Circuit Design Electrical Reference Manual for CP02B

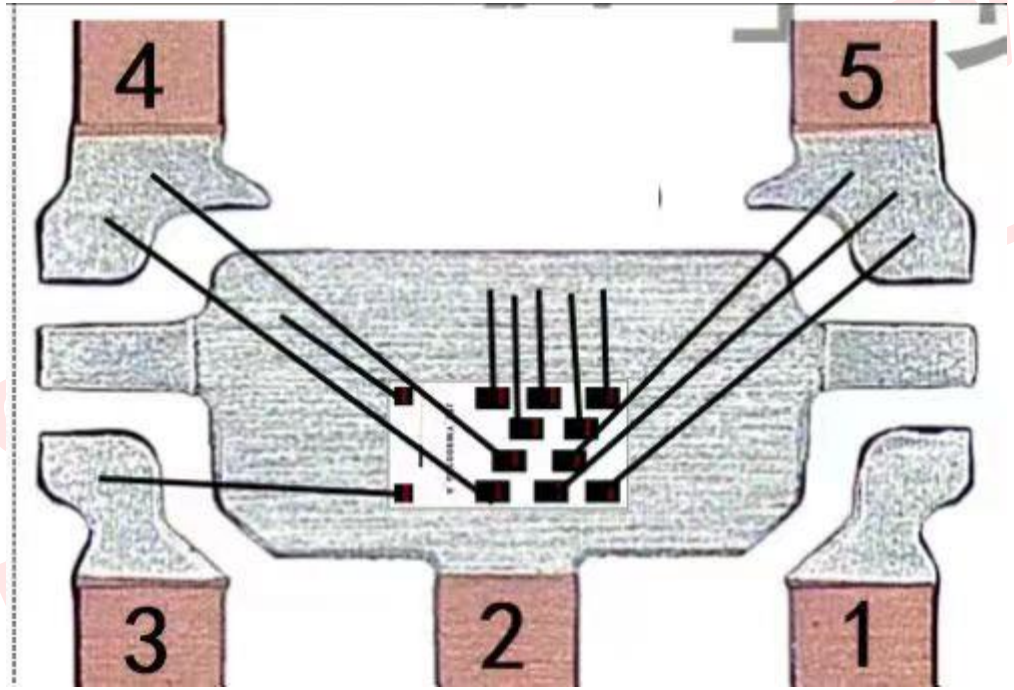
(Statistics of CP01A FT)

Confidential material / Don’t release it.

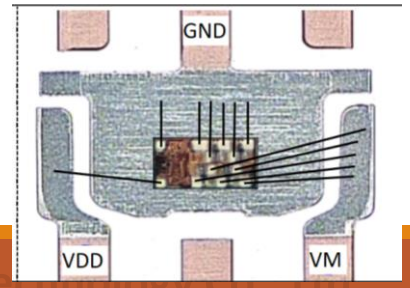
CorePower Technology Co., Ltd.

2023/02/25

CP02B Electrical Package Layout



CP02A layout



CP02B Electrical performance

Vcu (CP02B after package and Final Test):

Parameter / Model	Overcharge detection	Overcharge delayed release	Over-discharge detection	Over-discharge delayed release	Discharge overcurrent detection 1	Charge function to 0V battery
	Voltage	Voltage	Voltage	Voltage	Current	-
	Vcu	Vhc(Vcu-Vcd)	Vdl	Vhd(Vdl-Vdh)	Iiov1 (same as Viov1)	V0CH
CP02B-4300A	**4.300V+- 25mV**	**200mV+- 25mV**	**2.500V+-50mV**	**400mV+-50mV**	**2.5A+-250mA**	**V0CH,Allow**
CP02B-4275A	4.275V+- 25mV	200mV+- 25mV	2.500V+-50mV	400mV+-50mV	2.5A+-250mA	V0CH,Allow
CP02B-4300B	4.300V+-100mV	200mV+-100mV	2.500V+-100mV	400mV+-100mV	2.5A+-500mA	V0CH,Allow
CP02B-4275B	4.275V+-100mV	200mV+-100mV	2.500V+-100mV	400mV+-100mV	2.5A+-500mA	V0CH,Allow

-bin1 SPEC: 4.300v+-50mV

-bin2 SPEC: 4.200v~4.250v (eng. lot 4.100v~4.275v)

-bin3 SPEC: 4.350v~4.400v (eng. lot 4.325v~4.500v)

The statistic of CP02B FT (Excluding open/short)

-Vcu, Vhc, tcu, Vdl, Vhd, tdl

-Viov1, tiov1

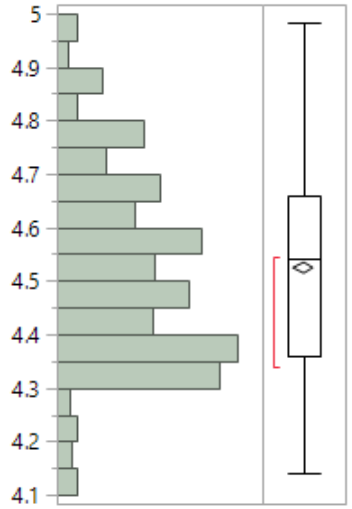
-Iope, Ipnd

-Rvm

Vcu: Overcharge Detection Voltage.
Vhc: Overcharge Hysteresis Voltage.

Distributions

VCU



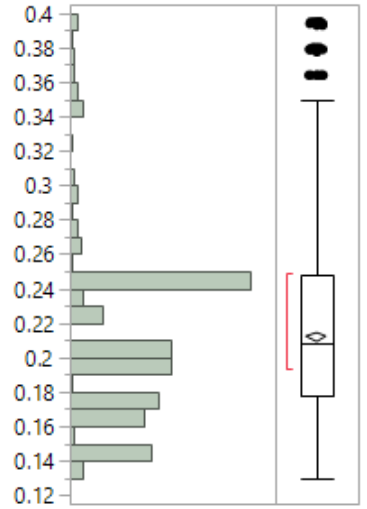
Quantiles

100.0%	maximum	4.981
99.5%		4.981
97.5%		4.91975
90.0%		4.7625
75.0%	quartile	4.659
50.0%	median	4.5405
25.0%	quartile	4.359
10.0%		4.3405
2.5%		4.17175
0.5%		4.1405
0.0%	minimum	4.1405

Summary Statistics

Mean	4.5248753
Std Dev	0.181621
Std Err Mean	0.0051186
Upper 95% Mean	4.5349173
Lower 95% Mean	4.5148333
N	1259

