
Qualcomm
quick charge 3.0

1. TEST RESULTS

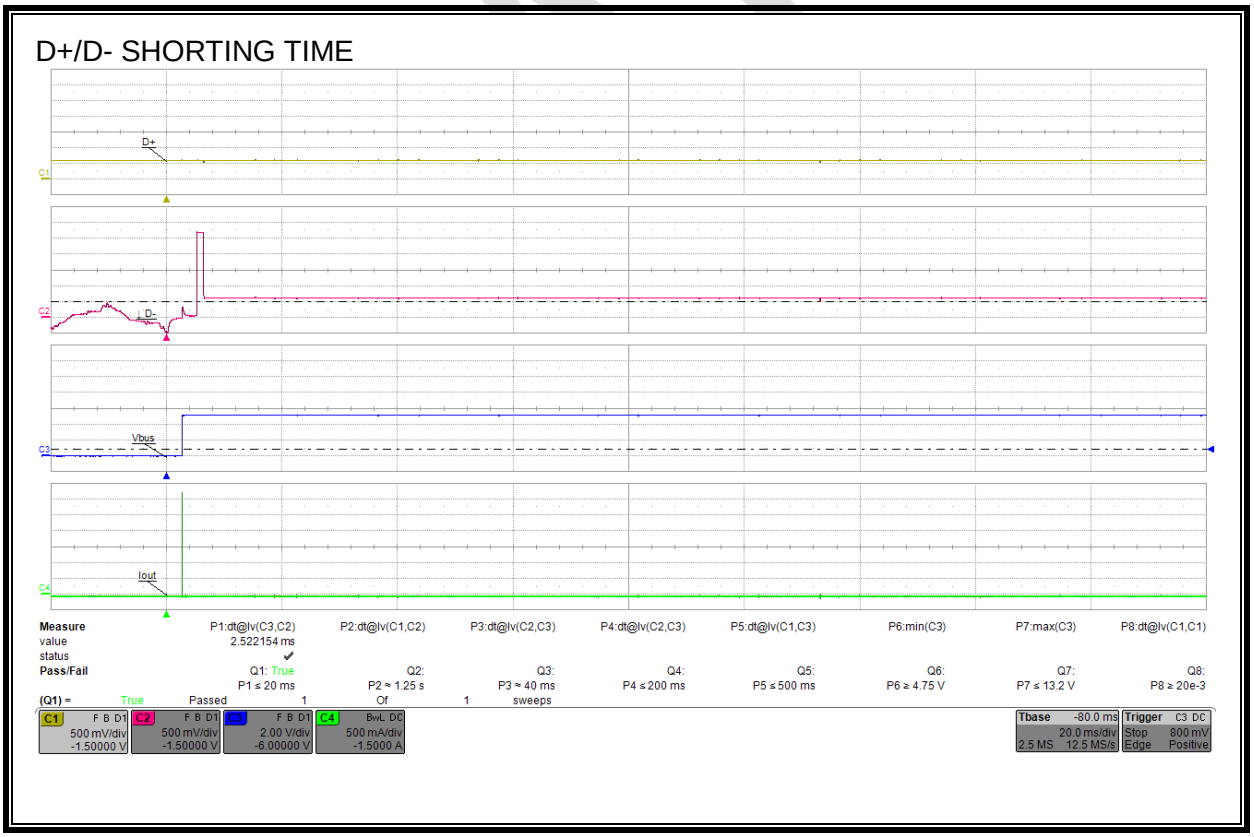
1.1. HVDCP Insertion

1.1.1. D+/D- Shorting Time

LIMITS AND RESULTS

Parameter	Start of Timing	End of Timing	Measured Value (ms)	Maximum Limit (ms)	Pass/Fail
Td+_d-_short	Vbus >= 0.8 V (Min Votg_sess_vld)	D- >= 0.5 V (Min Vdm_src)	2.522	20	PASS

WAVEFORM AND MEASUREMENTS



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1.1.2. D+/D- Remains Shorted at 3.3 V

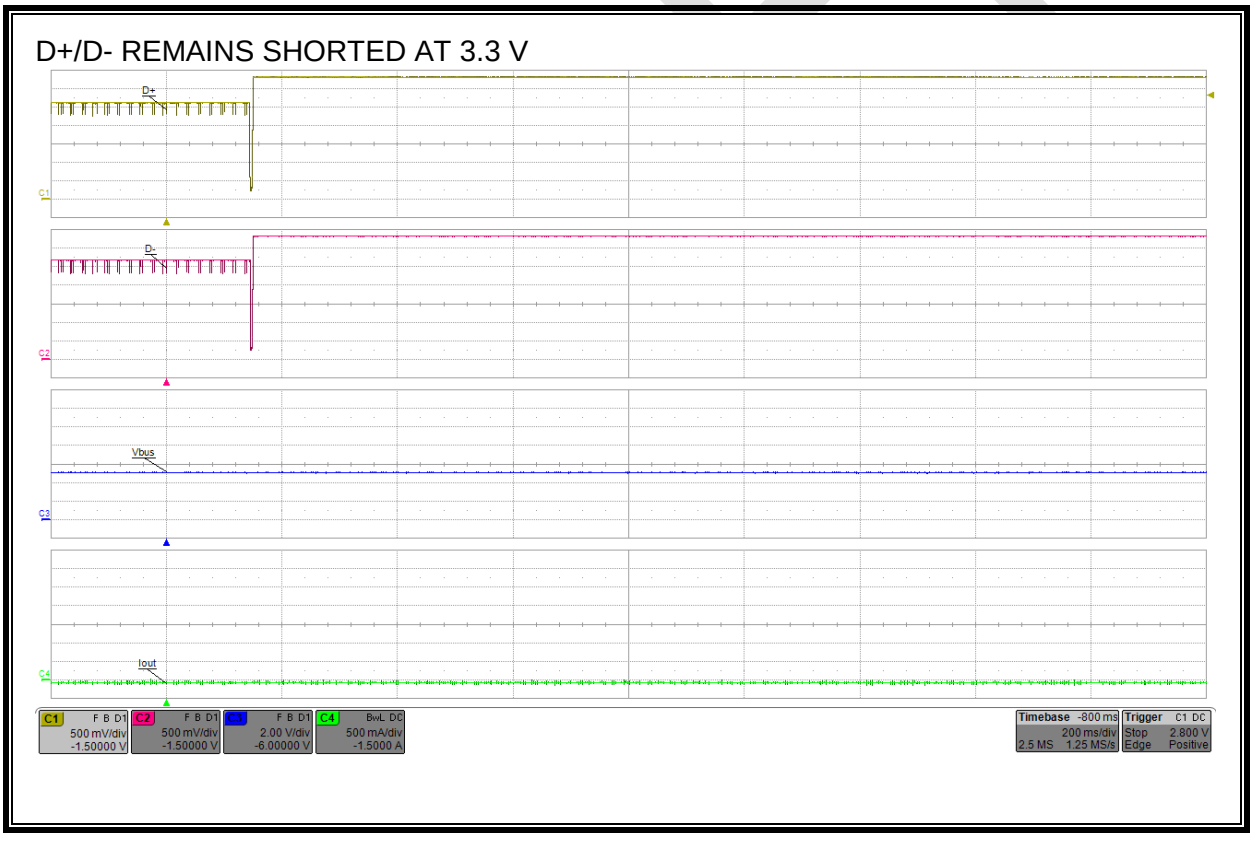
LIMITS AND RESULTS

Requirement: D- remains shorted to D+ when D+ is set to 3.3 V and D- Floats

Beginning 1.5 seconds (Max Tglitch_bc_done) after D+ >= 2.2 V (Max Vsel_ref), confirm D- >= 2.2 V (Max Vsel_ref)

Parameter	Measured Value (V)	Minimum Limit (V)	Pass/Fail
D-	3.30	2.2	PASS

WAVEFORM AND MEASUREMENTS



1.2. HVDCP Negotiation

1.2.1. One Second Glitch Filter

LIMITS AND RESULTS

Parameter	Start of Timing	End of Timing	Measured Value (s)	Minimum Limit (s)	Maximum Limit (s)	Pass/Fail
Tglitch_bc_done	D+ >= 0.4 V (Max Vdat_ref)	D- <= 0.25 V (Min Vdat_ref)	1.37	1.0	1.5	PASS

WAVEFORM AND MEASUREMENTS

1.2.2. Rdcp_dat

LIMITS AND RESULTS

Measured D+ Voltage (V)	Measured D- Voltage (V)	Measured D+ Current (mA)	Rdcp_dat Measured Value (ohms)	Rdcp_dat Maximum Limit (ohms)	Pass/Fail
0.600	0.593	0.990	7.2	40	PASS

1.2.3. Rdm_dwn

LIMITS AND RESULTS

Parameter	Measured Value (k ohms)	Minimum Limit (k ohms)	Maximum Limit (k ohms)	Pass/Fail
Rdm_dwn	18.980	14.25	24.80	PASS

1.2.4. Rdat_lkg

LIMITS AND RESULTS

Parameter	Measured Value (k ohms)	Minimum Limit (k ohms)	Maximum Limit (k ohms)	Pass/Fail
Rdat_lkg	628.7	300	1500	PASS

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1.3. Portable Device Request Recognition

1.3.1. Output Voltage

LIMITS AND RESULTS

Output Voltage at No Load					
Nominal Vbus (V)	**Load Current (A)**	**Measured Vbus (V)**	**Minimum Limit (V)**	**Maximum Limit (V)**	**Pass/Fail**
5	0.0	5.11	4.75	5.50	PASS
9	0.0	9.18	8.55	9.90	PASS
12	0.0	12.27	11.40	13.20	PASS

Output Voltage at Max Rated Load				
Nominal Vbus (V)	**Load Current (A)**	**Measured Vbus (V)**	**Minimum Limit (V)**	**Pass/Fail**
5	3.00	4.96	4.75	PASS
9	2.00	9.09	8.55	PASS
12	1.50	12.20	11.40	PASS

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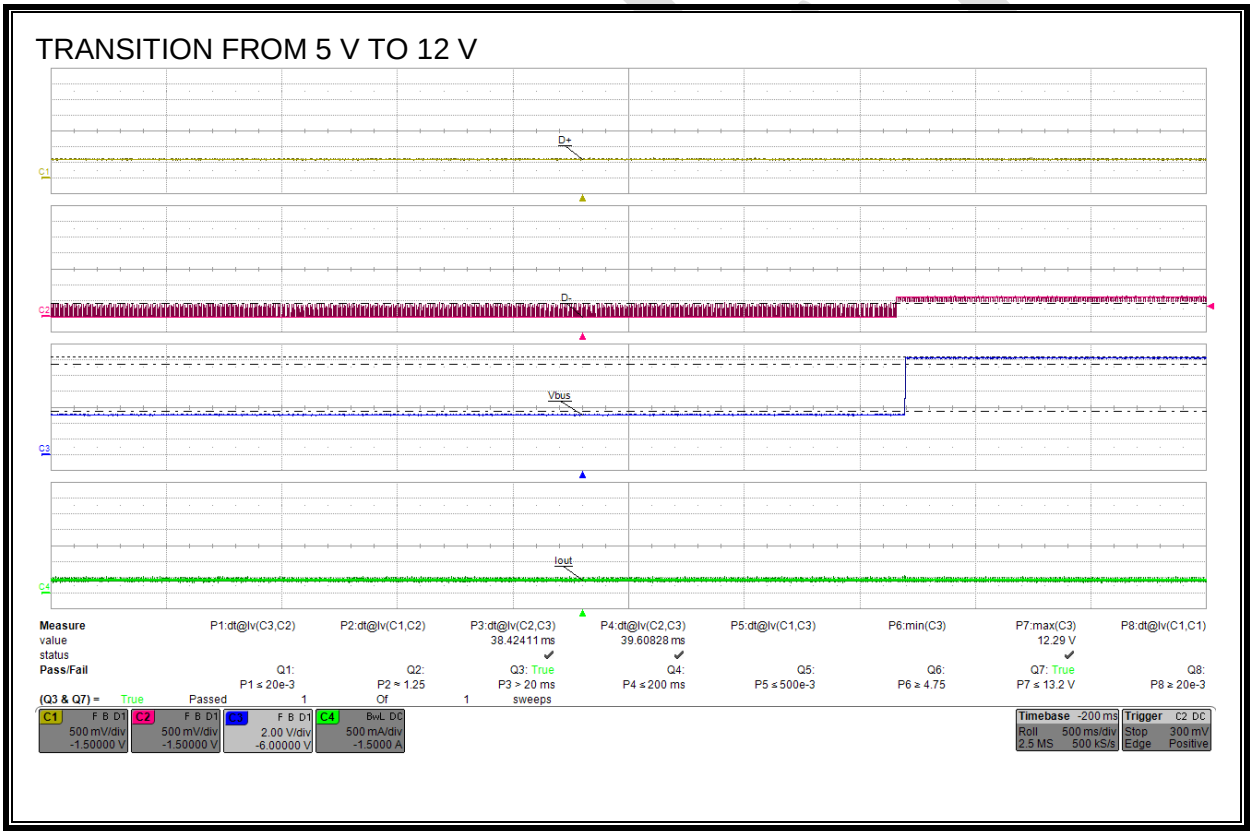
1.3.2. Transition from 5 V to 12 V

