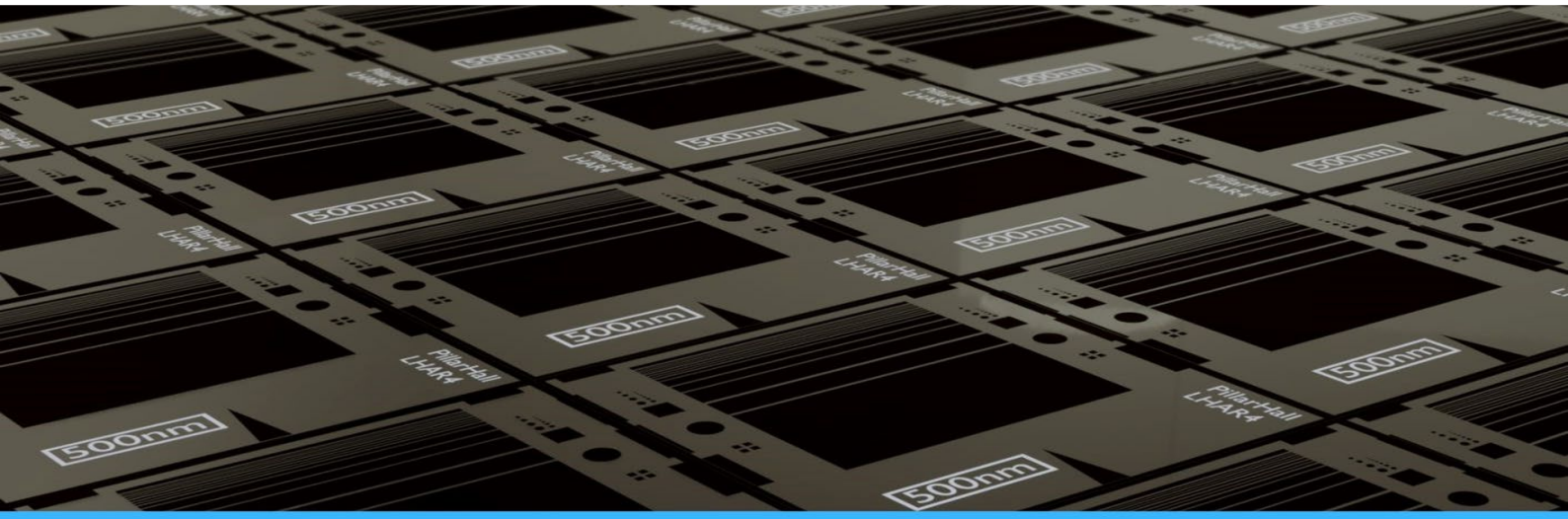
PillarHall®

PillarHall® LHAR4 Test Chip Data Sheet



Purpose of use

PillarHall® LHAR4 silicon test chip contains Lateral High Aspect Ratio (LHAR) test structures for ALD and CVD thin film characterization. It is used as a measurement tool for thin film conformality and side wall coverage measurements in a high aspect ratio trench.

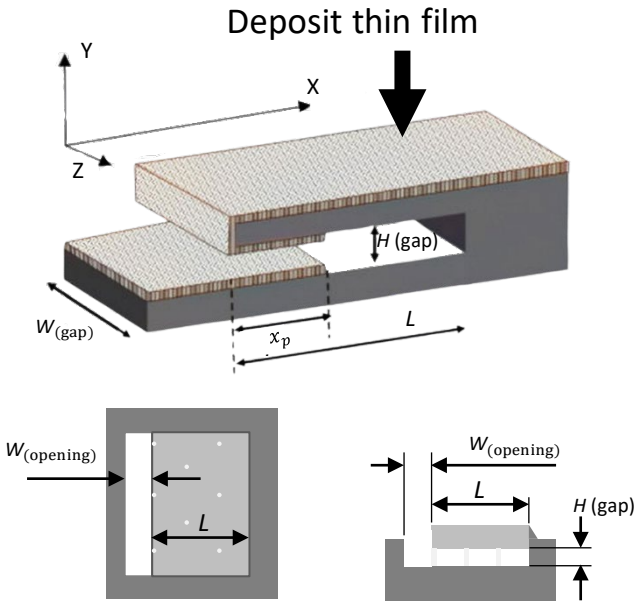


Figure 1. Geometry of the LHAR structure. *H* is the gap height. *L* is length (depth) of the trench, $W_{(gap)}$ is width of the trench, and $W_{(opening)}$ is the width of the trench opening, and x_p stands for film penetration depth. $W_{(opening)}$ is different from $W_{(gap)}$.