VHC

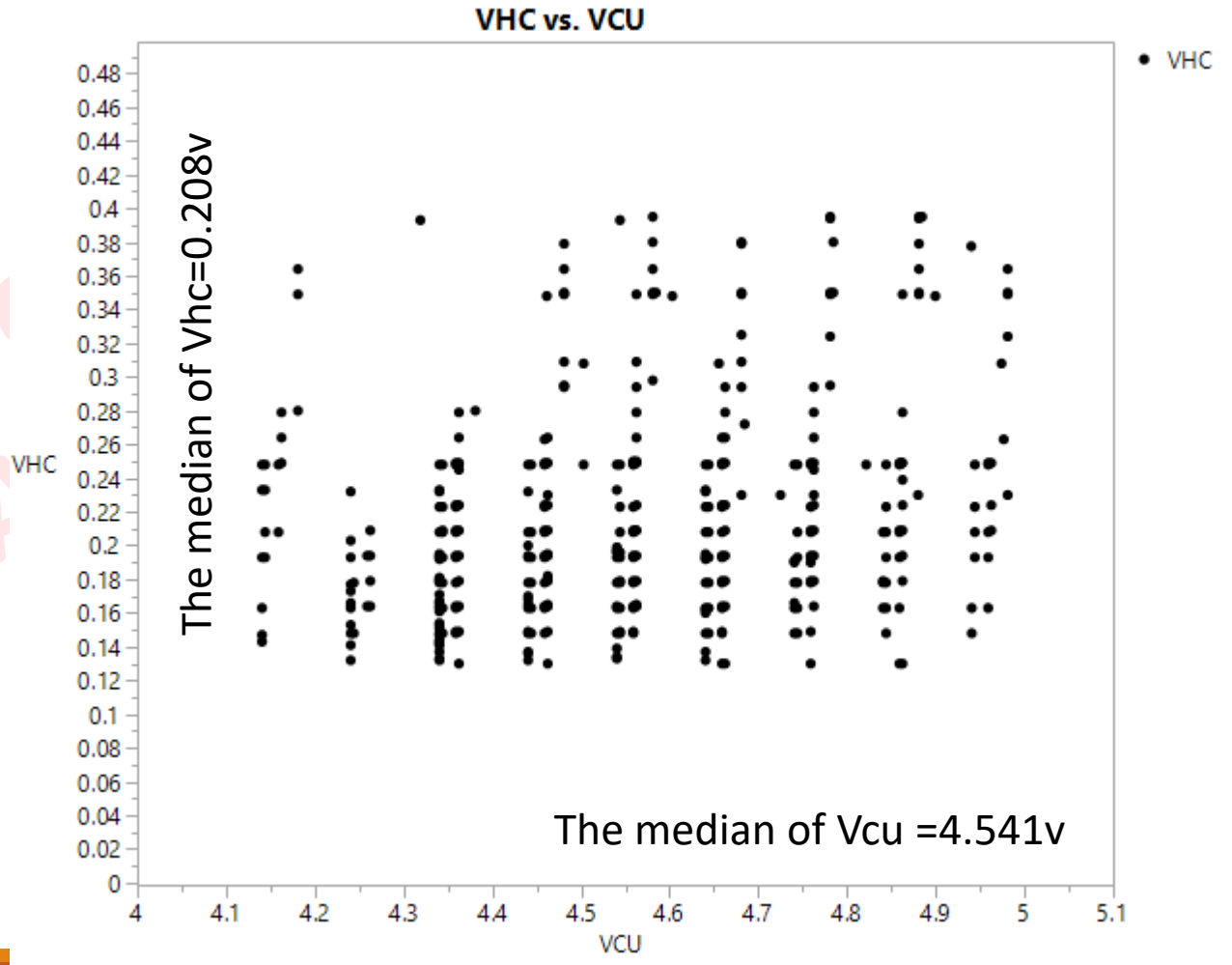


Quantiles

100.0%	maximum	0.395
99.5%		0.3947
97.5%		0.35
90.0%		0.249
75.0%	quartile	0.248
50.0%	median	0.208
25.0%	quartile	0.178
10.0%		0.148
2.5%		0.148
0.5%		0.13
0.0%	minimum	0.13

Summary Statistics

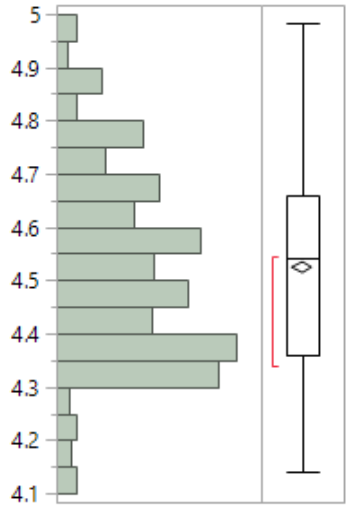
Mean	0.2118431
Std Dev	0.0516504
Std Err Mean	0.0014557
Upper 95% Mean	0.2146989
Lower 95% Mean	0.2089873
N	1259



Vcu: Overcharge Detection Voltage.
tcu: Overcharge Detection delay time.

Distributions

VCU



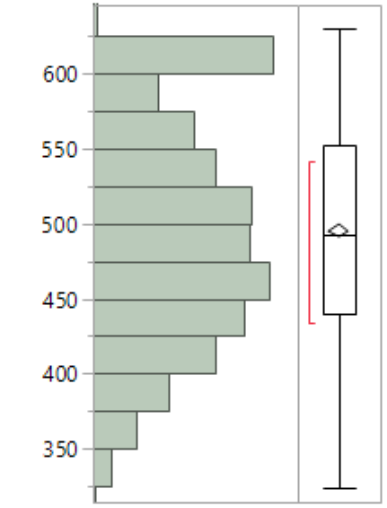
Quantiles

100.0%	maximum	4.981
99.5%		4.981
97.5%		4.91975
90.0%		4.7625
75.0%	quartile	4.659
50.0%	median	4.5405
25.0%	quartile	4.359
10.0%		4.3405
2.5%		4.17175
0.5%		4.1405
0.0%	minimum	4.1405

Summary Statistics

Mean	4.5248753
Std Dev	0.181621
Std Err Mean	0.0051186
Upper 95% Mean	4.5349173
Lower 95% Mean	4.5148333
N	1259

TCU

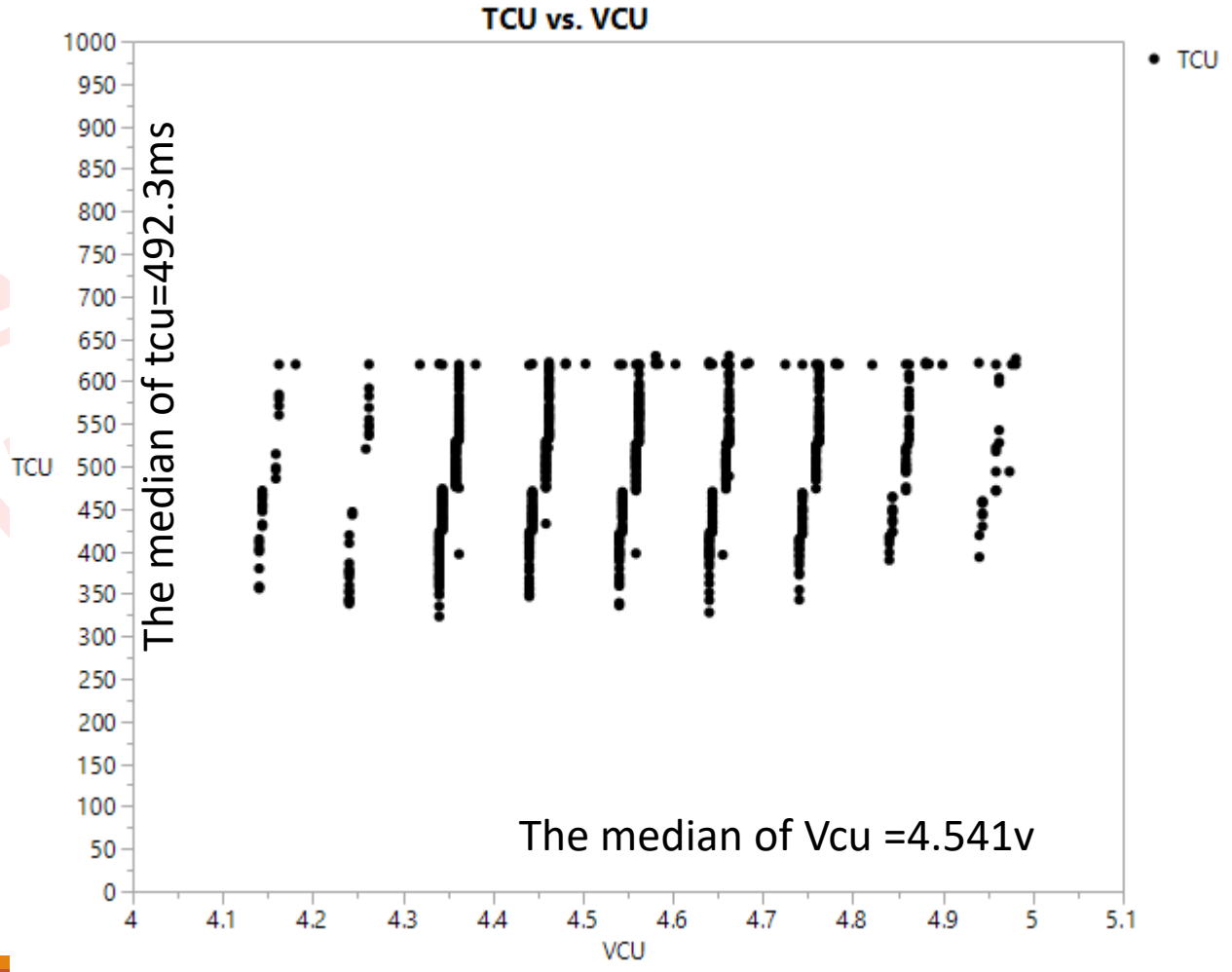


Quantiles

100.0%	maximum	630.099
99.5%		622.118
97.5%		620.016
90.0%		618.472
75.0%	quartile	551.832
50.0%	median	492.974
25.0%	quartile	440.199
10.0%		399.924
2.5%		359.557
0.5%		339.8827
0.0%	minimum	323.398

Summary Statistics

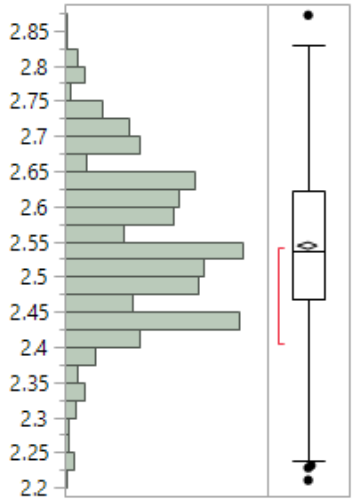
Mean	495.50802
Std Dev	74.277984
Std Err Mean	2.093376
Upper 95% Mean	499.61491
Lower 95% Mean	491.40112
N	1259



Vdl: Overdischarge Detection Voltage.
Vhd: Overdischarge Hysteresis Voltage.

