Texas Instruments

Test Report

June 2016

PMP40001 Test Results

1 General

1.1 Purpose

This test report is to provide the detailed data for evaluating and verifying the PMP40001 which employs one Buck-Boost Controller ---- LM5175 combined with a USB C PD DFP Controllers ---- TPS25740 which can negotiate with the external USB C PD devices for 3 sets of output voltage (5/12/20V). The maximal output power is designed as 60W and valid input voltage is from 6V to 13.5V which is compatible with the 2S and 3S lithium battery pack.

1.2 Reference Documentation

Schematic: PMP40001_Sch.pdf

Gerber: PMP40001_GerberNCdrills.zip

Layer Plot: PMP40001_PCBlayers.pdf

Assembly Drawing: PMP40001_Assy.pdf

CAD File: PMP40001_CAD.zip

BOM: PMP40001_BOM.pdf

1.3 Test Equipment

Multi-meter (current): Fluke 287C

Multi-meter (voltage): Fluke 287C

DC Source: Chroma 62006P-100-25

E-Load: Chroma 63105A module

Oscilloscope: Tektronix DPO3054

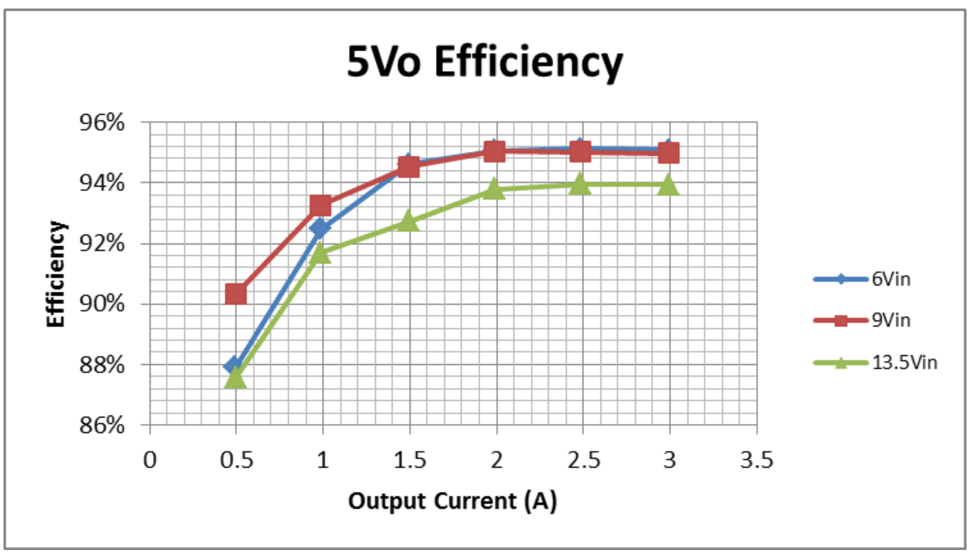
Electrical Thermography: Fluke Ti9

2 Performance Data and Waveform

2.1 Efficiency

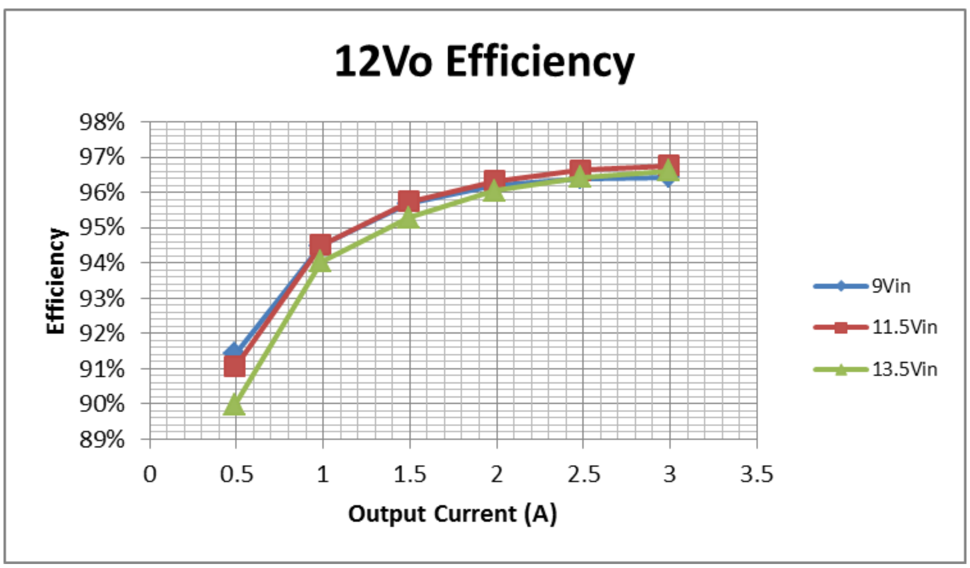
2.1.1 Output voltage: 5V

Vin(V)	Iin(A)	Vo(V)	Io(A)	Efficiency
6.002	0.130	5.170	0.087	57.78%
5.985	0.484	5.164	0.493	87.90%
5.964	0.922	5.156	0.986	92.49%
5.940	1.370	5.146	1.496	94.62%
5.921	1.817	5.136	1.991	95.07%
5.907	2.268	5.128	2.485	95.12%
5.889	2.736	5.116	2.994	95.08%
9.002	0.079	5.174	0.088	64.09%
8.998	0.314	5.165	0.494	90.33%
8.993	0.607	5.155	0.987	93.27%
8.987	0.906	5.144	1.496	94.53%
8.981	1.198	5.135	1.991	95.04%
8.976	1.493	5.124	2.485	95.02%
8.970	1.798	5.114	2.995	94.97%
13.501	0.060	5.175	0.088	56.28%
13.498	0.216	5.168	0.494	87.57%
13.494	0.411	5.156	0.986	91.70%
13.491	0.615	5.145	1.495	92.72%
13.487	0.808	5.135	1.990	93.78%
13.484	1.005	5.124	2.485	93.97%
13.479	1.209	5.113	2.994	93.94%



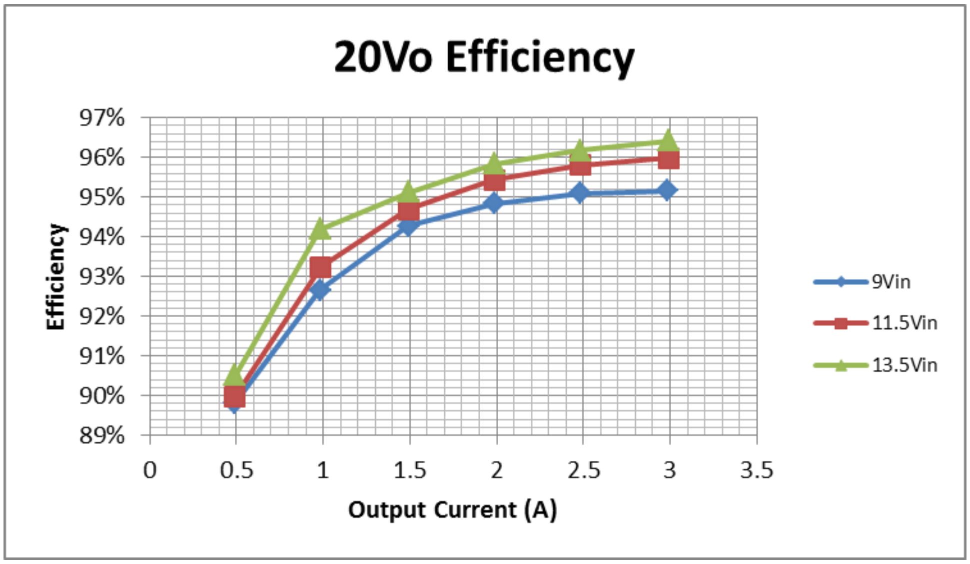
2.1.2 Output voltage: 12V

Vin(V)	Iin(A)	Vo(V)	Io(A)	Efficiency
8.998	0.175	12.089	0.087	66.95%
8.986	0.725	12.079	0.493	91.42%
8.971	1.404	12.068	0.986	94.50%
8.956	2.105	12.056	1.496	95.69%
8.941	2.788	12.045	1.991	96.22%
8.926	3.476	12.034	2.485	96.39%
8.910	4.189	12.021	2.994	96.44%
11.497	0.139	12.080	0.087	65.91%
11.487	0.569	12.070	0.493	91.06%
11.476	1.097	12.059	0.986	94.52%
11.464	1.641	12.046	1.495	95.75%
11.453	2.171	12.035	1.990	96.34%
11.441	2.703	12.025	2.485	96.64%
11.429	3.253	12.015	2.994	96.77%
13.497	0.127	12.071	0.087	61.41%
13.489	0.490	12.063	0.493	89.99%
13.479	0.938	12.054	0.986	94.03%
13.469	1.403	12.043	1.495	95.29%
13.460	1.852	12.030	1.990	96.05%
13.449	2.304	12.020	2.485	96.43%
13.439	2.769	12.008	2.994	96.63%



2.1.3 Output voltage: 20V

Vin(V)	Iin(A)	Vo(V)	Io(A)	Efficiency
9.097	0.312	20.123	0.086	61.19%
9.080	1.214	20.114	0.492	89.81%
9.059	2.357	20.096	0.984	92.65%
9.034	3.520	20.084	1.493	94.26%
9.013	4.662	20.068	1.986	94.83%
8.991	5.816	20.054	2.480	95.10%
8.968	7.016	20.039	2.988	95.16%
11.497	0.244	20.144	0.086	61.97%
11.484	0.956	20.105	0.491	89.97%
11.467	1.851	20.086	0.985	93.24%
11.450	2.765	20.074	1.493	94.69%
11.433	3.652	20.059	1.987	95.44%
11.416	4.547	20.046	2.481	95.80%
11.399	5.474	20.031	2.990	95.98%
13.498	0.203	20.109	0.086	63.33%
13.487	0.809	20.100	0.491	90.51%
13.472	1.558	20.083	0.984	94.19%
13.457	2.343	20.069	1.494	95.12%
13.443	3.094	20.056	1.988	95.84%
13.428	3.850	20.043	2.481	96.17%
13.413	4.630	20.028	2.990	96.42%

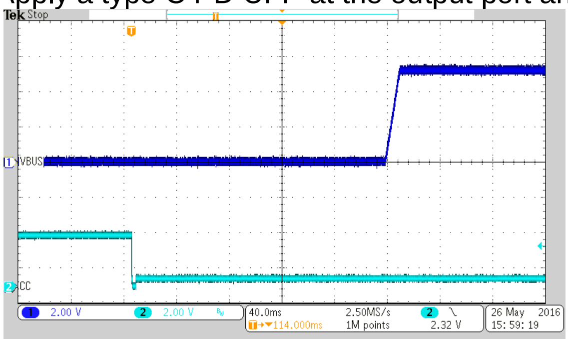


2.2 Standby Current

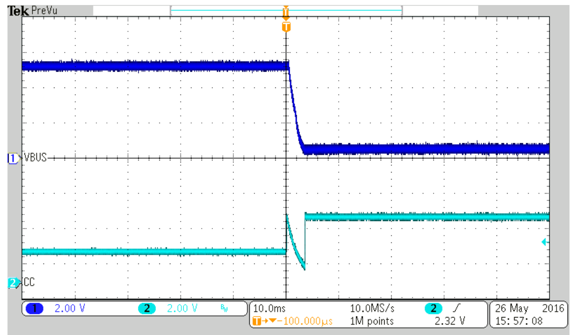
PARAMETER		TEST CONDITION	MIN	TYP	MAX	UNIT
I_{STD}	Standby current	Vin=6V, output port unattached		26.7		uA
	Standby current	Vin=9V, output port unattached		37.6		uA
	Standby current	Vin=13.5V, output port unattached		53.7		uA

2.2 Port Attach and Detach

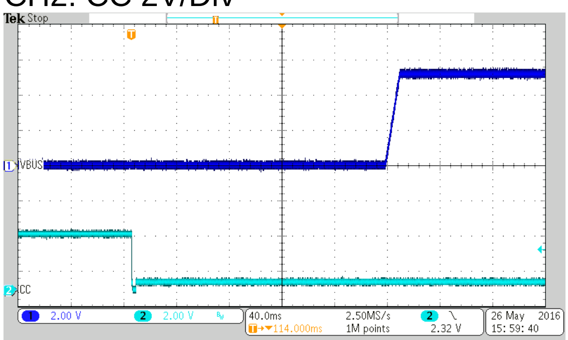
Apply a type C PD UFP at the output port and remove it after 10s.



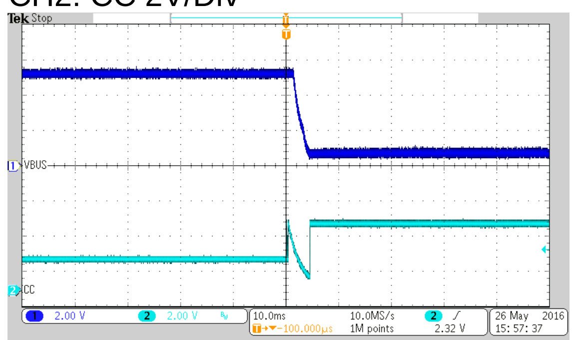
Vin=6V and Attach the 5V UFP
CH1: VBUS 2V/Div
CH2: CC 2V/Div



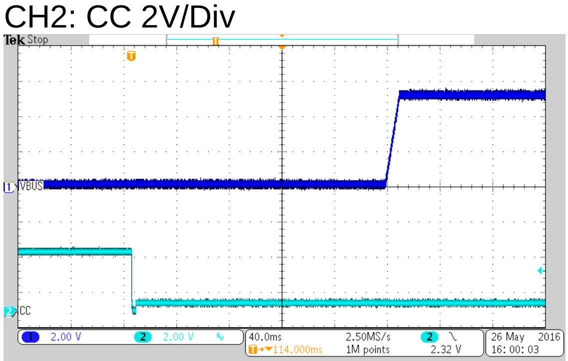
Vin=6V and Detach the 5V UFP
CH1: VBUS 2V/Div
CH2: CC 2V/Div

