MLCC Downsizing Proposals

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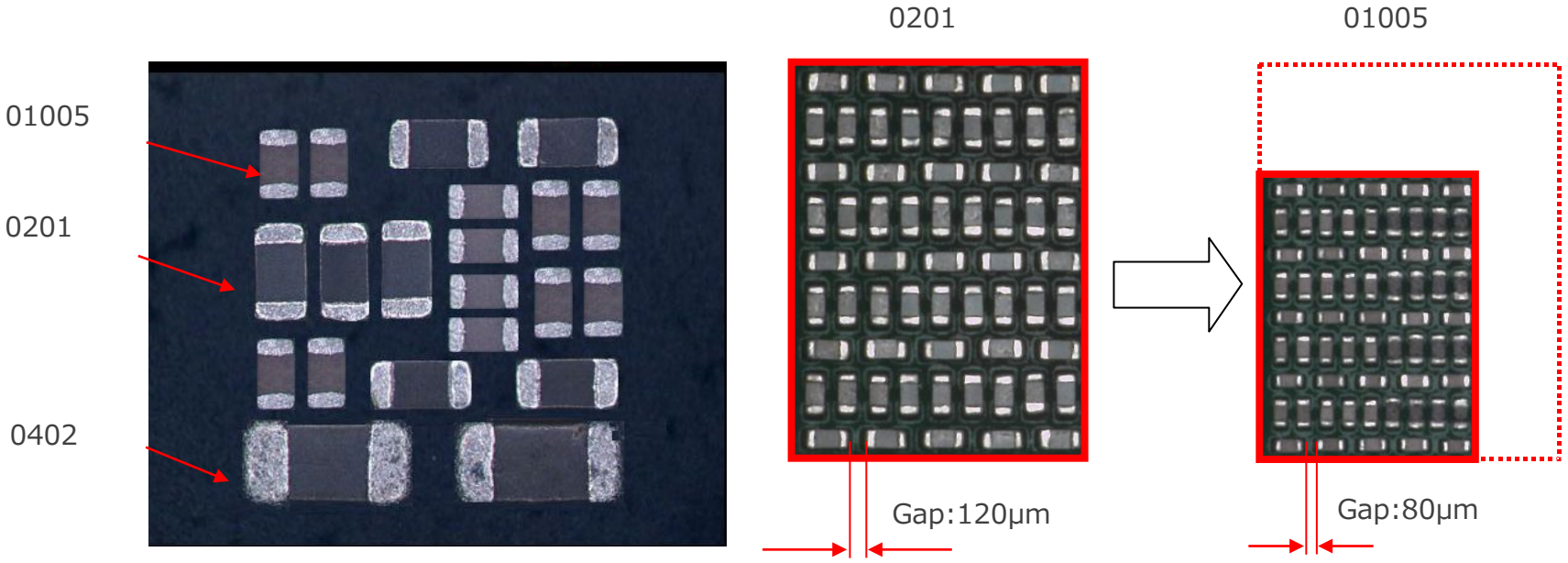
3. Recommended land pattern
4. Points in downsizing (mounting)

1. Benefits of MLCC downsizing

The following benefits can be expected by downsizing.

- Circuit miniaturization through area effective usage
- High-frequency characteristic improvement
- Environmental impact reduction (total energy reduction)

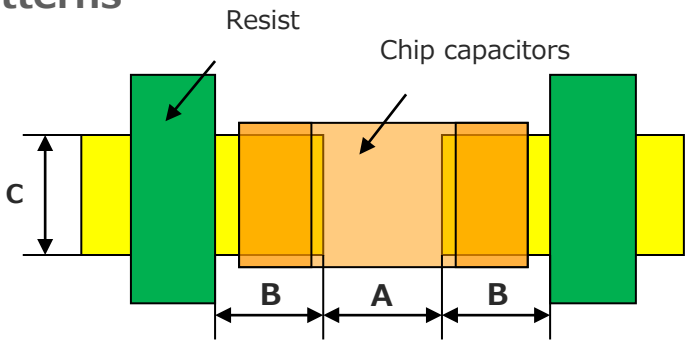
2. High-density mounting example



[unit:inch]	0402	0201	01005
Area	0.50mm^2	0.18mm^2	0.08mm^2
Area ratio (0402 size standard)	100%	36%	16%
Area ratio (0201 size standard)	-	100%	44%
Volume	0.250mm^3	0.054mm^3	0.016mm^3
Volume ratio (0402 size basis)	100%	22%	6%
Volume ratio (0201 size reference)	-	100%	30%