Distributions

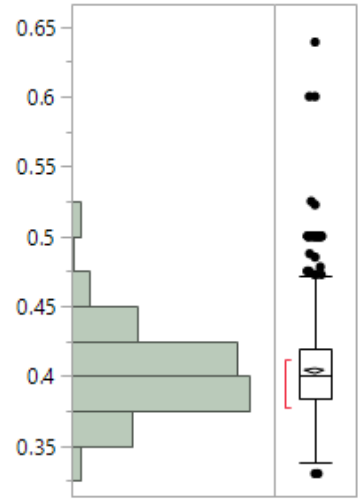
VDL



Quantiles		
100.0%	maximum	2.8715
99.5%		2.8165
97.5%		2.75975
90.0%		2.698
75.0%	quartile	2.621
50.0%	median	2.535
25.0%	quartile	2.468
10.0%		2.42
2.5%		2.332
0.5%		2.2388
0.0%	minimum	2.2105

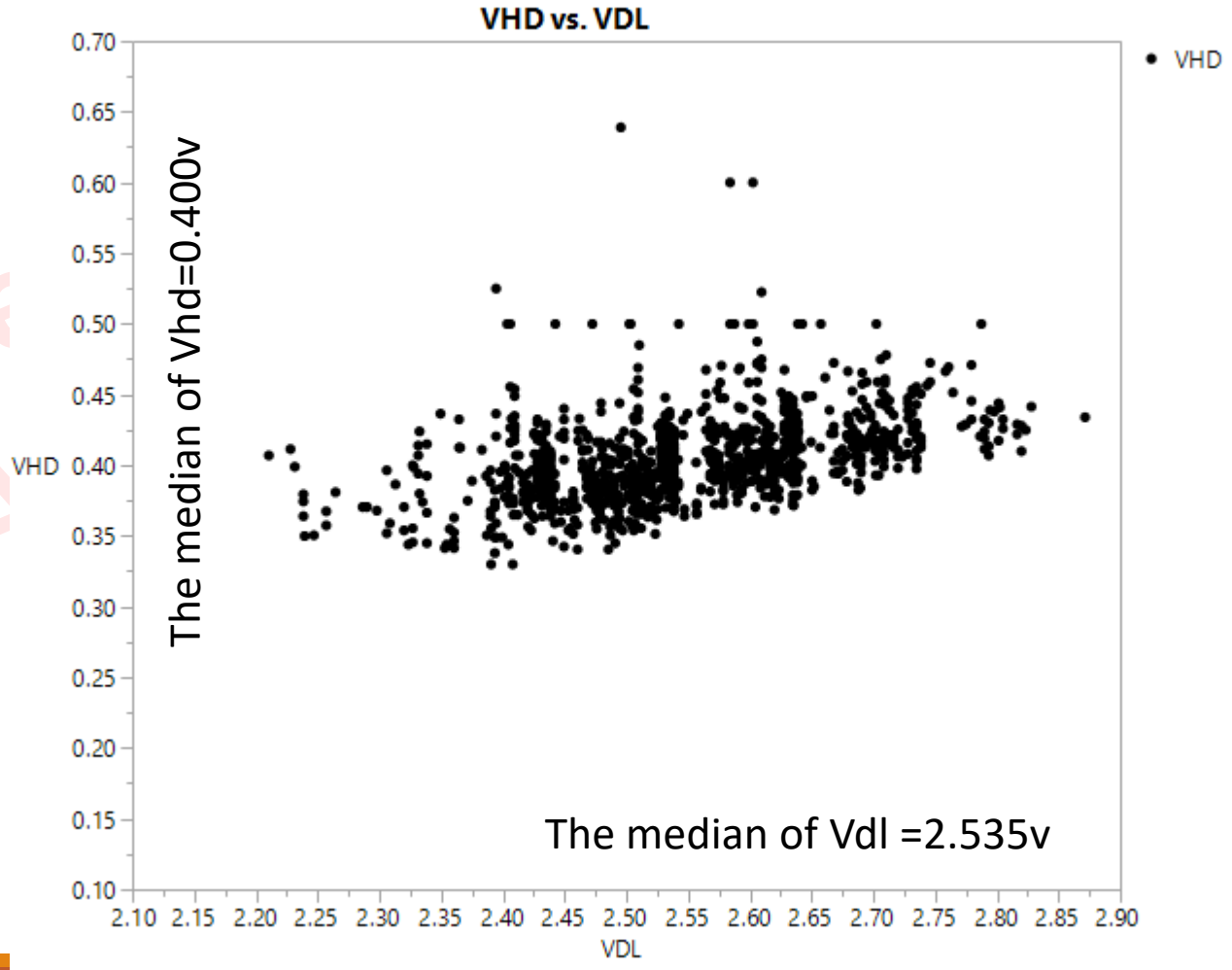
Summary Statistics	
Mean	2.5437431
Std Dev	0.1084097
Std Err Mean	0.0030553
Upper 95% Mean	2.5497371
Lower 95% Mean	2.537749
N	1259

VHD



Quantiles		
100.0%	maximum	0.639
99.5%		0.5
97.5%		0.4765
90.0%		0.438
75.0%	quartile	0.419
50.0%	median	0.4
25.0%	quartile	0.3835
10.0%		0.3715
2.5%		0.354
0.5%		0.3415
0.0%	minimum	0.33

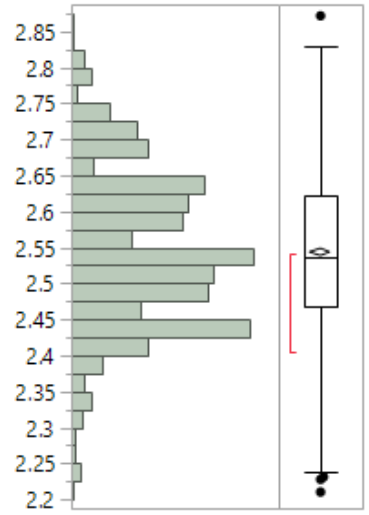
Summary Statistics	
Mean	0.4037224
Std Dev	0.0307173
Std Err Mean	0.0008657
Upper 95% Mean	0.4054208
Lower 95% Mean	0.402024
N	1259



Vdl: Overdischarge Detection Voltage.
tdl: Overdischarge Detection delay time.

Distributions

VDL



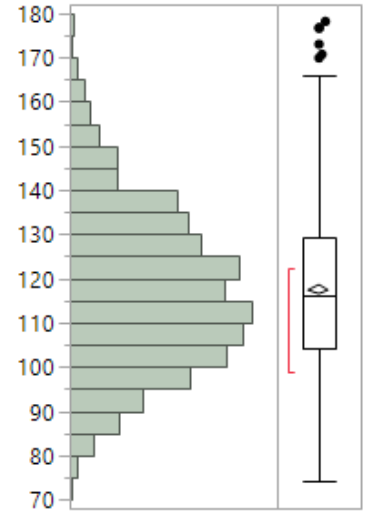
Quantiles

100.0%	maximum	2.8715
99.5%		2.8165
97.5%		2.75975
90.0%		2.698
75.0%	quartile	2.621
50.0%	median	2.535
25.0%	quartile	2.468
10.0%		2.42
2.5%		2.332
0.5%		2.2388
0.0%	minimum	2.2105

Summary Statistics

Mean	2.5437431
Std Dev	0.1084097
Std Err Mean	0.0030553
Upper 95% Mean	2.5497371
Lower 95% Mean	2.537749
N	1259

