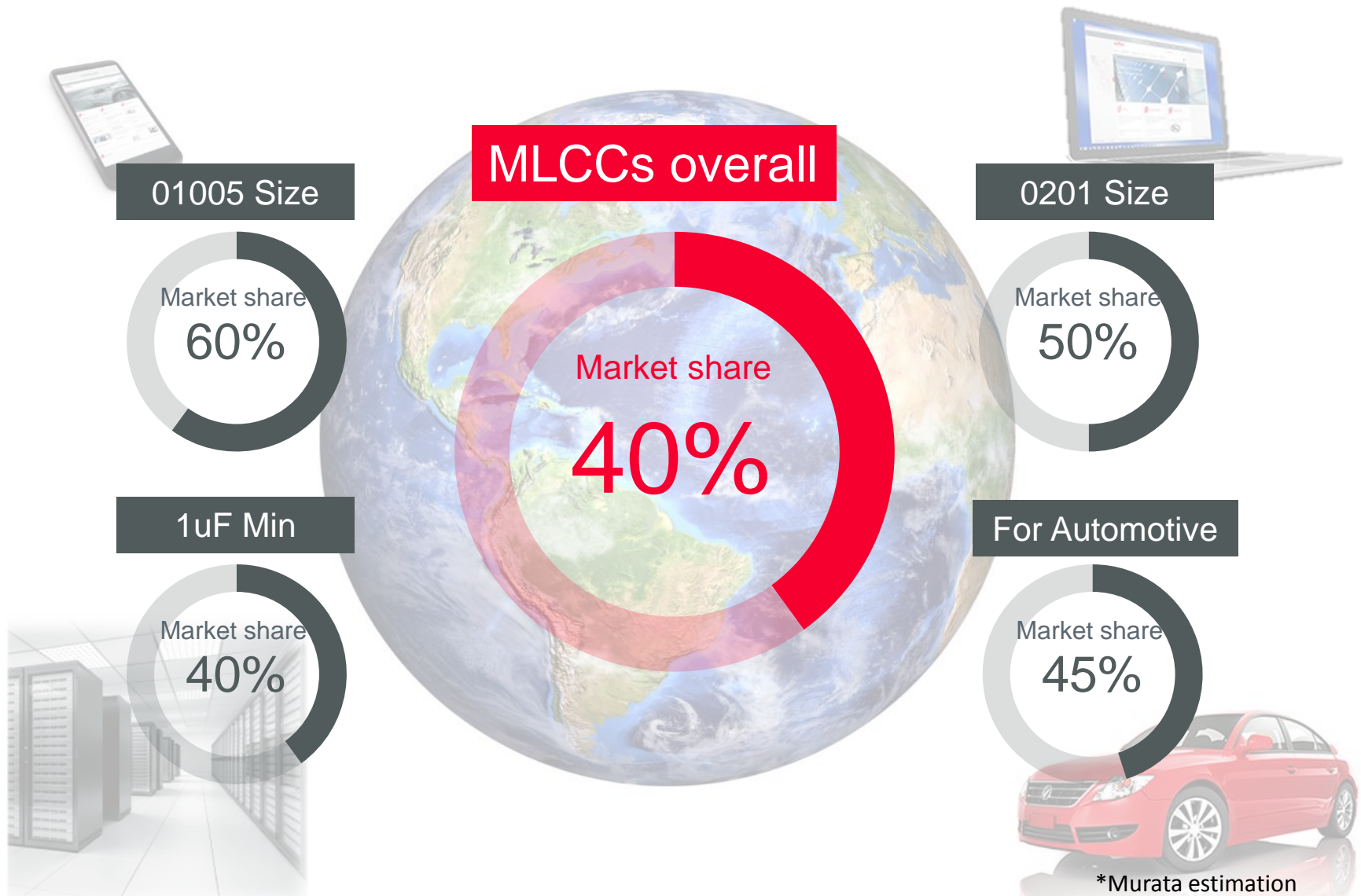


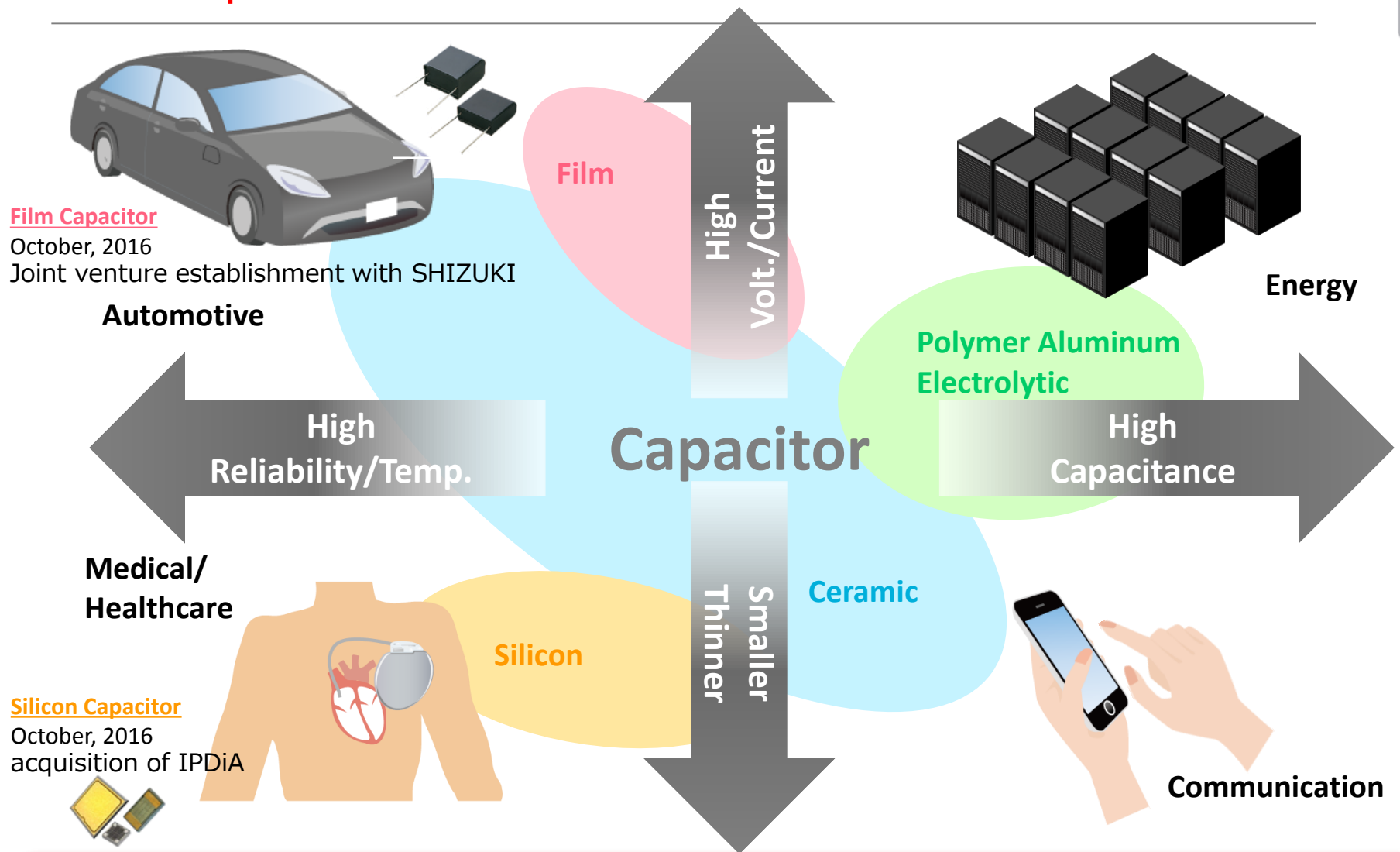
The downsizing guide line



Murata Core Business - MLCC!



As a capacitors house



We will expand the business as a leading company of capacitors by M&A and alliance.

Extensive lineup of Murata capacitors

Small, Thin & High-Cap.



