essemtec
A NANODIMENSION DIVISION

Brushless Motor Project

Kevin Domancich 01.04.2022

AGENDA

1. PCB Quality Control
2. SMT Programming
3. Machine Configuration and Setup
4. PCB Population
5. Reflow Profile
6. Results

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PCB QUALITY CONTROL

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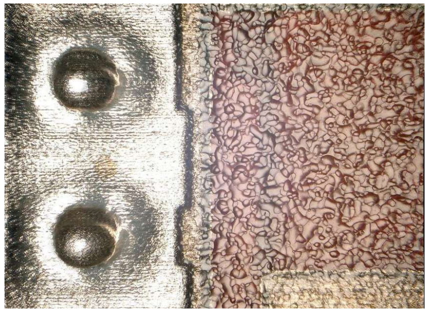
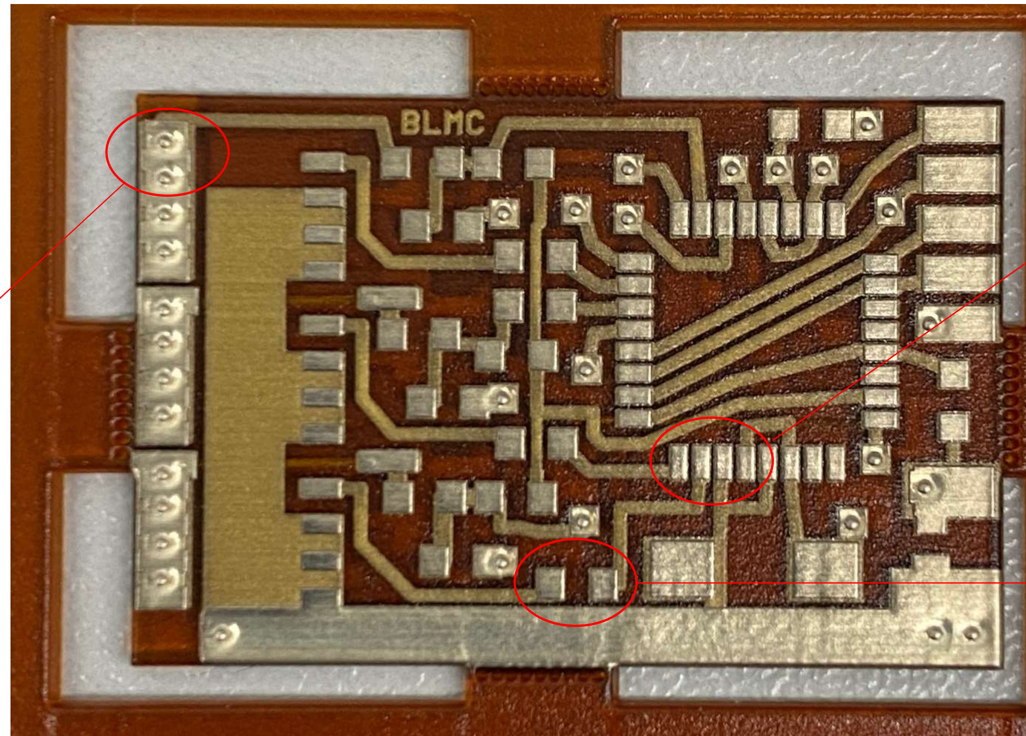
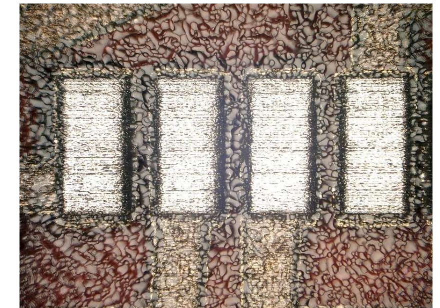
BLMC TOP PCB
INCOMING INSPECTION PRIOR TO POPULATING

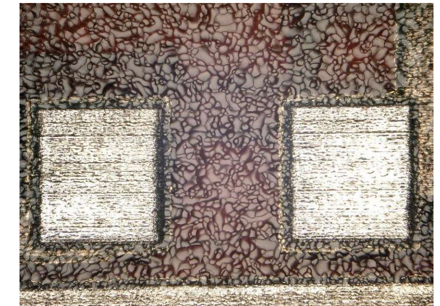


Raised pillars around Top side of PCB





IC Pads



0603 Pads

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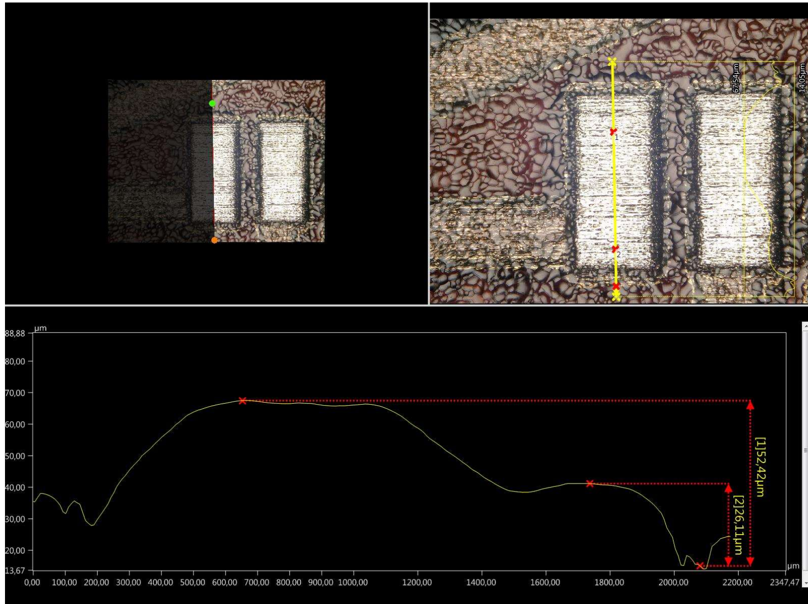
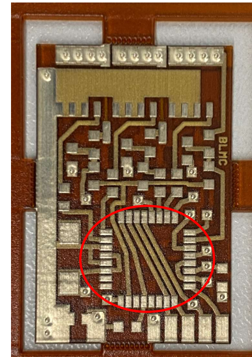
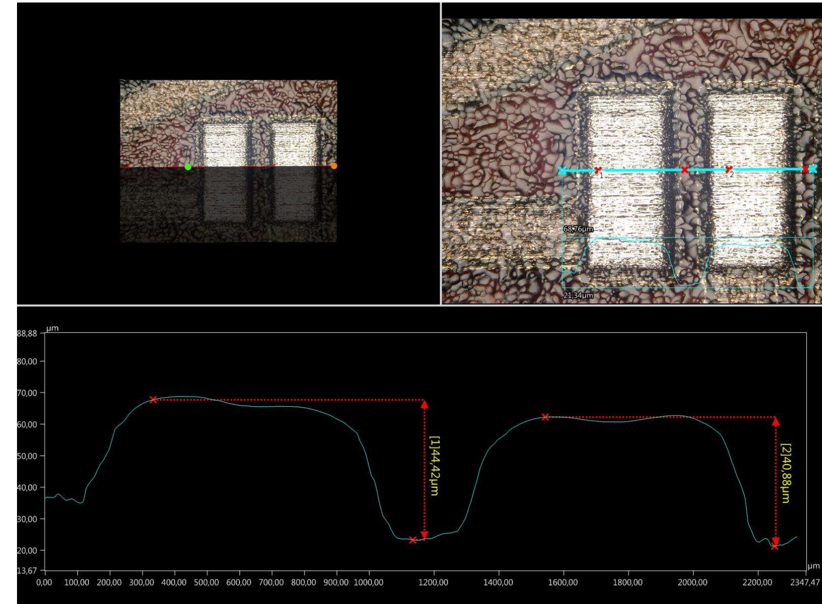
BLMC TOP PCB PAD QUALITY



Y Pad Profile





X Pad Profile

PCB QC

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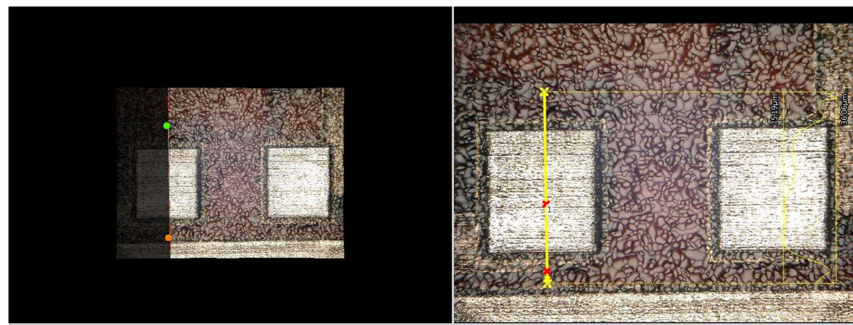
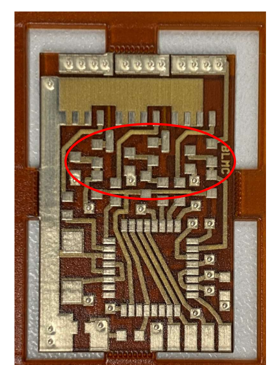
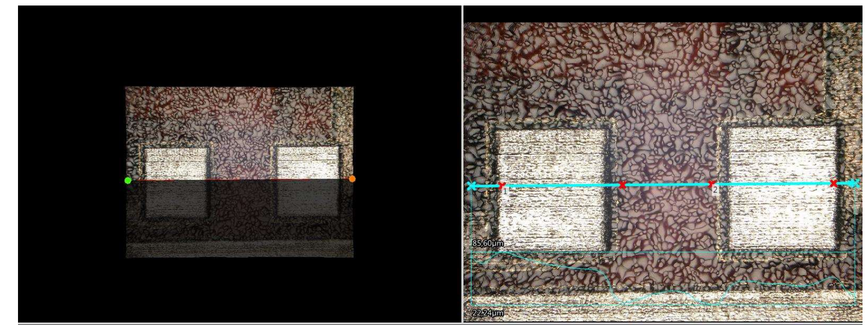
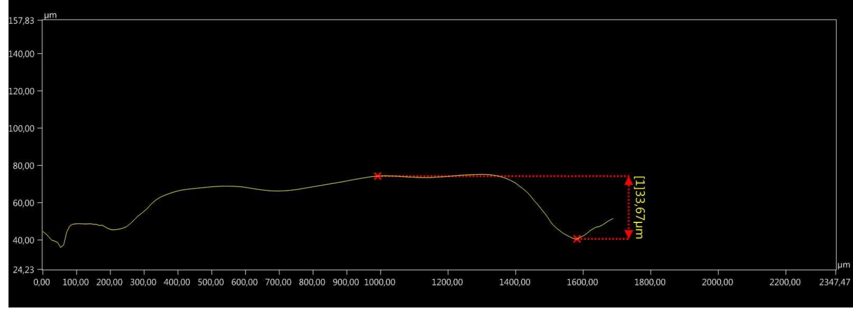
BLMC TOP PCB PAD QUALITY

