System Performance Test Report

RT7885A 1A1C 45W Power Bank EVB
with one USB-C and one USB-A outputs

System Dev & Application Eng Dept2
ACDC Business Group

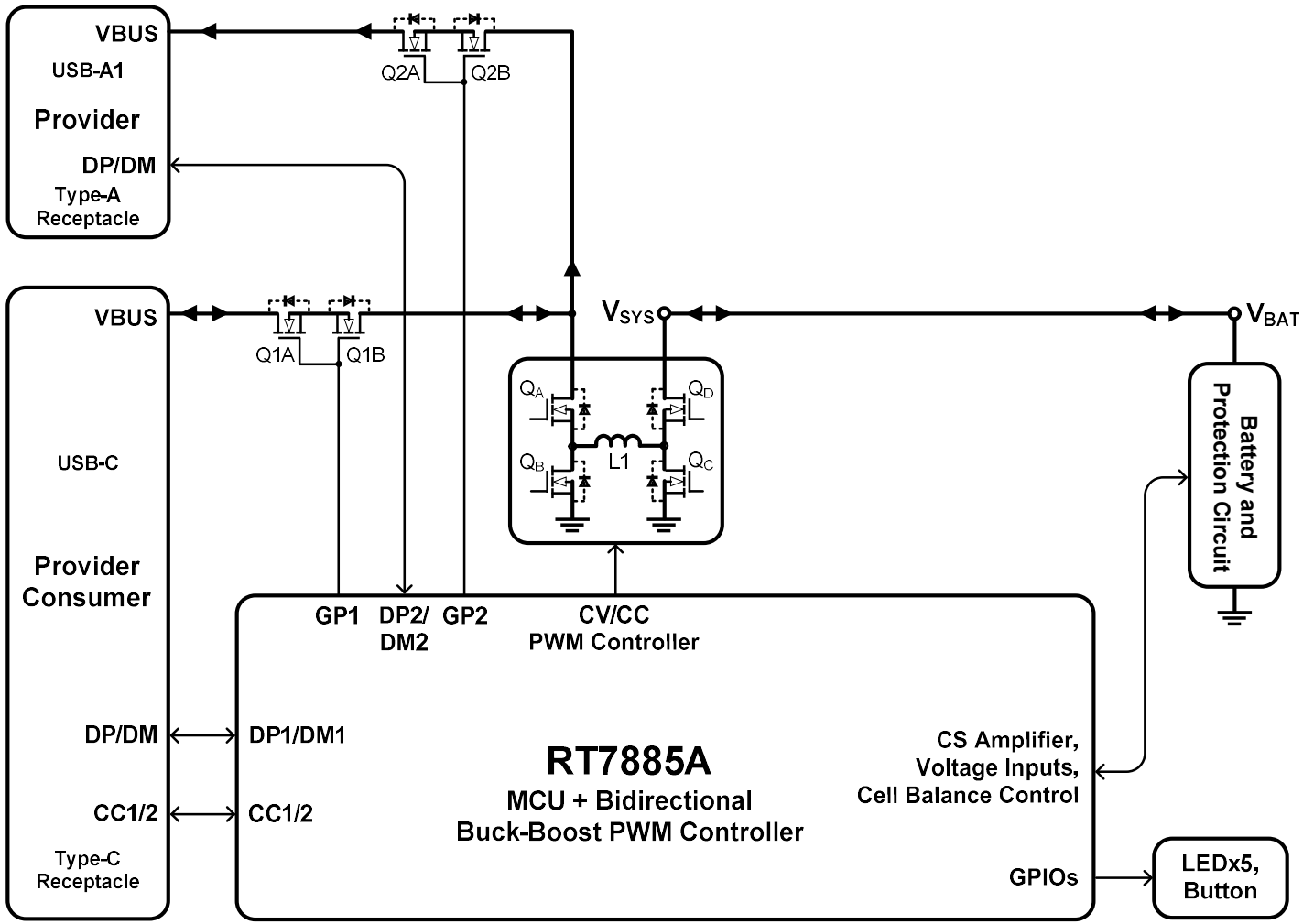
July. 1, 2019

RICHTEK
your power partner.

Outline

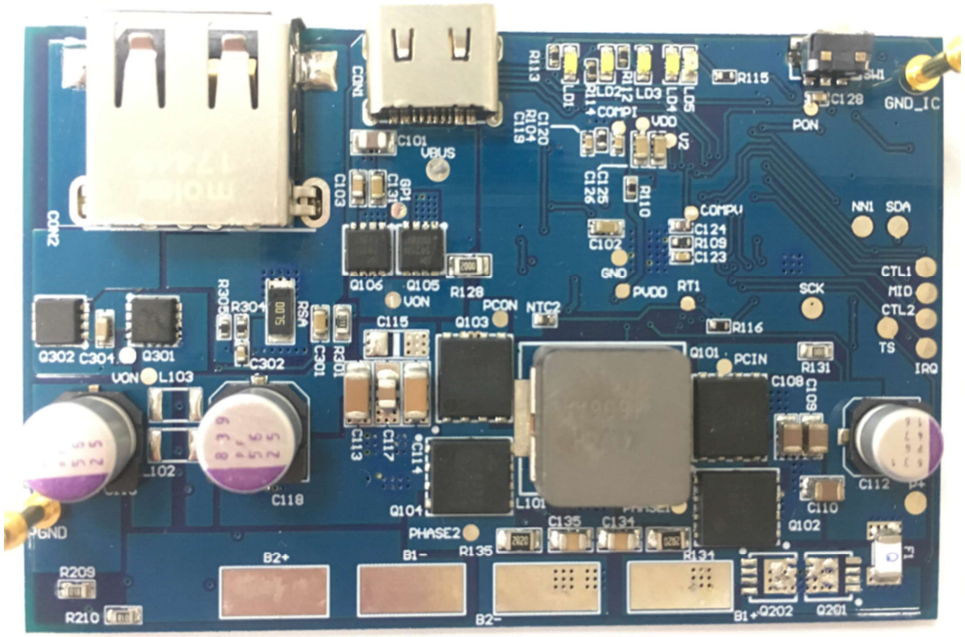
- System Diagram
- Pictures of Demoboard
- Features of Demoboard
- Schematic
- System Performance Test

System Diagram

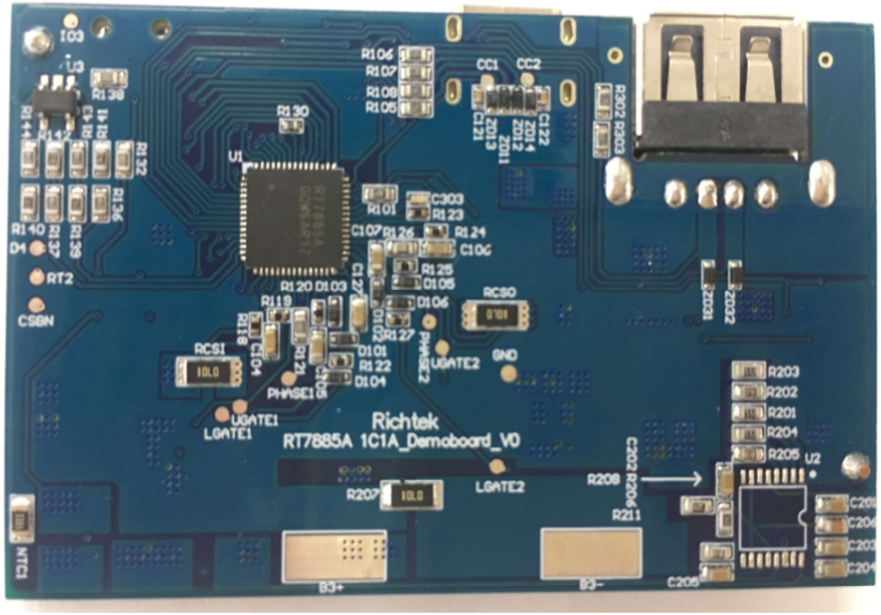


Pictures of Demoboard

Top View



Bottom View



Features of Demoboard

➢ Provider (Source) Mode

- V_{BAT} range : 9.5V~12.965V
- Output Support

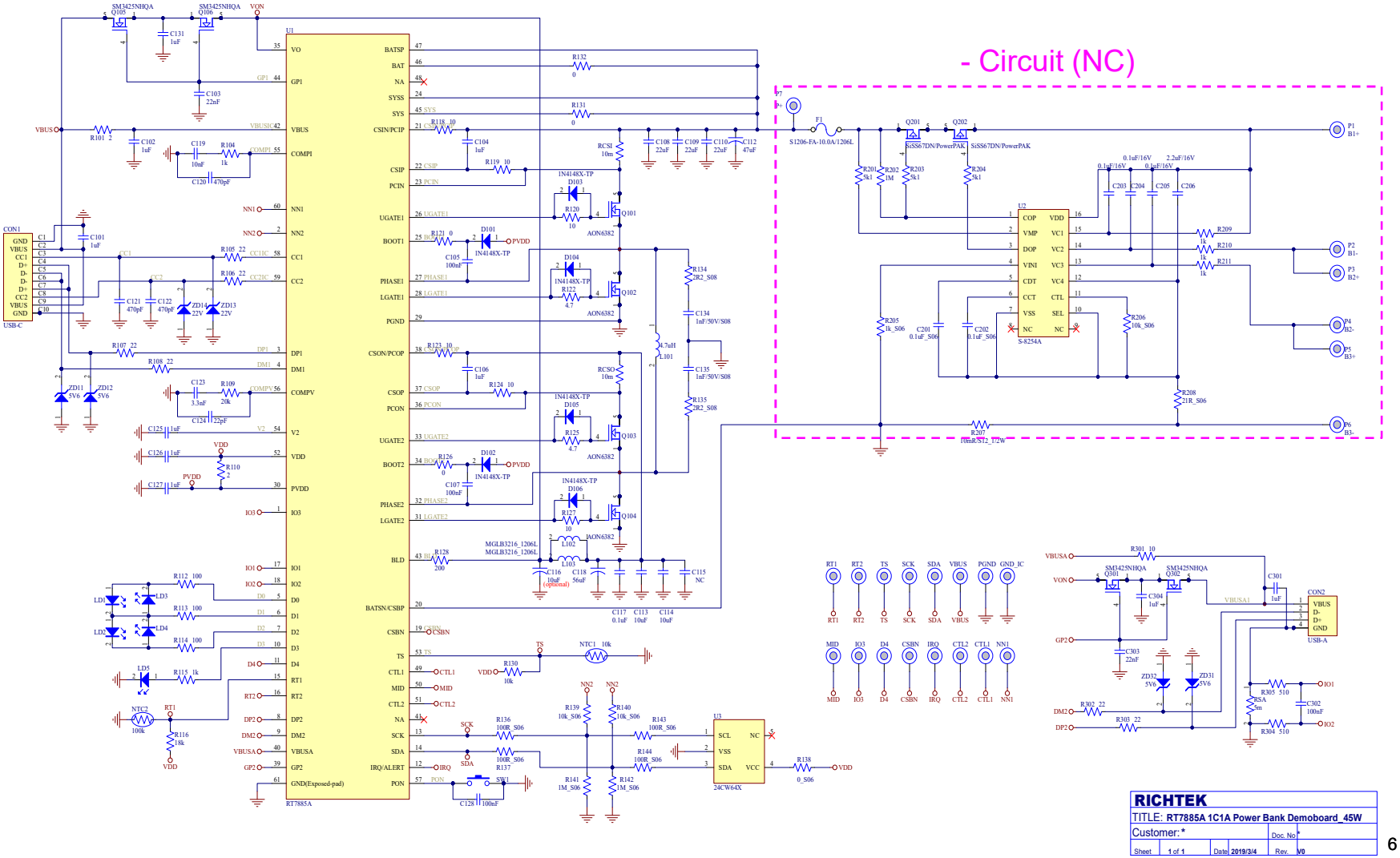
Type C: PD : 5V/3A, 9V/3A, 12V/3A, 15V/3A, 20V/2.25A
QC : 5.08V/2A, 9V/2A, 12V/2A(QC3.0: 3.6V-9V/3A, 9.2V-12V/2A)

Type A: PD : 5V/2A
QC : 5.08V/2A, 9V/2A, 12V/2A(QC3.0: 3.6V-9V/3A, 9.2V-12V/2A)

➢ Sink Mode

- Input voltage (V_{BUS}) range : Type C: 5V~20V
- Output: V_{BAT} 9.5V~12.965V

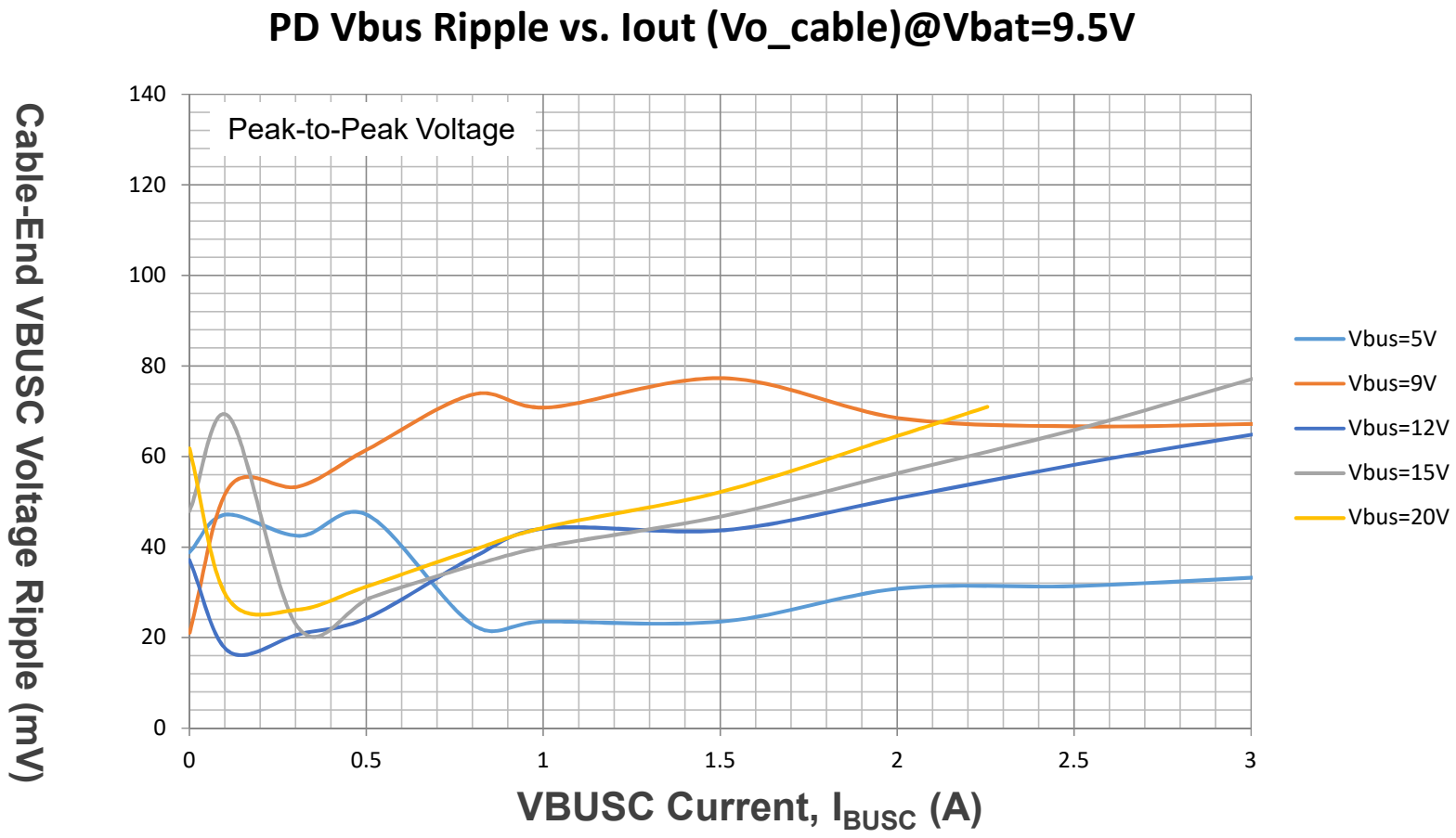
Schematic (1/1)



System Performance Test

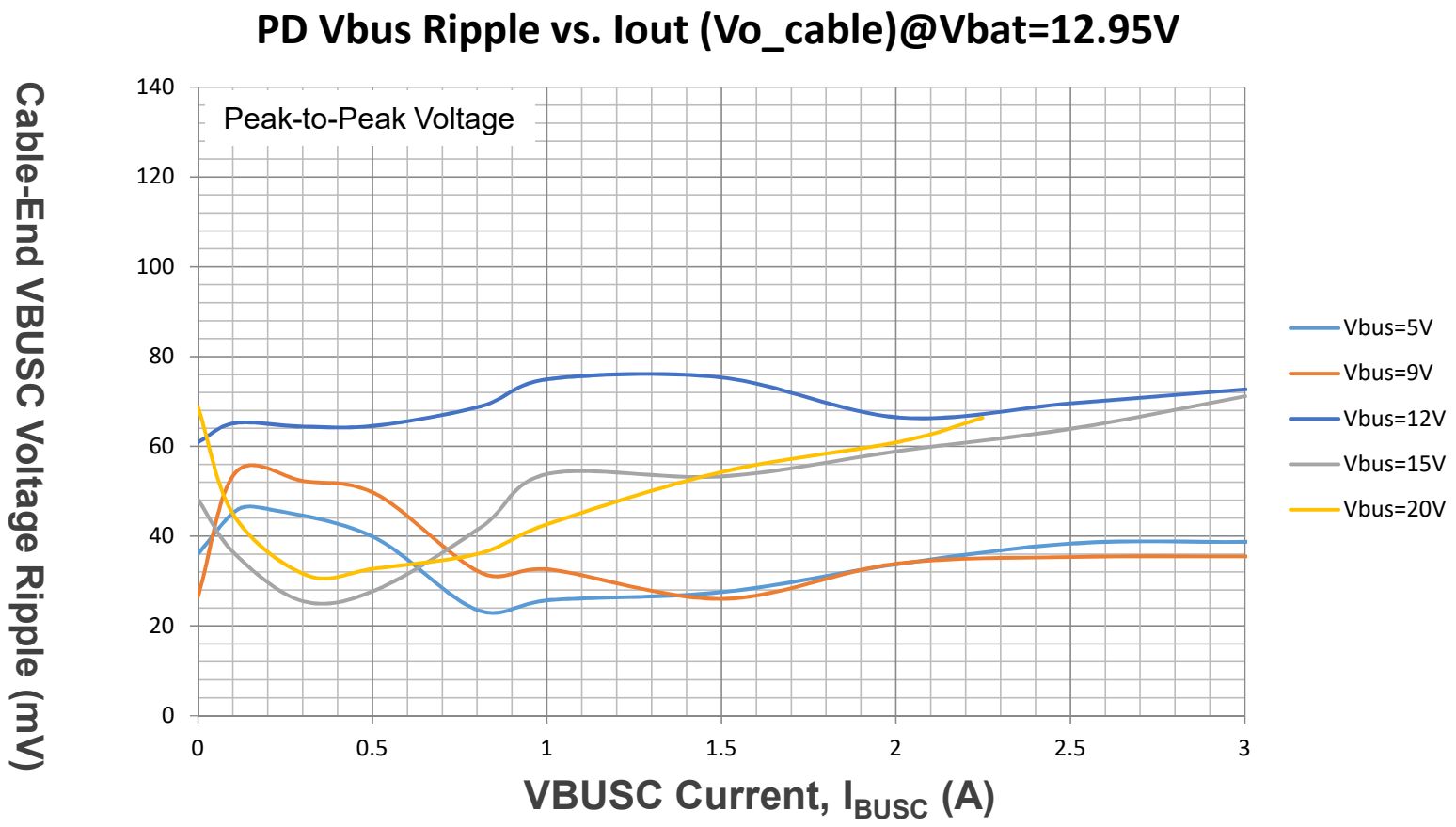
Cable-End VBUS Voltage Ripple vs. Current (1/4)

- To measure peak-to-peak voltage at cable end (V_{BUSC_CABLE})
- Oscilloscope BW : 20MHz, Using 0.1μF+10μF(EC)
- Provider mode (PD)



