

Belle2- ASIC Review July 2015

DEPFET sensor parameter

All dynamic measurements
on DEPFET matrices tested up to now
are coming
from prototype production

PXD6

PXD6 -> PXD9

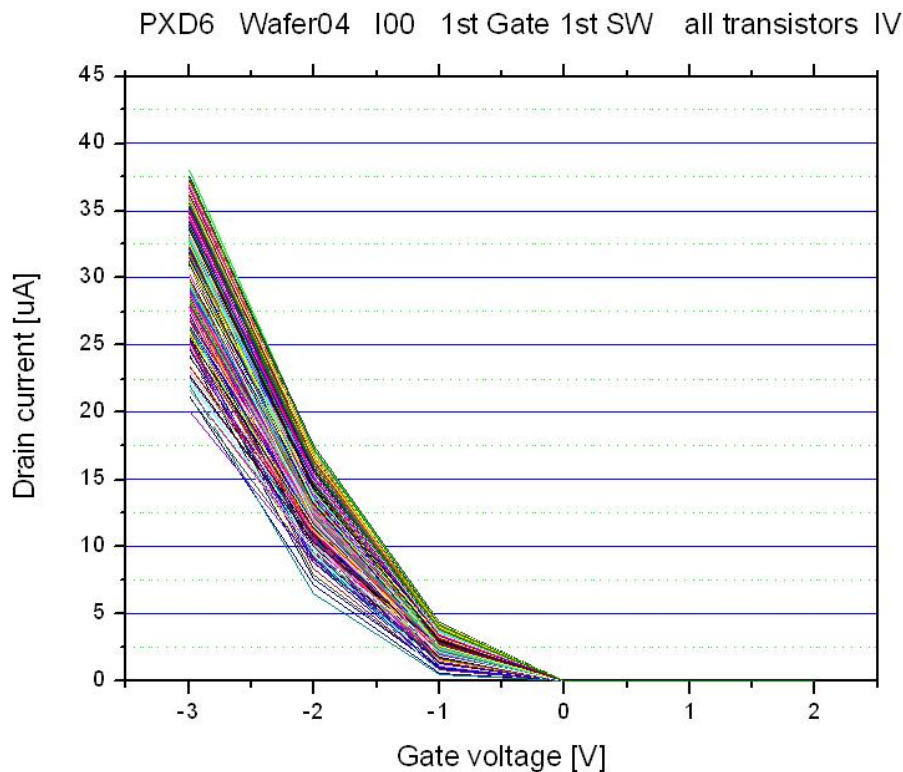
Significant technology improvements are introduced into the production run **PXD9**

- thinner gate oxides
- better lithography and etching control
- optimized process sequence
- Self aligned technology (all implantations)

Transfer characteristics taken within matrices (pedestal currents)

PXD6 (prototype run)

