中国科学院高能物理研究所
Institute of High Energy Physics
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TaichuPix-3 test

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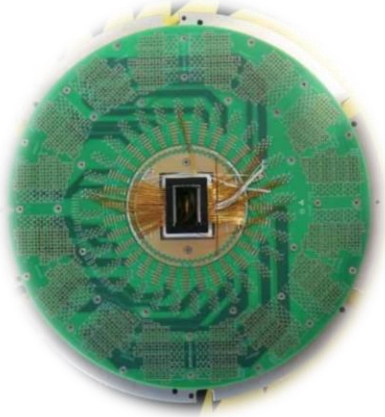
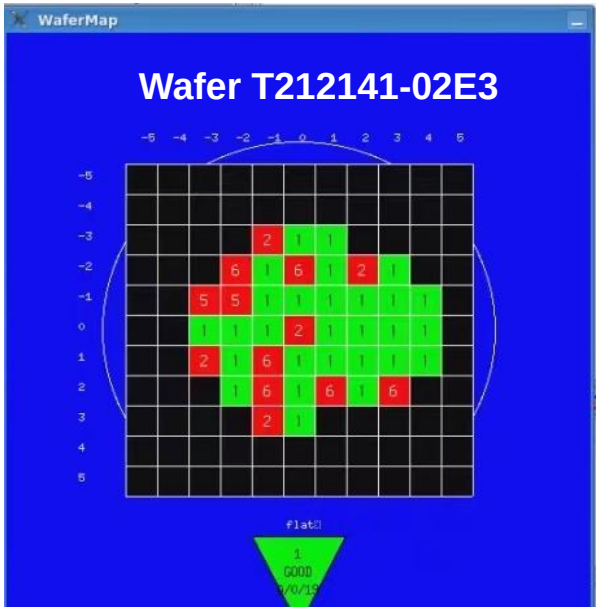
2022-9-8