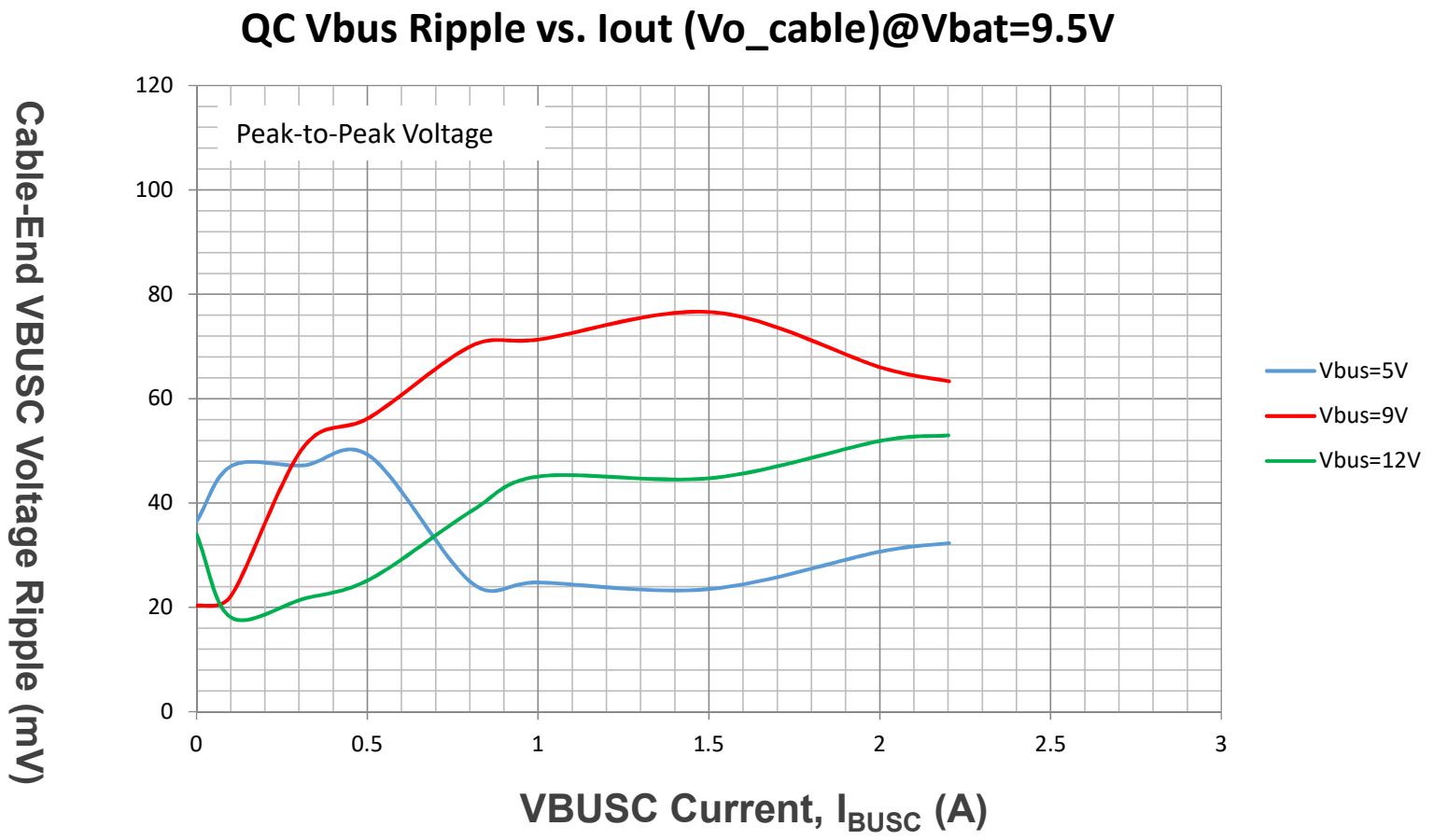
Cable-End VBUS Voltage Ripple vs. Current (2/4)

- To measure peak-to-peak voltage at cable end (V_{BUSC_CABLE})
- Oscilloscope BW : 20MHz, Using 0.1μF+10μF(EC)
- Provider mode (PD)



Cable-End VBUS Voltage Ripple vs. Current (3/4)

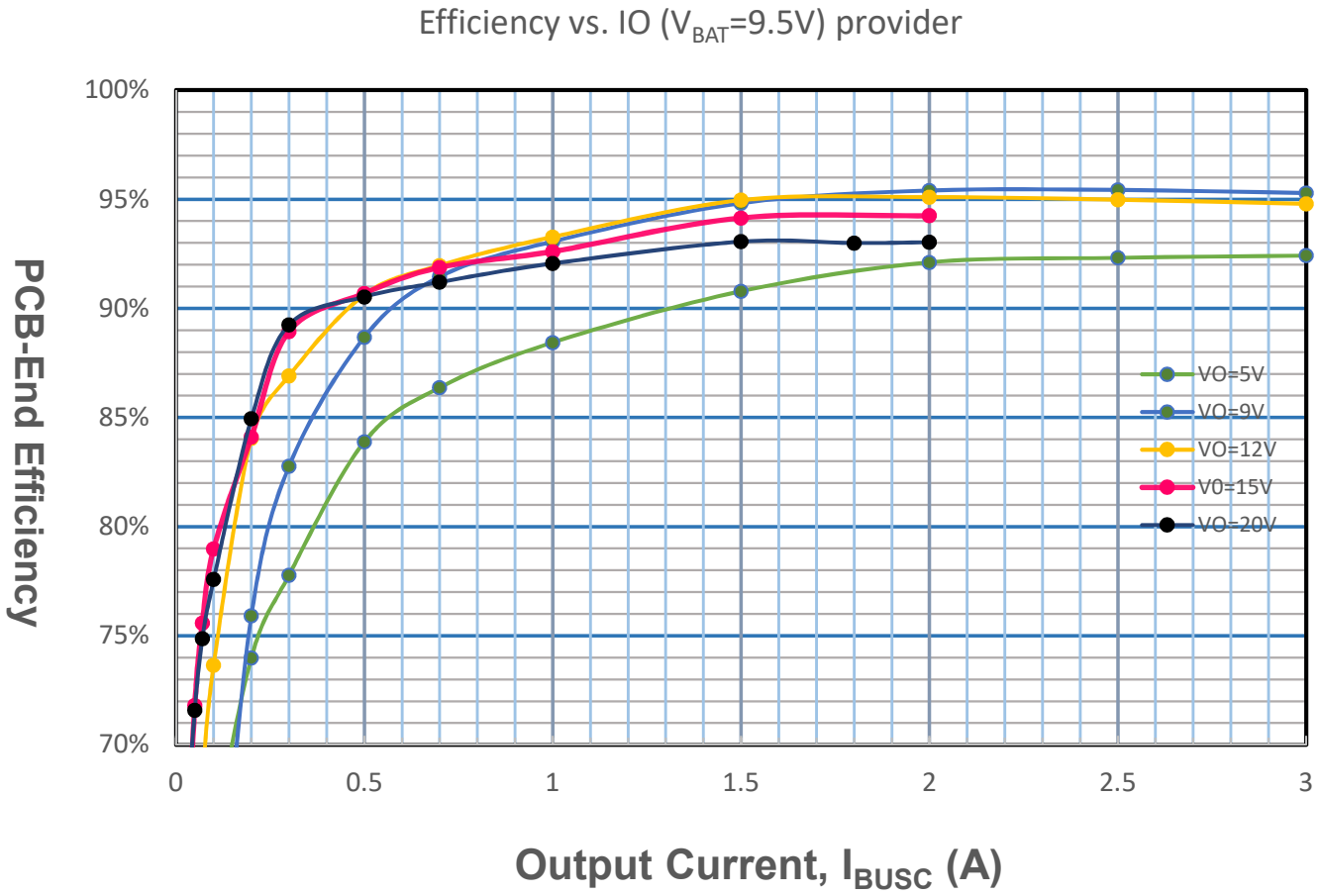
- To measure peak-to-peak voltage at cable end (V_{BUSC_CABLE})
- Oscilloscope BW : 20MHz, Using 0.1μF+10μF(EC)
- Provider mode (QC)



Efficiency vs. VBUS Current (1/8)

VBUSC Efficiency vs. Output Current at V_{BAT}=9.5V

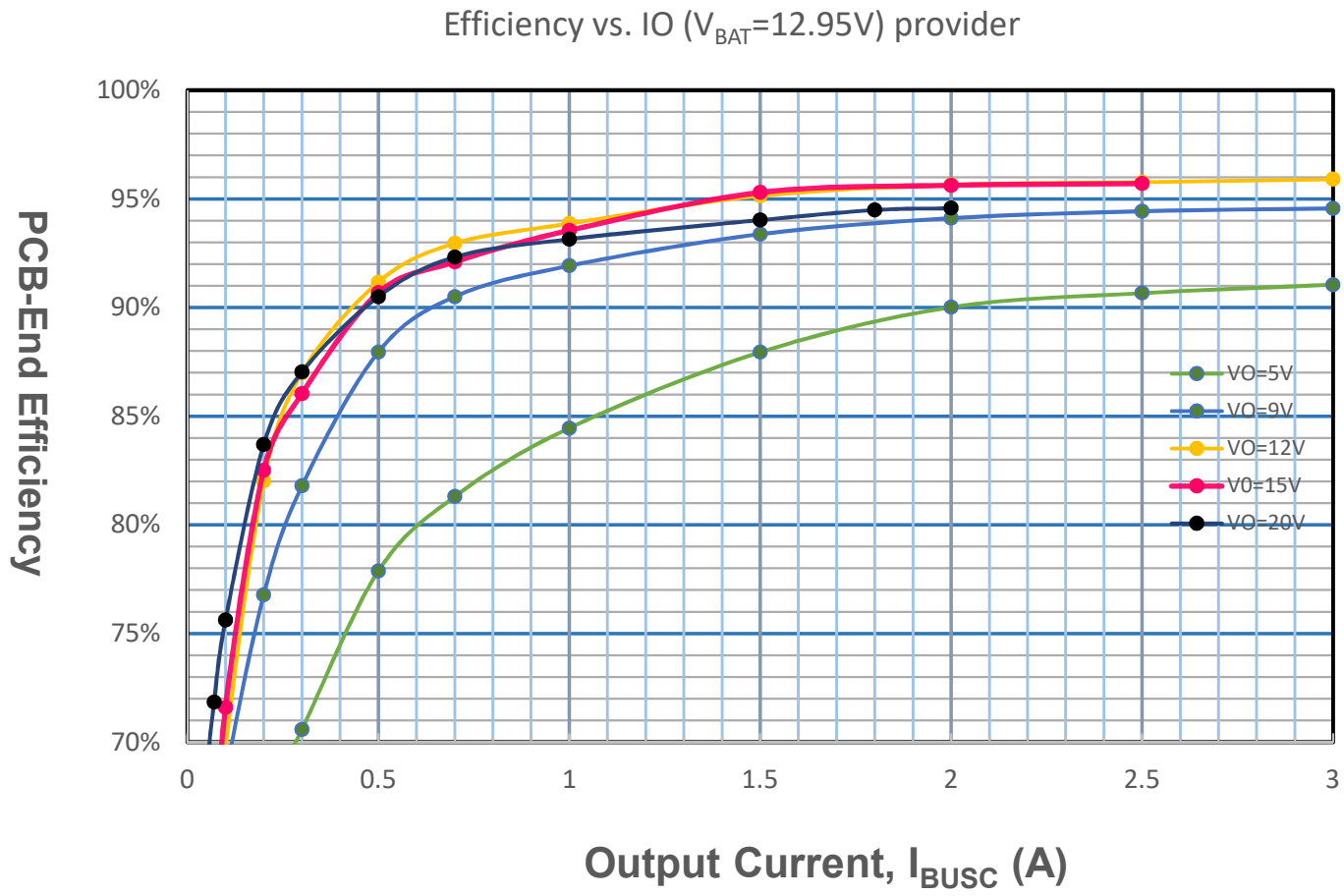
- Provider mode (PD)



Efficiency vs. VBUS Current (2/8)

VBUSC Efficiency vs. Output Current at V_{BAT}=12.95V

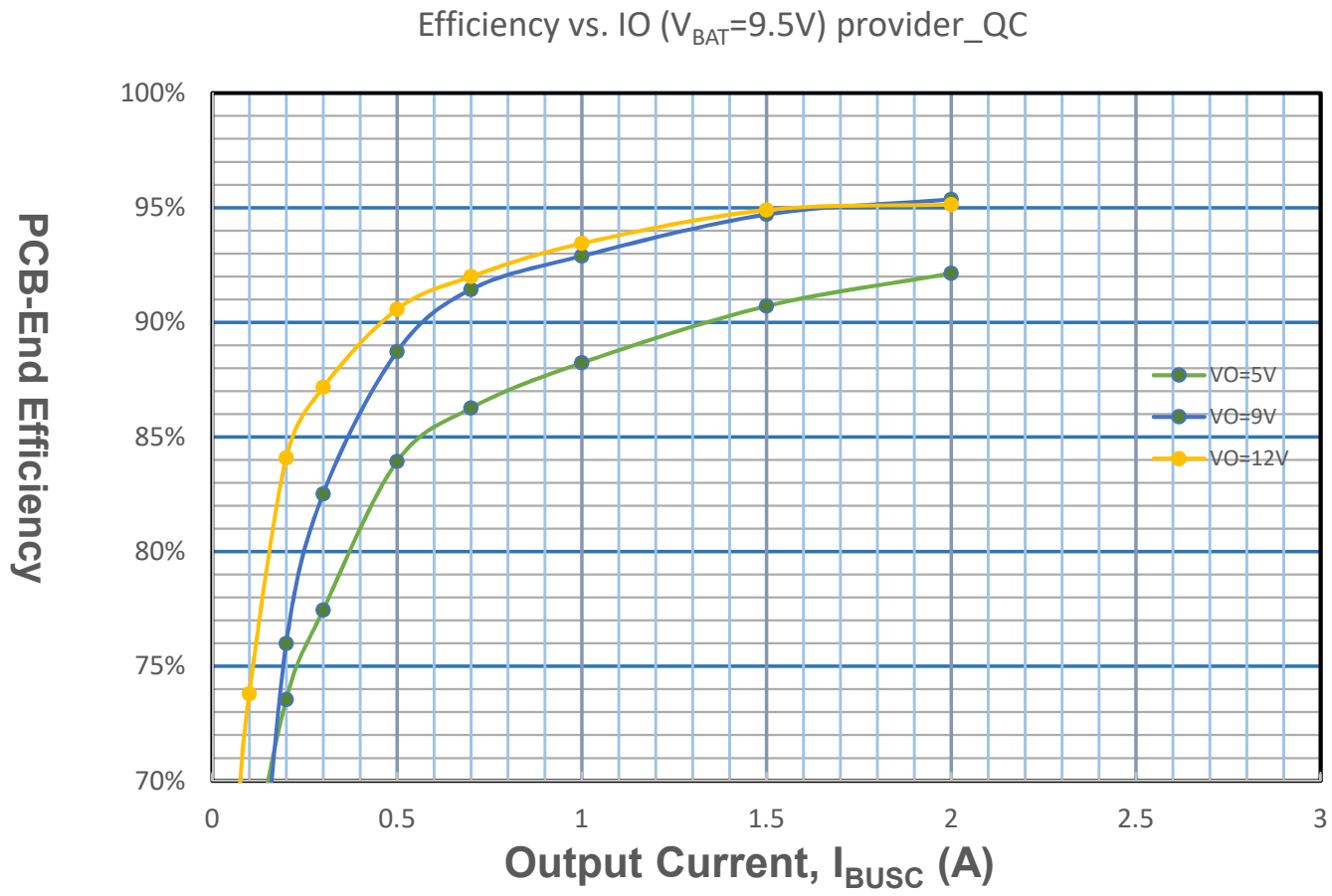
- Provider mode (PD)



Efficiency vs. VBUS Current (3/8)

VBUSC Efficiency vs. Output Current at V_{BAT}=9.5V

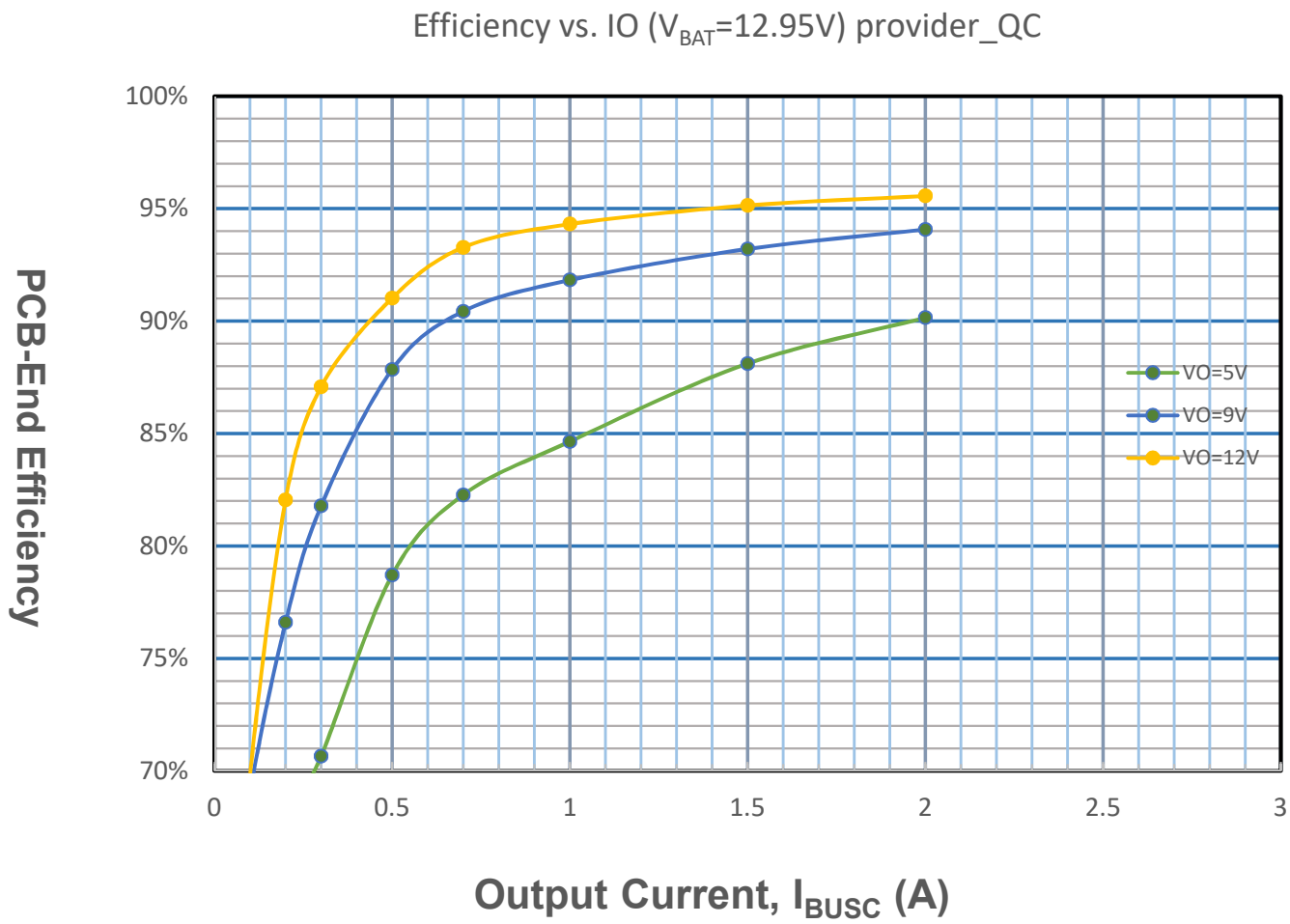
- Provider mode (QC)



Efficiency vs. VBUS Current (4/8)

VBUSC Efficiency vs. Output Current at V_{BAT}=12.95V

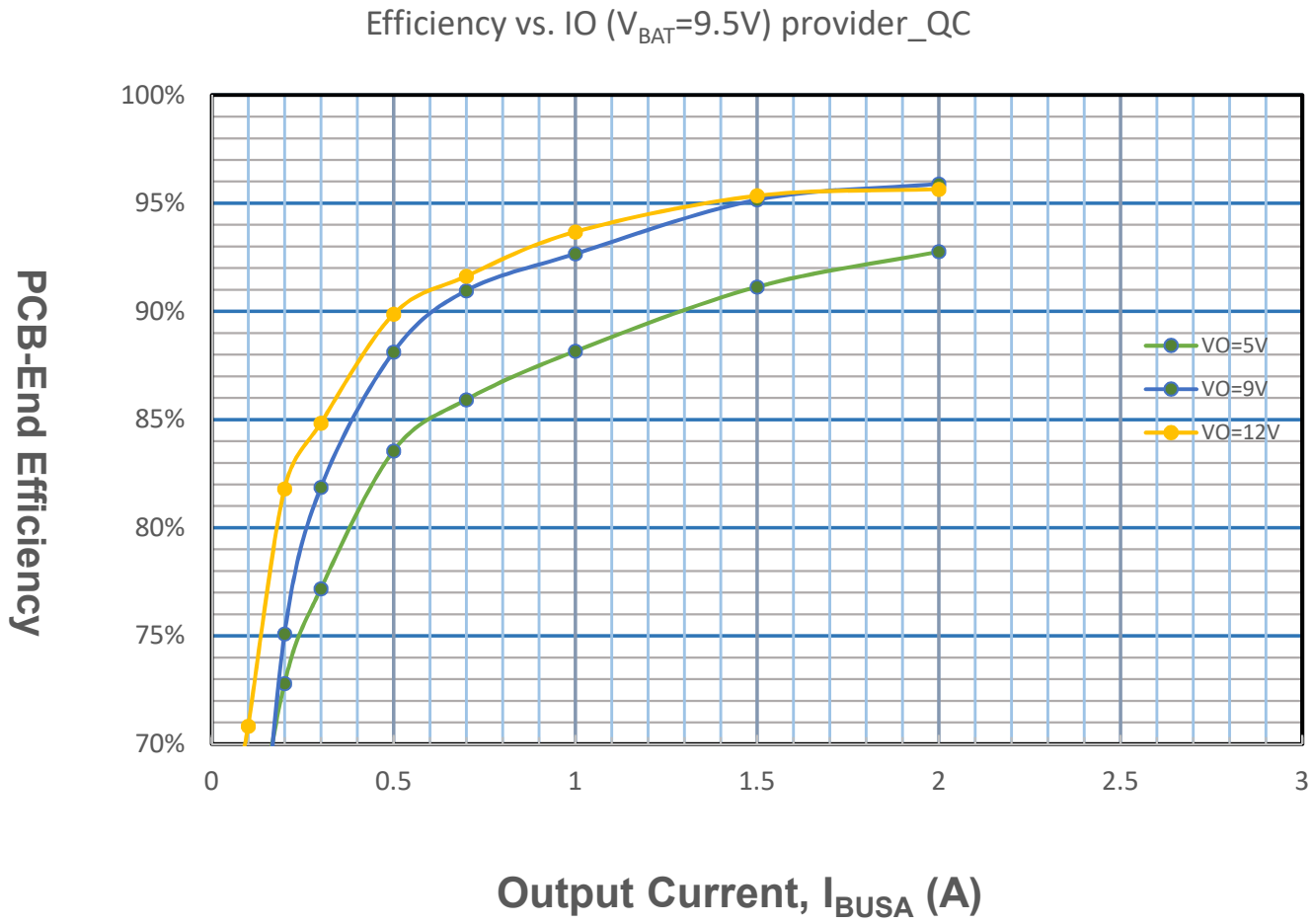
- Provider mode (QC)