LIMITS AND RESULTS

Parameter	Start of Timing	End of Timing	Meas Value (ms)	Min Limit (ms)	Max Limit (ms)	Pass/Fail
Tglitch_mode_change	D- >= 0.4 V (Max Vdat_ref)	Vbus >= 5.5 V (Max Vbus_5v)	38.42	20	60	PASS
Tv_new_request	D- >= 0.4 V (Max Vdat_ref)	Vbus >= 11.4 V (Min Vbus_hv)	39.61		200	PASS

WAVEFORM AND MEASUREMENTS

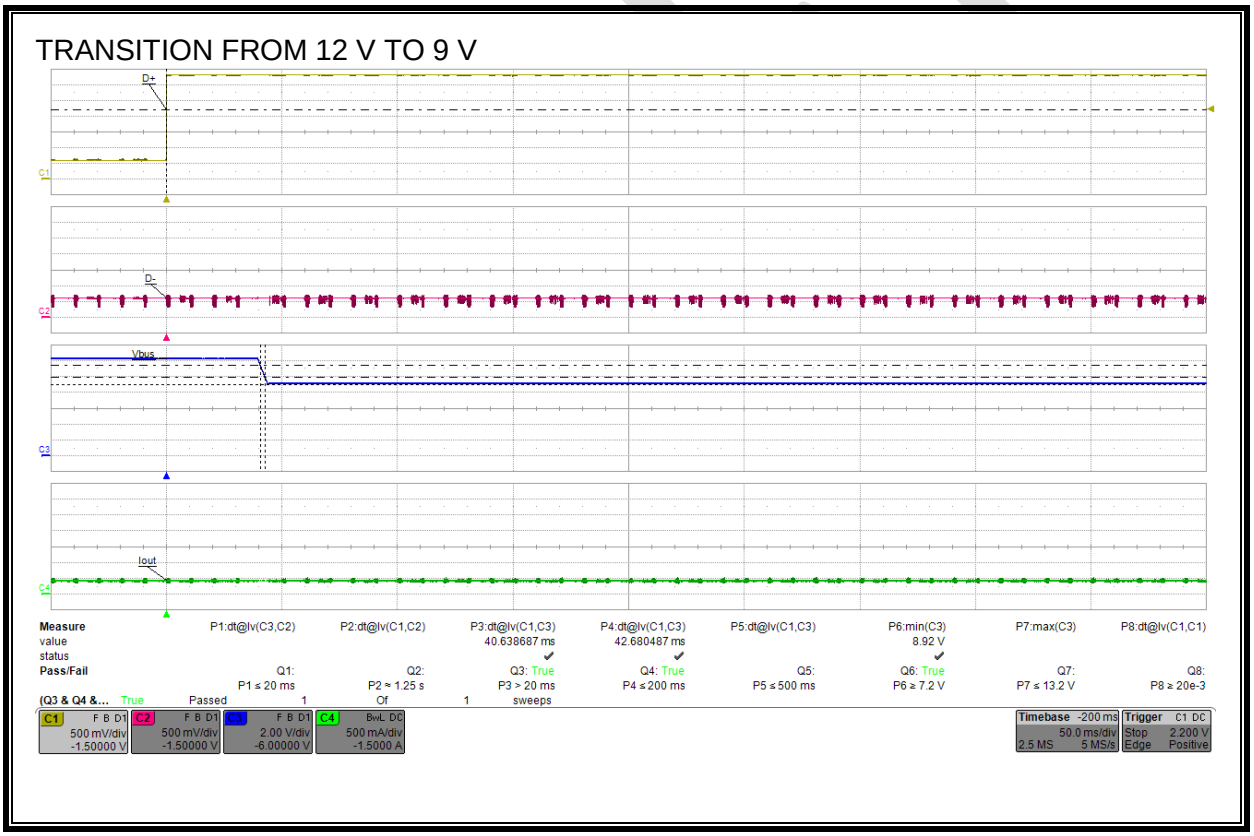


1.3.3. Transition from 12 V to 9 V

LIMITS AND RESULTS

Parameter	Start of Timing	End of Timing	Meas Value (ms)	Min Limit (ms)	Max Limit (ms)	Pass/Fail
Tglitch_mode_change	D+ >= 2.2 V (Max Vsel_ref)	Vbus <= 11.4 V (Min Vbus_hv)	40.64	20	60	PASS
Tv_new_request	D+ >= 2.2 V (Max Vsel_ref)	Vbus <= 9.9 V (Max Vbus_hv)	42.68		200	PASS

WAVEFORM AND MEASUREMENTS



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1.3.4. Maintain 9 V with Reserved Request

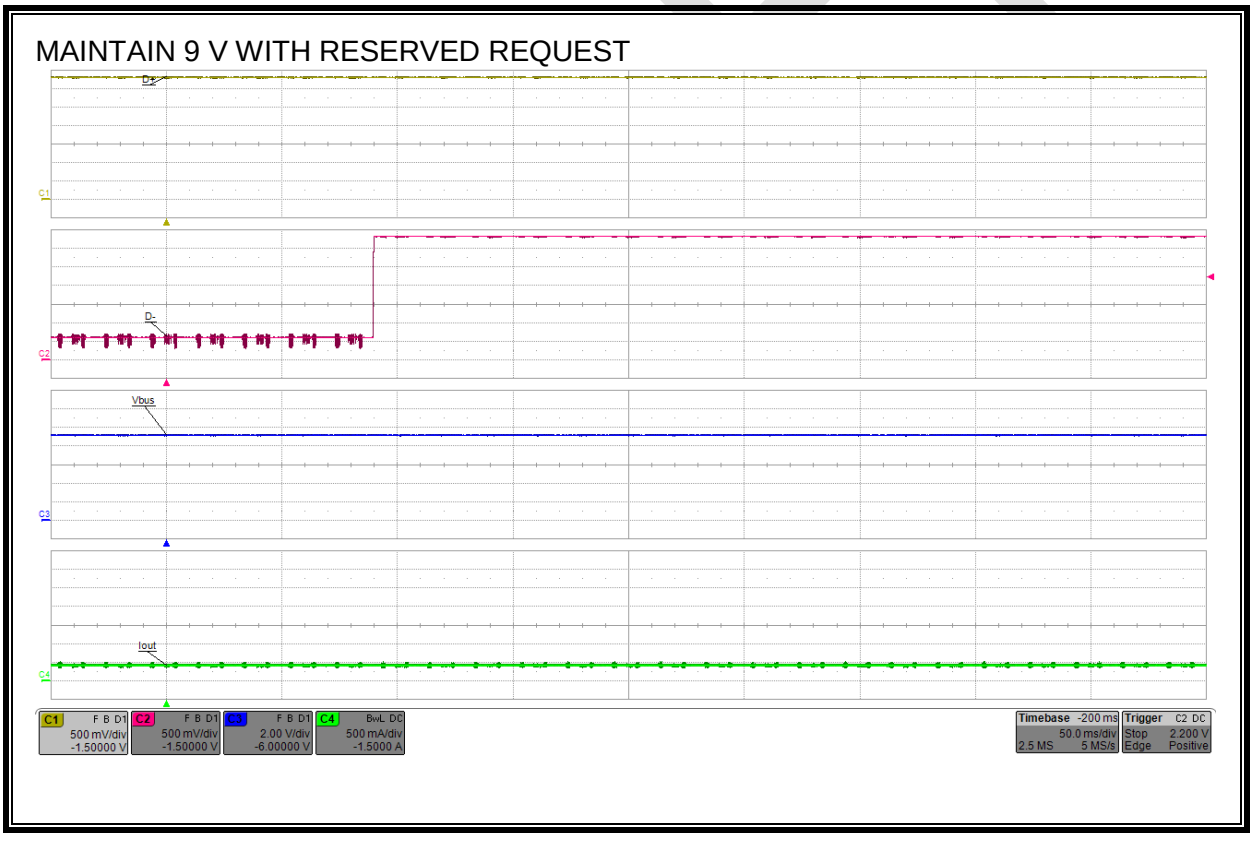
LIMITS AND RESULTS

Initial Condition: Vbus is 9 volts

Observation Period: Monitor for longer than 200 ms (Max Tv_new_request) after Reserved Request is asserted

Parameter	Measured Value (V)	Minimum Limit (V)	Maximum Limit (V)	Pass/Fail
Vbus	9.158	8.55	9.90	PASS

WAVEFORM AND MEASUREMENTS



1.3.5. Maintain 9 V with Continuous Request

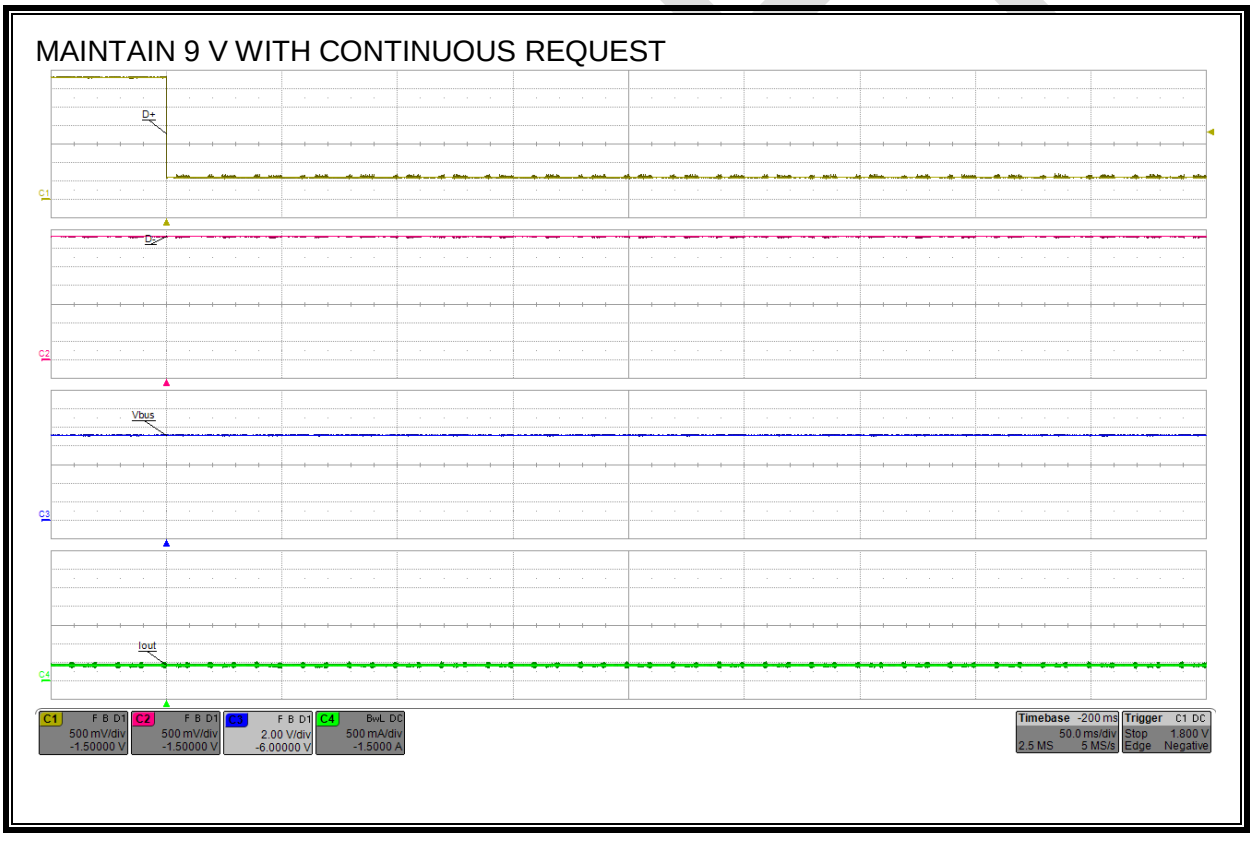
LIMITS AND RESULTS

Initial Condition: Vbus is 9 volts

Observation Period: Monitor for longer than 200 ms (Max Tv_new_request) after Continuous Request is asserted