TDL

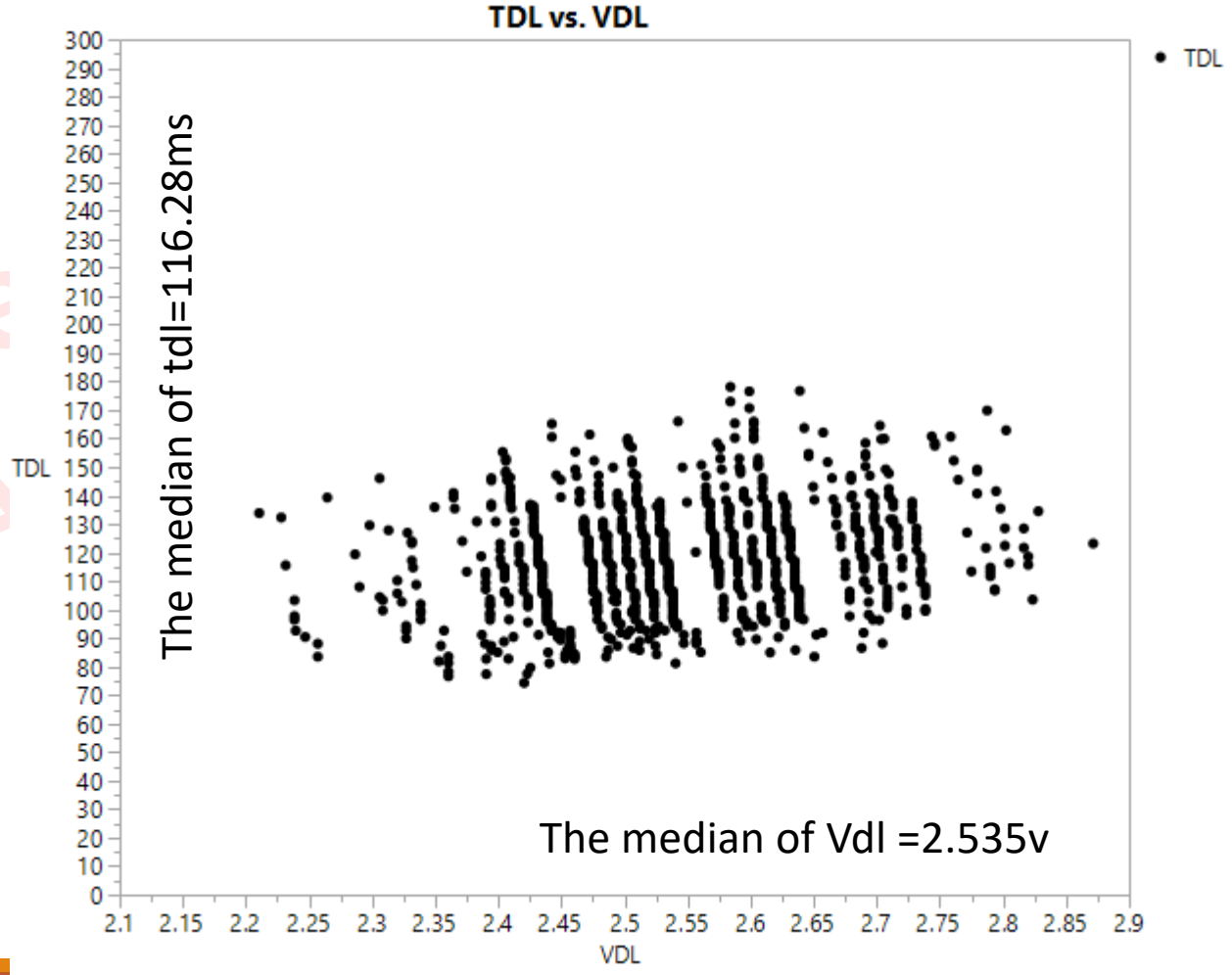


Quantiles

100.0%	maximum	178.159
99.5%		168.7434
97.5%		158.0495
90.0%		140.758
75.0%	quartile	129.347
50.0%	median	116.27
25.0%	quartile	104.188
10.0%		95.7245
2.5%		85.80755
0.5%		80.1493
0.0%	minimum	74.3583

Summary Statistics

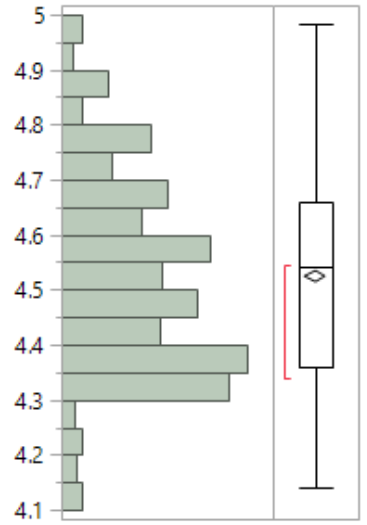
Mean	117.48692
Std Dev	17.926352
Std Err Mean	0.5052183
Upper 95% Mean	118.47809
Lower 95% Mean	116.49576
N	1259



Vcu: Overcharge Detection Voltage.
Vdl: Overdischarge Hysteresis Voltage.

Distributions

VCU



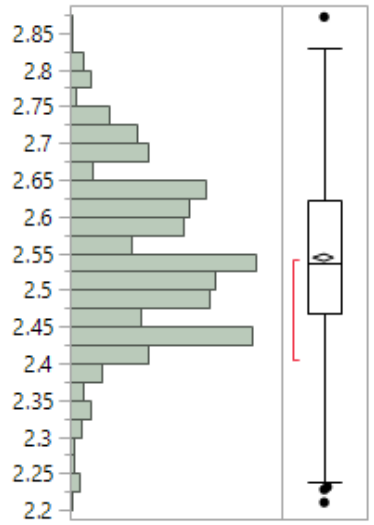
Quantiles

100.0%	maximum	4.981
99.5%		4.981
97.5%		4.91975
90.0%		4.7625
75.0%	quartile	4.659
50.0%	median	4.5405
25.0%	quartile	4.359
10.0%		4.3405
2.5%		4.17175
0.5%		4.1405
0.0%	minimum	4.1405

Summary Statistics

Mean	4.5248753
Std Dev	0.181621
Std Err Mean	0.0051186
Upper 95% Mean	4.5349173
Lower 95% Mean	4.5148333
N	1259