3. Recommended land pattern

● **Examples of land patterns**



< Standard size >
01005 ⇒ L:0.40±0.02mm / W(T):0.20±0.02mm
0201 ⇒ L:0.60±0.03mm / W(T):0.30±0.03mm

Size [unit:inch]	A	B	C
01005	0.15 to 0.25mm	0.15 to 0.20mm	0.15 to 0.30mm
0201	0.20 to 0.30mm	0.20 to 0.30mm	0.25 to 0.40mm

The recommended land dimensions in our company catalog are based on the assumption that the largest or smallest of the chip's dimensional specifications are mounted. Even for chips of the same size, the recommended land dimensions may differ if the dimensional tolerances differ significantly.

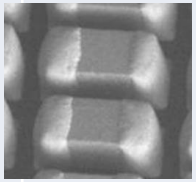
Note:The numerical data are recommended values alone, and the quality of mounting is not guaranteed. Kindly check with the customer.

4. Points in downsizing (mounting)

Points in downsizing (mounting)

Factors that determine mounting quality

Solder control	High-precision mounting	High-precision land pattern	Adsorption
・**Printing machine** Printing accuracy Printing quantity Cleaning frequency Leaving time ・**Metal mask** Metal mask thickness Dimensions and shape of openings Opening position accuracy/wall shape ・**Solder** Solder composition Particle size Type and quantity of flux Viscosity/moisture absorption characteristics	・**Mounting machine** Mount accuracy Part holding amount Nozzle design Vacuum control	・**Substrate** Land/resist dimensions and shape Land position accuracy Resist position accuracy Surface treatment Substrate warp Adsorption characteristics of the substrate	・**Parts/Tape** Shape Dimensions Electrode dimensions Measures against burrs and fluffs Measures against static electricity



Trouble cases and countermeasures

●Past mounting trouble cases

Trouble Case study	Factor	Phenomena	Countermeasures
Adsorption error	Static electricity	Static electricity causes chip pop-out in cover tape peeling during mounting. Chip pop-out, non-adsorption, or stand-up adsorption failure occurs.	Anti-static measures such as humidity control in the mounting environment (process)
Adsorption error	Feeder feed accuracy	Adsorption error occurs due to unstable tape feed operation of feeder during mounting.	Feed accuracy check and maintenance by feeder condition check
Misplaced mounting	Land design	Many Manhattan (chip stand) defects after reflow	Optimal land pattern design
Misplaced mounting	Nozzle dirt	Chip position-recognition correction error due to dirt sticking to the nozzle tip, resulting in a mounting error	Nozzle maintenance, revision of maintenance level, etc.
Misplaced mounting	Recognition nonconformity	Improper external shape recognition against chip shape causes misalignment of mounting.	Measures need to be taken for both parts and mounting equipment.
Chip damage	Mounting load	Nozzle load pressure mismatch leads to chip breakage.	Use a proper nozzle load pressure mounting machine.
Poor connection	Solder printing	A mismatch between the solder and the metal mask causes poor solder printability and connection.	Design of metal masks, selection of solder, etc.

The contents of this report are the main points we have grasped so far and not all points are covered.

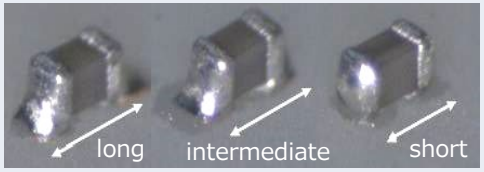
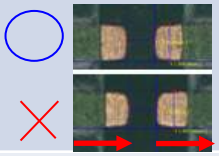
Items of concern in downsizing

●Examples of measures for items of concern (There are points to keep in mind regarding the board, material and equipment.)

Items of concern	Factors	Phenomena	Countermeasures
Land design	Solder amount	To make thin solder, use thin metal mask. In this case, with a mask of the same opening size, the solder amount is reduced.	Design for metal mask thickness, land pattern design, etc., assuming the required amount of solder after reflow
Metal mask design	Solder pullability	Decreased solder pullability due to reduced solder volume	Reduced roughness of the machined surface of a metal mask or utilization of surface treatment, etc.
Corresponding to printing machine	Printing accuracy	Solder quantity control error due to downsizing	Metal mask design, land design consideration
Corresponding to mounter	Mounting accuracy Mounting quality	Mounting failure caused by misalignment due to downsizing	Equipment response: Review of operation accuracy, camera correction accuracy, etc. Soft response: Focus on self-alignment effect by using solder position reference rather than land reference when mounting, etc.