Parameter	Measured Value (V)	Minimum Limit (V)	Maximum Limit (V)	Pass/Fail
Vbus	9.157	8.55	9.90	PASS

WAVEFORM AND MEASUREMENTS



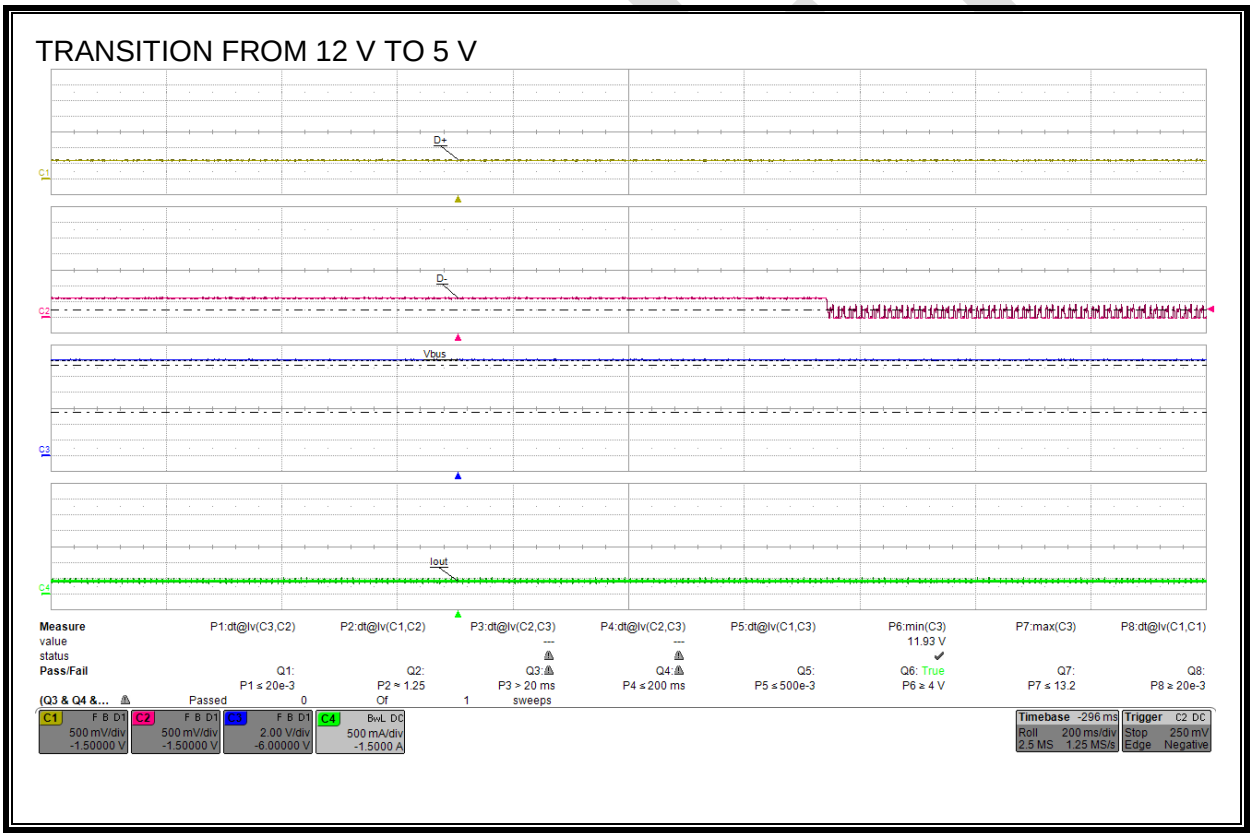
1.3.6. Transition from 12 V to 5 V

LIMITS AND RESULTS

Parameter	Start of Timing	End of Timing	Meas Value (ms)	Min Limit (ms)	Max Limit (ms)	Pass/Fail
Tglitch_mode_change	D- <= 0.25 V (Min Vdat_ref)	Vbus <= 11.4 V (Min Vbus_hv)		20	60	FAIL
Tv_new_request	D- <= 0.25 V (Min Vdat_ref)	Vbus <= 5.5 V (Max Vbus_5v)			200	FAIL

注：floatD-无法回到 5v

WAVEFORM AND MEASUREMENTS



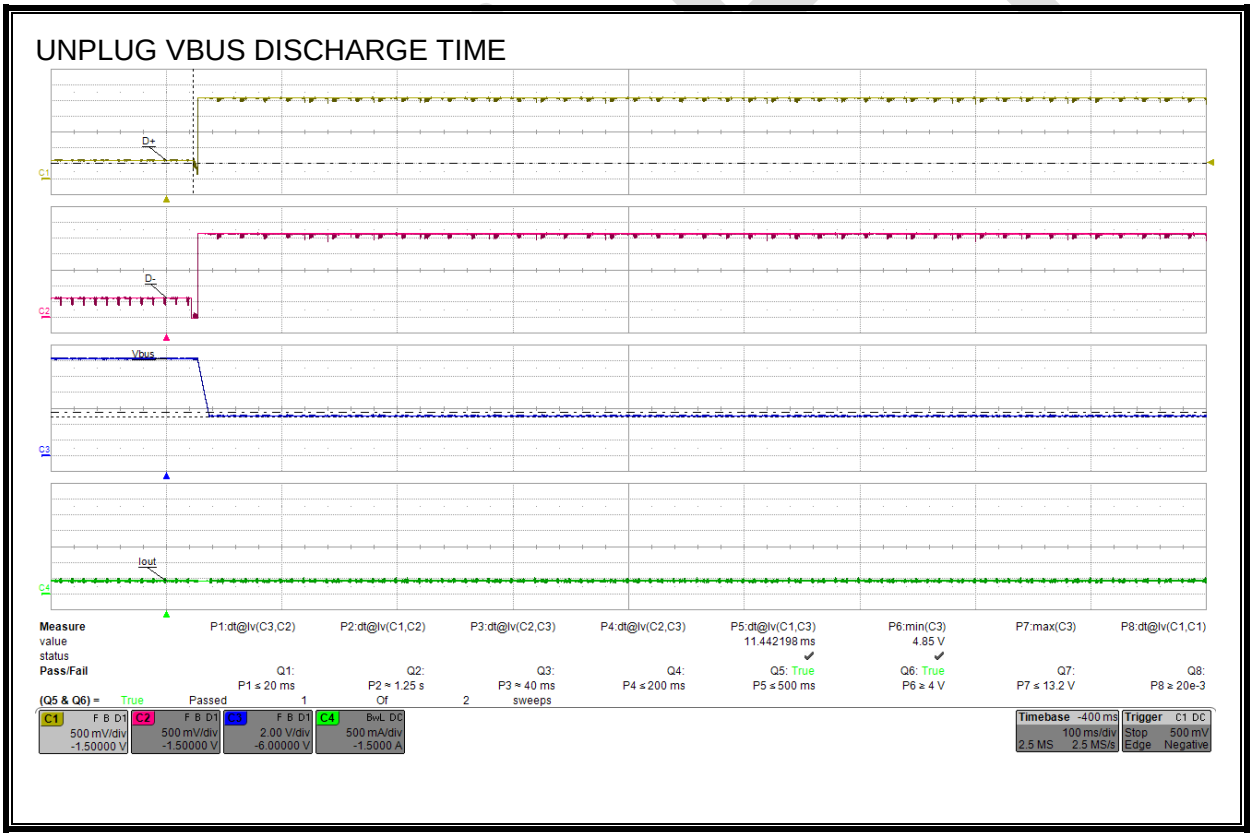
1.4. Portable Device Removal

1.4.1. Unplug Vbus Discharge Time

LIMITS AND RESULTS

Parameter	Start of Timing	End of Timing	Measured Value (ms)	Maximum Limit (ms)	Pass/Fail
Tv_unplug	D+ <= 0.5 V (Min Vdp_src)	Vbus <= 5.5 V (Max Vbus_5v)	11.44	500	PASS

WAVEFORM AND MEASUREMENTS



1.5. Portable Device USB PHY Error Rejection

1.5.1. Square Wave Error Rejection

LIMITS AND RESULTS

Initial Condition: Vbus is 5 volts
Applied Waveform: D+ = 0.6 V for 990 ms, then 0.6 V / 0 V pulse train, then remains at 0.6 V
Requirements: D- tracks D+ until Tglitch_bc_done after the completion of the pulse train, and Vbus remains at 5 volts
Observation Period: Monitor until at least 1.5 seconds after pulse train

Parameter	Measured Value (V)	Minimum Limit (V)	Maximum Limit (V)	Pass/Fail
D+/ D- Tracking				PASS
Vbus	5.069	4.75	5.50	PASS

WAVEFORM AND MEASUREMENTS

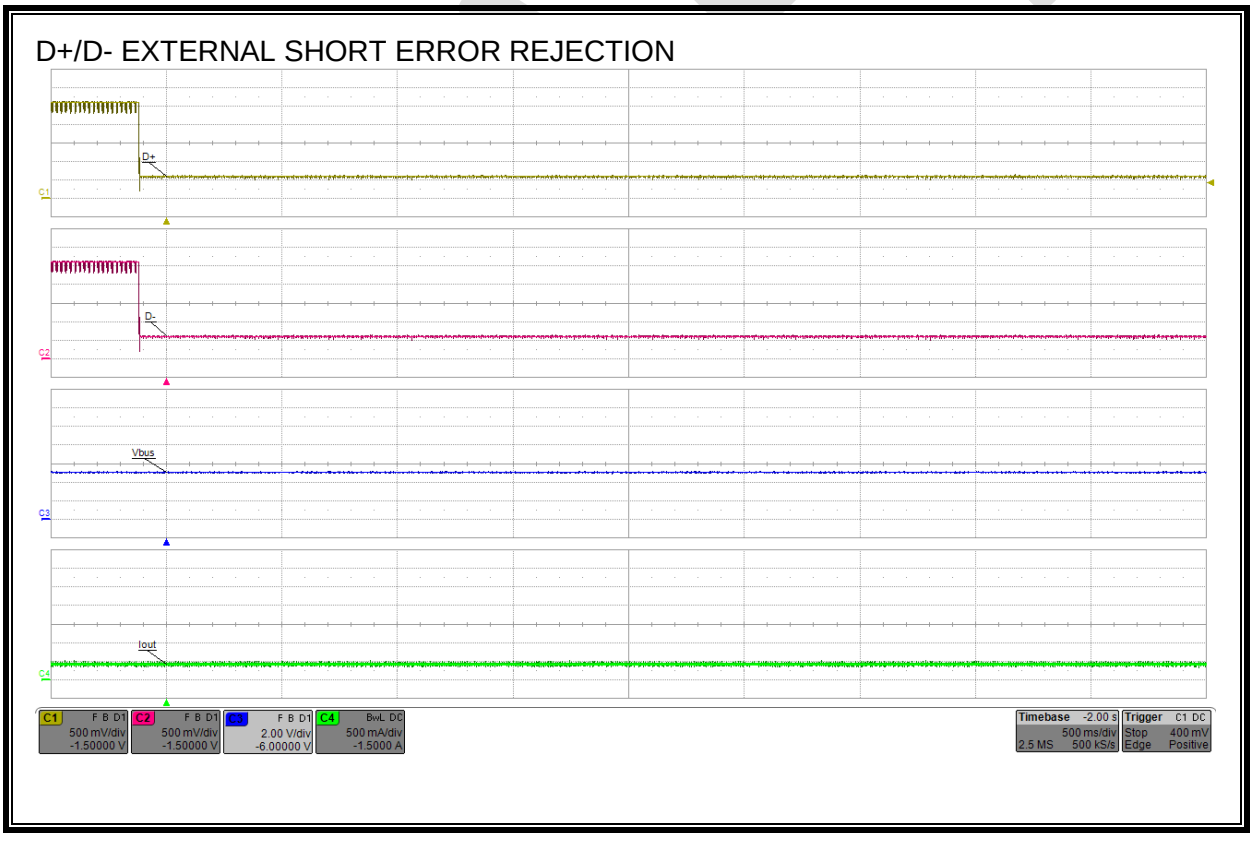
1.5.2. D+/D- External Short Error Rejection