VDL

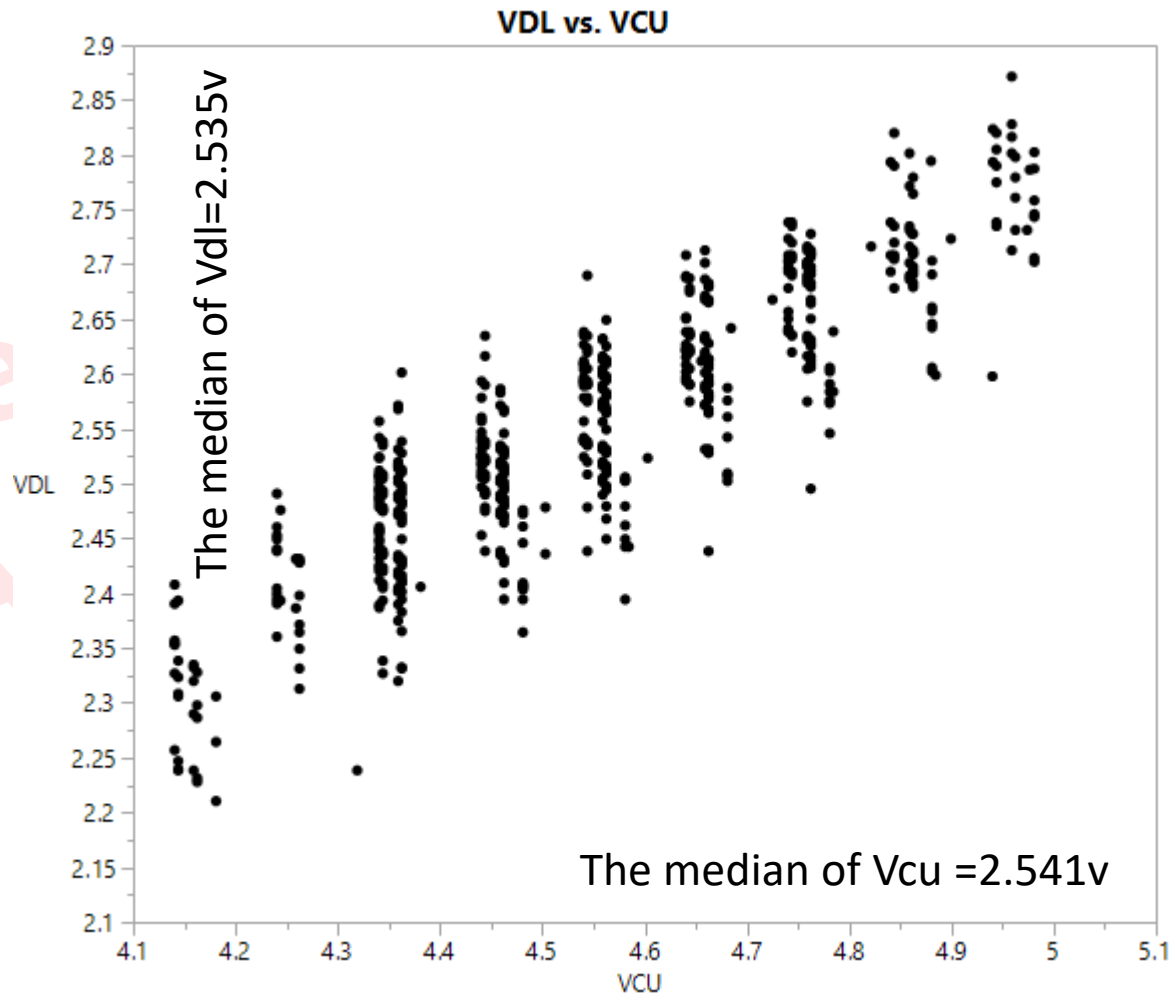


Quantiles

100.0%	maximum	2.8715
99.5%		2.8165
97.5%		2.75975
90.0%		2.698
75.0%	quartile	2.621
50.0%	median	2.535
25.0%	quartile	2.468
10.0%		2.42
2.5%		2.332
0.5%		2.2388
0.0%	minimum	2.2105

Summary Statistics

Mean	2.5437431
Std Dev	0.1084097
Std Err Mean	0.0030553
Upper 95% Mean	2.5497371
Lower 95% Mean	2.537749
N	1259



The statistic of CP02B FT (Excluding open/short)

-Vcu, Vhc, tcu, Vdl, Vhd, tdl

-Viov1, tiov1

-Iope, Ipnd

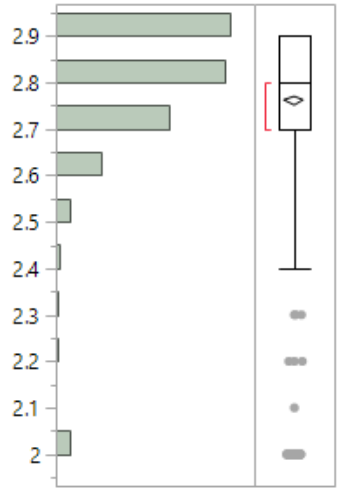
-Rvm

Viov1: Overcurrent 1 Detection Voltage.
tiov1: Overcurrent 1 detection delay time.

Viov1=Ron x Ion
Viov1=0.15v, Ron=60m Ohm => Ion=2.5Amp

Distributions

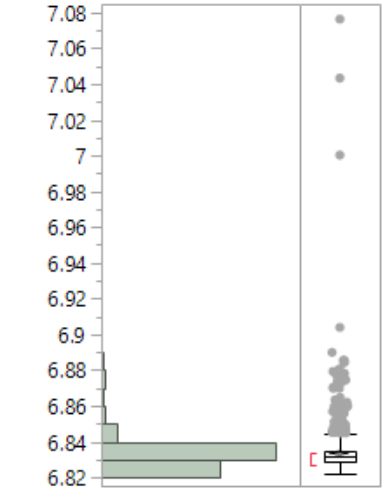
VIOV1



Quantiles		
100.0%	maximum	2.9
99.5%		2.9
97.5%		2.9
90.0%		2.9
75.0%	quartile	2.9
50.0%	median	2.8
25.0%	quartile	2.7
10.0%		2.6
2.5%		2.0475
0.5%		2
0.0%	minimum	2

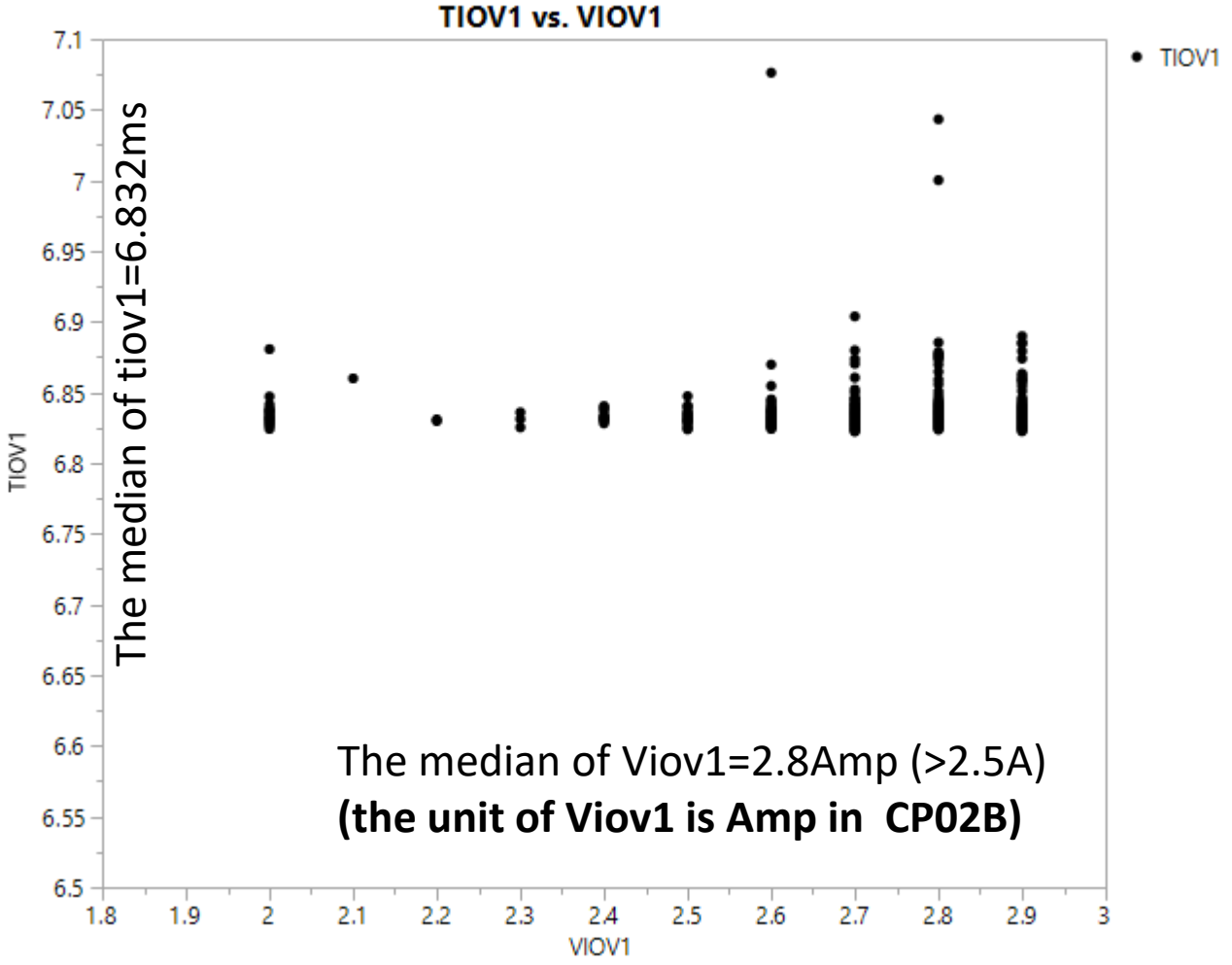
Summary Statistics	
Mean	2.7605723
Std Dev	0.1686306
Std Err Mean	0.0047544
Upper 95% Mean	2.7698998
Lower 95% Mean	2.7512449
N	1258

TIOV1



Quantiles		
100.0%	maximum	7.07632
99.5%		6.88551
97.5%		6.859544
90.0%		6.83886
75.0%	quartile	6.83523
50.0%	median	6.83159
25.0%	quartile	6.8288
10.0%		6.82629
2.5%		6.82433
0.5%		6.8230126
0.0%	minimum	6.82182

Summary Statistics	
Mean	6.8336086
Std Dev	0.0131588
Std Err Mean	0.000371
Upper 95% Mean	6.8343364
Lower 95% Mean	6.8328807
N	1258



The median of Viov1=2.8Amp (>2.5A)
(the unit of Viov1 is Amp in CP02B)

The statistic of CP02B FT (Excluding open/short)

-Vcu, Vhc, tcu, Vdl, Vhd, tdl

-Viov1, tiov1

-Iope, Ipnd

-Rvm

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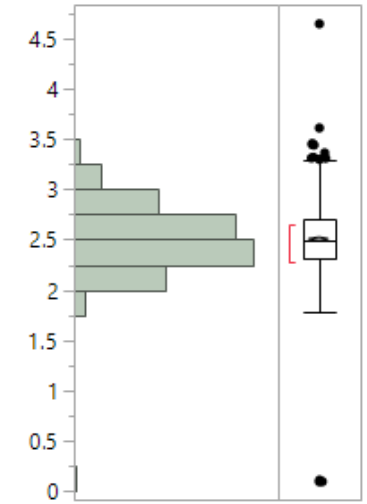
Iope: Normal Operation Current Consumption.