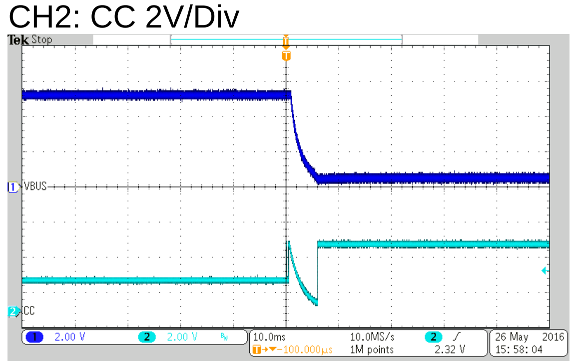


Vin=9V and Attach the 5V UFP
CH1: VBUS 2V/Div
CH2: CC 2V/Div

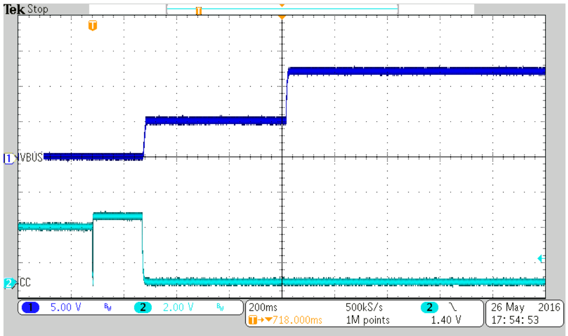


Vin=9V and Detach the 5V UFP
CH1: VBUS 2V/Div
CH2: CC 2V/Div

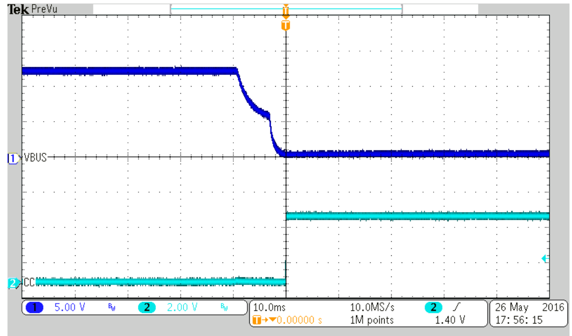




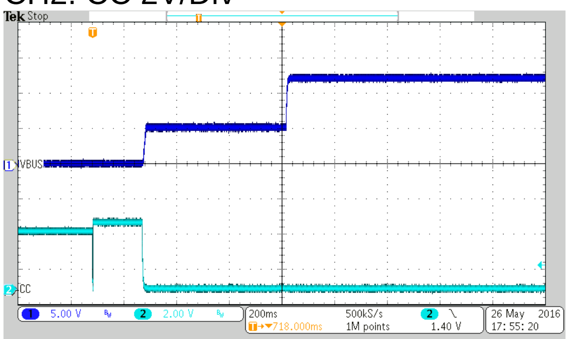
Vin=13.5V and Attach the 5V UFP
CH1: VBUS 2V/Div
CH2: CC 2V/Div



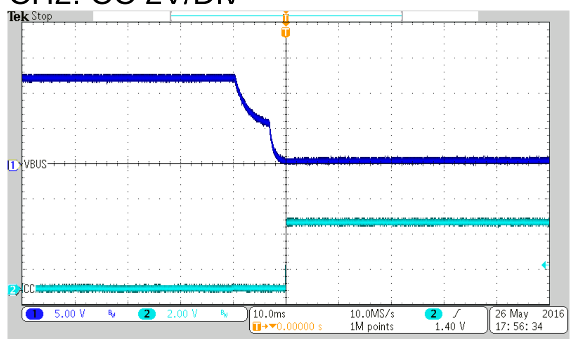
Vin=13.5V and Detach the 5V UFP
CH1: VBUS 2V/Div
CH2: CC 2V/Div



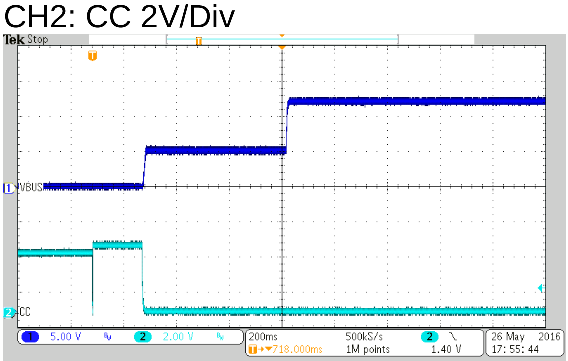
Vin=9V and Attach the 12V UFP
CH1: VBUS 5V/Div
CH2: CC 2V/Div



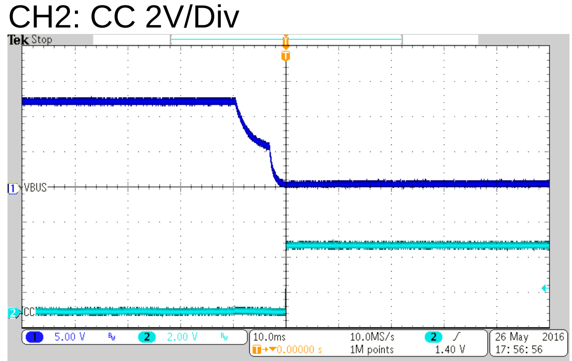
Vin=9V and Detach the 12V UFP
CH1: VBUS 5V/Div
CH2: CC 2V/Div



Vin=11.5V and Attach the 12V UFP
CH1: VBUS 5V/Div
CH2: CC 2V/Div

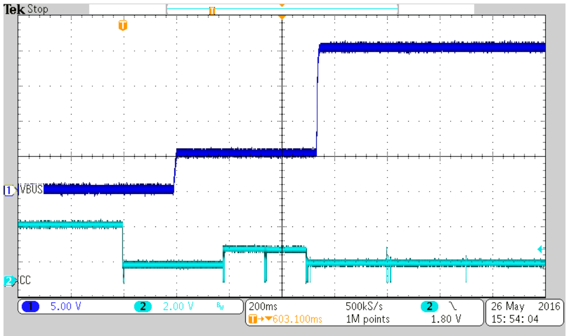


Vin=11.5V and Detach the 12V UFP
CH1: VBUS 5V/Div
CH2: CC 2V/Div

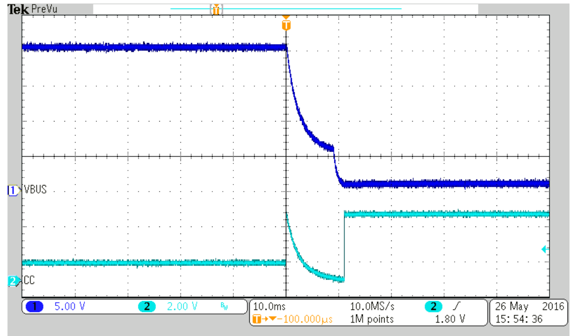


Vin=13.5V and Attach the 12V UFP
CH1: VBUS 5V/Div
CH2: CC 2V/Div

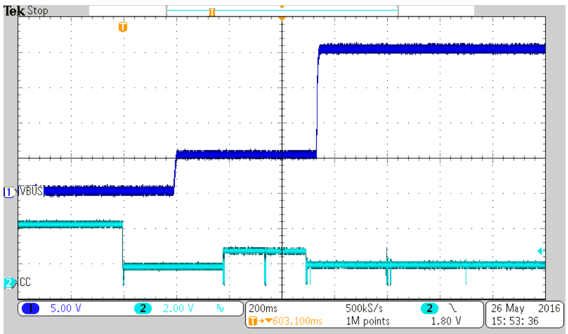
Vin=13.5V and Detach the 12V UFP
CH1: VBUS 5V/Div
CH2: CC 2V/Div



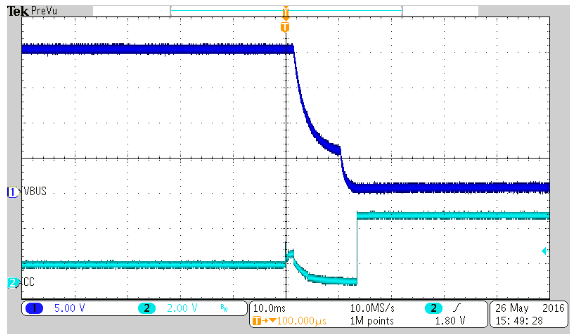
Vin=9V and Attach the 20V UFP
CH1: VBUS 5V/Div
CH2: CC 2V/Div



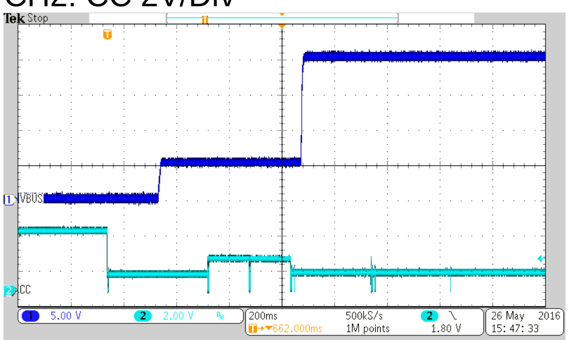
Vin=9V and Detach the 20V UFP
CH1: VBUS 5V/Div
CH2: CC 2V/Div



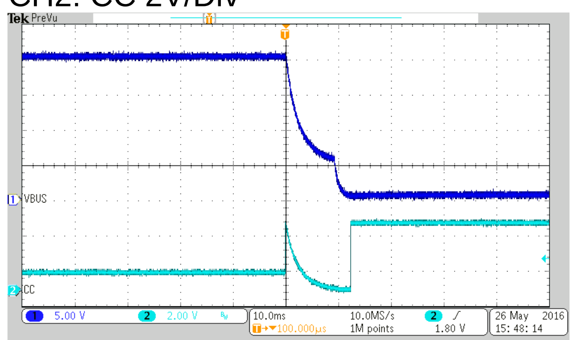
Vin=11.5V and Attach the 20V UFP
CH1: VBUS 5V/Div
CH2: CC 2V/Div



Vin=11.5V and Detach the 20V UFP
CH1: VBUS 5V/Div
CH2: CC 2V/Div



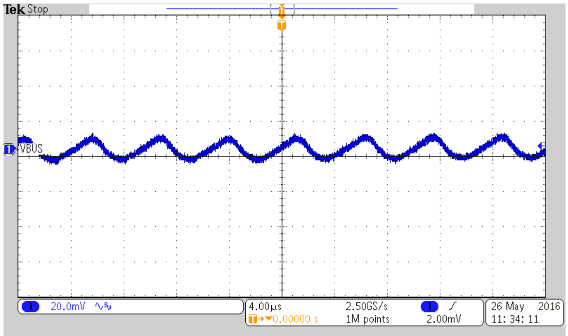
Vin=13.5V and Attach the 12V UFP
CH1: VBUS 5V/Div
CH2: CC 2V/Div



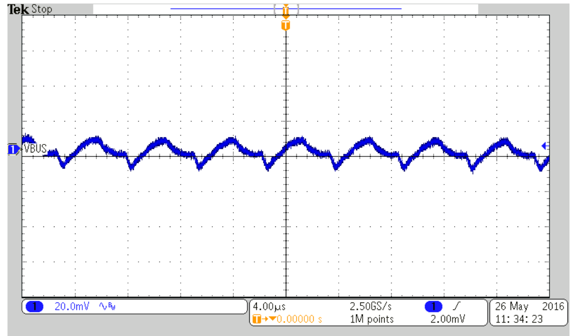
Vin=13.5V and Detach the 12V UFP
CH1: VBUS 5V/Div
CH2: CC 2V/Div

2.3 Output Voltage Ripple

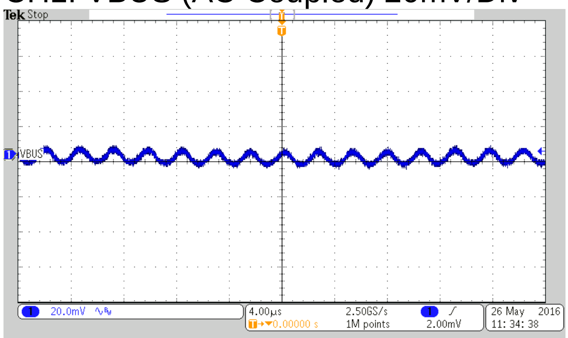
2.3.1 Output Voltage: 5V



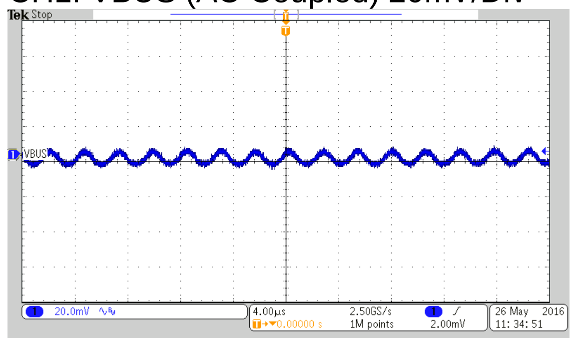
Vin=6V and No Load
CH1: VBUS (AC Coupled) 20mV/Div



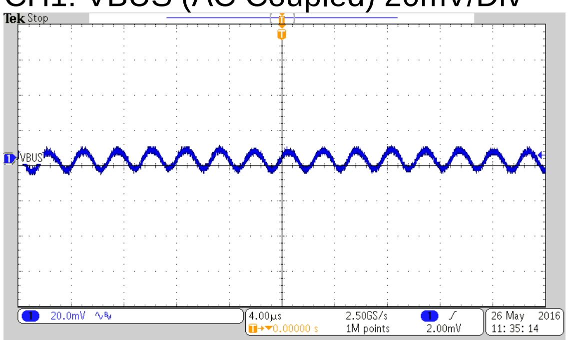
Vin=6V and Full Load
CH1: VBUS (AC Coupled) 20mV/Div



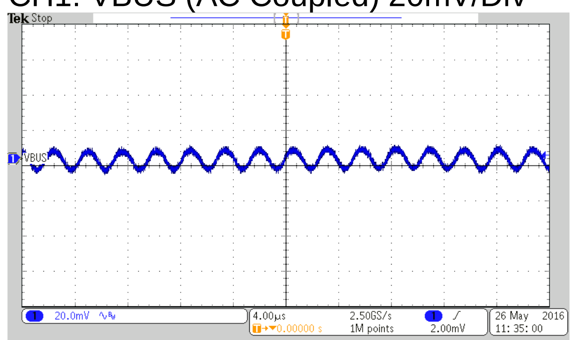
Vin=9V and No Load
CH1: VBUS (AC Coupled) 20mV/Div



Vin=9V and Full Load
CH1: VBUS (AC Coupled) 20mV/Div

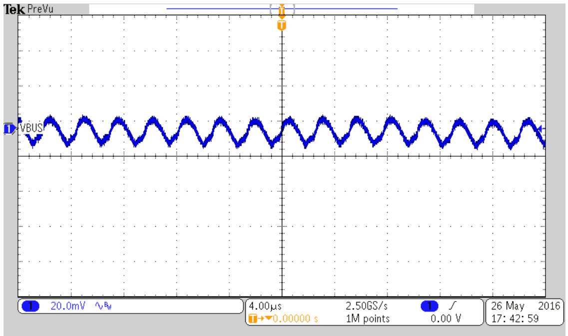


Vin=13.5V and No Load
CH1: VBUS (AC Coupled) 20mV/Div

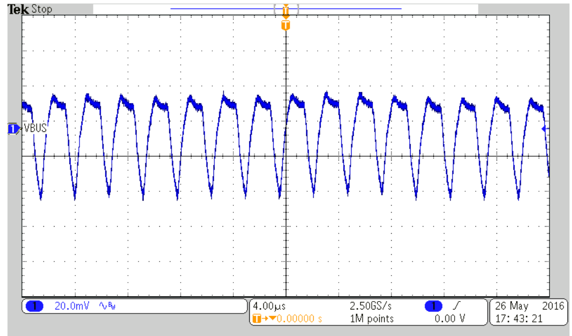


Vin=13.5V and Full Load
CH1: VBUS (AC Coupled) 20mV/Div

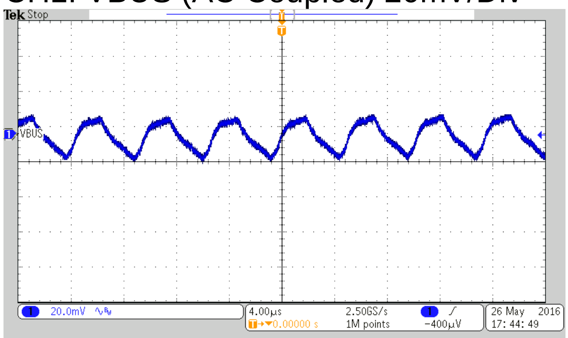
2.3.2 Output Voltage: 12V



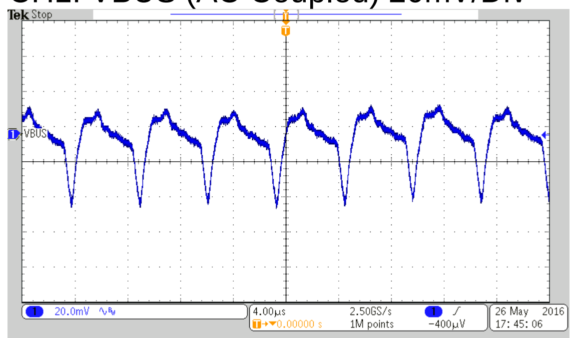
Vin=9V and No Load
CH1: VBUS (AC Coupled) 20mV/Div