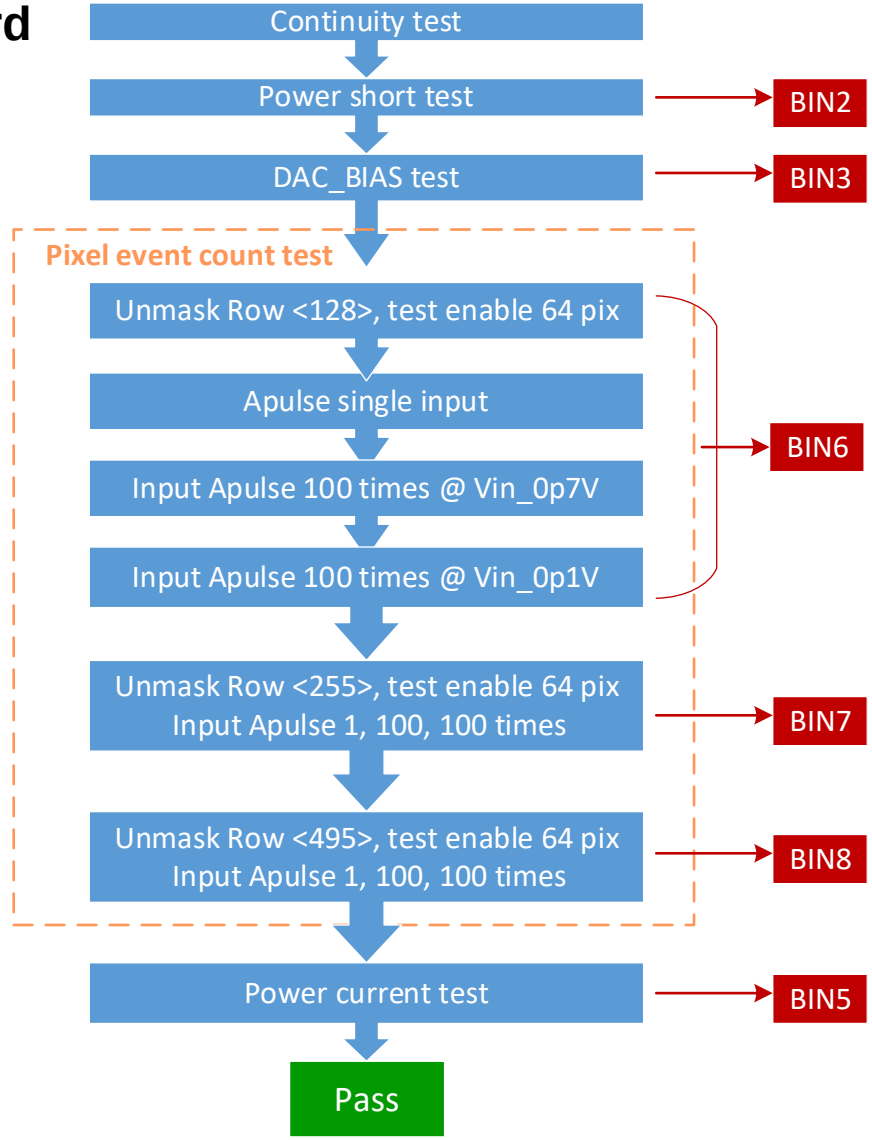
Wafer test

- **5 wafers tested on the prob card**



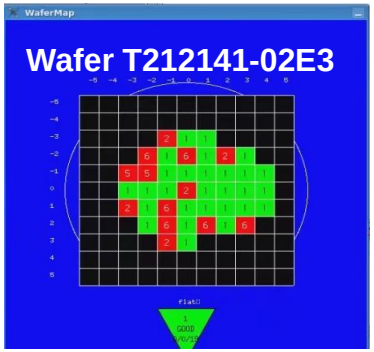
Wafer on the probe





Wafer test

- **Wafer T212141-02E3**
  - 30 of 41 dies pass the test (BIN1)