Efficiency vs. VBUSA Current (5/8)

VBUSA Efficiency vs. Output Current at V_{BAT}=9.5V

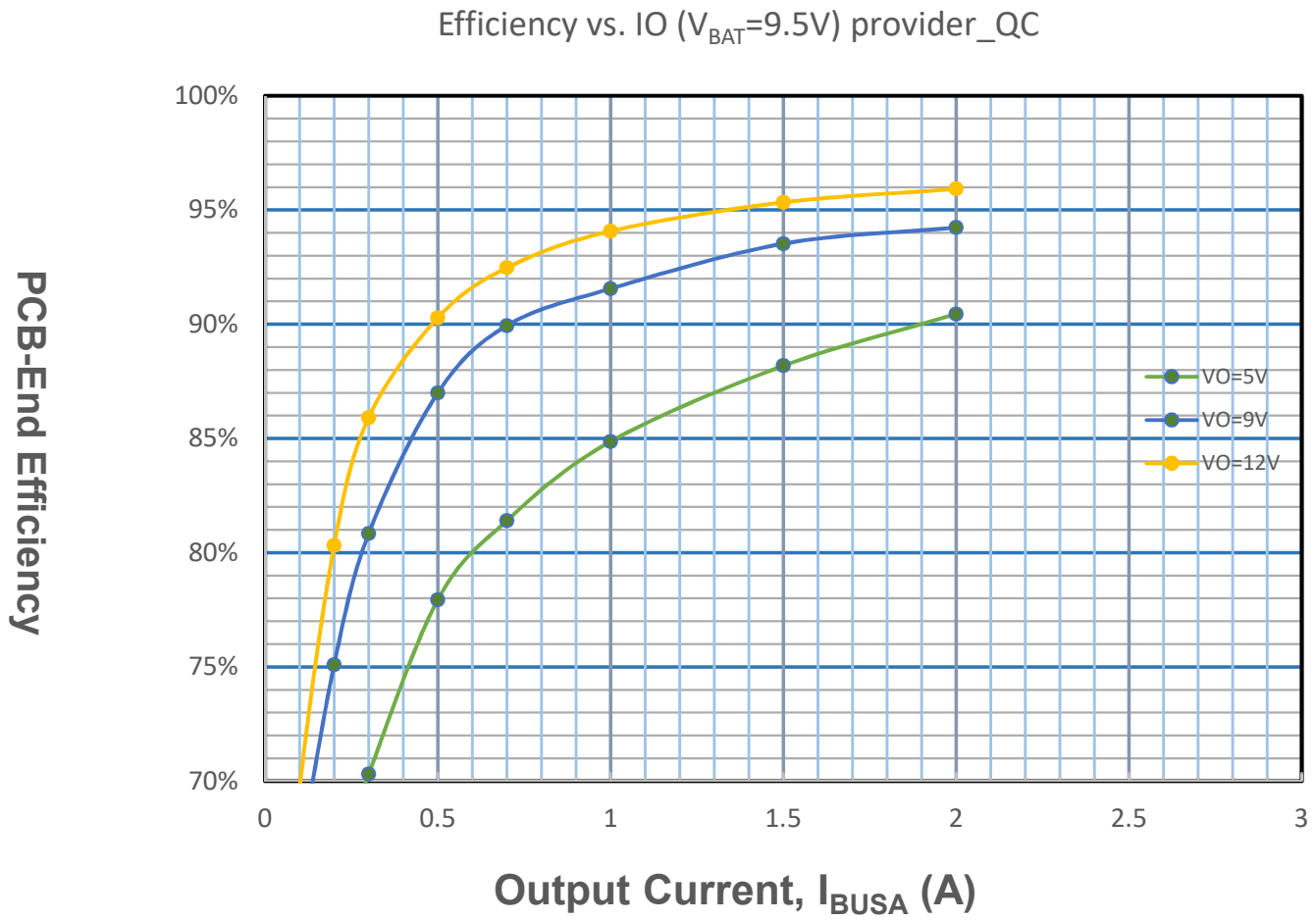
- Provider mode (QC)



Efficiency vs. VBUSA Current (6/8)

VBUSA Efficiency vs. Output Current at V_{BAT}=12.95V

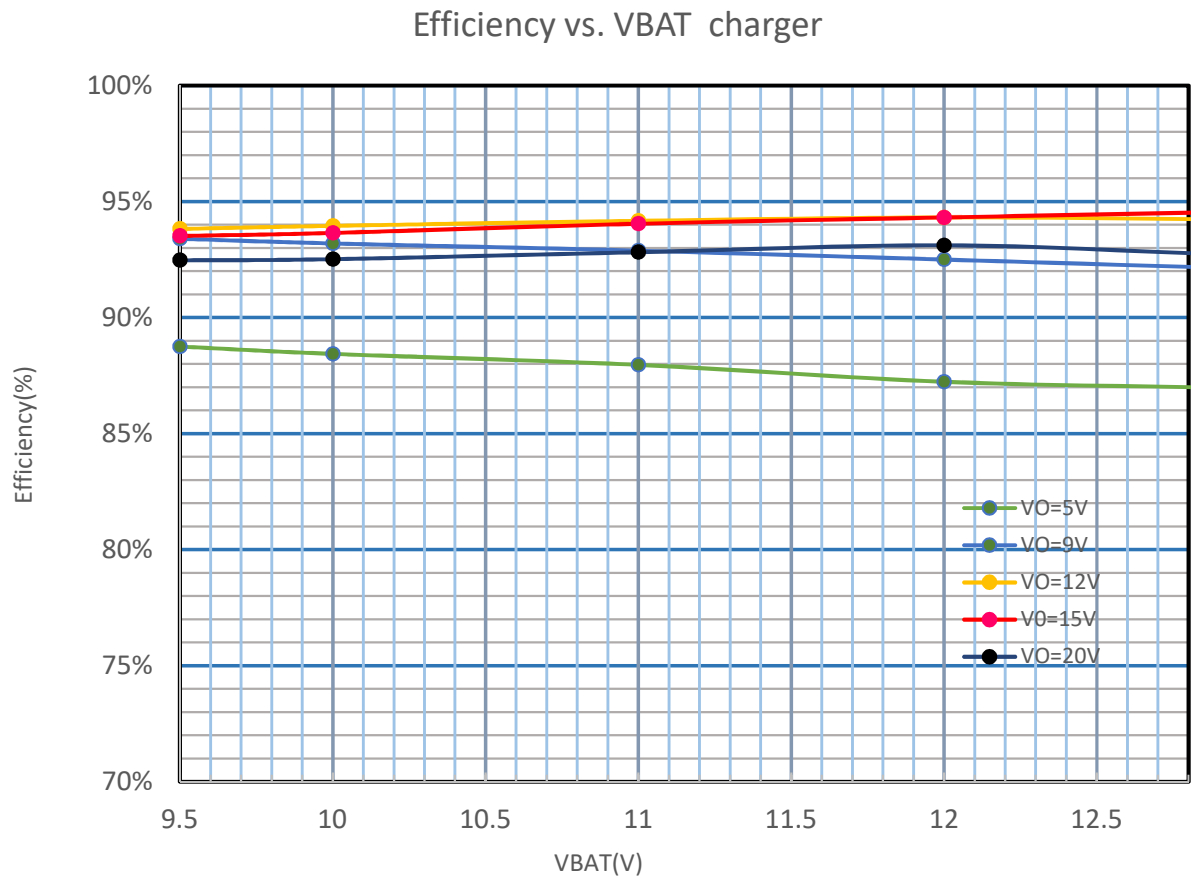
- Provider mode (QC)



Efficiency vs. VBUS Current (7/8)

VBUSC Efficiency vs. Output Current at V_{BAT}=12.95V

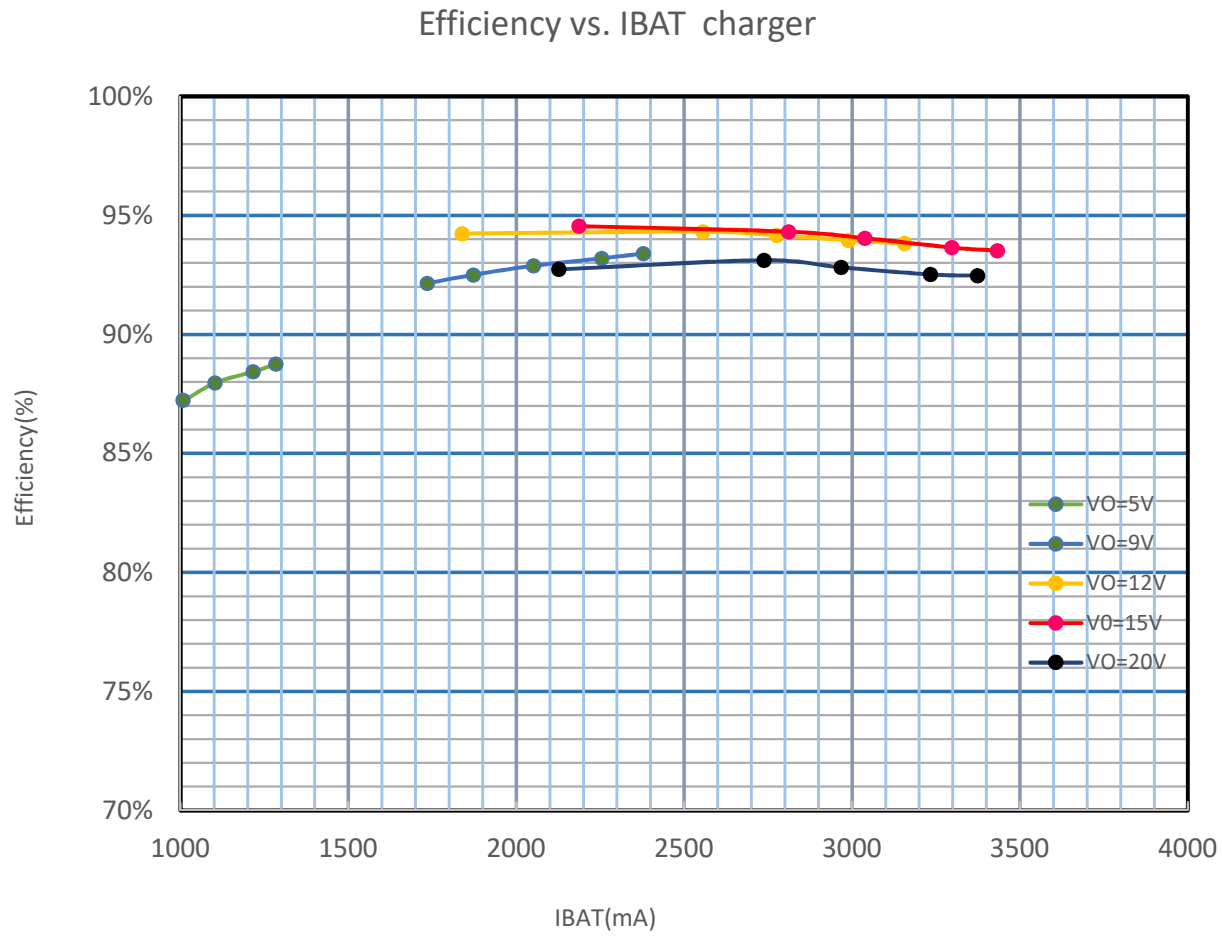
- Charger mode (PD)



Efficiency vs. VBUS Current (8/8)

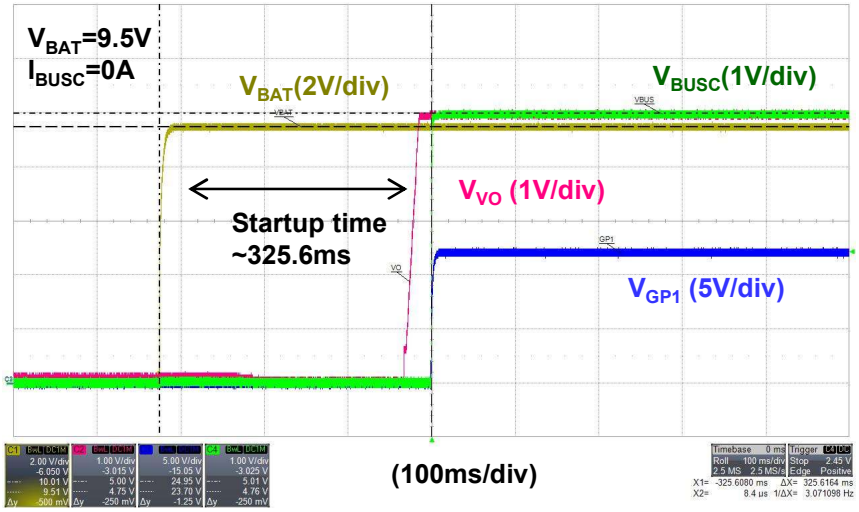
VBUSC Efficiency vs. Output Current at V_{BAT}=12.95V

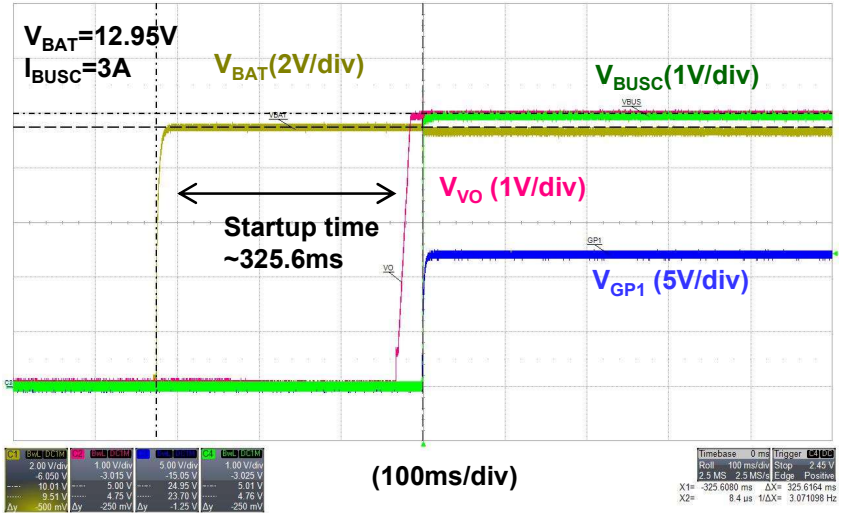
- Charger mode (PD)

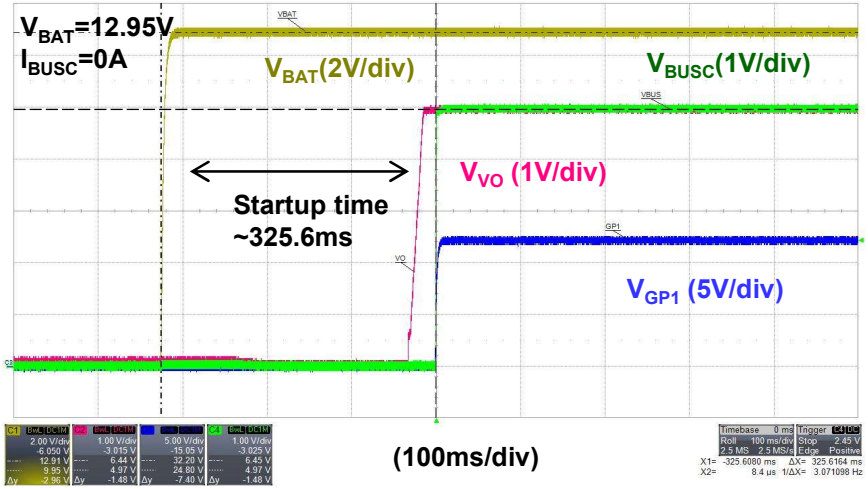


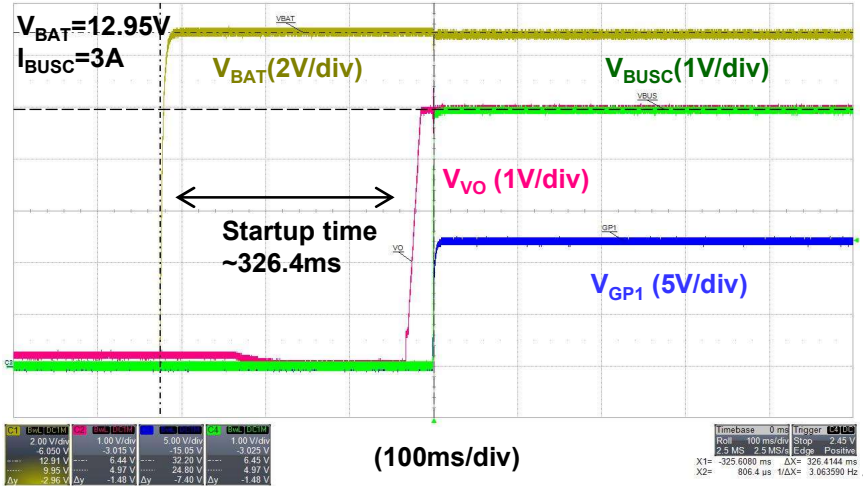
Start Up Time (1/2)

- V_{BAT}=9.5V or 12.95V, I_{BUSC}=0A or 3A, V_{BUSC_SET}=5V.