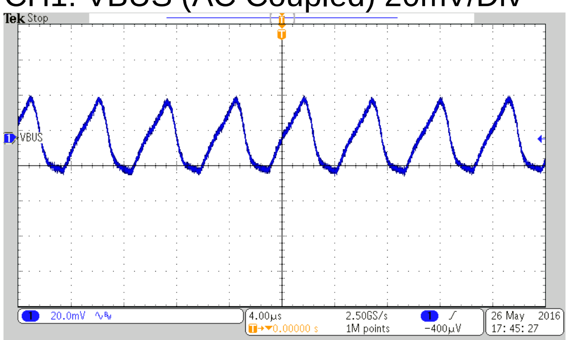
Vin=9V and Full Load
CH1: VBUS (AC Coupled) 20mV/Div



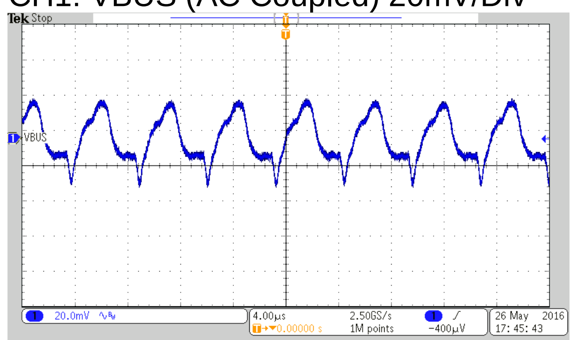
Vin=11.5V and No Load
CH1: VBUS (AC Coupled) 20mV/Div



Vin=11.5V and Full Load
CH1: VBUS (AC Coupled) 20mV/Div

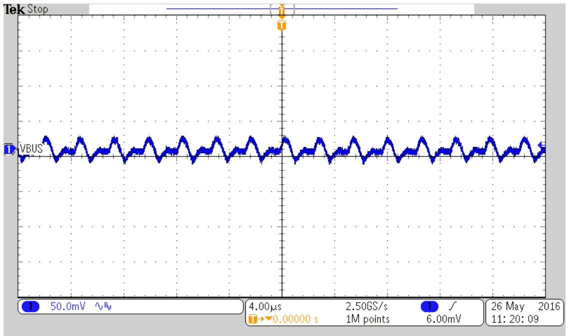


Vin=13.5V and No Load
CH1: VBUS (AC Coupled) 20mV/Div

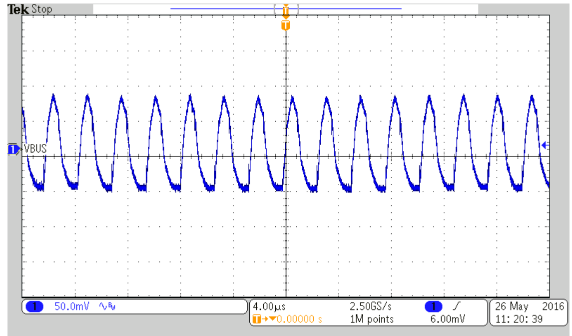


Vin=13.5V and Full Load
CH1: VBUS (AC Coupled) 20mV/Div

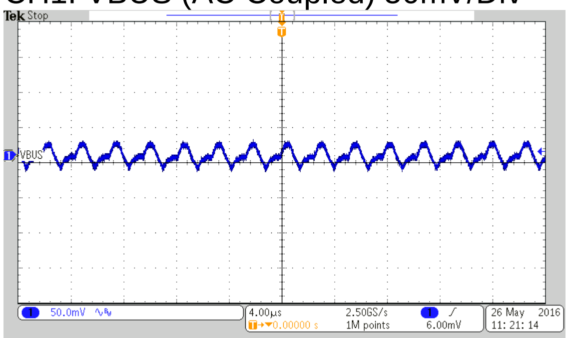
2.3.3 Output Voltage: 20V



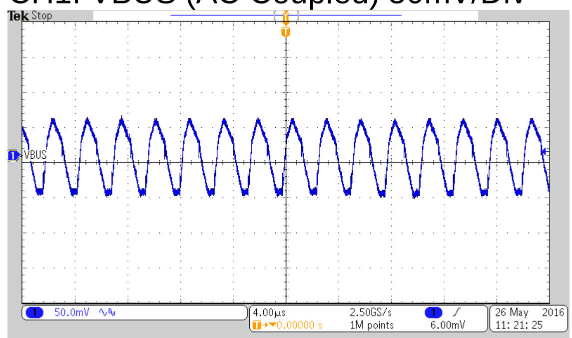
Vin=9V and No Load
CH1: VBUS (AC Coupled) 50mV/Div



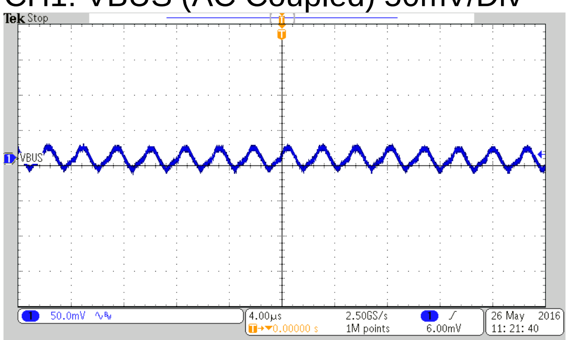
Vin=9V and Full Load
CH1: VBUS (AC Coupled) 50mV/Div



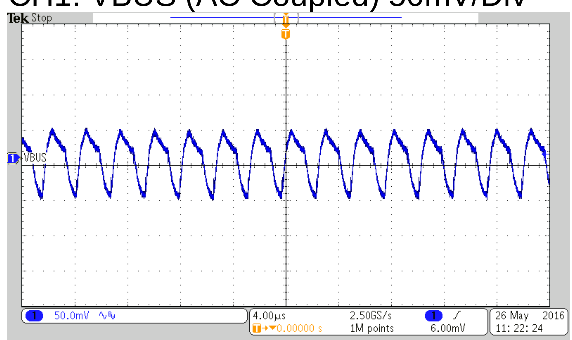
Vin=11.5V and No Load
CH1: VBUS (AC Coupled) 50mV/Div



Vin=11.5V and Full Load
CH1: VBUS (AC Coupled) 50mV/Div



Vin=13.5V and No Load
CH1: VBUS (AC Coupled) 50mV/Div

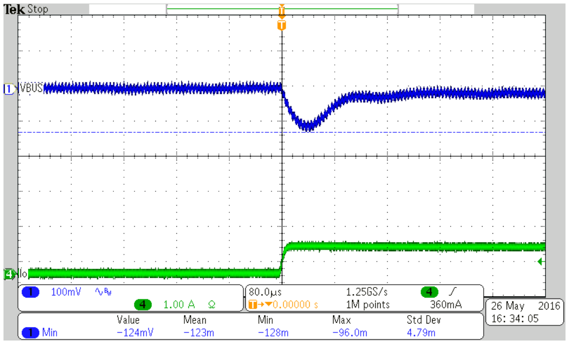


Vin=13.5V and Full Load
CH1: VBUS (AC Coupled) 50mV/Div

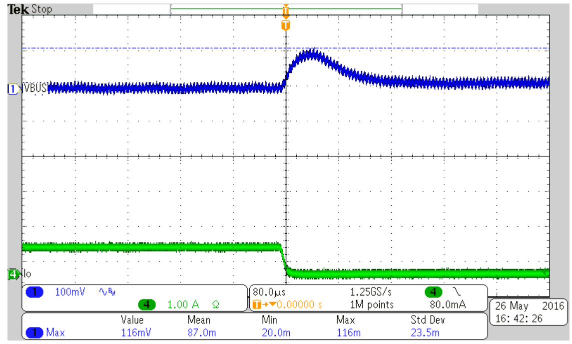
2.4 Dynamic Performance

2.3.1 Output Voltage: 5V

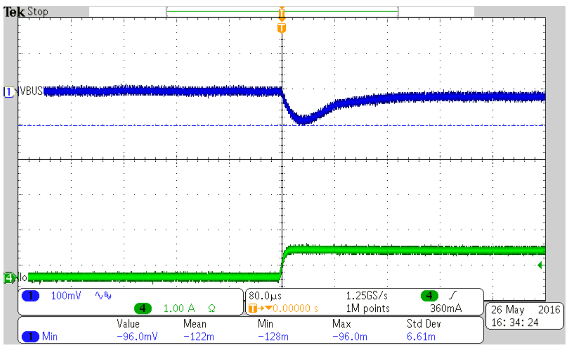
0↔25% Load Step @150mA/us



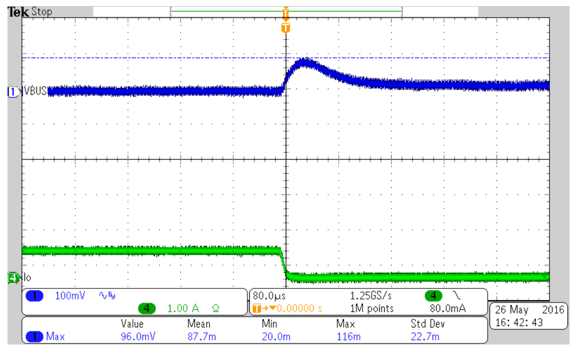
Vin=6V and Load switching from 0 to 25% Load
CH1: VBUS (AC Coupled) 100mV/Div
CH4: Io 1A/Div



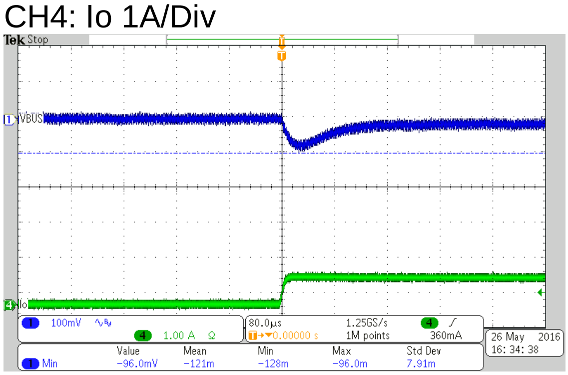
Vin=6V and Load switching from 25% to 0 Load
CH1: VBUS (AC Coupled) 100mV/Div
CH4: Io 1A/Div



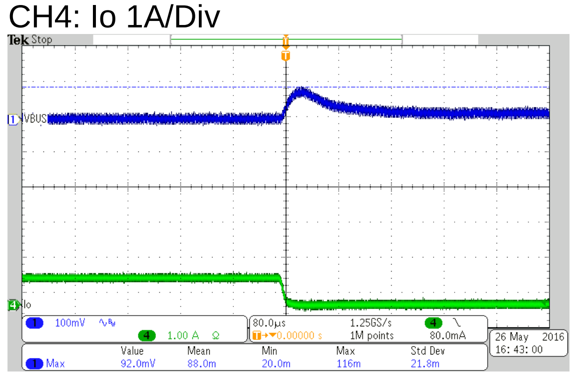
Vin=9V and Load switching from 0 to 25% Load
CH1: VBUS (AC Coupled) 100mV/Div
CH4: Io 1A/Div



Vin=9V and Load switching from 25% to 0 Load
CH1: VBUS (AC Coupled) 100mV/Div
CH4: Io 1A/Div

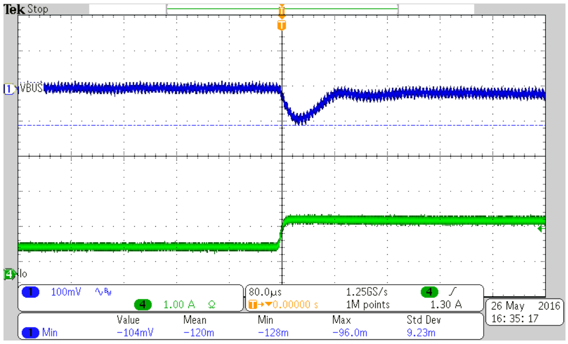


Vin=13.5V and Load switching from 0 to 25% Load
CH1: VBUS (AC Coupled) 100mV/Div
CH4: Io 1A/Div

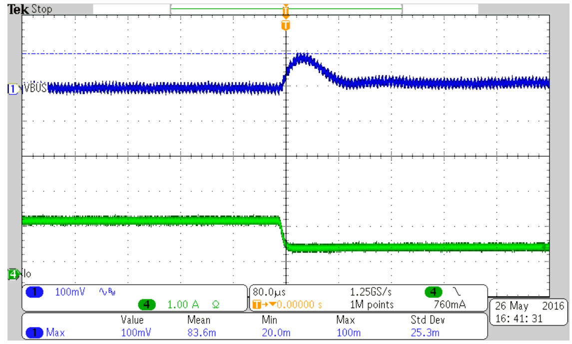


Vin=13.5V and Load switching from 25% to 0 Load
CH1: VBUS (AC Coupled) 100mV/Div
CH4: Io 1A/Div

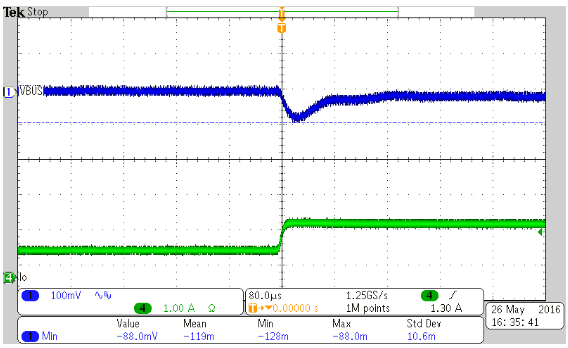
25%↔50% Load Step @150mA/us



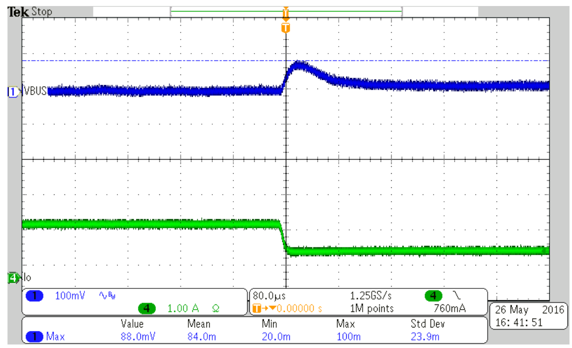
Vin=6V and Load switching from 25% to 50% Load
CH1: VBUS (AC Coupled) 100mV/Div
CH4: Io 1A/Div