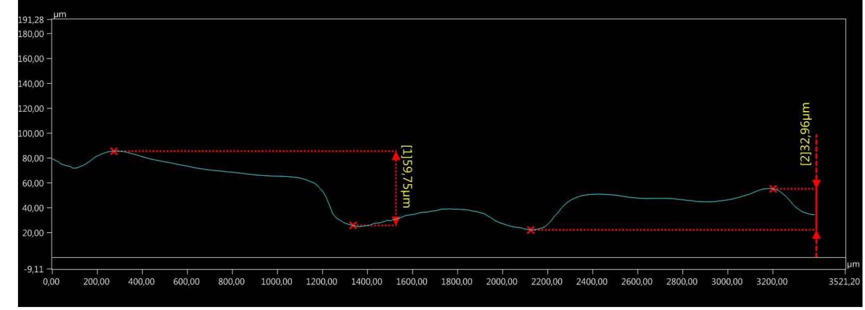








Y Pad Profile



X Pad Profile

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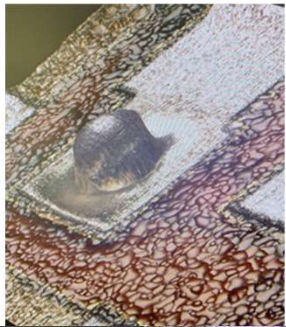
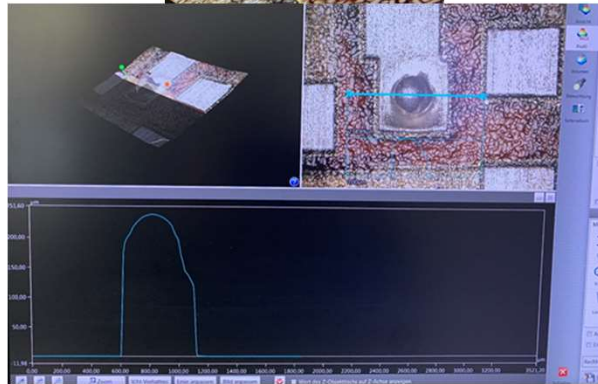
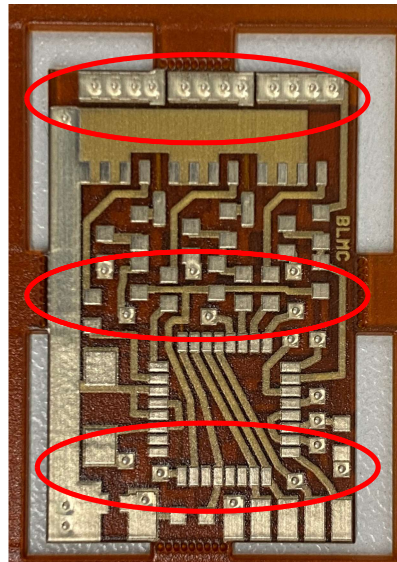
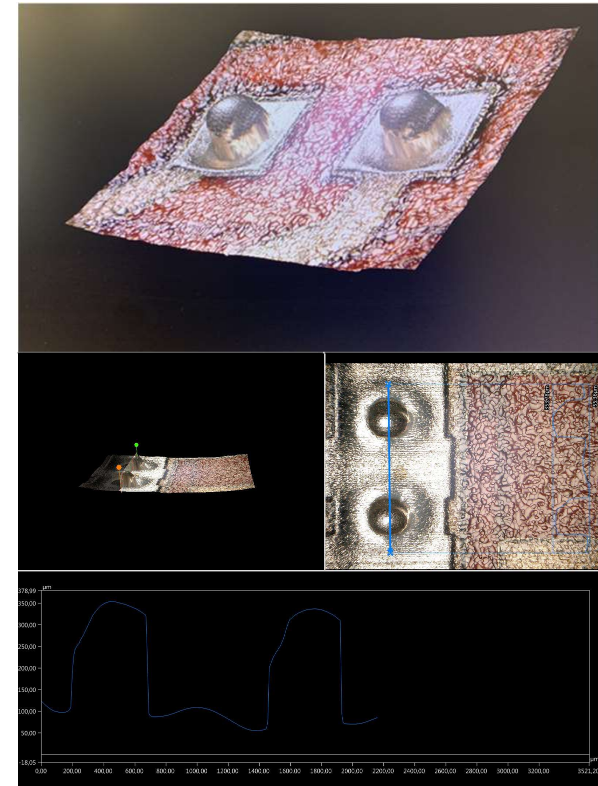
BLMC TOP – EXPOSED PILLARS ON PCB









Pillars around the PCB exposed 300 um

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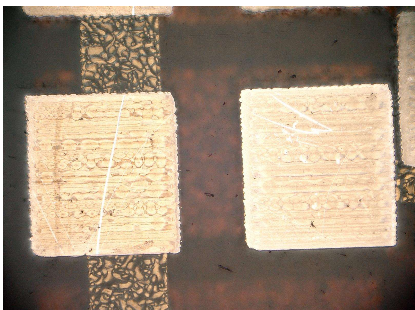
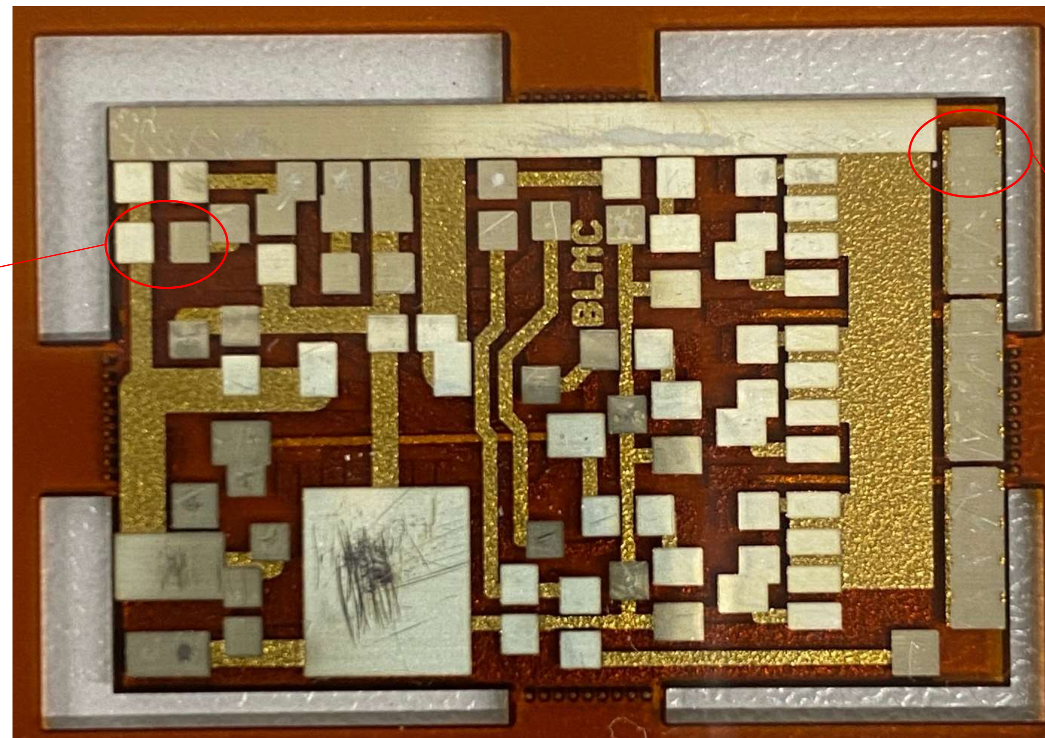
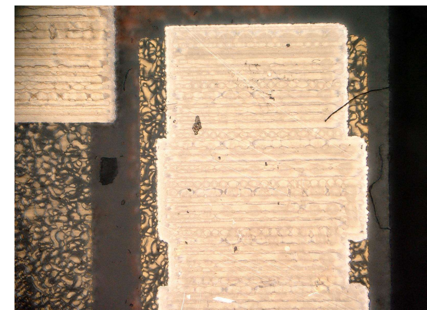
BLMC BOTTOM SIDE PCB
INCOMING INSPECTION PRIOR TO POPULATING



0603 Pads





SO8 Pad

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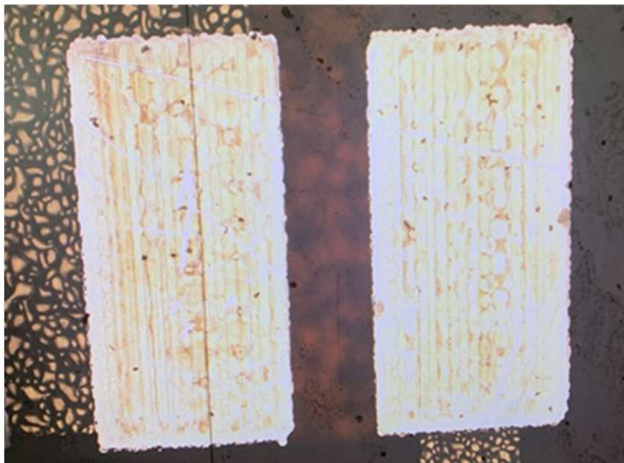
BLMC BOTTOM SIDE PCB
INCOMING INSPECTION PRIOR TO POPULATING

The pads of the bottoms side of the PCB are covered by a thin layer of dielectric material



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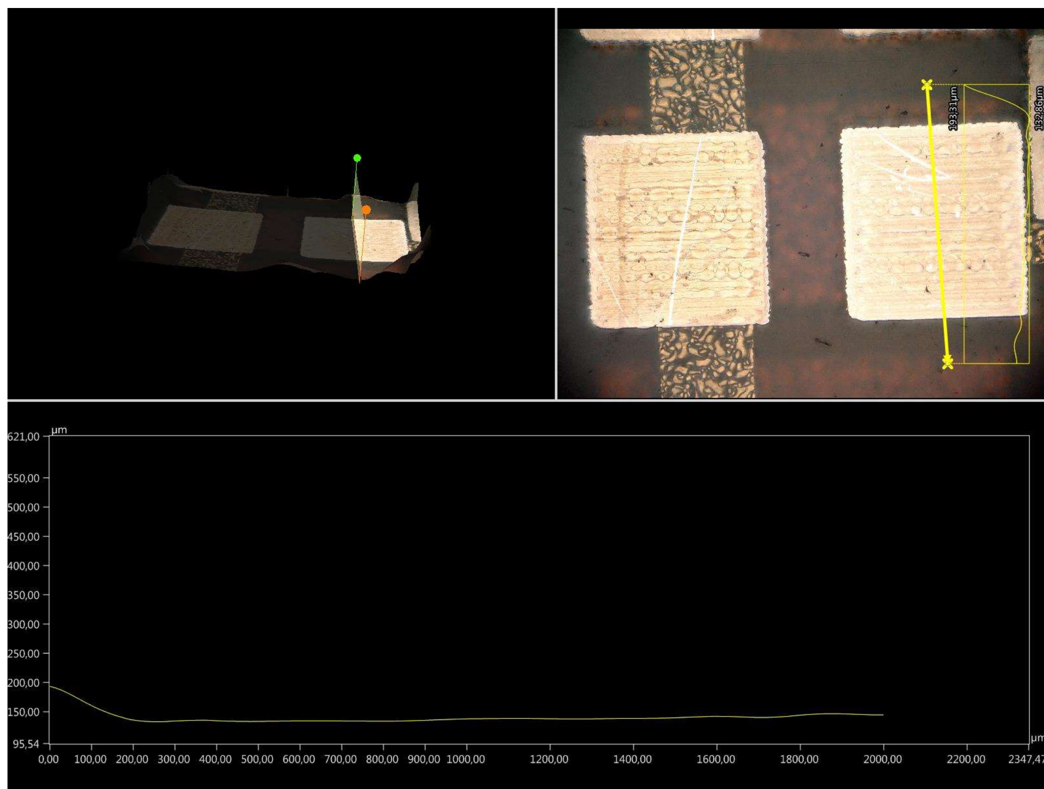
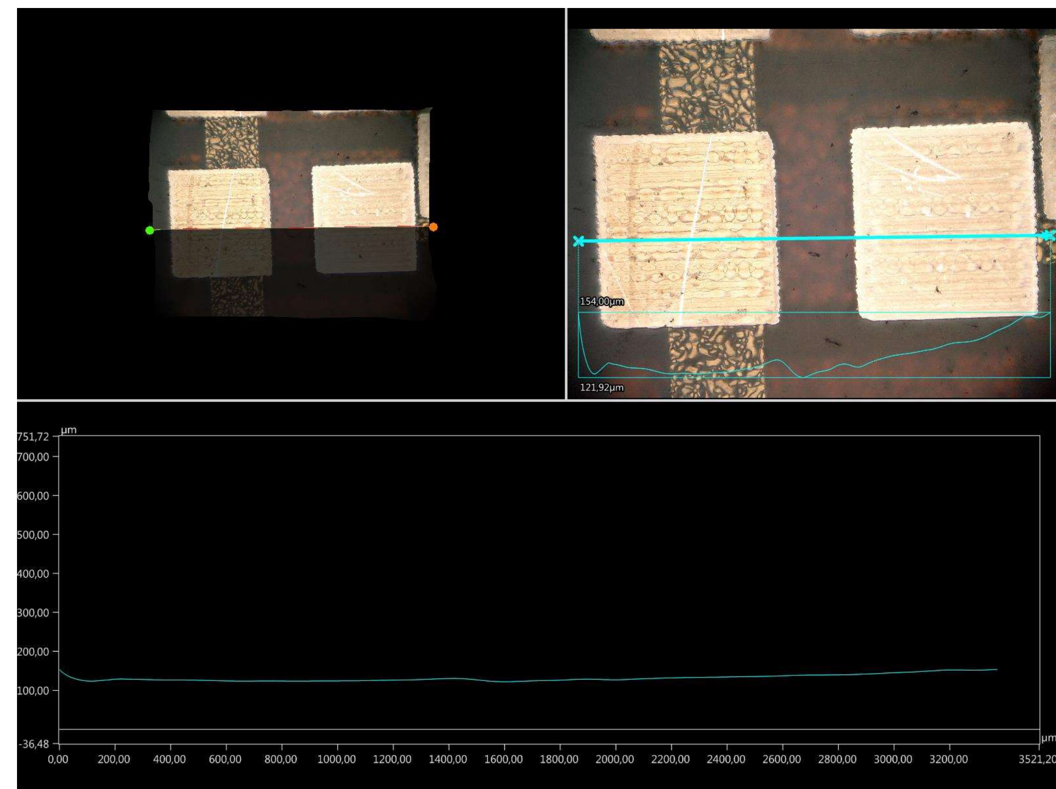
BLMC BOTTOM AS RECEIVED – 0603 PAD PROFILES





