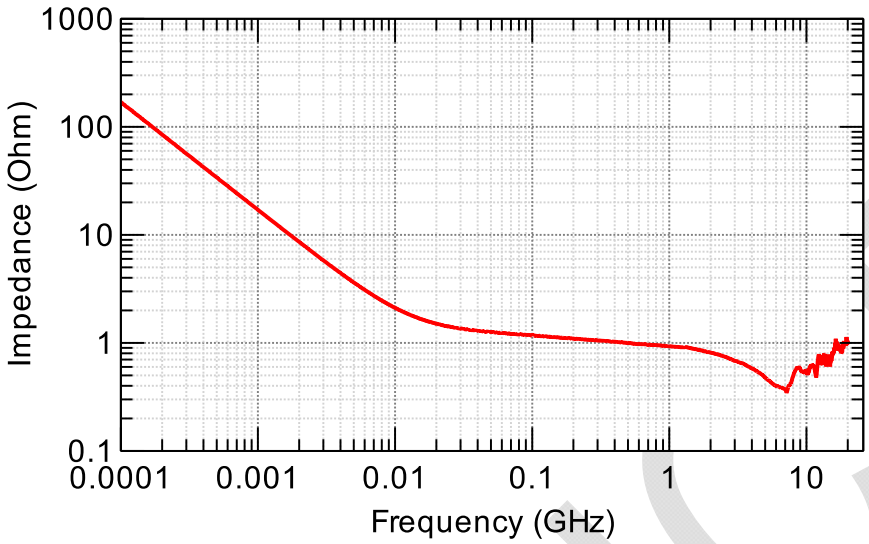

Figure 2 Impedance characteristic versus Frequency in shunt mode

Schematic of 10nF UWSC in Shunt mode

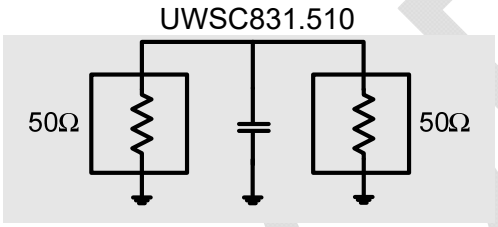

Figure 3 - 10nF UWSC measurement schematic

Example of mounted 0202

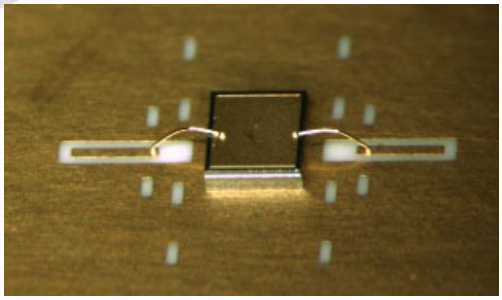

Figure 4 – micro picture of mounted 0202 UWSC

Pinning definition

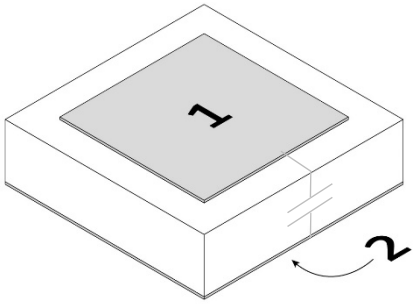

Figure 5 Pinning definition

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

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

Type number	Package		
	Packaging	Finishing	Description
935153831510-F1T	6” FFC(1)	Au(2)	UWSC 10nF/0202 – 1 bondpad – 0.50 x 0.50mm x
935153831510-F2T	8” FFC(1)	Au(2)	UWSC 10nF/0202 – 1 bondpad – 0.50 x 0.50mm x
935153831510-E1T	6” expander grip ring(1)	Au(2)	UWSC 10nF/0202 – 1 bondpad – 0.50 x 0.50mm x
935153831510-T3T	T&R 1Kunits(4)	Au(2)	UWSC 10nF/0202 – 1 bondpad – 0.50 x 0.50mm x
935153831510-W0T	Waffle pack 400units	Au(2)	UWSC 10nF/0202 – 1 bondpad – 0.50 x 0.50mm x
935154831510-F1T	6” FFC(1)	Au(2)	UWSC 10nF/0202 – 1 bondpad – 0.50 x 0.50mm x
935154831510-F2T	8” FFC(1)	Au(2)	UWSC 10nF/0202 – 1 bondpad – 0.50 x 0.50mm x
935154831510-E1T	6” expander grip ring(1)	Au(2)	UWSC 10nF/0202 – 1 bondpad – 0.50 x 0.50mm x
935154831510-T3T	T&R 1Kunits(4)	Au(2)	UWSC 10nF/0202 – 1 bondpad – 0.50 x 0.50mm x
935154831510-W0T	Waffle pack 400units	Au(2)	UWSC 10nF/0202 – 1 bondpad – 0.50 x 0.50mm x