LIMITS AND RESULTS

Initial Condition: Vbus is 5 volts
Applied Waveform: D+ and D- externally shorted together and held at 0 volts
Then 0.6 volts is applied to D+/D-
Requirement: Vbus remains at 5 volts
Observation Period: Monitor at least 2 seconds after 0.6 volts is applied

Parameter	Measured Value (V)	Minimum Limit (V)	Maximum Limit (V)	Pass/Fail
Vbus	5.068	4.75	5.50	PASS

WAVEFORM AND MEASUREMENTS



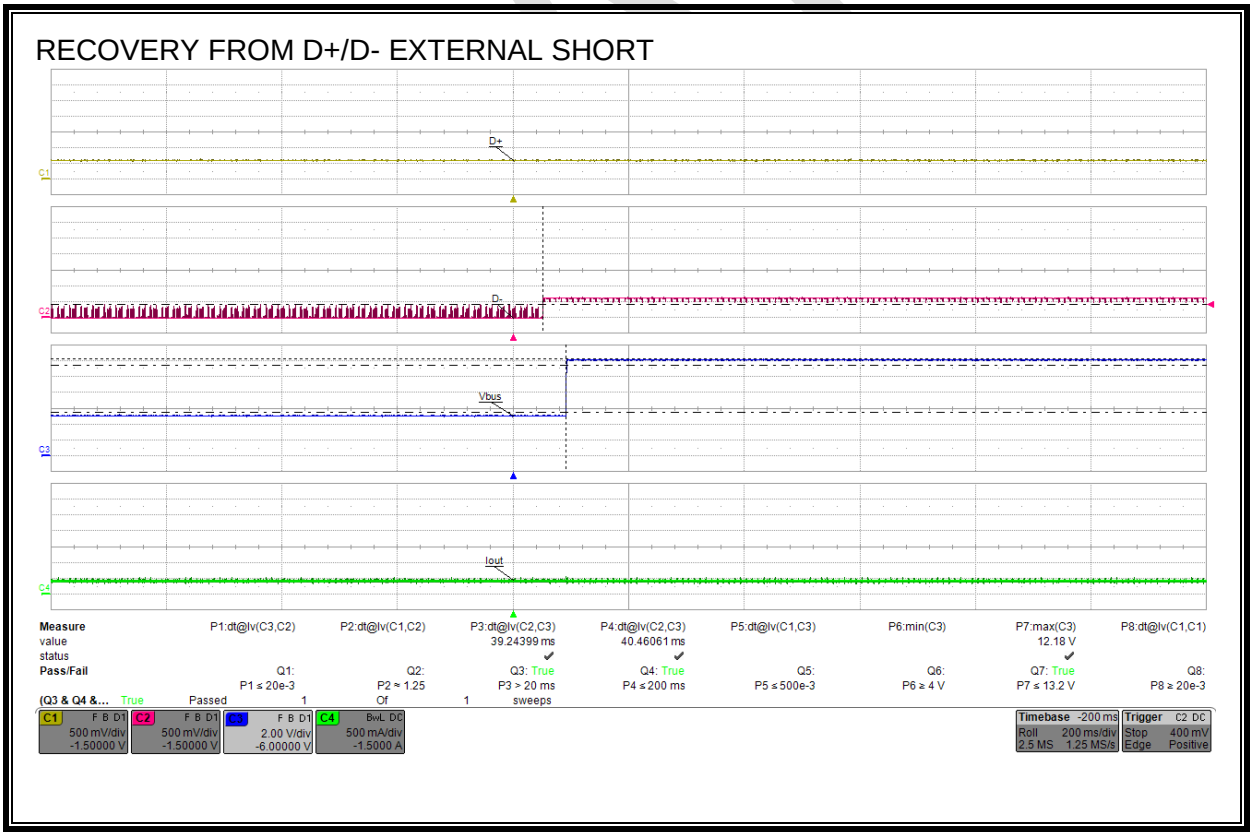
1.5.3. Recovery from D+/D- External Short

LIMITS AND RESULTS

Initial Condition: D+ and D- externally shorted together and held at 0.6 volts
Setup: Short is removed and D- allowed to float
Response: HVCDP asserts Rdm_dwn
Applied Waveform: 0.6 V is applied to D-
Requirement: Vbus makes a normal transition from 5 volts to 12 volts

Parameter	Start of Timing	End of Timing	Meas Value (ms)	Min Limit (ms)	Max Limit (ms)	Pass/Fail
Tglitch_mode_change	D- >= 0.4 V (Max Vdat_ref)	Vbus >= 5.5 V (Max Vbus_5v)	39.24	20	60	PASS
Tv_new_request	D- >= 0.4 V (Max Vdat_ref)	Vbus >= 11.4 V (Min Vbus_hv)	40.46		200	PASS

WAVEFORM AND MEASUREMENTS



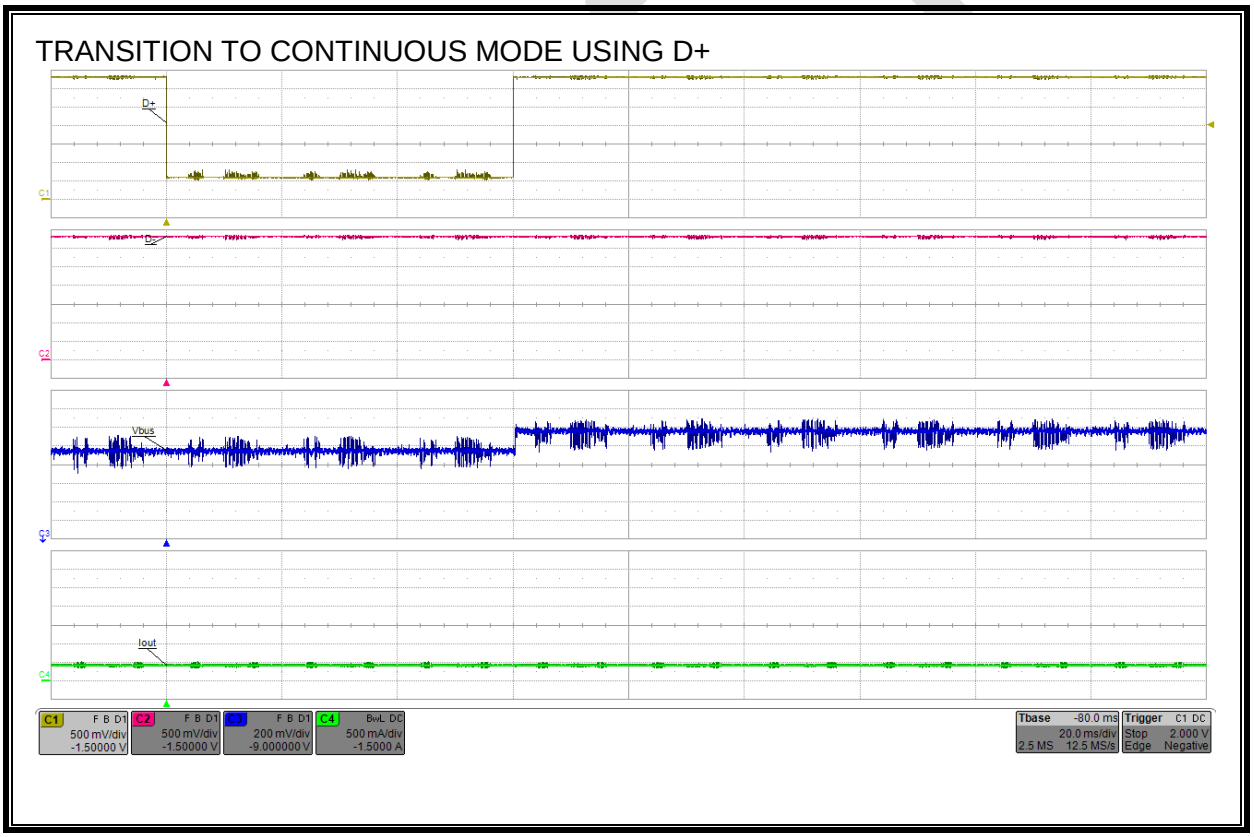
1.6. Continuous Mode Portable Device Request Recognition

1.6.1. Upper Bound of Tglitch_mode_change

LIMITS AND RESULTS

Charger Transition	Observation of Vbus	Pass/Fail
To Continuous Mode using D+ Pulse	Increments	PASS
To Continuous Mode using D- Pulse	Decrements	PASS

WAVEFORM FOR TRANSITION USING D+



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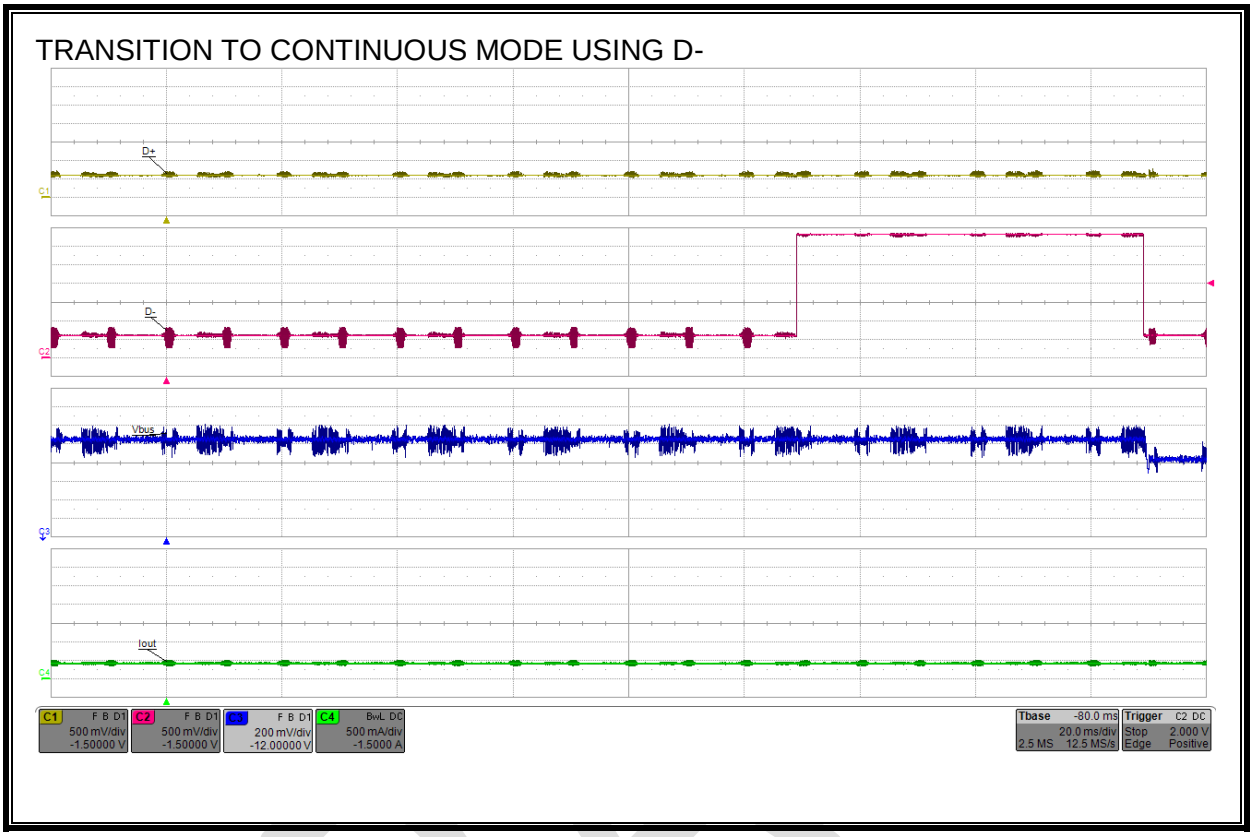
WAVEFORM FOR TRANSITION USING D-



