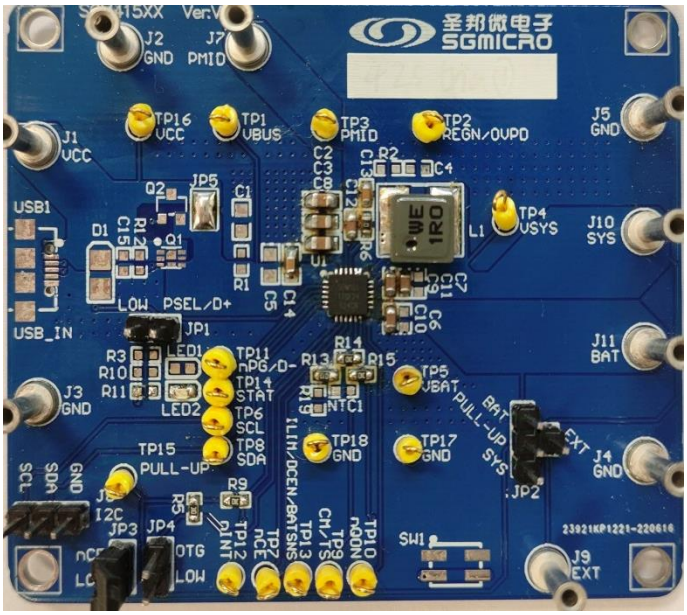
SGM41542S Demo Board Test Report

High Input Voltage, 5A Single-Cell Battery Charger

with NVDC Power Path Management

Demo Board Pictures:

Top



Bottom

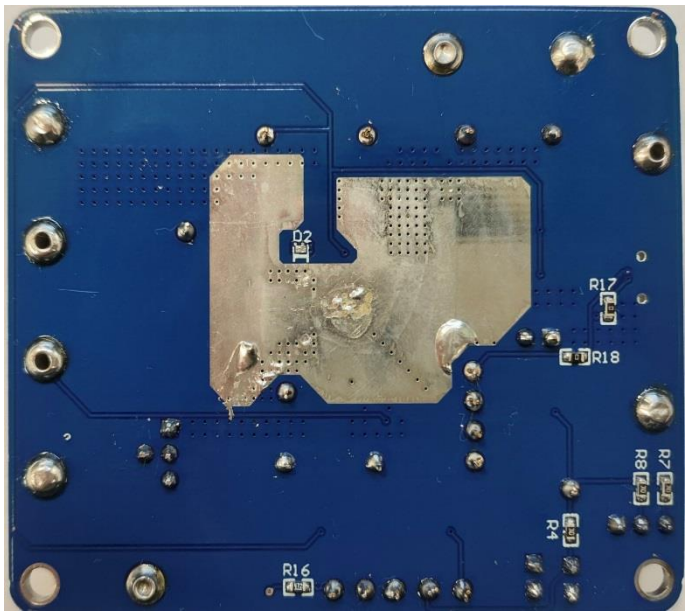


Table of Contents

1. Demo Board User's Guide

1.1 Test Setup for Charge Mode

1.1.1 Equipment and Jumper Cap Connection

A. J1&J3: connecting VCC/GND to input power supply.

B. J11&J4: connecting BAT/GND to DC power source and E-Load as emulated battery.

C. J10&J5: connecting SYS/GND to another E-Load as emulated system load.

D. JP3: connecting nCE to LOW.

E. J8: connecting SCL/SDA/GND to USB dongle.

1.1.2 Register Setup

A. After hardware setup done as shown in 1.1.1, connect the USB dongle to PC, then open the SGM USB GUI interface as Fig-1, choose the "SGM41516S_42S" and click "Entry" button to entry the GUI interface.

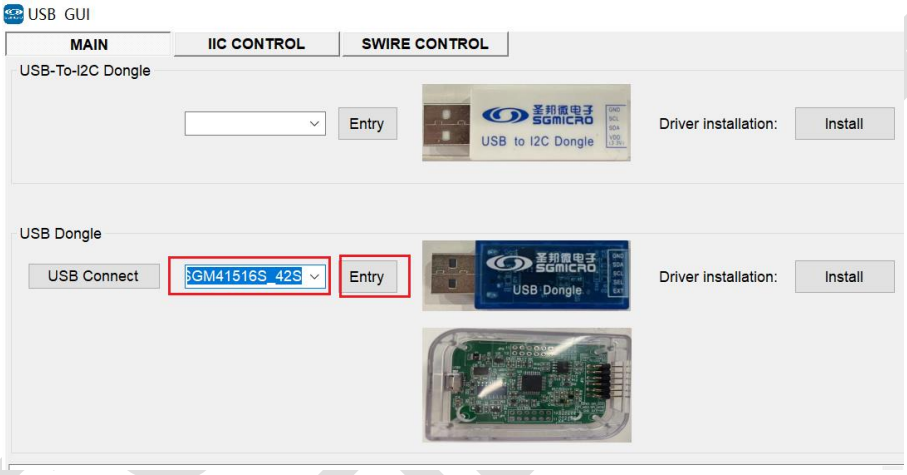


Fig-1: SGM USB GUI Interface

B. After entering the SGM41542S GUI interface as shown in Fig-2, choose the COM port and click the "Open Serial" button, then the bottom left corner of the page will display "Serial port opened" firstly. Next, choose the slave address "0x6B" and click the "Read All" button, if "Device Read OK!" is displayed, it means the I2C communication is normal.

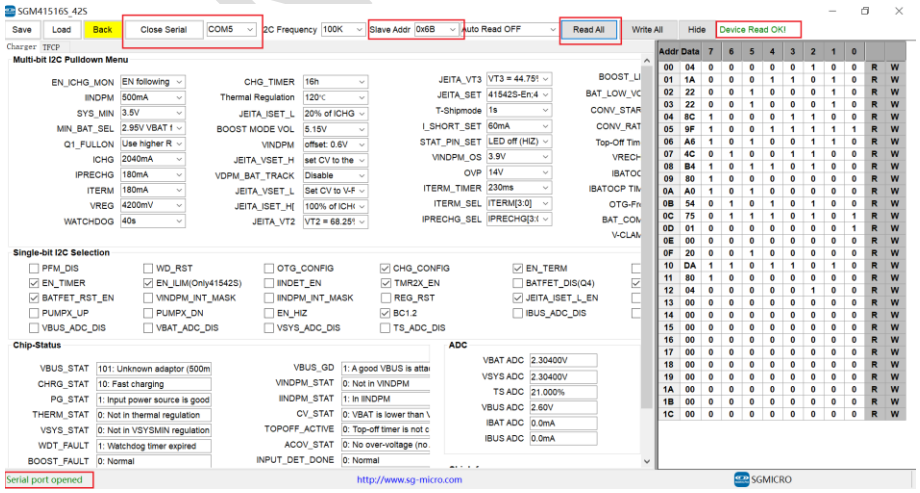


Fig-2: SGM41542S GUI Interface

1.2 Test Setup for OTG Mode

1.2.1 Equipment and Jumper Cap Connection

A. J1&J3: connecting VCC/GND to E-Load.

B. J11&J4: connecting BAT/GND to DC power supply.

C. JP2: connecting PULL-UP to BAT or SYS or EXT to pull up OTG pin.

D. J8: connecting SCL/SDA/GND to USB dongle.

1.2.2 Register Setup

As shown in 1.1.2, users can enter SGM41542S GUI interface and check the communication is normal or not. Click OTG_CONFIG as shown in Fig-3, then the device will enter OTG mode.

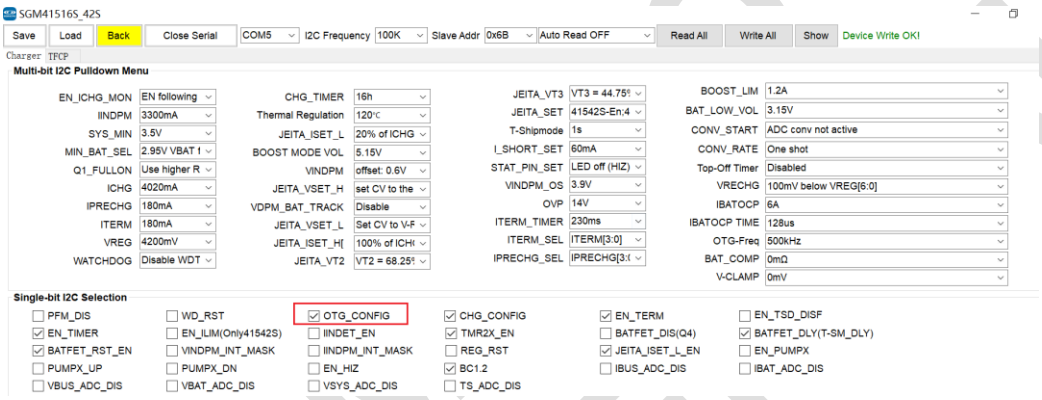
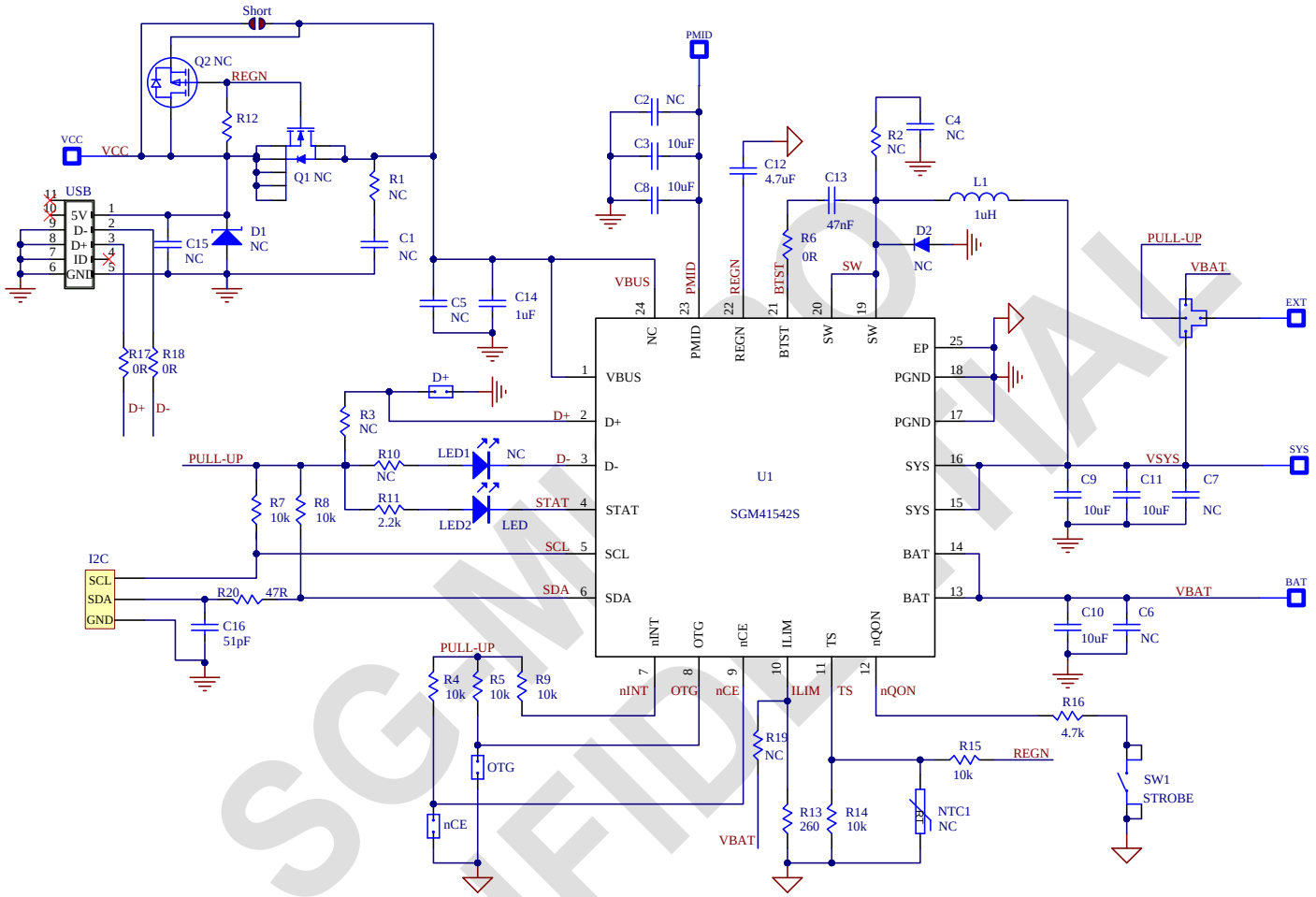


Fig-3: SGM41542S GUI Interface

1.3 Schematic, BOM List and PCB Layout

1.3.1 Schematic



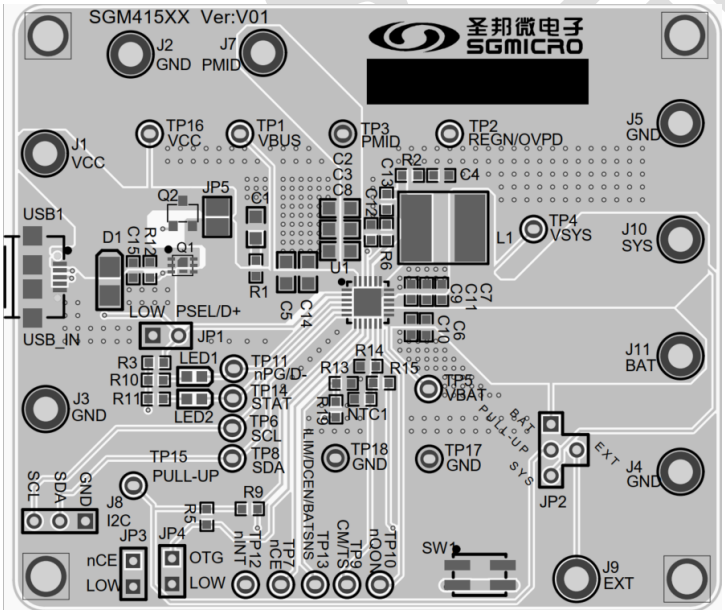
1.3.2 BOM List

Item	Designator	Quantity	Description	Manufactory
1	C1,C2,C4,C5 ,C6,C7,C15	0	NC	
2	C3,C8	2	Ceramic capacitor,10uF,25V,±10%,X5R,0805	SAMSUNG CL21A106KAYNNNE
3	C9,C10,C11	3	Ceramic capacitor,10uF,25V,±20%,X5R,0603	Murata GRM188R61E106MA73L
4	C12	1	Ceramic capacitor,4.7uF,25V,±10%,X5R,0603	Murata GRM188R61E475KE11D
5	C13	1	Ceramic capacitor,47nF,50V,±10%,X7R,0603	FH 0603B473K500NT
6	C14	1	Ceramic capacitor,1uF,25V,±10%,X5R,0603	Murata GRM188R61E105KAADD
7	C16	1	Ceramic capacitor,51pF,50V, ±5%,C0G,0603	Murata