Technical specifications		Remarks
Product ID	PillarHall® Test Chip LHAR4	
Material	Silicon	
Chip size	15 mm x 15 mm	
Test structures	19 LHAR in the main area 8 LHAR in the chip side	Layout next page
Aspect ratios (AR)	From 10048:1; to 2:1 See the table in the next pages.	On 500 nm nominal gap height (AR= *l : h*)
Nominal gap height	*H (gap)* = 500 nm	
Gap width	$W_{(gap)}$ = 10000 µm	In main LHAR structure area
Opening area ($W_{(opening)}$)	$W_{(opening)}$ = 5 - 100 µm	Illustrated in Figure, details in Table
Temperature *	Up to 800°C	
Pressure *	From high vacuum to atmospheric	

OPTIONS: In addition, Chipmetrics provides tailored designs with different dimensions. Ask for more information

Details of PillarHall® LHAR4 chips features

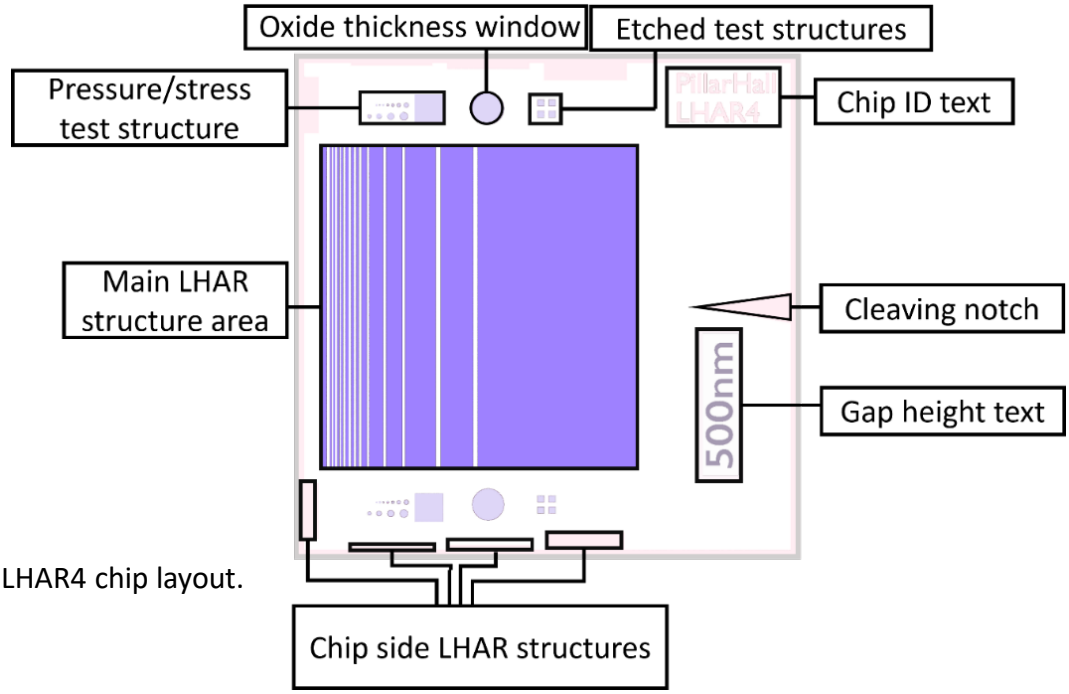


Figure 2. LHAR4 chip layout.