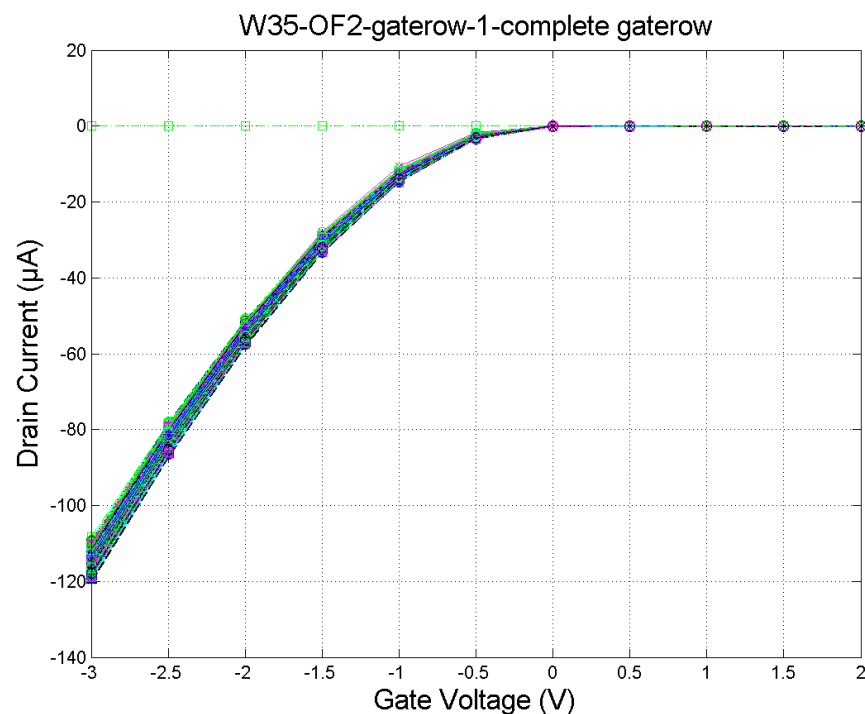
768 Depfets – Big Matrix I00 first row

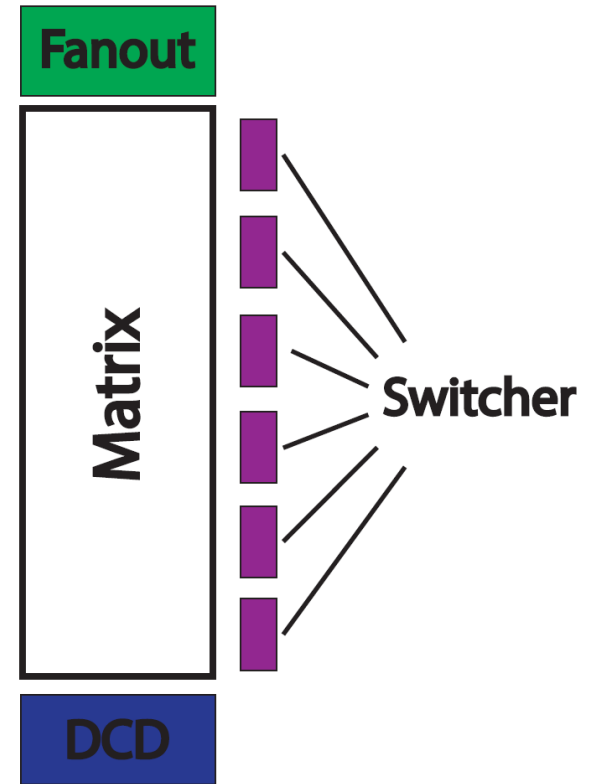
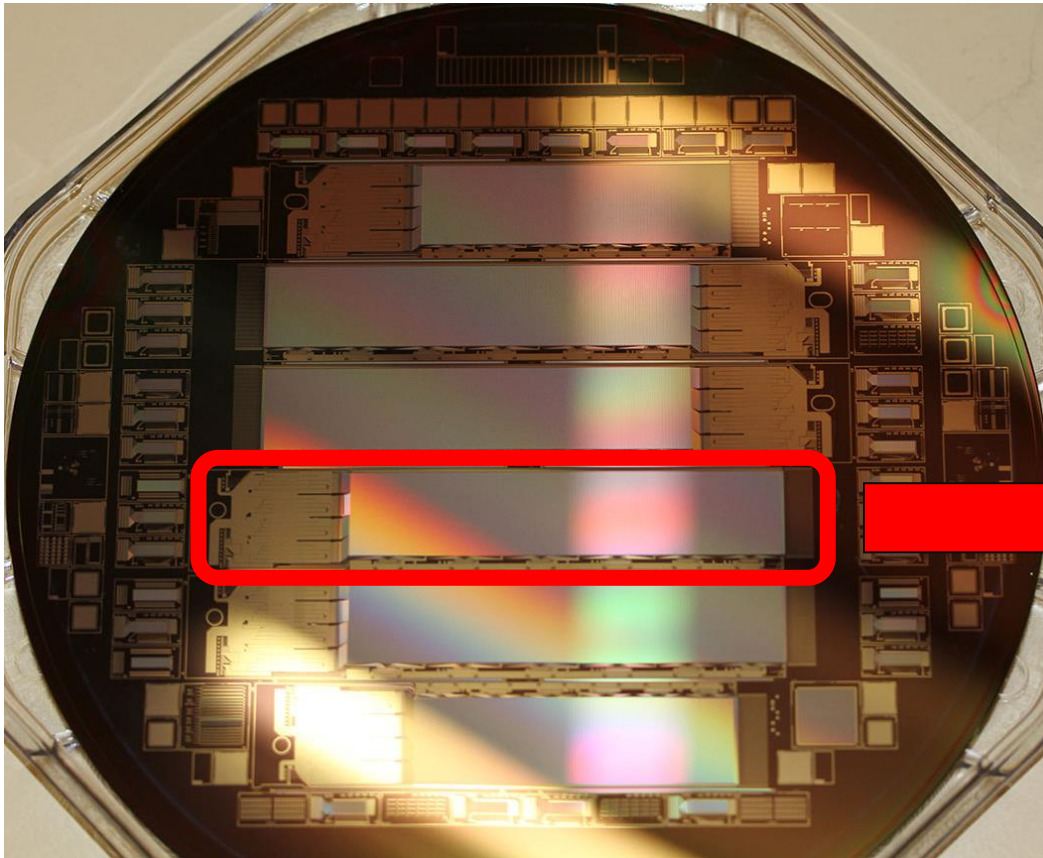