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1.6.2. Tv_cont_change & Vbus_cont_step at Upper Bound of D-Tglitch_cont_change

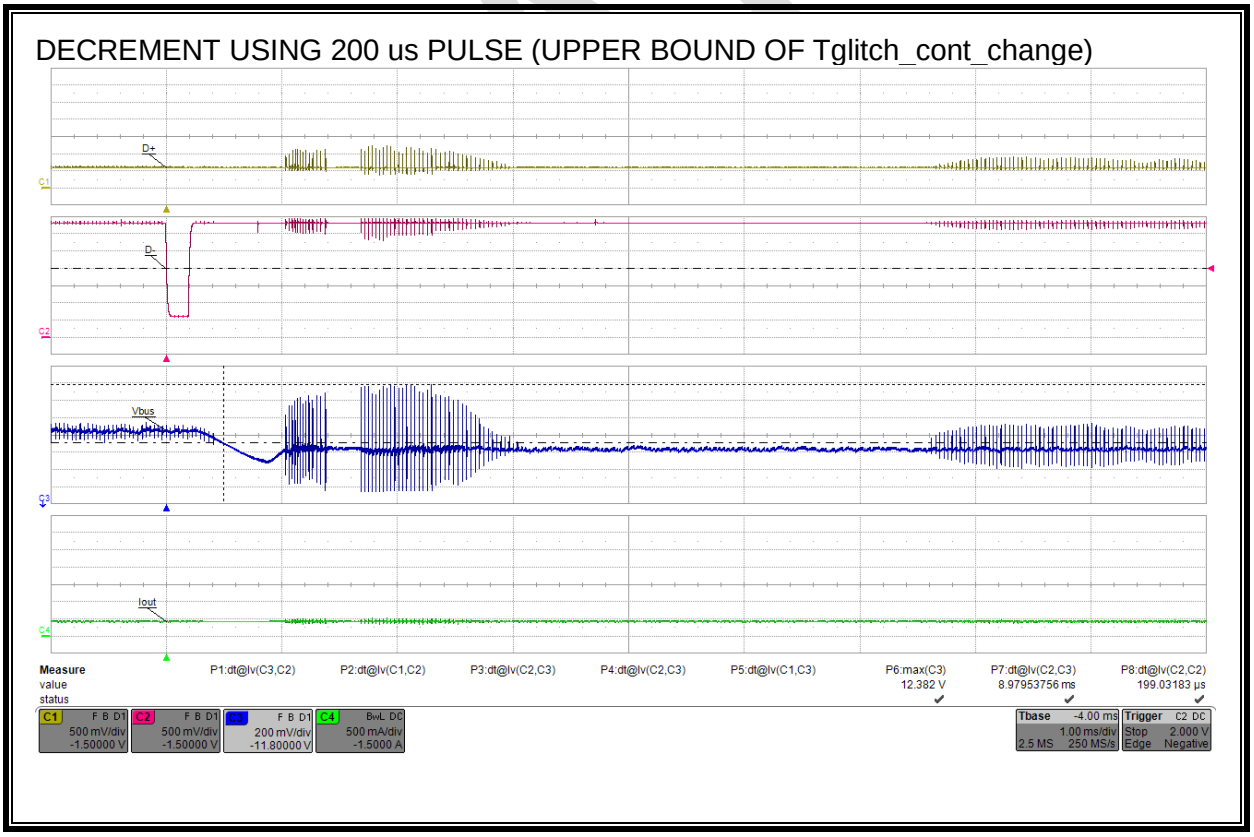
Tv_cont_change LIMITS AND RESULTS

Vbus Transition	Time from leading edge of request to completion of Vbus transition (ms)	Maximum Limit (ms)	Pass/Fail
11.8 V to 11.6 V	8.98	30.0	PASS

Vbus_cont_step LIMITS AND RESULTS

Vbus Transition	Starting Voltage (V)	Ending Voltage (V)	Delta Voltage (V)	Minumum Delta (V)	Maximum Delta (V)	Pass/Fail
11.8 V to 11.6 V	11.857	11.646	0.211	0.150	0.250	PASS

DECREMENT WAVEFORM



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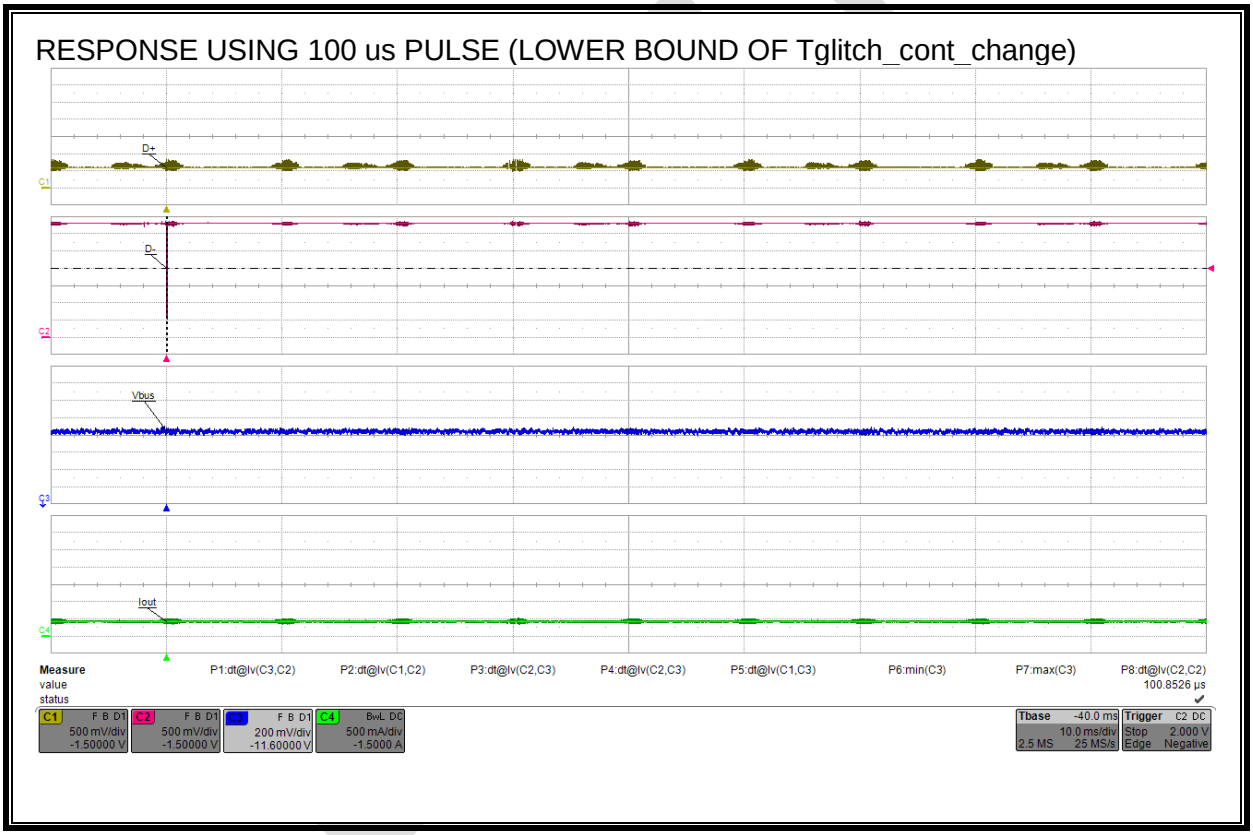
1.6.3. Lower Bound of D- Tglitch_cont_change

LIMITS AND RESULTS

D+ / D- Command	Observation of Vbus	Pass/Fail
Attempt to Decrement using D- Pulse Width < Minimum Tglitch_cont_change	Vbus does not Change	PASS

WAVEFORMS

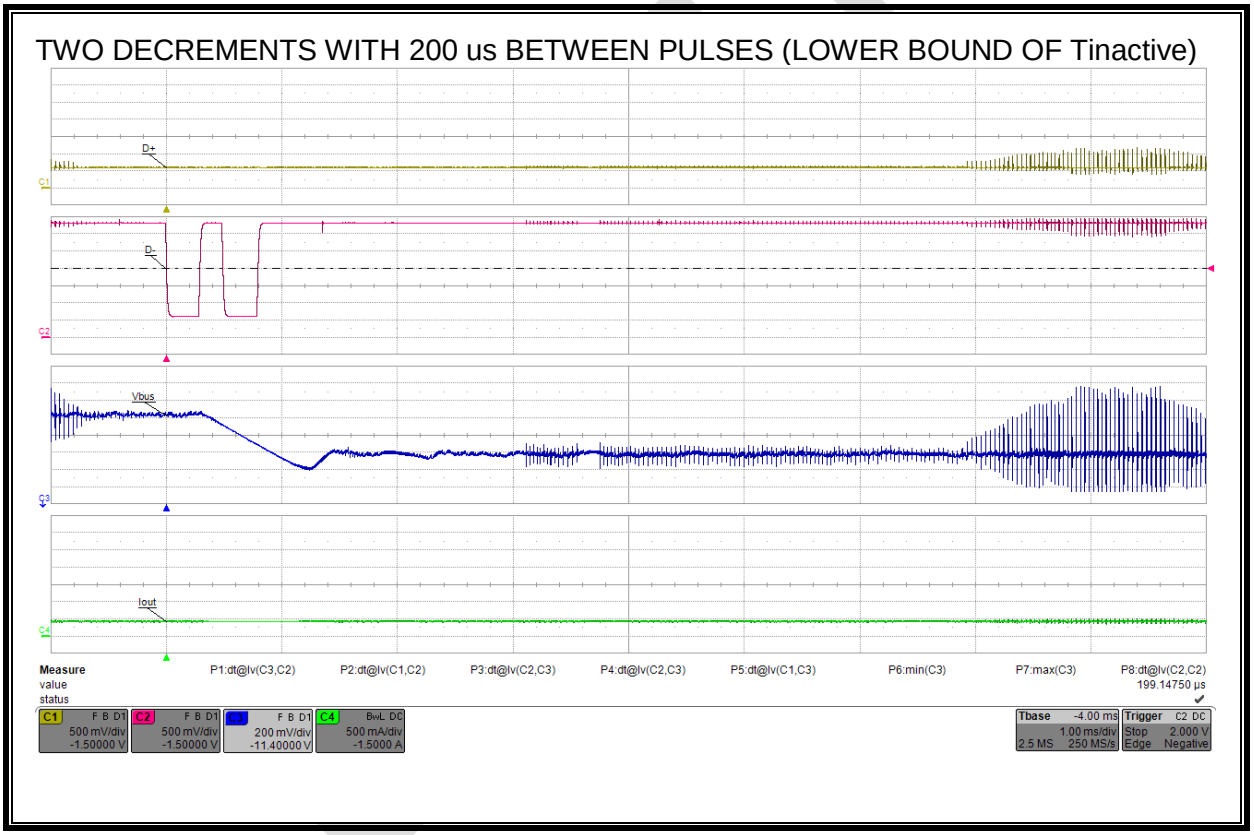


1.6.4. Lower Bound of D- Tinactive

LIMITS AND RESULTS

D+ / D- Command	Observation of Vbus	Pass/Fail
Two Decrement Pulses with minimum Tinactive timing	Vbus Decrements Twice	PASS