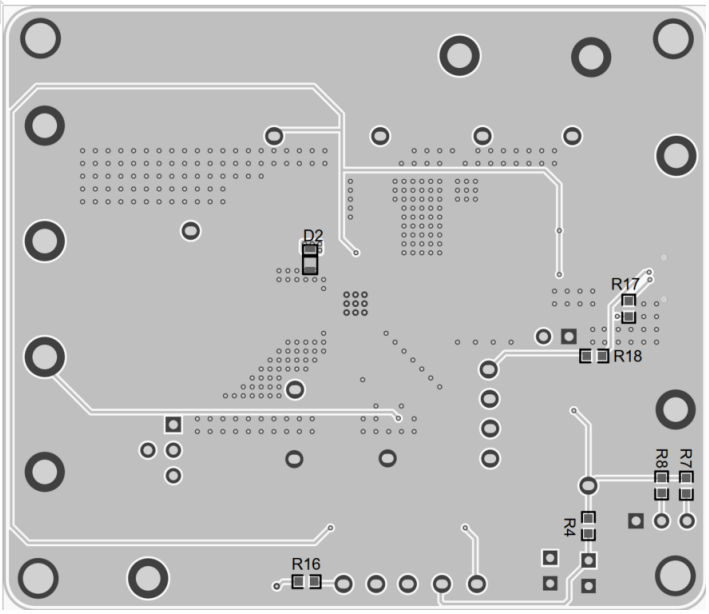
				GRM1885C1H510JA01D
8	D1,D2	0	NC	
9	L1	1	Inductor,1.0μH,±10%,Irms=12A,Isat=25A,DCR=5.5mΩ	WURTH 74439344010
10	LED1	0	NC	
11	LED2	1	Blue LED,0603	
12	NTC1	0	NC	
13	Q1,Q2	0	NC	
14	R1,R2,R3,R10,R12,R19	0	NC	
15	R4,R5,R7,R8,R9,R14,R15	7	Film resistor,10kΩ,0.1W,1%,0603	
16	R11	1	Film resistor,2.2kΩ,0.1W,1%,0603	
17	R13	1	Film resistor,260Ω,0.1W,1%,0603	
18	R16	1	Film resistor,4.7kΩ,0.1W,1%,0603	
19	R6,R17,R18	3	Film resistor,0Ω,0.1W,1%,0603	
20	R20	1	Film resistor,47Ω,0.1W,1%,0603	
21	SW1	1	Tact Switch	
22	U1	1	5A Single-Cell Battery Charger with Power Path Management	SGMicro SGM41542S
Conclusion: Total 27 components.				

1.3.3 PCB Layout

Top-Side Layout



Bottom-Side Layout



2. Demo Board Test Items

2.1 Leakage Current in Ship Mode

Test conditions: V_{BUS}=5V/9V/12V, no battery, ship mode, HIZ mode, measure the input supply current in BUCK mode.

V_{BUS}(V)	I_{BUS}(uA)
5	9.882
9	18.673
12	26.856

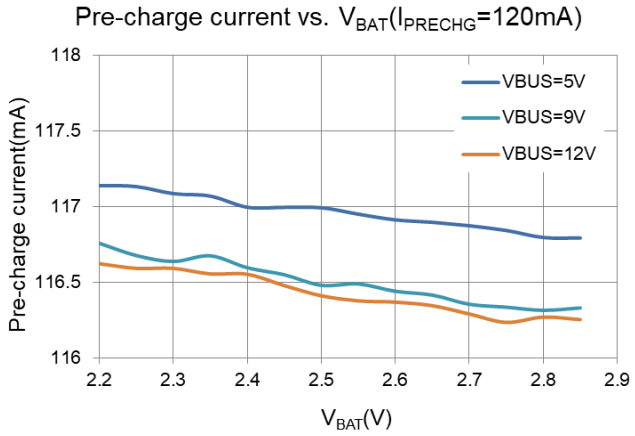
2.2 Leakage Current after Charge Termination

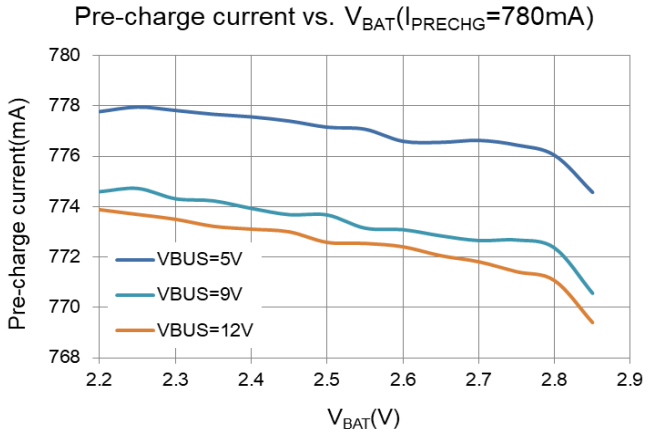
Test conditions: V_{BUS}=12V, charge termination, measure the battery current at different regulation voltage.

V_{BAT}(V)	I_{BAT}(uA)
4.0	16.293
4.2	16.781
4.4	17.233
4.6	17.776

2.3 Pre-charge Current

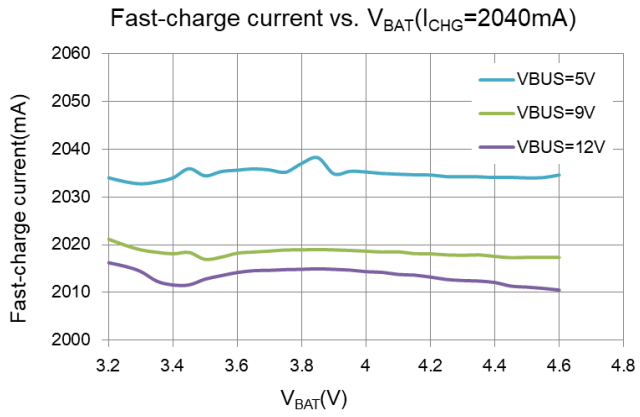
Test conditions: V_{BUS}=5V/9V/12V, V_{BAT}=2.2V~2.85V, I_{PRECHG_SET}=120mA/780mA, IINDPM=3.3A, EN_ILIM=0, charge enable, measure the charge current at different battery voltage.

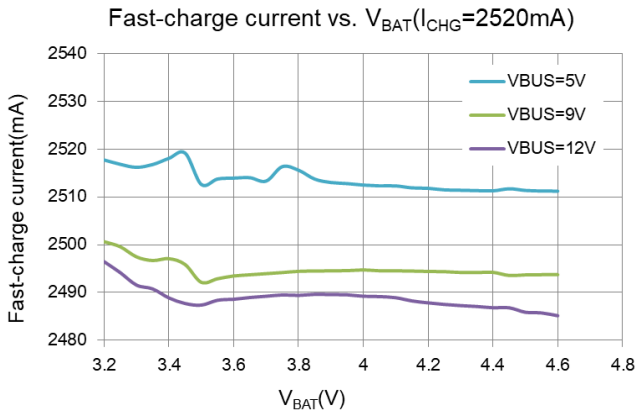




2.4 Fast Charge Current

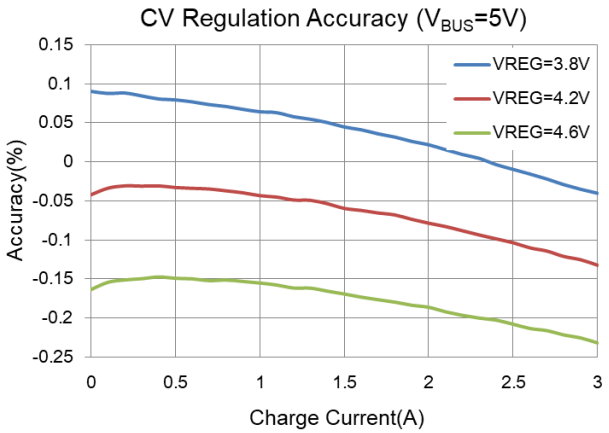
Test conditions: V_{BUS}=5V/9V/12V, V_{BAT}=3.2V~4.6V, I_{CHG_SET}=2040mA/2520mA, IINDPM=3.3A, EN_ILIM=0, VREG=4.77V, measure the charge current at different battery voltage.

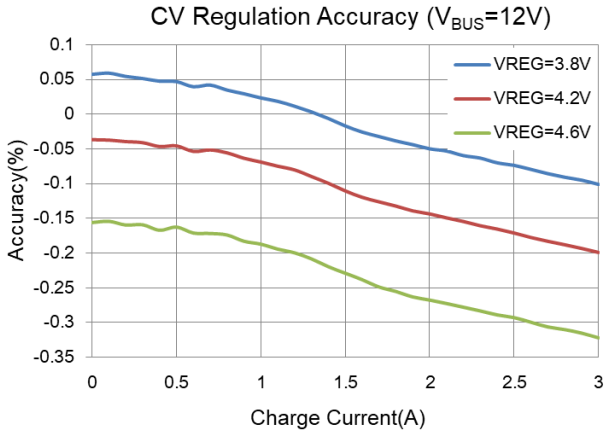




2.5 Constant Charge Voltage Accuracy

Test conditions: V_{BUS}=5V/9V/12V, VREG=3.8V/4.2V/4.6V, I_{CHG_SET}=5040mA, IINDPM=3.3A, EN_ILIM=0, EN_TERM=0, charge enable, increase I_{BAT} by E-Load and measure V_{BAT} at different charge current.





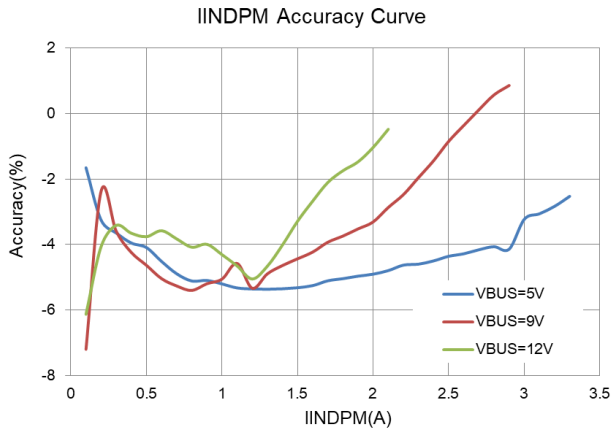
2.6 Termination Current Accuracy

Test conditions: V_{BUS}=5V/12V, VREG=4.2V, I_{CHG_SET}=2040mA, I_{TERM_SET}=180mA/960mA, charge enable, adjust V_{BAT} to check termination current.

V_{BUS}=5V			
I_{CHG_SET}(mA)	I_{TERM_SET}(mA)	180	960
2040	I_{TERM}(mA)	178.131	958.161
	ACC.(%)	-1.03	-0.2
V_{BUS}=12V			
I_{CHG_SET}(mA)	I_{TERM_SET}(mA)	180	960
2040	I_{TERM}(mA)	176.344	939.3
	ACC.(%)	-2.03	-2.15

2.7 IINDPM

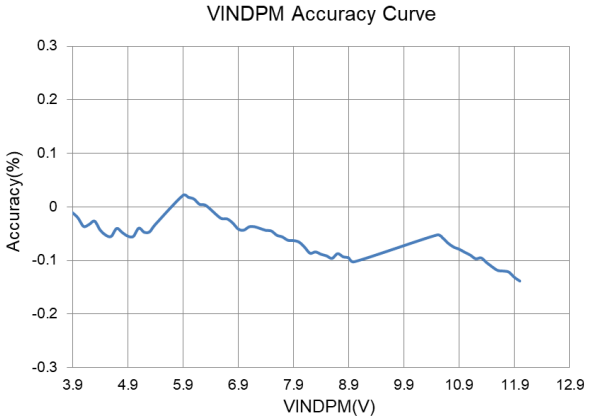
Test conditions: V_{BUS}=5V/9V/12V, V_{BAT}=3.8V, V_{SYS_MIN}=3.5V, charge disable, EN_ILIM=0, increase I_{SYS} and measure I_{BUS} to check IINDPM accuracy at different IINDPM bits setting.



Note: IINDPM accuracy of the device is trimmed as -5% of the value corresponded to register bits in the factory. The curve above illustrates the error between the measured value and the value corresponded to register bits.

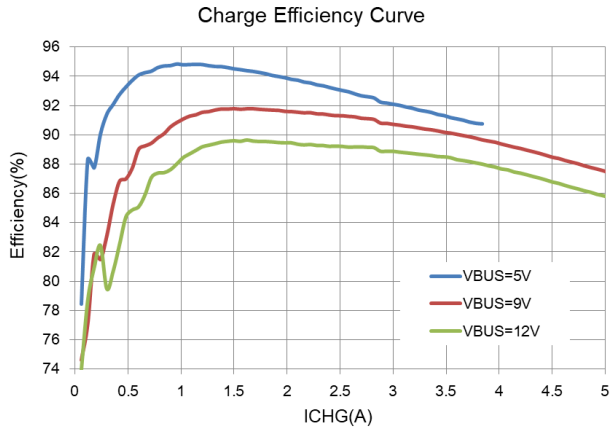
2.8 VINDPM

Test conditions: V_{BUS}=13V/0.5A, V_{BAT}=3.8V, I_{CHG_SET}=2040mA, IINDPM=3.3A, EN_ILIM=0, charge enable, measure V_{BUS} at different VINDPM setting.



2.9 Efficiency

Test conditions: V_{BUS}=5V/9V/12V, V_{BAT}=3.8V, IINDPM=3.3A, EN_ILIM=0, charge enable, check charge efficiency.