PXD9 (production run)

measured after 2nd metallization

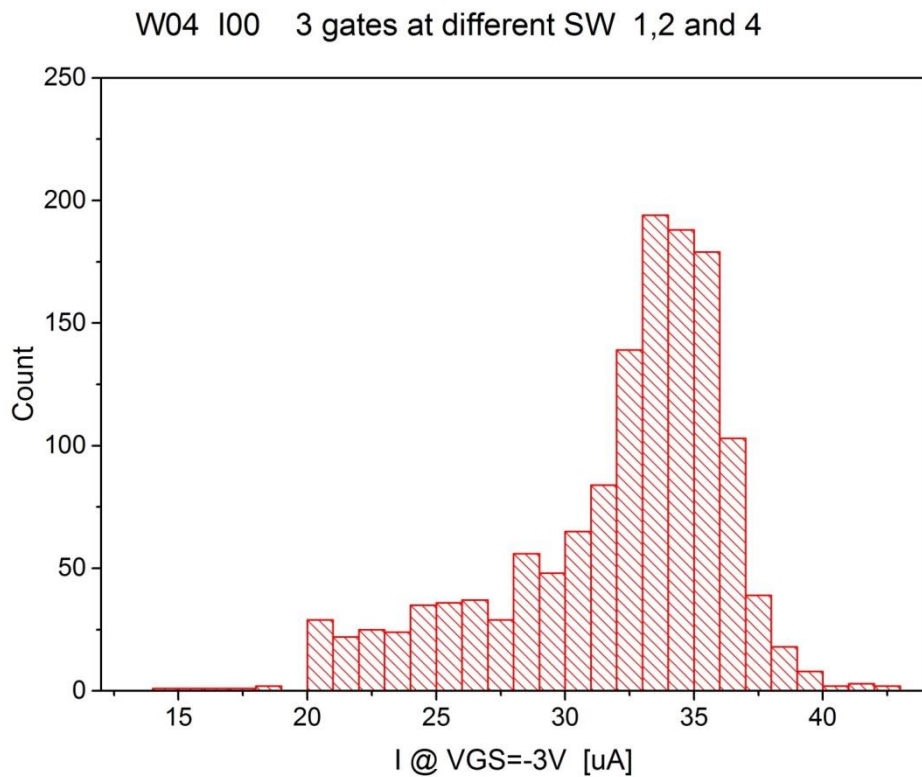
1000 Depfets – Outer forward 2



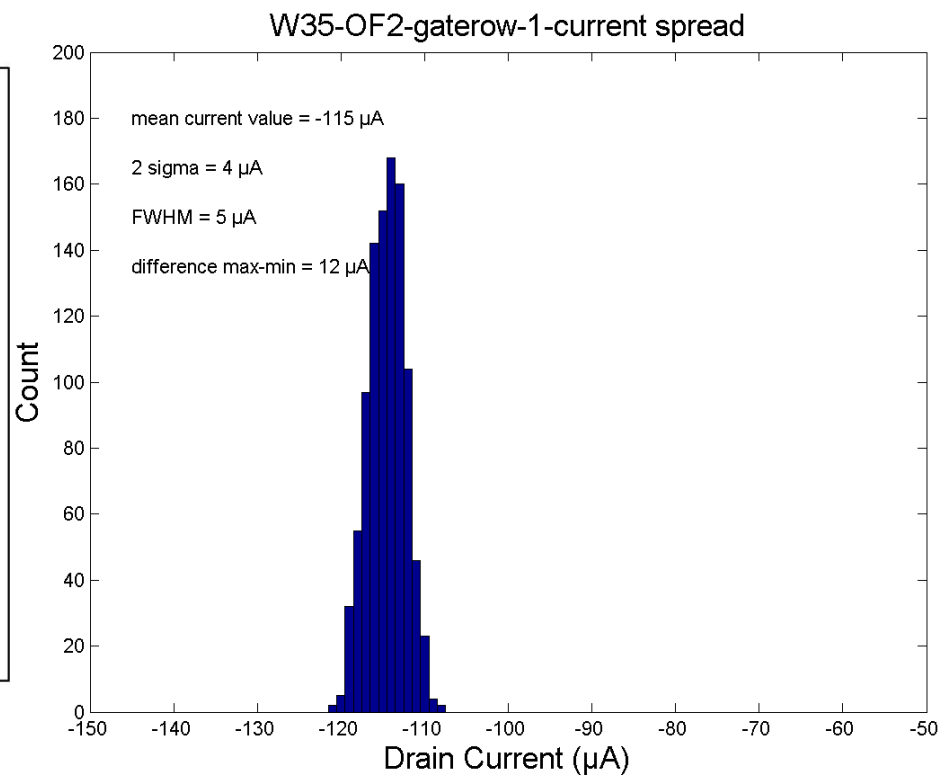


Pedestal currents spread

PXD6



PXD9





Drain currents PXD9 - W35 (OF1 22000, OF2 12000 pixel)



$V_G = -3V, V_{DS} = -5V$ $V_{AC} = 15V, V_{CG} = 5V$	Average current [- μ A]		pedestal spread [μ A] (2σ)		Threshold voltage [V]	
	OF1	OF2	OF1	OF2	OF1	OF2
switcher1 gaterow1	121	114	21 (7)	17 (6)	0,051	-0,016
switcher1 gaterow2	119	113	16 (6)	17 (5)	0,039	-0,020
switcher2 gaterow1	127	122	20 (8)	23 (9)	0,093	0,055
switcher2 gaterow2	126	123	22 (8)	24 (9)	0,098	0,061
switcher2 gaterow3	124	-	13 (5)	-	0,081	-
switcher2 gaterow4	123	-	15 (6)	-	0,073	-
switcher3 gaterow1	119	123	15 (5)	18 (6)	0,025	0,059
switcher3 gaterow2	120	123	17 (5)	16 (5)	0,029	0,057
switcher3 gaterow3	120	-	16 (6)	-	0,026	-
switcher3 gaterow4	121	-	17 (6)	-	0,054	-