The perfect planarity of the pads is due to the dielectric ink flooding the pads

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PCB PREPARATION AND REWORK PRIOR TO POPULATING PCB

The presence of a very thin layer of dielectric material covering the pads would prevent solder from wetting to them.

- The bottom side of the PCB was subject to gentle mechanical abrasion with fine-grit sandpaper in order to remove this unwanted layer of material

- The top side of the PCB was subject to the same gentle abrasion in order to remove the raised pillars to avoid any interference with placing the components

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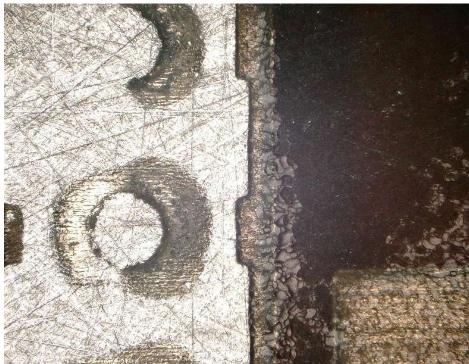
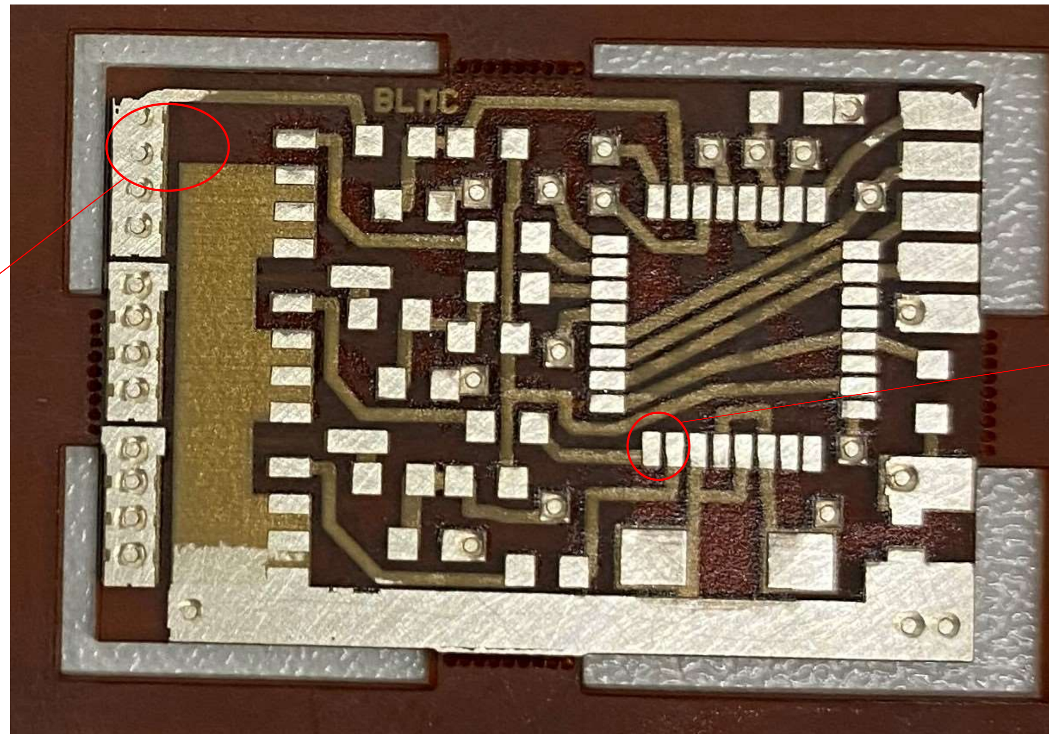
BLMC TOP AFTER REWORK



All raised pillars were removed by sanding



Pads

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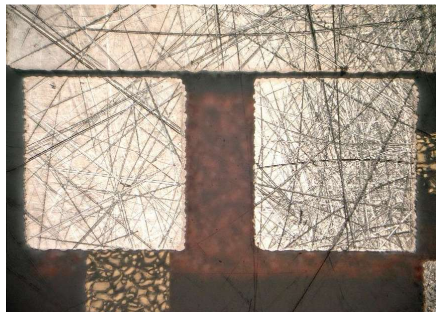
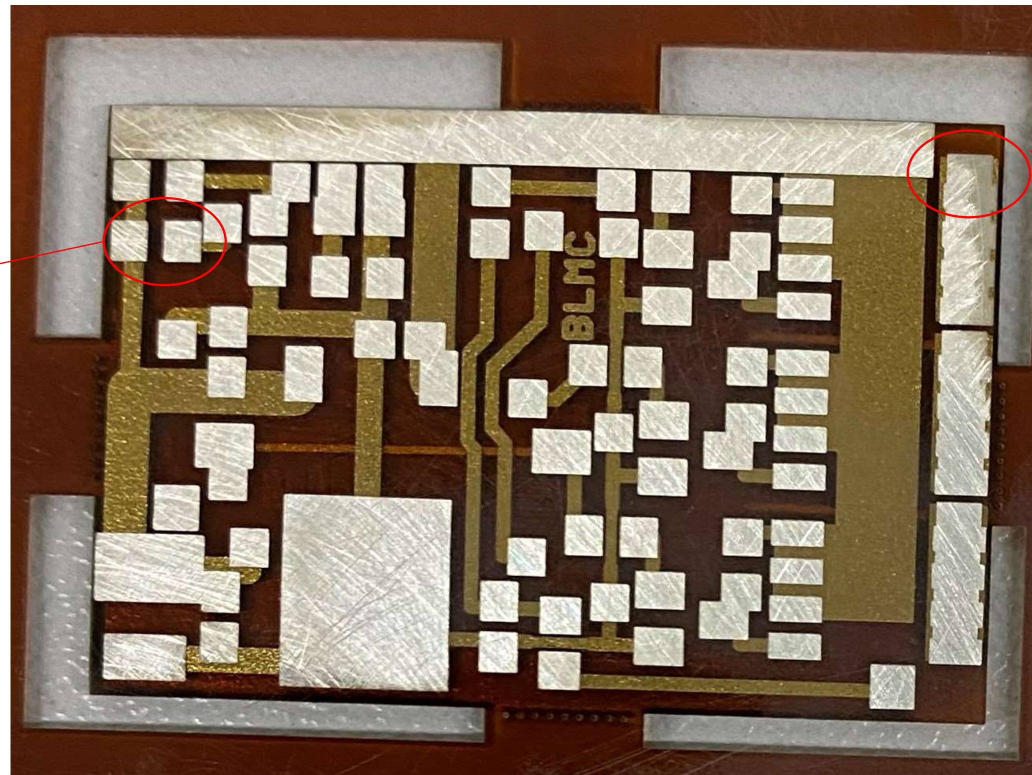
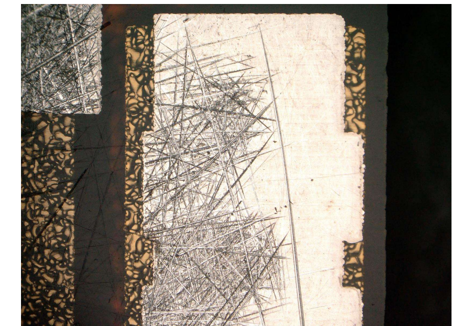
BLMC BOTTOM AFTER REWORK