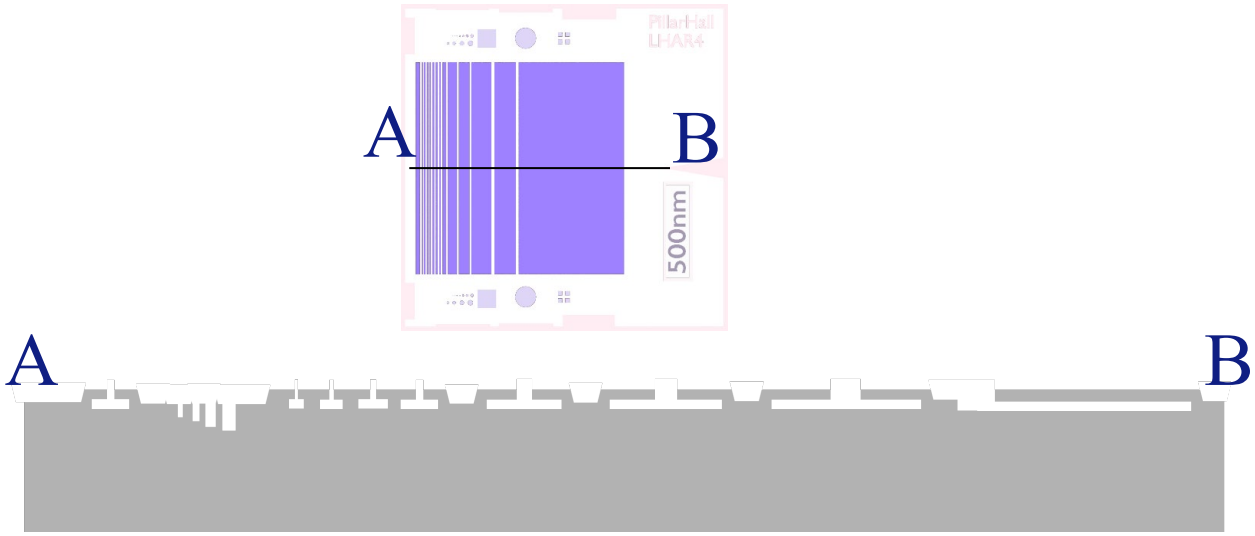


Figure 3. Cross-sectional (A-B) illustration of the main test structure area – not in scale. The picture above shows the position of this cross section on the LHAR4 main area.

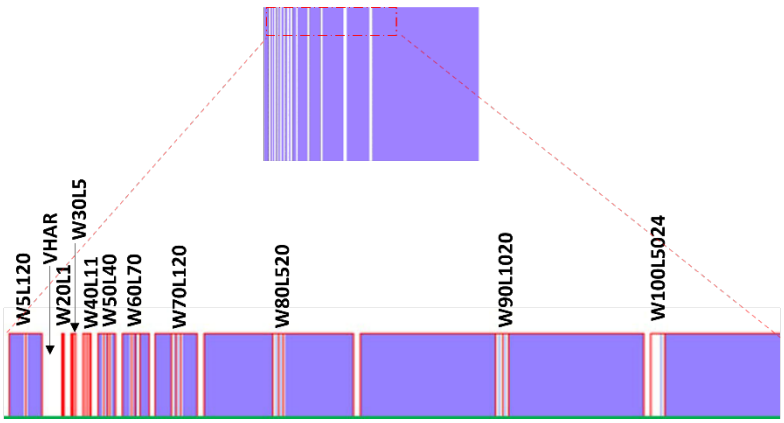


Figure 4. LHAR structure ID codes and their positions on the chip. Their dimensions are described in the Table.

LHAR Structure ID	2-directional LHAR	Gap lenght (L), µm	Opening width (w), µm	Aspect Ratio AR (L/H)
W100 L5024	No	5024	100	10 048 : 1
W90 L1020	Yes	1000	90	2 000 : 1
W80 L520	Yes	520	80	1 040 : 1
W70 L120	Yes	120	70	240 : 1
W60 L70	Yes	70	60	140 : 1
W50 L40	Yes	40	50	80 : 1
W40 L11	Yes	11	40	22 : 1
W30 L5	Yes	5	30	10 : 1
W20 L1	Yes	1	20	2 : 1
W5 L120	Yes	120	5	240 : 1