(1) Other film frame carrier are possible on request
(2) Au = TiWAu (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
UWSC831.510	WR0202510	UWSC 10nF/0202/BV30 – 1 bondpad – 0.50 x 0.50mm x 0.25mm
UWSC831.510	WR0202510	UWSC 10nF/0202/BV30 – 1 bondpad – 0.50 x 0.50mm x 0.10mm

Table 4 - Die information

Pad Metallization

The wire bondable capacitor like UWSC is delivered as standard with the bottom electrode in TiNiAu (Ti=0.1µm; Ni=0.3µm; Au=0.2µm) and top electrode in TiWAu (0.3µm) / Au (3µm).

Other Metallization, such as Thick Gold or Aluminum 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.

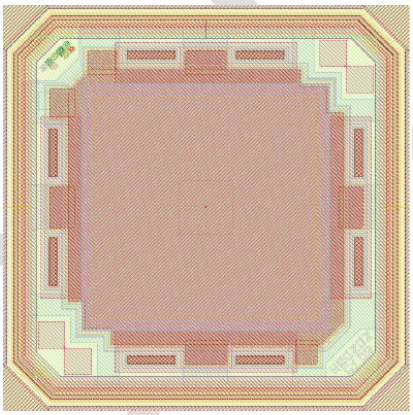

Figure 6 – layout view

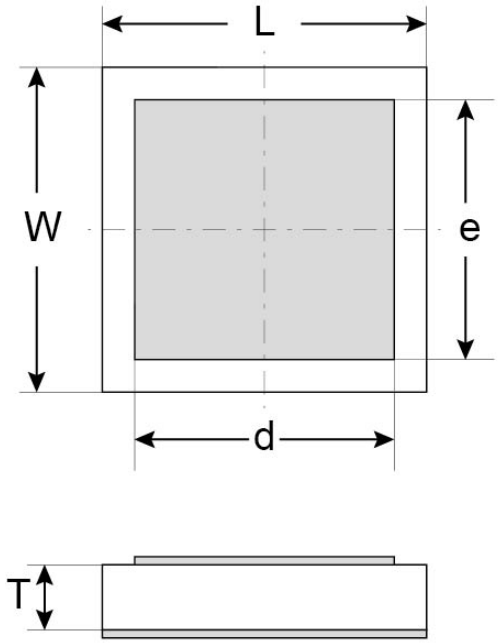

Figure 7 - Package outline drawing

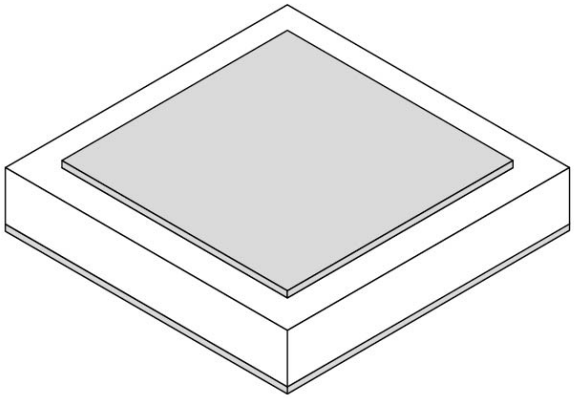

Figure 5 - Package isometric view

L (mm)	W (mm)	T (mm)	d (mm)	e (mm)
0.50 ±0.03	0.50 ±0.03	0.25 or 0.10 ±0.015	0.258	0.258

Table 5 - Dimensions and tolerances

Assembly

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 8 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.