Distributions

IOPE

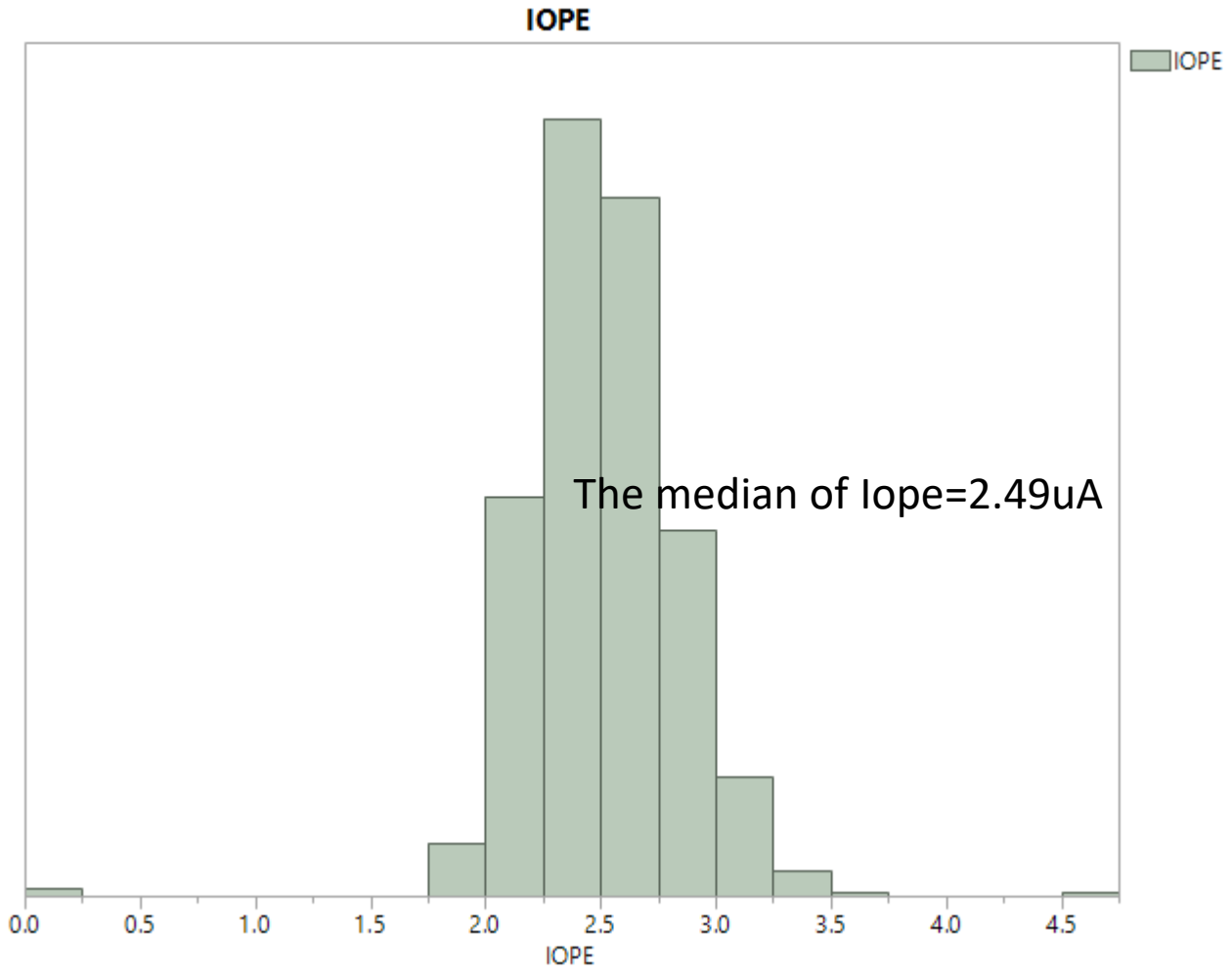


Quantiles

100.0%	maximum	4.64598
99.5%		3.3500167
97.5%		3.124163
90.0%		2.904045
75.0%	quartile	2.7084575
50.0%	median	2.496275
25.0%	quartile	2.3156075
10.0%		2.152012
2.5%		2.014611
0.5%		1.8481231
0.0%	minimum	0.0922622

Summary Statistics

Mean	2.5141712
Std Dev	0.3166911
Std Err Mean	0.0089289
Upper 95% Mean	2.5316883
Lower 95% Mean	2.4966541
N	1258



The median of Iope=2.49uA

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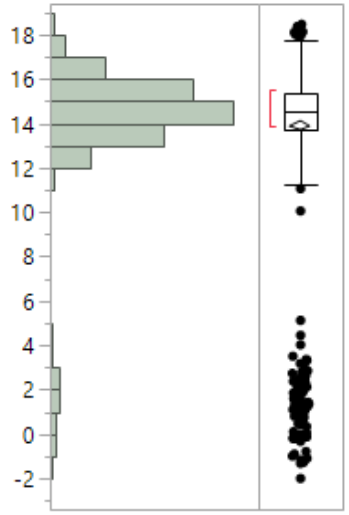
Ipdn: Power-down Current Consumption.