Test result

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V
55	53	Continuity_Test	passVolt_mV	TP_IO	-800.0000	-100.00(	mV	-3960.05	-324.636	-323.726	-321.393	-323.612	-324.352	-323.669	-325.831	-326.742	-329.474	-326.913	-324.978	-324.124	-323.953	-323.8
56	54	Continuity_Test	passVolt_mV	TRIGGER	-800.0000	-100.00(	mV	-3926.87	-343.416	-343.928	-341.026	-345.636	-346.091	-345.806	-347.457	-349.619	-349.619	-348.879	-346.888	-345.408	-345.294	-344.5
57	55	Continuity_Test	passVolt_mV	TVC	-800.0000	-100.00(	mV	-3997.21	-324.521	-322.643	-321.903	-324.35	-325.147	-325.83	-327.31	-328.676	-330.554	-327.936	-325.659	-324.92	-324.236	-323.7
58	56	Continuity_Test	passVolt_mV	VBG	-800.0000	-100.00(	mV	-3945.37	-323.271	-323.328	-321.62	-323.043	-323.043	-323.783	-325.376	-325.376	-329.36	-325.945	-325.149	-322.872	-323.214	-322.1
59	57	PowerShort_Test	passCurrentLin	AVDD	-30000.00	5.00000	mA		0	-0.1226	0.061299	13.48584	1.777679	0.183898	0	1.225985	0.122599	0.183898	0.061299	0.061299	0	0.1838
60	58	PowerShort_Test	passCurrentLin	DVDD	-30000.00	5.00000	mA		0.184213	0	0.061404	59.99198	0.061404	4.052682	0	3.86847	3.86847	3.561448	0.122809	0.184213	0.122809	0.2456
61	59	PowerShort_Test	passCurrentLin	VDD_PLL	-30000.00	5.00000	mA		-27.7212	-27.5986	-27.8439	-27.6599	-28.0279	-27.4759	-27.7212	-28.0279	-27.5373	-27.7212	-27.5373	-28.0892	-27.2306	-27.72
62	60	PowerShort_Test	passCurrentLin	VREST	-30000.00	5.00000	mA		0.122728	-0.06136	0.061364	0.061364	-1.77955	0.122728	0.061364	-0.49091	0.061364	0.245455	0.122728	0.061364	0.122728	0.1227
63	61	PowerShort_Test	passCurrentLin	VHIGH	-30000.00	5.00000	mA		-0.18439	0	0.245858	0.245858	-0.12293	-0.12293	0.061464	-0.18439	-0.06146	0.245858	0	0.184393	0.245858	
64	62	PowerShort_Test	passCurrentLin	VLOW	-30000.00	5.00000	mA		0.122757	0.184135	0.245514	0.245514	0.122757	0.184135	0.184135	-0.06138	0.245514	0.122757	0.245514	0.061378	0.184135	0.0613
65	63	DAC_BIAS_Test	VBG_BIAS	VBG	600.00000	900.000(	mV		792.86	806.8745	797.7144		798.0854	804.8917	793.6908	790.2227	805.0702	800.1365	795.0523	789.946	796.4998	796.89
66	64	DAC_BIAS_Test	DAC2_0x80	TP_IO	150.00000	400.000(	mV		220.7533	225.7379	214.9474		217.5623	218.5193	216.4515	212.5204	219.9868	217.6697	216.8595	212.8938	217.7102	218.48
67	65	DAC_BIAS_Test	DAC2_0x95	TP_IO	200.00000	600.000(	mV		468.307	480.555	464.0906		469.0116	475.438	467.8717	468.6289	477.2114	471.5585	472.5149	462.0406	472.4249	472.29
68	66	PIXEL_APULSE_SINGLI	EventCount	SER_VALIE	0	64			3	5	3		0	0	1	0	2	48	57	58	62	
69	67	PIXEL_VLOW_0p5_CY(	EventCount	SER_VALIE	0	6400			43	52	18		39	0	25	16	26	4917	5826	5650	6138	
70	68	PIXEL_VLOW_1p1_CY(	EventCount	SER_VALIE	0	200			47	58	16		59	0	26	6634	24	0	0	0	0	
71	69	PIXEL_APULSE_SINGLI	EventCount	SER_VALIE	16	300			63	64	61		60	0	49	48	60	44	60	56	59	
72	70	PIXEL_VLOW_0p5_CY(	EventCount	SER_VALIE	160	6400			6179	6163	6038		6004	0	4599	4916	5821	4768	6090	5540	5817	61
73	71	PIXEL_VLOW_1p1_CY(	EventCount	SER_VALIE	0	200			0	0	0		0	0	0	0	0	0	0	0	0	
74	72	PIXEL_APULSE_SINGLI	EventCount	SER_VALIE	16	640			120	116	127		100	512	496	497	122	497	120	116	126	1
75	73	PIXEL_VLOW_0p5_CY(	EventCount	SER_VALIE	160	64000			11689	11244	11700		9622	0	8846	8746	11675	8553	11717	11665	11530	116
76	74	PIXEL_VLOW_1p1_CY(	EventCount	SER_VALIE	0	200			0	0	0		0	0	0	0	0	1	0	0	0	
77	75	Power_Current	passCurrentLin	AVDD	30.000000	100.000(	mA		61.66706	57.68261	61.54446		64.11903	67.0001	64.91593	122.3533	61.66706	63.62864	65.09982	62.34136	63.19954	64.793
78	76	Power_Current	passCurrentLin	DVDD	30.000000	100.000(	mA		65.76398	66.071	66.19381		64.78151	153.6949	65.27275	125.9402	113.6593	117.8962	64.22888	65.76398	65.39556	64.65
79	77	Power_Current	passCurrentLin	VDD_PLL	30.000000	100.000(	mA		56.42378	55.19718	56.6691		58.20236	55.01319	56.85309	57.58905	54.33855	55.99447	55.68782	57.65038	54.70654	55.44
80																						
81		POS							0,-3	1,-3	3,-2		1,-2	0,-2	-1,-2	-2,-2	-3,-1	-2,-1	-1,-1	0,-1	1,-1	2,-1
82		BIN						2(2)	1(1)	1(1)	1(1)	2(2)	1(1)	6(6)	1(1)	6(6)	5(5)	5(5)	1(1)	1(1)	1(1)	1(1)
83																						