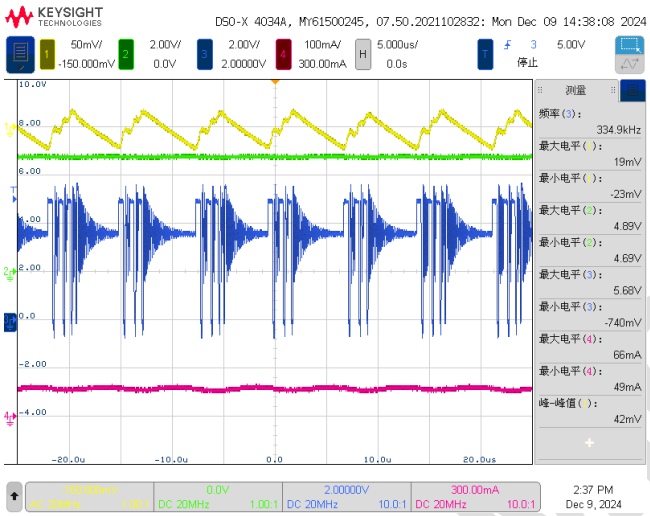
2.10 Steady State Operation

2.10.1 Charge Mode

A. Trickle charge

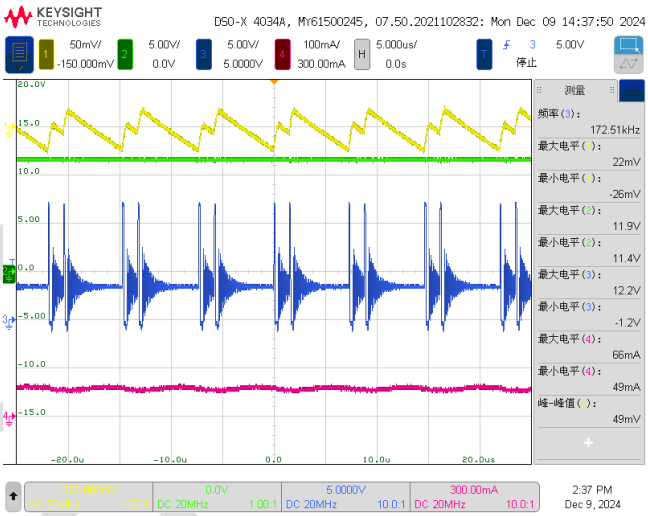
Test conditions: V_{BUS}=5V/12V, V_{BAT}=0V, I_{TRICHG_SET}=60mA, charge enable.

V_{BUS}=5V



CH1-$V_{SYS/ac}$, CH2-V_{BUS}, CH3-V_{SW}, CH4-I_{CHG}

V_{BUS}=12V

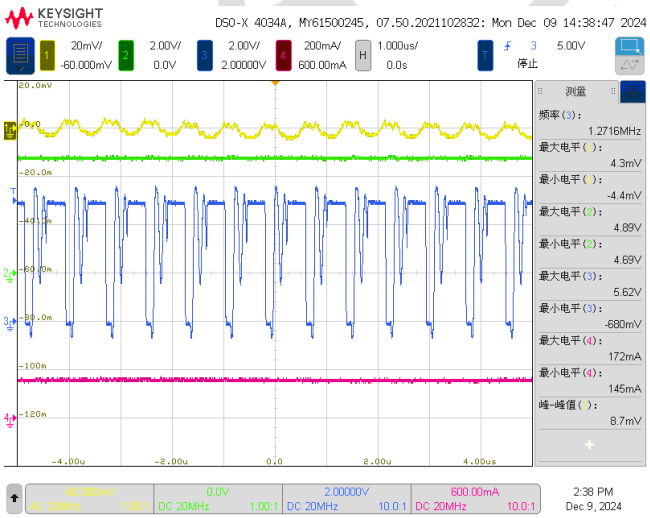


CH1-$V_{SYS/ac}$, CH2-V_{BUS}, CH3-V_{SW}, CH4-I_{CHG}

B. Pre-charge

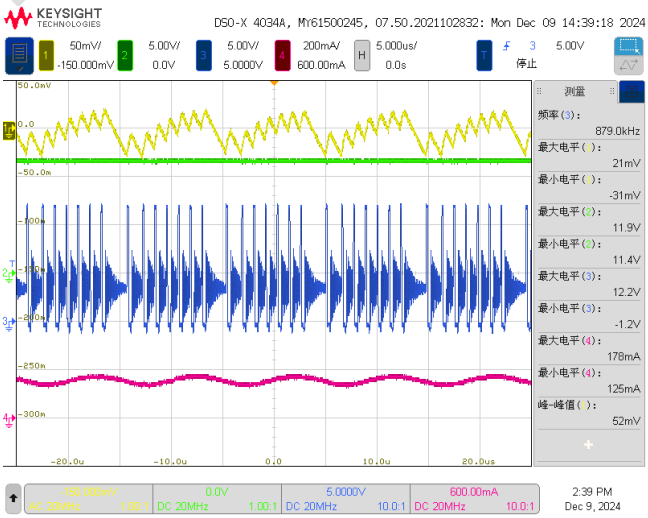
Test conditions: V_{BUS}=5V/12V, V_{BAT}=2.3V, I_{PRECHG_SET}=180mA, charge enable.

V_{BUS}=5V



CH1-$V_{SYS/ac}$, CH2-V_{BUS}, CH3-V_{SW}, CH4-I_{CHG}

V_{BUS}=12V

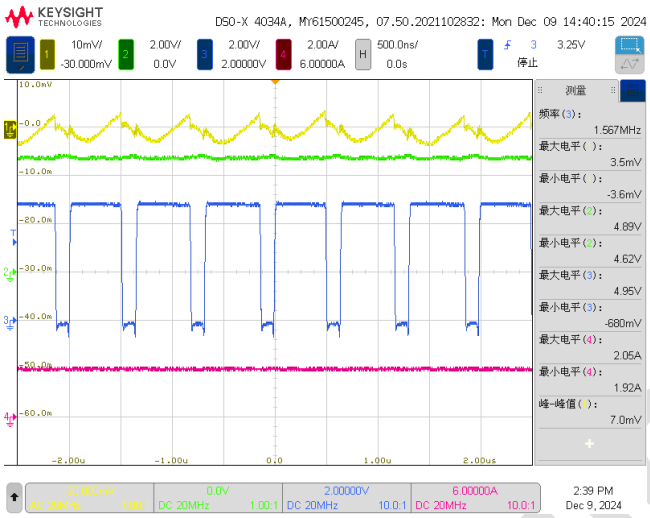


CH1-$V_{SYS/ac}$, CH2-V_{BUS}, CH3-V_{SW}, CH4-I_{CHG}

C. Fast charge

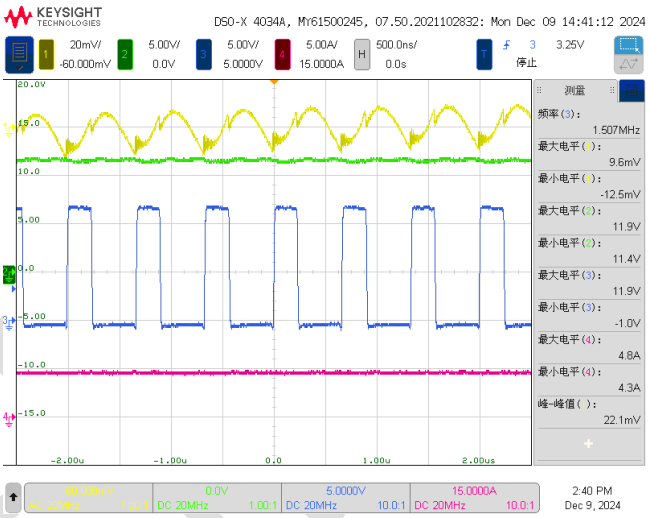
Test conditions: V_{BUS}=5V/12V, V_{BAT}=3.8V, I_{CHG_SET}=2040/5040mA, IINDPM=3.3A, EN_ILIM=0, charge enable.

V_{BUS}=5V, I_{CHG}=2040mA



CH1-$V_{SYS/ac}$, CH2-V_{BUS}, CH3-V_{SW}, CH4-I_{CHG}

V_{BUS}=12V, I_{CHG}=5040mA

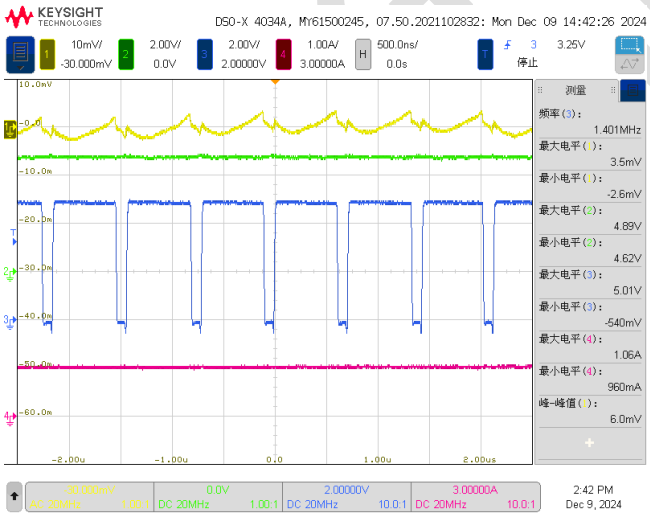


CH1-$V_{SYS/ac}$, CH2-V_{BUS}, CH3-V_{SW}, CH4-I_{CHG}

D. Constant voltage charge

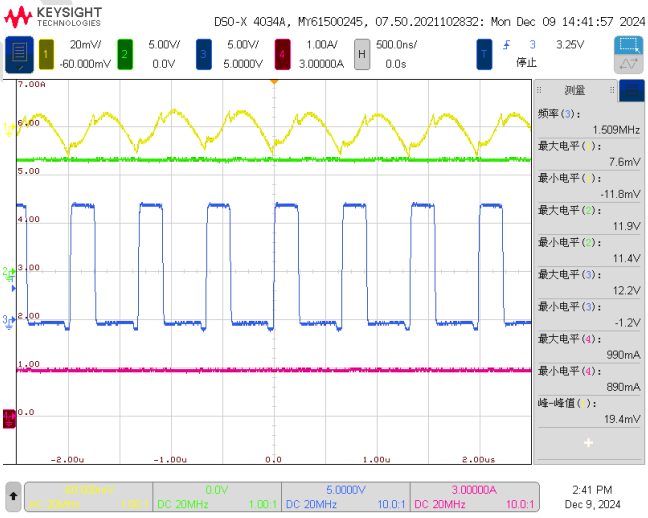
Test conditions: V_{BUS}=5V/12V, VREG=4.2V, IINDPM=3.3A, EN_ILIM=0, charge enable, constant voltage charge.

V_{BUS}=5V, I_{CHG}=1A



CH1-$V_{SYS/ac}$, CH2-V_{BUS}, CH3-V_{SW}, CH4-I_{CHG}

V_{BUS}=12V, I_{CHG}=1A

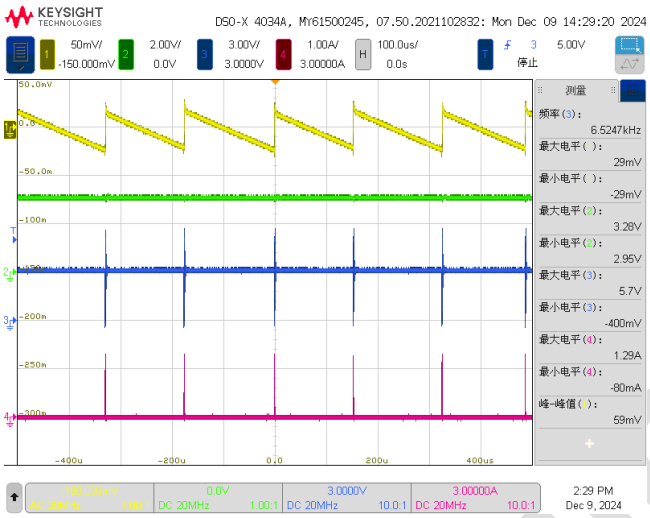


CH1-$V_{SYS/ac}$, CH2-V_{BUS}, CH3-V_{SW}, CH4-I_{CHG}

2.10.2 OTG Mode

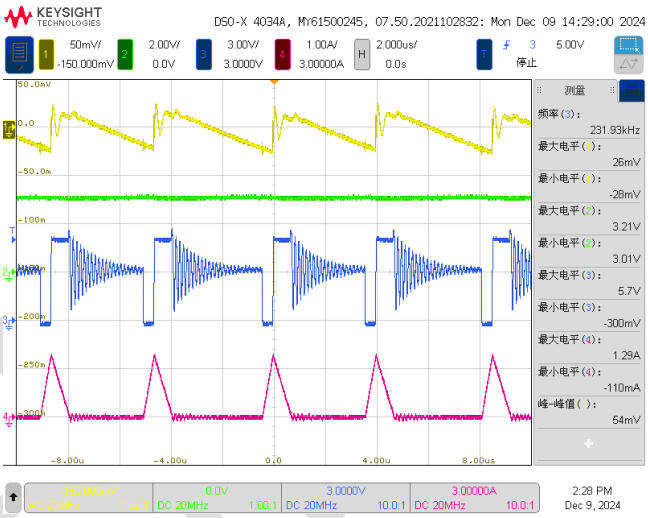
Test conditions: OTG mode, V_{BAT}=3.3V, V_{BUS_SET}=5.15V, BOOST_LIM=3.2A, IBATOCP=12A.