Distributions

IPDN

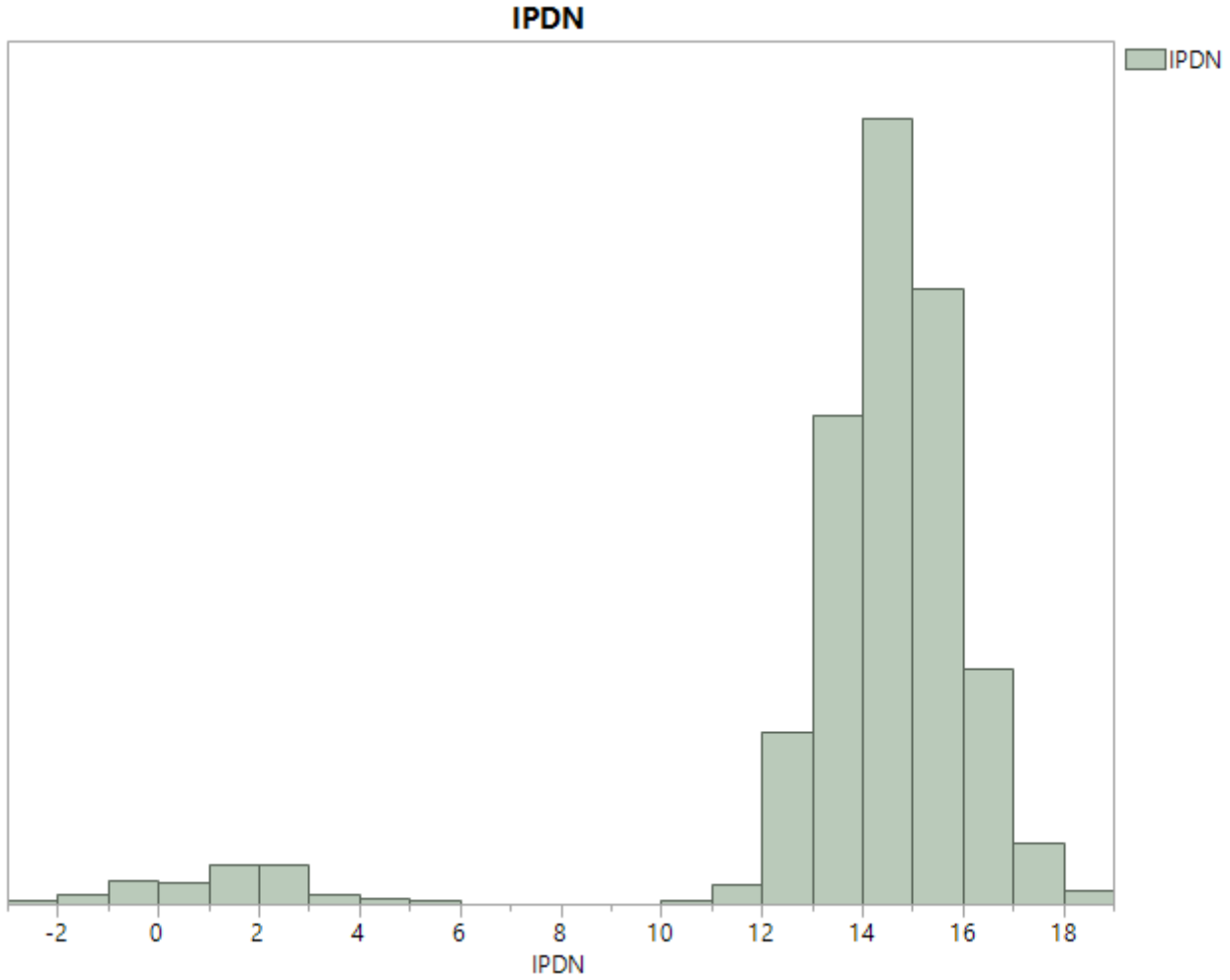


Quantiles

100.0%	maximum	18.4721
99.5%		17.9978025
97.5%		17.1682325
90.0%		16.18466
75.0%	quartile	15.3754
50.0%	median	14.5325
25.0%	quartile	13.680175
10.0%		12.64241
2.5%		1.24898
0.5%		-0.96690793
0.0%	minimum	-2.00093

Summary Statistics

Mean	13.907619
Std Dev	3.3021458
Std Err Mean	0.0931013
Upper 95% Mean	14.09027
Lower 95% Mean	13.724968
N	1258



Currently Ipdn is >10uA due to avoid mask flow out.
In production, Ipdn will become lower enough<3uA.

The statistic of CP02B FT (Excluding open/short)

-Vcu, Vhc, tcu, Vdl, Vhd, tdl

-Viov1, tiov1

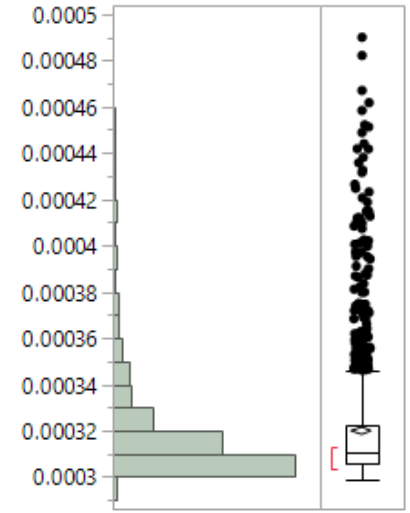
-Iope, Ipnd

-Rvm

Rvm: Internal Resistance between VM and VDD .
this test is also including Ron 60m Ohm in HV mos.

Distributions

RVM_3P5V

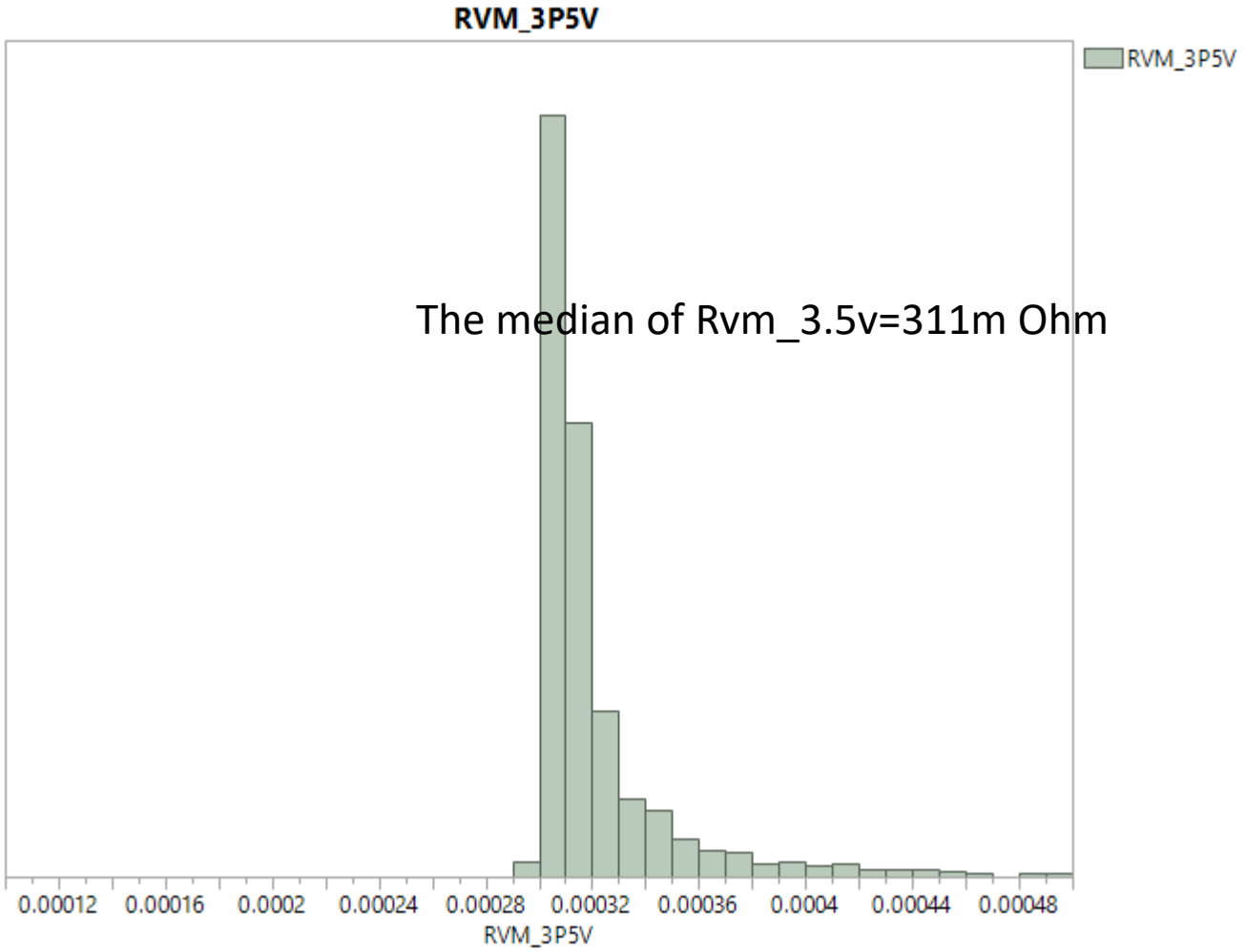


Quantiles

100.0%	maximum	0.000490006
99.5%		0.0004518952
97.5%		0.0004049245
90.0%		0.000346646
75.0%	quartile	0.000322154
50.0%	median	0.0003109
25.0%	quartile	0.000306217
10.0%		0.000303858
2.5%		0.0003015725
0.5%		0.0002996253
0.0%	minimum	0.000298851

Summary Statistics

Mean	0.0003202
Std Dev	2.5573e-5
Std Err Mean	7.2072e-7
Upper 95% Mean	0.0003216
Lower 95% Mean	0.0003188
N	1259



The median of Rvm_3.5v=311m Ohm

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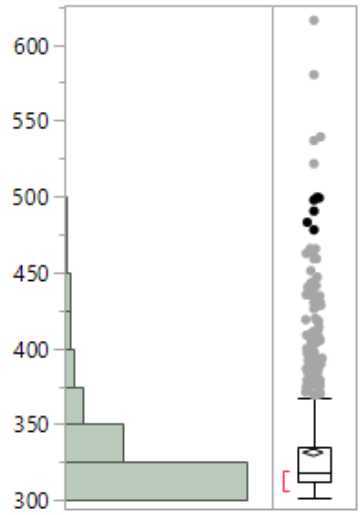
Distributions