0603 Pads




SO8 Pad

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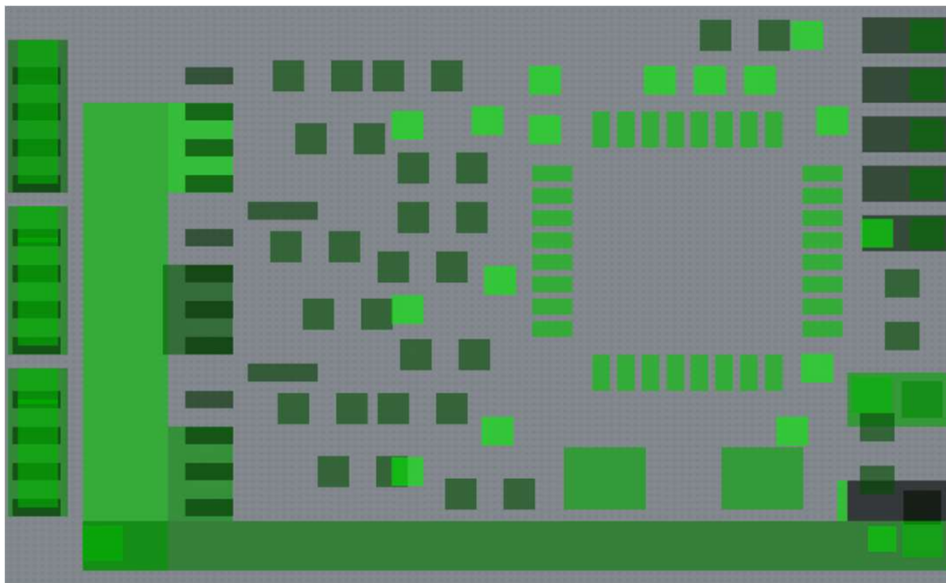
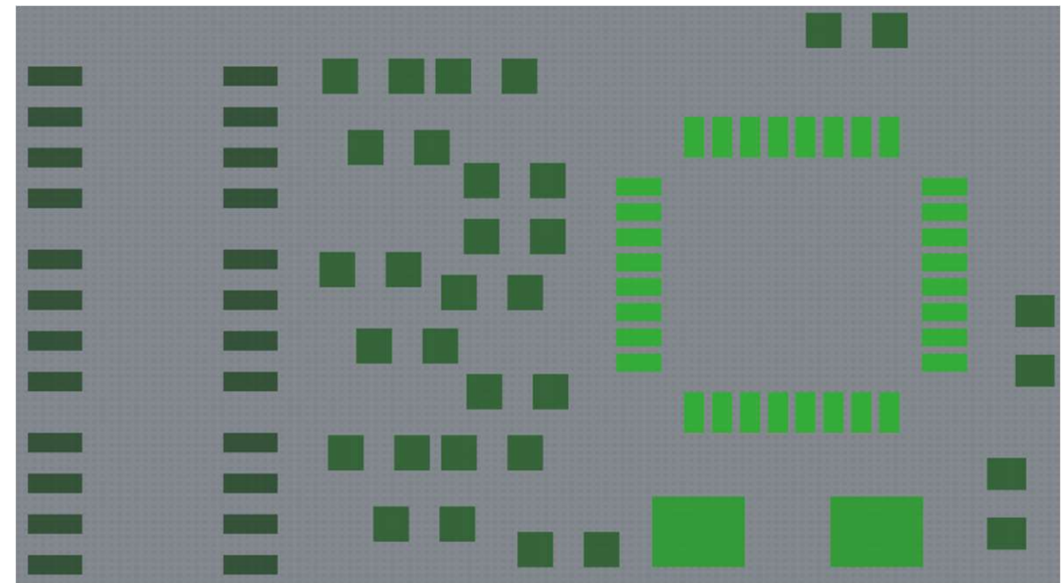
PCB PROGRAMMING

BLMC TOP SIDE – GERBER DATA IMPORT

Gerber data was filtered to remove non-existing pads



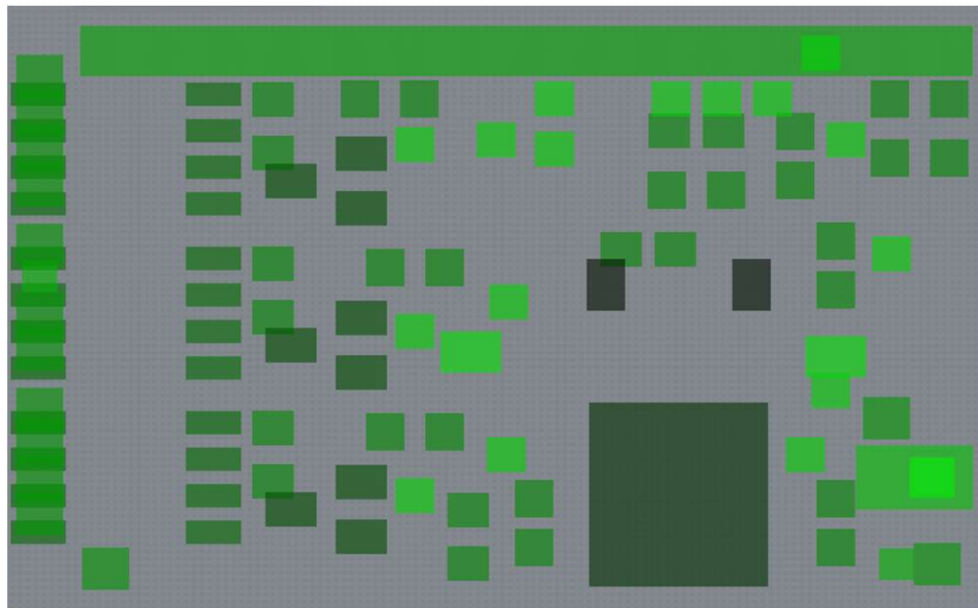
Original



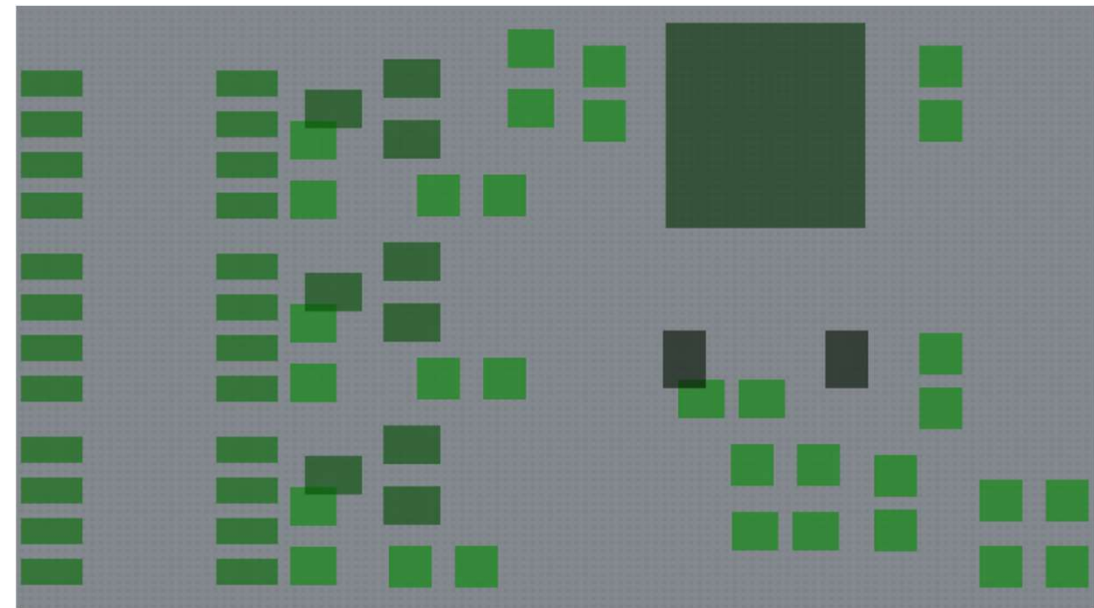
Modified version with unused pads removed

BLMC BOTTOM SIDE – GERBER DATA IMPORT

- Gerber data was filtered to remove non-existing pads



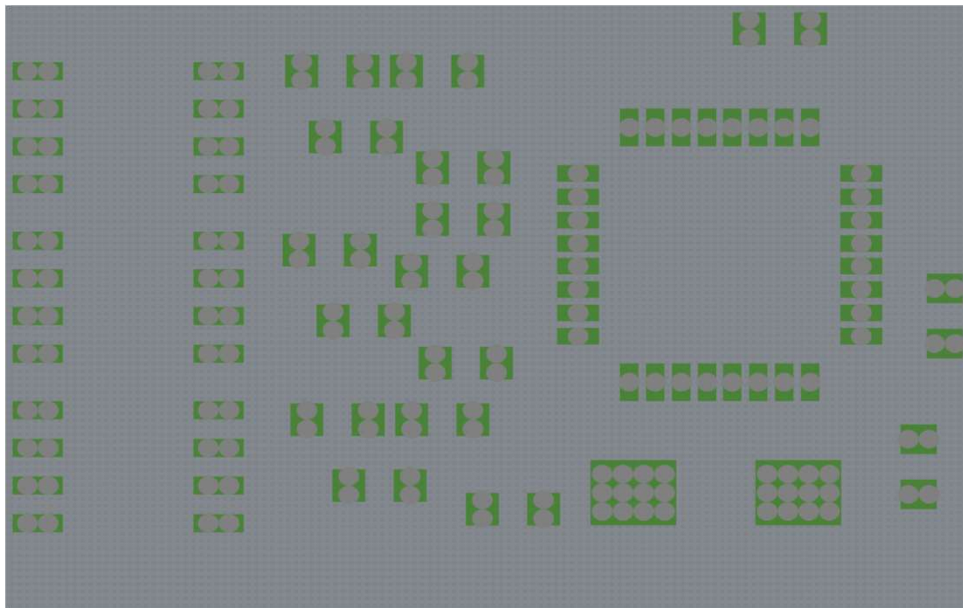
Original



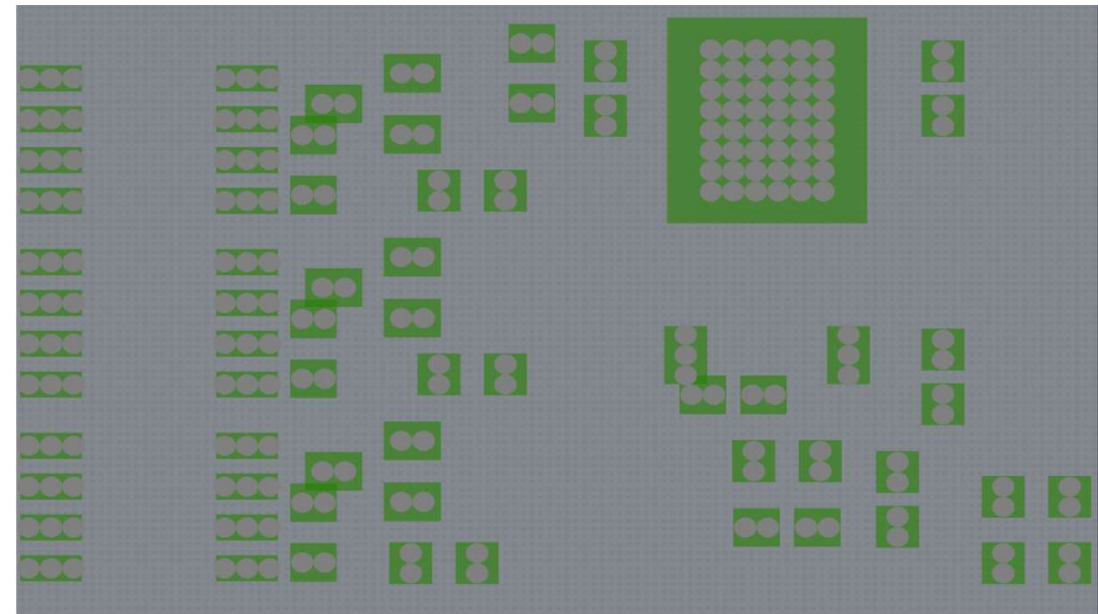
Modified version inverted and with unused pads removed

FILLING OF PADS WITH ePLACE

- Visualization of solder dots on pads in ePlace (simulating a stencil thickness of 120 um with 80% transfer rate).