I_{BUS}=0A



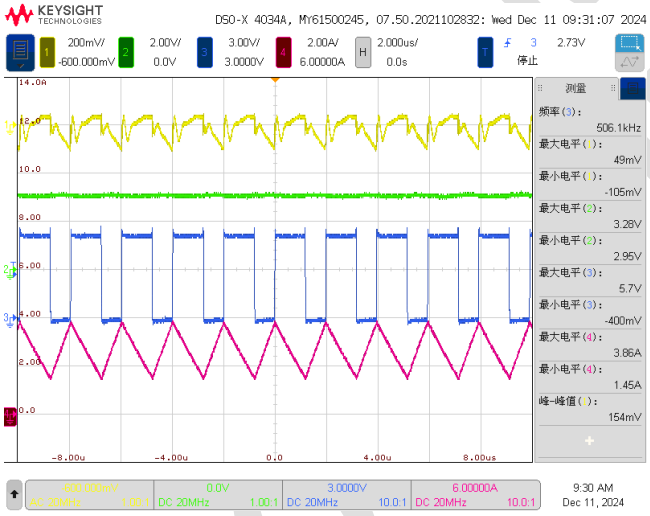
CH1-$V_{BUS/ac}$, CH2-V_{BAT}, CH3-V_{SW}, CH4-I_L

I_{BUS}=0.1A



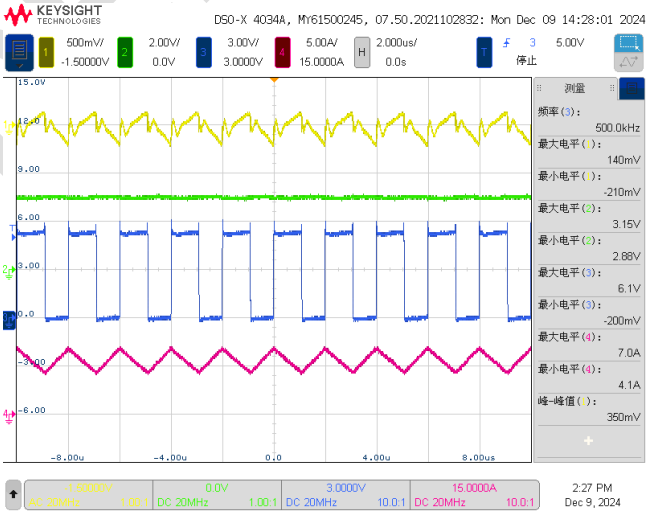
CH1-$V_{BUS/ac}$, CH2-V_{BAT}, CH3-V_{SW}, CH4-I_L

I_{BUS}=1.6A



CH1-$V_{BUS/ac}$, CH2-V_{BAT}, CH3-V_{SW}, CH4-I_L

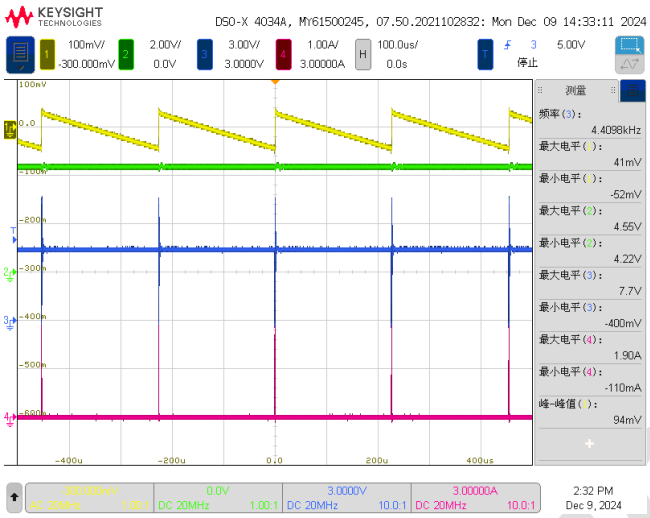
I_{BUS}=3.2A



CH1-$V_{BUS/ac}$, CH2-V_{BAT}, CH3-V_{SW}, CH4-I_L

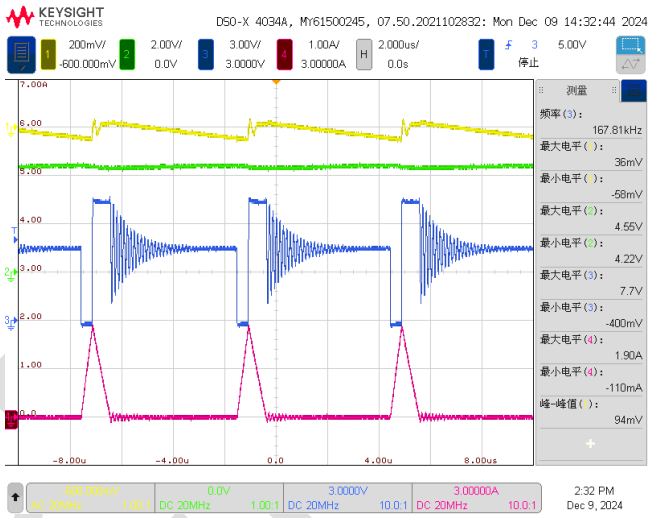
Test conditions: OTG mode, V_{BAT}=4.6V, V_{BUS_SET}=7.5V, BOOST_LIM=3.2A, IBATOCP=12A.

I_{BUS}=0A



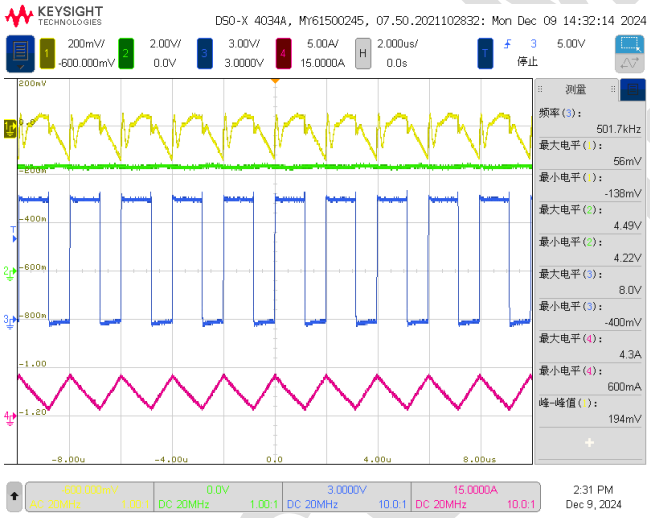
CH1-$V_{BUS/ac}$, CH2-V_{BAT}, CH3-V_{SW}, CH4-I_L

I_{BUS}=0.1A



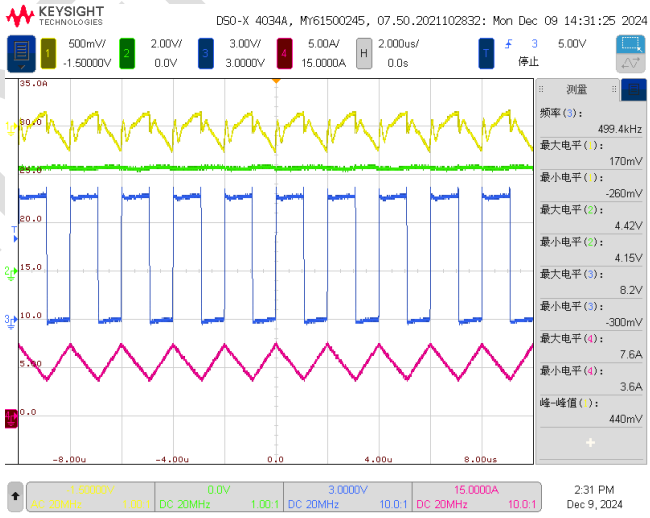
CH1-$V_{BUS/ac}$, CH2-V_{BAT}, CH3-V_{SW}, CH4-I_L

I_{BUS}=1.6A



CH1-$V_{BUS/ac}$, CH2-V_{BAT}, CH3-V_{SW}, CH4-I_L

I_{BUS}=3.2A

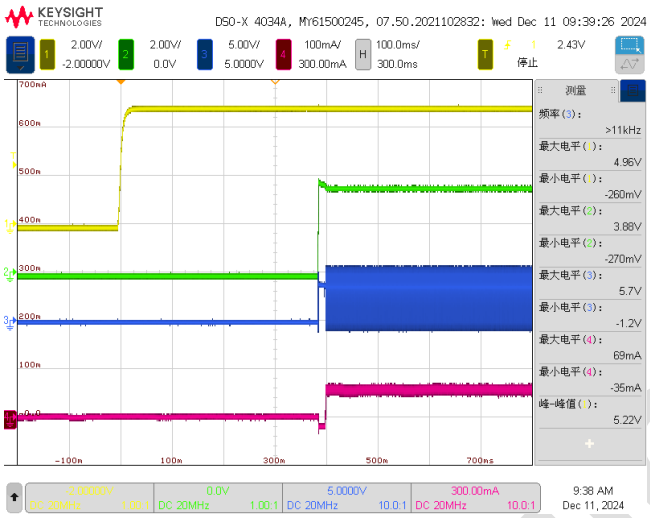


CH1-$V_{BUS/ac}$, CH2-V_{BAT}, CH3-V_{SW}, CH4-I_L

2.11 Charger Startup/Shutdown through VBUS

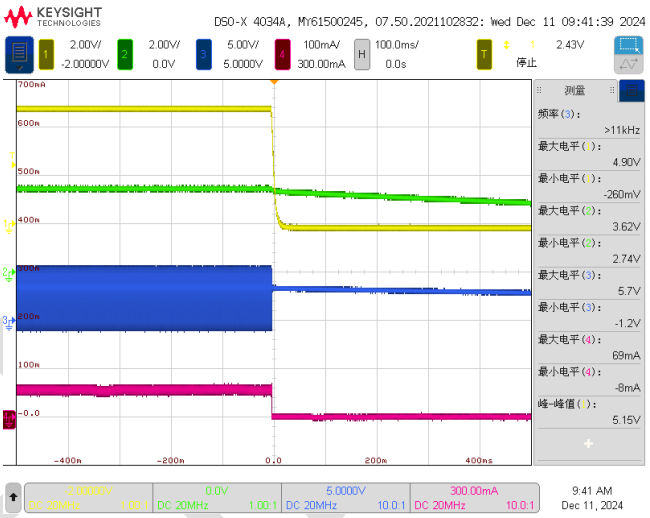
Test conditions: V_{BUS}=5V, registers default setting, DP and DM short, plug in/out adaptor at different battery voltage.

Plug in adaptor at V_{BAT}=1.5V



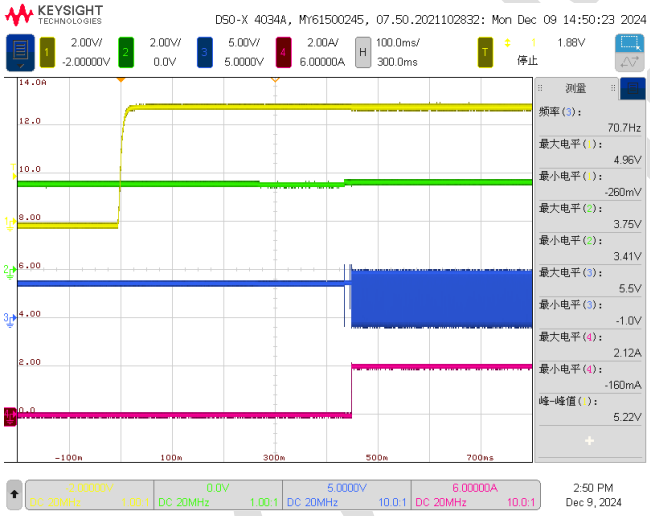
CH1-V_{BUS}, CH2-V_{SYS}, CH3-V_{SW}, CH4-I_{CHG}

Plug out adaptor at V_{BAT}=1.5V



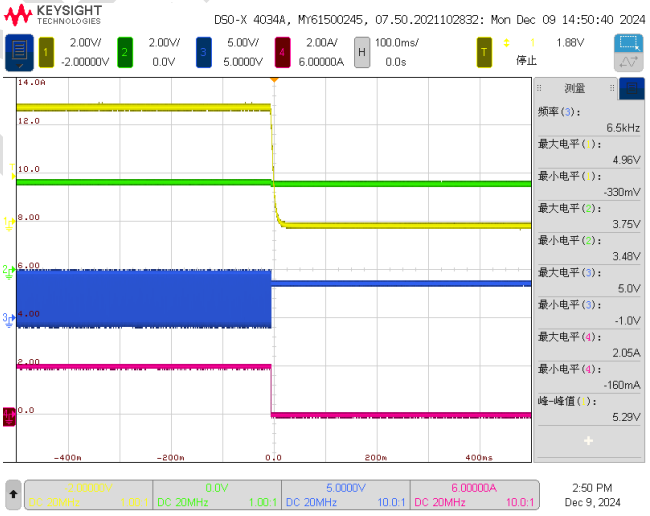
CH1-V_{BUS}, CH2-V_{SYS}, CH3-V_{SW}, CH4-I_{CHG}

Plug in adaptor at V_{BAT}=3.8V



CH1-V_{BUS}, CH2-V_{SYS}, CH3-V_{SW}, CH4-I_{CHG}

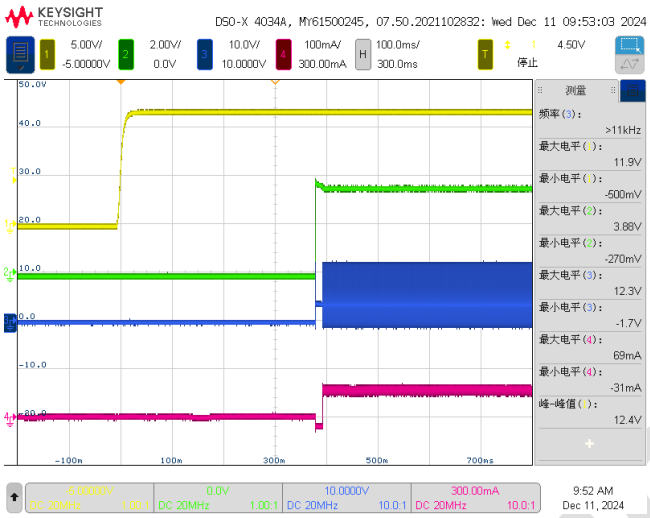
Plug out adaptor at V_{BAT}=3.8V



CH1-V_{BUS}, CH2-V_{SYS}, CH3-V_{SW}, CH4-I_{CHG}

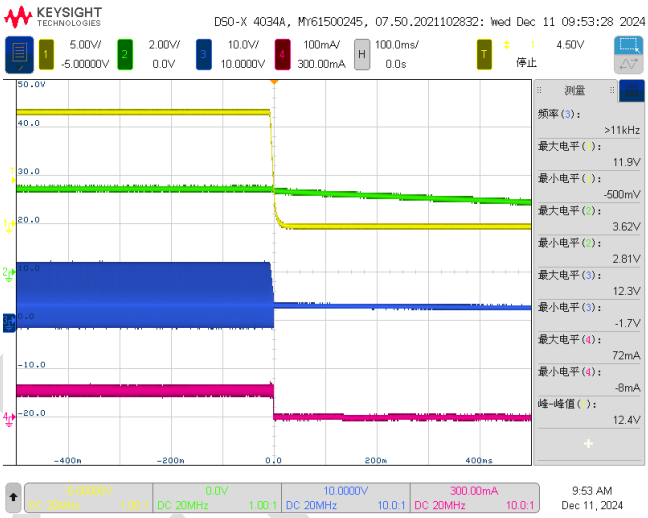
Test conditions: V_{BUS}=12V, registers default setting, DP and DM short, plug in/out adaptor at different battery voltage.