Ultra Small Size
(008004, 01005, 015008, 0201)



High Capacitance
(~470uF, 2.5V~100V)



Polymer Electrolysis
(~560uF, 2.5V~25V)



Low ESL
(~27uF)



Silicon capacitors



Safety Recognized
(Safety standard certified)



Wire bondable
(0303, ~0.47uF)

High Reliability



Automotive
(ISO9001, AEC-Q200, TS16949)



Implant Class D




Aerospace



Soft Terminal
(ISO9001, AEC-Q200, TS16949)




Epoxy Coating
(ISO9001, AEC-Q200, TS16949)
(~2kV, ~220uF)



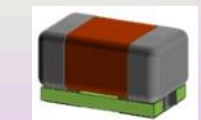
Metal Terminal
(ISO9001, AEC-Q200, TS16949)
(25V~1kV, ~100uF)



High temperature Film cap
(450V, 500V)



High Q
(25V~500V, 1GHz~10GHz)

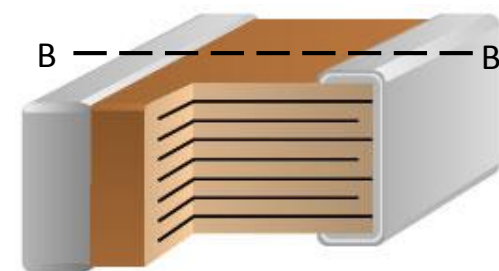


Anti Acoustic noise
(1608M, ~47uF)

Application Specific

MLCC technology road map

Higher Capacitance MLCC ! by not only material, but also the accuracy improvement for stacking and printing process.

