



# Power mezzanine PDB- LTM Revision after FDR

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Presented by Philippe/Hao



# FDR 1/2



## Feedback from FDR

- No formal report yet, only oral feedback during review
- Design points raised
  - Double-check the right inputs (50 ohms, high-Z) are available on all the 7 board flavours where they have to be.
  - Double check the planned unpowering (no negative power rails available) of the adder for Phase-2 does not harm the differential amplifier
  - Check the compatibility of the phase-2 FEB2 summed outputs with LTDB
  - Check need to power off parts of digital section (possibility exists)
  - Produce IPC356 netlists for PCB checking. This will help catching errors not visible with only Gerber-extracted netlists
  - Take into account possible bad environmental conditions for the PDB design (humidity, or even water) → check possibility to set LTM4619 voltage using lower value resistors
  - Put some thinking on avoiding risk of damage to the PDB during insertion on LTDB : design some tooling, move pins to MB and sockets to PDB, displace some ceramic caps prone to cracking
  - Increase the number of mounting holes around the PDB to ensure good thermal contact with cooling plates

Slide presented by Philippe during previous LAr week (September 2017).



# FDR 2/2



## Pre-production boards and demonstrators replacement

- Debate at the end of the FDR
  - Schedule is very tight ( $\approx 3$  months to produce an upgraded demonstrator board that will go into the pit)
  - Main condition on this board as for the demonstrators : maintain functionality of present analog L1 trigger
  - We should not detract ourselves from the main objective, which is to produce as soon as possible pre-series boards
  - → Minimal changes on prototype to produce upgraded demonstrators :
    - Correction of the adder (go back to HFA1135 as line driver instead of AD8001)
    - Exchange pins/socket between LTDB and PDB
    - Add mounting holes around the PDB
  - Any further changes to be implemented on pre-series boards
  - System test with FE will be done before the PRR
  - PRR expected beginning of 2018

Slide presented by Philippe during previous Lar wee (September 2017).



# Status of PDB production



Complete documentation for production sent to manufacturer.

PCB production is ongoing.

Critical components (LTM4619, LHC4913 and LHC7913) are at INFN Milan.

6 full populated boards have been ordered.

We are counting to have the board for mid November

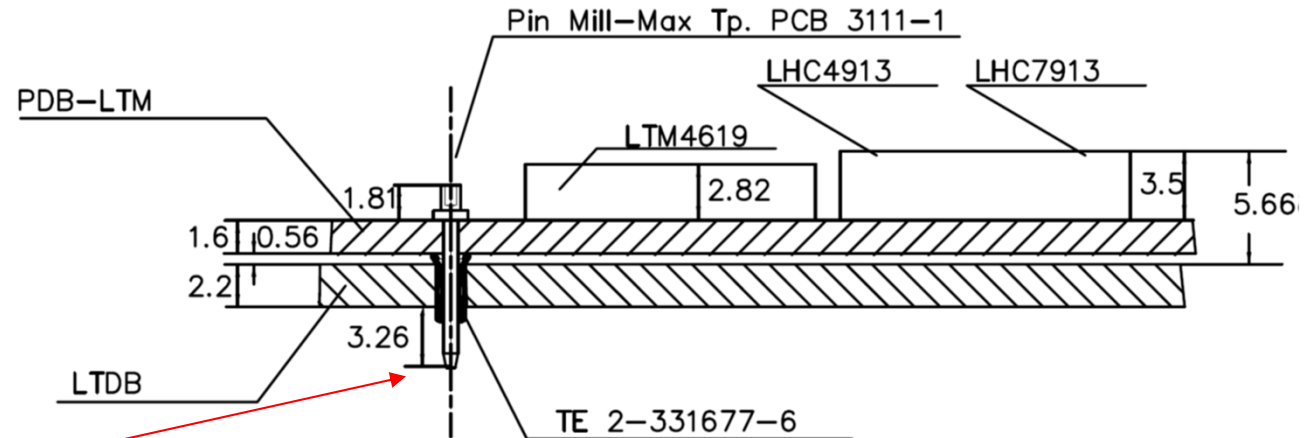
Gerber files sent to Hao for double check on PIN/SOCKET connections and mounting holes for cooling plate (LTDB vs PDB-LTM mechanical compatibility).