Plug in adaptor at V_{BAT}=1.5V



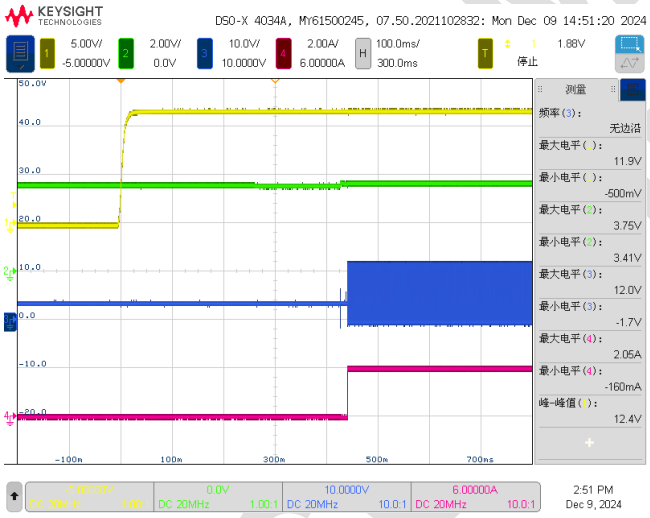
CH1-V_{BUS}, CH2-V_{SYS}, CH3-V_{SW}, CH4-I_{CHG}

Plug out adaptor at V_{BAT}=1.5V



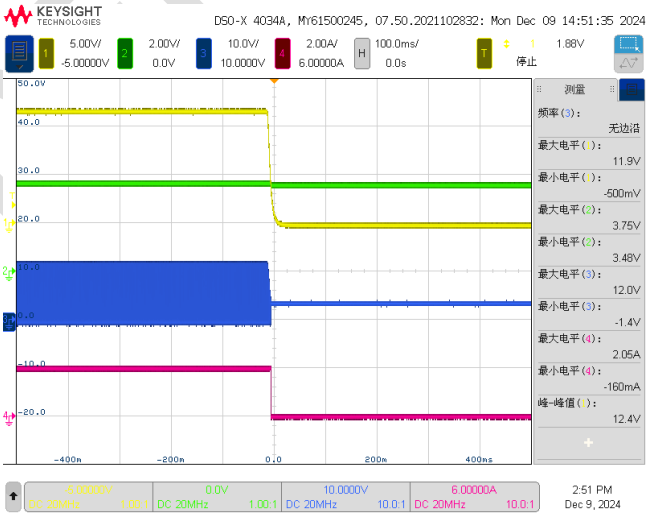
CH1-V_{BUS}, CH2-V_{SYS}, CH3-V_{SW}, CH4-I_{CHG}

Plug in adaptor at V_{BAT}=3.8V



CH1-V_{BUS}, CH2-V_{SYS}, CH3-V_{SW}, CH4-I_{CHG}

Plug out adaptor at V_{BAT}=3.8V

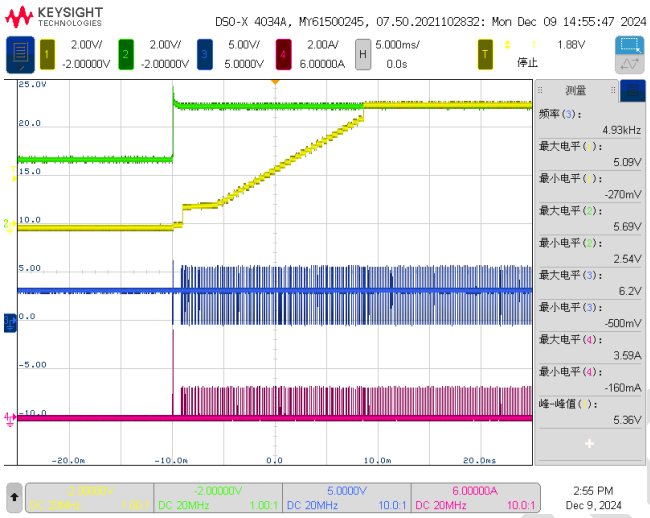


CH1-V_{BUS}, CH2-V_{SYS}, CH3-V_{SW}, CH4-I_{CHG}

2.12 Enter/Exit OTG Mode

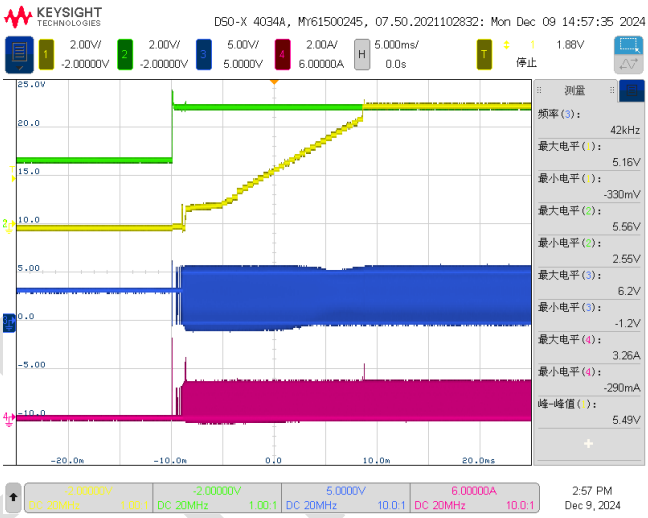
Test conditions: V_{BAT}=3.3V, enable OTG, enter OTG mode with different load.

Enter OTG mode, no load



CH1-V_{BUS}, CH2-PMID, CH3-V_{SW}, CH4-I_L

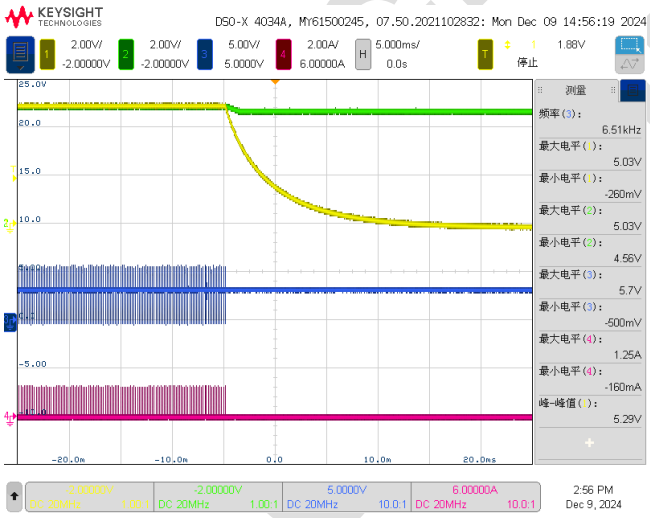
Enter OTG mode, I_{BUS}=0.3A



CH1-V_{BUS}, CH2-PMID, CH3-V_{SW}, CH4-I_L

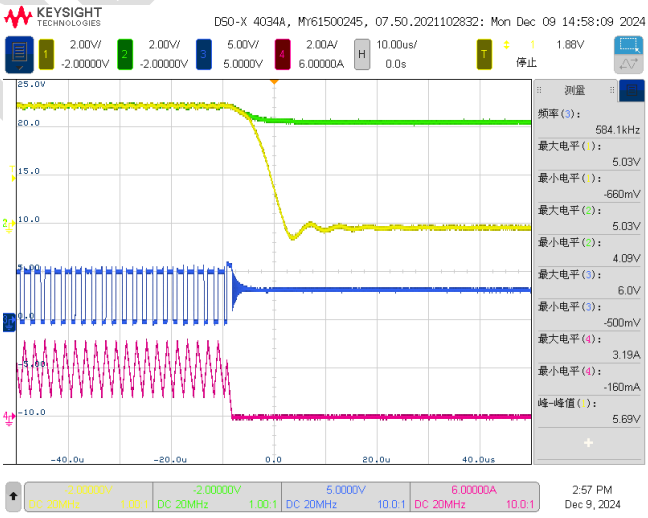
Test conditions: V_{BAT}=3.3V, disable OTG, exit OTG mode with different load.

Exit OTG mode, no load



CH1-V_{BUS}, CH2-PMID, CH3-V_{SW}, CH4-I_L

Exit OTG mode, I_{BUS}=1.2A

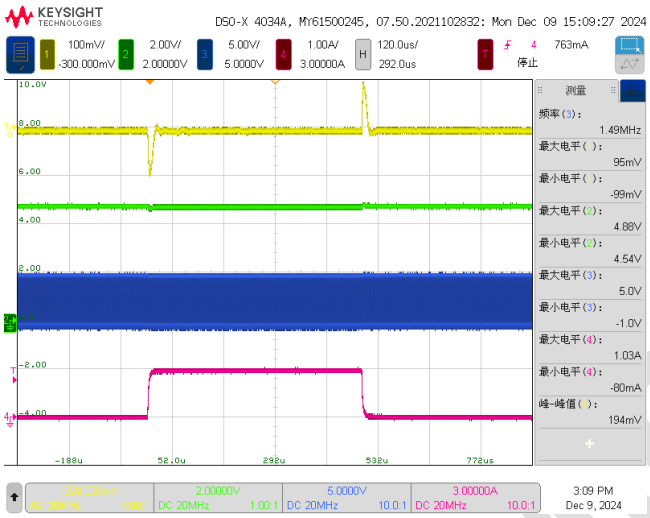


CH1-V_{BUS}, CH2-PMID, CH3-V_{SW}, CH4-I_L

2.13 Charger System Load Transient

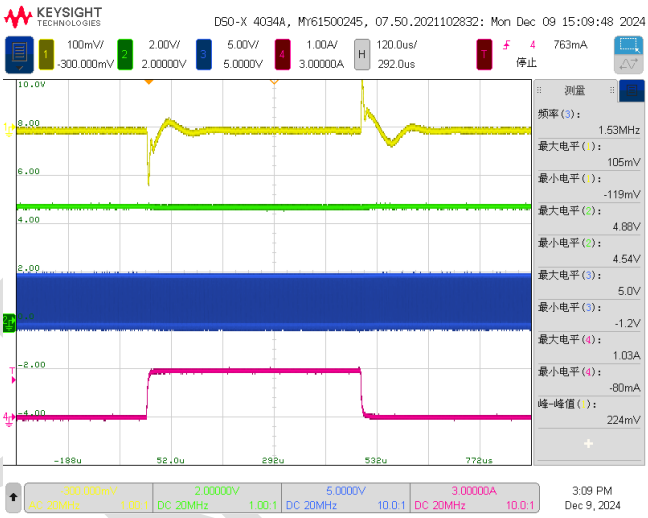
Test conditions: V_{BUS}=5V, V_{BAT}=3.2V/3.8V, I_{CHG_SET}=2040mA, IINDPM=3.3A, EN_ILIM=0, dynamic I_{SYS}=0A-1A-0A (slew rate: 1A/us).

V_{BAT}=3.2V, I_{SYS}=0A-1A-0A



CH1-$V_{SYS/ac}$, CH2-V_{BUS}, CH3-V_{SW}, CH4-I_{SYS}

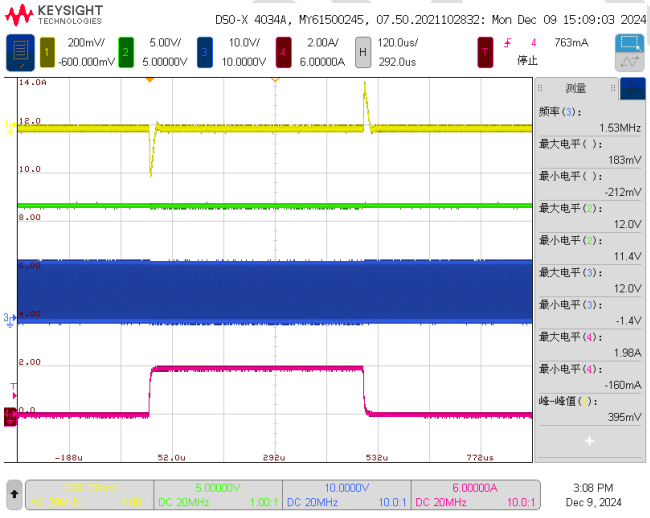
V_{BAT}=3.8V, I_{SYS}=0A-1A-0A



CH1-$V_{SYS/ac}$, CH2-V_{BUS}, CH3-V_{SW}, CH4-I_{SYS}

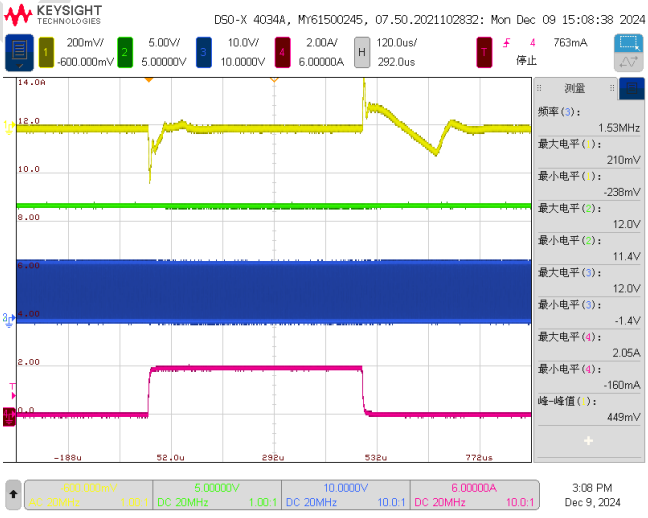
Test conditions: V_{BUS}=12V, V_{BAT}=3.2V/3.8V, I_{CHG_SET}=2040mA, IINDPM=3.3A, EN_ILIM=0, dynamic I_{SYS}=0A-2A-0A (slew rate: 1A/us).

V_{BAT}=3.2V, I_{SYS}=0A-2A-0A



CH1-$V_{SYS/ac}$, CH2-V_{BUS}, CH3-V_{SW}, CH4-I_{SYS}

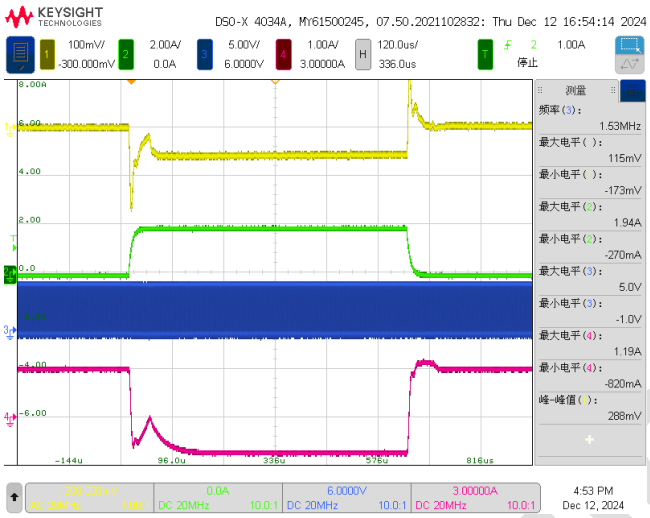
V_{BAT}=3.8V, I_{SYS}=0A-2A-0A



CH1-$V_{SYS/ac}$, CH2-V_{BUS}, CH3-V_{SW}, CH4-I_{SYS}

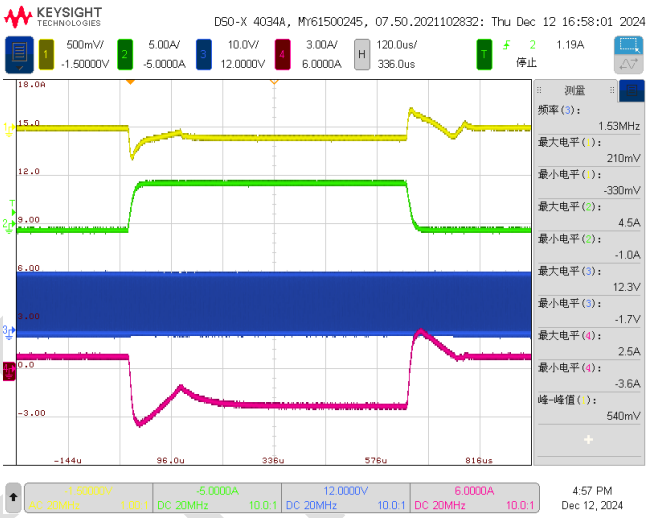
Test conditions: V_{BUS}=5V/12V, V_{BAT}=3.8V, I_{CHG_SET}=1020mA, IINDPM=1000mA, EN_ILIM=0, dynamic I_{SYS}=0A-1A-0A /0A-5A-0A (slew rate: 1A/us).