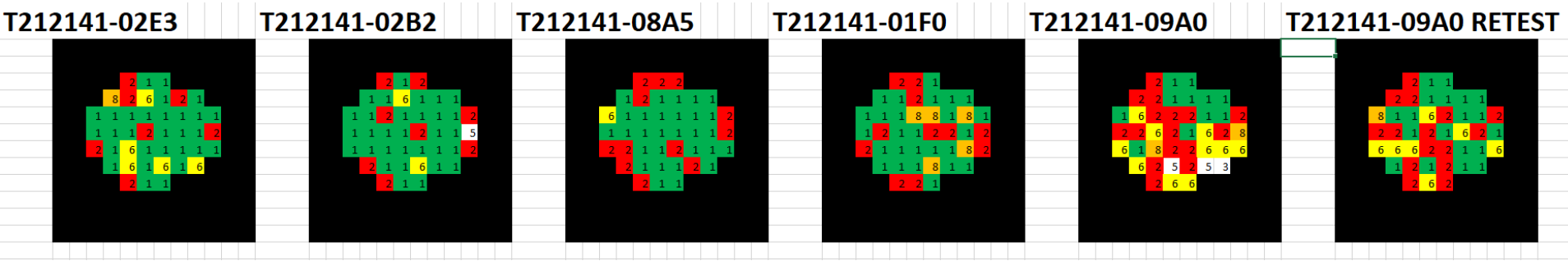
Wafer test

- **Wafer T212141-02E3 test result analysis, 13 dies failed**

Failed type	Die Position	Failed reason
BIN6	0,-2	Event count number=0 with 1 or 100 times of Apulse in row<3>, row<255>, event count num. = 512, 0 with 1 or 100 times of Apulse in row <495> Current of DVDD = 154 mA
	-2,-2	Event count num. =6634, with Vin=0.1V for row<3> Current of AVDD = 122 mA, twice of the nominal value (60 mA)
	-1,-1	Event count number=0 for all event test Current of AVDD = 800 mA, suspicious of oscillation
	3,2	Event count number=0 for all event test Current of AVDD = 100 mA
	1,2	Event count number=0 for all event test Current of AVDD = 800 mA, suspicious of oscillation
	-1,2	Event count number=0 for all event test Power current normal
BIN5	-3,-1	Current of DVDD =114 mA > highlimit of 100 mA, not a problem
	-2,-1	Current of DVDD =118 mA > highlimit of 100 mA, not a problem
BIN2	-1,-3 -1,3	On the edge of wafer, incomplete
	0, 0	Resistance of DVDD = 2 ohm
	-3,1	Resistance of AVDD & DVDD ~1 ohm
	2,-2	Resistance of AVDD = 7.7 ohm, DVDD = 1.7 ohm

Wafer test result

- **5 wafers tested**
  - Wafer #1-3 standard process
  - Wafer #1-3 modified process
- **It seems modified process wafer has a lower yield**
  - Substrate of modified wafer should be biased by a negative voltage, but not the case in the wafer test, may affect the result