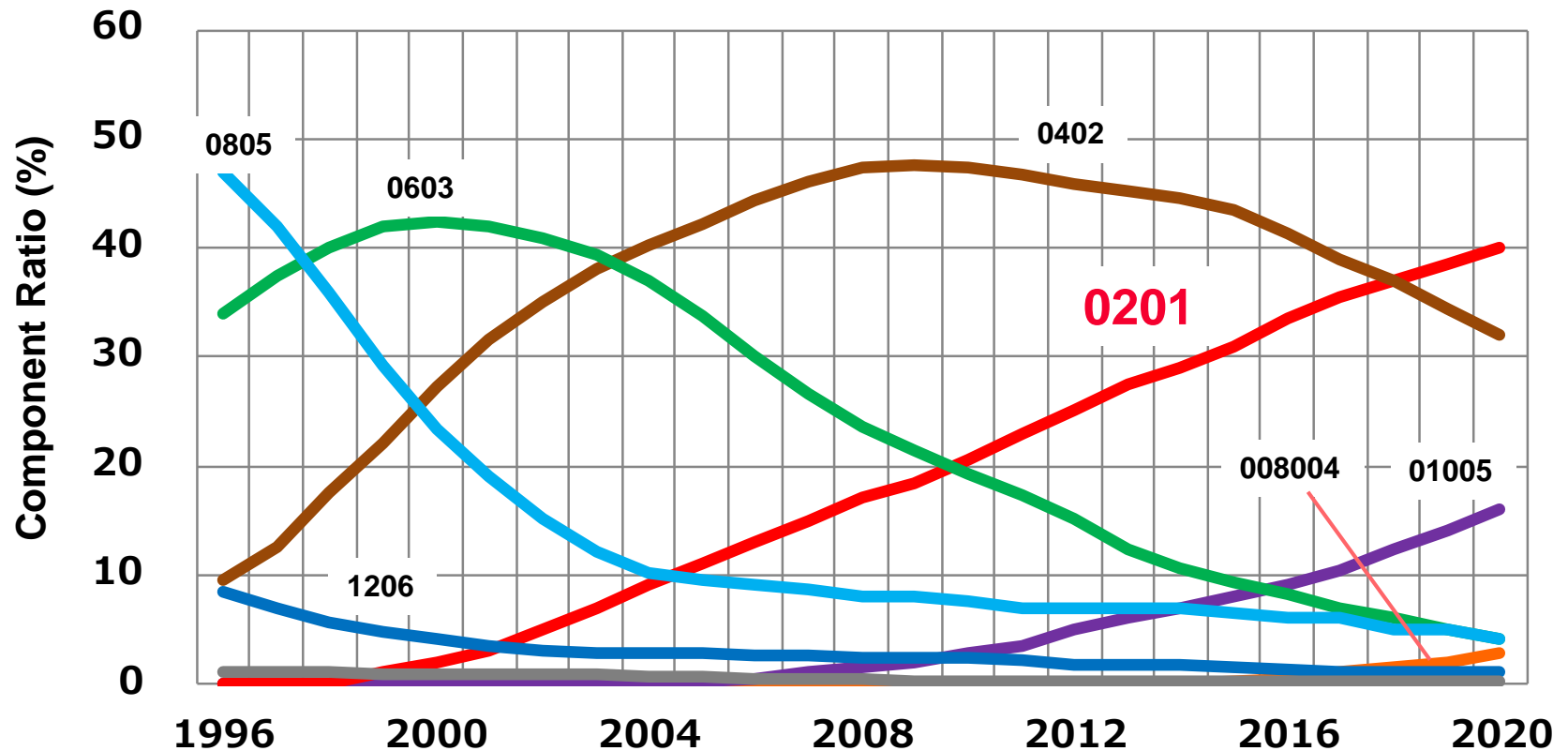


B-B' Cross section of 1210/330uF

- Dielectric layer thickness:1um
- Number of layer:1400

MLCC Size Trend in Overall market

Rapid adoption of smaller MLCC size is expected. 0201 is major size in the market.



Source : Murata Manufacturing Co., Ltd.

MLCC quantity comparison by size



$$1210: 3.2\text{mm} \times 2.5\text{mm} \times 2.5\text{mm} \times \underline{10 \text{ pcs}} = \underline{200\text{mm}^3}$$

$$0201: 0.6\text{mm} \times 0.3\text{mm} \times 0.3\text{mm} \times \underline{3700 \text{ pcs}} = \underline{200\text{mm}^3}$$



Proposal of downsizing

Purpose

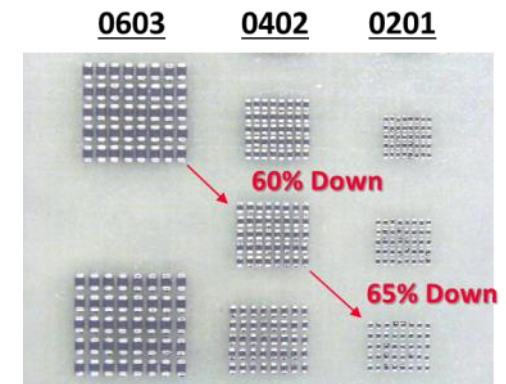
- >To realize more sufficient supply with increasing of the production quantity by downsizing.
- >To support the optimization of your design.

Approach

General application

Low cap ($<1\mu\text{F}$) : 0805/0603/0402 → 0201 or less

High cap ($\geq 1\mu\text{F}$) : Smallest case size is recommended.



Summary of recommended products

Series	Rated voltage	Class	Capacitance	Recommendation
GRM/GRJ series (General use)	$\leq 100\text{Vdc}$	* ¹)Class 1	All	The smallest case size in the product line-up.
		* ²)Class 2	Low cap. (<1 μF)	0201 case size or smaller.
			High cap. ($\geq 1\mu\text{F}$)	The smallest case size in the product line-up.
GC*/GRT series (Automotive use)	$\leq 100\text{Vdc}$	* ¹)Class 1	All	The smallest case size in the product line-up.
		* ²)Class 2	Low cap. (<1 μF)	0402 case size or smaller.
			High cap. ($\geq 1\mu\text{F}$)	The smallest case size in the product line-up.

*¹)Class 1 : Temperature Compensating Type (e.g. C0G, U2J, X8G)

*²)Class 2 : High Dielectric Constant Type (e.g. X5R, X6S, X7R, X7S, X8R)

Note

This is a summary based on the product status.

For the details, please check the product status and specification of individual products in Murata web site.

Benefit to the customers

	Benefit to the Customers		
	Price	Characteristics	Supply Flexibility
Low –Cap(<1uF)	depends on P/N	Not so significant difference	Smaller is better
High-Cap(\geq 1uF)	depends on P/N	Remaining cap. is lower	Smaller is better

Please kindly select higher capacitance value if you needed .