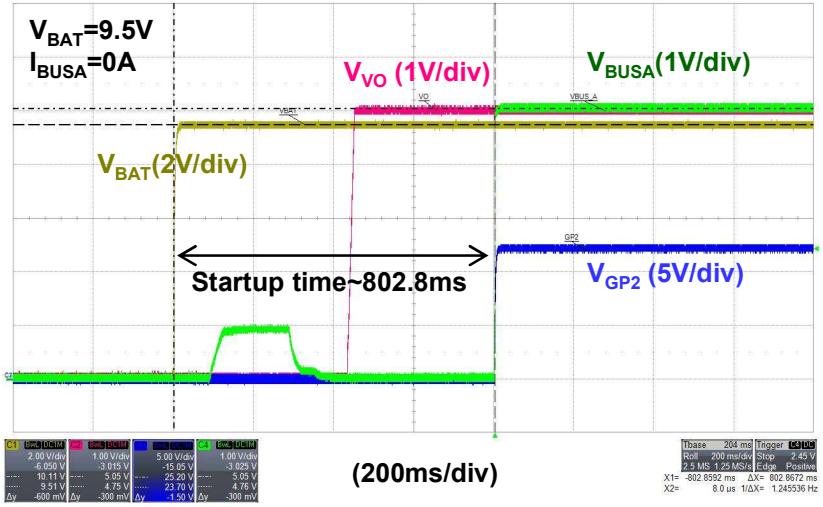


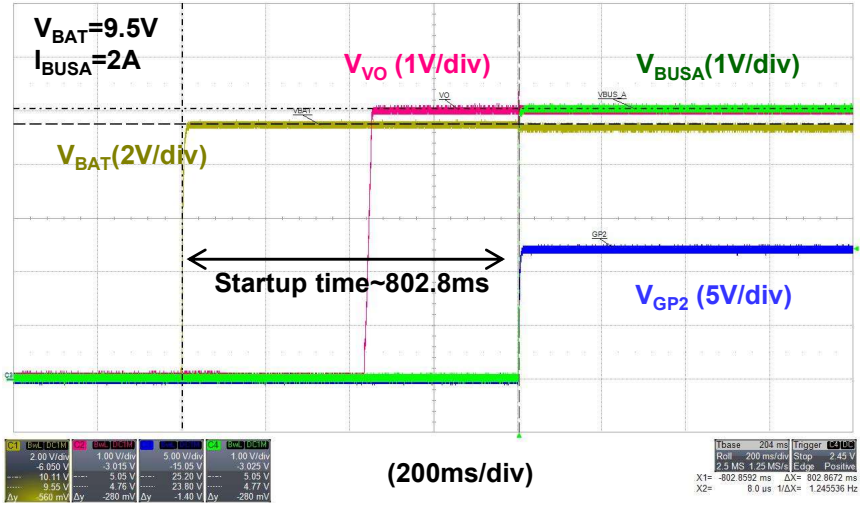


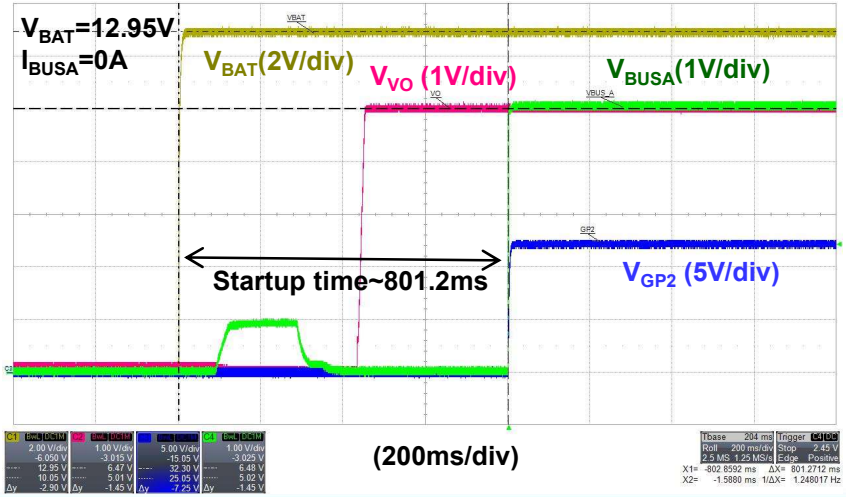


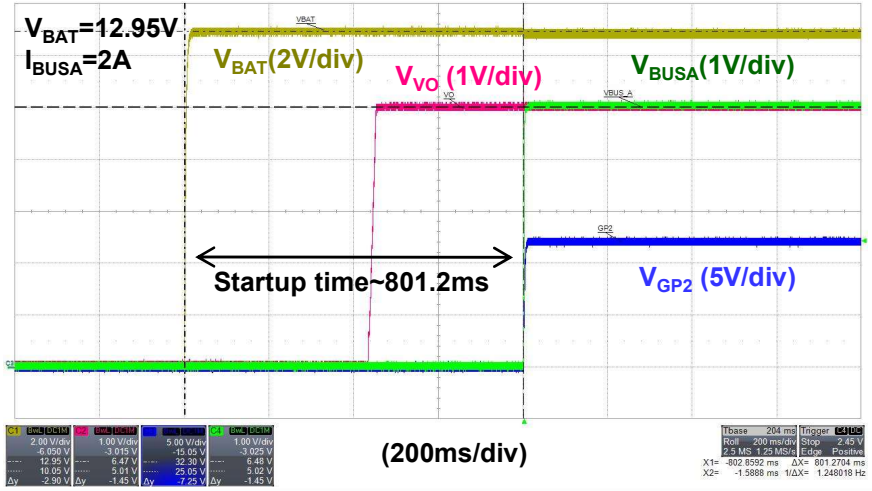
Start Up Time (2/2)

- V_{BAT}=9.5V or 12.95V, I_{BUSA}=0A or 2A, V_{BUSA_SET}=5V.



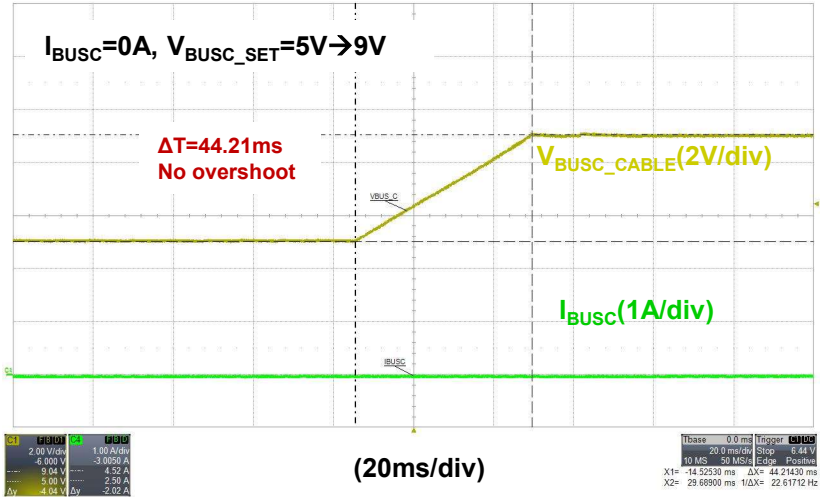


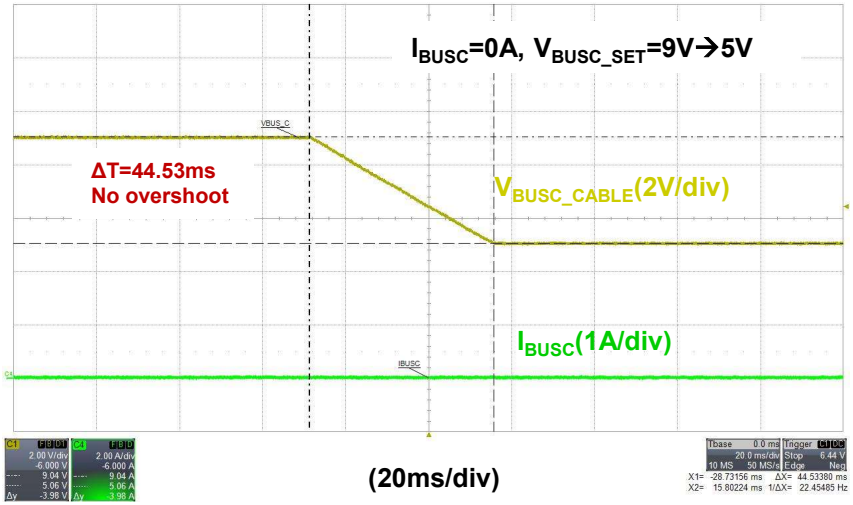


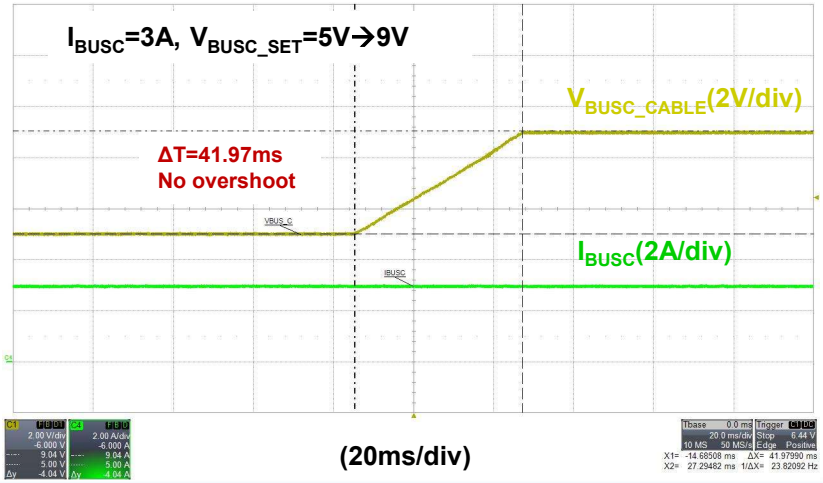


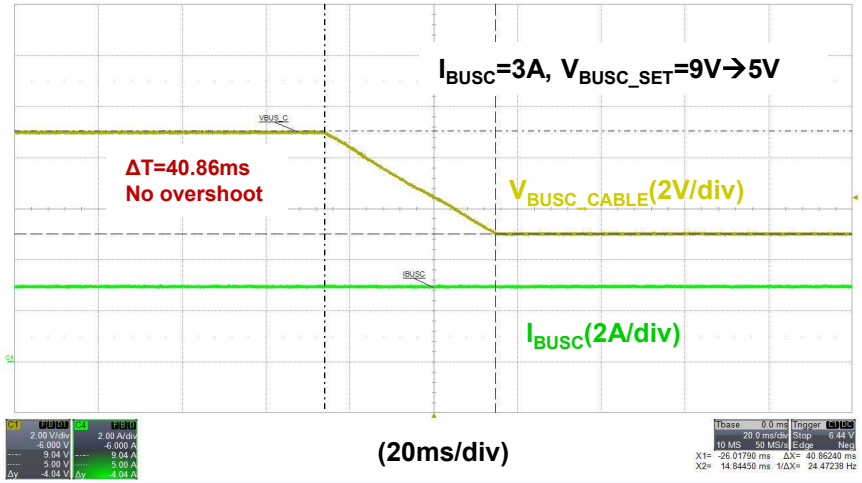
Positive and Negative VBUS Voltage Transitions(1/6)

- I_{BUSC}=0A or 3A; V_{BUSC_SET}=**5**V or **9**V (Provider PD)
- V_{BAT}=**9.5**V, $I_{BUSC\_CC\_SET}$=3.3A for V_{BUSC}=5V/9V



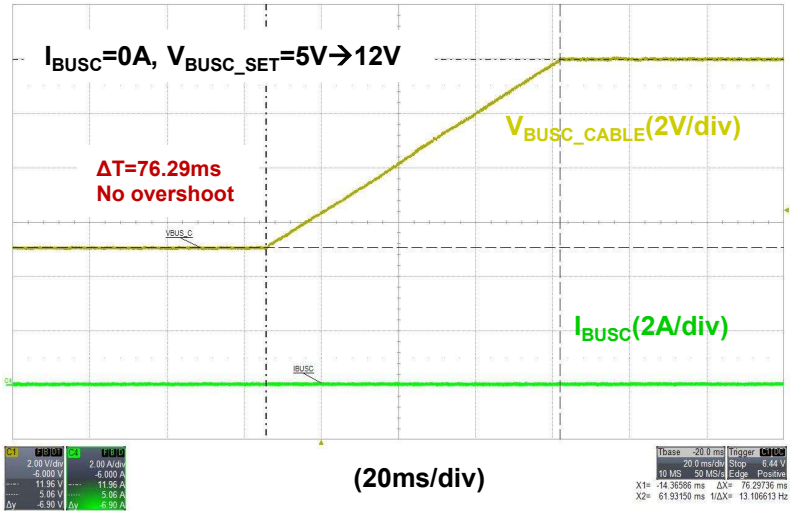


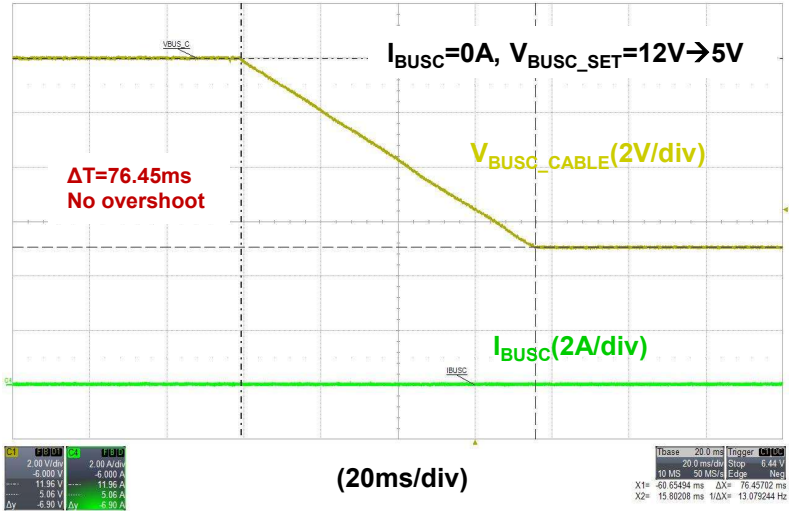


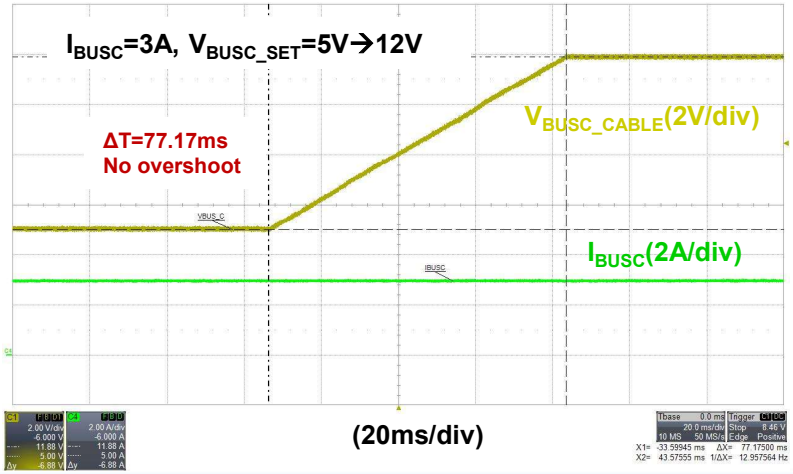


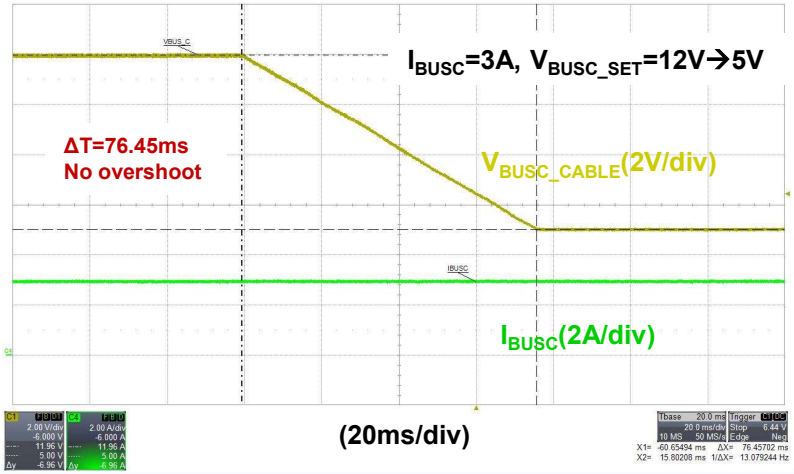
Positive and Negative VBUS Voltage Transitions(2/6)

- I_{BUSC}=0A or 3A; V_{BUSC_SET}=**5**V or **12**V (Provider PD)
- V_{BAT}=**9.5**V, $I_{BUSC\_CC\_SET}$=3.3A for V_{BUSC}=5V/12V



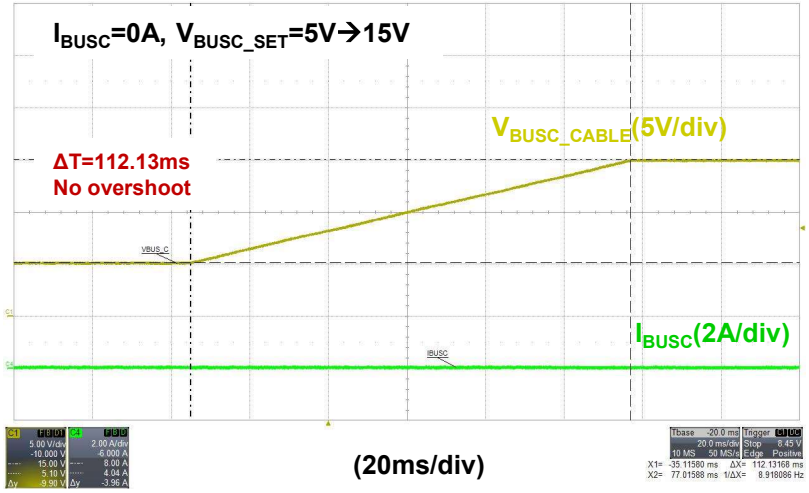


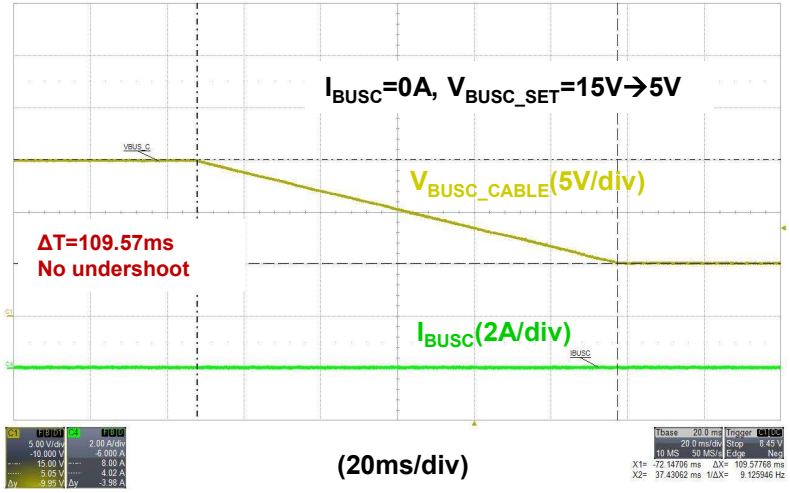


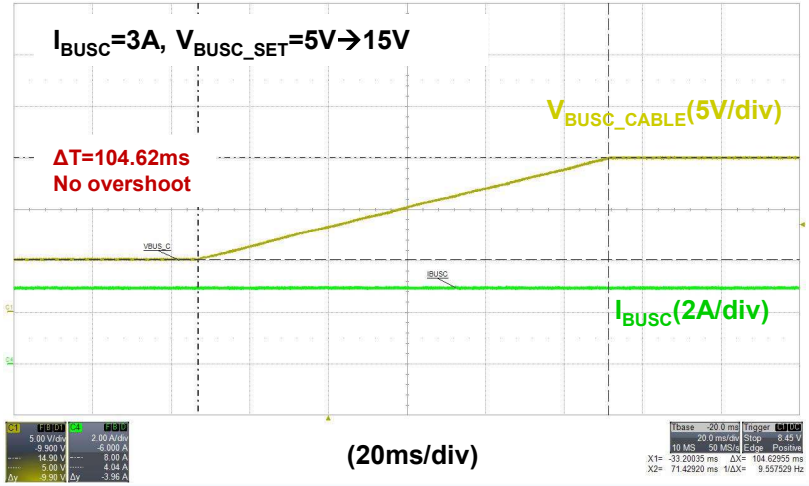


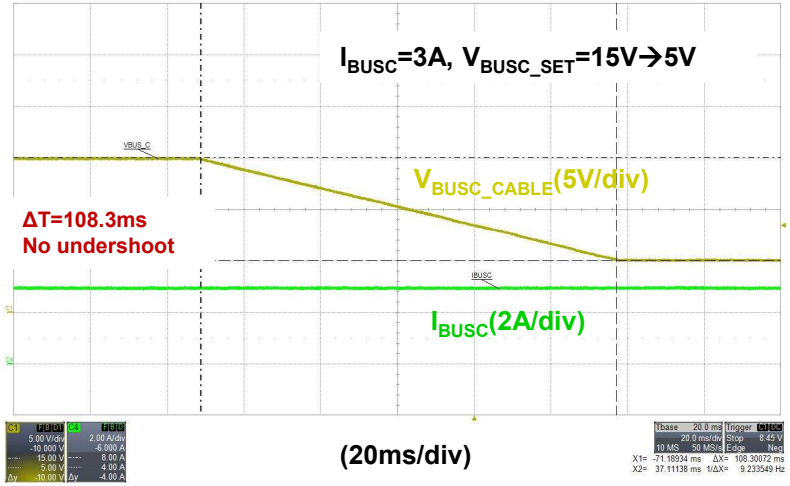
Positive and Negative VBUS Voltage Transitions(3/6)

- I_{BUSC}=0A or 2.67A; V_{BUSC_SET}=**5**V or **15**V (Provider PD)
- V_{BAT}=**9.5**V, $I_{BUSC\_CC\_SET}$=3.3A/3A for V_{BUSC}=5V/15V