# LTDB Vs PDB-LTM connections



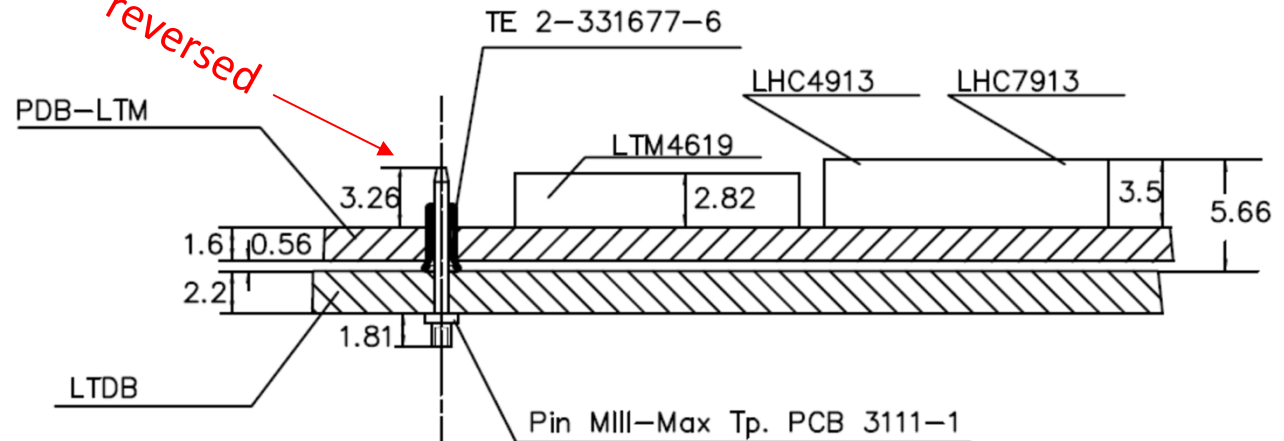
Current version  
(now at BNL)