Vertical HAR (VHAR) structures in PillarHall LHAR4 Test chip

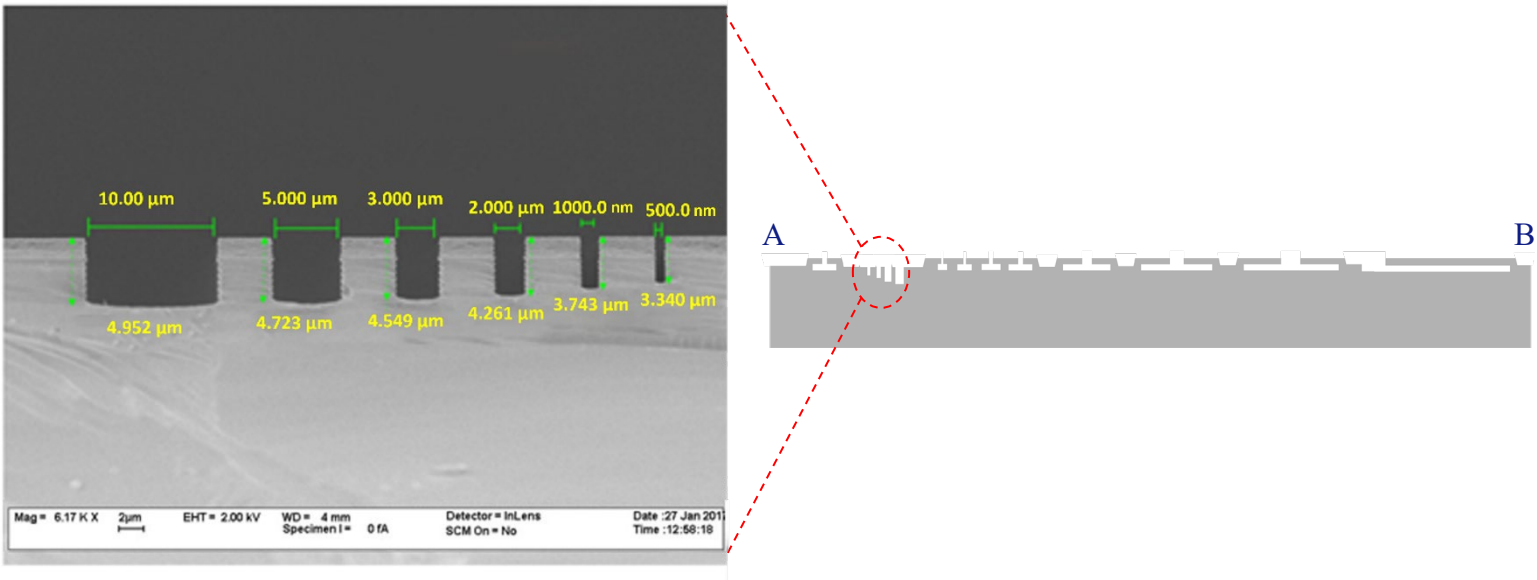
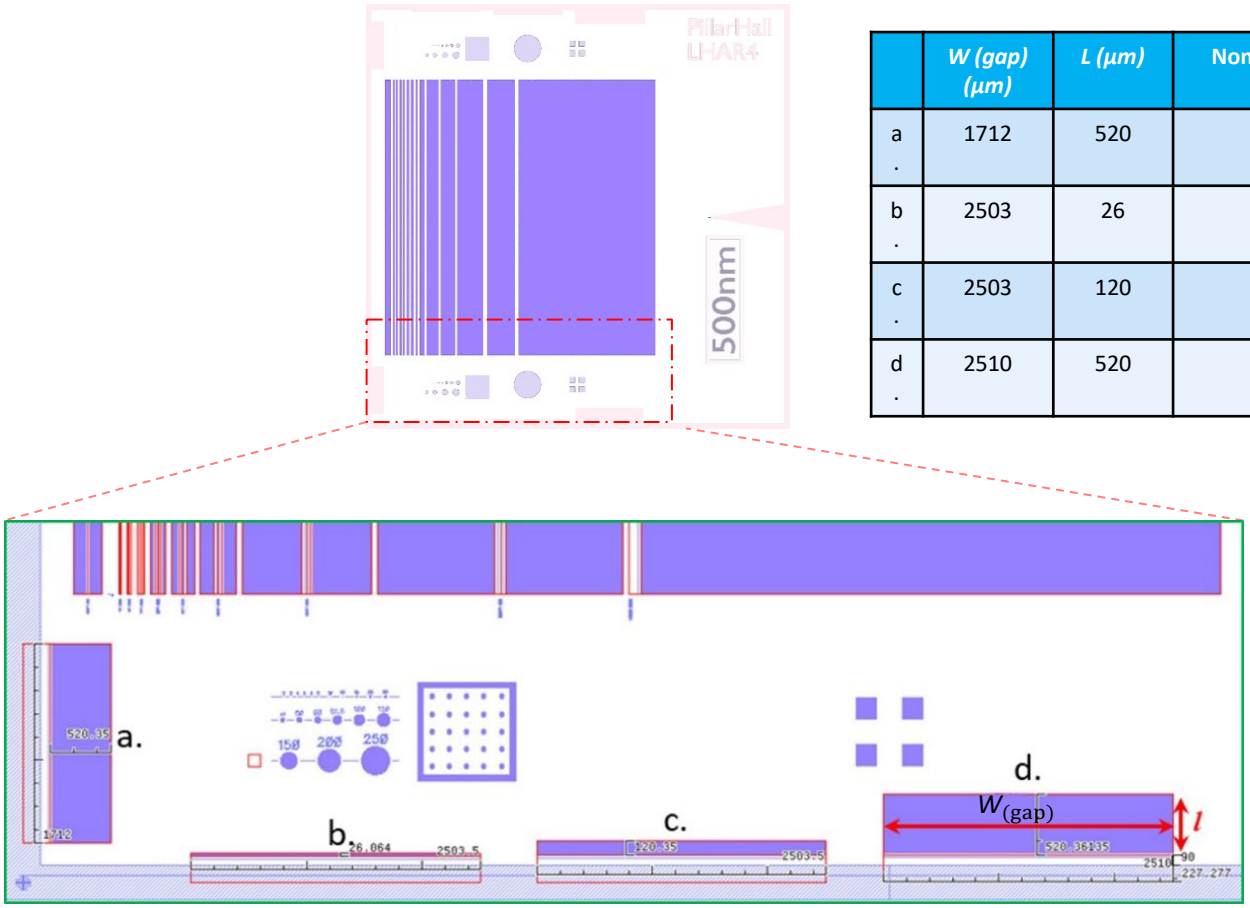