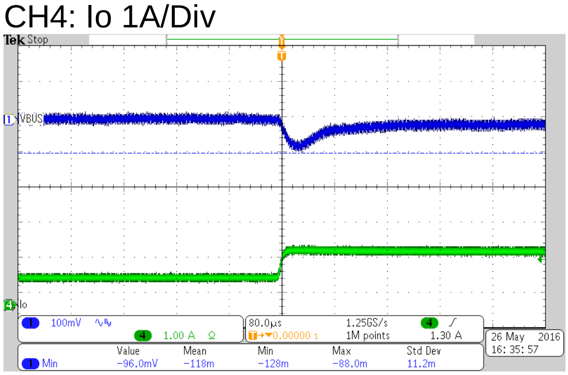
Vin=6V and Load switching from 50% to 25% Load
CH1: VBUS (AC Coupled) 100mV/Div
CH4: Io 1A/Div



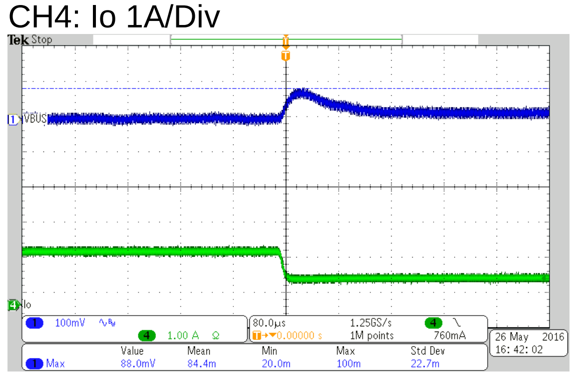
Vin=9V and Load switching from 25% to 50% Load
CH1: VBUS (AC Coupled) 100mV/Div
CH4: Io 1A/Div



Vin=9V and Load switching from 50% to 25% Load
CH1: VBUS (AC Coupled) 100mV/Div
CH4: Io 1A/Div

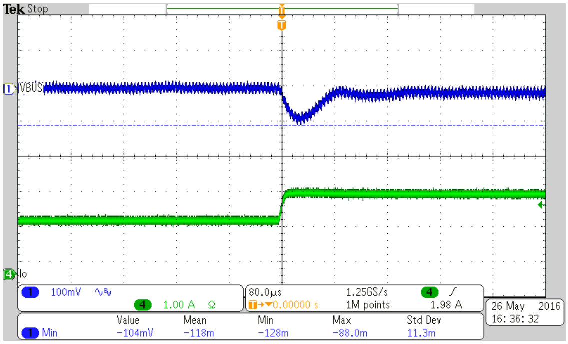


Vin=13.5V and Load switching from 25% to 50% Load
CH1: VBUS (AC Coupled) 100mV/Div
CH4: Io 1A/Div

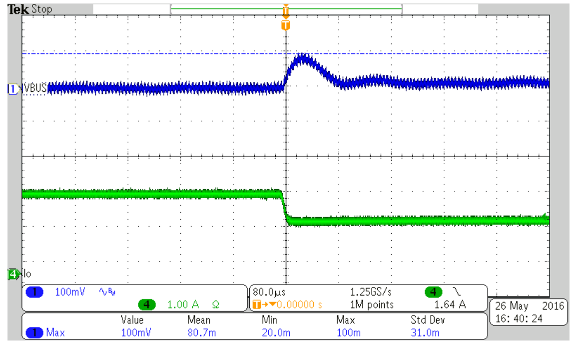


Vin=13.5V and Load switching from 50% to 25% Load
CH1: VBUS (AC Coupled) 100mV/Div
CH4: Io 1A/Div

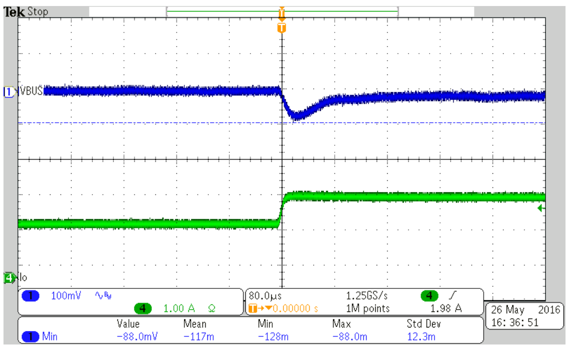
50%↔75% Load Step @150mA/us



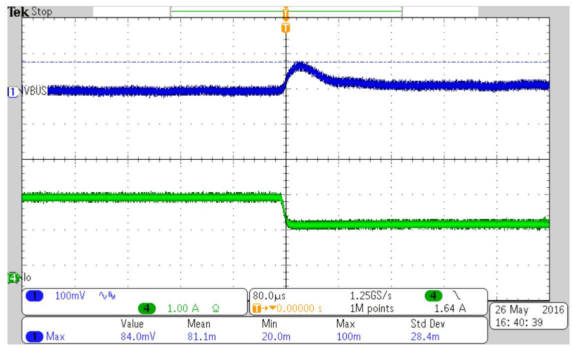
Vin=6V and Load switching from 50% to 75% Load
CH1: VBUS (AC Coupled) 100mV/Div
CH4: Io 1A/Div



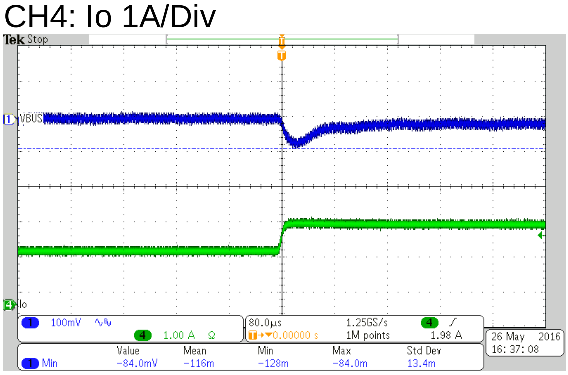
Vin=6V and Load switching from 75% to 50% Load
CH1: VBUS (AC Coupled) 100mV/Div
CH4: Io 1A/Div



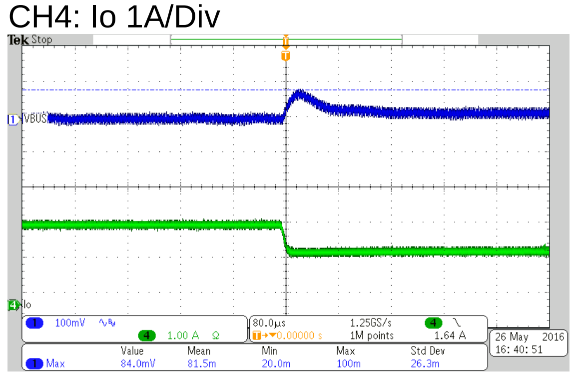
Vin=9V and Load switching from 50% to 75% Load
CH1: VBUS (AC Coupled) 100mV/Div
CH4: Io 1A/Div



Vin=9V and Load switching from 75% to 50% Load
CH1: VBUS (AC Coupled) 100mV/Div
CH4: Io 1A/Div



Vin=13.5V and Load switching from 50% to 75% Load
CH1: VBUS (AC Coupled) 100mV/Div
CH4: Io 1A/Div



Vin=13.5V and Load switching from 75% to 50% Load
CH1: VBUS (AC Coupled) 100mV/Div
CH4: Io 1A/Div

75%↔100% Load Step @150mA/us

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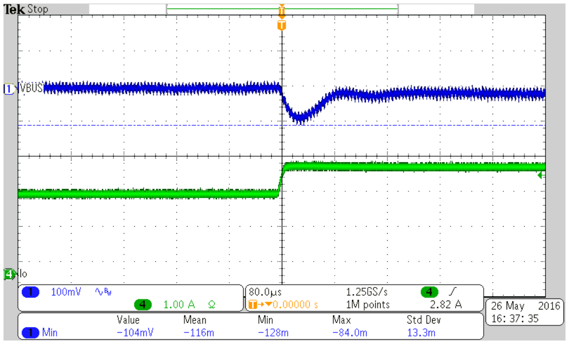
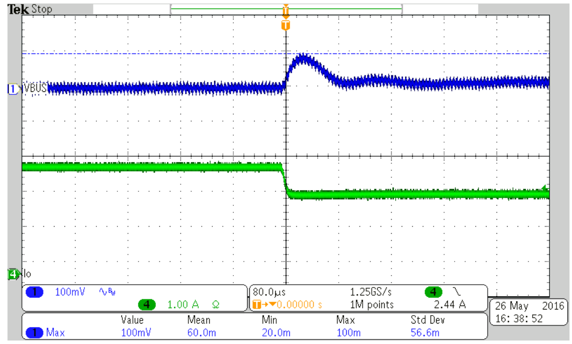
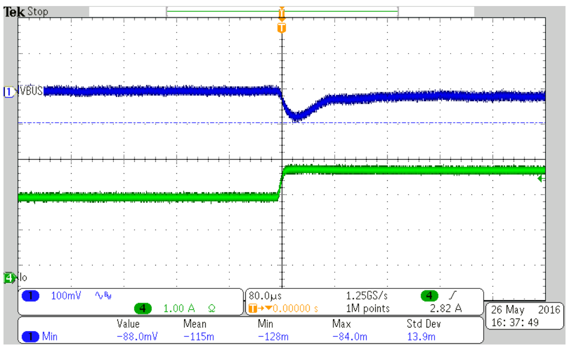


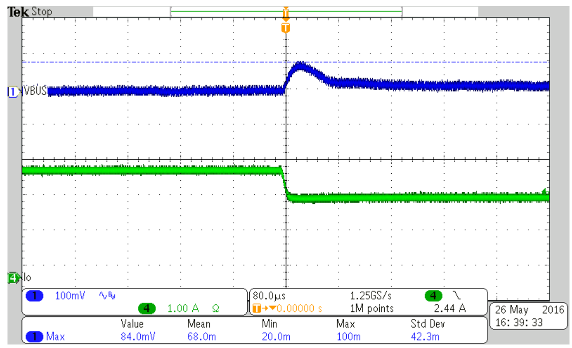
Vin=6V and Load switching from 75% to 100% Load
CH1: VBUS (AC Coupled) 100mV/Div
CH4: Io 1A/Div



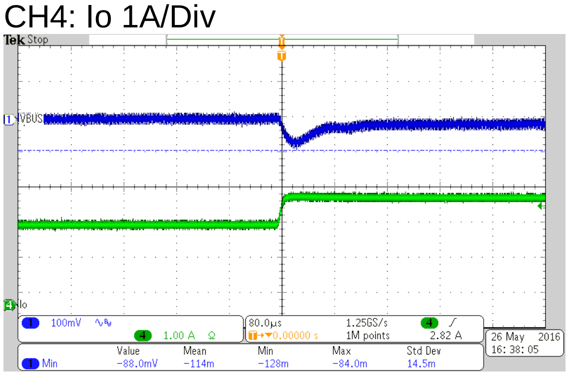
Vin=6V and Load switching from 100% to 75% Load
CH1: VBUS (AC Coupled) 100mV/Div
CH4: Io 1A/Div



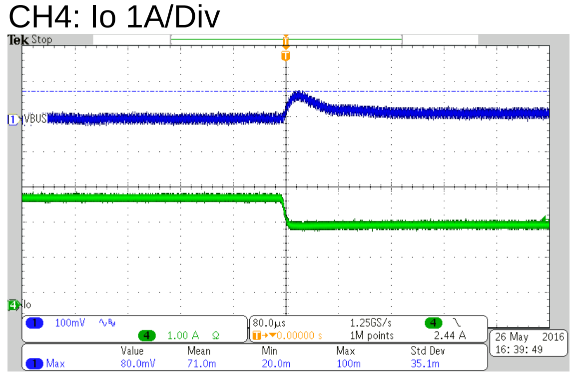
Vin=9V and Load switching from 75% to 100% Load
CH1: VBUS (AC Coupled) 100mV/Div
CH4: Io 1A/Div



Vin=9V and Load switching from 100% to 75% Load
CH1: VBUS (AC Coupled) 100mV/Div
CH4: Io 1A/Div



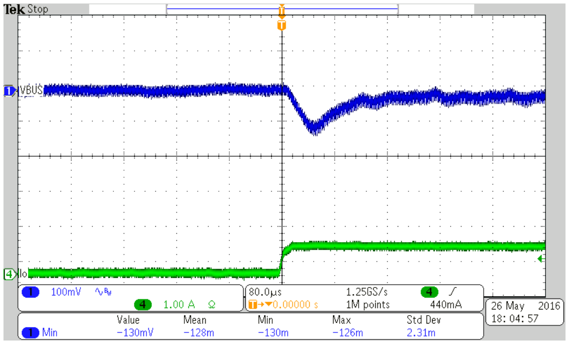
Vin=13.5V and Load switching from 75% to 100% Load
CH1: VBUS (AC Coupled) 100mV/Div
CH4: Io 1A/Div



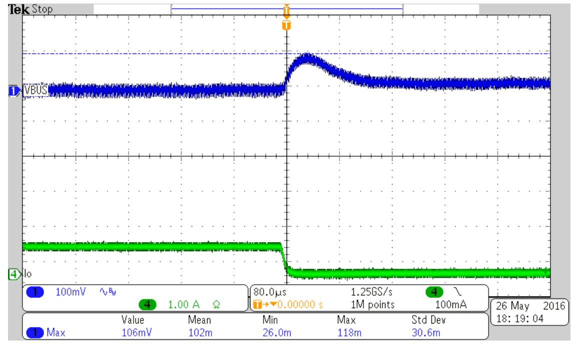
Vin=13.5V and Load switching from 100% to 75% Load
CH1: VBUS (AC Coupled) 100mV/Div
CH4: Io 1A/Div

2.3.2 Output Voltage: 12V

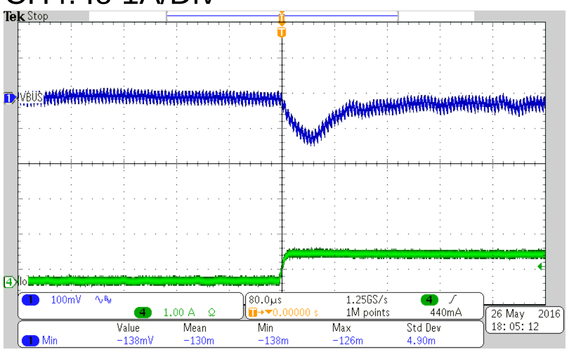
0↔25% Load Step @150mA/us



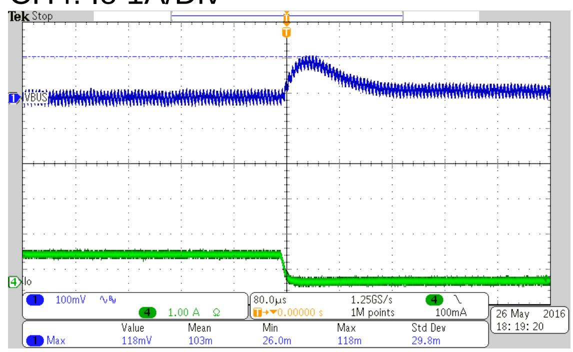
Vin=9V and Load switching from 0 to 25% Load
CH1: VBUS (AC Coupled) 100mV/Div
CH4: Io 1A/Div