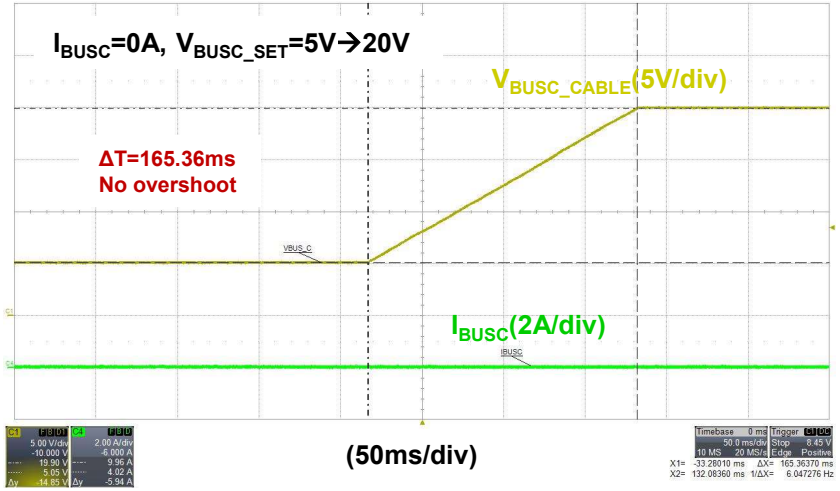


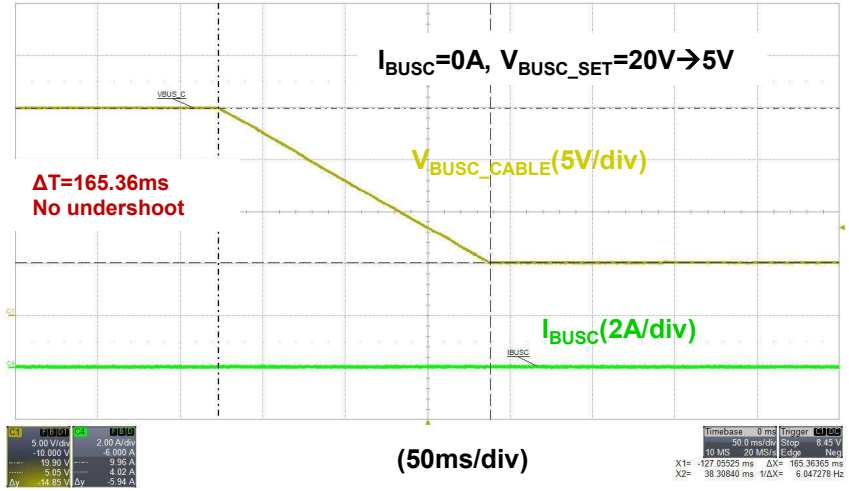


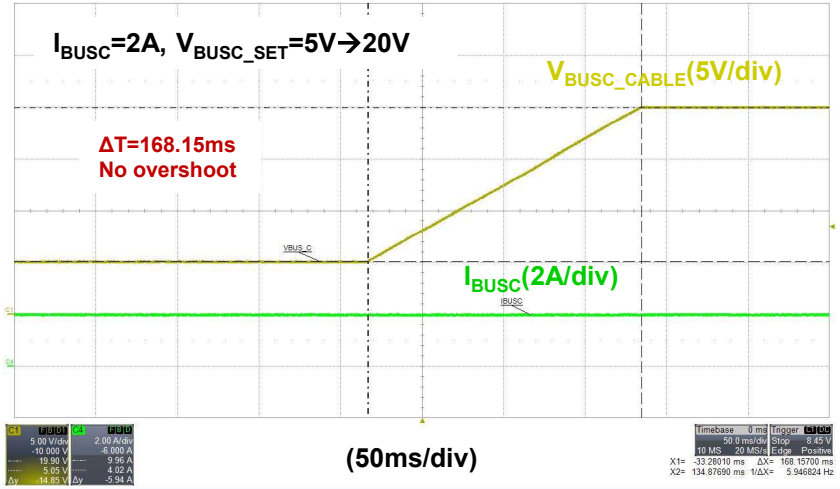


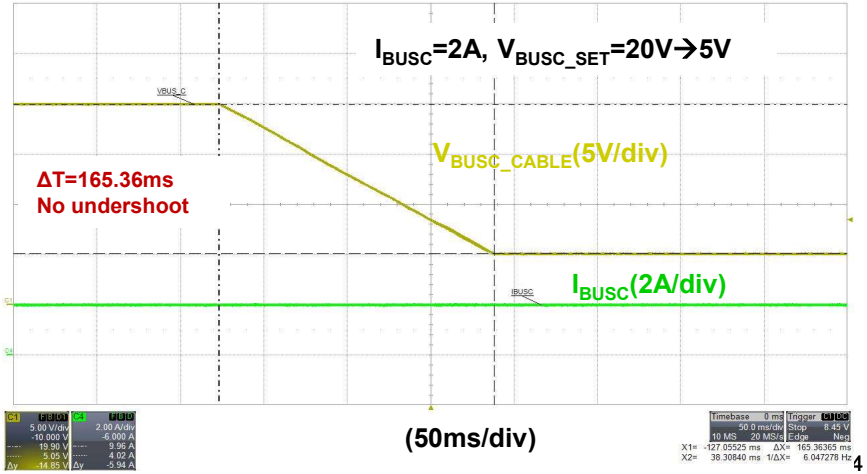
Positive and Negative VBUS Voltage Transitions(4/6)

- I_{BUSC}=0A or 2A; V_{BUSC_SET}=**5**V or **20**V (Provider PD)
- V_{BAT}=**9.5**V, $I_{BUSC\_CC\_SET}$=2.25A/2A for V_{BUSC}=5V/20V



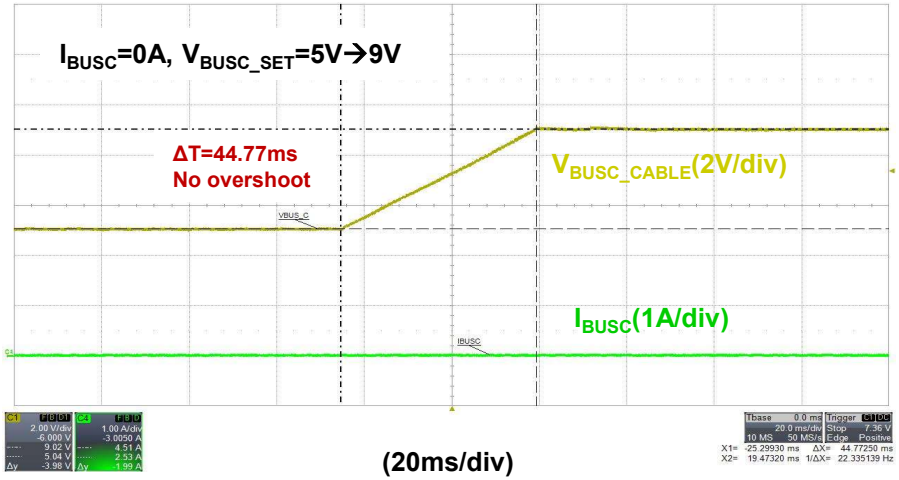


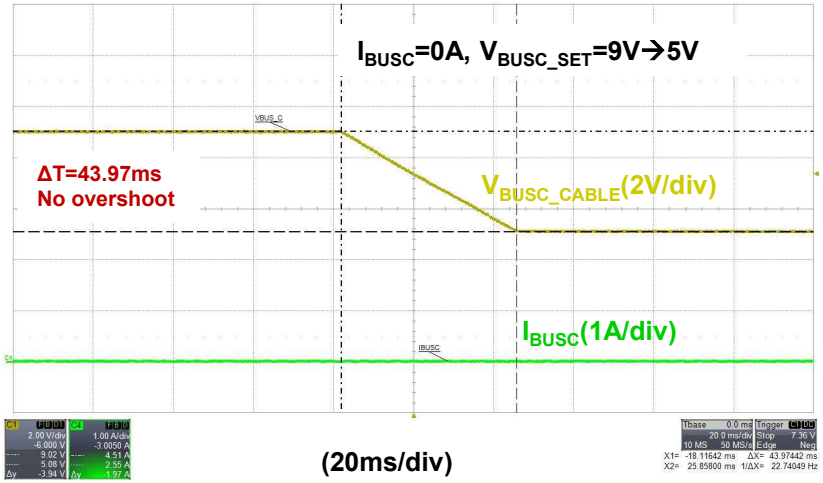


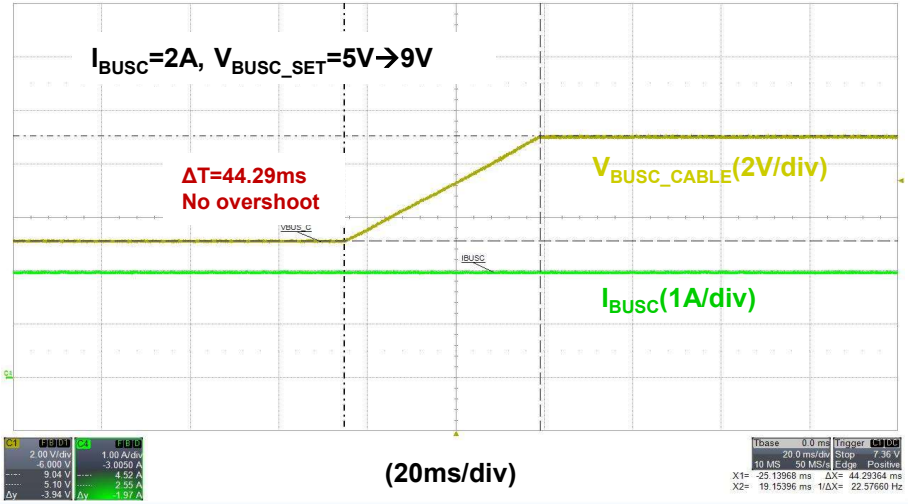


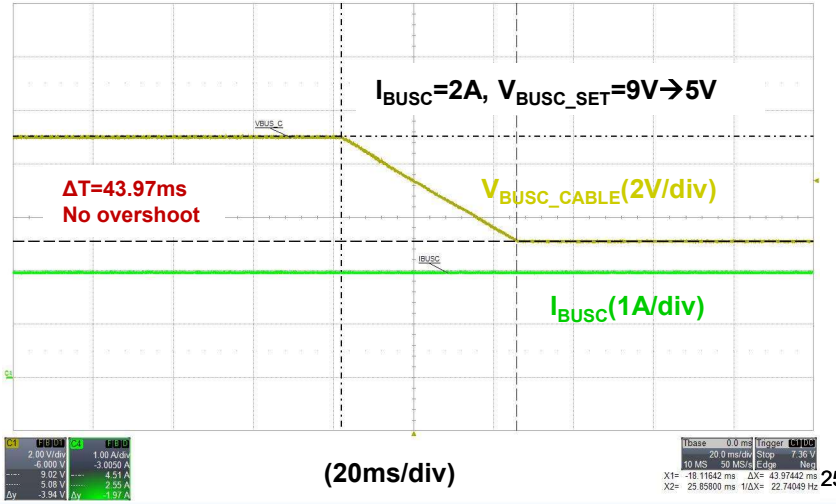
Positive and Negative VBUS Voltage Transitions(5/6)

- I_{BUSC}=0A or 2A; V_{BUSC_SET}=**5**V or **9**V (Provider QC)
- V_{BAT}=**9.5**V, $I_{BUSC\_CC\_SET}$=2.2A for V_{BUSC}=5V/9V



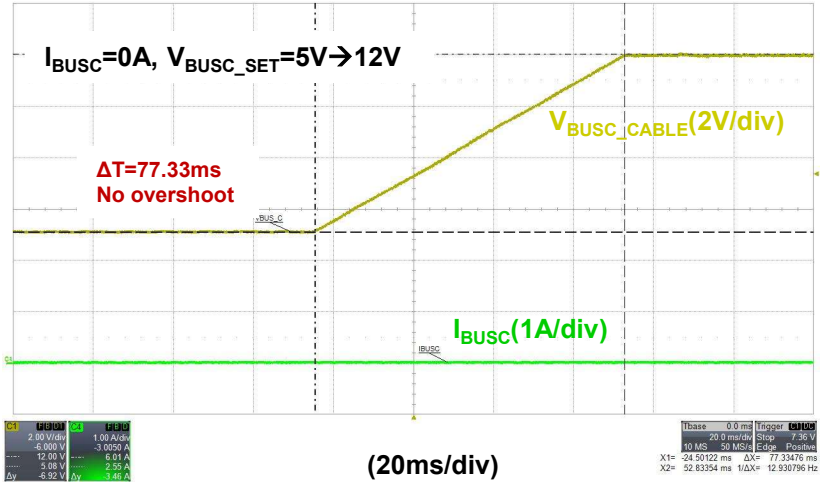


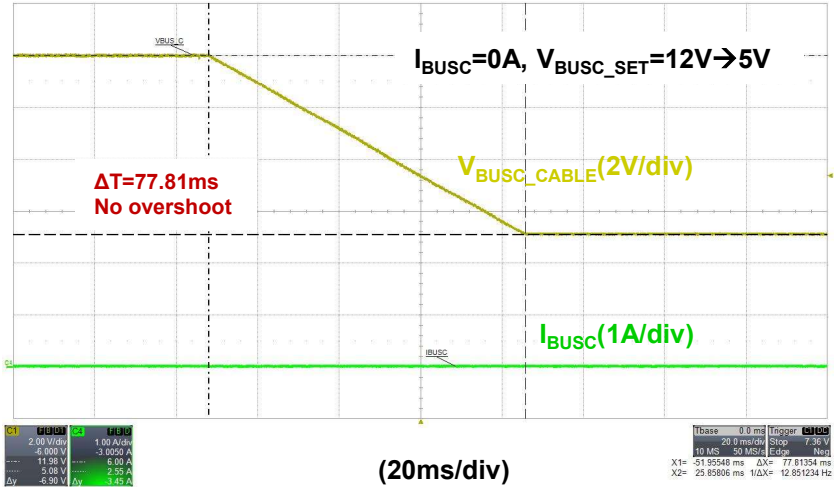


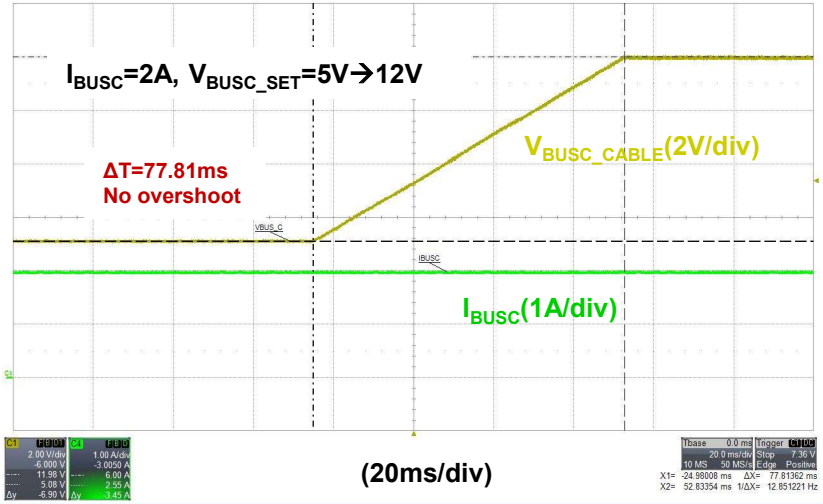


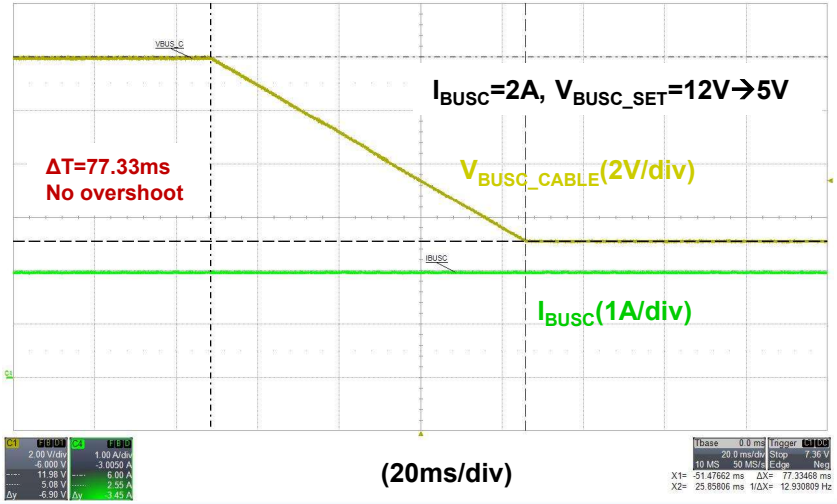
Positive and Negative VBUS Voltage Transitions(6/6)

- I_{BUSC}=0A or 2A; V_{BUSC_SET}=**5**V or **12**V (Provider QC)
- V_{BAT}=**9.5**V, $I_{BUSC\_CC\_SET}$=2.2A for V_{BUSC}=5V/12V



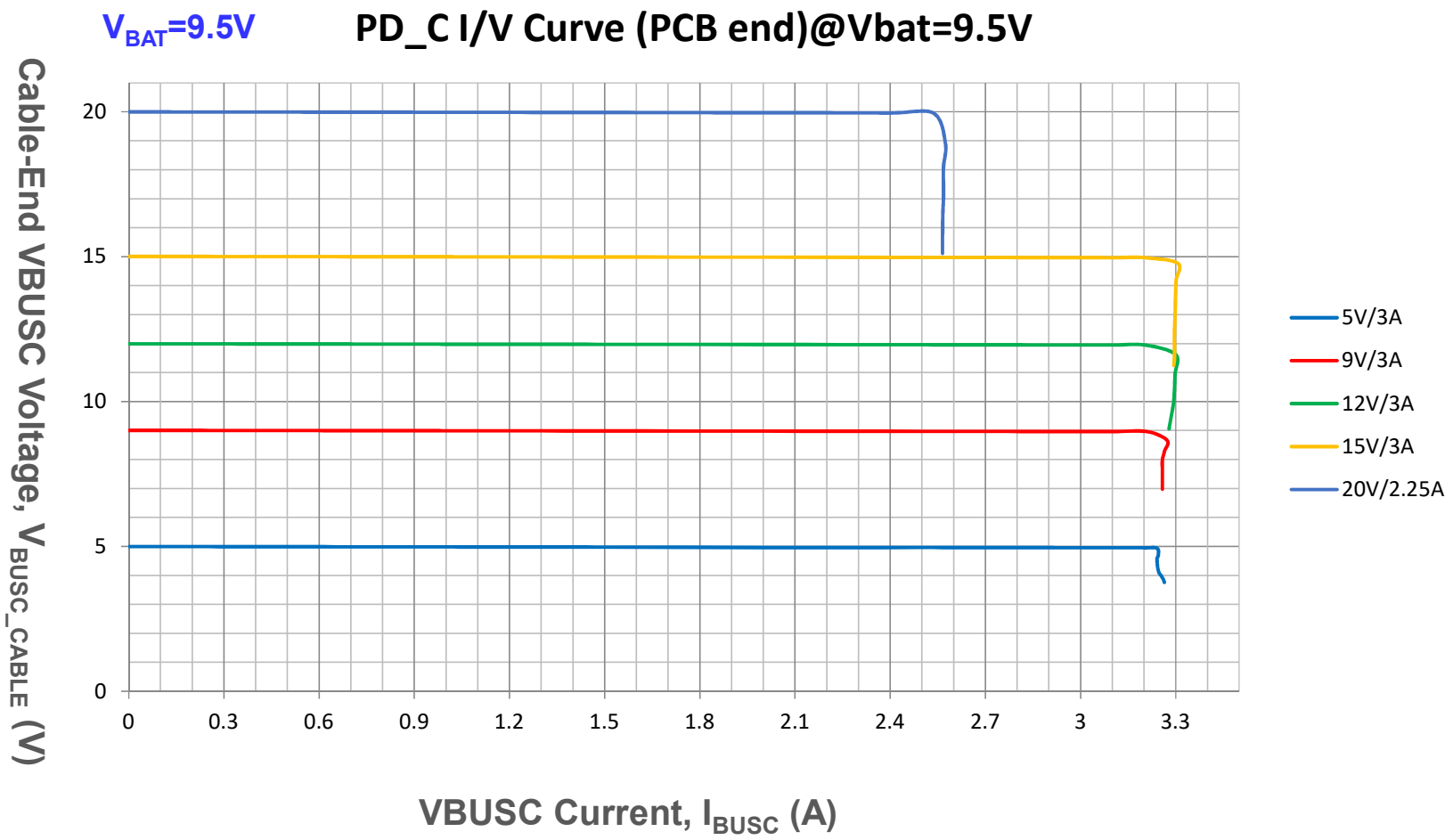






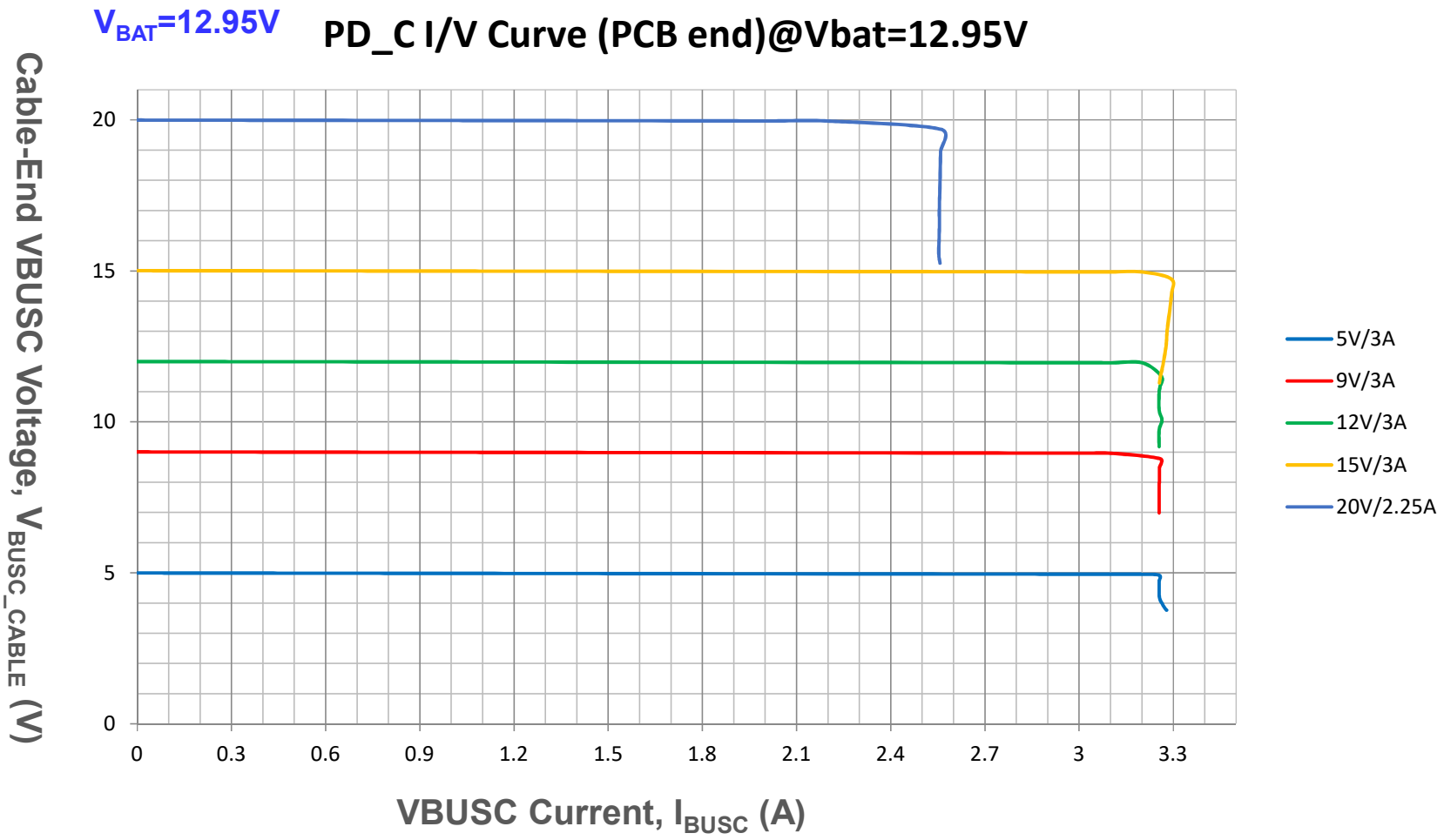
PCB-End VBUS Voltage vs. Current (1/4)