Figure 5. Cross sectional electron microscopic image of the VHAR trenches presenting the trench dimensions. Dimension accuracy is ± 10 % .

Chip side LHAR structures

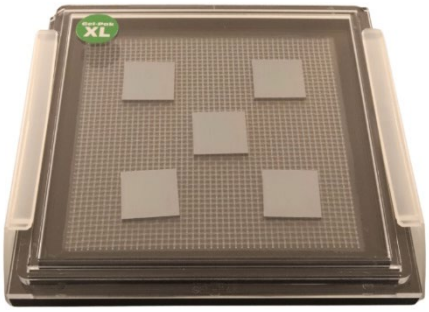


	W (gap) (µm)	L (µm)	Nominal AR (L/H)
a.	1712	520	1040
b.	2503	26	52
c.	2503	120	240
d.	2510	520	520

Figure 6. Chip side LHAR test structures in LHAR4.

- The opening width in the chip side LHAR structures is minimum $W_{(\text{opening})}$ = 90 µm. The exact dimension can be slightly higher, depending on the chip dicing precision.

Delivery and Shipment



Selected and inspected PillarHall LHAR4 test chips are delivered in vacuum release tray boxes.

- **Country of origin: Finland, EU**
- **Registered exporter FIREX31010316**
- **ISO 9001:2015 compliant. IC cleanliness certified**

List of further reading

1. PILLARHALL CHIP HANDLING GUIDELINES
This Document includes general handling guidance, storage conditions, shipment types, inspecting the shipment box, handling the box, transferring chips out from the box, inspecting and handling wafers, and transferring chips out from the wafer's shipper box.

2. PILLARHALL TEST CHIP ANALYSIS GUIDE
Various development versions, product models and other information of the PillarHall® Test Chips as well as information of their typical use in analysis are described in this PillarHall® Analysis Guide.

3. Application Note PILLARHALL LHAR4 – STANDARD PROCEDURE IN PROCESS MONITORING
This application note describes the standard procedure of PillarHall LHAR4 test chip use in 3D thin film deposition process monitoring.

4. Application Note PILLARHALL LHAR4 – COMPARING THE CONFORMALITY PERFORMANCE TO OTHER HIGH ASPECT RATIO STRUCTURES
This application note describes how the PillarHall LHAR4 film penetration depth profile results can be used to predict conformality in any high aspect ratio structure, when the dimensions of these structures are known.

5. Technical Note PILLARHALL LHAR4 – USE IN DIRECTIONAL DEPOSITIONS
This document provides information about the experimental arrangements of PillarHall LHAR4 test chip use in directional thin film growth process studies.

6. Technical Note PILLARHALL LHAR4 - MEASUREMENT UNCERTAINTY AND SURFACE ROUGHNESS
This document provides information about LHAR test structure dimensional uncertainty and surface roughness.

7. Application Note PILLARHALL LHAR4 – COMPATIBILITY WITH PE-CVD
This application note assesses PillarHall LHAR4 measurement tool compatibility with PE-CVD.

Further References

The scientific articles are listed at:

http://www.pillarhall.com/references.htm

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