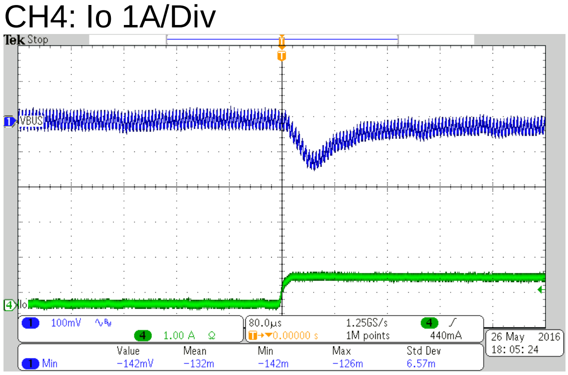
Vin=9V and Load switching from 25% to 0 Load
CH1: VBUS (AC Coupled) 100mV/Div
CH4: Io 1A/Div



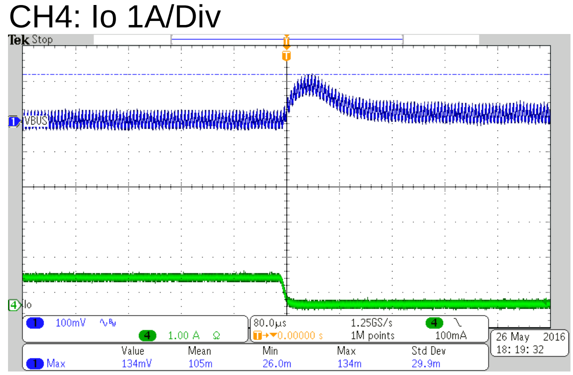
Vin=11.5V and Load switching from 0 to 25% Load
CH1: VBUS (AC Coupled) 100mV/Div
CH4: Io 1A/Div



Vin=11.5V and Load switching from 25% to 0 Load
CH1: VBUS (AC Coupled) 100mV/Div
CH4: Io 1A/Div

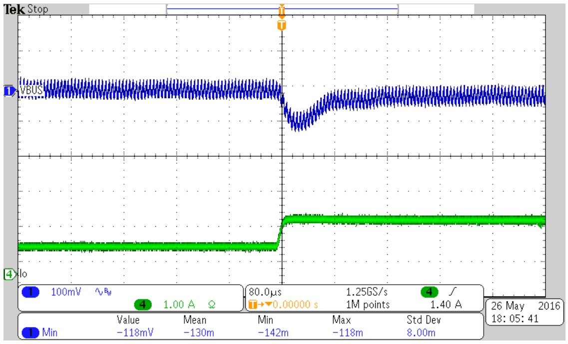


Vin=13.5V and Load switching from 0 to 25% Load
CH1: VBUS (AC Coupled) 100mV/Div
CH4: Io 1A/Div

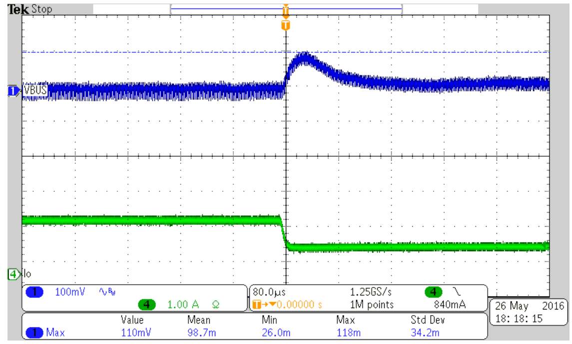


Vin=13.5V and Load switching from 25% to 0 Load
CH1: VBUS (AC Coupled) 100mV/Div
CH4: Io 1A/Div

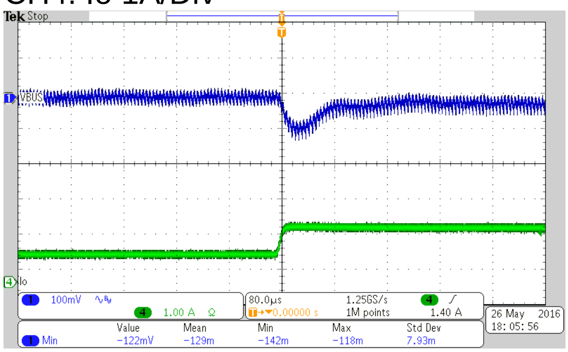
25%↔50% Load Step @150mA/us



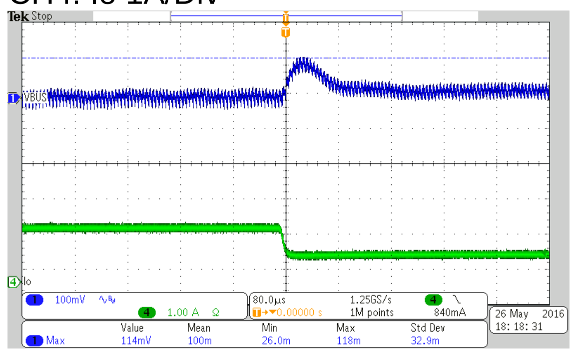
Vin=9V and Load switching from 25% to 50% Load
CH1: VBUS (AC Coupled) 100mV/Div
CH4: Io 1A/Div



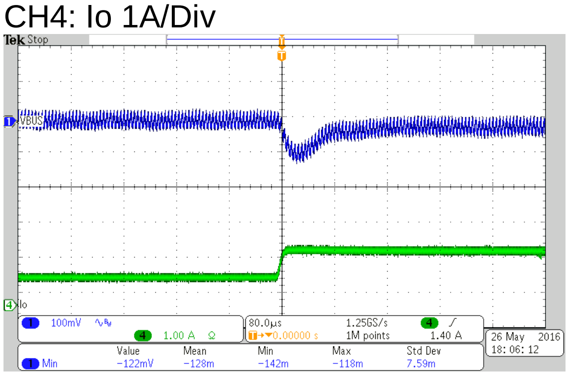
Vin=9V and Load switching from 50% to 25% Load
CH1: VBUS (AC Coupled) 100mV/Div
CH4: Io 1A/Div



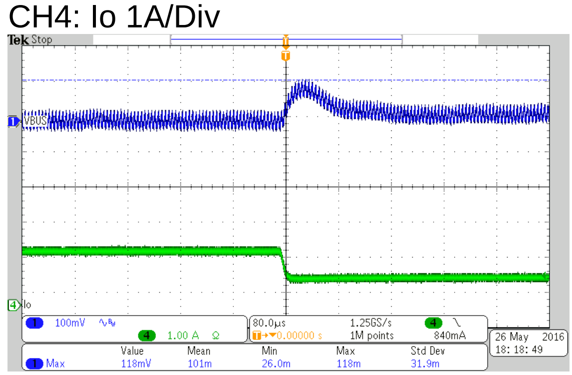
Vin=11.5V and Load switching from 25% to 50% Load
CH1: VBUS (AC Coupled) 100mV/Div
CH4: Io 1A/Div



Vin=11.5V and Load switching from 50% to 25% Load
CH1: VBUS (AC Coupled) 100mV/Div
CH4: Io 1A/Div

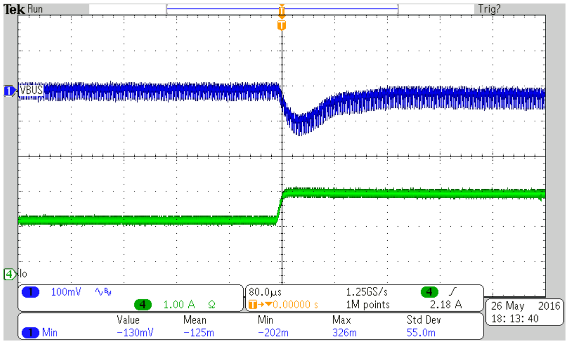


Vin=13.5V and Load switching from 25% to 50% Load
CH1: VBUS (AC Coupled) 100mV/Div
CH4: Io 1A/Div

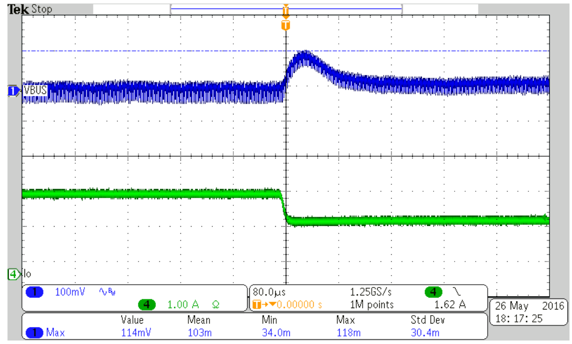


Vin=13.5V and Load switching from 50% to 25% Load
CH1: VBUS (AC Coupled) 100mV/Div
CH4: Io 1A/Div

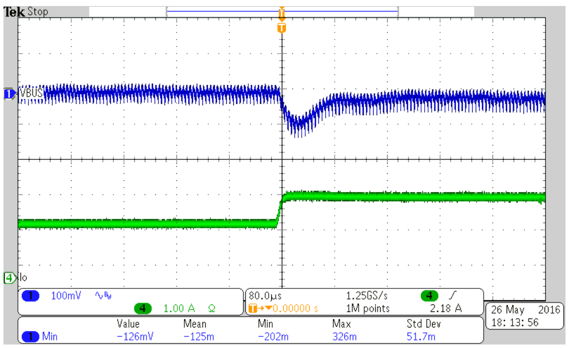
50%↔75% Load Step @150mA/us



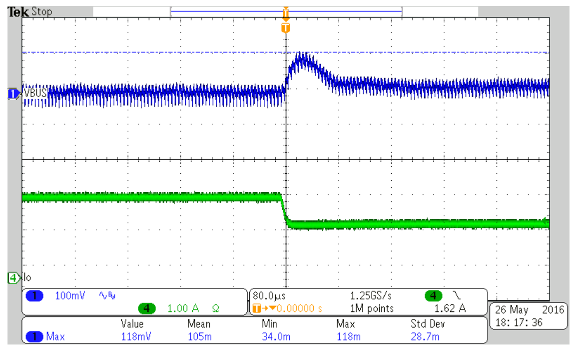
Vin=9V and Load switching from 50% to 75% Load
CH1: VBUS (AC Coupled) 100mV/Div
CH4: Io 1A/Div



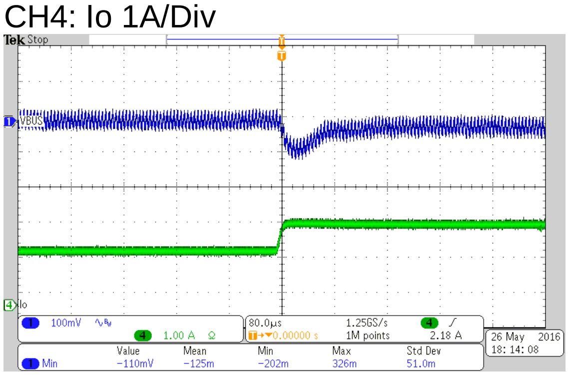
Vin=9V and Load switching from 75% to 50% Load
CH1: VBUS (AC Coupled) 100mV/Div
CH4: Io 1A/Div



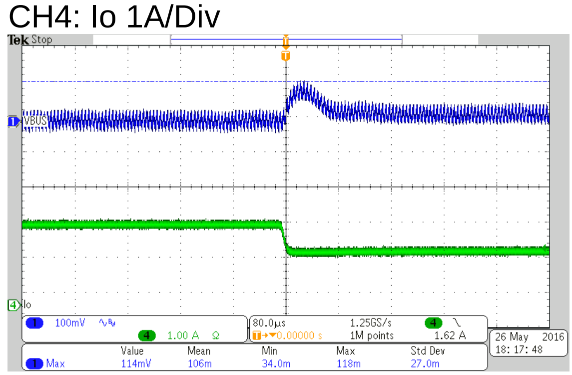
Vin=11.5V and Load switching from 50% to 75% Load
CH1: VBUS (AC Coupled) 100mV/Div
CH4: Io 1A/Div



Vin=11.5V and Load switching from 75% to 50% Load
CH1: VBUS (AC Coupled) 100mV/Div
CH4: Io 1A/Div

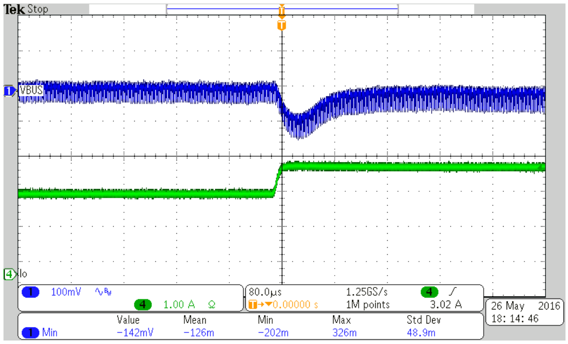


Vin=13.5V and Load switching from 50% to 75% Load
CH1: VBUS (AC Coupled) 100mV/Div
CH4: Io 1A/Div

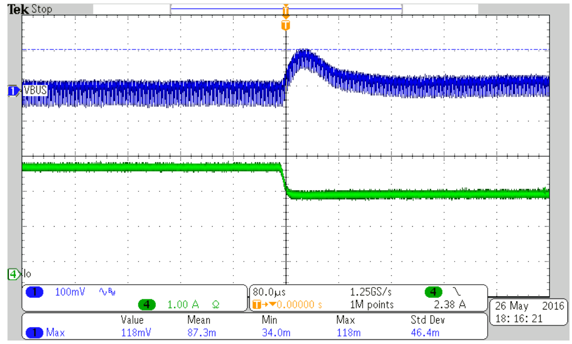


Vin=13.5V and Load switching from 75% to 50% Load
CH1: VBUS (AC Coupled) 100mV/Div
CH4: Io 1A/Div