64 connections

*reversed*

Proposed solution  
proposed during  
FDR





# 64 pin-sockets connections (1/2)



<i>Id</i>	<i>Connector</i>	<i>Footprint</i>	<i>X position</i>	<i>Y position</i>	<i>Mfg Part #</i>	<i>Digi-Key #</i>	<i>Hole diameter (mm)</i>	<i>Pad diameter (mm)</i>
1	J1	MIL-MAX-3111 (modified)	417mm	400mm	2-331677-6	A24875-ND	1,60	3
2	J2	MIL-MAX-3111 (modified)	417mm	390mm	2-331677-6	A24875-ND	1,60	3
3	J3	MIL-MAX-3111 (modified)	417mm	380mm	2-331677-6	A24875-ND	1,60	3
4	J4	MIL-MAX-3111 (modified)	417mm	370mm	2-331677-6	A24875-ND	1,60	3
5	J5	MIL-MAX-3111 (modified)	417mm	360mm	2-331677-6	A24875-ND	1,60	3
6	J6	MIL-MAX-3111 (modified)	417mm	350mm	2-331677-6	A24875-ND	1,60	3
7	J7	MIL-MAX-3111 (modified)	417mm	340mm	2-331677-6	A24875-ND	1,60	3
8	J8	MIL-MAX-3111 (modified)	417mm	330mm	2-331677-6	A24875-ND	1,60	3
9	J9	MIL-MAX-3111 (modified)	417mm	320mm	2-331677-6	A24875-ND	1,60	3
10	J10	MIL-MAX-3111 (modified)	417mm	310mm	2-331677-6	A24875-ND	1,60	3
11	J11	MIL-MAX-3111 (modified)	417mm	300mm	2-331677-6	A24875-ND	1,60	3
12	J12	MIL-MAX-3111 (modified)	417mm	290mm	2-331677-6	A24875-ND	1,60	3
13	J13	MIL-MAX-3111 (modified)	417mm	280mm	2-331677-6	A24875-ND	1,60	3
14	J14	MIL-MAX-3111 (modified)	417mm	270mm	2-331677-6	A24875-ND	1,60	3
15	J15	MIL-MAX-3111 (modified)	417mm	260mm	2-331677-6	A24875-ND	1,60	3