Electrical characteristics

- **Impedance characteristics**
Smaller case size is better than bigger case size
- **DC bias characteristics**
Smaller case size is worse than bigger case size
(Higher nominal capacitance might be required .)

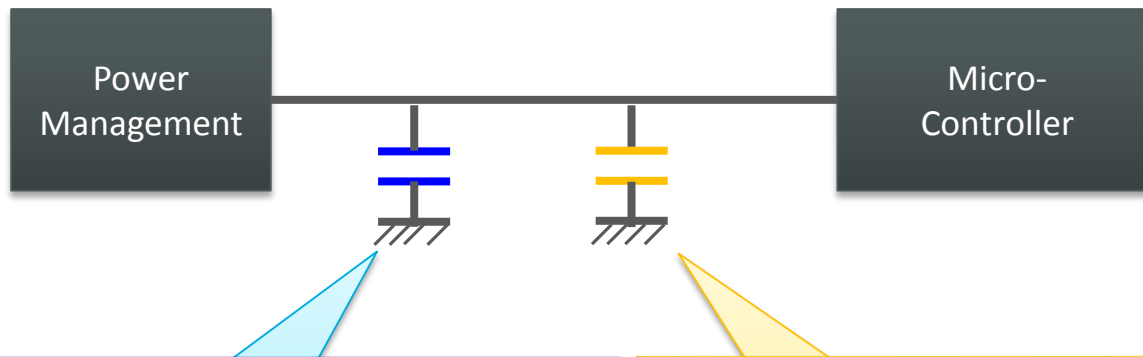
Mechanical stress

- Need to pay attention when designing PCB with smaller case size MLCC.

Mounting of 0201

- Need to change the PCB design , assembly condition

Approaching of down-sizing



High cap. products ($\geq 1\mu\text{F}$)
Smallest case size
(0201 and more)

Bulk Capacitor

Key function:

To supply the electrical charge

Key parameter:

Effective capacitance at the
operating condition

➔ To check DC-bias, Temperature char.

Low cap. products ($< 1\mu\text{F}$)
0201

Decoupling Capacitor

Key function:

Noise suppression

Key parameter:

Actual Impedance at the operating
condition

➔ To check Impedance char.

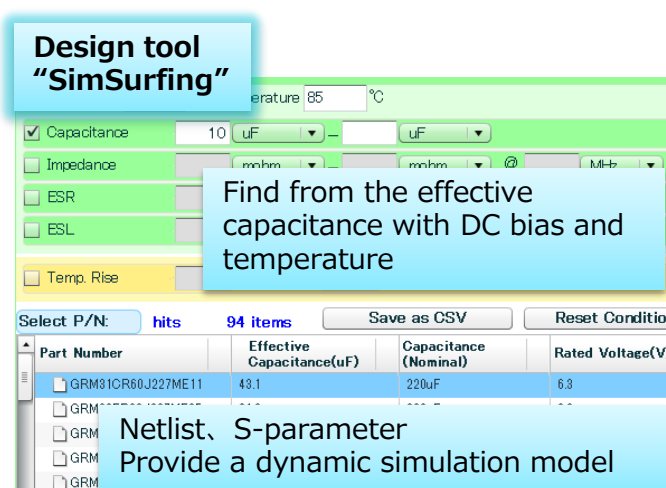
Support the design-in with the **"SimSurfing"** design support tool

If you are looking for a capacitor, use Murata's product search in **"pSearch"** on our web site.

**Design tool
"SimSurfing"**

Find from the effective capacitance with DC bias and temperature

Netlist, S-parameter
Provide a dynamic simulation model



**Product search
"pSearch"**

Comparison of multiple part number

Strong deflection crack resistant capacitor?
Find from the "Need" help!