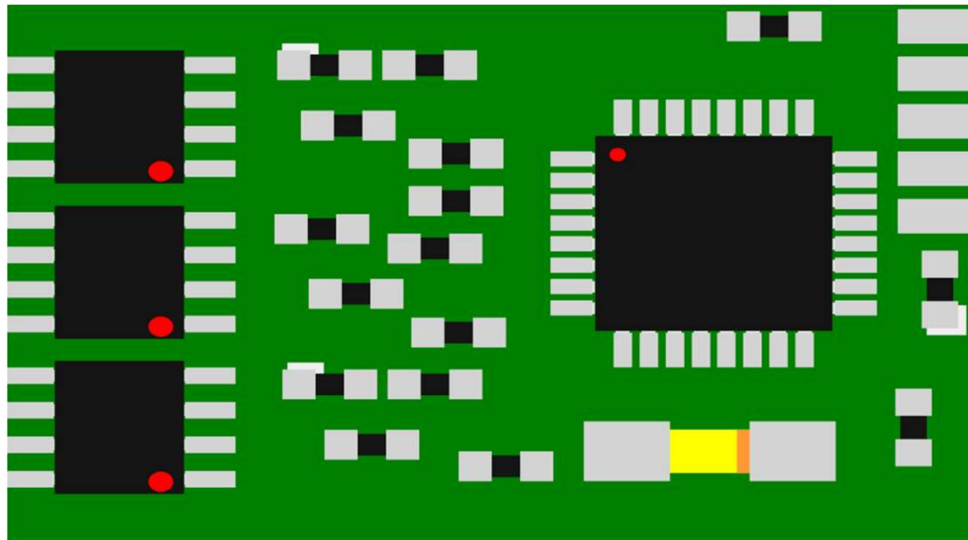


BLMC Top

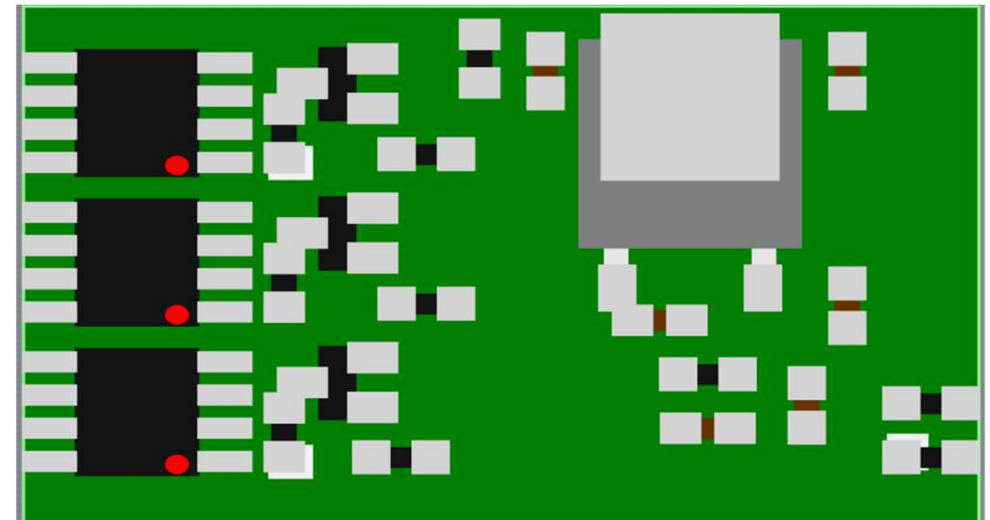


BLMC Bottom

COMPLETED PCB RECIPE IN ePLACE (VISUALIZATION)



BLMC Top View



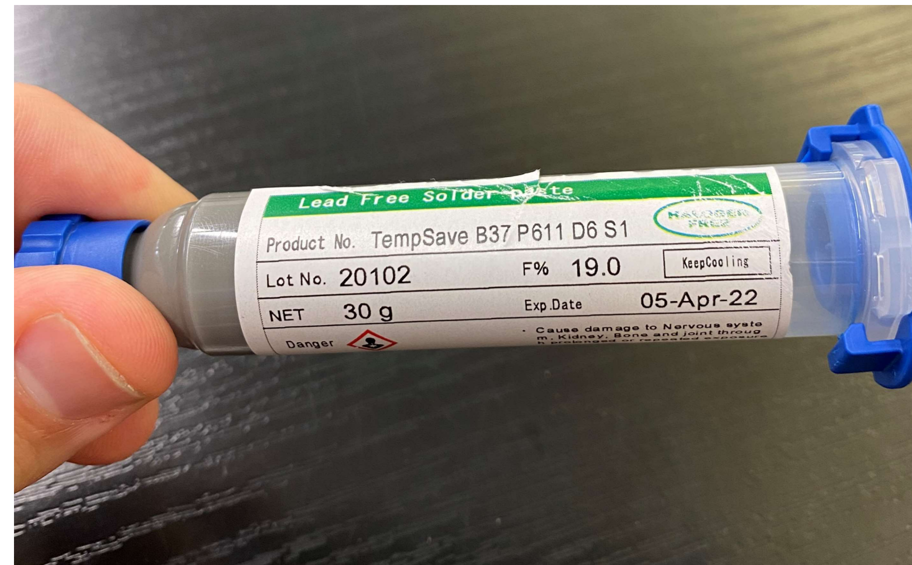
BLMC Bottom View

MACHINE CONFIGURATION AND SETUP

SOLDER PASTE DISPENSE VALVE AND MEDIUM

- **Screw valve was the best choice for this application due to variation of pad sizes**
- **Since PCB cannot withstand more than 170 deg C, Low Temperature Solder (LTS) was used**

Screw Valve



Nihon TempSave B37 Low Temp Solder Paste

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SOLDER PASTE DISPENSE PARAMETERS

- **Due to variation in pad size, various dot sizes were created to deliver the required volume**

Interpolated	Parameter	Default					
✔	Diameter [mm]	0	0.36	0.4	0.5	0.63	
	Weight [mg]	0	0.12	0	0	0.5	
✔	Dispensing Z height [mm]	0.3	0.25	0.3	0.3	0.3	
✔	Screw rotation [°]	80	10	10	15	23	
	Screw rotation speed [°/s]	200					
	Waiting after dispensing [ms]	10					
	Retract Z distance [mm]	3					
	Retract Z speed [mm/s]	100					
	Waiting after retract [ms]	0					
	Suckback rotation [°]	0					
	Number of dots	1					
	Delay between dots [ms]	0					
	Height between dots [mm]	0					

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KITTING COMPONENTS

- Most components were received in small tape strips of varying lengths containing inconsistent quantities of components

- TQFP32 were placed on a tray on the back tray slider

- The component cut outs are very time consuming and labor-intensive for the kitting process. (Each small strip needed to be mounted to a tray individually, and the position of each strip needed to be taught manually)

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PCB POPULATING AND RESULTS

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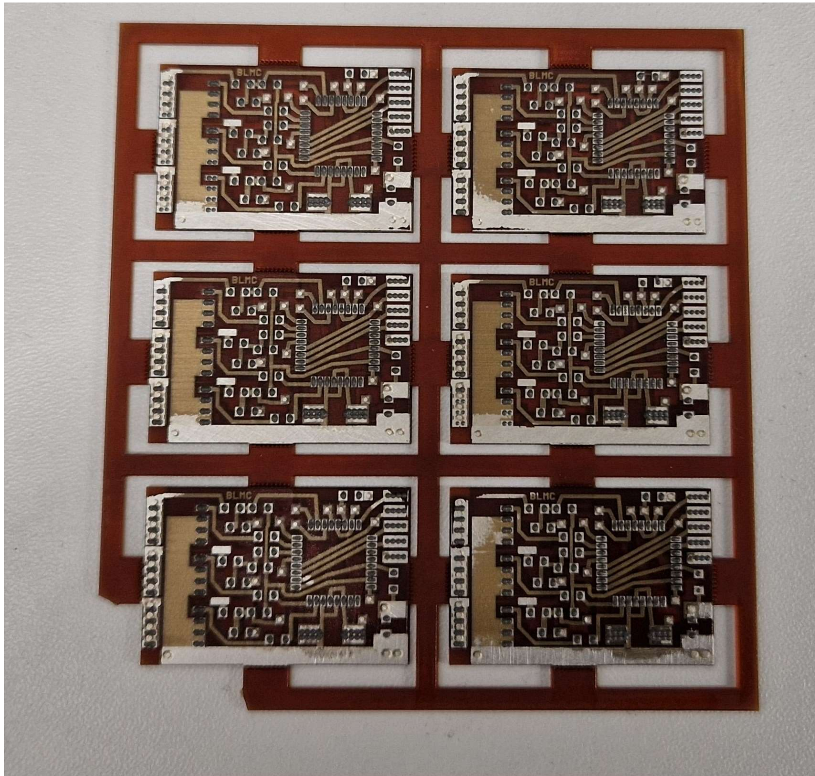
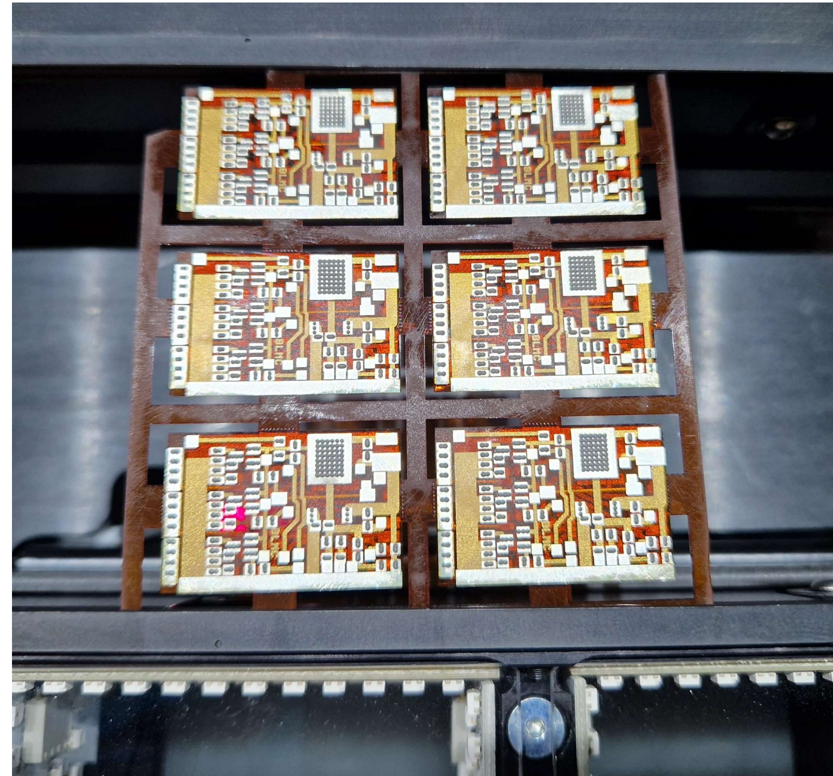
TOP AND BOTTOM SOLDER PASTE DISPENSE