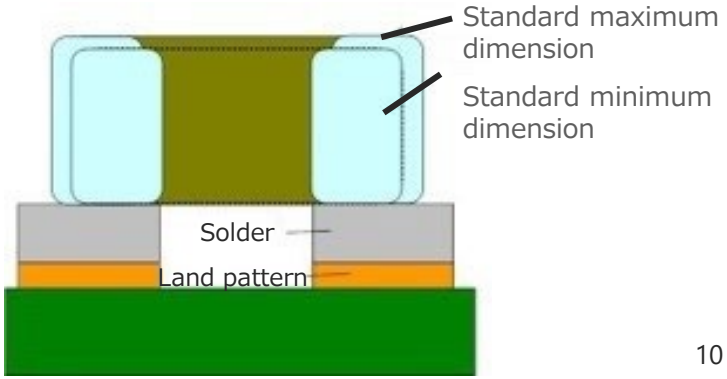
The contents of this report are the main points we have grasped so far and not all points are covered.

● Board concerns and countermeasures

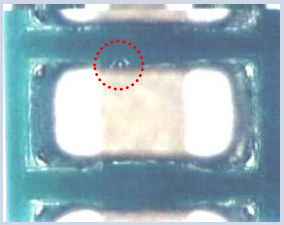
Items of concern	Trouble cases	Phenomena	Factor	Measures
Land pattern surface condition	Poor wettability	Poor solder wettability on land pattern	Oxidation Land dirt	Surface treatment Stain prevention
Land pattern design	Manhattan (Chip standing) Misalignment	Unsuitable land pattern 	Not suitable for chip shape	Best land pattern setting
Resist misalignment		Small land dimension 	Resist printing misalignment	High-precision substrate design
Resist thickness		Tilt of the chip	Resist thickness variation	High-precision substrate design

Land pattern example

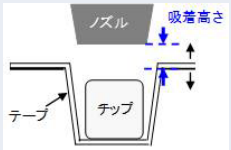
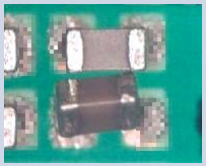
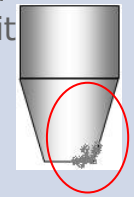
Set pattern considering the maximum and minimum dimensions of the chip standard



●Items of concern and measures for members

Items of concern	Trouble cases	Phenomena	Factor	Measures
Solder	Solder amount variation	The amount of solder Low	Solder grain size is larger than opening area.	Re-selection of solder Optimization of solder grain size
Metal mask			Thick metal mask Poor solder removal	Revised thickness of metal mask Roughness of the machined surface of the metal mask such as reduction or surface treatment utilization
	Solder leaching		・Back soldering ・Solder ball	Metal mask cleaning

●Items of concern and measures for equipment

Items of concern	Trouble cases	Phenomena	Factor	Measures
Corresponding to printing machine	Print position shift		・Land position shift on the Substrate ・Metal mask plate position accuracy	・Substrate positioning ・Metal mask positioning
Corresponding to mounter	<When adsorbed> Not adsorbed Adsorption misalignment		・Adsorption height ・Nozzle clogging	・Adsorption height optimization ・Nozzle management review ・Regular cleaning
	<At mounting> Misplaced mounting		・Recognition nonconformit ・Nozzle dirt 	・Recognition optimization ・Nozzle management review ・Regular cleaning
Corresponding to reflow furnace	Chip Stand		・Effect of furnace atmosphere ・Positional misalignment at the time of mounting	・Oxidation suppression by N_2 atmosphere ・Optimization of reflow profile
	Nonconformity of finish soldering		・N_2-atmosphere nonconformity in furnace ・Reflow-profile nonconformity	・Oxidation suppression by N_2 atmosphere ・Optimization of reflow profile

Summary

- The factors that determine the quality of mounting are not only the components themselves, but also other factors such as the board design, the equipment used, the components, the environment, and so on.

- Taiyo Yuden can also propose from this perspective.

- Please contact us for details.

https://www.yuden.co.jp/ut/contact/pro_priv.php

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