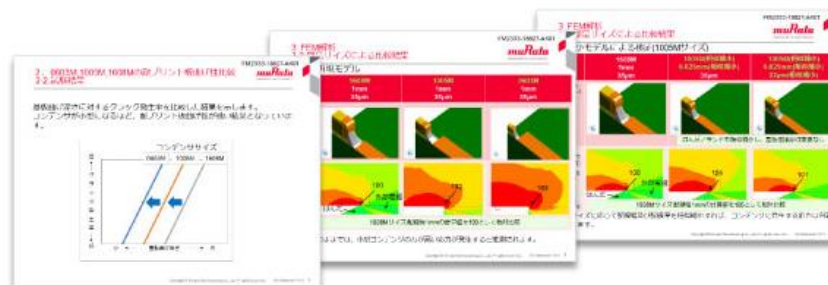
URL : <https://ds.murata.co.jp/simsurfing/mlcc.html?lcid=en-us>

URL (How to use) : <https://www.murata.com/en-global/tool/howtousevideo>

Guideline for Mechanical stress

Due to the increased risk of cracking caused by board bending, caution is required when switching from a 0402 size or larger capacitor to 0201 inch size and changing only the land size.

An explanation of the mechanism behind the risk increase and the measures to take for safe use are summarized in the following document.



Important Points Associated with the Miniaturization of Chip Multilayer Ceramic Capacitors — Board Design Recommendations —

(Created on Sept. 28, 2018)

Please download the document from this page to check the latest information.

Download PDF 

Murata web site

<https://www.murata.com/en-global/support/faqs/products/capacitor/mlcc/mnt/0030>

The pad design of Printed Circuit Board and the design of Metal mask Opening

Murata recommended Pad design is following .

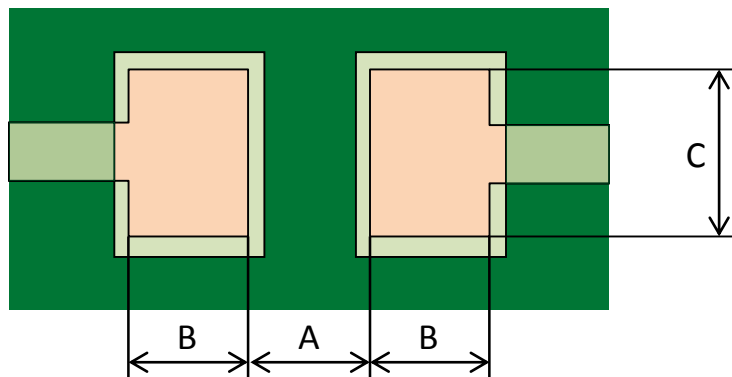
If you have any question ,please feel free to contact Murata .

Pad design	Pad / Mask Opening			Stencil thickness	Solder Particle size
	A [μm]	B [μm]	C [μm]	[μm]	[μm]
GRM033 series 0.6(L) \times 0.3(W) \times 0.3(T) muRata Catalog design	200 \sim 300	200 \sim 350	200 \sim 400		
GRM033 series Recommend Design	250	280	300	80 \sim 120(*1)	20 \sim 30

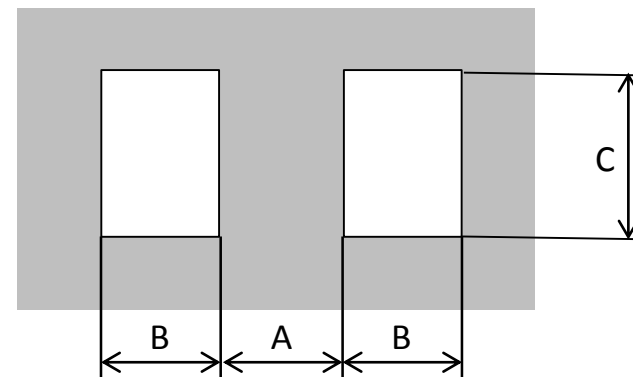
(*1)The filet type ,mask thickness : less than 120 μm ,

The filet-less type , the mask thickness : less than 100 μm

Pad Design



Mask Opening Design



The request to reduce the concerning about MLCC delivery

- Please select smallest products in murata web and line up.
- Please do not select NRND and TBD products for new project .

Technical point for downsizing

- Murata would like to suggest to clarify „Function of capacitors“ and focus on „Key parameters“ to consider the suitable alternative small case size product.
 - Low cap. products → Decoupling → Filter → Impedance
 - High cap. Products → Bulk cap → Electrical charge → DC-bias Char
- You can check the electrical characteristics on murata web site /simurfing .

Thank you !!