16	J16	MIL-MAX-3111 (modified)	417mm	250mm	2-331677-6	A24875-ND	1,60	3
17	J17	MIL-MAX-3111 (modified)	417mm	240mm	2-331677-6	A24875-ND	1,60	3
18	J18	MIL-MAX-3111 (modified)	417mm	230mm	2-331677-6	A24875-ND	1,60	3
19	J19	MIL-MAX-3111 (modified)	417mm	220mm	2-331677-6	A24875-ND	1,60	3
20	J20	MIL-MAX-3111 (modified)	417mm	210mm	2-331677-6	A24875-ND	1,60	3
21	J21	MIL-MAX-3111 (modified)	417mm	200mm	2-331677-6	A24875-ND	1,60	3
22	J22	MIL-MAX-3111 (modified)	417mm	190mm	2-331677-6	A24875-ND	1,60	3
23	J23	MIL-MAX-3111 (modified)	417mm	180mm	2-331677-6	A24875-ND	1,60	3
24	J24	MIL-MAX-3111 (modified)	417mm	170mm	2-331677-6	A24875-ND	1,60	3
25	J25	MIL-MAX-3111 (modified)	417mm	160mm	2-331677-6	A24875-ND	1,60	3
26	J26	MIL-MAX-3111 (modified)	417mm	150mm	2-331677-6	A24875-ND	1,60	3
27	J27	MIL-MAX-3111 (modified)	417mm	140mm	2-331677-6	A24875-ND	1,60	3
28	J28	MIL-MAX-3111 (modified)	417mm	130mm	2-331677-6	A24875-ND	1,60	3
29	J29	MIL-MAX-3111 (modified)	417mm	120mm	2-331677-6	A24875-ND	1,60	3
30	J30	MIL-MAX-3111 (modified)	417mm	110mm	2-331677-6	A24875-ND	1,60	3
31	J31	MIL-MAX-3111 (modified)	417mm	100mm	2-331677-6	A24875-ND	1,60	3
32	J32	MIL-MAX-3111 (modified)	417mm	90mm	2-331677-6	A24875-ND	1,60	3
33	J33	MIL-MAX-3111 (modified)	417mm	80mm	2-331677-6	A24875-ND	1,60	3



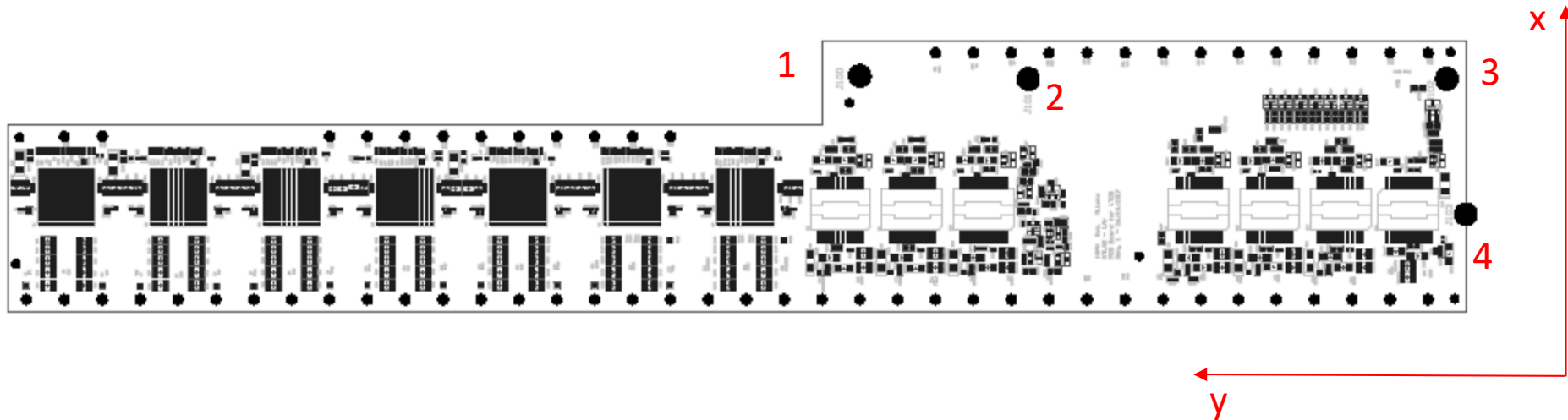
# 64 pin-sockets connections (2/2)