DECREMENT WAVEFORM



1.6.5. Tv_cont_change & Vbus_cont_step at Upper Bound of D+ Tglitch_cont_change

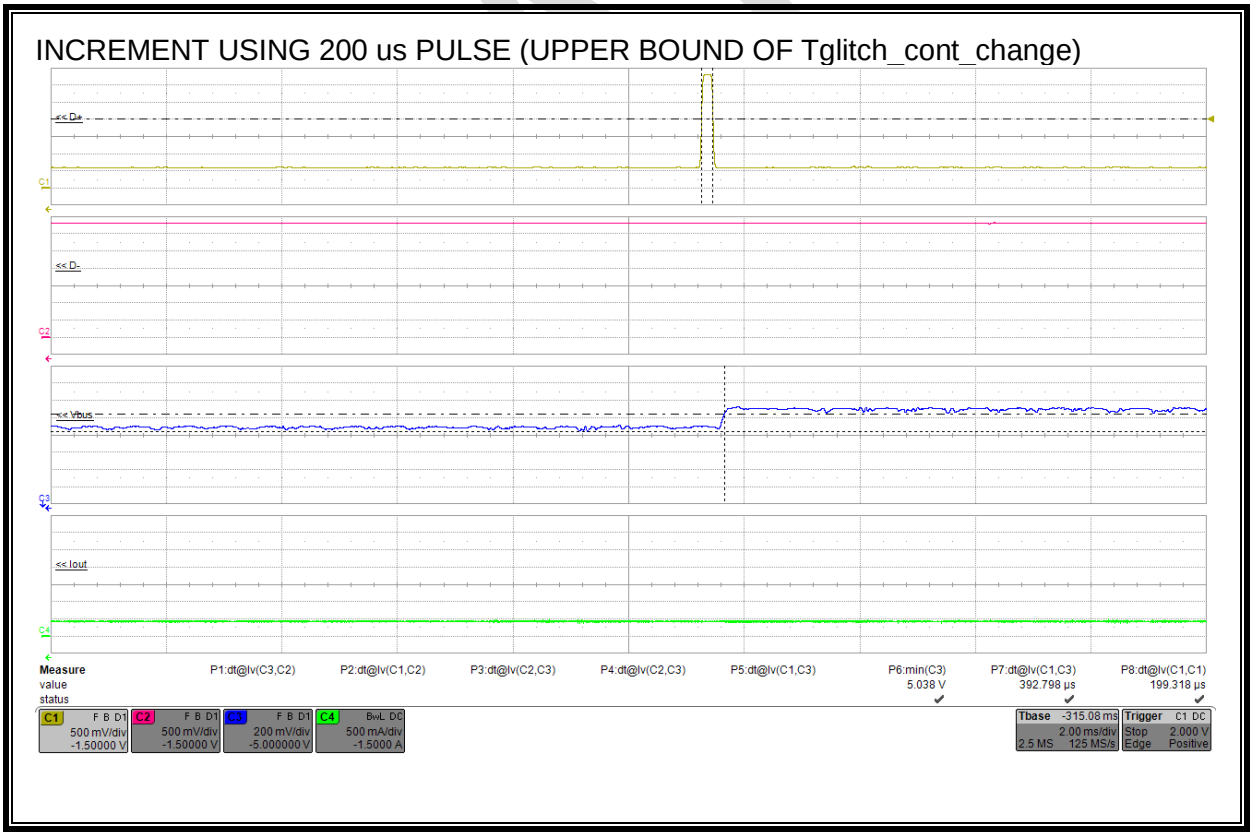
Tv_cont_change LIMITS AND RESULTS

Vbus Transition	Time from leading edge of request to completion of Vbus transition (ms)	Maximum Limit (ms)	Pass/Fail
5.0 V to 5.2 V	0.39	30.0	PASS

Vbus_cont_step LIMITS AND RESULTS

Vbus Transition	Starting Voltage (V)	Ending Voltage (V)	Delta Voltage (V)	Minumum Delta (V)	Maximum Delta (V)	Pass/Fail
5.0 V to 5.2 V	5.093	5.303	0.210	0.150	0.250	PASS

INCREMENT WAVEFORM

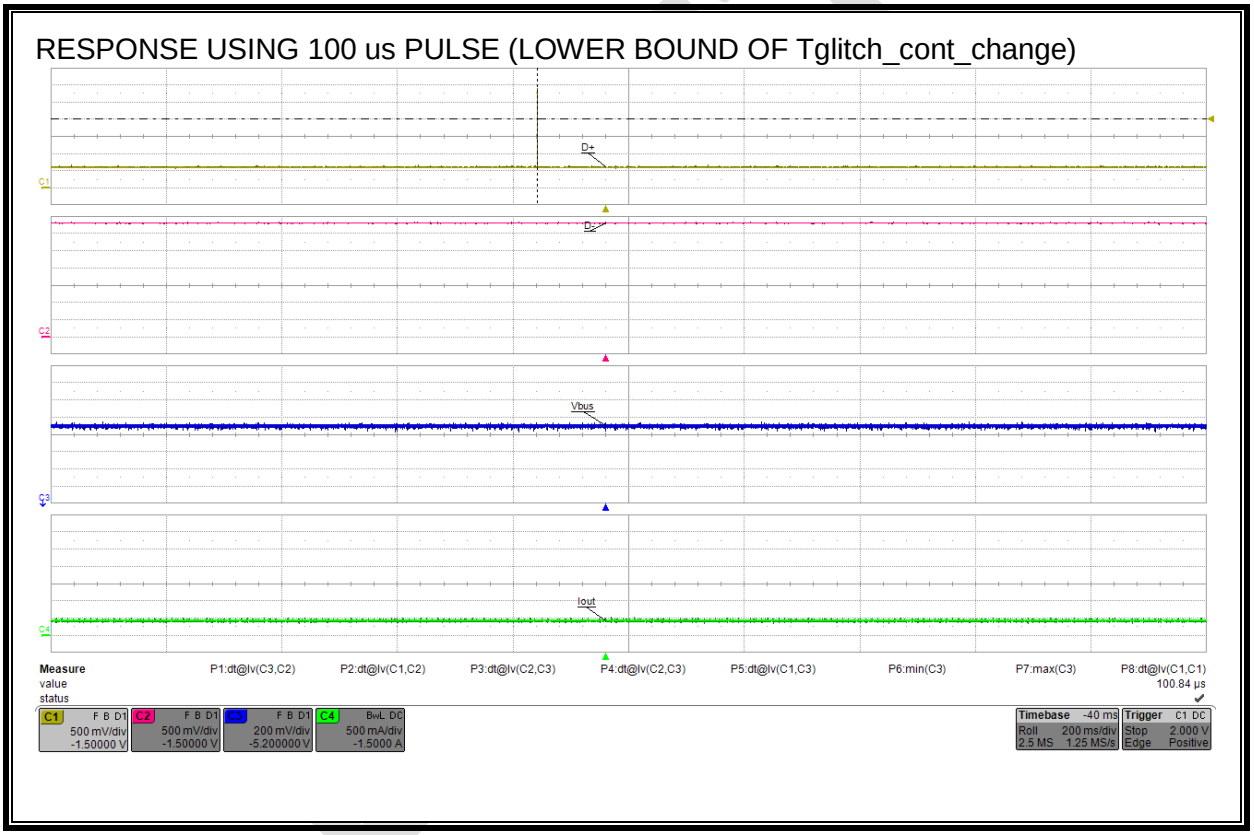


1.6.6. Lower Bound of D+ Tglitch_cont_change

LIMITS AND RESULTS

D+ / D- Command	Observation of Vbus	Pass/Fail
Attempt to Increment using D+ Pulse Width < Minimum Tglitch_cont_change	Vbus does not Change	PASS

WAVEFORMS

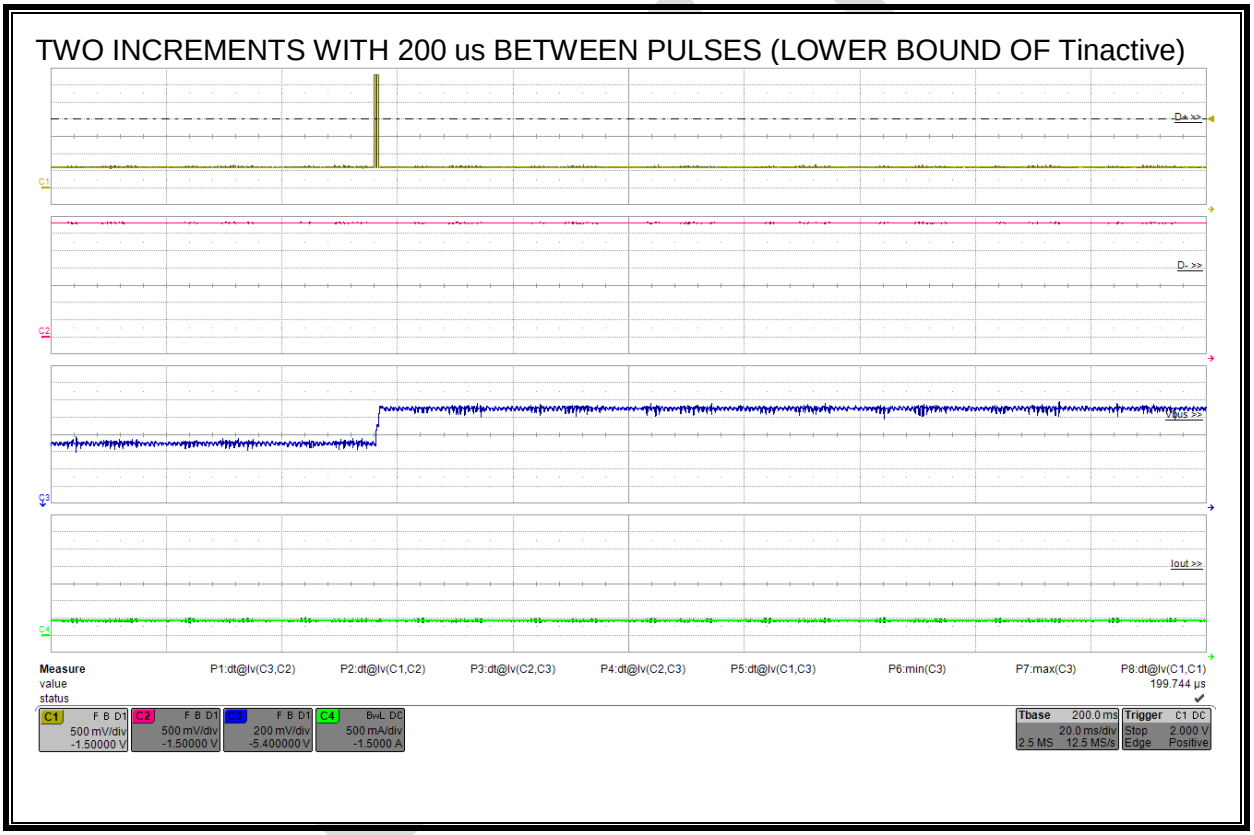


1.6.7. Lower Bound of D+ Tinactive

LIMITS AND RESULTS

D+ / D- Command	Observation of Vbus	Pass/Fail
Two Increment Pulses with minimum Tinactive timing	Vbus Increments Twice	PASS