- Provider (PD mode)



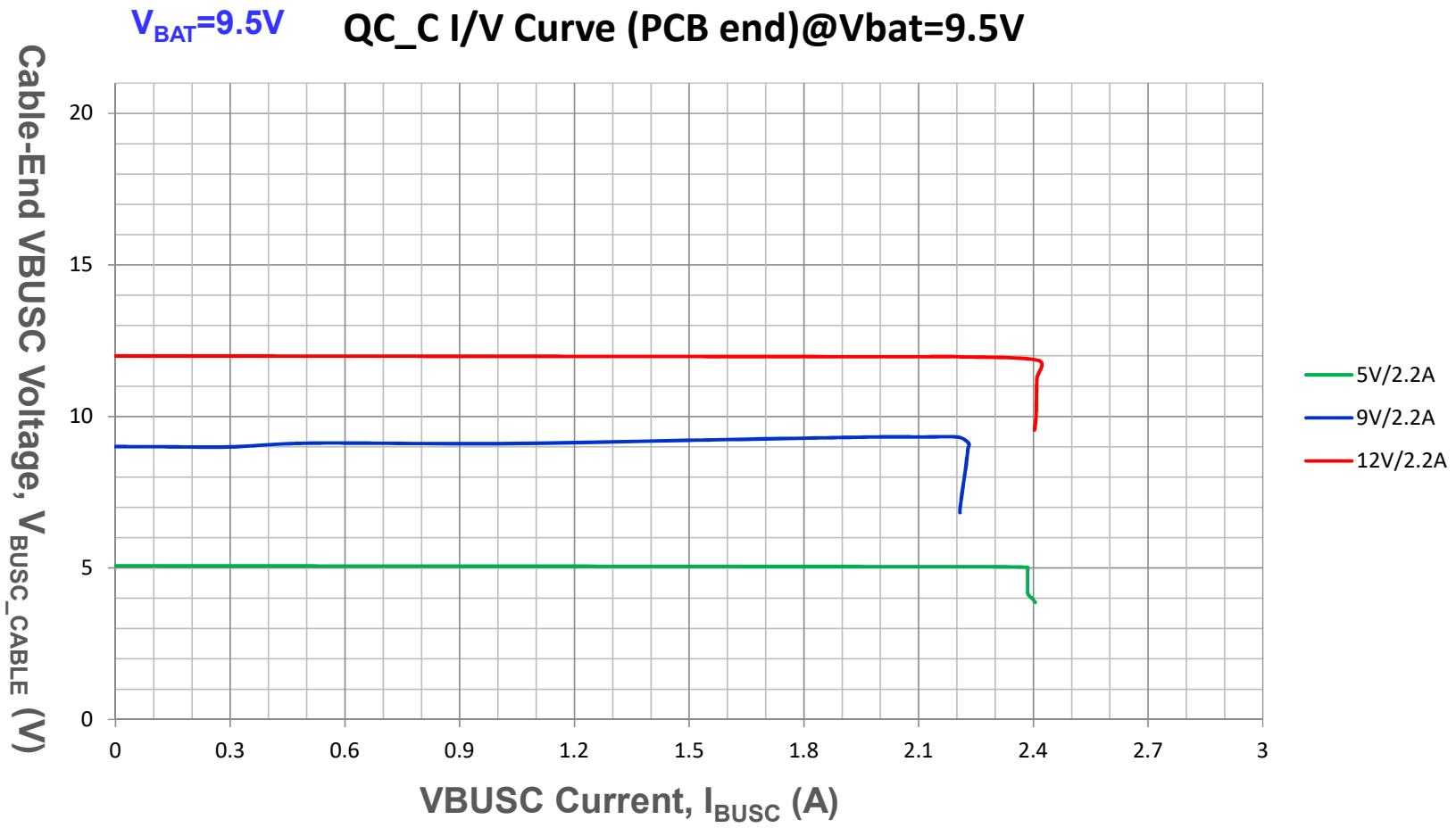
PCB-End VBUS Voltage vs. Current (2/4)

- Provider (PD mode)



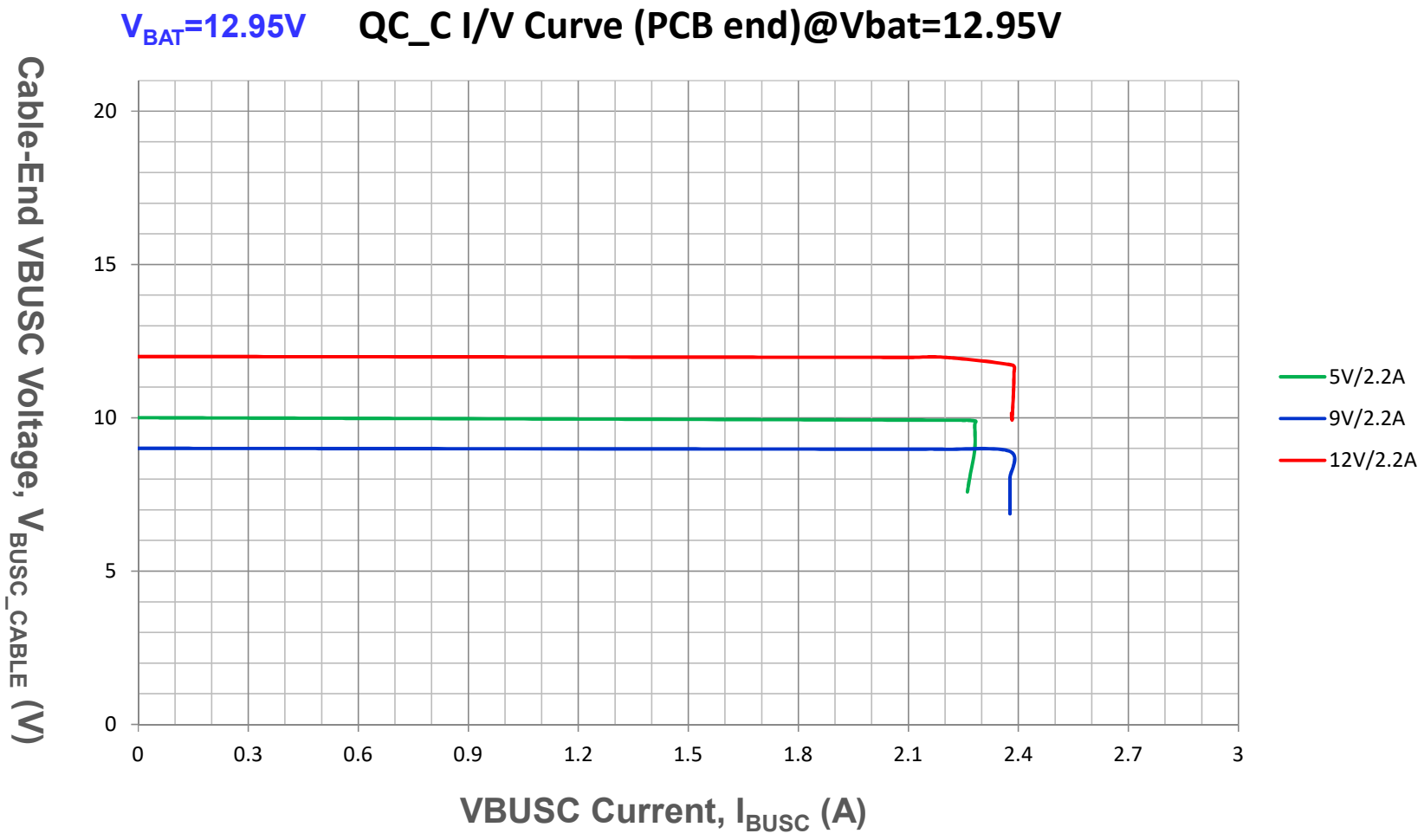
PCB-End VBUS Voltage vs. Current (3/4)

- Provider (QC mode)



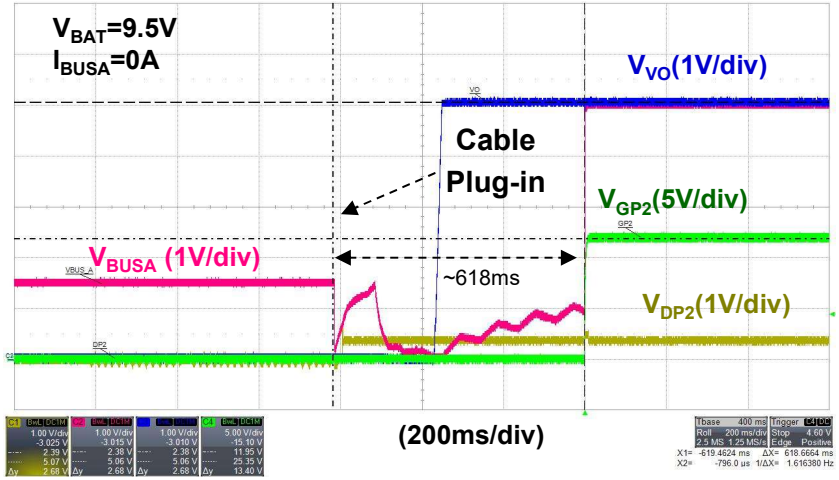
PCB-End VBUS Voltage vs. Current (4/4)

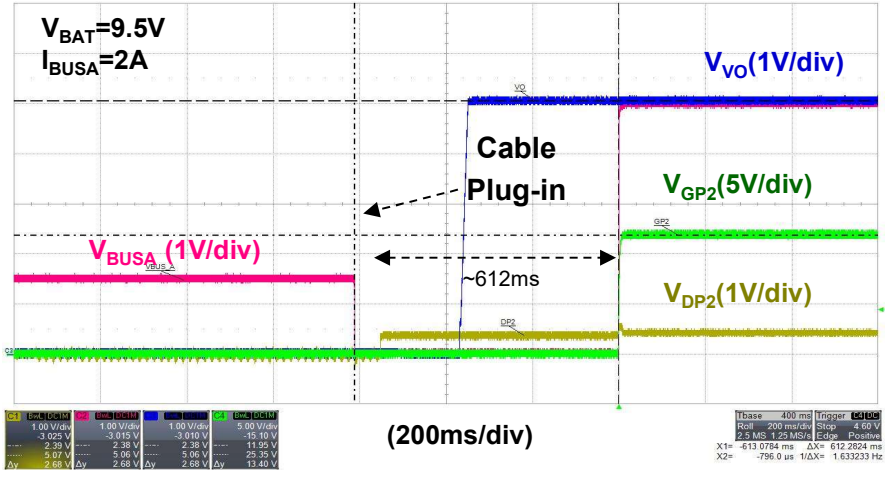
- Provider (QC mode)

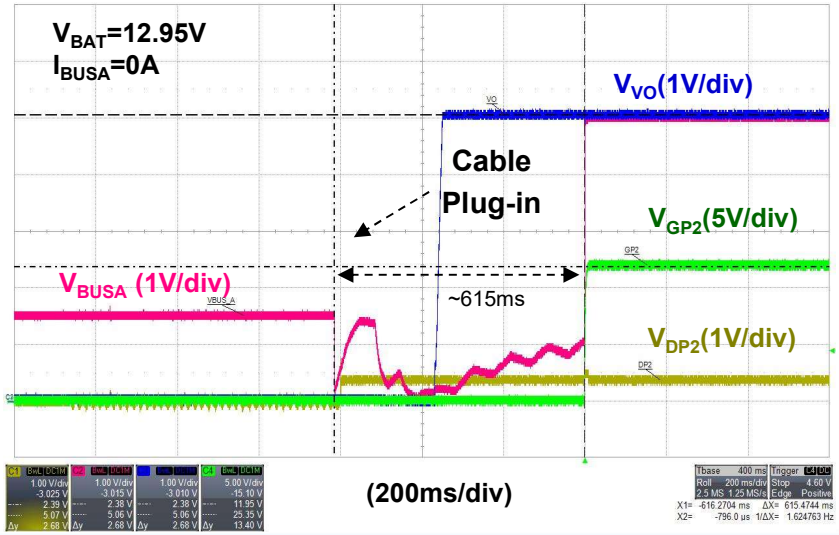


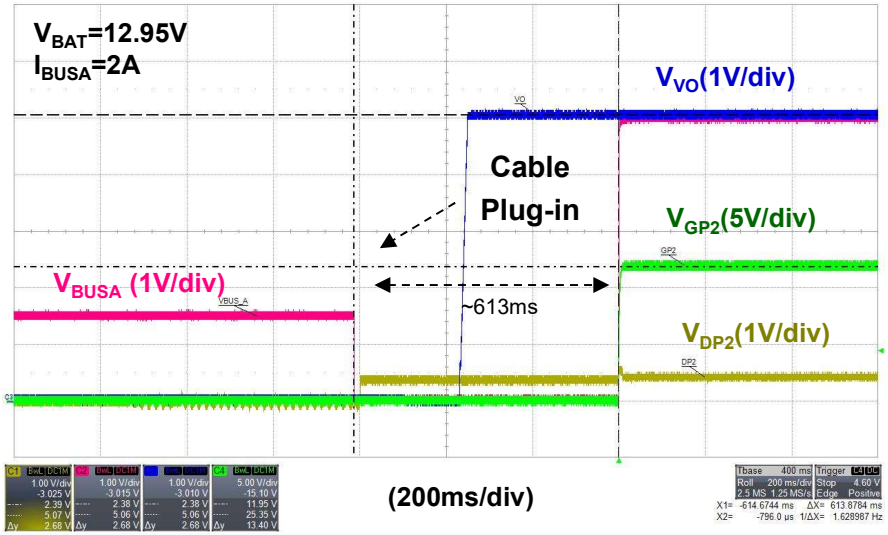
USB Cable Plug-In (2/2)

- V_{BAT}=9.5V / 12.95V, I_{BUSA}=0A or 2A , $I_{BUSA\_CC\_SET}$=2.4A



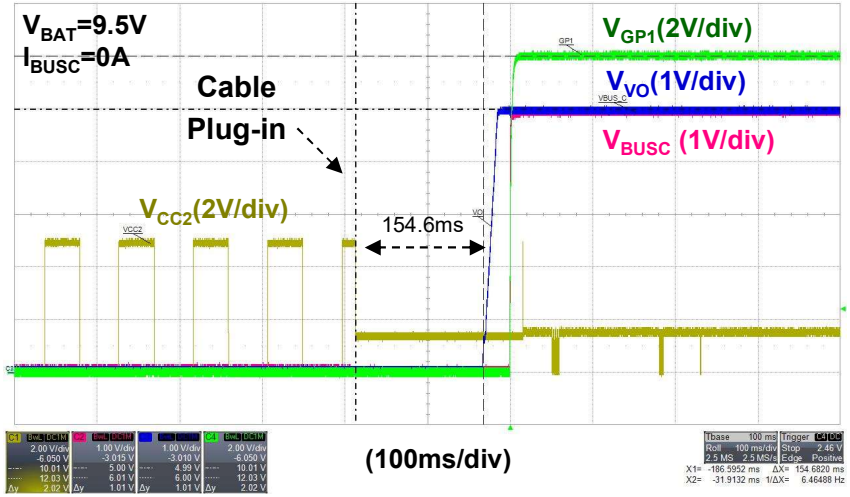


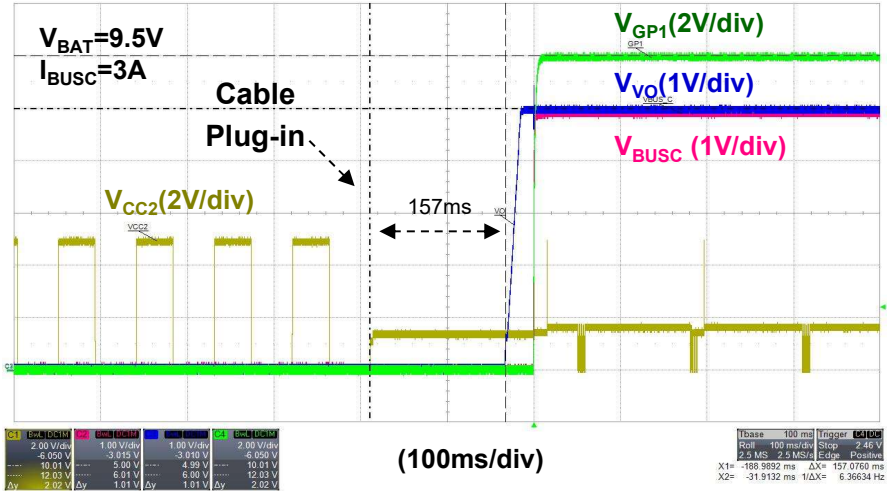


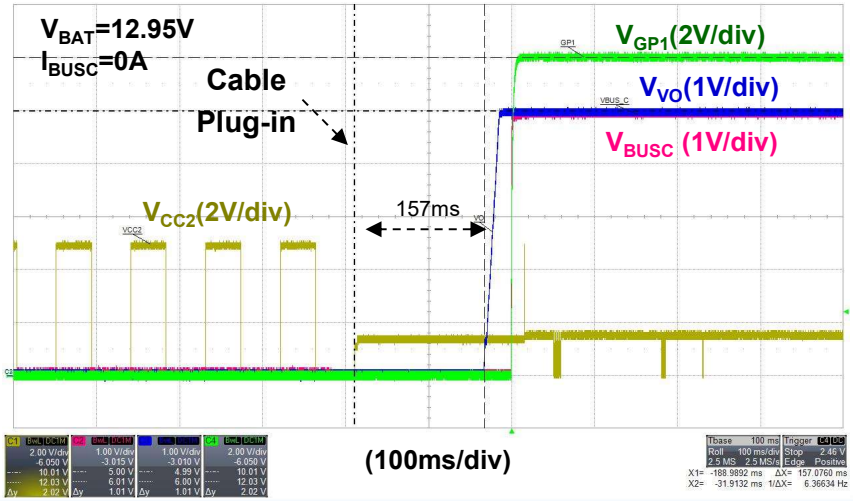


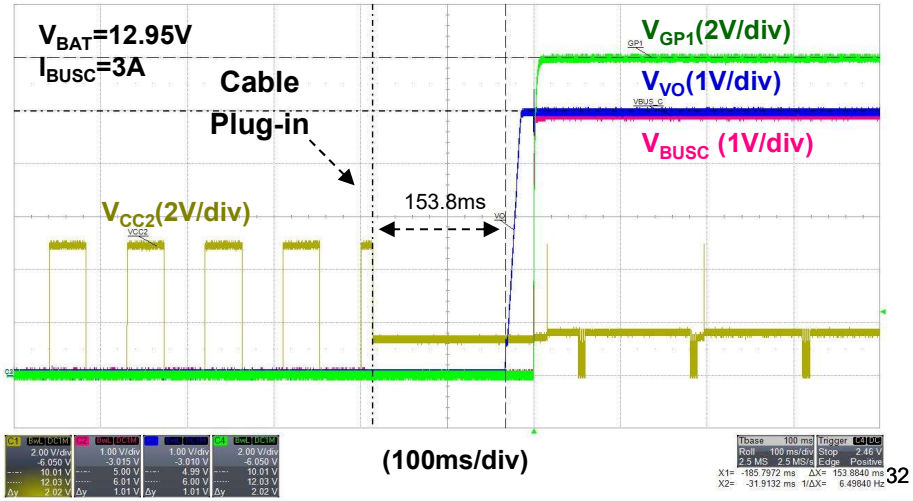
USB Cable Plug-In (1/2)