34	J34	MIL-MAX-3111 (modified)	417mm	70mm	2-331677-6	A24875-ND	1,60	3
35	J35	MIL-MAX-3111 (modified)	417mm	60mm	2-331677-6	A24875-ND	1,60	3
36	J36	MIL-MAX-3111 (modified)	417mm	50mm	2-331677-6	A24875-ND	1,60	3
37	J37	MIL-MAX-3111 (modified)	417mm	40mm	2-331677-6	A24875-ND	1,60	3
38	J38	MIL-MAX-3111 (modified)	417mm	30mm	2-331677-6	A24875-ND	1,60	3
39	J39	MIL-MAX-3111 (modified)	460mm	390mm	2-331677-6	A24875-ND	1,60	3
40	J40	MIL-MAX-3111 (modified)	460mm	380mm	2-331677-6	A24875-ND	1,60	3
41	J41	MIL-MAX-3111 (modified)	460mm	320mm	2-331677-6	A24875-ND	1,60	3
42	J42	MIL-MAX-3111 (modified)	460mm	310mm	2-331677-6	A24875-ND	1,60	3
43	J43	MIL-MAX-3111 (modified)	460mm	300mm	2-331677-6	A24875-ND	1,60	3
44	J44	MIL-MAX-3111 (modified)	460mm	290mm	2-331677-6	A24875-ND	1,60	3
45	J45	MIL-MAX-3111 (modified)	460mm	280mm	2-331677-6	A24875-ND	1,60	3
46	J46	MIL-MAX-3111 (modified)	460mm	270mm	2-331677-6	A24875-ND	1,60	3
47	J47	MIL-MAX-3111 (modified)	460mm	260mm	2-331677-6	A24875-ND	1,60	3
48	J48	MIL-MAX-3111 (modified)	460mm	250mm	2-331677-6	A24875-ND	1,60	3
49	J49	MIL-MAX-3111 (modified)	460mm	240mm	2-331677-6	A24875-ND	1,60	3
50	J50	MIL-MAX-3111 (modified)	460mm	230mm	2-331677-6	A24875-ND	1,60	3
51	J51	MIL-MAX-3111 (modified)	482mm	160mm	2-331677-6	A24875-ND	1,60	3
52	J52	MIL-MAX-3111 (modified)	482mm	150mm	2-331677-6	A24875-ND	1,60	3
53	J53	MIL-MAX-3111 (modified)	482mm	140mm	2-331677-6	A24875-ND	1,60	3
54	J54	MIL-MAX-3111 (modified)	482mm	130mm	2-331677-6	A24875-ND	1,60	3
55	J55	MIL-MAX-3111 (modified)	482mm	120mm	2-331677-6	A24875-ND	1,60	3
56	J56	MIL-MAX-3111 (modified)	482mm	110mm	2-331677-6	A24875-ND	1,60	3
57	J57	MIL-MAX-3111 (modified)	482mm	100mm	2-331677-6	A24875-ND	1,60	3
58	J58	MIL-MAX-3111 (modified)	482mm	90mm	2-331677-6	A24875-ND	1,60	3
59	J59	MIL-MAX-3111 (modified)	482mm	80mm	2-331677-6	A24875-ND	1,60	3
60	J60	MIL-MAX-3111 (modified)	482mm	70mm	2-331677-6	A24875-ND	1,60	3
61	J61	MIL-MAX-3111 (modified)	482mm	60mm	2-331677-6	A24875-ND	1,60	3
62	J62	MIL-MAX-3111 (modified)	482mm	50mm	2-331677-6	A24875-ND	1,60	3
63	J63	MIL-MAX-3111 (modified)	482mm	40mm	2-331677-6	A24875-ND	1,60	3
64	J64	MIL-MAX-3111 (modified)	482mm	30mm	2-331677-6	A24875-ND	1,60	3