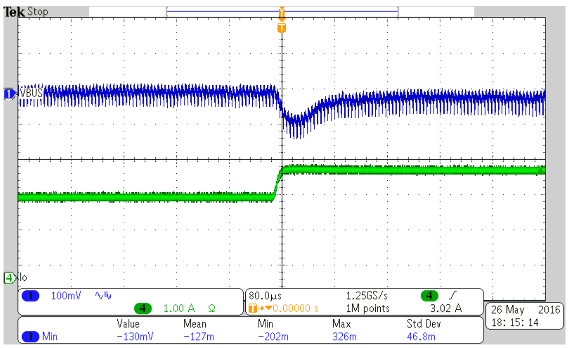
75%↔100% Load Step @150mA/us



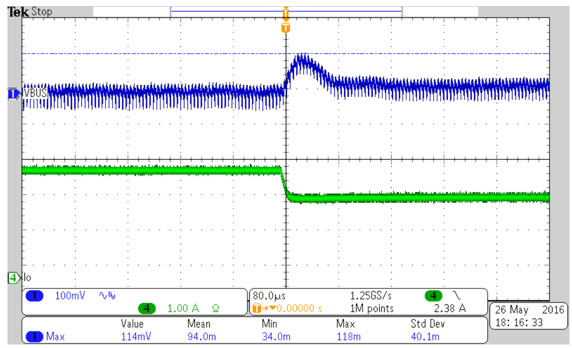
Vin=9V and Load switching from 75% to 100% Load
CH1: VBUS (AC Coupled) 100mV/Div
CH4: Io 1A/Div



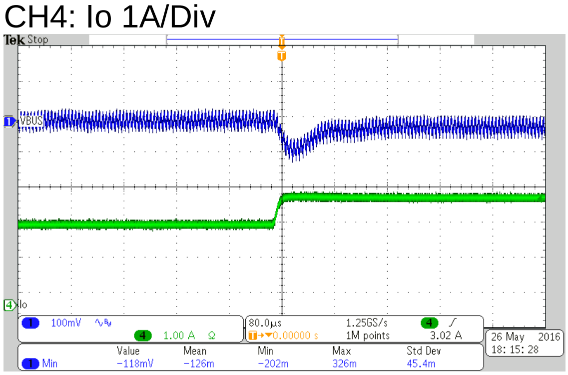
Vin=9V and Load switching from 100% to 75% Load
CH1: VBUS (AC Coupled) 100mV/Div
CH4: Io 1A/Div



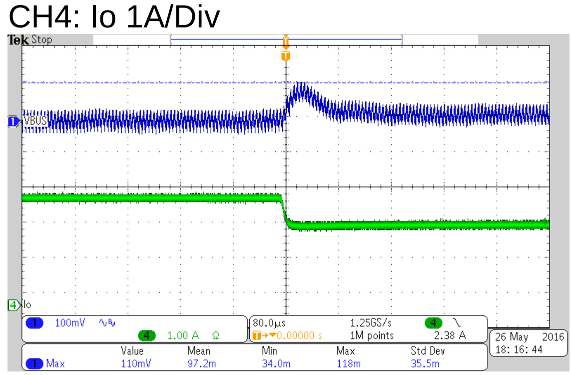
Vin=11.5V and Load switching from 75% to 100% Load
CH1: VBUS (AC Coupled) 100mV/Div
CH4: Io 1A/Div



Vin=11.5V and Load switching from 100% to 75% Load
CH1: VBUS (AC Coupled) 100mV/Div
CH4: Io 1A/Div



Vin=13.5V and Load switching from 75% to 100% Load
CH1: VBUS (AC Coupled) 100mV/Div
CH4: Io 1A/Div



Vin=13.5V and Load switching from 100% to 75% Load
CH1: VBUS (AC Coupled) 100mV/Div
CH4: Io 1A/Div

2.3.3 Output Voltage: 20V

0↔25% Load Step @150mA/us

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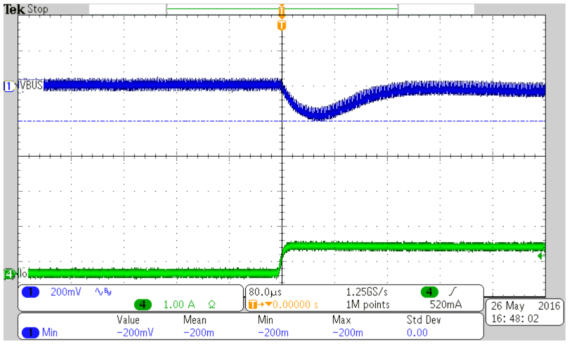
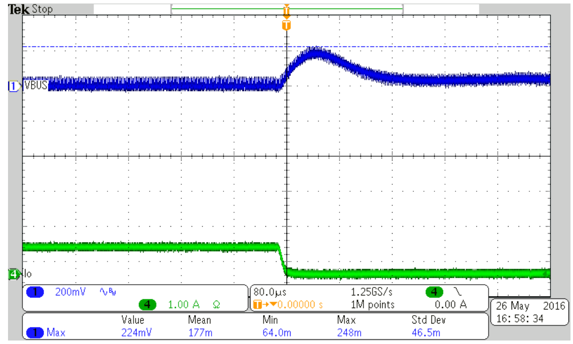
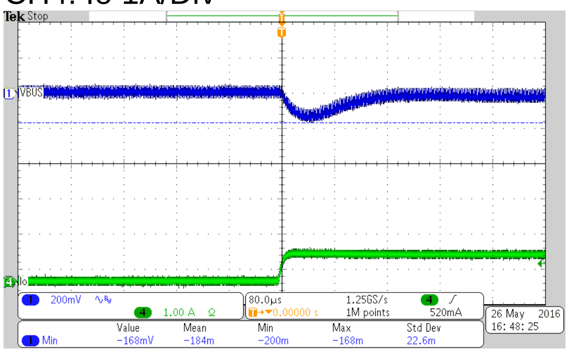


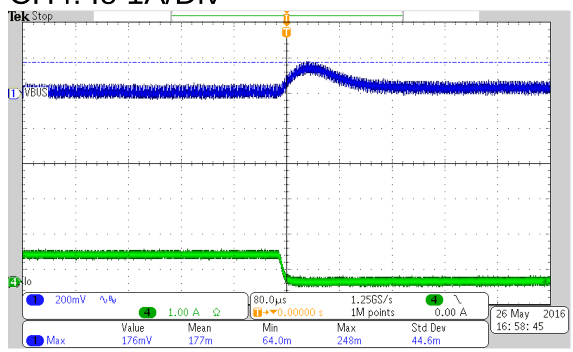
Vin=9V and Load switching from 0 to 25% Load
CH1: VBUS (AC Coupled) 200mV/Div
CH4: Io 1A/Div



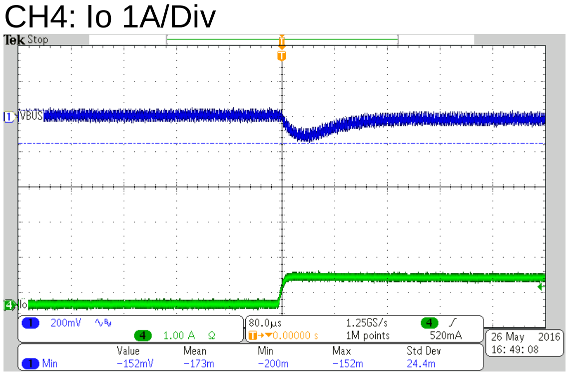
Vin=9V and Load switching from 25% to 0 Load
CH1: VBUS (AC Coupled) 200mV/Div
CH4: Io 1A/Div



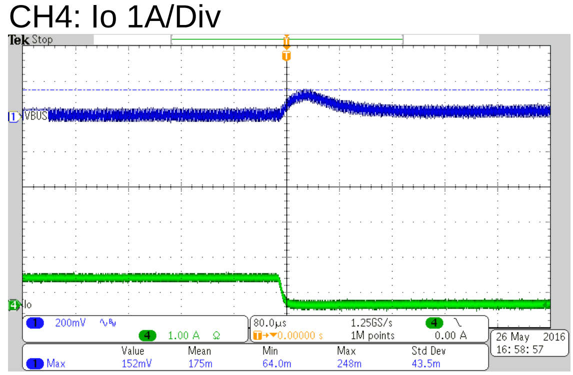
Vin=11.5V and Load switching from 0 to 25% Load
CH1: VBUS (AC Coupled) 200mV/Div
CH4: Io 1A/Div



Vin=11.5V and Load switching from 25% to 0 Load
CH1: VBUS (AC Coupled) 200mV/Div
CH4: Io 1A/Div

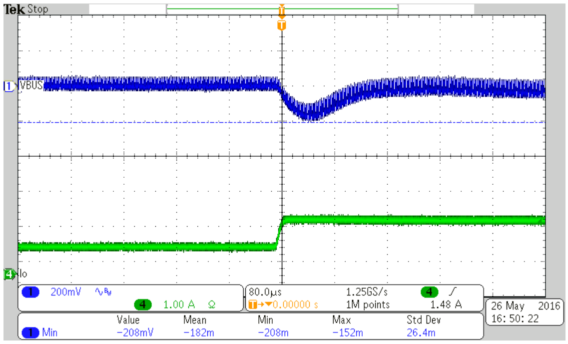


Vin=13.5V and Load switching from 0 to 25% Load
CH1: VBUS (AC Coupled) 200mV/Div
CH4: Io 1A/Div

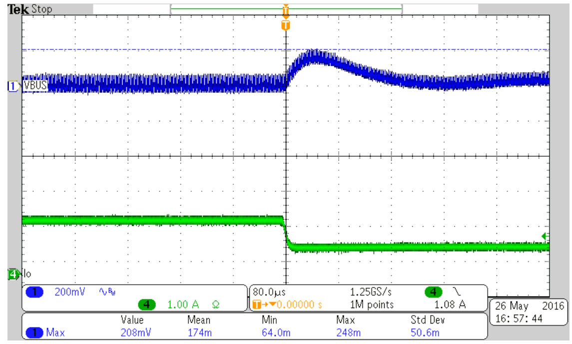


Vin=13.5V and Load switching from 25% to 0 Load
CH1: VBUS (AC Coupled) 200mV/Div
CH4: Io 1A/Div

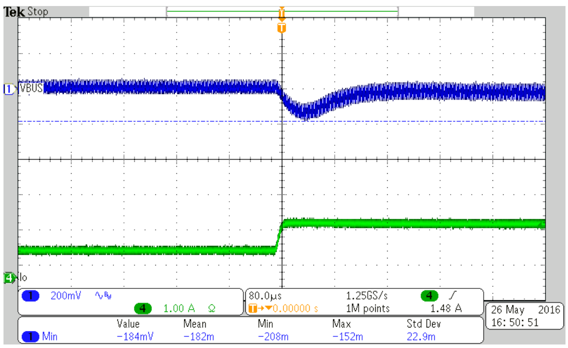
25%↔50% Load Step @150mA/us



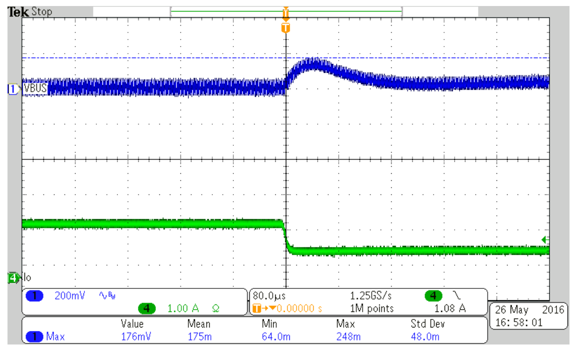
Vin=9V and Load switching from 25% to 50% Load
CH1: VBUS (AC Coupled) 200mV/Div
CH4: Io 1A/Div



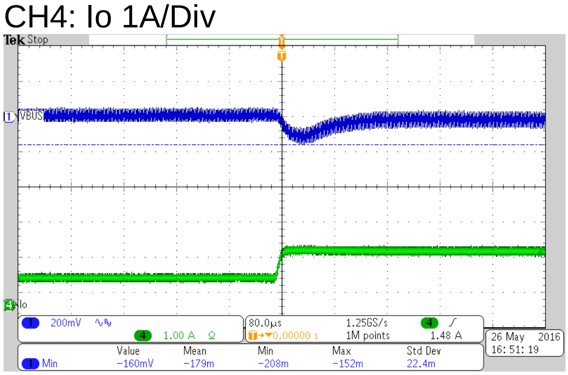
Vin=9V and Load switching from 50% to 25% Load
CH1: VBUS (AC Coupled) 200mV/Div
CH4: Io 1A/Div



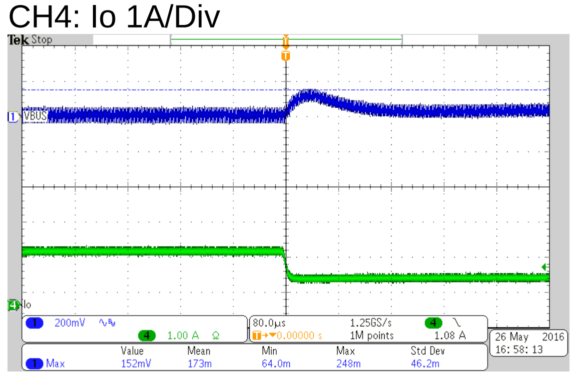
Vin=11.5V and Load switching from 25% to 50% Load
CH1: VBUS (AC Coupled) 200mV/Div
CH4: Io 1A/Div



Vin=11.5V and Load switching from 50% to 25% Load
CH1: VBUS (AC Coupled) 200mV/Div
CH4: Io 1A/Div

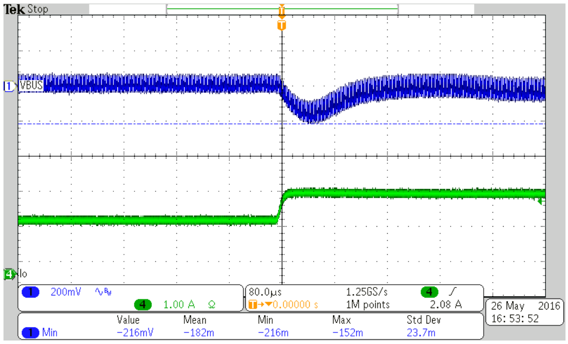


Vin=13.5V and Load switching from 25% to 50% Load
CH1: VBUS (AC Coupled) 200mV/Div
CH4: Io 1A/Div

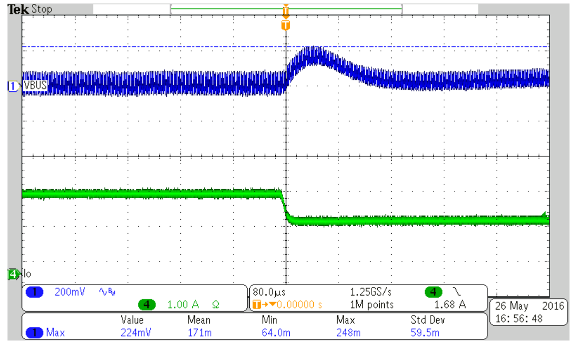


Vin=13.5V and Load switching from 50% to 25% Load
CH1: VBUS (AC Coupled) 200mV/Div
CH4: Io 1A/Div