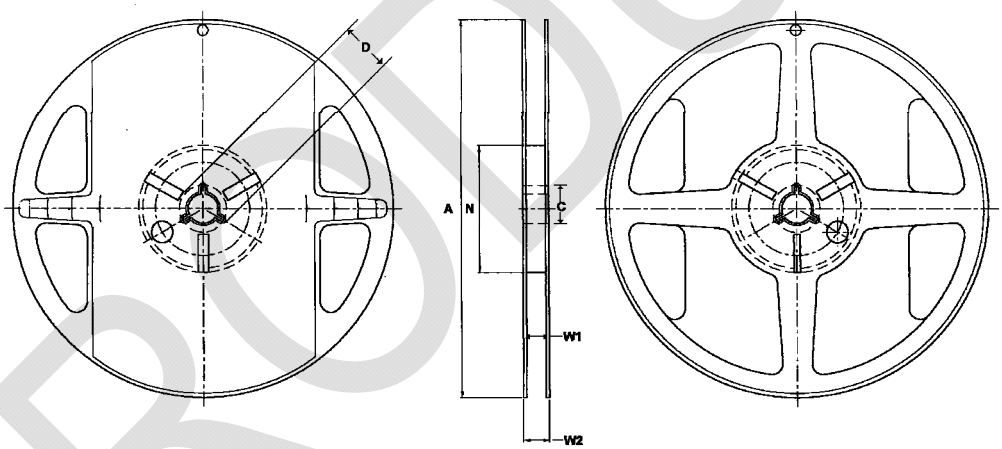

Figure 9 - Reel drawing

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)

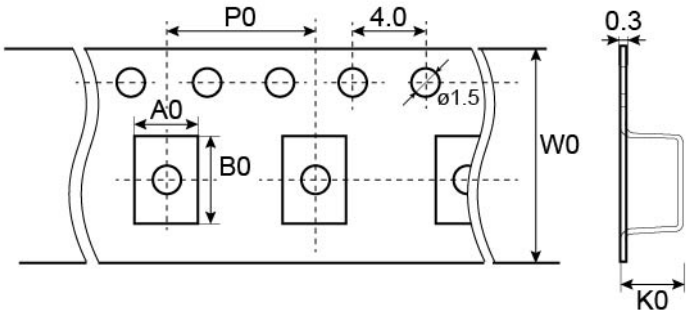

Figure 10 - Tape drawing

Cavity dimensions			Carrier tape width W0	Carrier tape pitch P0
Ao	Bo	Ko		
0.56	0.56	0.31	8 mm	4mm

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).

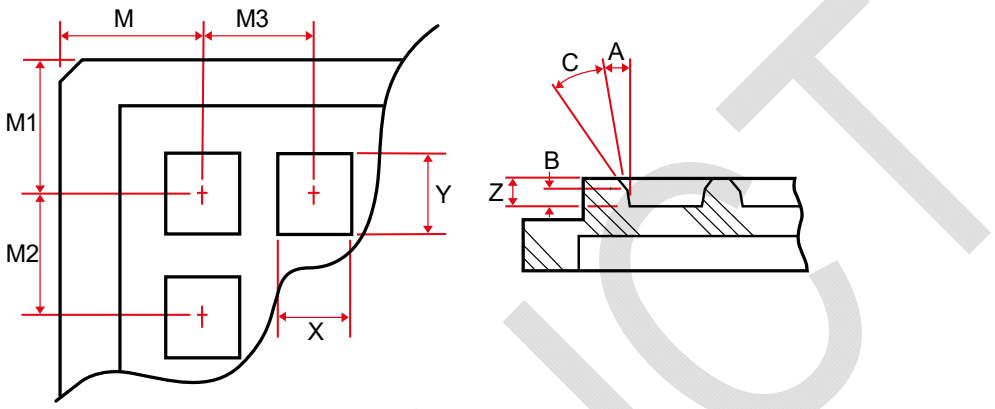

Table 8 - Waffle pack drawing

External dimensions	Max. capacity	Pocket length X	Pocket width Y	Pocket depth Z
2 inches	20 x 20	0.64 ±0.05	0.64 ±0.05	0.36 ±0.05

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

M	M1	M2	M3	A
4.65 ±0.08	4.65 ±0.08	2.18 ±0.05	2.18 ±0.05	15° ±1/2°

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	0.58 ±0.05	0.58 ±0.05	0.28 ±0.05

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

M	M1	M2	M3	A
4.89 ±0.08	4.89 ±0.08	2.16 ±0.05	2.16 ±0.05	18° ±1/2°

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.