INCREMENT WAVEFORM



1.6.8. Cumulative Tolerance of Vbus_cont_step

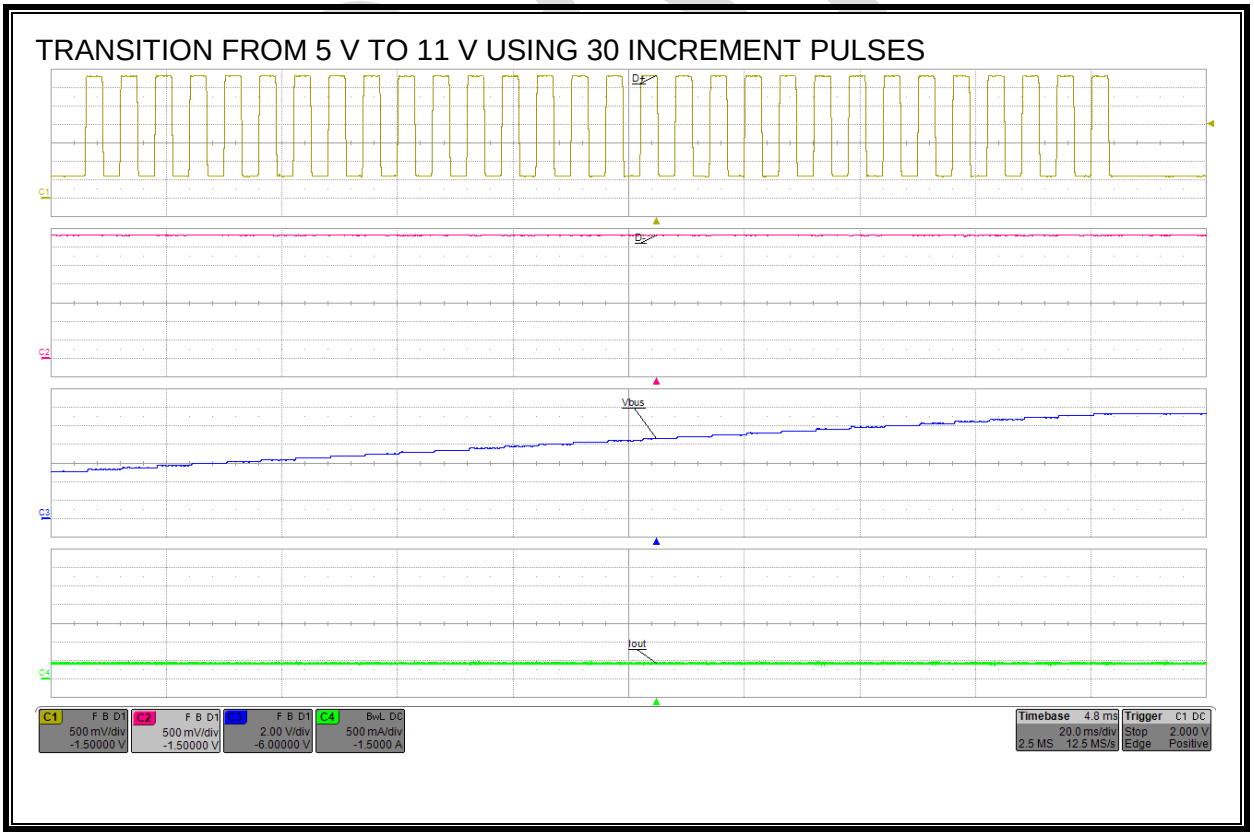
CUMULATIVE Vbus,cont,step LIMITS AND RESULTS

Requirement: Max. Tv_cont_change (30 ms) between the rising/falling edge of last pulse and the stable Vbus

Vbus Transition	Starting Voltage (V)	Ending Voltage (V)	Delta Voltage (V)	Minumum Delta (V)	Maximum Delta (V)	Pass/Fail
5 V to 11 V	5.09	11.28	6.19	4.50	7.50	PASS
11 V to 10 V	11.28	10.24	1.04	0.75	1.25	PASS

Vbus Transition	Observation of Vbus	Pass/Fail
5 V to 11 V	Vbus does not decrement during the process	PASS
11 V to 10 V	Vbus does not increment during the process	PASS

INCREMENT WAVEFORM



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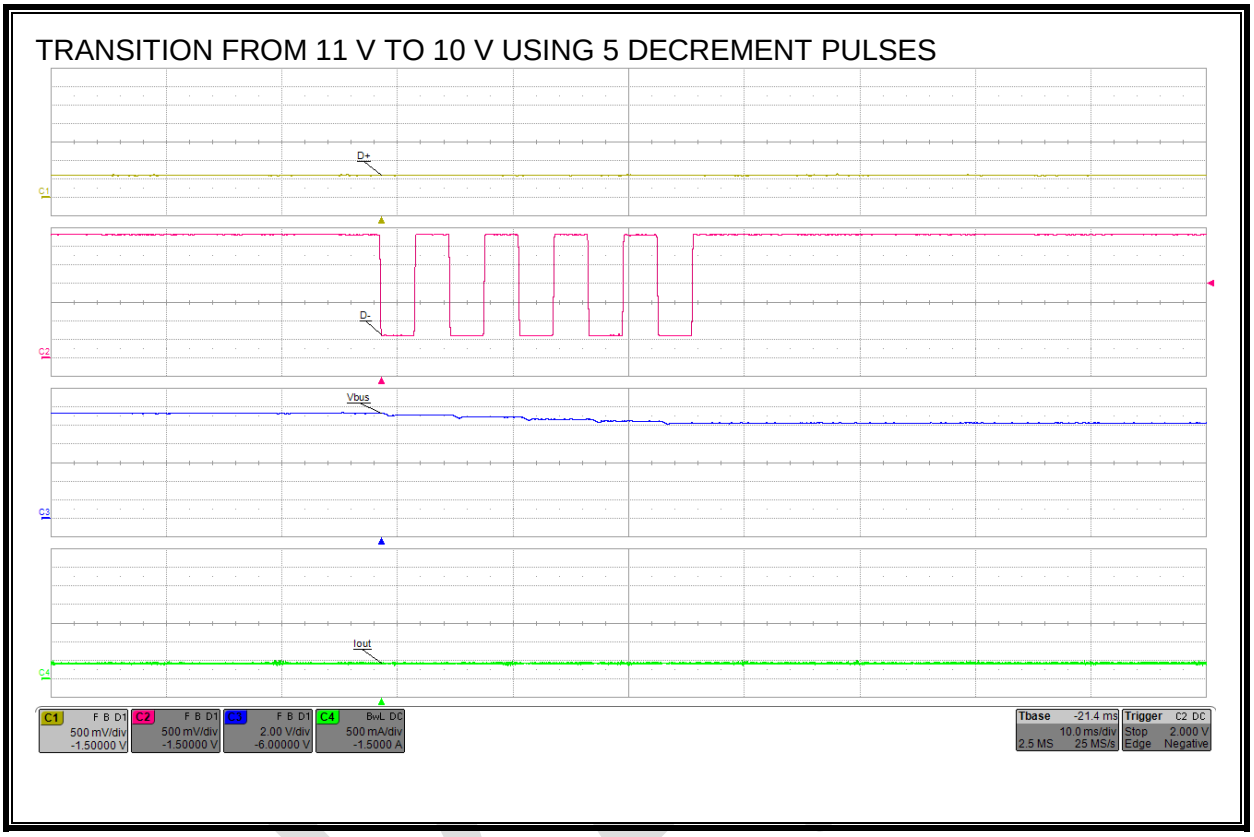
DECREMENT WAVEFORM



1.7. Transition from Continuous Mode to Fixed Mode

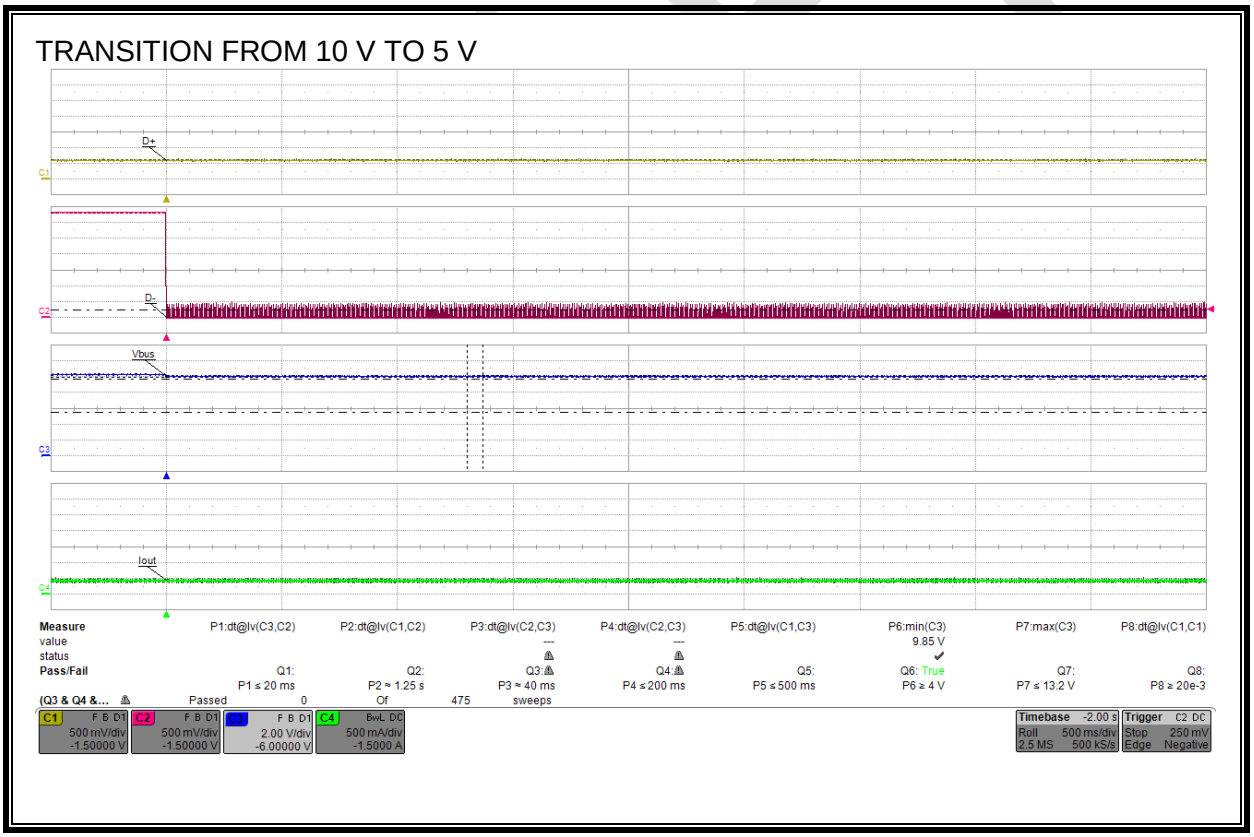
1.7.1. Transition from 10 V to 5 V

LIMITS AND RESULTS

Parameter	Start of Timing	End of Timing	Meas Value (ms)	Min Limit (ms)	Max Limit (ms)	Pass/Fail
Tglitch_mode_change	D- <= 0.25 V (Min Vdat_ref)	Vbus <= 9.6 V (Min Vbus_hv)		20	60	FAIL
Tv_new_request	D- <= 0.25 V (Min Vdat_ref)	Vbus <= 5.5 V (Max Vbus_5v)			200	FAIL

注：float D-后 vbus 不变，7.7.2、7.7.3 在此步骤上进行的测试均无法进行。

WAVEFORM AND MEASUREMENTS



1.7.2. Transition from 5 V to 12 V

LIMITS AND RESULTS

Parameter	Start of Timing	End of Timing	Meas Value (ms)	Min Limit (ms)	Max Limit (ms)	Pass/Fail
Tglitch_mode_change	D- >= 0.4 V (Max Vdat_ref)	Vbus >= 5.5 V (Max Vbus_5v)		20	60	FAIL
Tv_new_request	D- >= 0.4 V (Max Vdat_ref)	Vbus >= 11.4 V (Min Vbus_hv)			200	FAIL

WAVEFORM AND MEASUREMENTS

TRANSITION FROM 5 V TO 12 V

1.7.3. Transition from 12 V to 9 V

LIMITS AND RESULTS

Parameter	Start of Timing	End of Timing	Meas Value (ms)	Min Limit (ms)	Max Limit (ms)	Pass/Fail
Tglitch_mode_change	D+ >= 2.2 V (Max Vsel_ref)	Vbus <= 11.4 V (Min Vbus_hv)		20	60	FAIL
Tv_new_request	D+ >= 2.2 V (Max Vsel_ref)	Vbus <= 9.9 V (Max Vbus_hv)			200	FAIL