V_{BUS}=5V, I_{SYS}=0A-2A-0A



CH1-$V_{SYS/ac}$, CH2-I_{SYS}, CH3-V_{SW}, CH4-I_{CHG}

V_{BUS}=12V, I_{SYS}=0A-5A-0A

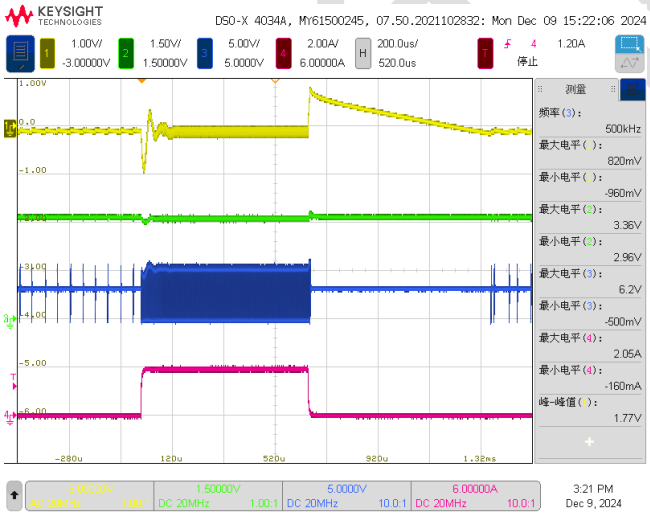


CH1-$V_{SYS/ac}$, CH2-I_{SYS}, CH3-V_{SW}, CH4-I_{CHG}

2.14 OTG Load Transient

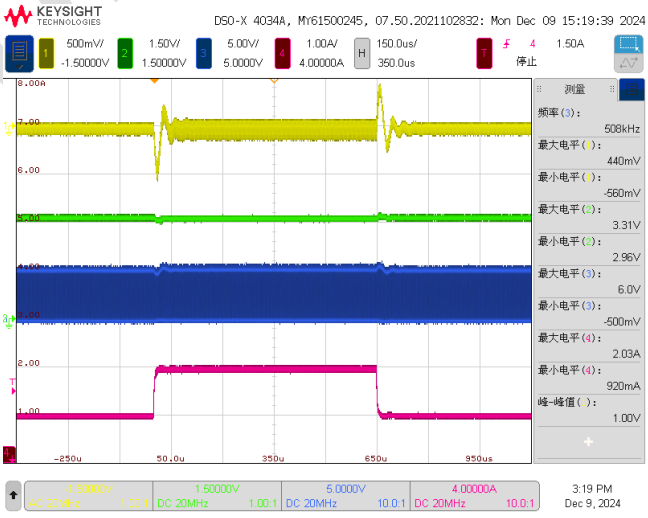
Test conditions: OTG mode, V_{BAT}=3.3V, V_{BUS}=5.15V, BOOST_LIM=3.2A, I_{BUS}=0A-2A-0A/1A-2A-1A (slew rate: 1A/us).

I_{BUS}=0A-2A-0A



CH1-$V_{BUS/ac}$, CH2-V_{BAT}, CH3-V_{SW}, CH4-I_{BUS}

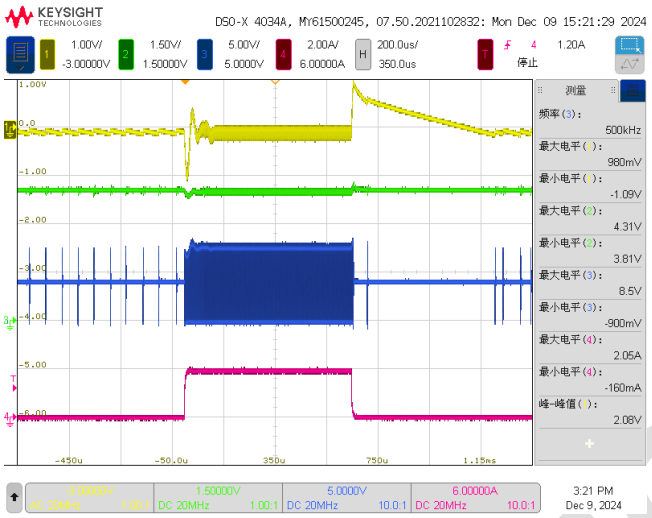
I_{BUS} =1A-2A-1A



CH1- $V_{BUS/ac}$, CH2-V_{BAT}, CH3-V_{SW}, CH4-I_{BUS}

Test conditions: OTG mode, V_{BAT}=4.2V, V_{BUS}=7.5V, BOOST_LIM=3.2A, I_{BUS}=0A-2A-0A/1A-2A-1A (slew rate: 1A/us).

I_{BUS}=0A-2A-0A



CH1-$V_{BUS/ac}$, CH2-V_{BAT}, CH3-V_{SW}, CH4-I_{BUS}

I_{BUS} =1A-2A-1A

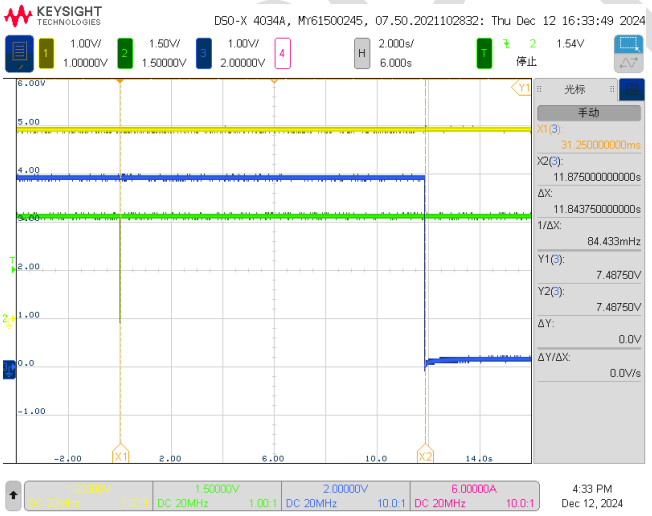
CH1- $V_{BUS/ac}$, CH2-V_{BAT}, CH3-V_{SW}, CH4-I_{BUS}

2.15 Enter/Exit Ship Mode

A. Enter ship mode

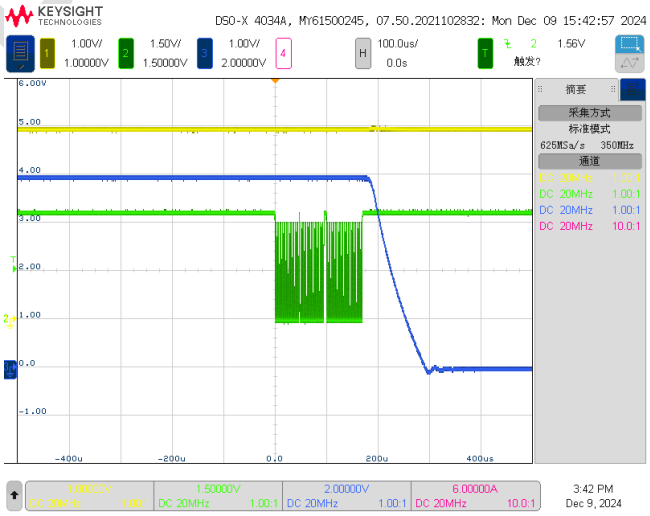
Test conditions: V_{BAT}=4V, VSYS connect to E-Load with 0.5A load in CC mode. Write BATFET_DIS=1 to enter ship mode with different delay time.

BATFET_DLY=1



CH1-V_{BAT}, CH2-SCL, CH3-V_{SYS}

BATFET_DLY=0



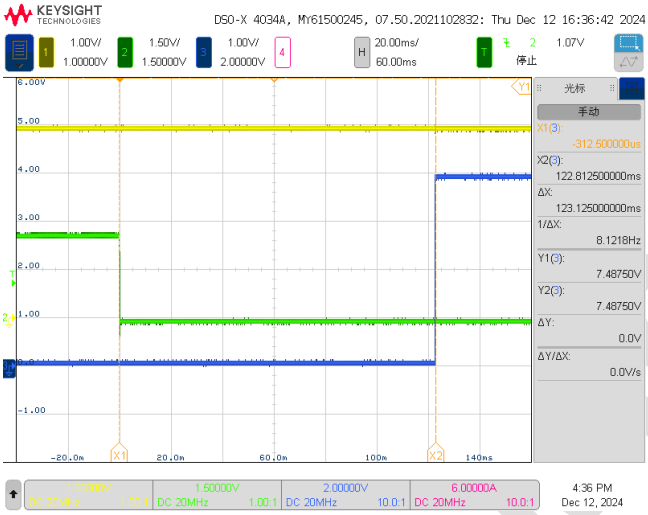
CH1-V_{BAT}, CH2-SCL, CH3-V_{SYS}

B. Exit ship mode

Test conditions: V_{BAT}=4V, SYS connect to E-Load with 0.5A load in CC mode. Exit ship mode by:

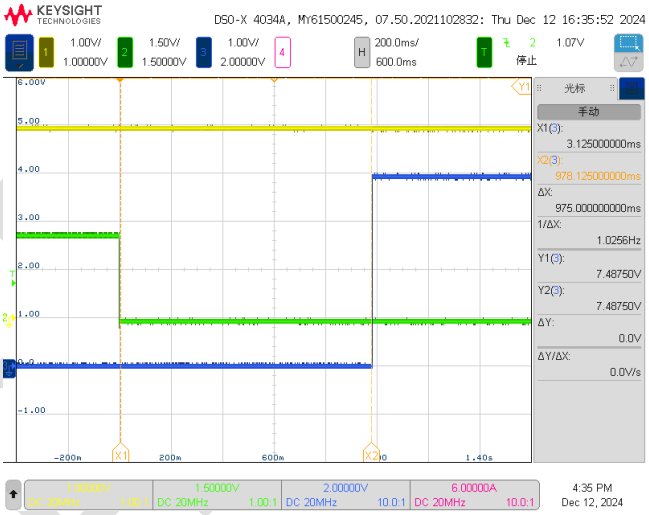
1. Pull nQON pin from logic high to low at least $t_{shipmode}$.
2. Clear BATFET_DIS bit using I2C.
3. Plug-in V_{BUS}.

Shorting nQON to GND, $t_{shipmode}$=100ms



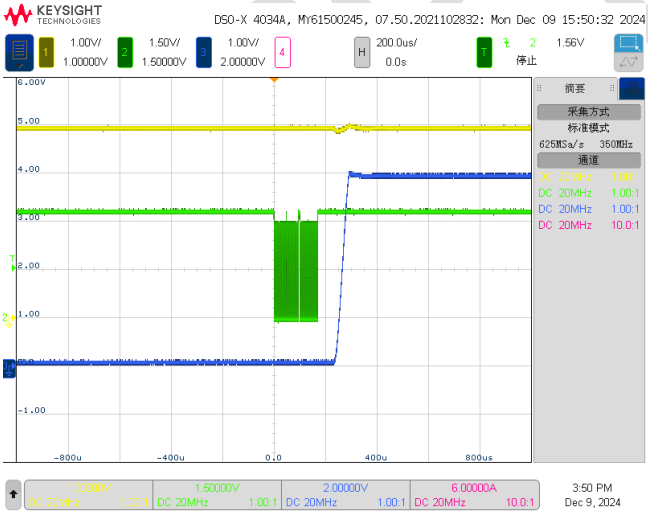
CH1-V_{BAT}, CH2-nQON, CH3-V_{SYS}

Shorting nQON to GND, $t_{shipmode}$=1s



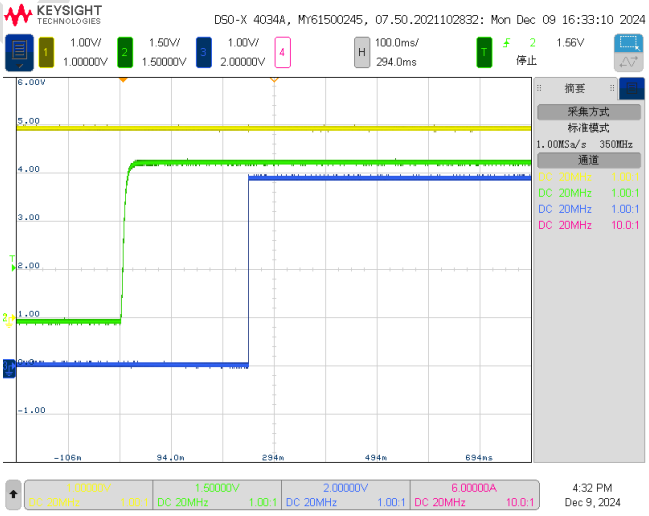
CH1-V_{BAT}, CH2-nQON, CH3-V_{SYS}

BATFET_DIS=0



CH1-V_{BAT}, CH2-SCL, CH3-V_{SYS}

Plug-in V_{BUS}

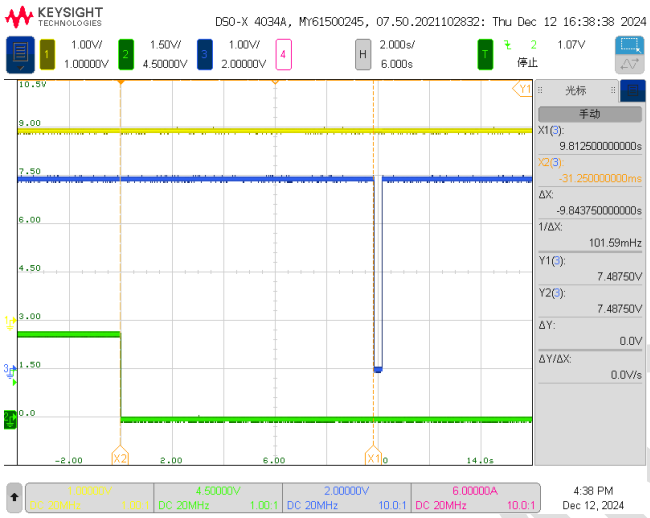


CH1-V_{BAT}, CH2-V_{BUS}, CH3-V_{SYS}

2.16 Reset VSYS

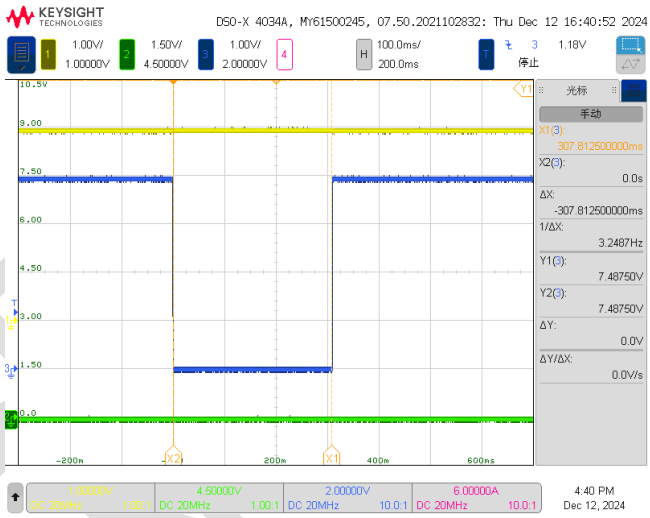
Test conditions: V_{BAT}=4V, SYS connect to E-Load with 0.5A load in CC mode. Pull nQON pin from logic high to low at least 10s.