# Mounting holes for Cooling Plate



<i>Id</i>	<i>Connector</i>	<i>Footprint</i>	<i>X position</i>	<i>Y position</i>	<i>Layer (Top/Bottom)</i>	<i>Rotation</i>	<i>Mfg Part #</i>	<i>Digi-Key #</i>	<i>Hole diameter (mm)</i>	<i>Pad diameter (mm)</i>
1	J100	CoolingPlateHole	476.000mm	180.000mm	T	0	N.A.	N.A.	6,604	6,604
2	J101	CoolingPlateHole	475.160mm	135.490mm	T	0	N.A.	N.A.	6,604	6,604
3	J102	CoolingPlateHole	475.160mm	25.000mm	T	0	N.A.	N.A.	6,604	6,604
4	J103	CoolingPlateHole	439.490mm	20.000mm	T	0	N.A.	N.A.	6,604	6,604

Coordinates in compliance with LTDB.





# Using Lower Values Resistors



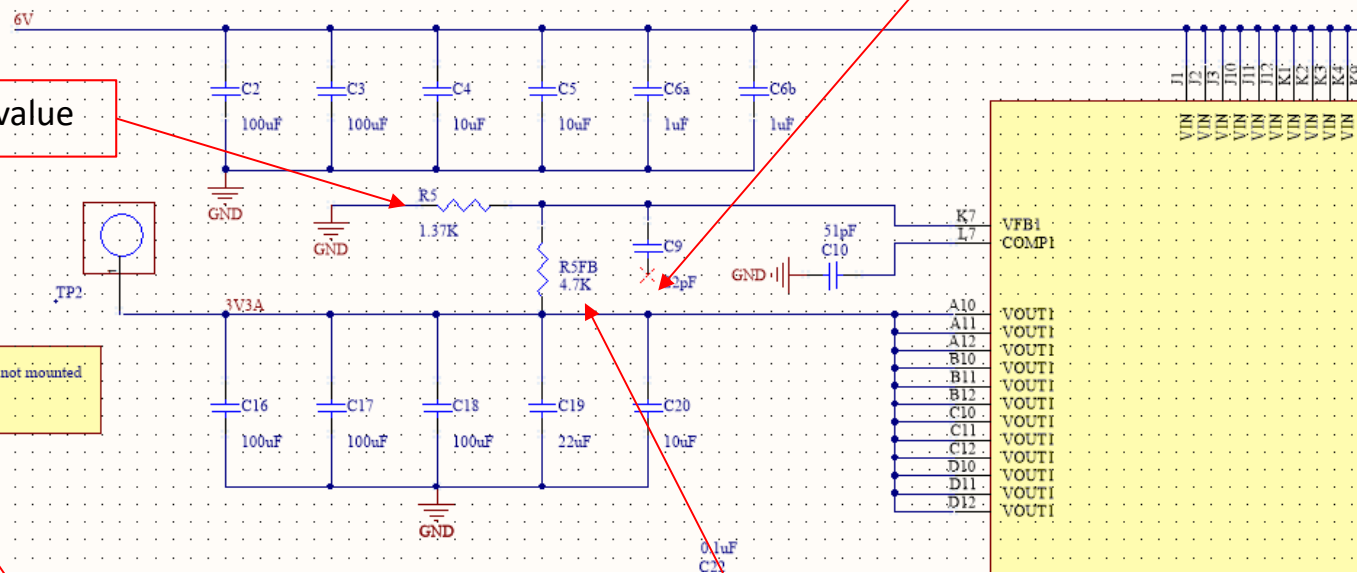
The behavior of the feedback network is still unclear when using changed resistor values. We have introduced the possibility of connecting the capacitor to both input voltage (previous version) and ground. This can be achieved by welding points (jumper solder type).

