



Notes – January 2025

Silicon Diodes for Defect Spectroscopy

Michael Moll, CERN, Geneva, Switzerland

Outline:

- *CiS: Kevin Lauer, Martin Schaedel*
- *CERN: Yana Gurimskaya, Michael Moll*

- A new sensor production at CiS
 -

Motivation

Defect spectroscopy needs different resistivity materials

- We are running out of previously produced p-type test structures
 - Interest: Need more EPI-test structures to complement previous studies
- We are missing low resistivity material for testing
 - Interest: n- and p-type dopants
 - Interest: high doping content; high electric field; fermi level close to bands

Why now?

- CiS is going to shut down the 4-inch production line
 - [January 2025 – last possible date for order]
- Mask set and wafers are available at CiS
 - re-use of mask set from last RD50 project on “mimicking LGAD”

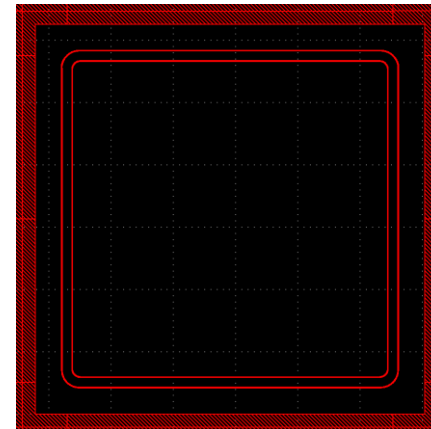
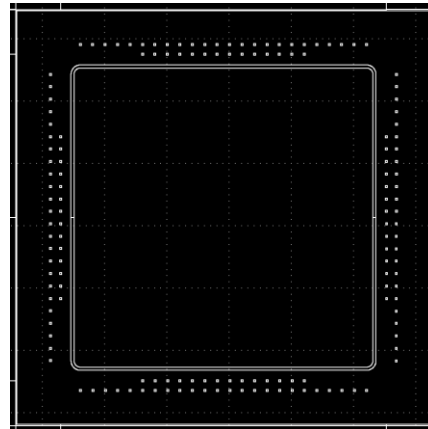
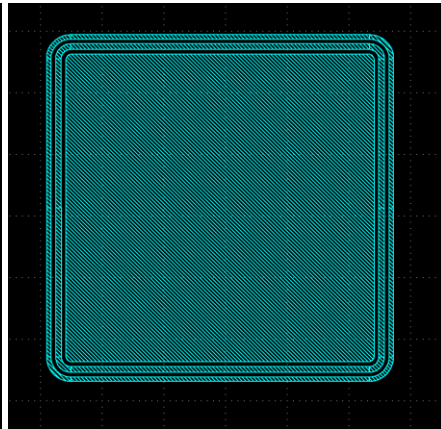
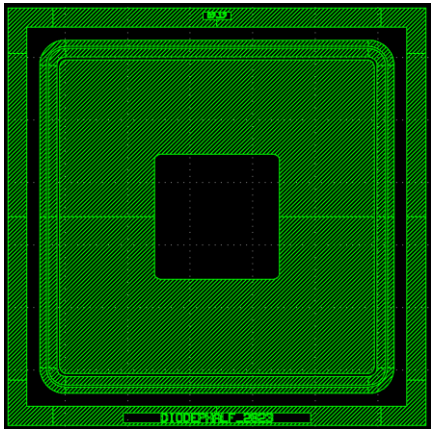
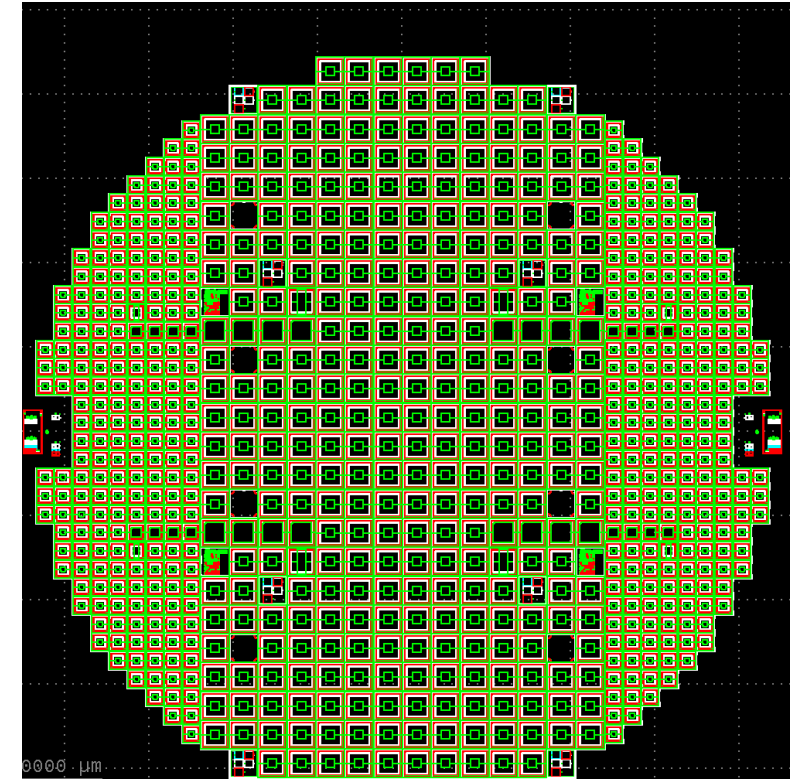
Why not DRD3 common project?