- V_{BAT}=9.5V / 12.95V, I_{BUSC}=0A or 3A , $I_{BUSC\_CC\_SET}$=3.3A



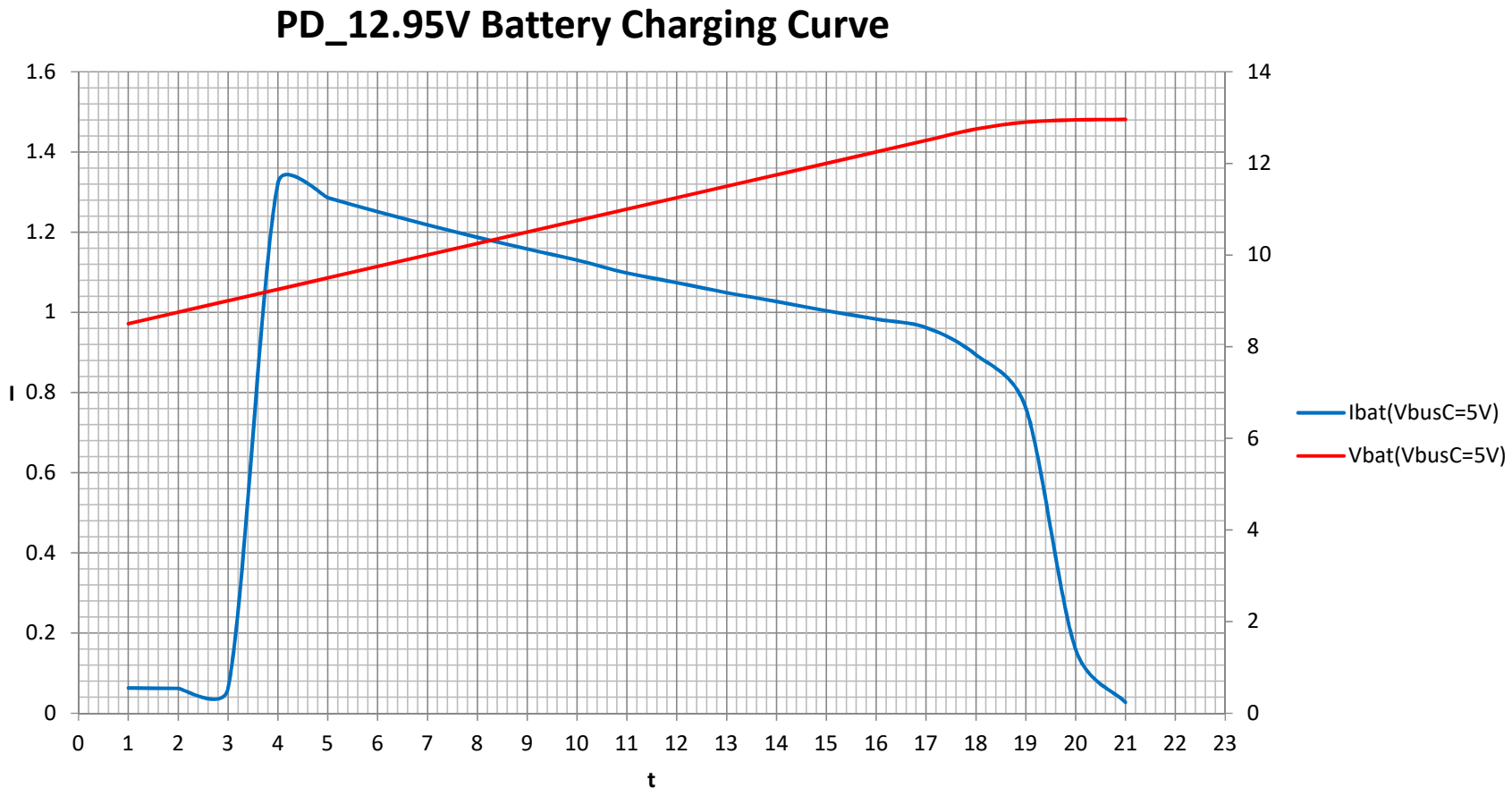






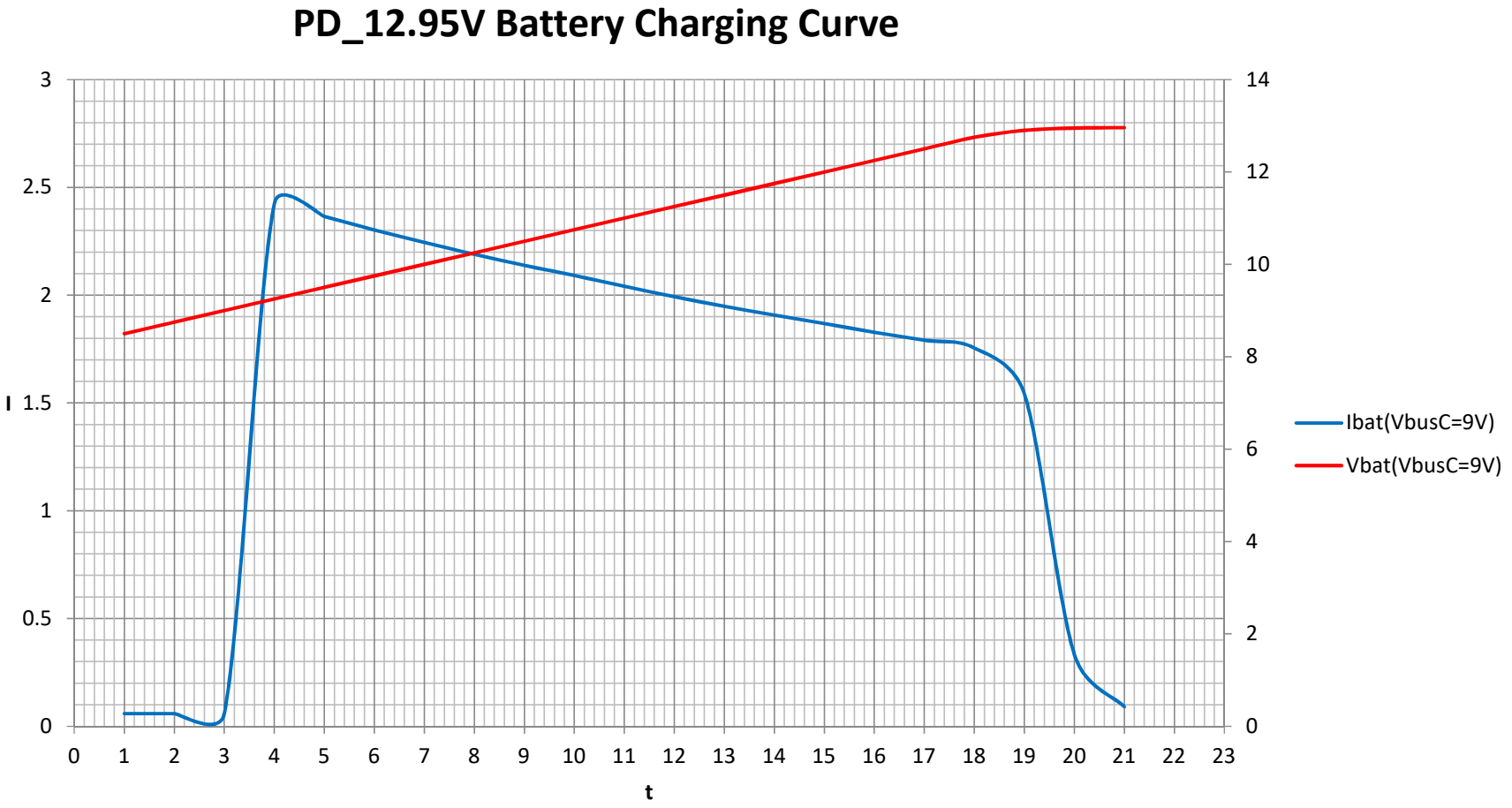
Battery Charging Curve (1/5)

- Charger mode (PD)



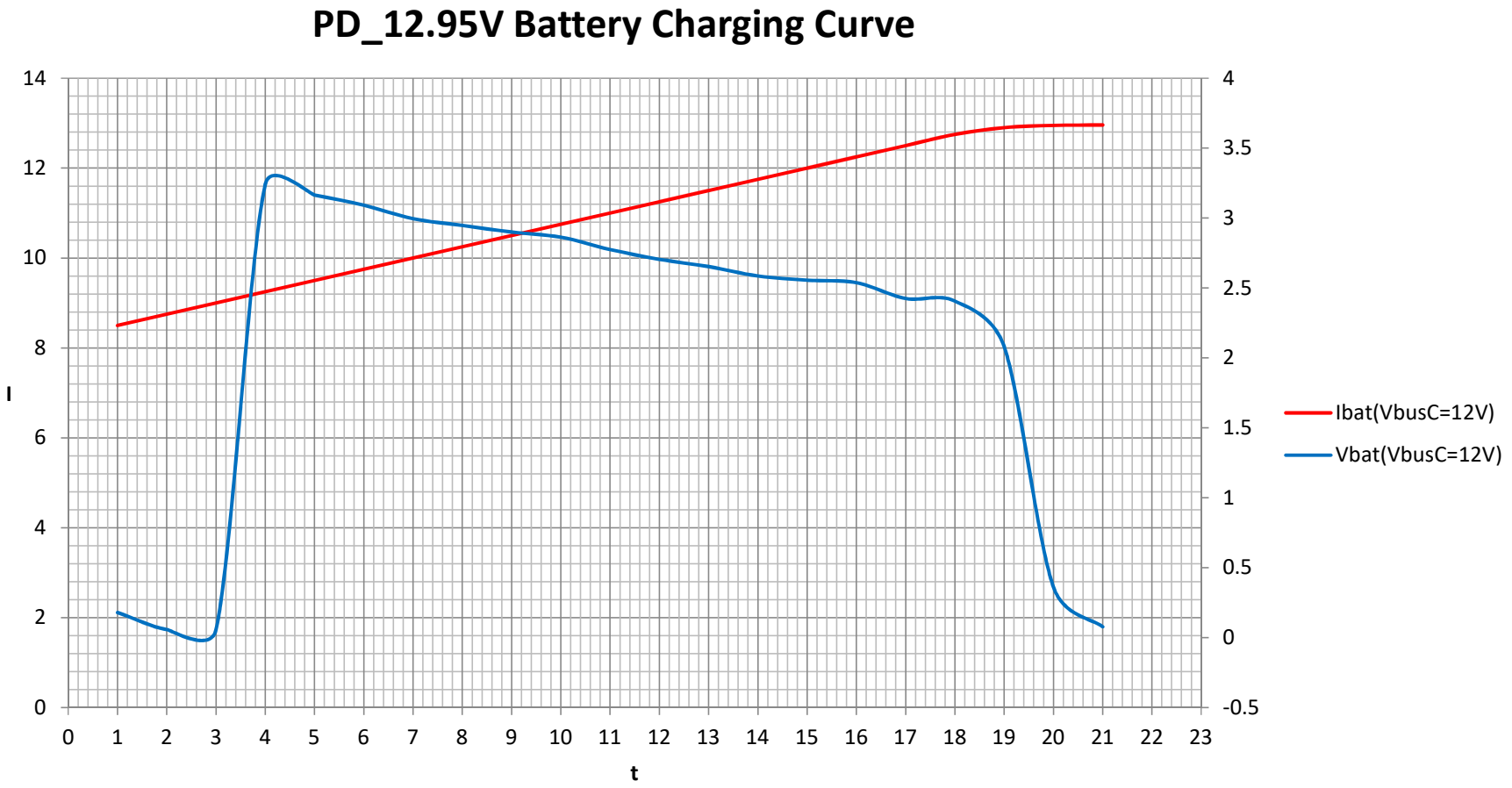
Battery Charging Curve (2/5)

- Charger mode (PD)



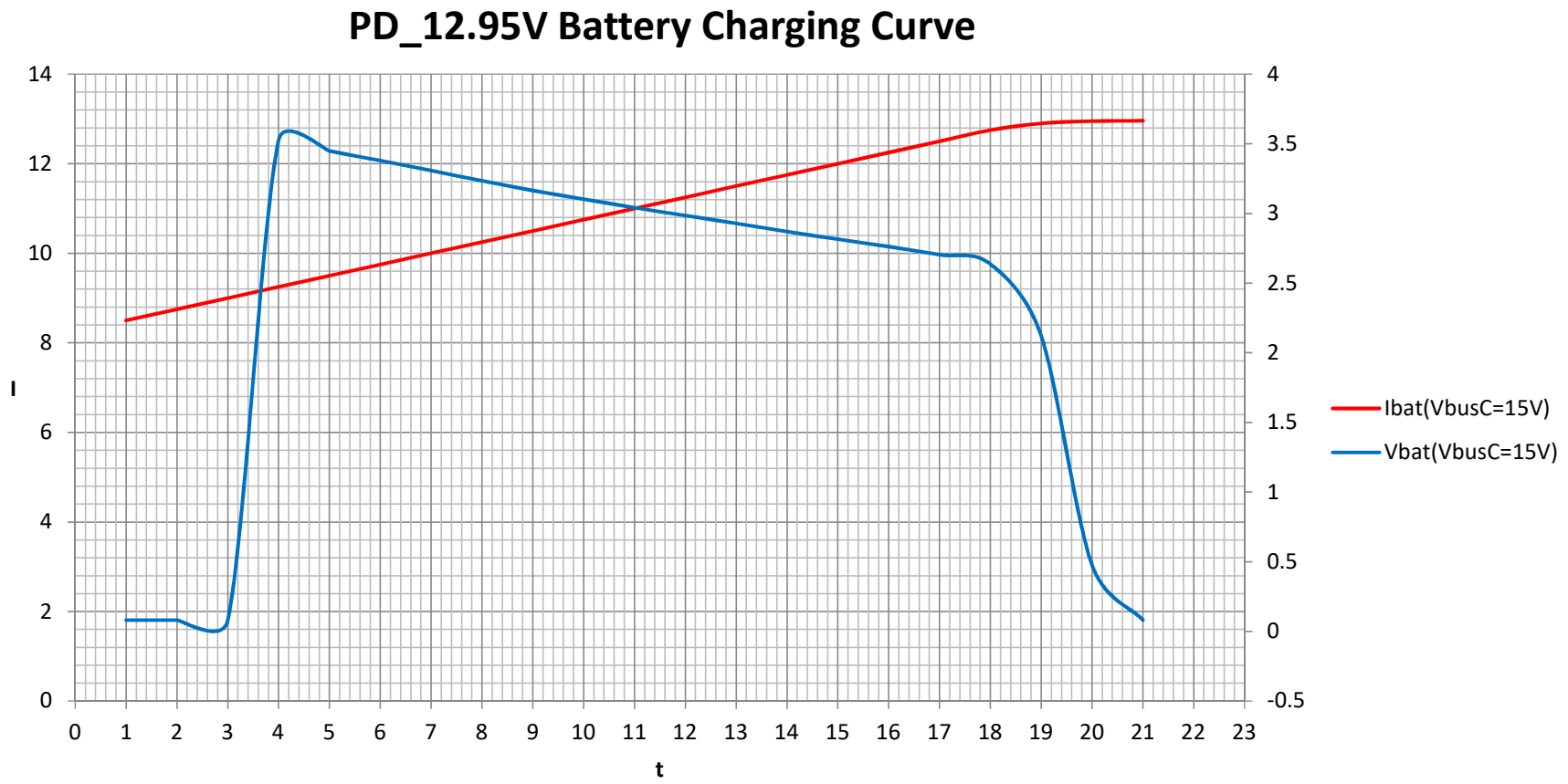
Battery Charging Curve (3/5)

- Charger mode (PD)



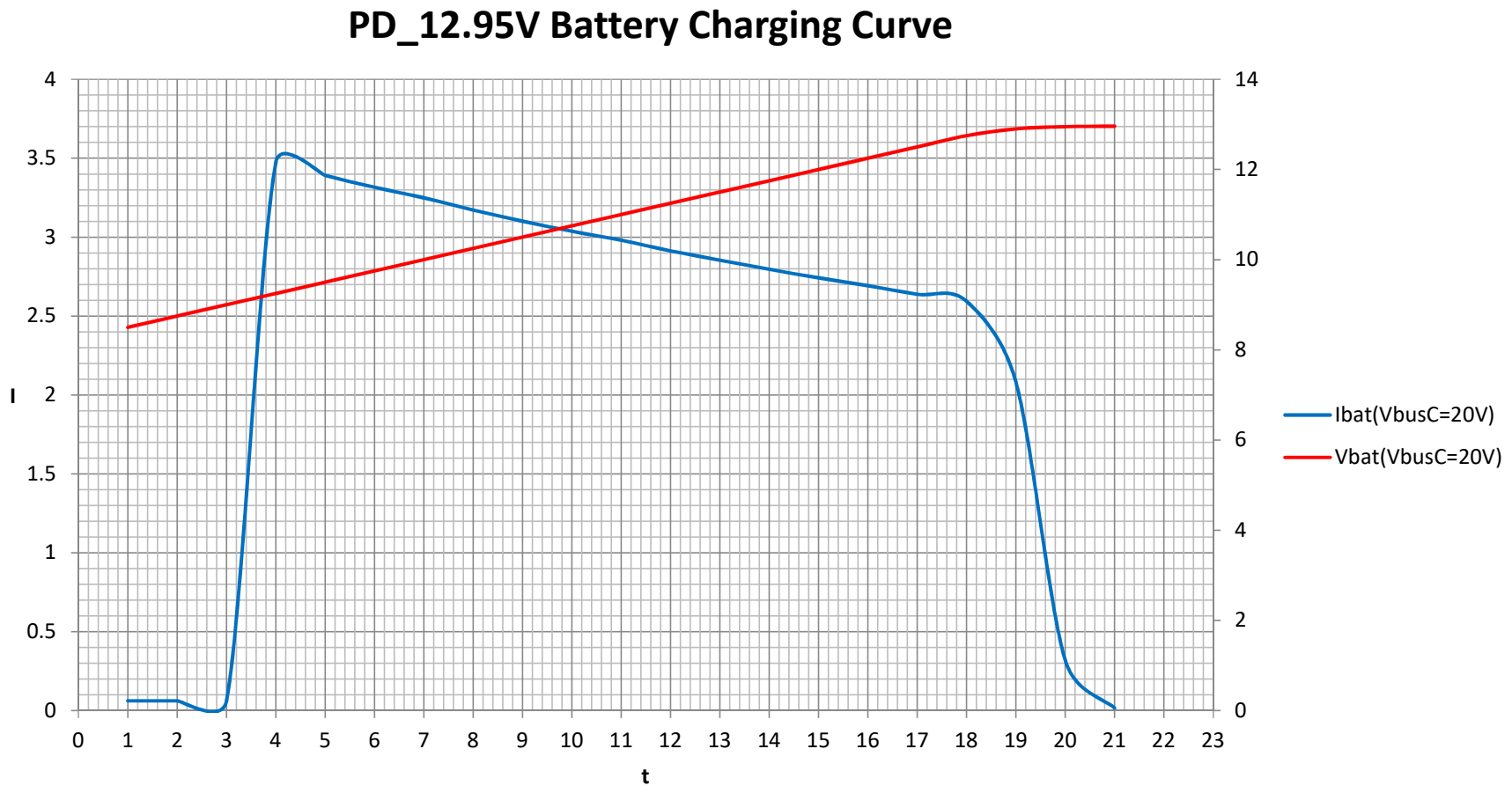
Battery Charging Curve (4/5)

- Charger mode (PD)