Resistor with changed value

Manufacturing Configuration:  $R_5 = 19.1K$ ,  $R_{5FB}$  = not mounted  
Default Configuration:  $R_5 = 1.37K$ ,  $R_{5FB} = 4.7K$

Both solution are possible (previous solution and solution suggested during FDR).  
Boards will be manufactured with the new solution.

New external resistor.





# Evaluating Resistors



Evaluation ...



Rinternal	60400					
FB	4700					
Rparallel	4360,675883					
Vout	1,2	1,5	1,8	2,5	3,3	4
Rext	8721,352	4983,630	3488,541	2052,083	1395,416	1090,169
Nominal	8660	4870	3480	2000	1370	1070
Vout	1,203	1,516	1,802	2,544	3,346	4,060
Error %	0,24	1,09	0,14	1,77	1,41	1,51

and

... commercial resistors

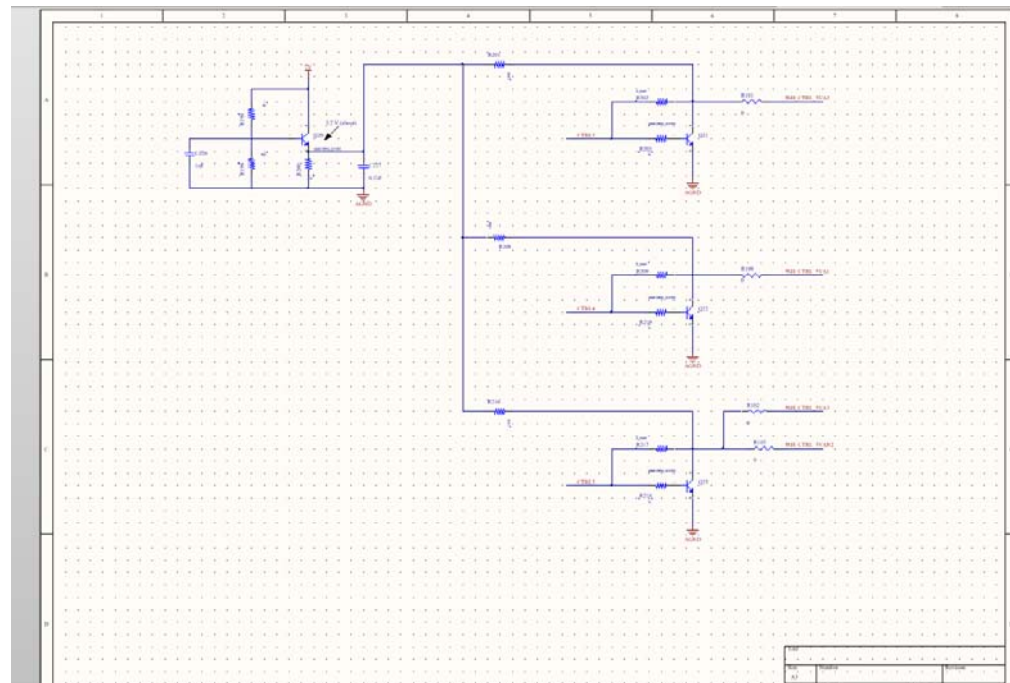


Value	Description	Mfg code	RS code
4,7k	Resistore SMD Panasonic 4,7kΩ ±1%, 0,1W, 402, serie ERJ2RK	ERJ2RKF4701X	732-5517
8.66k	Resistenza fissa per montaggio superficiale di precisione a film spesso Panasonic 8.66kΩ ±1%, 0,1W, 0402	ERJ2RKF8661X	105-1139
4.87k	Resistenza fissa per montaggio superficiale di precisione a film spesso Panasonic 4.87kΩ ±1%, 0,1W, 0402, serie ERJ	ERJ2RKF4871X	106-5279
3.48k	Resistenza fissa per montaggio superficiale di precisione a film spesso Panasonic 3.48kΩ ±1%, 0,1W, 0402	ERJ2RKF3481X	106-5243
2.0k	Resistore SMD Panasonic 2kΩ ±1%, 0,1W, 0402, serie ERJ2RK	ERJ2RKF2001X	732-5365
1.37k	Resistenza fissa per montaggio superficiale di precisione a film sottile TE Connectivity 1.37kΩ ±0.1%, 0.063W, 402	CPF0402B1K37E1	123-7070
1.07k	Resistenza fissa per montaggio superficiale di precisione a film spesso Panasonic 1.07kΩ ±1%, 0,1W, 402, serie ERJ2RK	ERJ2RKF1071X	106-4918



# CTRL circuits

CTRL circuit for Analog devices (LHC) have been modify as request by Hao during last LAr Week.