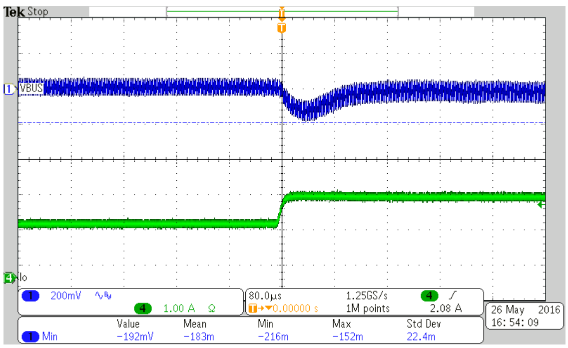
50%↔75% Load Step @150mA/us



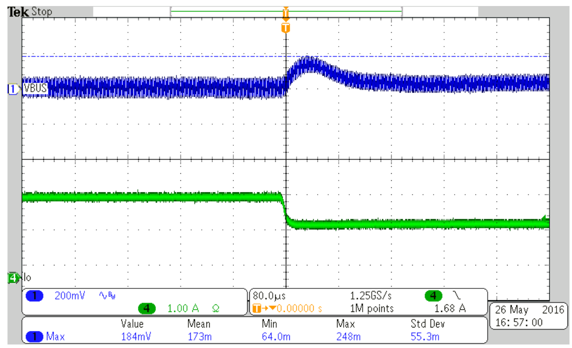
Vin=9V and Load switching from 50% to 75% Load
CH1: VBUS (AC Coupled) 200mV/Div
CH4: Io 1A/Div



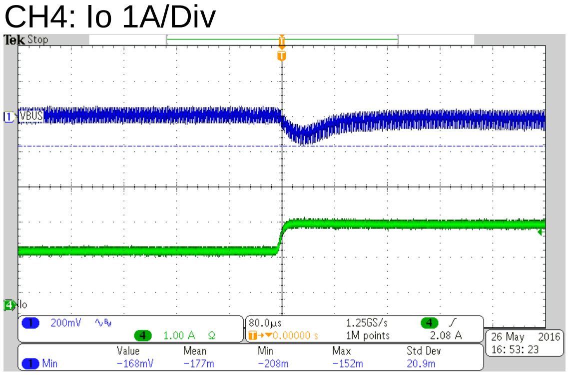
Vin=9V and Load switching from 75% to 50% Load
CH1: VBUS (AC Coupled) 200mV/Div
CH4: Io 1A/Div



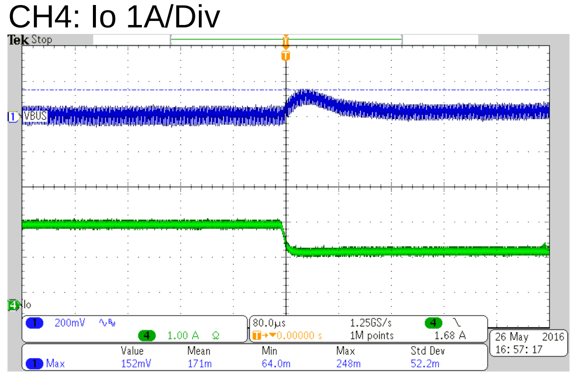
Vin=11.5V and Load switching from 50% to 75% Load
CH1: VBUS (AC Coupled) 200mV/Div
CH4: Io 1A/Div



Vin=11.5V and Load switching from 75% to 50% Load
CH1: VBUS (AC Coupled) 200mV/Div
CH4: Io 1A/Div

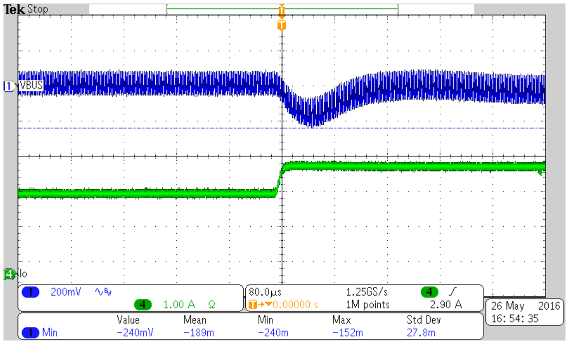


Vin=13.5V and Load switching from 50% to 75% Load
CH1: VBUS (AC Coupled) 200mV/Div
CH4: Io 1A/Div

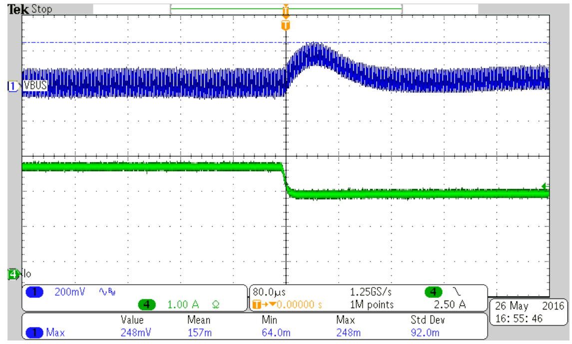


Vin=13.5V and Load switching from 75% to 50% Load
CH1: VBUS (AC Coupled) 200mV/Div
CH4: Io 1A/Div

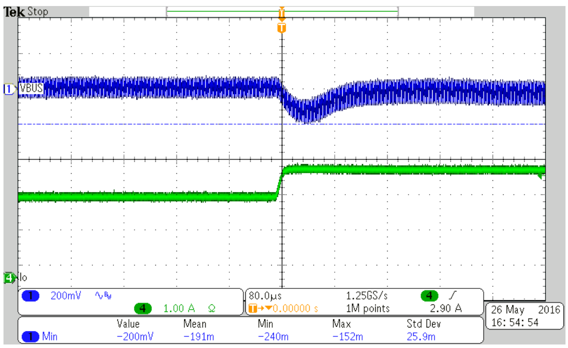
75%↔100% Load Step @150mA/us



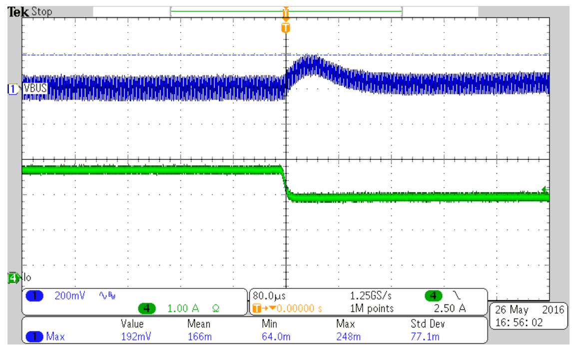
Vin=9V and Load switching from 75% to 100% Load
CH1: VBUS (AC Coupled) 200mV/Div
CH4: Io 1A/Div



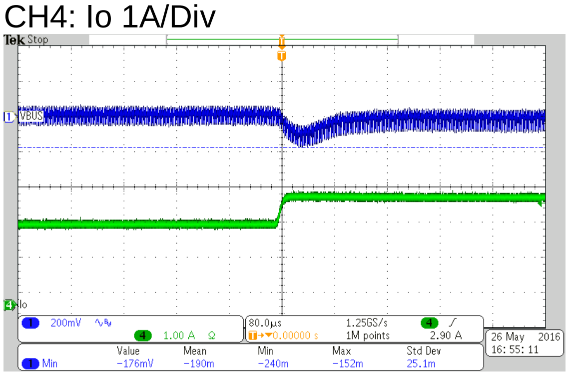
Vin=9V and Load switching from 100% to 75% Load
CH1: VBUS (AC Coupled) 200mV/Div
CH4: Io 1A/Div



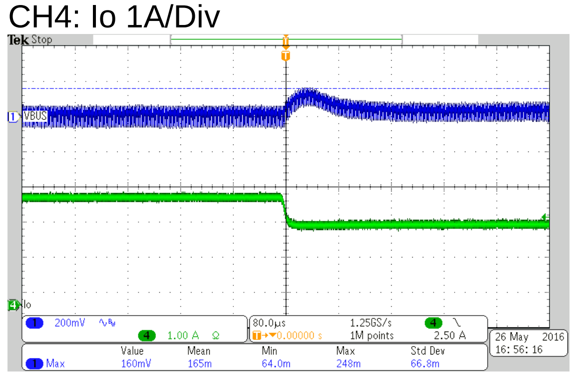
Vin=11.5V and Load switching from 75% to 100% Load
CH1: VBUS (AC Coupled) 200mV/Div
CH4: Io 1A/Div



Vin=11.5V and Load switching from 100% to 75% Load
CH1: VBUS (AC Coupled) 200mV/Div
CH4: Io 1A/Div



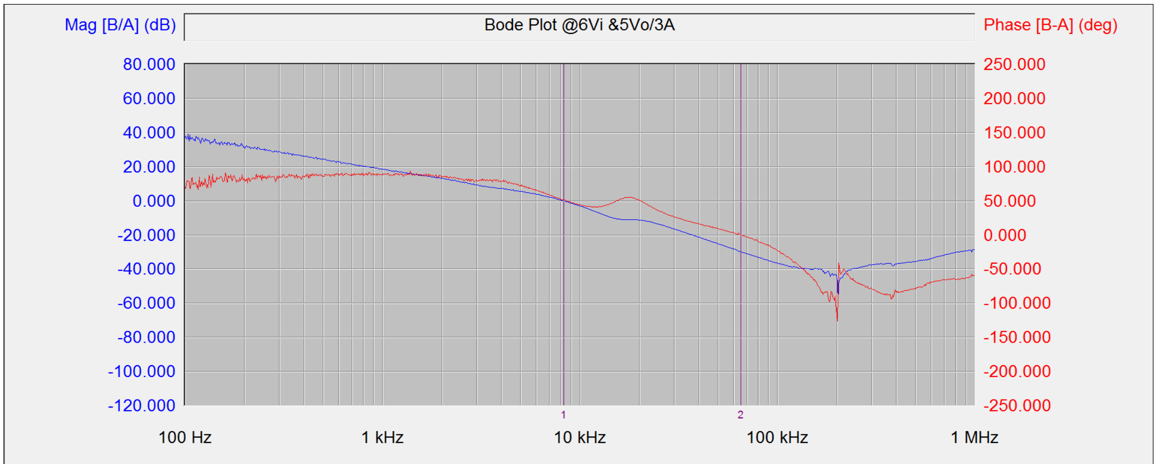
Vin=13.5V and Load switching from 75% to 100% Load
CH1: VBUS (AC Coupled) 200mV/Div
CH4: Io 1A/Div



Vin=13.5V and Load switching from 100% to 75% Load
CH1: VBUS (AC Coupled) 200mV/Div
CH4: Io 1A/Div

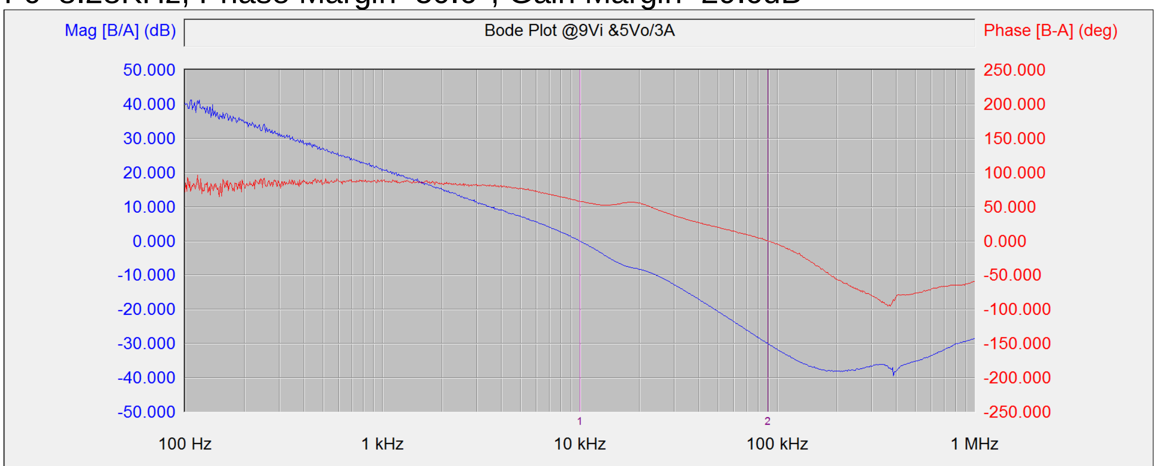
2.5 Bode Plot

2.5.1 Output Voltage: 5V



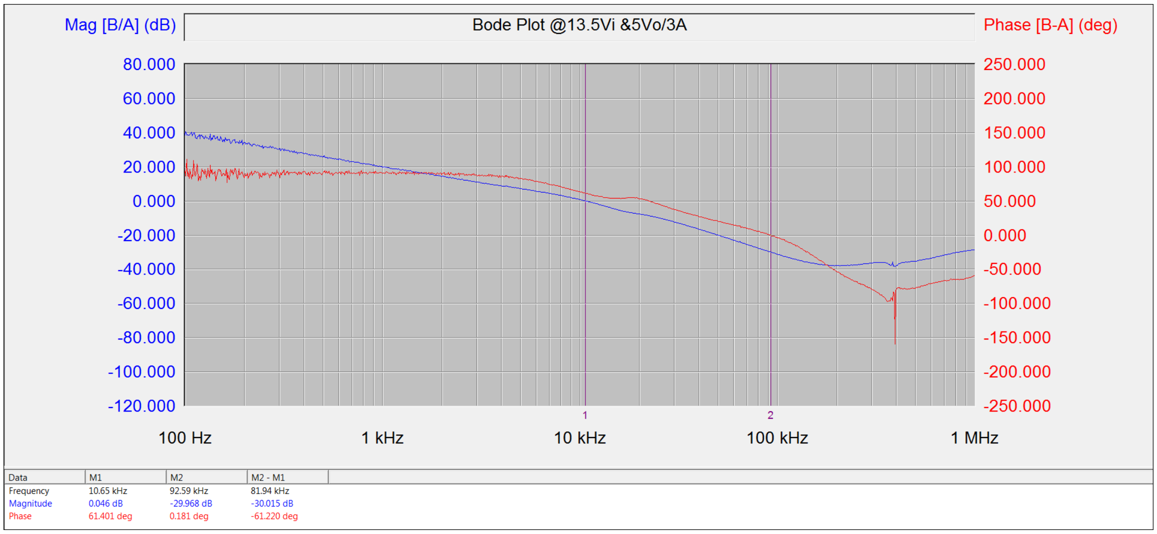
Data	M1	M2	M2 - M1
Frequency	8.28 kHz	65.25 kHz	56.97 kHz
Magnitude	-0.078 dB	-29.643 dB	-29.564 dB
Phase	50.563 deg	0.288 deg	-50.275 deg

Vin=6V and Io=3A
Fc=8.28KHz; Phase Margin=50.6°; Gain Margin=29.6dB



Data	M1	M2	M2 - M1
Frequency	10.00 kHz	89.41 kHz	79.41 kHz
Magnitude	-0.070 dB	-30.087 dB	-30.017 dB
Phase	57.902 deg	0.124 deg	-57.779 deg