Zoom in nQON Pull Down



CH1-V_{BAT}, CH2-nQON, CH3-V_{SYS}

Zoom in V_{SYS} Reset

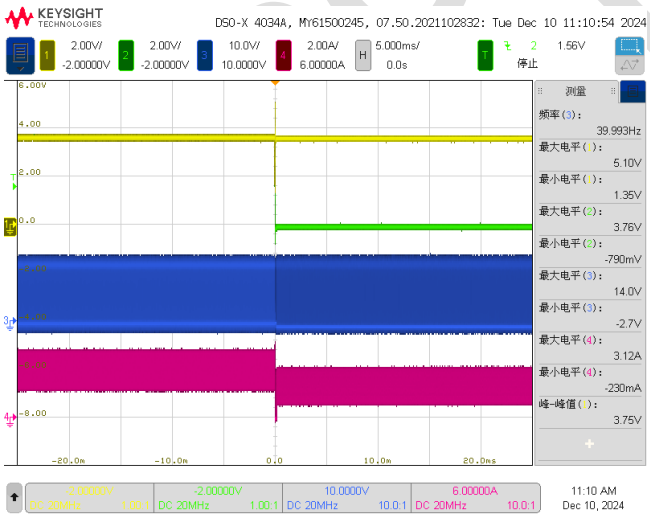


CH1-V_{BAT}, CH2-nQON, CH3-V_{SYS}

2.17 System SCP

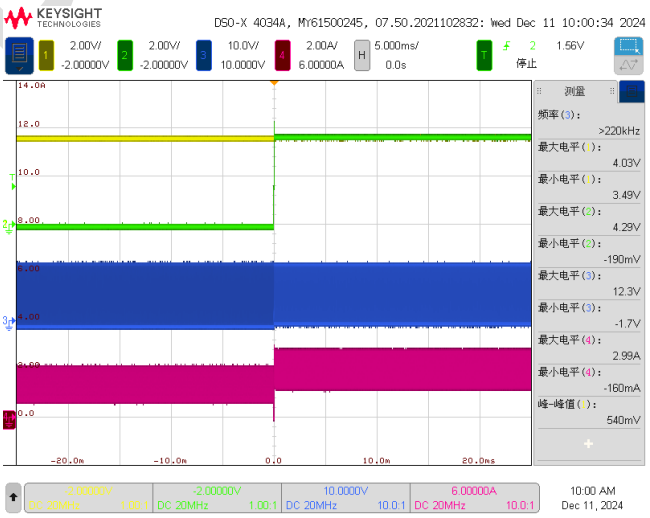
Test conditions: V_{BUS}=12V, V_{BAT}=3.8V, I_{CHG_SET}=2040mA, charge enable, short system to GND, then release.

Short



CH1-V_{BAT}, CH2-V_{SYS}, CH3-V_{SW}, CH4-I_L

Release

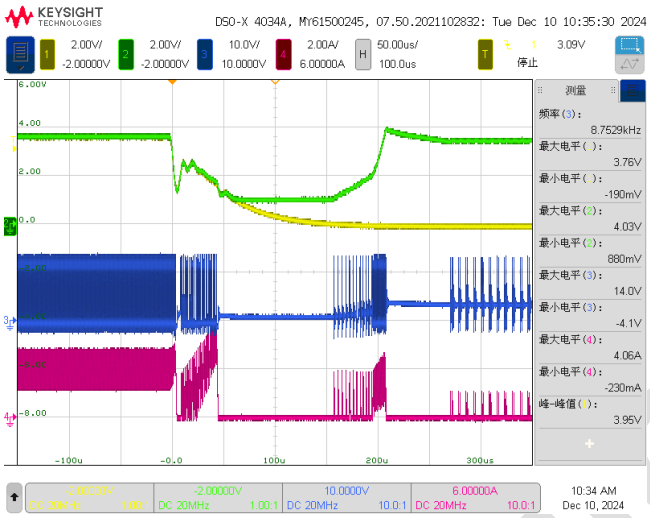


CH1-V_{BAT}, CH2-V_{SYS}, CH3-V_{SW}, CH4-I_L

2.18 Battery SCP

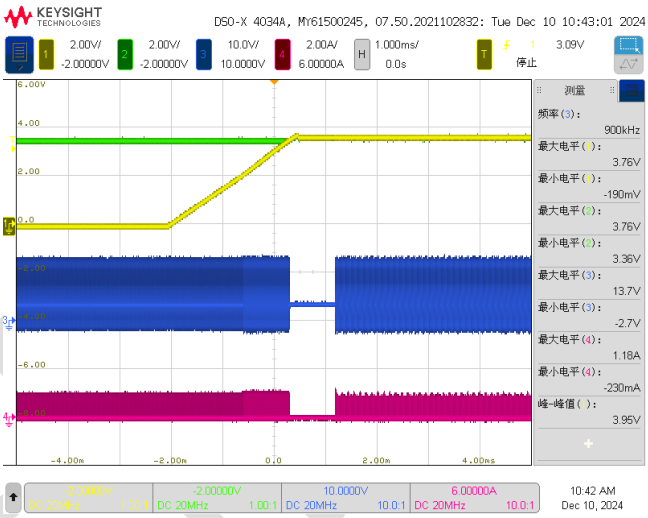
Test conditions: V_{BUS}=12V, V_{BAT}=3.8V, I_{CHG_SET}=2040mA, charge enable, short battery to GND, then release.

Short



CH1-V_{BAT}, CH2-V_{SYS}, CH3-V_{SW}, CH4-I_L

Release

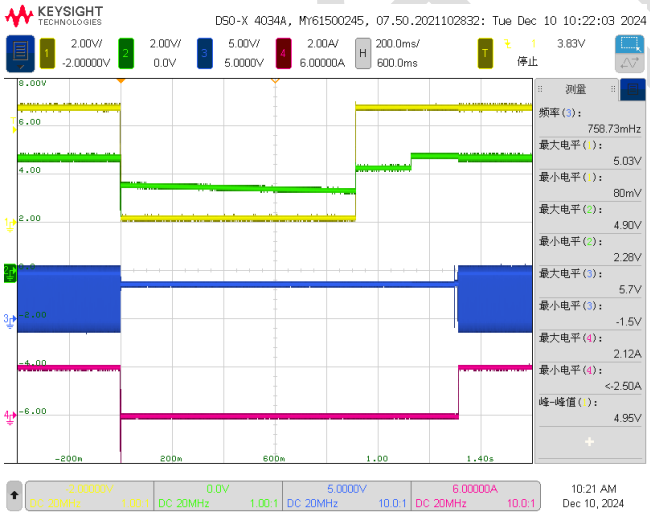


CH1-V_{BAT}, CH2-V_{SYS}, CH3-V_{SW}, CH4-I_L

2.19 VBUS SCP

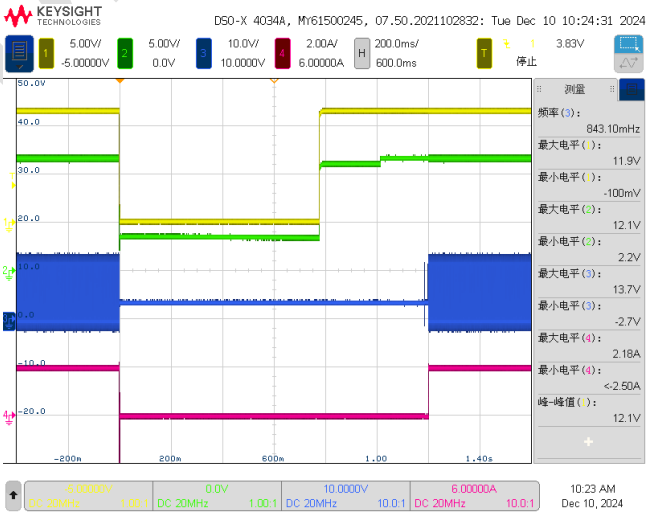
Test conditions: V_{BUS}=5V/12V, V_{BAT}=3.8V, I_{CHG_SET}=2040mA, charge enable, short V_{BUS} to GND, then release.

V_{BUS}=5V



CH1-V_{BUS}, CH2-PMID, CH3-V_{SW}, CH4-I_{CHG}

V_{BUS}=12V

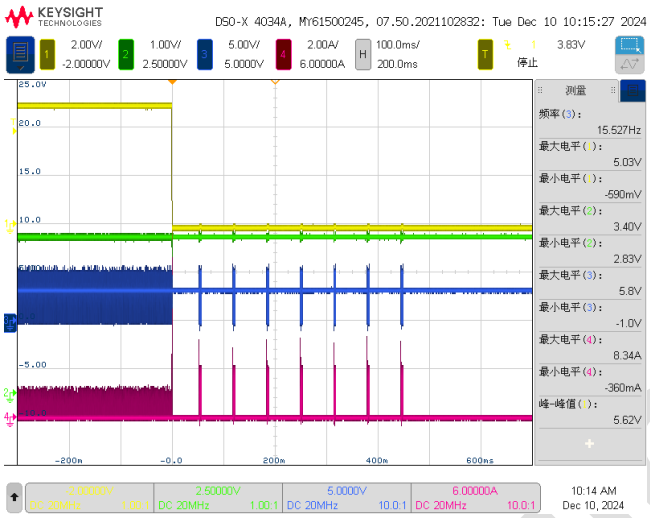


CH1-V_{BUS}, CH2-PMID, CH3-V_{SW}, CH4-I_{CHG}

2.20 VBUS SCP&OCP in OTG Mode

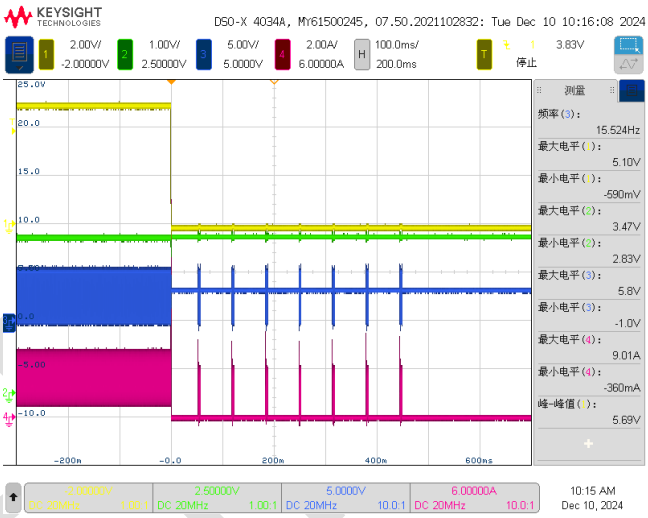
Test conditions: V_{BAT}=3.3V, V_{BUS_SET}=5.15V, enable OTG mode, then short V_{BUS} to GND

I_{BUS}=0A, short



CH1-V_{BUS}, CH2-V_{BAT}, CH3-V_{SW}, CH4-I_L

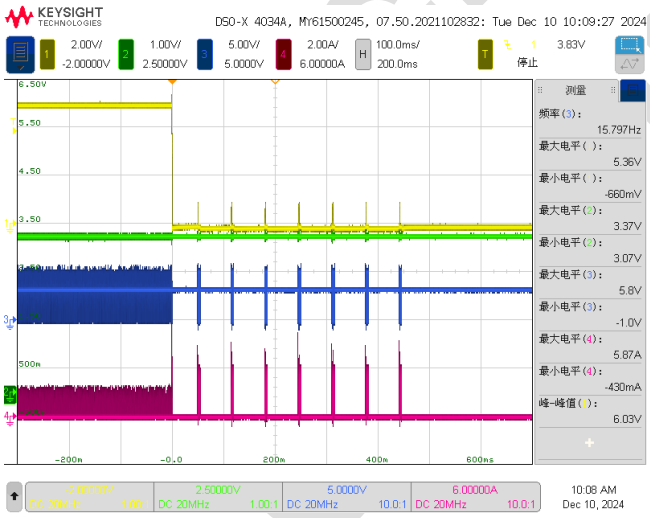
I_{BUS}=1A, short



CH1-V_{BUS}, CH2-V_{BAT}, CH3-V_{SW}, CH4-I_L

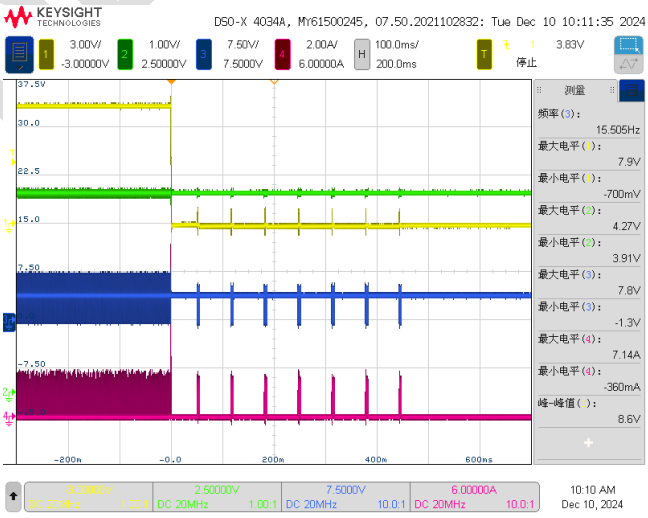
Test conditions: V_{BAT}=3.3V/4.2V, V_{BUS_SET}=5.15V/7.5V, BOOST_LIM=1.2A, enable OTG mode, increase I_{BUS} till OCP.