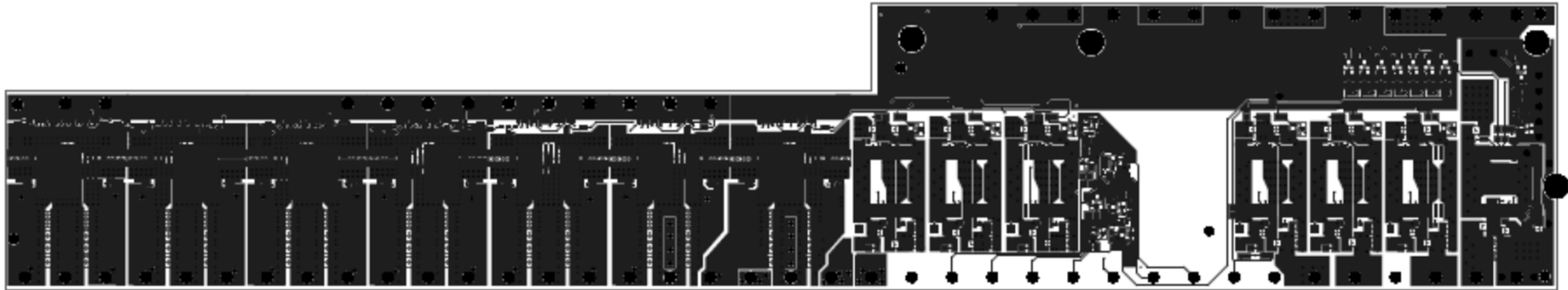


# Risk of damage during insertion

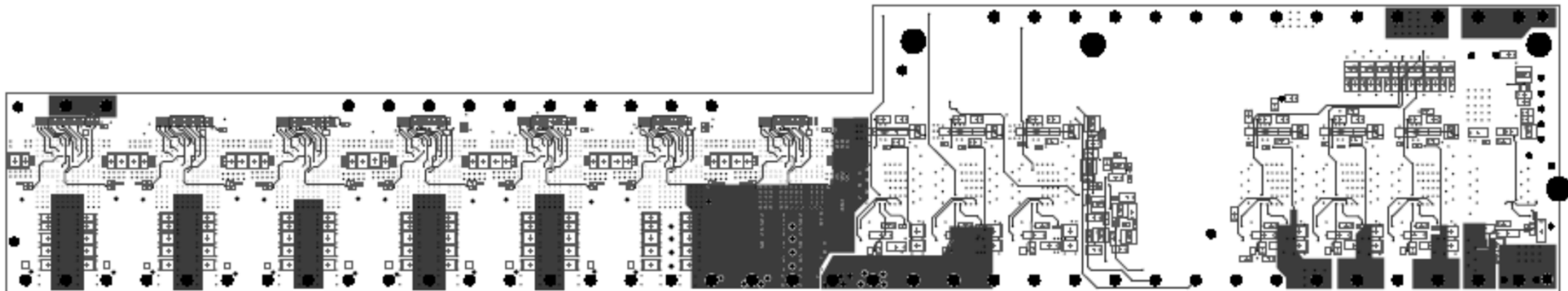


- 1) Caring during de-panelization and insertion on LTDB
- 2) Design of an *ad hoc* “frame” to give more rigidity to the PDB-LTM board (ongoing)
- 3) Design of an insertion tool (ongoing)

# Top Layer

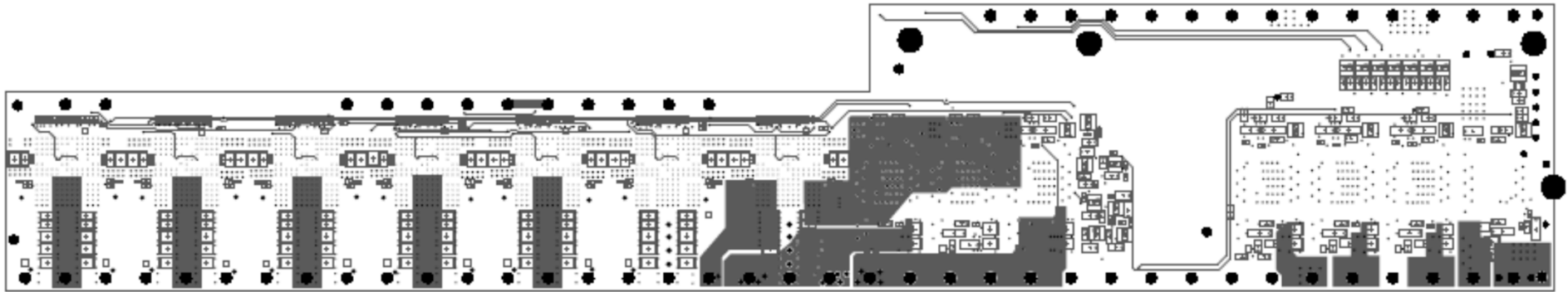


# Signal 1

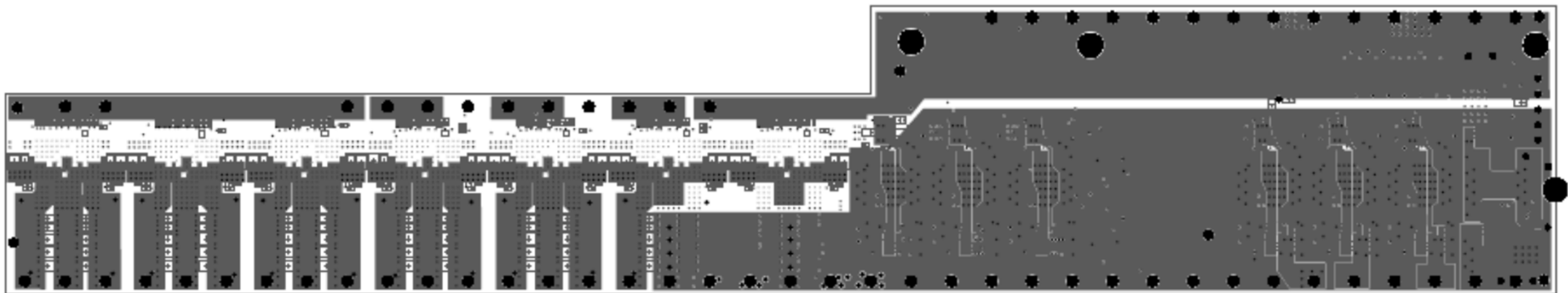




# Signal 2



# Bottom





# Further layers



Power and GND layers are not shown.

## Top overlay