BLMC Top


BLMC Bottom

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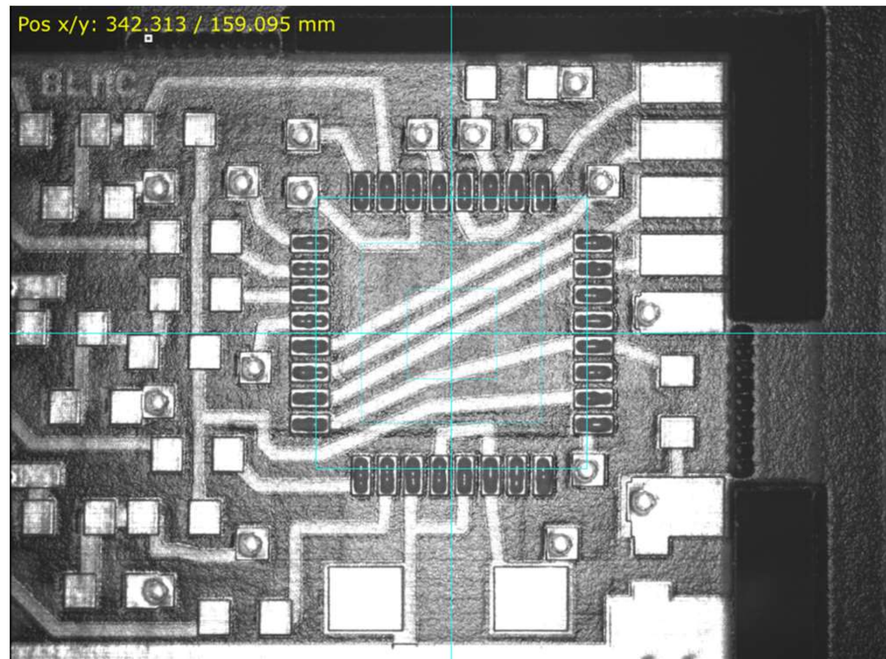
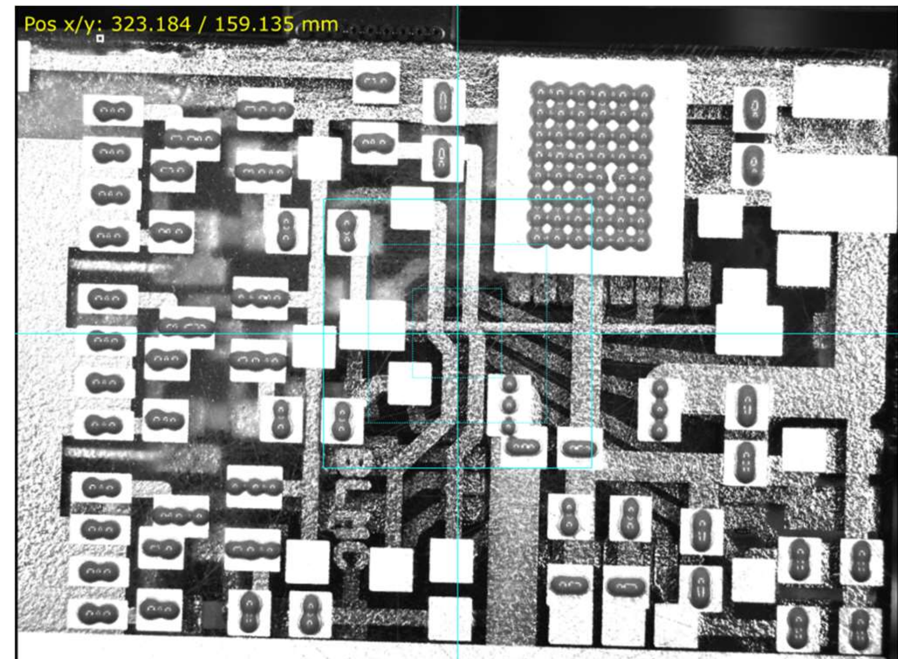
TOP AND BOTTOM SOLDER PASTE DISPENSE



BLMC Top



BLMC Bottom

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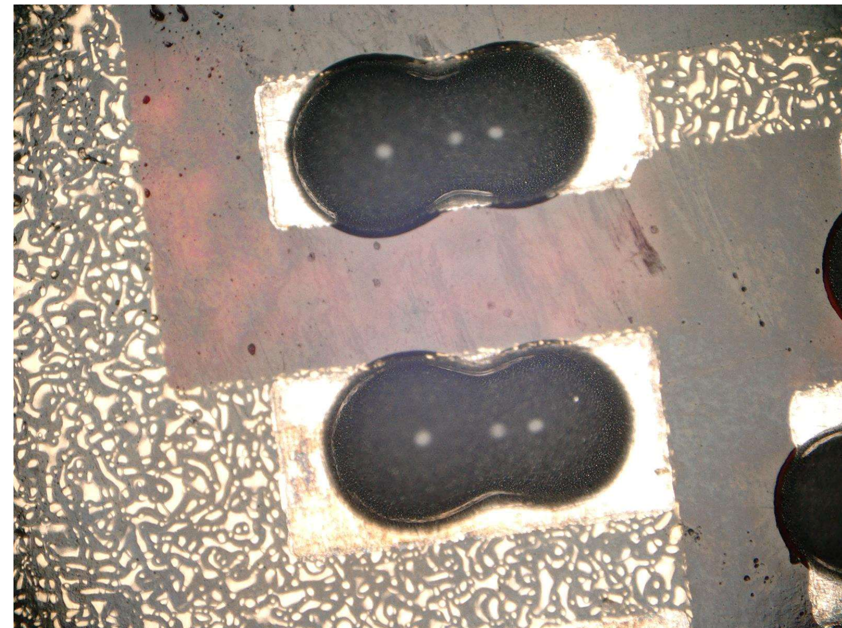
TOP AND BOTTOM SOLDER PASTE DISPENSE

IC Pads



SO8 Pads

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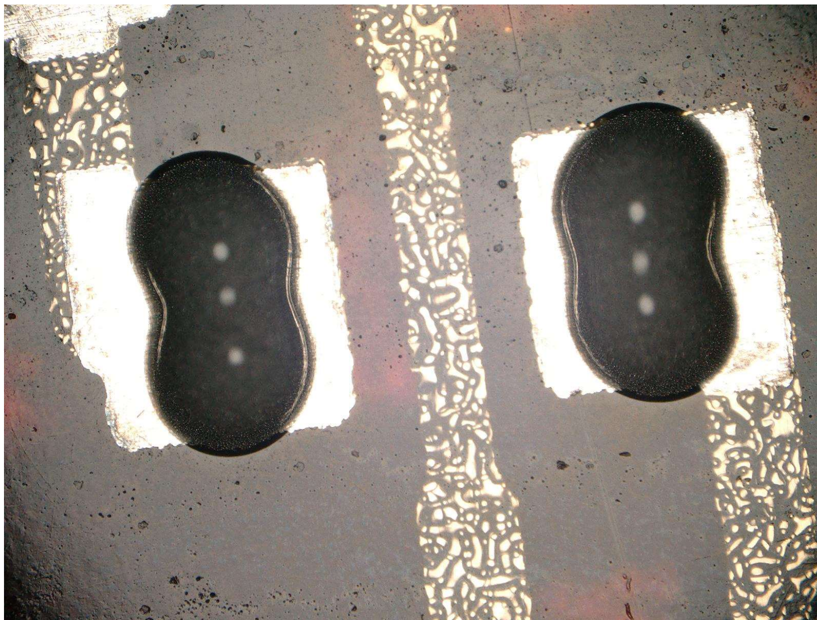
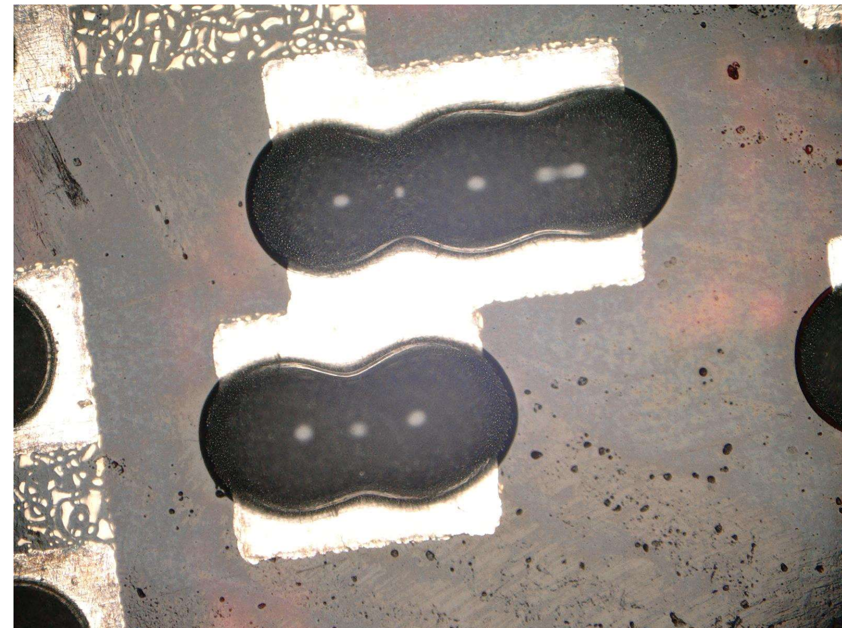
TOP AND BOTTOM SOLDER PASTE DISPENSE



0603 Pads



SOT 23 and 0603 Pads

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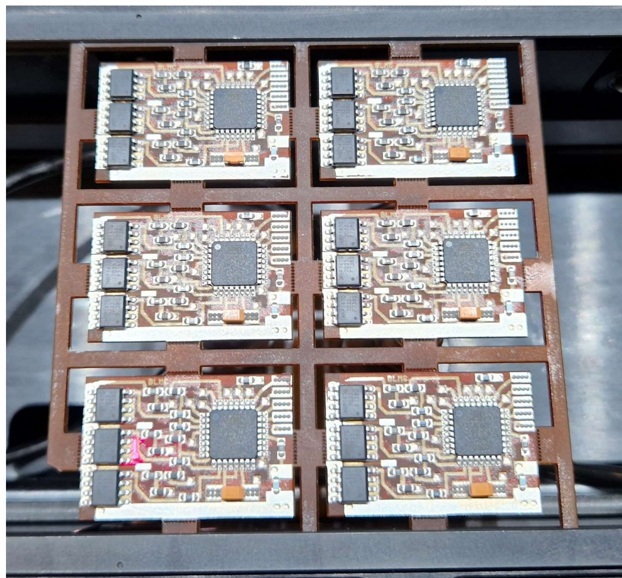
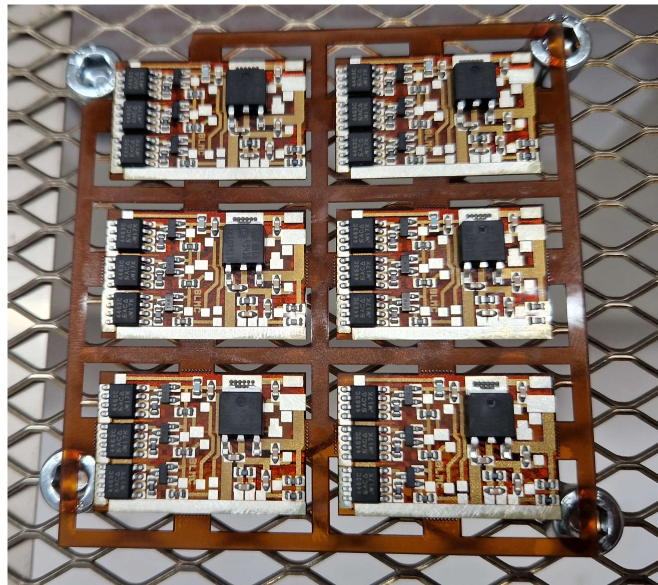
TOP AND BOTTOM PICK AND PLACE

- All components were placed successfully
- Since no fiducials were present on the PCB, pads had to be used for alignment and positioning
- Having fiducials on the PCB is a must for maximum alignment efficiency and accuracy

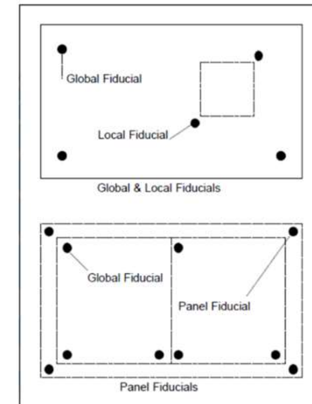


BLMC Top



BLMC Bottom

- Recommended fiducials for maximum accuracy



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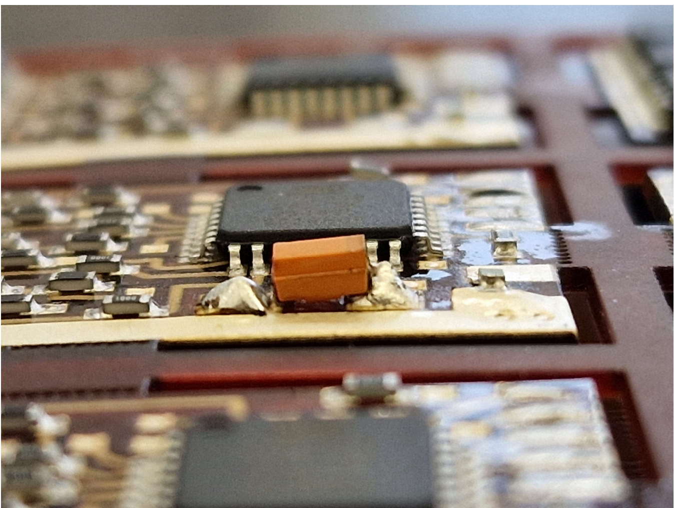
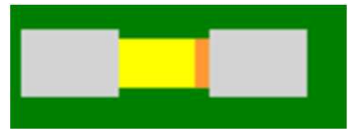
Due to the size of the component with respect to the footprint ,this component could not be placed (Soldered) properly