switcher4 gaterow1	125	124	19 (7)	25 (10)	0,102	0,081
switcher4 gaterow2	124	124	15 (5)	16 (5)	0,095	0,085
switcher4 gaterow3	124	-	13 (5)	-	0,093	-
switcher4 gaterow4	125	-	15 (6)	-	0,102	-
switcher5 gaterow1	122	120	19 (7)	23 (7)	0,090	0,097
switcher5 gaterow2	122	120	14 (5)	14 (5)	0,087	0,061
switcher5 gaterow3	123	-	16 (5)	-	0,109	-
switcher5 gaterow4	121	-	17 (6)	-	0,090	-
switcher6 gaterow1	122	120	15 (5)	19 (6)	0,074	0,055
switcher6 gaterow2	120	120	17 (6)	15 (5)	0,058	0,050
switcher6 gaterow3	122	-	15 (6)	-	0,076	-
switcher6 gaterow4	121	-	17 (6)	-	0,067	-
Total average	122,3	120,50	16,5 (6,0)	18,9 (6,5)	0,073	0,052

- **DEPFET parameter (relevant for ASICs)**

Pedestal current 110 μ A

Gm 75 μ S @Vgs_on = -3V, Vds = -5V

Gq (internal amplification): 400pA/e-

Vth* -0.5V

Vgs_on* -3V

Vgs_off* 5V

Vds = -5V

Vclear_on 20V

Vclear_off 5V

* changes with radiation