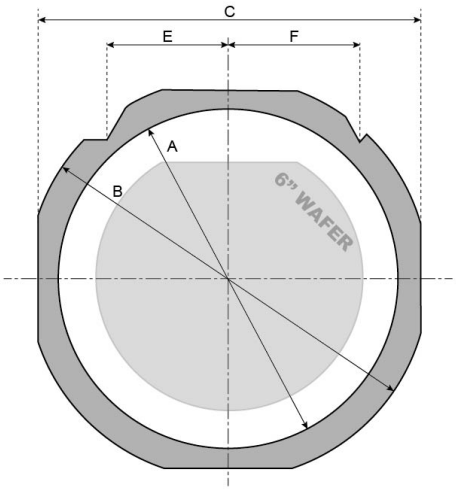

Figure 11 FF070 Frame with a 6" wafer

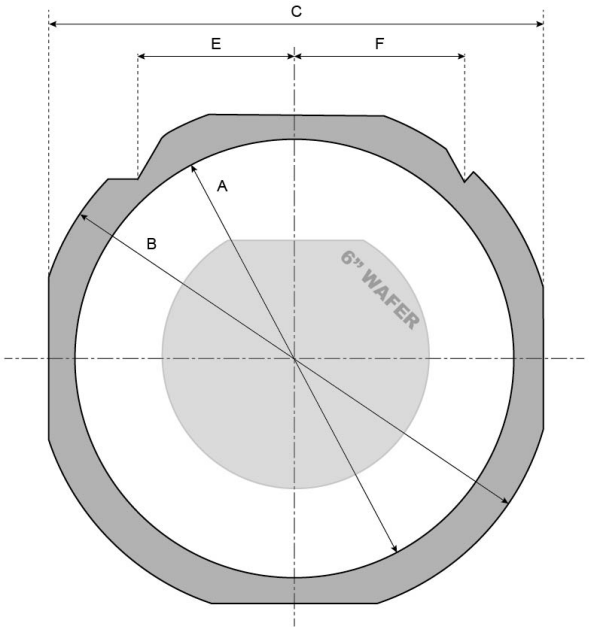

Figure 12 FF108 Frame with a 6" wafer

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 performed)

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

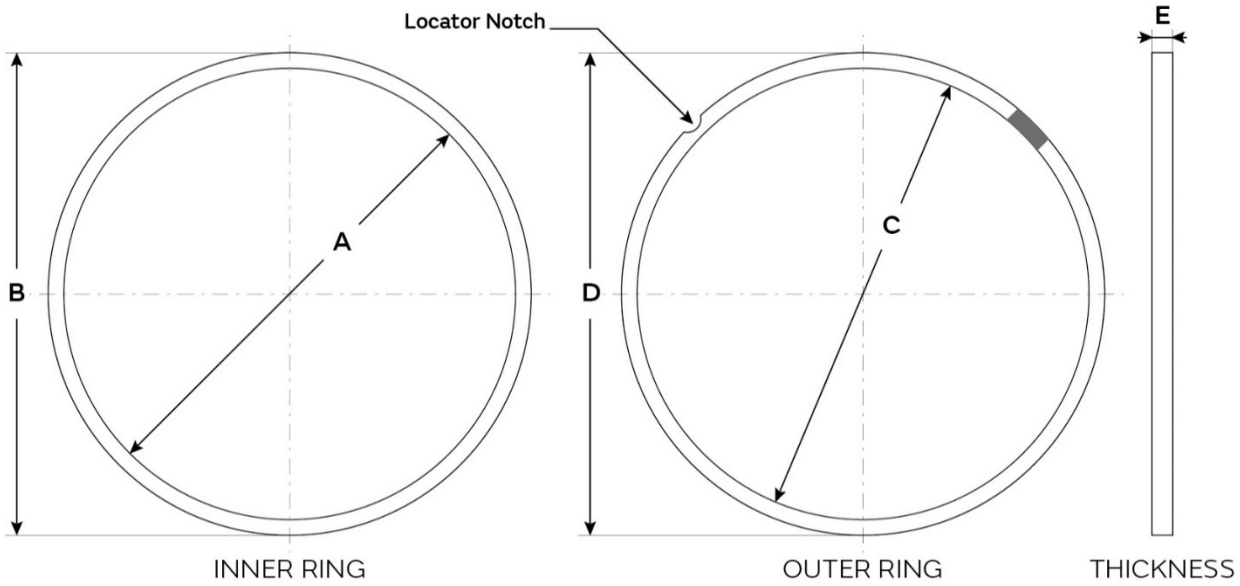

Figure 13 – Grip Ring drawing

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 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
Release 1.00	2014 July 25th	Creation	OGA
Release 2.05	2018 April 23th	Transfer FBC 0001	MSI / OGA
Release 3.00	2021 April 09th	Minor changes	LLR/SCA/CGU/ OGA

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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