RDSON

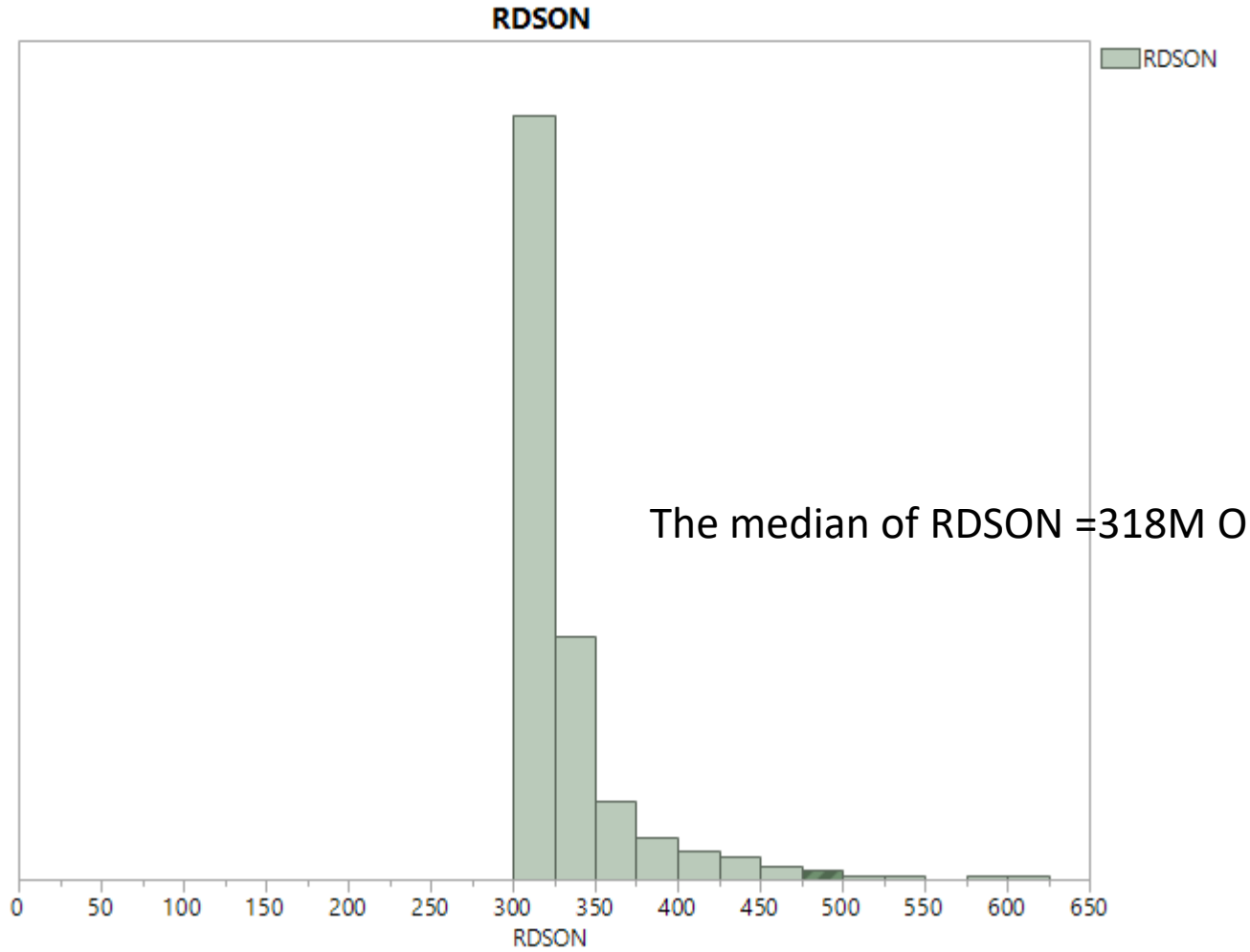


Quantiles

100.0%	maximum	615.941
99.5%		530.98998
97.5%		443.0988
90.0%		371.7846
75.0%	quartile	334.492
50.0%	median	318.451
25.0%	quartile	311.674
10.0%		308.6362
2.5%		305.9017
0.5%		303.36378
0.0%	minimum	301.846

Summary Statistics

Mean	331.66454
Std Dev	36.763029
Std Err Mean	1.2428172
Upper 95% Mean	334.10379
Lower 95% Mean	329.22528
N	875



The median of RDSON =318M Ohm

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CP02B Background Information

Background information(English version):

The simplest lithium battery protection IC, the mainland market is dominated by DW01A, which is produced by many manufacturers in the market. Due to the high and low market prices, there will be differences in chip electrical properties, packaging materials, and quality stability of semiconductor factories.

Generally, lithium battery protection ICs use the BCD process, mainly from 0.35um to 0.18um BCD. The chip area of 0.18um will be relatively small, which has a relatively price advantage, but the area is small, and the unit heat energy of the component must be reduced, which has a high impact on the process. requirements, once the manufacturing process is unstable, it is easy to have problems. Therefore, it is particularly important to choose a semiconductor factory for production. The S8621 has been designated by many Japanese customers since its early days. It can be seen that the stable chip quality is still the first choice. The other type is the low-price strategy, which will naturally make some trade-offs in terms of materials.

Core Power Technology's CP01A lithium battery protection IC is the first choice for a semiconductor foundry in Taiwan. It is a local design team in Taipei, Taiwan. The packaging and testing are mainly in mainland China, and the two shores and three places.

There are two ICs on the lithium battery protection PCB, one is CP01A (DW01A or S8621), and the other is 8205 HVmos. In the market, DW01A+8251 has been combined into one DW02A, with a maximum current of 2.5A.

Core Power's CP02B lithium battery protection IC contains CP01A and Hvmos. The chip area of CP02B is twice that of CP01A, and the maximum current is 2.5A. It is recommended to be used for 1A current. The PCB area of CP02B will be smaller than that of CP01A.

背景資料（繁體中文版）：

最簡易的鋰電池保護IC，大陸市場是以DW01A為主，市面上，很多家廠商有生產。因市場價格高低，在晶片電性上，在封裝用料上，和半導體工廠品質穩定度會有差。

一般鋰電池保護IC都會用BCD製程，主要從0.35um ~ 0.18um BCD，0.18um的晶片面積會相對較小，相對具有價格優勢，但面積小，元件的單位熱能必須下降，對製程有較高的要求，一旦製程不穩，也容易有問題。因此，選擇生產的半導體工廠，尤為重要。從早期至今的S8621，還是很多日本客戶指定使用，可見晶片品質穩定還是首選。另一類，則是低價策略，自然會在用料上，有所取捨。

芯動力科技的CP01A鋰電池保護IC，首選台灣地區半導體代工廠，是台灣臺北在地設計團隊，封裝測試以中國大陸為主，二岸三地。

鋰電池保護PCB板上，會有二顆IC，一顆CP01A(DW01A or S8621)，另一顆是8205 HVmos，市面上，已有將DW01A+8251合成一顆DW02A，最大電流2.5A。

芯動力科技的CP02B鋰電池保護IC，內涵CP01A和Hvmos，CP02B晶片面積是CP01A的二倍，最大電流2.5A ，建議用於1A電流使用， CP02B的PCB板面積會比CP01A更小。

背景资料（简体中文版）：

最简易的锂电池保护IC，大陆市场是以DW01A为主，市面上，很多家厂商有生产。因市场价格高低，在芯片电性上，在封装用料上，和半导体工厂质量稳定度会有差。

一般锂电池保护IC都会用BCD制程，主要从0.35um ~ 0.18um BCD，0.18um的芯片面积会相对较小，相对具有价格优势，但面积小，组件的单位热能必须下降，对制程有较高的要求，一旦制程不稳，也容易有问题。因此，选择生产的半导体工厂，尤为重要。从早期至今的S8621，还是很多日本客户指定使用，可见芯片质量稳定还是首选。另一类，则是低价策略，自然会在用料上，有所取舍。

芯动力科技的CP01A锂电池保护IC，首选台湾地区半导体代工厂，是台湾台北在地设计团队，封装测试以中国大陆为主，二岸三地。

锂电池保护PCB板上，会有二颗IC，一颗CP01A(DW01A or S8621)，另一颗是8205 HVmos，市面上，已有将DW01A+8251合成一颗DW02A，最大电流2.5A。

芯动力科技的CP02B锂电池保护IC，内涵CP01A和Hvmos，CP02B芯片面积是CP01A的二倍，最大电流2.5A ，建议用于1A电流使用， CP02B的PCB板面积会比CP01A更小。

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End