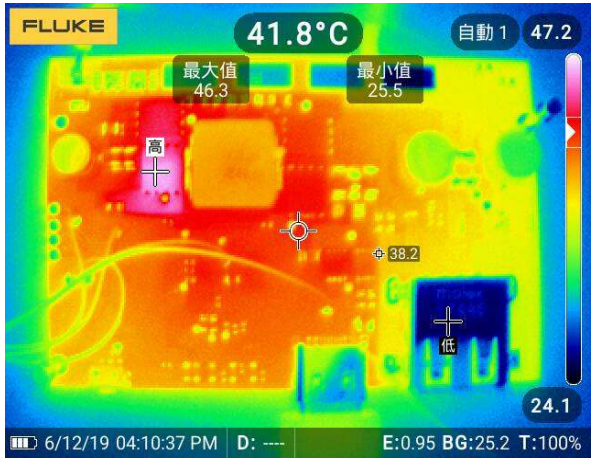
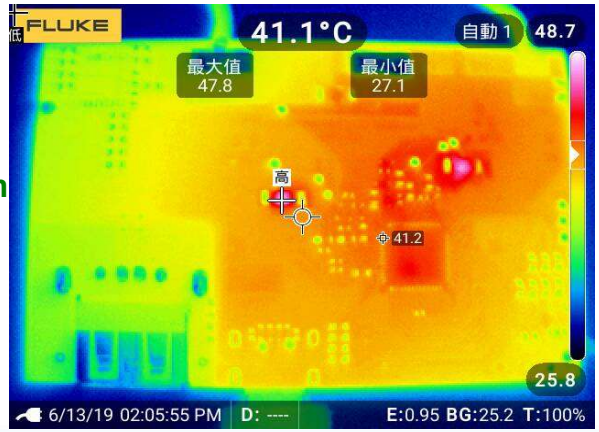
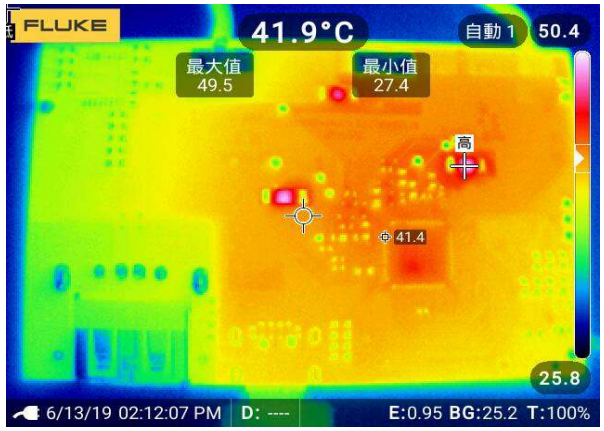
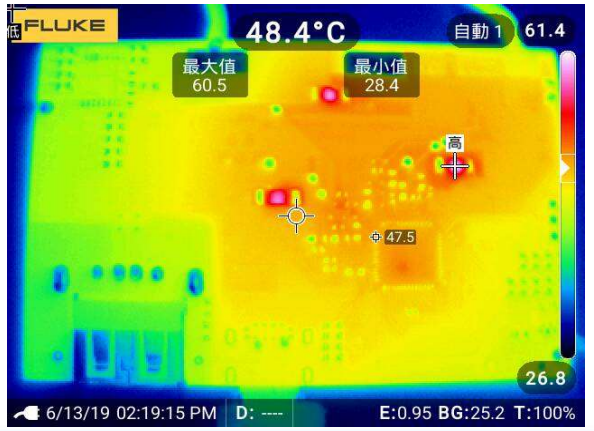
Battery Charging Curve (5/5)

- Charger mode (PD)



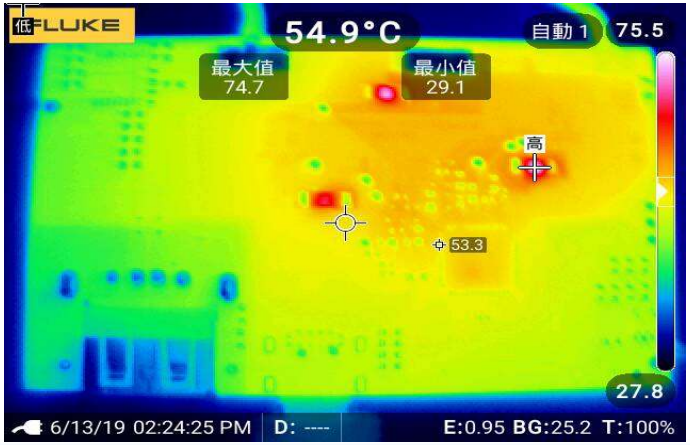
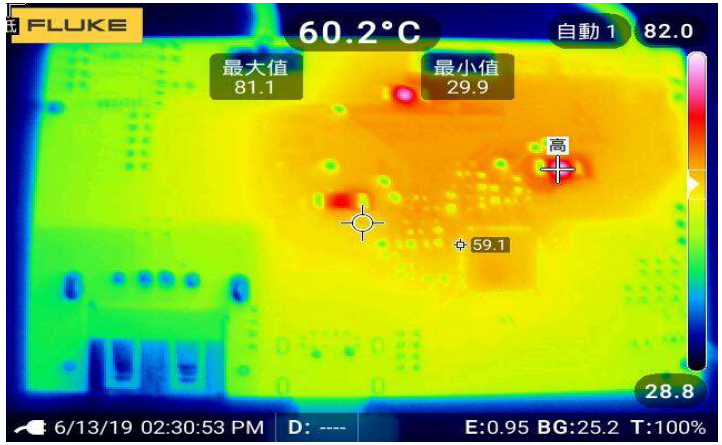
Thermal Images (1/6)

- Provider mode(PD).
- V_{BAT}= **9.5**V, Ambient temperature=25℃ .
- Measured at temperature steady state by using Thermal Imager Fluke Ti450.

	V_{BUSC}/I_{BUSC}=5V/3A	V_{BUSC}/I_{BUSC}=9V/3A	V_{BUSC}/I_{BUSC}=12V/3A
Top			
Bottom			

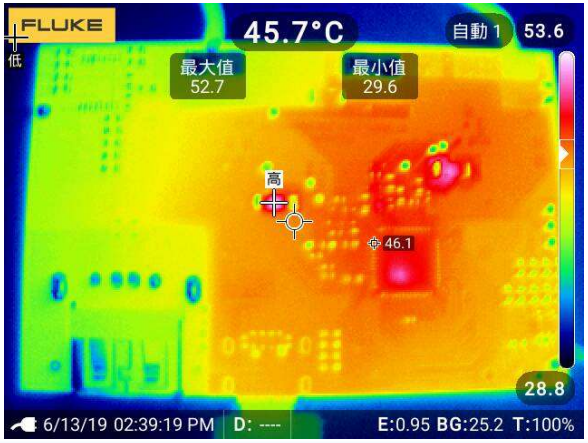
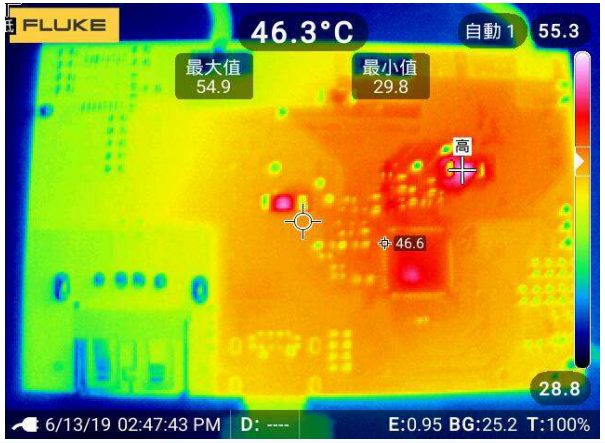
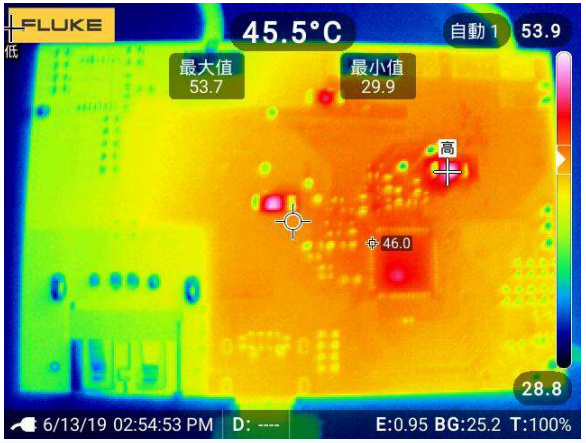
Thermal Images (2/6)

- Provider mode(PD).
- V_{BAT}= **9.5**V, Ambient temperature=25℃.
- Measured at temperature steady state by using Thermal Imager Fluke Ti450.

	V_{BUSC}/I_{BUSC}=15V/3A	V_{BUSC}/I_{BUSC}=20V/2.25A
Top		
Bottom		

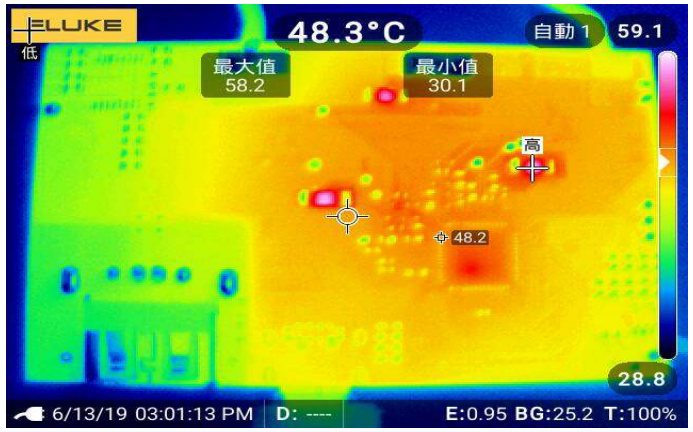
Thermal Images (3/6)

- Provider mode(PD).
- V_{BAT}= **12.95**V, Ambient temperature=25℃ .
- Measured at temperature steady state by using Thermal Imager Fluke Ti450.

	V_{BUSC}/I_{BUSC}=5V/3A	V_{BUSC}/I_{BUSC}=9V/3A	V_{BUSC}/I_{BUSC}=12V/3A
Top			
Bottom			

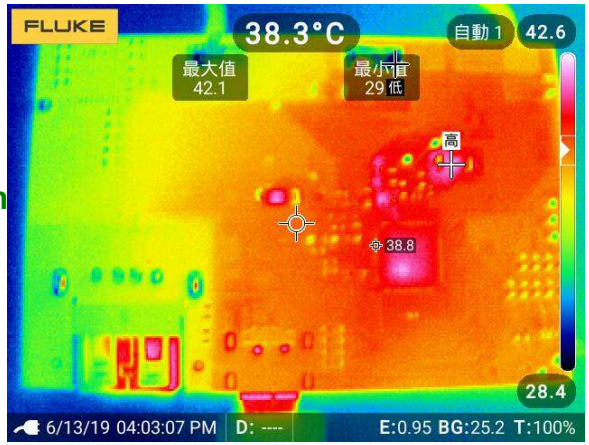
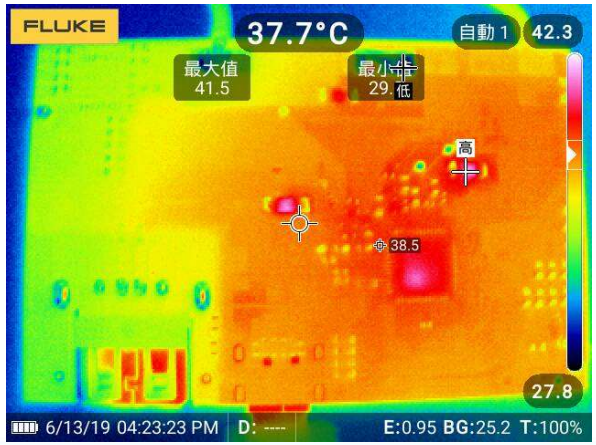
Thermal Images (4/6)

- Provider mode(PD).
- V_{BAT}= **12.95**V, Ambient temperature=25℃ .
- Measured at temperature steady state by using Thermal Imager Fluke Ti450.

	V_{BUSC}/I_{BUSC}=15V/3A	V_{BUSC}/I_{BUSC}=20V/2.25A
Top		
Bottom		

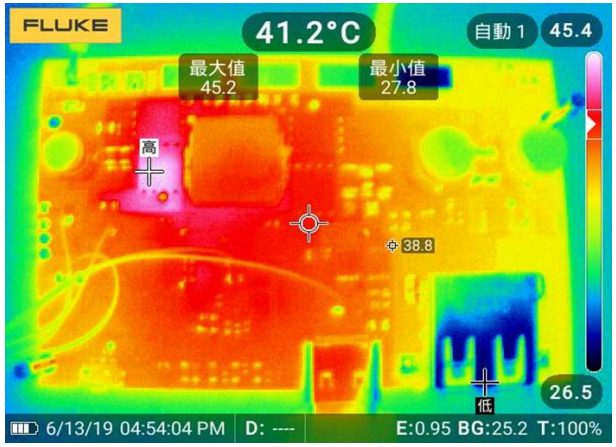
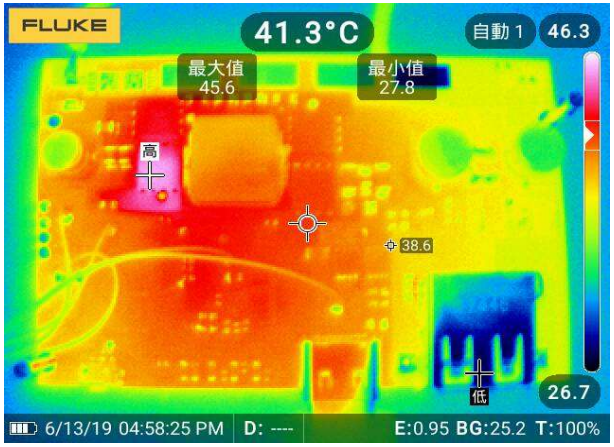
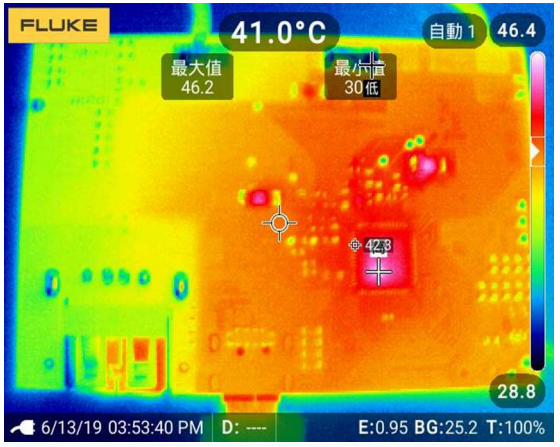
Thermal Images (5/6)

- Provider mode(QC).
- V_{BAT}= **9.5**V, Ambient temperature=25℃.
- Measured at temperature steady state by using Thermal Imager Fluke Ti450.

	V_{BUSC}/I_{BUSC}=5V/3A	V_{BUSC}/I_{BUSC}=9V/3A	V_{BUSC}/I_{BUSC}=12V/3A
Top			
Bottom			

Thermal Images (6/6)

- Provider mode(QC).
- V_{BAT}= **12.95**V, Ambient temperature=25℃ .
- Measured at temperature steady state by using Thermal Imager Fluke Ti450.

	V_{BUSC}/I_{BUSC}=5V/3A	V_{BUSC}/I_{BUSC}=9V/3A	V_{BUSC}/I_{BUSC}=12V/3A
Top			
Bottom			

BOM of Demoboard (1/4)

Item	Designator	Value	Description	Quantity	Manufacturer	Manufacturer Part No.
1	C101	1uF	0805, 50V, MLCC, X5R	1		
2	C102, C104, C106, C125, C126, C127, C131, C301, C304	1uF	0603, 50V, MLCC, X5R	9	Murata Electronics	GRT188R61H105KE13D
3	C103	22nF	0603, 50V, MLCC, X5R	1		
4	C105, C107	100nF	0603, 50V, MLCC, X5R	2		
5	C108, C109, C110	22uF	0805, 16V, MLCC, X5R	3	Murata Electronics	GRT21BR61C226ME13L
6	C112	47uF	5.3mmx5.3mmx4.4mm	1	Panasonic	16SVPG47M
7	C113, C114	10uF	1206 50V, MLCC, X5R	2	TDK	C3216X5R1H106K160AB
8	C115	NC	1206 50V, MLCC, X5R	0	TDK	C3216X5R1H106K160AB
9	C116	10uF	6.6mmx6.6mmx5.9mm	1	Panasonic	25SVPF56M
10	C117	0.1uF	1206 50V, MLCC, X5R	1	TDK	C3216X5R1H106K160AB
11	C118	56uF	6.6mmx6.6mmx5.9mm	1	Panasonic	25SVPF56M
12	C119	10nF	0402, 50V, MLCC, X5R	1		
13	C120, C121, C122	470pF	0402, 50V, MLCC	3		
14	C123	3.3nF	0402, 50V, MLCC, X5R	1		
15	C124	22pF	0402,, 50V, MLCC, X5R	1		
16	C128, C302	100nF	0402, 50V, MLCC, X5R	2		
17	C134, C135	1nF/50V/S08		2	Murata Electronics	GRT21BR61C226ME13L
18	C201, C202	0.1uF_S06	0603, 16V	2		
19	C203, C204, C205	0.1uF/16V	0603, 16V	3		
20	C206	2.2uF/16V	0603, 16V	1		

BOM of Demoboard (2/4)

Item	Designator	Value	Description	Quantity	Manufacturer	Manufacturer Part No.
21	C303	22nF	0402, 50V, MLCC, X5R	1		
22	CON1	USB-C	121U-2CST-01BR	1	JEM	121U-2CST-01BR
23	CON2	USB-A	USB-A 2.0 Receptacle	1	Molex	48258-0002
24	D101, D102, D103, D104, D105, D106	1N4148X-TP	SOD-523	6	Micro Commercial Components	1N4148X-TP
25	F1	S1206-FA-10.0A/1206L	(NC)	1		
26	L101	4.7uH	10.2mmx10.8mm	1	Vishay	IHLP4040EDER4R7M5A
27	L102, L103	MGLB3216_1206L	10.2mmx10.8mm	2	Vishay	
28	LD1, LD2, LD3, LD4, LD5		White color, SOD-110S, White color, SOD-110S, White color, SOD-110S, White color, SOD-110S, Yellow color, SOD-110S	5	LIGHTOP	LNL-190UW
29	NTC1	10k		1		
30	NTC2	100k	0402, 100kΩ±1% at 25℃	1	TDK	NTCG104EF104FT1SX
31	Q101, Q102, Q103, Q104	AON6382		4	ALPHA & OMEGA	AON6382
32	Q105, Q106, Q301, Q302	SM3425NHQA	DFN3.3x3.3A-8_EP	4	Sinopower Semiconductor,Inc	SM3425NHQAC-TRG
33	Q201, Q202	SiSS67DN/PowerPAK	(NC)	2		
34	R101	2	0603	1		
35	R104, R115	1k	0402	2		
36	R105, R106, R107, R108, R302, R303	22	0603	6		
37	R109	20k	0402	1		
38	R110	2	0402	1		
39	R112, R113, R114	100	0402	3		
40	R116	18k	0402	1		

BOM of Demoboard (3/4)

Item	Designator	Value	Description	Quantity	Manufacturer	Manufacturer Part No.
41	R118, R119, R120, R123, R124, R127	10	0402	6		
42	R121, R126, R131, R132	0	0603	4		
43	R122, R125	4.7	0402	2		
44	R128	200	0805	1		
45	R130	10k	0402	1		
46	R134, R135	2R2_S08	0805	2		
47	R136, R137, R143, R144	100R_S06	0603	4		
48	R138	0_S06	0603	1		
49	R139, R140, R206	10k_S06	0603	3		
50	R141, R142	1M_S06	0603	2		
51	R201, R203, R204	5k1	0603	3		
52	R202	1M	0603	1		
53	R205	1k_S06	0603	1		
54	R207	10mR/S12_1/2W	1206 (0R)	1		
55	R208	21R_S06	0603	1		
56	R209, R210, R211	1k	0603	3		
57	R301	10	0603	1		
58	R304, R305	510	0402	2		
59	RCSI, RCSO	10m	1206, 1%	2	ROHM Semiconductor	PMR18EZPFU10L0
60	RSA	5m	1206, 1%	1	ROHM Semiconductor	PMR18EZPFU5L00

BOM of Demoboard (4/4)

Item	Designator	Value	Description	Quantity	Manufacturer	Manufacturer Part No.
61	SCK	SCK	Golden pin	1		
62	SDA	SDA	Golden pin	1		
63	SW1	SW-PB	3.8 mm×1.9 mm Side-operational SMD Light Touch Switche	1	Panasonic	EVPAKE31A
64	T1	PGND	Golden pin	1		
65	T2	GND_IC	Golden pin	1		
66	TS	TS	Golden pin	1		
67	U1	RT7885A	WQFN-7x7-60L	1		
68	U2	S-8254A	(NC)	1		
69	U3	24CW64X		1		
70	VBUS	VBUS	Golden pin	1		
71	ZD11, mZD12, ZD31, ZD32	5V6	SOD-523	4	Vishay	BZX584C5V6-V-G-08
72	ZD13, ZD14	22V	SOD-523	2	Diodes Incorporated	BZT52C22T-7

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thank you.