V_{BAT}=3.3V, V_{BUS}=5.15V



CH1-V_{BUS}, CH2-V_{BAT}, CH3-V_{SW}, CH4-I_L

V_{BAT}=4.2V, V_{BUS}=7.5V



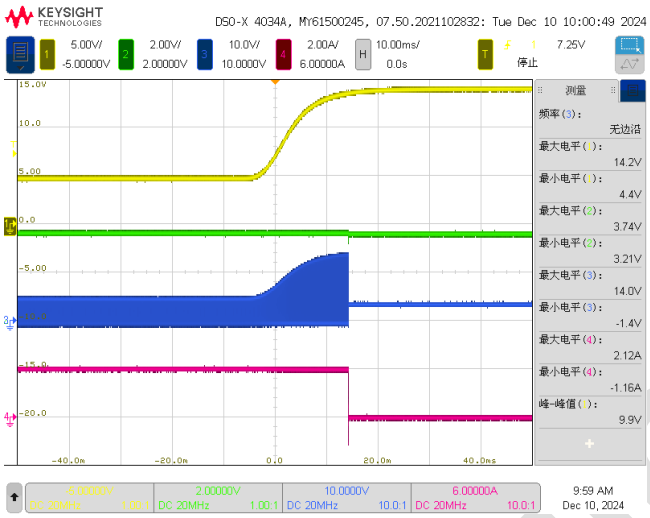
CH1-V_{BUS}, CH2-V_{BAT}, CH3-V_{SW}, CH4-I_L

Note: If release the short circuit or overload before the seventh restart, OTG can restart. Release the short circuit or overload after the seventh restart, then OTG needs to be re-enabled by I2C.

2.21 VBUS OVP

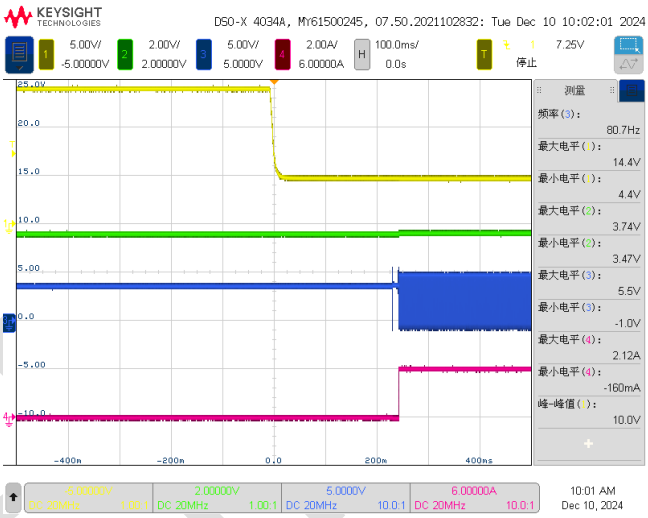
Test conditions: OVP set to 14V, V_{BUS}=5V, V_{BAT}=3.8V, I_{CHG_SET}=2040mA, charge enable, V_{BUS} ramp to 14.5V.

V_{BUS}=5V to 14.5V



CH1-V_{BUS}, CH2- V_{BAT}, CH3-V_{SW}, CH4-I_{CHG}

V_{BUS}=14.5V to 5V

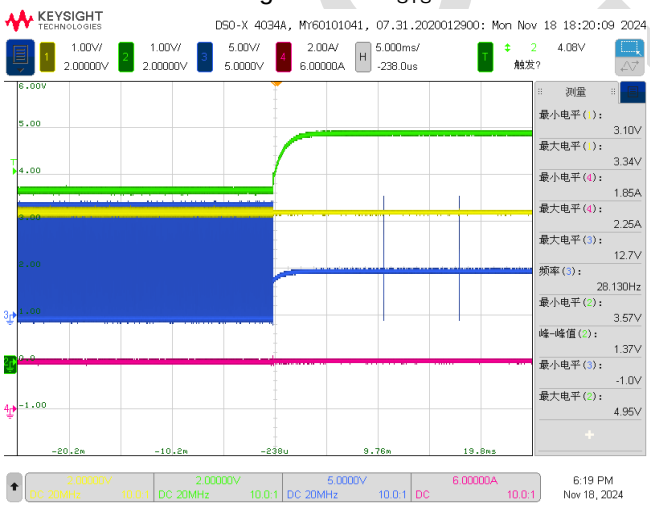


CH1-V_{BUS}, CH2- V_{BAT}, CH3-V_{SW}, CH4-I_{CHG}

2.22 VSYS OVP

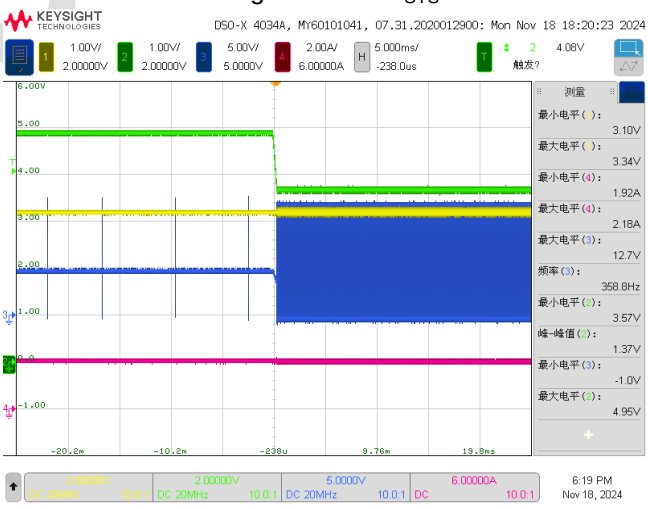
Test conditions: V_{BUS}=12V, V_{BAT}=3.2V, I_{CHG_SET}=2040mA, charge enable, I_{SYS}=0A, force a 5V external power supply on system.

Plug in 5V at V_{SYS}



CH1-V_{BAT}, CH2-V_{SYS}, CH3-V_{SW}, CH4-I_{CHG}

Plug out 5V at V_{SYS}

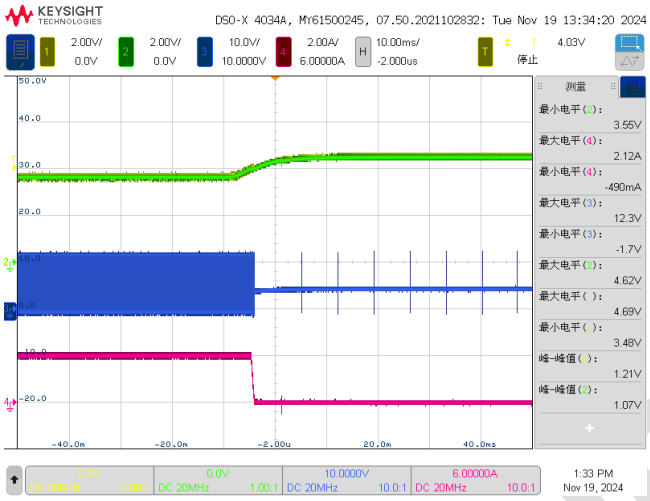


CH1-V_{BAT}, CH2-V_{SYS}, CH3-V_{SW}, CH4-I_{CHG}

2.23 VBAT OVP

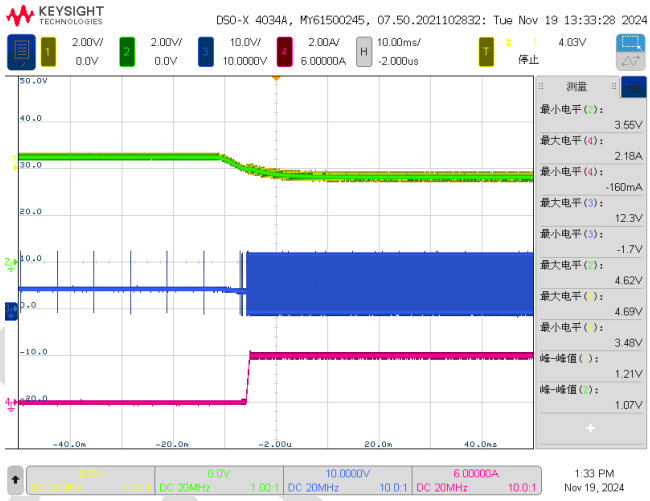
Test conditions: V_{BUS}=12V, V_{BAT}=3.8V, I_{CHG_SET}=2040mA, charge enable, VREG=4.2V, V_{BAT} ramp to 4.6V.

V_{BAT}=3.8V to 4.6V



CH1-V_{BAT}, CH2-V_{SYS}, CH3-V_{SW}, CH4-I_{CHG}

V_{BAT}=4.6V to 3.8V

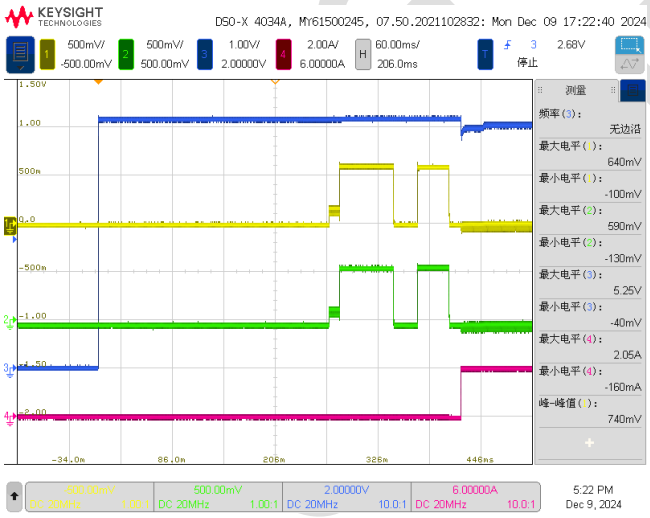


CH1-V_{BAT}, CH2-V_{SYS}, CH3-V_{SW}, CH4-I_{CHG}

2.24 BC1.2 Detection

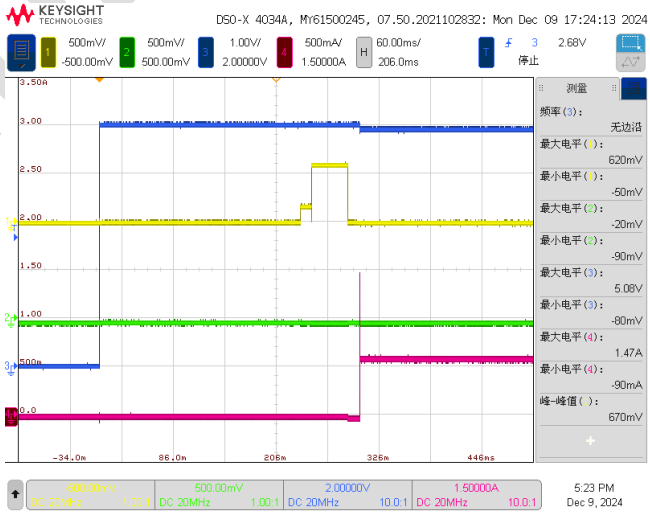
Test conditions: V_{BAT}=3.8V, I_{CHG_SET}=2040mA, charge enable, plug in different type adapter.

USB DCP(2.4A)



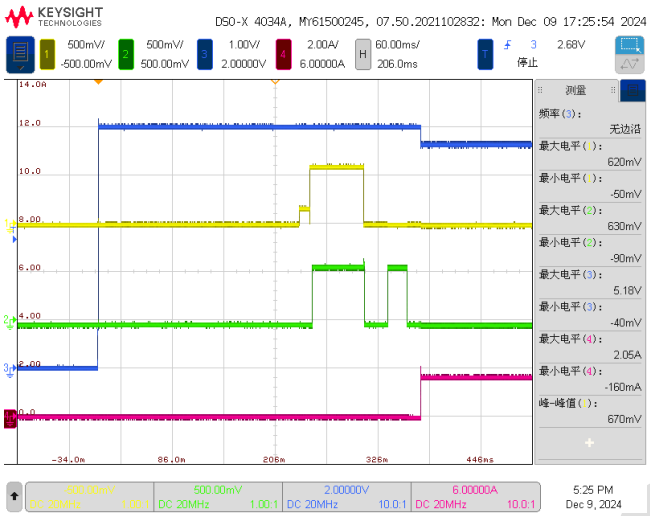
CH1-D+, CH2-D-, CH3-V_{BUS}, CH4-I_{CHG}

USB SDP(0.5A)



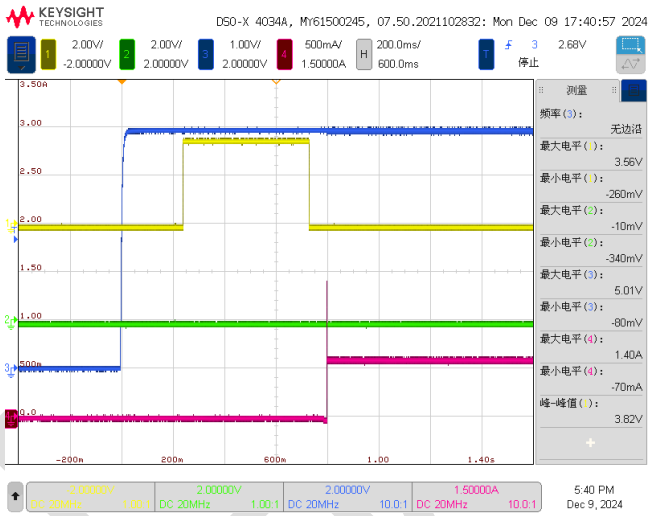
CH1-D+, CH2-D-, CH3-V_{BUS}, CH4-I_{CHG}

USB CDP(1.5A)



CH1-D+, CH2-D-, CH3-V_{BUS}, CH4-I_{CHG}

Unknown Adapter(0.5A)



CH1-D+, CH2-D-, CH3-V_{BUS}, CH4-I_{CHG}

2.25 Temperature Rise

Test conditions: V_{BAT}=3.8V, charge enable, measure the case temperature (Tc) rise with different input voltage and charge current.