- no time for DRD3 evaluation and approval process before placing order

Mask (4-inch)

Mask

- Existing mask set (project RD50-2022-01)
- Front side: Only diodes and test fields
- Back side: Full area implant and metal (cost saving)
- Same mask for n- and p-type (splitting of some process steps)
 - **Open Question: Use of p-stop layer for n-type sensors (yes/no)?**
- Additional masks needed for this production
 - 3 masks to be replaced with new ones (contaminated with carbon)
- Diodes $2.5 \times 2.5 \text{ mm}^2$ and $1.25 \times 1.25 \text{ mm}^2$



Material (p-type- DRAFT)

comment	producer	material	dopant	rho [Ωcm]		d [μm]	available	use		
Wafers from run 350153 [?]	ITME	EPI	B	1000	?	50+525	[CIS:4]	1		
Wafers from run 350153 [?]	ITME	EPI	B	250	?	50+525	[CIS:3]	2		
Wafers from run 350153 [?]	ITME	EPI	B	50	?	50+525	[CIS:3]	2		
Wafers from run 350153 [?]	ITME	EPI	B	10	?	50+525	[CIS:3]	2		
	?	FZ	B	>3000	100	525	CIS	1		
401782_01-12	?	FZ	B	100-200	100	350	[CIS:1]	1		
440603 Ioana Project		FZ	B	10.3	100	525	CIS	2		
440598 Ioana Project		FZ	B	1-3	100	250	CIS	2		
		CZ	B	8-12	100	525	CIS	1		
		CZ	B	5-10	100	525	CIS			
		CZ	B	1-5	100	525	CIS			
CZ3, 402757_25		CZ	B	1-2	100	475	CIS	1		
CZ2, 401782_13-15		CZ	B	0.5-1	100	250	CIS			spare
CZ1, 401782_19-21		CZ	B	0.224-0.26	100	525	CIS		15	p-type

Targets:

- Cover high doping range:
 - 1, 10, 100 Ωcm
 - prefer FZ over CZ (more reproducible ?)
- Include previous production
 - EPI from ITME
 - FZ from I.Pintilie project

...all selected wafers on-stock at CIS

Material (n-type- DRAFT)

comment	producer	material	dopant	rho [Ωcm]		d [μm]	available	use	
CIS (7.1.2025)		FZ	P	10000		525		1	
TOPSIL stock		FZ		10000		220	[TOPSIL stock:614]		
CIS (20.1.25)		FZ	P	500-700	100	?		1	
CIS (20.1.25)		FZ	P	200-260	100	?		1	
[EL-CAT :S5767]	SPC	FZ	P	approx:100	112-5	762	[EL-CAT stock: 15]		
[EL-CAT :7818]	CSW [6 weeks!]	FZ	P	90-120	100	200	[EL-CAT stock: 25]		
[EL-CAT :N442]	CSW [6 weeks!]	FZ	P	50-70	100	500	[EL-CAT stock: 15]		
TOPSIL stock	single side polished	FZ	n-type	9.0-15	100	280	[Topsil stock: 375]		
[EL-CAT :S5618]	Wacker [6 weeks!]	FZ	P	8.8-11.2	100	625	[EL-CAT stock: 75]		
Siegert 17.1.25		FZ	P	7.0 - 10			[Siegert stock: 5]	2	
[EL-CAT : H932]	CSW [6 weeks!]	FZ	P	6.0-7.4	111	470	[EL-CAT stock: 10]		
[EL-CAT : 11688]	TOPSIL	FZ	P	3.0-3.2	100	280	[EL-CAT stock: 100]	2	
Siegert 17.1.25		FZ	P	1.0-5.0	100	280	[Siegert stock: 5]		
[EL-CAT : B0530]	CSW [6 weeks!]	FZ	P	0.5-1.0	100	525	[EL-CAT stock: 5]		
[EL-CAT : B1522]	CSW [6 weeks!]	FZ	P	0.17-0.23	100	285	[EL-CAT stock: 5]		
CIS (20.1.25)		CZ	P	285-355	100	?		1	
CIS (20.1.25)		CZ	P	8-20	111	?			
CIS (20.1.25)		CZ	P	10-20	100	?		1	
CIS (20.1.25)		CZ	P	3.5-5.5	100	?			
CIS (20.1.25)		CZ	P	3-5	100	?		1	
									10 n-type

Targets:

- Cover high doping range:

- 1, 10, 100 Ωcm
- prefer FZ over CZ (more reproducible ?)

...would need to order wafers from Siegert and EL-CAT ??