WAVEFORM AND MEASUREMENTS

TRANSITION FROM 12 V TO 9 V

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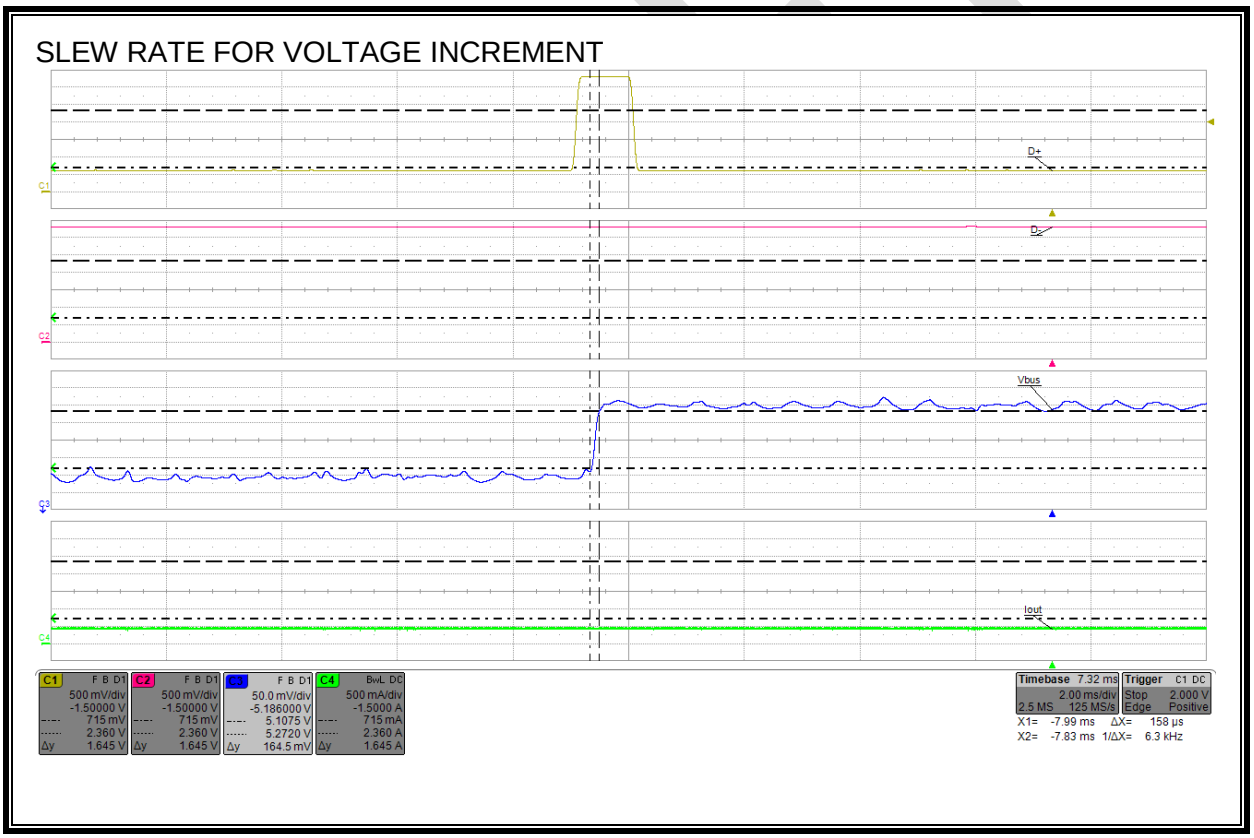
1.8. Operating Characteristics

1.8.1. Vslew_max

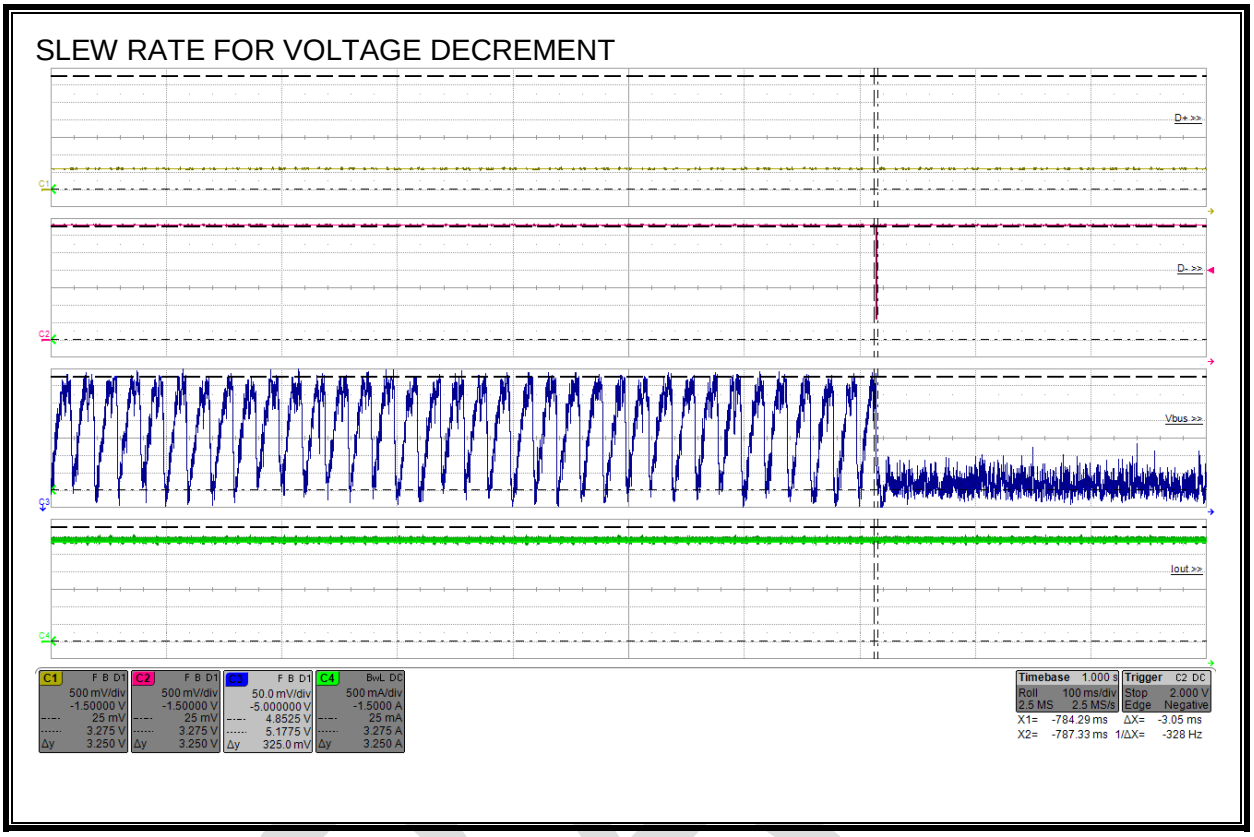
Vslew_max LIMITS AND RESULTS

Vbus Transition	Delta Voltage (mV)	Delta Time (usec)	Slew Rate (mV/usec)	Maximum Limit (mV/usec)	Pass/Fail
5.0 V to 5.2 V with 500 mA Load	164.500	158.000	1.041	30	PASS
5.2 V to 5.0 V with 3 A Load	352.000	3050.000	0.115	30	PASS

WAVEFORM FOR INCREMENTING SLEW RATE



WAVEFORM FOR DECREMENTING SLEW RATE



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1.8.2. Minimum Vbus_cont_range

Minimum Vbus_cont_range LIMITS AND RESULTS

Condition	Measured Value (V)	Minimum Limit (V)	Pass/Fail (Measured value must be <= Minimum Limit)
Current = 0.2 A	3.658	3.80	PASS
Current = Max Rated (3 A)	3.545		

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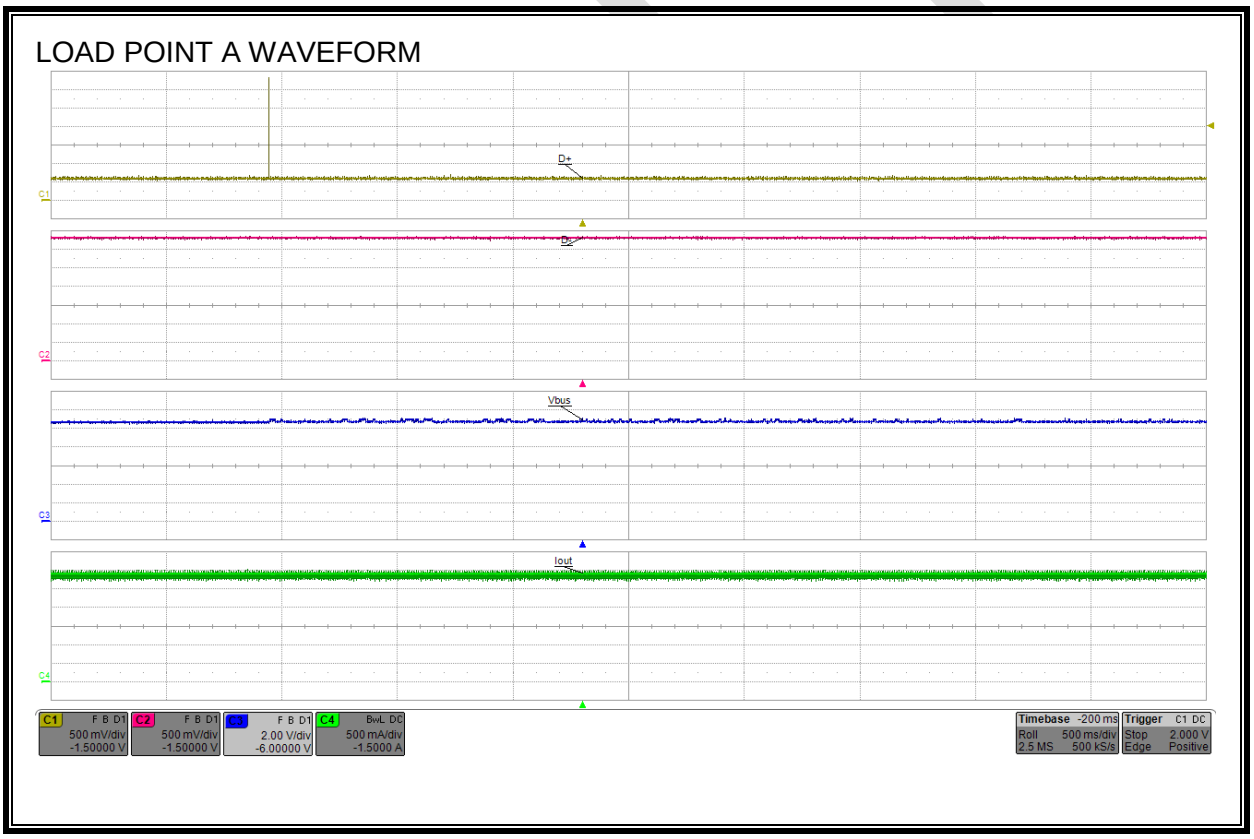
1.9. Power Profile

1.9.1. Load Point A & Minimum Pmax

LOAD POINT A LIMITS AND RESULTS

Measured Current (A)	Measured Load Point A Voltage Via Increment (V)	Minimum Voltage Limit (V)	Pass/Fail	Pmax (Watts)
3.00	10.068	6.00	PASS	30.20

VBUS REACHES LOAD POINT A



UL Verification Services (Guangzhou) Co., Ltd., Song Shan Lake Branch Form No.: CCSUP4701J
Building 10, Innovation Technology Park, No. 1, Li Bin Road, Song Shan Lake Tel: +86.769.22038881
Hi-Tech Development Zone, Dongguan, People's Republic of China

2. SETUP PHOTO

MEASUREMENT SETUP

END OF REPORT

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