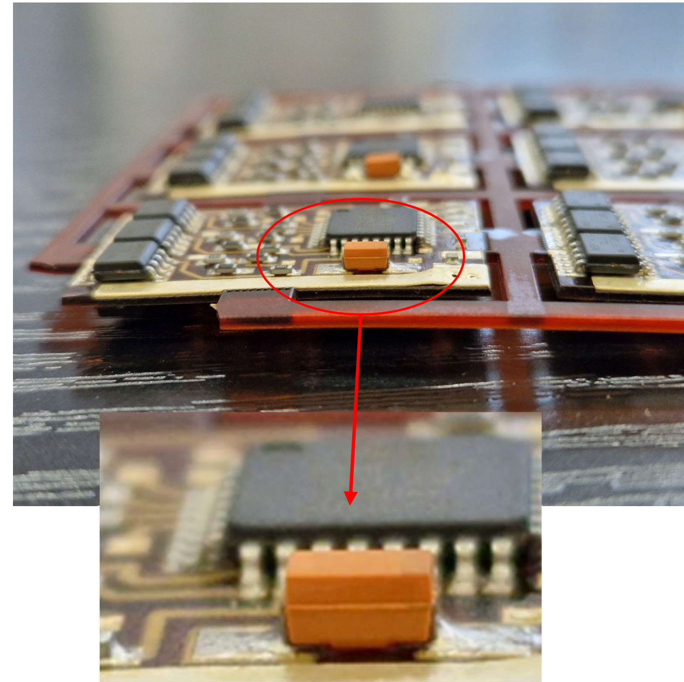


Tried rework with solder iron

- Component compared to the pad



1 nicely soldered component on the edge of the pads



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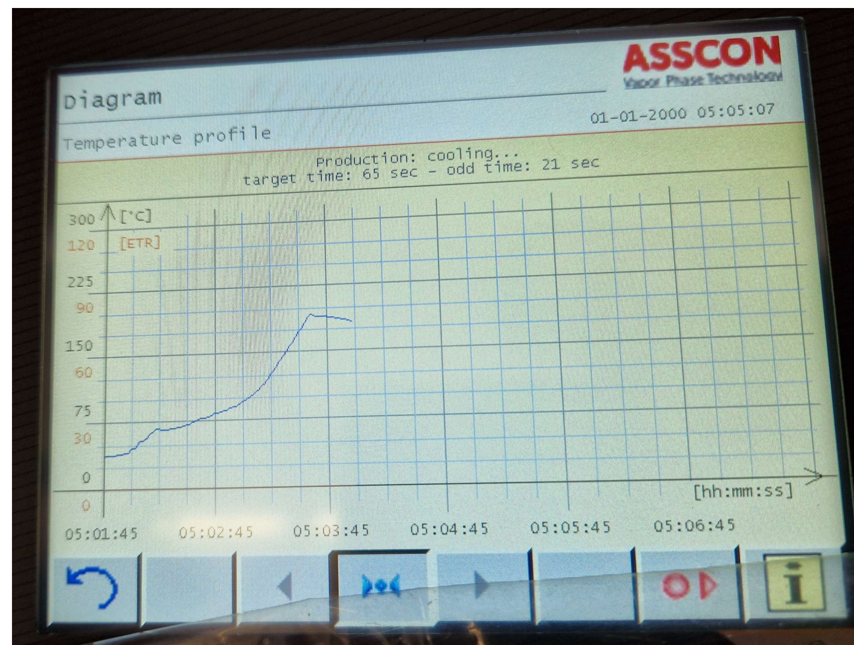
SOLDERING

TEMPERATURE PROFILE

- **Since the PCB is produced both sided, vapor phase technology was used for a better handling of the solder process**
- **The profile shows that as soon the PCB reached 150°C it stayed for 10s over the liquidus and then starts moving up for cooling down.**



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RESULTS

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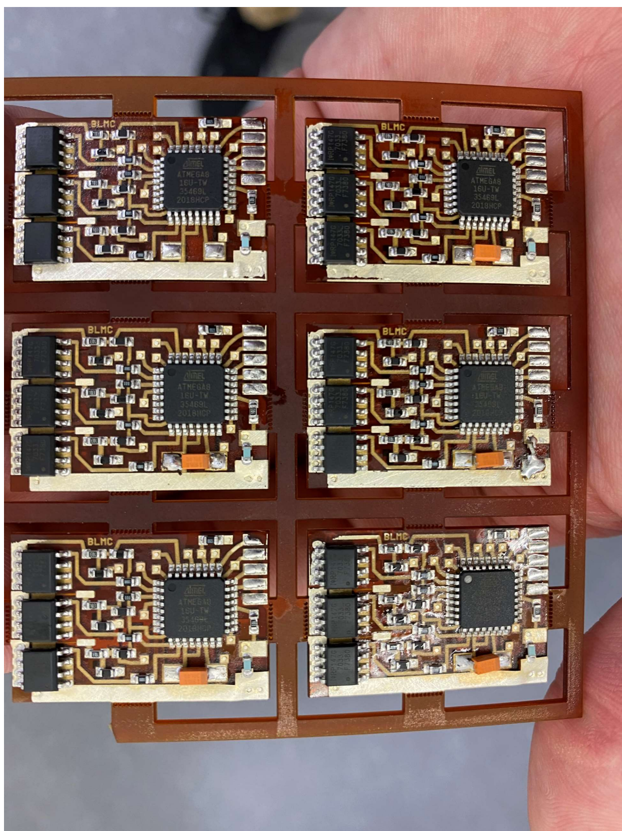
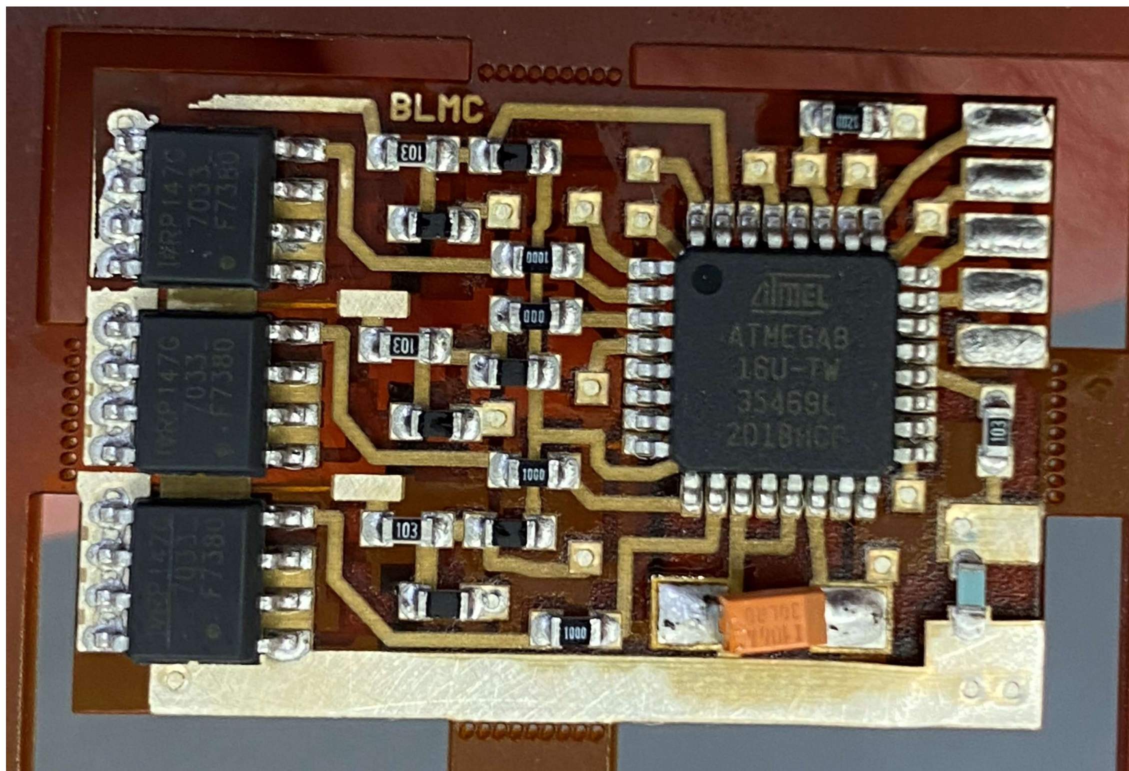
- **Soldered PCB Top side**





RESULTS

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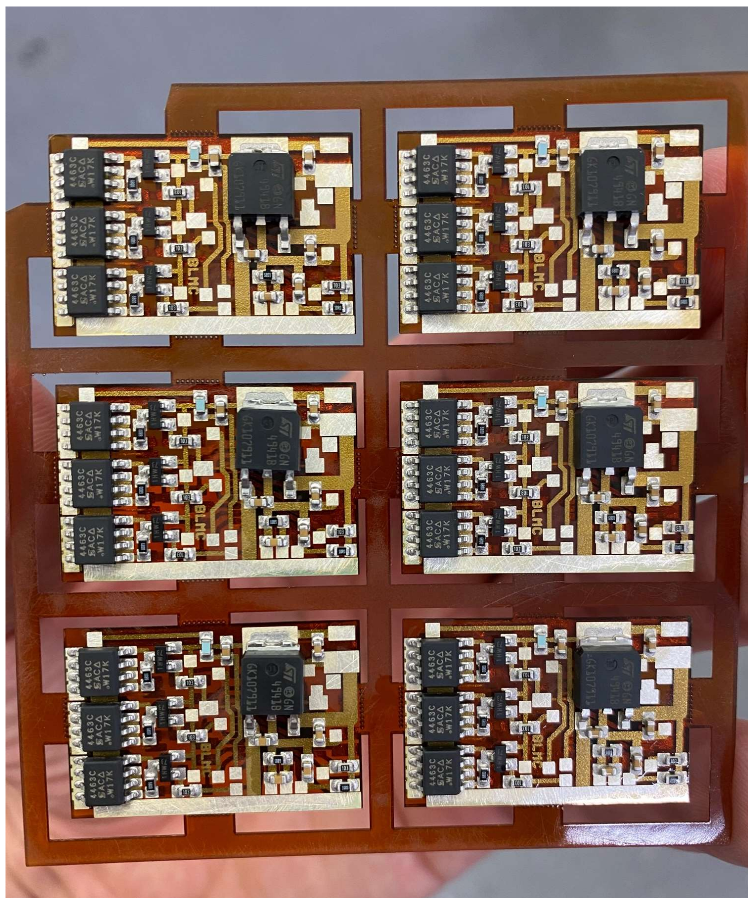