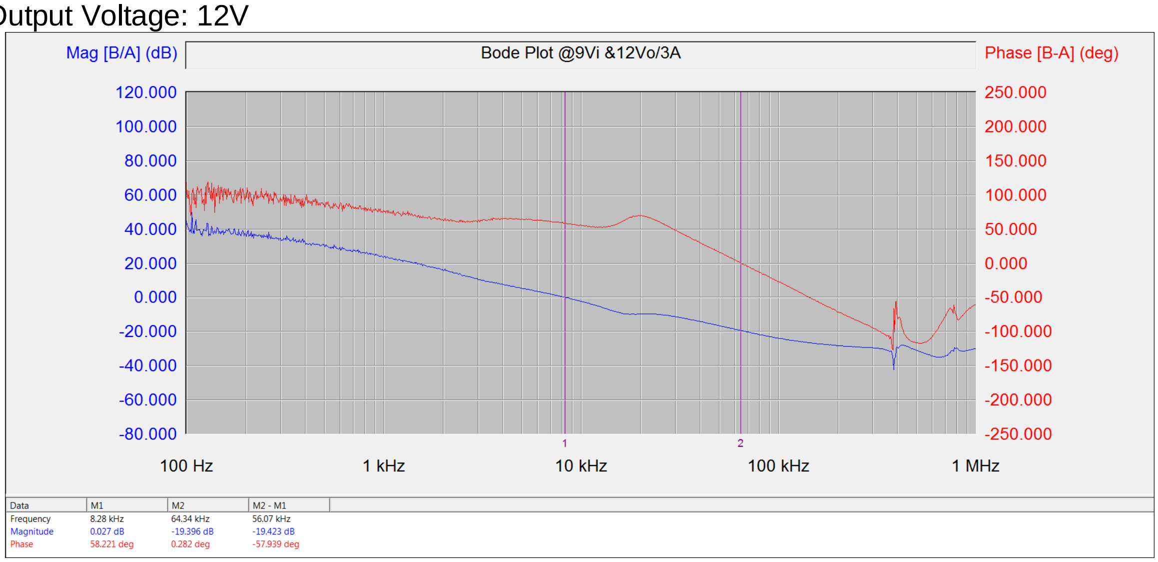
Vin=9V and Io=3A
Fc=10.0KHz; Phase Margin=57.9°; Gain Margin=30.1dB



Vin=13.5V and Io=3A

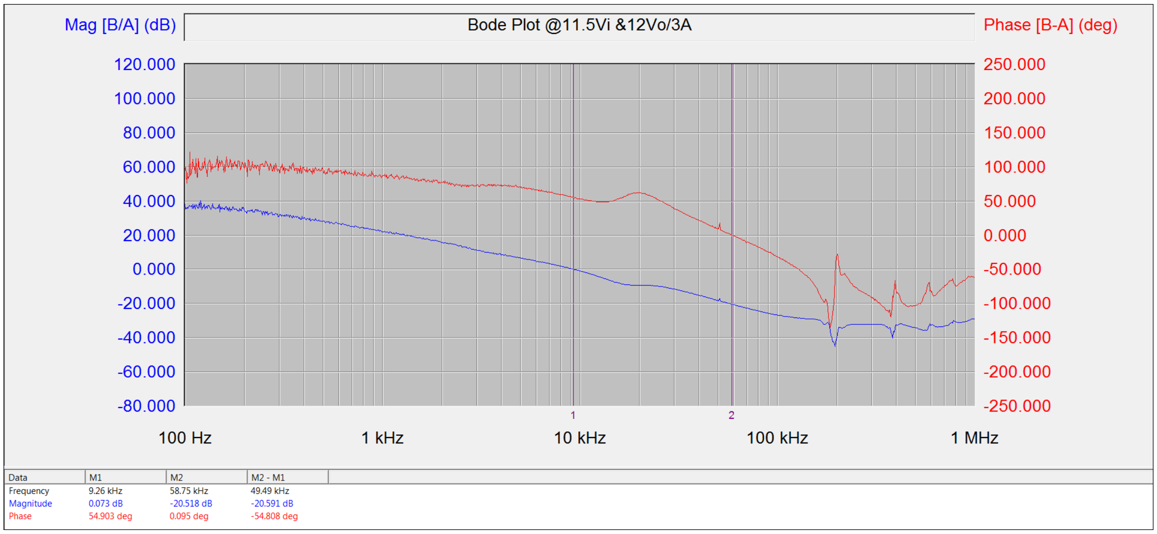
Fc=10.65KHz; Phase Margin=61.4°; Gain Margin=30dB

2.5.2 Output Voltage: 12V

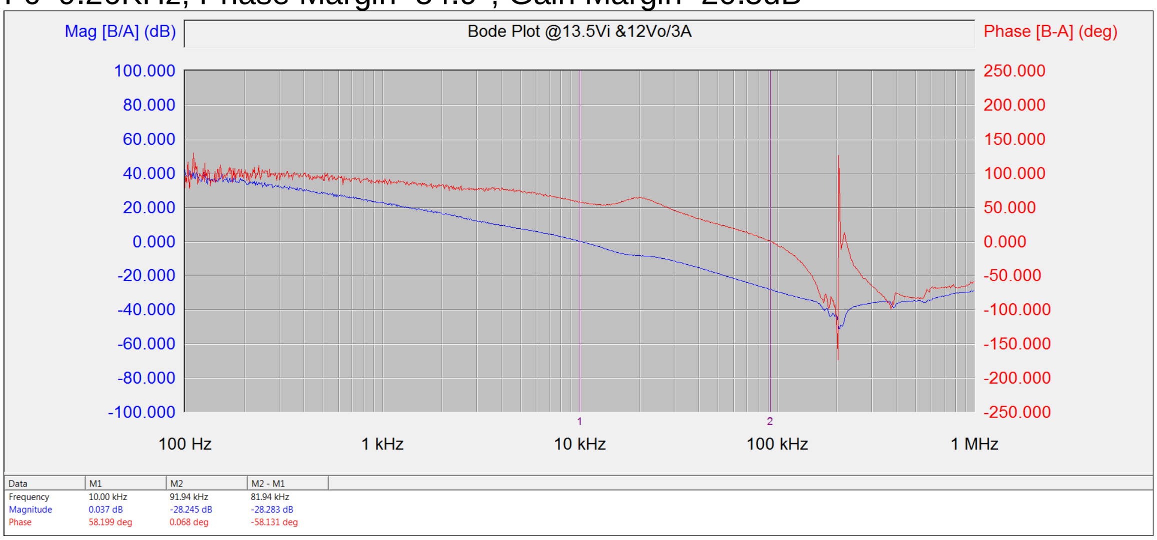


Vin=9V and Io=3A

Fc=8.28KHz; Phase Margin=58.2°; Gain Margin=19.4dB

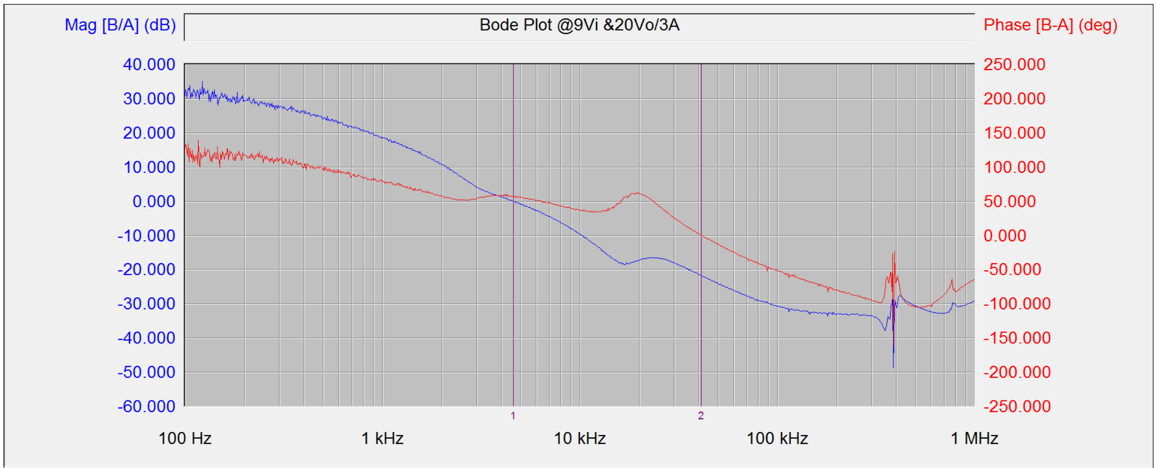


Vin=11.5V and Io=3A
Fc=9.26KHz; Phase Margin=54.9°; Gain Margin=20.5dB



Vin=13.5V and Io=3A
Fc=10.0KHz; Phase Margin=58.2°; Gain Margin=28.2dB

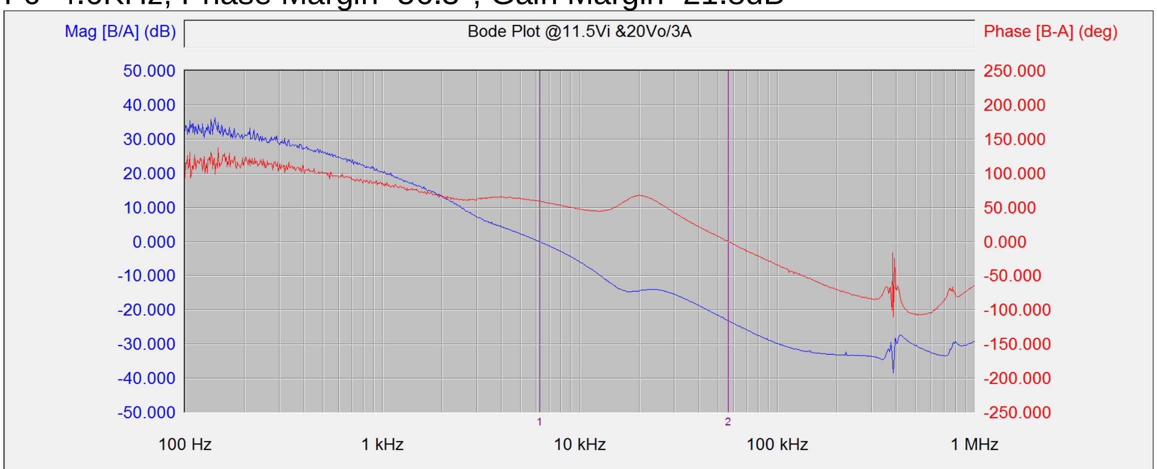
2.5.3 Output Voltage: 20V



Data	M1	M2	M2 - M1
Frequency	4.60 kHz	41.11 kHz	36.51 kHz
Magnitude	0.008 dB	-21.777 dB	-21.785 dB
Phase	56.295 deg	0.011 deg	-56.284 deg

Vin=9V and Io=3A

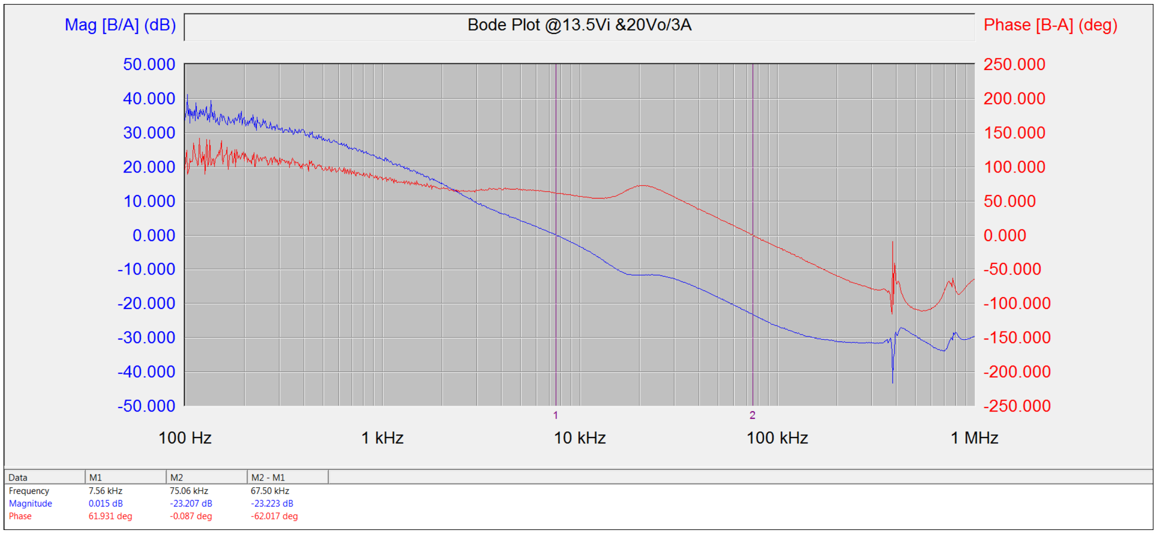
Fc=4.6KHz; Phase Margin=56.3°; Gain Margin=21.8dB



Data	M1	M2	M2 - M1
Frequency	6.26 kHz	56.33 kHz	50.08 kHz
Magnitude	-0.028 dB	-23.174 dB	-23.146 dB
Phase	58.916 deg	0.175 deg	-58.741 deg

Vin=11.5V and Io=3A

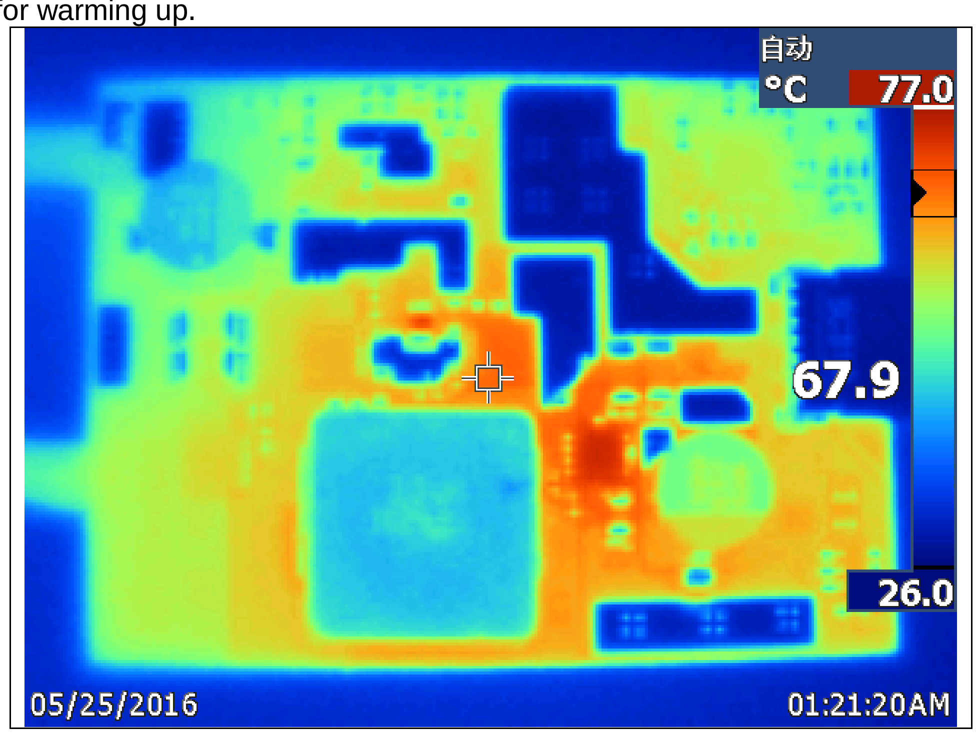
Fc=6.26KHz; Phase Margin=58.9°; Gain Margin=23.2dB



Vin=13.5V and Io=3A
Fc=7.56KHz; Phase Margin=61.9°; Gain Margin=23.2dB

2.6 Thermal Performance

The board is applied a 9V DC voltage and output 20V/3A load to the output port. Run about 10min for warming up.



Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265