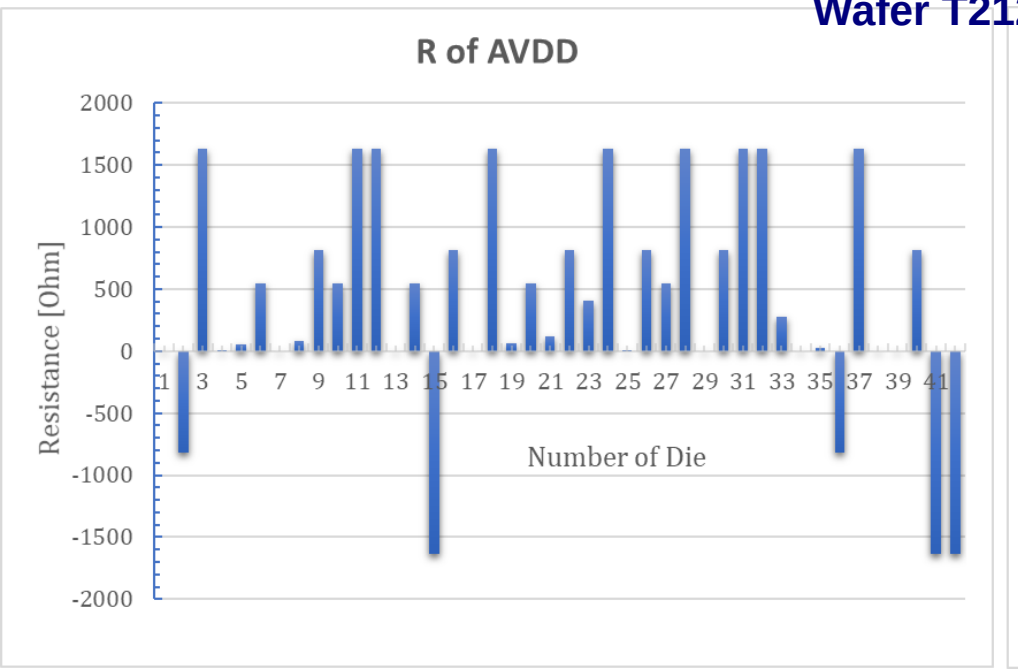


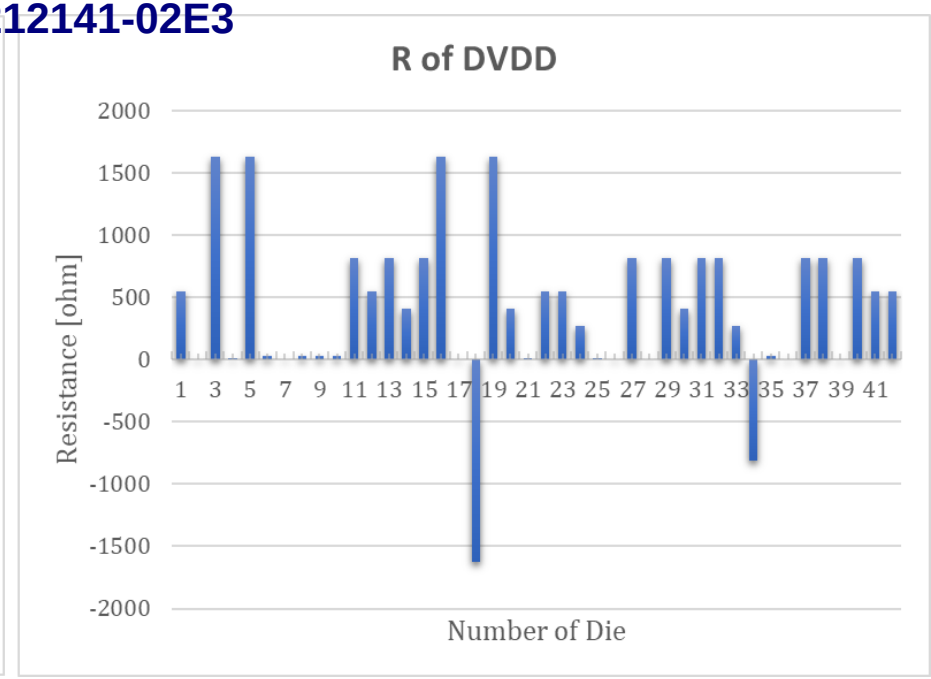
#2 #7 ? #8 #1 #9 #9

Discussion about power

- **Resistance of power may change during wafer thinning, dicing, gluing, wire-bonding**

Wafer T212141-02E3





- In the wafer test, **~8/41 chips** have low resistance (<100 ohm)
- After wire-bonding, **around half of chips** have low resistance (< 10 ohm) of DVDD

Discussion about power

- **Resistance of power supply**
  - After wire-bonding, around half of chips have low resistance (< 10 ohm) of DVDD

Chip num.		After gluing (ohm)	After bonding (ohm)	After power on
#8	AVDD		15k	4.4k
	DVDD	5	3	3.3k
#9	AVDD		16k	4.2k
	DVDD	136	1k	3k
#6	AVDD DAVDD		390 4.7	
#10	AVDD DAVDD		9.8k 4.2k	
#11	AVDD DAVDD		1.8 1.2	
#S1	AVDD DAVDD		4k 1.6	
#S2	AVDD DAVDD		31 k 1.5k	
#2	AVDD DAVDD			4.7k 4.3k
#1	AVDD DAVDD			451 87