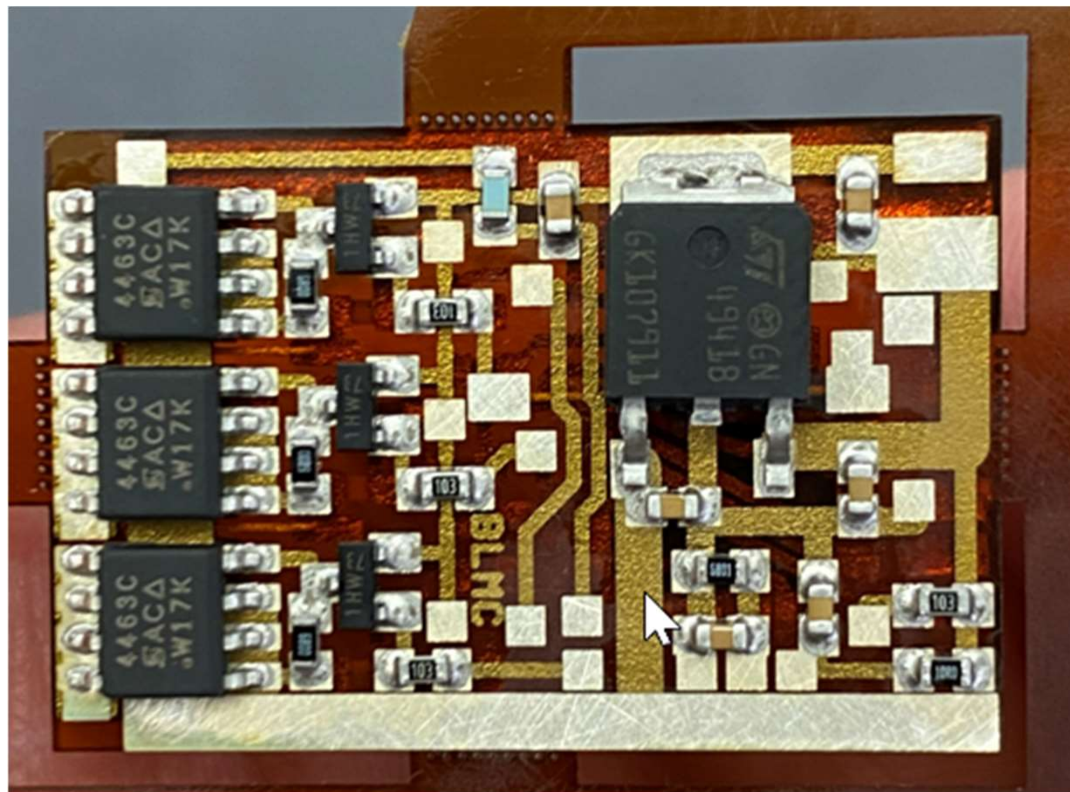

RESULTS

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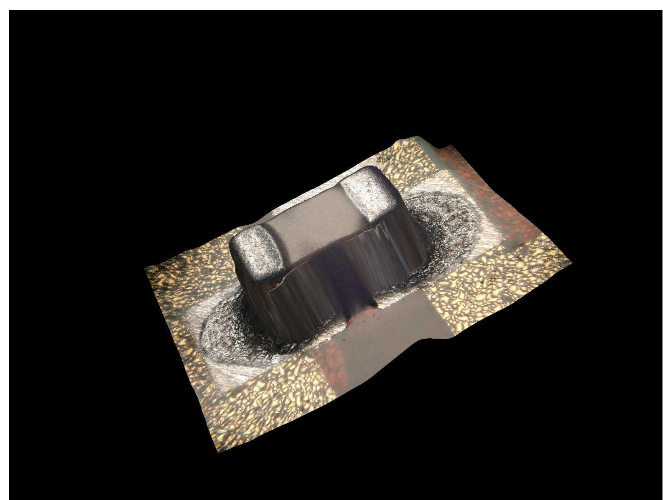

RESULTS

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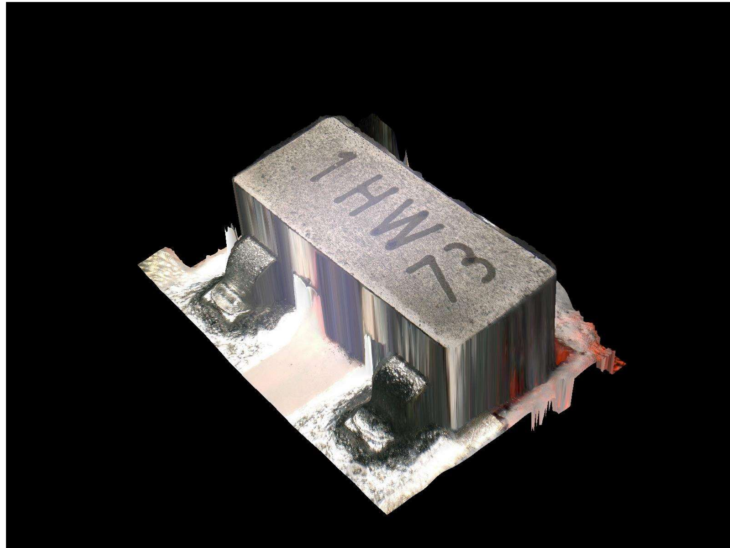
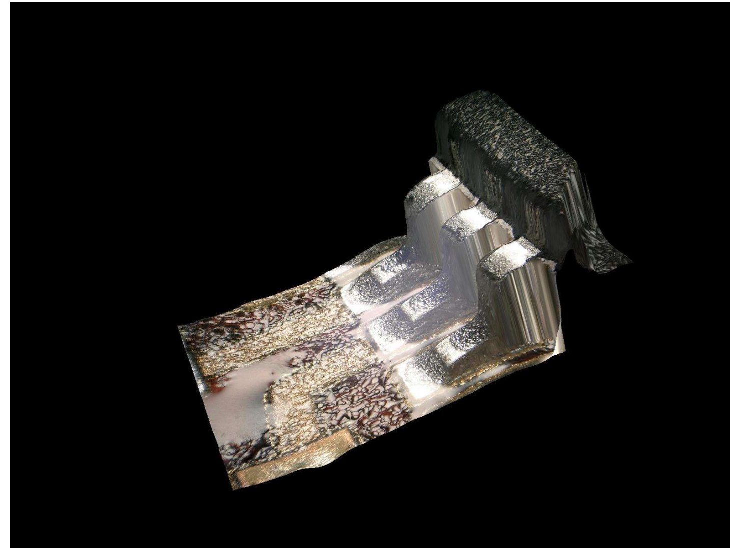
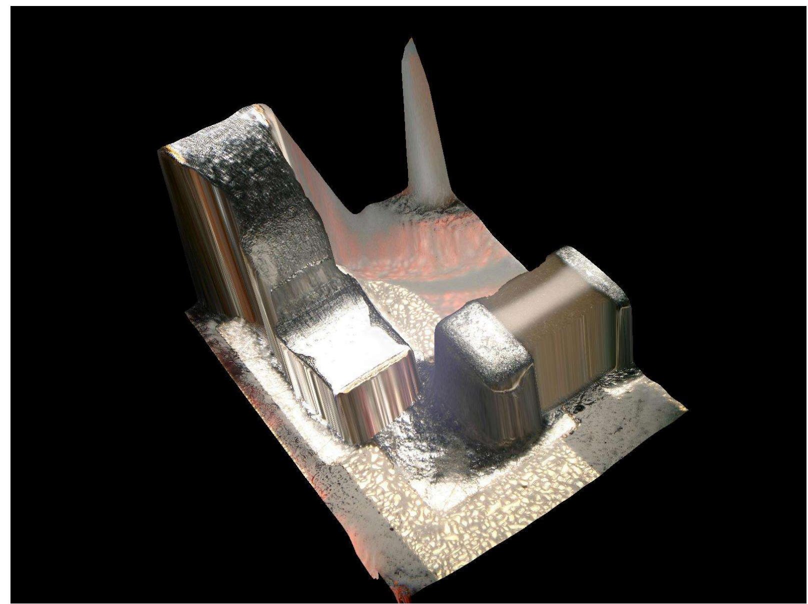

1HW 73



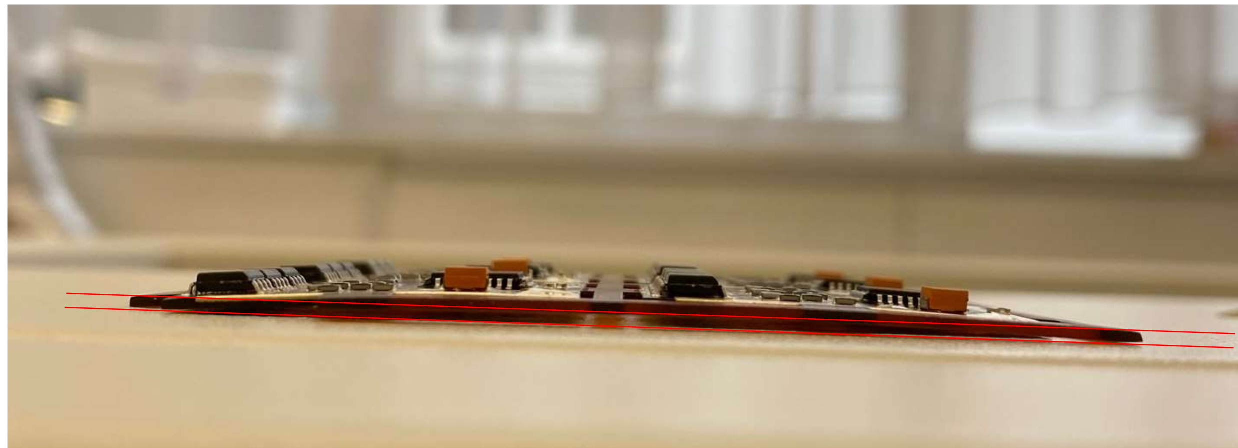
RESULTS

J.A.M.E.S

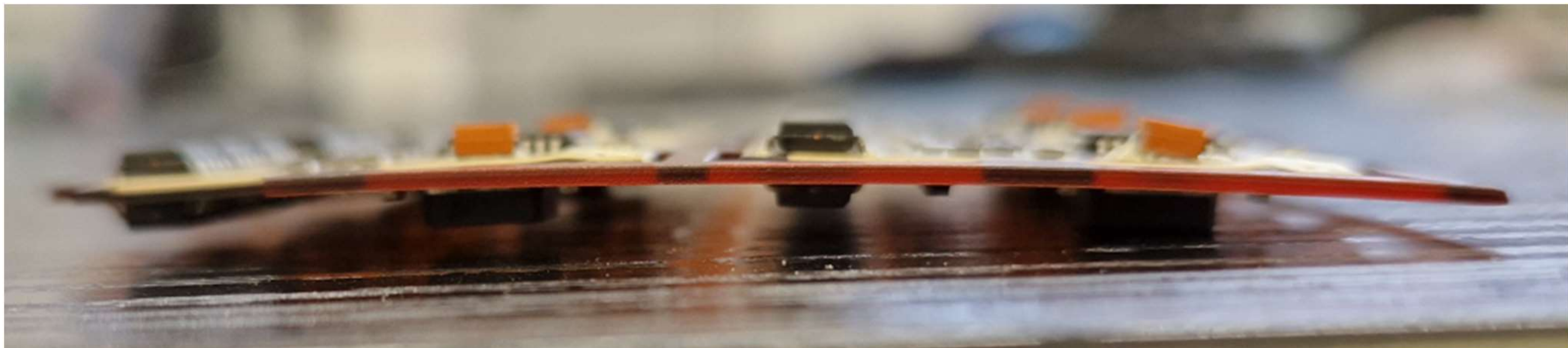
essemtec
A NANODIMENSION DIVISION



PCB warpage after just the first pass in the vapor phase



PCB warpage after both side populated and passed in the vapor phase



RESULTS

Lifted tracks → Reason unknown